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INCLUDING

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ASSISTED BY G. TALBOT, F.R.S.E.

MOTHS.

VOL. V

SPHINGIDÆ.

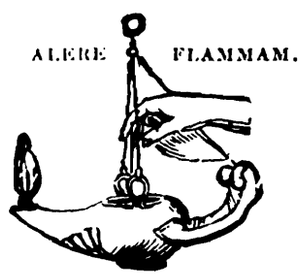
BY

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PREFATORY NOTE.

WITH the completion of the present volume our knowledge of the Hawk-Moths of the Indian Empire is now so advanced that a considerable time must elapse before any important additions can be made to it.

The authors and the editors have tried to make the volume as complete as possible, and the importance of structure, as well as pattern, is emphasized by the inclusion of full morphological details and illustrations. To this is added, for most species, an account of the early stages and illustrations of them, much of which is here published for the first time.

By kind permission of Lord Rothschild and Dr. K. Jordan, free use has been made of their 'Revision of the Sphingidæ,' published in 1903.

The text-figures of structure, excepting figs. 1–4, selected for the present work, were all reproduced from Rothschild and Jordan's book by Mr. W H. T. Tams, of the Natural History Museum.

The opportunity is taken here to acknowledge the useful and ready help received from the Editor, Mr. Tams and the authors in the task of preparing the work for publication; a special debt is owing to Mr. Tams for also reading through the page-proofs. Thanks are tendered to the printers for the very careful marking of the proofs. Acknowledgement is tendered to the India Office for permission to use twenty of the blocks illustrating Hampson's work (1892). The sources of other figures are acknowledged by the authors.

The following figures are from photographs and drawings by the authors :—1, 2, 3, 4, 9 A, 18 A, 29, 34, 44, 66, 69, 75, 79, 92, 96, 104, 107, 108, 112, 113, 115, 121, 122, 124.

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The following figures are from Hampson (1892) :—9 C, 10 A, 14 A, 19, 32, 37, 51 A, 53 A, 64 A, 71 A, 72 A, 75 A, 80 A, 84, 85 A, 89 A, 94, 109, 111.

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Text-figures 77 and 78 are taken from the Ent. Zeitschr. Frank., 1930 and 1931.

THE SUB-EDITOR.

AUTHORS' PREFACE.

THE Hawk-Moths of India were first classified by Sir George Hampson in 'The Fauna of British India.—Moths,' vol. i, published in 1892. In 1903 Rothschild and Jordan published 'A Revision of the Sphingidæ,' dealing with the Hawk-Moths of the World, and in 1904 Sir George Hampson published supplementary papers to 'The Fauna of British India' volumes, in which he adopted Rothschild and Jordan's classification as applied to the Hawk-Moths of India, in the 'Journal of the Bombay Natural History Society,' vol. xv, p. 630. Since that date nothing has been published dealing with the Hawk-Moths of India as a whole and separate from those of other regions.

In this volume we attempt to remedy this deficiency, and to bring together information which has been published by other authors, supplemented by the results of our own studies, in a form suitable for the use of students in India. Our work covers the whole Indian Empire, including Burma and the Andaman Islands, and Ceylon.

Our own studies have been concerned chiefly with the early stages, which have been hardly touched upon by previous authors. We have bred a large proportion of the Indian Hawk-Moths, and have made careful descriptions of the early stages, life-history and habits, supplemented by paintings of the early stages of many species made by Miss E. M. Bell and by Lt.-Col. F B. Scott, Indian Army, who has also taken photographs of the caterpillars and moths of many species.

We have also used some paintings made by Indian artists, some under the supervision of the late J. Davidson, Esq., I.C.S., and some under our own supervision.

A Bibliography is included giving a list of the principal literature of the subject. This should be consulted for author and year to which reference is made under each species in the body of the work.

The principal works consulted by us, and repeatedly cited, are as follows :—

F Moore, F.Z.S., ' The Lepidoptera of Ceylon,' vol. ii (1882).

Sir George F Hampson, ' Fauna of British India.—Moths,' vol. i (1892), vol. iv (1896).

Professor Dr. Ernst Hofman, ' Die Raupen der Grossschmetterling ' (1893).

The Hon. Walter Rothschild and Dr. Karl Jordan, "A Revision of the Lepidopterous Family Sphingidæ." ' Novitates Zoologicæ,' vol. ix, Supplement (1903).

Richard South, ' The Moths of the British Isles ' (1907).

The Rev. A. Miles Moss, " Sphingidæ of Pará, Brazil." ' Novitates Zoologicæ,' vol. xxvii, pp. 333–424 (1920).

Rudolph Mell, ' Biologie und Systematik der Südchinesischen Sphingiden ' (1922).

Adalbert Seitz, ' The Macrolepidoptera of the World,' vol. ii (1911), vol. x (1928).

Also numerous papers in ' The Journal of the Bombay Natural History Society.'

Hampson's work was extremely useful in giving the first description of Indian Hawk-Moths in a form available to the public in India, but was entirely superseded on the publication of Rothschild and Jordan's ' Revision ' in 1903. This outstanding work is a complete monograph of the whole family known to exist at the time of publication, and has many plates of the moths and their structure ; later volumes of ' Novitates Zoologicæ ' give descriptions of some of the

species discovered since 1903. Little was known of the early stages of any Hawk-Moths when the 'Revision' was published, and Mell's work, which is of real scientific value, is the first to give an account of the early stages of any Indian Hawk-Moths. It deals with the species occurring in South China, and contains many excellent plates of species common to S. China and India. Permission was granted to quote freely from Mell's work, and this we have done in respect of the larvæ and pupæ of species occurring in India but not bred by us. Seitz, in his great work on the 'Macrolepidoptera of the World,' follows the 'Revision' very closely. He gives many excellent plates of the moths.

Miles Moss, in his work on the 'Sphingidæ of Pará,' has very interesting notes on the life-history and habits of the Hawk-Moths of South America, and some excellent plates of the curious larvæ and pupæ of that region.

All our specimens have been identified by Lord Rothschild and Dr. Jordan, at the Tring Museum. New species and subspecies discovered by us have been described and named by the same authorities, to whom our best thanks are due for the great assistance and advice they have given us in this and other matters.

The work of putting the manuscript into shape for publication, of preparing the bibliography, glossary and indices, and of correcting the proofs, has devolved upon Mr. G. Talbot as sub-editor. We thank him for all the trouble he has taken, and for the efficient way in which he has carried out the task. We most certainly could not have coped with this work in anything like the manner in which Mr. Talbot's experience has enabled him to do. The arrangement of the figures in the plates and text has been done jointly by Messrs. Tams and Talbot.

We are very greatly indebted to Mr. Tams for undertaking the self-imposed task of making the large number of photographs used to illustrate the text. These comprise not

only the structural figures copied from Rothschild and Jordan's 'Revision,' but also figures of types of species described by Rothschild, Jordan, Hampson, Butler and Walker. To this end some specimens were kindly loaned from the Tring Museum, and others were made available by permission of the Trustees of the British Museum. Mr. Tams's help was freely given in his desire to render the book as complete and useful as possible.

We also desire to acknowledge the valuable help given in collecting and breeding by Brigadier H. L. Scott, D.S.O., M.C., brother of the junior author, and by Colonel Campbell, D.S.O.

In an appendix we give a list of the 135 species and subspecies of which the food-plants are known, together with the names of these plants; also an appendix containing a list of the food-plants, with the species which feed upon them.

T. R. D. Bell.
F B. Scott.

London,
June, 1937.

GLOSSARY OF TERMS.

Aciculate.—A surface that appears as if scratched with a needle.

Acuminate.—Tapering to a long point.

Ædeagus.—The outer chitinized sheath of the membranaceous penis.

Bevels.—Lateral (sometimes ridged) basal slopes of the movable segments of the abdomen in the pupa.

Carinate.—Keel-shaped.

Cariniform.—In the form of a keel.

Chætotaxy.—The arrangement of the setæ or bristles on any portion of the exoskeleton.

Cilia.—Series of fine hairs arranged in tufts or single lines; the fringe which edges the wing.

Cilium.—Pl. *cilia*, q.v.

Clasper.—A chitinized plate or flap, being a process attached to the ninth sternite in the imago, and serving to hold the female parts during copulation. Also applied to the pair of prolegs situated upon the tenth segment of the larva.

Clavate.—Clubbed; thickened gradually towards the tip.

Clypeus.—That sclerite of the head to which the labrum is attached.

Comb.—A row of long bristles, often prominent on the mid-tarsus of SPHINGIDÆ.

Costa.—The thickened anterior margin of the wing.

Coxa.—The basal segment of the leg, by means of which it is articulated to the body.

Coxal piece.—A small, bipartite, diamond-shaped plate on each side of the middle line of the pupal thorax, lying between the fore leg and the tongue-case.

Cremaster.—A specialized process on the tenth (the last) segment of the pupa.

Crenulate.—With small scallops.

Cross-veins.—Applied to the veins closing the discal cell of the wing. Also called the discocellulars.

Dentition.—Arrangement of the teeth, or the form of the teeth, on a chitinized part.

Dextrad.—Extending or directed towards the right.

Discocellulars.—The veins which close the discal cell of the wing.

Distal.—Farthest from the body, opposed to proximal.

Emarginate.—Notched; with an obtuse, rounded or quadrate section cut from a margin.

Epicranium.—A dorsal plate of the head forming laterally the sockets for the antennæ.

Episternum.—A ventral thoracic plate lying below the parasternum.

Epistome.—A plate of the head covering the base of the tongue.

Falcate.—Curved like a sickle.

False clypeus.—Area between clypeus and lobes of head; a very thin band on each side of true clypeus, not seen in the early instars.

Fasciculate.—Bundled; clustered as in a bundle; tufted.

Femur.—The third segment of the leg.

Filiform.—Slender, and of equal diameter; hair-like.

Frass.—The excreted pellets of the larva.

Frenulum.—A set of fused or closely contiguous bristles arising from near base of costa of hind wing, and used as a link with the fore wing in flight (see *retinaculum*).

Friction scales.—Modified scales found upon the male clasper, and supposed to assist in stridulating.

Frons.—The front or anterior portion of head lying between the bases of the antennæ and the clypeus.

Fusiform.—Spindle-shaped; tapering gradually to each end.

Genal process.—A more or less triangular projection between the pilifer and eye.

Glabrous.—Smooth, not hairy.

Harpe.—The ventral armature of the clasper.

Horn.—A fleshy process on the dorsum of the eighth abdominal segment of the larva.

Incrassate.—Thickened; rather markedly swollen at some one point, especially near the tip.

Instar.—The period or stage between moults in the larva. The first instar is the stage between the egg and the first moult; the final instar the stage preceding the change to a pupa.

Irrorate.—Marked with minute points; freckled.

Labium.—The lower lip; a compound structure which forms the floor of the mouth.

Labrum.—The upper lip; covers the base of the mandible and forms the roof of the mouth.

Ligula.—The part of the labium in front of the mentum.

Mentum.—A transverse arched stripe of chitin between the labial palpi; the second segment of the labium.

Merum.—The lateral area of the sternites of the thorax.

Mesial.—At the middle.

Mesonotum.—The upper surface of the second or middle segment of the thorax.

Mesothorax.—The second or middle segment of the thorax; bears the middle legs and anterior wings.

Metathorax.—The third segment of the thorax; bears the hind legs and second pair of wings.

Notum.—The dorsal or upper part of a segment of the thorax.

Obsolescent.—Becoming obsolete.

Obsolete.—Nearly or entirely lost.

Onychium.—The tarsal claw.

Paramerum.—A small plate in the lateral ventral part of the mesothorax.

Parapleurum.—A lateral plate of the first abdominal segment.

Parasternum.—A large thoracic ventral plate extending obliquely dorsad and mesiad from the meral suture, separating the meral and sternal parts of the sternite, to the membrane connecting meso- and prothorax.

Paronychium.—Two (or sometimes one) slender lobes arising from the tarsal claw; the so-called false claws.

Pectinate.—Comb-shaped; with even branches like the teeth of a comb.

Penis-funnel.—An aperture with raised and chitinized edges, situated between the tenth abdominal sternite and the ninth, from which protrudes the penis-sheath.

Penis-sheath.—The outer chitinized covering of the membranaceous penis; also called the ædeagus.

Peristernum.—An anterior ventral plate of the mesothorax.

Pilifer.—A small sclerite, in the form of a hairy process, at each side of the clypeus.

Postscutum.—The third posterior dorsal plate of the anterior thorax.

Præscutum.—The small anterior plate of the thorax.

Pro.—Anterior.

Prolegs.—The fleshy unjoined abdominal legs of the larva; those of the tenth segment sometimes called claspers.

Prothorax.—The first segment of the thorax; bears the anterior legs but no wings.

Protomerum.—A small plate in the lateral ventral part of the thorax lying below the paramerum.

Proximal.—Nearest to the body.

Pulvillus.—A pad-like structure between the tarsal claws.

Retinaculum.—A catch or bar on the underside of the fore wing, formed by stiff bristles, scales, or projecting membrane, and serving to engage the frenulum in flight.

Rugose.—Wrinkled.

Sclerite.—Any piece of the body-wall bounded by sutures.

Scutum.—A dorsal area of the thorax.

Seriate.—Placed in a row.

Setiferous.—Bearing setæ or bristles.

Setiform.—In the form of a bristle or seta.

Shagreened.—A surface roughened with minute tooth-like projections.

Sinistrad.—Towards the left.

Spinulose.—Set with spines or spinules.

Spiracles.—The lateral pores in the insect body through which air enters the tracheæ.

Sternite.—The ventral piece of a ring or segment.

Stigma.—A spiracle or breathing pore; a patch of modified scales on the wing; a small discocellular spot.

Subspiracular.—Applied to the lateral surface of the larva; the longitudinal area just below the spiracles.

Sulcate.—Grooved.

Tarsus.—The distal portion of the leg, consisting of five segments.

Tegula.—A small lateral sclerite of the mesonotum, situated just in front of and usually covering the base of the fore wing.

Tegumen.—The ninth abdominal tergite in the ♂.

Tergite.—The dorsal part of a segment of the abdomen.

Termen.—The outer margin of the wing.

Tibia.—The fourth segment of the leg, situated between femur and tarsus.

Trochanter.—The small second segment of the leg lying between the coxa and femur.

Tubercle.—A little solid pimple or short fleshy process, which may or may not give rise to a seta.

Tuberculate.—Covered with tubercles.

Tumid.—Swollen; enlarged.

Turgid.—Tumid.

Uncus.—The tenth abdominal tergite in the ♂.

Vaginal plate.—The part of the vaginal area in front of and behind the orifice.

Venter.—The belly or under surface of insects in any stage.

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Family **SPHINGIDÆ.**

I.—GENERAL INTRODUCTION.

MOTHS of the family SPHINGIDÆ, or Hawk-Moths, can, with few exceptions, be distinguished from other lepidopterous insects by their general appearance. The long, narrow, pointed fore wing, the short, triangular hind wing, the large eye, powerful thorax and sharply-pointed abdomen, the graceful, high-bred appearance of the whole creature, can hardly be mistaken. These characters are very constant throughout the family; although the end of the abdomen appears in some species, such as the Humming-bird Hawk-Moths (*Macroglossum*), to be broad instead of pointed, this broadening is only apparent, being caused by the expansion of lateral scales. When these have been removed the abdomen is found to be pointed as in other species. The venation of the wings, the smooth and appressed hair or scales of the body, and other external characters are also very constant. The antenna is filiform or setiform in many species, but is more or less strongly clubbed in others. There are usually spines on the abdomen and the tibiæ. The moths vary greatly in size, the largest being equal in bulk, but not in expanse of wing, to the largest moths, and the smallest with an expanse of only 20 mm. from wing-tip to wing-tip. The length of the tongue also varies greatly in different species, from being the longest tongue found in any insect (*Cocytius*, 250 mm.) to two tubercles barely 2 mm. in length. In the Indian *Herse convolvuli* it may reach a length of 130 mm., or nearly 5 inches, while in other species it is short and functionless. The labial palpi are usually large, but, like the tongue and other organs, may be much reduced. There is, throughout the family, a tendency to the modification and reduction of many organs. The colour of the moths is usually sober and cryptic, resembling the bark of trees and other natural objects, but some of the species are brightly coloured, and most have pleasing tones and markings. Some species mimic very closely bees and other insects, but there does not appear to be any Hawk-Moth which mimics another Hawk-Moth. The colouring of the male and female moths is usually the same, but the sexes are differently coloured in some species.

The eggs are either nearly spherical or more or less oval in shape. The surface is usually smooth and shining, and the colour some shade of green or yellow.

The larvæ, when full-fed, are nearly cylindrical in some subfamilies, but taper more or less strongly towards the head in others, the head being either rounded or triangular. There is always a horn on the twelfth segment, straight and bifid in the first instar, of various shapes and more or less strongly chitinized in the later instars, while it may be reduced to a short tubercle or a knob in a few species (e. g., *Langia zenzeroides*). The surface of the larva is usually naked, with only a few scattered hairs. Some species have tubercles and, rarely, fleshy spines. The colour of a great many is green with pale-coloured oblique stripes ; the colour-scheme, combined with the position in which they lie, causes them to resemble closely a leaf with its side-veins. Others are brown, yellow, or variegated, and many species have large eye-like spots, or ocelli, which give them somewhat the appearance of a snake's head.

The pupæ are usually short, cigar-shaped, rounded in front and pointed behind. In the species which pupate underground the colour is usually brown without any markings, while in those which pupate on or near the surface the colouring is cryptic, pale with darker streaks or dots.

Rothschild and Jordan state, in the Introduction to the 'Revision' (1903), that they were very much hampered in their attempts to classify the Hawk-Moths by a lack of material regarding the early stages. Only a few of the more common species had been bred, and the published descriptions of these were most inadequate. This lack of material has been remedied to some extent by the publication of Mell's work on the Hawk-Moths of S. China. We have now bred 105 species and subspecies of the Indian Hawk-Moths belonging to 40 genera ; 14 of these species were new to science at the time, and we give descriptions of the early stages and habits in this volume. Mell has described 12 species which extend from S. China to India, but which we have not bred ; incomplete descriptions of 15 more species are available from other sources. We therefore know something of the early stages of about 66 per cent. of the species and 85 per cent. of the genera which occur in India. The early stages of 69 species and of 8 genera are still quite unknown, and it is very desirable that as many as possible of these should be discovered and properly described and figured, or preserved in spirit, so that they may be properly described by others. Hampson and other authors, except Mell, confined their descriptions of the caterpillars to the colour, which is individually very variable, and to the shape of the head and horn, characters too constant throughout

whole subfamilies to be of much use in identification or classification ; they scarcely mentioned the pupæ and habits.

The Hawk-Moths are essentially a tropical family, the number of species existing in the temperate regions being comparatively small. Very few species extend into the Arctic Regions, and then only as occasional stragglers. Only seventeen species, some of them rare stragglers, occur in the British Isles. With the exception of the Arctic and Antarctic Regions the family is found throughout the world.

The Hawk-Moths were first classified by Linnæus in the year 1758, under the name " Sphinx," this name having been first used by Reaumur in 1736 for the English Privet Hawk-Moth, on account of the Sphinx-like attitude adopted by the larva when it is alarmed. Linnæus included in his genus *Sphinx* forms other than the true SPHINGIDÆ, and Samouelle adopted the name SPHINGIDÆ for the family in 1819. The SPHINGIDÆ of the world and of separate regions have been classified, revised or catalogued by many other authors.

The Hawk-Moths of India were first classified by Hampson in Blanford, ' Fauna of British India—Moths,' vol. i (1892). In 1904, after the publication of Rothschild and Jordan's ' Revision ' of the family, he published papers supplementary to the ' Fauna of British India ' volumes, in which he adopted Rothschild and Jordan's classification and applied it to the Hawk-Moths of India (' Journal of the Bombay Natural History Society,' vol. xv, p. 630 (1904). Hampson's original classification of the family, like that of other authors whose works were published before the ' Revision,' was based chiefly on external and easily visible characters. Rothschild and Jordan found that these characters alone could not be relied on for purposes of classification, as some (colour for instance) were so variable individually, and others (shape and venation of wings) so constant among nearly all sphingid forms. Their classification was based on characters revealed by a minute examination of the structure, both external and internal, of practically every Hawk-Moth known to exist when the ' Revision ' was published, and has been accepted by all later authors.

In 1903, when the ' Revision ' was published, there were 722 species of Hawk-Moths known throughout the world. In 1911 some 850 species were known, and the number has now risen to over 1,000. Of this total about 250 species, or one quarter, occur in the Oriental Region.

Hampson (1892) recorded 121 species from India and Ceylon, and in 1904 the number of known species had risen to 163 (J. Bombay Nat. Hist. Soc. xv, 1904, p. 630). Omitting two of Hampson's species, *Rethera kamarovi* and *Celerio zygophylli*, which occur in Afghanistan but have not been

found in India, the number of species and subspecies now known is 204. The Hawk-Moth fauna of India is therefore very rich.

We have followed, with slight modification, the system of classification, the nomenclature, and the general arrangement of the 'Revision.'

In describing the larva and pupa we number the segments from 1 to 14, segment 1 being the head and segment 2 that segment of the body lying immediately behind the head. The *length* of the larva is measured from the front of the head when held in the normal position for the species to the end of the anal claspers. The hairs which are always present on the head and body are not mentioned unless they present some peculiarity. The lengths of the various parts are measured along the dorsal line, the breadth at right angles to it. In the pupa measurements are taken from the most frontal part of the head; the *length* is the distance from this point to the tip of the cremaster. The measurements of the tongue, fore and mid-leg, and antennal case are made with reference to the distance from the front of the pupa to the tip of the wing-case; so that the statement that "the antenna is equal to the fore leg, which reaches to the middle of the wing-case," means that the tip of the fore leg case and that of the antennal case both reach to half the distance from the front of the head to the tip of the wing-case—the word "case" being omitted except when referring to the wing-case. The wings being folded up, their true length and their tips cannot be seen. The descriptions and keys refer to the full-fed larva unless any earlier instar is mentioned.

The imaginal characters of the family SPHINGIDÆ and of its subfamilies, tribes, and genera have been taken, with slight modification in some cases, from the 'Revision' and from later volumes of 'Novitates Zoologicæ,' and the imaginal characters of the species and subspecies have in most cases been taken from the same sources, rearranged and, where necessary, supplemented by the descriptions given in the 'Fauna of British India—Moths,' vols. i and iv, and other works. In describing the imago we have therefore used the same system of numbering the segments as that used in the 'Revision'—that is, the head, three thoracic segments and the abdominal segments—and we use the same system as that used in the 'Revision' in describing the venation. This system, and also that used in the 'Fauna of British India,' is shown in fig. 8.

Descriptions refer to the upperside except where the underside is specifically mentioned, and to both sexes unless the sex is specified.

In accordance with the latest practice we have used the termination "INI" instead of "ICÆ" for the names of tribes.

The food-plants of the larvæ have been given, so far as they are known, but in the case of the more common species some have been omitted for want of space.

II.—MORPHOLOGY.

The Egg.

Sphingid eggs are either nearly spherical or more or less oval in shape; they are broader than high. When oval the egg lies with the longer axis parallel with the surface to which it is attached. They vary from about 1 to 3 mm. in length. The size is not always proportionate to the size of the moth which lays it, the egg of the Convolvulus Hawk-Moth, for example, being about the same size as those of most of the Humming-bird Hawk-Moths, or about 1 mm. in length, though the Convolvulus Hawk-Moth is nearly as large as the Death's-head Hawk-Moths, whose eggs are about 2 mm. in length. The surface is smooth, usually shining, though sometimes dull to the naked eye, but under the microscope slight shagreening or an indication of reticulation can be seen in those of some species. When first laid the colour is often whitish; it may remain so, but usually turns some shade of yellow or green, more rarely brown. There are seldom any markings, though reddish bands and patches may appear in those of the genera *Marumba*, *Degmaptera* and *Panacra*; such markings are possibly due to coloured parts of the developing larva showing through the shell.

Mell (1922) discusses very fully the morphology of the sphingid egg and the number and proportion of embryos which reach maturity. Apparently *Herse* has the greatest number of embryos, all of which may reach maturity. *Oxyambulyx ocellata* lays only a small number of comparatively large eggs, from which, according to Mell, 88 may develop out of a possible 371. He obtained a maximum of 132 embryos out of 282 eggs of *Clanis bilineata* in China, but in many cases in S. India specimens of that moth laid more than 280 eggs *.

When the larva is about to emerge the head lies near one end of the egg, and the body stretches back to the other end,

* Mell considers the number of eggs laid by *Herse convolvuli* as "gigantic," and also mentions as something extraordinary the 1,100 eggs laid by a Ghost-Moth (HEPIALIDÆ). We once removed the abdomen of an apparently defunct female Ghost-Moth (*Phassus malabaricus*), and the detached abdomen laid 11,500 minute black eggs!

then bends sharply forwards again, venter against venter, to the head and under it, the horn continuing in the line of the body, but often not visible from the outside. The shell is thick and opaque in some species, translucent in others, and as the larva develops it is absorbed to some extent from the inside, till, just before the emergence of the caterpillar, it is nearly transparent. The axial line of the developing caterpillar becomes visible first; the eyes appear as minute dots before the outline of the head is visible, and they become darker and finally black; the dark tips of the mandibles are the first part to show any movement, opening and closing for quite a long time before they commence to bite their way through the shell.

Larva (fig. 1).

The sphingid larva is subcylindrical in shape when full-fed, tapering forwards slightly from segment 7 or sharply from 5. In the former case the head is usually large and in the latter small. These are, broadly speaking, the two types of larva, the former being common among the *Asemanophoræ* and the latter among the *Semanophoræ*. There are three pairs of true legs, one pair on each of segments 2, 3 and 4, a pair of prolegs on each of segments 7 to 10, and a pair of claspers on 14. There is a spiracle on each side of 2 and on 5 to 12. Whilst so far agreeing with many other lepidopterous larvæ, it is further characterized by the possession of a horn on the dorsum of segment 12. This horn is chitinized in the last instar and is present in all Indian species, though sometimes much reduced. A horn similar to that of the SPHINGIDÆ is found in a few species of NOTODONTIDÆ.

The *head* (fig. 2) consists of two lobes, together with the mouth-parts, and varies considerably in shape, not only generically and specifically but individually in different instars. It is invariably rounded in the first instar, and may remain so until the last instar, but in some genera it becomes triangular in the second instar; it may remain triangular or become rounded again in the last instar. The vertex is sometimes more or less conical, and a long process may arise from the apex of each lobe of the head in the second instar; these processes usually become shorter in proportion to the length of the head in succeeding instars, and are often represented in the final instar by a tubercle at the apex of each lobe. The two processes are closely appressed till near the tips, where they diverge shortly. The triangular shaped head characterizes the subfamily AMBULICINÆ, and is never found in the tribe Acherontiini (though appearing again in the genus *Dolbina* of the tribe Sphingulini), nor in the subfamilies CHÆROCAMPINÆ and PHILAMPELINÆ; but it occurs again

in the genus *Sataspes* of the tribe Sesiini, subfamily SESIINÆ, connecting the *Asemanophoræ*, Ambulicine insects, with the *Semanophoræ*, Philampeline forms.

The highest region of the head is called the vertex ; behind the vertex is the occiput, with a small triangular sinus situated dorsally on the hinder margin and called the occipital sinus ; the front of the head is called the face, the side the cheek, the underside of the head behind the mouth-parts the gula or throat.

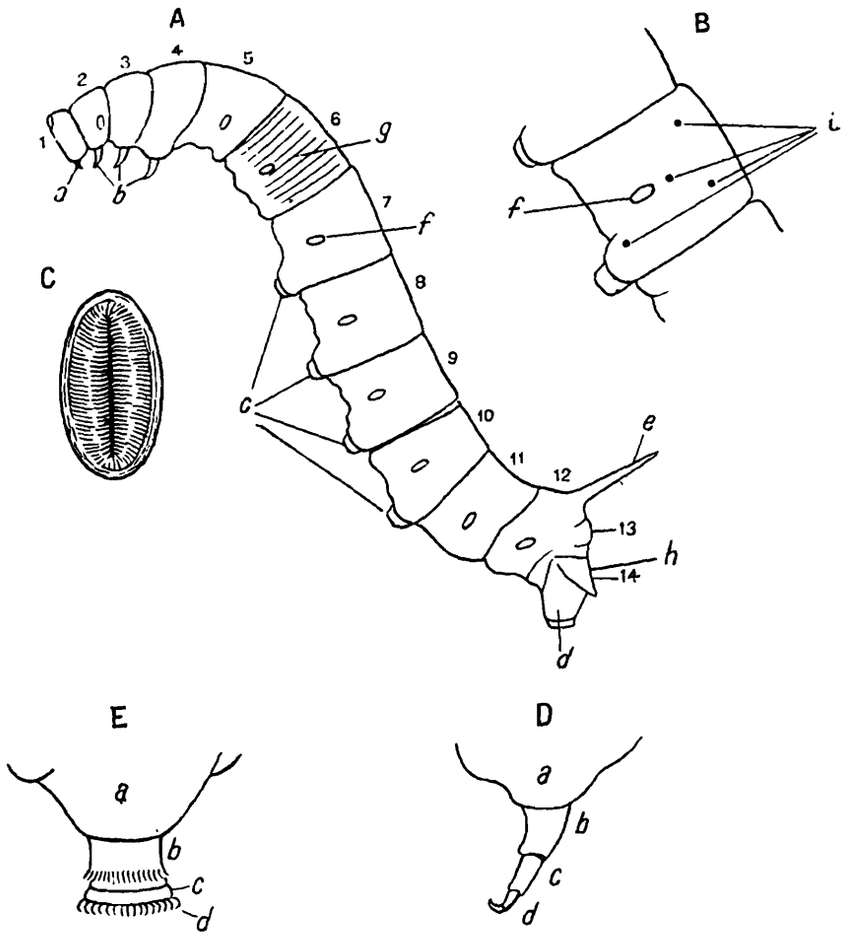


Fig. 1.

A. A sphingid larva. The segments are numbered 1 to 14. *a*, antenna; *b*, true legs ; *c*, prolegs ; *d*, claspers ; *e*, horn ; *f*, spiracle ; *g*, secondary rings ; *h*, anal flaps.
B. Segment 8, enlarged. *f*, spiracle ; *i*, the four main hairs.
C. Spiracle, enlarged, showing central slit.
D. One of the true legs. *a*, base ; *b*, first segment ; *c*, second segment ; *d*, third segment, bearing a claw.
E. Proleg. *a*, base ; *b*, shank, with terminal fringe of hair ; *c*, ankle ; *d*, foot, with a fringe of hooklets.

The true *clypeus* (fig. 2 A, *b*) is roughly triangular, but the apex may be rounded ; the sides may be straight or curved inwards or outwards ; the base is generally somewhat emarginate and the basal angles are frequently occupied by low

rounded tumidities. The length of the clypeus is rarely more than half that of the head, and often considerably less than half. The false clypeus (fig. 2 A, *d*) is a narrow strip

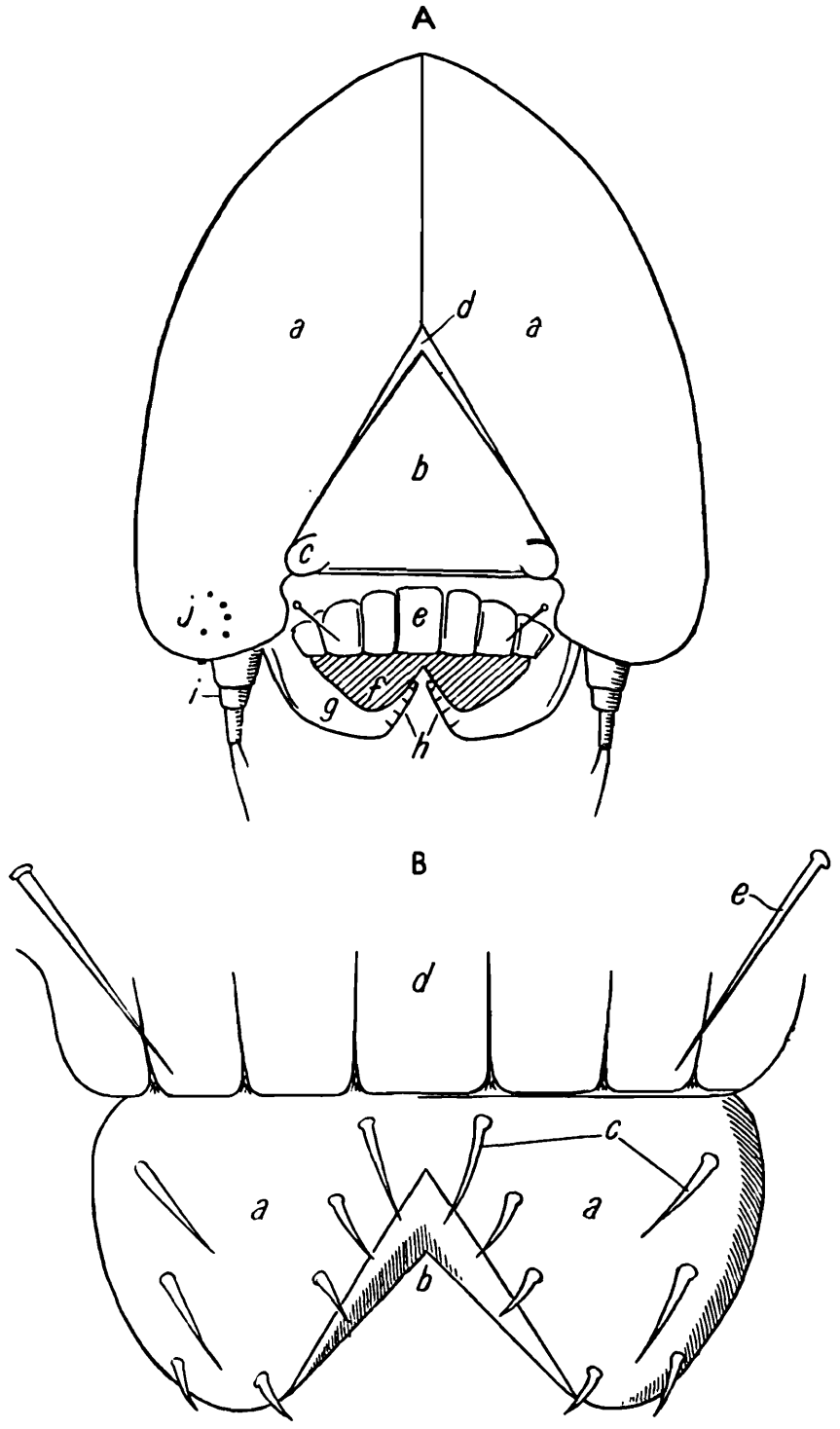


Fig. 2.

A. A diagrammatic representation of the larval head, seen from the front. *a*, lobes; *b*, true clypeus; *c*, basal tumidities; *d*, false clypeus; *e*, labrum, with lateral bristles; *f*, ligula; *g*, mandibles; *i*, antenna, with special bristles; *j*, eyes.

B. Ligula and part of labrum of *Polyptychus trilineatus sonanthis*, seen from the front (greatly magnified). *a*, ligula; *b*, sinus, showing bevelled edge; *c*, bristles; *d*, labrum, lower part; *e*, labial bristles.

lying outside the true clypeus; its apex may be acute or rounded, and the sides may extend downwards to the base of the true clypeus. The false clypeus is not present in the earlier instars, but is always present in the last instar, though sometimes it is difficult to trace, as in the genus *Macroglossum*.

The *labrum* (fig. 2 A, *e*) is a transverse plate, the proximal part chitinized, the distal part generally membranous; measured along the dorsal line it is between one-half to one-third the length of the true clypeus. The front or lower margin is straight and the hinder margin arched towards the base of the clypeus; the hinder margin is connected with the base of the clypeus by membrane which allows it a certain amount of movement. In many species the labrum is sculptured by longitudinal ridges, as shown in the figure, but in other species it is smooth; at each side there is a prominent bristle (fig. 2 B, *e*), which is directed forwards, downwards and inwards.

The *ligula* (figs. 2 A, *f*; 2 B, *a*) lies below the labrum, and serves to direct the edge of the leaf to the cutting surfaces of the mandibles when the larva is feeding. It is apparently developed from the lining of the gullet, being rooted under the labrum and independent of it, as is shown both by dissection and by the fact that it can be seen to be protruded and retracted when the larva is feeding. It is also capable of being altered in shape at will, so that it is either transversely convex or flat. It is very generally kidney-shaped, with a frontal triangular sinus which varies in depth and width in different species. In some of the Ambulicine larvæ (genus *Oxyambulyx*) the ligula is very long and the sinus very deep and narrow; the structure then resembles in shape two sausages joined at the base. The surface is smooth and set with stout bristles, the position of which in *Polyptychus trilineatus sonanthis* is shown in fig. 2 B. We are unable to say if these bristles occupy the same position in all genera and species.

The *mandible* (fig. 2 A, *g*) is a strong, truncated, hollow wedge, the base fitting into a socket in the skull near the base of the antenna. The basal half is curved gently away from the antenna, and the distal end is flattened, bevelled and more strongly curved in the same direction, so that the outer edges nearly face each other inwards and form the cutting edges. In the first instar the cutting edges are definitely toothed, but the teeth become less prominent in later instars until, in the last instar, they have almost disappeared, and are often represented only by transverse grooves.

The *antenna* (fig. 2 A, *i*) is composed of three segments. Its base is set in a cavity of the skull into which the whole

organ can be more or less retracted. The basal segment is the thickest, and is usually equal in length to the third; the second segment is shorter and is of less diameter than the basal segment; the third is the thinnest, and has at its tip two bristles of varying (in different species) and markedly unequal length. The colour is uniform in different colour-forms of one species.

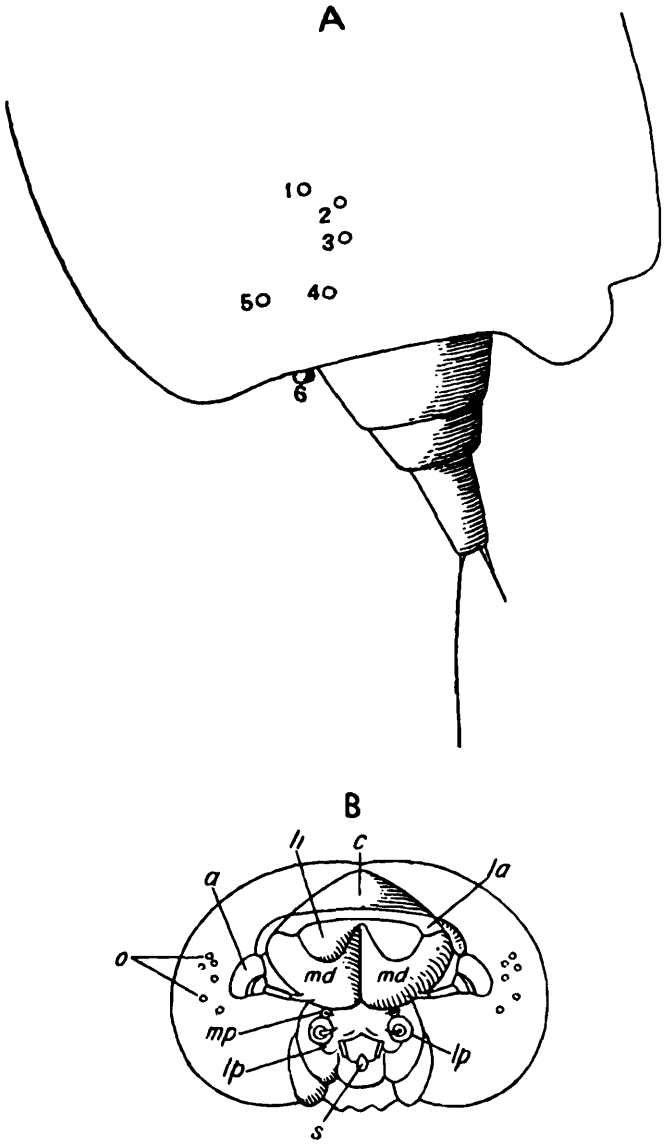


Fig. 3.—Larval head.

A. Lower portion of the right lobe, seen from the front, showing position of eyes (greatly magnified).

B. A diagrammatic view, seen from below. *a*, antenna; *c*, clypeus; *la*, labrum; *li*, ligula; *lp*, labial palpi; *md*, mandibles; *mp*, maxillary palpi; *o*, eyes; *s*, spinneret.

The *eyes* (figs. 2 A, *j*, 3 A) are situated partly on the cheeks and partly on the gula. They are six in number on each side, in a group just above the base of the antenna. They are simple, round and convex, and are often raised on a chitinous base. They are vitreous in appearance, often nearly

colourless, with a black pupil, and the base often reddish-brown or black in colour.

We call the uppermost eye no. 1, and number the rest downwards. Eye 2 is a little below and on the inner side of 1 ; 3 is below and slightly on the inner side of 2 ; 4 is well below and slightly on the outer side of 3 ; 5 is slightly below 4, and on the outer side of all the rest ; 6 is the lowest, and is situated on the under surface of the head near the base of the antenna, directed downwards. Eyes 1 to 4 lie on a curve convex to the base of the mandible, 3, 4 and 6 always more or less in a straight line, with 6 at a greater distance from 4 than the latter is from 3 ; 5 is always on the outer side of 4 and 6 ; 4, 5 and 6 often lie at the corners of an equilateral triangle. Within these limits the arrangement of the eyes varies in different species, and the size of the eyes also varies.

The *surface* of the head may be dull or shining and polished ; it may be smooth or covered more or less closely with setiferous tubercles, and between these there may be superficial corrugations or reticulations ; in addition to the bristles on the labrum, ligula and antenna already mentioned, there are main hairs arranged very similarly to those on the body segments—one on each side of the apex of the false clypeus, one on each side at its middle, and one on each side near the base of the true clypeus.

The *body* in the first instar has the same shape in all subfamilies. It is always cylindrical, with a straight bifid horn, the diameter of the body and the length of the horn varying with reference to the length of the body in different species. In the full-fed larva the shape varies with the subfamily. In the ACHERONTIINÆ the body is nearly cylindrical, tapering only slightly from segment 7 to the large rounded head ; in the AMBULICINÆ the body tapers more sharply from segment 5 to the large triangular head ; the SESIINÆ larvæ either resemble those of the AMBULICINÆ or have bodies nearly cylindrical ; the larvæ of the subfamilies PHILAMPELINÆ and CHŒROCAMPINÆ taper sharply forwards from segment 5 to a small rounded head, and segments 4 and 5 are sometimes tumid and, more rarely, laterally flanged. Except for the horn, important processes of any kind are rare in Hawk-Moth larvæ ; in the genus *Polyptychus* the newly-hatched larva has a dorsal prominence on segment 14, but it disappears in the later instars ; *Pseudodolbina fo* has long fleshy tubercles on segments 3, 4 and 14 ; in a larva recently discovered by us (*Apocalypsis velox*) some of the tubercles are developed into long fleshy spines ; *Meganoton nyctiphanes* has a fleshy hump on 3. The proportional lengths of the

segments are very similar to those of other lepidopterous larvæ, the divisions between them being always visible, though more clearly defined in some species than in others. Each segment from 2 to 12 has more or less deeply depressed transverse lines which divide the segment into *secondary rings* (fig. 1, *g*); on segment 2 there are three rings, on segment 3 there are usually six, on segment 4 seven, and on segments 5 to 11 eight each; on segment 12 there are three or four complete rings near the front margin and others which do not reach the dorsum. In the first instar the horn is always straight, tapering gently from a truncate-conical base to a shortly bifid tip, each arm of the fork bearing a seta. It is usually long, and may be very long. In succeeding instars it becomes proportionally shorter, except in a few species, and often changes in shape. In the full-fed larva it may be straight, or curved downwards or upwards, or curved first downwards and then upwards, as in the genus *Acherontia* (but not in *Psilogramma*, as stated by Rothschild & Jordan, 1903, p. 42). It may be long or short, stout or thin; in *Langia zenzeroides* and in some of the species of *Clanis* it is reduced to a large conical tubercle, in the genus *Elibia* to a rounded tubercle; in *Rhodosoma* and *Degmaptera* it is flattened laterally, and in *Rhagastis* and *Cechenena* it may be flattened laterally or clubbed. It usually ends in a simple point, but may remain bifid to maturity.

The *surface* of the body may be dull or shining, with or without tubercles on some or all of the segments, or with tubercles in some instars only. In the first instar the surface of the horn is either smooth and shining or dull, and in some species it is covered with small setæ which may arise from granules. In the last instar the surface of the horn may be rough, with pointed or rounded setiferous tubercles, or smooth as in most of the genus *Macroglossum* and the subfamily CHŒROCAMPINÆ: it is usually strongly chitinized and shining, but may be dull; the bifid tip usually disappears, being replaced by a simple point. In the flattened horn of *Degmaptera mirabilis* the setæ become spinous on the under surface.

The *legs* (fig. 1 D) consist of a base *a* and three segments *b*, *c* and *d*, the last of which bears a simple claw. The *proleg* (fig. 1 E) consists of a base *a*, shank *b*, ankle *c*, and the foot *d*, set with curved hooklets. The proleg of segment 10 is invariably larger than that of segment 9, and the latter is sometimes larger than the co-equal pairs of segments 7 and 8. The *clasper* is similar in construction to the proleg, but the shank is larger and more conical. The upper edges of the claspers are covered by the triangular anal flap.

The horn appears to have developed from a pair of tubercles on segment 12. The tubercles are most strongly developed in the subfamilies ACHERONTIINÆ and AMBULICINÆ, and are largest on the dorso-lateral line and on the oblique stripes; they are least in evidence in the subfamily CHŒROCAMPINÆ, and their presence or absence is of considerable phylogenetic importance. They are often present on segment 2 and on the anal flap and claspers when entirely wanting elsewhere. They are frequently wanting in the newly-hatched larva, but may develop in later instars; more rarely the reverse occurs. They develop rarely into long fleshy spines or processes, as mentioned above.

The *spiracles* are always oval in shape, with a central longitudinal slit and often a raised chitinous rim. Those on segments 2 and 12 are usually larger than the rest, and that on 12 is placed obliquely, the long axis roughly on a line drawn from the base of the horn to the lower edge of the front margin of the segment. The remaining spiracles have the long axis at right angles to the dorsal line of the larva.

Chætotaxy.—We have, unfortunately, not studied the hairs of the newly-hatched larvæ of many of the species we have bred, but in the case of *Clanis phalaris* they are arranged in small groups; in *Cephonodes* and *Gurelca* they are branched; in *Sataspes infernalis* they are bifid; in *Rhopalopsyche nycteris* they are simple; the compound hairs in each case becoming simple in the second or third instar. The secondary hairs are sometimes wanting. The body of the larva in the last instar is covered with minute hairs, amongst which, on each segment, there are some much larger ones which we call the main hairs. The minute secondary hairs are arranged, usually in a single row, along the secondary rings. On segment 2 there are two transverse rows of main hairs, one row close to the front margin and another row at about the middle of the segment; on segments 3 and 4 there is one row at about the middle of the segment; each row is composed of four hairs on each side of the dorsal line—one subdorsal, one dorso-lateral, one supra- and one subspiracular. On the remaining segments the hairs are not in a row; on 5 to 11 the subdorsal hairs are in front, usually on the third secondary ring, the dorso-lateral hair being behind on the sixth ring; the supraspiracular hair is just above and in front of the spiracle, and the subspiracular below the spiracle; the two upper pairs of hairs form what is called the *dorsal trapeze*. On 12 the dorsal trapeze is arranged differently, the dorso-lateral pair of hairs being in front and the subdorsals behind; on 14 the trapeze is similar to that on 12 except that the subdorsals are at the very end of the anal flap;

the hairs which on this segment take the place of the supra- and subspiracular hairs on the other segments are placed one behind the other, also on the edge of the anal flap, in front of the subdorsals. The distance between the subdorsal and the dorso-lateral pairs of hairs is about one-third the length of the segment, and the subdorsals are about the same distance apart from each other; the subdorsals are the shortest and are hardly traceable among the secondary hairs; the dorso-laterals and supraspiraculars are about equal in length and slightly longer than the subdorsals; the subspiraculars are the longest, and may in the last instar be about twice the length of the spiracle. The main hairs are usually simple (the secondary ones are always so), but there are species in which the subspiracular is compound; it is palmately branched in a horizontal plane in *Psilogramma* and *Cizara*, as well as in a few species of other genera; it is always very fine and delicately inserted, and appears to be always moving from the base; it is very easily broken off or removed by slight friction; when simple it is usually erect, but may be decumbent.

In addition to the hairs described above there are always some ventral main hairs, and, in the adult larva, there are some hairs on the segments of the true legs and a fringe of eight to twelve comparatively stout hairs starting from the lower margin of the shank and subtending the ankles of the prolegs, three more on the base of the proleg and some along the hind margin of the clasper face. The fringe at the end of the shank is never developed in the newly-hatched larva, in which there is a single hair. Each hair arises from a circular spot, which often develops into a granule and in many genera into a rounded or conical tubercle of a horny or fleshy consistency, which may be simple or multiple.

Coloration.—Commonly some shade of green or bluish-green, with various markings, but is sometimes brown, black, yellow, reddish or variegated. Colour dimorphism is not rare, and in some species there is trimorphism or even polymorphism. The head may be immaculate or dotted and longitudinally striped. The markings of the body take the form of longitudinal and oblique stripes, patches and bands with dots or transverse lines. Eye-like markings (*ocelli*) are common in some of the subfamilies, and in a few species the spiracle on segment 5 is surrounded by an ocellus-like spot. The horn is usually black in the first instar, but may be yellow, green or parti-coloured (*Rhyncholaba*). In later instars the colour is very varied. The colour and markings of the larvæ are characteristic of whole genera and even of some of the subfamilies.

Pupa (fig. 4).

We number the segments of the pupa from 1 to 14 as in the larva, segment 1 being the head and segment 14 the anal or cremastral segment. Segment 2 is the prothorax, 3 the mesothorax and 4 the metathorax, the three together forming the thorax ; segments 5 to 14 form the abdomen.

Head.—The front is called the frons, the lower part the

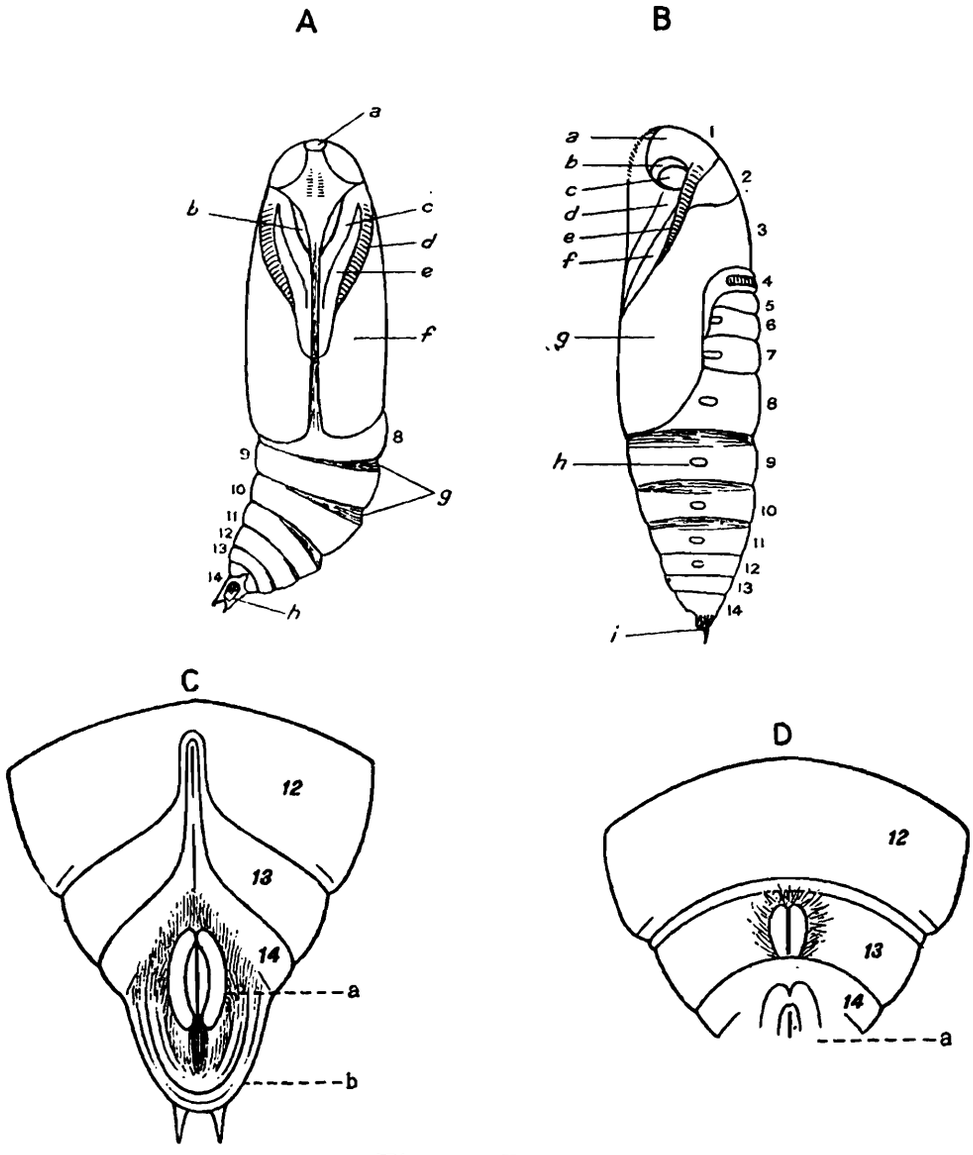


Fig. 4.—Pupa.

A. Ventral view, showing *a*, appendage to clypeus, consisting of labrum and ligula ; *b*, coxal piece ; *c*, fore leg ; *d*, antenna ; *e*, mid-leg ; *f*, wing-case : *g*, bevels of movable segments ; *h*, cremaster.

B. Lateral view, showing segments 1 to 14. *a*, frons and clypeus region of head ; *b*, eye-crescent ; *c*, eye ; *d*, fore leg ; *e*, antenna ; *f*, mid-leg ; *g*, wing-case ; *h*, spiracle ; *i*, cremaster.

C. Female pupa of *Acherontia lachesis*, showing segments 12, 13, 14. *a*, clasper scar ; *b*, cremaster.

D. Male pupa of *Acherontia lachesis*, showing segments 12, 13. *a*, clasper scar.

clypeus. The larval clypeus is altogether wanting in the pupa; the name has, however, been retained and applied by most authors to the lower portion of the frons. In the process of the transformation of the larva into the pupa the head appears to undergo a bilateral screwing motion which obliterates the larval clypeus and raises the eye-region and antennæ towards the vertex of the pupal (and imaginal) head. Attached to the pupal clypeus is a composite piece which appears to correspond with the labrum and ligula of the larva.

The top of the head adjoining segment 2 is called the vertex; on each side of the head is a large eye-case; the base of the tongue-case is next to the composite appendage of the clypeus; its tip sometimes does not reach beyond the anterior junction of the wing-cases, as in many AMBULICINÆ, but more commonly continues as a narrow ridge entirely separating the wing-cases. In those species of which the imago has a very long tongue some special arrangement has to be made for its storage in the pupal case. This is provided by the extension of the head of the pupa into a laterally flattened hollow sheath, as in *Cechenena lineosa*, or by the development of a free tongue-sheath in the form of a tube projecting from the front of the head and bending backwards towards the venter, the closed end being bulbous to allow of the tongue turning back without too sharp a bend. The free sheath is of varying length in different species, and the distal portion may be curved into a semicircle or a spiral. This free sheath is found in some of the genera of the tribes Acherontiini and Sphingini of the subfamily ACHERONTIINÆ, and again in *Rhyncholaba acteus* of the subfamily CHŒROCAMPINÆ.

Thorax.—The case of the fore leg lies nearly parallel with the tongue-case (fig. 4); in some species there is a small, bipartite, diamond-shaped piece between the tibia and the tongue-case; Mell calls it the "shin," but it is doubtful what it represents. We have reason to suppose it to be the coxal trochanter of the fore leg, and we call it the "*coxal piece.*" In many species it is hidden under the femur and tibia of the fore leg. The mid-leg (fig. 4 A, *e*) lies immediately outside the fore leg and the antenna outside the mid-leg, with its base near the top of the head next to the eye-case. The hind leg is hidden beneath the wing-case, but the extreme tip may in some instances just appear between the apices of the wing-cases, which always end at or near the hind margin of segment 8; the fore wing lies over the hind wing and covers all but a narrow band of it which is visible along segments 4 to 7 Segments 9, 10 and 11 of the abdomen

are usually movable, and the margins are more or less deeply bevelled.

Markings.—The surface of the pupa is dull or polished and shining, and either smooth or pitted, wrinkled or corrugated. Sculpturing is often present on the head, segment 4, the antespiracular region of 9, 10 and 11, the ventral surface of 13 and 14, and the cremaster. Head-sculpturing is found in the genera *Marumba*, *Parum* and *Sataspes* in the form of a pair of frontal, very rugose ridges; sculpturing on segment 4 in *Acherontia* and *Meganoton* as subdorsal pear-shaped, raised and roughened surfaces, and in *Psilogramma* and *Herse* as a pair of subdorsal weals or ridges. The antespiracular sculpturing consists of a specifically varying number of roughly parallel ridges on the front bevels of the movable segments 9, 10 and 11; this is found in most of the Acherontiine pupæ and in *Compsogene*, *Clanis*, *Marumba* and other Ambulicine forms, with slight indications of it in some of the CHŒROCAMPINÆ. The sculpturing on segments 13 and 14 consists of the clasper scars and sex marks, and the cremaster is often corrugated, pitted or ridged. The sex of a pupa can, in most cases, be determined by examining the ventral aspect of segments 13 and 14. The scars of the anal claspers (fig. 4 C, D) are on segment 14 in front of the base of the cremaster, the scar on each side of a central depression forming a somewhat sausage-shaped thickened "lip," the two scars together forming a longitudinally-placed, mouth-shaped organ. In the ♂ pupa (fig. 4 D) there is on 13 a similar but smaller mark and no mark on 12, and the margins of 12, 13 and 14 are not emarginate. In the ♀ pupa (fig. 4 C) these margins are distorted by the middle anterior portion of segment 14 being produced in a tongue-like or triangular process right across 13 and forwards to the middle of 12, carrying, so to speak, the middle part of 13 with it, as shown in the figure. The large "mouth" in the figure is formed by the clasper scars; the black median line on 13 is the posterior of two marks which always occur in ♀ pupæ; it probably represents the anus of the imago. This mark may be shorter or it may be broader than in the figure, or may even be more or less circular, and it is often connected by a depressed line with the generally better defined and usually broader and rounder mark in the middle of 12, in the very apex of the tongue or triangle; in some cases this latter, presumably sexual, depression is also mouth-shaped. Sometimes these "sex" marks are faint and difficult to distinguish, but a single mark on segment 13 and no mark on 12 always indicates a ♂ pupa; a blurring of the segment margins and a mark in the middle of segment 12 always indicates a ♀.

Spiracles (fig. 4 B, *h*).—These are situated on segments 2 and 5 to 12, as in the larva, though those on 5 are generally hidden beneath the visible inner margin of the hind wing; those on 2 are placed in the division between segments 2 and 3 and are often covered by a lobe extending from the front margin of 3 which fits into a corresponding emargination of the hind margin of 2. They are oval in shape as in the larva.

The *cremaster* is a chitinous extension from the dorsal surface of segment 14; it may be broadly or narrowly conical, or flattened, long or short, with the tip usually bifid; in some species there are additional lateral teeth or spines, and these, like the terminal ones, may be branched or end in hooks, or may be simple. In *Langia* the cremaster is reduced to a minute spine or is absent.

Coloration.—In those species which pupate in a cell underground the colour is either black, brown or chestnut, without any markings, except in *Degmaptera mirabilis*, which is chestnut with the eye-cases cream-coloured; the surface of these pupæ is usually highly chitinized and shining. The pupa of *Psilogramma menephron* is exceptional in being covered with a plum-like bloom. The pupæ of those species which pupate in a cocoon on the surface are usually pale in colour with darker stripes and spots, or parti-coloured, but the pupæ of the subfamily SESIINÆ are of the uniform dark type, though they pupate on the surface. In the subfamily PHILAMPELINÆ the pupa of *Cizara sculpta* is prettily marked and those of the genus *Panacra* are variegated, resembling green and grey lichens; that of *Angonyx testacea* is an exception in being nearly uniform black in colour. Pupæ of the subfamily CHŒROCAMPINÆ are usually pale with darker stripes and dots.

*Imago** (figs. 5, 6, 7, 8).

Head (fig. 5).—The dorsal skeleton is divided by two transverse sutures into the clypeus (*cl*), epicranium (*ecr*), and occiput (*occ*).

The *epicranium* forms laterally the sockets for the antennæ, which stand nearer the eye in some Hawk-Moths than in others.

The *clypeus* is the largest plate of the three; it is more or less strongly convex, especially mesially. It bears at the anterior margin the *labrum* (*lr*). The labrum is in most instances raised to a large, transverse, cariniform tubercle, which is generally vertical in front. It projects sometimes frontad over the base of the tongue, concealing the mesial part of the epistome (*ep*).

* This account is taken from Rothschild and Jordan's 'Revision,' 1903.

The *epistome* covers the base of the tongue. When normal it has a thin mesial lobe and a large process at each side. The lateral processes are designated "pilifer" by Kellogg. The normal *pilifer* (*p*) is a curved obtuse process, concave and flattened on the inner side, and is beset on the inner surface with a great number of long stiff bristles which project over the base of the tongue, which they touch.

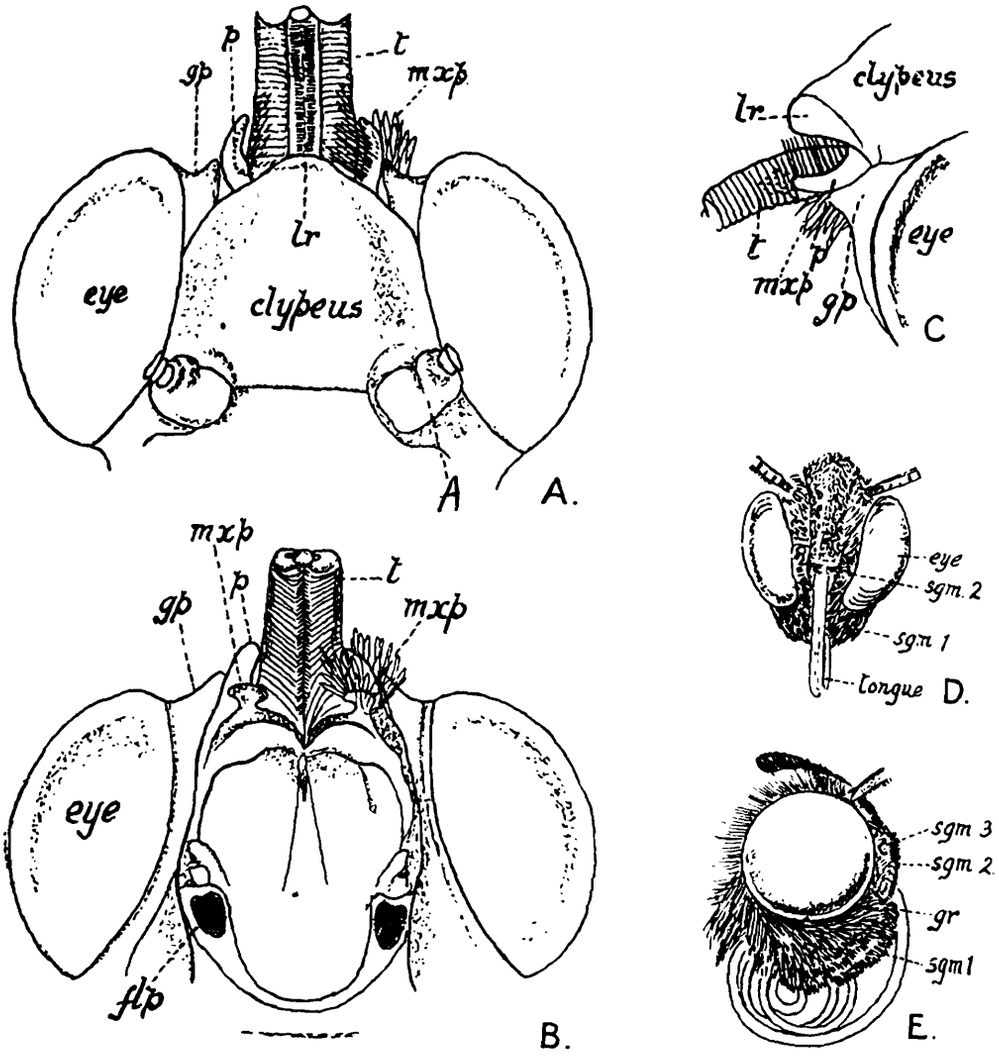


Fig. 5.—Morphology of head.

A. Head of *Psilogramma menephron*, denuded, dorsal view. *A*, base of antenna; *gp*, genal process; *lr*, labrum; *mxp*, maxillary palpus; *p*, pilifer; *t*, tongue.

B. Head of *Psilogramma menephron*, denuded, ventral view, labial palpi removed. *flp*, groove in which labial palpus is inserted; other lettering as in A.

C. Mouth-parts of *Psilogramma menephron*, lateral view. Lettering as in A.

D. Head of *Cechenena lineosa*, frontal aspect.

E. Head of *Cechenena lineosa*, lateral aspect. *gr*, cavity of first segment.

The *genal process* (*gp*) is a more or less triangular projection between the pilifer and eye, supporting the former laterally. It is an enlargement of the brim which separates the eye from the large labial cavity of the underside of the head.

It is very large in *Macroglossum* and is smallest in the CHŒROCAMPINÆ.

Below the pilifer close to the tongue on each side is a short process which is the remnant of the maxillary palpus (*mxp*). It is in most cases densely clothed with long white scales. The size of the vestigial maxillary palpus is not constant in the family, nor has the palpus always the same shape. The transverse arched strip of chitin between the labial palpi is the *mentum*.

The *proboscis*, or tongue, is formed by the first pair of maxillæ, and consists of two halves closely applied to each other. Each half is concave on the inner side, and bears at the inner edge a very dense fringe of cilia. The sucking-tube itself, formed by the two halves of the glossa, is closed above by the fringe, the cilia of which are fused together to form a membrane. Among SPHINGIDÆ we find the longest tongue of all insects, but it varies from 25 cm. in *Cocytius* to 2 mm. in some *Polyptychus*.

The *palpus* (fig. 7 G), if not reduced, is large, broad in lateral aspect, closely contiguous to the head, and has a short third segment. A palpus like this does not occur outside the family. There are always three segments; the third is, however, nearly always very short and concealed in the scaling of the second, projecting as a little knob.

The first segment is the longest as a rule, and is curved, lying along the eye. The inner surface is more or less regularly annulated or wrinkled, flattened or slightly convex, or somewhat concave. It is naked, except the edges, with some long hair-like scales; or it is more or less loosely scaled for the greater part. A character of the greatest importance in the classification of the Hawk-Moths is found at the base of the first segment—that is, a patch of variable size of short (and doubtless sensory) hairs (*a*), which is always present in one section of the family, excepting a few reduced forms, and equally constantly absent from the other section. This basal patch is found in butterflies, and is of wide occurrence in moths.

A peculiar modification of the first segment is found in *Megacorma* and in a great number of CHŒROCAMPINÆ. There is at the apex of the segment, ventro-laterally, a space devoid of the ordinary scaling, being either quite naked or clothed with a few long hair-like but flat scales. The scaling around this naked space, which is often somewhat concave, is more or less regular, especially ventrally, and, surrounding the naked space, forms a kind of cavity (fig. 5 E, *gr*).

The second segment undergoes many modifications in shape; it may be subcylindrical, quadrangular, triangular, ovate; it may be longer or shorter than broad, or square.

The *antennæ*, when strongly clubbed, have the proximal segments occasionally nearly or totally scaled. The sense-bristles are stiff hairs of varying length. The normal number of the bristles found on the non-scaled surface, if we except the end-segment, is two on each side. The number is sometimes doubled, but there is never a complete transverse series, and the bristles are never apical. The dorso-lateral bristles, situated close to the edge of the scaled area, are very often so prolonged and become so stout that the antenna has the appearance of being pectinated.

There occur all intergradations in shape between the most strongly clubbed antenna of *Hæmorrhagia* to the setiform antenna of *Megacorma*. The cilia are apparently always fasciculate. They occur in the males of all Hawk-Moths, except *Rhopalopsyche*, and are also present in a good many females, though they are here always developed in a lesser degree than in the respective males.

The well-known hook in which ends the antenna of very many SPHINGIDÆ, but not of all, occurs in all subfamilies. The end-segment is of particular taxonomic value. The length and shape, and the clothing with scales and bristles of this segment, vary very much and offer good distinguishing characters of genera and even tribes.

The *eye* is subglobular and varies much in size. It is never hairy, but is often covered above by a kind of eyebrow and below by a large tuft of hairs.

Thorax (fig. 6 A, B).—The *mesonotum*, composed of the præscutum, scutum and postscutum (=scutellum), is very large. The *præscutum* (*psc*) is distinctly triangular in dorsal view. The *scutum* (*msc*) is widest behind and a little longer than broad. The *postscutum* (*mscl*) varies obviously in size and shape. Similar parts compose the *metanotum*. The scutum (*mtsc*) is divided into two halves widely separate. The postscutum (*mtscl*) is always narrow.

The ventral parts of the meso- and metathorax do not differ much in size. The *sternum* (*st*) and *peristernum* (*pest*) are not completely separated from one another. The peristernum is large and remains broad at the obliquely truncate upper end, where it leans against the *parasternum* (*past*). This is a large plate extending obliquely dorsad and mesiad from the meral suture (*smn*), separating the meral and sternal parts of the sternite, to the membrane connecting meso- and prothorax. Between this plate and the notum the mesothoracic tegula (*mtg*) is inserted. Below the parasternum lies the *episternum* (*est*), with which are fused the *hyposternum* (*hyst*) and the marginal strips along the coxal cavity. The episternum is always obliquely truncate, with the upper inner angle more or less pointed.

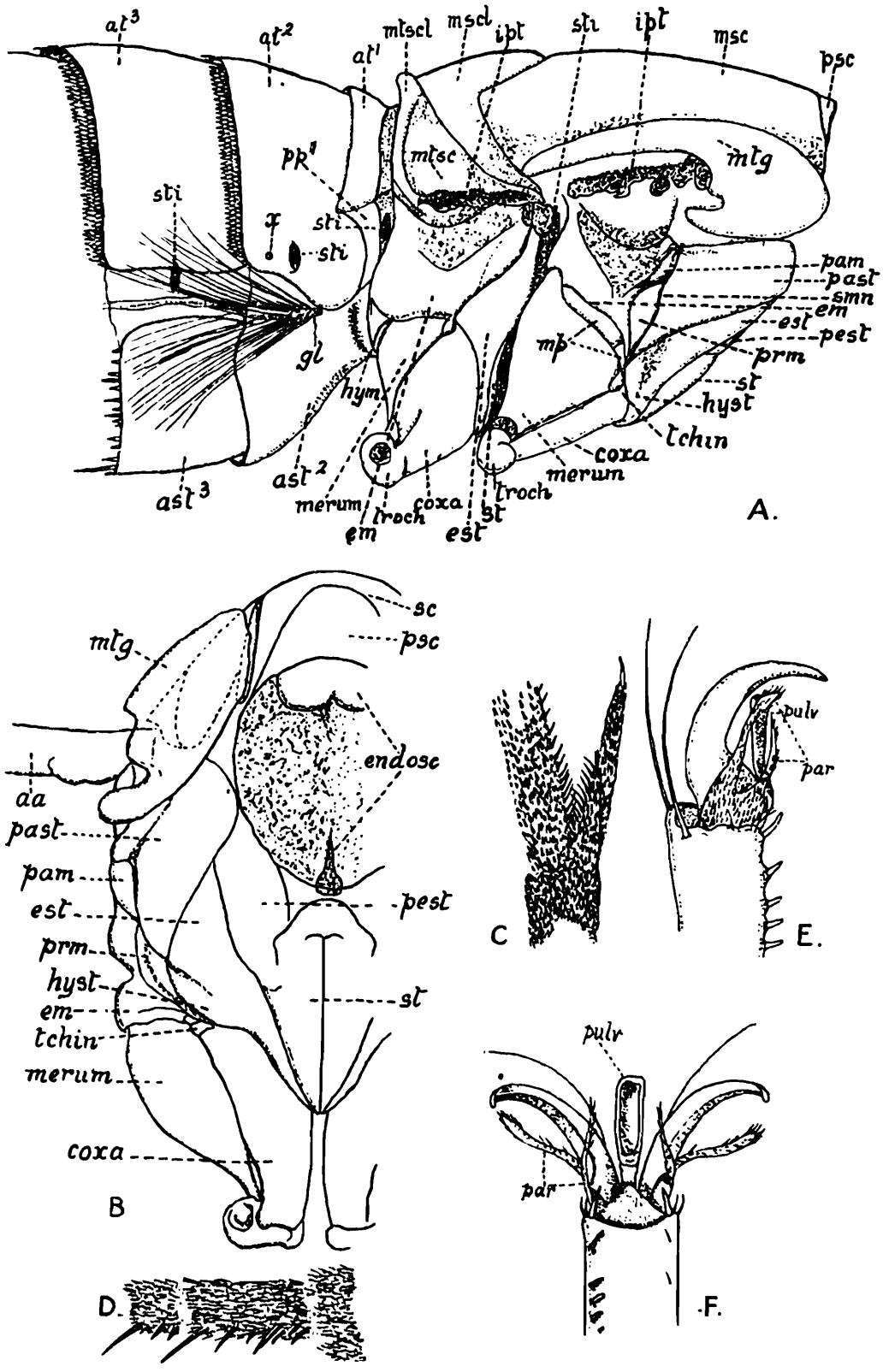


Fig. 6.—Morphology of thorax.

A. Mesothorax and first abdominal segments of *Herse convolvuli*, lateral aspect. at^1–at^3, tergites of first, second and third abdominal segments; ast^2, ast^3, sternites of second and third abdominal sternites; *em*, epimerum; *est*, episternum; *gl*, gland between sternite and tergite of second abdominal segment; *hym*, hypomerum; *hyst*, hyposternum; *ipt*, insertion of wing; *mp*, marginal strip; *msc*, scutum of mesothorax; *mscl*, scutellum of mesothorax; *mtsc*, scutum of mesothorax; *mtscl*, scutellum of metathorax; *mtg*, mesothoracic tegula; *pam*, paramerum; *past*, parasternum; *pest*, peristernum; *pp*, parapleurum; *prm*,

The meral half of the sternite is made up of the *paramerum* (*pam*) and the *protomerum* (*prm*), two more or less strongly convex plates, together with the large *epimerum* (*em*). A marginal strip (*mp*), situated along the meral cavity, is separated by a more or less distinct suture from the epimerum.

The metasternite is more simplified than the mesosternite. The episternum and epimerum are the only large plates.

Leg (fig. 6 C, D, E, F).—The segments forming the leg comprise the coxa, trochanter, femur, tibia and tarsus.

The *coxa* is inserted in a groove formed by the sternal part of the sternite. The *trochanter* (*troch*) is borne by the coxa and is supported behind by the merum. The *femora* always remain simple. *Tibia* and *tarsus* undergo several modifications. The apex of the fore tibia is often produced into a strong process (a thorn). The tibiæ are more or less spinose. The mid-tibia has one pair of slender spurs. The hind tibia possesses normally two pairs of spurs, but the proximal pair very often disappears.

The mid-tarsal spines are specialized to form a comb in many SPHINGIDÆ, especially in ACHERONTIINÆ. The hind tarsus is generally longer than the mid-tarsus. The comb is less strongly developed.

The fifth segment of all tarsi bears some stout and pale sensory hairs at the end on each side close to the apical spine, forming often a brush. There are two long bristles dorsally close to the edge, curving ventrad.

The claw-segment is composed of the claw (*onychium*), the false claw (*paronychium*), the pad (*pulvillus*) and the *empodium*. The empodium is a small tubercle above the pad between the claws, bearing one bristle, seldom two. It is seldom found in SPHINGIDÆ. The claws are simple and dilated at the base. The *pulvillus* (*pulv*) is sometimes absent. The *paroncychium* (*par*) possesses in its most generalized state two slender lobes on each side.

Wings (fig. 8).—The neuration or arrangement of the veins of the wing is dealt with in the systematic section. The frenulum and retinaculum are sometimes reduced, vestigial

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protomerum; *psc*, præscutum of mesothorax; *st*, sternum; *smn*, meral suture; *sti*, stigma; *tchin*, trochantinus; *troch*, trochanter.

B. Mesothorax of *Herse convolvuli*, frontal aspect. *aa*, anterior wing; *endosc*, endoskeleton; *sc*, scutum; other lettering as in A.

C. Mid-tibia of *Nephele accentifera*, showing spurs and base of first tarsal segment.

D. Tarsus of *Acherontia styx*; first and second protarsal segments, lateral aspect.

E. Tarsus of *Cocytius duponchel*; fifth and claw-segment of fore tarsus, lateral aspect. *par*, paronychium; *pulv*, pulvillus.

F. As fig. E, ventral aspect.

or absent. The fore and hind wings are very variable in shape.

Abdomen (fig. 7 D, E).—Lepidoptera have ten segments. The ninth and tenth of the male and the eighth to tenth of the female are modified. The sphingid abdomen possesses an armature of spines. The spines stand at the edges of the segments, and are found on segments 2 to 8 in the male and 2 to 7 in the female. The most frequent arrangement consists of several rows of elongate, flattened spines, those of the proximal row being the shortest and those of the last row the longest. There is a second type of spine in which they are all flat, black and glossy, being very strongly chitinized. This kind of spination makes the abdomen smooth and slippery. In the third type, which is connected by intergradations with the first, there is only one series of spines, which stand often well apart and are long, conical and very strong.

The first abdominal segment (fig. 6 A) consists of a *tergite* (*at*) and a more or less triangular lateral plate, the *parapleurum* (*pp*) ; it bears no trace of real spines. The first abdominal stigma (*sti*) lies free in the membrane in front of the parapleurum. The second to sixth tergites are essentially of the same structure, the spines of the posterior ones becoming stronger. The seventh tergite is longer, with the sides more strongly converging anad in most species. The eighth tergite (fig. 7 F) is small and partly (♂) or completely (♀) concealed by the seventh. The parapleura of segments 2 to 8 are membranaceous and bear the stigmata. The second stigma, however, is situated upon the tergite, and the third one half upon the tergite and half upon the parapleurum.

The *sternites* of the first and last segments undergo sometimes remarkable modifications. The second (=basal) sternite of SPHINGIDÆ touches the merum of the hind coxa, with which it is connected by a short membrane. In by far the larger number of species it is slanting, transversely impressed in front, the impression ending at each side in a small but often deep groove, and is mesially carinate in front, the carina fitting in between the coxæ.

The sternite of the seventh segment appears in the female sex of SPHINGIDÆ in two principal types. The ordinary type is shown on fig. 7 B. Here the apical portion of the sternite is more or less broadly membranaceous ; the stronger chitinized plate is short, broadly rounded, or sometimes elongate-trapeziform, with the apex slightly sinuate. It does not bear any spines.

The second type is shown in figs. 7 D, E. The membrane connecting the sternite (VII. *v*) with the tergite (VII. *t*) is very small ; the sternite is not membranaceous apically, the

strongly chitinized plate extending right to the apex. The apex of the sternite is spinose.

The eighth sternite of the male is modified; it is always without spines, deeply sinuate as a rule, and occasionally incrassate mesially or produced into a process (figs. 21 J, 22 B, F, *Oxyambulyx*). The eighth tergite of the male is spinose and varies in size and shape.

The scaling of the posterior segments exhibits sometimes striking features. The scales at the ventral apical angles are occasionally prolonged to tufts. The expansible fan-tail found in numerous SESIINÆ and Nephelini is generally tripartite; it occurs also in *Cypa* and allies of the subfamily AMBULICINÆ.

Genitalia.—♂. The copulatory apparatus of the male is composed of the ninth and tenth segments. The accompanying diagram (fig. 7 A) will make clear the relative position of the various elements of the clasping-organs.

The ninth segment * is a strongly chitinized girdle, broadest above, and here sinuate basally. This belt is ventro-laterally dilated into a large flap (*Cl*), the *clasper* or valve, and bears the *harpe* (*H*). The pleurum is attached to a proximal strip of chitin (*pl*) and to the sternite. The tenth segment † (x. *t* and x. *v*) stands in very close connection with the ninth; there is no intersegmental membrane between them, except occasionally a remnant on the upper side. The tenth tergite is strongly chitinized and is movable in a vertical direction, or, if completely divided, also mesiad.

Between the sternite and tergite is the *anus* (*A*), and between the tenth sternite and the ninth the *penis-funnel* (*P-F*), from which protrudes the *penis-sheath* ‡ (*P*).

The tenth tergite bears stiff hairs, which stand either singly or form a more or less dense covering on the upper and lateral surface. There are two principal forms of the tergite, it being either divided mesially or simple.

The tenth sternite is a belt running from the base of the tergite ventrad, encircling a membranaceous area, from which projects the anal cone, the end of the gut (*A*). The ventral transverse part of the sternite is in by far the larger proportion of Hawk-Moths as strongly chitinized as the vertical side parts, and is produced into one or two processes or lobes of various shapes and sizes §.

The *clasper* is normally sole-shaped, with the dorsal and ventral margins rounded. There are various modifications by reduction and by division and the development of a special

* Sometimes called the tegumen.
† Usually called the uncus.
‡ Also called the ædeagus.
§ Also called the scaphium.

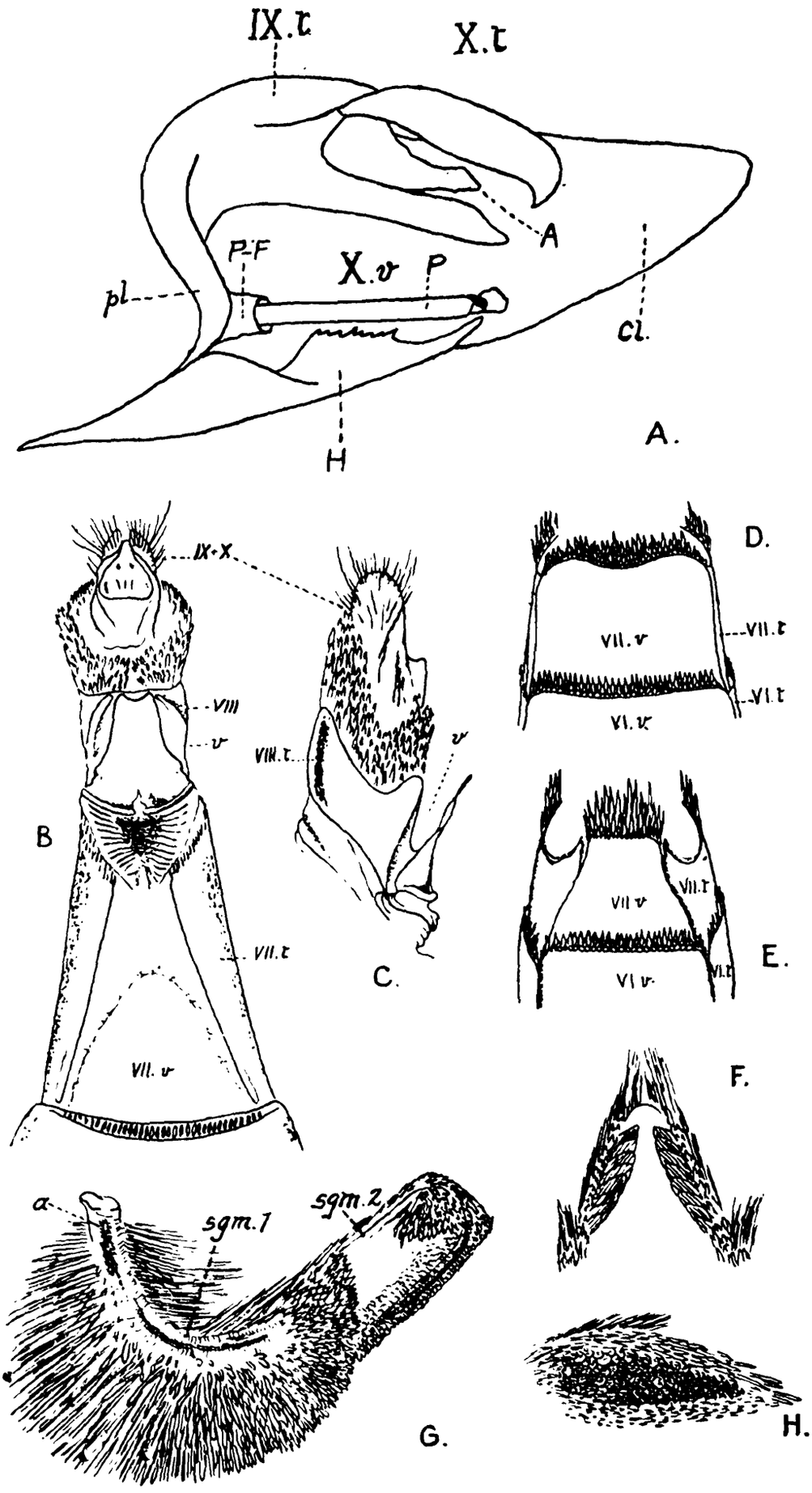


Fig. 7.

[For explanation of figures see opposite page.]

armature. Lobes, processes and teeth appear very often in connection with the reduction of the clasper.

The clasper consists of an external and an internal plate. The inner sheath is more or less covered with hairs, and is in most species raised into special armatures. There is very often a conspicuous subdorsal longitudinal setiferous fold. The ventral armature of the clasper is termed the harpe.

The external plate of the clasper is divided by a longitudinal rib-like incrassation into a narrow dorsal and a large ventral portion. The dorsal part is generally concave above the rib. Upon and near the rib there is found in a great number of SPHINGIDÆ a peculiar modification of the scaling (fig. 7 H). This is thought to be an organ of friction, by means of which a sound of some kind is produced. There are two types of this organ, the one confined to the SPHINGIDÆ ASEMANOPHORÆ the other to the SPHINGIDÆ SEMANOPHORÆ. In the former group it is a patch of scales lying more or less flat upon the clasper, and in the latter group it consists of lanceolate scales which are half erect.

The area between the two claspers and the tenth sternite is more or less membranaceous. There is a central hole, of which the edges are more or less raised and chitinized, forming the *penis-funnel* (*P-F*).

The *penis-sheath* projects from and is supported by the penis-funnel. It is provided at the end or near it with processes and teeth of various shapes and sizes. Within the sheath is found the membranaceous penis proper, the duct of the sperma. This duct can be pushed out, and has, in most cases, an armature of its own.

♀. In order to examine the female organs it is necessary to remove the seventh to tenth segments and relax them, and then draw them apart, which can be done with the help of a pin. The vaginal armature, lying hidden in a cavity in most species, must be pushed outwards by pressure from the inside to become plainly visible.

A. Diagram of copulatory apparatus of male. IX. *t*, ninth segment (tegumen); X. *t*, tenth segment (uncus); *A*, anus; *Cl*, clasper; *H*, harpe; *P*, penis-sheath; *P-F*, penis-funnel; *pl*, pleural attachment.

B. ♀ genitalia of *Protoparce rustica*; end of abdomen, segments 6 to 10, ventral aspect. VII, VIII, IX, X, abdominal segments.

C. As fig. B, segments 8 to 10, lateral aspect.

D. Sixth and seventh abdominal segments of *Cephonodes hylas*, ventral aspect.

E. Sixth and seventh abdominal segments of *Sesia fadus*, ventral aspect.

F. Eighth tergite of *Meganoton nyctiphanes*.

G. Palpus of *Cechenena lineosa*, internal aspect. *a*, sensory hairs; *sgm.* 1, 2, segments 1 and 2.

H. Friction-patch of clasper of *Psilogramma menephron*.

The ninth and tenth segments are fused into one (fig. 7 B, C) and covered with bristles. Between the two halves of this double segment lies the anus, and, ventrally to the anus, the aperture of the oviduct. The segment is always short in SPHINGIDÆ, and there is no ovipositor. The vagina lies between the seventh and eighth sternites, and the orifice is surrounded by more or less obvious folds, ridges, processes and grooves.

The part of the vaginal area in front of the orifice is termed the *antevaginal plate*, and the posterior part the *postvaginal plate*.

Besides the vaginal ventral area there is the eighth tergite. This is covered by the seventh, is never spinose, and varies in size and shape.

Scent-organs.—One absolute sexual distinction occurs in all Hawk-Moths. This is a scent-organ situated at the base of the abdomen. It is found in all species. The orifice of the organ lies in the pleural membrane above the upper edge of the basal sternite (fig. 6 A, *gl*). It is a cavity from which protrudes a bundle of long scale-hairs, which serve as distributors of the scent produced by the scent-cells. A groove or fold runs backwards from the orifice of the cavity over the pleura of the third segment, ending on the fourth.

Another scent-organ is found on the hinder side of the anterior coxæ. It is very frequently absent or vestigial, and is on the whole more prominent in the *Semanophoræ*.

III.—HABITS.

The moths have the habit, unique among lepidopterous insects, of feeding and of depositing their eggs while hovering on the wing.

The eggs are usually laid singly on the underside of a leaf or on a twig of the food-plant, to which they firmly adhere. Owing to the crepuscular habits of the moths the method of depositing the egg cannot often be observed, but in some of the day-flying species the moth lays the egg while poised delicately on the wing. The moths, by some means which is not understood, select with marvellous accuracy the particular plant or plants which will form the food of their progeny, though an egg may occasionally be found on a blade of grass close to the food. A few species, such as *Celerio euphorbiæ*, in the West Himalayas, deposit their eggs in batches of twenty or more on the underside of a leaf of a gregarious species of spurge, close to the ground, and in this species the larvæ live gregariously, a dozen or more on one plant. *Clanidopsis exusta* often lays its eggs in pairs, and Mell states that the moths of the genus *Parum* usually

deposit two or three eggs together, but sometimes lay twenty or more in one clump. The Pine Hawk-Moth of Europe (*Sphinx pinastri*) lays its eggs in small masses, and in this case, as in *Celerio euphorbiæ*, the larvæ may occur locally in great numbers. When the eggs are laid in masses the moth presumably settles on the food-plant for the operation.

The egg is usually whitish when first laid, but soon assumes its normal colour, which again changes to pale yellow as the larva forms inside it. The eggs hatch in a period varying from five to ten days or more, the larva biting its way through the shell with its mandibles. The hole thus made is round and is usually situated on one side of the egg. In most species the horn of the newly-hatched larva is movable in a vertical plane and is frequently raised and lowered as the larva moves about. The power to move the horn gets less in later instars, and is usually lost entirely except in the case of a few species in which the horn remains thin till maturity. The larva usually eats a portion or all but the base of the egg-shell soon after emerging, before eating any of the food-plant, and it will usually suck up a drop or two of water with avidity if it finds any. In some of the species, such as *Polyptychus trilineatus*, in which the head becomes triangular in the second instar, it eats nothing but the egg-shell until after the first moult, but usually, after resting for a time stretched along the midrib or a vein on the underside of a leaf, it starts to feed. It often punctures small holes in the middle of the leaf before eating from the edge. After feeding for a few days it rests for a day or two preparatory to moulting, often spinning a pad of silk for the prolegs and claspers to get a firm hold. The new and larger head can be seen forming behind the existing head, and the old, now empty, head-case is pushed forward until the skin parts at the neck, rupturing first near the throat, last at the occipital sinus. The skin is worked backwards by an undulatory motion of the body until it reaches the claspers and is shed, the case of the old head remaining attached to the mouth-parts of the new head until removed by being rubbed against some object. Most species eat the cast-off skin. After resting for a time, to allow the new skin to harden, the larva starts feeding again until the next moult is due. Usually there are four moults before the larva is full-fed, though a larger number of moults have been noticed. There is often an extra moult in those species which assume a triangular head in the second instar.

When about to pupate, the larva stops feeding and rests for about twenty-four hours, during which time the colour becomes darker or the dorsum becomes suffused with brown or reddish. It then leaves the food-plant and wanders about in search of a suitable place to pupate. It hurries along with an

undulatory motion of the body, and the prolegs and claspers gradually lose their prehensile power. Some species burrow into the ground and form an oval cell (ACHERONTIINÆ and AMBULICINÆ), others (most of the PHILAMPELINÆ and all the CHŒROCAMPINÆ) make a rough cocoon of leaves and rubbish, held together with strands of silk, on or very near the surface of the ground, sometimes even on the food-plant itself. Some of the burrowing species dig as deep as 6 inches in suitable soil ; they make an ovoid cell, smoothing the inside apparently by pressing with the head, and some species coat the walls with silk. After a period, which is normally about a week or ten days but may extend to months, the larval skin splits along the dorsal line of the head and along one side of the clypeus to the end of the third segment of the body, and is forced backwards by the alternate inflation and contraction of the body. When the pupal cell is lined with silk or pupation takes place in a cocoon, the larva spins a pad of silk at one end and this pad is gripped by the claspers before pupation. When the pupa is nearly free of the larval skin, it thrusts out the anal segment bearing the cremaster and fixes the hooks of the cremaster into the pad of silk by a screwing motion of the abdomen which also completely displaces the larval skin. The larval head-case remains attached to the skin with the two lobes separated and the clypeus, labrum and ligula in one piece. In some genera, such as *Clanis*, *Leucophlebia* and *Clanidopsis*, the larva does not pupate for a long time after burying itself, but retains its larval skin for a period which may extend into months. It then pupates, and the moth emerges after two or three weeks.

When the pupa first breaks through the larval skin it is green in colour, soft and plastic, and nearly as long as the larva was before pupation. The tongue, antennæ, legs and wings, or, rather, the cases in which these organs will be formed, are at first separate from the body, but very quickly settle into their appointed places and become fused together. The abdomen shrinks considerably in length as the membranes between the segments contract, and in about an hour's time the pupal case has assumed its final form, the surface has hardened and the green colour has changed to the final coloration. The pupa lies quiescent, and the main bulk of the tissue undergoes degeneration into a liquid fatty substance from which the moth takes form. In some cases the moth emerges in as short a period as fourteen days, but the period may extend to several months, or even years. Before the moth emerges the pupal case becomes fragile, thinning in some way from the inside as the moth develops. The pupal case splits, in much the same way as the skin of the larva splits in its final moult, down the dorsal line of segments 2 to 4.

The head-case comes off more or less in one piece, together with the leg, tongue and antenna-cases, though frequently the portion consisting of the eye-cases, vertex, frons and clypeus separates off in the process. The moth emerges in a few minutes, each part being withdrawn from its special case; the two halves of the tongue are separate at first, but quickly join together along the edges, and the tongue is then rolled into a spiral between the palpi. The body is at first wet with some fluid and is soft and sausage-like, and the wings limp and closely folded. The moth usually crawls about until it finds a place where it can hang by its fore legs with sufficient space below to allow its wings to expand freely; but some of the smaller Humming-bird Hawk-Moths (*Macroglossum*) remain on the ground, and the wings expand upwards, as in the case of many of the Skippers among butterflies. The body contracts and dries as the wings expand. If the moth has received any injury to its wings while emerging or after, the fluid which is being pumped from the body into the wings in order to expand them escapes through the wound and dries there.

The moth usually emerges in the evening, and sits quietly till after dark on the following day, allowing its wings to harden. Before making its first flight it usually squirts with some force a jet of yellowish fluid from the end of the abdomen. It then darts off to feed or to find a mate. The day-flying species, such as those of the genera *Macroglossum* and *Cephonodes*, may be seen on the wing at any time of the day and late in the evening; the night-flying species are seldom seen except when visiting flowers or when attracted to artificial light.

In some species the tongue is very short and functionless, and these species do not feed at all in the imaginal stage, but the short-tongued Death's-head Hawk-Moths (*Acherontia*) are an exception to the general rule, as they are known to steal the honey from bee-hives.

Hawk-Moths in all stages have little power of defending themselves against their numerous enemies, and they have to rely chiefly on their cryptic colouring to avoid destruction. Their eggs are destroyed by various species of parasitic ichneumons, which lay their eggs on those of the Hawk-Moths. We have counted as many as twenty ichneumons emerging from a single egg of *Acherontia styx*. The larvæ are preyed on by spiders and by ants and other insects, as well as by birds. Some Slender Loris which we kept as pets devoured the large larvæ of *Clanis phalaris* with gusto, and it is probable that monkeys and other mammals eat them in natural conditions. The greatest destruction, however, is caused by parasitic Hymenoptera and Diptera. Some species appear to be

immune from attack, while others are attacked in varying degree. In some cases a large number of fully-fed grubs make their way through the skin of the living larva, and spin small cocoons which stick out like almonds from a pudding ; in a day or two they fall off, each leaving a black spot on the skin of the larva, which then dies. In other cases the larva may remain apparently healthy till full-fed, but after burying itself underground or after spinning its cocoon, often after successfully pupating, it is found to be dead and the larval or pupal skin occupied by maggots or cocoons ; or the larva is found hanging by its claspers and one pair of prolegs, the body limp and filled with grubs. We have also noticed both eggs and larvæ being attacked by a small red mite.

The larvæ depend chiefly on their protective colouring and the position in which they lie for evading attack, though when discovered and molested many species strike sideways with their heads. Those of *Acherontia lachesis* increase the effect by making a loud clicking noise with their mandibles, and those of *Langia zenzeroides* by making a squeaking noise as they turn from side to side. This noise appears to be made by air being forced through the spiracles. Those larvæ which have eye-like markings expand segments 4 and 5 and draw in the head and anterior segments, swaying the body from side to side in a menacing manner, their appearance and movements resembling those of a snake. The larvæ of *Panacra metallica*, when further molested, stretch out the head and thorax and bend it downwards on to the venter, twisting the body at the same time ; those of *Celerio euphorbiæ nervosa*, which live gregariously, throw the head and thorax up and back, and eject drops of green fluid, and it is noteworthy that the colour of this larva is yellow and black—a common "warning" coloration. Some species, when in the later instars, seek protection by hiding during the day low down on the stem of the food-plant, or even by burying themselves in the earth at its foot.

The pupæ rely on concealment for protection, and are either buried deep in the earth or, if on the surface, have cryptic colouring and are covered by a rough cocoon. Most sphingid pupæ are capable of a very free motion of segments 9, 10 and 11, and can move the abdomen from side to side or round and round ; some rapidly contract and elongate the abdomen as well, producing a shivering motion of the whole body which can be felt when the pupa is held in the hand. The pupæ of a few species, such as *Langia zenzeroides* and *Theretra castanea*, have very little power of motion ; these pupæ have hard, rugged surfaces and dull colouring. Some pupæ are able to produce audible

sounds. Those of the genus *Macroglossum* make a dull knocking noise when moving the abdomen from side to side; those of *Meganoton nyctiphanes* a slight hissing noise. The pupæ are so seldom found in natural conditions that it is not known what enemies they may have, but bred specimens are frequently destroyed by the larvæ of a small scavenging fly which lays its eggs at the junction of the abdominal segments.

The moths are so swift on the wing, and so well concealed by their colouring when resting, that they probably have few enemies. They are, however, often captured and eaten by bats. The species *Acherontia lachesis* and *Langia zenzeroides*, if disturbed when resting, alternately raise and lower the body, at the same time partly opening and raising the wings and producing a squeaking note. Many other species vibrate the partially opened wings very rapidly, producing a low humming note. Some of the day-flying species which mimic bees bend the abdomen about as their models do when stinging.

The food-plants of Indian Hawk-Moths cover a very large range, comprising some sixty widely separated families of plants and hundreds of species, and including the largest trees and small herbs, and even grasses. The larvæ of some species feed on a large number of plants of different families, others confine themselves to a single family or even a single species of plant, or whole genera choose their food-plants from a single family. In some species the larvæ become so abundant in some localities in certain seasons as to cause serious damage to the vegetation on which they feed. Those of *Herse convolvuli* and *Acherontia styx* sometimes devastate the crops which form their food-plants; those of *Leucophlebia emittens* occur in immense numbers in some years, and destroy the grass crop; all Rubiaceous shrubs in certain areas are sometimes defoliated by the larvæ of *Cephonodes hylas* and *C. picus*. The large larvæ of *Langia zenzeroides* strip apple and other fruit trees of their leaves.

IV.—DISTRIBUTION.

The Hawk-Moths are a widely distributed family, being found in all parts of the world except the Arctic and Antarctic, and occurring as stragglers even in the Arctic Regions. Owing to their swift and powerful flight and habit of wandering some of the species have a very wide range. This habit also causes stragglers to appear in areas beyond their normal range, but their permanent establishment in such areas is often checked by a tendency of the females to become

sterile outside their usual habitat. The Convolvulus Hawk-Moth, for instance, appears as a straggler in England, but the females are usually sterile, and the species is thus prevented from becoming resident in England, though the food-plant of its larva grows there freely.

There is one cosmopolitan species, *Celerio lineata*, the English Striped Hawk-Moth, with three subspecies in different parts of the world. *Herse convolvuli*, the English Convolvulus Hawk-Moth, and *Hippotion celerio*, the English Silver-striped Hawk-Moth, occur practically throughout the Old World. Four Indian genera extend into the Neotropical and Nearctic Regions (America), thirty-four genera into the Palæarctic Region, and twelve genera into the Æthiopian Region (Central and South Africa).

Within the Oriental Region 34 Indian genera are represented in S. China, 33 in Malaya, 23 in the Philippines, 17 in Papuasia, and 15 in Australia.

In the Indian area the distribution is as follows :—

West Himalayas :
62 species, subspecies and forms belonging to 37 genera.
East Himalayas :
135 species, subspecies and forms belonging to 50 genera.
South India :
75 species, subspecies and forms belonging to 27 genera.
Ceylon :
58 species, subspecies and forms belonging to 26 genera.
Burma :
49 species, subspecies and forms belonging to 24 genera.
The Andaman Islands :
22 species, subspecies and forms belonging to 16 genera.

It will be seen that the E. Himalayas are very rich in both genera and species. The North Kanara District of Southern India, which has been worked intensively, is very rich for its size, with 63 species belonging to 27 genera. Burma has been very little worked, and has probably a much richer fauna than the above figures indicate.

There are nine genera peculiar to the Indian subregion : *Apocalypsis*, *Pentateucha*, *Pseudodolbina*, *Dolbinopsis*, *Rhodoprasina*, *Clanidopsis*, *Agnosia*, *Anambulyx* and *Lepchina*, all from the W. or E. Himalayas. Some of the species belonging to these and other Indian genera are very rare and local.

The distribution of the moths is dependent to some extent on the range of the plant or plants on which their larvæ feed, though on account of their wandering habits individuals may be found at a considerable distance from their nearest food-plant. A species cannot, however, become established permanently where there is no plant growing which its larva

will accept as food, but, on the other hand, its range is often far more restricted than that of its food-plant or plants. This can sometimes be accounted for by the presence of a physical barrier, or by a change of climate within the range of the food-plant, but in other cases there does not appear to be any such cause to account for the limited range. Possibly the sterility of the females operates in such cases.

The abundance or rarity of individuals is very variable. Individuals of some species are always common, of others always rare; or a usually uncommon species may appear in great numbers in certain seasons, or may be locally abundant in a part of its range. Many of the rare species are very delicate and difficult to breed in captivity, and this possibly accounts for their rarity in nature. On the other hand *Leucophlebia emittens*, which is sometimes exceedingly abundant, is very difficult to rear in captivity, and we have never succeeded in obtaining a pupa. Some species are far more subject to attack by parasites than others, and parasites act as a powerful check on the increase of susceptible species. Seasonal variation in numbers is probably often attributable to their attacks. When, owing to favourable conditions, the numbers of a species increase unduly, its parasites also increase, and sooner or later obtain control.

The Forest Entomologist at Maymyo, Burma, records that serious defoliation of a plantation of *Broussonetia papyrifera* was caused by immense numbers of a sphingid larva (since identified as *Parum colligata* Walker). In one season 600 acres of the plantation were defoliated three times. The larvæ were so numerous that the trunks of the trees were obscured by the masses descending to the ground, either to pupate or in search of fresh supplies of food. The earlier instars of the larva had suffered from the attacks of a multiple braconid, the yellowish cocoon masses of which were strikingly obvious on the defoliated trees. The full-fed larvæ were being attacked by a tachinid fly, which was present in such numbers that the hum of their wings was most noticeable. The presence of such large numbers of the host caused a corresponding increase in the numbers of the parasites. The plantation has now been abandoned, but *Parum colligata* does not appear to be at all common, and the parasites appear to have obtained control. *Rhagastis albomarginatus albomarginatus* is not a common insect in most of its range, but at Shillong, in the Khasi Hills, its larva feeds on the hydrangea, which is grown as hedges and in the gardens, and it is locally extremely abundant. We have seen a hydrangea bush stripped of all its leaves three times in one season, eggs being laid on the fresh crop of young leaves as soon as they appeared.

This species appears to be very free from the attacks of parasites.

The local abundance of these usually uncommon sphingids is apparently due to a suitable food-plant having been grown in a large area, combined with suitable climatic and other conditions, but another factor is the number of broods which occur in the year. In both the cases mentioned above there appear to have been three broods, and the pupal stage was very short, varying from two to four weeks. Many species have a single brood in the year, and such species are less likely to increase rapidly in numbers. The eggs of *Pseudodolbina fo* are not laid until the rainy season is well established, and the pupæ always hibernate, at least in captivity. The hibernating pupæ lie exposed for many months to disease and accidents, and suffer far greater losses than in species which have several broods with a short pupal stage between each brood. In parts of the country where the cold is not severe in the winter some common species, such as *Deilephila nerii*, continue to breed throughout the year, but where the cold is severe nearly all the species appear to hibernate as pupæ, though we have seen imagos of *Rhopalopsyche nycteris* on the wing on sunny days throughout the year at an elevation of 7,000 feet in the Himalayas.

Distribution Table.

The following account of the distribution of the Sphingidæ in the Indian area is compiled from the 'Revision' (1903), *with additions* to date.

We have divided India into three areas:—The West Himalayas, including the whole Himalayan and connected ranges west of Nepal, and the Siwalik Mountains. The East Himalayas, including the whole Himalayan range east of Nepal up to the frontier of Burma, the Khasi and Jaintia Hills, the Naga Hills and adjoining areas and hills in Assam. South India, including the rest of Peninsular India.

The dividing line between the W and E. Himalayan sphingid fauna has been assumed to be Nepal, as, although the fauna of this area is practically unknown, that to the west of it belongs to the West Himalayan type and that to the east of it to the East Himalayan type.

The plains and hills of Northern and Central India, south of the Himalaya and Siwalik Mountains, have been included in Southern India, as these areas have no distinctive sphingid fauna.

Note.—Rothschild and Jordan in the 'Revision' (1903) referred to the W Himalayas as "North-West India" and to the E. Himalayas as "North India."

The Distribution of SPHINGIDÆ *in the Indian Region.*

	W. Himalayas.	E. Himalayas.	S. India.	Ceylon.	Burma.	Andamans.
1. *Acherontia lachesis* (Fabr.)	+	+	+	+	+	+
2. —— *styx styx* Westw.	+	+	+	+	+	+
3. *Herse convolvuli convolvuli* (Linn.)	+	+	+	+	+	+
4. *Meyacorma obliqua obliqua* (Walk.)		+		+	+	
5. *Meganoton analis* (Feld.)		+				
6. —— *nyctiphanes* (Walk.)		+	+	+	+	+
7. —— *rufescens rufescens* (Butl.)		+				+
8. *Psilogramma menephron menephron* (Cram.)	+	+	+	+	+	+
9. *Apocalypsis velox* Butl.		+				
10. *Pentateucha curiosa* Swinh...		+				
11 *a*. *Pseudodolbina fo celator* Jord.	+					
11 *b*. —— —— *fo* (Walk.)						
12. —— *æqualis* Roths. & Jord.		+				
13. *Sphinx uniformis* (Butl.)	+					
14. *Dolbinopsis grisea* (Hampson)		+				
15. *Dolbina inexacta* (Walk.)	+	+	+			
16. *Compsogene panopus panopus* (Cram.)	+	+	+	+	+	+
17. —— *mansoni* Clark		+				
18 *a*. *Oxyambulyx sericeipennis sericeipennis* (Butl.)	+					
18 *b*. —— —— *agana* Jord.		+			+	
19. —— *placida* (Moore)	+	+				
20. —— *maculifera* (Walk.)		+			+	
21. —— *belli* Jord....			+			
22. —— *lahora* (Butl.)..	+					
23. —— *ochracea* (Butl.)		+				
24. —— *liturata liturata* (Butl.)		+			+	
25 *a*. —— *substrigilis auripennis* (Moore)				+		
25 *b*. —— —— *aglaia* Jord.			+			
25 *c*. —— —— *substrigilis* (Westw.)		+				+
26. —— *matti* Jord.			+			
27. —— *canescens canescens* (Walk.).						+
28. —— *subocellata* (Feld.)		+	+	+		+
29. —— *cyclasticta* Joicey & Kaye					+	
30. *Clanis phalaris* (Cram.)		+	+	+		+
31. —— *undulosa undulosa* Moore		+				
32. —— *deucalion* (Walk.)	+	+				
33. —— *bilineata bilineata* (Walk.)		+	+			
34. —— *titan titan* Roths. & Jord.		+	+		+	
35. *Leucophlebia lineata* Westw..	+	+	+	+		
36. —— *emittens* Walk..	+		+		+	
37 *a*. *Polyptychus trilineatus luteatus* Roths. & Jord.				+		
37 *b*. —— —— *sonanthis* Jord.			+			
37 *c*. —— —— *trilineatus* Moore	+					
37 *d*. —— —— *undatus* Roths. & Jord.		+			+	

The Distribution of SPHINGIDÆ *in the Indian Region* (cont.).

	W. Himalayas.	E. Himalayas.	S. India.	Ceylon.	Burma.	Andamans.
37 *e*. *Polyptychus trilineatus mincopicus* Jord.						+
38. —— *dentatus* (Cram.)			+	+		
39. *Marumba gaschkewitschi fortis* Jord.		+				
40. —— *cristata cristata* (Butl.)		+				
41. —— *spectabilis spectabilis* (Butl.)		+				
42. —— *dyras dyras* (Walk.)	+	+	+	+		+
43. —— *nympha* Roths. & Jord.			+			
44 *a*. —— *sperchius albicans* (Butl.).	+					
44 *b*. —— —— *gigas* (Butl.)		+				
45. —— *poliotis* Hampson			+			
46. —— *indicus* (Walk.)		+	+			
47. —— *bengalensis* Hampson			+			
48. —— *decoratus* (Moore)		+				
49. *Daphnusa ocellaris ocellaris* Walk.		+			+	
50. *Langia zenzeroides zenzeroides* Moore	+	+				
51. *Rhodoprasina floralis* (Butl.)		+				
52. —— *callantha* Jord.		+				
53. *Clanidopsis exusta* (Butl.)	+					
54. *Agnosia orneus* (Westw.)	+		+	+		
55. —— *microta* (Hampson)			+			
56. *Parum porphyria* (Butl.)		+				
57. —— *colligata* (Walk.)		.			+	
58. *Cypa decolor decolor* (Walk.).		+				
59 *a*. —— *pallens pallens* Jord..	+					
59 *b*. —— —— *enodis* Jord.		+				
60. —— *ferruginea* Walk.				+		
61. *Smerinthulus perversa* (Roths.)		+			+	
62. *Degmaptera mirabilis* (Roths.)		+				
63. *Callambulyx rubricosa rubricosa* (Walk.).		+				
64. —— *junonia* (Butl.)		+				
65. —— *pœcilus* (Roths.)	+					
66. *Anambulyx elwesi* (Druce)		+				
67. *Smerinthus kindermanni obsoleta* Staud..	+					
68. *Phyllosphingia dissimilis perundulans* Swinh.		+				
69. *Hæmorrhagia fuciformis fuciformis* (Linn.)	+					
70. —— *saundersi* (Walk).	+					
71. —— *rubra* (Hampson)	+					
72. *Cephonodes hylas hylas* (Linn.).	+	+	+	+	+	
73. —— *picus* (Cram.)	+		+	+		
74. *Sataspes infernalis* f. *infernalis* Westw.		+	+		+	
—— —— f. *uniformis* Butl.		+	+			
75. —— *tagalica* f. *tagalica* Boisd.		+				
—— —— f. *thoracica* Roths. & Jord.		+				
—— —— f. *collaris* Roths. & Jord.					+	
—— —— f. *hauxwelli* de Nicéville.					+	
76. —— *scotti* Jord.	+					

The Distribution of SPHINGIDÆ *in the Indian Region* (cont.).

	W. Himalayas.	E. Himalayas.	S. India.	Ceylon.	Burma.	Andamans.
77. *Chromis erotus erotus* (Cram.).				+		+
78. *Deilephila nerii* (Linn.)	+	+	+	+	+	
79. —— *hypothous hypothous* (Cram.)		+	+	+	+	
80. —— *layardi* (Moore)				+		
81. —— *placida placida* (Walk.)						+
82 *a*. —— *minima ernestina* (Moore)				+		
82 *b*. —— —— *minima* (Butl.)			+			
83. *Dahira rubiginosa* Moore	+					
84 *a*. *Ampelophaga rubiginosa fasciosa* Moore.	+					
84 *b*. —— —— *harterti* Roths.		+				
85. —— *khasiana khasiana* Roths.		+				
86. —— *dolichoides* (Felder)		+				
87. —— *obliquifascia* Hampson		+				
88. *Elibia dolichus* (Westw.)		+				
89. *Acosmerycoides leucocraspis leucocraspis* (Hampson)		+				
90. *Acosmeryx naga* (Moore)	+	+				
91. —— *anceus sub lentata* Roths. & Jord.		+	+			
92. —— *socrates* f. *socrates* Boisd.		+	+	+		
—— —— f. *cinerea* Butl.		+	+	+		
93. —— *sericeus sericeus* (Walk.)		+				
94. —— *omissa* Roths. & Jord.		+				
95. *Lepchina tridens* Oberthür		+				
96 *a*. *Panacra busiris atima* Roths. & Jord.			+			
96 *b*. —— —— *busiris* Walk.		+			+	
96 *c*. —— —— *marina* Roths. & Jord..						+
97. —— *automedon* Walk.		+				
98. —— *moseri* Gehlen		+				
99. —— *dohertyi* Roths.		+				
100. —— *variolosa* Walk.		+				
101. —— *sinuata* Roths. & Jord.		+				
102 *a*. —— *metallica anfracta* Gehlen	+					
102 *b*. —— —— *metallica* Butl.		+				
103. —— *perfecta* Butl.		+				
104. —— *mydon mydon* Walk.		+			+	
105. *Angonyx testacea testacea* (Walk.)		+	+	+	+	
106. *Enpinanga assamensis* (Walk.)		+				
107. —— *labuana oceanica* Roths. & Jord.						+
108. *Cizara sculpta* (Felder)			+		+	
109. *Nephele didyma* f. *didyma* (Fabr.)	+	+	+	+	+	
—— *didyma* f. *hespera* (Fabr.).	+	+	+	+	+	
110. *Gurelca hyas hyas* (Walk.)	+	+	+		+	
111. —— *masuriensis* (Butl.)	+					
112. —— *himachala himachala* (Butl.)		+				
113. —— *montana* Jordan		+				
114. *Sphingonæpiopsis pumilio* (Boisd.)		+				
115. *Eurypteryx bhaga bhaga* (Moore)		+				

The Distribution of SPHINGIDÆ *in the Indian Region* (cont.).

	W. Himalayas.	E. Himalayas.	S. India.	Ceylon.	Burma.	Andamans.
116. *Rhodosoma triopus* (Westw.).		+				
117. *Macroglossum stellatarum* (Linn.) .	+		+			
118. —— *bombylans* (Boisd.) .	+	+				
119. —— *regulus* (Boisd.)			+	+		
120. —— *gyrans* (Walk.). .	+	+	+	+	+	
121. —— *affictitia* (Butl.)			+	+	+	
122. —— *particolor* Roths. & Jord. .			+			
123. —— *belis* (Linn.) . .	+		+	+		
124. —— *assimilis* Swainson			+	+		
125. —— *pyrrhosticta pyrrhosticta* (Butl.) .		+				
126. —— *troglodytus* (Boisd.)		+	+	+		
127. —— *insipida insipida* (Butl.) .		+	+	+		
128. —— *vicinum* Jord. .			+			
129. —— *sitiene* (Walk.) .		+	+	+		
130. —— *fringilla* (Boisd.) .			+			
131. —— *divergens* (Walk.)				+		
132. —— *prometheus prometheus* (Boisd.) .				+		
133. —— *variegatum* Roths. & Jord... .. .	+					
134. —— *saga* (Butl.)		+				
135. —— *glaucoptera* (Butl.) .				+		
136. —— *semifasciata* (Hampson) .					+	
137. —— *aquila* (Boisd.). . .		+				
138. —— *sylvia* (Boisd.)		+		+		
139 *a*. —— *corythus corythus* (Walk.). .			+	+		
139 *b*. —— —— *luteata* (Butl.) .		+				+
140. —— *hemichroma* (Butl.)		+				
141. —— *passalus rectifascia* (Felder) .			+	+		
142. —— *faro* (Cram.)			+			
143. —— *mitchelli imperator* (Butl.) .		+	+	+		
144 *a*. *Rhopalopsyche nycteris* (Kollar) .	+	+			+	
144 *b*. —— —— *bifasciata* Butl.			+	+		
145 *a*. *Celerio euphorbiæ robertsi* (Butl.) .	+					
145 *b*. —— —— *nervosa* Roths. & Jord. .	+					
146. —— *gallii gallii* (Rottenburg) . .	+					
147. —— *nicæa lathyrus* (Walk.) .	+					
148. —— *lineata livornica* (Esper).... .	+		+			
149 *a*. *Pergesa elpenor rivularis* (Boisd.) .	+	+				
149 *b*. —— —— *macromera* (Butl.) .		+				
150. *Hippotion velox* (Fabr.) .		+	+	+	+	
151. —— *celerio* (Linn.) .. .	+	+	+	+	+	+
152. —— *echeclus* (Boisd.) .		+	+		+	
153. —— *rafflesi* (Butl.) . .		+	+	+	+	
154. —— *boerhaviæ* (Fabr.) .	+	+	+	+		
155. *Theretra nessus* (Drury) .	+	+	+	+	+	
156. —— *boisduvali* (Bugnion) .		+		+		
157. —— *clotho clotho* (Drury) .	+	+	+	+	+	+
158. —— *gnoma* (Fabr.)			+	+		

The Distribution of SPHINGIDÆ *in the Indian Region* (cont.).

	W. Himalayas.	E. Himalayas.	S. India.	Ceylon.	Burma.	Andamans.
159. *Theretra latreillei lucasi* (Walk.)		+	+	+	+	+
160. —— *alecto alecto* (Linn.)	+	+	+		+	
161. —— *mansoni* Clark					+	
162. —— *suffusa* (Walk.)		+				
163. —— *lycetus* (Cram.)	+	+	+	+	+	
164. —— *oldenlandiæ oldenlandiæ* (Fabr.)	+	+	+	+	+	
165. —— *pinastrina pinastrina* (Martyn)		+	+	+	+	
166. —— *insignis insignis* (Butl.)						+
167. —— *griseomarginata* (Hampson)		+				
168. —— *pallicosta* (Walk.)		+	+	+	+	
169. —— *castanea* (Moore)			+			
170. *Rhyncholaba acteus* (Cram.)	+	+	+	+	+	
171. *Rhagastis velata* (Walk.)		+				
172. —— *acuta acuta* (Walk.)		+				
173. —— *aurifera aurifera* (Butl.)		+				
174. —— *confusa* Roths. & Jord.	+	+				
175 *a*. —— *lunata sikhimensis* Roths. & Jord.		+				
175 *b*. —— —— *lunata* (Roths.)		+				
176. —— *olivacea* (Moore)	+	+			+	
177. —— *gloriosa* (Butl.)		+				
178. —— *albomarginatus albomarginatus* (Roths.)		+				
179. *Cechenena mirabilis* (Butl.)	+					
180. —— *ægrota* (Butl.)		+				
181. —— *helops helops* (Walk.)		+				
182. —— *minor minor* (Butl.)	+	+				
183 *a*. —— *lineosa scotti* Roths.	+					
183 *b*. —— —— *lineosa* (Walk.)		+				
	62	135	75	58	49	22

V.—SYSTEMATIC SECTION.

Family SPHINGIDÆ.

Samouelle, Ent. Comp., 1819, p. 243.

"*Imago* varying in length of body from 12 to 80 mm., and in length of fore wing from 10 to 90 mm. (*Sphingonæpiopsis obscurus* and *Cocytius antæus*).

"*Head.*—Tongue varying from being several times as long as the body to being reduced to two small tubercles. Pilifer clothed with bristles or scales, the brush even, or the bristles short at apex, or absent. Genal process naked, mostly triangular, very often reaching to tip of pilifer. Labrum convex in middle, often raised into a rather prominent tubercle. Palpus very variable in size and structure; first segment with or without patch of sensory hairs on inner surface at base; inner surface of second segment scaled or partly naked, sometimes excavate; scaling at apex of first segment externally sometimes forming a kind of cavity; third segment mostly short, always shorter than second, broad, naked and conical if very prominent. Eye variable in size, naked; *no ocelli*. Scaling of head often raised to a crest, especially in forms with reduced head. Antenna filiform, setiform, or clavate, prismatically compressed or cylindrical, tapering at end, and mostly curved to a hook, sometimes pectinate; end-segment long or short, scaled dorsally, the scaling mostly dense and forming often a dorsal tuft projecting distad, or sparse and rough, or almost absent. There are often long bristles on the end-segment, two at end near the tip, and several scattered over the surface of the segment; the whole dorsal surface of antenna scaled, two rows of scales to each segment, but the rows quite irregular, proximal segments scaled also ventrally in a few cases where the clubbed antenna is very thin basally. Ventral surface densely clothed with fine hairs; besides, there are some subdorsal and lateral sense-bristles, not obvious except on distal segments; a single ventral mesial sense-cone on each segment, apical or subapical. ♂: with one exception (*Rhopalopsyche*), the segments impressed at the sides and provided basally, dorsally, and apically along the groove with a row of fasciculate long hairs, the proximal row of hairs of either side continuous ventrally, but the hairs always shorter in and near the ventral mesial line, the distal row seldom extended to the mesial line. Sometimes the dorsal edge of the groove widened laterad to a process which bears the fasciculate hairs on the underside at the edges ♀: without fasciculate hairs as a rule; however, there are many forms

in which the segments resemble those of the ♂, but the fasciculate hairs and the pectinations are not so long, and the grooves not so deep.

"*Thorax*.—Sterna : parasternum of mesosternum large, epi- and hyposternum fused together, sternum and peristernum separate ; suturale of mesosternum swollen.

"*Legs* : fore coxa in ♂ often with strongly developed scent-organ ; tibiæ simple or spinose, fore tibia often ending in a thorn or claw ; mid-tibia with two apical spurs, which are sometimes much reduced ; hind tibia with two pairs, or the proximal pair absent ; the spurs occasionally spinose, in a few cases the spines long and arranged in a single row, comb-like ; tarsi with four ventral rows of spines, often with additional spines, especially on outer surface ; not rarely some or many of the spines absent, and some developed to prominent hooks ; fourth row of mid-tarsus and third of hind tarsus often basally developed into a prominent comb ; fifth segment with two (seldom four) long dorsal terminal bristles ; pulvillus present or absent ; paronychium with two pairs or one pair of lobes, or vestigial ; claws simple.

"*Abdomen* : first tergite shorter than second, a mere linear strip in *Macroglossum*, tergites 2 to 8 (♂), or 2 to 7 (♀), and sternites 2 to 6 (♂♀), or 2 to 5 (many ♀♀) armed at end with *spines*, variable in number, size and chitinization, spines of tergites generally stronger than those of sternites, the latter often without spines. Some forms have the tergites spinose all over, while the spines are wanting in others. ♂ *always* with tuft of long (scent-distributing) hairs in groove above upper edge of sternite of second segment (sternite of first segment absent, or probably fused with that of second).

"Genital armature of ♂ : tenth segment simple or divided, the tergite as well as the sternite, the latter often without process, the segment asymmetrical in several instances. Claspers very variable in size and shape, often with a patch of friction-scales dorsally on outer surface, the number of such scales sometimes reduced to one, in many cases this organ quite absent ; in some AMBULICINÆ a corresponding organ on inner side of eighth tergite. Armature of clasper very variable according to species and genera, sometimes the two sides different. Penis-sheath and penis-funnel also much diversified in the family. Genital armature of ♀ : vaginal aperture generally surrounded with ridges, processes or folds, but often lacking special armature, occasionally asymmetrical in position.

"*Wings* (fig. 8).—Frenulum and retinaculum present or absent ; an elongate subbasal patch of glossy, modified scales on fore wing below behind SM^2, on hind wing above before C. Neuration (fig. 8) : fore wing, no areole ; SC^1 and $SC^{2,3}$ before apex of cell, SC^2 and SC^3 on a long stalk,

free part of SC^2 very weak and short, and mostly absent (individually variable); SC^2 ending close to apex of wing, sometimes continued along edge and joining SC^4 at apex; SC^5 from SC^4 at about one-third the way from cell to apex; R^1 from upper angle of cell or shortly stalked with $SC^{4.5}$; R^2 from below centre of apex of cell, but always well above angle; M^1 before angle of cell, M^2 in or near middle of cell; SM^1 absent, SM^2 forming fork at base with SM^2; upper angle of cell more distal than lower angle. Hind wing: C and SC^2

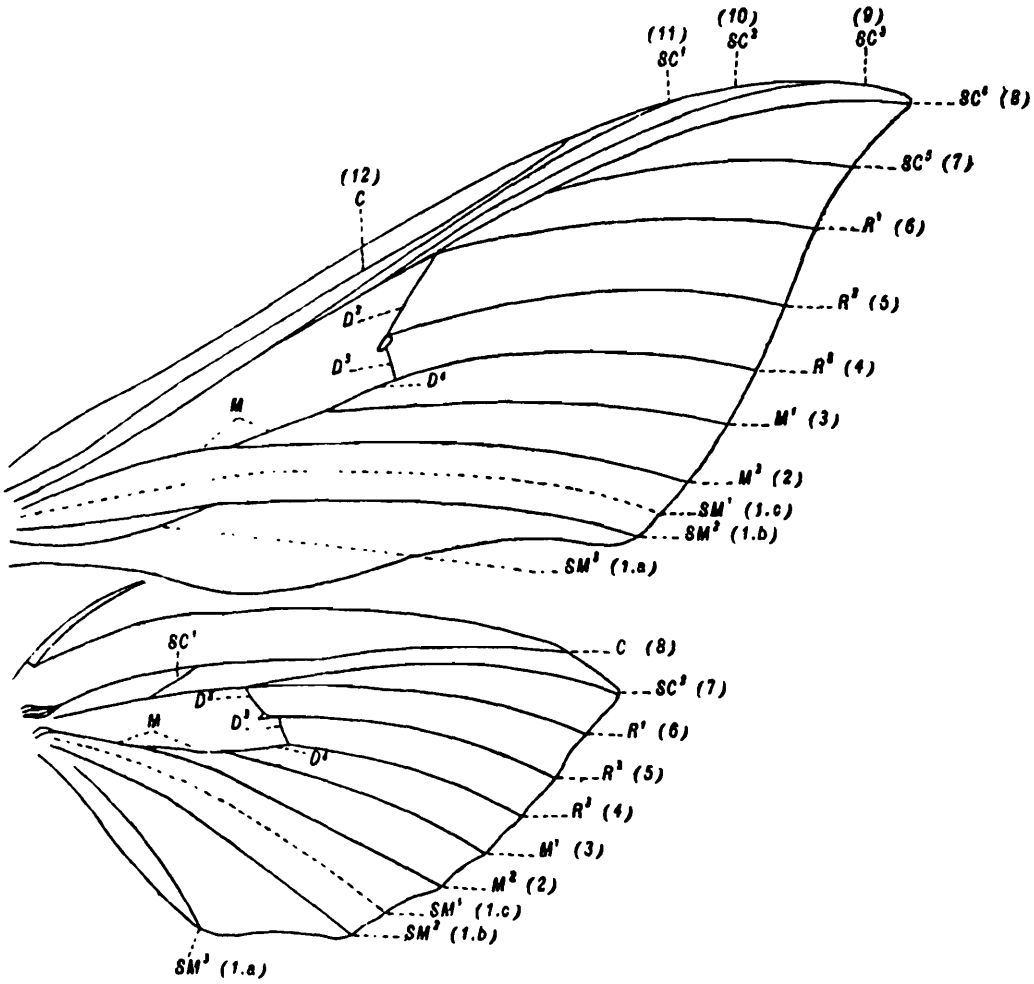


Fig. 8.—Wing venation.

SM^1–SM^3, 1st, 2nd and 3rd submedians; M^1, M^2, 1st and 2nd medians; R^1–R^3, 1st, 2nd and 3rd radials; SC^1–SC^5, 1st to 5th subcostals; C, costal vein; D^2–D^4, discocellular veins; M, median vein.

separate, connected with one another by a conspicuous slanting bar (=SC^1) in or near middle of cell; SC^2 or (seldom) R^1 ending at farthest point of wing; R^1 from upper angle of cell, often from SC^2; R^2 in or near centre of cell, never from lower angle; R^3 and M^1 separate, or (seldom) stalked; SM^1 absent" (Roths. & Jord., 1903, p. 1).

Egg.—Nearly spherical, or oval, surface shining or dull, smooth except when seen under the microscope.

Larva.—Head round or triangular, apparently always round in the first instar, sometimes first round, then triangular, and again round in the last instar. Body tapering gently or strongly from segment 5 forwards, rest of body nearly cylindrical; segments 4 and 5 often swollen and more rarely flanged; horn on segment 12 straight, bifid, and sometimes movable in the earlier instars, of various shapes and usually rigid in the later instars, sometimes much reduced in the last instar. The surface dull or shining, and smooth or with setiferous tubercles, or rarely spinose. Colour variable, often green or brown.

Pupa.—Tongue reaching tip of wing-case, or shorter, tongue-case sometimes enlarged basally or tongue in a free sheath; coxal-piece present or not; surface dull or shining, smooth or rugose; often sculpturing on segment 4 and antespiracular ridges; cremaster very variable, often bifid, and sometimes with hooks and spines.

Habits.—The eggs, except in a few cases, laid singly; the larva usually with five instars; pupation in a cell underground or in a rough cocoon on the surface, rarely on the food-plant. The moth feeds and deposits eggs while hovering on the wing.

Hab. All regions except the Antarctic Zone, most plentiful in the tropics.

Rothschild and Jordan (1903) divide the SPHINGIDÆ into the following groups :—

A.—**Sphingidæ Asemanophoræ.**

Subfamily ACHERONTIINÆ.

Tribe Acherontiini.
Tribe Sphingini.
Tribe Sphingulini.

Subfamily AMBULICINÆ.

B.—**Sphingidæ Semanophoræ.**

Subfamily SESIINÆ.

Tribe Dilophonotini *.
Tribe Sesiini.

Subfamily PHILAMPELINÆ.

Tribe Philampelini *.
Tribe Nephelini.

Subfamily CHŒROCAMPINÆ.

(Roths. & Jord., 1903, p. cxxxv).

* The tribes Dilophonotini and Philampelini are not represented in India.

Key to the Subfamilies.

Imagines.

1. First segment of palpus without patch of short sensory hairs on the inner surface near base. (*Asemanophoræ*) . . . . . 2.
   First segment of palpus with a patch of short sensory hairs on the inner surface near base. (*Semanophoræ*) . . . . . 3.
2. Terminal segment of antenna long and thin, with long hairs and bristles (short in *Dolbinopsis* and *Dolbina*, but these two genera may be distinguished from the AMBULICINÆ by the fore wing not being sinuate) . . **Acherontiinæ,** [p. 48.
   Terminal segment of antenna short (long in *Compsogene*, *Oxyambulyx* and *Cypa*, but these three genera may be distinguished from the ACHERONTIINÆ by the fore wing being sinuate) . **Ambulicinæ,** [p. 98.
3. Pilifer normal. . . . . 4.
   Pilifer consisting of a terminal part bearing short or vestigial bristles and a proximal part bearing long bristles. . . . **Chœrocampinæ,** [p. 397.
4. Abdomen with the tenth segment mesially divided . . . . **Sesiinæ,** p. 238.
   Abdomen with the tenth segment not mesially divided **Philampelinæ,** [p. 259.

It is difficult to make keys to the larvæ and pupæ by subfamilies, as the larval and pupal characters cut across the divisions in which the imagines have been placed.

In the subfamily ACHERONTIINÆ, for instance, the larval head is usually round, but in *Dolbina inexacta* it is triangular, as in many of the AMBULICINÆ. In the subfamily AMBULICINÆ the head may be round, as it is in most of the ACHERONTIINÆ, or triangular. In *Rhodoprasina callantha*, of the AMBULICINÆ, the spiracle of segment 5 is surrounded by an ocellus-like marking, a character which reappears in some larvæ of the tribe Nephelini, subfamily PHILAMPELINÆ.

In the tribe Sesiini, subfamily SESIINÆ, the larvæ of one genus (*Hæmorrhagia*) are Philampeline, of another genus (*Cephonodes*) Acherontiine, and of the third (*Sataspes*) Ambulicine. In the tribe Nephelini, subfamily PHILAMPELINÆ, many of the larvæ closely resemble those of the CHŒROCAMPINÆ. The horn and other characters are very variable in all the subfamilies.

In dealing with the pupæ we meet with similar difficulties. Pupæ of the *Asemanophoræ* can usually be distinguished from those of the *Semanophoræ* by the uniform colouring of the former, and by their being formed in a cell underground, those of the *Semanophoræ* being seldom of uniform colouring except in the Sesiini, and being formed in a rough cocoon on the surface of the ground or among leaves, but it is difficult to find any constant characters distinguishing the pupæ

of the subfamilies ACHERONTIINÆ, AMBULICINÆ and SESIINÆ from each other, or those of the PHILAMPELINÆ from the CHŒROCAMPINÆ.

A more minute study of the larvæ and pupæ may reveal constant differences between those of the different subfamilies, but in the present state of our knowledge we are unable to construct useful keys.

A.—SPHINGIDÆ ASEMANOPHORÆ.

Roths. & Jord., 1903, p. 3.

Imago.—"♂♀. The patch of sensory hairs is absent from the palpus in all the species. The friction-scales of the ♂ lie flat upon the clasper. The tendency of development in this section of the family is reduction of organs, leading to the disappearing of the tongue, frenulum and retinaculum, pulvillus and paronychium, of the proximal pair of spurs of the hind tibiæ, the friction-scales of the ♂, the meso- and metatarsal combs, and the abdominal spines, the most reduced forms representing the highest stages of development. The bristles of the pilifer become rather often modified into scales, or disappear almost entirely in a few instances" (Roths. & Jord., 1903, p. 3).

Egg.—More or less oval in shape, sometimes nearly spherical.

Larva.—Head large, round or triangular, always round in first instar; body nearly cylindrical or slightly tapering in front; segments 2 and 3 never retractile; horn long or short, straight, down-curved or up-curved, or curved first down and then up (*Acherontia*); two or more segments may be tuberculate; colour usually green, but yellow and brown forms also in some species, and forms with dark-coloured patches in others; longitudinal and oblique stripes usually present, and the spiracle on segment 2 may be situated in an ocellus-like spot (*Rhodoprasina*), but lateral or subdorsal ocelli never present.

Pupa.—Tongue very long, or short, in a free sheath or not, but never housed in a forward extension of the head as occurs in many of the Philampeline and Chœrocampine species; coxal-piece present or absent; surface usually shining, often pitted or corrugated; sculpturing on segment 4 and ante-spiracular ridges present or absent; colour usually uniform chestnut or brown, never striped or mottled.

Habits.—Eggs laid singly, except in *Parum*. Larva sluggish, except when looking for a suitable place to pupate; it rests with the head and front of the body raised from the resting surface, the head bent downwards and the true legs bunched together; it strikes sideways with the head when

molested, and some species make a clicking or hissing noise; pupation in a cell underground. The moths vary greatly in habits; when resting they hold the wings sloping downwards, steeply in some species, and completely covering the abdomen or leaving the dorsal stripe only visible; seldom seen on the wing, but a few species may be seen feeding at flowers, and others are attracted by light.

Cosmopolitan, with two subfamilies, ACHERONTIINÆ and AMBULICINÆ.

Subfamily ACHERONTIINÆ.

Butler, 1887 A, p. 517; Roths. & Jord., 1903, p. 4; id., 1907, p. 5; Jordan, 1911, p. 231.

Imago.—"Owing to the frequent reduction or obliteration of a number of organs in this subfamily and the AMBULICINÆ there is no single distinguishing character applying to all species. The two subfamilies can, however, be separated by taking several characters together, as explained under AMBULICINÆ (see this subfamily)" (Roths. & Jord. 1903, p. 4). Terminal segment of antenna long and thin except in the tribe Sphingulini (*Dolbinopsis*; *Dolbina*) and in *Pentateucha* of the tribe Sphingini (it is short in all AMBULICINÆ except *Compsogene*, *Oxyambulyx* and *Cypa*, but these genera have the fore wing with apex sinuate, a character never present in any Acherontiine moth). *Pentateucha* has three claws at end of fore tarsus, and head and thorax clothed with long hairs; *Dolbinopsis* has a single claw and *Dolbina* no claw. In all species the wings are sombre in hue, the markings mostly transverse; fore wing never falcate or truncate, and the outer margin never concave or scalloped, though it may be feebly undulate between the ends of the veins; a "skull-mark" sometimes present on dorsum of thorax, and there may be abdominal side-bands or patches. Frenulum and retinaculum wanting in a few species.

Egg.—Usually green, shortly ovoid or nearly spherical in shape except when first laid and when near hatching; that of *Herse convolvuli* very small, only 1 mm. in length, while those of the other species are double that length.

Larva.—Head round except in *Dolbina*, where it is shortly triangular. Body nearly cylindrical or tapering slightly forwards, the segments and secondary rings well defined; *Meganoton nyctiphanes* has a fleshy conical hump on the dorsum of segment 3, which is wanting in the other two species of the genus. Horn always straight in the earlier instars, but in the last instar straight, down-curved or curved first down and then up as in *Acherontia*. Surface usually smooth in the last instar, though rounded tubercles may be present, and one species has fleshy spines. Pale-coloured oblique stripes always present on segments 5 to 11; ocelli never present.

Pupa.—Variable in shape; tongue reaching tip of wing-case, or shorter, not shorter than fore leg, though equal to it in *Dolbina*; in a free sheath in *Herse* and some other genera; spiracle of segment 2 covered by a large lobe projecting from the front margin of segment 3.

Cosmopolitan, with three tribes, of which the third comes very near the AMBULICINÆ in several respects—Acherontiini, Sphingini, Sphingulini—and eleven Indian genera.

Key to the Genera.

Imagines.

1. Hind wing yellow; fore wing upperside blackish; a "death's-head" mark on thorax; expanse 90–130 mm. . [p. 52. ACHERONTIA Lasp.,
   Hind wing dusky, reddish-brown or rufous. 2.
2. Abdomen with pink or yellow side-patches. 3.
   Abdomen without side-patches 4.
3. Side-patches of pink colour HERSE Oken, p. 60.
   Side-patches of yellow colour . PSEUDODOLBINA, [Roths., p. 86.
4. Fore wing upperside dark brown with a curved yellow streak from apex continued as a very dentate line to outer angle; expanse 136 mm. [p. 81. APOCALYPSIS Butl.,
   Fore wing never so marked . . . . 5.
5. Thorax covered with long hairs; fore tarsus with *three claws*; fore wing red-brown with a large white discal spot; hind wing rufous [p. 85. PENTATEUCHA Swinh.,
   Thorax not hairy. . . . . 6.
6. Fore tibia with *one naked thorn* at end; fore wing upperside grey . . [& Jord., p. 93. DOLBINOPSIS Roths.
   Fore tibia without apical thorn; fore wing upperside grey or brown . . 7.
7. Thorax with a "death's-head" mark . DOLBINA Stgr., p. 94.
   Thorax without "death's-head" mark . 8.
8. Thorax very long, extending far beyond base of fore wing; the tornal angle of fore wing produced; a black discal streak under R^1 of fore wing reaching outer margin . . . . . [Jord., p. 65. MEGACORMA Roths. &
   Thorax of normal length; black streaks under R^1 and M^1 usually present. . . 9.
9. Upperside grey, with a large subapical costal patch outlined with black; expanse over 100 mm. . . . [& Jord., p. 77. PSILOGRAMMA Roths.
   No such subapical costal patch. . . . 10.
10. Upperside grey, hind wing reddish-brown; tibiæ not spiny, spurs very short; expanse under 100 mm. . . . SPHINX Linn., p. 92.
    Upperside brown or grey; yellow or white side-patches except in *analis* [p. 69 MEGANOTON Boisd.,

Larvæ.

1. All segments except the head, segment 2 and anal segments bearing long fleshy spines . . . . [p. 82. APOCALYPSIS Butl.,

No such spines, but with longitudinal or oblique stripes or both ..	2.
2. Horn ~-shaped; green, brown and yellow colour-forms	[p. 54. ACHERONTIA Lasp.,
Horn not ~-shaped; straight, down- or up-curved	3.
3. Head triangular, green with broad yellow cheek-stripe; body green with pale oblique stripes, that on segment 11 strongest; horn, anal flap and claspers tuberculate; spiracles with a white slit widening above and below	DOLBINA Stgr., p. 96.
Head round	4.
4. No tubercles on body or horn, horn strongly down-curved; head with a broad cheek-stripe; in the brown form subdorsal, subspiracular and oblique stripes present; in the green form oblique stripes only .	HERSE Oken, p. 63.
Tubercles on anterior segments and horn and sometimes on anal flap and claspers.	5.
5. Rows of small tubercles on segments 2 to 4, or a large hump on 5; small tubercles on the horn, which is long and slightly up-curved; a varying number of oblique stripes. .. .	[p. 69. MEGANOTON Boisd.,
Rows of large tubercles on segments 2 to 4; horn straight or slightly down-curved; large tubercles on horn, anal flap and claspers; seven oblique stripes	[& Jord., p. 79. PSILOGRAMMA Roths.
Rows of small tubercles on segments 2 to 4; a subdorsal tubercle on 3, a dorso-lateral one on 4 and on the anal flap much larger; horn straight and tuberculate	[Roths., p. 89. PSEUDODOLBINA

Pupæ.

1. Tongue shorter than mid-leg, the distance from front of pupa to end of wing-case about equal to free abdomen ..	DOLBINA Stgr., p. 97.
Tongue always longer, usually reaching tip of wing-case; length from front of pupa to tip of wing-case always more than length of free abdomen	2.
2. Pupa with a free tongue-sheath .	3.
Pupa without free tongue-sheath .	7.
3. Tongue-sheath spiral; sculpturing on segment 4 like shining weals; cremaster conical, with two teeth	HERSE Oken, p. 64.
Tongue-sheath not spiral, shaped like the handle of a jug	4.
4. Antenna in ♂ 3 mm. longer than fore leg, in ♀ equal to or slightly longer than fore leg	[p. 69. MEGANOTON Boisd.,
Antenna in both sexes shorter or longer than fore leg; cremaster with two teeth.	5.
5. Antenna in both sexes longer than fore leg; no sculpturing on segment 4 ..	6.
Antenna in both sexes shorter than fore leg; sculpturing on segment 4; colour chestnut with plum-like bloom	[& Jord., p. 80. PSILOGRAMMA Roths.

6. Cremaster an oval or rounded flattened plate; colour reddish-brown without bloom	[p. 84. APOCALYPSIS Butl.,
Cremaster triangular; colour chestnut without bloom; length of pupa 42 mm.	[Roths., p. 90. PSEUDODOLBINA
7. Tongue reaching tip of wing-case, its base transversely file-ridged; sculpturing on segment 4 like raised pear-shaped weals.	[p. 54. ACHERONTIA Lasp.,

Tribe ACHERONTIINI.

Acherontiicæ, Roths. & Jord., 1903, p. 4; id., 1907, p. 5, t. 1, fig. 7; Jordan, 1911, p. 231.

Imago.—"♂♀. Palpus on the inner side without basal patch of short sensory hairs; second segment *impressed, this cavity covered by a roof of long scales.* Labrum raised to form a rounded carina, which is highest mesially. Tongue strong, either longer than the body or shorter than the thorax—in the latter case (*Acherontia*) very stout. Genal process very small. Second segment of palpus considerably shorter than the first, third small; first externally with deep apical cavity in scaling in *Megacorma*. Antennal segments impressed laterally in ♂; subprismatic with the sides rather rounded in ♀, distal segments compressed, in trans-section elongate-elliptic, in side-view subserrate dorsally as well as ventrally; end-segment *long* and thin, with long scales and bristles. Abdominal tergites and sternites with several irregular rows of spines at the apical margins. Spurs of tibiæ unequal, hind tibia with two pairs; pulvillus present or absent; paronychium with two lobes or one on each side.

"♂. Scent-organ of anterior coxa present, but not always conspicuous. Tenth abdominal tergite long, more or less pointed. Claspers rough, with short spiniform setæ near the apex of the harpe; the patch of friction-scales on the outer side, if present, large, consisting of multidentate scales; apical edge of clasper with bristles, which are sometimes short and stout, spiniform. Harpe short, divided into two or three processes, the upper process armed at the edge with long teeth in *Megacorma*.

"♀. In front of the vaginal orifice there is a flap, rounded, truncate, or divided" (Roths. & Jord., 1903, p. 4).

Larva.—Head round, body tapering slightly frontad: horn down-curved in the last instar, sometimes recurved upwards (*Acherontia*). Surface without tubercles in the last instar except in *Acherontia*. Pale-coloured oblique stripes on segments 5 to 11. Two or more colour-forms.

Pupa.—With a free tongue-sheath (*Herse*), or base of tongue with transverse ridges; coxal piece, sculpturing on segment 4

and antespiracular ridges present. Surface shining, with some pitting on abdomen. Colour chestnut or brown.

Habits.—Eggs laid singly on food-plants belonging to a number of families. Larvæ sluggish. Pupation in a cell underground. Moths heavily built and sluggish except when on the wing; are attracted by light.

Cosmopolitan, with three Indian genera.

Key to the Genera.

Imagines.

1. Tongue shorter than thorax, the latter with skull-mark on dorsum .. [p. 52. ACHERONTIA Lasp.,
   Tongue longer than body; thorax without skull-mark . .. .. 2.
2. First segment of palpus externally with large apical cavity formed by the scaling; abdomen without pink side-patches ... [& Jord., p. 65. MEGACORMA Roths.
   Scaling of palpus normal; abdomen with pink side-patches . HERSE Oken, p. 60.

Larvæ.

Horn tuberculate, curved first down, then up ... [p. 54. ACHERONTIA Lasp.,
Horn smooth, curved downwards. HERSE Oken, p. 63.

Pupæ.

Tongue-sheath free, recurved HERSE Oken, p. 64.
Tongue not in a free sheath . . . . ACHERONTIA Lasp., [p. 54.

Genus **ACHERONTIA** Laspeyres. (Fig. 9).

Laspeyres, 1809, p. 99; Ochsenheimer, 1816, p. 44; Roths. & Jord., 1903, p. 16; id., 1907, p. 8; Jordan, 1911, p. 231.

Genotype: *atropos* Linn.

Imago.—Large and heavily built; upperside of fore wing blackish, hind wing yellow, and yellow side-patches on the abdomen; a "skull" or "death's-head" marking on the dorsum of the thorax, from which the species occurring in England, *Acherontia atropos*, receives its name of "The Death's-head Hawk-Moth."

"♂♀. Tongue short, very thick, hairy, opening before end large, dorsal. Palpi not touching each other, second segment a little shorter than the first; carina of clypeus and base of tongue visible. Antenna thick, much shorter than the fore wing is broad at its widest point. Body very stout. Legs short and stout; anterior tibia short, a little longer than the cell of the hind wing is broad; spur reaching end of tibia; lateral spines of anterior tarsus heavy; middle and hind tarsi strongly compressed, spines heavy; two ventral rows, besides an interno-lateral row of shorter ones, and a number of dorsal and subdorsal spines representing the fourth row; these latter spines fewer in number and gradu-

ally becoming more ventro-lateral on the distal segments; no comb of prolonged spines; posterior tarsus as long as the

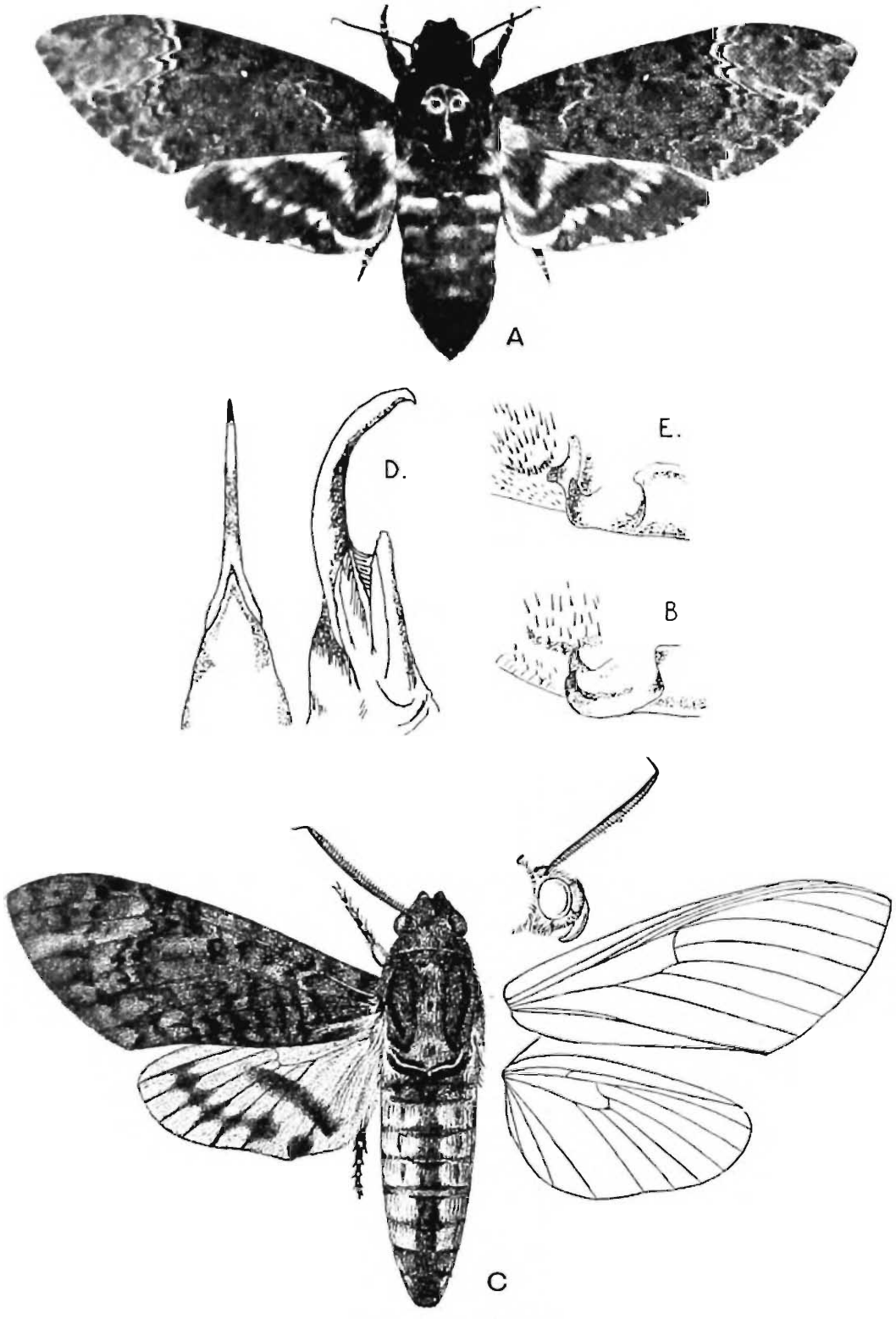


Fig. 9.—*Acherontia* Lasp.

A, *A. lachesis* (Fabr.), ♂; B, harpe. C, *A. styx* Westw., ♂; D, 10th segment, dorsal and lateral aspects; E, harpe.

cell of the hind wing. Pulvillus absent, paronychium reduced to a short broad lobe. Scaling of body and legs (inclusive

of spurs of mid- and hind tibiæ) woolly ; scales of the upper layer of the fore wing multidentate, the teeth long and thin, especially on the under surface ; the scales of the hind wing longer, narrower, partly hair-like, the broader ones deeply slit or long-toothed.

"♂. Tenth abdominal tergite long, slender, pointed, the same in the three species of the genus ; harpe with two processes or teeth ; clasper sole-shaped, with a patch of large multidentate friction-scales. Penis-sheath long and thin, without armature.

"♀. Aperture of vagina with an elliptical rim ; eighth tergite shallowly sinuate " (Roths. & Jord., 1903, p. 16).

Egg.—Nearly spherical, surface smooth and shining, colour green. Length 2 mm.

Larva.—May be distinguished from all other sphingid larvæ in India, except *Rhodosoma triopus*, by the horn being curved first down and then up ; three colour-forms, green, grey and yellow.

Pupa.—Tongue reaches to near tip of wing-case, with transverse file-like ridges at base ; fore leg one-third, mid-leg two-thirds length of wing-case ; a long, narrow coxal piece ; surface smooth and shining ; sculpturing on segment 4 and antespiracular ridges present. Colour chestnut.

Habits.—Eggs laid singly on food-plants belonging to several families. The larvæ when alarmed make a clicking noise with the mandibles, and the moths when molested a squeaking note which is produced by air being forced through the tongue. The moths enter beehives to steal the honey, and are the only Indian Hawk-Moths which are known to feed otherwise than on the wing.

Hab. The Old World, except the Papuan Subregion. Two Indian species and subspecies.

Key to the Species.

Imagines.

Hind wing upperside with the basal third marked with black . . . . . [p. 55.
A. lachesis (Fabr.),

Hind wing with the basal third immaculate
A. s. styx Westw., [p. 58.

Larvæ.

Distal half of horn much curved upwards, sometimes forming a ring ; horn covered with large tubercles ; dotting on dorsum of body smaller, sparser than in *s. styx*, and hardly reaching the front margins of the segments ; spiracles black. [p. 56.
A. lachesis (Fabr.),

Distal half of horn less strongly curved upwards, never forming a ring ; horn covered with small tubercles ; dotting on dorsum of body bolder and reaching the front margins of segments ; spiracles whitish .. [p. 59.
A. s. styx Westw.,

Pupæ.

Segment 2 nearly 4 mm. long; sculpturing on segment 4 slightly concave — *A. lachesis* (Fabr.), [p. 57.

Segment 2 about 2 mm. long; sculpturing on segment 4 flat — *A. s. styx* Westw., [p. 60.

1 **Acherontia lachesis** (Fabr.) (Fig. 9 A, imago, B, genitalia; Pl. I, figs. 1, 2, larva: Pl. VII, fig. 8, pupa; Pl. XIII, fig. 1, larva).

Sphinx lachesis, Fabricius, 1798, p. 434 (Ind. or.).

Acherontia morta, Hübner, 1822, p. 140; Butler, 1877 A, p. 598, pl. xcii, fig. 9 (larva); Moore, 1879 A, p. 595 (Pt. Blair); Butler, 1881 A, p. 613 (Kurachi); Swinhoe, 1885 A, p. 290 (Poona, Bombay: sound of larva, variat. of larva accord. to food); id., 1886, p. 435 (Mhow); id., 1890, p. 164 (Moulmein); Hampson, 1891, p. 2 (Nilgiris, 6,000 ft.).

Acherontia satanas, Boisduval, 1836, pl. xvi, fig. 1.

Acherontia lethe, Westwood, 1848, p. 87, pl. xlii, fig. 2.

Acherontia circe, Moore, 1857, p. 267.

Acherontia lachesis, Moore, 1882, p. 6, pl. lxxvii, figs. 1, 1 *b*, 1 *c* (l., p., i.); Hampson, 1892, p. 67; Roths. & Jord., 1903, p. 17; Jordan, 1911, p. 232, t. 36 *a*; Seitz, 1928, p. 526; Mell, 1922, p. 10, pl. i, figs. 1–9; pl. xxi, fig. 1 (larva); pl. xiv, fig. 40; pl. xv, figs. 1, 2 (pupa); pl. xxi, fig. 2.

Acherontia styx, Swinhoe, 1884, p. 513 (Karachi: larva diff. on diff. plants).

Manduca lachesis, Kirby, 1892, p. 700.

Imago.—♂♀. Large, heavily built and sombre looking; head and thorax blackish, powdered with white, yellow and blue-grey scales; a "skull-mark" on dorsum of thorax, which is more striking than in *styx*, taking the form of round black "eyes" ringed with yellow or pink, and the pale outline of the skull on a darker ground. Abdomen black with a broad, interrupted, grey-blue dorsal stripe and small yellow side-patches on the four proximal segments.

Fore wing blackish, powdered with white, yellow and blue-grey scales; black basal, subbasal, antemedian, median and postmedian transverse bands, of which only the costal portions are clearly defined; a double pale, transverse band immediately following the black postmedian, as well as a pale subterminal lunulate band widening out at costa; a white speck at end of cell; a large apical, costal, fulvous patch reaching down one-third of the terminal margin of wing and variegated with two pale double bands. Hind wing, basal quarter black except for the extreme base, which is yellow; a broad, black, median band from below costa to anal angle, turning up to inner margin; a broad, black terminal band stopping before anal angle. *Undersides* of both wings yellow, the inner half of fore wing with a black patch about middle of cell and a black spot in the end of it, and beyond the cell a dusky, straight, transverse, blurred band followed by a double postmedian dusky line; hind wing

similar; underside of abdomen yellow, the distal five or six segments blackish, leaving only a narrow, yellow, terminal band to these segments. Antenna black, tip shortly yellow; legs black banded with yellow. *Expanse* 102–132 mm.

♂. Armature of harpe (fig. 9 B) represented by two parallel hooks, sinus between them rounded (in dorsal view).

♀. Vaginal aperture provided proximally with a transverse ridge or flap, which is rounded laterally and shallowly sinuate mesially.

Hab. Throughout INDIA, CEYLON and BURMA. Also occurs in China and eastwards to the Southern Moluccas. Common, especially in hills and forest areas.

Larva :—

1st instar. Head and body pale yellow; horn black, long, straight, bifid.

In the succeeding instars, head and body green, horn green; pale yellow oblique stripes develop, and pointed tubercles which disappear in the fourth instar. A grey and a canary-yellow as well as the green form may appear in the third instar.

5th instar. Head with shining surface, covered sparsely with small, glassy tubercles, surrounded by groups of minute tubercles; broadly semi-elliptical, vertex flattened; true clypeus about one-third length of head, basal angles broadly rounded; apex of false clypeus rounded, reaching to one-half length of head; labrum broader than clypeus, narrowing frontad to half the breadth of its base; ligula kidney-shaped; eyes 1 to 4 equidistant, in a gentle curve, 6 in line with 3 and 4 and twice as far from 4 as 4 is from 3; 5 at right angles to the line 3, 4, 6, and about as far from 4 as 4 is from 6. Body tapering slightly frontad from segment 7; each secondary ring on 2 to 4 raised into a sharp ridge in the dorsal area, the anterior ring of 3 higher than the rest. Surface dull and smooth. Horn long, stout at base, tapering first gently, then more strongly, to a sharp point, basal half curved downwards and distal half strongly upwards, sometimes forming a complete ring; surface shining and thickly set with large, conical tubercles.

Coloration.—A grey, a green and a yellow form, the grey being the most common.

Grey form: Head black or dark brown; a paler brown or white subdorsal stripe, and a similar stripe separating the face from the cheek, the two stripes meeting near vertex; a white dorsal stripe from vertex to apex of clypeus, thence running down each side of clypeus; clypeus white with black edges labrum and ligula whitish; antennal basal segment white with the outer sides black, second segment brown, end segment pale pink; mandible shining black. Body grey or greenish-grey, each hair rising from a dusky-coloured

dot ringed with yellowish ; a narrow, pure white dorsal stripe, a broad black subdorsal stripe and a broader white lateral stripe on segments 2 to 4, the subdorsal stripe crossed by a narrow white transverse stripe at the junctions of the secondary rings, all these stripes very sharply defined ; a greyish-green saddle-shaped marking on 2, below the subdorsal stripe ; seven whitish oblique stripes, edged above with purple, on 5 to 11, that on 11 running across 12 to base of horn, the others confined to one segment each. Horn of the body colour ; true legs shining black ; prolegs smoky-black, the feet with long black hooklets ; clasper of the body colour, with a black triangular-shaped mark at the upper edge. Spiracles broadly oval, velvet black with the upper and lower edges tipped with yellow.

Green form : Head green, with a broad, shining black stripe down the cheek ; body grass-green tinged with yellow and sparsely dotted with dark green on the dorsum of segments 5 to 11 ; oblique stripes yellow edged above with broad purple ; horn green with the tubercles paler green, prolegs and claspers green.

Yellow form : Head and body bright canary-yellow with markings as in the green form. Length 100–125 mm. ; breadth 15 mm.

Pupa.—Stout in build, head broadly rounded ; antenna shorter than fore leg ; surface smooth and shining ; base of tongue prominently raised, with a series of 12 short transverse ridges on each side resembling the teeth of a coarse file ; sculpturing on segment 4 consisting of a raised, pear-shaped area on each side of the dorsal line, the broad end laterad, the surface concave and dull and edged anteriorly by a sharp ridge ; five well-developed, parallel, antespiracular ridges on 9 to 11, the longest just in front of the spiracle and the others decreasing in length frontad. Spiracle of 2 covered by a transverse oblong lobe extending from the front margin of 3 ; remaining spiracles oval, the surface rising inwards to a more narrow oval containing the central slit, which has narrow, raised edges. Cremaster broadly triangular, the dorsal surface coarsely, longitudinally rugose, the tip ending in two short teeth, each bearing a bristle. Colour deep chestnut, dorsum of segments 4 to 6 and cremaster nearly black ; spiracles black. Length 57 mm. ; breadth 14 mm.

Habits.—Eggs laid singly on the underside of leaves of a great variety of food-plants, belonging to the families Solanaceæ, Verbenaceæ, Leguminosæ, Oleaceæ, Bignoniaceæ, Labiatæ, etc. The young larva eats the egg-shell after hatching and rests on the midrib or on a vein on the underside of a leaf. It usually eats the cast skin after moulting, rests in the typical *Sphinx* attitude, and when

molested throws the head and anterior segments of the body from side to side, at the same time making a rapidly repeated clicking noise, which appears to be produced by the mandibles. When ready to pupate it stops feeding for some days, and the dorsum becomes suffused with purplish (in the green form) or brown (in the grey and yellow forms). It then leaves the food-plant and hurries along the ground in search of a suitable place to burrow in the earth, moving with a quick undulatory motion. The prolegs and claspers lose most of their prehensile powers during this period. On finding a suitable place it pushes its head into the earth, buries itself in a few minutes, and makes an ovoid cell about 6 inches under the surface and about 80 mm. long by 40 mm. broad, the inside smooth but not lined with silk. The pupa is rather sluggish. The moth rests with the wings folded pent-house-wise, covering the abdomen completely. When disturbed it raises the body from the surface on which it is sitting, at the same time partially opening and raising the wings, and emitting a squeaking note. Mell states that this moth enters bee-hives to steal the honey, as in the case of the English Death's-head Hawk-Moth. It comes to light freely.

2. **Acherontia styx styx** Westw. (Fig. 9 C, imago, D, E, genitalia ; Pl. VIII, figs. 1, 2, larva).

Sphinx (*Acherontia*) *styx*, Westwood, 1848, p. 88, pl. xlii, fig. 3 (E. Indies).

Acherontia styx, Moore, 1865, p. 793 (Bengal) ; id., 1882, p. 7, pl. lxxvi, figs. 1, 1 *a*, *b*, *c* (l., p., i.) ; Swinhoe, 1885 A, p. 290 (Poona, Bombay ; l. sound, colour variable acc. to food) ; id., 1886, p. 435 (Mhow) ; id., 1888, p. 119 (Karachi) ; Warren, 1888, p. 293 (Campbellpore) ; Hampson, 1892, p. 67, fig. 40 (♂) ; Dudgeon, 1898, p. 406 (Sikkim ; Bhutan ; up to 6,000 ft.) ; Nurse, 1899, p. 513 (Cutch).

Manduca styx, Kirby, 1892, p. 700.

Acherontia styx styx, Roths. & Jord., 1903, p. 23 ; Jordan, 1911, p. 232 ; Seitz, 1928, p. 527, t. 60 *a* ; Scott, 1931, pl. ii, fig. 1 (larva).

Imago.—♂♀. Distinguished from *lachesis* by basal third of hind wing upperside being immaculate instead of marked with black, the skull-mark being less conspicuous and the yellow side-patches being more extensive. Fore wing upperside with tawny-russet streaks and a patch of the same colour beyond the greyish-white discal lines. Antenna much more slender and longer in both sexes than in specimens of *atropos* of the same size , the middle segments in the ♀ barely three times as high as long. Anterior tibia longer than in *atropos*, first segment more slender and, like the other segments, with fewer spines than in either *atropos* or *lachesis* ; the lateral apical spines prolonged ; the number of spines individually variable as in the other species ; middle tibia as long as the

first tarsal segment; hind tibia equal in length to tarsal segments 1 to 3. *Expanse*: 90–130 mm.

♂. Ventral process of harpe (fig. 9 E) almost vertical on the plane of the clasper, its broader side nearly horizontal; second process triangular as in *atropos*, its broader side dorso-ventral (vertical); both processes simple or indistinctly notched.

♀. Aperture of vagina without process, but with a mesial carina running proximad from the rim of the opening.

Hab.—Throughout INDIA, BURMA and CEYLON. Very common in open country. We have bred it in many localities, including desert areas.

Larva:—

1*st instar*. Head and body pale yellow, horn black, long, straight, bifid. 2*nd instar*. Head and body bluish-green, dotted with white; seven white oblique stripes; horn purple on dorsal surface, green on ventral. 3*rd instar*. Head and segments 2 to 4 green, rest of body bluish-green; the oblique stripes more strongly marked and edged above with dark green. 4*th instar*. Head and segments 2 to 4 apple-green, rest of body yellowish-green in dorsal area, bluish-green in lateral and ventral; horn green covered with pointed tubercles.

5*th instar*. Head rather square in shape, vertex rounded; true clypeus one-half length of head, its basal angles rounded and tumid; false clypeus forming a broadly rounded arch over apex of true clypeus, reaching to one-half length of head; labrum as broad at base as clypeus, narrowing frontad; ligula kidney-shaped, the lobes broadly rounded. Eyes 1 to 4 equidistant in a gentle curve, about an eye-diameter apart, 6 about three diameters from 4, nearly in a line with 3 and 4; 5 forming an equilateral triangle with 4 and 6. Surface of head shining, minutely irregularly corrugate; body smooth and dull; nearly cylindrical, tapering slightly from segment 7 frontad; the secondary rings of 3 and 4 raised into ridges in the dorsal area. Horn less stout at base than that of *lachesis*, tapering evenly to a sharp point, basal half curved gently downwards and distal half gently upwards; distal two-thirds of anal flap shining and covered sparsely with minute tubercles; horn shining and set sparsely with minute tubercles.

Coloration.—Three forms as in *lachesis*, but the green form is the most common.

Green form (Pl. VIII, figs. 1, 2): Head dark green; a broad, shining black stripe down the cheek; labrum whitish with a black spot in the middle of each half; ligula whitish, the lobes streaked with black; basal segment of antenna white, middle segment white with black base, third segment pale red; mandible pale green with the tip broadly black. Segments 2 to 4 of body yellowish-green, rest of body grass-green; dorsum and sides of 5 to 11 with dark bluish dots along each secondary

ring; seven sharply defined yellow oblique stripes on 5 to 11, each stripe extending upwards and backwards to near the dorsal line of the segment behind, that on 11 extending backwards to the base of the horn; each stripe edged above with dark blue, sharply defined at the common edge but diffuse dorsad. Horn canary-yellow; true legs black; prolegs and claspers green; anal flap green edged with yellow. Spiracles oval, yellowish-white with the central slit black, the whole bordered with brownish-green.

Yellow form: The green colour of head and body replaced by canary-yellow, the markings remaining the same.

Brown form: Head ochreous with the stripe dark brown; body brown; on segments 2 to 4 a broad black dorsal stripe and below it a broad ochreous stripe; the subspiracular area dotted and streaked with brown; a brown oval marking on each side of the dorsum of 2; oblique stripes purple; horn ochreous, legs and prolegs black, claspers brown. Length 90 mm. or more; breadth 12 mm.; horn 10 mm.

Pupa.—Very similar to that of *lachesis* in shape, surface marking and colour. Segment 2 shorter in proportion than in *lachesis*, and the surface of the pear-shaped sculpturing on 4 flat, not concave as in *lachesis*. Antenna slightly longer than fore leg. Cremaster stout, triangular, dorsal surface rugose, tip ending in two teeth, each bearing a bristle. Length 57 mm.; breadth 14 mm.

Habits.—The food-plants belong to much the same families as those of *lachesis*, but *styx styx* feeds also on *Sesamum indicum* DC., of the family Pedaliaceæ. The habits are very similar to those of *lachesis*. The eggs of this species are often attacked by a hymenopterous parasite, which lays its eggs in or on those of the moth. Infected eggs become gradually mottled black and white as the larvæ of the parasite develop. As many as twenty parasites may emerge from one egg. The larvæ sometimes occur in such numbers as to cause serious damage to crops, such as *Sesamum indicum* DC.

Genus **HERSE** Oken. (Fig. 10).

Oken, 1815, p. 762; Roths. & Jord., 1903, p. 6; id., 1907, p. 6; Jordan, 1911, p. 233.

Genotype: *convolvuli* Linn.

Imago.—"♂♀. Tongue very long, strongly attenuate apicad. Palpus without cavity in the scaling at the end of the first segment externally, second segment about a quarter shorter than the first; inner surface of first longitudinally impressed; cavity of second deep, covered by a conspicuous roof of scales. Antenna almost equal in width from near base to near hook in ♂, slightly clubbed in ♀. Tarsi slender; fore tarsus with several prolonged external spines; mid- and hind tarsus

with basal comb of bristles ; posterior tibia longer than first tarsal segment, pulvillus very small, paronychium with *one* lobe at each side instead of two, the smaller ventral lobes obliterated. Scaling of antenna white from base to tip.

" ♂. Procoxal scent-organ not strongly developed. Tenth abdominal tergite more or less dilated before end, apex pointed, compressed : sternite membranaceous, without lobe, continuous with the anal cone, which is long. Clasper sole-shaped, rounded, dilated dorsally before end, this portion curved inwards, inner surface with long bristles except near apex of harpe, where the bristles are short and stout, spine-like. Harpe rather short, with two distal lobes, one above the other, both curving upwards and inwards, the upper one always pointed, the lower one spatulate or pointed. Penis-sheath much thicker than in *Acherontia*, without armature. A patch of large multidentate scales on clasper.

" ♀. A smallsflap in front of the vaginal aperture " (Roths. & Jord., 1903, p. 6).

Hab. Cosmopolitan, with one Indian subspecies.

3. **Herse convolvuli convolvuli** (Linn.). (Fig. 10 A, imago, B–D, genitalia ; Pl. IX, figs. 1, 2, 3, 4, 5, 6, larva ; fig. 7, pupa).

Sphinx convolvuli, Linnæus, 1758, p. 490 ; Buckler, 1887, pp. 22, 108, pl. xxi, fig. 2 *a–c*, pl. xxii, fig. 1.

Protoparce convolvuli, Hampson, 1892, p. 103, fig. 60 (♂).

Herse convolvuli, Roths. & Jord., 1903, p. 11 ; Mell, 1922, p. 22, pl. ii, figs. 18–24 ; pl. iii, fig. 1 ; pl. xxi, fig. 5 (larva) ; pl. xv, figs. 5, 6 (pupa).

Herse convolvuli convolvuli, Jordan, 1911, p. 233, t. 36 *a* ; Seitz, 1928, p. 527.

Protoparce orientalis, Butler, 1877 A, p. 609, pl. xci, figs. 16, 17 (l., p.) ; Moore, 1882, p. 5, pl. lxxv, figs. 1, 1 *a–e* (l., p., i.).

Imago.—♂♀. Upperside grey ; abdomen with a narrow brown dorsal stripe, a broad grey stripe on each side of it, and with narrow white and broader pink and black side-patches. Fore wing with many narrow whitish lunulate bands, nearly obsolescent in some specimens ; black streaks outwards from cell under R^1 and M^1 ; a white discoidal dot, with a black streak from it to apex of wing. Hind wing pale grey, with broad subbasal, two median and postmedian fuscous transverse bands. *Underside* similar, with a black discoidal spot. *Expanse* : 80–120 mm. ; tongue up to 130 mm.

♂. Tenth tergite (fig. 10 B) rounded-dilated before end, apex compressed, pointed, higher than broad ; ventral process of harpe (fig. 10 C) somewhat spatulate.

♀ (fig. 10 D). The mesial flap in front of vaginal aperture arises from an impression and is very thin ; it belongs to the membrane connecting the seventh and eighth tergites ; there is a tubercle at each end of the vaginal orifice and another behind it.

Hab. Eastern Hemisphere except the higher latitudes; rarely in Siberia; straggler in northern countries. It occurs very rarely in England, where it is known as the Convolvulus Hawk-Moth. Occurs throughout the Indian Subregion, in

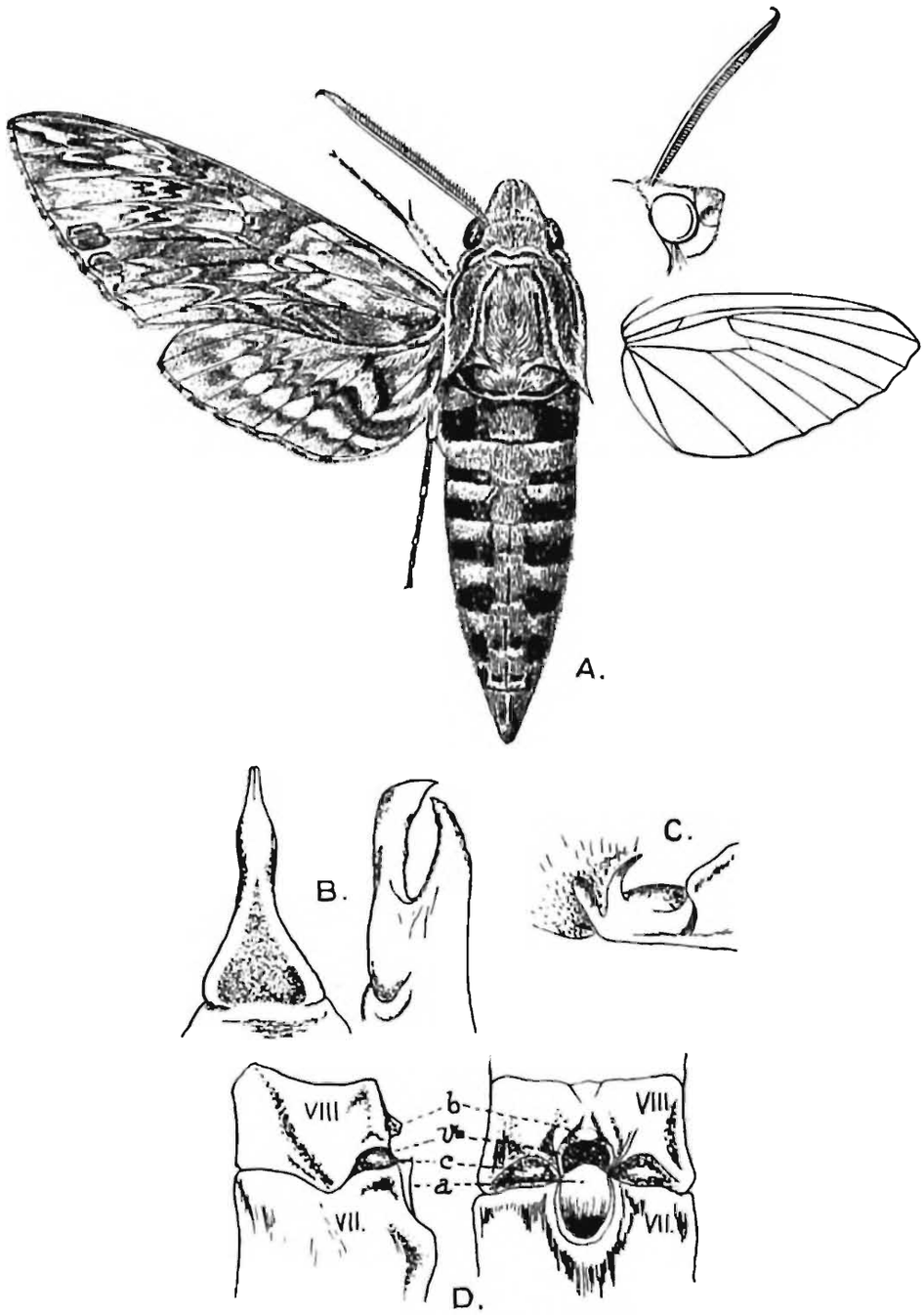


Fig. 10.—*Herse convolvuli* (Linn.).

A, Imago, ♂; B, 10th segment, dorsal and lateral aspects; C, harpe; D, ♀, 7th and 8th tergites, lateral and ventral aspects; *a*, mesial flap, *b*, post-vaginal tubercle, *c*, lateral tubercle, *v*, vaginal orifice.

both wet and dry areas, and at all elevations up to 7,000 feet. We have bred it in many localities.

Egg.—Very small for the size of the insect, shortly ovoid; surface smooth and shining; colour bright bluish-green. Length 1 mm.; breadth 0·9 mm.; height 0·75 mm.

Larva :—

1*st instar*. Head small, body long and thin, horn straight, of medium length, tip bifid ; head and body green, horn black. 2*nd instar*. Little change. 3*rd instar*. Head small ; body increasing gradually in diameter from segment 2 to 8, then nearly cylindrical ; horn nearly vertical, thick at base and tapering evenly to a sharp point ; surface of head and body smooth and shining. Two colour-forms ; in the green form head and body green dotted with white, with seven narrow oblique stripes, whitish, edged above with dark green ; horn green with the base brown ; in the dark-coloured form (Pl. IX, fig. 1) the head brown with a yellow cheek-stripe ; body brown dotted with yellow, and a broad yellow subdorsal stripe from segment 2 to base of horn ; a narrow, waved, yellow subspiracular stripe from segment 2 to 12 ; horn brown with a red stripe on each side. 4*th instar*. Little change ; the dark-coloured form is very variable in colour and markings, one variety being figured (Pl. IX, fig. 2).

5*th instar*. Head round, dorsal line of vertex slightly depressed ; segment 2 of greater diameter than head, the segments increasing in diameter gradually to 7, rest of body nearly cylindrical ; horn of medium length, sharply down-curved, stout at base and tapering evenly to a sharp point. Surface of head and body smooth and slightly shining, of the horn smooth and polished.

Colour very variable, the form figured in Pl. IX, fig. 4, being the most common. In this the head pale yellow with a narrow black dorsal stripe dividing at the apex of the clypeus and running down each side of it ; a broad black subdorsal stripe and a still broader dorso-lateral black stripe separating face from cheek, but not reaching vertex or base of antenna ; labrum and ligula dark brown ; antenna soiled whitish ; mandible and eyes black. Dorsum of body smoky-brown, with short black lines across the secondary rings ; a broad, clearly defined, yellow subdorsal stripe from 2 to 5, crossed by a black line at the margins of the secondary rings, and continued as a broken stripe on the anterior half of segments 6 to 11 ; a broad, pale yellow subspiracular stripe, widening upwards to embrace the spiracles on segments 5 to 12, and sharply defined above by the seven black oblique stripes. Horn black ; legs, prolegs, claspers and venter smoky-brown. Spiracles large, oval, flush, black in colour and lying in a round black patch.

In the green form (Pl. IX, fig. 6) the head grass-green, with a broad pale yellow stripe separating face from cheek ; body grass-green, the oblique stripes pale yellow edged above with violet ; horn orange with a black tip ; legs, prolegs and claspers green. Spiracles orange-red, edged narrowly with dark green. Length 95 mm. ; breadth 14 mm. ; height of head 5 mm. ; horn 9 mm.

Pupa.—Rather slender, head small, frons at right angles to the longitudinal axis of body; tongue reaching tip of wing-case, in a free sheath which starts from the front of head at right angles to body, curves backwards till parallel with the body and then forwards again to touch the ventral surface of the pupa, the slightly bulbous end being near the base of the eye; dorsum of segment 2 slightly notched; antenna of ♂ about 1·5 mm. longer, of ♀ about 1·5 mm. shorter than fore leg; a long, narrow coxal piece. Surface shining; abdomen finely pitted, the margins of the abdominal segments more coarsely pitted; sculpturing on segment 4 a pear-shaped, raised, polished area on each side of the dorsal line, the broad ends ventrad and reaching to about the dorso-lateral line; veins of wings slightly raised; ante-spiracular ridges on segments 9 to 11, three coarse ridges on each. Spiracles oval, rising slightly from shallow depressions, that of 2 covered by a short wide lobe extending from the front margin of 3. Cremaster conical, long and stout, dorsal surface rugose, and ending in two short, stout, conical teeth. Colour leather-brown, spiracles and cremaster black. Length 47 mm.; breadth 12 mm.; tongue-sheath about 13·5 mm. long.

Habits.—Eggs laid singly on any part of the food-plants, usually of the families Leguminosæ and Convolvulaceæ. They are very small, probably the smallest of the sphingids in proportion to the size of the moth. On emerging, the young larva first eats the egg-shell, and after resting on the underside of a leaf commences feeding on it. When small it lies on the leaves, but the full-fed larva may be found on any part of the plant or even on the ground hiding among the roots during the day. It usually rests with the body stretched out straight, the head slightly contracted against segment 2 and 2 against 3. When alarmed it bends the body to one side with the head touching the body near the prolegs of segments 9 and 10, and sometimes raises the anal claspers off the surface on which it is resting, the soles of the feet joined together and quite hidden under the anal flap. It never adopts the typical "sphinx" attitude of raising the front segments and retracting the head. It strikes sideways with the head when molested. The larval stages last from three to four weeks. The larva then rests without feeding for three or four days, and the dorsal area assumes a darker hue. It finally leaves the food-plant, and, in contrast to its usual sluggish habits hurries along the ground till it finds a suitable place to burrow into the earth, in which it forms an ovoid pupal-cell 3 or 4 inches underground. The larvæ, which feed on cultivated pulses (*Phaseolus*), sometimes occur in immense numbers in spite of the havoc caused by crows and other birds, rats, lizards, parasitic flies and ichneumons and burrowing wasps, all of which take heavy toll of them.

The length of the pupal stage is very variable, depending to some extent on the period of the year. It may be as short as seventeen to twenty-six days, but late in the year may last from four to six months, or even longer.

The moths are fast fliers, and appear at dusk to feed at flowers, tubular flowers such as those of *Convolvulus*, *Ipomea*, *Hibiscus*, *Begonia*, *Petunia* and tobacco being the favourites. The extremely long tongue (up to 5 inches in length) enables them to reach the honey at the end of the corolla tube. They are often attracted by light, and are amongst the commonest of sphingids to be caught at lamps. On entering a lighted room they usually fly round for some time and then settle, assuming a characteristic position with the wings folded pent-house-wise over the body, hiding it entirely or leaving only a small portion uncovered, the antennæ being folded back over the wings.

Genus **MEGACORMA** Roths. & Jord. (Fig. 11).

Roths. & Jord., 1903, p. 15 ; id., 1907, p. 7.

Genotype : *obliqua* Walk.

Imago.—"♂♀. Tongue much longer than the body. Second segment of palpus narrower at base, triangular, very much shorter than first segment ; apex of the latter with a regular and large cavity ; the inner surface of the first segment flat, not obviously concave as in *Herse*, scaling at apical margin very regular, this scaling visible from the outer side ; inner surface of second segment all scaled, cavity less deep than in *Herse* and *Acherontia*, the roof of scales over the cavity not quite so distinctly separate from the other scaling of the segment as in the allied genera. Antenna thickest not far from base, gradually thinning towards end. Thorax very long, extending far beyond the base of the fore wing. Tarsi long, slender, spines short ; middle and hind tarsi with conspicuous comb of prolonged spines ; hind tibia as long as first tarsal segment ; pulvillus present, paronychium with two lobes on each side.

" ♂. Tenth abdominal sternite with a broad, rounded, mesial lobe, convex below. Harpe armed with long teeth. Clasper with a broad patch of very broad, multidentate scales, and eighth tergite with elongate, tawny friction-scales at apex ; these scales turned inside, but not forming a ribbon as in AMBULICINÆ. Anterior coxæ with scent-organ ; the tufts of hairs generally visible without removal of the coxæ.

" ♀. Eighth tergite shallowly and broadly sinuate, the angles strongly rounded. Vaginal plate membranaceous proximally, much folded ; anterior margin of the vaginal orifice produced into a truncate, feebly sinuate lip, the angles prominent ; post-vaginal part of plate more strongly chitinized, smooth, short." (Roths. & Jord., 1903, p. 15).

Hab. Oriental Region. One Indian subspecies.

4. **Megacorma obliqua obliqua** (Walk.). (Fig. 11 A–C, genitalia).

Macrosila obliqua, Walker, 1856, p. 208 (Ceylon).
Diludia obliqua, Butler, 1877 A, p. 614 (Ceylon); Moore, 1882, p. 4, pl. lxxiv, fig. 2.
Megacorma obliqua, Roths. & Jord., 1903, p. 15.
Megacorma obliqua obliqua, Seitz, 1928, p. 528, t. 60 *b*.
Sphinx nestor, Boisduval, 1875, p. 113 (Himalayas, ♀).
Pseudosphinx discistriga (non Walk.), Hampson, 1892, p. 105.

Imago.—Has been confused with *Psilogramma menephron* by Hampson and other authors, though recognized as distinct by Walker in 1856. Can be distinguished at once from *P. menephron* by: (1) the second segment of the palpus being impressed, the cavity covered by a roof of long scales, while in *P. menephron* it is not sunken or only slightly concave, and is normally scaled, with a naked streak on the inner surface; (2) by the abnormally long thorax and by the heavy

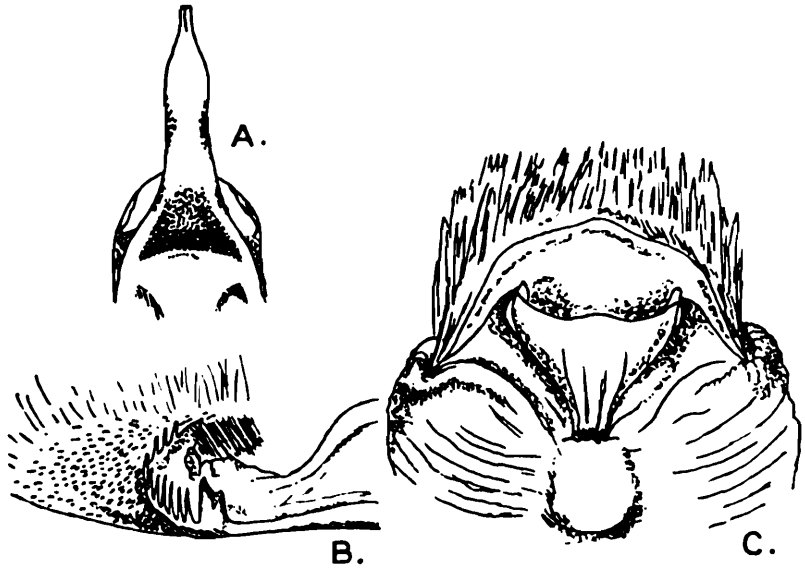


Fig. 11.—*Megacorma* Roths. & Jord. Genitalia.
A, *M. obliqua* (Walk.), 10th segment, dorsal aspect; B, harpe; C, vaginal plate.

black streak under and along R^1 of the fore wing reaching the outer margin. *Expanse*: ♂ 122 mm., ♀ 142 mm.

♂♀. Tenth abdominal tergite (fig. 11 A) resembling in a dorsal view that of *Herse convolvuli*, more slender in a lateral view, gradually narrowed to a point. Clasper sole-shaped, rounded-dilate dorsally before end, ventral margin oblique; harpe (fig. 11 B) with a broadly sickle-shaped distal process which points dorsad and is armed at the rounded ventro-distal edge with long suberect teeth, the most proximal tooth broad; spines of clasper near harpe longer than in the species of *Herse*. Penis-sheath unarmed externally, as broad as in *Herse*.

Hab. E. HIMALAYAS, CEYLON and BURMA; also occurs in Malaya. Has a wide range, but is apparently rare. Early stages unknown.

Tribe SPHINGINI Grote & Rob.

Sphingini, Grote & Robinson, 1865, p. 161.
Sphingicæ, Roths. & Jord., 1903, p. 27 ; id., 1907, p. 9 ; Jordan, 1911, p. 233.

Imago.—" ♂♀. Tongue varying from being many times as long as the body to being very short. End-segment of antenna always long, rough, with dispersed long scales and bristles, reduced in length in *Oliographa*. Second segment of palpus on inner side normally scaled, not sunken or only slightly concave, in *Psilogramma* with a naked streak ; third segment in some of the otherwise more generalized genera long and prominent ; palpus small and rough-scaled in many of the specialized genera. Size of head and eyes very variable ; the latter generally lashed in the reduced forms, and the head often crested. Pilifer normal, or the bristles modified into scales. Spinosity of abdomen varying ; the spines very weak in the specialized genera, seldom absent ; there are always more rows than one to each segment ; the spines of the sternites always much weaker than those of the tergites. Tibiæ simple or spinose, fore tibia often ending in a thorn ; proximal pair of spurs of hind tibia present or absent ; mid- and hind tarsus with comb or without ; the bristles of the comb very long in the generalized forms ; fore tibia not rarely reduced in length and then armed with stout and long spines externally ; pulvillus and paronychium present or absent, the pulvillus disappearing before the paronychium, there being no species with pulvillus and without paronychium, the order in which these organs become obsolete being as follows: ventral lobes of paronychium, pulvillus, lateral lobes of paronychium.

" ♂. Some of the lower (=generalized) genera have a strongly developed procoxal scent-organ, a friction-patch on clasper, and a mesially divided tenth segment, or one of these characters ; the last two characters occurring only in Old-World forms, none of the numerous American species possessing a friction-patch, or having the tenth tergite mesially divided. Armature of clasper and penis-sheath very variable ; the armature of the latter, if there is any, consisting of one, seldom two, apical processes, which are rarely dentate.

" ♀. Antenna in many cases with traces of the fasciculate cilia found in the ♂, and more often incrassate distally than in the ♂. Vaginal plate often rather large, and mostly provided with some kind of armature." (Roths. & Jord., 1903, p. 27).

Egg.—Spherical or ovoid in shape ; surface smooth and shining ; colour green, yellow or brownish-yellow.

Larva.—Nearly cylindrical in shape ; head round or semi-elliptical ; horn well developed, usually straight ; tubercles present on segments 2 to 4, and on horn, anal flap and claspers ;

one genus (*Apocalypsis*) develops long fleshy spines; only one colour-form, generally green, but brown patches may occur in individuals of *Psilogramma menephron*; oblique stripes always present, but never ocelli.

Pupa.—With a free tongue-sheath, the other characters variable.

Habits.—Eggs laid singly on food-plants belonging to several families; pupation in a cell underground, except in the case of *Meganoton nyctiphanes*; the moth rests with the wings held somewhat below the horizontal.

Hab. Cosmopolitan. This is the largest tribe in the sub-family. It is not a homogeneous group, and includes insects which are intermediate in development between the Acherontiini and the Sphingulini. Six Indian genera.

Key to the Genera.

Imagines.

1. Pulvillus present . . .. 2.
   Pulvillus absent or reduced to a triangular lobe .. .. 4.
2. Paronychium with two lobes on each side; long terminal spur of hind tibia only one-fifth shorter than the tarsal segment . [p. 69. MEGANOTON Boisd.,
   Paronychium with one lobe on each side 3.
3. End-segment of antenna long; second segment of palpus with naked stripe on inner side .. . . [& Jord., p. 77. PSILOGRAMMA Roths.
4. Hind tibia with two pairs of spurs. 5.
   Hind tibia with one pair of spurs . SPHINX Linn., p. 92.
5. Fore tarsus with three long curved claws on first segment . .. [p. 85. PENTATEUCHA Swinh.,
   Fore tarsus without such claws. 6. [p. 81. APOCALYPSIS Butl.,
6. Expanse over 120 mm.. PSEUDODOLBINA [Roths., p. 86.
   Expanse less than 80 mm.

Larvæ.

1. Horn down-curved, thin, whip-like, colour blue. ... . [p. 82. APOCALYPSIS Butl.,
   Horn straight, or slightly up- or down-curved ... ... 2.
2. Horn long, straight, blue with a red stripe up each side from base .. . .. [Roths., p. 89. PSEUDODOLBINA
   Horn straight or slightly down-curved, green with paler tubercles. . . .. [Jord., p. 79. PSILOGRAMMA Roths. &
   Horn straight or slightly up-curved near tip, black with sides yellow or bluish-green without crimson stripe [p. 69. MEGANOTON Boisd.,

Pupæ.

1. Colour chestnut with a plum-like bloom. PSILOGRAMMA Roths.
   Colour chestnut or reddish-brown without plum-like bloom . ... [& Jord., p. 80.
2. Tongue-sheath short and thick, not highly arched . . . . 2. [p. 69. MEGANOTON Boisd.,
   Tongue-sheath long and thin, highly arched. 3. [p. 84. APOCALYPSIS Butl.,
3. Length of pupa about 60 mm. PSEUDODOLBINA
   Length of pupa about 40 mm. [Roths., p. 90.

Genus **MEGANOTON** Boisd. (Fig. 12).

Boisduval, 1875, p. 55 (part.); Roths. & Jord., 1903, p. 34; id., 1907, p. 12, t. 2, fig. 3; Jordan, 1911, p. 234.

Genotype : *nyctiphanes* Walk.

Imago.—Brown or grey on the upperside of the fore wing,

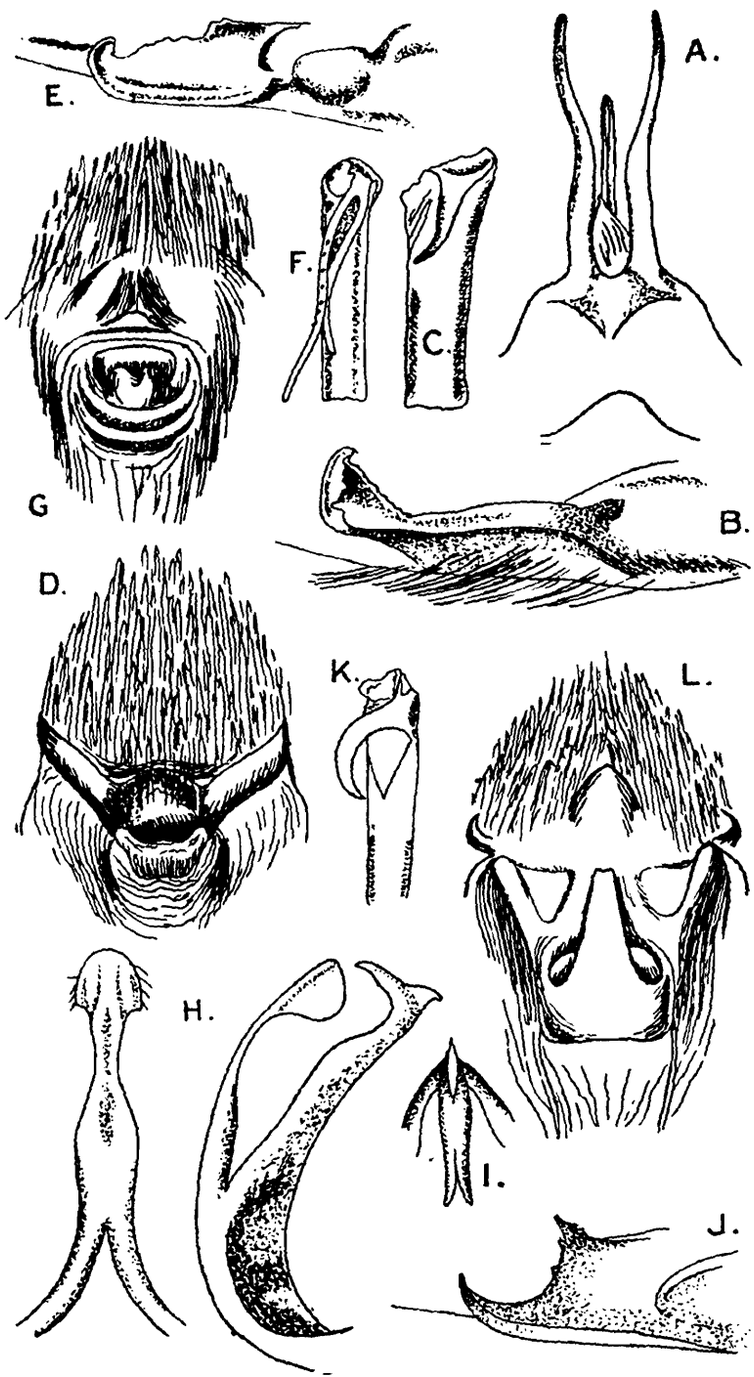


Fig. 12.—*Meganoton* Boisd. Genitalia.

A, *M. analis* (Feld.), 10th segment, dorsal aspect; B, harpe; C, penis-sheath; D. ♀, vaginal plate.
E, *M. nyctiphanes* (Walk.), harpe; F, penis-sheath; G, ♀, vaginal plate.
H, *M. rufescens* (Butl.), 10th segment, dorsal and lateral aspects; I, 10th sternite, apical; J, harpe; K, penis-sheath; L, ♀, vaginal plate.

thorax and abdomen. Species very similar to *Psilogramma menephron*, from which they may be distinguished by the naked stripe on the inner side of the second segment of the palpus in the latter species.

"♂♀. Antenna long and slender, with a long and slender hook. Palpus large, prominent, second segment almost as broad in side-view as long. Eyes large, not lashed. Legs long; tibiæ *not* spiny; fore tarsus without prolonged spines, first segment *shorter* than segments 2 to 5 together; mid-tarsus with very strong basal comb which terminates abruptly, being continued by much shorter bristles; comb of hind tarsus also prominent, the spines gradually shortening distad; spurs long, long apical one of hind tibia at least two-thirds the length of the first tarsal segment, which is *longer* than the tibia and also the other four segments together; hind tarsus *more than twice* the length of the cell of the hind wing (measured along SC); SC^2 and R^1 of hind wing on a rather long stalk; D^2 very oblique. With pulvillus and paronychium, the latter with *two* flaps on each side.

"♂. Clasper with patch of modified scales on outer side; penis-sheath armed at end with one or two long tapering processes which are curved basad." (Roths. & Jord., 1903, p. 35).

Egg.—Rather small, yellowish-brown or green in colour.

Larva.—Similar to that of *Psilogramma menephron*, but the tubercles on the anterior segments, horn, anal flap and claspers smaller; colour green with oblique stripes. The larva of *M. nyctiphanes* has a large fleshy hump on the dorsum of segment 3.

Pupa.—Tongue-sheath free; coxal piece, sculpturing on segment 4 and antespiracular ridges present; colour chestnut.

Habits.—The food-plants belong to the families Verbenaceæ and Laurineæ. Pupation takes place in a cell underground, except in the case of *nyctiphanes*.

Hab. Oriental Region. Three Indian species and sub-species.

Key to the Species.

Imagines.

1.	Hind wing with several pale spots on the disc	[p. 73. *M. nyctiphanes* (Walk.),
	Hind wing without pale spots on the disc.	2. [p. 76.
2.	Abdomen with yellow side-patches.	*M. r. rufescens* (Butl.),
	Abdomen without yellow side-patches	*M. analis* (Feld.), p. 70.

Larvæ.

1.	A large fleshy process on dorsum of segment 3 . .	[p. 74. *M. nyctiphanes* (Walk.)
	Without such process	*M. analis* (Feld.), p. 72

Pupæ.

Seven antespiracular ridges on segment 9	*M. nyctiphanes* (Walk.), [p. 75.
Three antespiracular ridges on each of segments 9 to 11	*M. analis* (Feld.), p. 72.

5. **Meganoton analis** (Felder). (Fig. 12 A–D, genitalia).

Sphinx analis, Felder, 1874, pl. lxxviii, fig. 4 (Shanghai).
Meganoton analis, Roths. & Jord., 1903, p. 37 ; Jordan, 1911, p. 234, t. 36 *c* ; Seitz, 1928, p. 528, t. 60 *b* ; Mell, 1922, p. 34, pl. ii, figs. 2, 3, pl. xxi, fig. 8 (larva), pl. xiii, figs. 1, 2, pl. xv, figs. 7–9 (pupa), pl. xxi, fig. 9 (♂).
Diludia grandis, Butler, 1875, p. 260 (Nepal).
Diludia tranquillaris, Butler, 1877 A, p. 641 (Darjeeling).
Pseudosphinx discistriga, Hampson (non Walk.), 1892, p. 105.

Imago.—♂♀. Upperside of body and fore wing grey, the hind wing and dark markings of fore wing and abdomen walnut-brown ; underside of body and first segment of palpus greyish-white ; wings pale walnut-brown with grey base. Fore wing above with distinct white discocellular dot lying in the anterior broad portion of the antemedian transverse band ; between the lower radial and upper median branches a longitudinal streak, connected with the transverse band and distally reaching an elliptical submarginal spot ; between the cell and margin four transverse lines, the first two of which are more or less confluent, the third one slightly developed, the fourth widened anteriorly and here connected with the broad apical oblique stripe. Hind wing with whitish-grey markings before the hind margin and at the anal angle. Distal margin of fore wing not undulate as in the two preceding species, shallowly sinuate before posterior angle. Second segment of palpus rather smaller than in the other species. Row 2 of spines of first segment of hind tarsus extending close to the base as in *Psilogramma*. *Expanse* : 106–150 mm.

♂. Tenth tergite (fig. 12 A) divided into two long and slender processes, which are regularly curved downwards and gradually narrowed to a point ; the processes approach each other a little in middle ; the sternite produced into a long cylindrical process, which is slightly bent downwards at end, the apex obtuse. Clasper sole-shaped, dorsal margin bent inwards ; the large clay-coloured patch of modified scales on the outer side consisting of large, multidentate, ribbed scales ; harpe (fig. 12 B) ladle-shaped, minutely dentate ; subdorsal longitudinal groove of clasper sharply defined, deep, the fold below it with long bristles. Penis-sheath (fig. 12 C) with one pointed process, which is rather broad at base. Eighth tergite *without* friction-scales on the inner surface.

♀. Vaginal plate (fig. 12 D) very feebly chitinized, the whole postvaginal part membranaceous and scaled, the antevaginal

part also membranaceous; from the vaginal cavity a narrow stripe of chitin extends to each side; the upper edges of these plates continuous, forming an arcuate ridge which borders the vaginal cavity behind; the proximal edge of the cavity formed by a very thin membranaceous fold, which is preceded by a stronger fold.

Hab. E. HIMALAYAS (Darjeeling; Khasi Hills) and China. Mell has bred the species in S. China, where it occurs in mountainous country at an elevation of from 1,500 to 2,000 feet.

Egg.—Relatively very small, broadly oval; surface smooth and shining; colour pale yellow. Length 1·5 mm.; breadth 1·25 mm.

Larva :—

Final instar. Body tapering slightly from segment 5 forward to the large round head; horn long, straight, conical. True clypeus less than half the height of the head. Surface of head and body dull; the segments well defined, with five secondary rings on segments 2 and 3, six on 4, and eight on 5 to 11; each ring on 2 to 10 has a transverse row of small rounded tubercles, which become smaller on the posterior segments and disappear on 11 and 12; horn and faces of anal claspers tuberculate and a triangle of polished, button-like tubercles on the anal flap. Coloration: Head and body green above the spiracles, greyish-green below these and on the venter; segments 2 to 4 immaculate; yellow oblique stripes on 5 to 7 and on 11, the latter running across 12 to base of horn, the dorsal area between the stripes lilac. Horn black above, yellow on the sides. Spiracles oval, greyish-yellow, with the central slit coffee-coloured, the whole lying on oval yellow patch. Length 90 mm.; horn 11 to 13 mm. long.

Pupa.—Similar in shape to that of *M nyctiphanes*; tongue-sheath free, not curved into a spiral, touching venter at about middle of thorax; the bulbous end reaches to tip of wing-case; antenna reaches to middle of wing-case; the fore leg shorter and the mid-leg longer than the antenna; coxal piece very small and narrow. Surface shining, abdominal segments well defined; the sculpturing on segment 4 narrow flat surfaces, broadening slightly laterad; antespiracular ridges on 9 to 11 in the form of three parallel ridges on each. Cremaster stout, conical, rugose above and below, with a ventral median ridge at extremity which is prolonged into a short, highly polished, bifid shaft. Colour reddish-brown. Length 60 mm.

Habits.—Food-plant: *Sassafras Tzumu* Hemsl., family Laurineæ (in China). Pupation in a cell underground. The resting position of the moth is the same as that of *M nyctiphanes.*

6. **Meganoton nyctiphanes** (Walk.). (Fig. 12 E–G, genitalia; Pl. IX, fig. 8, larva; fig. 9, pupa).

Macrosila nyctiphanes, Walker, 1856, p. 209 (Silhet).
Meganoton nyctiphanes, Boisduval, 1875, p. 59 (N. India); Roths. & Jord., 1903, p. 35; Seitz, 1928, p. 528, t. 60 *c*.
Pseudosphinx nyctiphanes, Butler, 1877 A, p. 610; id., 1881 B, p. 15, pl. lxxxi, fig. 7; Hampson, 1892, p. 105, fig. 59 (l., p.).
Pseudosphinx cyrtolophia, Butler, 1875, p. 259 (Madras); id., 1877 A, p. 611, pl. xci, figs. 11–13, pl. xcii, fig. 6 (l., p.); Hampson, 1892, p. 168.

Imago.—♂♀. Upperside dark brown. Fore wing variegated with various shades of brown and grey scales and crossed by numerous waved dark lines, of which about six are median and one submarginal; a pale small spot in end of cell; black streaks from the cell under R^1 and M^1 not reaching outer margin, which is undulate. Hind wing dark brown with a series of pale spots across the disc, cilia brown and whitish. Thorax with black streaks at sides nearly meeting on the dorsal line, where there are a few blue scales; head, thorax and abdomen white below; abdomen with white segmental streaks at sides. Eye large. Palpus very large. Fore tarsus with first segment as long as segments 2 to 4 together. *Expanse*: ♂ 120 mm., ♀ 140 mm.

♂. Tenth tergite long, compressed, carinate below, highest beyond middle, strongly curved at base, then nearly straight, and at apex again curved, tip truncate; the broad and rather long lobe of sternite flat, slightly curved upwards, deeply sinuate, each half rounded externally, angulated at sinus. Clasper broad, dilated dorsad before middle, long hair-scales of dorsal margin and scaling proximally of patch of modified scales white; this patch clay-colour, large, the scales small, very close together, longer than broad, somewhat narrowed at end, bidentate; harpe (fig. 12 E) with a spatulate process, which is curved upwards at end, the oblique upper edge irregularly notched and toothed. Penis-sheath (fig. 12 F) with *two* long unequal processes close together, the longer one denticulate. Eighth segment laterally tufted; on the inner surface on each side a series of large friction-scales, which are *not* present in the other two species of the genus.

♀. Vaginal plate (fig. 12 G) much folded, raised mesially from base to vaginal cavity; proximal edge of the latter raised into a double tubercle.

Hab. E. Himalayas, S. India, Ceylon, Burma and the Andamans; also in Malaya. A rare, local insect, apparently confined to forests with heavy rainfall up to 1,000 feet elevation. We have bred the species in S. India.

Egg.—Spherical, surface smooth and shining, colour green. Diameter 1·75 mm.

Larva :—

1*st instar*. Very pale green, becoming darker after feeding; horn straight, black, bifid; the anal flap has a small fleshy protuberance on dorsum. 2*nd instar*. Green with faint oblique stripes; horn black with a broad white subterminal band, tip bifid. 3*rd instar*. Colouring similar to that in 2nd instar but oblique stripes more strongly marked; a protuberance on the dorsum of segment 3. 4*th instar*. Shape and colouring as in the full-fed larva.

5*th instar*. Head broadly semi-elliptical in shape, large and powerful; true clypeus one-third length of head; false clypeus a wide arch over apex of true clypeus, reaching to one-half length of head; labrum three-quarters length of clypeus, hind margin gently curved backwards, front margin curved, emarginate and half as long as hind margin; ligula in the form of two narrow ovals joined proximally and diverging distally, hind margin as long as front margin of labrum; eyes 1 to 4 about one eye-diameter apart, 6 about three diameters from 4, 5 three diameters from 4 and four diameters from 6; the line joining 1 and 2 at right angles to the straight line joining 3, 4 and 6; eye 3 slightly larger than the rest. Surface of head moderately shining, with large, low, glassy tubercles interspaced with minute tubercles; labrum with small tubercles on its lateral edges. Body tapering slightly frontad from segment 5; the protuberance on 3 a fleshy, triangular, truncated pyramid 3 mm. high, flattened in front and behind. Horn rising from a tumidity, straight to near tip, where it is slightly up-curved, tip narrowly and minutely bifid. Surface of body smooth and dull; a line of small tubercles starting subdorsally at the front margin of 2, running to the top of the protuberance on 3 and thence to the hind margin of 4; the subspiracular hair on segments 7 to 11 composed of about nine short stems, each of which branches into a much longer fork, the whole spread horizontally into a fan; on 5, 6 and 12 there are only two or three branched stems, on 2, 3, 4, 13 and 14 the subspiracular hair is simple; horn covered with small glassy tubercles.

Colour of head dark green, the tubercles forming an obscurely grey mottling; labrum and ligula yellow; basal segment of antenna yellow, other segments pale pink; mandible whitish with the edge narrowly and the tip broadly black. Body bright green dorsally, dull green speckled with pale yellow dots laterally; the line of tubercles on segments 2 to 4 yellow; a glaucous white dorsal stripe on 6 to 11; oblique stripes on the same segments, the last running across 12 to base of horn; these stripes may be broad, indistinct and bluish-grey in colour, becoming narrow and white near the hind margin of the adjoining segment

behind, or may be formed of a quadrate white spot just above the spiracle followed by four or five parallel white lines touched with lilac, or even formed of a few enamel-white spots. Horn bluish-green with the tip green. Legs with basal segments yellowish, other segments dull rose-colour; prolegs and claspers green with the feet livid-white. Spiracles flush, oval, white with a coarse black edge, lying on a larger oval of bluish-green. Length 80 mm.; breadth, 13 mm.; length of head 7 mm.; horn 14 mm.

Pupa.—Similar in shape to that of *Psilogramma menephron*, except for the free tongue-sheath, which is comparatively short and stout; it commences between the eyes at right angles to the longitudinal axis of the body, then bends sharply to become parallel with that axis; cylindrical near the base and thickens distally to a bulbous tip opposite venter of segment 2; tongue reaches tip of wing-case; fore leg shorter and mid-leg longer than antenna; coxal piece long and narrow. Surface shining; frons and a ring round the head smooth; tongue-sheath with basal half transversely lined, the bulbous end smooth; antenna with shallow transverse ridges; legs smooth, costal vein of wing prominent and beaded; the sculpturing on segment 4 takes the form of a rugose half-disc on each side of dorsal line, separated by a depression; the base extends the whole length of the segment, and the rounded end to about three-quarters of the depth of the segment; thorax rugose, remaining segments pitted, the pitting being most dense at the front margins of the segments; antespiracular ridges on 9 in the form of seven evenly-spaced ridges. Spiracle of 2 oval, with a rough convex surface, the other spiracles oval and sunken, with a large central slit. Cremaster triangular, very rugose dorsally and ventrally, and ending in a smooth round-topped extremity bearing a pair of short, soft, pale-coloured hairs. Colour dark chestnut, paler on wings, darker on tongue-sheath and cremaster; spiracles dull black. Length 45–60 mm.; tongue-sheath 7–10 mm.

Habits.—Eggs laid singly on the underside of a leaf of the food-plant *Symphorema involucratum* Roxb., family Verbenaceæ. On hatching, the larva eats the egg-shell and lies on the underside of a leaf when feeding, but usually retires to a secluded twig among thick foliage when resting. It is sluggish, and when at rest raises the fore part of the body from the resting surface, the face parallel with it, the true legs bunched together. When ready to pupate it turns brownish and wanders for some distance from the food-plant. It does not burrow into the earth, but makes a rough cocoon on the surface by binding leaves and rubbish together with silk. The pupa, if disturbed, makes a hissing noise by moving

the abdominal segments 9 and 10 rapidly to and fro, at the same time rapidly contracting and lengthening the abdomen. The moth has rather a weak flight. It rests with the wings slanting rather broadly and widely penthouse-wise. We have never seen the moth feeding nor coming to light.

7 **Meganoton rufescens rufescens** (Butler). (Fig. 12 H–L, genitalia).

Diludia rufescens, Butler, 1875, p. 260 (N. India).
Diludia rufescens, Swinhoe, 1892, p. 33 (Silhet).
Meganoton rufescens rufescens, Roths. & Jord., 1903, p. 37 ; Seitz, 1928, p. 528, t. 60 *c*.
Pseudosphinx discistriga, Walk., Hampson, 1892, p. 105.

Imago.—♂♀. Similar to *M nyctiphanes*, but of a darker brown, and without pale spots on disc of hind wing ; sides of mesothoracic tegulæ of the same brown colour as the fore wing ; abdomen with three or four yellow side-patches, bordered above by a black continuous band. Palpus as large as in *nyctiphanes*, second segment shorter than broad (scaling included). Antenna of ♂ rather thicker than in *nyctiphanes*. *Expanse* : 116–162 mm.

The species bears a remarkable resemblance to dark specimens of *Psilogramma menephron*, with which Hampson confused it.

♂. Tenth abdominal segment very peculiar ; the tergite (fig. 12 H) gently curved, strongly spatulate, the sides of the dilated apical portion clothed with some long stiff hairs and turned downwards, apical margin rounded-truncate ; tergite thin ; sternite longer than tergite, suddenly turned upwards near end, and produced at the curvature into an obtuse process, which is compressed like the vertical cleft apical part of the sternite (fig. 12 I). Clasper : ventral margin oblique ; dorsal margin first straight, then somewhat dilated and turned inward ; apex obliquely rounded ; patch of friction-scales clay-colour, the scales large and multidentate ; harpe (fig. 12 J) produced into a curved, almost finger-like, pointed, ventral process, the oblique upper margin dilated into a triangular lobe, which is armed with teeth. Penis-sheath (fig. 12 K) with one curved process, which is less than twice as long as the sheath is wide ; the process recurved towards the sheath.

♀. Vaginal plate (fig. 12 L) rather strongly chitinized, glabrous, convex mesially ; vaginal cavity before middle, covered by a long sinuate-truncate lobe which narrows distally.

Hab. E. HIMALAYAS (Sikkim ; Silhet), the ANDAMANS, Borneo, Mindanao and the Sulu Islands. Early stages unknown.

Genus **PSILOGRAMMA** Roths. & Jord. (Fig. 13).

Roths. & Jord., 1903, p. 42; id., 1907, p. 14; Jordan, 1911, p. 234.

Genotype: *menephron* Cram.

Imago.—" ♂♀. Antenna shorter than in *Meganoton*, hook shorter, penultimate segment about as long as high, the preceding ones shorter than high. Palpus differing from that of all other species of the present subfamily in the second segment having a *naked* stripe over the inner surface (as prolongation of the naked stripe of the first segment). Labrum very little raised in middle. First segment of fore tarsus somewhat longer than segments 2 to 4 together; comb of mid-tarsus well developed, that of hind tarsus as in *Meganoton*; long spur of mid-tibia about half, the long apical one of hind tarsus nearly two-thirds, the length of the respective first tarsal segment. Pulvillus and paronychium present, these latter with *one* lobe on each side.

" ♂. Clasper with patch of modified scales, the scales large, rounded, entire, multistriate; harpe vestigial, represented merely by a thickly scaled slight incrassation of the ventral margin of the clasper; process of penis-sheath short, forked. No friction-scales on the inner surface of eighth tergite.

" ♀. Antenna subcylindrical, cilia not prolonged." (Roths. & Jord., 1903, p. 42).

Hab. Oriental Region. One Indian subspecies.

8. **Psilogramma menephron menephron** (Cramer). (Fig. 13 A–F, imago; Pl. I, figs. 4, 5, larva; Pl. VIII, fig. 5, pupa; Pl. XIII, fig. 2, larva).

Sphinx menephron, Cramer, 1780, p. 164, pl. cclxxxv, fig. A (♀) (Amboina).

Psilogramma menephron menephron, Roths. & Jord., 1903, p. 43; Jordan, 1911, p. 234; Seitz, 1928, t. 60 *d*; Scott, 1931, pl. ii, fig. 2 (larva).

Psilogramma menephron, Mell, 1922, p. 48, pl. ii, figs. 4–8, pl. xxi, figs. 10, 11 (larva), pl. xiii, fig. 3, pl. xv, figs. 12, 13 (pupa), pl. xxi, fig. 12 (♀).

Macrosila discistriga, Walker, 1856, p. 209 (Silhet, Hong-kong, N. China); Moore, 1865, p. 793 (Bengal).

Pseudosphinx discistriga, Hampson, 1892, p. 105 (part.).

Sphinx abietina, Boisduval, 1875, p. 108 (Himalaya).

Diludia vates, Butler, 1875, p. 13 (Ceylon, Madras); Moore, 1882, p. 3, pl. lxxiv, fig. 1 *a* (♂♀); Swinhoe, 1885 A, p. 289 (Poona, Bombay); id., 1890, p. 165 (Moulmein); Hampson, 1891, p. 2 (Nilgiris); Swinhoe, 1892, p. 34 (Bengal).

Imago.—♂♀. Head, thorax, abdomen and fore wing grey; dark brown bands along sides of palpi and thorax meeting on metathorax, where there are a few blue and yellow scales; abdomen with a blackish dorsal stripe and brown subdorsal,

segmental patches. Fore wing with dark oblique lines from costa ; two black streaks from cell, one under R^1 and one under M^1 ; a black streak under SC^5 apicad, continued as a dentate streak to apex of wing and obliquely to costa at the proximal end and sharply defining a pale apical patch ; a series of whitish submarginal lunules ; cilia chequered black and white. Hind wing brown, with a black patch at anal angle, limited inwardly by a pale submarginal line, and more or less suffused with grey.

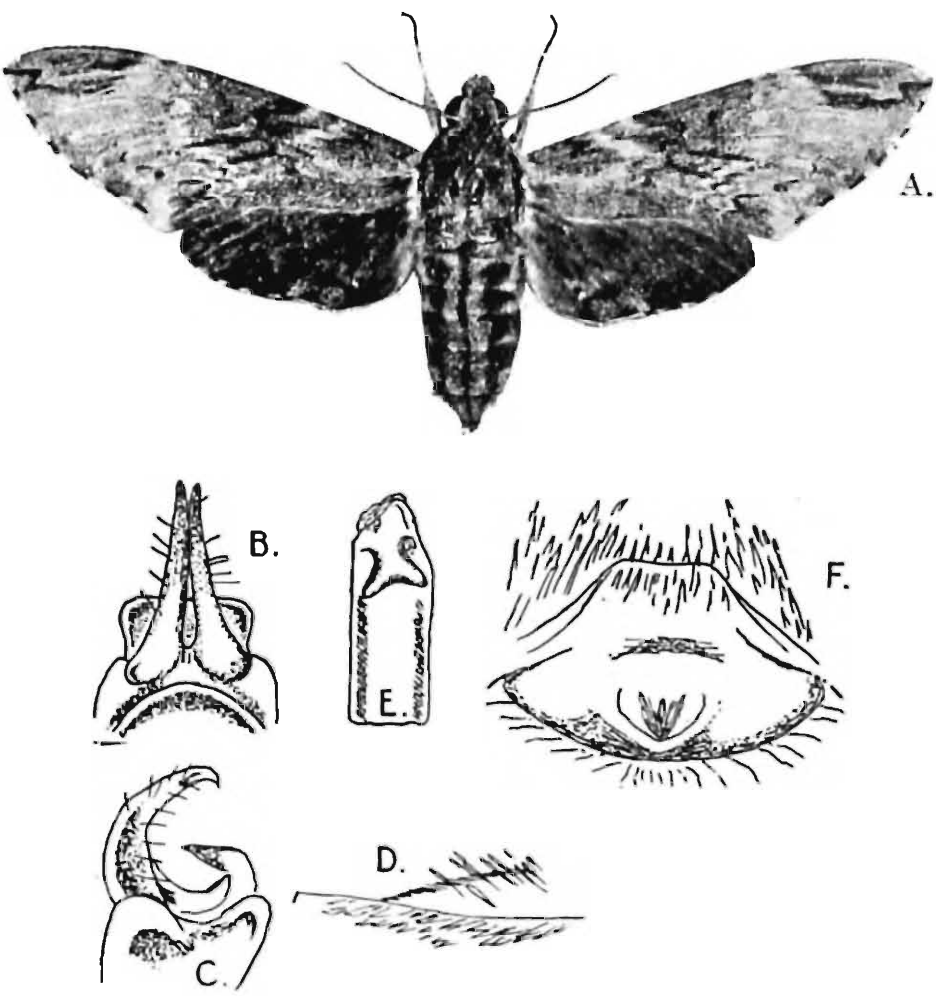


Fig. 13.—*Psilogramma* Roths. & Jord.

A, *P. menephron* (Cram.) ; B, 10th segment, dorsal aspect ; C, 10th segment, lateral aspect ; D, harpe ; E, penis-sheath ; F, ♀, vaginal plate.

The moth very variable in size, colour and markings, some specimens being very dark with subbasal, antemedian, median and postmedian lines showing plainly, others very grey, with these lines obsolescent. The black streaks under R^1, M^1 and SC^5 are always present. Specimens bred during the rainy season are usually dark. *Expanse* : ♂ 82–122 mm., ♀ 108–138 mm.

The name *vates* Butler applies to pale specimens.

♂. Tenth tergite (fig. 13 A, B) divided into two slender curved processes which lie close together, but are movable separately : sternite short and broad, the lobe broader than long, truncate-sinuate, the angles slightly produced, sides distally rounded-dilate. Patch of modified scales about three times as long as broad, deep brown except at edges. Process of penis-sheath (fig. 13 E) very characteristic, sometimes distinctly asymmetrical.

♀. Postvaginal portion of vaginal plate (fig. 13 F) chitinized, smooth, scaled, half-moon-shaped, somewhat truncate, the lateral margins elevated ; vaginal cavity surrounded proximally and laterally by a wrinkled membranaceous ridge.

Hab. Throughout the Indian Sub-region, China and eastwards to the Solomon Islands. Widely distributed and locally common, in both forests and open country, up to 6,000 feet elevation. We have bred it in the E. Himalayas (Khasi Hills) and S. India.

Egg.—Shortly ovoid, surface smooth and shining ; colour pale green. Length 1·6 mm. ; breadth 1·4 mm.

Larva :—

Final instar. Head round, slightly longer than broad, vertex rounded ; true clypeus one-third to one-half length of head, basal angles rounded and slightly tumid ; labrum three-quarters length of clypeus ; ligula as long as labrum, shaped like a bent sausage ; eyes 2, 3, 4 and 6 nearly in a straight line, 1, 2 at an angle of about 120° to that line ; 1 and 2 and 3 and 4 less than an eye-diameter apart ; 5 and 6 about two diameters from 4, 5 about three diameters from 6. Surface of head smooth and shining. Body nearly cylindrical, tapering slightly from segment 5 frontad. Horn long, straight or slightly down-curved, stout at base and tapering evenly to a blunt point. Surface of body smooth and dull ; on segments 2 to 4 transverse rows of large, shining, rounded tubercles, two rows each on 2 and 3, one row on 4, each row running along a secondary ring over the dorsum, about eight tubercles in each row ; horn shining and covered with large, shining tubercles.

Colour. Head grass-green ; a white stripe running down the cheek from near vertex to base of antenna ; labrum and ligula opaque white, sinus of ligula bordered rusty-red ; basal and second segment of antenna pale yellow, third segment pale rusty-red ; mandible pale yellow, outer face pale rusty, tip broadly reddish-brown. Segments 2 to 4 of body bluish-green, the tubercles white or yellow, rest of body bright grass-green in dorsal area, paler bluish-green in lateral area ; a narrow whitish dorsal stripe from 5 to base of horn ; seven broad white oblique stripes on 5 to 11, the upper edge sharply defined and bordered with dark green, the lower edge ill-defined ; each stripe runs back to join the dorsal stripe

on the adjoining segment, that on 11 running back to base of horn. Horn green with paler tubercles. True legs pale yellow with the end-segment rust-coloured; prolegs and claspers green; tubercles on anal flap and claspers black. Spiracles oval, flush, white with a central black slit, the whole ringed narrowly with green. Some individuals develop irregular patches of lilac or brown above the oblique stripes, and these sometimes extend to the dorsum on some of the segments to the anal flap, claspers and venter. Length up to 90 mm.: horn about 12 mm.

Pupa.—The shape as figured (Pl. VIII, fig. 5); tongue reaching to tip of wing-case; tongue-sheath free, a cylindrical tube with bulbous end, shaped like the handle of a jug, starting from the frons in a line at right angles to the axis of the body, then curving backwards in an arc or semicircle, the bulbous end touching the venter of the pupa at the middle of the wing-case, where it often forms a depression in the surface, though remaining free; antenna shorter than fore leg in both sexes; coxal piece present. Surface smooth and shining, covered with a bluish plum-like bloom; eye-crescent black, shining and depressed; the head and thorax minutely wrinkled; sculpturing on segment 4 in the form of a subdorsal, flat, oblong weal, slightly raised, black and shining, with a median channel; ante-spiracular ridges on 9 to 11, four ridges on each. The spiracle of 2 indicated by a raised, black, oval spot, those on the other segments oval and lying on a larger oval depression. Cremaster triangular, flattened dorsally and laterally, the edges of the dorsal surface raised into a ridge, leaving a median channel; the dorsal surface rugose, the ventral surface shallowly hollow with a slight median keel and raised edges; the truncate tip ends in two slighty converging teeth. Colour chestnut under the bluish bloom; spiracles the same with black central slits; cremaster black. Length 55 mm.; tongue-sheath 19 mm.

Habits.—Eggs laid singly on a number of food-plants, including *Olea dioicum* Roxb., *Jasminum* Linn., *Ligustrum* Linn., and *Nyctanthes Arbor-tristis* Linn., family Oleaceæ; *Tectona grandis* Linn., *Clerodendron infortunatum* Linn., *Vitex negundo* Linn., and *Callicarpa arborea* Roxb., family Verbenaceæ. The habits of the larva are similar to those of moths of the genus *Acherontia*; it is sluggish, resting by day and feeding by night, the resting position being the characteristic sphinx-like attitude of raising the front part of the body from the surface, bowing the head and bunching the fore legs together. When molested it strikes sideways with the head and makes a clicking noise. The larva moults four times. Pupation in a cell underground. Habits of the imago similar to those of the genus *Acherontia*; when disturbed raises the front part

of the body and wings ; sometimes makes a clicking noise similar to that made by the larva ; flight rapid. Frequently comes to light, and may often be caught feeding at tubular flowers after dusk.

Genus **APOCALYPSIS** Butler. (Fig. 14).

Butler, 1887 A, p. 641 ; Roths. & Jord., 1903, p. 99 ; id., 1907, p. 23.

Genotype : *velox* Butl.

Imago.—" ♂♀ Eye not lashed spur of fore tibia not reaching end of tibia, long terminal spur of hind tibia more than two-thirds the length of the first tarsal segment, little shorter than the tibia Antenna of ♀ similar to that of ♂, compressed, with long fasciculate cilia.

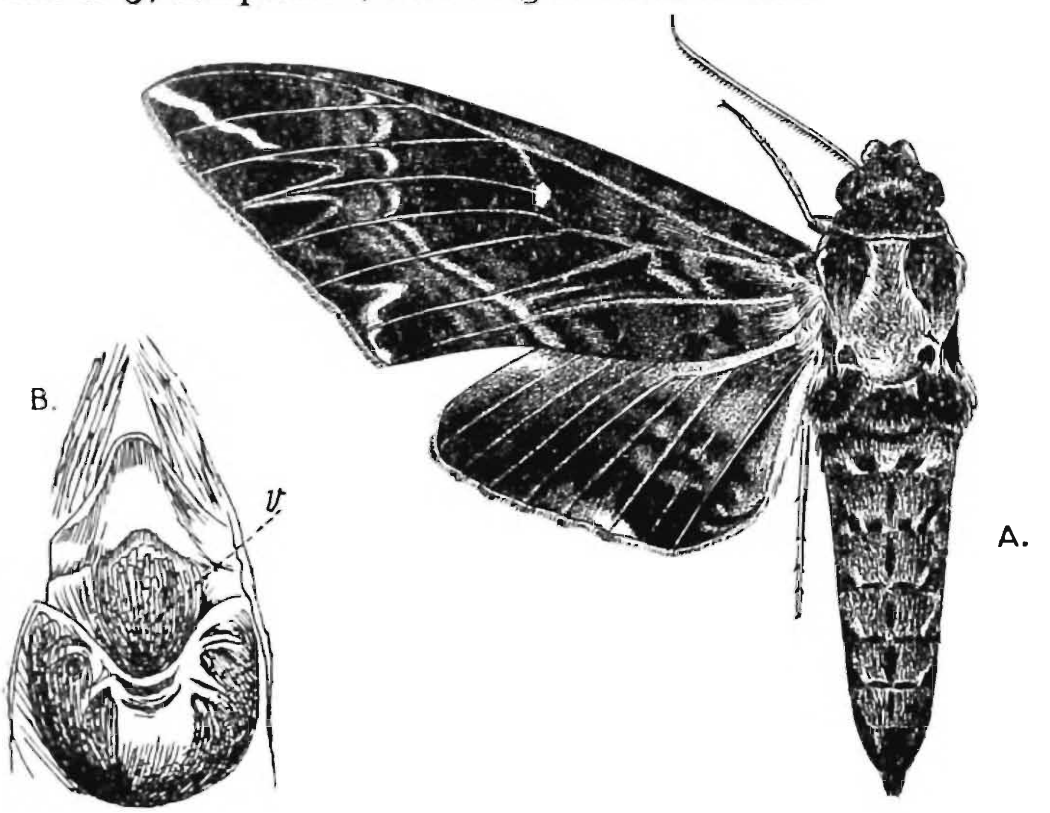


Fig. 14.—*Apocalypsis* Butl.
A, *A. velox* Butl., ♂ ; B, ♀, vaginal plate (*v*, vaginal cavity).

" ♂. Tenth tergite long, narrow, pointed, curved downward, carinate beneath ; sternite also elongate, slightly narrowed to the end, which is rounded. Clasper without patch of modified scales ; harpe obtusely triangular, not prominent, densely covered with half-erect scales, which conceal the outline of the harpe. Penis-funnel ventrally ending in a short, rounded lobe ; penis-sheath armed with a strong, conical, apical tooth, which points dextro-laterad and a little distad, and is shorter than the diameter of the penis-sheath.

"♀. Vaginal plate (fig. 14 B) much folded in front of the large vaginal cavity; the postvaginal part smooth, rather stronger chitinized than the proximal part" (Roths. & Jord., 1903, p. 99).

Hab. E. HIMALAYAS. One Indian species.

9. **Apocalypsis velox** Butler. (Fig. 14, ♂, A, imago, B, genitalia; Pl. XIII, figs. 3, 4, larva).

Apocalypsis velox, Butler, 1877 A, p. 641 (Darjeeling); Hampson, 1892, p. 107, fig. 62 (♂); Roths. & Jord., 1903, p. 100; Seitz, 1928, p. 530, t. 60 *d*.

Imago.—♂♀. Head dark brown; thorax dark brown, with pale paired lines on each side of vertex; abdomen dark brown, with a series of black dorsal streaks and black segmental lines with white specks on them. Fore wing dark brown; white spots at extremities of veins, which are pale; pale obliquely waved antemedian double lines; a curved postmedian pale band formed of three conjoined lines; a yellow streak from the apex continued as a very dentate line to outer angle. Hind wing dark brown, with traces of lines near anal angle; inner margin yellowish; cilia chequered yellowish and brown. *Underside* of both wings brown, with median and postmedian indistinct lines. *Expanse*: 136 mm.

Hab. E. HIMALAYAS (Sikkim; Khasi Hills). Rare and very local.

Egg.—Shortly ovoid; surface smooth and shining; colour pale yellowish-green. Length 2·25 mm.; breadth 2 mm.

Larva:—

1*st instar*. Head round, body cylindrical; horn long, straight, tip broadly bifid. Surface of head and body smooth and shining; the whole horn, including the bifid tip, set densely with the most minute hairs, each rising from a very small tubercle; anal flap with a pair of mid-dorsal tubercles. Colour of head and body yellowish-green; horn black. 2*nd instar*. Shape of head and body unchanged, but the long, thin, bifid horn rises vertically from a shining cone, and then bends downward; long spine-like tubercles present on all segments of body; those on 3 to 11 longer than the rest, and some on 2, 3, 4 and 12 bifid; small, scattered, setiform tubercles on head and horn; surface of head, body and horn, including the tubercles, smooth. Colour of head pale blue, tubercles paler blue; body pale orange, with a pale blue rectangular mark above each spiracle and another behind each spiracle on 5 to 11; subdorsal tubercles white, lateral tubercles blue; those on anal flap and claspers black. True legs pale blue, prolegs pale green; horn blue with black tubercles. 3*rd instar*. Very little change, but the colour of

body a deeper orange. *4th instar*. Similar to the final instar except in size.

5th instar. Head semi-elliptical in shape, vertex very broad and flattened ; true clypeus one-half length of head, no false clypeus, ligula kidney-shaped. Surface of head, body, horn and tubercles smooth and shining, the head set with small tubercles, a larger subdorsal tubercle on the front of the vertex of each lobe, another large tubercle below that. Body nearly cylindrical. Horn long, very thin, bifid, rising vertically from a large cone, and bending backwards and slightly downward ; the truncated anal flap and the claspers very big and heavy. A transverse row of five large rounded tubercles near the front margin of segment 2, and two tubercles and three spines in a transverse row farther back on the same segment ; on the front margin of 3 a pair of subdorsal spines placed transversely, behind them a longer subdorsal pair, and behind these again a still longer pair, with a pair of long double-pointed spines below them, and three small spines near base of leg ; on the front margin of 4 a transverse row of four spines, at about the middle of the segment a transverse row of three long double-pointed spines, and on the hind margin a row of small spines, and a pair of short spines near base of leg ; 5 has a long subdorsal spine behind the front margin with a second shorter one behind it, a pair of short spines with their bases confluent in front of the spiracle, and a group of five or six small ones below it ; there is also a long subspiracular spine ; 6 has an extra pair of short spines placed subdorsally in addition to spines as on 5 ; 7 to 11 have spines as on 5. The thin, slightly tapering, bifid horn rises from a large cone on 12, and this segment has a long spine below and behind the base of the horn, another long subdorsal spine behind it and a pair of long spines below this ; there is also a long spine in front of the spiracle and a pair with confluent bases below and behind it. The uppermost tubercle or spine of each of the transversely-placed pairs, or of each transverse row mentioned above, is subdorsal, and there are, of course, an equal number of tubercles and spines on the other side of the dorsal line ; the spines are thick at the base, which is longitudinally oval in section, and taper sharply to a point, the whole spine bending slightly backward. Anal flap truncate and tumid, with a large pointed tubercle at each lateral angle and a longitudinally-placed pair nearer the base ; several similar tubercles on clasper-faces.

Coloration.—Head yellowish-green with a broad pale stripe running from the vertex of each lobe to base of antenna. Body canary-yellow, with a green tinge on segment 2, the anal flap, claspers and venter ; the tubercles and spines on 2 to 12 white or blue with white tips ; those in the dorsal

area have a brown line above and below the base, those in the lateral and spiracular area have the base completely ringed with brown. Broad oblique stripes starting above the spiracles on 5 to 11 and extending backwards and slightly upwards to the hind margin of each segment, blue near the spiracle becoming paler and then white at the hind margin, the whole edged narrowly above and below by brownish-purple. Horn, and the cone from which it rises, blue with scattered black tubercles; the tubercles on anal flap and claspers shining black. Legs and prolegs green. Spiracles elliptical in shape, with a narrow central slit widening at the top and bottom, the whole cream-coloured and ringed with green. Length about 90 mm.; longest spine 4 mm.

Pupa.—Slender, with a free tongue-sheath; this is evenly arched and recurved basad, but not into a spiral; the tube rather thin, with a bulbous end; tongue reaching tip of wing-case; antenna in both sexes slightly longer than fore leg and considerably shorter than mid-leg; no coxal piece. Surface smooth and shining; tongue-sheath coarsely wrinkled with parallel transverse ridges; the depressions between the ridges a good deal narrower than the ridges themselves; head and thorax with the surface broken by shallow uneven cracks; no sculpturing on segment 4; segments 5, 6 and 7 sparsely and not very coarsely pitted, the hind margins nearly smooth; ante-spiracular ridges on 9 in the form of three very narrow ridges separated by wide, smooth, polished furrows, the ridges not extending below the spiracles. Spiracles flat, the central slit bordered by a coarse flattened lip on each side. Cremaster a thin oval or rounded plate, markedly constricted at base, and with two very short blunt teeth at tip; dorsal surface flat, ventral slightly concave, both surfaces coarsely pitted. Colour reddish-brown, darker in the dorsal area when fresh; nearly black when old: spiracles black. Length 57–62 mm.

Habits.—Eggs laid singly on underside of leaves of *Callicarpa arborea* Roxb., family Verbenaceæ. Eggs and larvæ found on both saplings and large trees, eggs in June and larvæ in July and August.

The first specimen found was in the 3rd instar, and its appearance was so peculiar that we were uncertain of its identity. The yellow colour of the body, the blue spines and the thin whip-like horn were quite unlike any other sphingid larva we had seen. We later found three eggs on the same food-plant, and the larvæ which hatched from these were typical of many sphingid larvæ in the 1st instar. After the first moult the colour, spines and the shape of the horn showed these larvæ to be identical with the one first discovered, and the latter to be a sphingid larva. The larvæ are sluggish

and have no peculiar habits. The pupa is formed in a cell underground, and is also sluggish. Both larva and pupa are very delicate and difficult to rear. There is only one brood in the year and the pupæ hibernate.

Genus **PENTATEUCHA** Swinhoe.

Swinhoe, 1908, p. 61.

Genotype : *curiosa* Swinh.

Imago.—Tongue fully developed. Palpus upturned, slender, reaching about to middle of frons, second segment fringed with long hair in front; third segment short. Frons with a tuft of hair. Antenna of female ciliate. Thorax clothed with long hair. Tibiæ fringed with long hair ; hind tibia with two pairs of spurs ; fore tarsus with three long, curved claws on first segment. Abdomen with long, rough hair. Frenulum present. Fore wing with apex rounded, termen evenly curved, crenulate ; vein M^1 from well before end of cell ; R^2 from middle of discocellulars ; R^1 from upper angle of cell ; $SC^{3.4.5}$ stalked ; $SC^{1.2}$ from cell. Hind wing with M^1 from well before end of cell ; R^2 from well above lower end of cell ; R^1, SC^2 from upper end ; C approximated to SC^2 beyond cell (*vide* Hampson, J. Bombay Nat. Hist. Soc. xx, 1910, p. 85).

Hab. E. Himalayas. Only one species at present known.

10. **Pentateucha curiosa** Swinhoe. (Fig. 15).

Pentateucha curiosa, Swinh., 1908, p. 62 (Khasi Hills) ; Hampson, 1910, p. 85, pl. F, fig. 18.

Imago.—Head and thorax clothed with deep red-brown hair tipped with white ; pectus and legs rufous, tarsi blackish ;



Fig. 15.—*Pentateucha curiosa* Swinh., ♂ holotype.

abdomen blackish mixed with grey-white, forming obscure segmental bands ; anal tuft and ventral surface rufous. Fore wing clothed with dark red-brown hairy scales mixed

with white, some rufous scales at base of inner area ; faint traces of a dark antemedian line ; an oblique, elliptical, white discoidal spot ; postmedian line with oblique, dark bar from costa, then very indistinct, excurved to vein 3, then incurved ; subterminal line indistinct, double, oblique, waved, bent inwards to costa, where there is a white mark on it ; a dentate line beyond it arising from apex, white and prominent as far as R^1, then indistinct, forming white points on the veins lower down. Hind wing bright rufous, the inner area whitish to tornus, where there is a dark patch with whitish bar beyond it ; an indistinct, diffuse, pale postmedian line. Cilia with some white scales at tip. *Underside* of both wings rufous. Fore wing with a pale discoidal spot, an obliquely curved postmedian band, and prominent, dentate, white band from apex to above vein 6. Hind wing suffused with white to beyond middle and tornus ; an oblique, slightly waved, rufous, median line and an indistinct postmedian line bent outwards to just above tornus ; the terminal area irrorated with whitish. *Expanse* : 104 mm.

Hab. E. HIMALAYAS (Khasi Hills). Very rare, and early stages unknown.

Genus **PSEUDODOLBINA** Rothschild. (Fig. 16).

Rothschild, 1894 A, p. 27 ; Roths. & Jord., 1903, p. 100 ; id., 1907, p. 23.

Genotype : *fo* (Walk.).

Imago.—" ♂♀. Closely allied to *Apocalypsis*. Eye lashed. Antenna of ♀ almost cylindrical, with the basal rows of fasciculate cilia vestigial. First segment of hind tarsus shorter than tibia, not longer than segments 2 to 5 together, twice as long as long terminal spur of hind tibia.

" ♂. Tenth tergite elongate, tapering to end, which is somewhat obtuse ; sternite much broader, triangular, the sides turned upwards, hence the under surface convex, apex more or less distinctly sinuate. Clasper without patch of modified scales ; inner surface covered distally with hair-scales which lean basad ; harpe covered with suberect, short scales, except at end. Penis-sheath with a single long, pointed tooth which is directed dextro-laterad, pointing somewhat proximad.

" ♀. Vaginal cavity large, mouth subcircular, in and before middle, the edge somewhat raised, without lobes ; postvaginal part of plate (fig. 16 G) chitinized in middle " (Roths. & Jord., 1903, p. 100).

(For the early stages and habits see *P. fo fo*. Those of *P. æquaiis* are not known).

Hab. W and E. HIMALAYAS. Three species or subspecies.

Key to the Species.

Imagines.

1. Terminal spurs of hind tibia equal in length. *P. æqualis* Roths. & [Jord., p. 91.
   Terminal spurs of hind tibia not equal in length ..... 2. [p. 87.
2. Harpe bearing a ventral tooth close to apex. *P. f. celator* Jord.,
   Harpe without such a tooth *P. f. fo* (Walk.), p. 88.

There is no noticeable difference between the larvæ and the pupæ of *fo fo* and *fo celator*, and those of *æqualis* are unknown.

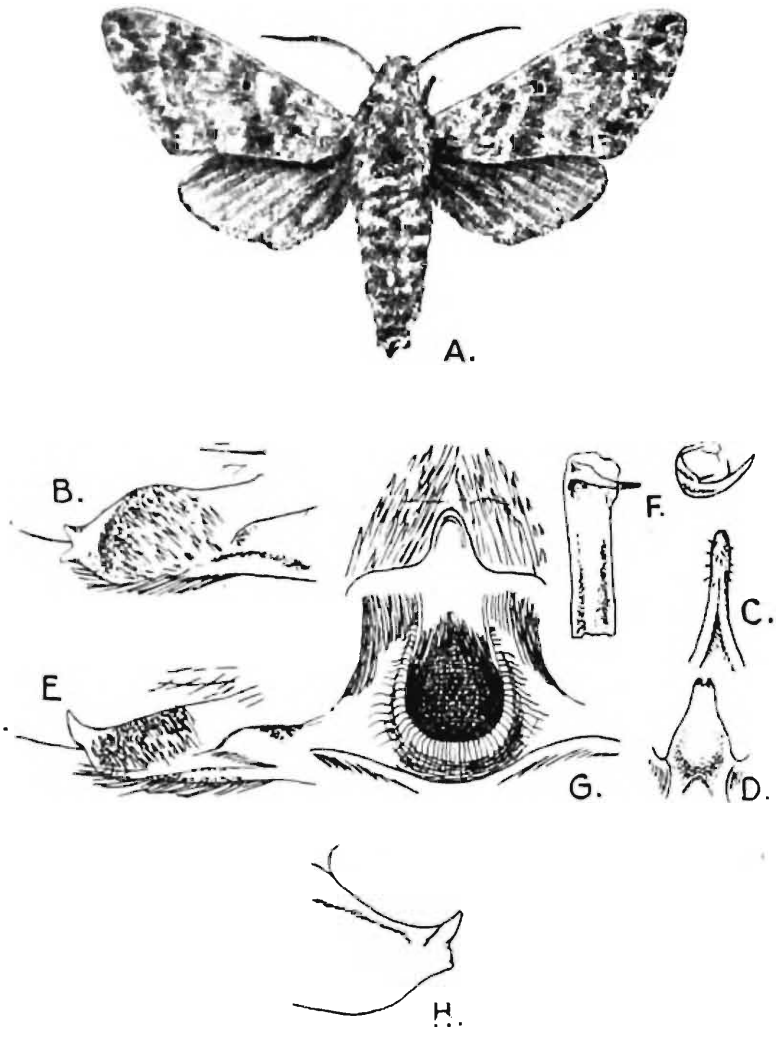


Fig. 16.—*Pseudodolbina* Roths.

A, *P. æqualis* Roths. & Jord.; B, harpe. C, *P. fo fo* (Walk.), 10th tergite, dorsal aspect; D, 10th sternite, ventral aspect; E, harpe; F, penis-sheath; G, ♀, vaginal plate. H, *P. fo celator* Jord., harpe.

11 *a*. **Pseudodolbina fo celator** Jordan. (Fig. 16 H, genitalia, Pl. I, fig. 3, larva).

Pseudodolbina fo celator, Jordan, 1926, p. 379, fig. 3 (genit.) (Dharmsala); Seitz, 1928, p. 530.

Imago.—♂. Differs from specimens of *P. fo fo* from Assam

and Sikkim in the harpe (fig. 16 H) bearing a ventral tooth close to the apex, variable in size. *Expanse*: 64–68 mm.

Hab. W HIMALAYAS (Dharmsala; Simla; Mussooree). We have bred this subspecies in the localities mentioned above, where it is common locally at elevations from 4,000 to 7,000 feet, in areas of heavy rainfall.

The early stages are so similar to those of *P. fo fo* that we were unable to distinguish any difference. The food-plants of the two subspecies are the same. The larvæ of this subspecies were first discovered by Col. J. D. Campbell, D.S.O., in Mussooree in 1923, but all those obtained during this and the following seasons died. Finally, in 1926, we obtained a few moths from a large number of eggs and larvæ. Eggs are not laid until the rainy season is well established. The tangled mass of vegetation in which the larvæ live is drenched continually by heavy rain, and in captivity they require a very liberal supply of water to be sprinkled on the food-plant. Curiously enough, we did not have the same difficulty in breeding the larvæ of *P. fo fo*, though they were obtained from Cherrapunji, in the Khasi Hills, the wettest place in the world.

11 *b*. **Pseudodolbina fo fo** (Walker). (Fig. 16 C–G, genitalia; Pl. XIII, figs. 5, 6, larva).

Zonilia fo, Walker, 1856, p. 195 (N. India).
Pseudosphinx fo, Butler, 1881 B, p. 16, pl. lxxxi, fig. 9; Hampson, 1892, p. 104.
Pseudodolbina fo, Roths. & Jord., 1903, p. 101.
Pseudodolbina fo fo, Jordan, 1926, p. 379; Seitz, 1928, p. 530, t. 60 *e*; Scott, 1931, pl. ii, fig. 4 (larva).
Pseudodolbina veloxina, Rothschild, 1894 A, p. 27, pl. vi, fig. 18 (Khasi Hills).

Imago.—♂♀. Head, thorax, abdomen and fore wing olive-brown, deeper in colour in fresh specimens, less yellow than in *æqualis*, much dusted with grey scales; mesothoracic tegula with a short black streak; anterior segment of abdomen with large yellow side-patches. Fore wing crossed by subbasal, antemedian, median and postmedian double waved black lines; a large white stigma. Hind wing dark brown. The yellow side-patches are larger than in *æqualis*, yellow colour of palpus more sharply defined, fore tarsus more extended yellow on upperside, stigma of fore wing larger; the interspace between the two lines of fore wing proximal to stigma not filled up with black scaling, and the pale parts of fringe of both wings more yellow than in *æqualis*. Spurs of hind tibia *unequal*, long terminal one about one-third longer than the other *Expanse*: 64–68 mm.

♂. Harpe (fig. 16 E) ending in a single, rather prominent, pointed process directed dorso-distad. Tooth of penis-sheath (fig. 16 F) a little longer than in *æqualis*.

Hab. E. HIMALAYAS (Khasi Hills, Assam ; Sikkim). We have bred this subspecies in the Khasi Hills, where it is common locally at Cherrapunji, at an elevation of about 4,000 feet, in an area of very heavy rainfall.

Egg.—Spherical in shape ; surface smooth and shining ; colour bright green ; rather large for the size of the moth.

Larva :—

1*st instar*. Head round and large, body cylindrical ; horn straight, of medium length, strongly bifid, with a bristle on each point ; colour of head and body pale yellowish-green, with short, scattered white hairs ; horn black. 2*nd instar*. Head round and of considerably larger diameter than the cylindrical body, which is long and slender ; horn rather long, thick at base and tapering rather sharply to a strongly bifid tip ; surface of head and body dull, that of horn shining and covered with short black hairs ; colour of the head yellow, body bluish-green, with short scattered white hairs ; horn black. 3*rd instar*. Head slightly bilobed, body nearly cylindrical, long for its diameter ; horn long, thick at base and tapering evenly to a bifid tip ; surface of head and body dull ; three transverse rows of small tubercles on segment 2 ; a pair of large tubercles, one on each side of the dorsal line, at about the middle of 3 and 4, with a transverse row of smaller tubercles in front of and behind each pair ; remaining segments with transverse rows of very small tubercles in the dorsal area ; horn shining and covered sparsely at the base, thickly towards the tip, with tubercles. Colour of head bright green with a broad yellow stripe down each cheek from the vertex of each lobe to base of antenna ; mouth-parts pale blue ; segments 2 to 4 of the body bright green, rest of body pale bluish-green in the dorsal area, dark bluish-green dotted with white below the oblique stripes, the tubercles all yellow ; oblique stripes on 5 to 11 formed by a triangular white patch on each segment with a black stripe above it, the black stripe broadest on 5 and very narrow on 11 and 12 ; horn pale blue with an orange patch on each side of the base, and the tubercles and tip black. 4*th instar*. As above, except that the cheek-stripe is white ; the body with segments 2 to 4 as above, the rest of the body yellowish-green ; oblique stripes as above, except that the portion of the last oblique stripe on 12 is yellow ; horn bright blue on dorsal surface, green on lateral and ventral surfaces, with black tubercles as above ; the stripe on base of horn red instead of orange ; anal flap edged with yellow and with two large green tubercles covered with short white bristles.

5*th instar*. Head about as high as segment 2, semi-elliptical, dorsal line of vertex strongly impressed ; true clypeus less than half height of head, basal angles rounded and tumid ; apex of false clypeus acute and reaching to one-half length of head ; labrum half as long as clypeus and slightly broader,

narrowing frontad ; ligula semicircular in shape ; eyes 1 to 4 in a gentle curve, 1 about one eye-diameter from 2 ; 2, 3 and 4 closer together ; 6 in line with 3 and 4, about one diameter from 4 ; 5 rather more than one diameter from 4 and 6 ; 5 smaller than the rest, which are co-equal. Body long and slender, horn very long, thick at base, tapering gently to near tip, then becoming broader and flattened above and below, dividing into a blunt fork, the arms rounded and setiferous ; the end of the anal flap tumid. Surface of head and body dull and smooth, each secondary ring set with large, smooth, low, oval tubercles ; on segment 2 a transverse row of six larger tubercles on the front margin, a row of six on the hind margin and a row of four between these two rows ; on 3 a very large, fleshy, sub-dorsal, conical tubercle, and on 4 an equally large but more rounded dorso-lateral tubercle ; on 14 a similar but smaller one on each side of the dorsal line, the tubercles on 14 each bearing two setæ, one behind the other ; horn closely set with conical tubercles.

Coloration.—Head green with a broad yellow cheek-stripe from near vertex to base of antenna ; labrum and ligula whitish-green ; basal segment of antenna white, the others pale green ; mandible pale green at base, rust-coloured in middle and black at tip. Body green, the tubercles yellow, giving it a mottled appearance ; oblique stripes on segments 5 to 11, each extending backwards to near the dorsal line of the adjoining segment behind, that on 11 broader than the rest and running to base and for a short distance up the side of the horn, the stripes white near each spiracle, yellow behind it, and edged broadly above with dark green. Horn dark blue with tip paler blue, a crimson stripe up the side from base touching the upward extension of the oblique stripe and extending higher up the horn ; tubercles on dorsum of horn black ; anal flap edged with yellow. Legs, prolegs and claspers green. Spiracles large, oval, white with a broad reddish-brown band across the middle, the whole with a narrow, green rim. Length 60 mm. ; breadth 7 mm. ; horn 12 mm.

Pupa.—Body slender and sharply pointed ; the free tongue-sheath very thin up to the clubbed tip, its base directed forwards in the same line as the axis of the body, the sheath then turning in a high arch, the clubbed tip reaching to middle of wing-case, where it touches the ventral surface of the pupa ; eye rather prominent, and just behind it the dorsal surface of the pupa rises first steeply and then gently to the middle of the body, forming a kind of step ; antenna mid-way in length between fore leg and mid-leg in both sexes ; coxal piece very narrow. Surface shining ; head prominently corrugate-rugose, tongue-sheath transversely ridged ; veins

of the fore wing prominent but not beaded, costal vein finely, transversely striate, surface of wing-case transversely lined; hind wing shows beyond the hind margin of the fore wing under the spiracle of 6; thorax and abdomen with transverse corrugations, except on the front bevels of 9, 10 and 11, which are coarsely pitted; no sculpturing on 4; ante-spiracular ridges on 9 to 11, four distinct ridges on each in two pairs, with a smooth broad channel between each pair. Spiracle of 2 indicated by a long dull black transverse band, spiracles on the other segments small, oval in shape, and including a more narrow oval with a thin raised rim. Clasper-scar on 14 a deep, longitudinal, rather long furrow, with a tumidity on each side of it, forming an oval mouth-shaped organ; in the ♂ pupa the sex-scar is a circular mouth with rather prominent lips; in the ♀ the ventral margins of 14 and 13 are arched forwards, and the sex-scar is a small depression in the middle of 12, with a similar depression on 13. Cremaster with a highly polished surface, stout, triangular, very narrowly and shortly bifid at the tip; dorsal surface rugose, ventral surface shallowly hollowed out, the hollow oval in shape. Colour dark chestnut, head and cremaster nearly black. Length about 42 mm.

Habits.—Eggs laid singly on the underside of a leaf of *Strobilanthes alatus* Nees, and *S. dalhousianus* C. B. Clarke, family Acanthaceæ, which, so far as we know, are unique food-plants for sphingid larvæ. There appears to be only one brood in the year, as eggs and larvæ are not found until the monsoon is well established, and the pupæ hibernate in captivity. Pupation takes place in a cell underground.

12. **Pseudodolbina æqualis** Rothschild & Jordan. (Fig. 16 A, imago, B, genitalia).

Pseudodolbina æqualis, Roths. & Jord., 1903, p. 101 (♂) (Assam); Seitz, 1928, p. 530.

Imago.—♂. Ground-colour of upperside of body and fore wing of a peculiar greenish-olive colour, with a distinct shade of yellow in fresh specimens. The interspace between the two lines proximal of stigma on fore wing more or less filled up with blackish scaling, at least in front. Pale parts of fringe of both wings greyish-white with a shade of yellow. Terminal spurs of hind tibia of almost exactly the same length *Expanse*: 65 mm.

♂. Harpe (fig. 16 B) sinuate at end, the two lobes nearly the same in length.

Hab. E. Himalayas (Khasi Hills; Cherrapunji). Rare, and early stages unknown.

Genus **SPHINX** Linnæus.

Linnæus, 1758, p. 489 ; id., 1767, p. 799 ; Jordan, 1911, p. 235.
Hyloicus, Hübner, 1822, p. 138 (part.) ; Roths. & Jord., 1903, p. 116.
Thamnœcha, Roths. & Jord., 1903, p. 153.

Genotype : *ligustri* Linn. (Jordan, in Seitz, Pal. ii, p. 235).

The only species of this genus occurring in India, *uniformis* Butler, was placed by Rothschild and Jordan (1903) in a new genus, *Thamnœcha*. Seitz (1928) places it in the genus *Sphinx* Linn., which Rothschild and Jordan (1903) called *Hyloicus* Hübner. The name *Sphinx* Linn. has been adopted instead of *Hyloicus* Hübner on the suggestion of the Committee on Nomenclature of the International Zoological Congress. The characters given below apply to the one Indian representative of the genus.

Imago.—"♂. Antenna long (tip broken off in the three specimens seen), distinctly narrowed at the base, the segments not touching one another ventrally, middle ones feebly dilated laterad subdorsally, almost as long as high, trans-section little higher than broad. Pilifer with brush of bristles. Palpus small, rough. Tongue short. Tibiæ *not* spiny ; spurs very short, proximal pair of hind tibia *absent* ; *no* pulvillus, paronychium very small, *without* lobes, first segment of front tarsus with four long spines, the apical one nearly half the length of the segment, second segment as long as the first.

" Tenth abdominal tergite obtuse, feebly sinuate at end. Harpe narrow, without patch of modified scales, subdorsal fold of inner surface high, with bristles ; harpe simple, not dentate, ending in an obtuse process. Penis-sheath thin, prolonged into a flat, feebly concave process curving sideways, ending in a very short pointed hook. ♀ unknown " (Roths. & Jord., 1903, p. 153).

Hab. Nearctic, Neotropic and Palæarctic Regions. One Indian species, of which the early stages are unknown.

13. **Sphinx uniformis** (Butler).

Hyloicus uniformis, Butler, 1875, p. 261 (N.W Himalaya).
Thamnœcha uniformis, Roths. & Jord., 1903, p. 153.
Sphinx uniformis, Jordan, 1911, t. 36 *d* ; Seitz, 1928, p. 531.
Pseudosphinx concolor, Hampson, 1892, p. 106 (Subathu, Simla).

Imago.—♂. Head, thorax and abdomen grey, sides of head black ; collar fringed with black, and tegula streaked with black. Fore wing grey ; traces of a median ferruginous band most prominent on inner area ; two black streaks in the interspaces between R^1 and M^2 ; dark points on the cilia at veins. Hind wing reddish-brown, the cilia uniform grey. *Expanse* 50 mm.

Hab. W HIMALAYAS (Sabathu, Simla). Very rare, and the early stages not known.

Tribe SPHINGULINI.

Sphingulicæ, Roths. & Jord., 1903, p. 154; id., 1907, p. 37, t. 1, fig. 5; Jordan, 1911, p. 236.

Imago.—" ♂♀. End-segment of antenna short, not prolonged into a thin filiform process. Tongue half the length of the body, or shorter. Spinulation of abdomen weak, spines of sternite absent, or as weak as scales. No patch of friction-scales on clasper. Mesotarsus without basal comb. Paronychium with two lobes at each side, or without lobes, never with one lobe " (Roths. & Jord., 1903, p. 154).

The early stages of the genus *Dolbina* only are known. In the larva and pupa of this genus the general characters are decidedly Ambulicine; while the sculpturing on segment 4 of the pupa is entirely wanting, there are indications of ante-spiracular ridges on segments 9 to 11.

Hab. Oriental Region, with two Indian genera.

Key to the Genera.

Imagines.

Fore tibia armed with an apical thorn; no pulvillus	[Jord., p. 93. DOLBINOPSIS Roths. &
Fore tibia without apical thorn; pulvillus present	DOLBINA Stgr., p. 94.

Genus **DOLBINOPSIS** Rothschild & Jordan. (Fig. 17).

Roths. & Jord., 1903, p. 159; id., 1907, p. 33; Jordan, 1911, p. 237.

Genotype: *grisea* (Hamps.).

Imago.—" ♂. Allied to *Dolbina*, of which it is a development. Palpus small. Pilifer with a few bristles as in *D. inexacta*.

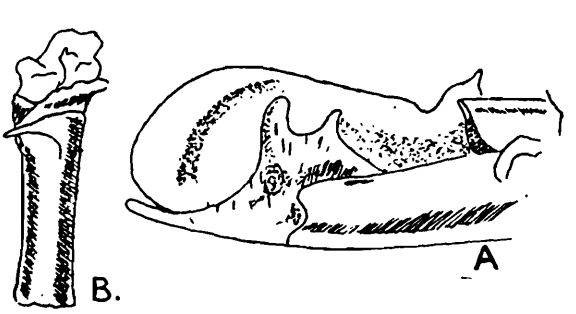


Fig. 17.—*Dolbinopsis* Roths. & Jord.
A, *D. grisea* (Hamps.), clasper and harpe; B, penis-sheath.

Antennal segments not quite touching one another ventrally, penultimate segment longer than high. Fore tibia ending in a naked *thorn*; *no* pulvillus, paronychium scarcely indicated; first segment of fore tarsus longer than tibia (thorn excluded), shorter than segments 2 to 5 together; tibiæ rather smoothly scaled; mid-tibia much longer than first tarsal segment;

spurs very short, two pairs to hind tibia, the proximal pair almost concealed under the scaling. SC^2 and R^1 of hind wing separate ; R^2 from centre of cell. Sexual armature of the *Dolbina* type.

" ♀. Unknown " (Roths. & Jord., *l. c.*).

Hab. W HIMALAYAS. One Indian species.

14. **Dolbinopsis grisea** (Hampson). (Fig. 17 A, B, genitalia).

Pseudosphinx grisea, Hampson, 1892, p. 104 (Kulu).
Dolbinopsis grisea, Roths. & Jord., 1903, p. 159 ; Jordan, 1911, p. 237 ; Seitz, 1928, p. 532, t. 61 *a*.

Imago.—♂. Markings similar to those of *Dolbina inexacta*, but differing in the ground-colour of head, thorax and abdomen being grey ; the black lines similar, but no white on thorax. Fore wing similarly marked, but the ground-colour grey. Hind wing pale fuscous ; cilia grey, with black points at nervules, not chequered black and white. *Expanse* : 52 mm.

♂. Tenth abdominal tergite broad, obtusely triangular, curved downward distally, more suddenly narrowed from the point of curvature to the end ; sternite with a divided lobe, the two halves slender. Clasper (fig. 17 A) without patch of modified scales, broadly rounded, broadest beyond middle ; harpe with a finger-like ventro-distal process, and two dorsal processes, of which the proximal one is the narrower. Penis-funnel obliquely truncate ; penis-sheath (fig. 17 B) armed with a horizontal tooth pointing sinistro-laterad ; on the inner side of the sheath opposite the tooth there is a patch of spines, which are visible from the outer side as fine dots.

♀ and early stages unknown.

Hab. W HIMALAYAS (Kulu). Very rare, only a few ♂♂ known.

Genus **DOLBINA** Staudinger. (Fig. 18).

Staudinger, 1887, p. 155 ; Roths. & Jord., 1903, p. 159 ; id., 1907, p. 34 ; Jordan, 1911, p. 237.

Genotype : *tancrei* Stgr.

Imago.—" ♂♀. Differs from *Sphingulus* and *Kentochrysalis* [two non-Indian genera] in the much more robust thorax and abdomen, in the stronger spinulation of the latter, the presence of weak spines also on the sternites, the less slender antennæ, the segments of which are not rounded-dilate laterad and have longer cilia ventrally in the proximal series. Antenna of ♂ rather thick in basal fourth.

" ♂. Tenth abdominal tergite broad and short, triangularly narrowed at end, minutely sinuate ; upperside scaled mesially ; sternite with two short, straight processes. Penis-sheath armed with an apical tooth, curving sinistro-laterad. No

patch of modified scales on clasper ; the latter small, very strong ventro-basally ; harpe large, with broad ventro-distal process and three rounded dorsal lobes.

" ♀. Vaginal plate feebly chitinized, except at the large vaginal cavity ; the edge of this cavity armed with two processes " (Roths. & Jord., 1903, p. 159).

Hab. W and E. HIMALAYAS to China and Japan. One Indian species.

15. **Dolbina inexacta** (Walker). (Fig. 18 A, imago, B–D, genitalia ; Pl. VIII, fig. 4, larva).

Macrosila inexacta, Walker, 1856, p. 208 (N. India).
Pseudosphinx inexacta, Butler, 1877 A, p. 611 (N. India, Mussooree) ; id., 1881 B, p. 16, pl. lxxxi, fig. 8 ; Hampson, 1892, p. 104.
Dolbina inexacta, Roths. & Jord., 1903, p. 160 ; Mell, 1922, p. 59, pl. ii, figs. 9–25, pl. xxii, fig. 3 (larva), pl. xiii, fig. 5, pl. xv, figs. 20–22 (pupa), pl. xxii, fig. 4 (♂) ; Seitz, 1928, p. 532, t. 61 *a*.
Meganoton khasianum, Rothschild, 1894 A, p. 90 (Khasi Hills).

Imago.—♂♀. Head and thorax dark brown grizzled with white ; thorax with some white marks at sides and round

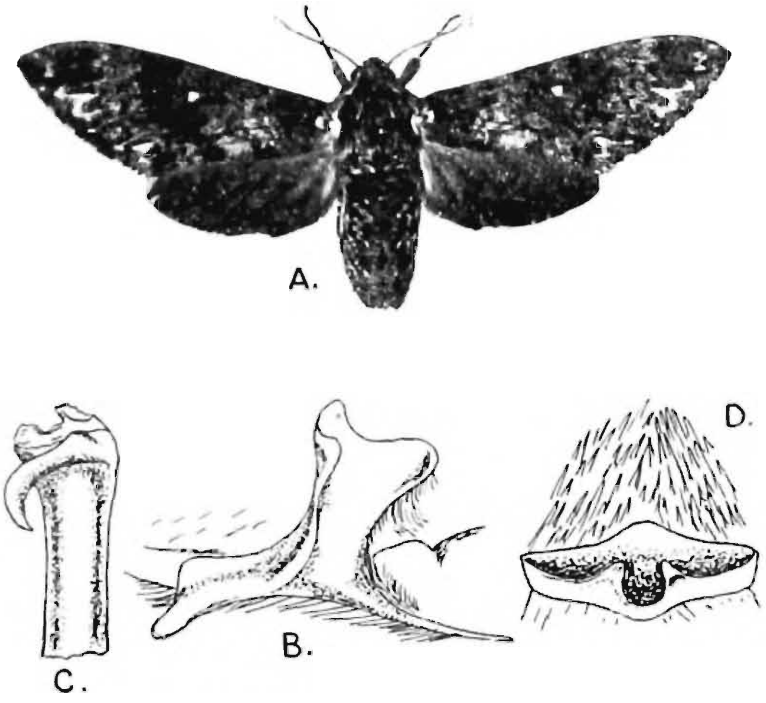


Fig. 18.—*Dolbina* Stgr.
A, *D. inexacta* (Walk.) ; B, clasper and harpe ; C, penis-sheath ; D, ♀, vaginal plate.

vertex ; abdomen golden-brown above, brown at sides a black streak on the dorsum of each segment. Fore wing variegated with grey, dark brown and golden-brown ; somewhat indistinct dark waved antemedian, median, postmedian and submarginal lines, of which the median is the most strongly marked ; a conspicuous white spot at end of cell. Distal

margin of fore wing almost straight in ♂, somewhat sinuate before hinder angle. Hind wing brown, cilia chequered brown and white. *Underside* of abdomen with large black and white mesial patches; legs, breast and wings mummy-brown, contrasting strongly with the white scaling in the middle of meso- and metasternum and at the edges of the abdominal sternites; the greyish-white tips of the tarsal segments and the tibiæ also conspicuous. Pilifer with a few *bristles*, no scales. *Expanse*: 86 mm.

♂. Tenth abdominal tergite flat, curved, short, medially membranaceous to near the end, dilated before end, then triangularly narrowed. Lobes of sternite farther apart than in *P. æqualis* (fig. 16 D), shorter and more oblique. Ventral process of harpe (fig. 18 B) dorsally rounded-sinuate, the tip blunt; dorsal process divided into a rounded, single, basal lobe, and double distal lobe. Hook of penis-sheath (fig. 18 C) long; inner side of sheath with small apical patch of spines ventrally.

♀ (fig. 18 D). The lobes at the edge of the vaginal cavity stand in front of the cavity; they are triangular and about as long as the sinus between them is broad.

Hab. W and E. HIMALAYAS and S. INDIA, also China. We have bred the species in the E. Himalayas and S. India, where it is confined to wooded hills and is fairly common.

Egg.—A nearly perfect ovoid; surface smooth and shining; colour pale yellowish-green. Length 2 mm., breadth and height 1·25 mm.

Larva:—

1*st instar*. Head round; body cylindrical; horn straight, long, tip bifid; anal flap tumid dorsally; colour pale yellow, horn reddish. 2*nd instar*. Head triangular, with a small tubercle at the vertex of each lobe; horn straight, of medium length, with bifid tip; colour of head green with a broad yellow cheek-stripe from vertex to base of antenna. Body grass-green, with a transverse row of pointed yellow tubercles on each secondary ring; large yellow dots on the subspiracular line of 2 to 4; seven oblique stripes formed of yellow tubercles, those on 5 and 11 better defined than the rest, that on 10 obsolescent; horn dark red, tip black. True legs carmine ringed with white. 3*rd instar*. Tubercles more prominent, those on the oblique stripes multi-pointed. 4*th instar*. Horn straight, tip shortly bifid; head and body bluish-green, the stripes white or yellow; horn green dotted with black, tip black.

5*th instar*. Head shortly triangular, a little higher than broad; true clypeus one-third length of head, each basal angle with a small tumidity; false clypeus with acute apex reaching to one-half length of head; labrum less than half

length of clypeus; ligula as long as labrum; eyes 1 to 4 equidistant, forming a quarter circumference of a circle; 6 in line with 3 and 4 and twice as far from 4 as 4 is from 3; 5 forming an equilateral triangle with 4 and 6. Surface shining, set widely with low, minute tubercles. Body gently tapering frontad from segment 7 Horn long, straight, thick at base and tapering evenly to a blunt point. Surface dull; secondary rings of segments 2 to 4 raised into ridges on dorsum; horn covered densely with small pointed tubercles; large, round, closely-set tubercles on anal flap and claspers.

Coloration.—Head bluish-green with a broad, pale yellow cheek-stripe from vertex to base of antenna; false clypeus dark green; labrum and ligula rust-coloured; basal segment of antenna dark brown, other segments rust-colour; mandible pale orange, tip black. Body rich bright green with a glaucous suffusion on dorsum; oblique stripes white or yellow, each crossing two segments and spreading into a more or less well-defined patch round the spiracles. Horn, anal flap and claspers green. Legs pale orange, base rose-coloured and a black ring on each segment; prolegs green. Spiracles reddish-brown with a white central slit widening slightly at top and bottom, the whole ringed with yellow, oval in shape and flush. In some specimens there are carmine patches round the spiracles, above the oblique stripes and at bases of true legs. Length 70 mm.; breadth 11 mm.; horn 8·5 mm.

Pupa.—Ambulicine in shape, rather like that of *Marumba dyras*, thickest in the middle; shoulders evenly rounded; dorsum of segment 2 very steeply inclined, rising nearly at right angles to the axis of the body, the dorsal line of 3 being nearly parallel with the axis; tongue equal to fore leg, reaching to about the middle of wing-case, mid-leg longer, antenna slightly shorter than fore leg; no coxal piece. Surface shining, irregularly corrugate on the head and thorax, elsewhere pitted with coarse shallow pits, except on wing-case; ante-spiracular ridges on 8 to 10, in the form of three short parallel ridges on each. Spiracle of 2 crescent-shaped; the remaining spiracles oval. Cremaster stout, ending in a short bifid tooth; the dorsal surface very rugose except for the tooth, which is smooth. Colour chestnut to blackish-brown, the bevels of the free abdominal segments paler; the spiracles brown. Length 48 mm.; breadth 14 mm.

Habits.—Eggs laid singly on the underside of a leaf in evergreen or semi-evergreen jungles, often on the edges of streams. In the Kanara district the food-plants are *Olea dioica* Roxb. and *Linociera malabarica* Wall. In the Khasi Hills the larva feeds on *Ligustrum robustum* Bl., and in S. China on the same bush and also on *Fraxinus* Linn.,

all of the family Oleaceæ. The larva is sluggish, except when seeking for a place to pupate, and when at rest adopts the typical " sphinx " attitude. It rests without feeding for a couple of days before commencing to pupate, and while wandering about in search of a suitable place to burrow is more or less neutral coloured, losing all the markings. Pupation takes place in an ovoid cell, smooth inside but not lined with silk, and placed about 6 inches underground.

Subfamily AMBULICINÆ.

Butler, 1877 A, p. 514 ; Roths. & Jord., 1903, p. 166 ; id., 1907, p. 35 ; Jordan, 1911, p. 238.

Imago.—There does not appear to be any single character which separates all the AMBULICINÆ from all the ACHERONTIINÆ. An Ambulicine species may, however, be distinguished from the Sphingini by the end-segment of the antenna being short, densely scaled above ; the few genera with prolonged end-segment (*Compsogene*, *Oxyambulyx*, *Cypa*) may be recognized by the apex of the fore wing being sinuate or the distal margin more or less angulate below the middle, or by the long tarsi being without a mid-tarsal comb.

The tribe Sphingulini, in which the end-segment of the antenna is as short as in most AMBULICINÆ, agrees so closely in structure with this subfamily that only a combination of characters separates one from the other. In the AMBULICINÆ the tip of the fore wing is sinuate, or the distal margin irregular or concave ; or the margin is straight and the tibiæ spinulose ; or the frenulum, or the pulvillus, or the proximal pair of hind tibial spurs are absent.

The tongue of the AMBULICINÆ never reaches beyond end of abdomen ; it is generally short and weak, and there are several species in which it is reduced to two short lobes. The mesial fringe of the tongue by which the two halves are kept together above forms, in the species with a strong tongue (*Compsogene* and allies), a kind of thin membrane, the hairs being soldered together, while the fringe of a weak tongue is generally long and loose, the hairs being more or less separate, or is absent. Base of tongue not rarely covered with long weak scales (*Leucophlebia* for instance) ; in *Cypa* it is tubercled on upper side near base. The weak tongue is functionless, only the lower (*i. e.*, less specialized or less reduced) forms being able to use the tongue as a sucking-tube. The only Indian genera possessing a fully functional tongue are *Compsogene*, *Oxyambulyx* and *Clanis*.

Palpi normally of a rounded triangular shape, with the inner surface clothed with long bristles, which are often modified into scales. Palpus large in the lower forms (*Compsogene*, etc.), and very small in a number of genera.

Antenna never club-shaped, but thinner at base than in and before middle. The segments always compressed and grooved in the ♂, with long fasciculate cilia, and there are sometimes short pectinations.

Tibiæ usually spinose. No scent-organ on fore coxa. Fore tibia often ends in a thorn. Spurs very long in some forms. The proximal pair of spurs of hind tibia often disappears; the distal pair never disappears. No mid-tarsal comb, as is also the case in the Sphingulini. Pulvillus small or absent. The paronychium preserves the two lobes of each side in most AMBULICINÆ; in some the ventral lobe disappears, also in a few genera both ventral and lateral lobes.

The fore wing is always more or less falcate in the Indian genera, the outer margin sinuate. The colour of the fore wing is usually protective, being of various shades of brown, reddish-brown, or clay-colour to grey. The markings generally consist of transverse lines, though some genera have a longitudinal stripe (*Clanis*, *Leucophlebia*). The hind wing is sometimes brightly coloured (*Rhodoprasina*, *Callambulyx*).

The spines at the edges of the abdominal segments are always weak and elongate; they are sometimes modified into scales; on the other hand, the under-scales of the abdominal tergites are often spiniform; the sternites are usually without spines.

The copulatory armature is complicated, the species often differing very remarkably from one another.

Egg.—Nearly spherical in *Clanis*, broadly ovoid in the other genera; colour usually green, but that of *Langia zenzeroides* brown.

Larva.—The shape of the head, and its change of form in different instars, the presence of tubercles on the head and body and their development in different instars, the colouring and pattern of the body and the shape and colour of the spiracles are all characteristic of the subfamily. Only in the genus *Parum* does the round head of the newly-hatched larva persist to maturity; in all the other genera it becomes triangular and develops apical processes at the first moult; these may persist or disappear again in the last instar. The horn is variable and may be straight or down-curved, long or very short (*Clanis*, *Langia*); in *Degmaptera* it is flattened laterally, and bifid in all instars. The development of tubercles is very common, especially on the stripes of the body. The head has a white or yellow cheek-stripe (black in *Degmaptera*) and from the apex of each lobe to the nape a subdorsal stripe which is continued on the body. All the species known have a green form, and some a yellow (*Clanis*) or reddish (*Leucophlebia*) form as well, but brown or black forms do not occur; in some genera (*Oxyambulyx*, *Polyptychus*, *Marumba*, *Degmaptera*)

individuals often develop red, purple or yellow patches; there is generally a dorso-lateral stripe and seven oblique stripes. The spiracles are variable in colour, black in *Rhodoprasina callantha*.

Pupa.—Differs from those of the subfamily ACHERONTIINÆ in the absence of transverse file-markings at the base of the tongue, the tongue never being in a free sheath; the sculpturing of segment 4 never round or pear-shaped; coxal piece generally present. Many species of *Marumba* and *Agnosia* have two horn-like projections on the head. Colour chestnut or blackish, the bevels of the movable abdominal segments sometimes paler than the rest of the body; in *Degmaptera* a cream-coloured patch round the eye.

Habits.—Eggs laid singly, usually on the underside of a leaf. Mell states that *Parum colligata* oviposits a number of eggs together in small heaps; the habits of *P. porphyria* are not known. The habits of the larvæ vary a good deal and are described under the genera and species. Pupation takes place in a cell underground. *Clanis*, *Leucophlebia*, and *Clanidopsis* often spend months without feeding in the larval state before pupation, the imago emerging very soon after the pupal state is assumed. Very little is known of the habits of the moths, except those bred in captivity. They usually rest with the wings in one plane, or directed slightly downwards, separated so as to leave the body, or at least the dorsum of the body, visible, the only exceptions being the moths of *Leucophlebia* and *Langia*, which hold the wings penthouse-wise as in the ACHERONTIINÆ. In many genera the abdomen is bent upwards when resting, especially in the males. *Degmaptera* rests with the costal lobe of hind wing showing broadly outside costa of fore wing. The size of the moths differs greatly; those of *Langia* may have an expanse of 160 mm., while in the males of *Degmaptera* it may be as little as 40 mm. The strong-tongued species visit flowers, but the bulk of the subfamily do not feed.

Cosmopolitan; nineteen Indian genera.

Key to the Genera.

(In the keys to larvæ and pupæ we are able to include only some of the genera).

Imagines.

1. Mid-tibia with spines, at least at end ..... 2.
   Mid-tibia without spines ..... 8.
2. Hind tibia with two pairs of spurs; with frenulum ..... 3.
   Hind tibia with two pairs of spurs; without frenulum ..... 7.
   Hind tibia with one pair of spurs ..... 5.

3. Fore wing with a broad maize-yellow streak from base to apex .. . .. [p. 156.
Fore wing without such a streak . LEUCOPHLEBIA Westw., 4.
4. Joint of palpus not open ; long terminal spur of mid-tibia obviously shorter than first tarsal segment .. .. .. CLANIS Hübn., p. 139.
Joint of palpus open ; long terminal spur of mid-tibia obviously shorter than first tarsal segment. . [p. 160.
5. Wings green and red. . POLYPTYCHUS Hübn., RHODOPRASINA Roths.
Wings not green and red . . 6. [& Jord., p. 198.
6. SC^2 and R^1 of hind wing on a long stalk ... . [p. 192.
SC^2 and R^1 of hind wing on a short stalk, or not stalked ; pulvillus large ; paronychium with two lobes . . DAPHNUSA Walk., [p. 172.
7. Distal margin of fore wing very irregular.. MARUMBA Moore, PHYLLOSPHINGIA [Swinh., p. 234.
8. Hind tibia with one pair of spurs ; with frenulum . . .. 16. [Jord., p. 231.
Hind tibia with one pair of spurs ; without frenulum ; apex of fore wing pointed. ANAMBULYX Roths. &
Hind tibia with two pairs of spurs ; with frenulum 9. [Jord., p. 206.
9. No pulvillus .. CLANIDOPSIS Roths. & 10.
With pulvillus ; end-segment of antenna long. ....
With pulvillus ; end-segment of antenna less than four times as long as basally high .. 12.
10. Spurs very short .. . .. CYPA Walk., p. 217.
Longer spurs, several times as long as the tibia is broad. 11. [& Jord., p. 109.
11. Apex of fore wing acute .. OXYAMBULYX Roths.
Apex of fore wing rounded-truncate COMPSOGENE Roths. & [Jord., p. 103.
12. First segment of fore tarsus normal ; spurs short ... . 13.
First segment of fore tarsus normal ; spurs long. . .. . 15.
13. Costal margin of hind wing dilated distally into a lobe . [p. 224.
Costal margin normal .. . . DEGMAPTERA Hamps., 14.
14. Apex of fore wing acute, distal margin even ... . [& Jord., p. 228.
Apex of fore wing sinuate, distal margin uneven ; hind wing not red CALLAMBULYX Roths. [p. 223.
15. Distal margin of fore wing uneven .. SMERINTHULUS Huwe, LANGIA Moore, p. 194.
16. Fore tibia ending in a strong, curved, horny spine . . . [Jord., p. 209.
Fore tibia ending in a thorn AGNOSIA Roths. & SMERINTHUS Latr., [p. 232.
Fore tibia not ending in a thorn PARUM Roths. & Jord., [p. 213.

Larvæ.

1. Head round, without apical processes DAPHNUSA Walk., p. 192.
Head shortly triangular, without processes, or with very short processes . . 2.
Head elongate-triangular, with or without processes 8.

2. Body with a subdorsal line of large pointed tubercles from segment 2 to base of horn; horn down-curved ... ... [p. 162. POLYPTYCHUS Hübn.,

Body with a dorsal line of large multi-pointed tubercles from segment 2 to base of horn .. .. [Jord., p. 211. AGNOSIA Roths. &

Body with lateral tubercles denser and higher than dorsal ones; horn red, black above ... . [Swinh., p. 234. PHYLLOSPHINGIA

Body not so; usually a dorso-lateral line of large tubercles; horn not red and black. .. . 3.

3. Horn long, usually straight 4.

Horn short, usually straight . .. 6.

4. A dorso-lateral line of large tubercles on segments 2 to 11; horn very long, up-curved .. .. [Jord., p. 106. COMPSOGENE Roths. &

Dorso-lateral line of large tubercles on segments 2 to 4 only . 5.

5. Head with a dorsal stripe from vertex to nape, or without any stripe; tubercles on secondary rings large and pointed [p. 174. MARUMBA Moore,

Head with a subdorsal stripe from apex of each lobe to nape; tubercles on secondary rings low and blunt, or absent. [Jord., p. 109. OXYAMBULYX Roths. &

6. No oblique stripes; stripes longitudinal. LEUCOPHLEBIA Westw.,

Oblique stripes present. . ... 7. [p. 156.

7. Body very stout and nearly cylindrical; horn reduced to a conical tubercle, except in *C. b. bilineata*. Length 100 mm. or more . .. . CLANIS Hübn., p. 141.

Body stout and nearly cylindrical; horn short but well developed; front margin of segment 2 raised into a sharp ridge bearing tubercles. Length 55 mm. . [Jord., p. 207. CLANIDOPSIS Roths. &

8. A dorso-lateral line of large pointed tubercles from segment 2 to base of horn; horn reduced to a conical tubercle. Length 125 mm. . . . .. LANGIA Moore, p. 196.

A subdorsal line of large pointed tubercles from segment 2 to base of horn; spiracle of segment 5 modified into an ocellus-like marking .. .. [& Jord., p. 203. RHODOPRASINA Roths.

Neither subdorsal nor dorso-lateral line of large tubercles .. .. 9.

9. Horn flattened laterally, tip strongly bifid. Length 55 mm. ... . [p. 226. DEGMAPTERA Hamps.,

Horn not flattened laterally, tip minutely bifid. Length 60 mm. CYPA Walk., p. 221.

Pupa.

1. Tongue reaching tip of wing-case; wing-case more than one-half total length of pupa ... . .. 2.

Tongue not reaching tip of wing-case; wing-case one-half or less total length of pupa. .. . 4.

2. Coxal piece, sculpturing on segment 4 and ante-spiracular ridges present; cremaster not bifid, constricted and perforated near base [Jord., p. 107. COMPSOGENE Roths. &

No coxal piece . . . .. 3.

3.	Sculpturing on segment 4 usually present; cremaster wedge-shaped, tip bluntly bifid	[Jord., p. 111.
	No sculpturing on segment 4; cremaster wedge-shaped, not bifid. . .	Oxyambulyx Roths. &
4.	Sculpturing on segment 4 .	Clanis Hübn., p. 141.
	No sculpturing on segment 4 .	5.
5.	Frontal ridges on head .	8.
	No frontal ridges on head	6.
6.	Ante-spiracular ridges present.	7. [p. 174.
	Ante-spiracular ridges absent . .	Marumba Moore,
7.	Cremaster conical, simply pointed; length of pupa 47 mm.	Agnosia Roths. & [Jord., p. 212.
	Cremaster 5-sided, simply pointed; length of pupa 30 mm.	Rhodoprasina Roths [& Jord., p. 205.
		Degmaptera Hamps.. [p. 227.
8.	Tongue equal in length to fore leg; cremaster simply pointed .	Leucophlebia Westw.,
	Tongue shorter than fore leg	9. [p. 156.
	Tongue longer than fore leg; cremaster vestigial . .	Langia Moore, p. 197.
9.	Cremaster bifid	10.
	Cremaster not bifid, channelled dorsally and ventrally; two dorso-lateral teeth, one near base, one near tip.	Cypa Walk., p. 222.
10.	Segments 4, 5 and 6 with a subapical belt of pointed tubercles . .	[Swinh., p. 234. Phyllosphingia
	No belts of pointed tubercles	Polyptychus Hübn., [p. 162.

Genus **COMPSOGENE** Rothschild & Jordan.

Roths. & Jord., 1903, p. 188; id., 1907, p. 41.
Amblypterus, Moore, 1882, p. 13.

Genotype: *panopus* Cram.

Imago.—" ♂♀. Tongue strong at base, reaching middle of abdomen. Palpus large, prominent, truncate, terminal surface nearly as long as the frons in ♂, first segment strongly curved, nearly 3 mm. long in a straight line from base to tip; second (inclusive of scaling) 5 mm. long and 3 mm. broad. Antenna of ♂ 3 mm. and of ♀ 5 mm. shorter than R^1 of fore wing, end-segment prolonged, setiform, with a rather large number of bristles; segments grooved in ♂, almost cylindrical in ♀. Abdomen with spines at the edges of the sternites as well as the tergites, but the spines of the former very weak and small. Tibiæ *not* spinose, as long as, or a little longer than, the first tarsal segment; spurs long, unequal, two pairs on hind tibia, long terminal pair little shorter than first tarsal segment; hind tarsus half as long again as cell of hind wing measured along SC, end-segment (claw excluded) not longer than last but one; pulvillus large, paronychium with two lobes at each side, upper lobe long and slender, lower lobe much broader. Distal margin of fore wing entire, apex truncate-sinuate; cell of hind wing small, not quite a third the length of the wing, measured along SC; R^2 of hind wing before

centre of cell, D^2 angled or curved. Clasper and eighth tergite with organ of friction" (Roths. & Jord., 1903, p. 188).

Hab. Throughout INDIA to China, Malaya and the Philippines. Two Indian species.

16. **Compsogene panopus panopus** (Cramer). (Fig. 19, imago; Pl. I, fig. 11, larva; Pl. VIII, fig. 3, pupa).

Sphinx panopus, Cramer, 1779, p. 50, pl. ccxxiv, figs. A, B (Java).
Calymnia panopus, Moore, 1867, p. 675 (Silhet); id., 1884, p. 234 (Cachar); Cotes & Swinh., 1887, p. 34 (Silhet, Nilgiris); Swinhoe, 1890, p. 165 (Rangoon); Hampson, 1891, p. 2 (Nilgiris); id., 1892, p. 76, fig. 48 (♀); Swinhoe, 1892, p. 35 (Burma); Dudgeon, 1898, p. 407 (Sikkim, Bhutan).
Amblypterus panopus, Moore, 1882, p. 13, pl. lxxxi, figs. 1, 1 *a*, *b*, *c* (l., p., i.).
Compsogene panopus, Roths. & Jord., 1903, p. 189; Mell, 1922, p. 72, pl. iii, figs. 2–5, pl. xxii, figs. 5, 6 (larva), pl. xv, figs. 23–25 (pupa), pl. xxii, fig. 7 (♂).
Compsogene panopus panopus, Seitz, 1928, p. 532, t. 61 *a*.
Calymnia pavonica, Moore, 1877, p. 596 (Andamans).

Imago.—♂♀. Upperside of thorax and terminal segments of abdomen dark chocolate; rest of abdomen ashy-pink, this colour forming a broad, sharply-defined band and connecting, when the moth is in the resting position, with a similarly coloured, transverse, oblique band of the same width on the upperside of each fore wing; top of head and base of fore wing similarly coloured; base of fore wing crossed by a dentate line and by three narrow dentate bands, all of the same colour as the thorax, the outermost band the broadest and defining the inner margin of the ashy-pink oblique medial band; a broad oblique chocolate band bordering the ashy-pink median band on its outer side, nearly straight and sharply defined at its junction with the ashy-pink band and gradually shading, on its outer side, into an area of paler pink with a yellow tinge; two submarginal, chalky-white lines, excurved strongly from the costa (where they start from small black patches), and then incurved round a triangular, fuscous, marginal patch between the ends of SC^5 and M^1, finally disappearing near the tornal angle, where there is a black ocellus-like patch bordered internally by two chalky-white curved lines; three or four median, dentate, indistinct transverse lines on the ashy-pink band, all chocolate in colour and more clearly marked near the costa.

Hind wing upperside flesh-colour, the outer area brown, with antemedian, median and two postmedian black lines, the veins in the brown area black. *Underside* of both wings yellow; the outer area of fore wing above M^1 rust-coloured, the triangular marginal patch ashy-grey; a straight median and an excurved and dentate brown line, and some brown

mottling; a brown postmedian waved line and a median, slightly sinuate brown band among the mottling; the marginal area ashy-grey. Antenna ashy-pink above, rusty-yellow below; palpus rusty-yellow; mid- and hind femora and tibiæ pale pink above, rusty-yellow below, as is also the underside of the thorax and abdomen; fore leg brown. *Expanse*: ♂ 130–154 mm., ♀ 168 mm. Some females are not larger than some males.

♂. Eighth tergite with a spatulate mesial process, about 1½ mm. long. Tenth tergite long, narrow, slightly compressed, curved downward, finger-like, not sharply pointed; sternite produced into a mesial plate a little longer than broad, sides almost parallel, apex sinuate, lobes rounded. Clasper

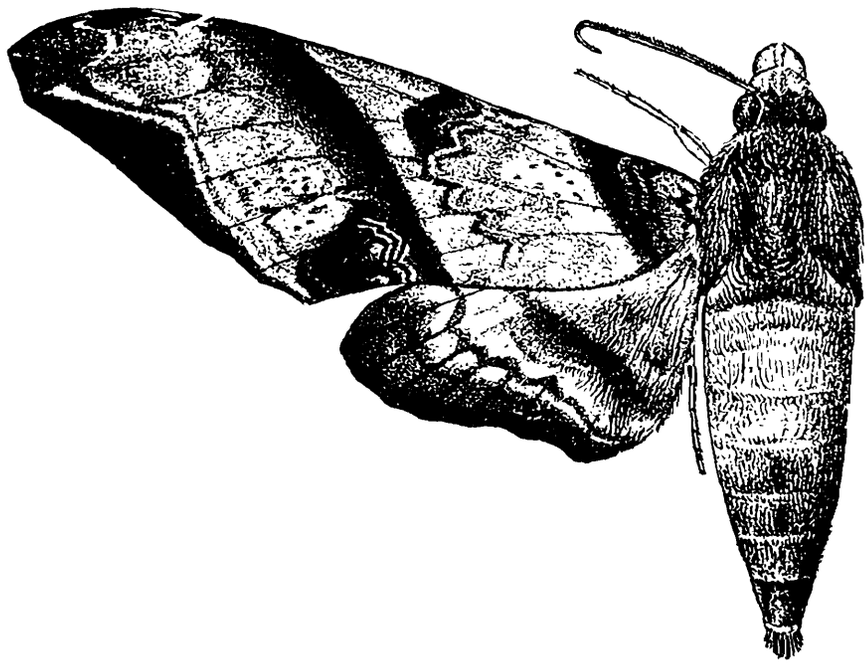


Fig. 19.—*Compsogene panopus panopus* (Cram.).

very large, apex rounded, scales of outside short, excepting edges, where they are prolonged, a large ochraceous patch of small bidentate sulcate scales, the patch rounded distally and dorsally, obliquely truncate-rounded basally; harpe represented by a small basal ridge which stands at right angles to the ventral edge of the clasper and leans distad. Eighth tergite at each side with a belt of enlarged scales on the inner surface, the belt formed by several rows of scales which are closely packed one upon the other, no scales mesially at apex of segment. Penis-sheath with a small tooth; from the mouth project two tongue-like flaps which are beset with triangular projections bearing short bristles.

♀. Eighth tergite transverse, membranaceous at apex; edge irregularly sinuose. Vaginal plate more or less membranaceous except the strongly rounded distal edge.

Hab. Throughout the INDIAN REGION, China, Malaya and the Philippines. We have bred it in S. India, where larvæ were obtained in wooded hills.

Egg.—A perfect ovoid ; surface smooth and shining ; colour yellow. Length 2·6 mm. ; breadth 2·15 mm.

Larva :—

1st and 2nd instars not recorded. *3rd instar*. Head triangular, a spiniform process rising from vertex of each lobe, the two processes appressed into a long cone-shaped extension two-thirds the length of the head. Surface of head smooth, covered sparsely with small tubercles ; the processes shining and set with pointed tubercles. Body nearly cylindrical, tapering slightly from segment 5 frontad ; surface smooth, with a dorso-lateral line of pointed tubercles on 2 to 11 ; horn very long, thin, sharply pointed, curved gently upwards ; surface shining and covered with small tubercles. Colour of head glaucous-green, with a yellow cheek-stripe from vertex to base of antenna and from vertex to nape ; body white above the longitudinal line of tubercles, with a broad green dorsal stripe, grass-green below the line of tubercles ; the tubercles yellow on 2 to 4 and then white ; yellow oblique stripes on 5 to 11 ; horn dark brown dorsally, yellowish ventrally ; true legs brown, prolegs and claspers green, anal flap and claspers edged with yellow. *4th instar* not recorded.

5th instar. Head triangular, higher than broad, vertex slightly truncate, without apical processes ; clypeus one-half length of head, sunken, apex rounded, basal angles tumid ; no false clypeus ; ligula trapeze-shaped, widening frontad, the sinus wide and deep. Surface of head shining, very shallowly corrugate and set with sparse, irregularly-spaced, small, circular tubercles. Body tapering slightly from segment 7 frontad, flattened laterally from segment 8 to 12 ; surface dull. Horn long, thick at base, tapering evenly to a sharp point, basal half horizontal, distal half gently up-curved. A transverse row of small, sharply pointed, conical tubercles on each secondary ring ; a dorso-lateral line of large tubercles on segments 2 to 11, as in the 3rd instar ; oblique stripe on segment 11 set with large tubercles.

Coloration.—Head glaucous-green ; a dorsal stripe from vertex to apex of clypeus, then dividing and running down sides of clypeus ; a stripe separating face from cheek ; a subdorsal stripe from vertex to nape, where it joins the subdorsal line of tubercles on the body ; all these stripes narrow and yellow ; labrum glassy-greenish ; ligula greenish ; basal segment of antenna yellowish-green, other segments pale reddish-brown ; mandible violet, tip brown. Body grass-green, dorsum glaucous-white ; tubercles and oblique stripes

yellow. Horn glaucous-green ; legs pink, prolegs and claspers green ; anal flap and claspers green edged with yellow. Spiracles oval, flush, violet-grey with a narrow blue central slit. Length 110 mm. ; breadth 16 mm. ; horn 20 mm.

Pupa.—Stout in build ; vertex of head at right angles to the axis of the pupa ; tongue reaches to tip of wing-case, fore leg to about the middle of wing-case, antenna slightly shorter and mid-leg slightly longer ; a small coxal piece. Surface moderately shining, coarsely and shallowly rugose, with minute tubercles on the rugosities ; costal margins of wings beaded, sculpturing on segment 4 a bracket-shaped, transverse, narrow, shining line on each side of dorsum ; segment 4 also deeply transversely furrowed by two broad parallel channels ; 5, 6 and 7 each with three depressed lines parallel with their margins ; ante-spiracular ridges on 9 to 11 in the form of four parallel ridges on each ; front margins of 9 to 11 tumid behind the bevelled portions, the tumidity deeply pitted ; spiracle of 2 indicated by a long, flat, narrow, black strip on front margin of thorax, with a crescent-shaped slit in front of it, the other spiracles sunken ovals with raised centres. Cremaster short and triangular, constricted near base, surface shining and rugose, a deep hollow on each side of the ventral surface penetrating to the dorsal surface and thus making a perforation. Colour dark red-brown, nearly black on segments 1 to 3 and on 13 and 14. Length 58 mm. ; breadth 15 mm.

Habits.—Egg laid singly on the underside of a leaf. In India the most common food-plant is *Mangifera indica* Linn. (mango), family Anacardiaceæ, and we have also bred it on *Calophyllum inophyllum* Linn., family Guttiferæ ; Mell records other food-plants of the same two families in China.

The larva lives on the underside of a leaf, generally choosing one in a dense cluster. It lies stretched out straight when at rest, is sluggish, and feeds chiefly at night. Before leaving the food-plant to pupate it becomes suffused with brown-pink, and later is somewhat greasy looking. Pupation in a cell underground. The pupal stage lasts about three weeks except in the case of hibernating pupæ, when it may last as many months or even longer. The moth is one of the most beautiful of Indian sphingids. It is sluggish during the day-time and allows itself to be handled, but at night it flies strongly. We have never seen it feeding at flowers, nor have we ever known it to come to light, though Mell states that it has frequently been caught at light in Java. It emerges from the pupa after dark, and pairs after midnight when in captivity. When resting the wings are spread widely in a plane below the horizontal, the fore wings not quite covering the hind wings, the latter just covering the sides of the abdomen :

in this position the moth is a wonderful example of protective colouring. The broad, clear-cut, parallel-sided ashy-pink band runs across the wings and abdomen, dividing the insect into a chocolate-coloured apical triangle and a distal transverse trapeze of grey, pink and brown in a variegated pattern, and produces the impression of two different objects unconnected with each other.

Attempts to breed this species at first failed, the males and females refusing to pair. When captive females were exposed at Karwar, on the low-lying coast, wild males never came to them, although caterpillars had been found there. The experiment was repeated at an elevation of about 1,500 feet above sea-level, and during the course of four nights eight males were captured, at about 3 to 4 A.M. One of the wild males paired with a captive female after they had been left together for several days, and the female laid eighty-eight eggs on the 1st September and more on succeeding days, laying over a hundred altogether. The eggs commenced to hatch on the 7th September. The larvæ pupated in due course and a fine series of moths was obtained.

17 **Compsogene mansoni** Clark. (Fig. 20).

Compsogene mansoni, Clark, 1924, p. 17 (♂) (Sikkim).

♂. Palpi yellow, bordered with brown along the eye to the tips. Fore wing dark brown, median area extending straight across the wing basally more obliquely than in *C. panopus*.

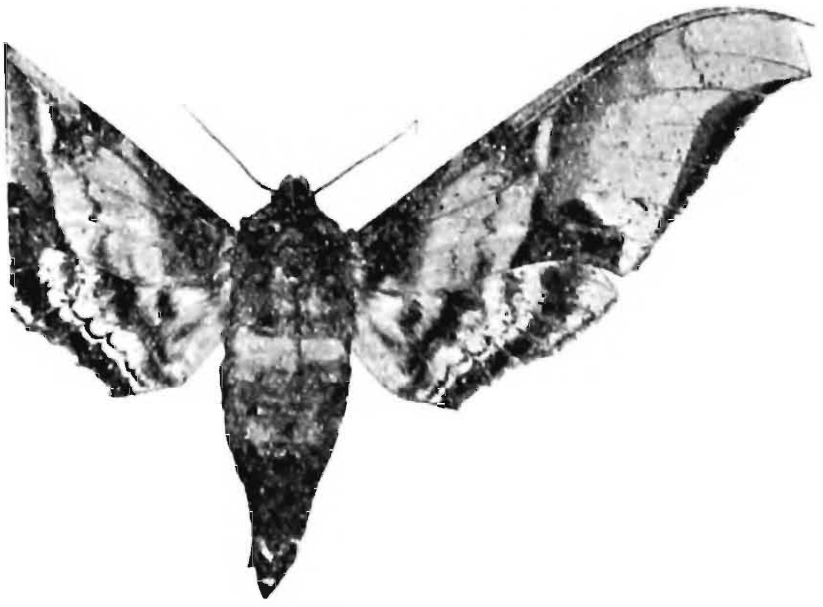


Fig. 20.—*Compsogene mansoni* Clark, ♂.

On the costal margin it is 11 mm. in width, thence it broadens to a width of 16 mm. on R^1. Between R^1 and R^2 it narrows sharply to 6 mm. Its narrowest point is between R^2 and R^3, where it is but 5 mm. wide. From this point it broadens

to the hinder angle, where it is 14 mm. in width. Within this area, between M^2 and SM^2 and extending somewhat beyond M^2, is a black area which lacks the fine white lines basad of it of *C. panopus*.

Hind wing above light yellow with very dark brown markings much as in *panopus*. Beneath light yellow with dark markings which roughly duplicate those above.

Hab. SIKKIM. Besides the type in the Preston Clark collection in the Carnegie Museum, Pittsburg, Pa., there is a second specimen in the British Museum from Kurseong in Sikkim (R. P. Andrews). The ♀ is unknown.

This insect much resembles *panopus*, except for the yellow palpi and the yellow colouring of the hind wing above.

The figure is from the specimen in the British Museum.

Genus **OXYAMBULYX** Rothschild & Jordan. (Figs. 21–23).

Roths. & Jord., 1903, p. 192; id., 1907, p. 43; Jordan, 1911, p. 238.

Genotype: *substrigilis* (Westw.).

Imago.—♂♀. Body and fore wing ashy-grey, clay-colour or terra-cotta, hind wing yellowish, underside yellow, deep chrome, tawny or terra-cotta. " end-segment of antenna compressed, bottle-shaped or conical in side-view, variable in length, but at least four times as long as the preceding one, which is longer than high, two bristles at end and several others on the lateral and ventral surface; dorsal surface of segment covered with appressed scaling. Head with a sharp inter-antennal crest. Spurs unequal, short ones more than half the length of the long ones, longer apical one of hind tibia more than half the length of the first tarsal segment. Apex of fore wing acuminate, not excised; R^2 of hind wing in or below centre of cell, D^3 as long as or longer than D^4. Scales at lateral edge of eighth tergite in ♂ prolonged to a triangular crest" (Roths. & Jord., *l. c.* 1903).

Egg.—Short or elongate ovoid, green or yellow in colour. Rather small for the size of the moths, excepting that of *ocellata*, which is very large.

Larva.—Head triangular after first instar, but never with long processes, higher than segment 2. Ligula very strongly developed, being three times as long as labrum instead of about equal in length to it, as in most sphingid larvæ, and hiding the mandibles from a front view. Body rather slender, muscular and firm to the touch; it increases in diameter from segment 2 to 8, and then decreases slightly to 12; horn long, straight or only slightly curved up or down; tubercles prominent in the earlier instars, less so in the last instar, where they are rounded, seldom pointed, and most conspicuous on the body-stripes; colour green, individuals having

rusty-red, maroon or purplish patches; a dorso-lateral line of tubercles, a similar subspiracular one on the anterior segments, and seven similar oblique stripes on segments 5 to 11.

Pupa.—Rather slender, head rounded; tongue reaches tip of wing-case, never in a free sheath; antenna shorter than fore leg, which reaches to about middle of wing-case; coxal

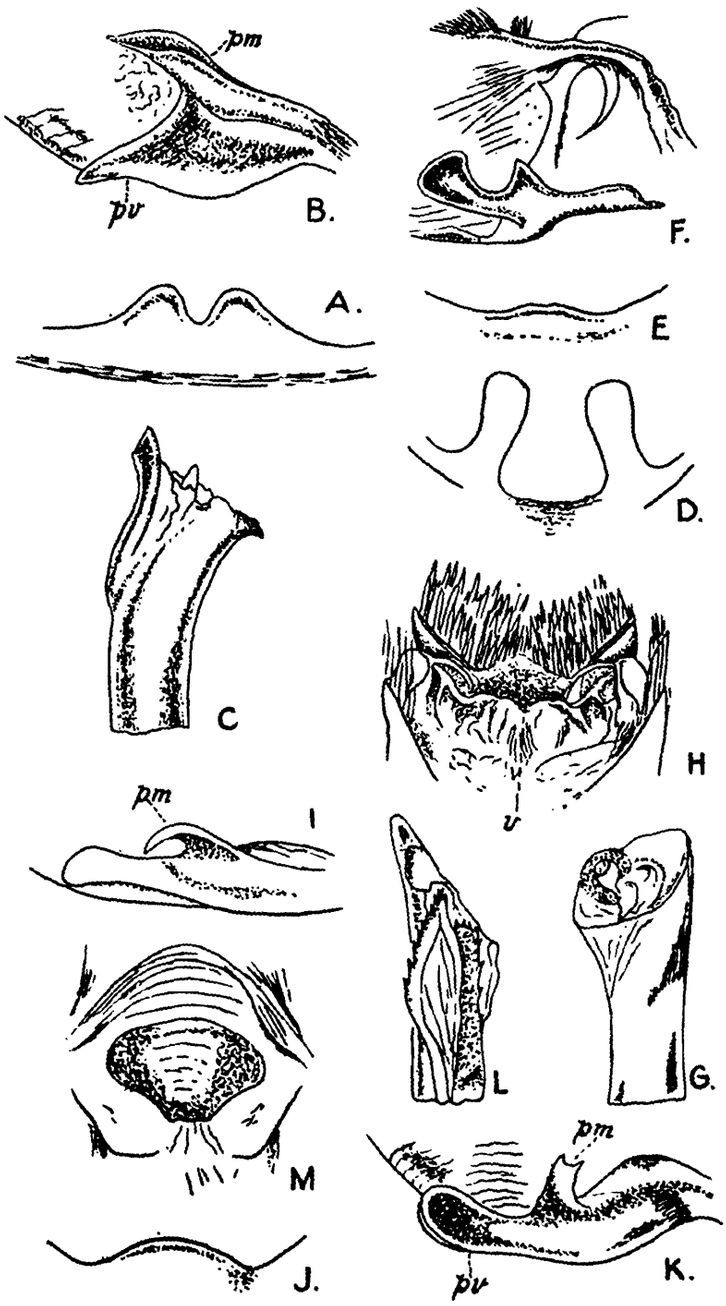


Fig. 21.—*Oxyambulyx* Roths. & Jord. Genitalia.

A, *O. placida* (Moore), ♂, 10th sternite, ventral aspect; B, ♂, harpe; C, ♂, penis-sheath. D, *O. subocellata* (Feld.), ♂, 10th sternite, ventral aspect; E, ♂, 8th sternite, apical margin; F, ♂, harpe; G, ♂, penis-sheath; H, ♀, 8th tergite and vaginal plate. I, *O. substrigilis auripennis*, (Moore), ♂, harpe. J, *O. liturata* (Butl.), ♂, 8th sternite, apical margin; K, ♂, harpe; L, ♂, penis-sheath; M, ♀, vaginal plate (*pm*, medium process; *pv*, ventral process).

piece present or absent ; surface shining, pitted or shagreened ; usually sculpturing on segment 4, but ante-spiracular ridges seldom present ; cremaster variable ; colour chestnut.

Habits.—Eggs laid singly, usually on the underside of a leaf. The food-plants belong to several families. The larva has a characteristic resting position, with the head and anterior segments held away from and parallel with the surface of the leaf or

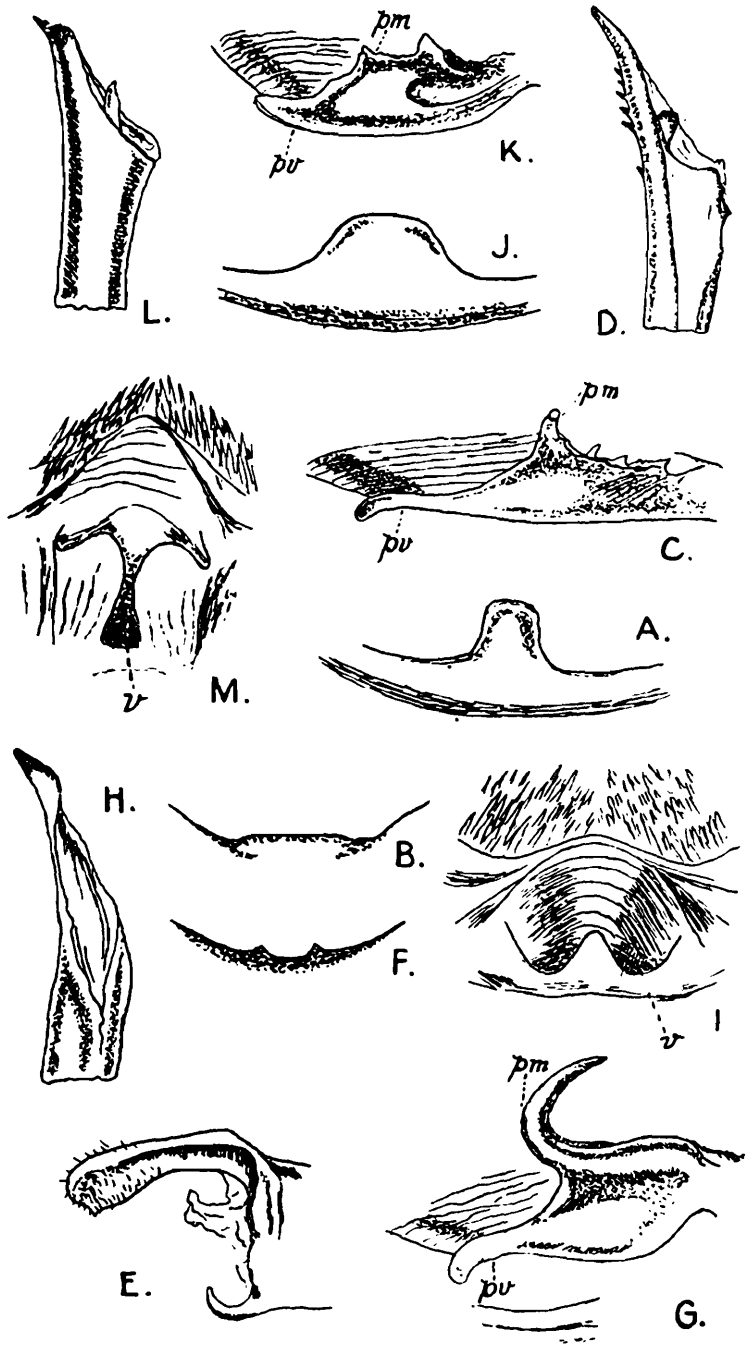


Fig. 22.—*Oxyambulyx* Roths. & Jord. Genitalia.

A, *O. sericeipennis* (Butl.), ♂, 10th sternite, ventral aspect ; B, ♂, 8th sternite, apical margin ; C, ♂, harpe (*pm*, mesial ridge; *pv*, distal process) ; D, ♂, penis-sheath. E, *O. maculifera* (Walk.), ♂, 10th segment, lateral aspect ; F, ♂, 8th sternite, apical margin ; G, ♂, harpe (*pm*, submesial hook ; *pv*, ventral process) ; H, ♂, penis-sheath ; I, ♀, vaginal plate. J, *O. ochracea* (Butl.), 10th sternite, ventral aspect; K, harpe (*pm*, mesial ridge, *pv*, distal process) ; L, penis-sheath ; M, ♀, vaginal plate.

twig, the body being then bent sharply to the surface, meeting it at the anterior pair of prolegs, the rest of the body lying close to the surface; in the earlier instars when disturbed it bends the head round to touch the body on one side at about segment 7 The dorsum becomes suffused with pink

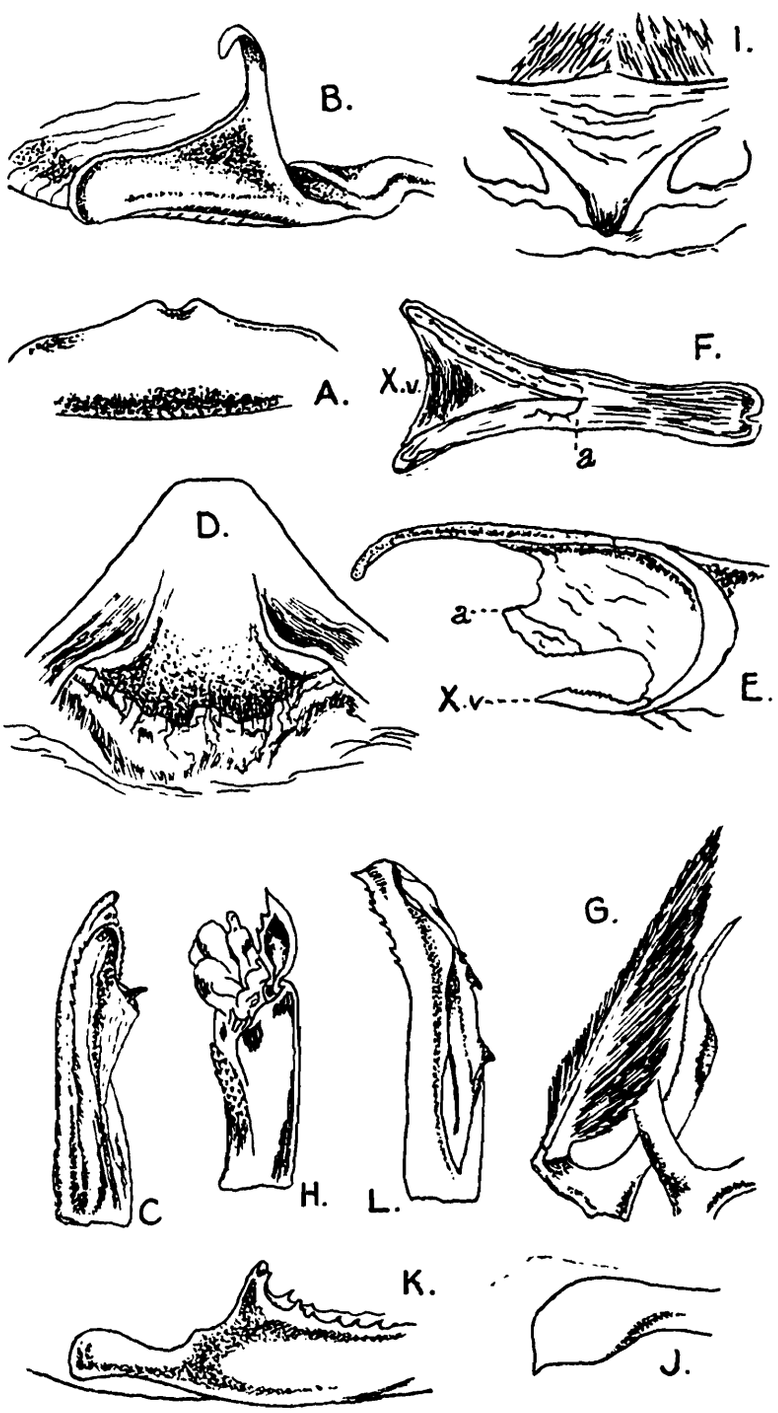


Fig. 23.—*Oxyambulyx* Roths. & Jord. Genitalia.

A, *O. substrigilis* (Westw.), ♂, 10th sternite, ventral aspect; B, ♂, harpe (*pm*, process of upper ridge); C, ♂, penis-sheath; D, ♀, vaginal plate. E, *O. canescens* (Walk.), ♂, 10th segment, ventral aspect; F, ♂, 10th segment, lateral aspect (x. *v*, 10th sternite; *a*, anus); G, ♂, clasper and harpe; H, ♂, penis-sheath; I, ♀, vaginal plate. J, *O. lahora* (Butl.), ♂, 10th tergite, lateral aspect; K, ♂, harpe; L, ♂, penis-sheath.

or violet before pupation, and the larva then jumps violently when touched by bending the head round to the anal segments on one side and then suddenly to the other side. Pupation in an ovoid cell underground. The moths are seldom seen on the wing, and little is known of their habits.

Hab. Widely distributed from the Palæarctic Region to the Philippines. Fifteen Indian species and subspecies.

Key to the Species and Subspecies.

Imagines.

1. Fore wing upperside with three or four subbasal spots behind cell. .. . 2.
   Fore wing upperside with less than three subbasal spots . . . 3.
2. Olive-green band on thorax about 1 mm. broad in middle; abdomen without dorsal line in either sex .. ... . [p. 136. *O. subocellata* (Feld.),
   Band on thorax broader; three subbasal spots on fore wing besides a spot in the cell; upperside whitish-grey; abdomen without dorsal line in either sex. . [p. 135. *O. c. canescens* (Walk.),
3. Fore wing ground-colour yellow; a round subbasal costal spot and one large subbasal spot behind cell; abdomen without dorsal line (eighth tergite of ♂ excepted) .. .. .. [p. 124. *O. ochracea* (Butl.),
   Fore wing ground-colour not yellow . 4.
4. Fore wing usually with no subbasal costal spot; abdomen with dorsal line in both sexes; no patch on eighth tergite in ♂.. 5.
   Fore wing with a round subbasal costal spot. ... . 8.
5. Basal patch of hind wing upperside black or tawny ... . 6.
   Basal patch of hind wing less tawny and never black . .. . 7.
6. Fore wing with submarginal line on upper and lower sides; subbasal costal spot sometimes present .. .. [Jord., p. 128. *O. substrigilis aglaia*
7. Fore wing with submarginal line absent below ... . [(Moore), p. 127. *O. s. auripennis*
   Fore wing with submarginal line present below . .. . 8.
8. Fore wing with submarginal line more proximal posteriorly than in *O. s. substrigilis* ... . [p. 125. *O. l. liturata* (Butl.),
   Fore wing with submarginal line less proximal posteriorly than in *O. l. liturata* . ... [(Westw.), p. 131. *O. s. substrigilis*
9. Fore wing underside with no submarginal line; abdomen with dorsal line and a patch on eighth tergite in ♂ (♀ not known) . .. . [p. 123. *O. lahora* (Butl.),
   Fore wing underside with no submarginal line; abdomen without a dorsal line. [Kaye, J. . 139. *O. cyclasticta* Joicey &
   Fore wing underside with a brown submarginal line 10.

10.	Fore wing underside with grey marginal area reaching outer margin of wing at M^2; abdomen with dorsal line in both sexes, and a patch on eighth tergite in ♂ . . .	*O. maculifera* (Walk.), [p. 118.
	Fore wing underside with grey marginal area continued beyond M^2	11.
11.	Fore wing underside with submarginal line ending on inner margin	12.
	Fore wing underside with submarginal line ending on outer margin or angle; very faint dorsal line in both sexes, no patch on eighth tergite in ♂	14.
12.	Abdomen with strong dorsal line in both sexes; a patch on eighth tergite in ♂ .	13.
	Abdomen with faint line in ♂; no patch on eighth tergite .	[p. 118. *O. placida* (Moore),
13.	Underside deep chrome	*O. s. sericeipennis* [(Butl.), p. 115.
	Underside paler yellow, particularly in outer half . .	*O. s. agana* Jord., p. 117.
14.	Upperside pinkish-grey .	*O. matti* Jord., p. 132.
	Upperside deep ochreous tawny; sub-basal costal spot sometimes vestigial.	*O. belli* Jord., p. 119.

Larvæ.

1.	Spiracles yellowish-grey with a reddish tinge, central slit greyish-brown and shaped like a candle-flame . . .	[p. 124. *O. ochracea* (Butl.),
	Spiracles pale green with the ends white.	*O. substrigilis aglaia*
	Spiracles blue	2. [Jord., p. 129.
2.	True legs yellowish-grey ringed with rusty-brown	[p. 126. *O. l. liturata* (Butl.),
	True legs red with base green	*O. subocellata* (Feld.), [p. 137.
	True legs pink, base of each segment white.	*O. matti* Jord., p. 133.
	True legs red banded with black	3.
3.	Horn long, straight, green, with paler tubercles.	[(Butl.), p. 115. *O. s. sericeipennis* [p. 117. *O. s. agana* Jord.,
	Horn long, slightly down-curved, red, with red tubercles	*O. belli*, Jord., p. 121.

Pupæ.

1.	Coxal piece present (sometimes wanting in *O. subocellata*)	2.
	Coxal piece wanting	3. [p. 138.
2.	Ante-spiracular ridges present.	*O. subocellata* (Feld.),
	Ante-spiracular ridges wanting . . .	*O. substrigilis aglaia* [Jord., p. 130.
3.	No sculpturing on segment 4; very faint ante-spiracular ridges.	*O. l. liturata* (Butl.), [p. 127.
	Sculpturing on segment 4; no ante-spiracular ridges	4.
4.	Sculpturing on segment 4 a deep transverse channel across dorsum	*O. belli* Jord., p. 122.
	Sculpturing on segment 4 a transverse subdorsal raised line .	[p. 125. *O. ochracea* (Butl.),
	Sculpturing on segment 4 two transverse channels on each side of the dorsal line; frons and vertex of head clothed with minute hairs	*O. matti* Jord., p. 134.

18 *a*. **Oxyambulyx sericeipennis sericeipennis** (Butler). (Fig. 22 A–D, genitalia ; Pl. I, fig. 9, larva).

Ambulyx sericeipennis, Butler, 1875, p. 252 (Masuri).
Oxyambulyx sericeipennis, Roths. & Jord., 1903, p. 195.
Oxyambulyx sericeipennis sericeipennis, Jordan, 1929, p. 85.
Oxyambulyx citrona, Joicey & Kaye, 1917, p. 309 ; id., 1924, pl. x, fig. 4 ; Seitz, 1928, p. 533.

Imago.—♂♀. Similar to *O. maculifera*, much more grey, outer margin of fore wing proportionally longer, submarginal line of same wing extended to internal margin both above and below. Fore wing with one subbasal spot behind cell and a subbasal costal spot. Abdomen of ♂ with patch on eighth tergite, a distinct mesial line in both sexes. *Underside* deep chrome. *Expanse* : ♂ 100–124 mm., ♀ 110–124 mm.

♂. Eighth tergite (fig. 22 B) of abdomen slightly bisinuate, the mesial portion almost straight, not distinctly lobed, its edge incrassate internally, having, in a view from the apical side, the appearance of being turned dorsad. Harpe (fig. 22 C) with a long finger-like distal process which points ventrad ; the mesial ridge consisting of two lamellæ, irregularly dentate and distally produced into a cone, the extreme end of which is turned ventrad. Penis-sheath (fig. 22 D) shaped nearly as in *maculifera*, but there is a row of teeth dorsally and also some irregular teeth ventrally ; from the sheath protrudes a blunt, somewhat club-shaped "love-dagger." Tenth tergite lobed mesially, the lobe rather narrow, almost truncate. Process of penis-sheath of type-specimen suddenly curved ; normal in a second specimen from N.W India.

♀. Vaginal plate similar to that of *maculifera*, but the mesial lobe longer and broader.

Hab. W Himalayas. We have bred it at Mussooree at an elevation of about 6,000 feet, the larva feeding on *Juglans regia* Linn. (walnut), of the family Juglandaceæ.

Egg.—Shortly ovoid ; surface smooth and shining ; colour when first laid pale green, turning after a few days to a beautiful orange, and then, a day or two before hatching, to translucent white.

Larva :—

1*st instar*. Head round, body long and thin, horn long, straight ; surface of head and body smooth and shining ; colour pale yellow with the horn black. 2*nd instar*. Head triangular, with a short process on apex of each lobe, body cylindrical, long and thin, horn long and straignt ; head and body yellowish-green, body with transverse rows of small white tubercles ; horn dark purple with small tubercles of the same colour. 3*rd instar*. Head triangular, very large, with a short process on the apex of each lobe ; segments 2 to 4 of the body much less in diameter than the length of the head, the

segments then increasing in diameter to 7; horn as above; surface of the head moderately shining, of the body dull with tubercles as before. Colour of the head dark green dotted with white; two narrow, whitish stripes down the face and one down each cheek; the processes brown, and a brown dorsal stripe running from their tips to the nape; body green with yellow tubercles; oblique stripes on 5 to 11 formed of larger yellow tubercles; horn as before. Some specimens have irregular reddish blotches and oblique stripes. *4th instar*. Little change.

5th instar. Head triangular, vertex rounded, with a short blunt process on the apex of each lobe, length greater than the diameter of segments 2 and 3. Surface of head smooth and shining, covered with small, low, evenly-spaced tubercles. Body increasing gradually and evenly from 2 to 8, and then decreasing slightly to 12. Horn straight, thick at base and tapering evenly to a blunt point. Surface of body dull, with a transverse row of low tubercles on each secondary ring; a dorso-lateral line of large pointed tubercles from segment 2 to base of horn; seven oblique stripes also formed of pointed tubercles; horn covered with smaller tubercles.

Coloration.—Head bluish-green, the tubercles white; a narrow white stripe on each side of dorsal line from vertex to apex of clypeus; a broad white stripe down each side, separating the face from the cheek; the processes pale yellow; a white subdorsal stripe running from each process to the nape and then joining the subdorsal line of tubercles on the body. Body bright bluish-green, paler below the spiracles, the rows of tubercles yellow; the subdorsal dorso-lateral line of tubercles and those forming the oblique stripes yellow; a narrow supra-spiracular stripe on 2 to 4, meeting the oblique stripe on 5 at its lower end, also yellow. Horn green with the tubercles paler green; legs reddish with a black ring on each segment; prolegs and claspers green.

In another form of the larva the transverse rows of tubercles white, those forming the subdorsal and oblique stripe mauve, and the supraspiracular stripe also mauve.

In a third form the head-processes and a dorsal stripe down back of head brown; dorso-lateral line of tubercles and supraspiracular stripe whitish, with a broad, irregular, purple-brown band between them and below them on to venter; triangular blotches of brown and purple above each oblique stripe; oblique stripes orange; horn dark purple; legs, prolegs, and a large triangle on claspers brown. There are still other forms intermediate between the above. Spiracles oval, sky blue, with a raised edged to the central slit and a narrow border of paler blue. Length 80 mm.; breadth 12 mm.; horn 12–16 mm.

Pupa.—Closely resembles others in the genus. Length 51 mm.

Habits.—Eggs laid usually on the underside, but sometimes on the upper side of a leaf, or on twigs of the food-plant, from about May to July. Food-plant: *Juglans regia* Linn. (walnut), family Juglandaceæ. The larva lies on the underside of a leaf, and adopts the characteristic attitudes described under the genus *Oxyambulyx*. It rests without feeding for four or five days before leaving the food-plant to seek a place to pupate, and the dorsum becomes suffused with violet. If touched during this resting period, or while on the ground looking for soft earth to dig in, it jumps violently, bending the head to one side till it touches the claspers and then suddenly to the other side. The movement is so vigorous that the larva sometimes jerks itself off the food-plant on to the ground. Pupation takes place in a cell underground, smoothed and lined with silk inside. The pupal stage lasts from about three weeks to many months in the case of hibernating pupæ. The moth rests with the wings held almost horizontal and the abdomen bent sharply upwards. We have never seen it in the wild state.

18 *b*. **Oxyambulyx sericeipennis agana** Jord. (Pl. I, figs. 6, 7, larva; Pl. VII, fig. 11, imago; Pl. XIII, fig. 9, larva).

Oxyambulyx sericeipennis agana, Jordan, 1929, p. 85 (Sikkim); Scott, 1931, pl. i, fig. 1.
Oxyambulyx sericeipennis Roths. & Jord., 1903, pl. ix, fig. 2 (♂).

Imago.—♂♀. On the whole larger than *O. s. sericeipennis*. *Underside* of both wings paler yellow than in *O. s. sericeipennis*, less brick-red, particularly in the outer half. Process (uncus) of anal tergite narrower, its apical portion as seen from the side wider vertically; dentate ridge of harpe somewhat larger.

Hab. E. Himalayas (Sikkim, Assam) and Burma. We have bred it in the Khasi Hills, where it is common at an elevation of from 4,000 to 5,000 feet. The larva and pupa so closely resemble those of *O. s. sericeipennis* that no separate description is given.

Habits.—Food-plants: *Rhus insignia* Hk. f., family Anacardiaceæ; *Juglans regia* Linn. (walnut) and *Engelhardtia spicata* Blume, family Juglandaceæ; *Myrica nagi* Thunb., family Myricaceæ; *Betula alnoides* Ham. (birch), family Betulaceæ; *Quercus* Linn. (oak), family Fagaceæ. Eggs were found in May and June, and larvæ up to September. If the larvæ are fed on walnut the leaves must be fresh or the larvæ are poisoned and die.

19. **Oxyambulyx placida** (Moore). (Fig. 21 A–C, genitalia).

Ambulyx placida, Moore, 1888, p. 390 (Solon); Butler, 1889, p. 25, pl. cxxi, fig. 1.
Oxyambulyx placida, Roths. & Jord., 1903, p. 196, pl. ix, fig. 3 (♂); Seitz, 1928, p. 533, fig. 61 *a*.
Ambulyx substrigilis, Hampson, 1892, p. 77 (non Westw.).

Imago.—♂♀. A very pale species. Fore wing similar to that of *sericeipennis*, but first discal line, which is the only distinct line, more distal, at R^3 about mid-way between cell and the broad yellowish proximal border of the submarginal line; line across apex of cell in the same or nearly the same direction as the streak upon R^3; subbasal spot behind cell and a subbasal costal patch. Abdomen in ♂ with fine mesial line, no patch on eighth tergite; in ♀ without line. *Underside* of wings deep chrome. *Expanse*: ♂ 104 mm., ♀ 114 mm.

There are apparently two subspecies:

(*a*) A pair from the W Himalayas is very pale grey on fore wing; the line across apex of cell forms an obtuse angle with the line upon R^3; the round subbasal spot behind cell small; the eighth sternite of the ♂ has a truncate-sinuate mesial lobe, of which the angles are not distinctly toothed.

(*b*) The individuals from Sikkim (E. Himalayas) have the subbasal round patch of fore wing, behind cell, enlarged, the line across apex of cell more horizontal, and the angles of the lobe of the eighth sternite produced.

♂. Tenth sternite (fig. 21 A) deeply sinuate, the two lobes rounded. Eighth sternite mesially with a lobe which is or is not toothed at the angles. Harpe (fig. 21 B) broad; distal process rather short, somewhat concave above, curved downward, obtusely pointed; submesial process hollow, formed by two lamellæ being curved towards each other and together produced distad, this process resembling that of *japonica*. Penis-sheath (fig. 21 C) wider than in the allied species, ventrally chitinized to end, armed with a short stout ventral hook and an obliquely truncate dorsal process which is irregularly notched.

♀. Vaginal area similar to that of *liturata*.

Hab. W and E. Himalayas. The early stages unknown.

20. **Oxyambulyx maculifera** (Walker). (Fig. 22 E–I, genitalia).

Ambulyx maculifera, Walker, 1866, p. 185 (Darjeeling, ♀); Butler, 1877 A, p. 580; id., 1881 B, p. 10, fig. 3.
Oxyambulyx maculifera, Roths. & Jord., 1903, p. 197, pl. ix, fig. 4 (♂); Seitz, 1928, p. 534, fig. 61 *d*.
Ambulyx consanguis, Butler, 1881 B, p. 11, pl. lxxx, fig. 2 (Darjeeling, ♂).
Ambulyx substrigilis, Hampson, 1892, p. 77, fig. 49 (♀) (non Westw.).

Imago.—♂♀. Recognizable by the presence of a large subbasal patch at the costal margin of fore wing, the mesial line

on abdomen developing in the ♂ into a patch upon the eighth segment, the strong curvature of the submarginal line of fore wing, this line reaching the edge of the wing at M^2, and by the posterior bars composing the discal line of fore wing being obviously arched. Fore wing ochraceous-clay colour *above* in the ♂, nearly burnt-umber brown shaded with grey in the ♀. A few spines on fore tibia externally near apex. *Underside* of wings much shaded with tawny in the basal area, especially in the ♀; abdomen and wings much less yellow than in *sericeipennis* and *placida*. *Expanse*: ♂ 110 mm., ♀ 130 mm.

♂. Eighth abdominal sternite (fig. 22 F) mesially very slightly sinuate, the sinus limited on each side by a small tooth. Penis-sheath (fig. 22 H) dorsally gradually narrowed to a point; it is devoid of any additional armature. The harpe (fig. 22 G) has a very heavy, strongly curved, submesial hook, which is the distal prolonged part of a double submesial ridge; ventral process curved downwards, rather blunt, finger-like. Tenth sternite mesially lobed as in *sericeipennis*.

♀. Eighth tergite deeply incised. Vaginal plate (fig. 22 I) similar to that of *sericeipennis* and *schauffelbergi*, the mesial lobe narrower.

Hab. E. HIMALAYAS (Sikkim) and BURMA. The early stages not known.

21. **Oxyambulyx belli** Jord. (Fig. 24 A, imago, B–H, genitalia; Pl. I, fig. 8, & Pl. II, fig. 1, larva; Pl. VIII, fig. 6, pupa).

Oxyambulyx belli, Jordan, 1923, p. 186, figs. 1–7 (genit.) (North Kanara); Seitz, 1928, p. 534.

Imago.—♂♀. A rather small species. General colour a deeper ochraceous-tawny than in the other Indian species of *Oxyambulyx*, with the exception of *O. subocellata*. In markings somewhat resembling *O. maculifera*. Abdomen with an indistinct dorsal line, which is not widened into a patch on eighth tergite of the ♂, the line sometimes scarcely traceable. Fore wing flushed with purple, especially in the ♀, which is darker tawny than the ♂; two dark olive subbasal spots, the costal spot vestigial, in one ♀ both spots; the costal bar of the outer antemedian line reaches hind margin of cell at some distance from lower cell-angle, being less oblique than in *O. maculifera* and more oblique than in *O. ochracea*; discocellular not inconspicuous; in the ♂ the veins in outer two-fifths of wing slightly darker than the ground, especially R^1 and R^3, this outer area from R^1 backwards a deeper colour than rest of wing; olive-black submarginal line posteriorly close to termen, accompanied by a pale line as in other species, but this pale line bounded on the proximal side by more or less

distinct traces of a dark line. Hind wing with the usual markings, its ground-colour paler than on fore wing, the abdominal area slightly shaded with pinkish-grey, base not darkened; fringe white in the last two marginal recesses (the long scales only), dentition stronger than in *O. substrigilis*.

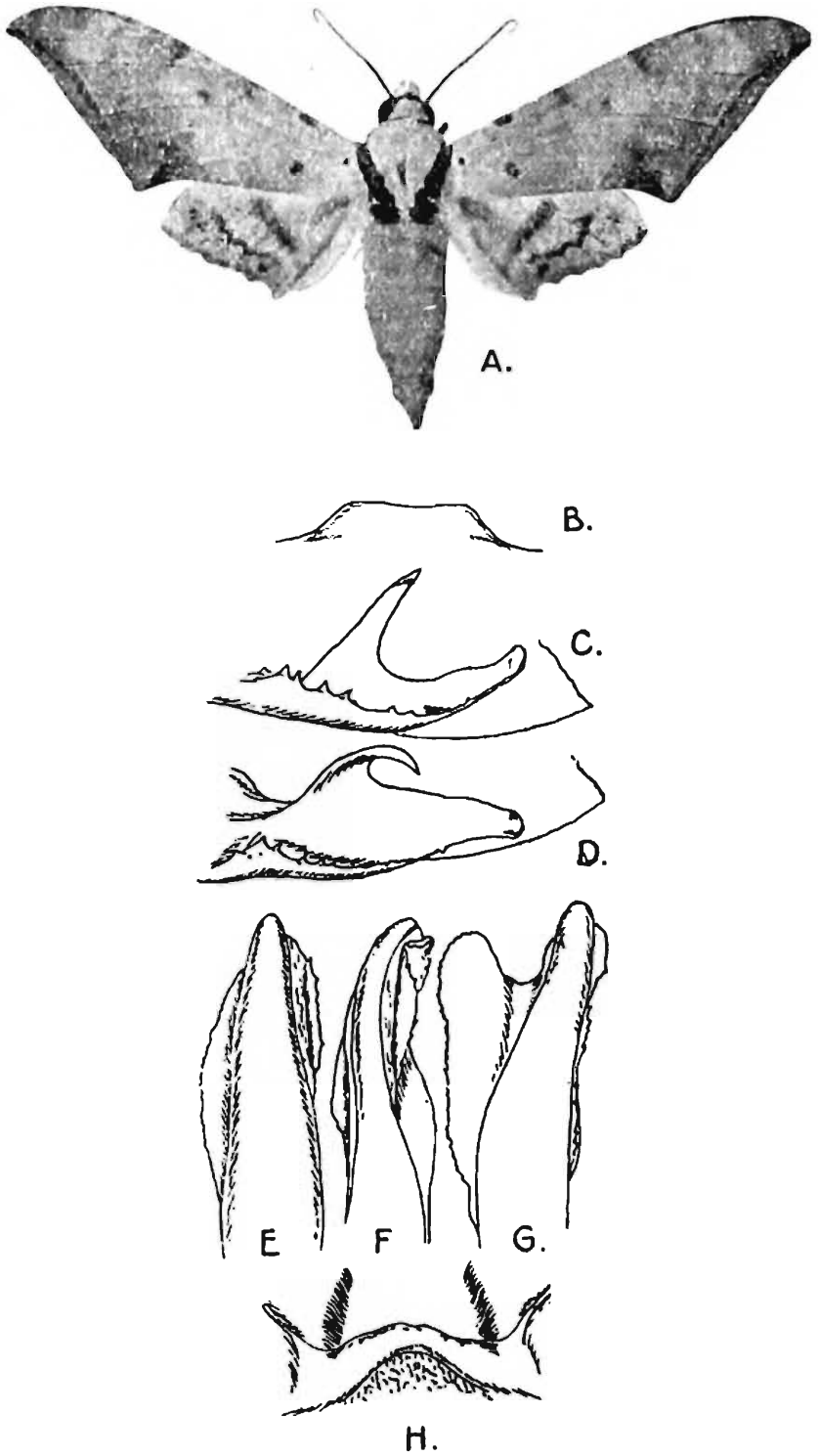


Fig. 24.—*Oxyambulyx belli* Jord.

A, ♂, Anago; B, lobe of 8th sternite; C, clasper, inner side, ventral aspect; D, surface of harpe; E, penis-sheath, dorsal aspect; F, penis-sheath, lateral aspect; G, penis-sheath, dorsal aspect, another example; H, ♀, post-vaginal sclerite.

Underside tawny, slightly paler proximally, feebly irrorated with small darker speckles, no blotches ; fore wing with a grey terminal band, which is very narrow posteriorly and does not reach tornus ; the blackish line bounding this band diffuse, feebly marked, often vestigial. Hind wing : the bands of upperside present, or at least the median band indicated, shadowy. Body similar to wings ; palpus and breast tawny, sides of breast with a vinous-red tint. *Expanse* ; 100–110 mm.

♂. Eighth sternite (fig. 24 B) with a distinct median lobe which is truncate, with the angles more or less rounded and sometimes turned inward (=upward). Tenth sternite broad, with a very small, round, median sinus. Armature of clasper (fig. 24 C, D) recalling *O. substrigilis* and *O. placida*, with two processes, the upper process pointed and somewhat curved mesiad (*i. e.*, away from the inner surface of the clasper), the apical process much broader, a little longer, gradually narrowed, but remaining obtuse, with the apex also curved mesiad ; both processes slightly variable in length and width ; above the ventral margin of this harpe a row of teeth variable in number. Penis-sheath (fig. 24 E, F, G) of the same type as in *O. substrigilis*, ending with a rod-like process which is much broader and shorter than in that species ; at each side of this dorsal rod, which is slightly curved ventrad apically, there is a longitudinal dentate ridge connected with the sheath by a membrane and capable of being moved a short distance away from the sheath.

♀. Post-vaginal sclerite (fig. 24 H) smooth, transversely concave nearly in centre ; in front of orifice a definite ridge of chitin, sharp, slightly uneven, highest in middle.

Hab. S. India (Kanara District), where we have bred this species. It is not rare, but rather local, and occurs in forests with heavy rainfall up to 1,000 feet elevation.

Egg.—Not known.

Larva :—

Final instar. Head triangular, vertex broadly rounded, much higher than segment 2 ; processes represented by a very small tubercle on the apex of each lobe ; true clypeus one-third length of head, apex acute, basal angles very rounded and tumid, the tumidity separated from rest of clypeus by a deep channel, whole clypeus shaped like an ace of spades ; false clypeus hardly traceable, a narrow strip along upper part of true clypeus ; labrum one-third length of and slightly broader than clypeus, with a deep dorsal longitudinal depression flanked on each side by a longitudinal ridge ; ligula four times as long as labrum, shaped like a sausage constricted in the middle, and covering the greater part of the mandibles ; eyes 1 to 4 in a curve ; 6 in line with 3 and 4 ; 5 forming an equilateral triangle with 4 and 6. Surface of head shining and

smooth. Body similar in shape to that of others in the genus; surface dull. Horn long, stout, gently down-curved, tapering gently to a blunt point. A transverse row of very small conical tubercles along dorsum of each secondary ring; a dorso-lateral line of larger tubercles on segments 2 to 11, the tubercles near the margins of the segments larger than the median ones. Horn shining, covered closely with minute tubercles and sparsely with larger tubercles; anal flap and claspers covered sparsely with small tubercles.

Coloration.—Head glaucous-green, becoming less glaucous frontad; a faint subdorsal stripe from apex of each lobe to nape; labrum green; ligula white, with a broad, pale, rusty suffusion on dorsum; basal segment of antenna green, second segment whitish with pale rusty base, end-segment reddish-brown; mandible green, tip dark reddish-brown; eyes colourless glassy with black pupils. Body green, dotted with yellow tubercles on dorsum and with yellow dots below the dorso-lateral line of tubercles; lateral area a brighter green than dorsum; tubercles on dorso-lateral line white and situated on a white stripe which is continuous on segments 2 to 5 and interrupted on each of the succeeding segments; seven white oblique stripes on 5 to 11, broadening upwards, that on 11 running back to base of horn. Horn maroon-red, the underside of base paler in colour than the rest, tubercles of the same colour; true legs maroon colour, the bases of first two segments banded with shining black; prolegs green, anal flap glaucous-green with tubercles of the same colour, claspers green in front, maroon behind, with jet-black tubercles; venter glaucous-green with a darker green central line. Spiracles large, oval, sky-blue, suffused with pale purple on each side of the central slit, and surrounded by a very narrow, raised, shining green rim.

Some larvæ have a number of red markings; the dorso-lateral stripe may be bordered with red above and below, this red border sometimes extending downwards to form a triangular patch on some of the segments. Length 80 mm.; breadth 11 mm.; horn 11 mm.; head 9 by 7 mm.

Pupa.—Shape as in others of the genus. Surface shining, base of tongue minutely rugose, shoulders and dorsum of thorax more prominently rugose; wing-cases transversely lined, the veins prominently beaded; abdomen coarsely pitted, especially on front margins of segments, which are broadly tumid; segment 4 with a deep transverse channel across dorsum. Spiracle of 2 in the form of dull, thickened margins to 2 and 3 on each side of the central slit, the remaining spiracles rather pointed-oval, lying in slight oval depressions. Cremaster conical, abruptly narrowed into a blunt tooth, shining-black in colour and very rugose. Colour dark red-

brown, paler on wing-cases and on the front bevels of segments 9 to 11, the spiracles black. Length 52 mm. ; breadth 13 mm.

Habits.—Food-plant : *Xylia xylocarpa* Taub., family Leguminosæ. We have never found the eggs. The larva feeds chiefly at night; it rests in the same position as others of the genus, but sometimes with the head thrown back. The moths have never been caught at light nor seen feeding on flowers. We did not succeed in attracting wild males to bred females.

22. **Oxyambulyx lahora** (Butler). (Fig. 23 J–L, genitalia ; fig. 25, ♂ holotype).

Ambulyx lahora, Butler, 1875, p. 251 (N.W Himalayas) ; id., 1877 A, p. 580, pl. xciii, fig. 9.
Oxyambulyx lahora, Roths. & Jord., 1903, p. 198 ; Seitz, 1928, p. 533.
Ambulyx semifervens, Hampson, 1892, p. 78 (non Walk.).

Imago.—♂. Resembling *maculifera*, more reddish in tint. Abdomen with dorsal line, which is dilated to a patch on the



Fig. 25.—*Oxyambulyx lahora* (Butl.), ♂ holotype.

eighth tergite. Fore wing above with large subbasal costal patch, submarginal line vestigial, with grey border ; hind wing more distinctly dentate, margin chestnut, not black, few speckles. *Underside* of body and wings rufous-tawny like the upperside of the hind wing, lines on disc of fore and hind wing slightly deeper in tint, no distinct speckles, no submarginal line on fore wing, grey marginal area broad. *Expanse* : ♂ 98–108 mm., ♀ 108 mm.

Eighth abdominal sternite rounded. Tenth tergite (fig. 23 J) with dorsal apical surface more slanting than in *maculifera*. Harpe (fig. 23 K) similar to that of *sericeipennis* in the submesial ridge, consisting of two dentate lamellæ which are together produced into a cone of which the tip curves ventrad ; distal process spoon-shaped as in *maculifera*, *liturata* and *substrigilis substrigilis*, the process less broad than in these

forms. Penis-sheath (fig. 23 L) curving dorsad, with a dorsal row of teeth, apex truncate; a stronger chitinized ventral fold bearing three heavy teeth.

Hab. W HIMALAYAS; one ♂ in the British Museum; ♀ and early stages not known.

23. **Oxyambulyx ochracea** (Butler). (Fig. 22 J–M, genitalia).

Ambulyx ochracea, Butler, 1885, p. 113 (Japan).
Oxyambulyx ochracea, Roths. & Jord., 1903, p. 199, pl. viii, fig. 14 (♂); Jordan, 1911, p. 238, fig. 37 *a*; Mell, 1922, p. 92, pl. xvi, figs. 13, 14 (pupa), pl. xxiii, figs. 8, 9 (♂♀); Seitz, 1928, p. 534.
Ambulyx substrigilis, Hampson, 1892, p. 77 (non Westw.).

Imago.—♂♀. Both sexes without a dorsal line on abdomen, but the ♂ has a patch on the eighth tergite. The posterior subbasal patch of fore wing very large, larger than the costal patch. The ♂ is the most uniformly yellow species of the Indo-Malayan *Oxyambulyx*; the ♀ is darker than the ♂. In both sexes the distal submedian line crosses M at the base of M^1, the portion of the line within the cell being less oblique than in *maculifera*, *schauffelbergeri* and others, not extending distad to the lower angle of the cell. *Expanse*: ♂ 92–104 mm., ♀ 114 mm.

♂. Eighth sternite of abdomen mesially rounded. The harpe (fig. 22 K) has a blunt, concave, distal process, the mesial ridge short and produced into a heavy tooth; the ridge connecting this tooth with the distal process irregularly dentate. Penis-sheath (fig. 22 L) bears no armature besides the dorsal process, which, being obliquely truncate in a ventro-dorsal direction, is sharply pointed. Tenth sternite (fig. 22 J) very much broader mesially than in *sericeipennis* and *schauffelbergeri*, and has, as in these species, no mesial sinus.

♀. Vaginal plate (fig. 22 M) with a high ridge before the cavity, the ridge deeply sinuate, the sinus widened proximally, the lobes of the ridge thus formed strongly rounded, projecting mesiad; postvaginal part of plate with the sides oblique, shallowly sinuate, apex rounded.

Hab. E. HIMALAYAS to China and Japan. Mell has bred the species in S. China.

Egg.—A slightly depressed ovoid; surface smooth and shining; colour pale green. Length 2 mm.; breadth 1·4 mm.; height 1·2 mm.

Larva:—

1*st instar*. Head broader than body; horn short, straight, tip broadly bifid; head brownish, body greyish-green, set with fine bristles, all of the same length, on each segment; horn black with the base shortly reddish-brown. 2*nd instar*. Head broader and higher than segment 2, without processes on the vertex; body dull brownish-yellow, horn straight, reddish-brown, the broadly bifid tip black.

Final instar. Shape as in others of the genus except that the horn is slightly up-curved. Surface smooth, the transverse rows of tubercles very low; very small white tubercles on ventral surface.

Coloration.—Head greyish-green with a whitish line on each side of the dorsal line from vertex to apex of clypeus, and a white stripe separating face from cheek; a small orange-coloured tubercle on the apex of each lobe; a whitish subdorsal stripe from each tubercle to the nape, joining the subdorsal stripe of the body; apex of clypeus reaching to two-fifths length of head. Body yellowish-green above the spiracular line, greyish-green below it; a white, clearly defined subdorsal stripe on segment 2, becoming yellow dorso-laterally, and less clearly defined on the posterior segments; a narrow, yellow, subspiracular stripe from the front margin of 2 to hinder margin of 4, where it meets the oblique stripe on 5 at its lower end; seven yellow oblique stripes on 5 to 11; on the median segments the angle between the oblique stripes and the dorso-lateral stripe filled in with pale violet triangular patches, these patches often bordered with rusty-red or rusty-brown colour, which may spread so as to cover the whole body excepting the triangular patches. Spiracles oval, yellowish-grey with a reddish tinge, the central slit shaped like a candle-flame and dark greyish-brown. Length about 70 mm.

Pupa.—The shape the same as in others of the genus. Surface superficially shagreened, especially on the dorsum; sculpturing on segment 4 a transverse subdorsal raised line, the two lines sometimes meeting on dorsum where the junction forms a short shining streak. Cremaster longer than broad, flat dorsally and finely rugose, the tip a transverse shortly oblong piece with a small bristle or tooth at each lateral corner. Length 36–44 mm.; breadth 12 mm.

Habits.—Food-plant: *Poupartia Fordii* Hemsl. (=*Spondias axillaris* Roxb.), family Anacardiaceæ (in China); a specimen was caught at rubiaceous flowers with a ♀ *O. sericeipennis*, which seems to indicate that these two species feed.

24. **Oxyambulyx liturata liturata** (Butler). (Fig. 21 J–M, genitalia).

Ambulyx liturata, Butler, 1875, p. 250 (Hab. ?); id., 1877 A, p. 580, pl. xci, fig. 2 (larva), 3 (pupa).
Oxyambulyx liturata, Roths. & Jord., 1903, p. 200, pl. viii, fig. 10 (♂); Mell, 1922, p. 96, pl. iii, figs. 18, 19, pl. xxiii, fig. 10 (larva), pl. xvi, figs. 10–12, pl. xiii, fig. 6 (pupa), pl. xxiii, fig. 11 (♀).
Oxyambulyx liturata liturata, Seitz, 1928, p. 534, t. 61 *b*.
Ambulyx rhodoptera, Butler, 1875, p. 251 (Darjeeling); id., 1877 A, p. 580, pl. xciii, fig. 8 (♀).
Ambulyx substrigilis, Hampson, 1892, p. 77 (non Westw.).

Imago.—♂♀. Easily distinguished from *maculifera* by the

absence of the round subbasal costal patch, which is occasionally indicated in the present species by a longitudinal dash. Abdomen with mesial line which is *not* dilated to a patch on the eighth tergite of the ♂. From the continental form of *substrigilis*, with which *liturata* is easily confused, it can be distinguished, apart from the different sexual armature, by the base of the hind wing being less tawny and never black and by the submarginal line of fore wing being more proximal posteriorly.

Some of the ♀♀ are as pale as the ♂♂, while others are deeper in tint and have a more distinct violet-grey gloss on the fore wing. *Expanse* : ♂ 106 mm., ♀ 106–134 mm.

♂. Eighth abdominal sternite bisinuate, being rounded-convex mesially (fig. 21 J), the edge of this lobe thickened internally, which gives the edge the appearance of being bent internad. Tenth sternite similar to that of *placida*, being more deeply sinuate than in *substrigilis*. Harpe (fig. 21 K) with an almost vertical submesial process at the distal end of the submesial ridge ; distal process very broad, spoon-shaped. Penis-sheath (fig. 21 L) with two dentate folds, which are unequal in length ; the strongly chitinized dorsal part of the sheath prolonged into a short obtuse process.

♀. Vaginal plate (fig. 21 M) with a very large vaginal cavity ; proximal part of plate membranaceous, edge of cavity raised to a folded ridge which is mesially sinuate, here less chitinized than laterally ; distal part of plate rounded, transversely multicarinate. Eighth tergite mesially membranaceous, the strongly chitinous plate deeply incised.

Hab. E. HIMALAYAS (Sikkim ; Assam), BURMA and China. Mell has bred this subspecies in S. China.

Egg.—Broadly ovoid, surface smooth and shining, colour a fine green. Length 2 mm. ; breadth 2·3 mm.

Larva :—

Final instar. Shape as in others of the genus. Head triangular, horn long, slightly up-curved. Surface of head smooth, with a few minute tubercles on the apex of each lobe. Body dull ; no tubercles on the secondary segmental rings ; a single line of long conical tubercles starting subdorsally from the front margin of segment 2 and becoming dorso-lateral on 3 to 11 ; the tubercle at the front margin of 2 to 5 is the largest, the tubercles then decreasing in size to the hind margin of each of these segments ; from 6 to 11 the tubercles increase in size from the front margin to the hind margin of each segment. Horn without tubercles.

Coloration.—Head greyish-green, with a white subdorsal stripe from the apex of each lobe to the nape, where it joins the subdorsal stripe of the body at the front margin of segment 2 ; a dark dot near each basal angle of clypeus. Body

green with a blurred white dorso-lateral stripe from 2 to base of horn, this stripe broadest at the hinder margin of 4 ; the line of long tubercles is situated on this stripe ; they are white on 2 to 4, salmon-red on 5, and still more red on 6, where the red colour expands backwards and downwards into a triangular patch reaching from just below the dorso-lateral stripe to the level of the spiracle at the hind margin of the segment ; a corresponding larger, rhomb-shaped patch on segment 7 purplish-red, with salmon-coloured centre and some salmon-coloured spots edged with purple ; similar patches, decreasing in size backwards, on segments 8 to 11, segment 12 being without any patch ; the oblique stripes whitish, best defined on the posterior segments, that on segment 5 being obscure, edged above with sap-green, and interrupting the dorso-lateral stripe without extending above it. Horn bluish-green. Legs yellowish-grey ringed with rusty-brown ; prolegs and claspers green bordered with rusty-brown. Spiracles oval, pale blue with a slightly raised, paler-coloured central slit and a narrow dark rim ; the whole situated on a smooth, flat patch of the body colour. Length 100 mm. ; breadth 13 mm.

Pupa.—Shape much the same as in others of the genus. Surface shining, weakly pitted ; the wing-cases finely, transversely lined, the veins somewhat prominent and slightly beaded, the costal edges raised above the tongue and more strongly beaded ; a slight keel along dorsal line of segments 4 and 5 ; ante-spiracular ridges on 9 to 11 very faint. Cremaster stout, conical, rugose, longitudinally ridged, the tip short, either a simple point or extremely minutely bifid. Colour dark chestnut. Length 60 mm. ; breadth 15 mm.

Habits.—Food-plants : *Quercus* Linn. ; *Castanopsis* Spach., family Fagaceæ ; *Poupartia Fordii* Hemsl., family Anacardiaceæ ; and *Canarium album* Raeuschel, family Burceraceæ (in China). Pupal cell lined with silk-slime. The time spent in the pupal state varies from 12 to 32 days in the summer, and in the winter, when the pupæ hibernate, from 153 to 207 days. The habits of the larva and moth are similar to those of others of the genus, but the moth is excitable and flies readily when touched.

25 *a*. **Oxyambulyx substrigilis auripennis** (Moore).

Ambulyx auripennis, Moore, 1879 A, p. 388 (Ceylon) ; id., 1882, p. 11, pl. lxxix, fig. 1 (♂), 1 *a* (larva), 1 *b* (pupa).
Oxyambulyx substrigilis auripennis, Roths. & Jord., 1903, p. 202 ; Seitz, 1928, p. 534.
Ambulyx substrigilis, Hampson, 1892, p. 77 (non Westw.).

Imago.—♂. Body below deeper yellow than in *O. s. substrigilis*. Markings of wings less heavy ; submarginal black

line of fore wing vestigial above, absent below; long scales of fringe of hind wing white. Process of harpe (fig. 21 I) shorter and slenderer than in *O. s. substrigilis*; process of penis-sheath stouter.

♀. Not known.

Larva (as figured by Moore (1882)).—Green, a white subdorsal line from segment 2 to base of horn, six yellowish oblique stripes, a whitish subspiracular stripe, interrupted; horn stout. Food-plant *Dipterocarpus*.

Pupa.—Also figured by Moore, but details not clear. Shows a prominent cremaster; apparently no tubercles on head.

Hab. CEYLON. The subspecies is very rare.

25 *b*. **Oxyambulyx substrigilis aglaia** Jord. (Pl. II, fig. 2, larva).

Oxyambulyx substrigilis aglaia, Jordan, 1923, p. 188 (North Kanara); Seitz, 1925, p. 534.

Imago.—♂♀. This subspecies (and other subspecies of *O. substrigilis*) is easily distinguished from other species of *Oxyambulyx* by the large black or tawny basal patch of hind wing upperside. Dorsal line of abdomen distinct, but not dilated to a patch on eighth tergite. The costal subbasal spot on fore wing upperside usually absent, but sometimes nearly as large as the one behind cell. Fore tibia with spines at end.

♂. Fore wing upperside more grey than in *O. liturata*, agreeing in this respect better with *O. sericeipennis*; underside of body, palpi and wings and upperside of hind wing deep orange-fulvous.

♀. Fore wing upperside, the antemedian pair of lines less distinct than *O. s. substrigilis*, sometimes absent, closer together before hind margin and here more oblique. On underside wings more sparsely irrorated with brown. In two colour forms: a pale form nearly as bright tawny-ochraceous as *O. belli*, underside brighter orange than *O. s. substrigilis*; and a dark drab form darker than any *O. s. substrigilis* ♀♀, with the markings of hind wing above smaller.

♂. Tenth sternite mesially sinuate, the sinus smaller than in *liturata*, *placida*, etc. Eighth sternite mesially produced into a truncate lobe, of which the angles are somewhat pointed, each bearing, moreover, internally a pointed tubercle or tooth, which is just visible in a ventral view of the segment. Harpe varying strongly geographically, and slightly also individually; it consists of a ventral and a submesial ridge; the ventral ridge is either denticulate or entire; the upper ridge is produced into a long, tapering, pointed, curved, somewhat twisted process, which stands nearly vertically

upon the plane of the clasper; the form of this process is not constant either individually or geographically; the ventral process may be either pointed, gradually tapering to the end, or broadly spoon-shaped. Penis-sheath ventrally membranaceous for several millimetres; along this membranaceous part runs at each side a dentate fold; the dorsal side of sheath heavily chitinized and produced into a subcylindrical and more or less pointed and bent process of geographically variable length; from the mouth of the sheath protrudes a spine-like process situated upon the membrane of the duct.

♀. Vaginal plate characterized by a heavy, irregularly notched ridge in front of the orifice.

Hab. S. India (Kanara District), where we have bred this subspecies, larvæ being obtained in dense jungle near the coast.

Egg.—Broadly ovoid; surface shining, minutely pitted; colour bright grass-green. Length 2 mm.; breadth 1·7 mm.

Larva:—

Final instar. Head rounded-triangular; true clypeus one-third length of head, apex acute, basal angles tumid and broadly rounded, giving the clypeus the shape of an ace of spades; false clypeus a rounded arch rising very little above the true clypeus; labrum divided into three sections, the central section four-sided, lateral sections triangular and tumid, the central section again divided by a wide dorsal channel; ligula four times as long as labrum and as broad as the central section of labrum, shaped like a sausage constricted in the middle; eyes 1 to 4 in a curve, 2 and 3 close together; 3, 4 and 6 in a straight line, 6 much farther from 4 than 4 is from 3; 5 forming an equilateral triangle with 4 and 6. Surface of head shining, covered sparsely with very small, low, round tubercles; a very small tubercle on the apex of each lobe. Body of the same shape as that of others of the genus; surface dull. Horn long, straight, tapering evenly to a blunt point. A line of small tubercles starting subdorsally at front margin of segment 2 and becoming dorso-lateral from segment 5 to near base of horn, where it joins the posterior oblique stripe, these tubercles much larger and transversely elongate near the common margins of the segments. Horn covered with very small tubercles; many small shining tubercles on anal flap and claspers.

Coloration.—Head bluish-green in front of a broad white cheek-stripe, bright green behind it; the cheek-stripe edged behind with suffused brown; labrum glassy-green; ligula pale yellow suffused with brown on the face of each lobe; basal segment of antenna whitish, other segments soiled pale brown; mandible greenish at base, rusty at tip. Body

bright yellowish-green with transverse rows of small white spots, above the dorso-lateral line of tubercles; lateral area yellowish-green; subspiracular area and venter glaucous-green suffused with white; the line of tubercles pure white; glaucous-white oblique stripes on segments 5 to 11, that on 11 becoming broad and pure white from above the spiracle on 11 and across 12 to base of horn. Horn pale brownish-pink or rose-colour, with the apical third yellowish; true legs pink or rose-colour; the base of each segment narrowly dark brown; prolegs glaucous-green at base, shanks green, ankles pink or rose-colour; anal flap and claspers yellowish-green. In some specimens the yellowish-green of the dorsum shades gradually into the glaucous-green of the central parts, the line of tubercles is alternately yellowish-green and white, and on segments 7 to 10 the white colour expands into triangular patches below that line; the base and sides of the white triangle may be edged with reddish-brown. Spiracles oval, large, flush, very pale green with the upper and lower ends white, the whole surrounded by a narrow brown rim; those of segments 2 and 12 with a broad, white, central slit. Length 75 mm.; breadth 11 mm.; horn 13 mm.

Pupa.—Very similar in shape to that of *O. belli*; tongue slightly broadening apicad; coxal piece present. Surface shining; tongue smooth, antenna obscurely cross-lined; thorax and abdomen exceptionally rough, with confused corrugation; shoulders tuberculate; sculpturing on segment 4 two deep transverse channels on each side of dorsal line, meeting at dorsal line, a raised triangle between each pair; in the remaining abdominal segments the front margin of each is tumid, coarsely pitted and wrinkled, and much darker in colour than the rest of the segment, the rest of each segment also pitted, but decreasingly so backwards; anterior bevels of movable segments 9 to 11 also pitted and wrinkled, posterior bevels paler in colour and minutely lined parallel with the segment margins; hind margin of 11 raised into a ridge. Spiracle of 2 much longer than the rest, the central slit enclosed by a raised lobe on each side, one lobe on 2 and the other on 3; the other spiracles large, oval, depressed, the central slit surrounded by a raised edge. Anal clasper-scars somewhat prominent; in the ♂ pupa, in front of these scars on segment 13, the organ-scar circular, mouth-shaped, the depressed line horizontal and occupying three-quarters of 13 posteriorly; 13 is curved forwards and is twice as broad ventrally as it is dorsally. In the ♀ pupa segment 12 is divided by a longitudinal medial line ventrally, and 13 is produced forwards in a triangle into the middle of 12. Cremaster wedge-shaped, triangular when seen from above or below; the upper edge of base of wedge attached to dorsum of segment 14 by a broad,

flattened neck; 14 produced ventrad nearly to meet the lower edge of base of wedge, making a transverse perforation; the cremaster suddenly narrowed to a blunt tip which is very bluntly bifid; upper surface very rugose and corrugate, under surface deeply and medially channelled. Colour dark chestnut; spiracles and cremaster black. Length 50 mm.; breadth 12 mm.

Habits.—Food-plant: *Aglaia littoralis* Talbot, family Meliaceæ. When alarmed the larva raises the front part of the body and throws back the head so that the mouth-parts point away from the surface on which it is lying. We have only seen the moth in captivity, when it is sluggish during the day. Attempts to pair the moths in captivity failed.

25 *c*. **Oxyambulyx substrigilis substrigilis** (Westw.). (Fig. 23 A–D, genitalia; fig. 26, imago).

Sphinx (*Ambulyx*) *substrigilis*, Westwood, 1848, p. 61, pl. xxx, fig. 2 (♂) (Silhet).
Ambulyx substrigilis, Walker, 1856, p. 122; Moore, 1865, p. 793 (Bengal); Butler, 1877 A, p. 579; Hampson, 1892, p. 77 (part.).
Oxyambulyx substrigilis substrigilis, Roths. & Jord., 1903, p. 202, pl. viii, fig. 2 (♂); Manson, 1921, p. 745; Seitz, 1928, p. 534.

Imago.—♂♀. A small form, resembling *O. s. aglaia*, but the basal patch of hind wing often pale tawny and inconspicuous, as in *O. liturata*. *Expanse*: ♂ 96–114 mm., ♀ 120 mm.

♂. Underside of body, palpi and wings, and upperside of hind wing much less deep orange-fulvous than in *O. s. aglaia*.

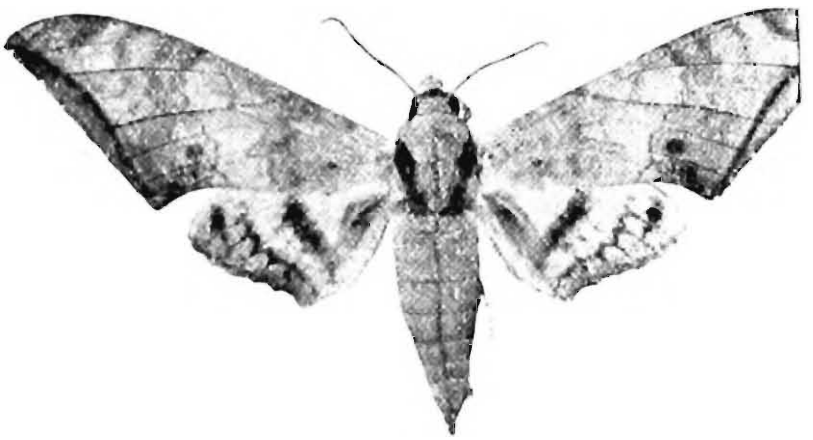


Fig. 26.—*Oxyambulyx substrigilis* (Westw.), ♂.

Distal process of harpe (fig. 23 B) very broad, spoon-shaped, shorter than in *liturata*. Ventral process of harpe longer than in *O. s. aglaia*; penis-sheath (fig. 23 C) stouter, apical process short, blunt at end, curved ventrad.

Hab. E. Himalayas (Sikkim; Assam) and the Andaman Islands. Early stages not known.

26. **Oxyambulyx matti** Jord. (Fig. 27, ♂ holotype).

Oxyambulyx matti, Jordan, 1923, p. 188 (North Kanara).
Oxyambulyx substrigilis matti, Seitz, 1928, p. 534.

Seitz (1928, p. 534) regards this insect as a subspecies of *O. substrigilis* (Westw.), but as it occurs in the same area (North Kanara District of S. India) as *O. substrigilis aglaia* Jord., it appears to be more than a geographical race or subspecies.

Imago.—♂. Intermediate between *O. belli* and *O. substrigilis aglaia*. Upperside of body and fore wing with a pink tint, less cold grey than in *O. s. aglaia* ♂, and much less warm tawny than *O. belli*. Abdomen with a very faint median line. Fore wing with two blackish-olive subbasal spots, the posterior one larger than the costal spot, its diameter rather longer than the distance of the spot from the fringe of the hind margin ; costal portion of outer antemedian line as oblique

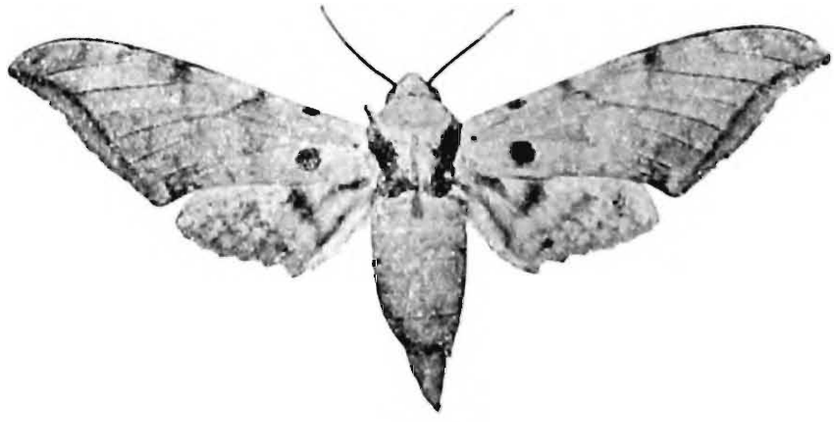


Fig. 27.—*Oxyambulyx matti* Jord., ♂ holotype.

as in *O. s. aglaia*, running to lower cell-angle and appearing as a continuation of the dark vein R^3 ; proximal discal line just outside upper cell-angle, the second discal line (which is very faint) crossing the stalk of the subcostal fork about 1 mm. from SC^5, both these lines being more proximal than in *O. s. aglaia*, the two outer bars before hind margin near tornus distant from each other, slightly curved, not forming a horseshoe mark as in *O. s. aglaia* ; before this group of bars no rounded spot, as is usually the case in the ♂♂ of *O. substrigilis* from India. Hind wing narrower than in *O. substrigilis* ; ground paler yellow, the dark brown basal patch smaller ; abdominal area less shaded with grey ; dark brown median band very distinct, touching lower cell-angle, second band less distinct than in *O. s. aglaia*, less crenulate, extending forward to R^1 ; submarginal band vestigial inclusive of its anterior portion, which is present in *O. s. aglaia* as a subapical spot or short band ; long scales of fringe more or less extended white or whitish between the veins as in *O. s. aglaia*. *Underside*

of body and wings slightly paler yellow than in South Indian *O. s. aglaia*. On fore wing a pinkish-brown subcostal spot close to upper cell-angle between $SC^{4,5}$ and R^1, only a minute yellow dot separating it from that angle; outer fourth of fore wing rather densely and coarsely irrorated; grey terminal band continued to tornus as a thin line. Median band of hind wing touching lower cell-angle. *Expanse*: 100–110 mm.

♂. Eighth tergite, as in *O. substrigilis*, without distinct median lobe. Ninth tergite somewhat broader in dorsal aspect, its frontal margin less deeply sinuate. Compressed apical portion of tenth tergite slightly wider in a lateral view, and its tip without the right and left ridge present in South Indian *O. s. aglaia*. Tenth sternite intermediate in shape between these sclerites of *O. substrigilis* and *O. belli*, the lobes being broader than in the former species and narrower than in the latter. Clasper and its armature as in *O. belli*, but with fewer and smaller subventral teeth. Penis-sheath similar to that of *O. s. substrigilis*—that is, slightly stouter than in *O. s. aglaia*, and the right side dentate ridge longer (the left side in a dorsal view with the tip-sheath directed upwards).

Hab. S. India (Kanara District), where we have bred this species. Very rare, only four larvæ having been found, in forests of heavy rainfall up to 2,000 feet elevation, and three ♂♂ and one ♀ obtained from them.

Egg.—Not known.

Larva:—

Final instar. Head triangular, broad, vertex broadly rounded, without processes or tubercles; true clypeus about one-third length of head, apex acute, basal angles rounded and tumid; false clypeus with acute apex rising little above apex of true clypeus; labrum one-third length of clypeus, three times as broad as long; ligula four times as long as labrum, nearly covering mandible, shaped like a sausage constricted in the middle; eyes 1 to 4 in a gentle curve, 1 and 2 and 3 and 4 two eye-diameters apart, 2 and 3 less than one diameter apart; 6 in line with 3 and 4, and three diameters from 4; 5 two diameters from 4 and three diameters from 6. Surface of head moderately shining, very superficially and irregularly corrugate, and with a few minute glassy tubercles; surface of labrum rugose, with a broad, deep, dorsal channel. Body similar in shape to that of *O. belli*, but tapering more strongly frontad; surface dull. Horn long, straight or gently down-curved throughout its length, tapering evenly to a blunt point. A transverse row of very small, low tubercles along each secondary ring; a dorso-lateral line of slightly larger tubercles on segments 2 to 11. Horn covered with small, low, glassy tubercles and a few larger ones; similar tubercles on anal flap and claspers.

Coloration.—Head immaculate glaucous-green. Body green, so suffused with white on dorsum that only a narrow dorsal stripe and a stripe forming the upper border to the longitudinal line of tubercles remain green; below this line paler green; venter green suffused with white and a rose-brown, white-speckled ventral band; tubercles on body white; a very faint whitish subspiracular stripe on segments 3 to 5, joining the lower end of the oblique stripe on 6; similar coloured oblique stripes on 6 to 11, that on 11 running back across 12 to base of horn. Horn bluish in colour, the tubercles on it brown or livid. Legs opaque pink, each segment banded narrowly with white at its base; prolegs green speckled with white; anal flap and claspers glaucous-green, both edged narrowly with white. Spiracles oval, azure-blue, the upper and lower ends shortly whitish, suffused with purplish on each side of the blue central slit. Length 95 mm.; breadth 14 mm.; horn 13 mm.

Pupa.—Shape similar to that of others of the genus; coxal piece wanting. Surface shining; frons and vertex smooth medially, rugose laterally, and clothed with minute hairs, a peculiarity we have not noticed in other sphingid pupæ except *Hippotion echeclus*; thorax coarsely and irregularly corrugate; abdominal segments with deep pits at the bottom of shallow, wide depressions; sculpturing on segment 4 two transverse channels on each side of the dorsal line, having a raised triangular area between them; costal margin of wing beaded, veins prominent and beaded; base of tongue tuberculate; a large, prominent horn-scar on segment 12 with a transverse furrow behind it; proleg scars prominent; clasper scars large, smooth and shining. Spiracle of 2 covered by a lobe projecting from front margin of 3, leaving the central slit visible between it and hind margin of 2; remaining spiracles oval, shining, the narrow central slit with raised edges. Cremaster wedge-shaped, base undercut, two projections from its lower edge meeting two projections from venter of segment 14; tip bluntly bifid; surface very deeply rugose excepting tip. Colour dark chestnut, hind bevels of segments 8 to 10 brighter. spiracles black. Length 55 mm.; breadth 15 mm.

Habits.—Food-plant: *Terminalia tomentosa* Bedd., family Combretaceæ. This is a large timber-tree, and the few larvæ found were, with one exception, on the topmost branches at a height of 80 feet or so from the ground. No eggs were found. The larvæ eat the leaves of the food-plant completely except for the midribs, which they then, curiously enough, eat through at the base so that they fall to the ground. The fallen midribs and the frass reveal the presence and position of the larvæ, which are otherwise very difficult to locate.

27. **Oxyambulyx canescens canescens** (Walk.). (Fig. 23 E-I genitalia).

Ambulyx canescens, Walker, 1864, p. 38 (Cambodia).
Oxyambulyx canescens, Roths. & Jord., 1903, p. 205, pl. ix, fig. 5 (♂).
Oxyambulyx canescens canescens, Seitz, 1928, pp. 535, 571, t. 61 *d*.
Ambulyx argentata, Druce, 1882, p. 17 (Cochin-China); Waterhouse, 1883, pl. cxxxvi, fig. 2.

Imago.—♂♀. Upperside whitish-grey; band of thorax broad, three contiguous postcellular subbasal spots on fore wing besides a spot in the cell. No dorsal line on abdomen. Fore tibia armed with some spines at and near the end. Hind tibia a little longer (in ♂ ½ mm.; in ♀ 1½ mm.) and its long terminal spur only about one-third shorter than the first tarsal segment. *Expanse*: ♂ 98 mm., ♀ 110 mm.

♂. Eighth abdominal sternite deeply sinuate mesially, the edge of the segment very oblique, each side very slightly and almost evenly convex from the most dorsal point to bottom of sinus. The harpe (fig. 23 G) is the most peculiar in the genus, it being connected with the body of the clasper only at base; it is a very long, slightly twisted process, of which the apical third is rather suddenly narrowed and gently bent dorsad; the two harpes lying across each other, as shown in the figure. Penis-sheath (fig. 23 H) armed apically with a process which is concave ventrally and armed with some teeth at ventral edge; the process is apparently movable, being joined to the penis-sheath; ventrally another armature consisting of an elongate, oblique patch of teeth a little before distal edge of sheath. Tenth tergite (the supra-anal hook) (fig. 23 E, F) very different from that of other *Oxyambulyx*, in which it is uniform in structure: in *canescens* it is longer than elsewhere in the genus, broad, mesially incised at end, and the lateral edges turned ventrad a little, the upper surface of the tergite being somewhat convex; in a lateral view (fig. 23 F) it is slightly curved ventrad. Tenth sternite in a ventral view triangular, sharply pointed; in a lateral view it resembles somewhat the blade of a knife, the mesial line of the sternite being raised into a thin but comparatively high carina, which is minutely denticulate. The membrane just above the anus more strongly chitinized, forming a short, smooth brown bar.

♀. Eighth tergite long, truncate, *not* sinuate. Vaginal plate (fig. 23 I) with a sinuate ante-vaginal ridge; at each side of the orifice a pointed curved process which has a rather close resemblance to the armature of *Polyptychus pygarga*; post-vaginal part of plate small, transversely folded.

Hab. ANDAMAN ISLANDS; also Malaya and South Indo-China. Early stages unknown.

28. Oxyambulyx subocellata (Feld.). (Fig. 21 D–H, genitalia; Pl. VIII, figs. 7, 8, larva, fig. 9, pupa).

Ambulyx subocellata, Felder, 1874, t. 76, fig. 3 (♀) (Java).
Oxyambulyx subocellata, Roths. & Jord., 1903, p. 206; Seitz, 1928, p. 535, t. 61 *d*.
Ambulyx turbata, Moore, 1882, p. 11, pl. lxxx, fig. 1 (♀).
Ambulyx thwaitesi, Moore, 1882, p. 11, pl. lxxx, fig. 2 (♂).

Imago.—♂♀. Can be distinguished from all others of the genus in India by the thinness of the thoracic stripe over the tegula and by the series of subbasal spots on fore wing upperside. Body reddish-brown, thoracic stripe very thin, olive-green, broken before joining a much broader transverse band at base of abdomen, the latter broken on dorsum; no dorsal stripe on abdomen. Fore wing with a series of four subbasal spots, green edged with white, the costal spot the largest. Fore tibia with a few spines at and near apex exteriorly; hind tibia 1 to 2 mm. longer than, and longer apical spur three-fifths length of, first tarsal segment.

♂. Fore wing yellowish-grey with a violet gloss, darkening to ochreous-brown beyond the postmedian line, submarginal area earth-yellow. Hind wing yellow, very pale on costa, cilia pure white, brownish at ends of veins.

♀. Fore wing reddish-brown. Hind wing rust-colour. ♂♀. *Underside* yellowish. *Expanse*: ♂ 100 mm., ♀ 110 mm.

♂. Eighth abdominal sternite (fig. 21 E) with an obtuse, very faintly sinuate mesial lobe; edge of lobe internally incrassate to two tubercles which stand closely together, not being visible in a ventral view. Harpe (fig. 21 F) extending basally from ventral to dorsal edge of clasper, this ventro-dorsal ridge low, produced at end into a long pointed process which evenly curves ventrad; generally a tooth at base of this hook; ventral part of harpe produced distad into an irregularly spatulate process, of which the upper edge is dilated into a large triangular tooth. Penis-sheath (fig. 21 G) without external armature; duct with a ribbon-like organ which is densely beset with minute, sharply pointed teeth. Tenth sternite separated into two lobes which are somewhat widened at end and incline towards each other.

♀. Eighth tergite (fig. 21 H) mesially less chitinized than at sides but not membranaceous, shallowly sinuate. Vaginal cavity large, the ridge before it irregularly folded, mesially sinuate, continued laterad to the base of the tergite, lateral part higher, hollow at its ventral end, forming a kind of roof over end of lower ventral ridge.

Hab E. Himalayas, S. India, Ceylon and the Andaman Islands extending to S. China and Malaya. We have bred the species in the E. Himalayas and S. India, where it occurs

locally in forests of heavy rainfall at about 4,000 feet and below 1,000 feet elevation respectively.

Egg.—Similar to that of *O. s. aglaia*, but slightly smaller.

Larva :—

Final instar. Very similar to that of *O. s. aglaia*, but body rather more slender and horn longer and thinner. Head triangular, three times as long as broad, vertex rounded, a low, conical tubercle on apex of each lobe ; true clypeus not one-third length of head ; false clypeus very narrow, apex acute ; labrum short, slightly broader than long ; ligula open horseshoe-shaped, each side produced into a long arm, length three-quarters that of true clypeus ; eyes arranged as in others of the genus. Surface of head slightly shining, very obscurely and irregularly transversely wrinkled, covered very sparsely with minute setiferous tubercles. Body dull ; a transverse row of small conical tubercles along each secondary ring, reaching the dorso-lateral line ; a dorso-lateral row of larger tubercles from segment 2 to segment 11 ; similar large tubercles on oblique stripes, extending backwards across dorsum. Horn set sparsely with large tubercles and closely with small, pointed tubercles.

Coloration.—Head glaucous bluish-green ; a narrow, double, yellowish dorsal stripe from vertex to apex of clypeus and from vertex to nape ; a broader white stripe separating face from cheek ; tubercles white ; labrum glassy-bluish in colour ; ligula reddish-brown ; basal segment of antenna green, other segments reddish ; mandibles green, tip reddish-brown. Body grass-green on dorsum between the dorso-lateral lines of tubercles ; the tubercles yellow or rising from yellow dots, except those of the dorso-lateral line on segments 3 to 5, which are white ; below the dorso-lateral lines body paler green, strongly suffused with glaucous and dotted with white ; seven narrow oblique stripes on 5 to 11, that on 11 white and running back to base of horn ; the others white with white tubercles on them below the dorso-lateral line of tubercles, and extending backwards as a line of yellow tubercles over the dorsum of each segment behind and then on to the dorso-lateral line, forming crosses of tubercles ; a large maroon-coloured spiracular patch on 3 and 4 ; a maroon-coloured patch above the dorso-lateral line on hind margins of 4 to 10, that on 4 small, the rest increasing in size to 7, where it runs forward along the whole length of the dorso-lateral line to the front margin and upwards along that margin ; large maroon-coloured patches in front of bases of prolegs and on venter of 12, sometimes spreading across venter from spiracle to spiracle. Horn green, paler below and with a blackish tip. Legs red with base green ; prolegs green,

anal flap green edged with orange ; claspers bluish, edged with orange. Spiracles oval, flush, bluish, the bluish slightly suffused with pale brown inside the rim, the rim a fine dark maroon ; the spiracles of segments 2 and 12 larger than the rest. Length 86 mm. ; breadth 11 mm. ; horn 15 mm.

Pupa.—Similar to that of *O. substrigilis aglaia*, but more slightly built ; sometimes a small coxal piece. Surface shining ; body, except for the hind bevels of segments 8 to 10, roughened with irregular wrinkles, corrugations and groups of tubercles, nowhere prominent ; in addition the abdominal segments shallowly pitted ; a narrow, smooth dorsal line on thorax ; veins of wings prominent, wing-cases transversely lined ; sculpturing on segment 4 two deep transverse channels on each side, one close to and parallel with front margin and one close to and parallel with the hind margin, having a smooth, raised, flat area between them, the dorsal line carinate ; segment 6 also dorsally carinate ; ante-spiracular ridges on 9 to 11 ; those on 9 consisting of very narrow, shining ridges separated by eight deep, narrow, parallel, smooth channels ; similar but fewer and shorter ridges on 10 and 11. Spiracle of 2 indicated by a lappet on the front margin of 3, with the hind margin of 2 curved-emarginate and thickened in front of it ; remaining spiracles oval, flat, with a narrow raised slit. Cremaster wedge-shaped, triangular from dorsal view, base broad and undercut, laterally compressed, as high as broad except at tip where it ends in a smooth, low, short ridge dividing into two short diverging teeth ; the surface (except for the teeth at tip) very rugose and wrinkled. Colour dark chestnut except for hind bevels of segments 8 to 10, which are much paler in colour ; spiracles black with central slit chestnut ; cremaster nearly black. Length 50 mm. ; breadth 13 mm. in ♂ ; 46 mm. and 11·5 mm. in ♀.

Habits.—Food-plants : *Odina wodier* Roxb. and *Buchanania latifolia* Roxb., both of the family Anacardiaceæ, in India, and *Canarium album* Raeuschel, family Burseraceæ, in China. The resting position is the same as for others of the genus. They do not change colour much before pupation, only becoming duller in shade. Pupation in an ovoid cell about 6 inches underground. In the Kanara District larvæ are fairly common during the monsoon months, July and August, and there is a second brood in November. The monsoon larvæ produce moths about three weeks after pupation, but moths from the November larvæ do not come out till the following June. The moths rest in the same position as others of the genus. They are very sluggish during the day and unwilling to move, but fly well at night. All attempts to induce them to pair in captivity failed.

29. **Oxyambulyx cyclasticta** Joicey & Kaye.

Oxyambulyx cyclasticta, Joicey & Kaye, 1917, p. 308 (Burma); id., 1924, pl. xi, fig. 6; Seitz, 1928, p. 535.

Imago.—Fore wing reddish-ochre. A small dark spot at base; a squarish olive-coloured spot on costa, and below it beyond cell a large circular olive spot with a pale ring; a pair of elbowed transverse lines slightly wider apart at costa than at inner margin, the first passing through cell and almost touching the discocellular, the second well beyond cell. Between veins M^1 and M^2, close to the outer transverse line, is a dull-coloured rather inconspicuous round spot. A dark marginal shade ending at apex and before tornus in a point. Between this shade and outer transverse line ground-colour darker, with faint indication of two crenulate transverse lines and a rudimentary third line before apex. Hind wing ochreous, with a straight oblique line just beyond cell and a greatly curved and indented line between this and the outer margin. Outer margin crenulate, with white cilia between the veins. Thorax reddish-ochreous with dark reddish-olive sides. *Underside*: fore wing with dark spot between veins M^1 and M^2 conspicuous, ground-colour reddish-fawn. Outer area, especially in apical portion, heavily marked with reddish freckling. Hind wing reddish-ochreous, with first line well defined, second curved line merged in the general reddish freckling towards costa. *Expanse* 108 mm.

Hab. BURMA. Very rare, and early stages unknown.

Genus **CLANIS** Hübner. (Fig 28).

Hübner, 1822, p. 138 (part.); Roths. & Jord., 1903, p. 212; id., 1907, p. 46; Jordan, 1911, p. 239.

Genotype: *phalaris* (Cram.).

Imago.—Upperside of fore wing and body some shade of cinnamon-brown to red-brown, and that of the hind wing varies from cinnamon-yellow or buff to red-brown; underside similar but paler; usually a greyish, median, costal patch and a small subapical patch which is darker than the surrounding area; hind tibiæ white above in some cases, and in others both hind and mid-tibiæ white above. The moths are all large, the ♂♂ up to 135 mm. and the ♀♀ up to 150 mm. expanse.

"♂♀. Tongue rather stout, but not reaching beyond the hind coxa. Pilifer with bristles. Palpus incrassate distally, rather prominent in ♂, the seriated cilia short in and near the mesial line, segments circular in trans-section in ♀, with very slightly prolonged basal and apical cilia; the end-segment is short. Abdomen with many weak spines dorsally underneath the ordinary scaling, apical spines of segments numerous. Tibiæ *spinose*; spurs unequal, *two* pairs to hind tibiæ; pulvillus and paronychium present, the latter with

two lobes, of which the upper one is very slender. Distal edge of wings entire, frenulum and retinaculum present.

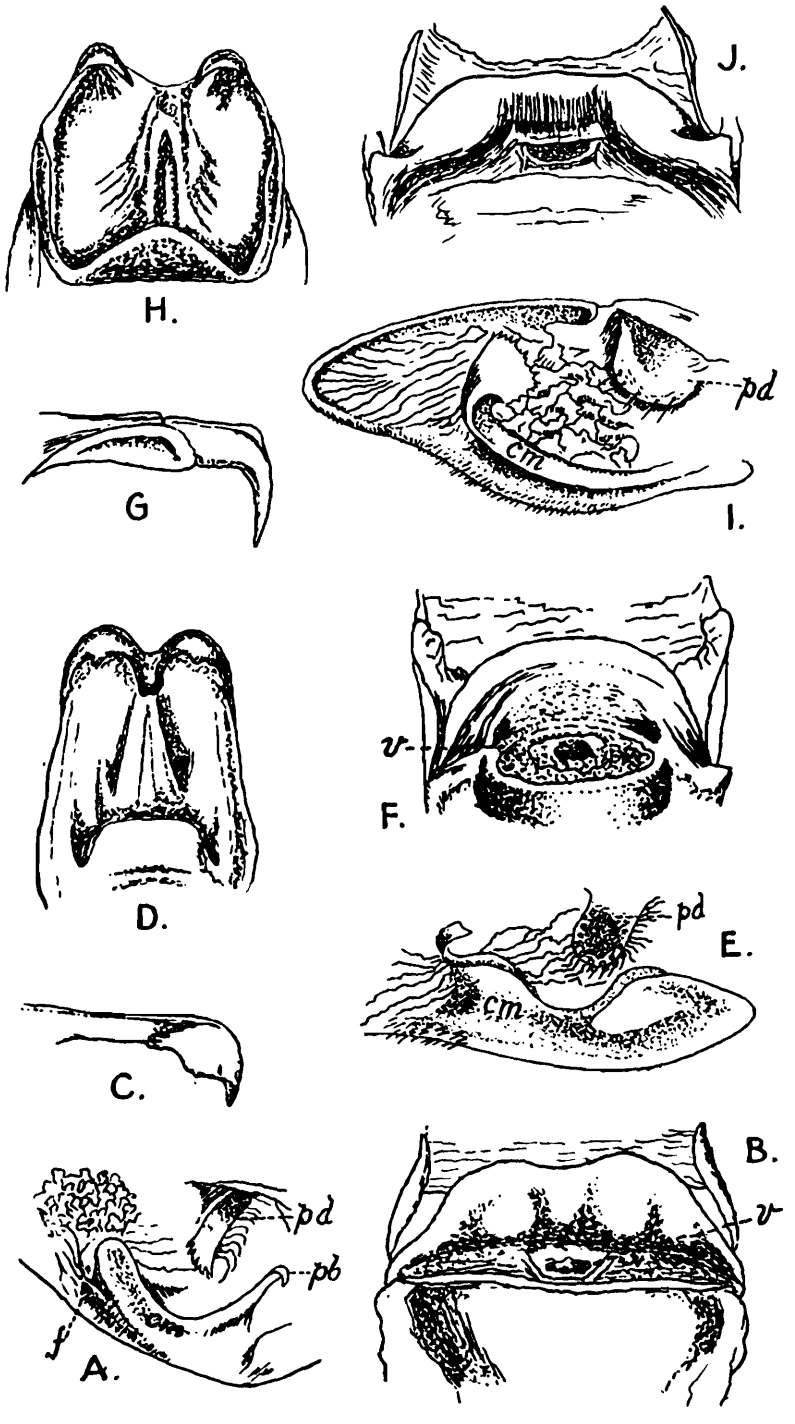


Fig. 28.—*Clanis* Hübn. Genitalia.

A, *C. phalaris* (Cram.), harpe (*f*, fold of distal process; *pb*, basal process; *pd*, dorsal process); B, ♀, vaginal plate. C, *C. undulosa* Moore, ♂, 10th segment, lateral aspect; D, ♂, 10th segment, ventral aspect; E, ♂, harpe (*cm*, mesial ridge; *pd*, dorsal process); F, ♀, 8th tergite and vaginal plate. G, *C. titan* Roths. & Jord., 10th tergite, lateral aspect; H, 10th segment, ventral aspect; I, clasper and harpe (*cm*, mesial ridge; *pd*, dorsal process); J, ♀, vaginal plate.

" ♂. Clasper and seventh tergite without organ of friction; the former with dorso-basal tuberculate process; penis-sheath without armature.

" ♀. A large postvaginal plate, which is strongly chitinized and projects distad " (Roths. & Jord., 1903, p. 213).

Egg.—Nearly spherical; surface smooth and shining; colour green.

Larva.—In the 1st instar the larva has a covering of *branched* hairs; head round, but becomes triangular and with apical processes from the 2nd instar to last instar, when it is again rounded. In the last instar head very large, body stout and nearly cylindrical, horn very short except in *bilineata*; surface covered with small tubercles; colour green or yellow, with seven pale oblique stripes.

Pupa.—Somewhat slender in build; tongue reaches tip of wing-case; no coxal piece except in *bilineata*; antenna shorter than fore leg; surface smooth and shining; no sculpturing on segment 4; ante-spiracular ridges on segments 9 to 11: cremaster wedge-shaped, very rugose and ending in a longitudinal ridge; colour chestnut, cremaster black. Mell (1922) states that there is an indication of a small spiracle on segment 5, which is not visible in any other genus of the family with which he is acquainted. We have verified the presence of this spiracle in the case of *bilineata*, *phalaris* and *titan*.

Habits.—Eggs laid singly on plants of the family Leguminosæ. The larva eats the egg-shell on hatching; it assumes the typical " sphinx " attitude when resting, and strikes sideways with the head when molested. The colour does not change before pupation, which takes place in a cell underground. Most of the Indian species have the curious habit of many individuals remaining in the larval state for a long period after they have buried themselves in the earth, the moth emerging in a comparatively short period after pupation has taken place; in these cases hibernation takes place in the larval instead of the pupal stage. The moths are sluggish during the day; they rest with the wings held below the horizontal, the anal angles of the hind wings nearly touching each other, the tornal angles of fore wings more widely separated, exposing the edges of the hind wings; abdomen not bent upwards. The moths often hang with the body supported by the fore legs only. We have never seen the moths feeding, and most of them do not appear to be attracted by light.

Hab. Oriental, extending into the Palæarctic and Aethiopian Regions. Five Indian species and subspecies.

Key to the Species.

Imagines.

1. Fore wing underside with a black streak behind the cell . . . . . 2.
   Fore wing underside without a black streak behind the cell 5.

2. Mid-tibia white above like the hind tibia	*C. b. bilineata* (Walk.), 3. [p. 150.
Mid-tibia not white above	
3. Fore wing upperside with a pale costal area and a pale line before R^3, long terminal spur of hind tibia more than half the length of first tarsal segment . .	[p. 146. *C. u. undulosa* Moore,
4. Fore wing upperside without pale costal area and pale line, spurs shorter, very uneven	[p. 149. *C. deucalion* (Walk.),
5. Mid-tibia without white streak on upperside ; fore wing with pale costal patch and pale line before R^3 ...	[p. 142. *C. phalaris* (Cram.),
Mid-tibia with white streak on upperside like hind tibia	[Jord., p. 153. *C. t. titan* Roths. &

Larvæ.

1. Horn well developed	[p. 152. *C. b. bilineata* (Walk.), 2.
Horn much reduced	
2. Spiracles whitish with a broad rust-brown band across the middle	[p. 147. *C. u. undulosa* Moore,
Spiracles bluish-green with a broad, longly-oval, depressed, central, longitudinal area green.	[Jord., p. 154. *C. t. titan* Roths. &
Spiracles soiled greenish-buff, with a narrow dark brown rim	[p. 144. *C. phalaris* (Cram.),
Spiracles reddish with a white stripe down each side of the central slit	[p. 149. *C. deucalion* (Walk.),

We have not sufficient material to enable us to make a reliable key to the pupæ.

30. **Clanis phalaris** (Cram.). (Fig. 28 A, B, genitalia ; fig. 29, imago ; Pl. I, fig. 10, larva).

Sphinx phalaris, Cramer, 1777, p. 83, pl. cxlix, fig. A (Coromandel).
Clanis phalaris, Roths. & Jord., 1903, p. 217 ; Seitz, 1928, p. 536, t. 66 *a* ; Scott, 1931, pl. i, fig. 7 ; pl. ii, fig. 6 (larva).
Sphinx nicobarensis, Schwarz, 1810, p. 1, t. 1, figs. 1, 2.
Clanis nicobarensis, Butler, 1881 B, p. 14.
Basiana cervina, Walker, 1856, p. 237 (partim, N. India) ; Moore, 1865, p. 793 (Bengal) ; Butler, 1877 A, p. 596 ; Swinhoe, 1886, p. 435 (Mhow).
Clanis cervina, Butler, 1881 B, p. 15, pl. lxxxi, fig. 6 ; Forsayeth, 1884, p. 393, pl. xv, figs. 1, 2 (larva, pupa) (Mhow).
Ambulyx pagana Fabr., Hampson, 1892, p. 80.

Imago.—♂♀. Mid-tibia not white above like hind tibia, and no black streak behind cell on fore wing underside ; the pale costal patch of fore wing upperside expands in the submarginal region between SC^3 and R^2, while in *titan* it is much narrower, expanding only between SC^5 and R^1; a pale line before R^3. Hind tibia nearly as long as first and second tarsal segments together ; short spurs not half length of long ones, these not half length of first tarsal segment. Distal margin of fore wing about 3 mm. shorter than inner margin. *Expanse* : ♂ 102–130 mm., ♀ 102–160 mm.

♂. Tenth abdominal tergite similar to that of *titan*, but the two apical hooks proportionally longer ; sternite resembling that of *euroa*, but mesially more rounded, as regards outline standing about mid-way between the sternites of *euroa* and *titan*. The harpe (fig. 28 A) consists of a ventro-submesial plate which is raised into a submesial ridge ; this ridge basally prolonged into a sharply pointed long hook, and distally into a broad apically rounded process which is somewhat concave on the broad side ; the edge of this process raised distally and ventrally, running down to near the edge of clasper,



Fig. 29.—*Clanis phalaris* (Cram.), resting attitude.

while on the underside the process bears a fold which connects it with the inner sheath of clasper, the fold disappearing in a patch of very irregular, strongly curved, small folds ; the dorsal process of clasper ribbon-like on upperside, rather pointed ventrally at end and irregularly denticulate ; between this process and the harpe a rather conspicuous fold.

♀. Eighth tergite swollen and rounded laterally ; it does not project distad over the scale-bearing membrane. Vaginal plate (fig. 28 B) with a transverse fold before vaginal orifice ; the post-vaginal part of the plate projecting distad as in the other species, its apical margin shallowly sinuate.

Hab. E. HIMALAYAS (Sikkim), S. INDIA, CEYLON and the ANDAMAN ISLANDS. We have bred it in S. India, where it is very common in both open and forest-clad country.

Egg.—Broadly ovoid ; surface smooth and shining ; colour pale grass-green. Length 2·3 mm. ; breadth 1·8 mm.

Larva :—

1*st instar.* Head large and round ; body cylindrical, horn of medium length ; surface covered with small tubercles, each bearing a clump of about five minute bifurcate hairs ; main hairs also present ; horn covered with small tubercles, each bearing a forked hair ; a prominent tubercle on anal flap behind base of horn. Colour pale yellow on emerging from the egg, after feeding bright green with the tubercles yellow, head with a yellow stripe from apex of each lobe to base of antenna, separating face from cheek, and from apex of each lobe to nape ; a narrow yellow stripe from vertex to apex of clypeus on each side of the dorsal line ; body with a narrow yellow subdorsal and subspiracular stripe on segments 2 to 4, the latter meeting the lower end of oblique stripe on 5 ; seven narrow, yellow, oblique stripes on 5 to 11, extending backwards to near dorsal line of body. 2*nd instar.* Head triangular, a short process rising from apex of each lobe, the two processes closely appressed ; horn of medium length, bifid ; the branched hairs on the tubercles less prominent ; colour of the head and body brighter ; head-processes red-brown, the markings of body the same as before, horn red-brown with the sides yellowish near base and a yellowish-green band before tip. 3*rd instar.* Little change ; horn shorter in proportion, basal half brown, extreme tip black and the rest whitish. 4*th instar.* Stripes on head and body set with tubercles, the subspiracular stripe on segments 2 to 4 and the oblique stripes on 5 and 11 with larger tubercles than the rest ; horn shorter than in 3rd instar

5*th instar.* Head very large and deep, broadly semi-elliptical in shape, each process represented by four small tubercles ; true clypeus one-third length of head, the basal angles rounded and tumid ; false clypeus just visible ; labrum over half length of and broader than clypeus ; ligula kidney-shaped, the sinus rather narrow ; eyes 1, 2, 3, 4 and 6 nearly in a line, 1, 2 and 3 about two eye-diameters apart, 4 more than two diameters from 3, 6 twice as far from 4 as 4 is from 3 ; 5 level with 4 and as far from 4 as 4 is from 3 ; 3 slightly larger than the rest. Surface of head moderately shining, covered with minute tubercles ; a line of larger tubercles from apex of each lobe to base of antenna ; large, scattered tubercles on clypeus among the smaller tubercles. Body thick and nearly cylindrical. Horn reduced to a conical tubercle 1 mm. long. Surface of body dull ; a transverse

row of small rounded tubercles along each secondary ring; a subdorsal and a subspiracular stripe on segments 2 to 4; and the oblique stripes on 5 to 11 formed of lines of larger tubercles, these larger than the others, those on 11 running across 12 to base of horn. Horn covered with large tubercles; anal flap edged with small tubercles, and small tubercles on shanks of fore legs; the subspiracular hairs on segment 5 bifid, those on 6 to 11 with eight branches spread fan-wise horizontally, that on 12 simple; supraspiracular hairs simple, subdorsal and dorso-lateral hairs wanting.

Coloration.—Face pale greyish-blue, rest of head green; a narrow subdorsal stripe from vertex to nape, and the larger tubercles yellow, smaller tubercles white; labrum and ligula milky-white; basal segment of antenna pale green, other segments rose-brown; mandible pale pink, tip narrowly black. Body bright yellowish-green, venter glaucous-green; all tubercles yellow. Horn green; true legs deep rose-colour; prolegs and claspers green. Spiracles parallel-sided, the ends rather pointed, surface slightly depressed, central slit very narrow; colour soiled greenish-buff, the ends shortly whitish, with a narrow dark brown rim, the whole lying on a large, smooth, green oval.

6*th instar*. No change except in size. Some individuals develop plum-coloured patches on the median segments, and there is also a form in which the whole body is canary-yellow. Length 100 mm.; breadth 18 mm.; horn 1 mm.

Pupa.—Surface shining; head smooth; segments 2 and 3 very superficially transversely corrugate; 4 smooth except for a dorsal carina; abdominal segments tumid and deeply pitted at front margins, otherwise smooth; ante-spiracular ridges on 9 to 11 in the form of six sharp ridges separated by deep, rounded, smooth channels four times as broad as the ridges; in the ♂ pupa a circular mouth-shaped organ-scar on venter of 13; in the ♀ pupa organ-scar on 12 heart-shaped. Spiracle of 2 a slit with an oblong lobe behind it on the front margin of 3; the other spiracles narrow ovals with a raised central slit. Cremaster a deep, short wedge, ending in a narrow longitudinal ridge, the surface shining and, excepting the ridge, deeply corrugate. Colour chestnut, with the tumid front margins of abdominal segments darker and spiracles and cremaster black. Length 65 mm.; breadth 18 mm.

Habits.—The food-plants all belong to the family Leguminosæ, the pea family. The most common is *Xylia xylocarpa* Taub., then *Pongamia glabra* Vent., and more rarely *Pterocarpus marsupium* Roxb., the usual food-plant of *Clanis*

titan. It has also been found on *Millettia atropurpurea* Benth., *Macuna pruriens* DC., *Dalbergia volubilis* Roxb., all large climbers, and on *Cassia fistula* Linn., the Indian laburnum. The larva eats the cast skins after moulting. The larval growth takes about a month and a half.

This species is even more common than *C. bilineata*, and the larvæ are very plentiful during the monsoon months, usually feeding on *Xylia* in jungle country and on *Pongamia* in open country. The moth never comes to light, and we have not observed it feeding. We have occasionally found moths in the jungle, but always paired. Bred females attract wild males readily, and we have bred several series from eggs obtained thus. The only occasion on which we succeeded in getting bred pairs to mate was when a whole brood of nearly 200 specimens from one female were kept together in a large cage, and three or four pairs mated. The moths did not feed before mating, but they flew about, the males flying a great deal more than the females. The latter sat for days sometimes without moving. The males are always smaller than the females.

31. **Clanis undulosa undulosa** Moore. (Fig. 28 C–F, genitalia; Pl. II, fig. 4, larva).

Clanis undulosa, Moore, 1879 A, p. 387 (N. China, ♀); Roths. & Jord., 1903, p. 214.

Clanis undulosa undulosa, Jordan, 1911, p. 239, t. 37 *b*; Seitz, 1928, p. 536.

Clanis gigantea, Rothschild, 1894 A, p. 96 (partim; Khasia Hills, ♂, ♀ alia spec.).

Imago.—♂♀. Underside of femora, inner side of anterior tibia and tarsus, upperside of mid- and hind tarsi and of antenna pink, upperside of mid-tibia and outer side of all tibiæ blackish; hind tibia of ♂ longer than, of ♀ as long as, the first tarsal segment; spurs longer than in the other species of *Clanis*, the short ones over half the length of the long ones, those of the apical pair of hind tibia not so widely different in length as in other species, the longer one more than half the length of the first tarsal segment. Wings more elongate than in any other species of this genus. Distal margin of fore wing in ♂ longer, in ♀ very little shorter, than the inner margin; the lines of lunules of the fore wing on the whole more strongly marked than in *bilineata*, with which the species has been confused by Leech and Hampson; there are in some specimens four such lines between the cell and the post-discal line which begins at the apical patch; the black area of the hind wing is more extended than in *bilineata*. *Expanse*: ♂ 118–148 mm., ♀ 160 mm.

♂. The tenth tergite (fig. 28 D) sinuate at end, the lobes

curved downwards and pointed, with the edges irregularly notched ; in a lateral view (fig. 28 C) the lobe appears rather dilated before the apex, convex. The sternite membranaceous laterally ; the mesial lobe is subtruncate, trapeziform, with the edges somewhat rounded. The harpe (fig. 28 E) consists of a mesial ridge which is deeply curved twice and distally raised to a flattened process, which curves basad and somewhat resembles the process of *titan* ; dorsal process short and broad, and beset with rough warts which bear each a short bristle.

♀. Eighth tergite (fig. 28 F) short, broadly sinuate, the sinus rounded, the sides projecting, rounded. Vaginal orifice surrounded by two folds ; the post-vaginal plate broadly rounded.

Hab. E. HIMALAYAS. We have bred it in the Khasi Hills, where eggs and larvæ are common at an elevation of from 4,000 to 5,000 feet in thickly wooded areas with heavy rainfall.

Egg.—Broadly ovoid, surface smooth and shining ; colour ivory-yellow. Length 2·5 mm. ; breadth 2 mm.

Larva :—

1*st instar*. Head large and round, body cylindrical, of less diameter than head ; horn straight, of medium length, the tip shortly, broadly bifid ; on emerging from the egg head and body pale yellow and horn pale grey ; after feeding head yellow, body yellowish-green, horn reddish-brown with a whitish median ring and the tip black. 2*nd instar*. Head broadly triangular with a process rising from the apex of each lobe, these processes half as long as rest of head and diverging from their bases ; horn straight, of medium length ; head with a line of tubercles separating face from cheek ; body with transverse rows of small tubercles, one row along each secondary ring ; narrow subdorsal and subspiracular stripes of larger tubercles on segments 2 to 4, the latter stripe meeting the lower end of the oblique stripe on 5 ; narrow oblique stripes formed of larger tubercles on 5 to 11, extending backwards to near dorsal line of body, that on 11 running across 12 to base of horn ; the head green, the processes red-brown, the line of tubercles yellow ; body bright green, the transverse rows of tubercles white, the larger tubercles forming the stripes yellow. In the succeeding instars there is little change, except that the head-processes and the horn become proportionally shorter and the tubercles less prominent.

5*th instar*. Head large and deep, rounded-triangular, dorsal line of vertex depressed, the processes reduced to a small tubercle on the apex of each lobe. Surface of head shining ; a line of large, flat, oval tubercles running from apex of each

lobe to base of antenna, separating the face from the cheek, down each side of the dorsal line from vertex to apex of clypeus and down each side of clypeus; face covered with large, irregularly shaped, flattened tubercles which touch each other; rest of head with large, rounded, scattered tubercles. Body short and thick, nearly cylindrical; horn a conical tubercle 1 mm. long. Surface of body dull; a transverse row of rather widely spaced tubercles along each secondary ring; a subspiracular stripe of larger tubercles on segments 2 to 4, meeting the lower end of the oblique stripe on 5; oblique stripes formed of large tubercles on 5 to 11, the last running across 12 to base of horn and along sides of horn to its tip; large scattered tubercles on anal flap and claspers.

Coloration.—Head green; the stripe of large tubercles separating face from cheek, and down the dorsal line, yellow; tubercles on rest of face steel-blue; those on rest of head yellow; labrum, ligula and mandible reddish-brown. Body green; the transverse rows of tubercles white, those forming the subspiracular stripe on 2 to 4, the oblique stripes and those on anal flap and claspers yellow. Horn green, the stripe of tubercles yellow. Legs reddish-brown, prolegs and claspers green. Spiracles narrow ovals, whitish, with a broad rust-brown band across the middle. Length 100 mm.; breadth 16 mm.; head 12·5 mm. high by 10 mm. broad by 5 mm. deep; horn 1 mm.

Pupa.—Very like that of *C. bilineata*, but can be distinguished from it by segments 4 to 7 having a single row of deep pits along the front margin, and by having the abdomen shagreened. Cremaster larger than in *bilineata*, bent slightly upwards, the under surface flat and finely longitudinally channelled. Colour a fine chestnut.

Habits.—Food-plant: *Lespedeza Thompsoni* Benth., family Leguminosæ. The larva is very sluggish, and the growth slow. When molested it turns the face to the aggressor, the true legs bunched together under the mandibles. The larva does not pupate soon after burying itself in the earth, but remains in the larval state for several months (in one case for at least eighteen months). If uncovered it is found lying in a torpid condition, the head bent round to touch the body at about segment 8 or 9; it then slowly straightens itself and digs into the earth again. It remains in this state during the winter and then pupates, or, if allowed to get too dry, slowly shrivels and dies. The moth emerges in a fortnight or three weeks after pupation finally takes place. It is sluggish during the day, but can fly swiftly. Eggs and larvæ may be found in June and July in the Khasi Hills. There is only one brood in the year, the larvæ hibernating.

32. **Clanis deucalion** (Walk.). (Fig. 30, ♀).

Basiana deucalion. Walker, 1856, p. 237 (N. India, ♀).
Clanis deucalion, Butler, 1881 B, p. 15, pl. lxxxi, fig. 5 (N. India); Roths. & Jord., 1903, p. 215; Seitz, 1928, p. 536.
Ambulyx deucalion, Hampson, 1892, p. 80.

Imago.—♂♀. In colour closely resembles *undulosa*, with which it agrees in the mid-tibia *not* being white above like the hind tibia, and in the presence of a black streak on underside of fore wing. Differs from *undulosa* in the fore wing upperside having three sharply marked dentate lines on disc, equidistant from each other and from cell and the postdiscal, indistinct line which begins at the apical patch; no pale line before R^3 and no pale costal area. The black patch on hind wing more restricted, longer at SM^2 than at R^3; tawny-brown scales between this patch and apex of wing.

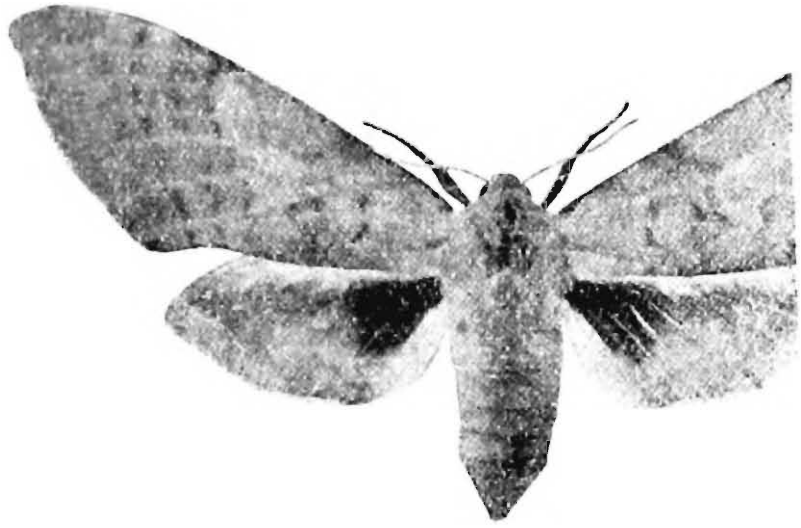


Fig. 30.—*Clanis deucalion* (Walk.), ♀.

Fore wing less elongate than in *undulosa*; hind tibia as long as first tarsal segment, and this barely longer than 2 to 5 together; terminal pair of spurs very unequal, shorter than in *undulosa*, the long one only half length of first tarsal segment. *Expanse*: ♂ 104–116 mm., ♀ 124 mm.

Genital armature as in *undulosa*, but the lobes of tenth tergite more slender, and sternite rounded.

Hab. W and E. Himalayas. We have bred specimens obtained at Mussooree by Col. J. D. Campbell, D.S.O., R.E., at an elevation of about 7,000 feet. Rare and local.

Larva:—

Final instar. Head large, broadly rounded-triangular; a large rounded tubercle on apex of each lobe; clypeus acutely triangular, about one-third length of head; labrum long and very narrow. Surface of head moderately shining, covered with low, rounded, shining tubercles. Body short

and thick, nearly cylindrical. Horn very short, thick at base and tapering sharply to a blunt point. Surface of body dull; one or two transverse rows of tubercles along each secondary ring, these tubercles larger and more closely set on the front margin of segment 2; a subdorsal stripe of large tubercles on 2 to 4; a line of tubercles along each oblique stripe, those on the stripes of 5 to 9 of equal size, those on the stripe of 10 very small, and those on the stripe of 11 larger than those on the stripes of 5 to 9. Horn covered with pointed tubercles; a line of tubercles at base of ankle of proleg.

Coloration.—Head bright green with the shining tubercles yellow; a broad bright blue stripe from the apex of each lobe to the base of antenna, separating face from cheek; labrum translucent yellow, ligula and base of mandible yellow, tip of mandible black; basal segment of antenna yellow, the remaining segments pale chestnut; eyes black. Body pale green, the tubercles yellow; the oblique stripes narrow, yellowish-green, each crossing two segments and reaching nearly to the dorsal line, the tubercles on the stripes yellow. Horn green with green tubercles; true legs pale flesh-colour, a reddish ring at the base of each and the end-segment reddish; prolegs and claspers green, the tubercles at base of ankles chestnut, feet pale reddish-brown. Spiracles oval, reddish with a white stripe down each side of the central slit.

There is another form of the caterpillar in which the ground-colour is yellow instead of green, with a triangle of pale purple above each oblique stripe; a broad, pale purple, subspiracular stripe crossed by the oblique stripes. Length 100 mm.

Pupa.—Very much like that of *undulosa*.

Habits.—Food-plant: *Robinia pseudo-acacia* Linn., family Leguminosæ. The habits are similar to those of *undulosa*. Hibernates in the larval state, the moths emerging in the spring two or three weeks after pupation takes place. The species is rare, and there are very few imagos in collections. We have two specimens which were caught sitting on a white-washed wall at Simla, so this species appears to be attracted by light.

33. **Clanis bilineata bilineata** (Walk.). (Fig. 31 A–E, genitalia; Pl. II, figs. 5, 6, larva).

Basiana bilineata, Walker, 1866, p. 1857 (Darjeeling).
Clanis bilineata, Butler, 1881 B, p. 14, pl. lxxxi, fig. 4 (Darjeeling); Roths. & Jord., 1903, p. 213 (part.).
Ambulyx bilineata, Hampson, 1892, p. 80.
Clanis bilineata bilineata, Jordan, 1911, p. 239, t. 37 *c*; Seitz, 1928, p. 537.

Imago.—♂♀. Mid- and hind tibiæ white above; the latter in ♂ as long as, in ♀ 2 mm. longer than, first tarsal segment;

spurs very unequal, short one less than half the length of the long ones, these not quite half the length of first tarsal segment. Fore wing *underside* with black streak behind cell, hinder margin in ♂ about as long as, in ♀ 4 to 6 mm. longer than, distal margin ; the pale costal area on fore wing above distinct. *Expanse* : ♂ 94–136 mm., ♀ 112–150 mm.

♂. Tenth abdominal tergite (fig. 31 A, B) very different from that of all the other species, its apical half being very strongly narrowed with the apex *not* sinuate ; underside of this narrow portion strongly chitinized, having the appearance

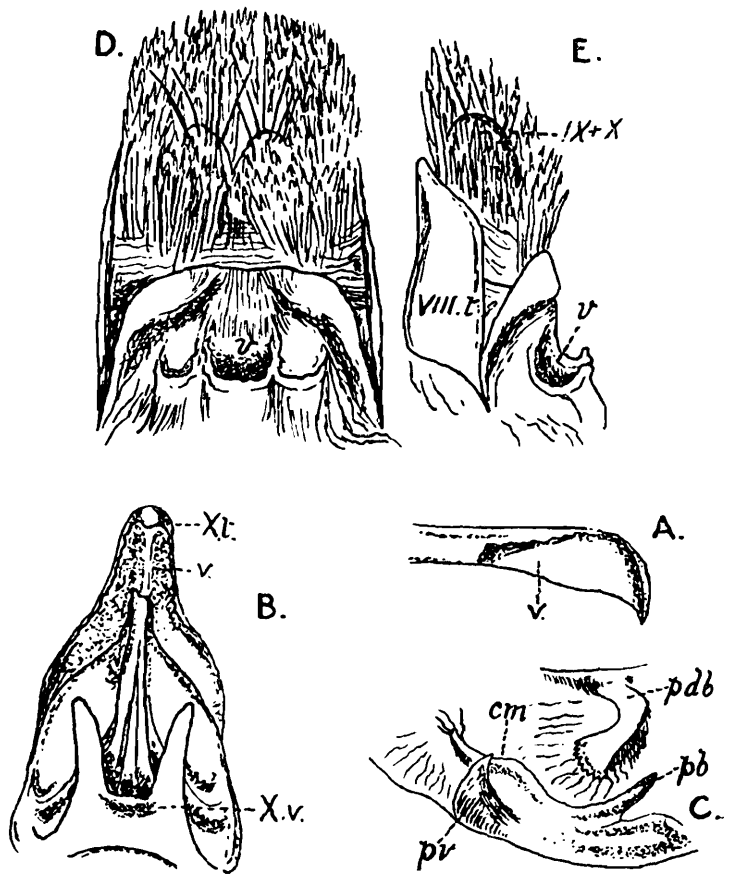


Fig. 31.—*Clanis bilineata* (Walk.). Genitalia.

A, ♂, 10th tergite, lateral aspect ; B, ♂, 10th segment, ventral aspect (x.*t*, 10th tergite ; x.*v*, 10th sternite) : C, ♂, harpe (*cm*, submesial ridge ; *pb*, basal process ; *pdb*, dorsal-basal process ; *pv*, ventral process) ; D, ♀, vaginal plate ; E, ♀, vaginal plate and 8th tergite, lateral aspect (VIII, IX, X, tergites ; *v*, vaginal orifice).

as if the sides of the tergite, instead of being spread out laterad, were bent downwards and had become fused together in the mesial line ; tip of the tergite curved ventrad, forming a hook which is vertically thicker (side-view) than in the allied species, owing to the under surface slanting from each side towards the raised mesial line ; sternite also very remarkable, being produced into two long processes. The harpe (fig. 31 C),

consists of a ventral triangular ridge which is subvertical upon the plane of the clasper and covered for the greater part with small scales ; the submesial ridge basally produced into a compressed process, while it fades away distally into the vermicular folding of the clasper ; the dorso-basal process slender, curved, apically dilated, and here beset with bristle-bearing tubercles.

♀. Eighth tergite (fig. 31 E) very different from that of the other species in being deeply divided by a narrow sinus, the two lobes more or less notched or irregularly emarginate. Vaginal plate (fig. 31 D) also characteristic ; the vaginal orifice mesial, surrounded proximally and laterally by a fold, at each side of the orifice a groove bordered by a fold ; post-vaginal plate very broadly rounded, almost truncate, extremely feebly emarginate mesially.

Hab. E. HIMALAYAS and S. INDIA, extending to S. China and Japan. We have bred the species in S. India, where it is found commonly in both forest and open country, usually near water.

Egg.—Indistinguishable from that of *C. phalaris*.

Larva :—

Final instar. Head large and heavy, semi-elliptical in shape, vertex rounded ; true clypeus small, apex acute, basal angles, rounded and tumid ; labrum and ligula similar in shape to those of *C. phalaris* ; eyes arranged as in *phalaris*. Surface of head moderately shining, covered with small, low, smooth, rounded tubercles ; a line of larger tubercles from apex of each lobe to base of antenna, and parallel lines of tubercles on cheek. Body similar in shape to that of *phalaris* but more slender. Horn short but well developed, thick at base, tapering sharply to a blunt point, slightly down-curved. Surface of body dull ; a transverse row of small, low tubercles along each secondary ring ; a dorso-lateral and a subspiracular line of larger tubercles on segments 2 to 4, the latter joining the lower end of the oblique stripe on 5 ; a line of large tubercles forming each oblique stripe, those forming the oblique stripes on 5 and 11 larger and more sharply pointed than the rest, the latter running across 12 to base of horn ; horn covered densely with small tubercles, and larger tubercles on anal flap and claspers.

Coloration.—Head glaucous-green, the tubercles yellow ; labrum watery white ; ligula pinkish ; basal segment of antenna dirty white, other segments brownish ; mandible pinkish, tip blackish ; eyes dark brown. Body grass-green with a glaucous tinge, tubercles yellow. Horn green with the tubercles yellow. Spiracles large, flush, parallel-sided, ends broadly rounded, colour yellowish-green. Length 100 mm. ; breadth 15 mm. ; horn 6 mm.

Pupa.—Large and slender ; length from front of pupa to end of wing-cases more than rest of pupa ; frons broadly visible from below ; antenna shorter than fore leg ; often a distinct coxal piece. Surface shining ; frons shallowly rugose-corrugate, base of tongue minutely transverse-corrugate ; costa and veins of wing obscurely beaded ; segment 4 pitted ; strong antespiracular ridges on 9 to 11 ; a very small spiracle visible on 5. Cremaster wedge-shaped, upturned, the lower edge of base touching clasper-scars on 14 ; its surface very rugose and corrugate, excepting the narrow longitudinal ridge at the end, which is smooth and shining. Colour bright chestnut, bevels of movable segments paler, spiracles and cremaster black. Length 57 mm. ; breadth 22 mm.

Habits.—Food-plants : *Pongamia glabra* Vent., *Millettia atropurpurea* Benth. and *Pterocarpus marsupium* Roxb., in India ; *Mucuna* Adans. and *Pueraria* DC. in China, all of the family Leguminosæ. The full-fed larvæ are usually found at the ends of branches from 10 to 20 feet from the ground ; in the resting position the front part of the body is raised from the surface, the head bowed and the true legs bunched together—the characteristic position for the whole genus. We once succeeded in getting a pair of moths to mate in captivity.

34. **Clanis titan titan** Roths. & Jord. (Fig. 28 G–J, genitalia ; Pl. II, fig. 11, pupa, fig. 12, larva).

Clanis titan, Roths. & Jord., 1903, p. 218 (Khasi Hills, ♂ ; Sikkim, ♀) ; Manson, 1921, p. 746.
Clanis titan titan, Seitz, 1928, p. 537, t. 66 *c*.
Ambulyx phalaris, Hampson, 1892, p. 79 (non Cram.).
Clanis gigantea, Rothschild, 1894 A, p. 96 (♀, not ♂ ; Sikkim).

Imago.—♂♀. Mid- and hind tibiæ white above (in *phalaris* the mid-tibia *not* white), the latter as long as (♂), or (♀) 1 mm. longer than, first tarsal segment ; short spurs barely one-third of the long ones, little longer than the tibia is broad. Scaling of antenna pale pink ; frons and end of palpus very little darker than sides of occiput. Fore wing : distal margin about 1 mm. shorter than internal one in ♂, 7 mm. in ♀ ; chestnut, paler and somewhat pinkish towards base, a large vinaceous-cinnamon patch expanded between costal margin and R^3, extended to distal margin between SC^5 and R^1, not between SC^5 and R^2 as in *phalaris* ; the transverse lines not dentate ; a broad subbasal line about 5 mm. from base of M^2, distinct, another almost parallel with it a little distal of M^2, indistinct, some traces of lines between this and internal angle ; within the pale area a large brown patch or cloud, representing two lines, situated upon the subcostal fork ; another line between this

cloud and the apical patch. Hind wing upperside as in *phalaris*, but the basal area darker chestnut. *Underside* as in *phalaris*, the transverse lines of fore wing less distinct; middle line of hind wing close to proximal line, the interspace partly filled up with scaling of the same colour as the lines. *Expanse*: ♂ 128–132 mm., ♀ 128–148 mm.

♂. Tenth abdominal tergite (fig. 28 G, H) very broad, apex very broadly but not deeply sinuate, the two lobes slender, strong, pointed, curved downward, forming a hook; sternite rounded. The harpe (fig. 28 I) consists of a curved subventral ridge, distally produced into a broad, strongly chitinized flap with irregular teeth at the edge, the flap curving proximad; the dorsal process of clasper short and very broad, and bears scarcely any setiferous tubercles, the few bristles at its edge being nearly all inserted in the usual way in punctures; the interspace between harpe and dorsal process filled up with very high and very thin lamellæ of the inner membrane of the clasper; ventral edge of clasper clothed with short bristles.

♀. The eighth abdominal tergite strongly chitinized, long, very feebly bi-emarginate, projecting, the angles strongly rounded, the sides convex. Vaginal plate (fig. 28 J) short, a short curved ridge in front and at sides of orifice, post-vaginal part of plate truncate, with the angles strongly rounded and the sides slanting.

Hab. E. HIMALAYAS (Sikkim; Khasi Hills), S. INDIA (North Kanara District) and BURMA. We have bred it in the North Kanara District, where it is scarce and local, larvæ being found only in forests with rainfall of over 100 inches and up to 1,000 feet elevation.

Larva:—

Final instar. Head large and deep, broadly semi-elliptical in shape; true clypeus less than one-third length of head, basal angles tumid; false clypeus showing as a narrow strip near basal angles of true clypeus, widening upwards, apex acute; labrum one-quarter length of clypeus, not as broad as clypeus; ligula longer than labrum but not so broad, kidney-shaped; eyes very small, nos. 2, 3, 4 and 6 nearly in a straight line, 3 one eye-diameter from 2, 4 two diameters from 3, 6 four diameters from 4; 5 two diameters from 4 and five diameters from 6. Surface of head moderately shining, superficially, coarsely corrugate and set with small, hemispherical, shining, setiferous tubercles and scattered, still smaller tubercles; clypeus coarsely, transversely corrugate. Body stout and nearly cylindrical. Horn a conical tubercle about 1 mm. long. Surface of body dull; a transverse row of small tubercles along each secondary ring; a transverse row of larger tubercles along the front margin of segment 2;

a subdorsal and a subspiracular stripe formed of large tubercles on 2 to 5, the latter joining the lower end of the oblique stripe on 5; oblique stripes formed of large tubercles on 5 to 11, each running back to near the dorsal line, that on 11 running across 12 to base of horn, and formed of larger tubercles than the rest; large tubercles on horn, anal flap and claspers.

Coloration.—Head glaucous bluish-green, the tubercles whitish; labrum and ligula glassy-white; antenna whitish; mandible pale pink, the tip shortly black. Body pale green or dark yellowish-green, the small tubercles white, the large ones forming the stripes yellow, those on anal flap and claspers rose-coloured. Horn green; true legs pink, the outer sides dark brown; prolegs and claspers green; venter glaucous-green. Spiracles broadly oval, bluish-green with a narrow oval, depressed, central longitudinal area green. Length 110 mm.; breadth 15 mm.; head 12 mm. long by 10 mm. broad; horn 1 mm.

Pupa.—Surface shining, head smooth, segment 2 and wing-cases superficially, transversely, coarsely corrugate; segment 4 smooth; front margins of 5 to 12 slightly tumid and coarsely pitted except on venter; ante-spiracular ridges on 9 to 11 in the form of six narrow, parallel ridges, separated by channels. Spiracle of 2 covered by a short, rounded lobe, sunken behind, raised in front, projecting from the front margin of 3 into a corresponding concave emargination of the hind margin of 2, the whole dull and minutely shagreened; the remaining spiracles narrowly oval, flat, raised, with a narrow, shining rim. Cremaster wedge-shaped, short, surface very coarsely rugose and ending in a narrow, shining, longitudinal ridge. Colour chestnut, the tumidities at the front margins of the abdominal segments, spiracles and cremaster black. Length 68 mm.; breadth 18 mm.

Habits.—Food-plant: *Pterocarpus marsupium* Roxb., a large tree of the family Leguminosæ. The larva may pupate in a month or so, but frequently lies up as a larva for eight months or more, and may even come to the surface again and pupate there. The pupa, if touched, wriggles and makes a slight hissing noise (by rubbing the ante-spiracular ridges against an opposing surface?). We have never known the moth to come to light nor have we ever come across it in the wild state. The captive females have never attracted a wild male, though often exposed in the hope of their doing so. The bred moths which emerged soon after pupation were paler in colour than those which emerged after a long period

Genus **LEUCOPHLEBIA** Westwood. (Fig. 32).

Westwood, 1848, p. 46 ; Roths. & Jord., 1903, p. 229 ; id., 1907, p. 48 ; Jordan, 1911, p. 239.

Genotype : *lineata* Westw.

Imago.—The moths can be distinguished from others of the family in India by the fore wing upperside being pink with a maize-yellow longitudinal streak.

" ♂♀. Tongue short and weak, naked or scaled. Pilifer with bristles. Antenna strongly compressed in ♂ (inclusive of distal segments), deeply grooved, dilated above the grooves, outline crenate in dorsal view, penultimate segment about as long as high, last one triangular, about three times as long as basally high, or the antenna pectinate ; in ♀ slightly prismatical, scarcely grooved, without distinctly prolonged seriated cilia, broader than high in trans-section, distal segments somewhat flattened ventrally. No eyelashes. Palpus

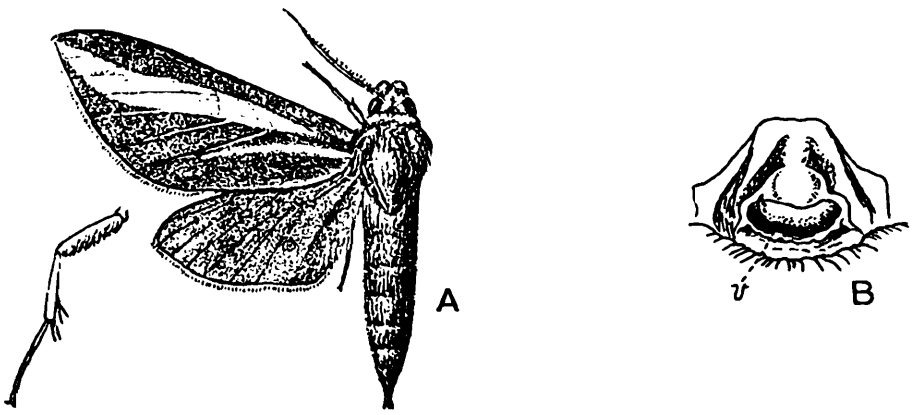


Fig. 32.—A, *Leucophlebia lineata* Westw., ♂.
B, *L. lineata*, ♀, vaginal plate.

much larger in ♂ than in ♀ ; joint not open. Abdominal tergites spinose, at least at the edges. Tibiæ *spinose* ; two pairs of spurs to hind tibia, longer terminal spur about one-third the length of the first tarsal segment ; pulvillus and paronychium *present*, but the lobes of the latter short and slender, the ventral lobes longer than the lateral ones, which are almost obsolete. Distal margin of wings entire, apex of fore wing pointed, but not produced, hinder angle completely rounded ; D^2 of hind wing in or near centre, seldom far below centre. Clasper without friction-scales ; penis-sheath without armature " (Roths. & Jord., 1903, p. 230).

Egg.—Elongate-ovoid, surface smooth and shining, colour pale yellow.

Larva.—Head triangular, body nearly cylindrical, horn short and straight ; surface dull covered with small tubercles ; colour green or brick-red with longitudinal but no oblique stripes.

Pupa (of *lineata*).—Brown-ochreous in colour, surface smooth and shining.

Habits.—The larvæ feed on grasses, family Gramineæ, which do not form the food-plant of any other sphingid caterpillar. They have the same peculiar habit as those of the genera *Clanis* and *Clanidopsis* of remaining in the larval state for long periods after they have buried themselves, and are very difficult to breed. The moths rest with the wings held steeply penthouse-wise.

Hab. Oriental and Aethiopian, with two Indian species.

Key to the Species.

Imagines.

Fore wing upperside with one broad, longitudinal maize-yellow streak . . *L. emittens* Walker, [p. 159.

Fore wing upperside with a broad upper and a narrow lower, longitudinal maize-yellow streak *L. lineata* Westw., [p. 157.

Larvæ.

Head very pale green with a rose-coloured cheek-stripe . . .. .. *L. lineata* Westw., [p. 158.

Head glaucous-green or rose-coloured with no cheek-stripe *L. emittens* Walker, [p. 160.

The pupa of *emittens* is not known, so no key to the pupæ can be made.

35. **Leucophlebia lineata** Westw. (Fig. 32 A, imago; B, genitalia; Pl. II, figs. 13, 14, larva, fig. 15, pupa).

Leucophlebia lineata, Westwood, 1848, p. 46, pl. xxii, fig. 2 (♀) (Cent. India; Assam, etc.); Moore, 1865, p. 793 (Bengal); Butler, 1877 A, p. 594 (Nepal; Java); Hampson, 1892, p. 74, fig. 46 (♂); Roths. & Jord., 1903, p. 230; Jordan, 1911, p. 240, t. 37 *c*; Seitz, 1928, p. 537; Mell, 1922, p. 121, pl. iv, fig. 16, pl. xxiv, fig. 8 (larva), pl. xvi, figs. 23, 24 (pupa), pl. xxiv, fig. 9 (♂).
Leucophlebia rosacea, Butler, 1875, p. 15, pl. ii, fig. 4 (♂) (Coimbatore); Moore, 1882, p. 10, pl. lxxx, fig. 3.

Imago.—♂♀. Palpus and frons brown; antenna ochreous; vertex of head and sides of thorax and abdomen pale pink; a brownish-ochreous stripe on vertex of thorax and abdomen. Fore wing bright pink; a yellow stripe from the base of the cell to apex, widest beyond the cell; a short narrow yellow streak in the interno-median interspace from the base; veins M^2, M^1 and R^1 white, with some diffused fuscous below them. Hind wing tawny. Cilia yellowish-white. *Expanse*: ♂ 64–76 mm., ♀ 75–82 mm.

♂. Tenth tergite gradually narrowed to the end, longitudinally impressed, the strongly chitinized lateral edges somewhat elevated, apex truncate; sternite with a broad, rounded, mesial lobe. Clasper sole-shaped, apex evenly rounded, harpe without distinct processes and ridges; basi-dorsal tuberculate process of clasper short.

♀. Eighth tergite rounded-truncate, the angles rounded. Vaginal plate (fig. 32 B) not strongly chitinized, not scaled, posterior part truncate, with the sides oblique; edges of orifice somewhat raised; no processes.

Hab. W and E. HIMALAYAS, S. INDIA and CEYLON, also in China, Malaya and the Philippines. We have bred the species in S. India, where it is very common in some seasons.

Egg.—Shortly oval in shape; surface smooth and shining; colour pale yellow or yellowish-white. Length 1·6 mm.; breadth 1 mm.; height 1 mm.

Larva:—

1*st instar*. Head round, without processes; horn straight and very short; colour yellowish. 2*nd instar*. Head triangular, with very short, blunt processes; horn longer; colour green. 3*rd instar*. Horn about the same length, shorter in proportion to the size of the body; colour green. 4*th instar*. Not recorded.

5*th instar*. Head triangular, vertex rounded, without processes, much higher than segment 2. Surface of the head dull, covered with small tubercles. Body long and thin, nearly cylindrical, surface dull; prolegs and claspers small. Horn short, straight, thick at the base and tapering sharply to a point. The secondary rings of the body clearly defined, each ring with a transverse row of small tubercles; a dorso-lateral stripe, formed of a larger pointed tubercle on each ring, from the front margin of segment 2 to the base of the horn. Horn, anal flap and claspers set with small tubercles.

Coloration.—Head very pale green; a rose-coloured cheek-stripe, broad at the base of the antenna and narrowing upwards to a point below the vertex; the tubercles white. Body grass-green or brick-red, the tubercles white; the dorso-lateral line of larger tubercles rising from a broad white dorso-lateral stripe. Horn brick-red in both colour-forms, with a white stripe from base to tip in continuation of the dorso-lateral stripe; the true legs rose-coloured in both forms; prolegs and claspers green in the green form, rose-coloured in the brick-red form. Spiracles flush, oval, pale yellow, with the central slit brown. Length 75 mm.; breadth 7·5 mm.; the head 6·5 mm. high; horn 5 mm.

Pupa.—The shape as figured (Pl. II, fig. 15), the head rather small, dorsal line of thorax rising sharply; tongue the same length as fore leg, strongly narrowed distally; antenna shorter than fore leg; the fore leg broad, the mid-leg narrow; coxal piece just visible. Surface smooth and shining; legs and veins of wings not prominent; front margins of abdominal segments minutely pitted; ante-spiracular ridges on segments 9 and 10. Cremaster with the base broad, narrowing suddenly

to a simple point. Colour brownish-ochreous, the head and segments 13 and 14 rusty-red, spiracles and cremaster black. Length 35 mm. ; breadth 9 mm.

Habits.—Eggs laid singly on both sides of leaves of *Saccharum* Linn. (sugar-cane) and other coarse grasses, all of the family Gramineæ. The larva lies along the midrib of a leaf or along the stem, and is difficult to detect. Pupation in a cell underground, but the larva frequently fails to pupate after burying itself in the earth, or remains for months in the larval state before pupating, the moth emerging soon after pupation finally takes place. The moth sits with the wings held steeply penthouse-wise, unlike others of the subfamily which (except *L. emittens*) hold them horizontal. It comes to light freely, but is never caught feeding on flowers, as the tongue is weak and functionless.

36. **Leucophlebia emittens** Walk. (Pl. II, fig. 16, larva).

Leucophlebia emittens, Walker, 1866, p. 1858 (Hindostan) ; Hampson, 1892, p. 75, ; Jordan, 1911, p. 240 ; Seitz, 1928, p. 537, t. 62 *c* ; Manson, 1921, pp. 746–747.

Leucophlebia bicolor, Butler, 1875, p. 16, pl. ii, fig. 5 (Almorah) ; id., 1877 A, p. 595 ; Moore, 1879 B, p. 7; Butler, 1881 B, p. 11, pl. lxxx, fig. 6 ; Swinhoe, 1886, p. 435 (Mhow).

Leucophlebia damascena. Butler, 1875, p. 392 (Sikkim) ; id., 1877 A, p. 639 ; id., 1881 B, p. 11, pl. lxxx, fig. 7.

Imago.—♂♀. Differs from *lineata* in the palpus and frons being pink ; fore wing with the yellow streak broader and extending below the cell ; veins M^1 and R^1 yellow, without fuscous below them ; outer margin of hind wing narrowly pink ; thorax with a narrow tawny streak on vertex. *Expanse* : ♂ 50–56 mm., ♀ 60 mm.

♂. Tenth tergite more abruptly narrowed than in *lineata*, apex somewhat sinuate ; lobe of sternite broad, shallowly sinuate at the sides and apex, the strongly rounded apical angles being a little produced distad and laterad, the segment reminding one of that of *Clanis euroa*. Clasper and harpe essentially as in *lineata*.

Hab. W Himalayas, S. India and Burma. We have bred the species in S. India from the egg to the full-fed larva, but have never succeeded in obtaining a pupa. In S. India the species is found in open grass-land above 1,500 feet elevation and with rainfall not exceeding about 50 inches a year. In some seasons the caterpillars appear in immense numbers in the down-like country round Belgaum, east of the Western Ghats, and do great damage to the grass-crop. It is rare on the coast, and also in some seasons round Belgaum.

Egg.—Elongate-ovoid ; surface smooth and shining ; colour green.

Larva :—

Final instar. Head triangular, vertex rounded but more pointed than in *lineata*, higher than segment 2 ; clypeus small ; ligula kidney-shaped. Surface of head moderately shining. Body tapering slightly from 7 frontad. Horn short, straight, thick at base, tapering sharply to a blunt point ; prolegs and claspers small. Surface of body dull ; a transverse row of small tubercles along each secondary ring ; a dorso-lateral line of larger bluntly-pointed tubercles from front margin of segment 2 to base of horn. Horn covered with small tubercles.

Coloration.—Head glaucous-green, the tubercles white ; ligula whitish ; antenna pink. Body grass-green ; a bluish-green dorsal stripe flanked on each side by a narrow yellow stripe ; a narrow white dorso-lateral stripe on which the dorso-lateral line of tubercles lies, edged above with dark brown, the tubercles white ; a yellowish-green subspiracular stripe, also edged above by dark brown. Horn rose-brown ; legs, prolegs, anal flap and claspers rose-coloured. The area between the dorso-lateral and subspiracular stripes sometimes suffused with rose-brown, the legs, prolegs and middle of venter then suffused with pink. Spiracles oval, flush, colour yellowish. Length 55 mm. ; breadth 5 mm. ; horn 3 mm.

In the earlier instars the head is elongate-triangular, with a long process on the apex of each lobe ; horn long and straight ; head and horn rose-colour, body green.

Pupa.—Not known.

Habits.—Eggs laid singly on the underside of blades of grass, family Gramineæ, all the more coarse species of which appear to form its food-plant. The larvæ, when small, lie with the body straight along the midrib of a leaf and close to it, the long head-processes directed forwards. When mature they clasp the stalk when feeding, but retire to rest near the ground, with the head downwards. We never succeeded in inducing them to pupate. They stopped feeding and burrowed into the earth in a normal manner, but, instead of making a cell and pupating, they came to the surface again, then gradually shrivelled up and died. The moths come freely to light from about 8 P.M. They rest with the wings held steeply penthouse-wise, as in *lineata*.

Genus **POLYPTYCHUS** Hübner. (Fig. 33).

Hübner, 1822, p. 141 (part.) ; Roths. & Jord., 1903, p. 232 ; id., 1907, p. 49 ; Jordan, 1911, p. 240.
Pseudosmerinthus, Butler, 1877 A, p. 593.

Genotype : *dentatus* Cram.

Imago.—Grey, with dark oblique lines on fore wing.

" ♂♀. Joint of first and second palpal segments more or

less open ; tibiæ all spinose ; two pairs of spurs to hind tibia ; pulvillus, paronychium, frenulum and retinaculum present.

" Closely allied to *Clanis*, distinguishable by the open joint of the palpus, or a very weak tongue, or a scalloped distal margin of the wing, or the absence of spinules from the abdominal tergites (excepting edges) . . " (Roths. & Jord., 1903, p. 233).

In the two species which occur in India " the tongue is very thin and short, not reaching the end of the fore-coxa, yellowish-buff, not visible between the palpi if rolled in.

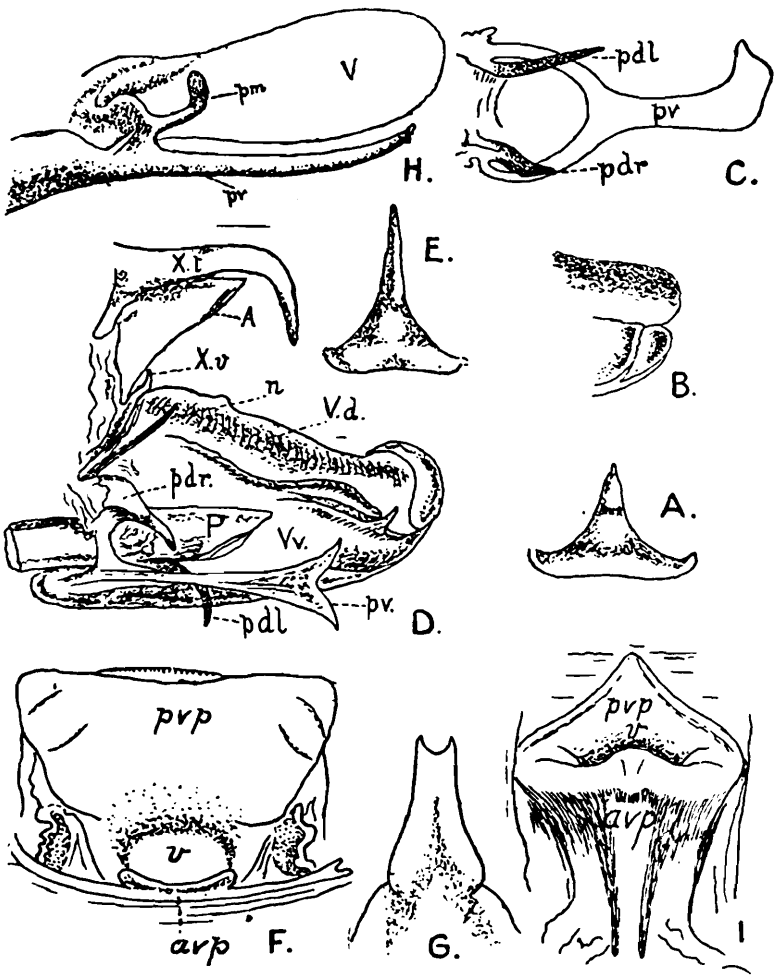


Fig. 33.—*Polyptychus* Hübn. Genitalia.

A, *P. trilineatus luteatus* Roths. & Jord., ♂, 10th tergite, dorsal aspect; B, end of clasper ; C, harpe (*pdr* and *pdl*, submesial processes; *pv*, ventral process). D, *P. trilineatus undatus* Roths. & Jord., sexual armature, ♂, lateral view, left clasper removed (*A*, anus; *n*, process between clasper and 10th sternite; *P*, penis; *pdl*, lateral process of right harpe; *pdr*, process of left clasper; *pv*, process of harpe; *Vd*, dorsal lobe of clasper ; *Vv*, ventral lobe of clasper ; x. *t*, 10th tergite; x. *v*, sternite) ; E, ♂, 10th tergite, dorsal aspect; F, ♀, vaginal plate (*avp*, ante-vaginal plate ; *pvp*, post-vaginal plate; *v*, vaginal orifice). G, *P. dentatus* (Cram.), ♂, 10th tergite, dorsal aspect ; H, clasper and harpe (*pm*, submesial process of harpe; *pv*, ventral process of harpe; *v*, clasper) ; I, ♀, vaginal plate; (*avp*, ante-vaginal plate; *pvp*, post-vaginal plate; *v*, vaginal orifice).

Joint between palpal segments 1 and 2 not open; palpus smaller in ♀ than in ♂. Antennæ grooved in both species. Spurs not spinose. Distal margin of fore wing more or less scalloped or uneven, no black dot at base; cross-veins of hind wing very oblique, lower angle of cell acute. Abdominal tergites with weak spines all over, the spines denser and stronger at the apical margins. Penis-sheath without armature, clasper and eighth tergite without friction-scales" (Roths. & Jord., 1903, p. 236).

Egg.—Broadly ovoid, surface smooth and shining, colour green. Length 3 mm.; breadth 2·5 mm.; height 2 mm.

Larva.—Head large, round in 1st instar, triangular with apical processes in 2nd to 5th instars, rounded-triangular in final instar; body stout; horn straight or down-curved. Surface covered with pointed tubercles, and a dorso-lateral line of larger tubercles from segment 2 to horn. Colour green, with some individuals developing red-brown or purple-brown patches.

Pupa.—Of ordinary sphingid shape, surface smooth and shining; tongue much shorter, and antenna slightly shorter than fore leg; a coxal piece and ante-spiracular ridges present; colour chestnut.

Habits.—The food-plants belong to the family Boragineæ. The young larva eats the egg-shell, and then makes its first change of skin before eating any of the food-plant. Pupation in a cell underground. The moths seldom come to light and we have never seen them feeding.

Hab. Aethiopian and Oriental Regions; six Indian species and subspecies are known.

Key to the Species.

Imagines.

1.	Post-discal line of fore wing straight . . .	*P. dentatus* (Cramer), [p. 169.
	Post-discal line of fore wing curved distad behind R^2	2.
2.	Dentate line between two outer lines of fore wing obscure or absent	3.
	Dentate line distinct	5.
3.	Body and wings pale with grey bloom	4. [p. 163.
4.	Anal tergite short	*P. t. sonanthis* Jordan,
	Anal tergite long	*P. t. trilineatus* Moore, [p. 167.
5.	Body and wings cinnamon-isabella or cinereous-grey; distal margin of fore wing not scalloped, convex in middle. . . .	[Jord., p. 163. *P. t. luteatus* Roths. &
	Body and wings olive mummy-brown with a pinkish flush	6.
6.	Apical teeth of harpe very unequal in length	[Jord., p. 168. *P. t. undatus* Roths. &
	Apical teeth almost of equal length	*P.t.mincopicus* Jordan, [p. 168.

Larvæ.

Spiracles with a black slit bordered on each side with pinkish-white, the whole with a narrow yellow rim.	[p. 165. *P. t. sonanthis* Jordan,
Spiracles pale violet or reddish, the central slit white edged with black	[p. 170. *P. dentatus* (Cramer),

The larvæ of the remaining subspecies are unknown or undescribed, and the pupæ of *P. dentatus* and *P. t. sonanthis* resemble each other so closely that we are unable to give a key.

37 *a*. **Polyptychus trilineatus luteatus** Roths. & Jord. (Fig 33 A–C, genitalia).

Polyptychus trilineatus luteatus, Roths. & Jord., 1903, p. 237, pl. xxv, fig. 4, pl. xxxiv, figs. 8, 10 (genitalia) (Ceylon) ; Seitz, 1928, p. 537.

Imago.—♂♀. Body and wings cinnamon-isabella colour, or cinereous-grey. Markings as in *P. t. undatus*, but the dentate line between the discal and post-discal lines of fore wing nearly as distinct as in *dentatus*. The distal margin of the fore wing not scalloped, convex in middle.

♂. Tenth abdominal tergite (fig. 33 A) much shorter than in *undatus*, the sternite higher, more strongly chitinized, the distal edge slightly bisinuate, with a short, narrow, mesial lobe. Clasper divided into a dorsal and ventral lobe (fig. 33 B, C), but the incision not so deep as in *undatus*, and the lobes differently shaped ; the ventral one especially disagreeing in being rounded and provided before the end with a transverse fold which inclines apicad and gives the lobe the appearance of being transversely cleft ; the ventral unpaired process common to the two harpes apically bent towards the right side.

♀. The eighth tergite has no special armature on the dorsal surface, the pyramidal cone of *undatus* being represented by a mere swelling.

Hab. CEYLON. Very rare, and early stages unknown.

37 *b*. **Polyptychus trilineatus sonanthis** Jordan. (Pl. II, fig. 17, larva).

Polyptychus trilineatus sonanthis, Jordan, 1930, p. 2 (North Kanara : Karwar).

Imago.—♂♀. The various local forms of *P. trilineatus* resemble *P. dentatus*, but are easily distinguished from *dentatus* by the post-discal line of the fore wing not being straight but curving distad behind R^2. The following characters are common to all the subspecies :—

Fore wing with a straight transverse dark line in basal

fourth, followed by a rather irregular line, on the disc two lines which run about parallel with the outer margin, the inner one straight, the outer one curved as stated above. Hind wing with faint discal line and a bluish-grey spot at anal angle. *Underside* paler than above, both wings with one or two distinct discal lines.

♂. Tenth tergite narrowed to an acute hook; sternite represented by a low ridge; between the sternite and the penis-sheath there is at each side a strongly chitinized, needle-like process. Clasper divided apically by a longitudinal slit; ventral processes of clasper fused together, completely or partially, to form a single ventral process, while the submesial processes are quite unequal. The details of the armature are very different in the specimens from different countries, and there is also some individual variability.

♀. Eighth tergite mesially sinuate; on the upper surface of the lobes a projecting cone or lobe, or no further armature. The vaginal plate agrees better with those of the members of *Clanis* than with the plate of *dentatus*; the ante-vaginal part is very restricted, membranaceous, with a low, more strongly chitinized, smooth ridge in front of the vaginal orifice; the post-vaginal plate very large, this plate visible in the specimens after removal of part of scaling of seventh sternite; this armature different, like the eighth tergite, in the different subspecies. The antenna similar to that of ♂, the middle and basal segments much higher than broad; the horizontal diameter of the ventral part of the trans-section about half as long as the diameter of the dorsal part.

P. t. sonanthis, from S. India, resembles *P. t. luteatus*, from Ceylon, very closely in structure, but in colouring it agrees better with *P. t. trilineatus*, being pale with a grey bloom, and the dentate line between the two outer lines of fore wing upperside being obscure or absent.

♂. Anal tergite somewhat longer than in *luteatus*, but much shorter than in *trilineatus* and *undatus*. Anal sternite a rather high thin ridge incurved in middle, where in *luteatus* it is medianly produced into an obtuse lobe. Clasper as in *luteatus*, the ridge on the harpe somewhat longer. Unpaired ventrad process of penis-sheath not fish-tail like as in *trilineatus* and *undatus*, but asymmetrical as in *luteatus*, the apex dilated towards one side only, this projection a little shorter than in *luteatus*.

♀. Post-vaginal plate somewhat more rounded laterally than in *undatus*; eighth tergite divided into two rounded lobes, which do not bear a hump on upperside as they do in *undatus*.

Hab. S. India (North Kanara District), where we have bred the subspecies. Rather local and rare, larvæ being found in forests with heavy rainfall.

Larva:—

1*st instar*. Head semi-elliptical, vertex flattened; body long and thin, horn short, straight, the tip bifid and flattened above and below; surface of head slightly shining and very minutely reticulate; body dull; a transverse row of minute tubercles along each secondary ring; a conical tubercle placed dorso-laterally on middle of anal flap; horn smooth and shining; head and body yellow, horn green. 2*nd instar*. Head triangular, with a long process on apex of each lobe, the two processes closely appressed except at the tips; the processes as long as the head; body long and thin, horn long, straight and bifid; surface of head dull and covered with minute tubercles, each tubercle bearing a small hair; body shining; a transverse row of minute conical tubercles on each secondary ring; a dorso-lateral line formed of larger tubercles; the pair of tubercles on anal flap proportionally shorter; surface of horn smooth and shining; colour of head yellowish-green, the tubercles paler, the processes dark brown; body green above the dorso-lateral line of tubercles, yellowish below it; a black dorsal stripe on segment 2, continuing as a broad ill-defined stripe of dark green to base of horn; horn black; true legs black; prolegs and claspers yellowish. 3*rd instar*. Little change in shape, surface or colour; the tubercles on the anal flap disappear. 4*th and* 5*th instars*. Little change.

6*th instar*. Head triangular, vertex rounded, without processes; true clypeus about one-third length of head, apex acute, basal angles rounded and tumid; false clypeus a narrow strip outside true clypeus; labrum one-half as long as clypeus, three times as broad as long; ligula semicircular; eyes with the line joining 1 and 2 at right angles to the straight line joining 3, 4 and 6; 1, 2 and 3 about one eye-diameter, 3 and 4 two diameters and 4 and 6 four diameters apart; 5 four diameters from 4 and three diameters from 6; all of equal size. Surface of head slightly shining; lines of small, low tubercles down face and cheeks, with groups of two to five minute pits between them; labrum longitudinally corrugate. Body with segment 2 of greater diameter than head, and segments increasing in diameter to 8, then decreasing slightly to 12. Horn long, straight or slightly down-curved, tapering evenly to a blunt point. Surface of body dull; a transverse row of minute conical tubercles along each secondary ring; a dorso-lateral line of much larger pointed tubercles from front margin of segment 2 to base of horn, one tubercle on each secondary ring, each large tubercle flanked by a much smaller one in front and behind. Horn shining and covered with small tubercles.

Coloration.—Head pale green; labrum whitish; ligula dark brown; basal segment of antenna pale green, other segments reddish-brown; mandible dark brown. Body

bright yellowish-green above the dorso-lateral line of tubercles, pale bluish-green below this line; the small tubercles white, dorso-lateral line of large tubercles orange; faint whitish oblique stripes on segments 5 to 10, just reaching the dorso-lateral line. Horn green, the tubercles orange; basal segment of true leg shining black with white tubercles, and a pink patch round base, second segment shining black with white tubercles, end-segment pink or yellow, claw rust-colour; prolegs of the same colour as the body below the dorso-lateral line, anal flap and claspers of the same colour as the body above the dorso-lateral line, anal flap covered with small shining orange tubercles; a double row of similar tubercles near distal edge of claspers, the distal edge black or brown. Spiracles oval, the slit black bordered on each side with pinkish-white, the whole surrounded by a narrow yellow rim. Length 90 mm.; breadth 14 mm.; horn 15 mm.; head 7 mm. high by 6 mm. broad.

Pupa.—Similar in shape to that of *Marumba dyras*, the ventral line straight, dorsum of segment 7 slightly tumid and forming the highest point of body; head scarcely visible from above as it is placed near the ventral surface, with the dorsal line of 2 rising at a sharp angle; body slightly constricted at the junction of 6 and 7 Eyes rather prominent; tongue reaches to two-thirds length of wing-case, antenna to between one-half and two-thirds, and fore leg to barely one-half, mid-leg to three-quarters; a small coxal piece; dorsal margin of fore wing sharply incurved just under the spiracle of 7, the dorsal margin of hind wing appearing as a rounded projection let into the curve. Surface shining; frons and vertex corrugate; wing-case superficially wrinkled; end of tibial joint of fore leg swollen; antenna feebly, transversely ridged; thorax transversely corrugate; no sculpturing on segment 4; abdomen feebly pitted; ante-spiracular ridges on the front bevels of 9 to 11 in the form of one broad ridge, deeply pitted along its centre, with a narrow sharp ridge in front of it; the broad ridge extends right across the dorsum of each of the segments, making the front margins tumid; similar but less well-developed ridges on 5 and 6. Spiracle of 2 indicated by the hind margin of 2 being deeply curved-emarginate, the edge of the emargination slightly raised, and a narrow lobe from the front margin of 3, longitudinally ridged, fitting into the emargination of 2; remaining spiracles oval, flat, the central slit with thin, raised edges. Cremaster a short, deep, triangular projection from the dorsal surface of 14, ending in two well-defined triangular teeth. Colour a bright chestnut, the spiracles, bevels of movable segments, ante-spiracular ridges, clasper scars and cremaster black. ♀ pupa: length 47 mm.; breadth 15 mm.; ♂ slightly smaller.

Habits.—Food-plants: *Ehretia lævis* Roxb. and *Cordia obliqua* Willd., both of the family Borragineæ. The larva eats the egg-shell on hatching and then rests, without eating any of the food-plant, until after it has made the first moult. This habit of eating nothing but the egg-shell till after the first moult is peculiar to this genus and to a few other genera of Hawk-Moths, and is not often noticed among other lepidopterous insects. It will be noted that the larvæ which have this habit have round heads in the first instar, as is the case with all sphingid larvæ, the head becoming triangular at the first moult. The larva, when small, lies stretched straight along the midrib or a vein on the underside of a leaf; when alarmed it turns the head to one side till it touches the middle of the body. In later instars it lies along the midrib of a leaf, with the head and anterior segments raised slightly from the surface, the head held so that the long processes lie parallel with the surface. In the last instar the larva adopts the typical sphinx attitude. Pupation takes place in a cell underground. The moth is seldom attracted by light, and we have not seen it feeding. Bred ♀♀ do not attract wild ♂♂ readily, and we have only once succeeded in getting a bred pair to mate.

In a batch of moths bred from the egg the history was as follows:—Larvæ hatched five days after eggs were laid; larval growth with five (or sometimes six) moults, about thirty days; pupal stage about eighteen days.

37 *c*. **Polyptychus trilineatus trilineatus** Moore.

Polyptychus trilineatus, Moore, 1888, p. 390 (Dharmsala, ♀); Butler, 1889, p. 25, pl. cxxi, fig. 4.
Polyptychus trilineatus trilineatus, Roths. & Jord., 1903, p. 238; Jordan, 1911, p. 240; Seitz, 1925, p. 537.
Polyptychus dentatus, Hampson (non Cram.), 1892, p. 69.

Imago.—The type-specimen, a ♀, is an aberrant individual. In a ♂ bred by us the colour agrees closely with *P. dentatus*, being pale with a grey bloom, paler than *P. t. undatus*, but the lines of the fore wing are in the same position as in the other subspecies of *trilineatus*; dentate line between the two outer lines of fore wing upperside obscure or absent. *Expanse*: ♂ 74–102 mm., ♀ 90–112 mm.

♂. The two apical teeth of harpe close together, the ventral tooth but slightly longer than the upper one. The fish-tail process and the lateral processes of penis-funnel as in *undatus*, the right prong of fish-tail longer than left one, as is also the case in *undatus*.

Hab. W Himalayas (Dharmsala; Dehra Dun). Very rare, few specimens in museums. We have bred a few from larvæ found in the Siwalik Mountains near Dehra Dun, in forests with heavy rainfall at an elevation of about 2,500 feet.

The larva and pupa so closely resemble those of *P. dentatus* that we mistook them for those of that species, and did not describe them. The food-plant is *Ehretia lævis* Roxb., of the family Boragineæ, and the habits similar to those of *P. dentatus*. Very delicate and difficult to rear.

37 *d*. **Polyptychus trilineatus undatus** Roths. & Jord. (Fig. 33 D–F, genitalia).

Polyptychus trilineatus undatus, Roths. & Jord., 1903, p. 238 (Assam ; Sikkim) ; Jordan, 1911, p. 240, t. 37 *c* ; Seitz, 1928, p. 537.
Smerinthus dentatus, Walker (non Cram., 1777), 1856, p. 252.
Polyptychus dentatus, Hampson (non Cram.), 1892, p. 69.
Polyptychus dentatus var. *timesius*, Dudgeon (non Stoll), 1898, p. 406 (Sikkim, 1,800 ft.).

Imago.—♂♀. Body and wings olive mummy-brown, with a pinkish-grey flush ; disc of fore wing sometimes paler in patches, in which case a brown shadowy band situated beyond the antemedian line becomes more conspicuous.

♂. Tenth tergite (fig. 33 E) a long strong hook, while the sternite is a small fold. The dorsal lobe of clasper (fig. 33 D) rather weak, apically dilated and bent inwards, irregularly ladle-shaped, the ventral lobe ending in two heavy teeth ; the unpaired process common to both harpes fish-tail-shaped ; the lateral processes of harpe very unequal, that of the right harpe being long and pointed, projecting beyond ventral edge of clasper, while the process of the left clasper is short and more or less obtuse. The needle-like process between clasper and tenth sternite very prominent.

♀. Eighth tergite with a sharp prominent cone upon the upper surface at each side, pointing distad. Vaginal armature (fig. 33 F) with a large post-vaginal plate which is very prominent ; the distal margin slightly bi-emarginate, the mesial portion somewhat produced and bent ventrad, so that the plate appears mesially almost sinuate in an anal aspect ; the angles of the plate rounded.

Hab. E. HIMALAYAS (Khasi Hills ; Sikkim) ; BURMA (Maymyo).

The larva has been very briefly described by Boisduval, and appears to be similar to those of the other subspecies so far as they are known.

37 *e*. **Polyptychus trilineatus mincopicus** Jordan.

Polyptychus trilineatus mincopicus, Jordan, 1930, p. 3 (Andamans).

Imago.—♂. In colour and pattern like *P. t. undatus*, differing only in the genital armature ; the two apical teeth of harpe almost of equal length, nearer together than in *P. t. undatus* ;

the ventral margin of the harpe convex close to base of lower tooth, and tergite apically somewhat flatter and less pointed than in *undatus*. Unpaired fish-tail process of penis-funnel apically broader than in *undatus*, with the two prongs less produced.

Hab. ANDAMAN ISLANDS; Port Blair. 1 ♂ in Mus. Tring. The early stages are not known.

38. **Polyptychus dentatus** (Cramer). (Fig. 33 G–I, genitalia, fig. 34, imago; Pl. II, figs. 7, 8, 9, larva, fig. 10, pupa; Pl. XIII, fig. 7, larva).

Sphinx dentatus, Cramer, 1777, p. 42, pl. cxxv, fig. G (Coromandel).
Polyptychus dentatus, Butler, 1883, p. 154 (Belgaum; Mhow); Forsayeth, 1884, p. 395 (Mhow; larva and habits); Swinhoe, 1885 B, p. 290 (Poona; Belgaum; Bombay); id., 1886, p. 435 (Mhow); id., 1888, p. 119 (Karachi); Hampson, 1892, p. 69; Roths. & Jord., 1903, p. 240; Jordan, 1911, p. 240; Seitz, 1928, p. 538, t. 66 *a*; Mell, 1922, p. 124, pl. iv, fig. 17–21 (larva).
Sphinx timesius, Stoll, 1790, p. 172, pl. xi, fig. 1 (Coromandel).
Sphinx modesta, Fabricius, 1793, p. 356 (Tranquebar).
Smerinthus denticulatus, Hearsey, 1864, p. 100 (larva, on *Cordia sebistena*).

Imago.—♂♀. Whitish-cinereous. The post-discal and discal lines of fore wing parallel, straight, the former not curved



Fig. 34.—*Polyptychus dentatus* (Cram.).

distad beyond R^2. the dentate line between them distinct. *Expanse*: ♂ 92–108 mm., ♀ 116–120 mm.

♂. Tenth tergite (fig. 33 G) not strongly narrowed to the end, apex sinuate, the angles pointed; sternite developed to a large mesial plate which is deeply sinuate, with the lobes rounded at end. Clasper sole-shaped; no organ of friction; harpe (fig. 33 H) with two processes—one submesial, short, somewhat twisted, curved upwards, the widened part concave, the process being more or less ladle-shaped; the other long, ventral, not quite so long as the clasper, pointed, somewhat curved at end, the ventral processes of the two claspers not

fused together as in *trilineatus*. Penis-sheath less stout than in *trilineatus*, bearing a very long and slender apical process directed frontad but movable to some extent at the junction with the sheath.

♀. Antennal segments less deeply grooved than in *trilineatus*. The eighth tergite (fig. 33 I) of the abdomen trilobate, the middle lobe, however, remarkably different from that of *trilineatus*; the orifice postmedian; before it the plate is convex, raised at orifice into a thick, rather glossy ridge, convex mesially, forming a short mesial lobe; this ridge visible without dissection after the removal of the scales at the edge of the seventh sternite; the post-vaginal plate not strongly chitinized, sunken, triangular.

Hab. S. INDIA, and as far north as Allahabad; UNITED PROVINCES; CEYLON; China. We have bred the species in S. India and at Allahabad. Common in open country with rainfall below about 50 inches.

Larva:—

1st instar. Head round, body cylindrical, long and thin; horn short, straight, bifid; head and body pale green, horn darker green. *2nd instar*. Head large, triangular, with a long pointed process rising from the vertex of each lobe, the two processes closely appressed to near the tips, which are shortly bifid; body cylindrical, long and thin; horn long, straight, tapering to a simple point; surface smooth except for the head-processes and the horn, which are tuberculate; the colour of the head pale green, the processes from their tips to the nape of the neck brown with black tubercles; the body yellowish-green with quadrate black patch on the dorsum of segment 2 and V-shaped, pale brown markings on the dorsum of 4 to 12, the apex of the V pointing frontad; horn brown with black tubercles. *3rd instar*. Shape as in the 2nd instar, head processes as long as the head itself; surface of head with small tubercles, and of body with a transverse row of small tubercles on each secondary ring; a subdorsal line of large pointed tubercles from the front margin of segment 2 to base of horn; tubercles on head-processes and horn as in 2nd instar; colour as in the 2nd instar, but the tubercles on head and body white; a broad yellow subdorsal stripe on which the subdorsal line of tubercles lies; seven pale green oblique stripes edged above with darker green, the brown V-shaped markings forming backward extensions to the oblique stripes; horn as in the second instar; legs reddish. *4th instar*. The same as in the 3rd instar except that the head and segment 2 are pale green, rest of body apple-green; head-processes darker green with reddish tubercles; the tubercles on body reddish above the spiracular line, white below it; there is sometimes a brown patch on each side of 12 between the base of the horn and the

spiracle ; horn green with reddish tubercles ; legs red ; spiracles reddish. *5th instar*. Similar to the 4th instar. The body now increases in diameter from segment 2 to 7, then decreases slightly to 12. The horn is held nearly horizontal.

6th instar. Head rounded-triangular, the vertex rounded, without processes ; clypeus small, triangular. Surface of head somewhat shining, covered with small, rounded tubercles. Body stout for its length. Horn of medium length, stout at base and tapering evenly to a blunt point, strongly down-curved. Segment 2 of the body as broad as the head, and the segments gradually increasing in diameter to about 7, then very gradually decreasing to 12. Surface of body dull, covered sparsely with small pointed tubercles, arranged somewhat irregularly on the dorsum and along the secondary rings in the lateral area ; a few tubercles on the bases of the prolegs ; a subdorsal line of larger tubercles from front margin of segment 2 to near base of horn, some of these tubercles with two or three points, forming a serrate ridge. Horn tuberculate.

Coloration.—Head bluish-green, the tubercles white ; labrum shining, pale brown ; basal segment of antenna whitish, the other segments blackish-brown with a white ring round each ; mandible brown with the tip darker. Body yellowish-green above the subdorsal line of tubercles, bluish-green below it ; the smaller tubercles on the body violet with yellow tips ; the subdorsal line of larger tubercles pink or purple ; whitish or yellowish oblique stripes, clearly defined on 8 to 11, faint on the anterior segments, that on 11 extending backwards to base of horn ; in some larvæ there are purple or brownish-purple triangular patches between the upper part of each oblique stripe and the subdorsal line of tubercles, and broader, rounded patches above this line, the patches not reaching dorsum. Horn yellowish-green with the tubercles yellow or purplish ; true legs pink with yellow tubercles ; prolegs and claspers bluish-green, with yellow or purplish tubercles, the clasper with a violet-brown band at the distal edge. Spiracles oval, flush, pale violet or reddish, the central slit white edged with black. Length 100 mm. ; breadth 15 mm.

Pupa.—Very closely resembles that of *P. t. sonanthis*, the only notable differences being that in *dentatus* the dorsum of segment 2 is more rugose, and these rugosities are *black*, and the dorsal line of the same segment is generally raised into a ridge. All other details as in *P. t. sonanthis*.

Habits.—Eggs laid singly on the underside of a leaf of the food-plant, which is usually *Cordia obliqua* Willd., but the larva will also feed on *Ehretia lævis* Roxb., both of the family Boragineæ. The larva eats the egg-shell and then rests without eating for about two days, when it makes the first moult and commences feeding on the leaves of the food-plant. This

habit of eating nothing but the egg-shell has been noticed also in the larvæ of *P. trilineatus* and a few other larvæ which exchange a round head for a triangular head at the first moult. In later instars the larva eats the end-half of the leaves only, and its presence may be detected by looking out for leaves cut sharply across the middle. The larvæ are very subject to attack by parasites, chiefly Diptera. The dorsal area turns brown before pupation, which takes place in a cell underground. As in the case of some species of the genus *Clanis* the larva may lie quiescent for six months or more before pupating, the moth then emerging soon after pupation has taken place. The moth rests with the wings held horizontal and not touching the abdomen, which is held strongly up-curved in the ♂, straight in the ♀. The moths do not come to light or flowers, and bred ♀♀ do not attract wild ♂♂ readily.

Genus **MARUMBA** Moore. (Fig. 35).

Moore, 1882, p. 8; Roths. & Jord., 1903, p. 266; id., 1907, p. 54; Jordan, 1911, p. 240.

Genotype: *dyras* (Walk.).

Imago.—" The pattern of the wings is very uniform, varying only in details in the different species. Fore wing: a subbasal and three or four antemedian lines, the latter more or less convergent behind; a discal line at (seldom) or beyond end of cell, immediately followed by one or two feeble lines; three postdiscal lines, more or less strongly ⌒-shaped on right wing (∼-shaped on left wing), curving round a double spot situated upon M^2 and SM^2 near angle of wing, one of these three lines mostly vestigial. Hind wing with double spot before anal angle as remnant of a post-discal band.

" On the *underside* we find no lines in the proximal half of the fore wing, while the hind wing bears three lines between the base of M^2 and distal margin, the most proximal one being as a rule accompanied distally by vestiges of one or two more lines, of which one is often rather indistinct. This similarity in pattern misled Hampson to unite under *M dyras* no less than five distinct species " (Roths. & Jord., 1903, p. 268).

" ♂♀. Tongue very short and weak, the two halves quite separate in several species. Pilifer a short, obtuse, triangular process. Palpus larger in ♂ than in ♀, visible from above in ♂, second segment about twice as long as broad, joint more or less open, at least in ♂. Antennal segments deeply grooved in ♂, rather feebly in ♀, cilia much longer in ♂ than in ♀, last segment short, penultimate one higher than long. Abdominal tergites without broad scales, densely spinose all over. Tibiæ *spinose*, hind tibia as long as, or longer than, the first

two tarsal segments; spurs not spinose, *one* pair to hind tibia, short; tarsi stout, some of the spines of the underside more or less erect and inclining mesiad, pulvillus and paronychium present, the upper lobe of the latter broad. Distal margin of fore wing more or less undulate; apex of hind wing rounded, proportional length of D^2 and D^3 variable, but D^2 never twice the length of D^3, sometimes even shorter than D^3; pattern almost the same in all the species. No organ of friction on clasper and eighth tergite.

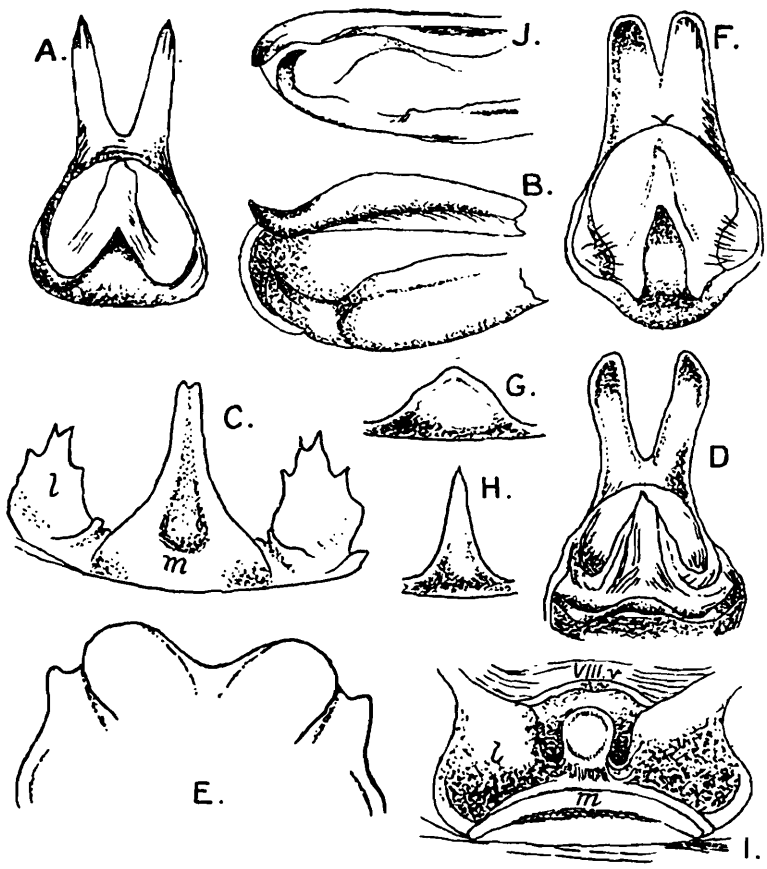


Fig. 35.—*Marumba* Moore. Genitalia.

A, *M. cristata* (Butl.), ♂, 10th segment, ventral view; B, clasper and harpe; C, ♀ vaginal plate (*l*, lateral flap; *m*, mesial tubercle). D, *M. spectabilis* (Butl.), ♂, 10th segment, ventral view; E, ♀, vaginal plate. F, *M. dyras* (Walk.) ♂, 10th segment, ventral view; G, 10th sternite, ventral view (Ceylon specimen); H, 10th sternite, ventral view (Assam specimen); I, ♀, vaginal plate (VIII. *v*, 8th sternite; *l*, lateral flap; *m*, mesial tubercle). J, *M. indicus* (Walk.), ♂, clasper and harpe.

"Clasper and harpe similar in the various species; the former divided distally into a dorsal and a ventral lobe, the dorsal lobe mostly strongly chitinized and pointed, the ventral one obliquely rounded, weak, both close together, imperfectly separated; harpe represented by a very strongly chitinized hook curving upwards; a subdorsal basal fold of the clasper

is produced mesiad into a plate which lies above the penis-sheath and is prolonged distad into a sharp process, which is the same on both sides, while in *Polyptychus trilineatus* the left one differs from the right one. Penis-funnel short, more or less transversely folded above; penis-sheath without processes, but more or less rugose or granulose at the end" (Roths. & Jord., 1903, p. 266).

Egg.—Depressed ovoid, large or medium in size; surface smooth and shining; colour pale yellow, sometimes with brown markings.

Larva.—Head large, round in 1st instar, triangular with apical processes in the intermediate instars, rounded-triangular without processes, or very short processes, in final instar; body nearly cylindrical, tapering very little frontad; horn medium or long, usually straight. Surface of head, body and horn tuberculate, especially along the stripes. Colour green.

Pupa.—Stout, with two frontal ridges; tongue shorter than fore leg; coxal piece and ante-spiracular ridges present; colour reddish-brown.

Habits.—Eggs laid singly on underside of a leaf. Food-plants belong to several families. The larva eats the egg-shell on hatching; rests on the underside of a leaf; adopts the sphinx-like attitude when at rest, and strikes sideways with the head when molested. The dorsum usually becomes suffused with pink before pupation, and at this period the larva jumps from side to side when touched. Pupation in an ovoid cell underground. The moth rests with the wings held nearly horizontal, not covering the abdomen, which is bent upwards.

Hab. Widely distributed from the Oriental to the Palæarctic Region. Eleven Indian species and subspecies.

Key to the Species.

Imagines.

1.	Fore tibia ending in a long thorn or claw	2.
	Fore tibia without apical thorn	3.
2.	Fore wing with a large chocolate, submarginal patch from apex to R^1, bounded by an inwardly curved line; hind wing reddish	[p. 189. *M. indicus* (Walker),
	Fore wing without such a patch; hind wing grey suffused with brown	[p. 187. *M. poliotis* Hamps.,
3.	Hind wing red shaded with brown distally	*M. gaschkewitschi*
	Hind wing not red	4. [*fortis* Jord., p. 175
4.	Fore wing with a large chocolate-brown patch from costa to below R^1, with incurved inner edge	[p. 190 *M. bengalensis* Hamps.,
	Fore wing with a large irregular median brown patch, bordered with pink on costa, and partly including a pale reniform spot.	[p. 191 *M. decoratus* (Moore),
	Fore wing with no such patch	5.

5. Fore wing underside with a large, anteriorly sharply defined, orange-tawny area from R^3 to near hind margin, rest of wing very much darker	[(Butler), p. 178. *M. s. spectabilis*
Fore wing without that patch, or the patch small and clayish tawny, not well defined anteriorly	6.
6. Body with a prominent dorsal line; upper side of body and wings very uniform in colour, without distinct paler shades, sub-anal spot M^2 of hind wing absent or vestigial	(Butler), p. 176. *M. c. cristata*
Body without prominent dorsal line, or wings with pale shades	7.
7. Fore wing with the most distal line double	8.
Fore wing with the most distal line single	9.
8. Fore wing grey, or earthen-brown with grey powdering	[p. 179. *M. d. dyras* (Walker),
Fore wing clay-colour, with a flush of pale vinaceous-buff	[Jord., p. 182. *M. nympha* Roths. & *M. sperchius gigas*
9. A large dark form	[(Butler, p. 185. *M. sperchius albicans*
A smaller, paler form, often losing lines of fore wing and anal spots of hind wing	[(Butler), p. 185.

Larvæ.

1. Horn long, straight, covered with large pointed tubercles, tip strongly bifid	[(Butler), p. 178. *M. s. spectabilis*
Horn long or of medium length, straight, tip not bifid	2.
Horn long, down-curved, covered with short, thick conical tubercles; head without apical processes	[Jord., p. 184. *M. nympha* Roths. &
2. Head with very short apical processes	3.
Apical processes reduced to a tubercle on apex of each lobe; oblique stripe on 5 widening into a patch of tubercles frontad.	[(Butler), p. 186. *M. sperchius gigas*
3. Horn broader than high in cross-section.	*M. c. cristata* (Butler),
Horn not broader than high	4. [p. 177.
4. Spiracles lilac to reddish-brown, central slit white	[p. 180. *M. d. dyras* (Walker),
Spiracles white with black rim	*M. indicus* (Walker), [p. 189.

The pupæ of the known species resemble each other so closely that we have been unable to construct a key.

39. **Marumba gaschkewitschi fortis** Jordan. (Fig. 36, nomino-typical form).

Marumba gaschkewitschi fortis, Jordan, 1929, p. 85 (Yunnan).

Imago.—♂♀. Fore wing upperside grey; the interspace between the two outer antemedian lines and that between the two inner discal lines filled in with brown, thus two transverse bands being formed which are more conspicuous and deeper in tone that in other subspecies of *M. gaschkewitschi*; terminal area deep brown, extending in costal two-fifths of wing to the outermost discal line; subtornal blackish-brown double

spot large. Hind wing red, much shaded with brown distally, anal mark large. *Underside*: the brown discal line of fore wing distinct from costa to below middle, separating a narrow grey band from the grey discal area, the disc proximally of this line washed with brown, more so in ♂ than in ♀. On the hind wing the interspace between the two proximal median lines filled in with brown, this band crossing tip of cell; the brown line beyond this band very distinct; terminal area contrasting strongly with the greyish discal band, the discal line which forms the boundary of the dark terminal area

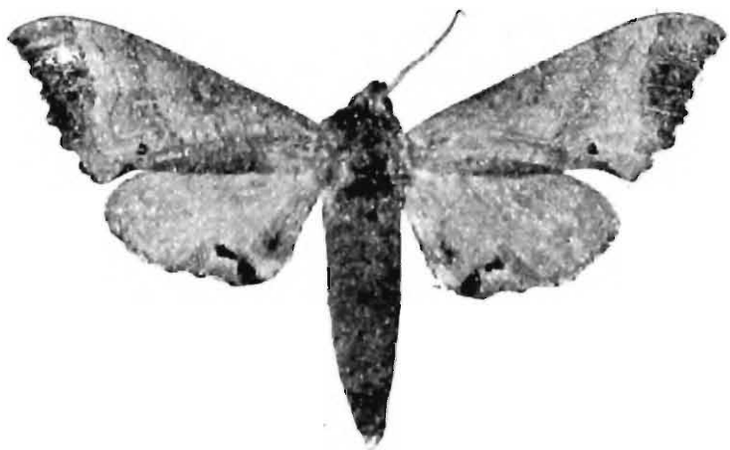


Fig. 36.—*Marumba gaschkewitschi gaschkewitschi* B. & G., ♂.

diffuse. Colouring of underside brighter in ♀ than in ♂. *Expanse*: ♂ 84–90 mm., ♀ 92–102 mm.

Hab. E. Himalayas and China (Yunnan). Early stages not known.

40. **Marumba cristata cristata** (Butler). (Fig. 35 A–C, genitalia).

Triptogon cristata, Butler, 1875, p. 253 (Darjeeling).
Marumba cristata, Roths. & Jord., 1903, p. 272.
Marumba cristata cristata, Jordan, 1911, p. 241, t. 42*e*; Seitz, 1928, p. 538; id., 1929, p. 571.
Polyptychus dyras, Hampson (non Walk.), 1892, p. 69.

Imago.—♂♀. This sombre-coloured insect is very constant and cannot easily be confused with other species. The uniform colour of the upperside, the heavy black mesial line of the body, the simple lines of fore wing, the presence of a small creamy stigma on fore wing, the absence of the first anal spot from the hind wing, and the rosy tint of the underside separate *cristata* at a glance from the other species of *Marumba*. Antenna less than one-third length of fore wing, thinner than in *dyras*; in ♂ grooved, the seriate basal cilia of the middle segments nearly as long as the segments. Tarsi very stout. *Expanse*: ♂ 100 mm., ♀ 120–124 mm.

♂. Tenth tergite (fig. 35 A) deeply divided into two slender, pointed lobes; sternite triangular, rather broad, not acute, slightly curved upwards at apex, covered with minute granules. Clasper (fig. 35 B) differing essentially from that of the allied species in the dorso-apical lobe being pointed and curved upwards and in the ventral lobe being broad and rounded; harpe not so strongly curved as in *sperchius* and *dyras*, not denticulate, reaching nearer to end of clasper.

♀. Vaginal plate (fig. 35 C) with a long, truncate or slightly sinuate process in front of the orifice, which process becomes visible on removal of some scales from the apex of the seventh sternite; at each side stands a dentate flap.

Hab. E. HIMALAYAS (Sikkim) and China. Mell has bred the form *ochrea* in S. China.

Egg.—Broadly ovoid, the surface smooth and shining, colour ivory-yellow. Length 2·75 to 3 mm.; breadth 2·5 mm.; height 2 mm.

Larva:—

Final instar. Very similar in shape to that of *M dyras*; the horn long, straight, the breadth greater than the height in a cross-section. Surface of head and body dull; head with a line of tubercles separating the face from the cheeks; transverse rows of small tubercles on the secondary rings; larger pointed tubercles along the oblique stripes; horn covered with small tubercles, and small tubercles along the edge of the anal flap and claspers.

Coloration.—Head pale green, with the line of tubercles between the face and cheeks obscurely white; a dark green dorsal stripe from the vertex to the nape. Body pale green; a dark green dorsal stripe to the hind margin of segment 4; the oblique stripes white, sometimes edged narrowly by red or yellow, running across three segments; tubercles on the oblique stripes orange. Horn blue-green, the tubercles on the basal half paler and those on the distal half darker than the body colour; the tubercles edging the anal flap and claspers paler than the body colour; true legs dull red banded with dull brown, and sometimes with a dull brown mark at the base; prolegs and clasper pale green. Spiracles oval, the central slit pale in colour, dilated at the top and bottom and with a red-brown band on each side of it. Length 68 mm.; breadth 11 mm.; head 8·5 mm. high by 7 mm. broad.

Pupa.—Similar in shape, surface and colouring to other pupæ of the genus; the cremaster large, tapering gently to a simple point, rugose. Length 50 mm.; breadth 15 mm.

Habits.—The larva feeds on *Litsæa elongata* Hook., *Phœbe* Nees, and *Machilus ichangensis* Rehd. & Wils. in China. The colour becomes paler and somewhat translucent-looking

before pupation. The species occurs in the northern part of S. China in jungle of mixed bamboo and deciduous trees, at an elevation of from 1,500 to 2,500 feet.

The above description of the early stages and habits is taken from Mell, 1922.

41. **Marumba spectabilis spectabilis** (Butler). (Fig. 35 D–E, genitalia).

Triptogon spectabilis, Butler, 1875, p. 256 (Darjeeling); id., 1877 A, p. 588, pl. xciii, fig. 1.
Polyptychus spectabilis, Hampson, 1892, p. 71
Marumba spectabilis spectabilis Roths. & Jord., 1903, p. 273; Seitz, 1928, p. 538, t. 66 *a*.

Imago.—♂♀. Much more conspicuously coloured than *dyras*, *sperchius* and *cristata*. *Underside*: fore wing, a large area between hind angle and R^3, and an apical patch, of an orange-tawny colour; first discal line several millimetres proximal of base of SC^5; hind wing, a submarginal patch of an orange-tawny colour before anal angle; first line of hind wing angulate between M^1 and M^2, fourth line angulate behind R^3, 4 to 6 mm. distant from tip of M^1. Antenna shorter and thinner than in *dyras*. *Expanse*: ♂ 94–108 mm., ♀ 118 mm.

♂. Tenth tergite (fig. 35 D) deeply divided, the lobes slender and obliquely rounded at end; sternite a low ridge slightly dilated, rounded in middle, mesial lobe short and broad, almost vestigial. Dorso-apical lobe of clasper more curved downward than in *sperchius* and *dyras*; harpe not dentate, long, resembling that of *amboinicus*.

♀. Ante-vaginal ridge of vaginal plate (fig. 35 E) sinuate in front of vaginal orifice, the lobe rounded; from each side of the ridge extends a longitudinal fold towards the eighth sternite.

Hab. E. Himalayas (Sikkim; Khasi Hills). A few larvæ were found and bred by Col. J. D. Campbell, D.S.O., R.E., in the Khasi Hills, in forests with heavy rainfall at an elevation of about 4,000 feet.

Larva:—

Final instar. Head rounded-triangular, with a small tubercle on the vertex of each lobe. Surface of head moderately shining, covered with small tubercles. Body shaped as in others of the genus. Horn long, straight, thick at base, and tapering evenly to a strongly, widely bifid tip. Surface of body dull; a transverse row of large pointed tubercles on each secondary ring; seven oblique stripes formed of larger pointed tubercles. Horn covered with large pointed tubercles.

Coloration.—Head grass-green; a broad whitish stripe separating face from cheek; the tubercles whitish. Body bright yellowish-green above the spiracles, the tubercles in this area yellow, sometimes with reddish tips; the area below

the spiracles and venter watery-green with white tubercles; these two areas sharply separated by a well-defined, bright yellow, subspiracular stripe on segments 2 to 4, this stripe edged below by chocolate, and sometimes continued back to 12; the oblique stripes formed of yellow or red tubercles, each running across three segments. Horn bright green, with tubercles of the same colour. Length 110 mm.; breadth 12 mm.; horn 15 mm.

Pupa.—Not recorded.

Habits.—Similar to those of others of the genus so far as they have been observed. Food-plant unfortunately not identified.

42. **Marumba dyras dyras** (Walk.). (Fig. 35 F–I, genitalia; fig. 37, imago; Pl. III, fig. 3, larva).

Smerinthus dyras, Walker, 1856, p. 250 (Ceylon).
Marumba dyras, Moore, 1882, p. 9, pl. lxxviii, figs. 1, 1 *a*, *b*, *c* (l., p., ♂, ♀).
Marumba dyras dyras, Roths. & Jord., 1903, p. 274; Jordan, 1911, p. 241, t. 42 *e*; Mell, 1922, p. 153, pl. v, figs. 15–17 (larva), pl. xvii, figs. 4–6 (pupa); Seitz, 1928, p. 538.
Triptogon silhetensis, Butler, 1875, p. 255 (Silhet).
Triptogon oriens, Butler, 1875, p. 255 (N.E. India); id., 1877 A, p. 587, pl. xciii, fig. 3.
Marumba ceylanica Butler, 1875, p. 255 (Ceylon); Moore, 1882, p. 9, pl. lxxix, fig. 2 (♀).
Triptogon massurensis, Butler, 1875, p. 256 (Mussooree); id., 1877 A, p. 587, pl. xciii, fig. 5.
Triptogon fuscescens, Butler, 1875, p. 256 (Darjeeling); id., 1877 A, p. 587, pl. xciii, fig. 2.
Triptogon andamana Moore, 1877, p. 595 (Pt. Blair).

Imago.—♂♀. Fore wing grey, or earthen-brown with grey powdering; of the most distal double line the external one is much heavier than proximal one; the former stops mostly at M^1, but occasionally continued beyond, curving basad and ending at the marginal spot; the inner line encircles the spot M^2, its posterior portion often very faint; there is sometimes a chocolate-coloured area along outer margin. Hind wing reddish to yellowish; with fuscous base and large anal spot. Tongue with fringe. Pilifer with brush of bristles. Antenna one-third length of fore wing in ♂, a little shorter in ♀. *Expanse*: ♂ 90–92 mm., ♀ 90–119 mm. A ♀ in the British Museum measures 124 mm.

♂. In Sikkim specimens tenth sternite (fig. 35 F) elongate bell-shaped, the sides rounded. Assam specimens (fig 35 H) have a more slender and longer tenth sternite, it being sometimes very narrow and straight. In specimens from S. India the tenth sternite is intermediate in shape between the Sikkim and Assam examples, while it is broad, obtusely triangular in Ceylon individuals (fig. 35 G).

♀. In Sikkim and Assam specimens the mesial tubercle of vaginal plate heavy (fig. 35 I), globose, more or less faintly grooved in middle, while in those from Ceylon it is very prominent, constricted at base, knob-shaped, sulcate.

Hab. W and E. HIMALAYAS, S. INDIA, CEYLON and the ANDAMAN ISLANDS. We have bred it in the W Himalayas (Siwalik Mountains) and in S. India. Common and widely distributed, but prefers thickly wooded areas with heavy rainfall.

Egg.—Slightly depressed ovoid; surface smooth to the naked eye, but under a strong lens irregularly superficially pitted; colour very pale green or yellow. Length 2·5 mm.; breadth 2·0 mm.; height 1·5 mm.

Larva:—

1*st instar*. Head round and large; body long and thin,

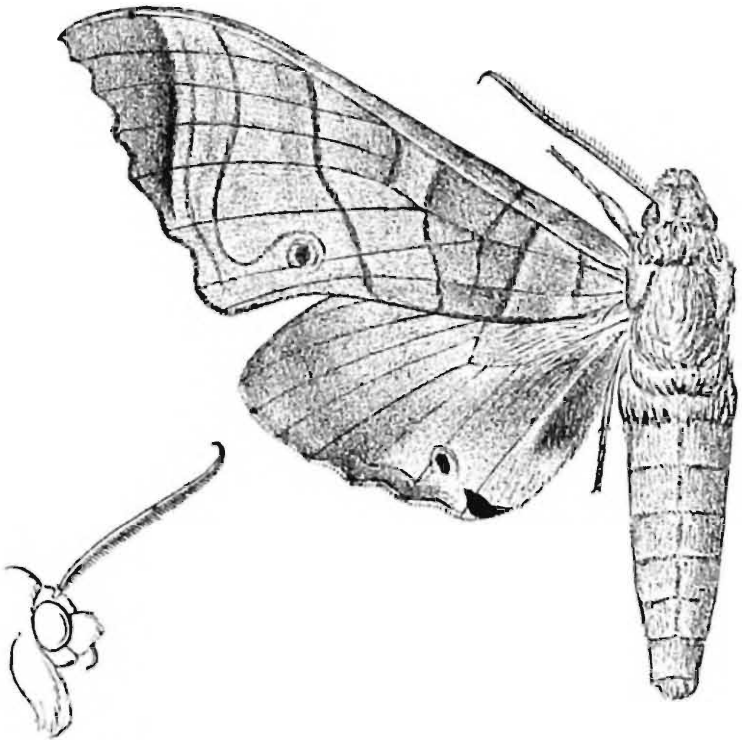


Fig. 37.—*Marumba dyras dyras* (Walk.), ♂.

cylindrical; horn long, straight, tip shortly bifid; the ends of the anal claspers extending behind the point of anal flap; surface of head dull, covered with minute tubercles; body dull; colour of the head and body yellowish-white; the basal three-fifths and the terminal fifth of the horn black, the middle fifth pale yellow; spiracles white. 2*nd instar*. Head triangular, with a short process rising from the vertex of each lobe, the two processes closely appressed except for a short distance near the tips. Surface of head shining and smooth except for two lines of prominent pointed tubercles on each side, one line running from near the vertex of each lobe down the side of the clypeus and the other separating the face from the cheek, and a few scattered tubercles on the cheek. Body long and

cylindrical; horn straight, of medium length, tip shortly bifid. A transverse row of small conical tubercles on each secondary ring of the body; a line of larger tubercles on the oblique stripes, some of these with two or three points. Colour of head and of dorsum of body yellowish-green, venter of body neutral tint; horn maroon, the base pale green, a ring of pale yellow two-thirds from base. *3rd instar.* Very similar to the 2nd instar. *4th instar.* Very little change.

5th instar. Head large, triangular, with a very short process on the apex of each lobe; face slightly convex; true clypeus one-third length of head, an equilateral triangle with the basal angles rounded and tumid; apex of false clypeus forming a narrow arch over the apex of true clypeus; labrum half as long and slightly broader than clypeus, narrowing frontad, with six longitudinal ribs, hind margin arched strongly backwards; ligula kidney-shaped, as long as and half as broad as labrum; eyes 1 to 4 in a curve, equidistant, 6 in line with 3 and 4; 5 equidistant from 4 and 6; 4 larger than the rest. Surface of head dull, covered sparsely with small conical, shining tubercles, those on the cheek slightly larger than the rest. Body shaped as in others of the genus. Horn of medium length, straight, tapering evenly to a blunt point. Surface of body dull; a transverse row of small, conical tubercles along each secondary ring; a subdorsal line of larger tubercles on segments 3 and 4, and a line of large tubercles along each oblique stripe. Horn covered with small tubercles.

Coloration.—Head pale bluish-green; basal angles of clypeus orange: labrum glassy-green; ligula opaque whitish; antenna very pale green, the end-segment tinted with rose; mandible pale peach-colour, tip dark reddish-brown. Body varying from bluish-green to yellowish-green or greyish-green, some individuals yellow; in the greenish forms the subdorsal and oblique stripes narrow and yellow; the tubercles bluish. Horn yellow, and sometimes yellow patches below the oblique stripes; in the yellow form the stripes and tubercles maroon-rose colour, horn orange or reddish; true legs pink, or orange-banded and blotched with red. Spiracles oval, lilac, rose-colour or reddish-brown, the central slit pure white, the whole with a narrow pale green rim. Length 80 mm.; breadth 13 mm.; horn 14 mm.

Pupa.—Similar in shape to others of the genus; frons with six transverse, very rugose, shining ridges on each side of the dorsal line and close to it, the anterior ridge the highest, forming horn-like projections from the front of the head; dorsal line of the head and segment 2 rising at a steep angle to the longitudinal axis of the body, the front part of 2 tumid and its dorsal line slightly carinate; thorax short; tongue broad and short, ending before middle of wing-case;

antenna shorter than fore leg, which reaches to middle of wing-case ; mid-leg reaching to about two-thirds the length of wing-case. Surface of head, thorax and wing-case very superficially corrugate-aciculate ; abdomen obscurely corrugate, the front quarter of each of segments 5 to 12 very deeply, coarsely, longitudinally pitted and corrugate ; one ante-spiracular ridge on the front bevel of 9, with a channel behind it ; 10 with a similar but smaller ridge and channel, and 11 with the ridge and channel nearly obsolete. Spiracle of 2 indicated by a slit at the junction of 2 and 3, the hind margin of 2 being raised in front of it, and a narrow up-tilted lobe projecting from the front margin of 3 bordering the slit behind ; the other spiracles parallel-sided, the ends broadly rounded, the whole slightly raised, with the central slit depressed. Cremaster triangular in shape, broad at base and ending in a short, oblong, minutely bifid tip ; the upper surface very coarsely longitudinally and transversely corrugate and pitted ; the whole surface shining. The clasper scars on segment 14 prominent ; in the ♂ pupa the sex-mark on 13 nearly as long as that segment ; round, with thickened lips and a depressed central slit ; in the ♀ pupa the sex-marks consist of a depression in the middle of 12 and a pit in a forward prolongation of 14 which runs across 13 to near the middle of 12. Colour dark red-brown, the frontal ridges and the tumid anterior portions of the segments darker ; spiracles and cremaster black. Length 47 mm. ; breadth 16 mm.

Habits.—The food-plants belong to the families Malvaceæ (*Bombax*, etc.), Sterculiaceæ (*Sterculia*, etc), Tiliaceæ (*Grewia* of various kinds), Euphorbiaceæ (*Bridelia* of various kinds) and Sapindaceæ (*Schleichera trijuga* Willd.). When large the larva usually eats straight across the leaves. The pupa, when touched, moves the tip of the abdomen round and round, and also makes a shivering motion by rapid contractions and expansions of the abdomen. The moths do not appear to be attracted by light ; we have not observed them feeding, for which the tongue is not well adapted. They do not mate readily in captivity and wild males do not come readily to bred females.

43. **Marumba nympha** Roths. & Jord. (Fig. 38, ♂ ; Pl. III, fig. 1, larva, fig. 2, pupa).

Marumba nympha, Roths. & Jord., 1903, p. 806 (♂) (Karwar, N. Kanara) ; Hampson, 1903, p. 640 ; id., 1904, pl. D ; Seitz, 1928, p. 539.

Imago.—♂. Clay-colour, with a flush of pale vinaceous-buff, especially on thorax and fore wing ; side of palpus, upper-

side of legs and scaling of antenna brownish-black, mesial line of head and thorax also somewhat blackish ; thorax crested ; abdomen without mesial vitta. Underside of body more ochraceous than upperside. Antenna rather short, thickest before middle. Fore wing : four lines between base and apex of cell, third and fourth closer together, all straight, but curving costad in front ; a rather conspicuous whitish stigma, no brown bar upon cross-veins ; first discal line situated as in *dyras* or nearer cell, second very faint, third rounded-angulate at M^1, here 7 mm. distant from outer margin, curving costad in front, crossing SC^5 about $2\frac{1}{2}$ mm. from subcostal fork ; fourth line not double, parallel with third from costal margin to M^1, then continued straight to hind margin ; all the lines tawny, not prominent ; spot M^2 encircled by a line ; hind margin and fringe of scalloped distal margin brownish-black ; costal area from base to fourth discal line, interspaces between third



Fig. 38.—*Marumba nympha* Roths. & Jord., ♂.

and fourth proximal lines and between first and third discal ones, and broad distal marginal area, which narrows in front and behind, without vinaceous-grey. Hind wing : burnt umber, darkest behind, where it is degraded with grey ; anal spots separate ; fringe pale in front, dark behind, here pale between veins. *Underside* similar in ground-colour to upperside of fore wing. Fore wing : a brown shade in middle at lower angle of cell, continued as a band towards costa ; two faint lines on disc, corresponding to third and fourth discal lines of upperside, more straight from costa to M^1, situated in a vinaceous-grey shade which extends from costal to distal margin. Hind wing with three lines, first heaviest, at apex of cell, third weakest, almost parallel with outer margin. *Expanse* : ♂ 80–94 mm., ♀ 102–112 mm.

Tenth tergite quite different from that of any other species ; each lobe divided horizontally by an irregular sinus ; sternite without mesial lobe. Dorso-apical process of harpe pointed,

curved downwards, harpe with two curved processes, one proximal the other distal, reminding one of harpe of *Rhodoprasina floralis* and *Agnosia orneus*. The two processes above penis-sheath pointed.

Hab. S. India (North Kanara District), where we have bred the species. Local and rather rare, a few larvæ being found in forests with rainfall of about 150 inches, up to 1,000 feet elevation.

Egg.—Broadly ovoid; surface shining, very minutely pitted; colour very pale yellow. Length 2·5 mm.; breadth 2 mm.; height 1·25 mm.

Larva:—

1*st instar*. Head round, body cylindrical, horn long, straight, minutely bifid; colour pale yellow. 2*nd instar*. Head rounded-triangular, dorsal line of vertex depressed, apex of each lobe rounded; horn straight, minutely bifid; colour bluish-green, with a dark brown dorsal stripe from vertex of head to base of horn. 3*rd instar*. Head triangular, with a short process rising from the apex of each lobe, the processes closely appressed; horn straight, minutely bifid; head and body glaucous-green, head-processes dark brown; dorsal stripe rose-brown. 4*th and* 5*th instars*. Little change.

6*th instar*. Head triangular, vertex rounded, without processes; true clypeus one-half length of head, equilaterally triangular, basal angles tumid; false clypeus a narrow strip on each side of true clypeus; labrum two-thirds length of clypeus, front margin thickened and curved forwards; ligula horseshoe-shaped, with narrow lobes and very deep sinus; eyes 1 to 4 equidistant in a slight curve, one eye-diameter apart; 6 in line with 3 and 4, about three diameters from 4; 5 about two diameters from 4 and from 6; 3 and 4 slightly larger than the rest. Surface of head feebly shining, smooth except for small, low scattered tubercles, larger on cheeks and lower part of face; clypeus transversely aciculate. Body shaped as in others of the genus. Horn long, slightly down-curved, tapering evenly to a blunt point. Surface of body dull; a transverse row of very low tubercles with short, sharp points along each secondary ring. Horn covered with low conical tubercles; larger tubercles on clasper faces.

Coloration.—Head glaucous-green with a dark green stripe separating face from cheek; tubercles white; labrum and ligula green; mandible green with tip reddish-brown. Body yellowish-green suffused with glaucous; a narrow, dark reddish-brown dorsal stripe from front margin of segment 2 to tip of horn, and thence to end of anal flap, bordered on each side by a narrow white stripe; oblique stripes on 5 to 11, reddish-brown edged below by white, that on 11 extending backwards to base of horn, the others extended to near dorsal

stripe ; hind margins of clasper faces broadly reddish-brown. Horn dull, deep reddish-brown. Spiracles oval, very dark reddish-brown, with central slit white.

Pupa.—Very similar to those of *M. dyras* and *M. indicus* in shape, surface and colour ; ante-spiracular ridges present on segment 9 only ; surface of abdomen more coarsely corrugate and pitted than in *dyras*.

Habits.—Food-plant: *Alseodaphne semicarpifolia* Nees, family Laurineæ. Habits of larva similar to that of *dyras*. Bred ♀♀ attract wild ♂♂ late at night. All the specimens known to us were bred from a captive ♀ at Karwar, S. India ; this ♀ attracted several ♂♂ and mated with one of them. A large series of moths were obtained from the eggs laid by her, the larvæ being put on a tree covered with gauze and protected from ants by a cloth soaked in kerosine-oil tied round the trunk.

44 *a*. **Marumba sperchius albicans** (Butl.).

Triptogon albicans, Butler, 1875, p. 254 (Mussooree) ; id., 1877 A, p. 586, pl. xciii, fig. 6 (♂).
Marumba sperchius albicans, Roths. & Jord., 1903, p. 281 ; Jordan, 1911, p. 241 ; Seitz, 1928, p. 539.
Polyptychus dyras, Hampson (non Walk.), 1892, p. 69.

Imago.—♂♀. A very pale form, the ♀ often losing the lines of the fore wing and the spots in the anal area of the hind wing. Tenth tergite more deeply notched than in the two other subspecies, the sternite feebly curved. *Expanse* : ♂ 106–120 mm., ♀ 121–144 mm.

The early stages are unknown.

Hab. W Himalayas.

44 *b*. **Marumba sperchius gigas** (Butl.). (Pl. VII, fig. 12, imago ; Pl. XIII, fig. 8, larva).

Triptogon gigas, Butler, 1875, p. 253 (Sylhet) ; id., 1881 B, p. 12, pl. lxxx, fig. 5.
Marumba sperchius gigas, Roths. & Jord., 1903, p. 281 ; Seitz, 1928, p. 539, t. 66 *b* ; Scott, 1931, pl. i, fig. 3 ; pl. ii, fig. 5 (larva).
Polyptychus dyras, Hampson (non Walk.), 1892, p. 69.
Marumba scotti, Rothschild, 1920, p. 480.

Imago.—♂♀. A large grey form ; the external line of the post-discal pair absent or vestigial, while the inner one is as distinct as the exterior discal line. The apical area outside the post-discal line of fore wing underside not tawny as in *M. dyras*. Fringe of fore wing not white between the veins. Antenna of ♂ very heavy, two-fifths length of fore wing larger and thicker than in *dyras* ; that of ♀ slightly compressed, very feebly grooved, seriate basal cilia barely half length of segment. *Expanse* : ♂ 88 mm., ♀ 138 mm.

♂. Tenth tergite rounded at the sides, obviously broader before end than in middle, the sinus narrow, lobes notched, inner angle acute; sternite straight, not or very feebly bent upwards, narrow and long, compressed, upperside rough with minute teeth. Dorso-apical lobe of clasper dagger-shaped; harpe irregularly notched and tuberculate; processes above the penis-sheath very long and slender.

♀. Vaginal ridge convex in middle, with a separate rounded lobe at each side of orifice.

Hab. E. HIMALAYAS (Assam). We have bred the subspecies in the Khasi Hills, where the larvæ are common at about 4,500 feet elevation.

Egg.—Elongate-ovoid in shape, pale green when first laid; after some days two reddish-brown stripes appear on the top, somewhat variable in shape and size, but roughly parallel with the long axis. Length 3·5 mm.; breadth 2·5 mm.

Larva:—

1*st instar*. Head round; front margin of segment 2 of greater diameter than head, rest of body cylindrical and of less diameter than head; horn straight, of medium length, tip bifid; surface of head and body dull, body with a transverse row of small tubercles along each secondary ring; horn covered with tubercles; colour of head and body pale yellow; horn reddish with a pale yellow band about two-thirds from base. 2*nd instar*. Head triangular, with a short process rising from the apex of each lobe, the two processes appressed to near the tips; body cylindrical; horn straight, of medium length; surface of head and body dull, the head covered with small tubercles, and a line of larger tubercles from the apex of each lobe to base of antenna; body with tubercles as in the 1st instar; seven oblique stripes formed of larger tubercles; the colour of the head pale green, the tubercles yellow; processes brown, and a brown dorsal stripe from their base to nape; body pale green, the tubercles pale yellow; horn yellow with the base and tip reddish, the tubercles black. 3*rd instar*. Little change. 4*th instar*. Little change, but the lower portion of the anterior oblique stripe, just above the spiracle on segment 5, wider and formed of larger tubercles, that on segment 10 very faint and that on segments 11 and 12 broader than the rest.

5*th instar*. The shape the same as that of other larvæ in the genus. Head triangular, process on the apex of each lobe reduced to a large low tubercle. Surface of head dull, covered with low rounded tubercles. Horn straight, with a blunt tip. Body dull; a transverse row of large pointed tubercles along each secondary ring, with some smaller tubercles set among them; a dorso-lateral line of larger

tubercles on segments 2 to 4, and seven oblique stripes of large tubercles, the lower part of the stripe on 5 widening into a patch of still larger multi-pointed tubercles above the spiracle: the oblique stripes extend backwards to dorsum and forwards (except the anterior one) well on to the segment in front; the stripe on 10 very inconspicuous, being formed of smaller tubercles than the others, that on 11 strongly marked. Horn covered with pointed tubercles.

Coloration.—Head bluish-green with white tubercles, and a white stripe from the apex of each lobe to base of antenna. Body bluish-green of various shades, the tubercles brown or reddish, with white tips, the dorso-lateral stripe and oblique stripes formed of mauve or yellow tubercles on a white ground. Horn green with paler tubercles; a pale ventral stripe from segment 5 to the claspers. Spiracles oval, blue or mauve in colour. Length 120 mm.; breadth 19 mm.; horn 13 mm.

Pupa.—Similar to those of others of the genus.

Habits.—Food-plants: *Quercus Griffithi* Hook. f. & T. and *Q. serrata* Thunb., family Fagaceæ. The habits of the larva are the same as those of other *Marumba* larvæ. The larva is often found with a number of small black flies sitting on it, but they do not appear to cause any ill effects. Larvæ were common on the oaks growing in gardens, but were difficult to rear to the imago stage, hibernating pupæ usually dying.

45. **Marumba poliotis** Hamps. (Fig. 39. ♂).

Marumba poliotis, Hampson, 1911, p. 86, pl. F, fig. 23 (Ganjam); Seitz, 1928, p. 539.

Imago.—Fore tibia with large curved claw at extremity.

♂. Head and thorax grey-white, head and tegulæ tinged



Fig. 39.—*Marumba poliotis* Hamps., ♂.

with rufous; metathorax with two slight tufts of blackish scales; tarsi ringed with black; abdomen grey-white, dorsally suffused with rufous except at base and with fine black dorsal line expanding into a small spot on penultimate segment. Fore wing grey suffused with reddish-brown and irrorated

with black; basal and terminal areas browner and post-median area whiter; some blackish suffusion before the whitish antemedian line, which is defined by blackish on outer side, oblique from costa to median vein, angled inwards in submedian fold, then excurved and angled inwards to inner margin; a dark median line excurved from costa to median vein, then incurved to near antemedian line; a small pale rufous discoidal spot, slightly defined by blackish; postmedian line dark, excurved from costa to R^2, then incurved and sinuous; subterminal line indistinctly double, excurved below costa, then oblique, dentate and with small, somewhat dentate black marks on its outer edge, the mark below costa extending as a streak to termen and the mark at R^1 larger; slight black marks on termen at the extremities of the veins. Hind wing grey suffused with brown; post-median line excurved and indistinct from costa to R^3, then incurved and with whitish patch beyond it in submedian inter-space, ending at tornus. *Underside* whitish irrorated with fuscous; the postmedian line fine, a curved dentate sub-terminal line with slight brownish band beyond it becoming terminal below R^3. *Expanse*: ♂ 52 mm., ♀ 60 mm.

Hab. S. India (Kanara and Ganjam Districts), where we obtained pupæ, but no eggs nor larvæ.

Pupa.—Similar in shape to others of the genus; the head was lost when the moth emerged, so no description of this is available. Surface shining; sculpturing on segment 4 consisting of a dull area on each side of the dorsal line, the front edge broadly rounded and sharply raised, the lower edge somewhat pointed and becoming flush with the surface of the segment: thorax minutely rugose; median portion of costal margins of wing-case coarsely beaded; abdomen more coarsely rugose and pitted; the front portions of segments 6 to 12 broadly tumid, with longitudinal lines dividing the tumid portions into squares; ante-spiracular ridges on 9 to 11, consisting of three narrow ridges separated by deep channels. Spiracle of 2 twice as long as those on the other segments, consisting of a deep slit bordered in front by the thickened hind margin of 2, this thickened margin divided into seven prominent beads, and behind by the thickened front margin of 3, which again is divided into from three to five beads, behind which is a deep linear depression; remaining spiracles oval with the edges of the slit raised. Cremaster short, conical, very irregularly coarsely corrugate on dorsal surface, tip narrowly bifid, the arms blunt. Colour of the pupa dark chestnut, the spiracle of segment 2 and cremaster black, the remaining spiracles of the body colour. Length 28 mm.; breadth 10 mm.

46. **Marumba indicus** (Walk.). (Fig. 35 J, genitalia).

Smerinthus indicus, Walker, 1856, p. 254 (N. India).
Marumba indicus, Roths. & Jord., 1903, p. 283 ; Seitz, 1928, p. 540, t. 56 *b*.
Triptogon rectilinea, Moore, 1879 A, p. 388 (N. India) ; Waterhouse, 1883, pl. cxl, fig. 5 (♂).
Triptogon indicum, Butler, 1881 B, p. 13, pl. lxxxi, fig. 2.
Polyptychus dyras, Hampson (non Walk.), 1892, p. 69.

Imago.—♂♀. Fore wing grey, in the ♀ with a brownish tinge ; the dark chocolate-coloured spots at the tornal angle often coalesce into one, and that on M^2 is more or less excavated distally ; in the ♀ the spot on M^2 is divided into two ; there is in both sexes a large chocolate submarginal patch extending from the apex to R^1, bounded by an inwardly curved line and a dark transverse band across the base of the abdomen. Hind wing reddish, the ♂ with fuscous at the base spreading towards anal angle ; the chocolate-coloured anal spots coalesce into a short broad band. Tibiæ with very few spines ; fore tibia ending in a long thorn as in *Agnosia orneus*. Antenna long and stout, similar to that of *sperchius*. Tenth tergite separated into two rather slender lobes ; sternite rounded at the sides, apex pointed. Dorso-apical lobe of clasper pointed (fig. 35 J), curving downwards ; hook of harpe strongly curved. *Expanse* : ♂ 60–80 mm., ♀ 92 mm.

Hab. E. Himalayas and S. India. We have bred it in the Kanara District of S. India, where it is rare and very local, being confined to forest-clad hills with heavy rainfall, under 1,000 feet elevation.

Larva :—

Final instar. Very similar in shape to that of *M. dyras dyras*. Head triangular with a short process rising from the apex of each lobe ; true clypeus with the basal angles broadly rounded ; false clypeus narrow and apex rising little above apex of true clypeus ; labrum one-third length of clypeus and as broad as clypeus ; ligula as long as labrum and half as broad, kidney-shaped ; eyes 1 to 4 in a slight curve, equidistant ; 6 in line with 3 and 4 ; 5 forming an equilateral triangle with 4 and 6 ; 3 the largest. Surface of head shining, covered with very small glassy tubercles ; some larger, sparsely-distributed tubercles on the cheek ; surface of clypeus transversely lined, with a tubercle in each basal angle. Body similar to that of *M dyras dyras*.

Coloration.—Head green, dorsal line and cheek whitish ; labrum, ligula, antenna and mandible very pale yellow, tip of mandible black. Body very pale glaucous-green, subdorsal and oblique stripes as in *dyras dyras* ; tubercles on body yellow, those on anal flap and claspers green. Horn of body colour, the tubercles whitish. Spiracles pure white with a narrow rim of shining black. Length 60 mm.

Pupa.—Similar in shape to that of *M. dyras dyras*, except that segment 14 has a lateral cushion-like tumidity on each side ; the frons sloping ventrad and with five transverse, very rugose ridges on each side of the depressed dorsal line, these ridges increasing in height forwards, the anterior one forming a prominent transverse crest at the extreme front of the pupa ; tongue broad, short, reaching to little more than one-third the length of wing-case ; antenna and fore leg reaching to one-half the length of the wing-cases, mid-leg to two-thirds ; a narrow coxal piece. Surface shining ; sides of frons, vertex and eye smooth ; anterior portion of each abdominal segment tumid, rugose and pitted ; the rest of the surface of the pupa smooth. The spiracle of 2 a wide slit, bordered by the thickened hind margin of 2 in front and by the thickened front margin of 3 behind ; the remaining spiracles oval, rising slightly from a shallow depression, the central slit again depressed ; in the ♀ pupa the sex-marks consist of a small elongated pit in the middle of 12 and a similar pit at the front margin of 13 ; the clasper scar a deep lineal depression, toothed along each edge, the cushion-like tumidities on 14, mentioned above, bordering it on each side. Cremaster conical, with an ear-shaped cavity on each side of the base ; the tip shortly bifid, the arms slightly diverging and each bearing a seta ; the base of the cremaster separated latero-ventrally from the cushion-like tumidities by a deep furrow ; surface shining and very rugose. Colour rich chestnut, the frontal ridges, rugosities on the abdominal segments, spiracles and cremaster black. Length 28 mm. ; breadth 10 mm.

Habits.—The habits of the larva the same as those of *dyras*, the usual food-plant being *Sterculia villosa* Roxb., family Sterculiaceæ, but it also feeds on *Helicteres isora* Linn., of the same family, and *Bombax malabaricum* DC., family Malvaceæ, and *Grewia tiliæfolia* Vahl., family Tiliaceæ. The moth rests in the same position as that of *dyras*. It has not been observed in the wild state, and no wild ♂♂ came to our bred ♀♀.

47 **Marumba bengalensis** Hamps. (Fig. 40, ♂ holotype).

Marumba bengalensis, Hampson, 1912, p. 1270 (Bengal : Chota Nagpur, Kalunga, ♂).

Imago.—♂. Head, thorax and abdomen pale red-brown tinged with grey, the dorsum of thorax with darker stripe ; frons dark red-brown at sides. Fore wing pale red-brown tinged with grey ; an oblique slightly incurved antemedian line ; two median lines ; some dark suffusion on inner median area ; a pale elliptical discoidal spot defined by fuscous and extending to well below cell ; a dark line just beyond cell, oblique below R^1 ; postmedian line dark, incurved to below

R^1 where it is hooked, then strongly retracted and incurved : a large chocolate-brown patch on terminal area from costa to below R^1, with incurved inner edge and two conjoined obliquely placed spots from below M^1 to tornus. Hind wing ochreous tinged with rufous a lunulate chocolate-brown patch before termen from M^1 to tornus *Underside* with two



Fig. 40.—*Marumba bengalensis* Hamps., ♂ holotype.

red-brown antemedian lines and two postmedian lines oblique from costa to between M^1 and R^1, then incurved. *Expanse* : 60 mm.

The early stages are unknown.

Hab. S. India (Kalunga ; Chota Nagpur). Very rare.

48. **Marumba decoratus** (Moore). (Fig. 41, ♀).

Smerinthus decoratus, Moore, 1872, p. 568 (Sikkim).
Triptogon decorata, Butler, 1877 A, p. 588.
Cypa decorata, Hampson, 1892, p. 71.
Smerinthulus decoratus, Roths. & Jord., 1903, p. 302, pl. lxv, fig. 2 (♀).
Marumba decoratus, Roths. & Jord., 1907, p. 55 ; Seitz, 1928, p. 540.

Imago.—♀. Dark olive-brown. Fore wing with outer margin highly excised between veins R^1 and SC^5 and much angulated towards outer angle ; suffused with pale pink ;



Fig. 41.—*Marumba decoratus* (Moore), ♀.

a large irregular median brown patch bordered with pink on costa and partly including a pale reniform spot, beneath which is a dark brown " inverted comma "-shaped mark ; two

curved postmedian pink lines, the inner one waved near the inner margin ; some diffused brown streaks near outer angle ; a triangular brown-edged patch on costa before apex, with a short white streak below it. Hind wing with a broad black and narrow pink streak near anal angle. *Expanse* : 72 mm.

Hab. E. HIMALAYAS (Sikkim ; Khasi Hills). The ♂ and early stages not known. This extremely rare insect was first placed by Rothschild and Jordan in the genus *Smerinthulus*, but it is now considered to be a *Marumba*.

Genus **DAPHNUSA** Walker. (Fig. 42).

Walker, 1856, p. 237 (part.) ; Roths. & Jord., 1903, p. 283 ; id., 1907, p. 56.
Allodaphnusa, Huwe, 1895, p. 368.

Genotype : *ocellaris* Walk.

Imago.—" ♂♀. Tongue very weak and short, the two halves filiform, separated, the fringe not always developed. Pilifers closer together than in other SPHINGIDÆ, and standing together with the triangular epistome on a kind of lobe or pedestal ; they are clothed with bristles and some scales ; genal process high, triangular ; carina of labrum short, high, almost tuberculiform. Palpus smooth-scaled, large in ♂, second segment angulate laterally in a ventral view ; end-surface in a plane with the frons, large, rhombiform ; joint open. Antenna grooved in both sexes ; distal segments narrow and short, the ventral part conical, almost cylindrical ; the sensory cone at the tip of these projections long ; scales at apex of last segment long. Tibiæ densely spinose ; hind tibiæ with *one* pair of short spurs ; pulvillus and paronychium present, the latter with two rather heavy lobes at each side. Abdominal tergites with the under scales mostly long, spiniform, but weak ; spines at the edges also long and weak. Distal margin of wings entire, apex of fore wing emarginate in ♀, often also in ♂ ; SC^2 and R^1 of hind wing on a *long* stalk, from near centre of cell, D^2 not or slightly curved ; frenulum and retinaculum present. Clasper without friction-scales.

" *Larva* (in Mus. Stettin).—Head large, rounded, thorax and anal segments strongly tuberculate ; horn long, straight, densely tuberculate. Green, a dorso- and a ventro-lateral series of purplish-brown spots, fourth segment [segment 8] almost entirely purple-brown, this belt produced backwards dorsally, forming a large patch on fifth segment [segment 9], a large divided dorsal patch on tenth [segment 14] " (Roths. & Jord., 1903, p. 283).

Hab. Indo-Malayan Subregion. One Indian subspecies.

49. **Daphnusa ocellaris ocellaris** Walk. (Fig. 42, A, B, genitalia).

Daphnusa ocellaris, Walker, 1856, p. 237 (Borneo); Swinhoe, 1890, p. 164 (Bassein); Hampson, 1892, p. 72.
Daphnusa ocellaris ocellaris, Roths. & Jord., 1903, p. 284; Seitz, 1928, p. 540, t. 62 *a*.
Allodaphnusa fruhstorferi, Huwe, 1895, p. 368, t. 3, fig. 2 (♀) (Java).

Imago.—♂♀. Pattern of fore wing similar to that of the species of *Marumba*, the two tawny marks with the brown patch near hind angle corresponding to the blackish-brown spots of *Marumba*.

♂. Pale reddish-brown or dark olive-brown; collar and vertex of thorax darker. Fore wing upperside with two waved subbasal lines angled outwards at SM^2, where they join an oblique antemedian band; a crenulate postmedian band bearing a large pale spot at inner margin, the inner side with some red dentate marks; two crenulate submarginal lines; a chestnut patch on costa before apex. Hind wing red-brown, with some bright chestnut lines above anal angle.

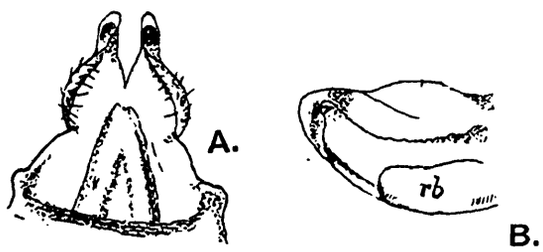


Fig. 42.—*Daphnusa* Walk. Genitalia.
A, *D. ocellaris*, ♂, 10th segment, ventral view; B, clasper and harpe; *rb*, end of the harpe.

Underside: fore wing with two crenulate submarginal lines; hind wing with curved median and postmedian lines.

♀. Darker brown; a dark brown band on metathorax.
Expanse: ♂ 80–92 mm., ♀ 112 mm.

♂. Tenth abdominal tergite carinate above (fig. 42 A), curved downwards, the curved part deeply cleft, each lobe bluntly pointed, very strongly chitinized at end; the sides dilated laterad and ventrad before apical hook; sternite membranaceous, vestigial. Clasper (fig. 42 B) reduced in size, dorsal margin bent ventrad, apex rounded, inner surface deeply concave; from this cavity projects distally the end of the harpe, proximal part of harpe large. Penis-sheath without external armature, apex more produced on one side than on the other, the projecting part often subglobose.

♀. Eighth tergite of abdomen scaled, cleft to base. Proximal part of vaginal plate convex mesially, the proximal and lateral edges of orifice raised into a smooth strongly chitinized ridge which is feebly sinuate; post-vaginal part of plate membranaceous, scaled.

‹ *Hab.* E. HIMALAYAS (Assam), BURMA, Malaya and the Philippines.

See under genus for all that is known of the early stages.

Genus **LANGIA** Moore. (Fig. 43).

Moore, 1872, p. 567 ; Roths. & Jord., 1903, p. 291 ; id., 1907, p. 58 ; Jordan, 1911, p. 242.

Genotype : *zenzeroides* Moore.

Imago.—" ♂♀. Tongue reaching end of fore coxa ; pilifer with a brush of scales instead of bristles ; genal process broad. Palpus just visible in dorsal view, not essentially different in the sexes, with long hairs laterally. Antenna of ♂ compressed, not strongly grooved, slightly dilated above the grooves, hence outline undulate in a dorsal view, distal

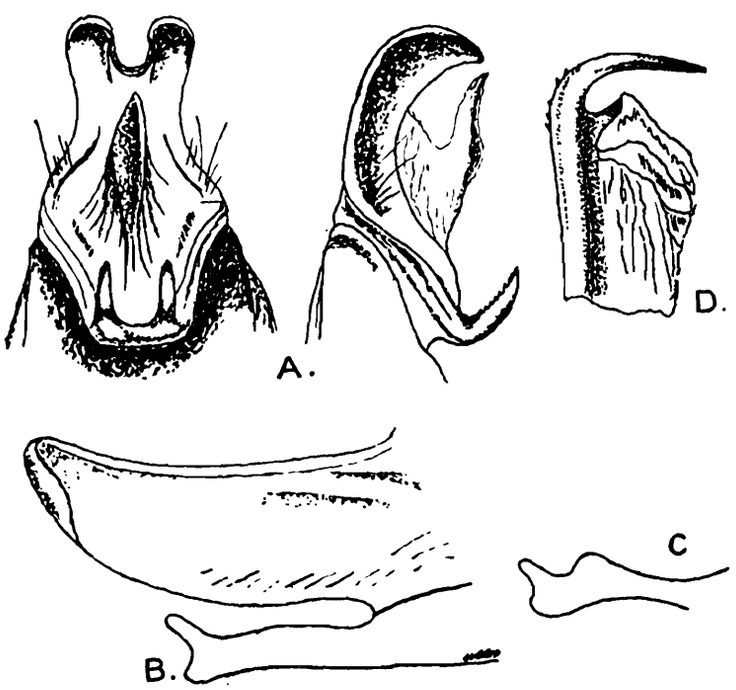


Fig. 43.—*Langia* Moore. Genitalia.
A, *L. zenzeroides*, ♂, 10th segment, ventral and lateral views ; B, clasper ; C, harpe ; D, penis-sheath.

segments much higher than long, but only slightly compressed ; of ♀ very feebly compressed, seriate cilia short ; end-segment very short and obtuse in both sexes. Body roughly scaled, excepting head, pro-mesonotum and end of abdomen ; the scales gradually widened towards ends, dentate ; *no* spines on abdomen. Tibiæ *not* spinose ; spurs long, two pairs to hind tibia, with long naked points ; tarsi short, lateral apical spines strong, outer spines of soles more or less erect and inclining mesiad ; claws and pulvillus large, paronychium with *one* broad lobe at each side. Distal margin of

fore wing dentate ; D^2 (upper discocellular) of hind wing curved, sending a long spur into cell, R^2 (vein 5) below centre of cell ; frenulum and retinaculum present. *No* organ of friction on clasper " (Roths. & Jord., 1903, p. 291).

Hab. W and E. HIMALAYAS to Japan. One Indian subspecies. Early stages described under that subspecies.

50. **Langia zenzeroides zenzeroides** Moore. (Fig. 43 A–D, genitalia ; fig. 44, imago ; Pl. III, fig. 4, larva, fig. 5, pupa ; Pl. VII, fig. 10, imago).

Langia zenzeroides, Moore, 1872, p. 567 (Kotghur, N.W. India) ; Cotes & Swinhoe, 1887, p. 25 (Simla, Sikkim) ; Hampson, 1892, p. 73, fig. 45 ; Dudgeon, 1898, p. 407 (Sikkim, 5,000 feet).
Langia zenzeroides zenzeroides Roths. & Jord., 1903, p. 292 ; Seitz, 1928, p. 540 ; Scott, 1931, pl. i, fig. 6.
Langia khasiana, Moore, 1872, p. 568 (Khasi Hills).
Langia zeuzeroides (!), Gott, 1877, p. 116 (larva hissing, on apricot ; imago squeaking).

Imago.—♂♀. Head pale ; vertex of thorax leaden, with some ochreous lines, the sides dark brown ; metathorax and abdomen covered with light and dark brown spatulate scales. Fore wing with the costal area leaden-grey, whitish below cell, dark grey towards inner and outer margins ; three very oblique dark lines from apex to near centre of inner margin ; a whitish submarginal line ; outer margin with light and dark lunules in the crenulations. Hind wing brown, with some dark brown and whitish lines near anal angle ; a marginal dark line ; cilia whitish towards anal angle. *Expanse* : ♂ 112–152 mm., ♀ 120–152 mm.

♂. Tenth abdominal tergite bilobate (fig. 43 A) ; sternite broadly divided into two processes. Clasper long (fig. 43 B), narrowed to apex, dorsally reduced in width, hence a wide gap between it and the supra-anal plate, ventro-apical margin turned inward ; harpe (fig. 43 C) produced into a long, horizontal ventral process, sinuate and lobate at end ; the process visible without dissection. Penis-sheath (fig. 43 D) irregularly compressed, very stout, armed at end with a long strong hook which curves ventrad.

♀. Anterior part of vaginal plate strongly chitinized, raised into a transverse, slightly undulate ridge in front of the large vaginal cavity ; post-vaginal part of plate also projecting distad, rounded, more or less membranaceous, except at the edge.

Hab. W and E. HIMALAYAS and S. China. We have bred it in the W and E. Himalayas. Very common in orchards in the Khasi Hills, where it causes much damage by defoliating the fruit-trees.

Egg.—Very broadly ovoid; surface smooth and shining; colour bright russet, turning whitish before hatching. Length 2·5 mm.; breadth 2 mm.

Larva:—

1*st instar*. Head round, body cylindrical, horn straight and very long; surface of head and body, including horn, covered with white hairs, which are far longer on the body than on the head; colour of head pale green, body yellowish-green, horn reddish-purple. 2*nd instar*. Head triangular, with a short process rising from the apex of each lobe; horn long, slightly up-curved, surface of body covered with pale tubercles; head



Fig. 44.—*Langia zenzeroides* Moore. Resting attitude.

and body green, processes on the head black; a dorso-lateral yellow stripe from head to base of horn; horn reddish. 3*rd instar*. Head triangular, with long apical processes; head and body apple-green, covered with white tubercles; a yellow stripe from the tip of each process on head to base of antenna and also down the back of the head, meeting the dorso-lateral stripe, which is now formed of yellow tubercles. 4*th instar*. Shape and colour of head and body as in the 3rd instar; horn thick, ending in a blunt point directed downwards, dark green with yellow tubercles. Spiracles blue.

5*th instar*. Head elongate-triangular, with a long process rising from the apex of each lobe, the two processes closely

appressed to near tip, where they diverge shortly ; head three times as long as broad ; segment 2 of less diameter than base of head, the segments then increasing in diameter to 7, rest of body cylindrical. Surface of head smooth and moderately shining. Body dull, with a transverse row of small pointed tubercles on each segmental ring ; a dorso-lateral line of larger pointed tubercles from the front of segment 2 to base of horn. Horn very short, thick at base, with a blunt point ; covered with large rounded tubercles ; anal flap and claspers heavy, also covered with large rounded tubercles.

Coloration.—Head and body apple-green ; apical processes pale yellow ; a white stripe from each process running down cheek to base of antenna, and also down the back of head to nape, meeting the dorso-lateral line of tubercles on segment 2 ; transverse rows of tubercles white ; dorso-lateral line of tubercles yellow or reddish, on a yellow stripe. Horn green with whitish tubercles ; tubercles on anal flap and claspers pale green ; terminal segments of the true legs red. Spiracles oval, very large, pale blue edged with black, and with a black crescent-shaped mark above and below. Length 125 mm.

Pupa.—Very short and stout, bluntly rounded at both ends ; tongue longer than fore leg, slightly longer than mid-leg, and reaching to the point where the wing-cases meet ; antenna very stout, longer than fore leg in both sexes ; no coxal piece ; abdominal segments raised into high ridges, especially on the dorsum, the divisions between the segments deeply constricted. Surface dull and shagreened, especially on the ridges of the abdominal segments, which are also covered with conical tubercles. Spiracles oval, the lips of the central slit raised into narrow ridges. Cremaster absent or a very small pointed spike. Colour iron-grey, almost black on dorsum, which has a reddish tinge when the pupa is freshly formed. Length 50 mm. ; breadth 20 mm.

Habits.—The large eggs are laid singly on the underside of a leaf ; the food-plants are apple, pear, cherry, and medlar, all of the family Rosaceæ. The larva lives on the underside of leaves and twigs, and is sluggish. When resting it holds on to a twig with the claspers and two or more pairs of prolegs, and bends the front of the body backwards, the long point of the head continuing in the line of the adjacent segments, the true legs bunched together, and the pairs of unoccupied prolegs held with the feet pressed together. When molested it strikes from side to side with its head, at each stroke making a loud hissing noise. This appears to be produced by the sudden forcing of air through the spiracles, as, if these be wetted, bubbles of air are seen to be forced through the film of water. The full-fed larva is very large and heavy, and eats a great number of leaves. Before pupating it rests for some days without feeding, then becomes suffused with

brown, leaves the food-plant and burrows into the earth. In the case of those bred by us the cell was merely a hollow on the surface of the earth, but this was probably due to the depth of earth provided not being sufficient for such large larvæ. The body becomes shorter and stouter, and besmeared plentifully with slime, which spreads to the surrounding earth. This slime appears to be secreted from the whole surface of the body, and not merely from the spinneret, and has a strong and very distinctive smell. The pupa is very stiff and, except for a few days after pupation, does not make any perceptible movement when handled. The wings of the moth take a long time to dry, and if a specimen is required for setting it should not be killed too soon after emerging. It is very sluggish during the day, but if alarmed raises its body and raises and partly opens its wings, at the same time making a hissing or squeaking note similar to that made by the Death's-head Moths. In the resting position the wings are held steeply penthouse-wise and the abdomen is bent upwards. The species is very common in the Khasi Hills, and the large caterpillar does considerable damage in orchards by defoliating the trees. Eggs were found from the end of April and larvæ up to about the end of August. The moth does not appear to be attracted by light, and we have never caught it at flowers.

Genus **RHODOPRASINA** Rothschild & Jordan. (Fig. 45).

Roths & Jord., 1903, p. 292 ; id., 1907, p. 59.

Genotype : *floralis* (Butl.).

Imago.—" ♂♀. Tongue very short and weak. Palpus very small, closely appressed to the head, this crested between the antennæ. Lower half of eye covered by a tuft of long hair-scales. Antenna of ♀ simple, cylindrical, without seriate prolonged cilia ; of ♂ peculiar, the side-grooves deep, extending all round the ventral side of the segment, the basal and apical edges of each segment produced ventrad, as shown in figure, this projection widened laterad near end, appearing spatulate in a ventral view. Tibiæ with *very few* spines at the end ; anterior tibia ending in a long naked *thorn* [no thorn in *R. callantha*] ; spurs of mid- and hind tibia very short, *one* pair to hind tibia ; pulvillus and paronychium present. Cell of hind wing broad, lower angle not acute, about 90°, R^2 from centre of cell, stalk of SC^2 and R^1 rather short. Distal margin of fore wing dentate. Scales of abdominal tergite long, no broad under-scales, apical spines weak " (Roths. & Jord., *l. c.*, 1903).

Hab. E. HIMALAYAS. Two species. For the early stages see under *R. callantha*.

Key to the Species.

Imagines.

Fore tibia with a long thorn at end	*R. floralis* (Butl.), [p. 199.
Fore tibia without thorn	*R. callantha* Jordan, [p. 200.

The larva and pupa of *floralis* have not been described in sufficient detail to enable keys to be made.

51. **Rhodoprasina floralis** (Butl.). (Fig 45 A–C, genitalia).

Ambulyx floralis, Butler, 1877 A, p. 639 (Darjeeling).
Cypa floralis, Hampson, 1892, p. 72.
Rhodoprasina floralis, Roths. & Jord., 1903, p. 293; Manson, 1907, p. 241, fig. A (larva), B (pupa), C (♂), D (♀); Seitz, 1928, p. 541, t. 62 *a*.
Triptogon florale, Butler, 1881 B, p. 13, pl. lxxxi, fig. 1 (♀).

Imago.—♂♀. Antenna pink, head and thorax green, abdomen olive. Fore wing with outer margin evenly curved, tornus produced backwards as a broad lobe; upperside green with a pink patch on base of inner margin; a dark,

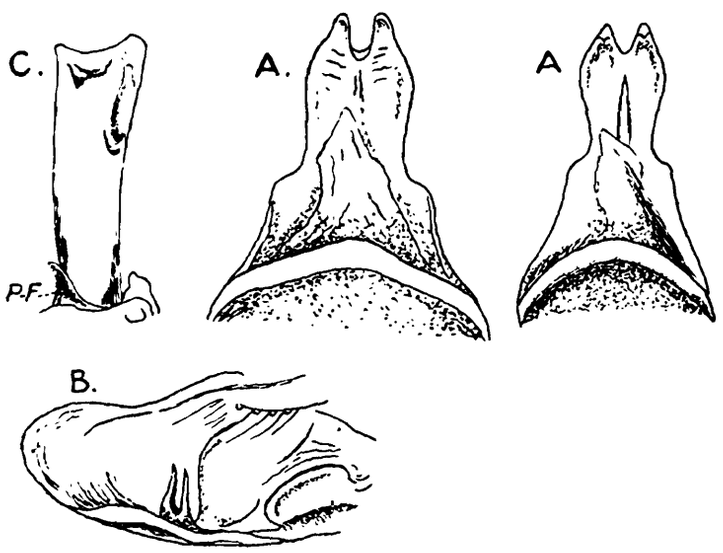


Fig. 45.—*Rhodoprasina* Roths. & Jord. Genitalia.
A, *R. floralis* (Butl.), ♂, 10th segment, ventral view; B, clasper and harpe; C, penis-sheath.

oblique, postmedian line; some brown on veins beyond cell and at outer angle; hind wing bright pink, outer margin broadly olive; cilia whitish towards anal angle. *Underside* green, fore wing with basal half except costa bright pink; an indistinct line beyond cell from costa to R^2; an oblique white and green postmedian line; an indistinct, lunulate, submarginal line; hind wing crossed by three straight oblique lines, the first subbasal. There is no such line in

any other Ambulicine species, the most proximal line of other AMBULICINÆ standing always distally of base of M^2. Fore tibia with a long thorn at apex. *Expanse* : 114 mm.

♂. Tenth tergite (fig. 45 A) broad, flat, sinuate, the two lobes pointed, their tips curved downwards, or longer and narrower, the division into two prongs indicated by an incision ; tenth sternite very broad and short, transverse, the edge incrassate, rounded. Clasper (fig. 45 B) without friction-scales, apical half narrower than basal half, also less chitinized ; harpe nearly concealed in the deep cavity of the clasper ; it ends in two strong, long, conical processes which point upwards. Penis-sheath (fig. 45 C) armed with a small subapical, denticulate, transverse ridge which is higher at the left side ; penis-funnel with a curved, pointed, flattened process on each side.

♀. Around orifice a moderately raised half-ring which is open posteriorly, the segment membranaceous in front of the half-ring and at sides, and wrinkled.

Hab. E. HIMALAYAS (Sikkim). Rare. It has been bred by Fellowes-Manson, and his description is given below :—

" *Larva* green, covered with whitish-coloured granules, a darker green stripe on dorsal surface together with a series of short orange-coloured spines from head to horn, on segments 2 to 5 is a subdorsal yellowish streak, a small white spot on segment 5 edged with black and with a disc of yellow near it, oblique lateral violet stripes edged with pale greenish-yellow below on segments 5 to 11 ; anal flap covered with orange-coloured spines, a white streak on each side of head which is green, triangular, and produced upwards ; horn long, nearly straight, rough, green with the tip black ; legs and claspers pale yellow. Length 80 mm." (Journ. Bombay Nat. Hist. Soc. xvii, 1906, p. 241).

Pupa not sufficiently described.

Habits.—Food-plant : *Acer campbelli* Hook. f. & T., family Sapindaceæ.

52. **Rhodoprasina callantha** Jord. (Figs. 46, ♂, 47, ♀; Pl. III, fig. 7, larva; Pl. X, fig. 1, larva; Pl. XIV, fig. 1, larva).

Rhodoprasina callantha, Jordan, 1929, p. 86 (Assam ; Shillong, ♂♀).

Imago.—♂♀. Antenna pink, thinner than in *R. floralis*, the segments less deeply constricted ; body and wings deeper coloured than in *floralis*, fore wing less dentate.

♂. Body olive-green, somewhat brighter below, particularly on abdomen, which has a yellowish tint. Tibiæ and tarsi more or less blackish, relieved with grey on upperside ; fore tibia without terminal claw : hind tibia with a minute ante-

apical spur and a pair of short apical ones. Fore wing olive-green, partly relieved with white, which gives it a sage-green appearance in certain lights; hind margin a little more deeply sinuate than in *R. floralis* and more convex in lower half, and here hardly at all dentate; three olive-green transverse lines nearly as in *floralis*, the first straight, shaded with white on outside, the second slightly convex, the third, which crosses R^3 half-way between cell and distal margin, more strongly convex in anterior third and here more distal than in *floralis*; between second and third lines a narrow band consisting of two rather faint olive-green lines which costally are curved basad; beyond this band a diffuse white costal spot; terminal area a little paler green, relieved with white, the proximal margin of this terminal border dentate, the grey shading projecting at R^2 to near the discal line; hind margin red at base. Hind wing carmine, costal area down

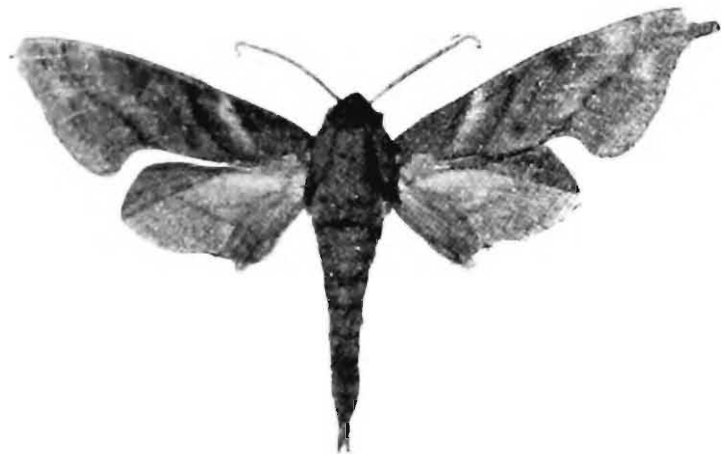


Fig. 46.—*Rhodoprasina callantha* Jord., ♂.

to R^1 and anal area dull olive-green, the former more sharply defined than in *floralis*; the red area extending to termen between R^1 and R^3, but washed with olive-green at the termen.

Underside paler green than upper, with a distinct yellowish-green tint; fore wing as in *floralis*, with a large carmine patch from near base to just beyond apex of cell; a discal line slightly S-shaped, bounded with white costally on the proximal side, the white scaling also forming a diffuse costal spot proximally of the white line, but connected with it; between this line and the termen a diffuse dark olive-green dentate line corresponding to the distal boundary of the olive-green area of the upperside. Hind wing: costal margin slightly but distinctly concave from near base, convex at three-fourths where the distal transverse line reaches the costal margin; three lines as in *floralis*, but the second line placed much nearer to the first than to the third; proximally of second

and third lines, conspicuous white edging along the lines, third line convex anteriorly, concave posteriorly (the line straight or nearly so in *floralis*); a lighter green terminal band very irregular, widest below costal angle (about 5 mm. broad at R^2), fading away at anal angle, anteriorly within this border diffuse olive-green spots close to termen.

♀. The olive-green colour of the ♂ replaced on the upperside by greenish tawny-olive, on the underside by brighter tawny-olive; in a crippled ♀ the colouring somewhat greener. The white suffusion on the upperside rather more extended than in the ♂. On the *underside* a blackish dot close to apex of fore wing corresponds to an olive-green minute dot of the ♂; centre of base of hind wing pale green; on both wings blackish and grey diffuse submarginal scaling which, on fore wing, forms an irregular triangular patch from anal angle



Fig. 47.—*Rhodoprasina callantha* Jord., ♀.

forward, and on hind wing an irregular band which is nearly interrupted before middle. *Expanse*: ♂ 90 mm., ♀ 120 mm.

♂. Tenth tergite longer than in *floralis*, particularly the narrowed apical portion, at apex a minute median incision, no division into two prongs; margin of tenth sternite slightly incurved in middle. Harpe of clasper as in *floralis*, but the neck, of which the pair of prongs are the continuation, a little shorter, the prongs slightly variable in length, either the proximal prong the longer or the distal one. Penis-sheath with a large, conical, slightly compressed horizontal tooth.

Hab. E. HIMALAYAS (Shillong, Khasi Hills, Assam). We have bred this new species in the Khasi Hills near Shillong, at an elevation of about 5,000 feet. Larvæ were fairly common, but very local in forests with heavy rainfall, during the rainy season

Egg.—Elongate-ovoid, surface smooth and shining, colour pale green.

Larva :—

1*st instar*. Head round, body cylindrical, horn long, straight; colour pale green ; head 1·5 mm. long by 1·1 mm. broad. 2*nd instar*. Head triangular, with a long tuberculate process rising from apex of each lobe, the two processes closely appressed ; body cylindrical ; horn of medium length, straight, ending in a conical point ; colour of head and body green ; a subdorsal line of multi-pointed orange tubercles from front margin of segment 2 to base of horn ; seven oblique stripes formed of orange tubercles ; the spiracle of segment 5 surrounded by an ocellus-like marking, dark green edged with crimson ; head 5 mm. long by 1·8 mm. broad. 3*rd instar*. Little change ; a transverse row of small orange tubercles on each secondary ring ; head 9·0 mm. high by 3·5 mm. broad.

4*th instar*. Head very elongate-triangular in shape, with a blunt-ended process rising from the apex of each lobe, the two processes so closely appressed that they appear to be an upward prolongation of the head. The anterior secondary ring of segment 2 of greater diameter than base of head, and the secondary rings decreasing in diameter to the middle of the segment ; from the middle of 2 the body increasing in diameter gradually to 10, then decreasing gradually. Surface of head moderately shining, set sparsely with small tubercles. Horn straight, of medium length, tapering evenly to a blunt point, held slightly above the horizontal ; anal flap and claspers heavy. Body dull ; a transverse row of small tubercles along each secondary ring ; a larger tubercle close to the dorsal line on each secondary ring, forming a subdorsal line of tubercles from front margin of segment 2 to base of horn, these tubercles increasing in size posteriorly ; seven oblique stripes formed of larger tubercles, that on 5 formed of larger tubercles than the rest ; scattered tubercles on horn, anal flap and claspers.

Coloration.—Head pale bluish-green, the tubercles white ; a narrow green stripe runs from the apex of each process to base of antenna, and from apex of each process to nape, where it joins the dorsal stripe of the body. Body : segments 2 to 4 pale bluish-green, rest of body green ; a broad dark green dorsal stripe from front margin of 2 to base of horn ; an indistinct whitish stripe on each side of the dorsal stripe, the tubercles on this pale stripe orange ; an indistinct whitish dorso-lateral stripe on 2 to 4 ; the oblique stripe on 5 pale yellow, the remaining oblique stripes whitish and less broad, the tubercles on the stripes orange. Horn pale yellow with orange tubercles ; the transverse rows of tubercles and those on anal flap and claspers orange. Spiracles white edged with black ; that on segment 5 broader than the rest,

and surrounded by an ocellus-like marking, dark green ringed with crimson. Head 9 mm. long by 3·5 mm. broad.

5th instar. Head very large and heavy, elongate-triangular in shape, vertex rounded and dorsal line shallowly impressed; the processes represented by a flat tubercle on apex of each lobe; true clypeus about one-fifth length of head, apex acute, basal angles rounded and tumid; false clypeus a very narrow strip outside true clypeus; labrum one-third length of clypeus and slightly broader than clypeus, with a ridge on each side of the dorsal line, the lateral ends tumid; ligula as long as broad, the deep triangular sinus having a narrowly rounded lobe on each side; eyes with the line joining 1 and 2 at right angles to the straight line joining 3, 4 and 6; 1 and 2 about one eye-diameter apart, 3 about two diameters from 2 and 4; 6 about three diameters from 4; 5 level with and about two diameters from 4, eyes 1 and 2 situated on a tumidity. Surface of head slightly shining, set sparsely and irregularly with minute tubercles. Body short and stout; the vertex of the head rises high above segment 2 and the segments increase in diameter gradually to 8, then decrease gradually to 12. Horn short, stout, straight, tapering gradually to a blunt point, and held horizontal or directed slightly downwards, touching or nearly touching dorsum of anal flap; anal flap and claspers tumid and heavy. Surface of body dull; a transverse row of small pointed tubercles along each secondary ring; a line of larger sharply-pointed tubercles on each side of dorsal line from front margin of segment 2 to base of horn, these tubercles gradually increasing in length to near base of horn; a line of pointed tubercles along each oblique stripe, the tubercles on the oblique stripes of 5 and 11 larger than the rest; those on the oblique stripe of 10 the smallest; the line of tubercles on each segment runs forward on to the adjoining segment, and backwards to near the dorsum of the segment behind, that on 11 running across 12 to base of horn. Large rounded tubercles on horn, anal flap and claspers; all the tubercles mentioned setiferous; the subdorsal and dorso-lateral main hairs are not distinguishable, but there are long and extremely fine supra- and subspiracular hairs, and some hairs on true legs, on shanks of prolegs and on edge of clasper-face.

Coloration.—Head: face bluish-green, cheek pale green; a whitish stripe, edged on the inner side with green, from apex of each lobe to base of antenna, separating face from cheek; a green dorsal stripe from vertex to nape; tubercles white; labrum pale green; ligula brown with a pale green stripe down each lobe; basal and middle segments of antenna greenish, end-segment greenish with brown tip; mandible pale green, tip dark brown. Body varying from pale apple-green to

pale bluish-green, segments 2 to 4 paler than the rest and the anal segments darker ; a whitish subdorsal stripe on 2 to 4 ; a broad, dark green dorsal stripe from the front margin of 2 to base of horn ; an indistinct whitish stripe on each side of the dorsal stripe, on which the subdorsal line of large tubercles is situated ; seven oblique stripes pale yellow, that on 5 broader than the rest, all edged above with dark green and bearing the oblique lines of tubercles. Horn green ; anal flap and claspers edged with yellow ; all the tubercles orange except those on edge of claspers, where they are yellow ; legs green ; prolegs pale blue, the hooklets on the feet red-brown ; venter pale bluish-green. Spiracles white edged with black, the white forming a narrow ellipse containing the central slit ; the white portion of the spiracle on segment 5 broader than that of the others, and this spiracle surrounded by an ocellus-like marking, dark green edged with crimson. Length 90 mm. ; breadth 18 mm. ; horn 6 mm. ; head 14 mm. long by 8 mm. broad.

Pupa.—Head rounded, rather small, frons nearly vertical ; segment 2 of about the same diameter as head, the segments then increasing rapidly to the middle of the body, which is stout ; tongue broad at base, reaching to about middle of wing-case, shorter than fore leg, the tip sometimes covered by the fore leg ; antenna as long as tongue, mid-leg a little longer than fore leg ; no coxal piece. Surface shining ; head irregularly corrugate ; segment 2 rugose, dorsally carinate, antenna distinctly cross-rayed ; wing-cases transversely, irregularly corrugate ; thorax transversely corrugate on dorsum, obliquely corrugate in lateral area ; abdomen pitted, especially near the front margin of each segment ; sculpturing on segment 4 consisting of a highly polished transverse weal on each side of the dorsal line, with a smaller weal behind it ; ante-spiracular ridges on 9 to 11 in the form of three parallel ridges of equal length. Spiracle of 2 indicated by a slit, bordered in front by the hind margin of 2 and behind by a weal along the front margin of 3 ; remaining spiracles oval with a very narrow rim, the surface rising from the rim to a smaller depressed oval containing the central slit. Cremaster conical, very coarsely corrugate ; a broad, corrugate keel along the venter ; the tip smooth, very shortly bent downwards, conical and bluntly pointed ; horn and clasper scars may be present or absent. Colour dark chestnut, the head, thorax, anterior part of wing-cases and cremaster darker, spiracles black with the central slit orange. Length 44–50 mm. ; breadth 15 mm.

Habits.—Eggs laid singly on the underside of a leaf of the food-plant, *Quercus fenestrata* Roxb., family Fagaceæ. The larva lies on the underside of a leaf when small and on twigs

and branches when large. In the resting position the front part of the body is raised slightly from the surface, the elongated head pointing upwards. The larva is very active; though none of those found were attacked by parasites they were very difficult to rear, dying for no apparent reason, especially in the earlier instars. They do not become suffused with brown or pink before pupation, which takes place in a cell underground. The pupæ are also delicate, and the moths which emerged were often crippled. One ♀ had no claws on the fore tarsi, and was unable to expand her wings in consequence. A ♀ exposed for three or four nights failed to attract a ♂. She was very active at night and battered her wings to pieces.

Genus **CLANIDOPSIS** Rothschild & Jordan. (Fig. 48).

Roths. & Jord., 1903, p. 294; id., 1907, p. 59; Jordan, 1911, p. 242.

Genotype: *exusta* (Butl.).

Imago.—" ♂. Tongue very short and weak. Palpus rather stout in ♂. Antenna thin, somewhat setiform, in ♂ prismatical,

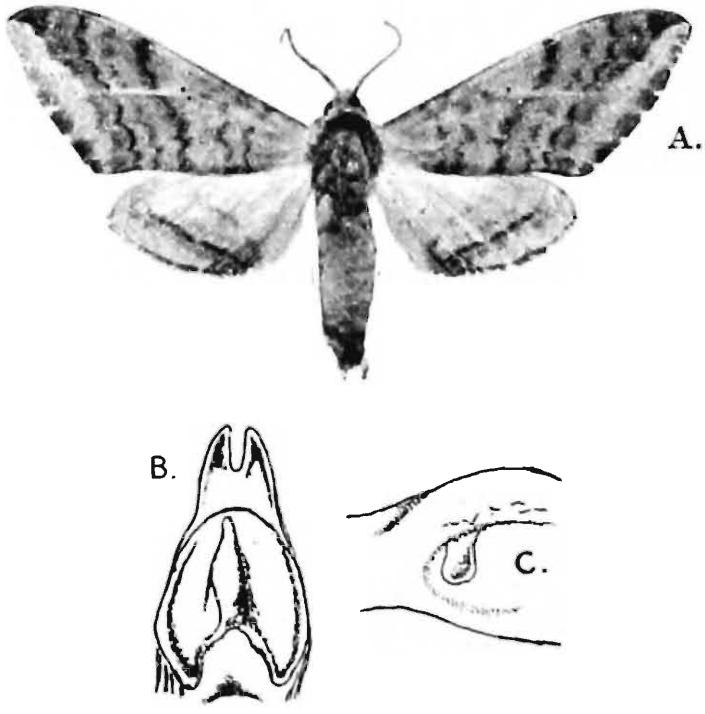


Fig. 48.—*Clanidopsis* Roths. & Jord.
A, *C. exusta* (Butl.), ♂; B, 10th segment, ventral view; C, clasper and harpe.

trans-section triangular; in ♀ cylindrical, with the seriate cilia rudimentary. Tibiæ *not* spinose; hind tibia with two pairs of spurs, long end-spur about as long as the second hind tarsal segment; pulvillus and paronychium *absent*. Abdominal tergites with spiniform under scales besides larger ones, the spines at the apical edges very numerous.

" ♂. Tenth tergite broad, sides slanting towards apex, the

latter sinuate, with the lobes obtuse ; sternite with a broad, triangular, mesial lobe, which is somewhat constricted at the base. Clasper sole-shaped, without friction-scales, apical half of internal surface hairy, the hairs pointing proximad, basal half smooth, deeper concave ; harpe represented by a rather weak mesial fold, which is longitudinal in position, ending in a flat spatulate process which curves ventrad ; there is no subdorsal basal tuberculate lobe as in *Clanis*. Penis-sheath weak, without armature.

" ♀. Not dissected " (Roths. & Jord., *l. c.* 1903).

Hab. W HIMALAYAS. One species. Early stages described under that species.

53. **Clanidopsis exusta** (Butl.). (Fig. 48 A, ♂, B, C, genitalia ; Pl. XIV, figs. 3, 4, larva).

Basiana exusta, Butler, 1875, p. 252 (Kunawur) ; id., 1877 A, p. 595, pl. xciii, fig. 4 (Kunawur).
Clanis exusta, Butler, 1883, p. 154 (Solun).
Ambulyx exusta, Hampson, 1892, p. 80.
Clanidopsis exusta, Roths. & Jord., 1903, p. 294 ; Jordan, 1911, p. 242, t. 37 *e* ; Seitz, 1928, p. 541.

Imago.—♂♀. Upperside reddish-brown ; dorsum of thorax dark brown ; fore wing with a pale, irregular, indistinct submarginal band ; hind wing with two indistinct postmedian and prominent submarginal and marginal dark lines. *Underside* of fore wing with three, and of hind wing with two, postmedian lines.

For details of genitalia see fig. 48 B, C.

The insect resembles very much the species of *Clanis* in colour and pattern. As in *Clanis phalaris*, there is no black streak behind cell on underside of fore wing nor a black basal patch on upperside of hind wing. Mid- and hind tibia are greyish-white on upperside. *Expanse* : ♂ 76–92 mm., ♀ 96 mm.

Hab. W HIMALAYAS, where eggs and larvæ were discovered and bred by Col. J. D. Campbell, D.S.O., R.E., at Mussooree, in 1932, at about 7,000 feet elevation.

Egg.—Elongate-ovoid, very large for the size of the moth ; surface smooth and dull ; colour green.

Larva :—

1*st instar*. Head round, of greater diameter than body ; body cylindrical ; horn short, stout at base, tapering gently to a bifid tip, each arm of which bears a short white bristle ; colour of head and body green, horn black with the base and ventral surface green. 2*nd instar* not recorded. 3*rd and* 4*th instars*. Head triangular, with a short process rising from the apex of each lobe ; body nearly cylindrical, of less diameter than head ; horn short, thick at base, tapering sharply to a point ; colour of head dark green with evenly-spaced

paler-coloured tubercles; of body, markings and tubercles as in the 5th instar, except that the subspiracular line of tubercles and the oblique stripes on segments 6 to 10 are formed of very small tubercles, and that the tubercles on dorsal and ventral surfaces of horn are shining black.

5th instar. Head rounded-triangular, very broad above the mouth-parts, dorsal line hardly depressed; apical processes of earlier instars reduced to a large, low, rounded tubercle on the apex of each lobe; clypeus about one-third length of head, no false clypeus; labrum as broad as clypeus, narrowing frontad; ligula not so broad as labrum. Surface of head shining, covered with unevenly-spaced, large, low, rounded tubercles, these tubercles smaller and more widely spaced on vertex and cheek. Body: segment 2 of greater diameter than head, its front margin raised into a sharp ridge; rest of body nearly cylindrical (but the venter somewhat flattened when full-fed), tapering slightly to 12. Horn short, stout at base, tapering sharply to a point, slightly down-curved. Surface of body dull; a shining, small, rounded tubercle on each side of the dorsal line on the frontal ridge of segment 2; a pair of larger and more pointed tubercles, one above the other, below this tubercle, and from the lower tubercle of the pair a continuous ridge, from which rounded tubercles rise, to the level of top of spiracle; smaller, widely spaced tubercles along the secondary rings of all the segments from 2 to 12; a larger tubercle on the subdorsal line of 3 and 4; a subspiracular line of large wart-like tubercles, each with three or four rounded points, starting from just below and behind the spiracle of 2 and meeting the front end of oblique stripe on 5 at a sharp angle; oblique stripes on 5 to 11 formed of a ridge, broken by the junctions of the secondary rings into oblong tubercles. Horn covered with shining pointed tubercles; anal flap edged with rounded tubercles.

Coloration.—Head dark bluish-green, immaculate; the tubercle on apex of each lobe yellow; labrum, ligula and basal segment of antenna pale yellow; rest of antenna chestnut; mandible pale chestnut, tip darker chestnut. Body green above the spiracular line, bluish-green below it, segments 2 to 4 darker than the rest; tubercles and ridge on front margin of 2 orange, remaining tubercles on 2 yellow; those on the remaining segments pale yellow above the spiracular line and of the body-colour below it, the four larger tubercles on the subdorsal line of 3 and 4 nearly white; subspiracular line of tubercles on 2 to 4, and oblique stripes, shining white, the oblique stripes on 5 and 11 slightly more prominent than the rest; oblique stripes edged above with dark green, and each stripe runs on to the adjoining segment in front and behind, not reaching the dorsum, the forward and backward extensions

being less prominent than the median part. Horn dark bluish-green, with paler tubercles on the dorsal and ventral surfaces, and pale yellowish-green with larger tubercles of the same colour on the sides and on the apical quarter; anal flap edged with yellow tubercles; basal segments of true legs pale yellow-green on the outer face and black on the inner, second segment brown on the outer face and black on the inner, third segment chestnut; a black patch on venter opposite the base of each leg; prolegs and claspers of the body-colour, feet pale brown. Spiracles oval, pale yellow edged narrowly with green. Length 55 mm.

Pupa.—Not recorded.

Habits.—The large oval eggs laid sometimes singly, but often in pairs, on the leaflets of a species of *Indigofera*, family Leguminosæ. The leaves of this plant close in the evening, so the eggs must be laid early, or the leaflets must be forced apart by the moth while ovipositing. The larva is sluggish and deliberate in its movements. In the resting position the front of the body is raised slightly from the surface, the face parallel with the surface. In this position the subspiracular line of tubercles forms almost a straight line with the oblique stripe on segment 5. The larva has the same habit as some of those of the genus *Clanis* of remaining in the larval state for a long period after burying itself in the ground. Some larvæ which went underground in September and October 1932 had not pupated in May 1933, and others did not pupate till June 1933. The moths emerged in about a fortnight after pupation.

Genus **AGNOSIA** Rothschild & Jordan. (Fig. 49).

Roths. & Jord., 1903, p. 294; id., 1907, p. 60.

Genotype: *orneus* (Westw.).

Imago.—"♂♀. Tongue short. Joint of palpus open. Antenna of ♂ deeply grooved, strongly compressed, cilia long; in ♀ almost cylindrical, feebly grooved, basal fasciculate cilia slightly prolonged. Tibiæ *not* spinose; fore tibia with apical thorn, shorter than first tarsal segment (thorn excluded); spurs short, *one* pair to hind tibia; pulvillus and paronychium *present*. Abdomen with spines all over the tergites, the spines denser at the apical margins. Distal margin of fore wing entire. No friction-organ in ♂" (Roths. & Jord., *l. c.* 1903).

This genus differs from *Clanis* and *Polyptychus* in the proximal pair of spurs being absent from the hind tibia and in the tibiæ not being spinose.

Hab. W. Himalayas to Ceylon. Two Indian species. For the early stages see under *A. orneus*.

Key to the Species.

Imagines.

Fore tibia terminated by a strong, curved horny spine .. .. . [p. 210. *A. orneus* (Westw.),

Fore tibia with a long, curved claw at extremity [p. 213, *A. microta* (Hampson).

The early stages of *microta* are unknown.

54. **Agnosia orneus** (Westw.). (Fig. 49 A–C, genitalia ; Pl. III, fig. 16, larva).

Sphinx orneus, Westwood, 1848, p. 13, pl. xvi, fig. 2 (Cent. India).
Ambulyx ornea, Hampson, 1892, p. 80.
Agnosia orneus, Roths. & Jord., 1903, p. 295 ; Seitz, 1928, p. 541, t. 56 *c*.
Smerinthus pudorinus, Walker, 1856, p. 253 (♂♀) (N. India).
Basiana pudorina, Butler, 1877 A, p. 596 (N. India).
Clanis pudorina, Butler, 1881 B, p. 14, pl. lxxxi, fig. 3 (♂) (Almorah).

Imago.—Head, thorax, abdomen and fore wing reddish-ochreous ; fore wing with broad greyish ante- and postmedian

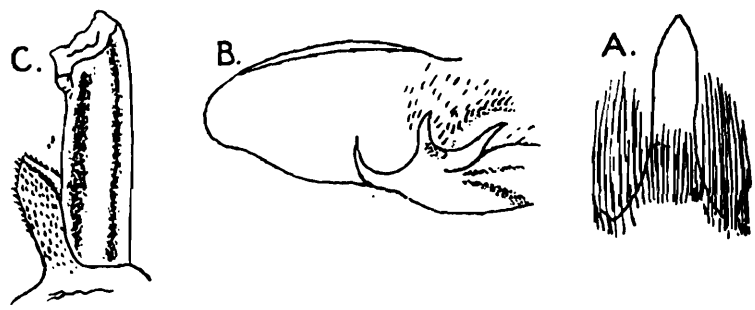


Fig. 49.—*Agnosia* Roths. & Jord. Genitalia.
A, *A. orneus* (Westw.), 10th tergite, dorsal view ; B, clasper and harpe ; C, penis-sheath.

bands ; a greyish band along inner margin with some dark strigæ on it ; a dark speck at the end of cell. Hind wing pink ; a grey patch at anal angle with some dark streaks on it. Fore tibia terminated by a strong, curved, horny spine. *Expanse*: ♂ 60–74 mm., ♀ 66–87 mm.

♂. Tenth tergite (fig. 49 A) elongate-spatulate, apex somewhat truncate ; ninth tergite with long hair-scales. Clasper sole-shaped (fig. 49 B), without friction-patch ; harpe with three hooks, nearly equidistant, one distal, the other two from the upper edge ; a convex patch of short bristles above the harpe. Penis-sheath (fig. 49 C) without armature, but the penis-funnel produced into a broad lobe which is covered with minute spines.

Hab. W Himalayas, S. India and Ceylon. We have bred the species in the W Himalayas (Siwalik Mountains) at an elevation of about 2,500 feet, in forests with heavy rainfall. Rare and local.

Larva :—

1st and 2nd instars not known. *3rd instar.* Head triangular, a short process rising from the apex of each lobe, the two processes closely appressed ; body nearly cylindrical ; horn straight, of medium length, markedly bifid. Head dark green, apical processes orange-red, a pale yellow stripe down each side of the dorsal line and a broader pale yellow stripe down each cheek. Body pale green, with a transverse row of pale yellow tubercles on each secondary ring ; seven oblique stripes formed of yellow tubercles, those on segments 5 and 11 edged above with dark purple, the rest edged above with dark green. Horn bright red, with a narrow black dorsal stripe on the basal half, and with scattered tubercles, some black and some pale yellow.

4th instar. Head triangular, with processes as in the 3rd instar, bright green, with a yellowish-green stripe down each side of the dorsal line and a broader white stripe down each cheek ; the processes green tipped with yellow. Body bright yellowish-green with yellow tubercles, those on the front margin of segment 2 larger and of a darker yellow than the rest ; a line of large rounded tubercles along the dorsum from 2 to base of horn, formed of single tubercles on 3 to 11, and a pair of tubercles placed transversely on 2 and 12 ; oblique stripes as before ; horn straight, of medium length, slightly bifid, orange or dull red colour, with scattered black, orange and yellow tubercles ; legs red, prolegs and claspers pink, venter bluish-green ; spiracles black ringed with dirty yellow.

5th instar. Head very large, rounded-triangular in shape ; the apical process reduced to a large rounded tubercle, the lobes separated dorsally by a deep, triangular sinus. Surface of head smooth and moderately shining, with small, scattered tubercles on the cheeks. Body nearly cylindrical, thinning very slightly to segment 2, which is of greater diameter than the head. Horn of medium length, curved slightly downwards, tapering evenly to a sharp point. Surface of body dull, with a transverse row of large tubercles on each secondary ring, each large tubercle surrounded by a group of three or four smaller ones, all the tubercles hemispherical, the tubercles on the front half of segment 2 larger than the rest ; a line of large tubercles on the dorsum from 2 to base of horn, formed of a single line of large tubercles, each with three or four blunt points on 3 to 11, and of pairs of tubercles placed transversely on 2 and 12 ; the oblique stripe on 6, and the lateral and dorsal portion of the oblique stripes on 5 and 7 to 11, formed of large rounded tubercles. Horn with scattered, large, pointed tubercles ; anal flap and claspers with scattered rounded tubercles.

[6] Coloration.—Face brownish-green dotted with yellow; a broad, white, subdorsal stripe and a broader white stripe separating the face from the cheek; behind this stripe the colour dark green with paler green spots and yellow tubercles; the tubercles to which the processes on the vertex are reduced dark yellow. Body bright apple-green, the tubercles yellow, those on the front half of segment 2 of a darker yellow than the rest; the dorsal line of tubercles green with yellow points; the oblique stripes broad, very sharply defined, each covering two segments, that on 5 pale mauve edged above and below by bright red-purple in the lateral area, changing abruptly to yellow tubercles in the dorso-lateral area; that on 6 formed entirely of yellow tubercles; those on 7 to 10 similar to that on 5 without the edging of red-purple below; that on 11 and 12 pale mauve, edged above and below with red-purple in the lateral area, green with yellow tubercles, edged above with red-purple in the dorso-lateral area, and running across 12 to base of horn. Horn red-purple, the bases of the tubercles red and the tips yellow; legs pink, prolegs and claspers pink or green, anal flap edged broadly with yellow. Spiracles oval, mauve, with the central slit black. Length 80 mm.

Pupa.—Similar in shape to those of the genus *Marumba*, the head rather small, with frontal ridges as in *Marumba*, these ridges converging slightly towards the dorsum, the front ends joined by a narrow transverse ridge; tongue reaching to about the middle of the wing-case, fore leg considerably longer, antenna slightly shorter and mid-leg slightly longer than fore leg. Surface shining, the head rugose; segment 2 superficially rugose; tongue, antenna, wing- and leg-cases all very superficially cross-rayed, rest of thorax more rugose; segment 4 with sculpturing consisting of a raised, shining, transverse, median weal, bent first forwards and then backwards in an S-shaped curve; the front margins of 6 to 12 closely and prominently beaded with shining, quadrate beads, smaller on the venter; rest of abdomen nearly smooth. Spiracle of 2 with the slit bordered by the slightly raised hind margin of 2 and front margin of 3; remaining spiracles oval, depressed, with a narrow raised rim, the central slit with raised edges. Cremaster conical, with a short, widely bifid tip, distal half of dorsal surface and ventral surface rugose, ventral surface with a longitudinal channel. Colour shining chestnut, the wing-cases paler, and the frontal ridges, beading and cremaster black. Length 29 mm.; breadth 9 mm.

Habits.—Food-plant: *Grewia asiatica*, family Tiliaceæ. The larvæ are sluggish and resemble in habits those of the genus *Marumba*. They do not eat the midribs or the larger veins of the leaves, and their presence can be detected by searching near leaves so treated. The pupa is formed in a cell underground.

55. **Agnosia microta** (Hamps.). (Fig. 50, ♂).

Marumba microta, Hampson, 1907, p. 327 (Madras: Godavery Dist.); id., 1911, p. 86, pl. F, fig. 11 (♂).
Agnosia microta, Jordan, 1926, p. 380; Seitz, 1928, p. 541.

Imago.—♂. Head and thorax red-brown, the head rather paler except palpi; antenna whitish; abdomen red-brown. Fore wing grey-brown suffused with purplish-rufous and with slight dark irroration; a black and rufous subbasal spot on SM^2; an oblique brown median line, diffuse on outer side; postmedian area somewhat greyer; an indistinct slightly curved subterminal line with two conjoined red-brown spots on it at inner margin; a small dark brown spot on termen below apex, defined by a grey lunule on inner side, and with a very indistinct triangular brown shade below it from termen to the subterminal line; cilia dark brown. Hind wing purplish red-brown with indistinct darker shade on termen near tornus; cilia dark brown with slight whitish tips towards



Fig. 50.—*Agnosia microta* (Hamps.), ♂.

tornus. *Underside* rather redder, with indistinct oblique median line and curved postmedian line. Fore tibia with a long curved claw at tip. *Expanse*: ♂ 37–44 mm.

The ♀ and early stages unknown.

Hab. S. India (Godavery District, Madras). Only one ♂ known.

Genus **PARUM** Rothschild & Jordan. (Fig. 51).

Roths. & Jord., 1903, p. 295; id., 1907, p. 60, t. 8, fig. 9; Jordan, 1911, p. 242.

Genotype: *colligata* (Walk.).

Imago.—" ♂♀. Tongue short and weak, with mesial fringe. Pilifer with bristles. Transverse carina of labrum long. Palpus larger in ♂ than in ♀, second segment smoothly scaled, joint not distinctly open. Tibiæ *without* spines; spurs very short, two or one pair to hind tibia; pulvillus and paronychium present, the latter with two small lobes at each side. SC^2 and R^1 of hind wing not stalked, or the stalk very short; R^2 in or a little below centre of cell, D^2 straight or very slightly curved; distal margin of wings entire; apex of fore wing obtuse, almost rounded-truncate. Distal segments of antenna

not much higher than long; seriate cilia of ♀ prolonged. No friction-scales on clasper" (Roths. & Jord., *l. c.* 1903).

Hab. E. HIMALAYAS to China and Japan. Two Indian species, of which the early stages of one are unknown.

Key to Species.

1. Hind wing below without a black streak on the disc . . . . . *porphyria* (Butler), [p. 214.
2. Hind wing below with a black streak on the disc . . . . . *colligata* (Walker), [p. 215.

56. **Parum porphyria** (Butl.). (Fig. 51 A, ♂, B–E, genitalia).

Daphnusa porphyria, Butler, 1877 A, p. 640 (Darjeeling); Hampson, 1892, p. 73, fig. 44 (♂); Dudgeon, 1898, p. 407 (Sikkim, 1,800 feet).

Parum porphyria, Roths. & Jord., 1903, p. 297; Seitz, 1928, p. 541, t. 62 *c*.

Imago.—♂♀. Brown; fore wing variegated with ferruginous and olive-brown; a dark patch below end of cell; another

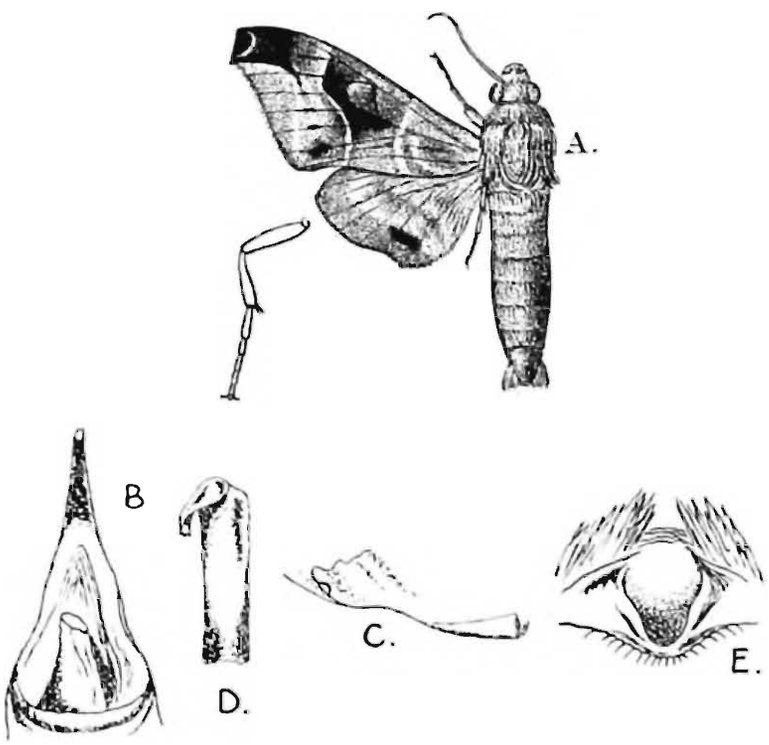


Fig. 51.—*Parum* Roths. & Jord.
A, *P. porphyria* (Butl.), ♂; B, 10th segment, ventral view; C, harpe; D, penis-sheath; E, ♀, vaginal plate.

at apex enclosed by a white lunule, with a dark streak below it; a spot near outer angle. Hind wing brown, with a dark spot above the lobe at anal angle. *Underside* with a submarginal pale line to both wings; apex of fore wing dark, with the apical lunule as above. Head with high broad crest of scales. Antenna thinner than in *colligata*, palpus larger. Pilifer pro-

longed, resembling a tooth-brush. Retinaculum and frenulum normal. Proximal pair of spurs absent from hind tibia. Abdominal tergites with the under scales mostly long spiniform but very weak, spines at the edges also prolonged, not strong, scarcely different from pointed scales. *Expanse*: 60 mm.

♂. Tenth abdominal tergite (fig. 51 B) long, slender, triangular, gradually narrowing to a point and curving downwards; sternite represented by a low transverse ridge, which is feebly sinuate mesially. Clasper sole-shaped, rounded apically, hairy on the inner surface; harpe pointed distad, slightly curved mesiad, surface somewhat concave, edge irregularly sinuate (fig. 51 C). Penis-sheath (fig. 51 D) with the apical edge bent proximad and produced into a denticulate lobe on one side.

♀. Eighth abdominal tergite mesially less strongly chitinized than at the sides. Vaginal plate (fig. 51 E) without special armature, lateral edges of orifice somewhat raised.

Hab. E. HIMALAYAS (Sikkim). Very rare, and the early stages unknown.

57 **Parum colligata** (Walk.). (Fig. 52, ♂).

Daphnusa colligata, Walker, 1856, p. 238 (N. China).
Parum colligata, Roths. & Jord., 1903, p. 296; Jordan, 1911, p. 242, t. 38 *b*; Seitz, 1928, p. 541.
Metagastes bieti, Oberthür, 1886, p. 29, pl. i, fig. 2 (Ta-tsien-lu).

♂♀. Upperside. Fore wing ground-colour grey tinged with brown, and with olive-brown and black markings. The



Fig. 52.—*Parum colligata* (Walk.), ♂.

outer border from SC^5 to tornus broad and much paler, limited by a curved grey-white submarginal line. At the apex between SC^5 and SC^4 a rounded blackish spot defined on the inside by grey-white as in *porphyria*, but much more distinct. A dark brown or blackish longitudinal streak from the submarginal line at R^1, passing through the lower angle of cell along its lower edge to about the middle, where

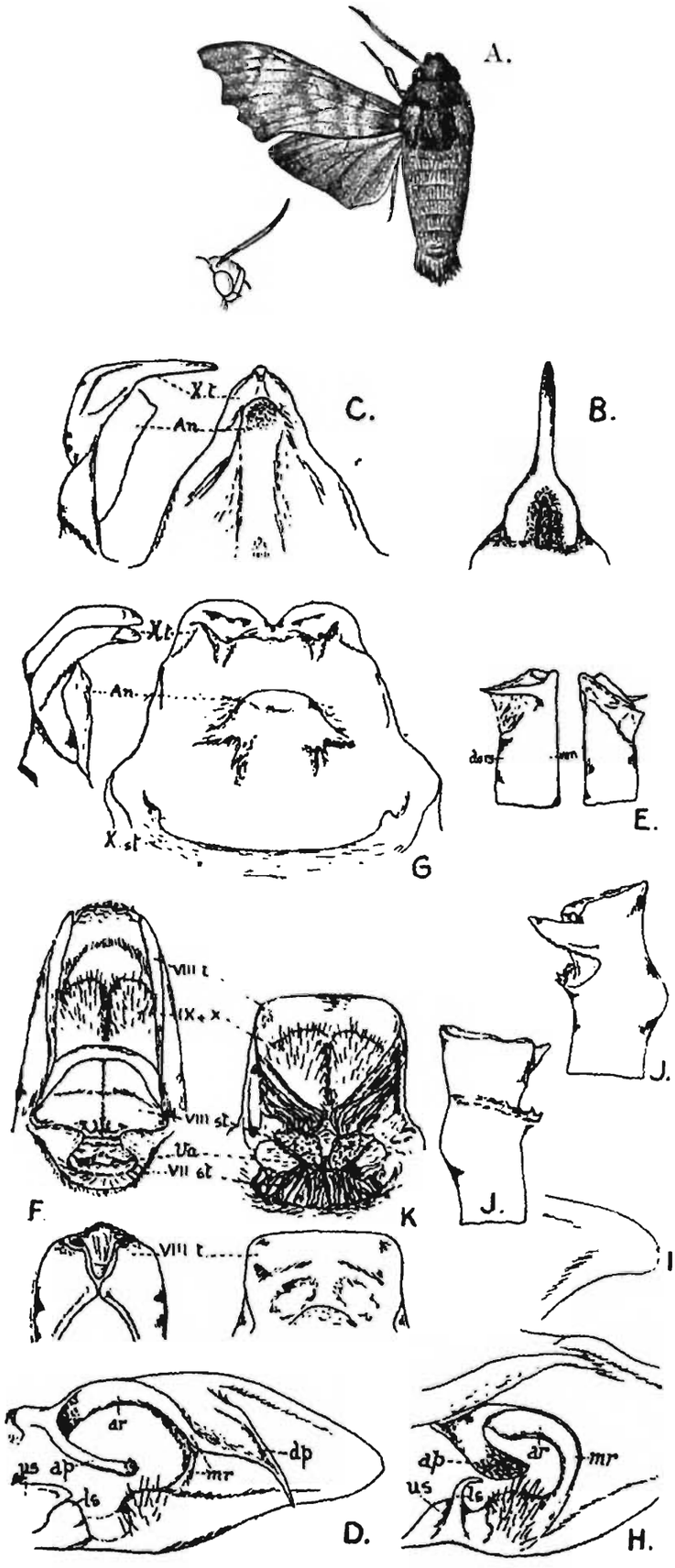


Fig. 53.—*Cypa* Walk.

[For explanation of figures see opposite page.]

it joins the discal band. Discal band from costa to inner margin, slightly curved, grey, narrower between lower edge of cell and costa. A post-discal olive-brown oblique band, curved inwards at the costa. A conspicuous but small silvery-white spot at lower angle of cell. Costal margin grey, more or less suffused brown.

Hind wing smoky-brown. A darker submarginal line at R^2 and R^3, about mid-way between cell and margin, sometimes indistinct. A curved heavy black anal bar from anal angle to M^1. *Underside* similar to upperside. Fore wing with the longitudinal streak black and well marked. Hind wing with a similar streak between veins R^1 and R^2, not entering the cell. A pale outer border as on fore wing and a narrow post-discal grey-white band divided by an indistinct blackish line.

Head, thorax, antenna and abdomen pale brown ; abdomen darker below, antenna grey or greyish-white above. *Expanse* : ♂ 78–90 mm., ♀ 90 mm.

Structure.—" Pilifer short. Retinaculum occasionally vestigial, frenulum shortened. Clasper sole-shaped, rounded apically, hairy on the inner surface ; distal part of harpe forming a strongly chitinized ventral ridge, which is longitudinal, slightly bent dorsad, granulose, with the ventral surface slightly concave and the dorsal side convex. Apical edge of penis-sheath bent proximad at the right and left side " (Roths. & Jord., 1903, p. 296).

Hab. Central, Eastern and Northern China ; Japan. Recently discovered in the Shan States, where the larva was found as a pest in plantations of a species of mulberry (see p. 35).

Genus **CYPA** Walker. (Fig. 53).

Walker (non Latr., 1802), 1864, p. 41 ; Roths. & Jord., 1903, p. 297 ; id., 1907, p. 60.

Genotype : *decolor* Walk.

Imago.—" ♂♀. Tongue very short and weak, fringe long, upper surface with tubercles. Pilifer short, with a large brush of scales ; genal process short, broad. Head small, crested ; eye small, lashed. Palpus closely appressed to

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A, *C. decolor decolor* (Walk.); B, 10th tergite, dorsal view; C, 10th tergite, lateral and ventral view ; D, clasper and harpe ; E, penis-sheath ; F, ♀ genitalia. G, *C. pallens enodis* Jord., 10th tergite, lateral and ventral views ; H, clasper and harpe ; I, end of clasper ; J, penis-sheath ; K, ♀, genitalia. x. *t*, anal tergite ; x. *st*, anal sternite ; *An*, anus ; *ap*, proximal process ; *ar*, arch ; *dp*, dorsal process ; *ls*, tubercle ; *mr*, anterior ridge ; *us*, tubercle ; *va*, vaginal orifice.

frons, not projecting, small. Antenna with long end-segment, which bears several bristles at and near tip, three preceding segments small, short, rhombiform in side-view; in ♂ strongly compressed, cilia long; in ♀ cylindrical, cilia not prolonged. Abdominal tergites with weak spines at the edges. Tibiæ *not* spinose; spurs minute (black), two pairs to hind tibia; pulvillus and paronychium present, this with two slender lobes at each side. Distal margin of fore wing irregularly lobed or at least not even; R^2 of hind wing below centre of cell; SC^2 and R^1 on a long stalk; D^2 and D^3 straight, upper angle of cell 90°, lower angle obtuse; costal margin of hind wing straight. Clasper without friction-scales" (Roths. & Jord., 1903, p. 297).

Hab. INDIA and CEYLON. Four species and subspecies. Early stages described under *C. p. enodis*.

Key to the Species.

1.	Distal margin of fore wing entire .	2.
	Distal margin of fore wing dentate ..	3. [p. 222.
2.	Second segment of palpus short	*C. ferruginea* Walker,
3.	Second segment of palpus long	*C. d. decolor* (Walker),
	Second segment of palpus short ...	4. [p. 218.
4.	Upperside clay-colour to cinnamon, with drab or fawn bloom ..	*C. p. enodis* Jordan, [p. 220.
	Larger than *C. p. enodis*, paler above and below	*C. p. pallens* Jordan, [p. 219.

The larva and pupa are unknown except in the case of *C. p. enodis*.

58. **Cypa decolor decolor** (Walk.). (Fig. 53 A, ♂, B–F, genitalia).

Smerinthus decolor, Walker, 1856, p. 255 (Hindostan).
Mimas decolor, Butler, 1877 A, p. 583 (Darjeeling).
Cypa decolor, Moore, 1886, p. 97 (Ponsokai, Siam); Swinhoe, 1890, p. 164 (Tavoy); Dudgeon, 1898, p. 407 (Sikkim, 4,500 feet); Hampson, 1892, p. 71, fig. 43 (♂).
Cypa decolor decolor, Roths. & Jord., 1903, p. 298; Manson, 1921, p. 747; Seitz, 1928, p. 542, t. 62 *c*; Jordan, 1931, p. 236, figs. 1, 2, 7, 10, 11, 16, 17 (genit.).
Cypa incongruens, Butler, 1881 B, p. 12, pl. lxxx, figs. 8, 9.

Imago.—♂♀. Upperside brown; in outer half of fore wing clayish or ochraceous-clay tint between dark shadowy bands. On fore wing *underside* this pale tint, often conspicuous in ♂, almost forming two blotches between R^1 and M^1; termen shaded with blackish-brown; terminal area as a whole not contrasting strongly with proximal two-thirds of wing, particularly in ♀. Distal margin of fore wing irregular, prominently lobed at R^2; palpus about as long as the distance from its apex to base of antenna, segments 2 and 3 being about twice as long as broad (inclusive of scaling). *Expanse*: ♂ 50–60 mm., ♀ 64 mm.

" ♂. Anal tergite (x. *t*) not divided, ending with a simple, long, narrow, subcylindrical process which is curved downwards (fig. 53 B, C), the narrow portion being almost straight in lateral aspect (fig. 53 C). No anal sternite. Clasper (fig. 53 D) ventrally with two rather strongly swollen tubercles, somewhat like condyli (*us* and *ls*); from dorsal margin a long subbasal process (*ap*) projects into the cavity of clasper, the process being slender, slightly claviform and a little curved, bearing at apex a variable number of teeth; this process arises from a dorsal arch (*ar*) which distally divides into an anterior low ridge (*mr*) and a posterior flat process, which widens dorsally and gradually narrows ventrally into a long sharp beak that sometimes reaches to the ventral margin of clasper; this process (*dp*) absent in the allied known species. Penis-sheath (fig. 53 E) close to apex, with a long, transversely directed, smooth process which gradually narrows to a sharp point; no armature on the other side.

" ♀. In front of the sexual orifice (fig. 53 F, *va*) a low ridge which is somewhat wrinkled; behind the orifice a large smooth plate (VIII. *st*) which has a smooth distal margin, bears an indication of an impressed median longitudinal line, and has proximally a slight tubercle at each side of middle line. Eighth tergite (VIII. *t*) medianly divided, a large sub-triangular cavity being formed which narrows proximally; margin of segment, on apical side of cavity, strongly folded or smooth, the folding being probably due to shrinkage. The contrast between this tergite and the simple one of *C. pallens* is very remarkable " (Roths. & Jord., 1931).

Hab. E. HIMALAYAS (Sikkim). Early stages unknown.

59 *a*. **Cypa pallens pallens** Jord. (Fig. 54, holotype ♀).

Cypa decolor pallens, Jordan, 1926, p. 380 (Masuri, ♀); Seitz, 1928, p. 542.

Cypa pallens pallens Jordan, 1931, pp. 238–241, figs. 5, 6, 9, 14, 15, 18, 19 (genit.).

Imago.—Larger than *C. p. enodis*; paler above and below. Ante-vaginal ridge and lateral submembranaceous portion of



Fig. 54.—*Cypa pallens pallens* Jord., holotype ♀.

segment 8 less wrinkled, and the two sclerites of eighth sternite larger, smooth, more glossy.

♀. Length of fore wing 34 mm., width 13·5 mm.

Hab. W HIMALAYAS (Mussooree). Very rare, and early stages unknown.

59*b*. **Cypa pallens enodis** Jord. (Fig. 53 G–K, genitalia; fig. 55, holotype ♂; Pl. III, fig. 6, larva; Pl. XIV, fig. 6, larva).

Cypa pallens enodis, Jordan, 1931, p. 240 (Assam; Shillong).

Imago.—♂♀. Upperside clay-colour to cinnamon, with a strong drab or fawn bloom in fresh specimens; hind wing tawny. *Underside*, basal two-thirds of fore wing (except margins) tawny, terminal area greyish, contrasting with the tawny area; hind wing clay-colour, with a long and prominent tawny smear along abdominal fold. Distal margin of fore wing irregular; second segment of palpus very short. Length of fore wing 30 mm. or less; width 12 mm. or less.

♂. Anal tergite (x. *t*) divided as in *C. uniformis*, but broader, the two apical processes much broader and shorter and obtuse;



Fig. 55.—*Cypa pallens enodis* Jord., holotype ♂.

the ridge representing the anal sternite (x. *st*) with a small tuberculiform projection on each side far away from middle, not near middle as in *C. uniformis* (fig. 53 G). Clasper (fig. 53 H) narrower at apex than in the previous species; above the armature a longitudinal setiferous fold as in *C. uniformis*; proximal process (*ap*) broad, convex on proximal side, concave on distal side, somewhat rugulose in apical half, without teeth; arch (*ar*) ventrally dilated near base; process of *C. decolor* absent. Penis-sheath (fig. 53 J) wider than in both previous species; on left side a triangular subapical process, sharply pointed, with the frontal margin dentate from close to base to apex; the process recalling that of *C. uniformis*, but more apical and different in shape and direction; on frontal side of process the sheath concave, as it is in the other species, but in contradistinction to them there is at the proximal side of this depression a dentate, transverse ridge which extends across the right side of the sheath, probably being homologous to the longitudinal ridge of *C. uniformis*.

♀. Ante-vaginal ridge of seventh sternite strongly wrinkled (fig. 53 K, VII. *st*), higher than in *C. decolor*. The smooth post-

vaginal plate of *C. decolor* replaced by a much smaller plate which is divided by a deep median channel into two sclerites (VIII. *st*) which are either smooth or more or less rugulose; behind these sclerites the membranaceous portion of the segment folded, the folds more or less parallel with the oblique posterior margin of the segment. Eighth tergite transverse, smooth, truncate, with the angles rounded off, without apical cavity or impression.

Hab. E. HIMALAYAS (Khasi Hills; Cachar; Sikkim). We have bred the subspecies in the Khasi Hills, where larvæ occur somewhat rarely in the rainy season, at an elevation of from 4,000 to 5,000 feet.

Larva:—

1st to 3rd instars not seen. *4th instar*. Head triangular, with a short process rising from apex of each lobe; body increasing in diameter from segment 2 to 7, then cylindrical; horn rather short, straight; colour of head pale green dotted with white tubercles, processes yellow; a pale yellow cheek-stripe; body pale green, with a transverse row of small white tubercles along each secondary ring; a broad dorsal stripe from segment 2 to base of horn dark green edged narrowly with white; seven narrow white oblique stripes; horn green with white tubercles.

5th instar. Head elongate-triangular, 7 mm. long by 4·5 mm. broad, with a short process rising from the apex of each lobe, the processes closely appressed to near tips; clypeus about one-third length of head, apex acute, basal angles rounded; false clypeus very narrow; labrum about one-half length of clypeus, slightly broader than clypeus, divided into five squares by longitudinal channels; ligula slightly longer and narrower than labrum, kidney-shaped, lobes rounded, with a channel down each lobe, these channels meeting above apex of sinus; eyes 1 to 6 in a slight curve, 1, 2 and 3 about one eye-diameter apart, 3, 4 and 6 about two diameters apart; 5 forming an equilateral triangle with 4 and 6; 4 larger than the rest. Face shining and superficially transversely wrinkled, cheek dull, the whole surface of head, including processes, covered sparsely with small, round, smooth, setiferous tubercles. Body: segment 2 much lower than head, segments increasing in diameter from 2 to 7, rest of body nearly cylindrical. Horn of medium length, gently down-curved, stout at base and tapering evenly to a blunt, bifid tip. Surface of body dull: a transverse row of very small tubercles along each secondary ring. Horn covered with larger tubercles; anal flap covered with small tubercles and one large subdorsal tubercle.

Coloration.—Face bluish-green, cheek pale green, tubercles white, processes yellow; a narrow whitish stripe, edged inside with dark green, from the base of each process to base of

antenna, separating face from cheek; a broad dark green dorsal stripe from vertex to nape. Body: segments 2 to 4 pale green, rest of body darker green, tubercles white; a broad dorsal stripe, dark green on 2 to 6, then greenish-brown to base of horn, edged below by a diffused white stripe and broken at segment margins; seven narrow oblique stripes, white or pale yellow, edged narrowly above by reddish-brown, the stripe on 11 more prominent than the rest and running back to base of horn. Horn green with brown tubercles; legs green, end-segment reddish, prolegs and claspers green, anal flap green, the small tubercles brown and the large subdorsal one green. Spiracles oval, with the central slit whitish, edged on each side with greenish-brown, the whole enclosed in a larger oval of pale green. Length 60 mm.; breadth 9 mm.; horn 7 mm.

Pupa.—Slender in build; head very small, the eye very low and near front of pupa; tongue shorter than fore leg and antenna. Surface smooth and shining. Cremaster channelled dorsally and ventrally; two small dorso-lateral teeth, one near base, one near tip. Colour brown; head, thorax and wing-cases darker brown. Length 30 mm.

Habits.—Food-plant: *Betula alnoides* Ham. (birch), family Betulaceæ. The larva raises the head and front segments when resting or alarmed, and strikes sideways with the head. Pupation takes place underground. The moth sometimes emerges as soon as two weeks after pupation.

60. **Cypa ferruginea** Walk. (Fig. 56, ♀ holotype).

Cypa ferruginea, Walker, 1864, p. 42 (Ceylon); Moore, 1882, p. 8, pl. lxxix, fig. 3 (♀); Hampson, 1892, p. 72; Jordan, 1931, p. 237.

Cypa decolor ferruginea, Roths. & Jord., 1903, p. 298; Seitz, 1928, p. 542.

Imago.—" The ♂ not known, one ♀ in the British Museum. In this specimen the distal margin of fore wing somewhat convex



Fig. 56.—*Cypa ferruginea* Walk., ♀ holotype.

in centre, but otherwise with hardly a trace of dentition. Palpus small as in *C. pallens*. Antenna more distinctly incrassate behind middle, slightly constricted at the joints,

the segments being somewhat rounded in a ventral aspect" (Jordan, 1931). *Expanse* : 60 mm.

The status of this Hawk-Moth is doubtful.

Hab. CEYLON Early stages unknown.

Genus **SMERINTHULUS** Huwe. (Fig. 57).

Huwe, 1895, p. 370 ; Roths. & Jord., 1903, p. 299 ; id., 1907, p. 61.

Genotype : *quadripunctatus* Huwe.

Imago.—" ♂♀. Differs from *Cypa* in the following characters : tongue not tuberculate near base. Pilifer vestigial, with few scales or bristles, or naked. End-segment of antenna

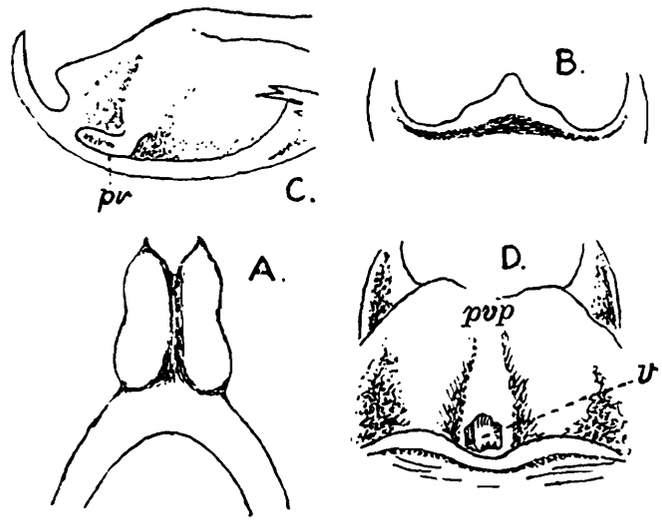


Fig. 57.—*Smerinthulus* Huwe. Genitalia.

A, *S. perversa*, 10th tergite, dorsal view ; B, 10th sternite, ventral view ; C, clasper and harpe (*pv*, process of inner sheath of clasper) ; D, ♀, vaginal plate (*pvp*, post-vaginal plate).

short, triangular in side-view, penultimate segment longer than in *Cypa*, antennæ of ♀ with prolonged cilia ; eighth tergite of ♂ with a brush of prolonged scales at the sides and at end, appearing trilobate. Penis-sheath without armature. SC^2 and R^1 of hindwing stalked or not" (Roths. & Jord., 1903, p. 299).

Hab. China, INDIA and Malaya. One Indian species, of which the early stages are unknown.

61. **Smerinthulus perversa** (Roths.). (Fig. 57 A–D, genitalia).

Cypa perversa, Rothschild, 1894 A, p. 70, pl. vii, fig. 6 (partim ; ♀, Sikkim ; non ♂) ; id., 1895, p. 28 (♂, Khasi Hills) ; id., 1896, pl. xiii, fig. 5 (♂).

Smerinthulus perversa, Roths. & Jord., 1903, p. 300 ; Seitz, 1928, p. 542, t. 62 *c*.

Imago.—♂♀. Larger and more brightly coloured than *Cypa decolor* ; anal angle of fore wing more pointed than in *C. decolor*.

Hind wing cinnamon-red with a blackish submarginal band. Abdomen with black stigma-dots. *Expanse*: ♂ 64 mm., ♀ 89·25 mm.

♂. Tenth tergite (fig. 57 A) broad, constricted at base and in middle, above longitudinally impressed mesially, sides convex, apex divided into two short pointed lobes; sternite (fig. 57 B) small, obtusely triangular, sides obliquely and shallowly sinuate. Clasper (fig. 57 C) apically sinuate, the ventral lobe produced into a long, pointed, strongly chitinized process which curves upwards; ventral margin of clasper incrassate, basally armed with two sharp, long teeth, beneath which there is another small tooth; the postmedian part of inner sheath of clasper convex, raised into a broad fold ventrally, which ends in a boot-shaped obtuse process. Penis-sheath without armature.

♀. Vaginal plate (fig. 57 D) large, distal margin sinuate, with the angles rounded; orifice proximal, a low ridge in front of it. Eighth tergite half-moon-shaped, the apical margin being strongly rounded.

Hab. E. HIMALAYAS (Khasi Hills; Sikkim); BURMA (Maymyo). The species is very rare and the early stages unknown.

Genus **DEGMAPTERA** Hampson. (Fig. 58).

Hampson, 1896, p. 452; Roths. & Jord., 1903, p. 302; id., 1907, p. 61.

Genotype: *mirabilis* (Roths.).

Imago.—" ♂♀. Differs from *Smerinthulus* in the hind wing being produced frontad near apex into a rounded lobe, the costal margin more or less sinuate proximally of this lobe, vein C almost following the curve of the lobe, not straight as in *Cypa* and *Smerinthulus*, stalk SC^2–R^1 shorter than D^2. Pilifer vestigial, naked " (Roths. & Jord., 1903, p. 302).

Hab. E. HIMALAYAS and Borneo. One Indian species. Early stages described under that species.

62. **Degmaptera mirabilis** (Roths.). (Fig. 58 A–C, genitalia; Pl. III, fig. 14, larva; Pl. XIV, fig. 2, larva; Pl. VII, fig. 9, pupa; Pl. XII, fig. 7, ♀).

Cypa mirabilis, Rothschild, 1894 A, pp. 542, 664 (♀, Khasi Hills).
Degmaptera mirabilis, Hampson, 1896, p. 452, fig. 240 (♂); Roths. & Jord., 1903, p. 303; Seitz, 1928, p. 543, t. 62 *c*; Scott, 1931, pl. iii, fig. 4 (larva).

Imago.—♂♀. Deep ferruginous-red, variegated with ochreous and orange-yellow. Abdomen with a dorsal central row of pale golden dots. Fore wing with sinuous subbasal and antemedian lines with yellow between them; a peculiar

fawn-coloured band just beyond cell, stopping at M^2 or SM^2; an oblique crenulate postmedian line ; traces of an irregularly crenulate submarginal line ; the area at apex and between lower angle of cell and outer angle variegated with ochreous and yellow and irrorated with ferruginous ; a conspicuous black stigma with a minute transparent centre. Hind wing deep reddish-brown, with traces of red median and submarginal bands. *Underside* variegated with ochreous and irrorated with ferruginous ; both wings with distinct postmedian line. The distal margin of both fore and hind wing of ♂ much more strongly sinuate before hind angle than in ♀. *Expanse* : ♂ 44–48 mm., ♀ 56–68 mm.

♂. Tenth tergite (fig. 58 A) very broad, broadly sinuate, the two lobes produced into sharp hooks which curve ventrad ; no sternite, but at each side of the anal cone a hairy lump,

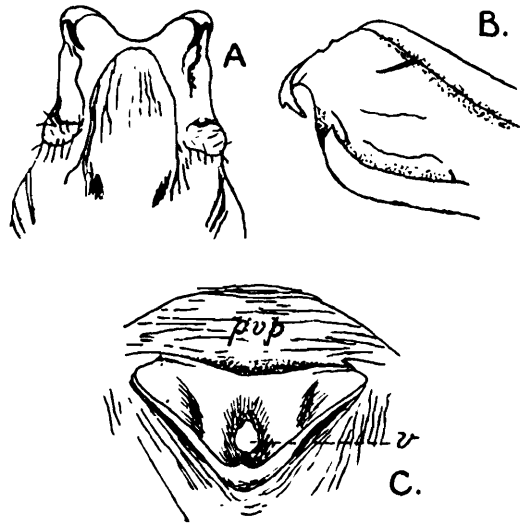


Fig. 58.—*Degmaptera* Hamps. Genitalia.

A, *D. mirabilis* (Roths.), 10th segment, ventral view; B, clasper and harpe ; C, ♀, vaginal plate (*pvp*, post-vaginal plate; *v*, vaginal orifice).

reminding one of a similar structure found in many other AMBULICINÆ (see *Marumba*). Clasper (fig. 58 B) widest before end, dorsal margin incrassate, bent inwards ; from beneath it projects a long sharp spine ; apex of clasper produced into a hook which bears a tooth ; two small teeth at dorsal apical edge of clasper ; harpe a ventral elongate piece of chitin ; curved upwards at end, resembling the runner of a sledge. Penis-sheath without armature.

♀. Vaginal plate (fig. 58 C) with the orifice proximal, situated upon a triangular smoothly chitinized plate, the proximal and lateral edges of which are turned upwards ; post-vaginal part of plate short, broadly rounded, weak, transversely wrinkled.

Hab. E. HIMALAYAS (Khasi Hills), where we obtained eggs and larvæ in forests with heavy rainfall at an elevation of about 5,000 feet. Larvæ were plentiful locally in the rainy season.

Egg.—Elongate-oval in shape, surface smooth and moderately shining, colour pale bluish-green when first laid, reddish-brown markings developing later. These markings take the form of a narrow reddish-brown stripe running round the lower portion of the egg roughly parallel with the line of attachment to the leaf, and broken at each end of the egg; a broad irregular stripe, of a paler reddish-brown, across the top, parallel with the long axis but slightly on one side of the centre line; a short, broad stripe, of the same colour as and parallel with, the longer stripe, on the opposite side of the centre line.

Larva :—

1*st instar*. Head round, very large, pale ochreous in colour; body cylindrical, rather long for its diameter, the anterior half orange-red, posterior half ochreous; horn of medium length, curved downwards, black, tip bifid, with a bristle on each point. 2*nd to* 4*th instars*. Very similar in shape and colouring to full-fed larva, but head relatively shorter, with short processes, and horn bifid but not flattened.

5*th instar*. Head elongate-triangular, the apex of each lobe produced upwards, these upward extensions closely appressed and together forming a blunt point; the processes of the earlier instars represented by a minute, smooth tubercle on the apex of each lobe; true clypeus one-quarter length of head, apex acute, basal angles rounded and tumid; false clypeus a narrow strip on each side of true clypeus, not reaching apex of true clypeus; labrum short, arched strongly backwards between basal tumidities of clypeus; ligula consisting of two long lobes broadening distad, completely covering mandibles; eyes with line joining 1 and 2 at right angles to the straight line joining 3, 4 and 6; all these eyes nearly equidistant; 5 forming an equilateral triangle with 4 and 6; 1, 2 and 5 smaller than 3, 4 and 6. Surface of head dull, covered with small tubercles. Body long and thin, diameter of segments 2 and 3 only half length of head, hind segments increasing gradually to 8, then decreasing slightly to 12. Horn long, gently down-curved, flattened laterally, bifid, the arms long and thin; anal flap and points of claspers much produced backwards. Surface of body dull; a transverse row of small, pointed tubercles along each secondary ring. Horn with a fringe of pointed tubercles on upper and lower edge, those on lower edge spine-like; small tubercles on prolegs, anal flap and claspers.

Coloration.—Head pale green, apex of each lobe reddish; a broad stripe, formed of small black tubercles, from near apex

of each lobe to base of antenna, and dorsally from near apex of each lobe to nape ; labrum green ; ligula whitish, the outer edges broadly brown ; basal segment of antenna pale green, second segment black, end-segment pale rusty ; mandible green, tip dark brown. Body green or bluish-green, darker than head ; tubercles white ; a dorsal stripe of black dots on segments 2 to 4, sometimes extending further back as a blackish quadrate patch on the middle of each segment, and always present on 5, where it is surrounded by yellow ; a large, enamel-white, irregular, rounded patch usually present in middle of subdorsal area of 8, with a line of black tubercles along its upper edge ; on one or more of the median segments usually subdorsal patches of varying size and shape, yellow ringed narrowly by red-brown ; seven narrow oblique stripes, each running across one segment and a portion of the adjoining segments, pale yellow, sharply defined above by a brown line, ill-defined below, that on 11 broader than the rest and running to base of horn. Horn green, with the tubercles and end-points dark brown ; true legs purplish, prolegs and claspers of body-colour. Spiracles small, those of segments 2 and 12 larger than the rest, narrowly oval in shape, colour brown. Length 55 mm. ; breadth 8 mm. ; horn 9·5 mm. ; head 8 mm. long by 5 mm. broad.

Pupa.—Slender, narrowly rounded in front, slightly tumid in middle ; vertex at right angles to longitudinal axis of pupa, frons slightly ventral and not visible from above ; tongue broad and short, shorter than fore leg ; antenna shorter than fore leg, mid-leg slightly longer than fore leg ; no coxal piece. Surface smooth and shining, segment 2 minutely pitted ; tongue, legs, antennæ and thorax superficially cross-rayed ; abdomen coarsely but not deeply pitted except on 13 and 14 ; sculpturing on 4 consisting of a raised, pear-shaped shining weal, pointed dorsad, on each side of dorsal line, reaching about half-way down the segment and occupying nearly its whole length ; ante-spiracular ridges on 9 to 11 consisting of four narrow parallel ridges separated by much wider channels ; spiracle of 2 a low, convex oval weal, the remaining spiracles oval and flush, the central slit with narrow raised edges. Cremaster stout, five-sided, ending in a simple, blunt point. Colour chestnut, a large rounded patch below and in front of eye, and the hind bevels of abdominal segments 8 to 10 pale cream-colour, abdomen darker, cremaster and spiracles black. Length 30 mm. ; breadth 10 mm.

Habits.—The eggs are laid singly, usually on the underside of a leaf of *Quercus fenestrata* Roxb., family Fagaceæ. The larva rests on the underside of a leaf ; when alarmed it raises the head and anterior segments, the head being held so that the long apical processes continue in the line of the body,

the true legs bunched together. In all instars the young tender leaves are ignored and only old hard leaves eaten, round holes being bitten between the side-veins, or the whole portion between two side-veins being removed. Before pupation the body becomes suffused with pink, and the larva leaves the food-plant and hurries about looking for a suitable place to pupate. At this period it jumps when touched like the larvæ of the genus *Oxyambulyx*, and the body is very hard and firm. Pupation takes place in a cell underground. The pupa is very lively, and moves the abdomen freely when handled. The moth rests with the wings horizontal and held so that the lobe of the hind wing projects well in front of the costa of fore wing, the abdomen being left uncovered and bent upwards. It is very sluggish during the daytime, and does not take to the wing for a long time after emerging from the pupa, but when it does so the flight is rapid. When handled it bends the long abdomen about as though attempting to sting. We have not seen the moth feeding, nor does it appear to be attracted by light. It emerges about two to three weeks after pupation, except when the pupa is formed about October. These late pupæ hibernate, and the moths emerge in the following spring.

Genus **CALLAMBULYX** Rothschild & Jordan. (Fig. 59).

Roths. & Jord., 1903, p. 307 ; id., 1907, p. 62.

Genotype : *rubricosa* (Walk.).

Imago.—♂♀. Large handsome moths with body and fore wing green, hind wing crimson. "Tongue short, weak, fringe at the mesial edges long. Pilifer somewhat swollen, with bristles. Genal process subglobose. Palpus slender, applied to the head, not projecting, larger in ♂ than in ♀. Labrum mesially raised to a high transverse tubercle. Scaling of head raised to a mesial crest. Antenna strongly compressed ventrally in ♂, subandromorphic in ♀ ; end-segment short, about as long as broad, with one or more bristles at tip, dorso-apical scales projecting beyond tip of segment, but the tuft thus formed shorter than the last two segments together. Tibiæ *simple*, longer than the respective first tarsal segments, these little longer than the cell of the hind wing is broad ; spur of fore tibia about half the length of the tibia ; those of mid- and hind tibia very *short*, long terminal one of hind tibia about half as long again as the tibia is broad ; paronychium with two lobes on each side ; pulvillus *present*. Frenulum and retinaculum *present*. Under scales of abdominal tergites partly spiniform.

"♂. Eighth tergite simple ; clasper reduced, without friction-patch ; harpe strongly developed, the apical process

double or simple, in the latter case (*junonia*) preceded by several teeth.

" ♀. Vaginal plate differently armed in the two species of which this sex is known " (Roths. & Jord., *l. c.*).

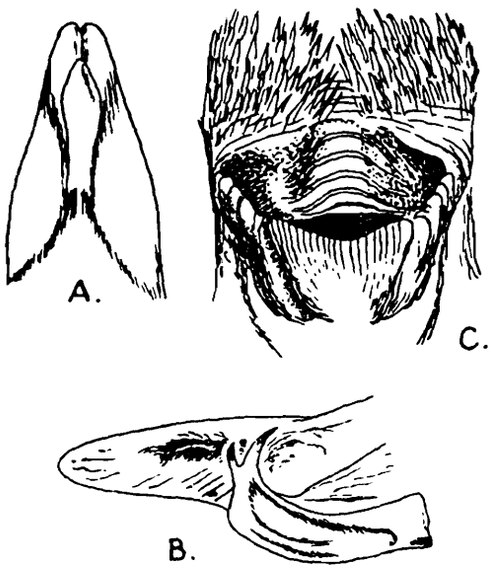


Fig. 59.—*Callambulyx* Roths. & Jord. Genitalia.
A, *C. rubricosa* (Walk.), 10th segment, ventral view ; B, clasper and harpe ; C, ♀ vaginal plate.

Hab. E. HIMALAYAS to Amur, Japan, and the larger Sunda islands. Three Indian species and subspecies, of which the early stages are unknown. The early stages of *C. tatarinovi* are of the same type as in *Sphinx ocellata*.

Key to the Species.

1. Hind wing with a large black post-discal patch centred with white . . [p. 230. *C. junonia* (Butler),
   The black patch, if present, near margin, with a white dot behind it, not within ; fore wing produced at apex into a hook . . 2.
2. Basal area of fore wing underside washed with red . . . . . [p. 231. *C. pœcilus* (Roths.),
   Basal area of fore wing underside not washed with red [p. 229. *C. r. rubricosa* (Walker),

63. **Callambulyx rubricosa rubricosa** (Walker). (Fig. 59 A–C, genitalia).

Ambulyx rubricosa, Walker, 1856, p. 122 (Hindostan) ; Butler, 1877 A, p. 582 (=*superba* ; Darjeeling, Calcutta) ; Hampson, 1892, p. 79 ; Dudgeon, 1898, p. 408 (Sikkim, 3,000 feet).
Callambulyx rubricosa rubricosa, Roths. & Jord., 1903, p. 309 ; Seitz, 1928, p. 543, t. 62 *b*.
Basiana superba, Moore, 1865, p. 793.

Imago.—♂♀. Head and vertex of thorax olive-brown, antennæ and a band between their bases white ; sides of

thorax purple; abdomen greenish, with a reddish-brown dorsal line. Fore wing bright glaucous-green, with olive-green markings and a patch of purplish-grey on inner margin; two indistinct waved antemedian lines; an oblique, nearly straight olive-brown band from middle of costa to outer angle; a spot at lower angle of cell; two lunulate postmedian lines and one waved line; outer area olive with some white on it; an oblique apical line white bordered with blackish-brown; white spots on outer margin. Hind wing brilliant crimson, the base and a post-discal band extending to M^2 darker red; traces of a median line; inner area brownish, marked with grey. *Underside* bright orange suffused with red, the lines of the fore wing at least partly red; median line of hind wing curved. *Expanse*: 132 mm.

♂. Tenth tergite (fig. 59 A) weak, pale, gradually narrowed distad, apex more strongly narrowed and mesially feebly sinuate, the surface more or less concave, rough, with bristle-bearing tubercles distally, the mesial line raised to a kind of carina; the proximal part of this supra-anal plate (namely, the ninth tergite) more strongly chitinized and densely clothed with long hair-scales which project beyond the end of the tenth tergite; the tenth sternite reduced, without a lobe. Clasper (fig. 59 B) narrow, rounded ventro-distally, produced into a long and a short, curved, pointed process; on a fold of the clasper, dorsally of the harpe, there is a dense clothing of spine-like bristles. Penis-sheath without armature.

Hab. E. HIMALAYAS (Sikkim; Khasi Hills). Rare; early stages unknown.

64. **Callambulyx junonia** (Butl.).

Ambulyx junonia, Butler, 1881 B, p. 9, pl. lxxx, fig. 2 (Bhutan); Hampson, 1892, p. 79.
Callambulyx junonia, Roths. & Jord., 1903, p. 310; Seitz, 1928, p. 543, t. 56 *c* (*e*).

Imago.—♂. Differs from *r. rubricosa* in having no white shaft to, or band between, the antennæ. Fore wing with the ante- and postmedian lines obsolete; the whole inner area purplish-grey; a large purplish-grey patch on outer margin, the outline between it and the green at apex irregular. Hind wing with a green line traversing the crimson beyond the cell; a large dark ocellus centred with grey below lower angle of cell; outer and inner areas brown. *Underside* greenish-yellow, some crimson on disc of fore wing; the markings brown. *Expanse*: 104 mm.

Tenth abdominal tergite flat, deeply sinuate, the lobes diverging, their mesial edge depressed, so that their upper surface slants inwards, each lobe with an inconspicuous

median cariniform tubercle. Clasper reduced distally ; harpe with a pointed apical hook and several, more proximal, teeth.

Hab. E. HIMALAYAS (Bhutan ; Naga Hills). Very rare ; early stages unknown.

65. **Callambulyx pœcilus** (Roths.).

Ambulyx pœcilus, Rothschild, 1898, p. 604, fig. 2 (Murree) ; Hampson, 1900, p. 39.

Callambulyx pœcilus, Roths. & Jord., 1903, p. 310, pl. i, fig. 13 (♂) ; Seitz, 1928, p. 543.

Imago.—♂. Intermediate between *tatarinovi* and *rubricosa* ; fore wing as strongly falcate as in the latter, but red below in basal half as in certain specimens of the former. Tongue very weak ; pilifer with very few bristles. *Expanse* : 77 mm.

Tenth tergite similar to that of *r. rubricosa*, narrower, apex more suddenly narrowed, curved downwards, pointed ; ninth tergite with long hair-scales as in *r. rubricosa* ; sternite reduced, without lobe. Clasper widened distally into a subquadrate flap, bearing dorsally on the inner surface a high triangular crest, which is continuous with the subdorsal fold of the more proximal part of the clasper ; this fold is rough, with setiferous tubercles ; harpe somewhat resembling that of *A. elwesi* in the shape of the distal part but is less concave, and has, besides the long apical hook, a short subapical hook at the dorsal edge ; the proximal ridge high.

Hab. W HIMALAYAS (Murree). One ♂ in the Tring Museum, also one ♂ in British Museum from Shillong. ♀ and early stages unknown.

Genus **ANAMBULYX** Rothschild & Jordan. (Fig. 60).

Roths. & Jord., 1903, p. 312 ; id., 1907, p. 63.

Genotype : *elwesi* (Druce).

Imago.—♂♀. Differs from *Callambulyx*, of which it is a development, in the absence of the retinaculum, the reduction

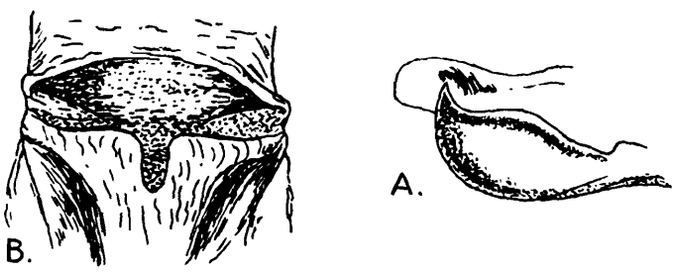


Fig. 60.—*Anambulyx* Roths. & Jord. Genitalia.
A, *A. elwesi* (Druce), clasper and harpe ; B, ♀ vaginal plate.

in length of the frenulum, the absence of the proximal pair of spurs from the hind tibia, and in the shape of the hind wing,

which has the costal margin straight or feebly concave before and in middle, and externally convex as in *Phyllosphingia*.

Hab. E. HIMALAYAS. One species. Early stages unknown.

66. **Anambulyx elwesi** (Druce). (Fig. 60 A, B, genitalia).

Ambulyx elwesi, Druce, 1882, p. 17 (Darjeeling); Waterhouse, 1883, pl. cxxxvi, fig. 3; Hampson, 1892, p. 79.
Anambulyx elwesi, Roths. & Jord., 1903, p. 312; Seitz, 1928, p. 543, t. 62 *b*.

Imago.—♂♀. A heavy-bodied insect with comparatively short wings, easily recognized by the very broad brownish-black border of the rosy-red hind wing and the olive-yellow stigma of fore wing. Head, thorax and abdomen brown, without the pale interantennal bar of *C. r. rubricosa*. Fore wing rich brown, the area from near base of costa to outer angle ochreous, crossed by a purplish-grey longitudinal stripe; apex olive-green without the oblique apical line of *C. r. rubricosa*. Hind wing bright pink, the outer half deep brown, with a line near anal angle. *Underside* paler. *Expanse*: 100 mm.

♂. Tenth tergite smooth, rounded at end, which is turned downwards, longitudinally grooved; ninth tergite (proximal part of the supra-anal process) not hairy; tenth sternite mesially produced into a triangular, apically rounded lobe. Clasper (fig. 60 A) obliquely rounded at apex, this apical lobe smaller than the harpe, which is concave, spoon-shaped, with the apex produced into a pointed hook directed dorsad; dorsal edge of clasper widened internad near end of harpe and densely beset with stiff hairs; the dense tuft of hair-scales near apex of harpe about twice as long as the clasper is broad before the end. Penis-sheath dorsally longer than ventrally, obliquely truncate, without external armature; within the sheath there is a membranaceous flap densely covered with pointed tubercles.

♀. Vaginal plate (fig. 60 B) deeply concave at sides; two obtuse flaps in front of vaginal orifice, separated by a deep sinus.

Hab. E. HIMALAYAS (Sikkim; Khasi Hills). Rare, and early stages unknown.

Genus **SMERINTHUS** Latreille.

Latreille, 1802, p. 401 (part.); Jordan, 1911, p. 244.
Sphinx, Linn., 1758 (part.); Roths. & Jord., 1903, p. 313; id., 1907, p. 63.

Genotype: *ocellata* (Linn.). (Jordan, in Seitz, Pal. 2, p. 235).

Imago.—" ♂♀. Tongue very weak and short. Palpus small in ♀, larger in ♂. Abdomen spinose all over dorsally, the spines very weak, dense at end near the apical edges of the segments; no broad under-scales on the tergites. Retina-

culum absent; frenulum reduced, the bristle of ♂ short but rather stout, the bristles of ♀ thin, hair-like. Pulvillus and paronychium present. Tibiæ not spinose; anterior tibia with or without apical thorn; one pair of spurs to hind tibia. Hind wing red for the greater part.

"♂. Antenna more distinctly dilated laterad than in *Amorpha*, sometimes subpectinate, or even pectinate. Tenth abdominal tergite rounded at end, or feebly sinuate; sternite triangular, simple. Harpe simple, rounded or obtusely pointed at end, not divided as in *Amorpha*. Penis-sheath with one or two conical teeth at end, pointing laterad.

"♀. Antenna with traces of the lateral expansion of ♂. Vaginal plate membranaceous, without a distinct ridge in front of the vaginal cavity, or the ridge is more or less wrinkled, not strongly chitinized" (Roths. & Jord., 1903, p. 313).

Larva.—Head triangular; body and horn tuberculate; colour green with white or yellowish oblique stripes, often spotted with red.

Pupa.—Stout, more or less rugose and pitted, surface glossy, sheath of antenna rather broad in both sexes.

Habits.—Food-plants: *Populus* Linn., *Salix* Linn., family Salicaceæ; *Prunus* Linn., family Rosaceæ.

Hab. Palæarctic and Nearctic Regions. One Indian subspecies, of which the early stages are unknown.

67. **Smerinthus kindermanni obsoleta** Stgr. (Fig. 61, ♀).

Smerinthus kindermanni var. *obsoleta*, Staudinger, 1901, p. 100 (Korla).
Sphinx kindermanni obsoleta, Roths. & Jord., 1903, p. 316.
Smerinthus kindermanni obsoleta, Jordan, 1911, p. 244.
Eusmerinthus kindermanni, Butler (non Led.), 1880, p. 413, pl. xxxix, fig. 11 (pupa), 12 (larva) (Kandahar).
Cypa kindermanni, Hampson (non Led.), 1900, p. 38.

Imago.—♂♀. Similar in colouring to *S. ocellata*; but hind



Fig. 61.—*Smerinthus kindermanni obsoleta* Stgr., ♀.

wing without a complete ocellus, which is replaced by two or three black transverse bars edged with grey or yellowish.

Anterior tibia ending in a thorn, which is mostly covered with scales. Antenna of ♂ subpectinate, the lateral projections about half as long as the segments are broad dorsally. Pulvillus reduced. *Expanse* : 80 mm.

♂. Tenth tergite obtuse. Dorsal edge of clasper internally with the trace of a stronger chitinized longitudinal ridge before end ; harpe with a single, somewhat spoon-shaped apical process, ventral margin shallowly sinuate, upper edge continued dorso-basad, ending in a rather high crest, which is situated below a longitudinal subdorsal fold clothed with long dispersed bristles. Penis-sheath with a conical tooth at end, membrane of duct with a patch of pale spines.

♀. Vaginal plate not strongly chitinized, much wrinkled ; the orifice preceded by a transverse ridge, forming the lower or anterior lip of the cavity, this ridge mesially indented.

Hab. W HIMALAYAS (Chitral) ; Eastern Turkistan and Kandahar.

Larva.—Described by Roberts as having yellow side-bands, white granules, a blue, green-tipped, curved horn.

Habits.—Food-plant : *Salix* Linn. (willow), family Salicaceæ.

Genus **PHYLLOSPHINGIA** Swinhoe. (Fig. 62).

Swinhoe, 1897, p. 164 ; Roths. & Jord., 1903, p. 337 ; id., 1907, p. 66 ; Jordan, 1911, p. 246.

Genotype : *dissimilis* (Brem.).

Imago.—" ♂♀. Tongue weak, reaching scarcely to end of fore coxa, the two halves separate, but with fringe. Pilifer with bristles. Palpus of ♂ prominent, smaller in ♀, second segment not rough-scaled, joint not open. Antenna setiform, side-line almost even in dorsal view in ♂ ; feebly constricted at the joints in ♀, without distinct seriate cilia (♀). Abdomen with large under scales, upper scales long, woolly, no spines, except at edges, but these spines very weak, scale-like. Tibiæ *spinose* ; hind tibia with *two* pairs of spurs, longer terminal one more than half the length of the first tarsal segment ; pulvillus present ; paronychium with *one* lobe at each side, the ventral lobes being vestigial. Distal margin of wings dentate, costal margin of hind wing concave in basal half, then convex, apex of wing rounded ; frenulum *vestigial*, no retinaculum. Clasper and eighth tergite without friction-scales " (Roths. & Jord., 1903, p. 337).

Larva.—Green, shagreened, with pale oblique stripes, which are occasionally bordered with red in front.

Pupa.—Strongly shagreened ; middle abdominal sternites posteriorly with short pointed tubercles, which serve as an organ of locomotion.

Habits.—Food-plant : *Juglans mandschurica,* family Juglandaceæ.

Hab. Japan and Amur to ASSAM. One Indian subspecies.

68. **Phyllosphingia dissimilis perundulans** Swinh. (Fig. 62 A, holotype ♂).

Phyllosphingia perundulans, Swinhoe, 1897, p. 164 (Jaintia Hills).
Phyllosphingia dissimilis perundulans, Roths. & Jord., 1903, p. 338 ; Seitz, 1928, p. 543.
Phyllosphingia dissimilis, Hampson (non Bremer), 1898, p. 280, fig. (♂).

Imago.—♂. Large, tawny. The dark discal patch of fore-

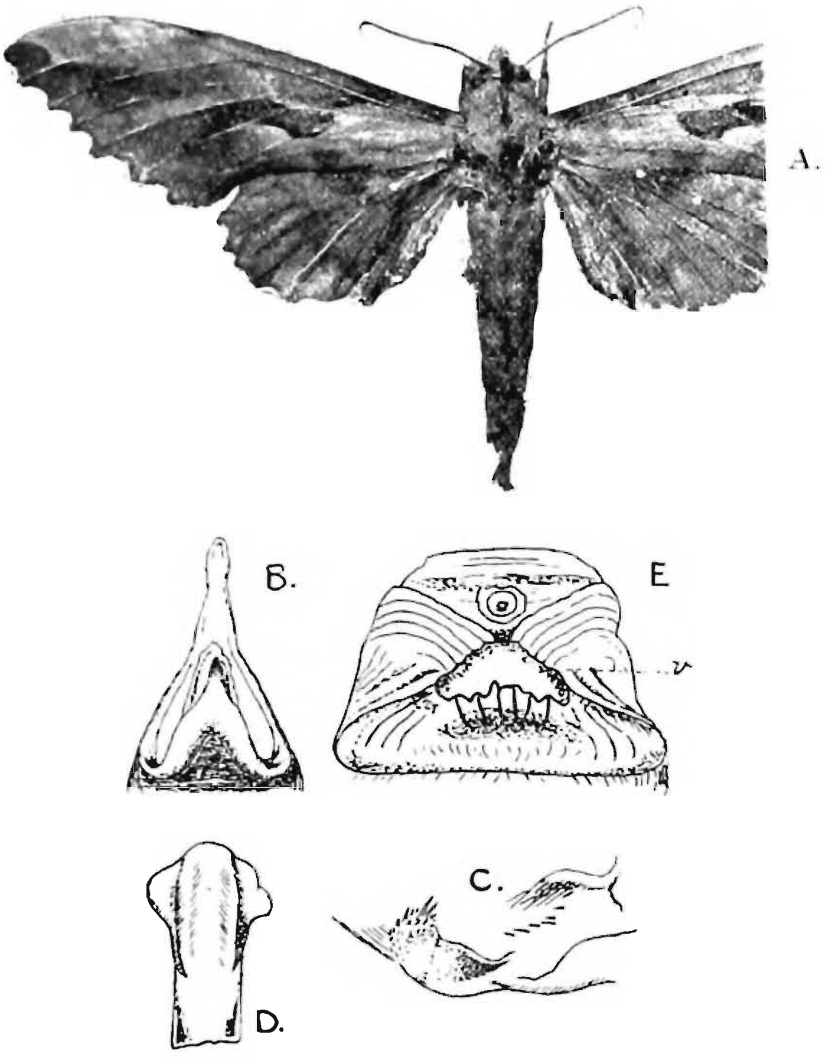


Fig. 62.—*Phyllosphingia* Swinh.

A, *P. dissimilis perundulans* Swinh., holotype ♂. B, *P. dissimilis dissimilis* (Brem.), 10th segment, ventral view ; C, harpe ; D, penis-sheath ; E, ♀ vaginal plate (*v,* vaginal orifice).

wing concave between M^1 and M^2 ; the brown marginal area projecting obliquely to lower angle of cell. *Expanse* : 120 mm.

Tenth abdominal tergite (fig. 62 B) narrowed to a point. slender; sternite triangular. Clasper large, triangular, with a basal mesial fold which bears heavy stiff bristles; harpe (fig. 62 C) armed with spines at the edge. Penis-sheath (fig. 62 D) with a longitudinal fold at end on each side, therefore appearing dilated in a ventral or dorsal view.

Hab. E. HIMALAYAS (Jaintia Hills, Assam). Early stages and ♀ not known; one ♂ in British Museum.

B.—SPHINGIDÆ SEMANOPHORÆ.

Roths. & Jord., 1903, p. 347.

Imago.—♂♀. The inner surface, near base, of first segment of palpus without scales; covered with short sensory hairs, or these hairs, which are seldom vestigial, restricted to a patch.

The number of species is about twice as large as in the SPHINGIDÆ ASEMANOPHORÆ. Specialization by reduction or loss is far less frequent in this division than among the ACHERONTIINÆ and AMBULICINÆ, while the modification of organs in functionally higher structures is very often met with, the prevailing tendency in the SEMANOPHORÆ being progressive development in contradistinction to the ASEMANOPHORÆ, where retrogression is the prevalent feature.

Tongue never excessively long nor very much reduced, always reaching the middle of the abdomen and remaining functional. Pilifer always prominent, peculiarly modified in the CHŒROCAMPINÆ; the bristles never become weak and flat or change into scales. Palpus varies much in size and proportionate length of first and second segments. Remarkable modifications of the palpus occur in the CHŒROCAMPINÆ. Antenna very variable, filiform or setiform in many species, without the indication of a club; in others moderately or excessively clubbed. The distal part may be abruptly recurved or scarcely curved at all. End-segment more often long than short. Eye lashed or not, varying much in size. Abdomen always with spines; first tergite and sternite of second segment often closely appressed to metathorax (*Macroglossum*). The broad expansible fan-tail and, in the ♀, the broadly trapeziform seventh sternite, which is often *spinose* at the edge, are characters confined (except for ♂♂ of *Cypa*, *Smerinthulus* and *Degmaptera*) to members of this division. The friction-scales of clasper are, as in the ASEMANOPHORÆ, often absent, but if they occur they are erect or half-erect, never forming a smooth patch as in ACHERONTIINÆ and AMBULICINÆ.

Tibiæ rarely spinose; proximal pair of spurs of hind tibia present in all Indian species; anterior tibia occasionally

produced into a thorn ; comb of mid- and hind tarsus often present, external spines sometimes very numerous, short and strong (*Macroglossum*). Pulvillus present in all Indian species except one species of *Hæmorrhagia*. Paronychium with few exceptions (*Gurelca*, *Sphingonæpiopsis*) with four lobes. Wings very variable in shape, frenulum and retinaculum always present.

Egg.—Spherical or broadly ovoid ; surface smooth and shining ; colour green or yellow, seldom with markings.

Larva.—Head usually small, round, without apical processes, but in *Sataspes* triangular, and with apical processes except in first and last instars, and in *Cephonodes* round but comparatively large ; in *Angonyx* large and semi-elliptical ; body in most genera tapering sharply from segment 5 to 2, the head and anterior segments more or less completely retractile into segment 5 ; rest of body nearly cylindrical ; horn very variable in size and shape, occasionally much reduced, in early instars sometimes long and movable in a vertical plane. Surface of head generally smooth and shining ; body smooth except in a few genera, seldom strongly tuberculate, and usually dull in the last instar (shining in *Rhagastis albomarginatus*) ; horn dull or shining, with or without tubercles. Colour very variable specifically and individually, often several colour-forms ; longitudinal and oblique stripes commonly present, and lateral ocelli occur in all Indian CHŒROCAMPINÆ and in some PHILAMPELINÆ. The size varies as greatly as in the ASEMANOPHORÆ.

Pupa.—Tongue reaches tip of wing-case ; in many genera the basal part of the tongue in a laterally flattened sheath projecting frontad and ventrad ; tongue in a free sheath in *Rhyncholaba acteus*. Surface smooth, either dull or shining. Colour variable, with stripes, spots or mottling, except in the SESIINÆ.

Habits.—Eggs laid singly (except in *Celerio euphorbiæ*) on a variety of food-plants, those of the families Ampelideæ, Rubiaceæ and Aroideæ being most commonly chosen, usually on the underside of a leaf. The larvæ, when small, lie on the underside of a leaf, when large often rest on the stem or hide on the ground while not feeding, with the body stretched out straight. When molested many species retract the anterior segments and expand the ocelli on segment 5 ; others adopt a snake-like pose, or throw back the head and eject juice from the mouth. Pupation takes place in a rough cocoon on the surface of the ground, except in the genus *Sataspes*. The moths rest with the wings held horizontal, the abdomen sometimes bent upwards. The SESIINÆ and the genera *Gurelca*, *Macroglossum* and *Rhopalopsyche* are day fliers.

Cosmopolitan, with three subfamilies, SESIINÆ, PHILAMPELINÆ and CHŒROCAMPINÆ.

Subfamily SESIINÆ.

Roths. & Jord., 1903, p. 349 ; id., 1907, p 69 ; Jordan, 1911, p. 247.

Imago.—" ♂♀. Tenth abdominal segment mesially divided, often asymmetrical, the left half of the tergite and sternite or the right half of the sternite being sometimes reduced, vestigial, or even absent ; right and left claspers occasionally also unequal ; no large friction-scales. The lower genera with uniserial abdominal spines, at least on the last segments, the spines all long, or long ones alternating with small ones. The seventh sternite of the ♀ trapeziform, or sinuate, often spinose at the apical edge, sometimes only laterally ; if the sternite is small and triangular, and the spination of the tergite multiserial, the mesonotum is prominently crested or the palpus angulate laterally " (Roths. & Jord., 1903, p. 350).

Cosmopolitan, with two tribes, Dilophonotini (not represented in India) and Sesiini.

Tribe SESIINI.

Sesiidæ, Roths. & Jord., 1903, p. 372 ; id., 1907, p. 74.

Imago.—♂♀. The moths closely resemble in outward appearance carpenter-bees (*Sataspes*) and humble-bees (*Hæmorrhagia*, *Cephonodes*), the wings being hyaline in the two latter genera. "Abdominal spines not uniseriate or, if uniseriate, then thorax not double-crested. End-segment of antenna long or short, in the former case the mid-coxal merum angulate " (Roths. & Jord., 1903, p. 372).

Egg.—Spherical, surface smooth and shining, colour green.

Larva.—Variable ; those of *Hæmorrhagia* resembling the larvæ of the genus *Macroglossum*, with round head and body tapering gently frontad ; those of *Cephonodes* rather Acherontiine, with rounded head and nearly cylindrical body ; those of *Sataspes* Ambulicine, with triangular head. Surface tuberculate or with tubercles on segment 2, anal segments and horn. Colour green, with longitudinal stripes in *Hæmorrhagia* and *Cephonodes* ; oblique stripes in *Sataspes*.

Pupa.—Tongue reaches tip of wing-case, no basal sheath. Uniform reddish-brown in colour. Other characters variable.

Habits.—The food-plants belong to the families Rubiaceæ (*Hæmorrhagia* and *Cephonodes*), Caprifoliaceæ (*Hæmorrhagia*) and Leguminosæ (*Sataspes*), and a few other families. Pupation takes place in a rough cocoon on the surface, occasionally just below the surface. The wings are held horizontal when resting. The moths all fly by day.

Cosmopolitan, with three India genera.

Key to the Genera.

Imagines.

Wings purple or green with metallic gloss, or drab-grey; closely resembling a carpenter-bee in appearance .. .... SATASPES Moore, [p. 251.

Wings hyaline; body green with reddish band ... . CEPHONODES Hübn., [p. 244.

Wings with hyaline patches bordered broadly with dark-coloured scales; or unicolorous, with more or less distinct vitreous spaces HÆMORRHAGIA Grote [& Rob., p. 239.

Larvæ.

1. Head triangular; no dorso-lateral line; six or seven oblique stripes . .. SATASPES Moore, [p. 252.
2. Head round; dorso-lateral lines; no oblique stripes . .. .. 3.
3. Large tubercles on front margin of segment 2; small tubercles on secondary rings and horn . . . . HÆMORRHAGIA Grote [& Rob., p. 241.

Tuberculate saddle-shaped mark on segment 2; rest of body smooth CEPHONODES Hübn., [p. 246.

Pupæ.

1. Ante-spiracular ridges and frontal ridges or tubercles present ... . 2.

Ante-spiracular ridges and frontal ridges or tubercles absent; cremaster a conical shaft, minutely bifid and longitudinally ridged dorsally .. .. CEPHONODES Hübn., [p. 246.

2. Cremaster triangular, bifid and with lateral setiferous tubercles .. .. .. HÆMORRHAGIA Grote [& Rob., p. 241.

Cremaster triangular, with a simple point and ventral extensor ridges SATASPES Moore, [p. 252.

Genus **HÆMORRHAGIA** Grote & Robinson. (Fig. 63).

Grote & Rob., 1865, pp. 149, 173; Roths. & Jord., 1903, p. 438; id., 1907, p. 85, t. 5, fig. 8; Jordan, 1911, p. 247.

Genotype: *thysbe* (Fabr.).

Imago.—♂♀. Wings more or less hyaline; moths resemble humble-bees in general appearance. Very variable as to size, colour and indentation of the marginal bands, and subject to strongly marked seasonal dimorphism. "Genal process large, triangular. Eye strongly lashed. Antenna strongly clubbed in both sexes, hook thin, abrupt; end-segment long, more or less cylindrical, with some bristles at end; previous segment also cylindrical, short, or obliquely produced ventrad with the sense-cone prominent (*rubra*). Spines of abdomen flat, very strong, proximal ones shorter than long (except on proximal sternites), rounded; sternite of seventh segment of ♀ *with* spines at end; fan-tail large, expansible.

Fore tibia with a few spines at apical edge, generally concealed by the scales ; spur of fore tibia long, only a little short of tip of tibia ; merum of mid-coxa produced into a sharp process, hind merum also with process, but this obtuse ; spines of comb of mid-tarsus not obviously prolonged ; spurs very unequal, long terminal one longer than second tarsal segment ; first segment of hind tarsus shorter than tibia ; pulvillus well developed or absent, with intergradations ; ventral pair of paronychial lobes present, or vestigial, or absent. Distal edges of wings entire ; fore wing with transparent spaces, or at least with a sharply defined marginal band. SC^2 and R^1

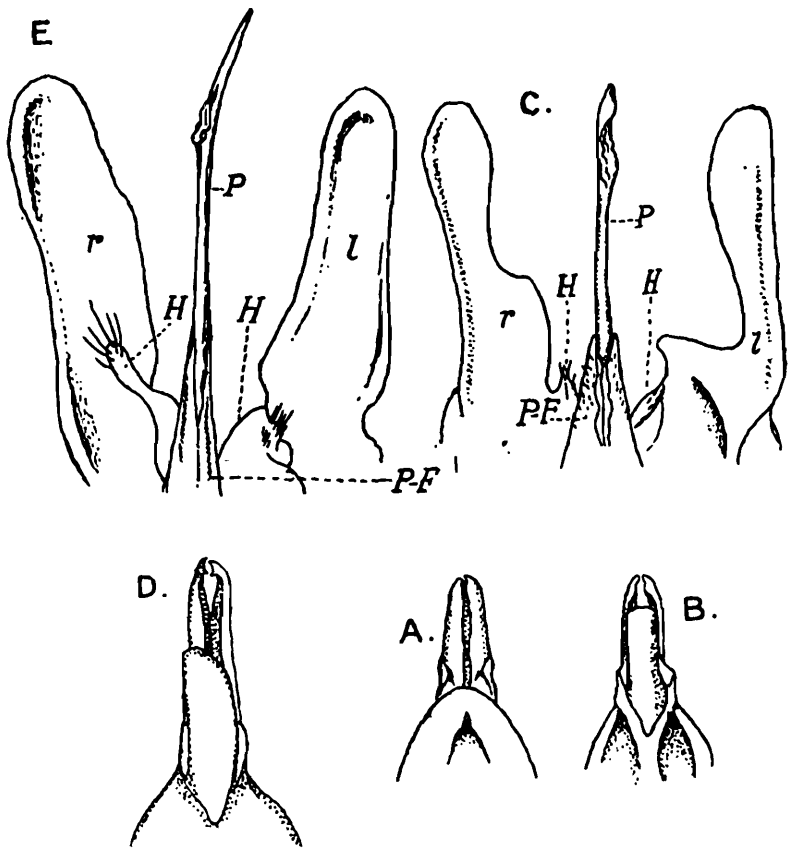


Fig. 63.—*Hæmorrhagia* Grote & Rob. Genitalia.

A, *H. fuciformis* (Linn.), 10th segment, dorsal view ; B, 10th segment, ventral view ; C, claspers, penis-funnel and sheath, dorsal view (*H*, harpe; *l*, left clasper; *P*, penis; *PF*, penis-funnel; *r*, right clasper). D, *H. saundersi* (Walk.), 10th segment, ventral view ; E, claspers, penis-funnel and sheath (lettering as in C).

of hind wing from a point or shortly stalked, R^2 central or a little before centre, cross-veins transverse, slightly curved, R^3 and M^1 always separate.

" ♂. Tenth tergite divided, slightly asymmetrical, sometimes the asymmetry more obvious ; sternite either with two long processes, or the right process aborted, the remaining left process more or less asymmetrical. Claspers unequal, elongate ; no friction-scales ; left harpe always vestigial ; right harpe sometimes vestigial, but mostly produced into

a more or less club-shaped process. Penis-funnel large, obliquely truncate or ventrally prolonged; penis-sheath mostly very slender, ending in a pointed or flattened process which is dentate at end in one instance (*gracilis*), seldom (*venata*) heavy, and armed with a dentate projection.

" ♀. Eighth tergite transverse, truncate-rounded, rather strongly chitinized also in middle; vaginal plate small, proximally membranaceous, vaginal orifice on the left side; membrane connecting seventh and eighth segments (resp. seventh segment and vaginal plate) rather long, there being a cavity all round between the two segments, allowing the tail a free movement " (Roths. & Jord., 1903, p. 438).

Larva.—Head round, body tapering slightly towards the front and back from segment 7; horn down-curved. Surface of head shining, with small tubercles; body dull, with large tubercles on segment 2 and small tubercles on remaining segments and horn. Colour green dotted with white and a whitish dorso-lateral stripe.

Pupa.—Slender; surface smooth and shining or dull and rugose; colour dark brown.

Habits.—Eggs laid singly on food-plants of the families Rubiaceæ, Caprifoliaceæ, Rosaceæ and Dipsaceæ. Pupation in a rough cocoon on or near the surface of the ground. The moths fly by day, feeding and ovipositing on the wing, and rest with the wings held horizontal.

Hab. Nearctic, Palæarctic and Oriental Regions. Three Indian species and subspecies.

Key to the Species.

Imagines.

1. Fore wing unicolorous, with more or less distinct vitreous spaces; hind wing ferruginous, without vitreous spaces . . [p. 244. *H. rubra* (Hamps.),
   Wings hyaline, with dark red band along outer margin of fore wing . . 2. [p. 242.
2. Cell of fore wing with scaled fold... *H. f. fuciformis* (Linn.),
   Cell of fore wing without scaled fold. *H. saundersi* (Walk.), [p. 243.

Larvæ.

1. A pale dorso-lateral line from segment 2 to horn .. .. 2.
2. A brownish-red subspiracular line from segment 2 to anus .. [p. 242. *H. f. fuciformis* (Linn.),
   No subspiracular line *H. saundersi* (Walk.), [p. 243.

The larva and pupa of *rubra* are not known, and the pupæ of the other two species not well enough known for a key to be made.

69. **Hæmorrhagia fuciformis fuciformis** (Linn.). (Fig. 63 A–C, genitalia).

Sphinx fuciformis, Linnæus, 1758, p. 493.
Hemaris fuciformis, Hampson, 1892, p. 119.
Hæmorrhagia fuciformis fuciformis, Roths. & Jord., 1903, p. 454; Jordan, 1911, p. 248, t. 40 *b*.
Hemaris simillima, Moore, 1888, p. 391 (Kangra).

Imago.—♂♀. Head, thorax and abdomen clothed with long, fine, olive-green pile; third and fourth abdominal segments dark red; anal tufts black. Fore wing hyaline, with costa and inner margin olive-green, outer margin with a broad dark red band; discocellulars black. Hind wing hyaline, inner margin olive-green, outer margin dark red; cilia brown. *Expanse*: ♂ 46 mm., ♀ 50 mm.

♂. Tenth tergite (fig. 63 A, B) scarcely more than twice as long as proximally broad, the two halves separated only at extreme end; sternite about one-third shorter than tergite, slightly asymmetrical, rounded at end. Left clasper spatulate, harpe represented by a basal incrassation which bears a few short bristles; right clasper with dorsal margin concave, ventral margin deeply sinuate just before middle, apical lobe spatulate, harpe represented by a conical process which varies individually and is clothed with bristles. Penis-funnel rough, with setiferous granules, little more produced ventrally than dorsally; penis-sheath with apical process flattened, obtuse (fig. 63 C).

Hab. W Himalayas. Also in Europe and North Africa. The subspecies has been bred in Europe, where it is known as the Broad-bordered Bee Hawk-Moth.

Larva:—

Final instar. Body smooth; horn tapering evenly to a sharp point, slightly down-curved. Colour of head bluish-green. Body bright green, paler on the dorsum; a darker green dorsal stripe; a subdorsal yellow stripe from segment 2 to base of horn, and a narrow yellow subspiracular stripe; spiracles lying on reddish-brown patches; venter reddish-brown. Horn lilac at base, purplish-brown in the middle, dark brown at tip; legs, prolegs and claspers reddish-brown. Length 35 mm.

Pupa.—Tapering somewhat sharply frontad. Surface slightly rough and shining. Colour dark brown, the bevels of the movable abdominal segments pale sienna-red. Cremaster a large, triangular, flattened spike.

Habits.—Food-plants (in England): *Lonicera* Linn., family Caprifoliaceæ; *Galium* Linn., *Rubia cordifolia* Linn., family Rubiaceæ.

70. **Hæmorrhagia saundersi** (Walk.). (Fig. 63 D, E, genitalia : Pl. X, fig. 3, larva ; Pl. XII, fig. 2, imago).

Sesia saundersi, Walker, 1856, p. 83 (N. India).
Hemaris saundersi, Butler, 1877 A, p. 520 ; id., 1886, p. 378 (Murree) ; Cotes & Swinhoe, 1887, p. 1 (Sikkim) ; Warren, 1888, p. 294 (Thundiani) ; Hampson, 1892, p. 119, fig. 68 (♂) (N.W. Himalayas ; Punjab).
Hæmorrhagia saundersi, Roths. & Jord., 1903, p. 458 ; Jordan, 1911. p. 248, t. 40 *c* ; Seitz, 1928, p. 544.
Macroglossa curtisi, Boisduval, 1875, p. 374 (Cochin-China ; Sylhet).

Imago.—♂♀. Similar in appearance to *Cephonodes hylas*. Upperside : head, body and abdomen olive-green, normally scaled ; fourth and fifth abdominal tergites brownish-red and a mesial patch of the same on sixth tergite. *Underside* of abdomen brownish-red, grey mesially. Fore wing hyaline, with a dark red marginal band about half as wide between M^1 and M^2 as this cellule is broad at margin. Cell without scaled fold, discocellulars not black. Hind wing without red border. *Expanse* : ♂ 50 mm., ♀ 60 mm.

♂. Tenth tergite (fig. 63 D) long and slender, left process a little longer than right one ; sternite asymmetrical, curved towards left side. Left clasper little projecting ventrad basally, slightly narrowed to apex, process of harpe represented by a subglobose hump which bears fine hairs ; right clasper less narrowed towards end than left clasper, its margin feebly sinuate in apical third, harpe produced into a subcylindrical process which is slightly twisted, club-shaped, and bears long hairs at end. Penis-funnel slender, gradually narrowed into a smooth ventral process ; process of penis-sheath long, but not sharply pointed, little thinner than sheath itself (fig. 63 E).

Hab. W HIMALAYAS (Mussooree ; Kumaon ; Gurais Valley, Kashmir) to Cochin-China. We have bred it at Mussooree, at an elevation of about 6,000 feet. Larvæ somewhat rare in scrub-jungle, and moths on the wing in April and May.

Larva :—

Final instar. Head smooth and shining. Body dull ; horn long, down-curved, tapering evenly to a sharp point ; a transverse band of large tubercles along the front margin of segment 2 ; a transverse row of small tubercles along each secondary ring ; horn, anal flap and claspers bearing small tubercles.

Coloration.—Head pale green, with a dark green stripe from vertex to base of antenna. Body pale green ; the tubercles on front margin of segment 2 bright orange, other tubercles white ; a narrow dorso-lateral stripe starting about the middle of 2 and running to base of horn, whitish on the anterior segments, pale pink and broader on posterior segments ; horn pink with purple tubercles ; legs pink ; prolegs and claspers green, the feet purple ; anal flap edged with orange. Spiracles

small, oval, bright purple. Length 45 mm. ; breadth 7 mm. ; horn 8 mm.

Pupa.—Slender, surface smooth and shining, colour dark brown, paler on bevels of movable segments. Length 30 mm.

Habits.—Eggs laid singly on leaves of *Lonicera quinquelocularis* Hardw., family Caprifoliaceæ, a shrub resembling honeysuckle. The larva turns reddish-brown before pupation, which takes place in a rough cocoon on the surface among leaves. Moths emerged in March from pupæ formed in the previous August.

71. **Hæmorrhagia rubra** (Hamps.).

Hemaris rubra, Hampson, 1892, p. 120 (Sind ; Gurais Valley ; Balta).

Hæmorrhagia rubra, Roths. & Jord., 1903, p. 459 ; Jordan, 1911, p. 249, t. 40 *e*.

Imago.—♂♀. Antenna black ; palpus black at sides, white below ; head and thorax dull olive-green ; abdomen black clothed with olive down above, second segment with a broad white band, third to fifth segments each with a slight, white, dorsal dash, fifth and sixth segments with lateral white tufts ; anal tuft black. Fore wing reddish-brown, base olive ; traces of a pale, median, oblique band ; a dark-coloured marginal line. Hind wing bright reddish-brown with a dark marginal line, cilia grey. *Underside* of head, thorax and base of wings whitish. Pulvillus very small ; ventral lobes of paronychium vestigial. *Expanse* : ♂ 44–52 mm., ♀ 58 mm.

♂. Tenth tergite as in *f. fuciformis* ; sternite broader at end and more obliquely rounded. Left clasper broader than in *f. fuciformis*, not spatulate, harpe represented by an obviously spinose hump ; right clasper feebly sinuate beyond middle at ventral margin, process of harpe long and slender, with long spines at and before end, equalling in length the diameter of the process. Penis-funnel hairy at end, produced into a slender lobe ; process of penis-sheath as in *f. fuciformis*.

Hab. W Himalayas (Sind and Gurais Valleys, Kashmir). Early stages not known.

Genus **CEPHONODES** Hübner. (Fig. 64).

Hübner, 1822, p. 131 (part.) ; Roths. & Jord., 1903, p. 460 ; id., 1907, p. 87 ; Jordan, 1911, p. 249.

Genotype : *hylas* (Linn.).

Imago.—♂♀. Head, thorax and abdomen yellowish, abdomen with a black and a dark red band, sixth tergite with a black mesial patch ; wings hyaline. Resemble large humble-bees, for which they might be mistaken. " Genal process large, high. Palpus pointed, terminal surface triangular. Eye not lashed. Antenna very strongly clubbed in both

sexes ; hook abrupt ; end-segment long and thin, little wider at base than at tip, with long scales on back and long bristles at and near end. Merum of mid- and hind coxæ produced into a tooth-like projection. Metanotum and abdomen

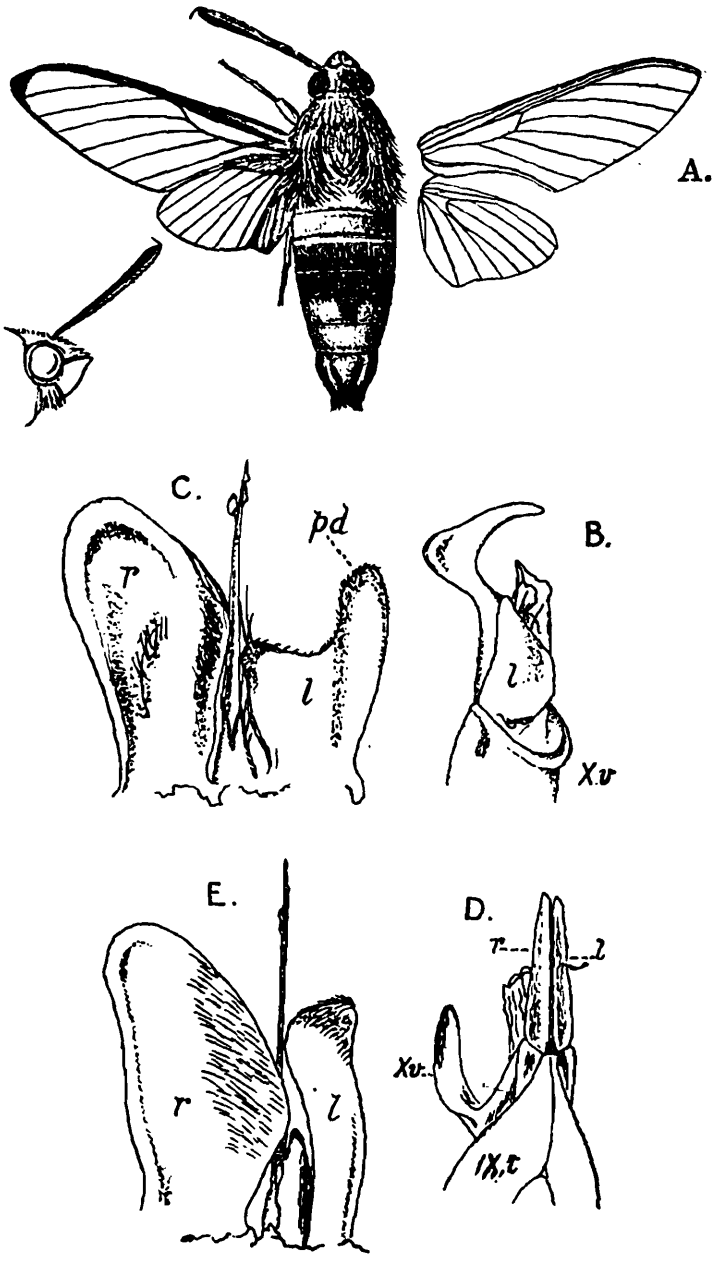


Fig. 64.—*Cephonodes* Hübn.

A, *C. hylas hylas* (Linn.), ♂ ; B, 10th segment, dorsal view (x. *v*, 10th sternite; *l*, left side of tergite) ; C, claspers, penis-funnel and sheath, dorsal view (*l*, left clasper; *pd*, dorsal lobe; *r*, right clasper). D, *C. picus* (Cram.), 10th segment, dorsal view (ix. *t*, 9th tergite; x. *v*, 10th sternite, *l*, *r*, left and right lobes of tergite) ; E, claspers, penis-funnel and sheath (*l*, *r*, left and right claspers).

broad ; first segment of the latter almost on a level with metanotum ; spines of abdomen as in *Macroglossum*, strong, flat, those of the first row broader than long ; seventh (♀) or eighth (♂) segment with an expansible fan-tail ; sternite

of seventh segment truncate, armed with spines at apical edge like the tergites, but the distal spines longer. External row of spines of fore tarsus reduced to hairs on first segment, the spines of second row sometimes at right angles to the segment; hind tarsus sometimes compressed, with or without additional spines on the outer surface of the first segment. SC^2 and SC^4 of fore wing anastomosed at apex of wing; cell of hind wing very short; SC^2 and R^1, and R^3 and M^1 stalked.

"♂. Sexual armature more or less asymmetrical. Tenth tergite divided, the right half often reduced; sternite lunulate or deeply divided into two broad lobes; more or less twisted, often removed towards the right side, or without lobes. Clasper without friction-scales; large, right and left generally very different; harpe vestigial, without process, practically absent. Penis-sheath thin, ending in a slender point, mostly armed with two teeth pointing basad.

"♀. Eighth to tenth abdominal segments much smaller in width than the preceding segments, there being a deep cavity all round between the seventh and eighth segments. Seventh tergite incrassate beneath laterally. Eighth tergite a narrow and transversely long half-moon. Vaginal plate chitinous, connected with seventh sternite by a plate of chitin; orifice small, proximal, a little removed towards the left side" (Roths. & Jord., 1903, p. 460).

Egg.—Shortly ovoid; surface smooth and shining; colour pale green. Length 1·2 mm.; breadth 1·1 mm.; height 1 mm.

Larva.—Head large and round or squarish in shape; body tapering little frontad; horn of medium length, down-curved. Colour variable; longitudinal but no oblique stripes.

Pupa.—Slight in build; antenna equal to fore leg and one-half to two-thirds length of wing-case, mid-leg about three-quarters. No coxal piece. Surface shining; sculpturing on segment 4 and ante-spiracular ridges present. Cremaster a polished shaft with minutely bifid tip. Colour dark brown.

Habits.—Eggs laid singly on a number of shrubs and trees of the family Rubiaceæ, usually on the underside of a leaf. Larvæ sluggish but eat very greedily and continuously. When molested they sometimes throw the head back over the dorsum until the mouth-parts are directed upwards, and eject green fluid from the mouth. The body becomes suffused with brown before pupation, which takes place in a rough cocoon on the surface of the ground amongst the foliage of the food-plant, or more rarely just under the surface of the earth. It is formed of leaves, earth particles etc., held together by a few strands of silk. The pupa is not attached to the inside of the cocoon. When the moth emerges, which it usually does in the early morning, the hyaline portion of the wings is covered densely with greyish scales. These come off in

a little cloud when the wings are rapidly vibrated before the first flight. The moths are rather slow in taking to the wing, but when they do so the flight is very rapid. They make a deep humming note, as do *Macroglossum* moths, when slightly alarmed. They are very active in the morning and evening, and dart rapidly from flower to flower, and oviposit on the wing. They are not attracted by light. Bred ♀♀ do not readily attract wild ♂♂, but the sexes pair freely in captivity.

Hab. Aethiopian and Oriental Regions, northwards to Japan. Two Indian species and subspecies.

Key to the Species.

Imagines.

Fore tibia without an apical thorn .	*C. h. hylas* (Linn.), [p. 247.
Fore tibia ending in a prominent thorn	*C. picus* (Cram.), [p. 250.

Larvæ.

Spiracles white, with a broad, transverse, orange, medial band	[p. 248. *C. h. hylas* (Linn.),
Spiracles white, immaculate	*C. picus* (Cram.), p. 251.

The pupæ are so similar that we are unable to give a key.

72. **Cephonodes hylas hylas** (Linn.). (Fig. 64 A, ♂, B, C, genitalia; Pl. III, figs. 8, 9, larva).

Sphinx hylas, Linnæus, 1771, p. 539 (China).

Cephonodes hylas, Moore, 1882, p. 31, pl. xciii, figs. 4, 4 *a*, *b* (l., p., i.); Swinhoe, 1885 A, p. 257 (Poona; Satara; Belgaum; Bombay); Warren, 1888, p. 294 (Campbellpore; Abdol); Hampson, 1892, p. 120, fig. 69 (♂); Jordan, 1911, p. 249, t. 40 *d*; Seitz, 1928, p. 544.

Hemaris hylas, Moore, 1884, p. 234 (Cachar); Swinhoe, 1890, p. 162 (Moulmein).

Cephnodes (!) *hylas*, Dudgeon, 1898, p. 419 (Sikkim; Bhutan).

Cephonodes hylas hylas, Roths. & Jord., 1903, p. 468; Mell, 1922, p. 195, pl. vi, figs. 29–33, pl. xxvii, fig. 9 (larva), pl. xiii, figs. 18–20, pl. xvii, figs. 34, 35 (pupa), pl. xxvii, figs. 10, 11 (♀); Scott, 1931, pl. ii, fig. 3 (larva).

Imago.—♂♀. Upperside: head, thorax and abdomen yellowish; abdomen with a black and a deep red band, sixth tergite with a black mesial patch, which often bears some red scales. *Underside* of palpus, breast, mesial patches of first abdominal sternites, side-patches of posterior sternites white, breast often slightly yellowish; tail black, rest of abdomen brownish-red. Fore tibia without apical thorn, but with some short spines. Individually variable in colour and size. *Expanse*: ♂♀ 60–73 mm.

♂. Ninth and tenth segments asymmetrical; tenth tergite twisted (fig. 64 B), apex pointing towards the right side, right half alone developed, forming an obtusely pointed hook; left

part of tergite reduced to a piece of chitin, visible in a ventral or a left-hand view; sternite without process, represented by a low rounded ridge. Right clasper large, broadly sole-shaped, ventral edge rounded or angulate in middle; left clasper reduced, broadly sinuate apically, dorsal lobe broad, not dilated at end, ventral lobe short and broad, both lobes clothed at and near the edge with short spines and longer bristles, no long bristles on inner surface. Penis-funnel rather small, with long bristles (fig. 64 C).

Hab. Throughout INDIA, BURMA and CEYLON, eastwards to China and Japan. We have bred it in many localities in India. It is found in both hills and plains in all types of country, always common, and in some seasons so numerous as to become a pest by defoliating Rubiaceous trees and shrubs.

Egg.—Surface without any sign of pitting, even under the microscope.

Larva:—

1st instar. Head round; body cylindrical; horn long, straight, bluntly bifid. Head covered with hairs 0·15 mm. long, shortly bifid, the branches 0·01 mm. long; body covered with bifid hairs, stem and branches both 0·05 mm.; horn shining and covered densely with bifid hairs. Head and body yellow; horn black. *2nd instar.* Similar to 1st instar but segment 2 yellow, rest of body green with black, transverse lines, or smoky-black. *3rd instar.* Head and a saddle-shaped marking on segment 2 orange, rest of body as above or oily-looking black. *4th instar.* Segment 2 of greater diameter than head or segment 3, the saddle-shaped collar raised above the surface of the segment; horn very long, straight, sharply pointed. Surface of head, saddle-mark, horn, anal flap and claspers tuberculate; the hairs of the 1st instar still present but proportionally much shorter. Head dark green, segment 2 green, the collar darker green with yellow tubercles; the remaining segments yellow; a broad, dark brown dorsal stripe, a white dorso-lateral stripe, and a black pear-shaped spot below it on 3 to 12; a narrow, black band along the margins of these segments, and an oval lateral black spot on 12; horn black; legs and prolegs dark red; anal flap and claspers dark green with paler tubercles; spiracles dark yellow.

In the dark-coloured form the head, anal flap and claspers greenish-ochreous; saddle-mark the same, with yellow tubercles; body oily-looking black; a broad, velvet-black dorso-lateral stripe.

5th instar. Head round; true clypeus less than half length of head, apex acute, sides slightly concave; false clypeus with apex broadly rounded, sides angled slightly outwards; labrum half length of clypeus and as broad as clypeus, narrowing slightly frontad, sides convex; ligula slightly longer than

labrum, kidney-shaped; eyes 1 to 4 in a slight curve, 6 in line with 3 and 4, all about one eye-diameter apart; the line from 5 to 4 at right angles to the line 4 to 6, and the distance from 5 to 4 equal to that from 4 to 6. Surface of head dull, covered with small, low, glassy tubercles. Body tapering gently from segment 7 frontad and posteriad to 12, 2 of greater diameter than head, and with a raised saddle-shaped collar covering most of the upper half of the segment. Horn long, down-curved, stout at base and tapering evenly to a sharp point, rising from a conical tumidity. Surface of body smooth and shining; saddle on 2 set closely with low, shining tubercles. Horn polished, set with small tubercles: clasper-faces with similar tubercles to the saddle; the supra- and sub-spiracular hairs visible.

Coloration very variable. In the green form (Pl. III, fig. 9) head and tubercles glaucous-green; labrum and ligula the same; basal segment of antenna glassy-green, second segment reddish, third pink; mandible green, with the tip broadly reddish-brown. Body glaucous-green above the subdorsal stripe, grass-green below it; saddle of segment 2 green, with yellow tubercles; an ill-defined purplish dorsal stripe from segment 3 to base of horn; a sharply defined subdorsal stripe, white on 3 to 11, yellow on 12, where it becomes broader and curves upwards to base of horn; this stripe edged very narrowly above with pink on 10 and 11; just below it a black comma or inverted pear-shaped patch, which may be continued as a narrow band to below the spiracle; an irregular-shaped purple patch from above spiracle of 12 to point of clasper; sometimes a white subspiracular stripe, edged above with black in the middle of each segment, on segments 6 to 10, and black dots where the white subdorsal stripe crosses the junctions of the secondary rings; venter purple. Horn yellowish-green, tip black, tubercles on upper surface black, on under surface yellowish-green; true legs pink; prolegs with bases dark purple, shanks pink. Spiracles oval, flush, pure white with a broad orange band across middle, the whole with a green or orange rim.

In the dark-coloured form (Pl. III, fig. 8) head brown or pale orange; segment 2, anal flap and claspers ochreous-orange; rest of body smoky-black; a sharply defined dorsal stripe, black or bluish; subdorsal stripe white or pink, with a broad black stripe below it and narrow black bands along the margins of the secondary rings; horn black; spiracles lying on oval orange patches. Length 60 mm.; breadth 8 mm.; horn 8·5 mm.

Pupa.—Head proximally round, distally conical; segments increase gradually in diameter from head to middle of pupa, then decrease more rapidly; dorsal line slightly convex, ventral

line nearly straight ; frons at right angles to longitudinal axis ; a small tumidity at the point where eye, tongue and frons meet. Surface shining, wing-cases nearly smooth, rest of surface covered with deep coalescing pits, strongest on 2 and on the abdomen ; segment 4 with sculpturing consisting of a median, transverse, raised band, interrupted at the dorsal line and extending downwards to lateral area ; several narrow, irregular, ante-spiracular ridges on 9, with pitting between them ; similar but less strong ridges on 10 and 11. Spiracle of 2 a narrow slit situated between the slightly raised hind margin of 2 and a long straight lobe on front margin of 3 ; remaining spiracles extremely narrow ovals, with narrow, raised edges. Cremaster thin, tapering, with a minutely bifid tip, the surface polished. Colour dark brown, the bevels of the free abdominal segments red-brown, spiracles dark brown and cremaster black. Length 35 mm. ; breadth 10 mm.

Habits.—See under *Cephonodes.*

73. **Cephonodes picus** (Cram.). (Fig. 64 D, E, genitalia ; Pl. X, fig. 2, larva).

Sphinx picus, Cramer, 1777, p. 38, pl. cxlviii, fig. B (Coromandel).
Macroglossum picus, Kollar, 1848, p. 458.
Cephonodes picus, Roths. & Jord., 1903, p. 469 ; Seitz, 1929, p. 545, t. 62 *d*.
Cephonodes hylas, Hübner, Butler, 1881 A, p. 613 (Kurrachi) ; Swinhoe, 1884, p. 514 (Kurrachi) ; id., 1886, p. 434 (Mhow) ; Hampson, 1891, p. 4 (Ceylon) ; id., 1892, p. 120 (part.).
Macroglossum hylas var., Guérin, 1843, p. 81 (Nilgiris).
Cephonodes hylas var. *cunninghami*, Swinhoe (non Walk. 1856), 1885 A, p. 287 (Bombay ; Poona).
Cephonodes cunninghami, Hampson (non Walk.), 1891, p. 1 (note) (Nilgiris, 3,000–6,000 ft., April).

Imago.—♂♀. No constant difference in colour from *C. hylas.* In fresh specimens the upperside of head, thorax and abdomen pure green instead of yellowish, but the green fades to yellowish in time ; red abdominal belt very often narrower, sometimes even absent, and individuals often rather smaller and less robust than those of *hylas.* Fore tibia ending in a prominent rust-coloured *thorn.* *Expanse* : ♂ 50–66 mm., ♀ 70 mm.

♂. Ninth and tenth segments asymmetrical, tenth sternite moved towards the right side ; tenth tergite (fig. 64 D) divided by a longitudinal groove, the two halves separated only at the tip, slightly tapering apicad, so twisted that the right lobe lies higher than the left one, the latter the shorter ; sternite curved, lanceolate. Right clasper very large, ventral part of inner surface covered with black hairs ; left clasper narrow, sides nearly parallel, apex somewhat dilated, subtruncate, ventral angle more rounded than upper one. Penis-funnel large (fig. 64 E).

Hab. W HIMALAYAS (Mussooree); S. INDIA and CEYLON, eastwards to the Marshall Islands. We have seen bred specimens from Mussooree. As common as *hylas*, and also defoliates Rubiaceous trees and shrubs in some seasons. May be found in all types of country.

Egg.—Surface with minute pitting visible under the microscope.

Larva.—Closely resembles that of *h. hylas* in all instars, but slight differences in the final instar.

Final instar. Head somewhat square in shape, clypeus one-half length of head, apex rounded, basal angles broadly rounded; false clypeus with apex acute; labrum one-third length of clypeus, base as broad as clypeus, narrowing frontad; ligula longer than labrum, as broad as front margin of labrum; eyes 1 to 4 in a sharp curve, one eye-diameter apart, 6 in line with 3 and 4, two diameters from 4; 5 two diameters from 6 and rather less from 4; all equal in size. Shape of body and surface and colour of head and body as in *H hylas*. Spiracles white, with no orange band. Length 60 mm. breadth 8 mm.; horn 8·5 mm.

Pupa.—Closely resembles that of *h. hylas*, but the ante-spiracular ridges are less strongly developed than in *h. hylas*. Length 35 mm.; breadth 10 mm.

Habits.—See under *Cephonodes*.

Genus **SATASPES** Moore. (Fig. 65).

Moore, 1857, p. 261; Roths. & Jord., 1903, p. 471; id., 1907, p. 88; Jordan, 1911, p. 249.

Genotype: *infernalis* (Westw.).

Imago.—♂♀. Closely resemble in appearance carpenter-bees of the genus *Xylocopa*. Upperside of wings purple or green with metallic gloss, or drab grey; thorax and abdomen more or less yellow. "Closely allied to *Hæmorrhagia*: differs especially in the following points:—

"Antenna shorter, not clubbed in ♂, more strongly compressed, deeply grooved; in ♀ slightly clubbed; end-segment distinctly widened at base; penultimate segment of the same shape as in the preceding one. Spines of abdomen as in *Hæmorrhagia*, except that those of the proximal rows are all longer than broad. Spurs shorter, those of mid-tibia less unequal. Cell of hind wing more than twice as long as broad.

♂. Tenth tergite divided into two diverging processes; sternite vestigial, without lobe. Clasper reduced and distorted; dorsal margin dilated into a broad plate, which lies upon the inner surface of the clasper, and is continuous with a dorso-apical process into which the clasper is produced; a ventral process represents the distal part of the large harpe

this process is armed at the upper corner with a prominent tooth. Penis-sheath without armature, flattened distally, rather stouter than in *Hæmorrhagia*, short, not produced into a thin apical process ; a slight transverse thickening ventrally in middle " (Roths. & Jord., 1903, p. 471).

Egg.—Only that of *S. infernalis* known.

Larva.—Ambulicine in appearance ; head round in 1st instar, triangular without processes in final instar, triangular with small processes in the intermediate instars ; body tuberculate, tapering slightly frontad ; horn down-curved. Colour green or yellow, with oblique stripes and variable dark-coloured patches.

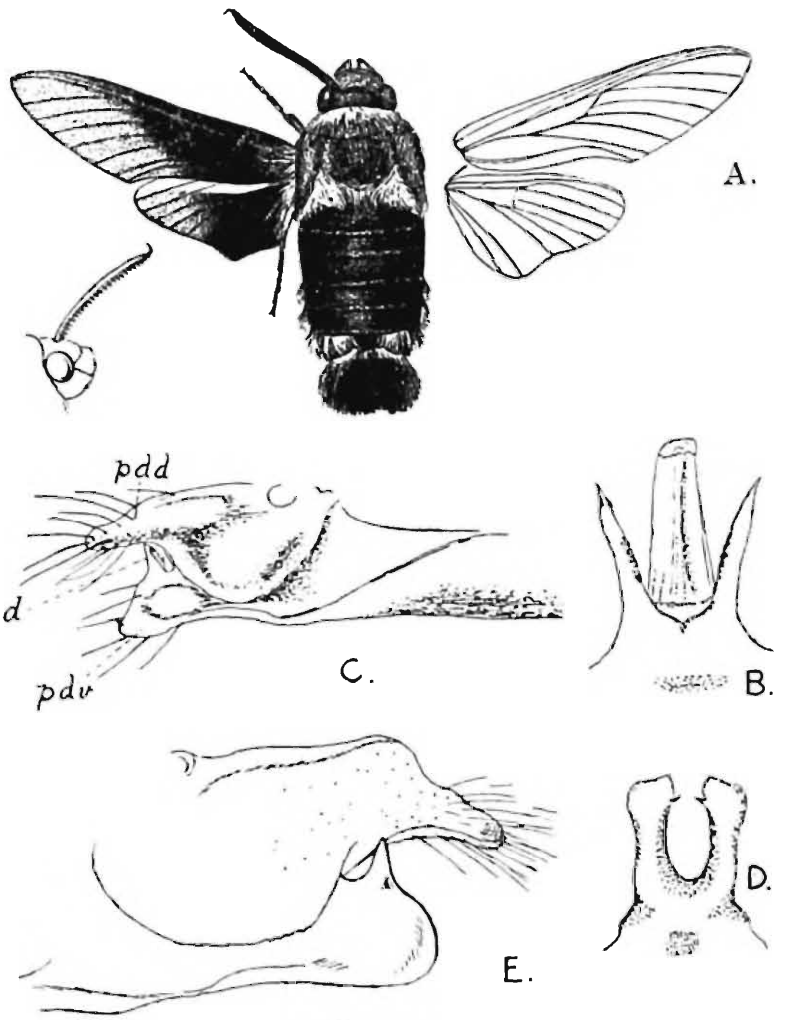


Fig. 65.—*Sataspes* Moore.

A, *S. infernalis* (Westw.), ♂; B, 10th segment, dorsal view; C, clasper (*d*, tooth of lobe; *pdd*, dorso-apical process of clasper; *pdv*, ventral lobe of harpe). D, *S. tagalica* Boid., 10th segment, dorsal view. E, *S. scotti* Jord., clasper and harpe.

Pupa.—Ambulicine in appearance ; no coxal piece; antenna shorter than fore leg. Frontal ridges, ante-spiracular ridges and sculpturing on segment 4. Cremaster triangular, with a bifid tip. Colour dark red.

Habits.—Food-plants belong to the family Leguminosæ. Pupation in a cell close to the surface, or in a rough cocoon

on the surface. The moths fly by day and rest with the wings held horizontal.

Hab. Indo-Malayan Subregion. Three Indian species.

Key to the Species.

Imagines.

♂, posterior abdominal sternites primrose-yellow; ♀, thorax not yellow; ♂♀, abdomen with a number of yellow patches or without yellow scaling .. .. *S. tagalica* Boisd., [p. 256.

Posterior abdominal sternites yellow only at sides; ♀, thorax yellow . . *S. infernalis* (Westw.), [p. 253.

Posterior abdominal segments not yellow; ♂♀, thorax and fore wing upperside drab-grey. *S. scotti* Jord., p. 257.

Larvæ.

Face pale green, rest of head darker green. *S. infernalis* (Westw.), [p. 254.

Face green, rest of head whitish *S. tagalica* Boisd., [p. 257.

Pupæ.

Cremaster with ventral extensor ridges; ending in a simple point .. .. *S. tagalica* Boisd., [p. 257.

Cremaster without extensor ridges; ending in a shortly bifid point *S. infernalis* (Westw.), [p. 255.

The larva and pupa of *S. scotti* have not been described in sufficient detail to fit them into the key.

74. **Sataspes infernalis** (Westw.).

Imago.—♂♀. Thorax yellow above, except for a black, ill-defined, transverse band anteriorly on mesonotum; sometimes the centre of thorax more or less black. The yellow band of abdomen occasionally reduced, seldom altogether absent.

♂. Tenth tergite (fig. 65 B) with the lobes compressed, pointed, slightly curved downwards, somewhat sabre-shaped, upper edge rough with notches near middle. Lobe of harpe truncate, the ventral edge acuminate, tooth pointed, plate large (fig. 65 C).

Hab. Indo-Malayan Subregion. Two Indian forms.

Sataspes infernalis f. **infernalis** Westw. (Fig. 65 A, ♂, B, C, genitalia; Pl. X, figs. 4, 5, larva, fig. 6, pupa.

Sesia infernalis, Westwood, 1848, p. 61, pl. xxx, fig. 3 (Silhet).
Sataspes infernalis Cotes & Swinhoe, 1887, p. 1 (Sibsagar; Buxa; Silhet); Hampson, 1892, p. 121, fig. 70 (♂) (part.); Dudgeon, 1898, p. 419 (Sikkim & Bhutan, up to 4,000 feet).
Sataspes infernalis f. *infernalis* Roths. & Jord., 1903, p. 472.
Sataspes infernalis infernalis, Jordan, 1911, p. 249, t. 40 *e*: Seitz, 1929, p. 546.

Imago.—♂♀. Abdomen with a more or less broad yellow band on sixth and seventh tergites; the other tergites generally

with dispersed yellow hair-scales ; disc of wings violet-purple, with little gloss. In specimens from S. India, thorax yellow, with the edges of scales of pronotum black, forming a black collar ; first abdominal tergite black, second black, sometimes with yellow scales, remaining abdominal tergites yellow except for the black anal tuft. The fore wing upperside fades to brownish soon after death. Hind wing *underside* with a white patch at base. *Expanse* : ♂♀, 56–70 mm.

Hab. E. HIMALAYAS ; S. INDIA ; BURMA and China. We have bred it in S. India, where it is not uncommon in September and October at the foot of the Western Ghats and in hills with heavy rainfall.

Egg.—Shortly oval in shape ; surface smooth and shining ; colour pale green. Length 1·2 mm. ; breadth 1 mm. ; height 1 mm.

Larva :—

1st instar. Head round, body cylindrical, horn straight and minutely bifid ; head covered with hairs, some simple and some forked ; body with a transverse row of small tubercles on each secondary ring, each tubercle with a forked hair ; colour of head yellowish, body pale green, horn black. *2nd instar.* Head triangular, with a short process rising from apex of each lobe ; tubercles and hairs as in 1st instar ; colour of head green, the processes rusty-pink, and a narrow yellow cheek-stripe ; body green with faint oblique stripes. *3rd and 4th instars.* Little change.

5th instar. Head large, triangular, with rounded vertex, no processes ; clypeus between one-third and one-half length of head, apex acute, basal angles tumid ; false clypeus chevron-shaped ; labrum about half the length of clypeus and slightly broader than clypeus ; ligula kidney-shaped, the lobes broadly rounded at ends ; eyes 1 and 2 nearly touching and lying at right angles to 3, 4 and 6, which are nearly in a straight line ; 2, 3 and 4 about one eye-diameter apart, 6 about three diameters from 4 ; 5 about one diameter from 4 and three from 6 ; eyes 3 and 4 larger than the rest. Surface of head shining, shallowly rugose, the cheek-stripe set into small tubercles. Body tapering gently from segment 8 to 2 and from 8 to 12, 2 about as broad as head. Horn short and stout, slightly down-curved, tapering evenly to a sharp point. Surface of body dull ; a transverse row of tubercles along each secondary ring, very minute except on segments 2 to 4 and on the anterior dorsal portion of remaining segments, where they are slightly larger ; supra- and subspiracular hairs visible, the latter having a short stem dividing into nine branches spread fan-wise horizontally.

Coloration.—Head pale green on face, darker green on rest of head, the two colours separated by a broad white cheek-

stripe running from vertex to base of antenna ; labrum green ; ligula white and shining ; two first segments of antenna green, end-segment paler green with tip rusty ; mandible green, the tip broadly dark reddish-brown ; eyes glassy greenish-brown. Body pale glaucous-green, darker on venter ; six whitish oblique stripes, that on segment 6 sharply defined, those on 7 to 10 diffuse and faint, that on 11 sharply defined, broader, and running across 12 to base of horn ; some larvæ have a large pale brown or a reddish-brown patch on 7 and 8 consisting of a diamond-shaped patch on the dorsum flanked by a larger, oval, lateral patch on each side reaching nearly to the spiracle on 8 ; these patches outlined narrowly with darker red-brown ; there may also be similarly coloured diamond-shaped patches on 7 and 10. Horn green.

The ground-colour is sometimes green and the oblique stripes yellowish, or canary-yellow with the patches chocolate ; the patches are variable in size, shape and colour. Spiracles yellow with the slit white. Length 60 mm. ; breadth 11 mm. ; head 6 mm. by 6 mm. ; horn 6 mm.

Pupa.—Ambulicine in shape ; head rounded, body broadest about the middle ; frontal ridges similar to those found in *Marumba*, roughly parallel, close together, the inner face of each ridge nearly vertical, the outer gently sloping. Surface shining, head, thorax and wing-cases coarsely lined in a manner resembling cracked lacquer ; the frontal ridges coarsely pitted and wrinkled ; abdomen deeply and coarsely pitted, especially on the anterior half of each segment dorsally and ventrally ; sculpturing on segment 4 consisting of a narrow, median, transverse weal on each side of the dorsal line, each weal outlined by a deeply depressed line ; ante-spiracular ridges on 9 to 11 consisting of three narrow ridges separated by wide channels. Spiracle of 2 a wide slit with narrow raised edges ; of remaining segments oval, the surface rising to the central slit with narrow raised edges. Cremaster an equilateral triangle coarsely pitted, ending in a short, stout, shortly bifid shaft. Colour dark red-brown to nearly black ; head, thorax, wing-cases and anal segments nearly black, spiracles red-brown. Length 35 mm. ; breadth 11 mm.

Habits.—Food-plants : *Dalbergia volubilis* Roxb. in India ; and *Lespedeza* Mich., *Albizzia lebbek* Benth., family Leguminosæ, in China. The young larva rests in a typical sphinx-like attitude. When molested it exudes a brownish juice copiously from the mouth. Pupation takes place in a cell a short depth below the surface, or in a rough cocoon on the surface. The moth may be seen feeding at flowers up till about 10 A.M.

The frass is peculiar, consisting of pieces of leaf held together loosely.

f. **uniformis** Butl.

Sataspes uniformis, Butler, 1875, p. 3 (Silhet).
Sataspes infernalis f. *uniformis*, Roths. & Jord., 1903, p. 473.
Sataspes infernalis uniformis, Seitz, 1929, p. 546.
Sataspes infernalis, Westw., Hampson, 1892, p. 121 (partim).

Imago.—♂. Abdomen with few or no yellow scales; otherwise like the preceding. ♀. Not known.

Hab. E. HIMALAYAS and S. INDIA. Very rare; early stages unknown.

75. **Sataspes tagalica** Boisd. (Fig. 65 D, genitalia).

Sataspes tagalica, Boisduval, 1875, p. 378, pl. x, figs. 3, 4 (Burias, Philippines).
Sataspes tagalica f. *tagalica*, Roths. & Jord., 1903, p. 473.
Sataspes tagalica tagalica, Seitz, 1929, p. 546.
Sataspes ventralis, Butler, 1875, p. 3 (Hong-Kong; Sylhet); id., 1877 A, p. 518; Hampson, 1892, p. 122 (Sikkim; Sylhet; Burma; Hong-Kong).

Imago.—♂. Posterior abdominal sternites pale primrose-yellow. Fore and hind wing with yellow basal costal tuft beneath; base of hind wing with some white scaling. *Expanse*: ♂♀, 56–70 mm.

Tenth tergite (fig. 65 D) with the lobes spatulate, apex somewhat twisted, feebly truncate, inner angle slightly acuminate, a sharp tooth at upper edge of lobe. Claspers as in *infernalis*, but tooth broader, lobe more rounded, plate smaller.

Hab. Indo-Malayan Subregion. Four Indian forms.

f. **tagalica** Boisd.

Imago.—♂. Disc of fore wing and almost the entire hind wing green; thorax yellow above, black in middle; abdomen with pale yellow dorsal patches.

♀. Like ♂, but abdominal sternites with traces only of the primrose-yellow area, and the dorsal patches rather less extended.

Hab. E. HIMALAYAS, Hong-Kong and the Philippines. Rare; early stages not known.

f. **thoracica** Roths. & Jord.

Sataspes tagalica f. *thoracica*, Roths. & Jord., 1903, p. 474 (Khasi Hills).
Sataspes tagalica thoracica, Seitz, 1929, p. 546, t. 64 *d*.

Imago.—♂. Thorax yellow; upperside of abdomen without yellow scales; disc of wings blue. ♀. Not known.

Hab. E. HIMALAYAS. Rare; early stages not known.

f. **collaris** Roths. & Jord.

Sataspes tagalica f. *collaris*, Roths. & Jord., 1903, p. 474 (Burma).
Sataspes tagalica collaris, Seitz, 1929, p. 546, t. 64 *c*.

Imago.—♂. Thorax only with a thin yellow transverse band on pronotum; abdomen without any yellow scales above; disc of wings blue. ♀. Not known.

Hab. BURMA and S. China, where Mell has bred this form (= *S. t. chinensis* Clark).

Larva :—

Final instar. Closely resembles that of *S. infernalis*, but differs in the face being green and rest of head whitish, while in *infernalis* the face is pale green and rest of head darker green; the oblique stripes in *tagalica* yellowish, those on segments 6 and 11 strongest; horn green dorsally, yellow laterally. Length 55 mm.; breadth 9 mm.

Pupa.—Very closely resembles that of *infernalis*, the only noticeable difference being that in *tagalica* the cremaster has lateral extensor ridges on the ventral surface, which run forwards to segment 11, and the cremaster ends in a simple point. Length 41 mm.; breadth 12·5 mm.

Habits.—Food-plant *Dalbergia* Linn., family Leguminosæ, in China. The larva becomes somewhat translucent in appearance before pupation, which takes place in a cell underground.

f. **hauxwelli** de Nicév.

Sataspes hauxwelli, de Nicéville, 1900, p. 173 (Tounghoo).
Sataspes tagalica f. *hauxwelli*, Roths. & Jord., 1903, p. 474.
Sataspes tagalica hauxwelli, Seitz, 1929, p. 546.

Imago.—♂. Not known. ♀. Abdomen without any yellow scales; disc of wings green, hind wing almost entirely green, as in *t.* f. *tagalica*; pronotum without yellow band, or only with a very few yellow scales.

Hab. BURMA. Very rare, and early stages not known.

76. **Sataspes scotti** Jord. (Fig. 65 E, genitalia; fig. 66, ♂).

Sataspes scotti, Jordan, 1926, p. 381, fig. 5 (genit.) (Dehra Dun, ♂); Seitz, 1929, p. 546.

Imago.—♂. Body drab-grey, segments 2 and 5 to 8 dorsally and tail laterally blackish; first tergite (almost concealed under the hairs of the thorax), tips of side-tufts of abdomen, anterior surface of fore coxa, upperside of fore tibia and tarsus, and outer surface of mid- and hind legs dull pale yellow, this colouring not at all conspicuous. Fore wing less elongate than in *S. infernalis*, distal margin shorter and more convex,

colour drab-grey like that of thorax, termen dark hair-brown, this border about 1·5 mm. broad at tornus, gradually becoming broader, and at costal margin from vein R^1 suddenly being produced basad to middle, the grey area traversed by an obscure broad subbasal band, beyond one-fourth by a straight line, and in middle of wing by another somewhat broader line, which begins at middle of costa and ends a little beyond middle of hind margin, these lines the same colour as the terminal band. Hind wing like termen of fore wing, shaded with drab grey from base to disc and anal angle, costal area (concealed) creamy, behind it some white hairs. *Underside* drab, with a slight tint of cinnamon and a faint purplish sheen, which is also present on the upperside in certain lights. In both wings R^1 branching off beyond cell. *Expanse*: ♂ 48 mm.; length of fore wing 21 mm.; width of thorax 7 mm.: ♀ larger; expanse 62 mm.; length of fore wing 27 mm.; width of thorax 9 mm.

Genitalia resembling those of *S. infernalis*, but horns of anal tergite rather more slender, harpe more rounded at apex, its tooth smaller (fig. 65 E).



Fig. 66.—*Sataspes scotti* Jord.

Hab. W Himalayas (Dehra Dun). One larva was found on the ground on the 7th November, 1925, under a tree of *Dalbergia sissoo* Roxb., family Leguminosæ. A ♂ moth emerged on the 26th April, 1926, and is now in the Tring Museum, together with a captured ♀.

Larva:—

Final instar. Head triangular; body shaped as in others of the genus; horn of medium length, down-curved. Colour of head green dotted with white, and a white stripe separating face from cheek. Body green, with a transverse row of white dots along each secondary ring; seven yellow oblique stripes; those on segments 6 and 11 broader than the rest, that on 11 running across 12 to base of horn. Horn with basal half purple, rest green. Spiracles oval, flush, white. Length 50 mm.

Pupa.—Frons with a subdorsal ridge, the two ridges close together. Cremaster a long thin spike. Colour dark brown.

Subfamily PHILAMPELINÆ.

Roths. & Jord., 1903, p. 475.

"♂♀. Sexual armature symmetrical; tenth segment (♂) not divided mesially, the tergite narrow; seventh sternite (♀) membranaceous distally, never spinose. Abdominal spines uniserial only in *Pholus* and *Tinostoma* [both American]. No high crest on mesonotum, and second segment of palpus (skeleton) not angulate laterally in any species" (Roths. & Jord., *l.c.* 1903).

Cosmopolitan. Two tribes, only one of which, *Nephelini*, is represented in India, the other, *Philampelini*, being American.

Tribe NEPHELINI.

NEPHELICÆ, Roths. & Jord. 1903, p. 498.

Imago.—"♂♀. Abdominal spines in more than one row.

"The genera of this tribe are in more than one organ either similar to the SESIINÆ or to the CHŒROCAMPINÆ. Very often a genus inclines towards one subfamily in one stage and towards the other subfamily in another stage. *Macroglossum*, for instance, is Sesiid in the imago and larva but Chœrocampid in the pupa; *Ampelophaga* is Chœrocampid in the imago and larva and Sesiid in the chrysalis. The imago of *Atemnora* is Sesiid in the strong flat spines, Chœrocampid in the large friction-scales. Such similarities are in so far affinities, as they show that the lines of development which prevail in the SESIINÆ on the one side and in the CHŒROCAMPINÆ on the other reappear in the *Nephelini*, a tribe of PHILAMPELINÆ, which subfamily stands between the two others.

"Progressive and retrogressive development is about equally frequent in this tribe. The normally non-crested head acquires a crest in reduced forms, like *Darapsa*, *Deidamia* and *Sphingonæpiopsis*, and the eyes become lashed and small. On the other hand, the eyes and the palpi are enlarged in *Elibia*, *Eurypteryx* and *Giganteopalpus*. The originally conical abdomen is flattened in a number of genera; the spines, which are never absent, develop like those in the SESIINÆ, becoming very weak in some genera and very strong and flat in others, *Macroglossum* and the two genera derived from it agreeing in the spination almost exactly with *Sesia* and allies; the basal sternite is not spinose, or has weak spines, or is as strongly spinose as the other sternites, and these sometimes nearly as strongly as the tergites, as is also the case in several SESIINÆ. In the species with strongly spinose and flattened abdomen the first segment is usually closely appressed to the thorax; in *Macroglossum* the first tergite

is reduced to a very narrow strip. The fan-tail is found in both sexes of a number of genera, sometimes only in the ♂ (*Eurypteryx*) ; it is a Sesiid character, indicated occasionally only by three small tufts (*Nephele* ♂♂). The scent-organ of the anterior coxa is sometimes strongly developed (*Chromis*). The mid- and hind coxal merum is simply carinate or subangulate ; but the large sharp tooth found in *Sesia* and allies appears also in this tribe (*Macroglossum* and allies), although the hind coxal merum is never as strongly produced as in *Sesia* " (Roths. & Jord., *l. c.* 1903).

The typical Philampeline moth has the fore wing marked with curved bands and triangles of various shades ; where these markings are replaced by longitudinal or oblique stripes, recalling the markings of Chœrocampine moths, the outer margin is usually sinuate or the apex falcate-truncate (*Panacra*).

Larva.—The larvæ of this tribe fall roughly into two groups : first, those resembling the larvæ of the tribe *Sesiini* (*Macroglossum* and allies) ; second, those resembling Chœrocampine larvæ, with body tapering strongly frontad and the anterior segments retractile. Subdorsal ocelli or an ocellus-like marking round the spiracle of segment 5 occur in the second group. The head is always round and small except in *Angonyx*, where it is large and semi-elliptical. The surface is shining or dull, and usually smooth, though tuberculate in *Ampelophaga* ; in *Macroglossum bombylans* there is a subdorsal line of spine-like tubercles. The colour is commonly green, but dimorphism and polymorphism occur.

Pupa.—In several genera (*Nephele*, *Panacra*, *Macroglossum*) basal part of tongue in a laterally flattened sheath projecting frontad and ventrad, as in many Chœrocampine pupæ. The three anal segments are sometimes fused into a cone or a hemisphere, the base of which fits into the deeply undercut hind margin of segment 11 (*Acosmeryx*). Tongue reaches tip of wing-case ; coxal piece present or wanting. Surface shining or dull, and smooth ; no sculpturing on segment 4 or ante-spiracular ridges. The colour is of various shades, with stripes, spots or mottling, except in *Angonyx*, which is the only uniformly coloured pupa.

Habits.—The food-plants belong to a large number of families, Rubiaceæ, Ampelideæ and Aroideæ being most commonly selected. The eggs are laid singly on the underside of a leaf, where the young larva lies stretched straight out. In later instars the same position is adopted, or the head and anterior segments are bent up at right angles to the rest of the body. The larvæ of some genera adopt a defensive attitude, which gives them a snake-like appearance (*Acosmeryx*,

Panacra). Pupation is always in a rough cocoon on the surface of the ground, never under it, or, more rarely, among the leaves of the food-plant (*Gurelca, Sphingonæpiopsis*). A large number of the smaller species fly by day, and lay their eggs while on the wing. The moth rests with the wings held nearly horizontal, the abdomen sometimes bent upwards.

Cosmopolitan; but in the Netropical Region occurring only in Northern Mexico. Nineteen Indian genera.

Key to the Genera.

Imagines.

1.	Spines of first row of abdominal tergites not longer than broad	2.
	Spines of first row of abdominal tergites longer than broad.	3.
2.	End-segment of antenna elongate; ♂, antenna with fasiculate cilia	[p. 345. MACROGLOSSUM Scop.,
	End-segment of antenna elongate; ♂, antenna similar to that of ♀, without prolonged cilia	[p. 393. RHOPALOPSYCHE Butl.,
3.	Fore tibia spinose	4.
	Fore tibia simple	5. [p. 328. GURELCA Kirby,
4.	Costal margin of hind wing deeply sinuate.	SPHINGONÆPIOPSIS [Wallengr., p. 338.
	Costal margin of hind wing not sinuate.	6.
5.	End-segment of antenna elongate, more or less long, filiform . ..	[p. 299. LEPCHINA Oberth.,
	End-segment of antenna long, but not filiform . .	10.
	End-segment of antenna short ..	[p. 324. NEPHELE Hübn.,
6.	Shorter mid- and hind tibial spurs with comb of bristles	7.
	Shorter mid- and hind tibial spurs without comb of bristles . . .	
7.	Distal margin of fore wing scalloped or angulate or dentate .	8.
	Distal margin of fore wing even.	9.
8.	End-segment of antenna not scaled, with a number of very long bristles	[p. 299. PANACRA Walk.,
	End-segment of antenna scaled	ACOSMERYX Boisd.,
9.	End-segment of antenna not scaled, with very long bristles. . ..	[p. 289. CHROMIS Hübn., p. 264.
	End-segment of antenna scaled .	DEILEPHILA Lasp.,
	End-segment of antenna scaled on ventral surface only	[p. 266. ACOSMERYCOIDES
10.	Eye strongly lashed and spines of abdominal sternites strong	[Mell, p. 287. RHODOSOMA Butl.,
	Not so ... .,	11. [p. 343.
11.	Mid-tibial spurs equal or nearly equal in length, very short, little longer than the tibia is broad . .	12.
	Mid-tibial spurs unequal, longer one at least twice as long as the tibia is broad.	14.
12.	Fore wing strongly falcate.	DAHIRA Moore, p. 276.
	Fore wing not falcate	13.

13. A straight creamy band across fore wing.	CIZARA Walk., p. 320.
No pale band across fore wing .. .	ENPINANGA Roths. & [Jord., p. 318.
14. Long terminal spur of hind tibia at least half the length of the first tarsal segment, which is shorter than the first mid-tarsal segment.. . .	[p. 315. ANGONYX Boisd.,
Spur shorter, or first hind tarsal segment longer than first mid-tarsal one..	15.
15. Abdomen with sharply marked pale dorsal line	16.
Abdomen without sharply marked pale dorsal line	[p. 341. EURYPTERYX Boisd.,
16. Palpus and eye large; hind tarsus twice the length of the cell of the hind wing; first hind tarsal segment longer than tibia	ELIBIA Walk., p. 285.
Palpus and eye small; first hind tarsal segment not longer than tibia	[& Grey, p. 278. AMPELOPHAGA Brem.

Larvæ.

1. Body tapering sharply frontad from segment 5; ocelli present or absent..	2.
Body tapering gently frontad; no ocelli ..	8.
2. Ocelli present (except in *D. placida*) ..	3.
Ocelli absent, but an ocellus-like marking round the spiracle of segment 5 .	5.
No ocelli or ocellus-like marking round spiracle of segment 5	6.
3. Ocelli of equal size on segments 4 to 11; horn short, down-curved .	[p. 265. CHROMIS Hübn.,
An ocellus on segment 4 only	4.
An ocellus on segment 5 only	[p. 300. PANACRA Walk.,
4. Horn a button-like prominence . .	ELIBIA Walk., p. 287.
Horn well developed; pale dorso-lateral stripes; no oblique stripes .	[p. 267. DEILEPHILA Lasp.,
5. Segments 4 and 5 flanged; a pale sub-dorsal stripe . .	[p. 290. ACOSMERYX Boisd.,
Segments 4 and 5 not flanged; a reddish-brown dorso-lateral stripe, crescent-shaped on segments 7 to 10	CIZARA Walk., p. 322.
6. Segments 4 and 5 flanged; transverse rows of tubercles along secondary rings..	[& Grey, p. 279. AMPELOPHAGA Brem.
Segments 4 and 5 not flanged; no rows of tubercles along secondary rings	7.
7. Horn long, stout, laterally compressed, basal half gently up-curved, distal half gently down-curved; tubercles on dorso-lateral line only . .	[p. 344. RHODOSOMA Butl.,
Horn short, slightly down-curved, colour green or black	DAHIRA Moore, p. 277.
Horn long, stout, down-curved, ending in a conical tooth, colour dark fuscous-violet	[p. 327. NEPHELE Hübn.,
8. Head large, vertex higher than dorsum of segment 2	[p. 317. ANGONYX Boisd.,
Head small, vertex not higher than dorsum of segment 2 ..	9.

9. A white, clearly defined subspiracular stripe from segment 2 to 14; a dorso-lateral stripe sometimes present, but no oblique stripes; length of larva not exceeding 40 mm.; horn short and straight, tapering sharply . . [Wallengr., p. 340. SPHINGONÆPIOPSIS

No white, clearly defined subspiracular stripe; pale oblique stripes always present; length of larva about 50 mm.; horn very variable . . [p. 329. GURELCA Kirby,

A pale subspiracular stripe present in some forms; oblique stripes often present: length of larva usually exceeding 40 mm.; horn very variable [p. 347. MACROGLOSSUM Scop., RHOPALOPSYCHE Butl., [p. 395.

Pupæ.

1. Head round, without any protuberances 2.
Head with one or more protuberances . 9.
2. Colour ochreous or terra-cotta, with a black mesial line and black spiracular spots . . . . . 3.
No black mesial line or black spiracular spots . . . . 4. [p. 267.
3. Cremaster bifid, processes simple . . . . DEILEPHILA Lasp.,
Cremaster bifid, processes subdivided CHROMIS Hübn.,
4. Hind margin of segment 11 undercut . . 5. [p. 265.
Hind margin of segment 11 not undercut . . . . . 6.
5. A transverse dorsal gash at the common margins of segments 4 and 5 [& Grey, p. 280. AMPELOPHAGA Brem.
No such gash ACOSMERYX Boisd.,
6. Length of pupa over 35 mm. 7. [p. 290.
Length of pupa less than 25 mm. . 8.
7. Cremaster a stout knob ending in a shaft set with five or six hooks and some tubercles on each side . . . . CIZARA Walk., p. 323.
Cremaster conical, tapering gently to a short, widely bifid tip: tongue-sheath projecting slightly frontad . . [p. 345. RHODOSOMA Butl.,
8. Two transverse black bars on each abdominal segment [Wallengr., p. 340. SPHINGONÆPIOPSIS
No such bars . GURELCA Kirby,
9. Hind margin of segment 11 undercut 10. [p. 329.
Hind margin of segment 11 not undercut. 11.
10. Head with a pointed projection directed frontad, and eyebrows tumid; colour of pupa iron-grey above, rust-red below, bevels of abdominal segments ochreous-brown . . . . . DAHIRA Moore, p. 278.
Head with a rounded boss on each side of dorsal line; colour of pupa reddish-brown, hind bevels of segments 8 to 11 dull black. . . . . [p. 317. ANGONYX Boisd.,
11. Basal part of tongue in a laterally flattened sheath . . . . 12. [p. 347.
12. Dorsum of segments 4 to 8 flattened; black spiracular spots . . . . MACROGLOSSUM Scop., RHOPALOPSYCHE Butl.,
Dorsum of segments 4 to 8 not flattened; no black spiracular spots [p. 396. 13.

13. Colour of pupa green or grey, with darker markings . . . . . [p. 300.
PANACRA Walk.,

Colour bone-colour, abdomen suffused with violet-brown [p. 327.
NEPHELE, Hübn.,

Genus **CHROMIS** Hübner. (Fig. 67).

Hübner, 1822, p. 138; Roths. & Jord., 1903, p. 503; id., 1907, p. 95.

Genotype: *erotus* (Cram.).

Imago.—" ♂♀. Close to *Deilephila*, but end-segment of antenna with very long bristles and without scales, the bristles several times as long as the segment, which resembles the *Theretra*-segment, but is longer. Genal process more sharply triangular than in *Deilephila*. Hind tarsus very long, reaching beyond tip of abdomen, when the leg is straightened out" (Roths. & Jord., 1903, p. 503).

Hab.—Oriental Region. One Indian subspecies. For the early stages see under *C. e. erotus*.

77 **Chromis erotus erotus** (Cram.). (Fig. 67 A, ♀; B, D, genitalia).

Sphinx erotus, Cramer, 1777, p. 12, pl. civ, fig. B (Hab. ?).
Chærocampa erotus, Hampson, 1892, p. 94.
Chromis erotus erotus, Roths. & Jord., 1903, p. 504; Seitz, 1929, p. 547.
Chærocampa erotus var. *andamanensis*, Kirby, 1877, p. 242 (Andamans).
Chærocampa andamanensis, Waterhouse, 1884, pl. cxli, fig. 1.

Imago.—♂♀. Fore wing brown with a slight purplish suffusion and clouded in parts beyond middle; two indistinct, antemedian, curved lines and two similar postmedian lines. Hind wing bright orange-yellow with a diffuse reddish-brown band, broad in the ♀, along the outer margin except at apex and outer angle; cilia reddish-brown. Throat and first segment of palpus pure white. Eye large. Antenna clubbed in both sexes, more distinctly in ♀ than in ♂. Fore tarsus (except distal segment) and fore tibia broad in ♂; scent-organ of fore coxa very strongly developed. First segment of hind tarsus longer than tibia, and in ♂ a little longer than segments 2 and 3 together, in ♀ as long as segments 2 to 5. *Expanse*: ♂ 70–92 mm., ♀ 90–114 mm.

♂. Tenth tergite (fig. 67 B) strongly compressed, hooked, dilated dorsad at the curvature; sternite nearly like that of *Deilephila nerii* in lateral and ventral aspect. Clasper with more than twelve pointed friction-scales; harpe (fig. 67 C) ending in a long and pointed hook. Penis-sheath (fig. 67 D) produced apically into a blunt process directed distad, bearing at

the right side a non-dentate projection pointing proximad and at the left side a short process ending in some teeth.

♀. Eighth tergite feebly chitinized mesially, sinuate. Vaginal plate membranaceous except rounded-triangular post-vaginal part ; orifice large, without special armature.

Hab. CEYLON, ANDAMAN ISLANDS and Malaya. Fairly common.

Larva.—Horn long and straight in early instars, down-curved in later instars. Colour brown or green ; a pale line from segment 6 to 11, the area below this line pale in the brown form ; an ocellus with white centre, surrounded by blue in the

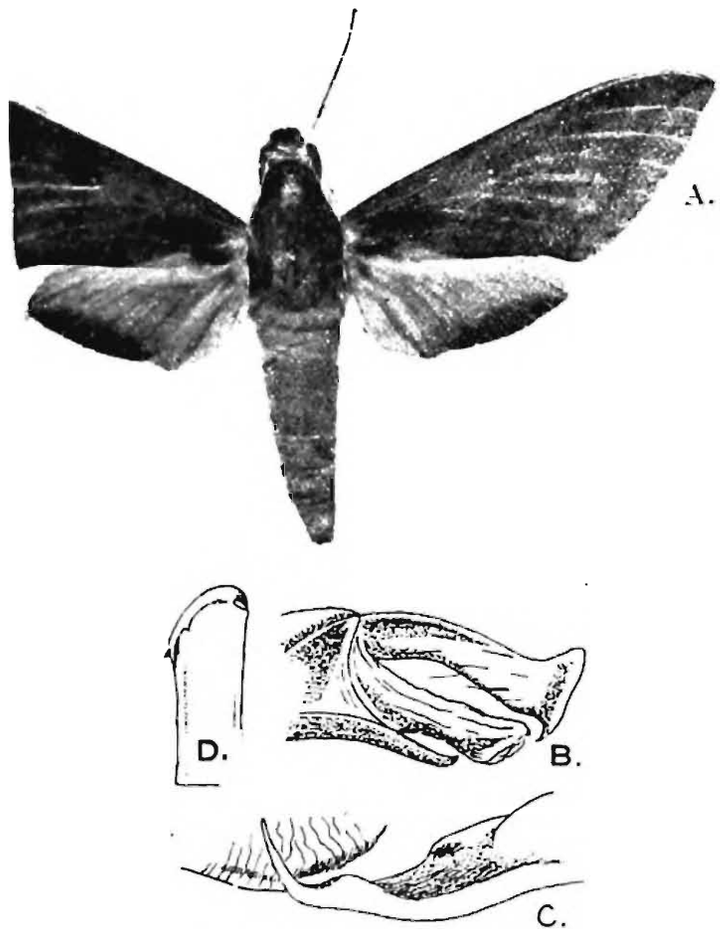


Fig. 67.—*Chromis* Hübn.

A, *C. erotus erotus* (Cram.), ♀; B, 10th segment, lateral view; C, harpe ; D, penis-sheath.

green form by green in the brown form, on segments 4 to 11, all of equal size ; pale oblique stripes on segments 5 to 11.

Pupa.—Similar to that of *Deilephila* ; cremaster bifid, each process again divided into two horizontal, conical, pointed processes, the external ones ending again in two hooks, of which one curves ventrad the other dorsad ; tongue-case carinate. A series of black stigmatal spots.

Habits.—Not known.

Genus **DEILEPHILA** Laspeyres. (Fig. 68).

Laspeyres, 1809, p. 99 (part.); Roths. & Jord., 1903, p. 505; id., 1907, p. 95; Jordan, 1911, p. 249.

Genotype: *nerii* (Linn.).

Imago.—♂♀. Large handsome moths, upperside green or brown, marked with curved bands and triangles of different colours. "Genal process triangular, obtuse, shorter than pilifer. Head broad, somewhat crested transversely on occiput. Eye large, not lashed. Palpus obtuse, large.

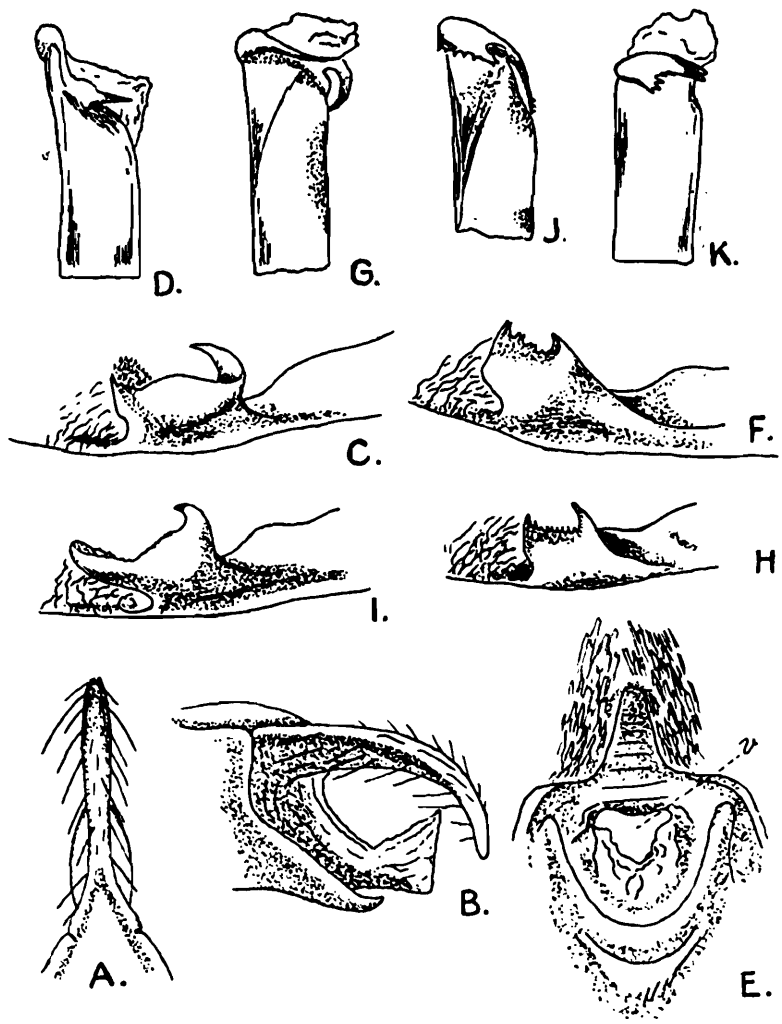


Fig. 68.—*Deilephila* Lasp. Genitalia.

A, *D. nerii* (Linn.), 10th segment, dorsal view; B, 10th segment, lateral view; C, harpe; D, penis-sheath; E, ♀ vaginal plate (*v*, vaginal orifice). F, *D. hypothous* (Cram.), harpe; G, penis-sheath. H, *D. layardi* (Moore), harpe. I, *D. placida* (Walk.), harpe; J, penis-sheath. K, *D. minima* (Butl.), penis-sheath.

Antenna, ♂ setiform, heavier than in *Acosmeryx*, somewhat clubbed in ♀; hook rather abrupt and short, subseriate in lateral aspect, end-segment prolonged into a long filiform process. Spines of abdomen in several rows, elongate, weak; first tergite large. Hind edge of mid-coxal merum subcariniform. Tibiæ simple; spurs very unequal, long terminal one of hind tibia much longer than second tarsal segment;

mid-tarsus with comb, the spines of which are, however, not much prolonged. Wings entire, apex of fore wing pointed; R^2 of hind wing before centre of cell.

"♂. Tenth tergite simple, tergite not or little narrowed to end, convex above at end and concave below; sternite elongate-triangular, sides sometimes nearly parallel (in dorsal aspect), apex more or less pointed, upperside concave, transversely ribbed or tuberculate at end. Clasper with less than ten large friction-scales, rounded-dilate dorsally; harpe with two processes, one proximal the other distal, both dorsal. Penis-sheath with one or two left processes, and a longer right process.

"♀. Vaginal plate suddenly narrowed at end, here concave, the apical margin raised and somewhat projecting ventrad" (Roths. & Jord., 1903, p. 505).

Egg.—Broadly ovoid, surface smooth and shining; colour green.

Larva.—Head small, body tapering sharply frontad from segment 4, rest of body nearly cylindrical; horn down-curved. Surface dull and smooth, tubercles on horn only. Colour green or brown, with a pale dorso-lateral stripe and a blue ocellus on segment 4 (except in *placida* ?).

Pupa.—Head round; surface smooth and shining; coxal piece present; antenna about equal to fore leg; cremaster bifid; colour ochreous or terra-cotta, with a black mesial line and a series of round black spiracular spots.

Habits.—The food-plants belong to the families Cornaceæ, Rubiaceæ and Apocynaceæ. The larva turns brown before pupation, which takes place in a rough cocoon on the surface. The abdomen is bent upwards when the moth is at rest.

Hab. Aethiopian and Oriental Region, one species (*nerii*) extending northwards into the Palæarctic Region. Six Indian species and subspecies.

Key to the Species and Subspecies.

Imagines.

1.	Pale apical line of fore wing widened to a spot close to apex. .	2.
	Pale apical line of fore wing simple. .	3.
2.	Green subbasal area of fore wing above externally sinuate at SC	[p. 272. *D. layardi* (Moore),
	Green subbasal area of fore wing above externally not sinuate	[(Cram.), p. 271. *D. h. hypothous*
3.	Abdomen with pale subbasal belt above	4.
	Abdomen without pale subbasal belt above.	5. [p. 274.
4.	Smaller, paler form	*D. m. minima* (Butl.),
	Larger, darker form	*D. m. ernestina* [(Moore), p. 274.
5.	Tegulæ and subbasal band of fore wing bright olive-green	*D. nerii* (Linn.), p. 268.
	Tegulæ and subbasal band of fore wing blackish or brownish olive-green	[p. 273. *D. placida* (Walk.)

Larvæ.

1. An ocellus on segment 4	2.
No ocellus on segment 4 . . .	4.
2. A broad, interrupted, blue dorso-lateral stripe .	[p. 272. *D. h. hypothous* (Cram.),
No such stripe . . .	3.
3. Ocellus blue with white pupil .	*D. nerii* (Linn.), p. 269.
Ocellus blue with darker blue pupil	*D. m. minima* (Butl.), [p. 275.
4. Spiracles orange.	*D. p. placida* (Walk.), [p. 274.

Pupæ.

1. Cremaster conical, ending in two short teeth	*D. nerii* (Linn.), p. 271.
Cremaster elongate-triangular, the tip truncate, with a short, sharp tooth at each lateral angle; ventral surface with a median keel	2.
2. Colour ochreous-brown; a black stripe from head to cremaster dorsally and from head to tip of tongue ventrally . .	[(Cram.), p. 273. *D. h. hypothous*
Colour pale terra-cotta; the black stripe on segment 2 only dorsally	[p. 275. *D. m. minima* (Butl.),

78. **Deilephila nerii** (Linn.). (Fig. 68 A–E, genitalia; fig. 69, imago; Pl. III, fig. 10, larva, fig. 11, pupa).

Sphinx nerii, Linnæus, 1758, p. 490; id., 1767, p. 798; Cramer, 1779, p. 51, pl. ccxxiv, fig. D (Coromandel).

Daphnis nerii, Moore, 1857, p. 272, pl. x, figs. 3, 3 *a* (l., p.) (Dukhun; Madras); id., 1865, p. 794 (Bengal); Butler, 1881 A, p. 613 (Kurachi); Moore, 1882, p. 14, pl. lxxxii, figs. 1, 1 *a* (l., i.); Swinhoe, 1884, p. 513 (Kurachi); id., 1885 A, p. 288 (Poona; Bombay); id., 1886, p. 435 (Mhow); id., 1888, p. 119 (Kurachi); Hampson, 1892, p. 94, fig. 54 (♀).

Deilephila nerii, Roths. & Jord., 1903, p. 507; Jordan, 1911, p. 250, t. 39 *c*; Seitz, 1929, p. 547.

Imago.—♂♀. Head green, rufous in front, a grey band on vertex. Thorax green, the collar outlined in grey; a triangular grey patch on vertex. Abdomen pale green, with dark green lateral oblique stripes and a pale subbasal belt; paired green lateral blotches on penultimate and a single dorsal blotch on terminal segment. Fore wing bright green; a basal white patch with a black spot on it; some median, whitish, conjoined bands, rosy towards hind margin; an outwardly oblique band from costa to R^3; an oblique streak from apex to R^1; a triangular, purplish patch from below cell to near outer margin. Hind wing fuscous with a pale, curved, submarginal line, beyond which the colour is dark olivaceous. *Underside* suffused with chestnut; a white submarginal line on both wings; a white speck at end of cell of hind wing. First segment of posterior tarsus considerably longer than tibia and than segments 2 to 5, long apical spur of

hind tibia as long as segments 2 and 3 together. *Expanse* : ♂ 84–116 mm., ♀ 84–126 mm.

♂. Tenth tergite long (fig. 68 A, B), rather strongly curved, apex rounded-truncate ; sternite much shorter than tergite, broad, somewhat rounded at sides, narrowed from middle to apex, which is pointed. Clasper rather strongly dilated dorsally before apex ; large scales somewhat spotted with brown at and before end ; harpe (fig. 68 C) : basal process prominent, apical process obtuse, densely dentate on upper surface. Penis-sheath (fig. 68 D) : apical margin dorsally produced into a rounded lobe which bears the left process ; this process short, triangular, pointing proximad ; right process horizontal, shorter than in allied species.

♀. Vaginal plate (fig. 68 E) regularly folded distally of mouth of vagina, the edges of the latter raised ; much wrinkled, a semicircular, ante-vaginal ridge rather prominent.



Fig. 69.—*Deilephila nerii* (Linn.).

Hab. Throughout INDIA, BURMA and CEYLON ; the Aethiopian Region and W Asia, as a wanderer to the northern parts of the temperate zone. Occurs as a rare straggler in England, where it is known as the Oleander Hawk-Moth. We have bred it in many localities in India, where it is very common, and may be found in all types of country, including the Sind desert and Aden, and the N.W Frontier.

Egg.—Superficial pits are visible under the microscope. Length 1·5 mm. ; breadth 1·25 mm. ; height 1·25 mm.

Larva :—

1*st instar*. Head round, slightly bilobed ; body long and thin, horn long, straight, bluntly bifid, with a seta on each arm. Surface dull, all the main hairs present, and horn set with erect spines at base and small hairs elsewhere. Colour honey-yellow, horn black. 2*nd instar*. Shape as in the 1st instar ; the whole body covered with minute hairs, among

which the main hairs are hardly traceable; base of horn smooth, rest tuberculate; colour bright green, with an indication of an ocellus on segment 4 and a bluish-grey dorso-lateral stripe from 6 to base of horn; horn black, with a basal lateral patch yellow. *3rd instar.* Similar in shape, surface and colouring to the full-fed larva, except that the horn is shining, basal half thick, then thinning suddenly to a long, translucent point; colour of horn green, with a black ring at the point where it becomes thin. *4th instar.* Similar in all respects to the full-fed larva.

5th instar. Head small, rather square, with rounded corners; true clypeus not quite one-half length of head, apex acute; false clypeus forming a wide arch over apex of true clypeus; labrum one-third length of clypeus; ligula longer but narrower than labrum, the lobes narrow, eyes 1 to 4 in a wide curve, 2 and 3 closer together than 1 is to 2 and 3 is to 4; 3, 4 and 6 in a straight line; 5 at the apex of an isosceles triangle formed by 4, 5 and 6; 2 very small, 3 and 4 larger than 1, 5 and 6. Surface of head moderately shining, very shallowly corrugate. Body with segment 2 of equal diameter to head, the segments then increasing rapidly in diameter to 5 and more gradually to 8, then decreasing slightly to 12. Horn short and stout, sausage-shaped, bent sharply downwards in middle, narrowing suddenly to a short, sharp point. Surface of body dull and smooth; horn polished and tuberculate.

Coloration.—Green form (Pl. III, fig. 10): head dark glaucous-green; labrum shining reddish-brown; ligula dark reddish-brown; eyes dark brown. Body: segment 2 soiled green, segments 3, 4, 13 and 14 bright yellow, rest of body bluish-green suffused with glaucous except on venter; a large subdorsal ocellus on front margin of 4, centre white, shading to pale blue and then to dark blue; some white spots ringed with dark green subdorsally on 4 and 5; a broad white dorso-lateral stripe from middle of 5 to base of horn, edged above with dark green and below by mauve on the median segments; above and below this stripe, on the median segments, white spots ringed with dark green above and with mauve below. Horn and its tubercles bright orange; legs purple, prolegs dark green. Spiracles oval, dark green, with the central slit velvety black edged narrowly with white.

In another form of the larva the ground-colour of head and body ochreous, with fuscous-grey oblique lateral patches on segments 6 to 12; ocellus darker than in green form and ringed with black; true legs black. There are also forms with intermediate colouring. Length 90 mm. or more; breadth 15 mm.; horn 6 mm.

Pupa.—Broadly rounded in front, the shoulders not prominent; segments 13 and 14 form together a short cone; antenna slightly shorter than fore leg, which reaches to middle of wing-case, mid-leg reaching to three-quarters of the wing-case; a long, narrow coxal piece. Surface shining, head, thorax and wing-cases smooth, abdomen coarsely pitted on dorsum, the pits forming irregular lines, venter transversely creased, segments 12 to 14 closely pitted all over. Spiracle of 2 a slit, with the front margin of 3 raised into a ridge behind it; remaining spiracles oval, convex, the central slit with raised edges. Cremaster short, thin, conical, ending in two short teeth, the surface rugose. Colour of head, thorax, wing-cases and sides and venter of abdomen dull orange; dorsum of abdomen reddish-brown speckled with black; a narrow black stripe starting from the frons and running to the tip of the tongue, and a broader black dorsal stripe on segments 2 to 4; spiracles black, lying in large black patches; cremaster black. Length 60 mm.; breadth 13 mm.

Habits.—Food-plants: *Nerium odorum* Soland., *Holarrhena antedysenterica* Wall., *Ervatamia heyneana* Wall., *Vinca rosea* Linn., *Tabernæmontana coronaria* Willd., and other plants of the family Apocynaceæ. In the earlier instars the larva turns the head round to one side when disturbed, in later instars it bends the head downwards and puffs out segment 4 so as to expand the ocelli. The body becomes suffused with brown dorsally and yellow ventrally before pupation. The pupa is free in the cocoon, and moves the abdominal segments when touched. The beautiful moth comes to light freely, and may also be seen feeding at flowers shortly after dark. Captive specimens pair without difficulty. Eggs and larvæ can be found at any time of the year in places where the nights are not very cold.

79. **Deilephila hypothous hypothous** (Cram.). (Fig. 68 F, G, genitalia; Pl. XIV, fig. 8, larva).

Sphinx hypothous, Cramer, 1780, p. 165, pl. cclxxxv, fig. D (Amboina).

Darapsa hypothous, Moore, 1867, p. 676 (Calcutta; larva and pupa).

Daphnis hypothous, Moore, 1882, p. 15, pl. lxxxiii, figs. 1, 1 *a* (l., p., i.); Cotes & Swinhoe, 1887, p. 21 (Sikkim; Sibsager; Calcutta; Ceylon; Andamans); id., 1889, p. 727 (Andamans); Hampson, 1892, p. 95; Dudgeon, 1898, p. 415 (Sikkim & Bhutan, up to 6,000 ft.).

Deilephila hypothous hypothous, Roths. & Jord., 1903, p. 570; Mell, 1922, p. 210, pl. vii, figs. 1, 2, pl. xviii, fig. 2, pl. xxviii, fig. 1 (larva), 2 (imago), pl. xiii, fig. 22, pl. xvii, figs. 36, 37 (pupa); Seitz, 1929, p. 547, t. 63 *a*.

Imago.—♂♀. Differs from *nerii* in the head and collar of thorax being uniformly dark purplish-brown; thorax and first

two segments of abdomen dark olive-green, with a white fringe to the first segment; the other segments dark olive-brown with stripes and spots as in *nerii*. Wings similar in pattern to those of *nerii*, but very much darker olive-green on both sides; fore wing with a white spot at apex on upperside and at end of cell on underside; the white apical line SC^4–SC^5, which borders the olive-green triangular patch, not prolonged beyond SC^5 as in *nerii*. Antenna thicker than in *nerii*, especially in ♂. First segment of hind tarsus as long as tibia and as segments 2 to 5. *Expanse*: ♂ 86–110 mm., ♀ 124 mm.

♂. Tenth tergite shorter and broader than in *nerii*; sternite nearly as long as the tergite, more strongly chitinized and narrower than in *nerii*. Large scales of clasper brown or black on midrib and at edge; harpe (fig. 68 F) shorter than in the other species except *layardi*, distal margin angulated, upper margin somewhat flattened, with two rows of teeth. Penis-sheath (fig. 68 G) armed with two slender processes, the left horizontal, the right obliquely curved towards the ventral side.

♀. The distal portion of the vaginal plate nearly smooth; the chitinized half-ring-shaped plate in front of the vaginal aperture not raised to a carina or ridge.

Hab. E. HIMALAYAS, S. INDIA, CEYLON and BURMA to Malaya and China. We have bred it in the Khasi Hills, where the larva occurs somewhat rarely at an elevation of about 4,000 feet in dense jungle during the rainy season.

Egg.—As for *nerii*.

Larva:—

Final instar. Head round, body as in *nerii*; horn rather long, stout, tapering gradually to near tip where it narrows suddenly to a simple point. Surface of head dull, covered with small tubercles. Body dull and smooth; horn covered with small tubercles.

Coloration.—Head green with the tubercles paler. Body: segments 2 to 4 dark green, rest of body paler, brighter green; a dull green saddle-shaped marking on dorsum of 2; a narrow dorso-lateral stripe from front margin of 3 to base of horn, orange on 3 to 5 and on 12, white edged above with dark green on the median segments; on 4, immediately below the dorso-lateral stripe, a small, shortly oval, transverse ocellus, dark blue above shading to white below; on 6 to 11, just below the dorso-lateral stripe, a broad, sky-blue stripe, broken at the margins of the segments and thus forming a series of oblong spots; on the same segments six dark green oblique stripes running in the opposite direction to that which is usual in sphingid larvæ. Horn brown with the tubercles paler brown; anal flap and claspers chocolate; legs pink. Spiracles oval, yellow with the central slit brown. Length 100 mm.

Pupa.—The same shape as that of *nerii*, but less slender; antenna longer than fore leg in ♂, equal to it in ♀; a small coxal piece. Surface smooth and shining. Cremaster elongate-triangular, the tip truncate, with a short sharp tooth at each lateral angle; ventral surface bi-concave, with a median keel and a ridge along each edge. Colour ochreous-brown a broad, interrupted brown spiracular and a paler brown subspiracular stripe; a narrow, jet-black ventral stripe from tip of tongue to frons, continued as a broad dorsal stripe from frons to cremaster; spiracles and cremaster black. Length 60–70 mm.; breadth 15 mm.

Habits.—Food-plant: *Uncaria* Schreb. in the Khasi Hills. Mell gives the food-plant as *Wendlandia paniculata* DC. in S. China, and the 'Revision' gives *Cinchona* Linn., all of the family Rubiaceæ. The larva is found on low bushes, usually near water. Other habits as for *nerii*.

80. **Deilephila layardi** (Moore). (Fig. 68 H, genitalia).

Daphnis layardi, Moore, 1882, p. 16, pl. lxxxiv, fig. 1 (Ceylon); Hampson, 1892, p 96.
Deilephila layardi, Roths. & Jord., 1903, p. 511; Seitz, 1929, p. 548, t. 63 *a*.

Imago.—♂♀. Differs from *hypothous* in being ruddy-brown, not olive; abdomen with a pale fringe to each segment. Subbasal band of fore wing above broader than the interspace between it and the dark discal area; antemedian line distinct only in front, almost touching at M^2 the olivaceous line which runs parallel with the outer edge of the subbasal band; proximal edge of discal area straight; a white dot at apex of fore wing above and at end of cell below. *Expanse*: ♂ 70–80 mm.

♂. Sexual armature similar to that of *hypothous*, but the harpe smaller (fig. 68 H).

Hab. CEYLON. Rare; early stages unknown.

81. **Deilephila placida placida** (Walk.). (Fig. 68 I, J, genitalia).

Darapsa placida, Walker, 1856, p. 186 (Sumatra).
Deilephila placida placida, Roths. & Jord., 1903, p. 512; Seitz, 1929, p. 548, t. 63 *a*.
Daphnis andamanus, Druce, 1882, p. 16 (Andamans); Hampson, 1892, p. 96.

Imago.—♂♀. Differs from *hypothous* in the head, thorax and abdomen being uniform reddish-brown without markings. Fore wing upperside reddish-brown; antemedian line mid-way between the subbasal and discal bands; the latter band not wider between M^1 and M^2 than at hind margin, externally rounded or angled at R^2, the most distal point on R^2, *not* on R^3; proximal edge of olive-green discal area deeply

incurved in front. Hind wing reddish-brown. No white apical spot above or below. *Expanse*: ♂ 66–84 mm., ♀ 77–92 mm.

♂. Tenth segment as in *hypothous*. Large scales of clasper rather strongly rounded at sides; clasper not strongly dilated dorsally, apex rounded; harpe (fig. 68 I) longer than in any of the preceding species, not or feebly dentate, shape of the two processes rather variable individually. Penis-sheath (fig. 68 J) with a short left process which is often dentate, the proximal edge of the incrassate apex of the sheath also dentate, the right process long, oblique, curved ventrad, more or less dentate at end.

♀. Vaginal plate without semicircular ridge proximally of the vaginal aperture.

Hab. ANDAMAN ISLANDS, Malaya and the Philippines.

Larva:—

Final instar. Horn long, down-curved, tuberculate. Colour: a pale dorso-lateral stripe from segment 2 to base of horn; a pale line on anal segment. Spiracles orange.

Pupa.—More slender than that of *hypothous*. Cremaster almost identical. Colour tawny-ochraceous, spotted with black on abdomen.

Habits.—Food-plant: *Tabernæmontana* Linn., family Apocynaceæ.

82 *a*. **Deilephila minima ernestina** (Moore).

Daphnis ernestina, Moore, 1887, p. 534, pl. ccxi, fig. 1 (Ceylon; Pundulova); Hampson, 1892, p. 96.
Deilephila minima ernestina, Roths. & Jord., 1903, p. 513; Seitz, 1929, p. 548.

Imago.—♂. Larger than *D. m. minima*, darker in colour, especially the hind wing above and the basi-discal area of the fore wing underside. *Expanse*: ♂ 62 mm., ♀ 70 mm. Process of penis-sheath shorter.

Hab. CEYLON. Rare; early stages unknown.

82 *b*. **Deilephila minima minima** (Butl.). (Fig. 68 K, genitalia; Pl. III, fig. 12, larva, fig. 13, pupa).

Daphnis minima, Butler, 1877 A, p. 573, pl. xcii, fig. 5 (S. India).
Daphnis minimus, Hampson, 1892, p. 97.
Deilephila minima minima, Roths. & Jord., 1903, p. 513; Seitz, 1929, p. 548, t. 63 *b*.

Imago.—♂. Very small and pale. Abdomen without pale subbasal belt. Fore wing above: antemedian line curved in front; discal band less oblique than in *placida*, wider behind and narrower before middle; discal lines not obviously dentate. *Expanse*: ♂ 44–54 mm.

Sexual armature as in *placida*, but proximal tooth of the boat-shaped process of the harpe higher, and the long process of the penis-sheath of *placida* represented in *m. minima* by a very short one (fig. 68 K).

Hab. S. INDIA, where we have bred it. It occurs somewhat rarely in the Western Ghats. The specimens bred by us resemble the Ceylon form and may not be different. The typical *minima* seems to be very rare.

Larva :—

Final instar. Head semi-elliptical, vertex flattened, with the dorsal line deeply depressed; true clypeus less than half length of head, equilaterally triangular, with basal angles rounded and tumid; false clypeus broad, with acute apex reaching to one-half length of head; labrum half length of and as broad as clypeus; ligula elongate kidney-shaped; eyes 1 to 4 in a curve, about one eye-diameter apart; 6 in line with 3 and 4 and two diameters from 4; 5 one diameter from 4 and two from 6. Surface of head moderately shining, covered sparsely with small, smooth tubercles. Body of the same shape as others of the genus. Horn of medium length, down-curved, rising from a prominent conical tumidity. Surface of body smooth; dorsum of segment 2 and tip of anal flap covered with small tubercles. Horn shining, set with larger tubercles.

Coloration.—Head dull green with a yellowish tinge; labrum glassy-green; ligula the same, with the ends of the lobes opaque-white; basal segment of antenna green, other segments rusty; mandible green, tip dark reddish-brown. Body rich yellowish-green, venter dark glaucous-green; a narrow white dorso-lateral stripe on segment 3, continued obscurely on 4 and 5, then becoming rose-coloured on 6 to 11, broken at the segment-margins; a bluish dorsal stripe and a subspiracular whitish or bright yellow stripe from 2 to 12; on 4, just below the dorso-lateral stripe, a large, round, pale blue ocellus with a dark blue centre, this ocellus about one-fifth the length of the segment; below the dorso-lateral stripe on 6 to 11 about six white dots on a bluish ground, and a few white dots running down the front and hind margins of the segments to bases of prolegs. Horn ochreous to near tip, where there is a narrow black band followed by a short, suddenly narrowed, yellow tip; true legs ochreous with black claws; prolegs translucent yellowish-green; anal flap edged with yellow. Spiracles oval, twice as long as broad, flush, brick-red in colour with a very narrow green rim. Length 65 mm., breadth 10 mm.

Pupa.—Shape as in others of the genus. Head covered with flat tubercles; tongue with a deep median channel, veins of wings, legs and antenna only slightly prominent;

thorax coarsely, superficially shagreened; abdomen less regularly shagreened and with obscure pits. Spiracle of 2 nearly covered by a lobe projecting slightly forwards from the front margin of 3 and another from the hind margin of 2, leaving a very narrow central slit visible; there is a deeply depressed line at the base of the lobe; remaining spiracles oval, flush, the surface slightly shining, the central slit with very slightly raised edges. Cremaster elongate-triangular, truncate at tip, with each corner of the truncation produced into a small acute tooth directed outwards; ventral surface of cremaster with a strong median longitudinal rib. Colour pale terra-cotta; the median channel of tongue black and ending in a black patch on the head; a narrow black dorsal line on segment 2; sides of thorax and abdomen suffused with fuscous, the spiracles black on large black patches. Length 43 mm.; breadth 10 mm.

Habits.—Similar to those of *D. nerii*. Food-plant: *Alangium Lamarkii* Thw., family Cornaceæ.

Genus **DAHIRA** Moore. (Fig. 70).

Moore, 1888, p. 390; Roths. & Jord., 1903, p. 515; id., 1907, p. 97.
Ambulyx, Butler, 1889, p. 2.

Genotype: *rubiginosa* Moore.

Imago.—" ♂. Genal process large, triangular, curved backwards. Head with mesial cariniform crest, which is most distinct between antennæ. Eye lashed. Palpus rounded,

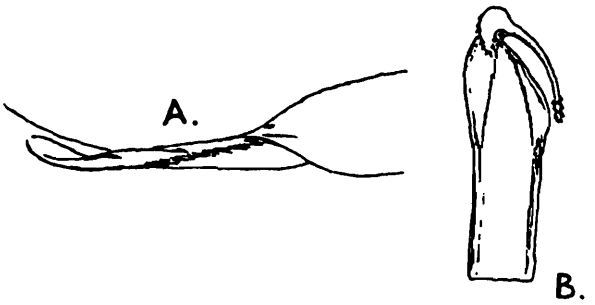


Fig. 70.—*Dahira* Moore. Genitalia.
A, *D. rubiginosa* Moore, harpe; B, penis-sheath.

somewhat projecting. Antenna fusiform, narrowed at base, gradually fining to a slender hook, strongly compressed, fasciculate, cilia long; end-segment *short*. Spines of abdomen weak. Mid-coxal merum somewhat angulate. Tibiæ unarmed; spurs *short*, mid-tibial ones equal in length, long terminal one of hind tibia shorter than the tibia is broad; no comb, pulvillus and paronychium not reduced. Wings entire; fore wing elongate, subfalcate, apex acute; cross-veins of hind wing slightly oblique, D^3 longer than D^4.

" ♂. Tenth tergite elongate, convex above, concave beneath,

apex entire ; sternite nearly as long as the tergite, broader, triangular, extreme tip sinuate. Clasper sole-shaped, with large friction-scales, irregularly arranged in four rows, besides some additional enlarged scales, extreme tip of these scales truncate ; harpe produced into a long ventral process, which is spatulate and somewhat twisted. Penis-sheath with a long dentate and curved process at the right side, ending in two points, and a much shorter, also dentate, lobe at the left side " (Roths. & Jord., 1903, p. 515).

Hab. W HIMALAYAS, S. China and Japan. One species, allied to *Ampelophaga*. For the early stages see *D. rubiginosa*.

83. **Dahira rubiginosa** Moore. (Fig. 70 A, B, genitalia).

Dahira rubiginosa, Moore, 1888, p. 391 (Mundi, N.W. Himalayas); Roths. & Jord., 1903, p. 515 ; Mell, 1922, p. 212, pl. vii, figs. 3–6, pl. xiii, figs. 23–25, pl. xvii, figs. 38, 39 (pupa), pl. xxviii, fig. 3 (larva), 4–7 (♀) ; Seitz, 1929, p. 548, t. 56 *c* (*b*).
Ambulyx rubiginosa, Hampson, 1892, p. 78.

Imago.—♂. Apex of fore wing pointed as in *Oxyambulyx*. Fore wing dark reddish-brown slightly suffused with grey ; numerous indistinct waved lines. Hind wing bright red ; thorax and abdomen yellow below. *Expanse* : 80 mm.

For details of genitalia see fig. 70 A (harpe), B (penis-sheath).

In specimens from S. China the fore wing is rusty-brown without markings, but with the greyish-blue bloom darkening towards apex.

Hab. W HIMALAYAS (Mundi), S. China and Japan. There are 3 ♂♂ in the British Museum from Mundi. Mell has bred the species in China, where it occurs in wooded hills at from 1,000 to 2,000 feet elevation.

Egg.—Broadly ovoid ; surface smooth and shining ; colour pale green. Length 1·4 mm. ; breadth 1·2 mm.

Larva :—

Final instar. Head small and round ; clypeus about one-half length of head, mandible very large. Surface of head and body smooth, no tubercles except on horn. Body tapering frontad from segment 5, rest of body cylindrical ; horn short, slightly down-curved.

Coloration.—Head green ; a pale yellow stripe separating face from cheek ; a yellow subdorsal stripe from vertex to nape ; a pale double dorsal stripe from vertex to apex of clypeus. Body green, closely dotted with white above the dorso-lateral stripe, and with yellow below it ; a dorso-lateral stripe, yellowish on segments 2 to 4, white and broader on 5 to 12 ; horn green, with black tubercles on upper surface ; true legs, prolegs and claspers green. There is also a dark form of the larva in which the head is greyish-black, with the dorsal stripe and a broad band above the mandibles green ; the body with a subspiracular blackish stripe from segment 2 to 12 ; horn

shining black; true legs and prolegs red-brown with a black band; anal flap and claspers black; spiracles lying on a greyish-brown patch; other markings as in the green form. Spiracles oval, blue-grey, with the central slit white. Length 80 mm.; breadth 10 mm.

Pupa.—Slender in build, head broadly rounded, with a pointed process directed forwards; eyebrows raised and prominent and with the central projection making the head appear three-pointed; clasper-scars also prominent and with the cremaster making the anal end also three-pointed; antenna equal to fore leg and reaching to half length of wing-case, mid-leg to about three-quarters; segment 12 of considerably less diameter at its front margin than 11 at its hind margin, the hind margin of 11 deeply undercut, as in the case of *Acosmeryx* pupæ. Surface rugose; a pit at the angle formed by the eye and the base of the antenna ventrally, as in the pupæ of *Theretra*; legs and antennæ not well expressed, costa of wing prominent; two deep pits behind the spiracle on 5 and 6. Colour soiled iron-grey dorsally, dark rust-red ventrally, the bevels of segments 9 to 11 ochreous-brown. Cremaster broad at base, triangular, with a simple point. Length 50–57 mm.; breadth 14 mm.

Habits.—Food-plant: *Ilex rotunda* Thunb., family Ilicineæ, in Japan. The larva becomes reddish-brown before pupation. The moth rests with the body parallel with the surface, the wings held slightly below the horizontal. When disturbed the moth presses its head against the surface and raises the body at an angle to it.

Genus **AMPELOPHAGA** Bremer & Grey. (Fig. 71).

Bremer & Grey, 1852, p. 61; Butler, 1881 D, p. 104; Roths. & Jord., 1903, p. 515; id., 1907, p. 97; Jordan, 1911, p. 250.

Genotype: *rubiginosa* Br. & G.

Imago.—♂♀. Of medium size, upperside brown or greyish, underside reddish. "Genal process triangular. Palpus rather long, rounded in lateral and dorsal aspect, closely appressed to head. Eye not lashed. Head with the scaling a little raised to a rounded crest. Antenna very slender, filiform, gradually fining distally, hook very gradual, end-segment short, triangular or conical, about twice the length of the previous segment. Spines of abdomen numerous, weak, pale. Merum of mid-coxa not carinate behind; tibiæ not spinose; spurs very unequal, longer ones over half the length of the first tarsal segment, this as long as the four other segments together, and a little shorter than the tibia; mid-tarsus with comb of more or less prolonged spines; pulvillus present, large; paronychium with two pairs of lobes. Wings entire.

" ♂. Friction-scales of clasper large. Tenth segment simple. Clasper sole-shaped ; harpe spatulate, dilated part dentate on upperside, or reduced, without process. Penis-sheath with a right and a left apical process, the left one always dentate at the edges.

" ♀. Eighth tergite sinuate. Vaginal plate suddenly narrowed as in *Deilephila* ; orifice large, free, edges slightly raised " (Roths. & Jord., *l. c.* 1903).

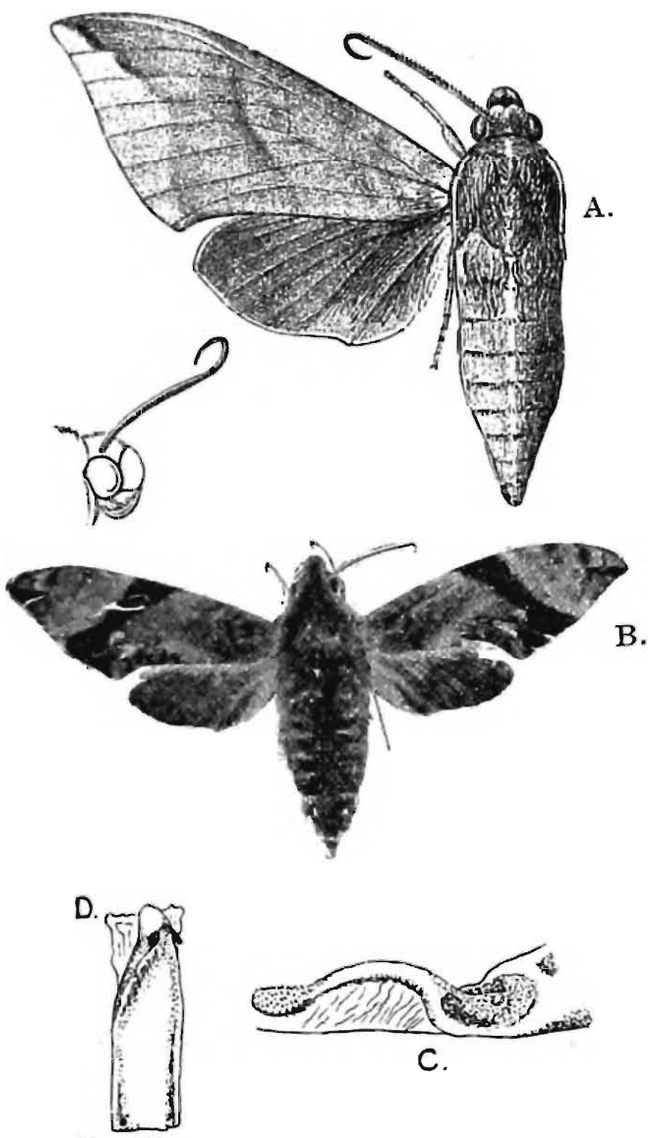


Fig. 71.—*Ampelophaga* Brem. & Grey.

A, *A. rubiginosa fasciosa* Moore. B, *A. obliquifascia* Hamps., ♀ holotype. C, *A. rubiginosa rubiginosa* Br. & G., harpe; D, penis-sheath.

Egg.—Broadly ovoid, surface smooth and shining, colour pale green.

Larva.—Head small, body tapering sharply frontad from segment 4, segments 4 and 5 tumid and somewhat flattened ventrally, with ventro-lateral flanges. Head and body more or less tuberculate. Colour green or red.

Pupa.—Stout, head round, base of segment 12 fitting into the undercut hind margin of 11 as in *Acosmeryx*.

Habits.—The food-plants belong to the families Ampelideæ, Saxifragaceæ and Ternstrœmiaceæ. The larva lies stretched straight out along the midrib of the underside of a leaf. When molested the head and anterior segments are partially retracted into the fourth and fifth segments, these two segments being dilated and the lateral flanges expanded, but less strongly than in *Acosmeryx*. The dorsum becomes suffused with brown before pupation, which takes place in a rough cocoon on the surface of the ground. The moths rest with the wings held nearly horizontal and the abdomen straight. We have seen only bred specimens.

Hab. W and E. HIMALAYAS, China, Japan and the Philippines. Five Indian species and subspecies.

Key to the Species.

Imagines.

1. Fore wing with sharply defined, parallel, greyish-white lines at nearly equal distances between base and outer margin; hind wing above blackish-brown	[p. 284. *A. dolichoides* (Feld.),
Fore wing without such lines	2.
2. Fore wing with a broad, dusky-brown, oblique band from middle of costa to termen above tornal angle	[Hamps., p. 285. *A. obliquifascia*
Fore wing without such oblique band ..	3.
3. Underside of hind wing and abdomen bright rufous-testaceous	[p. 283. *A. k. khasiana* Roths.,
Underside of hind wing and abdomen salmon-buff or clayish .. .	[Moore, p. 280. *A. rubiginosa fasciosa*,
Underside of hind wing and abdomen much brighter red	[Roths., p. 282. *A. rubiginosa harterti*

The larvæ and pupæ are not known sufficiently well to enable keys to be prepared, but the larva of *k. khasiana* can be distinguished by the presence of a dorso-lateral line of spine-like tubercles. The pupa of *obliquifascia* is said to have two horns on the head and three at the anal end.

84 *a*. **Ampelophaga rubiginosa fasciosa** Moore. (Fig. 71 A, imago; Pl. III, fig. 15, larva).

Ampelophaga fasciosa, Moore, 1888, p. 39 (Dharmsala); Butler, 1889, p. 25, pl. cxxi, fig. 3; Cotes & Swinhoe, 1887, p. 9 (Kulu; Simla; Sikkim).

Ampelophaga rubiginosa fasciosa, Roths. & Jord., 1903, p. 518; Jordan, 1911, p. 250, t. 39 *d*; Seitz, 1929, p. 549.

Ampelophaga rubiginosa, Hampson, 1892, p. 83, fig. 52 (♂).

Imago.—♂♀. Antenna whitish, scaling of tip blackish at anterior side; head, thorax and abdomen ruddy olive-brown;

a white dorsal stripe from behind head to tip of abdomen. Fore wing olive-brown with an indistinct basal band, a subbasal line, an antemedian band, an abbreviated discocellular band followed by a broad discal one, a discal line, usually dentate, and an oblique apical line, more or less indistinctly continued in zigzag form to hind margin; interspaces greyish: all these lines and bands very indistinct; distal marginal area glossy; a triangular patch on costa before apex. Hind wing fuscous, cilia nearly white. *Underside* salmon-buff or clayish, each wing with two faint transverse lines. No comb to mid- and hind tarsus. R^2 and R^3 of hind wing much farther apart than R^3 and M^1. *Expanse*: ♂ 90 mm., ♀ 100 mm.

♂. Tenth sternite truncate, feebly sinuate in distal view. Harpe rather regularly ladle-shaped (fig. 71 C). Penis-sheath (fig. 71 D): long left process irregularly and sparsely dentate and notched at proximal edge; the short right process mostly simple, but sometimes with one or two minute teeth.

Hab. W HIMALAYAS. We have bred the subspecies at Simla and Mussooree at an elevation of about 7,000 feet, and it is known also from Kulu, Dharmsala and Bukleh. Well distributed but nowhere very common.

Egg.—Nearly spherical, surface smooth and shining, colour pale green.

Larva:—

1st instar. Head round, body cylindrical; colour pale yellow, with a black bifid horn. *2nd instar.* Head round, body cylindrical and long for its diameter; horn of medium length, straight with a bifid tip; head yellowish, body pale green, horn black with base orange. *3rd instar.* A transverse row of small yellow tubercles on each secondary ring; horn long, bifid, reddish with black tubercles. *4th instar.* Head round; segment 2 of about the same diameter as head, and the segments increasing rapidly in diameter to 5; rest of body nearly cylindrical; horn long, straight; surface of head and body dull; head covered with small tubercles; body with a transverse row of small low tubercles along each secondary ring; horn set with tubercles; colour of head pale yellow-green, tubercles yellow; a yellow stripe down each side of dorsal line, and a yellow stripe down cheek; body pale yellowish-green, tubercles yellow; on segments 7 to 11 oblique stripes formed of larger tubercles, running in the opposite direction to that usual in sphingid larvæ; a narrow yellow subdorsal stripe from 2 to base of horn, edged above with a broader stripe of reddish-brown; there are sometimes reddish-brown oblique stripes running in the usual direction; horn pale red with black tubercles; legs and spiracles pale red.

5th instar. Shape as in others of the genus ; horn of medium length, down-curved, tapering unevenly to a blunt point. Head dull, covered with small tubercles ; body dull ; a line of low tubercles along the upper edge of the subdorsal stripe ; horn covered with tubercles. Two *colour-forms*. Green form : head bluish-green with yellow tubercles and a yellow cheek-stripe. Body bluish-green, brighter green in lateral area, with a transverse row of bright yellow spots along each secondary ring ; on segments 7 to 11 oblique stripes of yellow spots, the spots largest at the front of each segment and decreasing in size backwards, the stripes running in the opposite direction to that usual in sphingid larvæ ; a yellow subdorsal stripe from 2 to base of horn, edged above by purple tubercles on 6 to 12 ; faint purplish-brown oblique stripes on the same segments. Horn green with paler tubercles ; legs red with a black spot at base. Spiracles reddish-brown with a white dumb-bell-shaped line down the middle.

In the red form the green colour is replaced by bright orange-red ; horn reddish. Length 95 mm. ; breadth 16 mm. ; horn 13 mm.

Pupa.—Stout, elongate-ovoid in shape, head broadly rounded ; the hind margin of segment 11 deeply undercut on dorsum, segments 12, 13 and 14 together forming a cone, the base of which fits into 11, these segments resembling those of *Acosmeryx* pupæ ; tongue reaches tip of wing-case ; antenna equal to fore leg, about half length of wing-case, mid-leg two-thirds length of wing-case. Surface moderately shining, thorax and abdomen slightly shagreened. Cremaster broad at base, tapering gently to a cylindrical shaft ending in two teeth. Colour of head, thorax and wing-cases ochreous speckled with black ; a black spot on front of head ; abdomen : dorsal area rich brown, lateral and ventral areas paler brown ; spiracles and cremaster black. Length 50 mm. ; breadth 15 mm.

Habits.—Food-plant : *Vitex* Linn., family Ampelideæ. The moth has not been observed feeding at flowers nor coming to light.

84 *b*. **Ampelophaga rubiginosa harterti** Roths.

Ampelophaga harterti, Rothschild, 1894 B, p. 299 (Margherita, Upper Assam) ; Hampson, 1900, p. 39.

Imago.—♂♀. *Underside* of body and wings much more red in tint than in *A. r. fasciosa*.

Hab. E. Himalayas (Khasi Hills ; Margherita, Assam). We have bred the subspecies in the Khasi Hills, where it is common locally at an elevation of about 4,000 to 5,000 feet.

Larva and pupa.—Resemble very closely those of *A. r. fasciosa*.

Habits.—Food-plants : *Vitis* Linn., family Ampelideæ, and *Saurauja*, family Ternstrœmiaceæ. Other habits as for *A. r. fasciosa*.

85. **Ampelophaga khasiana khasiana** Roths. (Pl. III, fig. 17, larva ; Pl. XIV, fig. 5, larva).

Ampelophaga khasiana, Rothschild, 1895, p. 482 (Khasia Hills) ; Roths. & Jord., 1903, p. 518.
Ampelophaga khasiana khasiana, Jordan, 1911, p. 250 ; Seitz, 1929, pp. 549, 571, t. 63 *b* ; Scott, 1931, pl. iii, fig. 2.
Ampelophaga rubiginosa, Dudgeon, 1898, p. 409 (Sikkim).

Imago.—♂♀. Scaling of tip of antenna black. Upperside deeper in tint, dorsal stripe not so pale and sides of body far more red than in *r. rubiginosa*. Fore wing : interspaces between bands glossy whitish-grey, discal band rather narrower and more sharply defined than in *r. rubiginosa*, discal line broad, not dentate, band-like. *Expanse* : ♂ 80 mm., ♀ 102 mm.

♂. Tenth sternite not sinuate in dorsal aspect. Dilated apical part of harpe longer than in *r. rubiginosa*, more heavily spined proximally. Right process of penis-sheath longer.

Hab. E. Himalayas (Khasi Hills ; Sikkim) and China. We have bred the subspecies in the Khasi Hills, where larvæ occur rarely during the rainy months in dense forests, at an elevation of about 5,000 feet, usually near water.

Larva :—

Final instar. Head rather square in shape, vertex rounded ; true clypeus nearly half length of head, apex minutely rounded ; false clypeus shaped like a gothic arch over apex of true clypeus ; labrum one-half the length of and slightly broader than clypeus ; ligula nearly square, as long and as broad as clypeus ; eyes 1 to 4 equidistant in a gentle curve, 6 in line with 3 and 4, 5 forming an equilateral triangle with 4 and 6. Surface of head moderately shining and set sparsely with small, glassy, bubble-like tubercles. Body as in others of the genus. Horn down-curved, stout at base, tapering gently to a conical tip. Surface of body dull ; a transverse row of rounded tubercles along each secondary ring ; a dorso-lateral line of tubercles from front margin of segment 2 to base of horn ; these tubercles rounded, except for those on the three or four anterior secondary rings on 6 to 12, which are conical, almost spine-like, the tubercle on the second or on the third ring being longer and more spiniform than the rest ; a line of large rounded tubercles starting at the dorsal line at the front margins of 6 to 11, and running obliquely backwards and downwards to near the dorso-lateral line of tubercles, forming V-shaped markings, the apex of the V directed frontad. Horn set with small conical tubercles to the tip ; anal flap and clasper faces set with small truncate-conical tubercles.

Coloration.—Head dark green, the tubercles paler green; a broad yellow stripe separating face from cheek; a broad dorsal stripe, widening frontad to include the clypeus, paler green; labrum and ligula yellowish-green; mandible green, tip broadly black; antenna with basal segment green, other segments rusty. Body bright bluish-green in dorsal area, bright green in lateral area; tubercles yellow; seven indistinct pale oblique stripes. Horn green with paler tubercles; legs pink, with a large deep brown patch on outer side of each, and a bright yellow patch on venter of body near base of each leg. Spiracles whitish, with a broad reddish-brown band across the middle divided by the whitish central slit. Length 85 mm.; breadth 12 mm.

Pupa.—Very similar in appearance to that of *A. r. rubiginosa*. Stout in build, head round; the anal end resembles that of *Acosmeryx* pupæ in segments 12 to 14 being fused together to form a cone, the hind margin of 11 being of greater diameter than the front margin of 12 and deeply undercut, especially in the dorsal area. Surface smooth, moderately shining in dorsal area and dull in ventral; a deep transverse gash on dorsum at the common margin of segments 4 and 5, and a less conspicuous gash at the common margin of 5 and 6. Spiracle of 2 a curved slit, the remaining spiracles oval, flush, the slit with narrow raised edges. Cremaster a thin shaft, tapering gently to the truncate tip, the surface irregularly wrinkled to near the tip. Colour pale ochreous with a pinkish shade, dorsum of abdomen strongly suffused with reddish-brown, segments 12 to 14 darker than the rest, the bevels of the movable segments chestnut; spiracles, cremaster and the gashes on 4 and 5 and 5 and 6, and the undercut of portion 11, black. Length 47 mm.; breadth 15 mm.

Habits.—Food-plants: *Vitis* Linn., family Ampelideæ, and *Saurauja nepalensis* DC., family Ternstrœmiaceæ. The habits are similar to those of *A. rubiginosa fasciosa* so far as they have been observed.

86. **Ampelophaga dolichoides** (Feld.).

Philampelus dolichoides, Felder, 1874, pl. lxxvi, fig. 8 (Sikkim).
Ampelophaga dolichoides, Hampson, 1892, p. 84; Dudgeon, 1898, p. 410 (Sikkim, 1,800 ft.); Roths. & Jord., 1903, p. 518; Seitz, 1929, p. 549, t. 63 *b*.

Imago.—♂♀. Fore wing with four nearly straight, oblique grey lines, which are the proximal borders of tawny-olive bands; a feebly marked brown zigzag line between the two discal lines. Palpus pale with no ruddy tinge. Mid-tarsus with the spines of the fourth row prolonged, but not so much as in *Elibia*. R^3 and M^1 of hind wing less close together than in *khasiana*, D^3 not being longer than D^4. *Expanse*: ♀, 100 mm.

♂. Tenth sternite sinuate in distal aspect. About sixteen large friction-scales, rounded-truncate, broad at end. Process of harpe short, not dentate. Apex of penis-sheath asymmetrical, both processes dentate.

Hab. E. HIMALAYAS (Sikkim ; Assam). Very rare, and early stages unknown.

87 **Ampelophaga obliquifascia** Hamps. (Fig. 71 B, ♀).

Ampelophaga obliquifascia, Hampson, 1910, p. 87, pl. F, fig. 13 (Assam).

Imago.—♂♀. Head and thorax grey slightly mixed with reddish-brown, vertex of head and dorsum of thorax reddish-brown ; abdomen grey, with broad dorsal, diffuse, reddish-brown bands. Fore wing purplish-grey, tinged in parts with reddish-brown ; subbasal diffuse reddish-brown marks in cell and on SM^2 ; three rather indistinct, diffuse, waved, antemedian brown lines ; a small discoidal dot ; a broad blackish-brown band from middle of costa to outer margin at R^3, expanding into a large triangular patch on outer margin extending almost to tornus ; a postmedian line slightly dentate from costa to the blackish-brown band, then oblique and more strongly dentate, with some fulvous-yellow on its outer side, a waved line before it from M^2 to inner margin and two waved lines beyond it from the band to the inner margin ; a double brownish, slightly waved submarginal line from costa to R^2 ; a wedge-shaped brown mark on outer margin below apex ; cilia blackish-brown. Hind wing dark brown tinged with red, the inner area greyish ; cilia rufous, whitish at tips. *Underside* : breast orange-red ; fore wing fiery-red, with the outer margin grey, some dark brown suffusion in and below cell ; six indistinct waved lines in postmedian area ; a pale yellow subapical lunule and two wedge-shaped postmedian marks below M^1 and M^2 ; hind wing fiery-red, the inner area greyish, marginal area brownish ; three indistinct, minutely waved, red postmedian lines. *Expanse* : ♀ 78 mm. (one example).

Hab. E. HIMALAYAS (Khasi Hills).

The larva and pupa have been very briefly described by Badgley, and appear to resemble those of others of the genus.

Genus **ELIBIA** Walker. (Fig. 72).

Walker, 1856, p. 148 ; Roths. & Jord., 1903, p 521 ; id., 1907, p. 98.

Genotype : *dolichus* (Westw.).

Imago.—" ♂♀. Palpus large, rounded in side-view, third segment above frons. Eye very large, not lashed. Abdomen very long. Tarsi long, hind ones twice the length of

cell of hind wing ; first segment of hind tarsus a little longer than tibia ; comb of mid-tarsus very prominent, the spines much prolonged, and accompanied on the hinder side by another row of slender prolonged spines. Apex of hind wing very obtuse ; SC^2 and R^1 shortly stalked.

" ♂. Tenth tergite slightly narrowed in middle, apex truncate, angles rounded ; sternite as long as the tergite, strongly compressed, broad vertically, ventral line strongly

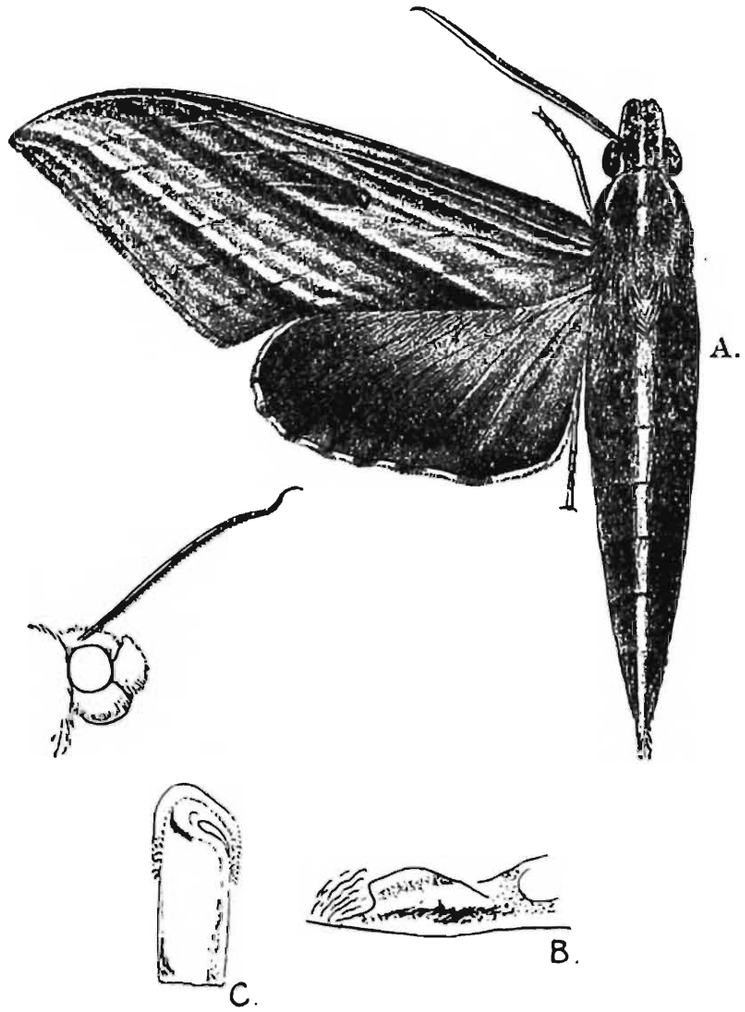


Fig. 72.—*Elibia* Walk.
A, *E. dolichus* (Westw.) ; B, harpe ; C, penis-sheath.

curved upwards in lateral aspect, apex rounded in distal view. Large friction-scales of clasper acuminate, not truncate ; harpe (fig. 72 B) short, represented by a rather thin ridge, which is truncate distally and feebly angulate dorsally. Penis-sheath (fig. 72 C) nearly symmetrical, both the right and the left processes denticulate at the edges and on the surface, the dentition of the left process continued on the sheath.

" ♀. Vaginal plate as in *Ampelophaga* and *Deilephila*, but broader apically.

" *Larva.*—Three stages figured by Piepers ; a round dorsal ocellus on fourth segment ; horn curved frontad in younger stages, reduced to a button-like prominence in last stage " (Roths. & Jord., 1903, p. 521).

Hab. E. HIMALAYAS to Java and Palawan. One species. All that is known of the early stages is mentioned above.

88. **Elibia dolichus** (Westw.). (Fig. 72 A, ♂, B, C, genitalia).

Sphinx (*Chærocampa*) *dolichus*, Westwood, 1848, p. 61, pl. xxx, fig. 1 (Sylhet).

Elibia dolichus, Hampson, 1892, p. 100, fig. 57 ; Dudgeon, 1898, p. 415 (Sikkim and Bhutan, up to 4,000 ft.) ; Roths. & Jord., 1903, p. 521 ; Seitz, 1929, p. 549, t. 67 *a*.

Imago.—♂♀. Head, thorax and abdomen brown, thorax with three pale stripes, abdomen with a broad pale dorsal stripe. Fore wing pale brown, with seven lines between lower angle of cell and outer margin, first and fifth heavy, the others often weakly marked ; second, third, fourth and sixth sometimes distinctly accentuated by vein-dots ; lines between lower angle of cell and costal margin feeble, that traversing the large black white-centred stigma the most obvious. Hind wing bluish at base, outer area blackish ; cilia chequered white and brown. *Underside* pale, abdomen white, with ferruginous-tawny or brown mesial markings on proximal sternites ; fore wing with a waved submarginal line, hind wing with two waved lines. *Expanse* : ♂ 120–132 mm., ♀ 146 mm.

Hab. E. HIMALAYAS (Sikkim ; Khasi Hills ; Assam) to Java and Palawan. See under *Elibia* for all that is known of the early stages.

Genus **ACOSMERYCOIDES** Mell.

Mell, 1922, pp. xii, 220 (*insignata* Mell).

Genotype : *leucocraspis* (Hamps.).

Imago.—♂♀. Resembles an *Ampelophaga*, with the markings more or less obsolescent. Antenna thinning gradually to a long thin hook, the end-segment short ; both sexes with fasciculate cilia on the median segments. Eye not lashed. Palpus large, rounded, closely appressed, second segment large. Scales of head somewhat lengthened and erect. Spurs unequal, the longer ones more than half as long as the first tarsal segment.

Larva.—Resembles those of *Acosmeryx*, but differs in the horn being long, thin and strongly up-curved in the last instar.

Pupa.—Similar to those of *Deilephila*.

Hab. E. HIMALAYAS (Dibrugarh, Assam) and S. China. One Indian subspecies, of which the early stages are unknown.

Habits.—Food-plant : *Vitis* Linn., family Ampelideæ.

89. **Acosmerycoides leucocraspis leucocraspis** (Hamps.). (Fig. 73, ♀).

Rhagastis leucocraspis, Hampson, 1910, p. 88, pl. F, fig. 25 (Upper Assam ; Dibrugarh).
Acosmerycoides leucocraspis leucocraspis, Mell, 1922, p. 220 ; Seitz, 1929, p. 550.

Imago.—♀. Head grey ; palpus whitish laterally ; tegula and patagium chocolate-brown, with a greyish-white stripe on outer edge ; vertex of thorax grey-brown ; pectus and legs pale grey tinged with rufous ; abdomen with the first three segments chocolate-brown, rest of dorsum greyish tinged with fulvous, sides whitish, ventral surface tinged with rufous. Fore wing purplish-grey, suffused in parts with rufous ; a subbasal rufous shade on costal area, base of inner margin chocolate-brown ; two obliquely curved antemedian brown lines, widely separated at costa, approximated at vein SM^2, where they terminate ; an oblique rufous shade from costa a

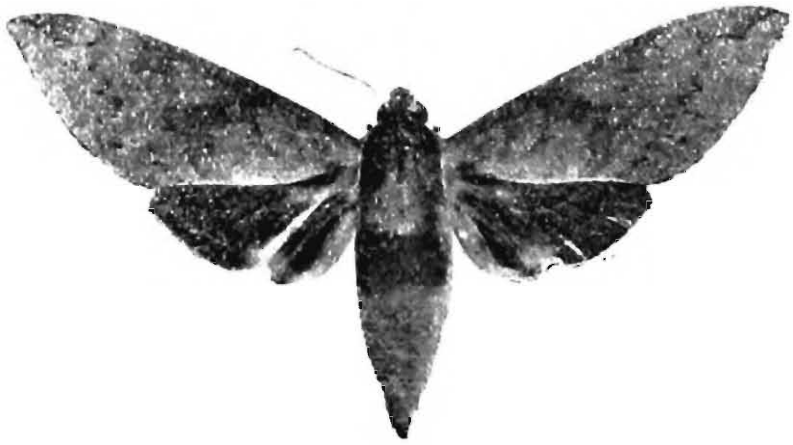


Fig. 73.—*Acosmerycoides leucocraspis leucocraspis* (Hamps.), ♀.

antemedian line to median line at vein M^1 ; median line double, waved, obliquely curved from costa to vein 2, then slightly incurved ; postmedian line obliquely curved, dentate, produced at veins R^1 and M^1 to points and with slight fulvous marks on it ; a triangular chocolate-brown patch on costa just before apex, the faint waved subterminal line arising from it ; the apex slightly tinged with white ; cilia dark brown. Hind wing black-brown, the inner margin, terminal area in submedian interspace and termen towards tornus whitish ; cilia grey with a brown line through them. *Underside* of fore wing reddish-fulvous, the disc fuscous, a fuscous striga from costa towards apex, subterminal line oblique from costa near apex to below SC^5, then dentate, the area beyond it grey ; hind wing reddish-fulvous, the inner area and termen greyish, an indistinct curved minutely waved postmedian line. *Expanse* : ♀, 96 mm.

Hab. E. Himalayas (Dibrugarh, Assam). Very rare ; early stages unknown.

Genus **ACOSMERYX** Boisduval. (Fig. 74).

Boisduval, 1875, p. 214 ; Roths. & Jord., 1903, p. 526 ; id., 1907, p. 100 ; Jordan, 1911, p. 251.

Genotype : *anceus* (Stoll).

Imago.—♂♀. Medium-sized moths, upperside brown and grey, the markings forming a tesselated pattern ; underside tawny. " Genal process anguliform, curving backwards,

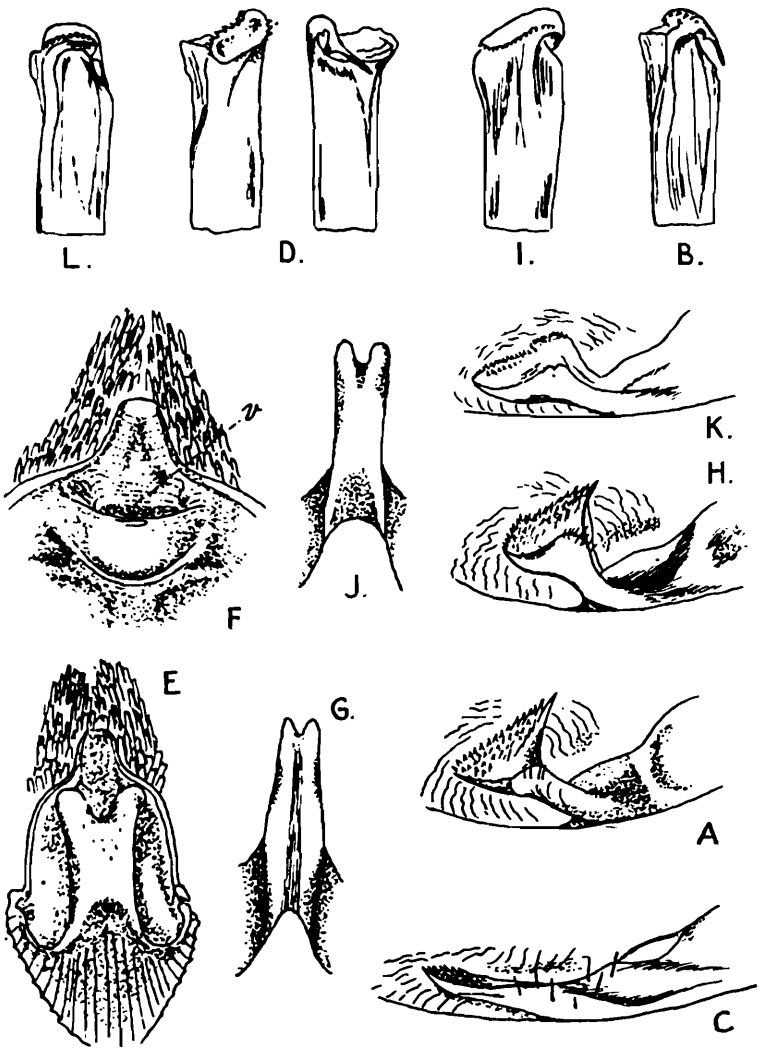


Fig. 74.—*Acosmeryx* Boisd. Genitalia.

A, *A. naga* (Moore), harpe ; B, penis-sheath. C, *A. anceus* (Stoll), harpe ; D, penis-sheath, right and left sides ; E, ♀ vaginal plate. F, *A. socrates* (Boisd.), ♀ vaginal plate. G, *A. sericeus* (Walk.), 10th sternite, ventral view ; H, harpe ; I, penis-sheath. J, *A. omissa* Roths. & Jord., 10th sternite, ventral view ; K, harpe ; L, penis-sheath.

nearly reaching tip of pilifer. Palpus large, rounded in side-view. Antenna setiform, slender, gradually thinning apicad, hook long, gradually curved ; end-segment very long, filiform, rough-scaled, penultimate one longer than vertically broad. No eyelashes. Spines of abdomen numerous, the

short ones pale, rather weak, the long ones stronger. Mid-coxal merum rounded behind; long spurs twice the length of the short ones; mid-tarsus with comb, spines of same not long; hind tibia heavily scaled. Forewing *sinuate* between SC^4 and SC^5.

" ♂. Præcoxal scent-organ vestigial. Sexual armature not very different in the various species, that of *anceus* being the best characterized (in both sexes). Tenth tergite simple, long, slender, slightly curved; sternite shorter, broader, somewhat boat-shaped, with the apex always sinuate. Clasper large, sole-shaped, with three or four rows of large friction-scales; harpe dilated at end, the dilated part armed with spine-like teeth which are directed upwards. Penis-sheath with a dentate lobe at left side, continuous with a slender, acute process at right side.

" ♀. Vaginal plate suddenly narrowed distally; orifice transverse, postmedian, sometimes covered by a bilobate ridge. Eighth tergite deeply sinuate, separate from sternite " (Roths. & Jord., 1903, p. 526).

Egg.—Broadly ovoid, surface smooth and shining, colour green.

Larva.—Head small, body tapering sharply frontad from segment 5, segments 4 and 5 with ventro-lateral flanges; horn of medium length, sharply down-curved. Colour green or reddish, with a pale subdorsal stripe, and an ocellus-like marking round the spiracle of 5.

Pupa.—Head round, no frontal tubercles (the statement on p. 527 of the 'Revision' being incorrect); segments 12, 13 and 14 together form a hemisphere, the base of which fits into the deeply undercut hind margin of 11. Cremaster ending in a bifid spike or shaft.

Habits.—Eggs laid singly on food-plants of the families Ampelideæ, Ternstrœmiaceæ and Dilleniaceæ. In the earlier instars the larva often rests with the head and anterior segments curved upwards and backwards, with the flanges expanded. When molested the head and anterior segments are strongly retracted into segment 5 and the flanges dilated, the body being twisted so as to present the ventral surface to the enemy, and then swayed from side to side in a snake-like manner. The dorsum becomes suffused with reddish before pupation, which takes place in a rough cocoon on the surface. The moth rests with the wings held slightly below, or at, the horizontal, the abdomen bent upwards.

Hab. Oriental Region from INDIA to China, Japan and Australia. Five Indian species and subspecies.

Key to the Species.

Imagines.

1.	Fore wing upperside, grey submarginal line or band straight, extending to SM^2 ...	[p. 291. *A. naga* (Moore),
	Fore wing upperside, grey submarginal line or band curved, ending at R^3 or a little beyond	2.
2.	Fore and hind wing distinctly dentate.	3.
	Fore and hind wing not dentate....	4.
3.	First discal line of fore wing straight from R^3 to SM^3, heavy	[p. 297. *A. s. sericeus* (Walk.),
	First discal line of fore wing thin, interrupted	[Jord., p. 298. *A. omissa*, Roths. &
4.	Hind wing underside almost entirely ferruginous-tawny or vinaceous; fore wing upperside tawny-cinnamon to chestnut-brown	[Roths. & Jord., p.294. *A. anceus subdentata*
	Hind wing underside much shaded with olive-grey, ground-colour of fore wing upperside greyish-olive	[p. 295. *A. socrates* Boisd.,

Larvæ.

1.	The subspiracular stripe on segments 2, 3 and 4 encircling spiracle on segment 5; a round plum-coloured spot surrounded by yellow on front margin of segments 5 to 11	[p. 296. *A. socrates* Boisd.,
	Subspiracular stripe not encircling spiracle on segment 5; no such spots	2. [p. 295.
2.	Spiracles white, central slit black as in *socrates*	[Roths. & Jord., *A. anceus subdentata*
	Spiracles orange, central slit black	*A. naga* (Moore), p. 292.

The pupæ resemble each other very closely; in *naga* the cremaster is longer than in the other two species of which the pupa is known.

90. **Acosmeryx naga** (Moore). (Fig. 74 A, B, genitalia; fig. 75, imago; Pl. IV, fig. 1, larva; Pl. XIV, fig. 14, larva; Pl. IV, fig. 2, pupa).

Philampelus naga, Moore, 1857, p. 271 (Darjeeling); id., 1865, p. 794 (Bengal).

Acosmeryx naga, Cotes & Swinhoe, 1887, p. 9 (Sikkim; Simla); Hampson, 1892, p. 83; Dudgeon, 1898, p. 409 (Sikkim, 3,000 ft.); Roths. & Jord., 1903, p. 529; Jordan, 1911, p. 251, t. 39 c; Mell, 1922, p. 225, pl. vii, figs. 13, 17, 18, 35, pl. xviii, figs. 5, 6 (pupa), pl. xxvii, fig. 13 (larva), pl. xxviii, fig. 8 (♀); Seitz, 1929, p. 550.

Imago.—♂♀. The most conspicuously marked species of the genus, easily distinguished from all others by the pattern of fore wing; brown discal band extending from costa towards middle of distal margin, sharply defined in front, the triangular area limited there by grey; a rather sharply defined

grey submarginal band from SC^5 to tip of SM^2, nearly straight, not undulate. *Expanse* : ♂♀, 86–112 mm.

♂. Antenna long. Tenth sternite with parallel sides. Process of harpe (fig. 74 A) rather acute distally, resembling a hand with the thumb lying against the forefinger and the other fingers curved back and upwards. Penis-sheath (fig. 74 B) : left lobe shorter than in all the other species.

♀. Vaginal plate resembling that of *anceus subdentata*.

Hab. W and E. HIMALAYAS, China and Japan. We have bred it in both W and E. Himalayas, where the larvæ are common during the monsoon months.

Egg.—Spherical ; surface smooth and shining ; colour deep rich green, turning whitish before hatching.

Larva :—

1*st instar*. Horn long and straight ; head and body green, horn black. 2*nd instar*. Segment 2 as narrow as head, body



Fig. 75.—*Acosmeryx naga* (Moore).

tapering sharply from 5 to 3 ; horn long and straight ; head and anal segments yellow, body green dotted with white ; the spiracle on 5 lying in a small black spot ; a yellow subdorsal stripe from 2 to base of horn ; horn reddish at base, then black with white tip. 3*rd and* 4*th instars*. A ventrolateral flange develops on segments 4 and 5 ; a yellow subspiracular stripe from 2 to just behind the spiracle on 5.

5*th instar*. Shape of head and body as in others of the genus ; horn stout, down-curved, of medium length, tapering evenly to near tip, where it tapers sharply to a point. Surface of head moderately shining and smooth ; body dull and smooth ; horn shining and smooth.

Coloration.—Green form (Pl. IV, fig. 1). Head grass-green, with a narrow pale yellowish subdorsal stripe and a broader stripe of the same colour separating face from cheek. Body : segments 2 and 3 grass-green with short darker stripes ; rest of body bluish-green, mottled with yellow above the

dorso-lateral stripe, pale blue with short darker lines below this stripe; a dorso-lateral stripe from 2 to base of horn, narrow and white on 2 and 3, broader and pale yellow on 4 and 5, then white to base of horn, and edged narrowly with orange above on 7 to 11; a narrow, white, subspiracular stripe on 2 and 3, becoming broader and yellow and outlining the upper edge of the flange on 4 and 5, turning upwards on 5 to form an oblique stripe; pale yellow oblique stripes on 5 to 11; horn pale purple dotted with darker purple; legs with basal and end-segments flesh-colour, median segment dark brown; dark purple patches on the body above the bases of the legs, increasing in size backwards, and extending along the lower edge of the flange on 4 and 5; prolegs bluish, ankles pale yellow, feet brown; clasper bluish; anal flap edged broadly pale yellow. Spiracles deep orange, central slit black.

There is also a dark-coloured form of the larva in which the head and segments 2 and 3 are pale brown, and the ground-colour of the rest of the body pink, with markings as in the green form. Length 100 mm.; breadth 13 mm.; horn 8 mm.

Pupa.—Shape as in other *Acosmeryx* pupæ, the hind margin of segment 11 deeply undercut. Surface shining, shallowly but coarsely pitted on segments 4 to 7 and 12 to 14; 2 finely, irregularly, longitudinally striate; 8 with a patch behind the spiracle, finely, regularly, transversely striate; front bevels of 9 to 11 finely pitted; rest of pupa smooth. Spiracle of 2 covered by a narrow transverse lobe projecting from the front margin of 3, the front edge of the lobe sharply raised; remaining spiracles shortly oval, flush, the edges of the central slit raised. Cremaster small, basal half bulbous, distal half a cylindrical shaft ending in two small hooks; dorsal surface of basal half honeycombed, shaft smooth. Colour of dorsum dark brown, sides and venter paler brown, abdomen marked with short darker stripes, and pits dark brown; a pale brown patch in front of eye; hind bevels of segments 8 to 11 dark brown; spiracles black ringed by dark brown, cremaster nearly black. Length 55 mm.; breadth 15 mm.; cremaster 2 mm.

Habits.—Food-plants: *Vitis* Linn., family Ampelideæ, and *Saurauja*, family Ternstrœmiaceæ. In the resting position the larva throws back the head and anterior segments in a sharp curve, the head held so that the face is in the same plane as the dorsum of segment 2, the true legs pressed close against the body, the flanges laterally dilated. When alarmed the head and first two segments of the body are retracted into segment 4, segments 4 and 5 being puffed out and the flanges further dilated. The moth has not been observed except when bred, and it does not appear to be attracted by light.

91. **Acosmeryx anceus subdentata** Roths. & Jord. (Fig. 74 C–E, genitalia ; fig. 75 A, imago ; Pl. IV, fig. 3, larva).

Acosmeryx anceus subdentata, Roths. & Jord., 1903, p. 528 (Sikkim) Seitz, 1929, p. 550.
Philampelus anceus, Moore (non Stoll), 1865, p. 794 (Bengal).
Acosmeryx anceus, Cotes & Swinhoe (non Stoll), 1887, p. 8 (Sylhet ; Sikkim).
Acosmeryx ancea, Hampson (non Stoll), 1892, p. 81, fig. 51 (♂).
Acosmeryx ancea f. *ancea*, Dudgeon (non Stoll), 1898, p. 409 (Sikkim ; Bhutan ; 2,000 ft.).

Imago.—♂♀. The smallest species of the genus, and markings different from those of all the other species. Palpus, breast and first two abdominal sternites pinkish. Fore wing distinctly angulate at R^3, often with traces of teeth. Upper side tawny-cinnamon to chestnut-brown ; an oblique distal band diffuse posteriorly ; first discal line heavy, continuous ; greyish costal apical area stopping at R^1 or beyond it ; a broad,

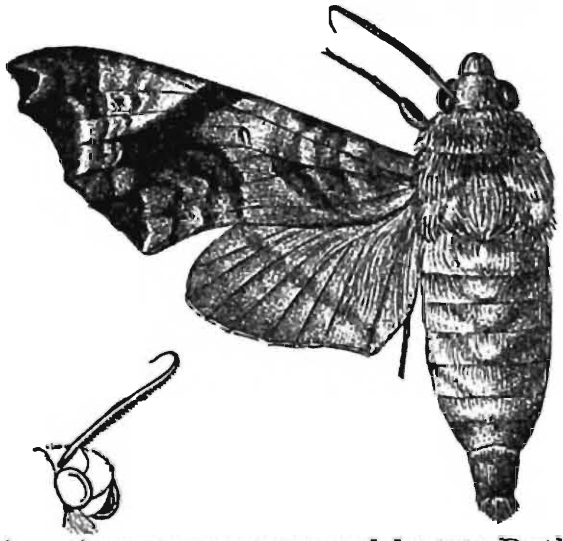


Fig. 75 A.—*Acosmeryx anceus subdentata* Roths. & Jord.

curved, pinkish-grey submarginal line continuous with apical lunules of the same colour. Hind wing fuscous. *Underside* : fore wing ochraceous clay-colour ; a subapical, triangular, costal, chestnut patch extending to R^1, straight proximally, where it is bordered by a grey or pinkish-grey line or patch ; outer disc between R^1 and SM^2 pinkish-vinaceous or vinaceous-cinnamon, not so dark as the subapical patch ; pinkish-grey submarginal scaling extended basad, basal half of costal margin of the same colour as the hind wing. Hind wing vinaceous, brown marginal border reaching R^2 only half-way to second pair of discal lines. *Expanse* : ♂♀, 70–88 mm.

♂. Harpe (fig. 74 C) much more prolonged than in the other species. Penis-sheath (fig. 74 D) with a broad left process rounded at end and dentate at distal and proximal edges.

♀. Vaginal plate (fig. 74 E) widely different from that in the other species ; sides nearly parallel, abruptly converging near

end, apical part narrow, deeply concave; orifice of vagina covered by a half-cylinder, the apical edge of which is sinuate, the prominent lobes obliquely rounded; proximal part of plate submembranaceous, almost regularly folded, lateral parts smooth and deeply concave at sides of half-cylinder.

Hab. E. HIMALAYAS, S. INDIA and Malaya. We have bred it in S. India, where the larva occurs rarely in dense forests with heavy rainfall, from sea-level to about 2,000 feet elevation.

Larva :—

Final instar. Head round, body of the same shape as others of the genus: horn down-curved, cylindrical to near tip, then narrowing abruptly to a short point. Surface as in *socrates*. Colour similar to *socrates*, but the ground-colour a darker shade of green, the subdorsal stripe and oblique stripes less conspicuous and the subspiracular stripe less conspicuous and barely reaching the spiracle on segment 5. Slightly smaller than *socrates*.

Pupa.—Hardly distinguishable from that of *socrates*, but usually slightly smaller.

Habits.—Food-plants: *Vitis indica* Linn. and *Leea* Linn., both of the family Ampelideæ. Otherwise as for *socrates* so far as they have been observed.

92. **Acosmeryx socrates** Boisd. f. **socrates** Boisd. (Fig. 74 F, genitalia; Pl. IV, fig. 4, larva, fig. 5, pupa).

Acosmeryx socrates, Boisduval, 1875, p. 217 (Manila).
Acosmeryx socrates f. *socrates*, Roths. & Jord., 1903, p 532; Seitz, 1929, p. 550.
Acosmeryx ancea, Hampson (non Stoll), 1892, p. 81 (partim).
Acosmeryx pseudonaga, Butler, 1881 B, p. 2, pl. lxxviii, fig. 3 (Bhutan); Swinhoe, 1890, p. 162 (Bassein).
Acosmeryx ancea f. *pseudonaga*, Dudgeon, 1898, p. 409 (Sikkim; Bhutan; 2,000 ft.).

f. **cinerea** Butl.

Acosmeryx cinerea, Butler, 1875, p. 245 (Silhet); id., 1881 B, p. 1, pl. lxxvi, fig. 2; Moore, 1882, p. 24, pl. lxxxix, figs. 2, 2 *a* (l., p., i.).
Acosmeryx ancea f. *cinerea*, Dudgeon, 1898, p. 409 (Sikkim; Bhutan; 2,000 ft.).
Acosmeryx socrates f. *cinerea*, Roths. & Jord., 1903, p. 533; Seitz, 1929, p. 550, t. 63 *d*.
Acosmeryx ancea, Hampson (non Stoll), 1892, p. 81, fig. 51 (♂).

Imago.—♂♀. Differs from all the other species in the less deeply sinuate apex of fore wing, the lobe SC^5 less produced than apical lobe. Wings not dentate. Upperside grey, fore wing with markings nearly as in *omissa*; third discal line M^1–SM^2 faint or absent. Hind wing blackish in apical third, this area not divided, the dark discal line of the other species visible only near anal angle. *Underside* less ferruginous

tawny than in *s. sericeus* and *omissa*; marginal band of fore wing widest at R^2, this projection generally rounded or sinuate. *Expanse*: ♂♀, 86–100 mm.

♂. Harpe as in *s. sericeus*. Left process of penis-sheath triangular.

♀. Vaginal plate (fig. 74 F) as in *naga*, orifice rather more proximal, with a concave space in front surrounded by a fold.

Hab. E. HIMALAYAS, S. INDIA and CEYLON, eastwards to Malaya and the Philippines. We have bred it in S. India, where larvæ are very common during the monsoon, from sea-level up to 2,500 feet elevation.

Two forms, occurring together and apparently not specifically distinct :—

(*a*) *A. socrates* f. *socrates*.

♂♀. Oblique discal band of fore wing widened behind R^2. Subapical costal patch of fore wing below bright chestnut.

(*b*) *A. socrates* f. *cinerea*.

♂♀. Oblique band of fore wing a little more distad at costal margin than in f. *socrates*, not dilated distad behind R^2, therefore narrower and straighter; disc of fore and hind wing below less ferruginous-tawny, subapical costal patch of fore wing shaded with olive, less bright than in f. *socrates*.

Larva :—

Final instar. Head round, small; true clypeus about half length of head, an equilateral triangle; false clypeus forming an arch over apex of true clypeus; labrum half as long as and about as broad as clypeus; ligula about as long and as broad as labrum, kidney-shaped; eyes 1 to 4 in a slight curve, equidistant; 6 in line with 3 and 4 and slightly further from 4 than 4 is from 3; 5 slightly further from 4 and 6 than 4 is from 6. Surface of head smooth except for sparse, minute, bubble-like tubercles visible only under a lens; labrum longitudinally ridged. Body shaped as in others of the genus. Horn of medium length, down-curved, nearly cylindrical to near tip, where it suddenly narrows to a short point. Surface of body dull and smooth. Horn shining, covered with small, flattened, pear-shaped tubercles.

Coloration.—Head glaucous-green, tubercles white; labrum green; ligula base soiled whitish, lobes reddish-brown; antenna with basal segment bright yellowish-green, other segments bright maroon; mandible green with reddish-brown tip; eyes 1, 2 and 5 green, others dark brown. Body bright yellowish-green with short dark green longitudinal stripes above the flange and the dorso-lateral stripe, bluish-green dotted closely with white below it; a dorso-lateral stripe from segment 2 to base of horn, narrow and yellow on segments 2 to 5, broad and white on 6 to 12, the stripe edged narrowly above by plum-colour,

more broadly below by pink, on 6 to 12; the flange edged broadly with yellow on 2 and 3 and the anterior half of 4, with brownish-maroon on rest of 4 and 5, the latter colour embracing the spiracle of 5, and again edged broadly by yellow, giving the spiracle the appearance of an ocellus; underside of flange fuscous on 2 and 3, black on 4 and 5; a round dorsal spot, plum-colour surrounded by yellow, on the front margins of 5 to 11; pale yellowish-green oblique stripes on 6 to 11; horn reddish-brown; true legs dark reddish-brown; anal flap edged with yellow. Spiracles white, the slit black and edged on each side with black, the whole with a narrow, shining black rim. Length 100 mm.; breadth 13 mm.

Pupa.—Shape as in others of the genus; antenna about one-third, fore leg one-half, and mid-leg two-thirds length to tip of wing-case. Surface shining, margins of segments deeply impressed, costa and veins of wings and legs beaded; head, thorax and wing-cases reticulate; dorsum of abdomen and whole of segments 12 to 14 closely, coarsely pitted, the pits smaller except on venter of 11; sex-marks, clasper and horn scars prominent, the sex-mark of ♂ large, broadly oval, tumid, with a central, spiracle-like slit. Spiracle of 2 a narrow slit between the curved hind margin of 2 and the narrow, raised front margin of 3; remaining spiracles broadly oval, flush, the central slit with narrow, raised edges. Cremaster a rugose knob ending in a short, cylindrical, minutely bifid tip. Colour reddish-brown dorsally, yellowish ventrally, wing-cases greenish with the beading of veins and legs black; spiracles, cremaster and sex-marks black. Length 52 mm.; breadth 14 mm.

Habits.—Food-plants: *Vitis* Linn. and *Leea* Linn., family Ampelideæ, and *Dillenia pentagyna* Roxb., family Dilleniaceæ. The moths have not been caught at flowers, nor do they appear to come to light. We never succeeded in inducing bred specimens to mate, nor bred ♀♀ to attract wild ♂♂.

93. **Acosmeryx sericeus sericeus** (Walk.). (Fig. 74 G–I, genitalia).

Philampelus sericeus, Walker, 1856, p. 181 (Sylhet).
Acosmeryx sericeus, Butler, 1881 B, p. 1, pl. lxxvi, fig. 2; Cotes & Swinhoe, 1887, p. 8 (Sylhet; Sikkim); Swinhoe, 1892, p. 8 (Assam); Roths. & Jord., 1903, p. 503.
Acosmeryx ancea f. *sericea*, Dudgeon, 1898, p. 409 (Sikkim; Bhutan; 2,000 ft.).
Acosmeryx sericeus sericeus, Seitz, 1929, p. 550, t. 63 *c*.
Acosmeryx ancea, Hampson (non Stoll), 1892, p. 81.

Imago.—♂♀. Metanotum chocolate-tawny at sides; chestnut-brown markings of abdominal tergites rather prominent. Fore wing upperside much shaded with violaceous-grey, the

brown lines more prominent than in the other species; first discal line heavy, straight from R^3 to inner margin, anteriorly merged together with an oblique band which reaches distal margin just before hind angle; grey submarginal band ending at or just beyond R^3; distal margin dentate. Hind wing: an indistinct brown discal line, followed by an indistinct, paler, slightly tawny band. *Underside* of abdomen, hind wing and disc of fore wing along marginal band bright tawny; white scaling at costal margins between the lines conspicuous. Antenna shorter than in *naga*, agreeing with those of the following species. *Expanse*: ♂ 96 mm., ♀ 106 mm.

♂. Tenth sternite (fig. 74 G) widest in middle. Process of harpe (fig. 74 H) distally more rounded than in *naga*, the ventral ridge higher and not dentate. Left process of penis-sheath broad (fig. 74 I).

Hab. E. HIMALAYAS to the Philippines. Rare, and early stages not known. Mell has bred the subspecies *A. s. rufescens* in S. China.

94. **Acosmeryx omissa** Roths. & Jord. (Fig. 74 J–L, genitalia).

Acosmeryx omissa, Roths. & Jord., 1903, p. 530 (Buxa, Bhutan); Seitz, 1929, p. 551, t. 63 *c*.
Acosmeryx ancea, Hampson (non Stoll), 1892, p. 81.

Imago.—♂♀. Easily confused with *S. sericeus*. Upperside far more uniform in colour, much less variegated with grey and chestnut. Fore wing: antemedian curved band less extended brown than in *s. sericeus*, the two lines composing it being separated for the greater part; first discal line thin, broken at the veins like the following lines, bars M^1 to M^2 of lines 3 and 4 heavier and closer together, often forming a single patch; oblique band as in *s. sericeus* in position, narrower in front, more or less dilated distad at R^2. The discal and submarginal obscure bands of hind wing of *s. sericeus* also present in *omissa*. *Underside*: costal margin less marked with greyish-white than in *s. sericeus*, the tawny colour more restricted and less bright; brown discal border of hind wing with a distinct white line as in *s. sericeus*, the border widest between R^2 and R^3, not upon R^2. Abdomen less bright tawny and breast more olivaceous than in *s. sericeus*. *Expanse*; ♂♀, 92–100 mm.

♂. Tenth sternite (fig. 74 J) slightly widened apically. Process of harpe (fig. 74 K) less triangular than in *s. sericeus*, hind edge not so heavily dentate. Left process of penis-sheath (fig. 74 L) nearly horizontal.

Hab. E. HIMALAYAS (Bhutan; Sikkim). Rare; early stages unknown.

Genus **LEPCHINA** Oberthür.

Oberthür, 1904, p. 76 ; Roths. & Jord., 1907, p. 101.

Genotype : *tridens* Oberth.

Imago.—♂. Differs from *Acosmeryx* in the eyes being small, with lashes ; end-segment of antenna not filiform ; tibial spines shorter ; first segment of mid-tarsus without elongate spines. Fore wing with termen produced to points at and below apex and excurved at middle. Hind wing with termen sinuate.

Hab. E. HIMALAYAS. One species. Early stages not known.

95. **Lepchina tridens** Oberth.

Lepchina tridens, Oberthür, 1904, p. 76 (Darjeeling) ; Hampson, 1910, p. 88 ; Seitz, 1929, p. 551.

Imago.—♂. Head and thorax violaceous-grey ; abdomen brown ; ventral surface reddish. Fore wing violaceous-grey with velvety-grey lines and patches ; basal area with three lines followed by a postmedian triangular patch touching a discoidal point with its inner edge and extending from costa to termen and inner margin ; apical area with streaks and marks. Hind wing brown with darker median and terminal shades. *Underside* ferruginous-red ; fore wing with basal half blackish, two greyish costal patches, a sinuate terminal violet-grey patch on both wings with a median whitish mark on fore wing ; two double brown lines on hind wing with a greyish costal patch beyond them. *Expanse* : 64 mm.

Hab. E. HIMALAYAS (Sikkim). ♀ and early stages unknown.

Genus **PANACRA** Walker. (Fig. 76).

Walker, 1856, p. 154 ; Roths. & Jord., 1903, p. 533 ; id., 1907, p. 101.

Genotype : *automedon* Walk.

Imago.—♂♀. Small moths, upperside brown mottled and lined with different colours. " Genal process large, triangular, concave behind, reaching nearly tip of pilifer. Palpus rather large, obtusely triangular in dorsal aspect ; second segment nearly as broad as long. Eyelashes vestigial. Head not crested. Antenna setiform in ♂, slightly incrassate distally in ♀, hook short, abrupt, end-segment narrow, elongate-conical, not produced into a long filiform process, clothed with long bristles, the segment similar to that of *Theretra* and allies. Abdomen ending in a simple tuft ; spines weak. Merum of mid-coxa not angulate ; tibiæ simple ; spurs of mid-tibia almost the same in length ; those of hind tibia very unequal, longer terminal one about as long as second tarsal

segment ; mid-tarsus with comb ; paronychium and pulvillus present.

" ♂. Tenth segment simple ; tergite narrow, sides parallel or slightly slanting distad ; apex sinuate, truncate, or entire ; sternite boat-shaped, shorter than tergite. Clasper with friction-scales, which vary in size and number ; harpe slender, simple, mostly somewhat spatulate. Penis-sheath with a right and a left process, the one or the other sometimes not detached, being replaced by a series of teeth.

" ♀. Vaginal plate elongate triangular, tip truncate, edges somewhat incrassate ; orifice large, free, with the edges somewhat raised but simple." (Roths. & Jord., 1903, p. 533).

Egg.—Shortly ovoid, surface shining and smooth except under the microscope, colour variable.

Larva.—Chœrocampine in shape, head semi-elliptical, body long and thin, tapering strongly frontad from segment 5, rest of body cylindrical, of less diameter than 5 ; venter of

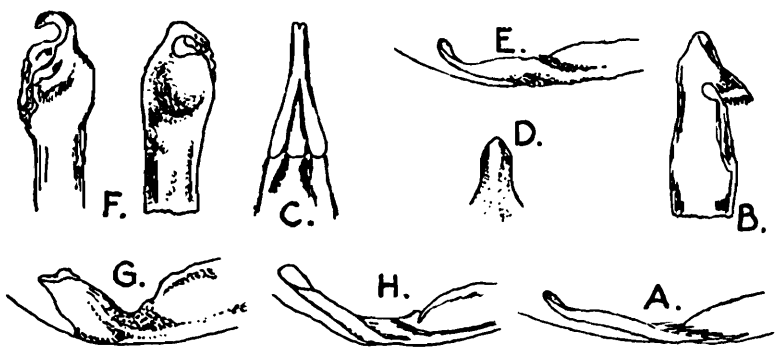


Fig. 76.—*Panacra* Walk. Genitalia.

A, *P. automedon* Walk., harpe ; B, penis-sheath. C, *P. dohertyi* Roths., 10th tergite, dorsal view ; D, 10th sternite, ventral view ; E, harpe ; F, penis sheath, right and left sides. G, *P. sinuata* Roths. & Jord., harpe. H, *P. metallica* Butl., harpe.

4 and 5 somewhat flattened ; colour green, more or less strongly marked with brown, and an ocellus with enamel-like surface on 5.

Pupa.—Chœrocampine in shape ; basal part of tongue in a laterally flattened sheath ; cremaster with many hooks and spines ; colour green or grey with dark markings.

Habits.—Eggs laid singly on plants of the family Aroideæ. In the later instars the larvæ feed chiefly at night, and hide during the day low down on the stem of the food-plant or on the earth or tree-trunks close by. They adopt a snake-like attitude when alarmed. The colour becomes darker before pupation, which takes place in a rough cocoon on the surface. The cremaster of the pupa is fixed firmly by its hooks to the silk of the cocoon The moth rests with the wings nearly horizontal.

Hab. Oriental Region ; twelve Indian species and subspecies.

Key to the Species.

Imagines.

1. Interspace between the antemedian and the discal lines of fore wing green, like head and thorax — 2.
   Median interspace not green — 4.
2. Median interspace wide at costa — 3. [& Jord., p. 302.
   Median interspace narrow at costa — *P. busiris atima* Roths.
3. Broad costal portion of median interspace shaded with olive-black ... — [Roths. & Jord., p. 305. *P. busiris marina*
   Broad costal portion of median interspace not shaded with olive-black . . . — [Walk., p. 304. *P. busiris busiris*
4. Third and fourth discal lines of fore wing heavily dentate, mesothoracic tegula with pale golden-metallic scales at hind edge — [Walk., p. 313. *P. mydon mydon*
   Third and fourth discal lines of fore wing not dentate behind . . ... . — 5.
5. Median interspace pale, band-like, a pale shade crossing the discal lines between R^2 and R^3, distal margin not angulate, not denticulate . ... — [p. 308. *P. variolosa* Walk.,
   Median interspace not band-like, antemedian lines indistinct. . .. .. . — 6.
6. Distal border of hind wing underside dilated before middle ... . — 7.
   Distal border of hind wing underside not dilated before middle . . .. .. — 8.
7. Distal margin of fore wing underside clay-colour or brown, second white submarginal mark an acute angle or a triangular spot . .. . . . — [p. 307. *P. dohertyi* Roths.,
   Distal margin of fore wing underside pale ochreous; second white submarginal mark an angle of 90° or more . . — 9.
8. Inner or main discal line of fore wing reaching the apex . . .. — [p. 305. *P. automedon* Walk.,
   Discal line of fore wing reaching the costa before the apex .. .. — *P. moseri* Gehl., p. 306.
9. Post-discal tawny or ochreous area of hind wing underside extended from costal to abdominal margin, interrupted before middle; fore wing not distinctly sinuate, submarginal double line of fore wing underside extended to hind margin, interspace pale, the lines not dilated in middle, but not joined to first discal line by a brownish-black streak . . — [p. 312. *P. perfecta* Butl.,
   Hind wing underside as before; fore wing sinuate, submarginal lines of fore wing underside dilated basad, joined to first discal line along R^2, pale band of hind wing upperside much broader than brown marginal border .... — [Gehl., p. 309. *P. metallica anfracta* [Butl., p. 312. *P. metallica metallica*
   Post-discal area of hind wing underside almost entirely replaced by olive-brown in upper half, greater part of hind wing brown; fore wing sinuate; pale band of hind wing upperside narrow — [Jord., p. 308. *P. sinuata* Roths. &

Larvæ.

A dark brown dorsal stripe from segment 2 to base of horn, narrow on 2 and 3, broad to base of horn; spiracles brown, central slit white .. . [Gehl., p. 310. *P. metallica anfracta*

Dorsal stripe brown, narrow on 3 and 4, then broken on each segment; spiracles pale yellow with brown suffusion across middle . . . [& Jord., p. 302. *P. busiris atima* Roths.

Dorsal stripe dark green, narrow, on segments 2 to 5 only; spiracles black edged broadly with white [Walk., p. 314. *P. mydon mydon*

Pupæ.

Cremaster ending in a bifid hooked shaft, with three similar shafts on each side of cremaster .. . . . . [& Jord., p.303. *P. busiris atima* Roths.

Cremaster ending in a shaft with two hooks at its tip and two spines on each side of it [Gehl., p. 311. *P. metallica anfracta*

Cremaster ending in a bifid shaft, each arm with two hooks; two shorter shafts, each with a single hook, on each side of the cremaster [Walk., p. 315. *P. mydon mydon*

96 *a*. **Panacra busiris atima** Roths. & Jord. (Pl. IV, fig. 6, larva, fig. 7, pupa; Pl. XIV, fig. 7, larva).

Panacra busiris atima, Roths. & Jord., 1915, p. 292 (S. India; Karwar, ♀); Seitz, 1929, p. 572.

Imago.—♂♀. Very similar to *P. b. busiris*, but upperside less green. Fore wing with the median area narrower, the two lines bordering on the latter more separated. *Underside* of a brighter and more even rusty-yellow. *Expanse*: ♂ 56–66 mm., ♀ 64–70 mm.

Hab. S. India, where we have bred the subspecies, the larvæ being found in dense, damp, evergreen jungles in the Western Ghats.

Egg.—Shortly ovoid; surface shining and smooth to the naked eye, but under the microscope seen to be very superficially sculptured like the skin of an orange; colour pale brownish-yellow, one side splashed with blood-red. Length 2·2 mm.; breadth 2 mm

Larva:—

Final instar. Head small, semi-elliptical in shape, vertex flattened; true clypeus about one-half length of head, basal angles broadly rounded, apex acute; false clypeus with apex broadly rounded, reaching to two-thirds length of head; labrum about one-half length of true clypeus; ligula longer than labrum, semicircular, with a very deep sinus; eyes with 1 to 4 equidistant in a sharp curve, 6 in line with 3 and 4 and twice as far from 4 as 4 is from 3; 5 forming an equilateral triangle with 4 and 6. Surface of head slightly shining, covered

sparsely with minute glassy tubercles ; basal half of labrum longitudinally striate. Body dull except for the enamel-like surface of the ocellus. Horn of medium length, slightly down-curved, somewhat flattened laterally, thick at base and tapering evenly to a sharp point ; covered sparsely with minute tubercles.

Coloration.—Head pale olive-green with subcutaneous dusky dots ; false clypeus edged narrowly with white, labrum glassy-white, the basal half suffused with pale fuscous ; ligula reddish-brown ; basal segment of antenna greenish, other segments reddish-brown ; mandible pale rusty with tip broadly reddish-brown. Body rich olive-green, segments 2 to 4 and the dorsum of the remaining segments up to 12 suffused with pale brown ; 13 and 14 yellowish-brown ; a narrow brown dorsal stripe on 3 and 4, continuing as a series of brown spots near the front margins of 5 to 11 ; a narrow dark brown dorso-lateral stripe on 2 to 4 ; a broad, pale, yellowish-brown spiracular stripe from the front margin of 2 to the spiracle of 5, which it surrounds, and continuing as a waved stripe on 7 to 10 ; a large ocellus behind the front margin of 5, centre round and black, bordered behind and below broadly with dark brown and then narrowly with pale brown ; the area between the ocelli spotted with white. Horn olive-green, tip shortly yellow ; legs yellow, prolegs pale brown ; venter olive-green, suffused with blackish on 2 to 4. Spiracles oval, flush, pale yellow with a brown suffusion across the middle. Length 85 mm. ; breadth 11 mm. ; horn 9 mm.

Pupa.—Slender in build ; tongue-sheath narrow and keeled in front, widening basad, semicircular in lateral aspect ; a large deep depression, invisible from above, between the base of the sheath and the eye. Surface dull ; base and venter of tongue-sheath deeply corrugate, rest of body covered with low rounded ridges and tumidities ; the front bevels of segments 8, 9 and 10 transversely ridged with narrow parallel lines. Spiracle of 2 a narrow slit, with a raised oval lobe projecting from the front margin of 3 just touching it ; other spiracles broadly oval, the central slit with narrow, raised edges lying in an oval depression. Cremaster an equilateral triangle with the apex broadly rounded-truncate, the sides, seen from the dorsal aspect, in the same line as the sides of segment 14, so that it appears to be a continuation of that segment ; the ventral surface deeply, longitudinally concave, the concavity continuous with a round axial depression in the hind end of 14 ; four pairs of strong, chitinized, bifid shafts, each arm ending in a hook, one shaft subdorsal at apex of cremaster, one lateral and one dorso-lateral farther forwards, and one subdorsal farther forward still, the apical pair the stoutest and branched well above base, the other

pairs branched shortly above base. Colour grey splashed and dotted with fuscous; front of tongue-sheath pale orange dotted with fuscous; wing-cases and abdomen marked with black strigæ; a black interrupted ventral stripe on segments 9, 10 and 11; spiracles, spiracular lobe of segment 3 and cremaster dark reddish-brown. Length 50 mm.; breadth 11 mm.; tongue-sheath projecting about 2 mm. in front of head.

Habits.—Food-plant: *Pothos scandens* Linn., family Aroideæ. The young honey-coloured larva is very difficult to detect, as it lies along the midrib on the underside of a tender whitish leaf. In the first instar the long black horn is moved freely in a vertical plane when the larva is moving. In later instars the green- and brown-coloured larva lies during the day along the stem of the food-plant or on an adjacent tree-trunk, where it is also very difficult to detect. It appears to feed mostly at night. Pupation takes place in a rough cocoon on the surface, formed of leaves etc. held together with coarse strands of silk, with a pad of silk at one end in which the hooks of the cremaster are entangled. The head of the pupa, which bears a fancied resemblance to the face of a monkey, often appears uncovered at the other end of the cocoon. The moths are rarely caught feeding at flowers and do not appear to be attracted by light.

96 *b*. **Panacra busiris busiris** Walk.

Panacra busiris, Walker, 1856, p. 158 (Sylhet); Moore, 1865, p. 793 (Bengal); id., 1877, p. 595 (Pt. Blair); Cotes & Swinhoe, 1887, p. 11; Swinhoe, 1890, p. 163 (Rangoon); Roths. & Jord., 1903, p. 536.

Angonyx busiris, Butler, 1881 B, p. 6, pl. lxxix, fig. 2.

Chærocampa busiris, Hampson, 1892, p. 89; Swinhoe, 1894, p. 149 (Khasi Hills); Dudgeon, 1898, p. 410 (Sikkim, 1,800 ft.).

Panacra busiris busiris, Roths. & Jord., 1915, p. 287; Mell, 1922, p. 231, pl. vii (viii), figs. 1–4, pl. xiii, fig. 36, pl. xviii, figs. 11, 12 (pupa), pl. xxix, figs. 11 (larva), 12, 13 (imago); Seitz, 1929, p. 551, 572, t. 64 *a*.

Imago.—♂♀. Head and thorax dark green; palpi pinkish-brown; delicate pinkish lines above eyes and outlining collar and patagia; abdomen brownish with darker lateral patches on first two segments. Fore wing with a brown patch at base, marbled with darker lines and extending further along costa than along inner margin; a white patch at base of inner margin; interspace between antemedian and discal lines green like upperside of head and thorax, wide at costa; a black mark at end of cell; marginal area pale brown with three dark, curved lines, the submarginal line waved and white near apex. Hind wing dark brown; pale brown marginal line widest at anal angle where there are some indistinct lines

inside it. *Underside* of wings green at base, marbled with reddish, purple and grey towards outer margin. Distal margin of fore wing deeply sinuate, apex more produced than in other species ; angle R^2 more acute in ♂♂ than in most ♀♀. Hind wing narrow, costal margin rather obviously dilated near base. *Expanse* : ♂ 68–72 mm., ♀ 80–82 mm.

♂. Tenth tergite rather short and broad, not much longer than sternite, sinuate ; sternite acuminate. Clasper with numerous rather small friction-scales ; harpe nearly as in *dohertyi* in lateral aspect, less curved. Penis-sheath : the two processes of nearly the same width, the left much longer than the right, both dentate, and situated on a common stem, the mesial part of the sheath narrowed and produced distad before giving off the two processes.

Hab. E. HIMALAYAS, BENGAL, BURMA, China and Malaya. The subspecies has been bred by Mell in China, but has not been bred in India.

96 *c.* **Panacra busiris marina** Roths. & Jord.

Panacra busiris marina, Roths. & Jord., 1915, p. 287 (Andaman Is.) ; Seitz, 1929, p. 572.

Imago.—♂♀. Similar in size to small specimens of *P. b. busiris*. Fore wing less strongly angulate at distal margin, and upperside of head and thorax, as well as the median area of fore wing, duller green, the median area also smaller, especially the narrow posterior portion, the broad costal portion much shaded with olive-black at the double line which bounds the green area distally ; outer half of fore wing also much more fuscous than in *P. b. busiris*. Hind wing *underside*, basal area less distinctly green and contrasting less with disc than in *P. b. busiris*. Length of forewing : 32 mm.

Hab. ANDAMAN ISLANDS. Early stages not known.

97 **Panacra automedon** Walk. (Fig. 76 A, B, genitalia).

Panacra automedon, Walker, 1856, p. 154 (Sylhet) ; Moore, 1867, p. 675 (Sylhet) ; Butler, 1877 A, p. 550 (Sylhet) ; Swinhoe, 1890, p. 163 (Rangoon) ; Roths. & Jord., 1903, p. 537, pl. lxvi, fig. 8 (♀) ; Seitz, 1929, p. 552, t. 64 *a*.
Angonyx automedon, Butler, 1881 B, p. 6, pl. lxxix, fig. 1.
Chærocampa automedon, Hampson, 1892, p. 90 ; Dudgeon (*C. antomedon*), 1898, p. 410 (Sikkim).
Panacra truncata, Walker, 1856, p. 160 (Sylhet, ♂).

Imago.—♂♀. Outer margin of fore wing angled at R^2, more so in ♂ than in ♀. Markings similar to those of *metallica* but colour much more dull, being pale ochreous speckled with brown. Discal lines of fore wing almost parallel with costal margin, the first line running towards apex of wing, the lines close together, stopping behind SC^5, not curving towards

costa; white angle between SC^4 and SC^5 preceded costally by an elongate brown shade; the angle formed by the white mark and SC^5 filled in with a blackish dot; white angle between SC^5 and R^1. *Underside* nearly uniform dull ochreous, first discal line of fore wing running towards apex as on upperside, a distinct white submarginal spot between SC^5 and R^1. *Expanse*: ♂ 50–54 mm., ♀ 80 mm.

♂. Tenth tergite subcarinate above, being compressed, apex subsinuate; sternite acuminate. Clasper with four large friction-scales; harpe (fig. 76 A) ending in a long, very slender, feebly spatulate curved process. Penis-sheath (fig. 76 B): left process long and free, denticulate at apex and proximal edge; right process broad, short, broadest at end, densely dentate at end, the teeth long, pointed and generally bearing smaller teeth.

Hab. E. Himalayas to Borneo and Java. Rare, and early stages not known.

98. **Panacra moseri** Gehlen. (Fig. 77, ♂).

Panacra moseri, Gehlen, 1930, p. 130, figs. 1, 2, ♂ (Upper Assam).

This species is said to resemble *automedon* Walk., and is described by Gehlen as follows:—

♂. Body like *automedon*, head and front of thorax, however, lighter, making the lateral stripe less distinct, pectus laterally



A. B.

Fig. 77.—*Panacra moseri* Gehl., ♂ (after Gehlen); A, upperside, B, underside.

with golden hairs. Shape of fore wing differs from that of *automedon*. On the termen the subapical sinus ends at R^1 instead of at R^2; termen convex between R^1 and R^2, so that it is not pointed as in *automedon* but blunt. The inner margin is more curved and the anal angle more advanced. Hind wing with the anal angle more prominent, making the termen more concave.

Upperside. Fore wing: ground-colour yellow, not so grey as in *automedon*. The discal lines approach each other closely at inner margin but are sharply defined. The main discal line does not run straight apicad but is directed costad, though

not as proximally as in *malayana*, and is not parallel with the termen as in *automedon*. The white angle-mark SC^5–R^1 is much more distal and is not really an angle but is rounded. Stigma black, small, sharply defined. Fringe yellow. Hind wing as in *automedon*, the disc darker. Submarginal line proximally more sharply defined.

Underside. Fore wing quite different from that of *automedon*. The chief discal line, which in that species is more or less distinct, is here non-existent; instead there is here a discal transverse line which runs more or less parallel with the outer margin from just beyond middle of inner margin to costa, crossing the fork SC^4–SC^5 and bent inwards. Spots on veins between this discal line and termen evanescent. No submarginal line before termen. Stigma black. Hind wing with a median line as on fore wing, losing itself parallel with outer margin. Submarginal line as on upperside; between the two lines are vein-spots as in *automedon*. A large golden stigma, larger than in *automedon*. *Expanse*: ♂, 40 mm.

Genital mechanism differs materially from that of *automedon* as well as from other species. Œdeagus especially thinner and sharper; left lobe differently toothed and directed more downward than in *automedon*. Lobe of harpe more regular and ventrally more bent down than in that species.

Hab. E. HIMALAYAS (Lakhimpur, Assam; Rungrong Valley, Darjeeling). Early stages not known.

Type ♂ in the Berlin Museum.

99. **Panacra dohertyi** Roths. (Fig. 76 C–F, genitalia).

Panacra dohertyi, Rothschild, 1894 A, p. 8 (Perak); Roths. & Jord., 1903, p. 538, pl. lxvi, fig. 4 (♀); Seitz, 1929, p. 552, t. 64 *b*.

Imago.—♂♀. Discal lines of fore wing in the same position as in *automedon*, but curving costad in front and reaching costal margin, at least the distal one; the two white subapical anguliform markings distinct, the second far more proximal than in *automedon*, its tip being 4 mm. distant from edge of wing; posterior part of mark obscure in ♂, as clearly white as upper part in ♀; distal margin of both wings denticulate. *Underside* much more extensively brown on fore wing than in *automedon*, first discal line heavy, extended to costal margin, crossing subcostal just outside fork; clayish or brown distal border of both wings ill-defined, dilated between R^1 and R^3, reaching the external discal lines. ♂ much paler than ♀ above and below. *Expanse*: ♂ 54–60 mm., ♀ 66 mm.

♂. Tenth tergite (fig. 76 C, D) longer than in *automedon* but only half the width, apex incised. Clasper with eight to ten friction-scales arranged in three rows; harpe (fig. 76 E) shorter than in *automedon* and broader, more distinctly

spatulate. Penis-sheath (fig. 76 F): left process narrow, short, dentate; right process curved distad and laterad, more projecting than in the other species, narrow, with a few heavy teeth at the end.

Hab. E. HIMALAYAS (Assam) and Malaya. Very rare, and early stages not known.

100. **Panacra variolosa** Walk.

Panacra variolosa, Walker, 1856, p. 156 (Sylhet); Swinhoe, 1892, p. 13, pl. i, fig. 4 (type); Roths. & Jord., 1903, p. 539; Seitz, 1929, p. 552, t. 64 *b*.
Chærocampa variolosa, Hampson, 1892, p. 89; id., 1896, p. 453.
Panacra vagans, Butler, 1881 B, p. 4, pl. lxxviii, fig. 7 (Borneo; Bhutan).
Panacra hamiltoni, Rothschild, 1894 A, p. 82 (Khasi Hills).

Imago.—♂♀. Head and thorax olive-green and brown with numerous brown lines; abdomen with a golden tinge, mottled with purplish-grey towards base. Fore wing less sinuate than in *dohertyi*; upperside olive-green, base marbled with purplish-grey; subbasal and antemedian lines more distinct than in the other species; median interspace pale, this pale shade extended towards outer margin behind R^2; discal lines reaching costal margin, here nearer apex of wing than in the allied species, the most distal of them touching the black border of the submarginal spot SC^5–R^1, a pale costal spot at the outer side of this line; hind angle of wing very obtuse, the outer margin being more oblique than in the allies. Pale band of hind wing short and narrow. *Underside* of body and wings beautifully suffused with golden-yellow; exterior discal lines distinct on both wings, touching the submarginal line. *Expanse*: 56–80 mm.

♂. Tenth segment as in *dohertyi*, sternite rather more pointed. Clasper with more than eight friction-scales; harpe nearly as in *automedon*, rather more spatulate. Right process of penis-sheath intermediate between the respective processes of *dohertyi* and *automedon*, left process broader than in *dohertyi*, obliquely rounded proximally, the penis-sheath agreeing almost with that of *sinuata* and allies.

Hab. E. HIMALAYAS (Sylhet; Khasi Hills) and Malaya. Rare. and the early stages unknown.

101. **Panacra sinuata** Roths. & Jord. (Fig. 76 G, genitalia).

Panacra sinuata, Roths. & Jord., 1903, p. 539, pl. vi, fig. 13 (♂) (Sikkim); Seitz, 1929, p. 552, t. 64 *b*.

Imago.—♂. Middle of thorax and proximal abdominal tergites of the same pale colour as in *variolosa*, a blackish-brown stripe underneath the tegula continued to abdomen.

Fore wing sinuate below apex, slightly scalloped like hind wing; fringe prominently dotted with blackish-brown; a bundle of fine discal lines, first and second fused to a band, ending at a spot at costal margin, the other three thin but sharply marked, extended to costal margin but faint in front, and nearly straight up to SC^5, then curved costad like the others. Pale band of hind wing not broader than the brown (double) border of the wing, often a mere line which does not reach costad beyond R^3. *Underside*: basal two-thirds of fore wing and greater part of hind wing dark brown. First discal line of fore wing broad, ending at a costal patch situated partly within subcostal fork; a large brown submarginal patch extended proximad along R^2 to first discal line; a conspicuous blackish-brown spot near hind angle behind M^2. Brown border of hind wing dilated before middle and merged together with the brown basi-discal area, costal edge, abdominal margin and a narrow submarginal band, which stops at R^3, clayish-ochraceous speckled with tawny and brown; three more or less dentate discal lines, second and third distinct, first the heaviest. *Expanse*: ♂ 58–68 mm., ♀ 67 mm.

♂. Tenth segment similar to that of *automedon*. Clasper strongly convex dorsally beyond middle; friction-scales large, asymmetrical, obliquely rounded-truncate, four or five in number; harpe (fig. 76 G) ending in a stout process spatulate in dorsal aspect. Penis-sheath: right process as in *automedon*, rather narrower and less truncate; left process also broad, much more proximal, apex obliquely rounded, heavily dentate.

Hab. E. HIMALAYAS (Sikkim; Khasi Hills). Rare, ♀ and early stages unknown.

102 *a*. **Panacra metallica anfracta** Gehlen. (Fig. 78, ♂; Pl. IV, fig. 8, larva; Pl. XIV, figs. 12, 13, larva).

Panacra metallica anfracta, Gehlen, 1930, p. 258, figs. 1, 2 (♂) (Simla).

Gehlen distinguishes this subspecies as follows:—

♂. Smaller than *metallica*. Length of fore wing 28 mm. Wings narrower.

Upperside much darker than in *m. metallica*. Fore wing: discal lines not so straight, being curved distad in front, basad behind, so that line 1 is brought very near end of cell, causing the space between line 1 and the outermost antemedial line to be narrower than in *m. metallica*. The two light apical spots or patches are smaller, the lower one being more proximal. On hind wing the light line is shortened, darker and not broader than the dark terminal area.

Underside more contrasted, the dark shades darker; especially is the basal half of fore wing so dark as to be indistinguishable from the first discal line. The light parts have

a more rusty tint between the discal lines of fore wing and along costa and termen of hind wing.

This is a slightly differentiated race. Smaller on the whole. Fore wing with paler light markings, the tornal patch more ochraceous and extending over the two outer discal lines, whilst in the typical *metallica* it does not reach further than the outer discal line. In general this form shows more contrasted markings. The band on hind wing is variable. *Expanse* : ♂ 60–73 mm., ♀ 73 mm.

Hab. W HIMALAYAS. We have bred it in the W Himalayas (Mussooree ; Simla), where it appears to be the most common



Fig. 78.—*Panacra metallica anfracta* Gehl., ♂ (after Gehlen) ; A, upperside ; B, underside.

species of *Panacra*, taking the place of *P. m. mydon* in the East Himalayas.

Egg.—Colour pale green, but before hatching the crimson colour of the larva forming inside shows through the egg-shell, so that the colour then appears to be partly pink.

Larva :—

1*st instar*. Body long and thin ; horn straight, of medium length, shortly bifid, with a bristle on each arm ; head very pale green, second and third segments bright bluish-green ; rest of body pale crimson in dorsal area, yellowish-green in lateral area ; horn with basal half pale purple, rest black. 2*nd instar*. Horn long ; head pale green ; body pale bluish with a darker blue, narrow dorsal stripe from segment 2 to base of horn ; an oval ocellus on 5 black above, pale blue below ;

horn black with small black tubercles on upper surface, pale green on under surface. *3rd instar*. Head pale green, body pale yellowish-green ; dorsal stripe black ; ocellus black above, very pale yellow below ; a white patch touching the upper edge of the ocellus, and some white dots between the ocelli. *4th instar*. Horn long, sharply down-curved, slightly flattened laterally, surface smooth ; head and segment 2 bluish-green, rest of body yellowish-green, with a transverse row of white dots on each secondary ring ; ocellus with a reddish longitudinal stripe in the yellow portion ; three or four transverse lines, curved backwards, in front of and behind the ocellus ; horn black above, greenish-brown below ; spiracles pale brown.

5th instar. Shape as in others of the genus ; horn sharply down-curved, slightly flattened laterally, ending in a blunt point. Head dull, body and horn smooth and shining.

Coloration.—Head bluish-green. Body bright yellowish-green ; dorsal stripe dark brown, narrow on segments 2 and 3, then broad to base of horn ; a dark brown subdorsal stripe on 2 to 4 ; ocellus : centre black above, brown below, the brown portion edged narrowly with white all round, the whole edged with black ; a curved white band above the ocellus ; the area between the ocelli brown flecked with white ; a brown patch on 6 to 12, narrow below the spiracle, broadening and turning dorsad at the anterior edge of each of the segments. Horn dirty yellow ; legs green ; prolegs green with base and end-segment brown ; anal flap and claspers dirty green. Spiracles brown, central slit white. Length 90 mm. ; breadth 10 mm. ; horn 6 mm.

Pupa.—The same shape as others of the genus. Surface dull. Cremaster broadly triangular, ending in a shaft with two hooks at the tip and two sharp spines on each side of the base. Colour of head, thorax and wing-case bright green ; eye and surrounding area ochreous ; tongue and wing-case speckled with black ; abdomen green with dark brown and ochreous strigæ. Spiracles dark brown. Length 50 mm. ; breadth 11 mm.

Habits.—Food-plant : *Arisæma curvatum* Kunth., family Aroideæ. The larva, when small, lies stretched straight out along the midrib on the underside of a leaf, and when alarmed bends the head round to touch the middle of the body. In the last two instars the larva feeds at night, and during the day lies head downwards along the stem of the food-plant close to the ground, or hides under stones and leaves close by. When alarmed it retracts the head and anterior segments into segments 4 and 5, and twists the body round so as to present the ventral surface of the anterior segments to the source of danger. When further molested it sometimes

stretches out the head and segments 2 and 3 and bends them downwards and backwards so that the head and anterior segments lie parallel with and close to the venter of 5, which segment is at the same time expanded. The anterior part of the body is swayed from side to side, and the larva presents a most curious aspect, which we have not noticed in any other species. The larva turns greenish-brown before pupation, which takes place in a rough cocoon on the surface, the hooks of the cremaster being fastened firmly in a pad of silk. The habits of the imago, so far as they are known, are the same as that of *P mydon*. There is only one brood, during the monsoon months.

102 *b*. **Panacra metallica metallica** Butl. (Fig. 76 H, genitalia).

Panacra metallica, Butler, 1875, p. 6 (N. India); Roths. & Jord., 1903, p. 540; Seitz, 1929, p. 552, t. 64 *c*.
Chærocampa metallica, Hampson, 1892, p. 89; Dudgeon, 1898, p. 410 (partim; Sikkim, 4,000 ft.).

Imago.—♂♀. Like *sinuata*, but differs as follows: more ochraceous in tint; side-stripe of thorax and proximal segments of abdomen tawny; discal lines of fore wing less longitudinal, not reaching costal margin, slightly curved distad between SC^5 and R^2; clayish-buff band of hind wing broader. *Underside* less extended brown, basal area of fore wing paler, with obvious traces of brown markings; hind wing buff tinged with tawny; submarginal buff area broader than brown marginal band, continued to costal margin, more tawny in front, interrupted before R^2.

♂. Harpe (fig. 76 H) much shorter than in *sinuata*, resembling that of *dohertyi*, but more strongly spatulate.

Hab. E. HIMALAYAS (Sikkim). Appears to be rare. Only two specimens in the British Museum.

103. **Panacra perfecta** Butl.

Panacra perfecta, Butler, 1875, p. 391 (Darjeeling); id., 1881 B, p. 4, pl. lxxviii, fig. 6; Roths. & Jord., 1903, p. 540; Seitz, 1929, p. 552, t. 56 *c* (*b*).
Chærocampa metallica, Hampson (non Butl.), 1892, p. 89; Dudgeon, 1898, p. 410 (Sikkim).

Imago.—♂. Similar to *metallica* in colour. Fore wing: sinus below apex vestigial or absent, discal lines a little more longitudinal than in *sinuata*, the first being at hind margin nearer the base than in *sinuata*, the three outer ones not reaching SC^5, first and second also obsolescent near costal margin; a distinct double submarginal line, parallel with outer margin. Pale band of hind wing a little wider than in *sinuata*, nearly reaching costal margin, but much obscured

by scaling in upper half. *Underside* as in *metallica*, but discal line of fore wing more oblique, a pair of more distinct submarginal lines with whitish interspace, brown submarginal patch R^1–R^2 smaller. Third discal line of hind wing as heavy as or heavier than first and accentuated by vein-dots. *Expanse* : ♂ 58–64 mm.

♂. Tenth tergite rather broader than in *sinuata* and *metallica*, less convex above, apex more broadly sinuate. Harpe more slender than in *metallica*, agreeing far better with that of *automedon*, but shorter.

Hab. E. HIMALAYAS (Sikkim ; Bhutan). Very rare, only a few ♂♂ known.

104. **Panacra mydon mydon** Walk. (Fig. 79, imago ; Pl. IV, fig. 9, larva, fig. 10, pupa ; Pl. XIV, fig. 11, larva).

♀. *Panacra mydon*, Walker, 1856, p. 155 (Sylhet) ; Butler, 1877 A, p. 550 (Sylhet ; Barrackpore) ; id., 1881 C, p. 5, pl. lxxviii, fig. 9.
Chaerocampa mydon, Hampson, 1892, p. 90.
Panacra mydon mydon, Roths. & Jord., 1903, p. 542 ; Seitz, 1929, p. 552, t. 64 *c*.
♂. *Panacra scapularis*, Walker, 1856, p. 157 (Sylhet).
♂. *Panacra frena*, Swinhoe, 1892, p. 12, pl. i, fig. 5 (Sylhet).

Imago.—♂♀. Mesothoracic tegula with metallic, pale golden apical fringe, thin metallic scales large but few in number. Middle of thorax and first abdominal tergites broadly greyish



Fig. 79.—*Panacra mydon mydon* Walk.

clay-colour ; a few white battledore-shaped scales laterally at the apices of the third to sixth tergites. Wings somewhat scalloped, fringe dotted heavily with black. Fore wing slightly sinuate below apex ; first discal line not quite straight, ending in a black costal spot just in front of the subcostal fork, third and fourth lines dentate, accentuated with vein-dots ; a brown triangular marginal cloud from R^1 backwards, separating a pale, more or less triangular area from distal margin. *Underside* : brown, distal border of fore and hind wing dilated before middle ; external discal line parallel with outer margin but curving costad in front, dentate, accentuated with vein-dots. *Expanse* : ♂ 53–56 mm., ♀ 62 mm.

♂. Tenth tergite as in *dohertyi*, tergite a little broader. Clasper with numerous friction-scales; harpe slender, nearly as in *automedon*. Penis-sheath: right process projecting as in *dohertyi*, but broader at end and more heavily dentate; left process as long as in *malayana*, but broader.

Hab. E. HIMALAYAS and BURMA, extending to Malaya and the Philippines. We have bred the subspecies in the Khasi Hills, where eggs and larvæ are common during the monsoon.

Egg.—Yellowish-green, the bright orange of the young larva showing through before hatching.

Larva:—

1*st instar*. Body long and thin, horn straight, of medium length; head and body orange, horn black. 2*nd instar*. Surface smooth and shining; head and body translucent pale green, horn black. 3*rd and* 4*th instars*. Body long and thin, segment 5 tumid; horn long, straight; surface of head and body smooth and dull, horn shining; head and body pale yellowish-green; an oval, longitudinal, black ocellus on 5; horn black above, pale green on sides and centre.

5*th instar*. Shape as in others of the genus; horn thick at base, tapering sharply to a blunt point, basal half at right angles to dorsum of larva, distal half bent sharply downwards. Body smooth and dull, excepting the ocellus and the band above it, which are shining as though enamelled, and the horn, which is shining and covered with small tubercles.

Coloration.—Head bright green. Body pale yellowish-green; segments 4 and 5 bright green on dorsum, marked with longitudinal white dashes; a dark green, narrow, dorsal stripe on 2 to 5, with a pinkish stripe on each side of it on 5; an oval longitudinal ocellus on 5, black above, reddish-brown below, the reddish-brown portion outlined by a narrow pale band, the whole edged by a narrow blackish line; above the ocellus, and touching it, a broad white band with a bright red quadrate spot in the centre of it; a broad, brown subdorsal stripe starts from the front margin of 2, runs across 3 and 4, below the ocellus on 5, then turns up to dorsum along hind edge of 5, this stripe being edged below by a narrow pale stripe; a brown spiracular stripe runs from the spiracle on 6 to the hind margin of 11, this stripe narrow at the spiracles, wider between them; 13 and anal flap brown, with a broad, green, dorsal stripe from base of horn to tip of flap. Segments 6 to 12 are sometimes immaculate except for the spiracular band, or marked with irregular brown patches. When bred in the dark the brown colour may spread over the whole of these segments. Horn orange; true legs pink, prolegs green. Spiracles black edged broadly with white. Length 95 mm.; breadth 8 mm.; horn 5 mm.

Pupa.—Very similar to that of *busiris*. Cremaster broadly triangular, dorsal surface rounded, ventral surface deeply, longitudinally concave, ending in a stout shaft which branches near base, each branch ending in two hooks; two shorter shafts, each with a single hook, on each side of base of central shaft. Length 50 mm.; breadth 10 mm.

Habits.—Food-plants: *Colocasia antiquorum* Schott., *Amorphophallus* Linn., *Caladium* Linn., *Arisæma curvatum* Kunth., and other plants of the family Aroideæ. The habits of the larva are similar to those of *metallica*, but we have not seen this larva adopt the peculiar attitude of defence described under that species. It merely retracts the head and anterior segments into segment 5, and expands that segment to show the ocelli, which are not visible in the resting position.

Genus **ANGONYX** Boisduval. (Fig. 80).

Boisduval, 1875, p. 317; Roths. & Jord., 1903, p. 543; id., 1907, p. 102.

Genotype: *testacea* (Walk.).

Imago.—" ♂♀. Genal process large, but rounded, not triangular. Palpus large, projecting, obtuse, terminal surface on a level with frons, second segment longer than first. Eye

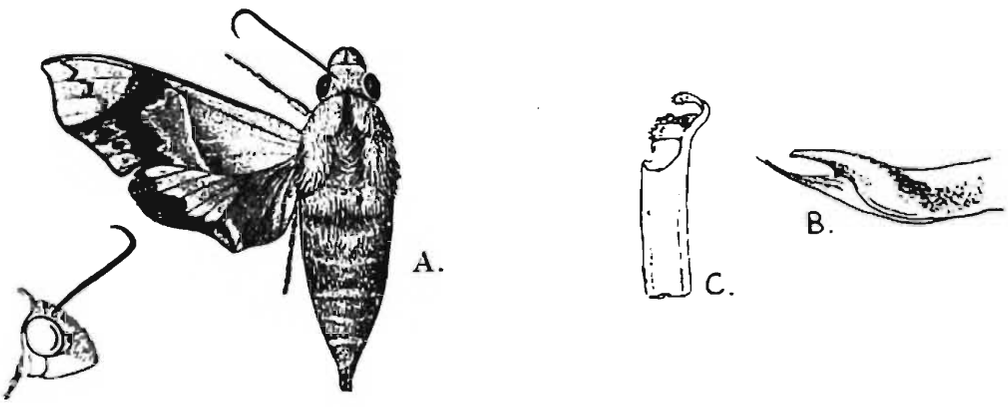


Fig. 80.—*Angonyx* Boisd.

A, *A. testacea testacea* (Walk.); B, harpe; C, penis-sheath.

large, not lashed. Antenna long, in ♂ longer than in ♀, setiform, gradually fining to a long and gradually curved hook; end-segment triangular, short. Spines of abdomen elongate. Spurs unequal, long terminal one at least half the length of the first tarsal segment, first segment of hind tarsus longer than that of mid-tarsus and considerably shorter than tibia, both mid- and hind tarsus with comb. Apex of fore wing obtusely pointed, distal margin convex before middle, sinuate in front; apex of hind wing rounded,

D^2 transverse, D^3 straight and very oblique, lower angle of cell acute.

" ♂. Scent-organ of fore coxa strongly developed. Tenth abdominal segment very long, narrow, simple, tergite compressed especially at end, pointed, apex rather abruptly curved downwards; sternite with nearly parallel sides, rather flat, evenly and slightly convex below, apex narrower, sinuate, with the short angles curved upwards so that the sternite appears hooked in lateral aspect. Clasper large, concave dorsally, convex ventrally, broadly sole-shaped; an erect crest of moderately large friction-scales, lanceolate, not truncate, about fourteen in number, arranged in a single row, situated at the ventral side of an ellipsoid patch of small, glossy, dentate scales; inner surface of clasper densely clothed with long hairs; process of harpe (fig. 80 B) small, either triangular or slender and more or less spatulate or lanceolate. Penis-sheath (fig. 80 C) with a right free process curving ventrad, often round the sheath, and a shorter left process which is not separate from the sheath, both processes dentate, their ends often close together.

" ♀. Vaginal plate triangular, regular in shape, feebly chitinized, apex rounded, edges incrassate, orifice at the end of a stronger chitinized half-cylinder " (Roths. & Jord., 1903, p. 543).

Hab. Oriental Region. One Indian subspecies. Early stages described under that subspecies. Both larva and pupa are abnormal for the subfamily, reminding one more of those of a *Marumba* of the subfamily AMBULICINÆ.

105. **Angonyx testacea testacea** (Walk.). (Fig. 80 A, imago, B, C, genitalia: Pl. X, fig. 9, larva, fig. 10, pupa).

Perigonia testacea, Walker, 1856, p. 102 (Hab. ?).
Panacra testacea, Butler, 1877 A, p. 550 (Ceylon); Hampson, 1891, p. 1 (Nilgiris, 6,000 ft.).
Angonyx testacea, Moore, 1882, p. 26, pl. lxxxix, fig. 1 (♂); Hampson, 1892, p. 101, fig. 58 (♂).
Angonyx testacea testacea, Roths. & Jord., 1903, p. 544; Seitz, 1929, p. 553; Manson, 1921, p. 748.
Panacra ella, Butler, 1875, p. 246 (Sylhet); id., 1877 A, p. 550, pl. xcii, fig. 7 (♀).

Imago.—♂♀. Head, thorax and abdomen dark green, metanotum often russet. Fore wing dark green with a narrow grey or white discal band not reaching costa; most specimens with black submarginal spots between R^2 and M^2, often extended to margin; a waved submarginal line; cilia black. Hind wing blackish umber-brown, with a grey spot before anal angle, sometimes with a clearly marked orange-rufous band; a broad, irregular, brown marginal band. *Underside*

russet-brown or yellow, shaded with pale green in fresh specimens. *Expanse* : ♂ 54–62 mm., ♀ 64 mm.

♂. Harpe (fig. 80 B) ending in a conical process which bears one tooth on the underside and is finely granulose beneath proximally.

Hab. E. HIMALAYAS (Khasi Hills), S. INDIA, BURMA and CEYLON to Malaya. We have bred the subspecies in S. India (Kanara District), where the larva is common in damp forests in the rainy season, from sea-level to 6,000 feet.

Larva :—

Final instar. Resembles a *Marumba* larva in shape. Head large, semi-elliptical, dorsal line of vertex slightly depressed ; true clypeus less than half length of head, apex acute, basal angles rounded ; no false clypeus ; labrum three-quarters length of clypeus, tapering sharply frontad ; ligula as long as labrum, long kidney-shaped, sinus very deep ; eyes 1 to 5 in a semicircle, 1, 2 and 3 equidistant, 4 and 5 slightly more widely spaced, 6 below 5, nearly twice as far from 4 as 4 is from 3. Surface of head shining and covered with minute hairs. Body smooth and dull. Segment 2 not as high as head, and the segments increasing gently in diameter to 5, then decreasing gently to 12. A very fine dorso-lateral, supra-spiracular and subspiracular hair, each rising from a minute tubercle. Horn long, straight, tapering evenly to a blunt point, rising from a fleshy cone.

Coloration.—Head grass-green ; a narrow black stripe from vertex to base of antenna, crossing the eyes, which are whitish with black pupils, and separating face from cheek; on the inner side of this stripe a slightly broader white stripe ; ligula fuscous-rusty colour, black round the sinus ; basal segment of antenna yellow, other segments white ; mandible pale rusty at base, rest black. Body bright grass-green dotted with darker green, and tinged with yellowish below the dorso-lateral line, somewhat glaucous above it ; a dark green dorsal stripe from front margin of segment 3 to base of horn, darker at the segment margins ; a narrow, pale vinous-brown dorso-lateral stripe starting at front margin of 3 and running to base of horn, edged narrowly with yellow below, most strongly on segments 10 to 12. Horn plumbeous-fuscous, base paler and tip yellowish-green ; true legs dark plumbeous, base and inner faces of basal segments deep orange ; prolegs and claspers fuscous. Spiracles narrowly oval, flush, white with a broad, brown, transverse band across middle. Length 65 mm. ; breadth 8 mm. ; horn 9 mm.

Pupa.—Front of head with a prominent rounded boss on each side of a wide, deeply impressed dorsal line ; a similar boss inside each eye ; the dorsal line of segment 2 rises at

an angle of about 45° to the longitudinal axis of the pupa, dorsal line of 3 and 4 at a less steep angle; 6 and 7 tumid dorso-laterally, 7 to 9 flattened dorsally; hind margin of 11 dilated and undercut, the base of 12 fitting into it as in *Acosmeryx* pupæ; fore leg equal to antenna and about half length of wing-case; a narrow coxal piece. Surface of head smooth except for the tops of the bosses, which are rugose; thorax shining and smooth except for very superficial corrugations; sculpturing on segment 4 in the form of a smooth, slightly raised, transverse weal, placed centrally and reaching from the subdorsal to the dorso-lateral region; abdomen shining and coarsely pitted, the pits better defined on segments 9 to 14. Spiracle of 2 indicated by a pear-shaped slit lying between a curved emargination of the hind margin of 2 and an oblong lobe projecting from the front margin of 3; remaining spiracles broadly oval, the central slit with raised edges. Cremaster a stout cone with a bifid tip formed of two conical teeth. Colour dark reddish-brown, hind bevels of segments 8 to 10 dull black, spiracles and spiracular lobe of 3 dull black, cremaster shining black. Length 36 mm.; breadth 10 mm.

Habits.—Food-plant: *Strychnos nuxvomica* Linn. and other species of the family Loganiaceæ. Though the colour of the pupa is similar to that of the species which pupate underground, the pupa of this species is formed in a rough cocoon on the surface. It produces a dull knocking sound when alarmed. The moth has been seen feeding at dusk, but does not appear to be attracted by light.

Genus **ENPINANGA** Rothschild & Jordan.

Roths. & Jord., 1903, p. 545; id., 1907, p. 102.

Genotype: *vigens* (Butl.).

Imago.—" ♂♀. Differs from *Angonyx* in the following characters:—Palpus and eye smaller; antenna much shorter in both sexes than the cell of the fore wing; first segment of fore tarsus much shorter than fore tibia; spurs short, longer terminal one of hind tibia about one-third the length of the first tarsal segment, this not shorter than the first mid-tarsal segment; comb of the latter less distinct than in *Angonyx*.

" ♂. Tenth segment much shorter than in *Angonyx*; tergite slender, slightly curved, not compressed; sternite broader than tergite, much shorter, truncate-sinuate. Clasper short, rounded sole-shaped, dorsal margin rounded dilated, concave at base; seven to nine large truncate friction-scales, arranged in three rows, situated in a depression. Penis-sheath with one

dentate process projecting distad" (Roths. & Jord., 1903, p. 546).

Hab. Indo-Malayan Subregion. Two species occur in the Indian Region, but very few specimens exist, and the early stages are unknown.

Key to the Species.

Imagines.

Abdomen with red and creamy lateral dots.	*E. labuana oceanica* [Roths. & Jord., p. 320.
Abdomen without such dots.	*E. assamensis* (Walk.), [p. 319.

106. **Enpinanga assamensis** (Walk.). (Fig. 81, ♂).

Panacra assamensis, Walker, 1856, p. 160 (Sylhet).
Chærocampa assamensis, Hampson, 1892, p. 90.
Enpinanga assamensis, Roths. & Jord., 1903, p. 546 ; Seitz, 1929, p. 553.

Imago.—♂. Fore wing highly angled at R^2 in both sexes. Head, thorax and abdomen pale greyish-brown ; paired dark brown streaks with pale streaks below them from top of head to second segment of abdomen. Fore wing greyish-brown, with a black speck at base and streak on inner margin ; a large black patch on discocellulars, with a triangular patch above and beyond it ; traces of a dark line from end of cell to inner margin ; a faint waved postmedian line met by a



Fig. 81.—*Enpinanga assamensis* (Walk.), ♂.

reddish oblique streak from apex, with some paler marks on it towards inner margin. Hind wing purplish-fuscous, with an obsolescent paler submarginal line ; inner margin pale ; a streak of dark hairs along SM^3. *Underside* clouded with ochreous and ferruginous, leaving an irregular dark outer margin to both wings. *Expanse* : ♂ 55 mm.

♂. Harpe produced into a slender, acute, curved process. Process of penis-sheath short.

Hab. E. Himalayas (Sylhet ; Assam). Very rare ; only 2 ♂♂ in the British Museum, and early stages unknown.

107 **Enpinanga labuana oceanica** Roths. & Jord. (Fig. 82, ♀ holotype).

Enpinanga labuana oceanica, Roths. & Jord., 1916, p. 120 (Andamans); Seitz, 1929, p. 553.
Daphnis labuana, Rothschild, 1894 B, p. 299, pl. v, fig. 3 (♀) (partim).
Enpinanga labuana, Roths. & Jord., 1903, p. 547 (partim).

Imago.—♀. Abdomen with red and creamy lateral dots. Fore wing with basal half contrasting sharply with outer half; grey shading of marginal area extends from apex to hind angle. Hind wing with a deep brown, well-defined, marginal band, dentate at the veins. *Underside* bright red. On the



Fig. 82.—*Enpinanga labuana oceanica* Roths. & Jord., ♀ holotype.

fore wing the costal portion of first and third discal lines form two distinct anguliform brown spots accompanied by two grey spots of nearly the same shape. Hind wing with three discal lines, first and third prominent, second vestigial. *Expanse*: 66 mm.

Hab. ANDAMAN ISLANDS. Very rare; ♂ and early stages unknown.

Genus **CIZARA** Walker. (Fig. 83).

Walker, 1856, p. 120; Roths. & Jord., 1903, p. 548; id., 1907, p. 103.

Genotype: *ardeniæ* (Lewin).

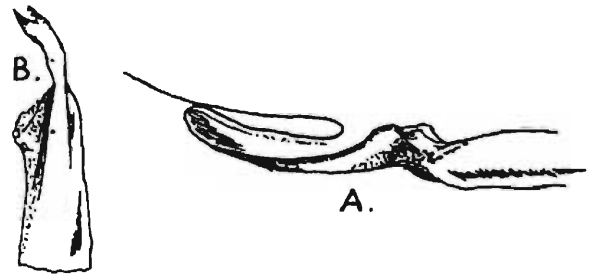


Fig. 83.—*Cizara* Walk. Genitalia.
A, *C. sculpta* (Feld.), harpe; B, penis-sheath.

Imago.—" ♂♀. Closely allied to *Enpinanga*, but eye heavily lashed, genal process triangular, first segment of hind tarsus

as long as segments 2 to 5 together, clasper without friction-scales " (Roths. & Jord., 1903, p. 548).

Hab. Oriental Region. One Indian species. For the early stages see under *C. sculpta.*

108. **Cizara sculpta** (Feld.). (Fig. 83 A, B, genitalia ; Pl. IV, figs. 11, 12, larva ; Pl. X, fig. 11, pupa ; Pl. XII, fig. 8, imago ; Pl. XIV, fig. 9, larva, fig. 10, pupa).

Microlophia sculpta, Felder, 1874, pl. lxxv, fig. 9 (♂) (Siam) ; Butler, 1877 A, p. 552 (S. India).
Angonyx sculpta, Hampson, 1892, p. 102.
Cizara sculpta, Roths. & Jord., 1903, p. 549 ; Seitz, 1929, p. 554, t. 63 *c* ; Manson, 1921, p. 749.

Imago.—♂♀. Head and thorax dark green ; thorax with a whitish lateral stripe and a pink stripe starting behind the eye, running to vertex and thence to hind margin ; abdomen with proximal segments orange at sides, black above, with a green spot on third segment ; fourth segment grey, distal segments black. Fore wing dark green, a grey streak at base ; a pinkish stripe along costa and inner margin ; a postmedian transverse pale or white, sharply-defined band not reaching costa ; a pale submarginal, dentate line beyond which the colour is grey. Hind wing orange at base, diffused outwards along costa and to anal angle ; a large black patch on outer margin with two grey spots near anal angle. First segment of palpus incrassate at end, subangulate. Antenna short and slender. Outer margin of fore wing excurved at median nervure, D^3 of hind wing very oblique, three times as long as D^4. *Expanse* : ♂ 50–57 mm., ♀ 70 mm.

♂. Tenth tergite not compressed, rather slightly convex above, hollow beneath, narrowed in middle, being slightly dilated from middle to apex, which is feebly sinuate. Clasper of almost even width from before middle to apex, ventral margin slightly convex, apex rounded ; harpe (fig. 83 A) rather large, the process situated below ventral edge of clasper. Penis-sheath (fig. 83 B) ending in a prominent forked process, which projects distad.

Hab. S. India, Burma and Siam. We have bred the species in S. India, where larvæ are local, but not scarce, in areas of heavy rainfall, but during the dry season. Fellowes-Manson has bred the species in Burma.

Egg.—Broadly ovoid, surface smooth and shining to the naked eye, but under the microscope seen to be covered with small shallow, irregular pits. Length 1·8 mm. ; breadth 1·6 mm.

Larva :—

1*st instar*. Head broad and round ; body nearly cylindrical and of smaller diameter than head ; horn very long, straight, bifid, the two arms short, conical, diverging at right angles to each other, each arm bearing a small hair ; surface of the head and body smooth and dull, horn shining, smooth for the distal half, the rest tuberculate ; the usual main hairs present, and horn covered densely with minute hairs with two or three branches ; colour of head and body very pale honey-colour, horn black. 2*nd instar*. Shape as in the first instar ; surface of head and body dull ; head and body, in addition to the main hairs, closely covered with forked hairs ; head dark green; body pale green dotted with white ; a large black dot on front margin of segment 6, and small dots on front margins of 5, 7 and 8, all on the dorsal line ; a very sharply defined dorso-lateral white stripe from middle of 2 to base of horn ; horn black, the sides of base green. 3*rd instar*. Body of greater diameter than head ; horn of medium length, slightly up-curved, bifid ; surface of head and body dull and smooth ; forked hairs as in the 2nd instar ; colour of head dark green ; body paler green dotted with white ; black dorsal spots as in the 2nd instar ; the dorso-lateral stripe narrow and faint on the anterior segments, broad and well defined on the posterior segments ; a dark, narrow dorsal stripe from segment 7 to base of horn ; basal half of horn fuscous-green, distal half first pale yellow, then black The spiracle on 5 larger than the rest and surrounded by a narrow black circle. 4*th instar*. Head small and round ; body tapering sharply frontad from segment 5 ; horn straight, minutely bifid ; colour as in 3rd instar except that the dots are yellow instead of white ; dorso-lateral stripe yellow on 11 and 12 ; some indistinct darkish oblique stripes ; spiracles white edged with black on each side, that on 5 larger than the rest and surrounded by bluish, outside which is a narrow circle of black ; horn green, base paler and tip black.

5*th instar*. Head round ; true clypeus over one-third length of head, equilaterally triangular ; false clypeus reaching to one-half length of head, apex very broadly rounded ; labrum half as long as clypeus ; ligula rather longer than labrum and not quite so broad, kidney-shaped, with narrow lobes ; eyes with 1 and 2 forming an angle of 100° with 3, 4 and 6, which are in a straight line ; 1, 2 and 3 closer together than 3, 4 and 6 ; 5 twice as far from 6 as 4 is from 6 and three-quarters this distance from 4. Surface of head dull, covered with minute, shining, conical tubercles ; labrum longitudinally furrowed. Body tapering sharply frontad from segments 5 to 2, the latter being of about the same

diameter as the head ; rest of body nearly cylindrical. Horn stout, tapering evenly to a sharp point, and sharply down-curved. Surface of body dull and smooth except for some small scattered tubercles on segment 2 and anal flap ; the subspiracular hair on 6 to 11 with a short stem branching into three arms, each arm dividing into two, and then again branched, forming a horizontal fan ; horn covered with small, shining, pointed tubercles directed distad.

Coloration.—Head green, tubercles white ; labrum emerald-green ; ligula pink, the sinus edged with white ; basal segment of antenna green, rest rose-colour ; mandible green, tip broadly dark reddish-brown. Body green ; segment 2 with a narrow saddle-like marking, green, covered with minute white dots ; remaining segments with a transverse row of dots along each secondary ring, these dots white and very small on 3 and 4, larger on 5, larger still and yellow on 6 to 12 ; a dorso-lateral stripe from 2 to base of horn, very faint, whitish on 2 and 3, clearly defined and yellow on 4, very faint again on 5 and 6 ; on 7 to 10 the stripe is reddish-brown, broken near the hind margin of each segment, and crescent-shaped on each segment, the lower, concave side of each crescent broadly suffused with chalky-white ; on 11 the stripe is straight and becomes whitish again on 12 to base of horn ; spiracle of segment 5 lying in a longitudinally oval ocellus-like marking, blue round the spiracle, then yellowish, the whole edged narrowly with white and then black. Horn brown, the dorso-lateral stripe running up each side for a short distance ; legs translucent white, with a reddish-brown streak down the outer face of basal segment, end-segment pale rose-brown ; shank of prolegs green with reddish-purple distal border, ankles dull black, feet pinkish ; claspers the same ; anal flap edged with whitish. Spiracles dusky-white, more or less suffused with fuscous. Length 70 mm. ; breadth 11 mm. ; horn 9 mm.

Pupa.—Stout in build, tapering sharply to head and to base of cremaster ; antenna slightly shorter than fore leg, which reaches to middle of wing-case, mid-leg to two-thirds length of wing-case ; no coxal piece. Surface shining ; head, thorax and wing-case obscurely lined in the manner of cracked lacquer ; abdomen very shallowly transversely corrugate ; sculpturing on segment 4 in the form of a narrow, transverse, central ridge on each side of the dorsal line, with a channel in front of and behind it ; ante-spiracular ridges in the form of seven (on segment 9) and six (on 10 and 11) short, parallel ridges. Spiracle of 2 a narrow slit lying between the raised hind margin of 2 and a short, rounded transverse lobe projecting from the front margin of 3 ; remaining spiracles

broadly oval, flush, the surface rising slightly to the central slit, which has raised edges. Cremaster a stout knob, ending in a short shaft set with five or six short hooks and some tubercles along the lateral edges basad on each side; upper surface very rugose. Colour pale ochreous; head and thorax suffused with brown and marbled with darker brown; wing-case suffused with pale brown, and with short, pale transverse lines; fore and mid-leg banded with very dark brown, nearly black; a pale bracket-shaped marking on fore tibia; abdomen marbled with dark brown, pinkish ventrally; hind bevels of segments 8 to 10 chocolate-brown; a brown interrupted ventral stripe; sculpturing on segment 4, spiracles and cremaster black; ante-spiracular ridges rusty. Length 35 mm.; breadth 11 mm.

Habits.—Food-plant: *Randia dumetorum* Lamk., family Rubiaceæ. In the resting position the head and segments 2 and 3 are retracted into 4 which, together with 5, is swollen. The larva is sluggish and moves in a jerky manner. Before pupation it turns livid slate-grey, the white markings turning yellow. Pupation takes place in a rough cocoon on the surface. The pupa is active, squirming energetically when touched, and making a low rustling sound. The moth has not been observed except in captivity, and bred ♀♀ do not attract ♂♂ readily. Eggs hatch after about five days, larval growth lasting about twenty-five days, pupal state about sixteen days.

Genus **NEPHELE** Hübner.

Hübner, 1822, p. 133; Roths. & Jord., 1903, p. 550; id., 1907, p. 104.

Genotype: *didyma* (Fabr.).

Imago.—" ♂♀. Patch of fine hairs at each side of base of tongue conspicuous. Genal process acuminate, longer than pilifer. Palpus prominent, second segment widened from base to apex, rounded-truncate at end; inner surface of first segment carinate ventrally. Eye large. Antenna slightly clubbed in ♀, not incrassate distally in ♂, end-segment long, rough-scaled. Spines of abdominal tergites and sternites numerous, in several rows, all elongate, flattened, strong; ♂ with three-cornered anal tuft, ♀ with a simple truncate one, which consists, as in ♂, of stiff (mostly reddish) brittle scales. Fore coxal scent-organ of ♂ feebly developed; legs slender, hind tibia with dorsal and ventral scaling prolonged, the tibia appearing compressed; first protarsal segment with external row of spines doubled or trebled; comb of mid- and hind tarsus strongly developed, the spines of hind tarsal comb long;

spurs very unequal, the short spur of mid-tibia and the short terminal one of hind tibia with a comb of stout spines, which extends on the mid-tibial spur from the base to the naked apical point, while it is more reduced on the hind tibial spur ; fifth tarsal segment shorter than fourth ; hind edge of merum of mid-coxa carinate, subangulate. Distal margin of fore wing entire ; D^2 of hind wing curved or angulate.

" ♂. Sexual armature nearly the same in all the species ; no appreciable difference in these organs between allied species. Tenth tergite very slender, simple, curved downwards, long ; sternite short, horizontal, with almost parallel sides and rounded apex, not strongly chitinized. Clasper sole-shaped ; large friction-scales arranged in one or two rows ; harpe ending in a sharply pointed, more or less evenly curved hook. Penis-sheath armed at end with two dentate processes, the proximal one long, curving round the mouth of the sheath (as in several *Macroglossum*), the other short and obtuse ; the armature reminding one strongly of that found in *Macroglossum*.

" ♀. Eighth tergite truncate-sinuate. Vaginal plate small, weakly chitinized, excepting postero-lateral edges which are somewhat incrassate ; orifice free, a little projecting. Seventh sternite broader than long, apical margin short, with strongly rounded angles " (Roths. & Jord., 1903, p. 550).

Hab. Aethiopian and Oriental Region. One Indian species, occurring in two forms. For the early stages see under that species.

109. **Nephele didyma** (Fabr.).

Imago.—♂♀. Head, thorax and abdomen olive-brown or green ; abdomen with lateral black segmental bands. Fore wing olive-brown or green, with six waved, transverse lines and an angled submarginal line, the space between it and outer margin paler. Hind wing raw-umber colour, with a tint of russet, or more russet ; outer marginal area darker in tint ; cilia ochreous. *Underside* paler, each wing with two transverse lines. Short terminal spur of hind tibia with a few rather thin spines in the distal half.

Two forms, which occur together.

f. **didyma** (Fabr.). (Pl. IV, fig. 13, larva ; fig. 14, pupa).

Sphinx didyma, Fabricius, 1775, p. 543 (Ind. or.).
Nephele didyma f. *didyma*, Roths. & Jord., 1903, p. 554 ; Seitz, 1929, p. 554, t. 63 *d*.

Zonilia morpheus, Cramer, 1777, p. 84, pl. cxlix, fig. D (Coromandel); Walker, 1856, p. 194 (Nepaul; Landoor; N. India; Canara; Ceylon).

Nephele hespera, Butler, 1877 A, p. 624, pl. xci, figs. 20, 21 (l., p.); Moore, 1882, p. 2, pl. lxxii, figs. 1, 1 *a*, *b* (l., i.); Swinhoe, 1885 A, p. 287 (Poona; Sattera; Bombay); id., 1886, p. 435 (Mhow); id., 1888, p. 119 (Kurachi); Warren, 1888, p. 293 (Campbellpore); Swinhoe, 1890, p. 165 (Mandalay); Hampson, 1891, p. 2; Swinhoe, 1892, p. 34; id., 1892, p. 108; Dudgeon, 1898, p. 416 (Sikkim, 1,800 ft.).

Imago.—♂♀. Fore wing with two silvery spots, separated by D^3, the second the larger, somewhat elongate and curved, the first rounded; there is, besides, often a small dot in upper angle of cell. *Expanse*: ♂ 70–78 mm., ♀ 72–86 mm.

Hab. Throughout INDIA, BURMA and CEYLON, extending to Malaya. We have bred it in many localities in India, and it is very common, especially in the plains.

Egg.—Broadly ovoid; surface smooth and shining, under the microscope seen to be obscurely pitted; colour pale green. Length 1·6 mm.; breadth 1·4 mm.

Larva:—

1*st instar*. Head round, body cylindrical, horn straight, long, bifid, the arms conical and each bearing a hair with a truncate-bulbous tip; body-hairs elongate-conical, with truncate-bulbous tips; horn covered densely with minute hairs; head and body honey-yellow, horn shining black, the base very shortly red.

Final instar. Somewhat chœrocampine in shape. Head rounded-quadrate; true clypeus less than half length of head, apex acute, basal angles slightly rounded; false clypeus forming a wide arch over apex of true clypeus, reaching to one-half length of head; labrum more than one-third length of clypeus, the sides curving inwards; ligula longer than labrum, the lobes very broadly rounded, the sinus small, rounded-triangular; eyes with 1, 2, 3 and 4 equidistant in a slight curve, 6 in line with 3 and 4, and 5 forming an equilateral triangle with 4 and 6. Surface of head dull and smooth. Body tapering somewhat sharply from segments 5 to 2, rest of body nearly cylindrical; surface dull and smooth. Horn rising from a conical tumidity; long, stout, tapering evenly to a blunt tip, from the dorsal surface of which projects a short conical tooth; basal half of horn slightly down-curved, distal half straight.

Coloration.—Head grass-green; labrum green; ligula dull violet; basal segment of antenna pale green, other segments blood-red; mandible yellow, tip dark reddish-brown; eyes brown. Body green, dotted closely with yellow; a narrow violet dorsal stripe, touched with black at the front

margins of segments 6 to 11 ; a pale yellow dorso-lateral stripe, starting at the middle of the hind margin of 7 and running to base of horn ; broad, white, and sharply defined on 12, edged narrowly above by dark green or violet ; very obscure yellowish-green oblique stripes on 4 and 5 ; a broad, white, sharply defined oblique stripe, finely veined with dark lilac, on 6, running back on to 7 ; a pure white oblique stripe on 11 and 12 meeting the dorso-lateral stripe at a sharp angle on 12, the angle between the two stripes filled in with white. Horn dark fuscous-violet, the conical point chestnut ; legs white with a dark brown streak down the outer face of each segment ; prolegs with base and shank green, ankle green tinged with violet, feet violet. Spiracles small, flush, brown with a dusky band across the middle and with a narrow, yellow rim.

There is also a dark-coloured form in which the green ground-colour is replaced by brown, with markings as in the green form. Length 70 mm. ; breadth 12 mm. ; horn 7 mm.

Pupa.—Slender in build ; tongue-sheath projecting much frontad, the ventral surface of sheath concave basad ; antenna about half length of wing-case, fore leg slightly shorter ; a narrow coxal piece. Surface dull, superficially, transversely wrinkled on head, thorax and wing-case, sparsely pitted on abdomen ; short, irregular ante-spiracular ridges on segment 9. Spiracle of 2 a narrow slit nearly covered by a narrow, oblong, transverse lobe projecting from the front margin of 3 ; remaining spiracles broadly oval, surface slightly convex, central slit with raised edges. Cremaster nearly oblong, with a small, conical tooth, directed outwards, at each lateral angle of the truncate tip ; dorsal surface convex and pitted ; ventral surface with a deep median channel. Colour bone-yellow, tongue-sheath pinkish, abdomen suffused with pale violet-brown ; a dark brown dorsal stripe on thorax becoming broad and greenish on abdomen ; venter pale pinkish-yellow, with a brown interrupted central stripe ; spiracles and cremaster black. Length 66 mm. ; breadth 13·5 mm.

Habits.—Eggs laid singly on the underside of a leaf or on a thorn of the food-plant, *Carissa carandas* Linn., and other plants of the genus, family Apocynaceæ. In the resting position the larva raises the head and anterior segments at a sharp angle with the rest of the body. The dorsum turns brown before pupation, which takes place in a rough cocoon on the surface of the ground. The moth rests with the wings held horizontal and the tip of the abdomen slightly upturned. The flight is rapid, and the moth comes to flowers before dark, being also attracted by light.

f. **hespera** (Fabr.). (Fig. 84, imago).

Sphinx hespera, Fabricius, 1775, p. 546 (Ind. or.).
Nephele didyma f. *hespera*, Roths. & Jord., 1903, p. 554; Seitz, 1929, p. 554.
Sphinx chiron, Cramer, 1777, p. 62, pl. cxxxvii, fig. E (Coromandel).
Perigonia obliterans, Walker, 1864, p. 28 (N. Hindustan).

Imago.—♂♀. Fore wing without silvery spots, or only with a minute dot.

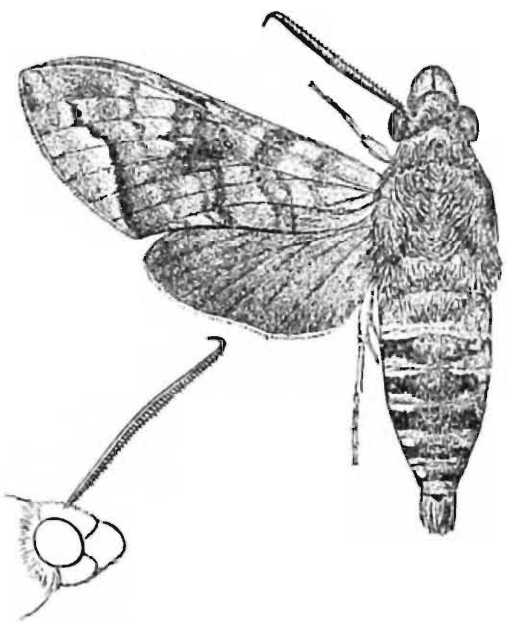


Fig. 84.—*Nephele didyma* f. *hespera* (Fabr.).

Habits and early stages the same as in the case of *N d.* f. *didyma*.

Genus **GURELCA** Kirby. (Fig. 85).

Kirby, 1880, p. 330 (part.); Roths. & Jord., 1903, p. 587; id., 1907, p. 109; Jordan, 1911, p. 251.

Genotype : *hyas* (Walk.).

Imago.—♂♀. Very small, grey marked with brown and black; outer margin of fore wing toothed, and costal margin of hind wing broadly excised. "Genal process triangular, obtuse, not reaching tip of pilifer. Palpus projecting, terminal surface triangular, almost quadrangular; scales laterally at apex of first segment prolonged, forming a kind of fan; basal patch of sensory hairs of inner surface absent. Eye strongly lashed; head crested, the crest divided into two carinæ which converge behind. Antenna short, filiform in both sexes, strongly compressed in ♂, cylindrical in ♀; end-segment short, conical. Spines of abdomen numerous, in several rows, all elongate and weak; ♂ with expansible obtusely triangular anal tuft, ♀ with smaller truncate tuft. Merum of mid-coxa

not carinate ; all the tibiæ with *some* spines ; paronychium with the ventral lobes obliterated ; no comb on tarsi, hind tarsus with few spines at base ; spurs of mid-tibia almost the same in length, long terminal one of hind tibia about as long as third tarsal segment, or shorter, about a third or a fourth longer than the second terminal spur. Distal margin of fore wing denticulate, more deeply sinuate behind M^1 ; R^2 and M^1 close together, M^2 from near middle of cell ; costal margin of hind wing broadly excised, C incurved at the sinus, approaching SC^2 ; this on a short stalk with R^1 ; R^2 from before centre of cell, lower angle of cell acute ; D^3 longer than D^4.

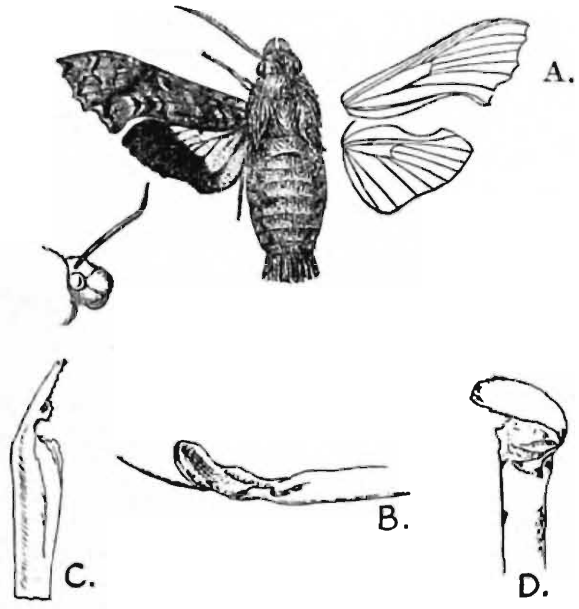


Fig. 85.—*Gurelca* Kirby.
A, *G. hyas hyas* (Walk.); B, harpe; C, penis-sheath. D, *G. montana*, penis-sheath.

" ♂. Tenth tergite compressed, slender, simple, pointed ; sternite broad, triangular or truncate. Clasper without friction-scales. Penis-sheath ending in a dentate process.

" ♀. Vaginal plate triangular distally, the distal edges somewhat incrassate and more or less elevate ; orifice free " (Roths. & Jord., 1903, p. 587).

Egg.—Broadly ovoid ; surface shining ; colour usually greenish.

Larva.—Macroglossine in shape, horn very variable in shape and length ; colour very variable.

Pupa.—No projecting tongue-sheath ; surface smooth and shining ; colour yellowish, marked with dark stripes, spots and bars.

Habits.—The food-plants belong to the family Rubiaceæ. In the resting position the head and anterior segments of the larva are raised at an angle of about 30° to the rest of the

body, the mouth-parts pointing frontad. The larvæ are sluggish and move in a jerky manner. In the later instars they keep close to the ground, and when disturbed drop to the ground and lie rigid. They feed mostly by night, and are very impatient of direct sunlight. Pupation takes place in a fairly compact cocoon either on the surface or among withered leaves of the food-plant, the cremastal hooks being entangled in a pad of silk. Bred specimens often make their cocoons in the upper corners of their cage. In the resting position the wings of the moth are held slightly above the horizontal, the fore wing covering the hind wing except for the prominent lobes on each side of the excision of the costa of the latter, which just appear ; the head is bowed down, the thorax sharply raised, the tip of the abdomen bent sharply upwards. This attitude, together with the mottled colouring, makes the moth closely resemble a withered leaf. The moths have a swift and jerky flight; they may be seen feeding in the morning and evening, and do not appear to be attracted by light. The sexes mate readily in captivity. There are several broods in the year.

Hab. W and E. HIMALAYAS and S. INDIA to China, Japan, Java and the Philippines. Four Indian species and subspecies.

Key to the Species.

Imagines.

1. Hind wing upperside with black border of even width. .. .. [p. 331. *G. h. hyas* (Walk.),
   Hind wing upperside with black border narrowing behind . .. . 2.
2. Lobes of costa of hind wing of equal width [p. 338. *G. montana* Jord.,
   Lobes unequal, basal lobe wider than apical lobe . . .. 3.
3. Border of hind wing sharply defined on inner side .. . . [p. 336. *G. h. himachala* (Butl.),
   Border not sharply defined on inner side, diffused on to disc [p. 334. *G. masuriensis* (Butl.),

Larvæ.

1. Horn short or of medium length... . . 2.
   Horn very long and thin, thickening basad and apicad, tip strongly bifid, each point again dividing into two ; hairs on horn very long . .. . [p. 336. *G. h. himachala* (Butl),
2. Horn with pale ring beyond middle, tip bifid ; subdorsal stripe continued on to segment 13 and then enclosing a rust-brown dorsal patch .. .. [p. 338. *G. montana* Jord.,
   Horn without pale ring, not bifid, bearing black tubercles with short hairs. 3.
3. Horn dark brown, very thick at base ; subdorsal stripe not continued on to segment 13 [p. 332. *G. h. hyas* (Walk.),

Horn basal half brown, apical half dirty yellow with black tip; subdorsal stripe continued to anal flap [p. 334. *G. masuriensis* (Butl.),

Pupæ.

Cremaster shortly triangular, ending in a short subcylindrical shaft branching into four irregularly disposed branches, each branch ending in two slightly curved hooks . . .. .. [p. 333. *G. h. hyas* (Walk.),

Cremaster elongate-conical, ending in a simply pointed shaft . .. .. [p. 335. *G. masuriensis* (Butl.),

Cremaster shortly conical, ending in a short shaft bearing about 12 anchor-shaped hooklets [(Butl.), p. 337. *G. h. himachala*

110. **Gurelca hyas hyas** (Walk.). (Fig. 85 A, imago, B, C, genitalia; Pl. X, fig. 8, larva; Pl. XV, fig. 1, larva).

Lophura hyas, Walker, 1856, p. 107 (Sylhet); Moore, 1865, p. 794 (Bengal); Butler, 1877 A, p. 538, pl. xc, figs. 1, 2, 3 (l., p.) (Hong-Kong; Sylhet; Java); Swinhoe, 1886, p. 434 (Mhow).
Gurelca hyas, Kirby, 1880, p. 330; Hampson, 1892, p. 110; Dudgeon, 1898, p. 417 (Sikkim; Bhutan; up to 5,000 ft.); Roths. & Jord., 1903, p. 588; Jordan, 1911, p. 251, t. 40 *g*; Manson, 1921, p. 750.
Gurelca hyas hyas, Seitz, 1929, p. 554.
Perigonia macroglossoides, Walker, 1866, p. 1851 (Darjiling).
Gurelca macroglossoides, Hampson, 1892, p. 110.

Imago.—♂♀. Head, thorax and abdomen greyish-brown; collar and tegula outlined with reddish-brown; abdomen with some reddish-brown, lateral, segmental markings. Fore wing greyish-brown, a black spot at base; two pale, indistinct, curved, antemedian lines; a grey streak on discocellulars with a dark, reddish-brown patch on each side of it; two highly angulate postmedian lines with a pale line between them from M^1 to inner margin, and a reddish-brown streak below R^3; a reddish-brown mark on inner margin before tornal angle, a curved submarginal line and a subtriangular dark marginal patch below apex. Hind wing yellow with an annular spot on the discocellulars; a broad, black marginal band of even width along outer margin. *Underside* of both wings ochreous, much marbled and suffused with brown and reddish-brown; hind wing yellow with a broad, irregular, greyish-brown marginal band. *Expanse*: 38–40 mm.

♂. Tenth tergite carinate above in middle; sternite trapeziform, truncate, feebly impressed mesially on underside, edges only stronger chitinized. Harpe (fig. 85 B) broadly spatulate, curving upwards at end. Penis-sheath (fig. 85 C) with an apical process which projects obliquely distad and is dentate at the ventral edge.

♀. Distal edge of vaginal plate very slightly raised ; orifice proximal.

Hab. Throughout INDIA and BURMA, in China, Malaya and the Philippines. We have bred the species in the E. Himalayas and S. India, Fellowes-Manson in Burma, and Mell in S. China. It is common in the E. Himalayas during the monsoon, but in S. India is more common during the dry months.

Egg.—Pale yellowish-green when first laid ; as the young larva develops two zones of red appear, representing the dorso-lateral stripes. Length 1·4 mm. ; breadth 1·2 mm.

Larva :—

1*st instar.* Head rounded-quadrate, body cylindrical and of the same diameter as head ; horn thick at base, tip truncate with a small setiferous tubercle at each corner of the truncation ; the main hairs bifid on head and trifid on body ; hair-like tubercles on horn. Head and body pale honey-yellow ; a broad, red, dorso-lateral stripe from segment 3 to base of horn ; soon after hatching this stripe becomes violet and the dorsum greyish ; horn black. 2*nd instar.* Main hairs now simple ; head greenish with a dark stripe separating face from cheek ; body pale green, dorsum greyish ; a narrow, dark, dorsal stripe expanding into a circular patch at segment margins ; a pale dorso-lateral stripe with a purplish suffusion below it on each segment. 3*rd instar.* Head brown, body grey marbled with brown ; paler coloured diagonal stripes on segments 5 to 11 ; a pale orange triangular patch below each oblique stripe except on 8 and 9. 4*th instar.* Body tapering slightly from segment 5 frontad ; horn tapering evenly to a truncate tip ; head greyish-white with a white stripe separating face from cheek ; body greyish-brown with a pink tinge ; a white dorso-lateral stripe on 2 to 4 ; whitish oblique stripes on 5 to 11, edged above with fuscous, and with orange patches below them as in the 3rd instar ; horn black above, yellow below, with black tubercles.

5*th instar.* Head nearly oval in shape ; true clypeus elongate triangular, one-half length of head, a small shining tubercle at each basal angle ; apex of false clypeus narrowly rounded and reaching to three-quarters the length of head ; labrum one-third length of clypeus and twice as broad as long, hind margin curved strongly backwards, front margin straight ; ligula kidney-shaped, longer than but of the same width as labrum ; eyes with 2, 3, 4 and 6 in a nearly straight line, the line joining 1 and 2 forming an angle of about 120° with that line ; 1 and 2 and 4 and 6 over one eye-diameter apart, 2 and 3 and 3 and 4 about one diameter apart, 5 about one diameter from 4 and more than one diameter from 6. Surface of head dull, covered with minute decumbent hairs. Body tapering slightly from segment 5 frontad ; surface dull,

covered with minute decumbent hairs; horn covered with small tubercles of medium length, stout at base, tapering evenly to a blunt point, the distal third strongly up-curved.

Coloration.—Head dusky-brown; hairs black; a pale buff stripe separating face from cheek; false clypeus edged narrowly with white; antenna white, basal segment with a pink patch on outer face, end-segment tinged with pink; mandible black; eyes black. Body very variable in ground-colour and markings; the ground-colour may be greenish, greyish, yellowish or brown; a transverse, chain-like row of white dots, each dot surrounded with chocolate and bearing a white decumbent hair, on each secondary ring; in one common form the ground-colour is grey marbled with brown; dorsum suffused with fuscous; a dorso-lateral stripe, narrow and white on segments 2 to 4, broad and yellow on 11 and 12 to base of horn; 2 to 5 below the dorso-lateral stripe, 12 below the oblique stripe and the whole of 13 and 14 dark chocolate; whitish oblique stripes on 5 to 11; a triangular dark chocolate patch below the oblique stripe on each of 6, 7, 10 and 11, but these patches sometimes orange as in the 4th instar. Horn dusky-brown, the tubercles shining black, the hairs white; venter chocolate; legs chocolate dotted with white, end-segment pale yellow; prolegs chocolate dotted with white. Spiracles oval, flush, white, edged narrowly with black, and a dark, transverse, central smudge. Length 50 mm.; breadth 7·5 mm.; horn 7 mm.

Pupa.—Elongate-ovoid, head bluntly rounded and of less diameter than body; segments 12, 13 and 14 form together an equilateral cone; antenna shorter than fore leg; a narrow coxal piece. Surface shining; head and thorax very superficially lined like cracked lacquer; abdomen shallowly, sparsely pitted with small pits; sculpturing on segment 4 consisting of a raised, subdorsal, elongate, transverse marking; eight very narrow, parallel, low ante-spiracular ridges on segment 9. Spiracle of 2 a narrow slit covered by a narrow transverse curved lobe projecting from the front margin of 3; other spiracles oval, slightly convex, with a coarse central slit. Cremaster triangular, very short, with a short subcylindrical shaft branching into four very short, irregularly disposed branches, each branch ending in two slightly curved hooks. Colour very pale bone-yellow; head and thorax so suffused with light fuscous that the ground-colour appears only as irregular lines; wing-case fuscous, the veins only of ground-colour; tongue, antenna and legs transversely barred with fuscous; a trapeze formed of four black spots on dorsum of head; a lateral black spot on 2; thorax with a small, black, subdorsal spot and a longitudinal, dorso-lateral series of three black spots; abdomen with a black, broken, dorsal

stripe ; a broad, transverse, fuscous band along hind margin of 5, 6, 7 and 11 ; hind bevels of 8, 9 and 10 fuscous ; coxal piece, sculpturing on 4, spiracles and shaft of cremaster black, except for the hooks, which are chestnut. Length 25 mm. ; breadth 8 mm.

Habits.—In S. India the food-plants are *Morinda tinctoria* Roxb., and *M citrifolia* Linn., in the E. Himalayas *Pæderia fœtida* Linn., all of the family Rubiaceæ. The eggs are frequently parasitized by minute wasps, as many as three wasps emerging from one egg.

111. **Gurelca masuriensis** (Butl.). (Pl. X, fig. 7, larva; Pl. XV, fig. 2, larva).

Lophura masuriensis, Butler, 1875, p. 244, pl. xxxvi, fig. 3 (Masuri).
Gurelca masuriensis, Swinhoe, 1892, p. 8 ; Hampson, 1892, p. 110 ; Jordan, 1929, p. 88.
Gurelca masuriensis masuriensis, Roths. & Jord., 1903, p. 589 ; Jordan, 1911, p. 251 ; Seitz, 1929, p. 554 (partim).
Lophura erebina, Butler, 1875, p. 621 (N.W. India).
Gurelca hyas, Hampson (non Walk.), 1892, p. 110, fig. 65 (♂).

Imago.—♂♀. Greyer than *G. himachala* ; anal lobe of fore wing shorter, the hind margin not quite so deeply excised as in *himachala* ; black border of hind wing narrowing behind, not sharply defined on inner side, diffused on to disc ; the yellow area paler, particularly on underside. *Expanse* : ♂ 42–48 mm., ♀ 50 mm.

♂. Anal tergite more compressed than in *himachala*, sternite less broad and more gradually narrowed to a point. Harpe spatulate, concave on upperside, apical margin incised or emarginate above middle, proximally of the apical dilated portion a low obliquely transverse ridge. The apical armature of penis-sheath consists of a prominent non-dentate ridge which ends at both sides with a sharp hook pointing frontad.

Hab. W Himalayas (Mussooree ; Simla ; Bukloh). Moths are rare in collections, but larvæ are fairly common at an elevation of about 6,000 feet during the monsoon months. They were first discovered by Col. J. D. Campbell, D.S.O., in Mussooree in 1926. The larva figured by Butler with a very long filiform horn is presumably that of *himachala*.

Egg.—Pale yellowish-green.

Larva :—

1*st instar*. Horn short, straight, bifid, a long bristle on each point ; long simple hairs on head, bifid hairs on segments 2 and 3 and trifid hairs on remaining segments, short simple hairs on horn ; head and body at first very pale yellowish-green ; a broad pale brown dorsal stripe and a broken pale brown lateral stripe ; after twenty-four hours head pale green ; dorsum of body dark green dotted with white ; rest of body pale green ; a whitish subdorsal stripe ; horn black, all the

hairs black. *2nd instar.* Hairs on body very short; head green; body bluish-green dotted with white; a pale brown dorsal stripe and a whitish subdorsal stripe from segment 2 to base of horn; very pale brown oblique stripes; horn black; spiracles black ringed with white. *3rd instar.* Horn of medium length; oblique stripes white; horn black with base purple. *4th instar.* Head green dotted with paler green; a yellowish stripe separating face from cheek; dorsum of body dark green, lateral area paler green; a transverse row of small white tubercles along each division of each segment; a broad white subdorsal stripe from segment 2 to base of horn; seven whitish oblique stripes; horn straight, of medium length, basal half purple, distal half white with a black tip, the whole covered with black tubercles; spiracles black; in some individuals there are irregular purplish-brown spots above the oblique stripes.

5th instar. Horn of medium length, thick at base, tapering abruptly to a sharp point, straight or curved slightly upwards and held nearly vertical. Surface dull and smooth except for the horn, which is covered with small tubercles.

Colour variable; in the green form head dark green dotted with white; a yellowish stripe, edged sometimes with pale brown, separating face from cheek. Body pale green in dorsal area, bright apple-green in lateral area; a transverse row of pale yellow dots along each secondary ring; a whitish, sharply defined subdorsal stripe on segments 2 to 6; seven sharply defined, white oblique stripes, that on 5 narrower than the rest, all edged above with irregular-shaped brown patches variable in size; irregular markings of dark brown on dorsum. Horn: basal half brown above, reddish below, distal half dirty yellow with black tip, the tubercles black; legs pale red; prolegs, claspers and venter brown. Spiracles black, the dumbbell-shaped central slit white.

In the dark-coloured form (Pl. X, fig. 7) the whole of the green areas are brown, and there are other forms intermediate between the green and the dark-coloured forms. Length 50 mm.; breadth 8 mm.; horn 5 mm.

Pupa.—Cremaster elongate-conical, ending in a simply pointed shaft. Head, thorax and wing-case very pale ochreous, dorsum spotted with dark brown, the lateral and ventral surfaces closely, transversely barred with dark brown; abdomen ochreous; a broad black transverse band on the hind edge of each segment running right round the body; broken dark brown transverse bars in the dorsal area turning to dots in the lateral and ventral areas; spiracles and cremaster black. Length 25 mm.; breadth 8 mm.

Habits.—Food-plant: *Leptodermis lanceolata* Wall., family Rubiaceæ.

112. **Gurelca himachala himachala** (Butl.). (Fig. 86, ♂ holotype ; Pl. XV, fig. 3, larva).

Lophura himachala, Butler, 1875, p. 621 (N.E. Himalayas).
Gurelca himachala himachala, Jordan, 1929, p. 88.
Gurelca masuriensis masuriensis, Roths. & Jord. (non Butl.), 1903, p. 589 ; Jordan, 1911, p. 251 ; Seitz, 1929, p. 554 (partim).

Imago.—♂♀. Darker than *masuriensis*, anal lobe of fore wing longer, the hind margin more deeply excised than in that species ; black border of hind wing narrower anteriorly and then much more sharply defined than in *masuriensis*. *Expanse* : ♂, 48 mm.

♂. Anal tergite less compressed than in *masuriensis*, sternite broader and more sharply narrowed to a point. Harpe with a basal process which is hollow, open above, the distal part of harpe raised to a sinuate ridge ; above this a hairy process on the clasper. Penis-sheath with a long flat process, curving proximad round the sheath and lying flat on it, the proximal edge of this process with vestigial denticulations.



Fig. 86.—*Gurelca himachala himachala* (Butl.), ♂ holotype.

Hab. E. HIMALAYAS to China and Japan. We have bred the subspecies in the Khasi Hills at an elevation of about 5,000 feet. The larvæ are fairly common during the monsoon, but not so common as those of *hyas*, with which they are sometimes associated on the same plant.

Larva :—

Final instar. Head nearly oval ; true clypeus narrow, about one-half length of head, basal angles hardly rounded ; false clypeus narrow, its apex forming a gothic arch over apex of true clypeus ; labrum one-half length of and slightly broader than clypeus ; ligula narrow kidney-shaped ; mandible with the cutting-edge toothed ; eyes with 1 and 2 forming an angle of about 120° with 3, 4 and 6, which are in a straight line ; 1, 2 and 3 about one eye-diameter apart, 4 slightly further from 3 ; 6 two diameters from 4 ; 5 forming an equilateral triangle with 4 and 6 ; eye 3 larger than the rest. Surface of head dull and set with short, curved, translucent hairs, each rising from a minute tubercle. Body dull and smooth. Horn very long, fairly thick at base, tapering gently to beyond middle and then thickening gently, tip strongly

bifid, each arm ending in two points, each of which bears a seta ; the basal half of the horn straight and held normally horizontal, the distal half strongly up-curved ; surface covered with very regularly placed, small tubercles, each bearing a long and strong seta.

Colour of head very variable, green, yellow, grey or brown. A dark brown stripe separating face from cheek. Body equally variable in ground-colour ; a yellow dorso-lateral stripe from segment 2 to base of horn, sharply defined above by brown, very narrowly on 2 to 6, more broadly on remaining segments ; 2 and 3 suffused with dark brown below this stripe, and 4 with a smaller patch of dark brown not reaching the subdorsal stripe ; the hind portion of 7 and most of 8 suffused with dark brown below the dorso-lateral stripe and also above it nearly to the dorsum, the stripe represented on 8 by a line of yellow spots ; whitish oblique stripes, sharply defined on 5 to 7, wanting on 8 and less sharply defined on 9 to 11, all stopping at the dorso-lateral stripe and edged above to a greater or lesser extent by dark brown ; the dark brown colour may spread on to the dorsum of 7 to 11 as a diamond-shaped mark on each segment. Horn smoky-black, the tubercles black ; legs flesh-colour ; prolegs, anal flap and claspers dark brown. Spiracles white with a broad dark brown band across the middle. Length 50 mm. ; breadth 7 mm. ; horn 18 mm.

Pupa.—Stoutish in build ; head long, rounded in front ; shoulders prominent ; antenna shorter than fore leg ; a well-developed coxal piece. Surface shining ; head with vertex and also thorax superficially, transversely, irregularly lined ; wing-case smooth, abdomen smooth except for very superficial transverse folds and pits ; very small erect hairs on frons and around spiracles ; sculpturing on segment 4 consisting of a small transverse subdorsal weal just behind the front margin ; a small pit above and behind the spiracle of 6 ; the spiracles of 9, 10 and 11 situated on the hind face of a ridge running round the front margins of those segments, segment 9 with small, irregular, ante-spiracular ridges. Spiracle of 2 covered by a rounded lobe projecting from the front margin of 3, its front edge raised ; remaining spiracles broadly oval, edges of central slit raised ; cremaster short, conical, ending in a short, stout, cylindrical shaft bearing about twelve very short-stemmed anchor-shaped hooklets. Colour ochreous ; head, tongue, wing-case, legs, antenna and thorax with regular transverse bars of leaden colour ; hind bevels of segments 8, 9 and 10 deep chestnut ; sculpturing on 4, pit on 6, spiracles and shaft of cremaster black, with the spiracles lying on black patches. Length 25 mm. ; breadth 8 mm.

Habits.—Food-plant : *Pæderia fœtida* Linn., family Rubiaceæ, which is also the food-plant of *hyas*. The long horn is moved freely in a vertical plane when the larva is walking.

113. **Gurelca montana** Jord. (Fig. 85 D, genitalia).

Gurelca montana, Jordan, 1915, p. 289 (♂, Tibet).

Imago.—♂. Upperside of body and fore wing silky ashen-grey, without the reddish-brown markings of other species. Fore wing with a short, dark, subbasal band bordered on the outer side with white ; a dark oblique band from costa towards tornal angle, also bordered on the outer side with white, reaching R^3. Hind wing : the blackish-brown border less sharply defined than in *himachala*, strongly broadened at costa where its inner margin reaches the proximal end of the apical lobe ; apical lobe ashy-bluish, bordered black proximally. *Underside* : fore wing dark brown as far as the postdiscal line at inner angle, the postmedian line thin, brownish-yellow in fresh specimens and ivory-yellow in old ones. Hind wing ashy greyish-brown, anal area pale straw-colour. Distal margin of fore wing more deeply emarginate under R^1 than in the other species ; inner margin also deeply emarginate before tornal angle ; costa of hind wing deeply emarginate. Length of fore wing 19·5 mm. ; width of fore wing 7·3 mm.

Hab. E. HIMALAYAS and China. Mell has bred the species in S. China, where the moth appears to be fairly common from July to October on grassy slopes at an elevation of about 2,000 to 2,400 feet.

Larva :—

Final instar. Horn of medium length, slightly up-curved, tip broadly bifid.

Coloration.—Head green with a white stripe separating face from cheek. Body green with a whitish subdorsal stripe from segment 2 to base of horn and thence on to 13, enclosing a rust-brown dorsal patch behind horn ; pale oblique stripes ; the angles formed by the junction of the oblique stripes with the subdorsal stripe filled in with rusty-red, and the subdorsal stripe edged above with rusty-red near these junctions ; horn slate-colour with a pale ring beyond the middle ; true legs reddish ; venter rust-brown on 2 to 4. Spiracles black with a white, dumbbell-shaped central slit.

Habits.—Food-plant : *Pæderia tomentosa* Bl., family Rubiaceæ, in China.

Genus **SPHINGONÆPIOPSIS** Wallengren.

Wallengren, 1858, p. 138 ; Roths. & Jord., 1903, p. 590 ; id., 1907, p. 110 ; Jordan, 1911, p. 251.

Genotype : *nanum* (Boisd.).

Imago.—" ♂♀. A near relative of *Gurelca*. Palpus rough-scaled, first segment with lateral apical fan as in *Gurelca*. Antenna dentate or pectinate in ♂, simple and clubbed in ♀ ;

end-segment very *short*. Eye lashed. Head with scaling raised to a large tuft. Spines of abdomen very weak. Merum of mid-coxa not angulate behind; tibiæ with some long *spines*; spurs of mid-tibia of nearly the same length; mid-tarsus with basal comb, hind tarsus with few basal spines; paronychium with the lateral lobes very small, the ventral ones absent; tarsi long. Distal margin of fore wing irregular, M^2 at apical third of cell, M^1 and R^3 close together; costal margin of hind wing nearly straight, convex near base, M^1 and M^2 close together, some distance from angle of cell, D^2 and D^3 straight, lower angle of cell not acuminate.

" ♂. Tenth tergite elongate-triangular, apex more or less rounded-truncate; sternite either strongly chitinized, with the upperside transversely ribbed distally, or short, broad, membranaceous. Clasper without friction-scales; harpe different in the various species. Penis-sheath without or with apical process.

" ♀. Vaginal plate triangular, apical edge projecting " (Roths. & Jord., 1903, p. 590).

Hab. South Russia to the Malay Peninsula and Madagascar. One Indian species. Early stages described under that species.

114. **Sphingonæpiopsis pumilio** (Boisd.). (Fig. 87, genitalia).

Lophura pumilio, Boisduval, 1875, p. 311 (Sylhet).
Sphingonæpiopsis pumilio, Roths. & Jord., 1903, p. 592; Mell, 1922, p. 245, pl. viii, fig. 12 (larva), pl. xiii, figs. 42, 43, pl. xviii, fig. 19 (pupa); Seitz, 1929, p. 555, t. 64 *d*.
Lophura pusilla, Butler, 1875, p. 244 (Sylhet); Moore, 1884, p. 234 (Cachar); Hampson, 1892, p. 111.
Lophura minima, Butler, 1876, p. 310, pl. xxii, fig. 4 (Ayerpanas, Malacca).

Imago.—♂♀. Similar in colouring and shape to *Gurelca hyas*, but differs in having a black spot at end of cell of fore

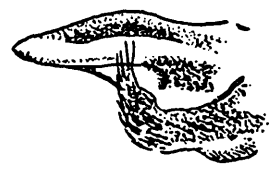


Fig. 87.—*Sphingonæpiopsis pumilio* (Boisd.), clasper and harpe.

wing and a broad, oblique, dark band from costa beyond cell to middle of inner margin. Hind wing with reddish-brown border of nearly even width. *Underside* of fore wing with marginal band narrow at tornus; hind wing with median and postmedian curved lines; no border. *Expanse*: ♂ 27 mm., ♀ 31 mm.

♂. Tenth tergite compressed, sharply pointed; sternite also pointed. Clasper (fig. 87) strongly narrowed in apical

half, almost pointed, longitudinally grooved along dorsal edge; harpe broad, densely beset with long spines distally, these spines flat upon the harpe except some near the apex. Penis-sheath without armature, or with short transverse subapical ridge, bent proximad.

Hab. E. HIMALAYAS, China and Malaya. We have bred the species in the Khasi Hills at an elevation of about 5,000 feet. The larvæ are very rare in some seasons, but in one season were extremely common.

Larva:—

Final instar. Head nearly round; true clypeus more than half length of head, apex narrowly rounded, basal angles not rounded; false clypeus forming a gothic arch over apex of true clypeus, apex nearly reaching vertex of head; labrum about one-third length of true clypeus; ligula kidney-shaped; mandible with the cutting-edge toothed; eyes arranged in rather an unusual manner, with 2, 3, 4 and 6 in a straight line, about one eye-diameter apart; 1 slightly outside this line, 5 slightly further back than 4 and just over one diameter from 4, 1 being the same distance from 2 as 5 is from 4. Surface of head dull and smooth; labrum minutely, longitudinally lined. Body dull and smooth, nearly cylindrical, tapering very slightly from segment 5 frontad. Horn short, straight, thick at base, and tapering evenly and sharply to a blunt point; covered with small tubercles directed distad.

Colour very variable. Head and body may be green, yellowish-green or greyish-yellow in the pale-coloured forms; reddish, chocolate or very deep brown in the dark-coloured forms; in the *pale-coloured forms* the head is immaculate; body with a more or less distinct, reddish-brown dorso-lateral stripe widening into dorsal patches on the posterior half of the body; a broad, well-defined, white subspiracular stripe from segment 2 to 14; a transverse row of white dots along each secondary ring. In the *dark-coloured forms* the head has a pale stripe from vertex to base of antenna; the body has the white subspiracular stripe and sometimes a black dorsal stripe with a pale stripe on each side of it on segments 2 and 3; venter paler. Spiracles white with a black or dark-coloured band across the middle, and a narrow, raised, black rim. Length 40 mm.; breadth 6 mm.; horn 6 mm.

Pupa.—Stout in build, head narrowing frontad and then rounded; antenna slightly longer than fore leg; a large coxal piece. Surface shining; head, thorax and wing-case very superficially, irregularly lined; abdomen sparsely, coarsely pitted; segment 9 with nine parallel ante-spiracular ridges. Spiracle of 2 a narrow slit, the front margin of 3 slightly thickened behind it; other spiracles oval, flush. Cremaster a short cone with a blunt tip. Colour honey-yellow; head

and thorax broadly barred with black ; legs, antenna and each half of tongue outlined black ; wing-case suffused with black, leaving the veins narrowly yellow ; each segment outlined thickly with black ; two black transverse bars on each abdominal segment ; front bevels of segments 8 to 10 ochreous, hind bevels black ; spiracles and cremaster black. Length 20 mm. ; breadth 6 mm.

Habits.—In the Khasi Hills the food-plant is *Hedyotis uncinella* Hk. & Arn., family Rubiaceæ, but Mell gives *Galium* Linn. and *Oldenlandia* Linn., of the same family, as the food-plants in China. Pupation takes place in a rough cocoon on the surface, and in captivity among leaves of the food-plant or in the upper corners of the box in which they are kept. The moth rests in the same attitude as species of *Gurelca*.

Genus **EURYPTERYX** Felder. (Fig. 88).

Felder, 1874, t. 74 ; Boisduval, 1875, p. 46 ; Roths. & Jord., 1903, p. 593 ; id., 1907, p. 111.

Genotype : *molucca* Feld.

Imago.—" ♂♀. Genal process very large, reaching tip of pilifer. Eye slightly lashed. Head feebly crested. Palpus

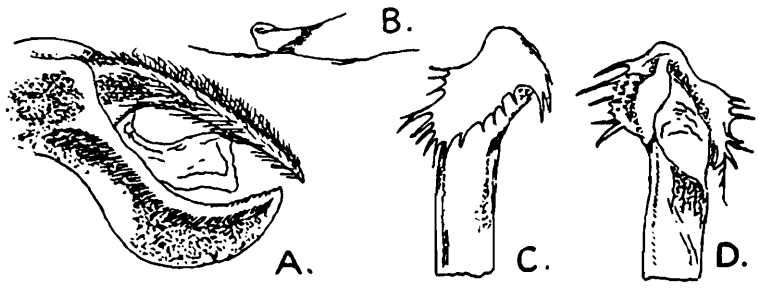


Fig. 88.—*Eurypteryx* Feld. Genitalia.

A, *E. bhaga* (Moore), 10th segment, lateral view ; B, harpe ; C, penis-sheath, dorsal view ; D, penis-sheath, ventral view.

large, prominent, second segment longer than first, nearly as broad as long. Antenna long, setiform, compressed and grooved, and furnished with fasciculate seriate cilia in *both* sexes ; hook long and gradual ; end-segment conical, not prolonged into a filamentous process. Abdomen conical, ending in a fan-tail which is truncate or triangulate ; spines elongate, rather strongly chitinized. Merum of mid-coxa angulate ; tibiæ simple, spurs unequal, long terminal one of hind tibia less than half the first tarsal segment, this equal to segments 2 to 4 ; mid-tarsus with moderate comb. Wings entire ; apex of fore wing produced, hind margin deeply

sinuate, D^3 shorter than D^4; R^2 of hind wing in or before centre, D^3 longer than D^4.

" ♂. Tenth segment simple (fig. 88 A); tergite densely hirsute, not compressed, slightly curved, apex rounded; sternite almost as long as tergite, much broader, compressed, curved, higher than broad, apex transversely ribbed. Clasper broad, dorsal and ventral margin convex; a patch of slender friction-scales; harpe small. Penis-sheath peculiar; a very large flap covers the apex of the sheath dorsally, armed with two or more long teeth at the edge; this flap is connected with the sheath by a short subcylindrical stalk, and breaks easily off; beneath the flap the sheath is dilated at the left side, subglobiform, and armed with short conical teeth.

" ♀. Vaginal plate narrow at end; orifice large, edges raised " (Roths. & Jord., 1903, p. 593).

Hab. Oriental Region. One Indian subspecies. Early stages not known.

115. **Eurypteryx bhaga bhaga** (Moore). (Fig. 88 A–D, genitalia).

Darapsa bhaga, Moore, 1865, p. 794 (N.E. Bengal).
Daphnis bhaga, Butler, 1877 A, p. 573; Cotes & Swinhoe, 1887, p. 22 (Sikkim); Hampson, 1892, p. 96 (Sikkim; N.E. Bengal; Singapore); Swinhoe, 1892, p. 24; id., 1894, p. 150 (Shillong; Cherrapunji); Dudgeon, 1898, p. 415 (Sikkim; Bhutan, 3,000 ft.).
Eurypteryx bhaga bhaga, Roths. & Jord., 1903, p. 594; Seitz, 1929, p. 555, t. 63 *e*.

Imago.—♂♀. Colouring like that of *Deilephila hypothous* and *D. placida*; head, thorax and abdomen uniform brown except for a dark, triangular dorsal patch on each of the last two segments of abdomen. Fore wing deeply excised below apex; the deep brown discal area not extended to subcostal fork; antemedian band with an obvious pale proximal border-line; a dark postmedian patch with angulate outer edge; a curved line across apex as well as an oblique line; apex of hind wing evenly rounded, feebly pointed at SC^2, uniform dark brown with a pale submarginal line near anal angle. *Underside*: fore wing with a pair of rather heavy discal lines, the interspace between them more or less filled in with brown; grey submarginal area rather well defined proximally by a brown line. *Expanse*: 82–84 mm.

♂. Harpe truncate (fig. 88 B); dorsal margin of clasper strongly convex. Penis-sheath (fig. 88 C, D): lobe with long slender teeth all round; globose dentate part of sheath large.

♀. Antenna little thinner than that of ♂.

Hab. E. Himalayas (Bhutan; Sikkim; Khasi Hills) and Malaya. Rare, and early stages not known.

Genus **RHODOSOMA** Butler. (Fig. 89).

Butler, 1877 A, p. 534 ; Roths. & Jord., 1903, p. 601 ; id., 1907, p. 113.

Genotype : *triopus* (Westw.).

Imago.—" ♂♀. Genal process large, triangular, reaching tip of pilifer. Head with an indication of a mesial crest, smoothly scaled like thorax and abdomen. Eye lashed. Palpus broad but rather short, obtuse, resembling the palpus of *Macroglossum*, but not pointed. Antenna long and slender, setiform, cylindrical in ♀, hook gradually curved ; end-segment short, conical, with a number of long bristles, not produced into a filamentous process. Abdomen flattened, stumpy, appearing truncate, segments short, especially the last ones, sternites emarginate ; spines flat, very *strong* on tergites and sternites, those of the first row about half as long again as broad, rounded, this armature approaching that of *Macroglossum*. Merum of mid-coxa not angulate or carinate ; tibiæ simple, spurs unequal,

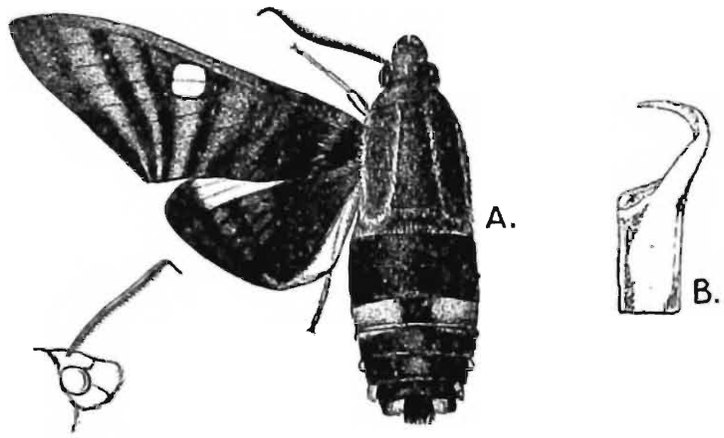


Fig. 89.—*Rhodosoma* Butl.
A, *R. triopus* (Westw.) ; B, penis-sheath.

longer terminal one of hind tibia less than half the first tarsal segment ; this as long as segments 2 to 4 together ; hind tarsus with additional externo-lateral spines ; spines of comb of mid-tarsus slightly prolonged, stout ; pulvillus and paronychium normal. Wings entire ; hind wing short, cell about half as long again as apically broad, cross-veins oblique, R^2 before centre, R^3 and M^1 almost from a point.

" ♂. Tenth segment elongate, slender, tergite scarcely curved, apex rounded ; sternite a little broader than tergite and somewhat shorter, with almost parallel sides, apex rounded, the apical edge curved a little upwards and appearing feebly sinuate in distal aspect. Clasper little curved, apex rounded, no friction-scales ; harpe of same type as in *Rethera* and *Cizara*, the process nearly as broad as in *Cizara*

sculpta, its ventral margin, which is bent upwards, serrate. Penis-sheath (fig. 89 B) ending in a long, pointed, curved process.

" ♀. Vaginal plate narrowed at end; orifice covered by a prominent proximal ridge, which is sinuate in middle " (Roths. & Jord., 1903, p. 601).

Hab. E. HIMALAYAS and S. China. One species, *R. triopus*. For the early stages see under that species.

116. **Rhodosoma triopus** (Westw.). (Fig. 89 A, imago).

Macroglossa triopus, Westwood, 1848, p. 14, pl. vi, fig. 4 (Assam, ♀).

Rhodosoma triopus, Hampson, 1892, p. 122, fig. 71 (♂); Dudgeon, 1898, p. 419 (Sikkim; Bhutan); Roths. & Jord., 1903, p. 601; Mell, 1922, p. 250, pl. viii, figs. 5, 6, pl. xiii, fig. 39, pl. xviii, fig. 22 (pupa), pl. xxx, fig. 8 (larva); Seitz, 1929, p. 556, t. 64 *e*.

Imago.—♂♀. Bee-shaped, and of peculiar appearance. Head and thorax olive-green or fulvous, with two creamy-white stripes on metanotum; abdomen black, with crimson lateral bands on segments 2 to 5, that on 4 the largest, fulvous dorsal and lateral spots on 5 to 8; short lateral tufts ochraceous-yellow, anal tufts black. Fore wing brownish-black crossed by three antemedian, outwardly oblique black bands; a large, white, semivitreous, quadrate spot beyond the discocellulars; postmedian, submarginal and marginal black bands. Hind wing black, with a large white patch on costa before apex; some fulvous postmedian specks on the veins; anal angle with a crimson and white patch. *Underside* of thorax fulvous; abdomen red, with four pairs of black spots; fore wing suffused with reddish-brown; hind wing red, with median and post-median black lines. *Expanse*: 64–78 mm.

Hab. E. HIMALAYAS (Sikkim; Bhutan; Assam) and S. China, where Mell has bred the species. Larvæ were found in deep, shady ravines.

Egg.—Broadly ovoid; surface smooth and shining; colour pale grass-green; size larger than those of *Macroglossum* and *Cephonodes*.

Larva:—

Final instar. Head round, surface smooth. Body tapering sharply frontad from segment 5; horn long, stout, laterally compressed, ending in a sharp point, basal half gently up-curved, distal half gently down-curved. Surface of body dull and smooth except for four small tubercles on the front half of each of segments 6 to 11, on the dorso-lateral stripe, those on 7 and 8 larger than the rest; horn with tubercles on dorsal and ventral surface.

Coloration.—Head green, with a white stripe separating face from cheek. Body pale green, the divisions between

the secondary rings white; an indistinct dark green dorsal stripe; a white dorso-lateral stripe, clearly defined on 2 to 4, faint on 5 to 11, and with white tubercles on 6 to 11, edged above with dark green on these segments; bluish-white oblique stripes, clearest on 7 to 9; horn bluish-green with a small, triangular, bluish latero-basal patch, the tubercles green; true legs pale flesh-colour, outer faces red; shanks of prolegs dull terra-cotta. Spiracles pure white with a broad transverse brick-red band across the middle of all except those on segments 11 and 12, which are immaculate white and twice as large as the rest. Length 70 mm.; breadth 11 mm.; horn 14 mm.

Pupa.—Very like that of *Cizara sculpta* in shape. Tongue-sheath projecting slightly beyond the frons; antenna equal to fore leg; coxal piece absent or rudimentary. Surface smooth and shining. Cremaster conical, tapering gently to a short, widely bifid tip. Colour: tongue greyish-green, darker at tip; thorax and wing-case greyish-green; two pale chestnut spots on segment 2; legs dark chestnut barred with pale orange; abdomen pale ochreous-brown above, reddish-brown with short longitudinal chestnut lines below; bevels of free abdominal segments dark chestnut; broad blackish patches and short black lines between the spiracles of segments 3 to 10. Length 42–52 mm.; breadth 11–14 mm.

Habits.—Food-plant: *Adina globiflora* Salisb., family Rubiaceæ, in China. The moth flies by day, and its resting position is the same as for those of the genus *Macroglossum*.

Genus **MACROGLOSSUM** Scopoli. (Figs. 90, 91).

Scopoli, 1777, p. 414; Roths. & Jord., 1903, p. 616; id., 1907, p. 118; Jordan, 1911, p. 252.

Genotype: *stellatarum* (Linn.).

Imago.—Small or medium-sized moths, resembling humming-birds in shape. In the Indian species the upper side of body and fore wing is dark coloured and the hind wing yellow with black border, or reddish-fawn. "♂♀. Genal process very large, triangular. Tongue long. Eye lashed. Palpus broad, pointed, projecting, end-surface triangular. Head feebly crested. Antenna clubbed, hook short and rather abrupt, variable in length; end-segment slender, different in length in the various species. Spines of abdomen flat, very strong, those of first row broader than long, excepting proximal segments, where they are longer than broad; plate of sternite of seventh segment triangular in ♀, *without* spines; fan-tail large in both sexes, previous segments with lateral tufts. Merum of mid-coxa produced backwards into a sharp tooth; upperside of mid- and hind tibia and underside of hind tibia

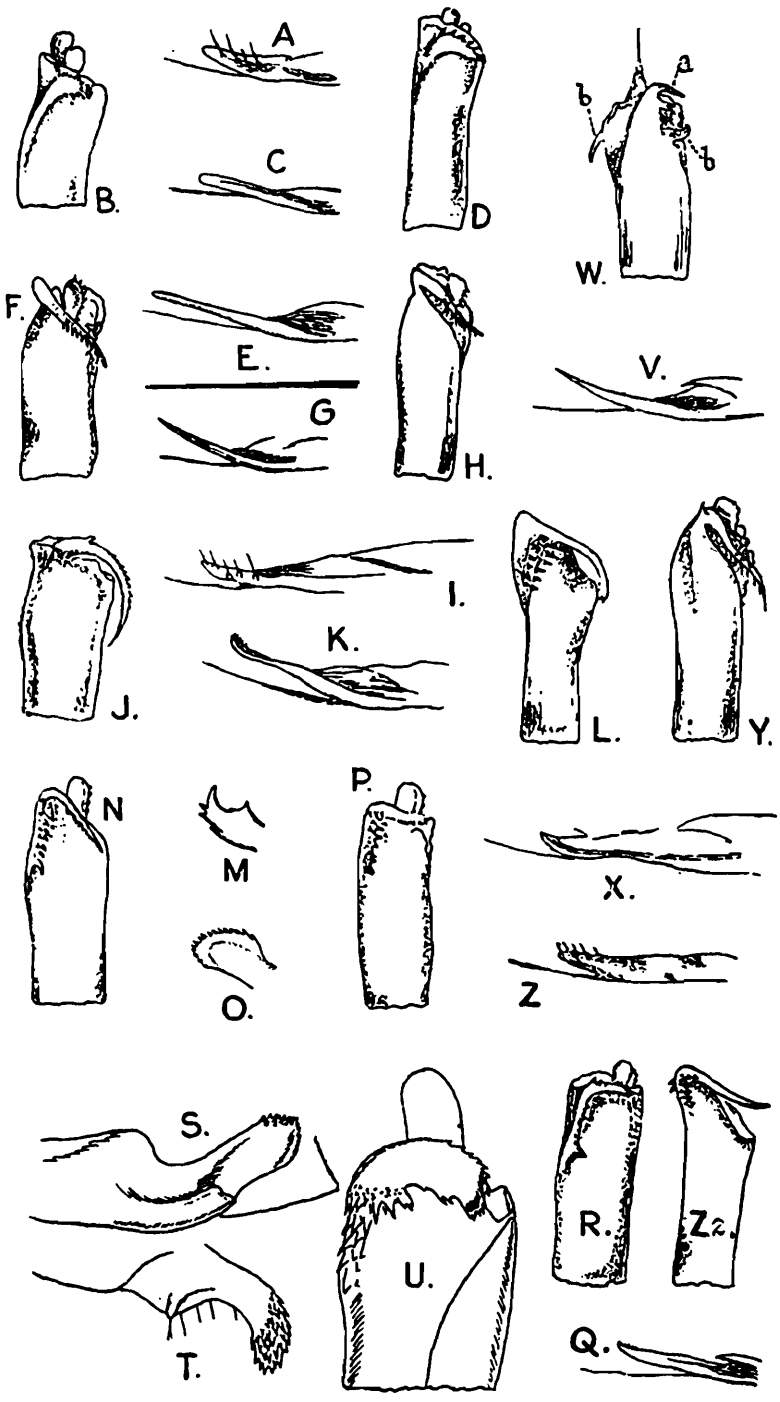


Fig. 90.—*Macroglossum* Scop. Genitalia.

A, *M. bombylans* (Boisd.), harpe; B, penis-sheath. C, *M. regulus* (Boisd.), harpe; D, penis-sheath. E, *M. gyrans* (Walk.), harpe; F, penis-sheath. G, *M. affictitia* (Butl.), harpe; H, penis-sheath. I, *M. particolor* Roths. & Jord., harpe; J, penis-sheath. K, *M. assimilis* (Swains.), harpe; L, penis-sheath. M, *M. pyrrhosticta* (Butl.), upper lobe of harpe; N, penis-sheath. O, *M. troglodytus* (Boisd.), upper lobe of harpe; P, penis-sheath. Q, *M. insipida* (Butl.), harpe; R, penis-sheath. S, *M. vicinum* Jord., harpe, lateral view; T, harpe, from above; U, penis-sheath. V, *M. sitiene* (Walk.), harpe; W, penis-sheath (*a*, apical process; *b*, lateral processes). X, *M. prometheus* (Boisd.), harpe; Y, penis-sheath. Z, *M. saga* (Butl.), harpe; Zz, penis-sheath.

at apex with long scaling ; shorter mid-tibial spur on inner side with comb of more or less heavy spines ; mid-tarsal comb present, but the spines not long ; spurs of hind tibia very unequal ; paronychium with two pairs of lobes, pulvillus present ; first segment of hind tarsus somewhat compressed, with additional spines on outer surface. Distal edges of wings entire ; SC^2 and R^1 of hind wing from upper angle of cell, R^2 central, R^3 and M^1 rather close together but always separate " (Roths. & Jord., 1903, p. 616).

Egg.—Broadly ovoid ; surface smooth and shining ; colour pale yellow, yellowish-green or green.

Larva.—Head small, round, semi-oval or subquadrate ; body tapering more or less gently frontad from segment 5 ; horn variable in length, usually straight. Surface dull, covered with minute hairs, tubercles small except in *M. bombylans*, which has a dorso-lateral line of spine-like tubercles. Colour variable specifically and often individually, commonly green, but dimorphism and polymorphism occur. Longitudinal stripes are usually present and oblique stripes also occur. No ocelli.

Pupa.—Slender in build ; dorsum of segments 4 to 8 flattened ; segments 12 to 14 together forming an equilateral cone ; basal half of tongue in a laterally flattened sheath, carinate ventrally ; tip of tongue usually spatulate ; antenna almost equal in length to fore leg ; often a narrow coxal piece. Surface moderately shining, superficially corrugate and pitted ; no sculpturing on segment 4. Colour yellowish or brownish, with black markings. Spiracles of abdominal segments lying in black patches of variable size and shape in different species.

Habits.—Most of the larvæ feed on plants of the family Rubiaceæ, some on Loganiaceæ and Euphorbiaceæ. The eggs are laid singly on the underside of a leaf. The larvæ lie stretched straight out, or with the head and anterior segments bent upwards. When alarmed some species eject green fluid from the mouth. The dorsum usually becomes darker before pupation, which takes place in a more or less well-formed cocoon on the surface. Some of the pupæ produce a dull knocking noise when moving the abdomen from side to side. The moths of many species of the genus do not climb up from the ground in order to expand their wings, but expand them while sitting on the ground. In the resting position the wings are held horizontal, the fore wing completely covering the hind wing, the dorsum of the abdomen left exposed. The flight is very rapid. Most of the species are on the wing at about dusk, but some may be seen feeding and laying their eggs at any time of the day. The eggs are deposited while the moth hovers on the wing. Some species appear to hibernate as imagos, as

they can be seen on the wing on fine days all through the winter, at an elevation of 7,000 feet or more in the Himalayas. Some species are attracted by light.

Hab. Old World. Twenty-eight Indian species and subspecies.

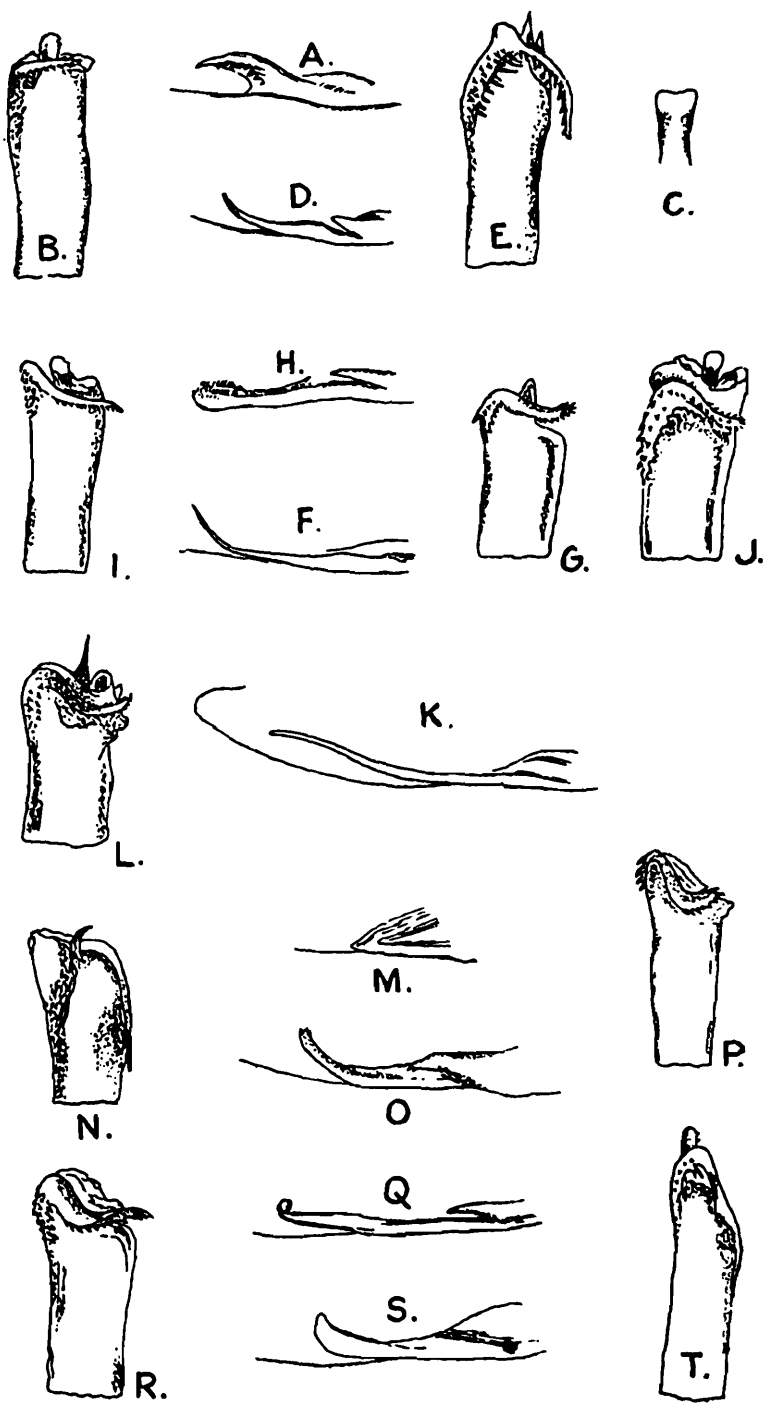


Fig. 91.—*Macroglossum* Scop. Genitalia.

A, *M. variegatum* Roths. & Jord., harpe; B, penis-sheath. C, *M. glaucoptera* (Butl.), end of 10th tergite, dorsal view; D, harpe; E, penis-sheath. F, *M. semifasciata* (Hamps.), harpe; G, penis-sheath. H, *M. aquila* (Boisd.), harpe; I, penis-sheath. J, *M. sylvia* (Boisd.), penis-sheath. K, *M. corythus luteata* (Butl.), harpe; L, penis-sheath. M, *M. hemichroma* (Butl.), harpe; N, penis-sheath. O, *M. passalus rectifascia* (Feld.), harpe; P, penis-sheath. Q, *M. faro* (Cram.), harpe; R, penis-sheath. S, *M. mitchelli imperator* (Butl.), harpe; T, penis-sheath.

Key to the Species.

Imagines.

1. Hind wing underside greyish-white at base like breast; upperside with yellow band; abdomen with yellow side-patches [p. 353. *M. bombylans* (Boisd.),
   Hind wing underside reddish-tawny, or yellow at base, or with a yellow patch before inner margin .. .. 2.
2. Costal margin of hind wing dilated into an antemedian lobe . . .. [p. 386. *M. aquila* (Boisd.),
   Costal margin of hind wing simple. .. . 3.
3. A band from middle of costal margin of fore wing to hind angle; no distinct antemedian and discal lines [p. 390. *M. hemichroma* (Butl.),
   No such band. .... 4.
4. Head and thorax with two broad grey stripes contrasting strongly with the greenish olive-black colour of head and thorax ... [(Butl.), p. 393. *M. mitchelli imperator*
   Head and thorax not so. .. ... 5.
5. Basal area of fore wing upperside black or greenish-black, sharply limited by the straight antemedian band .. 6.
   Basal area much paler than antemedian band .. .. 7. [p. 392.
6. Abdomen underside brown *M. faro* (Cram.),
   Abdomen underside tawny .. *M. passalus rectifascia* [(Feld.), p. 391.
7. Hind wing with very narrow tawny-brown border; abdomen with creamy-white side-patches . . .. [p. 352. *M. stellatarum* (Linn.),
   Hind wing with more or less broad tawny or black border, or nearly entirely black. 8.
8. Hind wing tawny, without yellow band; or if such a band present, then distal border gradually shading off proximally .. 9.
   Hind wing with sharply defined brownish-black distal border, often produced basad in middle; or the yellow band vestigial. 14.
9. Hind wing tawny; fifth abdominal segment without yellow side-patch.. 10.
   Hind wing with yellow-tawny band. ... 11.
10. Antemedian band of fore wing filled in with black... .. .. [p. 355. *M. regulus* (Boisd.),
    Antemedian band of fore wing not filled in with black .. .. [p. 356. *M. gyrans* (Walk.),
11. Fore wing upperside with a sharply defined grey costal discal area; antemedian band very oblique [& Jord., p. 362. *M. particolor* Roths.
    Not as above .. . .. . 12.
12. Yellow abdominal side-patches separate. 13. [p. 360.
    Yellow abdominal side-patches confluent *M. affictitia* (Butl.),
13. Brown post-discal spot SC^5–R^1 of fore wing upperside very prominent .. [p. 368. *M. assimilis* Swains.,
    Brown post-discal spot SC^5–R^1 not prominent .. .. *M. belis* (Linn.), p. 365.
14. Fore wing upperside: discal lines not distinct; no grey costal subapical area;

no grey streak R^1; no subapical brown spot SC^5–R^1. No brown dorsal spots on abdomen . . . . . 15.

One or other of these markings, or all, distinct . . . . . 17.

15. Underside of abdomen blackish-brown, with whitish-grey mesial patches; yellow area of hind wing underside sharply defined, restricted. . . . . [p. 387.
M. sylvia (Boisd.),

Underside of abdomen greyish-yellow or tawny . . . . . 16.

16. Side-tuft of third abdominal segment white . . . . . [(Butl.), p. 388.
M. corythus luteata

Side-tuft buff, extreme tip only white. . . *M. c. corythus* (Walk.), [p. 387.

17. Fore wing upperside with a costal apical grey area strongly contrasting with the brown scaling behind it; R^1 not grey behind the black subapical spot SC^5–R^1. *M. saga* (Butl.), p. 384.

No such grey area, or R^1 streaked with grey behind the subapical spot . . . . . 18.

18. Antemedian band of fore wing filled in with black in posterior half only; underside of wings blackish mummy-brown . . [(Hamps.), p. 386.
M. semifasciata

Antemedian band not filled in, or entirely black . . . . . 19.

19. Antemedian band and discal lines more or less merged together; palpus whitish-grey . . . . . [p. 385.
M. glaucoptera (Butl.),

Antemedian band and discal lines separated by a more or less greyish interspace . 20.

20. Vein R^1 grey; yellow band of hind wing not obviously curved . . . . . [(Boisd.), p. 383.
M. p. prometheus

Vein R^1 not grey, or yellow band of hind wing incurved . . . 21.

21. Vein R^1 grey; palpus dirty cinnamon-grey, not whitish-grey . . . . [& Jord., p. 384.
M. variegatum Roths.

Vein R^1 not grey, or palpus greyish-white. 22.

22. Antemedian band of fore wing filled in with black, its distal edge straight; median interspace grey, band-like; second discal line dilated behind R^1; palpus greyish-white; abdomen upperside olive-brown [p. 379.
M. fringilla (Boisd.),

Like *fringilla*, but fore wing upperside, outside the grey post-discal line, with a black line which is as broad as the second discal line [p. 382.
M. divergens (Walk.),

Not as above . . . . . 23.

23. Disc of fore wing underside and sternites of abdomen bright tawny, or the latter black with tawny spots . . 24.

Underside less bright tawny, more cinnamon; antemedian band of fore wing very prominent . . . . . [p. 378.
M. sitiene (Walk.),

24. Hind wing upperside: black marginal band reaching anal angle . . . 25.

Black marginal band not reaching anal angle, but connected with it by a diffuse patch . [p. 376.
M. vicinum Jord.,

25. Small species 26.

Larger species; greyish median interspace of fore wing wider; harpe of ♂ divided.	[(Butl.), p. 370. *M. p. pyrrhosticta*
26. Harpe not divided.	*M. i. insipida* (Butl.), [p. 373.
Similar to *i. insipida*, but harpe divided.	*M. troglodytus* [(Boisd.), p. 372.

Larvæ.

1. Food-plants Rubiaceæ only	2.
Food-plants Rubiaceæ and Loganiaceæ	9.
Food-plants Rubiaceæ and Tiliaceæ	10.
Food-plants not Rubiaceæ.....	11.
2. Food-plants *Galium* and/or *Rubia*	3.
Food-plants not *Galium* nor *Rubia* .	5.
3. A yellowish subspiracular stripe from 2 to tip of anal flap	[p. 352. *M. stellatarum* (Linn.),
No well-defined subspiracular stripe ...	4.
4. Dorso-lateral stripe formed of spine-like tubercles on 2 to 6	[(Boisd.), p. 354. *M. bombylans*
Dorso-lateral stripe not formed of spine-like tubercles..	[p. 355. *M. regulus* (Boisd.),
5. Food-plants *Morinda* and/or *Pæderia*	6.
Food-plants not *Morinda* nor *Pæderia*. .	8.
6. Spiracles orange, with the ends shortly white; horn yellow	[p. 357. *M. gyrans* (Walk.),
Spiracles whitish, with a broad red band	7. [Jord., p. 364.
7. Horn green, tip fuscous	*M. particolor* Roths. & [p. 379.
Horn bluish-grey, green and yellow, with black tubercles; slightly up-curved . ..	*M. sitiene* (Walk.), [(Butl.), p. 371.
Horn purplish, with yellow tip and black tubercles; straight.	*M. p. pyrrhosticta* [(Boisd.), p. 373.
8. Food-plant *Hedyotis*; spiracles reddish	*M. troglodytus* [& Jord., p. 384. *M. variegatum* Roths.
Food-plant *Chasalia*; horn green, sides of basal half white, tip yellow . .	[p. 376. *M. vicinum* Jord.,
Food-plant *Psychotria*; horn purple, tip orange	[p. 380. *M. fringilla* (Boisd.),
9. Horn long, two setæ at tip, pale brown, sides whitish, tubercles black; spiracles black edged with brown	[(Butl.), p. 389. *M. corythus luteata*
Horn shorter, black with black tubercles; legs black, or red with basal segment black; spiracles orange	*M. belis* (Linn.), p. 366.
10. Horn short and thick at base, black with orange tip; legs orange. . ..	[p. 374. *M. i. insipida* (Butl.),
11. Food-plant *Strychnos* (Loganiaceæ); horn black or green with black tip; legs black.	[p. 360. *M. affictitia* (Butl.),
Food-plant *Memecylon* (Melastomaceæ); spiracles white, with a narrow, black, minutely beaded edge	[p. 369. *M. assimilis* Swains.,
Food-plant *Daphniphyllum* (Euphorbiaceæ)	*M. saga* (Butl.), p. 385.
Food-plant *Photinia* (Rosaceæ); dorso-lateral stripe black spotted with blue; horn pale blue with a black ring at base.	[(Feld.), p. 392. *M. passalus rectifascia*

The pupæ of many of the species resemble each other so closely that we have not been able to construct a useful key.

117 **Macroglossum stellatarum** (Linn.).

Sphinx stellatarum, Linnæus, 1758, p. 803.
Macroglossum stellatarum, Swinhoe, 1884, p. 514 (Kurrachi); Butler, 1886, p. 378 (Murree); Buckler, 1887, p. 118, pl. xxvi, figs. 2, 2 *a*, 2 *b* (larva); Swinhoe, 1888, p. 117 (Karachi); Hampson, 1892, p. 113; Nurse, 1899, p. 513 (Cutch); Roths. & Jord., 1903, p. 627; Jordan, 1911, p. 253, t. 40 *f*; Seitz, 1929, p. 556.

Imago.—♂♀. Antenna strongly clubbed, hook short; end-segment not much prolonged. Head, thorax and first two segments of abdomen dark greyish-brown, rest of abdomen darker with pale yellow side-patches and side-tufts, anal tufts black. Fore wing dark greyish-brown, occasionally with a blackish median band; a narrow, dark brown ante-median line and a similar, outwardly-curved, postmedian line; a black discoidal spot. Hind wing rich orange shading to sienna-red at apex; base brown. *Expanse*: ♂ 44–50 mm., ♀ 74 mm.

♂. Tenth tergite slender, gradually narrowed to a point, slightly hooked, not dilated before tip either vertically or horizontally; sternite round at end. Clasper without friction-scales; harpe slightly curved, rounded-dilated at end, here rough with short spines and teeth. Penis-sheath with one long, slender, pointed process, which is densely and heavily dentate on the proximal surface; base of process also heavily dentate, dilated distad; internal rods obtuse, one clubbed and armed with a notched ridge, the other flat, concave on one side, with the edge finely serrate.

Hab. W Himalayas (Murree), S. India, and in Europe except the far north, east and south to Japan, Cochin China and in North Africa. The species has not been bred in India. It is known in England as the Humming-bird Hawk-Moth.

Egg.—Broadly ovoid, surface smooth and shining, colour green.

Larva:—

Final instar. Head small and round; horn straight, of medium length, stout at base, tapering evenly to a sharp point. Surface dull, a transverse row of small tubercles along each secondary ring.

Coloration.—Head and body greyish-green or brown; a darker dorsal stripe; a well-defined whitish subdorsal stripe, edged above with darker body-colour, from segment 2 to base of horn; a yellowish subspiracular stripe from 2 to tip of anal flap; horn bluish at base, tip yellow. Spiracles oval, black. Length 45 mm.

Pupa.—Tongue-sheath prominent. Surface shining, slightly shagreened. Cremaster a short sharp spike ending in two minute spines. Colour dull ochreous or brownish, tongue,

veins of wings, spiracles and cremaster dark brown. Length 35 mm.

Habits.—Food-plants : *Galium* Linn. and *Rubia* Linn., family Rubiaceæ (in Europe).

118. **Macroglossum bombylans** (Boisd.). (Fig. 90 A, B, genitalia ; fig. 92, imago ; Pl. IV, fig. 15, larva).

Macroglossa bombylans, Boisduval, 1875, p. 334 (Cent. Asia) ; Butler, 1877 A, p. 525 (N. India ; Dehra Dun ; Hong-Kong).
Macroglossum bombylans, Roths. & Jord., 1903, p. 632 ; Jordan, 1911, p. 253, t. 40*f* ; Mell, 1922, p. 257, pl. viii, fig. 29, pl. xiii, fig. 47, pl. xviii, fig. 23 (pupa), pl. xxx, fig. 9 (larva) ; Seitz, 1929, p. 556.
Macroglossa walkeri, Butler, 1875, p. 4 ; Hampson, 1892, p. 116 Dudgeon, 1898, p. 418 (Sikkim, 3,000–7,000 ft.).

Imago.—♂♀. Head, thorax and abdomen olive-green ; abdomen with yellow lateral bands on anterior segments, segment 4 with a rufous band in addition ; side-tuft of 3 pure white ; base of sixth tergite pure white ; terminal segments black with some rufous scales. Fore wing brown with a black antemedian band recurved along inner margin, first two postmedian lines prominent, third and subapical markings obsolescent. Hind wing with a more or less complete yellow median band in the ♀, in the ♂ this band reduced to an abdominal

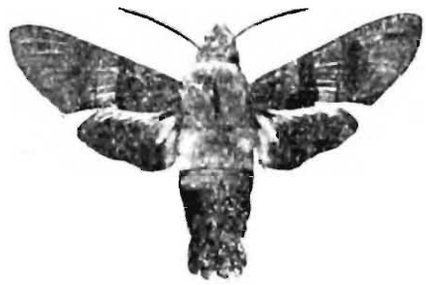


Fig. 92.—*Macroglossum bombylans* (Boisd.).

and a costal patch *Underside* of palpus and breast greyish-white, of abdomen rufous with a white mesial patch on the first two or three abdominal sternites ; wings dark reddish-brown with the lines very faint, base of both wings white. *Expanse* : ♂ 40–44 mm., ♀ 52 mm.

♂. Tenth tergite narrow, pointed ; sternite sinuate at end in an apical view. Clasper without friction-scales ; harpe (fig. 90 A) narrowing distad, point obtuse, the whole slightly up-curved, with some long bristles on side ; penis-sheath (fig. 90 B) with two obtuse internal rods, apical dentate process short.

Hab. W and E. HIMALAYAS, Japan and China. We have bred the species in Dehra Dun and the Khasi Hills, and Mell

has bred it in S. China. Fairly common at an elevation of 2,000 to 5,000 feet.

Egg.—Broadly ovoid ; surface smooth and shining ; colour bright green.

Larva :—

1*st instar*. Green with a straight, black, bifid horn of medium length. 2*nd instar*. Head and body green ; a pale subdorsal stripe from segment 2 to base of horn ; horn black, of medium length. 3*rd instar*. Head dark green with an obscure paler stripe separating face from cheek ; body dark green with a transverse row of small white tubercles along each secondary ring ; a broad pale green dorsal stripe with a bluish stripe on each side of it, formed of a line of dots on 2 to 6, then continuous to base of horn ; a subdorsal line of white tubercles on the same segments, continuing as a broad white stripe to base of horn ; a faint subspiracular stripe on 2 to 12 ; horn straight, of medium length, dark purple with black tubercles. 4*th instar*. Head dark green with a faint paler stripe down each side of the dorsal line and along sides of clypeus ; a yellowish stripe separating face from cheek ; body paler green ; the stripe on each side of dorsal stripe formed entirely of white dots ; subdorsal stripe formed of pale yellow tubercles ; horn straight, of medium length, blue, with the tip yellow and covered with black tubercles ; legs pale brown ; anal flap yellow.

5*th instar*. Shape the same as other macroglossine larvæ ; horn straight, of medium length. Head with moderately shining surface. Body dull ; a transverse row of small tubercles along each secondary ring ; one tubercle on each ring, on each side of the dorsal stripe, larger than the rest ; one tubercle in each row on the dorso-lateral line elongated, spine-like on segments 2 to 6, shorter on the remaining segments to base of horn ; horn covered with small tubercles.

Coloration.—Clypeus dark green ; a yellow stripe on each side of the dorsal line and along sides of clypeus ; a yellow stripe separating face from cheek and meeting the other stripe at base of antenna, the area between the two stripes bright blue ; cheek dark bluish-green ; antenna reddish. Body : segments 2 to 4 pale yellowish-green above the spiracles, dark green below them ; rest of body pale bluish-green above, the spiracles darker green below them ; the tubercles white except the dorso-lateral line of spine-like tubercles, which are yellow on segments 2 to 6, paler yellow on the other segments ; this line of tubercles bordered below by a bluish-white stripe from 6 to base of horn ; a faint pale subspiracular stripe from 2 to claspers. Horn bright blue, tip yellow, tubercles black ; legs pink. Spiracles white with a very broad black band across the middle, leaving only a dot at

top and bottom white. Length 50 mm.; breadth 7 mm.; horn 6 mm.

Pupa.—Not recorded.

Habits.—Food-plant: *Rubia cordifolia* Linn., family Rubiaceæ.

119. **Macroglossum regulus** (Boisd.). (Fig. 90 C, D, genitalia; Pl. XI, figs. 1, 2, larva).

Macroglossa regulus, Boisduval, 1875, p. 335 (Coromandel).
Macroglossum regulus, Roths. & Jord., 1903, p. 633, pl. iv, fig. 11 (♂); Seitz, 1929, p. 556, t. 65 *e*.
Macroglossa fervens, Butler, 1875, p. 4, pl. i, fig. 3 (Canara); Hampson, 1892, p. 112.

Imago.—♂♀. Antenna long and stout. Upperside of head, thorax and first three abdominal segments greenish; large, confluent, orange side-spots on segments 2 to 7; rest of tergites deep brownish-black, base of seventh pure white, tips of long scales of anal brush tawny; side-tuft of segment 3 white, of 5 black with buff tip. Fore wing with two ante-median lines curved basad behind, interspace black; no stigma; first discal line thin, second widened, angulate behind R^1, the dark scaling extended along hinder side of R^1 to subapical double spot, a subquadrate grey patch at proximal side of these spots. Hind wing chestnut-red, not darker at base, but distal margin slightly blackish, this colour not forming a well-defined border. *Underside* of palpus nearly pure white, breast and legs (posterior tarsus excluded), the greater part of the first sternite and a mesial spot on the second and third creamy; wings like upperside of hind wing, extreme bases maize-colour. *Expanse*: ♂♀ 36–44 mm.

♂. Tenth tergite pointed, slender at end; sternite sub-truncate, black at end. Clasper without friction-scales; harpe (fig. 90 C) slender, simple, straight, shorter than in *gyrans*, but similar in shape. Penis-sheath (fig. 90 D) with short process, denticulate at distal edge; two obtuse internal rods.

Hab. S. India and Ceylon. We have bred the species in S. India, where it is common during the wet months above 1,000 feet elevation.

Egg.—Broadly ovoid; surface smooth and shining; colour pale green.

Larva:—

Final instar. Head semi-oval; true clypeus triangular, short and broad; surface of head slightly shining and smooth except for a covering of short appressed hairs; body dull; a transverse row of minute tubercles along each secondary ring, one tubercle of each row, on the dorso-lateral line, being larger than the rest; horn covered with small tubercles; medium length, tapering evenly, nearly straight, held at an angle of 45° to the body.

Coloration.—Head green, veined obscurely with darker green, the hairs brown ; a dull yellowish subdorsal stripe and a bright yellow stripe separating face from cheek ; labrum green, ligula pale yellow ; basal segment of antenna green, other segments yellowish ; mandible green with dark brown tip. Body grass-green, suffused strongly with glaucous below the dorso-lateral stripe on segments 5 to 13, less strongly above the dorso-lateral stripe on 9 to 12 ; indistinct oblique stripes of the body-colour on 5 to 10, stopping at the dorso-lateral stripe ; all the tubercles white, the larger tubercles forming the white dorso-lateral stripe. Horn : basal half blue, next quarter black, last quarter yellow ; legs pink, prolegs and claspers green with the feet pink, ankles yellow, and on prolegs a shining black band above the ankle. Spiracles velvety-black, the extreme top and bottom orange. Length 48 mm. ; breadth 7 mm.

Pupa.—The usual shape of *Macroglossum* pupæ ; tongue-sheath semicircular in profile, most prominent ventrad ; tip of tongue spatulate. Surface shining and smooth except for minute and irregular pitting on abdomen ; front bevel of segment 9 very coarsely tuberculate. Spiracle of 2 a very narrow, curved oval sunk between the raised front edge of a transverse lobe projecting from the front margin of 3 and a corresponding emargination of the hind margin of 2 ; remaining spiracles narrow, parallel-sided depressed ovals with narrow rims. Cremaster elongate-triangular, flattened dorsally and ventrally, tip spatulate and ending in two forked teeth. Colour pale greenish-brown ; wing-case suffused with black ; a broad, greenish dorsal stripe, with diffuse edges, on the abdomen ; hind margins of segments 9 and 10, segments 12 to 14, and cremaster black ; spiracles reddish-brown ; venter of 9 to 13 blotched with black. Length 28 mm. ; breadth 8 mm.

Habits.—Food-plant : *Rubia cordifolia* Linn., family Rubiaceæ. Habits the same as for others of the genus.

120. **Macroglossum gyrans** (Walk.). (Fig. 90 E, F, genitalia).

Macroglossa gyrans, Walker, 1856, p. 91 (partim ; Madras ; Ceylon ; N. India ; Hindostan) ; Moore, 1882, p. 30, pl. xciii, fig. 2 ; id., 1884, p. 234 (Cachar) ; Swinhoe, 1885 A, p. 287 (Poona ; Bombay) ; id., 1888, p. 117 (Karachi) ; id., 1886, p. 434 (Mhow) ; Hampson, 1892, p. 113.

Macroglossum gyrans, Roths. & Jord., 1903, p. 634, pl. iv, fig. 6 (♂) ; Seitz, 1929, p. 557, t. 65 *f*.

Macroglossa zena, Boisduval, 1875, p. 337 (Simla).

Macroglossa burmanica, Rothschild, 1894 A, p. 68, pl. v, fig. 3 (Burma).

Imago.—♂♀. End-segment of antenna shorter than the three preceding segments together. Upperside of head, thorax

and basal half of abdomen of the same grey colour as fore wing ; posterior abdominal tergites not much darker, except a basal spot on each side ; three orange side-patches on segments 2 to 4, large, confluent ; first tergite and metanotum also tawny at side ; base of seventh white, the belt interrupted in middle by a black spot. Fore wing with two antemedian and two discal lines distinct, the interspaces not filled up with black, the two discal lines curved strongly costad at R^2, concave between R^3 and hind margin. Hind wing not darker at base than in middle, tawny-ferruginous, gradually becoming brown distally, the brown border not sharply defined. *Underside* of palpus and breast almost pure white, legs included, except hind tarsus ; sides of breast and legs shaded or speckled with brown scales ; abdomen drab, side-tuft of segment 3 white, of 6 brownish-black with buff tip ; wings dull ochraceous-tawny shaded with drab, bases more ferruginous, abdominal area of hind wing pale yellow at base, ochraceous rufous distally ; lines not prominent. *Expanse* : ♂ 38–52 mm., ♀ 54 mm. The variation in size is considerable, and the extreme sizes are more common than the intermediate sizes.

♂. Tenth tergite slightly dilated before the end, which is pointed ; sternite flattened, thin, sides oblique before end. Harpe (fig. 90 E) elongate, straight, simple ; clasper without friction-scales. *Penis-sheath (fig. 90 F) : dentate* process pointed, long, oblique in position, its base projecting distad, no spines at or near base ; internal rod obtuse, dentate at one edge.

Hab. W and E. HIMALAYAS, S. INDIA, CEYLON and BURMA, extending to Malaya and Papuasia. We have bred it in S. India, where it is common in open upland country with small rainfall, rare in low forest country

Egg.—Broadly ovoid ; surface shining and smooth to the naked eye, but under the microscope seen to be very shallowly pitted ; colour whitish when first laid, later pale honey-yellow.

Larva :—

1st instar. Head round, large ; body cylindrical ; horn straight, cylindrical, tip bluntly rounded ; head, body and horn covered with short hairs, and a single short hair at tip of horn ; colour pale honey-yellow, eyes and horn black. *2nd instar.* Little change. *3rd instar.* Horn short, straight, tip shortly bifid, surface shining and covered with small tubercles ; small tubercles on segment 2 and anal flap ; head, true legs, prolegs and claspers green ; body pale grass-green dotted with white ; a broad, pale yellow, dorso-lateral stripe from 2 to base of horn ; horn black above, green below. *4th instar.* Horn long, curved slightly first down and then up, tip shortly bifid ; surface of head, body and horn shining,

segment 2, horn and anal flap tuberculate: head yellow, segments 2 and 3 and anal segments dull orange; rest of body black above the dorso-lateral stripe, fuscous and then yellow below it; a broad, diffuse, dull violet dorsal stripe from 2 to base of horn; a narrow, clearly defined, white dorso-lateral stripe on 2 to 11; a narrow, yellow, subspiracular stripe on 2 to 12, obsolescent on 5 and 6; below this stripe black fading into diffuse fuscous-green on venter; horn, legs, shanks of prolegs and a transverse oval patch on the clasper shining black. Spiracles pale orange, each lying inside an orange-coloured patch. The dorsum is sometimes yellowish-pink dotted with white, and the tip of horn yellow.

5th instar. Head subquadrate; true clypeus with apex acute, less than half length of head; false clypeus forming a wide arch over apex of true clypeus, reaching to one-half length of head; labrum about one-half length of and as broad as clypeus; ligula slightly longer than labrum, kidney-shaped, sinus shallow; eyes with 3, 4 and 6 in a straight line, 2 slightly outside that line, 1 and 2 at right angles to 2 and 3; 5 forming an equilateral triangle with 4 and 6; 1, 2 and 3 equidistant, hardly one eye-diameter apart, 3 and 4 and 4 and 6 slightly more than one diameter apart. Surface of head dull, covered with minute shining tubercles. Body of the normal macroglossine shape. Horn rising from a fleshy cone, of medium length, straight, thin, evenly tapering. Surface of body dull; segment 2 with a transverse row of conical tubercles along each secondary ring; horn shining and covered densely with low conical tubercles, directed distad; hinder half of claspers and distal third of anal flap shining and covered sparsely with low conical tubercles; whole head and body covered with minute hairs.

Colour very variable. In the most common form the head is grass-green with darker green reticulations; an ill-defined, yellowish dorsal stripe from near vertex to apex of clypeus and running down each side of clypeus; a well-defined yellow stripe separating face from cheek; tubercles yellowish; labrum emerald-green; ligula yellowish-green; basal segment of antenna green, other segments rusty pink; mandible rust-coloured, tip black, cutting-edge toothed; eyes brown with black pupils. Body: segments 2 and 3 grass-green, the tubercles on 2 yellow, and 3 dotted with yellow; rest of body pale glaucous-green dotted with white; a pale violet dorsal stripe, with an indistinct whitish stripe on each side of it; a white dorso-lateral stripe from 2 to base of horn, tinged with yellow on 2 and edged above with green on 12. Horn yellow, the fleshy cone from which it rises pale green; legs with basal segment green and a black patch on outer face, other segments rusty; prolegs and claspers green; venter

grass-green on segments 2 and 3, pale glaucous-green on remaining segments. Spiracles oval, surface slightly raised, white with a broad orange band across middle.

Other forms are so different in appearance from that described above that they appear to belong to a different species. In one of these forms the head is deep brown, the true clypeus black, the tubercles and stripes yellow; body pale brown to greyish, dotted with white, dorsum suffused with fuscous; segment 2 with dull black saddle-shaped marking on anterior half, broken by a pale brown dorsal stripe and the dorso-lateral stripe, and covered with pale yellow tubercles; the dorso-lateral stripe yellow suffused with rusty-brown; horn pale pinkish-violet, the tip yellow, dorsum suffused with fuscous and tubercles black; distal two-thirds of clasper and of anal flap black. Spiracles orange, the ends very shortly white.

In another form the head and saddle-mark on segment 2 orange; body uniform black dotted with white; a white dorso-lateral stripe; a white subspiracular stripe; the spiracles lying on round patches of bright orange.

There are other forms in which the ground-colour is green or rich pink. In the latter form head and segment 2 orange; a black stripe below the white dorso-lateral stripe; horn black with yellow tip and base surrounded by yellow. Spiracles orange. Length 53 mm.; breadth 7 mm.; horn 3·5–4 mm.

Pupa.—Shape as in other macroglossine pupæ; tongue-sheath semicircular in profile; tip of tongue slightly tumid and spatulate; antenna equal to fore leg or slightly longer; a narrow coxal piece sometimes present. Surface shining; segment 2 sparsely and minutely pitted; 3 and 4 obscurely corrugate; wing-case smooth, the veins slightly raised; tongue and antenna defined by very narrow impressed lines; abdomen closely pitted, a row of larger pits along the hind margin of each segment; front bevel of segment 9 with a number of short transverse ridges; whole surface covered with minute hairs. Spiracle of 2 a narrow slit, the hind margin of 2 shallowly emarginate in front of it, a narrow transverse lobe projecting from the front margin of 3 behind it; remaining spiracles oval, slightly raised, central slit with narrow raised edges. Cremaster oblong with a shortly conical base, tip widely, shallowly bifid, dorsal surface flat, ventral surface longitudinally hollowed, with two longitudinal rounded ridges and the edges also prominently ridged, three channels between the ridges. Colour pinkish bone-colour; a black dorsal stripe on tongue-sheath, head (except vertex) and thorax; tongue, antenna, legs and wing-case closely marked with irregularly transverse leaden-grey lines: the pits on segments 10 to 12 rust-coloured, on 13 and 14 black; hind bevels of 8 to 10 chestnut; spiracular emargination

of segment 2 edged with black, lobe of 3 dusky rust-coloured ; cremaster black.

Habits.—Food-plants : *Morinda tinctoria* Roxb. and *M. citrifolia* Linn., family Rubiaceæ. The eggs are often attacked by a small black parasitic wasp. The moths feed in the morning and evening, and have been known to come to light.

121. **Macroglossum affictitia** (Butl.). (Fig. 90 G, H, genitalia ; Pl. XI, figs. 3, 4, larva, fig. 5, pupa).

Macroglossa affictitia, Butler, 1875, p. 240, pl. xxxvi, fig. 7 (Canara) ; Moore, 1882, p. 30, pl. xcviii, fig. 3 ; Hampson, 1892, p. 113 ; Nurse, 1899, p. 513 (Cutch).
Macroglossum affictitia, Roths. & Jord., 1903, p. 635, pl. iv, fig. 12 (♂) ; Seitz, 1929, p. 557, t. 65 *a* ; Manson, 1921, p. 751.
Macroglossa vialis, Butler, 1875, p. 240, pl. xxxvi, fig. 5 (Canara) ; Hampson, 1892, p. 112.

Imago.—♂♀. End-segment of antenna longer than in *M gyrans*. Similar in colour to *gyrans*, base of seventh abdominal tergite less pure and less extended white, this belt generally not visible or only indicated, unless the segment is removed ; sides of breast and legs of the dull drab-russet colour of the underside of the abdomen, the latter without white mesial patches ; underside of tail of the same dull tint. Fore wing : antemedian double line prominent, black, the lines close together ; interspace more or less filled up with black ; median interspace grey ; discal lines thin, not prominent, a dark shade on disc between R^1 and M^2. Hind wing : base and broad distal border-band blackish umber-brown, median band ochraceous-orange or more tawny. *Expanse* : ♂♀ 34–54 mm.

♂. Tenth tergite somewhat rounded at the sides just before the pointed tip ; sternite not black, rather flat, apex rounded. Clasper without friction-scales ; harpe (fig. 90 G) sharply pointed. Penis-sheath (fig. 90 H) with two rather broad internal rods ; apical process dentate at proximal edge, long, acute, not dentate at and near base, basally projecting distad.

Hab. S. India, Burma and Ceylon. We have bred it in S. India, where it is common though apparently confined to forests and hills, independent of the rainfall.

Egg.—Shortly ovoid ; surface smooth and shining ; colour pale olive-green. Length 1 mm. ; breadth 0·85 mm.

Larva :—

1*st instar*. Head round, body cylindrical, horn subcylindrical, tip truncate with a setiferous point at each lateral angle of the truncation, directed laterad ; surface smooth and shining ; horn covered densely with tubercles ; head orange ; body olive-green, segments 11 to 14 paler than the rest ; horn dull

black. *2nd instar*. Head pale orange, body darker olive-green, segments 2 and 11 to 14 paler ; a greyish dorso-lateral stripe from 3 to base of horn. *3rd instar*. Horn shining, set with strong, pointed, setiferous tubercles ; head degraded orange ; body dark olive-green above, pale olive-green below ; a broad, well-defined dorso-lateral stripe running from segment 2 to base of horn ; segment 14 yellowish. *4th instar*. Surface dull except for the horn, true legs and prolegs, which are shining, horn tuberculate as in 3rd instar ; head and body smoky-black, dotted with yellow below the dorso-lateral stripe ; this stripe broad, yellowish-green ; horn black.

5th instar. Head small, round ; true clypeus with apex acute, half length of head ; false clypeus forming a narrowly rounded arch over apex of true clypeus, apex reaching to two-thirds length of head ; ligula kidney-shaped ; cutting-edge of mandible shallowly toothed ; eyes with 1 to 4 in a curve, 6 in line with 3 and 4, all equidistant ; 5 forming an equilateral triangle with 4 and 6. Surface of head dull, minutely shagreened and covered with low, shining tubercles ; ligula shining. Body dull and smooth, covered with minute hairs. Horn straight, rising from a fleshy cone ; distal two-thirds of anal flap, clasper faces, and legs and prolegs shining.

Colour as variable as in the case of *gyrans*, *belis* and some other species. In one form (Pl. XI, fig. 3) the head dull black, the tubercles whitish ; labrum, ligula and antenna pale yellow ; mandible pale yellow, tip blackish. Segment 2 dull black ; 3 to 11 smoky-black, dotted with yellow especially on dorsum ; an obscure black dorsal stripe on 3 to 11, expanding into black patches near the front margins of 8 and 9 ; an obscure dorso-lateral stripe, edged below by black, on 3 to 11 ; anal segments pale brownish-pink suffused with fuscous laterally. Horn, distal two-thirds of anal flap, clasper sides and true legs black ; a black ventral stripe. Spiracles rather large, oval, flush, rich orange tipped with whitish at the upper and lower ends.

There is also a green form (Pl. XI, fig. 4) in which the head is green dotted with yellow, with a white stripe separating face from cheek ; body green dotted with yellow ; a pale indigo dorsal stripe from segment 3 to base of horn ; a narrow dorso-lateral stripe from 2 to base of horn, yellowish on 2 to 4 and white to base of horn, broader on 10 to 12 ; a yellow subspiracular stripe from 2 to tip of anal flap ; horn green with the tip and tubercles black ; true legs shining black. Spiracles orange, the ends shortly yellow.

In another form the head is pinkish-yellow, mouth-parts green ; body delicate pink dotted with yellow ; dorsal stripe pale blue ; dorso-lateral stripe yellowish on segments 2 to 4, then white ; horn orange, tubercles and tip black ; 14 and

anal flap green dotted with white. Spiracles orange with the ends white.

In another form the head is black; body black dotted with white, dorsum brownish, violet-brown or drab; the longitudinal stripes sometimes broken or wanting; horn and true legs shining black; venter pinkish.

These are the principal colour-forms, but intermediate forms also occur, and all are subject to variation. The only constant marking is the dorso-lateral stripe. Length 40 mm.

Pupa.—Shape the same as that of other macroglossine pupæ; tongue-sheath not very prominent; tip of tongue rounded and depressed; antenna slightly longer than fore leg; a short narrow coxal piece. Surface moderately shining; head, thorax and wing-case very shallowly, irregularly corrugate, veins of wings raised; abdomen pitted except for a narrow band near the hind margin of each; no sculpturing on segment 4; front bevel of 9 with a number of short, closely set ridges. Spiracle of 2 a narrow slit, with a raised oblong transverse lobe projecting from 3 behind it, and an emargination of the hind margin of 2 in front of it; remaining spiracles oval, slightly raised. Cremaster triangular, tip narrowly truncate, a small pointed tubercle at each lateral angle of the truncation; ventral surface slightly hollowed longitudinally and with a rounded central keel. Colour degraded greenish-white; wing-case covered with leaden-grey reticulations; tongue, antenna, legs and veins of wings rusty; thorax with a leaden-grey dorsal stripe and an obscure rusty dorso-lateral stripe; abdomen with a diffuse dark dorsal stripe and suffused with pinkish rust-colour; spiracles black, the central slit orange-brown; cremaster black. Length 30 mm.; breadth 8·5 mm.

Habits.—Food-plants: *Strychnos nux-vomica* Linn. and other species of *Strychnos*, family Loganiaceæ. The full-fed larva when alarmed raises the front part of the body, throws the head back over the dorsum, and ejects green fluid from the mouth. Before pupation it turns a livid pinkish colour. The moth makes a deep humming note before flight by a quivering motion of the wings. It does not appear to be attracted by light.

122. **Macroglossum particolor** Roths. & Jord. (Fig. 90 I, J, genitalia; fig. 93, imago; Pl. XI, figs. 6, 7, larva, fig. 8, pupa.

Macroglossum particolor, Roths. & Jord., 1903, p. 636, pl. iv, fig. 13 (♂) (Madras); Seitz, 1929, p. 557, t. 65 *a*.

Imago.—♂♀. Upperside of body and fore wing drab-grey; mesial line of head and thorax russet-brown, a large lateral

patch on mesothoracic tegula of the same colour, edged with grey. Abdomen with three orange side-patches, rather small, not separated from one another, the second the largest; fifth and sixth tergites laterally, seventh mesially tawny-olive, third and fourth with two blackish basal spots, not visible if the segments are telescoped too much into one another. Fore wing with a broad costally abbreviated subbasal band, separated distally by a thin grey line from a narrower band; two antemedian lines, oblique, especially the first, interspace filled up with dark scaling; first and second discal line rather sharply angled behind R^1, first line touching (or almost) second antemedian, the grey median interspace therefore hourglass-shaped or separated into two patches; second discal line much heavier than first, anterior half of interspace between the two filled up with blackish scaling, this scaling extended distad behind R^1, only separated from the conspicuous subapical dark patch SC^5–R^1 by the grey vein R^1, dark



Fig. 93.—*Macroglossum particolor* Roths. & Jord., ♂.

apical marginal half-moon conspicuous, grey costal space proximally of these patches sharply defined, separated by the grey border of the indistinct third discal line into a paler proximal and a slightly darker and sometimes a little rufous distal portion. Hind wing: base and a broad distal border blackish-brown, somewhat olive, median band cadmium-yellow, shaded with tawny along the distal border, especially in ♀. *Underside* of palpus greyish-white, with a white side-line; breast grey, shaded with wood-brown; abdomen wholly wood-brown. Wings hazel, shaded with grey, distal border brown, abdominal area of hind wing yellow, sharply limited in front. End-segment of antenna as long as the five preceding segments together. *Expanse*: ♂ 56 mm., ♀ 60 mm.

♂. Tenth tergite truncate, angles rounded, sternite incrassate at apex and here transversely carinate. Clasper *with* friction-scales; harpe (fig. 90 I) pointed, flat above, free part short. Process of penis-sheath (fig. 90 J) long, evenly curved, pointed

proximad, its distal surface denticulate, a longer subbasal tooth ; internal rods flattened, rounded at end.

Hab. S. INDIA, where we have bred the species. It is common in open country with moderate rainfall, but scarce in wet forest areas.

Egg.—Shortly ovoid ; surface shining and very minutely rugose ; colour grass-green, fading to pale yellow before hatching. Length 1·25 mm. ; breadth 1 mm.

Larva :—

1*st instar*. Horn minutely bifid ; surface dull, anal flap tuberculate ; colour pale green, horn black. 2*nd instar*. Head, body and horn shining ; head degraded yellow ; segments 2 and 14 pale yellow, rest of body green ; horn black. 3*rd instar*. Horn long, stout, minutely bifid, covered with small tubercles ; head and body pale yellowish-green, dorsum of body dark green ; horn pale rusty with black tubercles. 4*th instar*. Head green with a pale yellow stripe separating face from cheek ; segment 2 green, rest of body glaucous-green above a broad, pale yellow, dorso-lateral stripe, obscurely, closely dotted with white ; darker green, more sparsely dotted, below this stripe ; a dark green dorsal stripe from 4 to 11.

5*th instar*. Head round, surface dull ; true clypeus a little less than one-half length of head, apex acute, sides curved outwards ; apex of false clypeus acute, reaching to one-half length of head ; labrum one-third length of clypeus, transversely lined ; ligula kidney-shaped, slightly longer than labrum ; cutting-edge of mandible strongly toothed ; eyes with 4, 5 and 6 in a straight line, the line joining 1 and 2 at a slight outward angle to this line ; 1, 2, 3 and 4 equidistant, 6 slightly further from 4 than 4 is from 3 ; 5 at right angles to the line 4 to 6 and as far from 4 as 6 is from 4. Body dull and of the usual macroglossine shape ; horn long and straight.

Colour of green form (Pl. XI, fig. 6) : head pale green ; a narrow whitish subdorsal stripe and a broad whitish stripe separating face from cheek, the two stripes not reaching vertex ; ligula yellowish-green, the front margin rusty ; basal segment of antenna yellowish, with a maroon dorsal stripe, other segments pale flesh-colour ; mandible green, tip dark brown. Body green, suffused with glaucous on dorsum ; a transverse row of whitish dots along each secondary ring ; a dark green dorsal stripe ; a clearly defined whitish dorso-lateral stripe ; horn green, tip fuscous. Spiracles narrowly oval, yellowish, with a broad maroon band across the middle, broken by the yellow central slit.

There are also dark-coloured forms of the larva (Pl. XI, fig. 7) in which the head is brown, with stripes as in the green form but usually edged with darker brown ; body

varying from chocolate to ochreous-brown ; the dorso-lateral stripe pale body-colour, edged with darker brown, most distinct on anterior segments ; a dark brown dorsal stripe ; dots paler body-colour ; broad, broken supra- and subspiracular stripes ; venter brown. Spiracles as in green form, but darker in colour. Length 42 mm. ; breadth 5 mm. ; horn 9·5 mm.

Pupa.—Tip of tongue spatulate ; antenna slightly longer than fore leg ; no coxal piece. Surface shining ; head, thorax and wing-case smooth, veins of wings prominent, abdomen shallowly, irregularly corrugate ; front bevel of segment 9 rugose. Cremaster elongate-triangular, tip narrowly truncate, with a setiferous tubercle at each lateral angle. Colour pinkish bone-colour, head and thorax with a greenish tinge, the head, thorax and wing-case blotched with fuscous ; a black dorsal stripe on thorax ; a diffuse olive-green dorsal stripe on abdomen ; bottom of corrugations and front bevels of abdominal segments rusty. Cremaster black. Length 38 mm. ; breadth 10 mm.

Habits.—Food-plant : *Morinda citrifolia* Linn., family Rubiaceæ. The larva turns pinkish (in the green form) and pinkish-yellow (in the dark-coloured forms) before pupation. The moth, if alarmed when at rest, makes a deep, low, humming note. It may be seen feeding in the morning and evening.

123. **Macroglossum belis** (Linn.). (Fig. 94, imago ; Pl. XI, fig. 9, larva, fig. 10, pupa).

Sphinx belis, Linnæus, 1758, p. 493 ; Cramer, 1776, p. 147, pl. xciv, fig. C (China).

Macroglossa belis, Moore, 1884, p. 234 (Cachar) ; Swinhoe, 1885 A, p. 287 (Belgaum ; Sattara ; Bombay) ; id., 1886, p. 434 (Mhow) ; id., 1888, p. 117 (Karachi) ; Hampson, 1892, p. 113 ; Dudgeon, 1898, p. 417 (Sikkim ; Bhutan ; up to 3,000 ft.) ; Nurse, 1899, p. 513 (Cutch).

Macroglossum belis, Roths. & Jord., 1903, p. 637 ; Seitz, 1929, p. 557, t. 65 *a*.

Macroglossa opis, Boisduval, 1875, p. 345 (Silhet ; Darjiling).

Imago.—♂♀. End-segment of antenna about as long as the five preceding segments together. Abdomen with three cadmium-yellow side-patches, separated from each other, the first smallest, transverse, fifth segment with a lateral, sixth with a dorso-lateral, and seventh with a mesial patch of dark brown or black ; tips of side-tufts white. Fore wing with two antemedian lines, interspace filled up, but the band not prominent ; first and second discal line evenly curved costad in front, the second heavier than the first, interspace partly filled up with dark scaling, the lines straight behind or incurved ; dark subapical patches not prominent, grey costal space at its proximal side sharply limited at R^1. Hind wing with cadmium-yellow median band, basal and distal border

blackish-brown, the border somewhat shaded off along the yellow band, and here less deep in tint. *Underside* of breast and legs wood-russet brown, middle of prosternum more grey; palpus white with some brown scales; abdomen clayish cinnamon-rufous, basal sternite and a large indistinct mesial apical patch on each of the two following ones of the colour of the breast. Wings hazel-chestnut, rather brighter than abdomen; abdominal area of hind wing cadmium-yellow. *Expanse*: ♂♀ 50–60 mm.

♂. Tenth tergite obtusely pointed, not dilated laterally before end; sternite narrow, sides parallel, end rounded, somewhat incrassate. Clasper *with* friction-scales; harpe short, acutely triangular, ventral edge denticulate. Process of penis-sheath ending in a long point, distal edge with a few

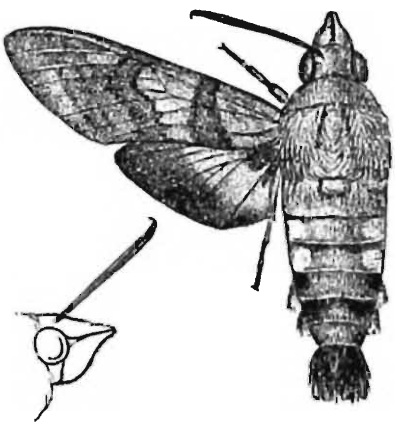


Fig. 94.—*Macroglossum belis* (Linn.).

teeth in middle, proximal edge dentate at least in basal half, base projecting distad.

Hab. W Himalayas, S. India and Ceylon to China and Japan. We have bred it in S. India and at Dehra Dun up to about 3,000 feet elevation. It is common in both forest and open country, independent of rainfall.

Egg.—Indistinguishable from that of *M affictitia*.

Larva:—

1*st instar*. Horn straight, bifid, of medium length; head and anal segments yellow, rest of body bluish-green, horn black. 2*nd instar*. A green and a dark-coloured form. Green form: head and segment 2 pale green, rest of body darker green, dotted with white; a broad dark green dorsal stripe with a broader pale green stripe on each side of it; a narrow dark green dorso-lateral stripe; horn pink with black tubercles. Dark-coloured form: head orange, body very dark green, almost black, dotted with white. 3*rd instar*. Horn long and curved upwards, tuberculate. Green form: head and body green dotted with white; a broad dark green dorsal stripe; a narrow pale yellow dorso-lateral stripe; horn pale green, tubercles black. Dark-coloured form: horn, legs, prolegs, anal

flap and claspers shining; head greenish-brown; segment 2 dark brown, a band of degraded pink near front margin; 3 and 4 greenish-brown, rest of body pale crimson, dotted with white; a greenish-brown dorsal stripe; a narrow white dorso-lateral stripe with a broader stripe of very dark greenish-brown below it; below this a still broader spiracular stripe of pinkish-brown; spiracles lying on reddish patches; horn black with black tubercles; legs, shanks of prolegs, anal flap and claspers black. *4th instar* similar to the 3rd instar.

5th instar. Head square with rounded edges; clypeus triangular, apex acute, less than one-half length of head; false clypeus with apex a narrow gothic arch reaching to slightly more than one-half length of head; labrum less than one-half length of clypeus and not quite so broad as clypeus; ligula kidney-shaped, as long as labrum and two-thirds as broad; cutting-edge of mandible shallowly, coarsely toothed; eyes with 1 to 4 in a sharp curve and about one eye-diameter apart; 6 in line with 3 and 4, and further from 4 than 4 is from 3; 5 as far from 6 as 4 is from 6, and slightly further from 4. Surface of head dull, covered with minute, conical, glassy tubercles. Body with dull surface; horn straight, of medium length.

Coloration.—Very variable, with green, black and pink forms. The colouring of the green and black forms is as described under the 3rd instar. Pink form: head degraded rust-colour or greenish-red; an indistinct yellowish subdorsal stripe; a yellowish stripe separating face from cheek; labrum, ligula and mandible green, the last with tip black; antenna greenish tinged with rusty. Body pink above the dorso-lateral stripe, glaucous-green below it, the whole dotted with white; segment 2, subspiracular region of 3 and 4 and venter of 5 and 6 suffused with yellowish-brown; other segments slightly suffused with orange in spiracular region; a faint, neutral-coloured dorsal stripe; a white dorso-lateral stripe from 3 to base of horn, very broad and well-defined on 12; a yellow, interrupted subspiracular stripe from 5 to tip of anal flap. Horn black, with black tubercles; legs red, with black claws and basal segment, by which the larva can be distinguished from that of *affictitia*; prolegs with a black band on front surface near base. Spiracles oval, flush, orange, the surface of the body round them suffused with dull orange. Length 50 mm.; breadth 8 mm.; horn 7 mm.

Pupa.—Tongue-sheath more prominent than in *affictitia*, semicircular in side-view; tip of tongue spatulate; antenna equal to fore leg and reaching to about one-third the wing-case, mid-leg about one-half. Surface shining, head, thorax and wing-case smooth; abdomen closely pitted; front bevel of segment 9 set with short, irregular ridges covering the

whole bevel. Spiracle of 2 a slit curving forwards, the hind margin of 2 and front margin of 3 thickened and curved in conformity with the slit; remaining spiracles broadly oval. Cremaster elongate triangular, tip emarginate-truncate, a conical setiferous tubercle, directed straight backwards, at each lateral angle of the truncation. Colour pinkish bone-colour; head, thorax and wing-case translucent; tongue-sheath, legs, antenna and wing-case transversely banded with leaden-grey; a narrow black dorsal stripe on head, vertex and thorax; dorsum of abdomen rusty, sides paler, pits rusty; cremaster reddish-brown, spiracles black, those on the abdomen lying in quadrate black patches. Length 40 mm.; breadth 11 mm.

Habits.—Food-plants: *Saprosma indicum* Dalz. & Gibs., family Rubiaceæ, and *Strychnos nuxvomica* Linn., family Loganiaceæ, in S. India, and *Hamiltonia suaveolens* Roxb., family Rubiaceæ, in the W Himalayas. The larvæ closely resemble those of *affictitia* in appearance and habits, and are found in company with those of *affictitia* on the strychnine-tree (*nuxvomica*).

124. **Macroglossum assimilis** Swains. (Fig. 90 K, L, genitalia; Pl. XI, fig. 11, larva, fig. 12, pupa).

Macroglossum assimilis, Swainson, 1821, pl. lxiv (♂♀) (Hab. ?); Roths. & Jord., 1903, p. 638; Seitz, 1929, p. 557, t. 65 *a*.
Macroglossa bengalensis, Boisduval, 1875, p. 341 (Pondicheri); Hampson, 1892, p. 115; id., 1900, p. 40.
Macroglossa taxicolor, Moore, 1879 A, p. 387 (Ceylon); id., 1882, p. 29, pl. xc, figs 3, 3 *a* (l., p., i.).
Macroglossa belis, Hampson (non Linn.), 1892, p. 114 (Trincomali, ♀).

Imago.—♂♀. Similar to *belis*: dark side-patches of fifth and sixth abdominal segments less black. Upperside: fore wing with a whitish-grey flush, the antemedian band broader behind, dilated basad at hind margin, first discal line vestigial behind, second strongly angled at R^2, concave between R^2 and hind margin, interspace between the two lines filled up; subapical dark spot SC^5–R^1 ovate, prominent, nearly black, the grey costal space at its proximal side not sharply limited behind, continuous with the grey submarginal area; the grey median interspace rather conspicuous; yellow band of the same colour as in *belis*, that is, deeper in tint than in *corythus* and allies. *Underside* of abdomen and wings less reddish than in *belis*. *Expanse*: ♂♀ 50–60 mm.

♂. Tenth tergite truncate-sinuate; sternite transversely multicarinate on the upperside, raised in the mesial line, appearing pointed in an apical view, apical half black. Clasper with friction-scales; harpe (fig. 90 K) elongate, spoon-shaped at end, the small widened part dentate. Penis-sheath

(fig. 90 L) with a long apical process, somewhat widened and dentate before end; from its projecting base proximad extend two series of long teeth on to the sheath; internal rods obtuse at end.

Hab. S. INDIA and CEYLON to Java. We have bred it in S. India, where it is common in forest and open country.

Egg.—Indistinguishable from that of *particolor*.

Larva:—

1*st instar*. Head black; horn long, slightly up-curved, black; body yellowish. 2*nd instar*. Similar to 1st instar. 3*rd instar*. Head yellowish-green; body: dorsum apple-green with a plum-coloured dorsal stripe; rest of body plum-colour, the whole dotted with yellowish; a narrow, white, dorso-lateral stripe on segments 11 and 12; a broad apple-green subspiracular stripe; horn, legs and a broad band on shanks of prolegs shining black. 4*th instar*. The plum-colour of the 3rd instar replaced by apple-green; an elongate, shining black spot near front edge of clasper-face and a duller black spot in the middle of clasper-face.

5*th instar*. Head round; true clypeus with apex acute, one-half length of head; apex of false clypeus forming a wide arch over apex of true clypeus and reaching to two-thirds the length of the head; labrum about one-half length of clypeus; ligula kidney-shaped, as long as labrum; cutting-edge of mandible obscurely toothed; eyes with 1 to 4 in a slight curve, 1 to 3 equidistant, 4 a little further from 3 than 3 is from 2; 6 in line with 3 and 4 and as far from 4 as 4 is from 3; 5 as far from 4 as 4 is from 3, and rather further from 6. Surface of head dull and smooth except for minute tubercles. Body with dull surface; segment 2 with a slightly shining short saddle-shaped marking; horn long, straight, not bifid; shining, with small tubercles directed distad; legs and prolegs shining.

Coloration.—Head dull grass-green; labrum green; ligula glassy-white; basal segment of antenna greenish, end-segment red, middle segment greenish tinged with red; mandible green, tip broadly reddish-brown; eyes whitish with black pupils. Body dull grass-green, dorsum of segments 5 to 12 suffused with glaucous, the whole with a transverse row of yellow dots along each secondary ring; a narrow dorsal stripe, jet-black on 2 to 4, bluish on remaining segments except at the front margin of each segment, where it is black; a broad white subdorsal stripe on each side of the dorsal stripe from 5 to base of horn; a narrow, obscure, whitish dorso-lateral stripe from 6 to base of horn, becoming broader and well-defined on 11 and 12. Horn entirely black, or the dorsum black, venter honey-yellow, tip shortly yellow, the tubercles black; legs red; shanks of prolegs greenish or yellowish, with

a broad black band, ankles reddish, feet livid-green. Spiracles narrowly oval, flush, white with a narrow, black, minutely beaded border. Length 55 mm.; breadth 7 mm.; horn 7 mm.

Pupa.—Shape the same as other macroglossine pupæ; tongue-sheath prominent; tip of tongue spatulate; antenna slightly shorter than fore leg, which reaches to middle of wing-case, mid-leg reaching to two-thirds. Surface of head and thorax shining, finely aciculate; of wing-case and abdomen dull, abdomen minutely, sparsely pitted; front bevels of segments 9 to 11 rugose. Spiracle of 2 a narrow slit covered by a narrow, raised, oblong, transverse lobe projecting from the front margin of 3, the hind margin of 2 slightly thickened in front of the slit. Cremaster: elongate-triangular, smooth and shining, tip shortly bifid, ventral surface hollowed longitudinally. Colour pinkish bone-colour, head, thorax and wing-case green, the wing-case marked with dark transverse lines and dots; a broad dorsal stripe from head to segment 12, jet-black on head and thorax, diffused green on abdomen; spiracles black; cremaster brownish orange. Length 37 mm.; breadth 11 mm.

Habits.—Food-plant: *Memecylon edule* Roxb., family Melastomaceæ. Habits similar to those of *belis*.

125. **Macroglossum pyrrhosticta pyrrhosticta** (Butl.). (Fig. 90 M, N, genitalia; fig. 95, imago; Pl. XI, fig. 13, & Pl. XV, fig. 4, larva; Pl. XI, fig. 14, pupa).

Macroglossa pyrrhosticta, Butler, 1875, p. 242, pl. xxxvi, fig. 8 (Shanghai); id., 1877 A, p. 527, pl. xc, fig. 8 (larva).
Macroglossum pyrrhosticta, Roths. & Jord., 1903, p. 641, pl. iii, fig. 12 (♂); Mell, 1922, p. 258, pl. viii, figs. 30, 31, pl. xviii fig. 24 (pupa), pl. xxx, fig. 11 (larva), fig. 12 (♂).
Macroglossum pyrrhosticta pyrrhosticta, Jordan, 1911, p. 253; Seitz, 1929, p. 557; Scott, 1931, pl. iii, fig. 7 (larva).
Macroglossa gilia, Boisduval (non Herr.-Schäff., 1854), 1875, p. 341 (partim); Moore, 1884, p. 234 (Cachar); Hampson, 1892, p. 117 (partim); Dudgeon, 1898, p. 418 (Sikkim; Bhutan; 2,000–5,000 ft.).
Macroglossa catapyrrha, Butler, 1875, p. 243, pl. xxxvi, fig. 6 (N. India).

Imago.—♂♀. Very like *troglodytus* but larger, antemedian band and first discal line of fore wing wider apart, all the grey interspaces more olivaceous, duller and not so prominent as in *troglodytus*, the wings appearing less variegated, though the number of lines and interspaces is the same in both species. *Underside* as bright ferruginous as in *troglodytus*, abdomen often with two rows of blackish patches as in many specimens of *troglodytus*. Underside of palpus and middle of breast rather variable in tint. *Expanse*: ♂ 44–55 mm., ♀ 48–56 mm.

♂. Sexual armature as in *troglodytus*, but upper lobe of harpe (fig. 90 M) *acuminate*, without teeth at upper edge, or only a few, and process of penis-sheath (fig. 90 N) longer and pointed.

Hab. E. HIMALAYAS to China, Japan and Malaya. We have bred it in the Khasi Hills, where it is common during the monsoon in forest areas with heavy rainfall, at an elevation of about 5,000 feet.

Egg.—Broadly ovoid ; surface shining and smooth ; colour greenish.

Larva :—

Final instar. Horn straight, of medium length, tapering evenly to a sharp point, minutely tuberculate. Surface dull and smooth.

Coloration.—Head dark green. Body with a yellow subdorsal and a yellow dorso-lateral stripe ; segments 2 to 4



Fig. 95.—*Macroglossum pyrrhosticta pyrrhosticta* (Butl.), ♂.

dark green, rest of body pale bluish-green ; a stripe from 2 to base of horn, yellow on 2 to 4, white on the remaining segments, edged above with green ; above this stripe a number of short narrow stripes, wanting on each side of the dorsal line, thus leaving a subdorsal stripe of the body-colour ; seven narrow, green oblique stripes ; horn purplish, end one-third orange, tubercles black ; legs reddish, basal segment with a shining black band. Spiracles white, with a broad red band across the middle. Length 50 mm. ; breadth 9·5 mm. ; horn 7 mm.

Pupa.—Tongue-sheath prominent, especially ventrad ; antenna slightly shorter than fore leg, reaching to middle of wing-case. Surface of head, thorax and wing-case shining and smooth ; abdomen shining and pitted dorsally and ventrally ; hind bevels of segments 8 to 10 smooth, front bevels of 9 to 11 with many transversely elongate tubercles. Cremaster triangular, tip bifid, the arms widely separated and very fine ; venter hollow, with thick lateral extensor-ridges. Colour greyish-yellow, with a green tinge on head, thorax and wing-case, sparsely dotted with brown ; thorax

with a narrow black dorsal stripe, continued as a greyish stripe on abdomen ; tongue, inner margin of wing and spiracles black ; cremaster with basal half brown above, rest black. Length 40 mm. ; breadth 11 mm. ; tongue-sheath projecting 3·5 mm. in front of head.

Habits.—Food-plant : *Pæderia fœtida* Linn., family Rubiaceæ, in India, and *P. tomentosa* Linn., in China.

126. **Macroglossum troglodytus** (Boisd.). (Fig. 90 O, P, genitalia ; fig. 96, imago ; Pl. XV, fig. 5, larva).

Macroglossa troglodytus, Boisduval, 1875, p. 344 (Assam ; Darjiling).

Macroglossum troglodytus, Roths. & Jord., 1903, p. 641, pl. iii, fig. 11 (♂) ; Jordan, 1911, p. 253 ; Mell, 1922, p. 261, pl. ix, figs. 6, 7, (larva), pl. xviii, figs. 36, 37 (pupa) ; Seitz, 1929, p. 557, t. 56 *c* (*e*).

Macroglossa gilia, Hampson (non Herr.-Schäff.), 1892, p. 117 ; id., 1893, p. 59, pl. clxxv, fig. 6 (larva).

Macroglossa belis, Hampson (non Linn.), 1892, p. 113.

Imago.—♂♀. A small species, generally confused with *insipida*. Fore wing much variegated with slaty-grey, the lines rather prominent, antemedian band oblique, not always



Fig. 96.—*Macroglossum troglodytus* (Boisd.).

completely filled in with black, often touching first discal line ; second discal line heavy, dilated distad behind R^1 *Underside* of abdomen and disc of wings ferruginous ; bases of wings more or less shaded with yellow ; palpus dirty grey, middle of breast vinaceous-olive. S. India and Ceylon specimens have the yellow band of hind wing deep in tint. *Expanse* : ♂♀ 40–54 mm.

♂. Tenth tergite sulcate beneath, convex above, truncate-rounded ; sternite rather flat, apex rounded, feebly acuminate in middle, transversely carinate above. Clasper without friction-scales ; harpe (fig. 90 O) forked like that of *pyrrhosticta*, but upper lobe flat, rounded in dorsal view, dentate at edges, lower lobe clubbed, tuberculate. Process of penis-sheath (fig. 90 P) obtuse, dentate at apex, basal teeth extending on to sheath, the most proximal tooth enlarged ; internal rods, rounded at end, sharp side-edge denticulate.

Hab. E. Himalayas, S. India and Ceylon to China and Java. We have bred it in the Khasi Hills, where it is very

common from May to September in forest areas at an elevation of about 5,000 feet, probably the most common species of *Macroglossum*.

Egg.—Broadly ovoid, smooth and shining, colour green.

Larva:—

1*st instar*. Yellow when first hatched, green after feeding, horn black. 2*nd instar*. Green, horn black. 3*rd instar*. Green, dorsum dotted with white; a whitish dorso-lateral stripe from segment 2 to horn. 4*th instar*. Head green with a darker green subdorsal stripe; body green dotted with yellow; a darker green dorsal stripe; a whitish dorso-lateral stripe; seven dark green oblique stripes; horn tuberculate, black with yellow tip.

5*th instar*. Head with surface moderately shining. Horn long, straight, with dull and smooth surface. Body dull and smooth except for a transverse row of small tubercles along each secondary ring in the dorsal area.

Coloration.—Head green with a whitish subdorsal stripe. Body green, dorsal tubercles white; a dark green dorsal stripe, flanked on each side by a white stripe, from segment 4 to base of horn; a yellow dorso-lateral stripe from segment 2 to base of horn; seven dark green oblique stripes; horn purple, tip yellow; legs and prolegs reddish; anal flap edged with yellow. Spiracles reddish.

There is also a dark-coloured form in which the head is purple, subdorsal stripes paler purple; body brown, the dorsal tubercles purple; the dorso-lateral yellow stripe broken or wanting on segments 5 to 11; oblique stripes dark brown dotted with purple; horn dark purple, tip yellow; legs orange; prolegs steel-blue, claspers purple. Spiracles yellow. Length 50 mm.; breadth 6 mm.

Pupa.—Shape and surface as in other macroglossine pupæ. Colour of head and abdomen yellow, thorax greenish. Spiracles black.

Habits.—Food-plants: *Hedyotis uncinella* Hook. & Arn. and *H. scandens* Roxb., family Rubiaceæ. The moth is frequently on the wing in the morning and evening.

127. **Macroglossum insipida insipida** (Butl.). (Fig. 90 Q, R, genitalia; fig. 97, imago; Pl. XI, fig. 15, larva, fig. 16, pupa).

Macroglossa insipida, Butler, 1875, p. 242 (Ceylon); Moore, 1882, p. 30, pl. xcii, figs. 3, 3 *a*, 3 *b* (l., p., i.); Hampson, 1892, p. 117; Dudgeon, 1898, p. 418 (larva and pupa descr.).

Macroglossum insipida insipida, Roths. & Jord., 1903, p. 642, pl. iii, fig. 10 (♂); Seitz, 1929, p. 558, t. 65 *a*.

Imago.—♂♀. Very close to *troglodytus*, with which it agrees

in size. Distal margin of fore wing more convex and apex less acute than in *troglodytus*. Antemedian band of fore wing above rather abruptly narrowed in anterior half and curved costad, being less oblique than in *troglodytus*. *Expanse*: ♂ 40 mm., ♀ 44 mm.

♂. Harpe (fig. 90, Q) quite different from that of *troglodytus* and *pyrrhosticta*, resembling that of *faro*; cylindrical, a little curved upwards at end, tip denticulate. Penis-sheath (fig. 90 R) with very few teeth proximally of base of process, the most proximal one large, triangular; process obtuse, dentate at end and proximal edge, teeth extending on to sheath in one row.

Hab. E. HIMALAYAS, S. INDIA and CEYLON to Malaya. We have bred the subspecies in S. India, where it is very plentiful towards the end of the rainy season, in forests with very heavy rainfall, up to 1,000 feet elevation.



Fig. 97.—*Macroglossum insipida insipida* (Butl.), ♂.

Larva:—

Final instar. Head rounded-quadrate in shape, dorsal line of vertex very slightly depressed; true clypeus less than one-half length of head, equilaterally triangular with apex rounded; false clypeus with apex acute, reaching to one-half length of head, sides curved outwards; labrum about one-half length of clypeus; ligula as long as labrum, kidney-shaped; cutting-edge of mandible finely toothed; eyes with 1 to 4 equidistant in a sharp curve; 6 in line with 3 and 4, further from 4 than 3 is from 4; 5 also further from 4 than is 3, and further still from 6; 3 much larger than the rest; surface of head dull and smooth. Body as in other macroglossine larvæ. Surface dull and smooth; horn rather short, thick at base, tapering evenly to a blunt point, covered with small, conical tubercles directed distad.

Coloration.—Head green; a whitish subdorsal stripe, running down side of clypeus; a whitish stripe separating face from cheek; labrum green; ligula whitish; basal segment of antenna green, other segments rusty; mandible pale green, tip dark rusty. Body grass-green covered with whitish dots; a darker green dorsal stripe from segment 2

to base of horn, with a diffuse whitish stripe on each side of it; a narrow white dorso-lateral stripe, edged narrowly above with darker green, on the same segments; broad white oblique stripes, upper edge diffuse, lower edge sharply defined, on 6 to 11. Horn with basal two-thirds plumbeous-black, distal third orange, tubercles black except at tip, where they are orange; true legs orange, basal segment suffused reddish; prolegs with ankles pale pink, feet livid white. Spiracles broadly oval, flush, pale yellow with a broad, reddish-brown central band, the whole narrowly bordered black.

There is also a dark-coloured form in which the head is dark brown with a russet-ochreous stripe separating face from cheek. Body russet-chocolate dotted with white; a darker dorsal stripe from 2 to base of horn; a russet-ochreous dorso-lateral stripe from 3 to base of horn, obscure on 2; similarly coloured oblique stripes on 5 to 11, the last running to base of horn, the angles between them and the dorso-lateral stripe also russet-ochreous, forming a series of triangular patches; horn black, tip shortly orange-red; true legs russet-ochreous; shanks of prolegs dark russet, feet whitish. Spiracles pale russet centred with darker russet. In another form the body-colour is dark brown, markings as above. Length 50 mm.; breadth 5·5 mm.

Pupa.—Tongue-sheath projecting shortly in front of head; tip of tongue spatulate; antenna longer than fore leg and reaching to middle of wing-case. Surface shining, head and thorax smooth, abdomen shallowly pitted; front bevel of segment 9 with a long channel reaching from dorso-lateral to ventro-lateral region and short, transverse, irregular ridges, the anterior ones more prominent and closer together than the posterior ones. Spiracle of 2 a slit, a slightly raised oblong transverse lobe projecting from the front margin of 3 behind it, the hind margin of 2 emarginate in front of it; other spiracles elongate-oval. Cremaster triangular, tip emarginate-truncate, a small conical tubercle at each lateral angle of the truncation; ventral surface longitudinally hollow, with a median keel near base; surface smooth and shining. Colour dry bone-colour, thorax and wing-case greenish, tongue-sheath and dorsum of abdomen rusty; wing-case, legs and antenna mottled sparsely with plumbeous-grey; a dorsal stripe, black on thorax, green on abdomen; broken, blackish, longitudinal stripes on venter; hind bevels of segments 8 to 10 brownish; spiracles black; cremaster pale rusty, tip black. Length 30 mm.; breadth 8 mm.

Habits.—Food-plants: *Spermacoce hispida* Linn., family Rubiaceæ, and *Corchorus capsularis* Linn., family Tiliaceæ. The pupa makes a low knocking note when alarmed. The moth does not appear to be attracted by light.

128. **Macroglossum vicinum** Jord. (Fig. 90 S, T, U, genitalia; fig. 98, imago; Pl. XI, fig. 17, larva, fig. 18, pupa).

Macroglossum vicinum Jordan, 1923, p. 189 figs. 8–10 (genit.) (N. Kanara); Seitz, 1929, p. 558.

Imago.—♂♀. In size, colour and markings similar to *M insipida insipida*. Palpus less grey, being rather strongly shaded with walnut-brown. Grey margin of tegula less contrasting. Fore wing as in *M i. insipida*, the markings the same but softer, the wing appearing less variegated. Hind wing: median band slightly deeper yellow, the black marginal band less angulate below centre than is usually the case in *M i. insipida*. *Underside*: fore wing uniformly dark cinnamon-rufous from base to terminal band, the basal area hardly at all shaded with darker brown, without yellow. Hind wing less extended yellow than in *M i. insipida*. Expanse: ♂♀ 40–48 mm.



Fig. 98.—*Macroglossum vicinum* Jord., ♂.

♂. Harpe (fig. 90 S, T) very different from that of *M i. insipida*, short, with a broadish subspatulate process, which is curved upwards and slightly away from inner surface of clasper and bears numerous teeth at the rounded apex, at margin as well as on outer and inner surfaces. Penis-sheath (fig. 90 U) with a transverse apical process, dentate around its obtuse apex and along its proximal margin; the teeth near base of process rather long, conical, the teeth extending on to sheath, the large triangular tooth found on the sheath of *M insipida* absent; inside the sheath two daggers, one acuminate and dentate, the other spatulate and non-dentate.

Hab. S. India. We have bred the species in the Kanara District, the only area from which it has been recorded, where larvæ are common in forests with heavy rainfall, above 1,000 feet elevation, during the rainy months.

Egg.—Broadly ovoid; surface smooth and shining; colour pale honey-yellow. Length 1·4 mm.; breadth 1·2 mm.

Larva:—

Final instar. Head round; cutting-edge of mandible

toothed ; eyes with 1 to 4 in a slight curve, about two eye-diameters apart ;. 6 in line with 3 and 4 and rather more than two diameters from 4 ; 5 about three diameters from 6, rather less from 4 ; surface of head dull and smooth. Body dull and smooth ; horn straight, long, base stout, tapering evenly to a point, covered with small tubercles and rising from a conical tumidity.

Coloration.—Head green, suffused lightly with glaucous ; an obscure yellowish subdorsal stripe, and a similar stripe separating face from cheek ; labrum pale glassy-green ; ligula similar, but sinus edges opaque white ; basal segment of antenna green, other segments red ; mandible green, tip narrowly dark reddish-brown. Body bright grass-green, dotted with white ; a narrow yellow dorso-lateral stripe from segment 2 to near base of horn, wanting on 5 ; white oblique stripes on 5 to 11, obscure on 5, broad on 11, narrow on 12 to base of horn, the lower part of each stripe formed of short grey lines ; horn with dorsal surface dull green, sides of basal half china-white with a bluish tinge, tip orange, the tubercles black on the green portion, white on the white portion and orange near the tip. Spiracles oval, flush, white suffused on each side of the central slit by reddish-brown.

There is also a dark-coloured form in which the head is green with pink reticulations, and a brown subdorsal stripe ; segments 2 to 5 brown ; remaining segments olive-brown, dorsum pinkish-brown ; an olive-brown dorsal stripe ; the dorso-lateral stripe yellow on 2 to 5, olive-brown on remaining segments ; seven pinkish-brown oblique stripes on 5 to 11, edged below by olive-brown, and that on 11 becoming white where it crosses 12 to base of horn ; horn fuscous with yellow tip. There are other forms intermediate in shade between the two described above. Length 55 mm. ; breadth 8 mm. ; horn 6 mm.

Pupa.—Tongue-sheath projecting considerably in front of head, semi-elliptical in profile ; tip of tongue spatulate ; antenna reaching to nearly the middle of wing-case, fore leg slightly shorter. Surface shining ; head, thorax and wing-case smooth ; abdomen coarsely pitted with coalescent pits except on hind bevels of segments 8 to 10 ; front bevel of 9 with seven or eight irregular short ridges, the anterior ridge the most prominent, ridges becoming shorter and less prominent backwards, a long channel reaching from dorso-lateral to ventro-lateral region in front of the anterior ridge. Spiracle of 2 as in pupa of *insipida* ; remaining spiracles oval, flush, the central slit with narrow raised edges. Cremaster triangular, tip truncate, a short tubercle at each lateral angle of the truncation, venter hollowed longitudinally, a central keel at base dividing into two parallel arms which do not reach the tip,

surface of cremaster smooth and shining. Colour bone-colour, tongue-sheath rusty along its edge, tongue black ; head, thorax and wing-case tinged with greenish, tongue-sheath, legs and wing-case mottled plumbeous-grey ; a dorsal stripe, narrow and black on thorax, diffuse green on abdomen ; pits on abdomen plumbeous ; hind bevels of segments 8 to 10 pale chestnut, ante-spiracular ridges of 9 dark brown ; venter of abdomen blotched with fuscous ; spiracles black ; cremaster chestnut. Length 32 mm. ; breadth 8 mm.

Habits.—Food-plant: *Chasalia curviflora* Thw., family Rubiaceæ. In the resting position the head and anterior segments of the body are raised, the head held with the mouth-parts directed frontad, the true legs held against the venter. The moth has not been observed feeding nor coming to light.

129. **Macroglossum sitiene** (Walk.). (Fig. 90 V, W, genitalia).

Macroglossa sitiene, Walker, 1856, p. 92 (partim ; " Natal," err. loc. ; Silhet ; Moulmein) ; Butler, 1877 A, p. 527 (Silhet) ; Dudgeon, 1898, p. 418 (Sikkim) ; Hampson, 1892, p. 115.

Macroglossum sitiene Roths. & Jord., 1903, p. 644, pl. iii, fig. 18 (♂) ; Mell, 1922, p. 268, pl. viii, figs. 12–14, 32, pl. ix, fig. 1, pl. xviii, figs. 39, 40 (pupa), pl. xxx, figs. 13, 14 (larva) ; Seitz, 1929, p. 558, t. 65 *b*.

Macroglossa nigrifasciata, Butler, 1875, p. 241, pl. xxxvii, fig. 3 (Ceylon) ; Moore, 1882, p. 28, pl. xcii, fig. 1.

Macroglossa orientalis, Butler, 1877 A, p. 528 (Moulmein) ; Moore, 1878, p. 844 (Upper Tenasserim) ; Swinhoe, 1890, p. 162 (Tenasserim).

Imago.—♂♀. Upperside of body and fore wing paler than in *fringilla*, clayish ; dorsal basal dots of abdominal tergites vestigial, seventh segment pale, with a very conspicuous mesial patch ; side-tufts all prominently tipped with white. Fore wing : antemedian band very prominent, sharply dilated basad behind ; first and second discal line curved as in *fringilla*, but the second not dilated distad behind R^1. Yellow band of hind wing deeper yellow than in *fringilla*, edge of black border less convex. *Underside* of palpus, middle of breast and mesial patches on the proximal abdominal sternites or on all, dirty grey, much less white than in *fringilla* ; hind wing more greyish distally, lines prominent. *Expanse* : ♂♀ 46–56 mm.

♂. Tenth tergite prismatical, rounded above, sulcate below, tip truncate ; sternite rounded at end. Clasper with friction-scales ; harpe (fig. 90 V) almost straight, sharply pointed. Penis-sheath (fig. 90 W) with two processes—one broad, hook-shaped, dentate at the concave edge, the other very slender and long, horizontal ; long internal rod broad, terminating in a long point.

Hab. E. HIMALAYAS, S. INDIA and CEYLON to the Philippines and China. Mell has bred the species in S. China.

Larva :—

Final instar. Shape similar to others of the genus. Body dull, with a transverse row of small tubercles along the secondary rings ; horn long, slightly up-curved, tuberculate.

Coloration.—Head green, with a white subdorsal stripe and a white stripe separating face from cheek. Body with segments 2 to 4 green, remaining segments greyish-green ; a dorso-lateral stripe made up of whitish tubercles on segments 2 to 4, then narrow and bluish-grey till 11 and 12, where it is broader and whitish to base of horn ; tubercles on anterior secondary ring of each segment yellow, rest whitish. Horn with basal three-fifths bluish-grey, sides violet near base, distal two-fifths green, shading to yellow at tip, tubercles black ; legs pale reddish-brown, basal segment with a black ring ; prolegs ivory-yellow with a black basal band. Spiracles cream-coloured with a broad, brick-red central band. Length 53–58 mm. ; breadth 8 mm. ; horn 7·5 mm.

Pupa.—Shape similar to other pupæ of the genus ; antenna slightly longer than fore leg and reaching to about one-third of wing-case. Surface slightly shining. Cremaster elongate-triangular, tip emarginate-truncate and slightly upturned, with a small conical tubercle at each lateral angle ; dorsal surface smooth, ventral with two curved longitudinal ridges down the middle and three channels, the central channel the broadest and shallowest. Colour of head and thorax dull greenish-grey, rest of body brownish-grey ; tongue-sheath with a median black stripe ; wing-case mottled with black ; body marked with dark dots and short stripes ; spiracles black. Length 42 mm. ; breadth 9 mm.

Habits.—Food-plants : *Pæderia tomentosa* Bl. and *Morinda umbellata* Linn., family Rubiaceæ, in China.

130. **Macroglossum fringilla** (Boisd.). (Pl. XI, fig. 19, larva, fig. 20, pupa).

Macroglossa fringilla, Boisduval, 1875, p. 352 (India).
Macroglossum fringilla, Jordan, 1911, p. 253, t. 40 *e* ; Seitz, 1929, p. 558, t. 65 *b* ; Mell, 1922, p. 265, pl. ix, figs. 8–12, pl. xxx, fig. 10 (larva), pl. xviii, figs. 34, 35 (pupa).
Macroglossa heliophila, Boisduval, 1875, p. 354, pl. xl.
Macroglossum heliophila, Roths. & Jord., 1903, p. 645, pl. iii, fig. 6 (♂) ; Manson, 1921, p. 752.

Imago.—♂♀. Head and thorax with a prominent dark mesial stripe ; a rather sharply marked triangular area of the same colour on tegula ; abdomen with a pair of prominent black dorsal spots on fourth tergite ; side-tufts all tipped with white. Fore wing : two antemedian lines filled in, forming a very prominent band which is nearly straight

distally and dilated basad at hind margin; first and second discal lines curved costad in front, concave between R^1 and hind margin, the first thin, the second heavier, interspace not quite filled in, the lines remaining quite distinct, the second dilated distad behind R^1 till reaching post-discal line, this spot-like dilation prominent; R^1 in front of it grey, bordering a sharply defined post-discal costal grey patch; subapical spot SC^5–R^1 prominent, while the space SC^4–SC^5 in front of it is more or less grey. Black border of hind wing convex, more or less angulated near M^1. *Underside* of palpus, middle of breast, and a mesial patch on first abdominal sternites greyish-white, rest of abdomen dull burnt-umber brown; tail rather darker; wings like abdomen, basal central area of fore wing darker, distal border duller, darker brown; bases shaded with yellowish-buff, yellow abdominal area sharply defined, about 1·5 mm. short of tip of SM^2. *Expanse*: ♂ 50–58 mm., ♀ 60 mm.

♂. Tenth tergite rather broad, rounded-truncate, flattened at end; sternite spatulate, upperside elevated in mesial line, apical margin acuminate. Clasper with friction-scales; harpe incrassate distally, obtuse, often with a subapical lateral tuberculate hump.

Hab. S. India to China, Malaya and the Philippines. We have bred the species in S. India, where larvæ are found in evergreen forests, above 1,000 feet elevation.

Egg.—Nearly spherical; surface smooth and shining; colour pale yellow. Length 1·5 mm.; breadth 1·4 mm.

Larva:—

1st instar. Horn long, straight, bifid; head, segment 2 and anal segments behind base of horn honey-yellow; rest of body blood-red; horn shining black. *2nd instar.* Head yellowish, segment 2 and anal segments pale yellow; rest of body dark maroon-red; horn shining black. *3rd instar.* Similar to above, but paler; body dotted with white; a dark dorsal stripe and a narrow whitish spiracular stripe. *4th instar.* Horn very long; head opaque pale green; body translucent pale green, dorsum suffused with yellow and in some cases with touches of maroon-red, the whole dotted with white; a dull olive-green dorsal stripe; horn with basal half shining black, distal half green with black tip, the whole covered with black tubercles; legs shining black, prolegs with a shining black band.

5th instar. Head round; clypeus with apex acute, not quite one-half length of head; false clypeus with apex acute, reaching a little more than one-half length of head; labrum one-half length of clypeus; ligula as long as labrum but narrower, kidney-shaped; cutting-edge of mandible strongly toothed; eyes with 3, 4 and 6 in a straight line, the line joining 1 and 2 forming an angle of 105° with that line;

5 forming an equilateral triangle with 4 and 6 ; 1 and 2 one eye-diameter apart, 2 and 3 about one-half diameter, the others about one diameter apart, 1 and 2 smaller than the rest ; surface of head dull, covered with minute bubble-like tubercles. Body of the usual macroglossine shape ; dull and smooth except for minute tubercles on the secondary rings of segments 2 and 14 ; horn very long, thin, tapering evenly to a fine point, distal half slightly up-curved ; shining and covered with small conical tubercles.

Coloration.—Green form : head yellowish-green ; labrum glassy-green ; ligula glassy yellowish-green ; basal segment of antenna green, other segments red ; mandible green, tip broadly dark reddish-brown ; eyes brownish. Body pale grass-green, with a transverse row of yellow or whitish dots along each secondary ring ; the dorsal stripe limited to a triangular marking, dark green or violet, at the front margin of segments 5 to 11. Horn with basal two-thirds pale purple, distal third greenish-yellow, tip orange ; legs with basal segment shining black, remaining segments rose-colour ; prolegs with base green, shank shining yellow with a broad black band, ankle maroon-rose, foot dirty white ; clasper with front half green, hind half bluish ; venter yellowish on segments 2 to 4, rest green. Spiracles oval, flush, white with a very broad rusty-orange band across the middle.

In the dark-coloured form the head is pale brown ; labrum green ; ligula brownish-green. Body dark smoky olive-green or olive-brown, dotted with white ; a saddle-shaped marking on segment 2 soiled ochreous-brown, covered with small white tubercles ; a bluish-black dorsal stripe, black and widening at the front margins of 5 to 11 ; horn reddish-brown at base, then olive-green, then reddish-brown again, tip and tubercles black ; legs with basal segment black, other segments blood-red or brownish-red ; prolegs with shanks orange with a broad black band, ankles pale yellow, feet livid white ; distal two-thirds of anal flap and of clasper faces soiled ochreous-brown, the clasper shank brown with a broad black band ; on the venter of segments 5 to 11 a transverse row of enamel-white dots along the anterior secondary ring of each segment. Spiracles white with a broad, dark, reddish-brown band across the middle. Length 70 mm. ; breadth 10 mm. ; horn 13 mm.

Pupa.—Shape as in others of the genus ; tongue-sheath short ; the hind margin of segment 11 somewhat tumid, 12 fitting in to it telescopically ; tip of tongue spatulate ; antenna slightly longer than fore leg and reaching to middle of wing-case, mid-leg to about two-thirds ; a very narrow coxal piece. Surface moderately shining ; tongue-sheath dorsally shallowly channelled ; head, thorax and wing-case smooth ; abdomen coarsely vermiculate-corrugate and pitted ;

segment 9 with a very prominent ante-spiracular ridge, the front bevel coarsely tuberculate and with a deep transverse channel at its base; less prominent ridges on 10 and 11. Spiracle of 2 with the slit bordered in front by the curved-emarginate, slightly tumid hind margin of 2, and behind by an oblong transverse lobe projecting from the front margin of 3; other spiracles oval, surface rising gently to the narrow rim of the central slit. Cremaster nearly oblong, narrowing slightly distad, end widely curved-emarginate, a short, sharp tooth, directed distad, at each lateral angle; in some specimens there is a smaller tooth on the inner side of the base of this tooth; two or three small teeth along outer edge of distal third of cremaster; upper surface smooth and shining, lower surface with a central keel and a broad channel on each side of the keel. Colour pinkish bone-colour, head, thorax and wing-case tinged with green; tongue with a narrow black median line not continued on to sheath; tongue, legs, antenna and wing-case marked with narrow transverse bands of olive-green; a black patch on frons, a black dorsal stripe on thorax, which is also dotted with black; an obscure fuscous lateral stripe on abdomen; a large black spot at lower end of hind bevel of segment 8; front bevel of 9 dark rusty; pits of abdomen rusty; spiracles black, lying in small black patches; cremaster rusty, with lateral edges of base olive-green. Length 40 mm.; breadth 11·5 mm.

Habits.—Food-plant: *Psychotria dalzellii* Hook., family Rubiaceæ. The long horn is moved freely in a vertical plane in all instars. The moths may be seen feeding during the afternoon, but do not appear to be attracted by light.

131. **Macroglossum divergens** (Walk.). (Fig. 99, imago).

Macroglossa divergens, Walker, 1856, p. 94 (Ceylon); Moore, 1882, p. 27, pl. xcii, fig. 2; Hampson, 1892, p. 117.
Macroglossum divergens, Roths. & Jord., 1903, p. 646; Seitz, 1929, p. 559.

Imago.—♂♀. Fore wing: first discal line vestigial, second heavy and dilated distad between R^1 and R^2; a distinct



Fig. 99.—*Macroglossum divergens* (Walk.), ♂.

black line outside the grey post-discal line as broad as the second discal one. *Expanse*: ♂♀ 46–54 mm.

Hab. CEYLON. Early stages unknown. Very rare, in the British Museum 1 ♂, 2 ♀♀.

132. **Macroglossum prometheus prometheus** (Boisd.). (Fig 90 X, Y, genitalia; fig. 100, imago).

Macroglossa prometheus, Boisduval, 1875, p. 355 (Java).
Macroglossum prometheus prometheus, Roths. & Jord., 1903, p. 651; Seitz, 1929, p. 559.

Imago.—♂♀. Tegula with grey fringe in fresh specimens. Abdomen above with two dark dots at the bases of segments 3 and 4; anal tuft dark, tip often paler, vinaceous, not yellow or tawny. Fore wing with grey streak of R^1 distinct, grey costal space in front of it prominent, black apical half-moon joined to the submarginal patch



Fig. 100.—*Macroglossum prometheus prometheus* (Boisd.), ♀ (Java).

SC^5–R^1, which is black distally and somewhat russet proximally, subapical patch SC^4–SC^5 russet; lines not prominent, interspaces grey, median interspace not more grey than interspace between the subbasal and the double antemedian lines. *Yellow band of hind wing very sharply defined, costal* margin not yellow. *Underside* of wings vandyke-brown, shaded with drab, dull in tint, yellow abdominal area contrasting sharply. *Expanse*: ♂♀ 45–64 mm. The figure is from a Java specimen.

♂. Tenth tergite truncate, very slightly sinuate, the angles somewhat projecting laterad. Clasper with prominent friction-scales; harpe (fig. 90 X) with a very short triangular, acuminate free process. Process of penis-sheath (fig. 90 Y) with a single basal tooth which points distad, and a number of teeth at and near proximal edge; no teeth on sheath near base of process.

Hab. CEYLON to Java and the Philippines. Early stages unknown. Fairly common.

133. **Macroglossum variegatum** Roths. & Jord. (Fig. 91 A, B, genitalia).

Macroglossum variegatum, Roths. & Jord., 1903, p. 653, pl. iii fig. 13 (♂) (Cherrapunji); Seitz, 1929, p. 559, t. 65 *d*.

Imago.—♂♀. Differs from *fringilla*, with which it agrees best, in the following points: abdomen with pairs of black dots at bases of tergites 3, 4 and 5. Antemedian band of fore wing not so prominent, much more curved, almost at right angles to costal margin; first and second discal lines also obviously more curved, S-shaped, median interspace less pale than in *fringilla*, shaped like an hour-glass, but upper part larger than lower, second discal line dilated distad behind R^1; R^1 grey; post-discal line and its grey border distinct, continuous from costal to hind margin; distal edge feebly scalloped in fresh specimens, with darker dots at tips of veins; a pale stigma with a dark spot at its proximal side in fresh specimens. *Underside* of palpus and middle of breast clayish, very much darker than in *fringilla*, abdomen generally deeper brown, without whitish-grey patches on the first sternites. *Expanse*: ♂♀ 50–54 mm.

♂. Tenth tergite truncate; sternite less acuminate than in *fringilla*. Clasper without friction-scales; harpe (fig. 91 A) short, acuminate, curved upwards and then distad, underside often with teeth. Process of penis-sheath (fig. 91 B) short, obtuse, slender, dentate at end as well as at proximal edge, basal teeth extending on to sheath; internal rods rounded at end.

Hab. E. Himalayas, China and Malaya. Mell has bred the species in S. China. Fairly common.

Larva and pupa.—So close to those of *troglodytus* that Mell was unable to distinguish them from those of that species.

Habits.—Food-plant: *Hedyotis* Linn., family Rubiaceæ.

134. **Macroglossum saga** (Butl.). (Fig. 90 Z, Zz, genitalia).

Macroglossa saga, Butler, 1878 A, p. 206 (Japan); id., 1878 B, p. 3, pl. xxi, fig. 1.
Macroglossum saga, Roths. & Jord., 1903, p. 653; Jordan, 1911, p. 253, t. 40 *f*; Seitz, 1929, p. 560.
Macroglossa glaucoplaga, Hampson, 1900, p. 40, pl. B, fig. 13 (Sikkim).

Imago.—♂♀. No white line above eye; head and thorax with darker mesial vitta, abdomen with two yellow side-patches besides a vestige of a patch on second segment; a double series of dark dorsal spots; tail blackish-brown; side-tufts of posterior segments with deep buff tips, those of proximal segments with white tips. Fore wing with the grey and the brownish-black parts rather sharply contrasting; antemedian lines curved, filled in with brownish-black, this

band dilated basad at hind margin; median interspace grey; first and second discal lines angulate at R^1, concave between R^1 and hind margin, interspace dark except behind, first line generally not prominent behind; grey costal space extended to apex of wing, the subapical rufous patch SC^4–SC^5 being shaded over with grey, grey post-discal line within this area conspicuous; R^1 grey between second and third line, the area behind the grey patch blackish, the grey area limited by the apical triangular half-moon, by the subapical patch SC^5–R^1 and the grey line R^1. Hindwing: yellow band somewhat variable in width, at R^2 barely half the width of the black border; fringe vinaceous-cinnamon. *Underside* of palpus white speckled with black scales; breast greyish wood-brown; wings dark russet, more or less shaded with grey on hind wing; yellow abdominal area of hind wing not very sharply defined distally. *Expanse*: ♂♀ 66 mm.

♂. Tenth tergite somewhat prismatical, truncate at end; sternite rounded at end. Clasper with friction-scales; harpe (fig. 90 Z) very short, obtusely pointed, conical. Process of penis-sheath (fig. 90 Z*z*) dentate at base only, to a varying extent the teeth sometimes extending on to sheath; internal rods obtuse at end.

Hab.—E. Himalayas to China and Japan. Mell has bred the species in S. China, but has no record of the early stages. Food-plant: *Daphniphyllum* Bl., family Euphorbiaceæ, in S. China. Fairly common.

135. **Macroglossum glaucoptera** (Butl.). (Fig. 91 C, D, E, genitalia).

Macroglossa glaucoptera, Butler, 1875, p. 241, pl. xxxvi, fig. 9 (Ceylon); Moore, 1882, p. 28, pl. xci, fig. 2; Hampson, 1892, p. 115.

Macroglossum glaucoptera, Roths. & Jord., 1903, p. 655; Seitz, 1929, p. 560, t. 65 *d*.

Macroglossa lepsha, Butler, 1877 A, p. 635 (Calcutta).

Imago.—♂♀. Similar to small specimens of *M. corythus luteata*. Fore wing deep in tint, dark brown in basal area, the two antemedian lines little darker, filled in with dark brown; median interspace greyish, wider in front than behind, discal lines not prominent, first and second very feebly curved, more or less filled in with dark brown. Hind wing: yellow band narrow, more or less interrupted in ♂, sometimes only vestigial; distal border very broad, broader behind than in *corythus corythus*. *Underside*: basal areas of both wings shaded with yellow, yellow abdominal area of hind wing not sharply limited distally. *Expanse*: ♂♀ 52–54 mm.

♂. Tenth tergite (fig. 91 C) truncate, slightly sinuate, the angles somewhat projecting laterad. Clasper with a few

friction-scales; harpe (fig. 91 D) similar to that of *semifasciata*, much shorter than in *corythus*, extreme tip truncate and notched. Process of penis-sheath (fig. 91 E) very long, dentate at proximal edge, very long teeth on sheath near base of process, besides numerous small ones; internal rods both acuminate.

Hab. CEYLON to Java. Very rare, and early stages unknown.

136. **Macroglossum semifasciata semifasciata** (Hamps.). (Fig. 91 F, G, genitalia).

Macroglossa semifasciata, Hampson, 1892, p. 115 (E. Pegu).
Macroglossum semifasciata, Roths. & Jord., 1903, p. 657; Seitz, 1929, p. 560, t. 65 *d*.
Macroglossum semifasciata semifasciata, Roths. & Jord., 1916, p. 122.

Imago.—♂♀. Yellow side-patches of abdomen very small, vestigial, the black patches prominent, seventh segment with a black mesial patch, anal tuft dark, side-tufts white-tipped. Fore wing with the interspace between the two oblique antemedian lines filled up with black in posterior half, this band narrow, curved basad behind; first and second discal lines not very distinct, interspace not filled up with black. Base of hind wing more extended black than in the allied species, reaching to the third discal line. *Underside*: palpus grey, breast darker, abdomen with ill-defined buffish-grey mesial patches on proximal segments, seventh sternite more or less grey in ♀. *Expanse*: ♂ 65 mm., ♀ 70 mm.

♂. Tenth tergite truncate; sternite rounded at end, carinate above. Clasper with friction-scales; harpe (fig. 91 F) slender, pointed. Process of penis-sheath (fig. 91 G) obtuse, dentate, its base projecting, two rows of teeth at its base; longer internal rod acuminate, not produced into a needle-like process.

Hab. BURMA to Borneo and Java. Rare.

Larva (figured by Piepers, 1897, as *Macroglossa faro* Cram.).—When adult, horn long; head and body blackish-brown dotted with grey; a dark dorsal stripe from segment 2 to base of horn; a pale dorso-lateral stripe on head and anterior segments of body.

137 **Macroglossum aquila** (Boisd.). (Fig. 91 H, I, genitalia).

Macroglossa aquila, Boisduval, 1875, p. 340 (Cochinchine).
Macroglossum aquila, Roths. & Jord., 1903, p. 657; Seitz, 1929, 1929, p. 560, t. 65 *d*.
Macroglossa interrupta, Butler, 1875, p. 242, pl. xxxvii, fig. 2 (Darjiling); Hampson, 1892, p. 119; Dudgeon, 1898, p. 419 (Sikkim).

Imago.—♂♀. Subapical spot SC^5–R^1 of fore wing above as prominent as in *assimilis*, antemedian lines more proximal

than in other species; costal edge of hind wing dilated into a lobe before middle. *Expanse*: ♂♀ 49–54 mm.

♂. Tenth tergite gradually narrowed, apex obtuse, slightly curved downwards; sternite rounded at end. Clasper with friction-scales; harpe (fig. 91 H) short, stout, upperside excavated and edges dentate, looking like a tooth-brush in a side-view. Process of penis-sheath (fig. 91 I) slender, denticulate at proximal edge and at the rather obtuse tip, a large patch of teeth at and near its base on the sheath.

Hab. E. HIMALAYAS to the Philippines. Rather rare, and early stages unknown.

138. **Macroglossum sylvia** (Boisd.). (Fig. 91 J, genitalia).

Macroglossa sylvia, Boisduval, 1875, p. 350 (partim; Celebes).
Macroglossum sylvia, Roths. & Jord., 1903, p. 658; Seitz, 1929, p. 560, t. 64 *f*.
Macroglossa proxima, Hampson (non Butl.), 1892, p. 114.
Macroglossa obscura, Butler, 1875, p. 5, pl. i, fig. 2 (Java); Swinhoe, 1890, p. 162 (Upper Tenasserim).

Imago.—♂♀. Close to *corythus luteata* in colour. Three small pale yellow side-spots on abdomen, the first reduced to a transverse line, the second smaller than the dark brown patch at its basal side, the third again more or less linear. *Underside* of abdomen with the seventh segment grey, proximal segments with grey mesial patches; side-tufts tipped with white, last two often somewhat ochraceous. Yellow area of hind wing reduced, not extending so close to distal margin as in most specimens of *corythus*, more sharply defined distally. *Expanse*: ♂ 60 mm., ♀ 66 mm.

♂. Harpe very short, hooked at end, obtuse, apical part denticulate. Process of penis-sheath (fig. 91 J) shorter than in *corythus*, obtuse, dentate at proximal and distal edges; teeth on sheath at base of process very numerous, extending far proximad, sometimes arranged in two long rows; rods within sheath both obtuse.

Hab. E. HIMALAYAS and CEYLON to Formosa. Rather rare, and early stages unknown.

139 *a*. **Macroglossum corythus corythus** (Walk.).

Macroglossa corythus, Walker, 1856, p. 92 (partim; Ceylon; (S. India).
Macroglossum corythus corythus, Roths. & Jord., 1903, p. 661; Seitz, 1929, p. 561.
Macroglossa proxima, Butler, 1875, p. 4, pl. i, fig. 1 (Canara; Ceylon); Moore, 1882, p. 29, figs. 1, 1*a*, 1 *b* (l., p., i.); Hampson, 1892, p. 114 (partim).

Imago.—♂♀. Abdomen paler below than in *luteata*, the anal tuft more often extended tawny, the side-tuft of the

third segment buff, only with the extreme tip white. *Expanse*. ♂♀ 50–66 mm.

Genitalia as in *luteata*.

Hab. S. INDIA and CEYLON. Rather rare, and early stages unknown.

139 *b*. **Macroglossum corythus luteata** (Butl.). (Fig. 91 K, L, genitalia).

Macroglossa luteata, Butler, 1875, p. 241, pl. xxxvii, fig. 5 (Sylhet); Moore, 1878, p. 844 (Upper Tenasserim); id., 1884, p. 234 (Cachar); Swinhoe, 1890, p. 162 (Tenasserim).

Macroglossum corythus luteata, Roths. & Jord., 1903, p. 661; Mell, 1922, p. 269, pl. ix, fig. 13 (larva), pl. xviii, figs. 28, 29 (pupa); Seitz, 1929, p. 561, t. 65 *e*.

Macroglossa proxima, Butler, 1877 A, p. 526 (partim); id., 1877 B, p. 815 (Formosa): Swinhoe, 1890, p. 162 (Moulmein); Hampson, 1892, p. 114; Dudgeon, 1898, p. 417 (Sikkim; Bhutan up to 2,000 ft.).

Imago.—♂♀. Sexually and individually variable in the amount of yellow on body and wings. Head and thorax with a distinctly darker mesial line in fresh specimens; abdomen with three yellow side-patches, variable in size, separate from each other, the first always transverse; anal tuft black, or tawny only at tip. Fore wing with the antemedian lines straight, basal area darker than the greyish median interspace, not so dark as in *passalus*; first and second discal lines rather far apart, very slightly curved; third line vestigial, a grey submarginal space from R^1 backwards, often blue in side-light, separated from or almost joined to a small discal costal space of the same colour; no distinctly marked dark subapical spots. Hind wing: median band deep chrome, base and distal margin black, inner edge of distal border covered by yellow hairs and scales, median veins more or less black, the yellow band often interrupted, especially in ♂♂. *Underside* of abdomen inclusive of tail dull chestnut-hazel, or deeper brown, side-tuft of third segment white; wings variable, abdominal area of hind wing yellow. *Expanse*: ♂♀ 50–66 mm.

♂. Tenth tergite truncate or rounded at end; sternite long, sole-shaped, rounded and incrassate at end, upperside transversely carinate, somewhat raised in mesial line. Clasper *with* friction-scales; harpe (fig. 91 K) long and pointed, reaching nearly to end of clasper, differing obviously from that of all other species of *Macroglossum*. Penis-sheath (fig. 91 L) with two internal rods, one produced into an acute point, the other obtuse; dentate process somewhat variable in length and armature, tip and apical part of distal edge always dentate, proximal edge dentate from base to apex, a number of teeth on sheath near base of process.

Hab. E. HIMALAYAS, S. INDIA and the ANDAMAN ISLANDS to China, Malaya and the Philippines. We have bred the

subspecies in the Khasi Hills and the Kanara District. In the Kanara District it is not uncommon near the sea-shore, and in the Khasi Hills at an elevation of about 5,000 feet, in forest areas of heavy rainfall in both localities.

Egg.—Indistinguishable from that of *M. belis.*

Larva :—

Final instar. Head round, surface dull, covered with small, sparse, rounded tubercles. Body dull, the same shape as that of *belis*, but horn longer, tapering evenly to a fine rounded point bearing two setæ, the whole strongly up-curved, or basal half up-curved, distal half down-curved ; closely tuberculate. Segment 2 with a moderately shining saddle-shaped marking covered closely with large tubercles ; anal flap covered sparsely with minute shining tubercles ; rest of body smooth.

Colour individually variable. In one form the head is fuscous-chocolate, vertex and face slightly paler ; labrum glassy-greenish ; ligula opaque greenish, front edge narrowly white ; basal segment of antenna red, other segments ochreous-red ; mandible whitish, tip narrowly black. Body fuscous-chocolate with a slight violet bloom, segments 3 to 11 with transverse rows of whitish dots along the secondary rings ; tubercles on saddle of 2 and anal flap ochreous-brown ; a dorsal stripe, narrow and black on 2, broader, obscure, purplish-green on remaining segments to base of horn ; a narrow, whitish dorso-lateral stripe from 3 to base of horn, clearly defined, but with irregular edges on 3, 4, 11 and 12, suffused with pinkish rust-colour, more or less obsolescent on median segments, often replaced there by an orange shade ; below this stripe a fuscous stripe on which white dots appear clearly on the median secondary rings ; a narrow orange supra-spiracular and a similar subspiracular stripe, these two stripes joined in the middle of each segment by an orange band, the spiracle lying in the middle of this band ; on segments 7 to 11 oblique stripes in the form of triangular, enamel-white patches, filling in the angle formed by the hind margin of each segment and the subspiracular stripe. Horn pale brown, the sides of base whitish, the tubercles black ; legs with basal segment shining black, other segments flesh-colour ; proleg with basal half of shank shining black, distal half shining ochreous, ankles purplish, feet pinkish-grey ; clasper with anterior edge shining black ; venter fuscous-black. Spiracles elongate-oval, central part black bordered with pale brown, the whole with a narrow, shining, pale brown rim.

Another form of the larva is nearly jet-black, the dorsum black, violet, ochreous or rusty ; the dorso-lateral stripe obsolescent except on 2 and 12 ; the patches round the spiracles very bright orange, the supra-spiracular stripe broad and the same colour ; the oblique stripes narrow and occurring on all the body-segments from 2 to 11, or wanting on the anterior

segments. In some individuals the spiracular patches are wanting. In all these varieties the legs and prolegs are as in the form first described. Length 70 mm.; breadth 10 mm.

Pupa.—Tongue-sheath well developed; tip of tongue spatulate; antenna equal to fore leg; a short, narrow coxal piece. Surface slightly shining; head and wing-case smooth, edge of tongue-sheath longitudinally grooved; thorax obscurely corrugate; abdomen more strongly corrugate and also marked with small pits; hind bevels of segments 8 to 10 with a row of small pits along their front margins; front bevel of 9 with a wide channel set with minute tubercles along its front margin, the rest of its surface set with prominent oval tubercles decreasing in size from the channel to the hind margin of the bevel. Spiracle of 2 a narrow slit, the hind margin of 2 shallowly emarginate and slightly raised in front of it, a narrow transverse oblong lobe projecting from the front margin of 3 behind it, the front edge of lobe prominently raised, the hind edge deeply depressed; other spiracles oval, the surface rising gradually to a smaller convex oval containing the central slit, which has narrow, raised edges. Cremaster large, triangular, broadly truncate, a minute tooth at each lateral angle of the truncation; upper surface smooth and shining, basal two-thirds convex, distal third flat, lower surface hollowed, basal one-quarter broadly keeled, and with lateral extensor-ridges nearly meeting basad. Colour bone-colour; a black dorsal stripe on frons and on thorax, median line of tongue-sheath fuscous ventrally; tongue-sheath, wing-case, legs, antenna and tongue marked with leaden-grey, transverse lines and bands; dorsum of abdomen with a russet tinge; an obscure dark dorsal stripe; broad, broken, fuscous, lateral, ventral and ventro-lateral stripes; spiracles black; abdominal pitting and cremaster russet. Length 44 mm.; breadth 11 mm.; cremaster 3 mm.

Habits.—Food-plants: *Morinda citrifolia* Linn. var. *bracteata* Hook, in S. India, and *Pæderia fœtida* Linn., in the Khasi Hills., family Rubiaceæ; and also *Strychnos nuxvomica* Linn., family Loganiaceæ, in S. India. The larva, when alarmed, throws back the head and anterior segments over the dorsum, and ejects green fluid from the mouth.

140. **Macroglossum hemichroma** (Butl.). (Fig. 91 M, N, genitalia).

Macroglossa hemichroma, Butler, 1875, p. 243, pl. xxxvii, fig. 1 (Sylhet); Hampson, 1892, p. 118.
Macroglossum hemichroma, Roths. & Jord., 1903, p. 664; Seitz, 1929, p. 561, t. 65 *e*.

Imago.—♂♀. Fore wing sharply divided into a pale basal

and a darker distal area, the line of separation running straight across the wing, beginning at costal margin just proximally of upper angle of cell and reaching hind margin several millimetres proximally of angle ; antemedian and discal lines vestigial, the former curved, the latter almost straight, little curved costad in front. Head and thorax with a dark mesial line. *Expanse* : ♀ 70 mm. (one example).

♂. Tenth tergite slightly dilated at end, truncate, angles rounded ; sternite incrassate at end, apical edge curving upwards, mesially acuminate, upperside transversely carinate, mesial line elevate. Clasper with friction-scales ; harpe (fig. 91 M) ending in a very short triangular pointed process. Process of penis-sheath (fig. 91 N) long and slender, directed proximad, lying close along the sheath, not denticulate, armed with a single long basal tooth which projects distad ; internal rods rounded at end, longer one dilated into a kind of tooth.

Hab. E. HIMALAYAS to Java and the Philippines. Rare, and early stages unknown.

141. **Macroglossum passalus rectifascia** (Feld.). (Fig. 91 O, P, genitalia).

Rhamphoschisma rectifascia, Felder, 1874, t. 75, fig. 7 (Ceylon).
Macroglossa rectifascia, Butler, 1877 A, p. 528 ; Moore, 1882, p. 27, pl. xc, fig. 2 ; Hampson, 1891, p. 1 (Nilgiris, 6,000 ft.) ; id., 1892, p. 118 ; id., 1893, p. 4 (Ceylon).
Macroglossum passalus rectifascia, Roths. & Jord., 1903, p. 665 ; Seitz, 1929, p. 561, t. 65 *e*.

Imago.—♂♀. Head and thorax mouse-grey, a dark mesial stripe and posterior half of mesothoracic tegula dark slate-colour, edge of tegula and metanotum russet, greenish in certain lights ; yellow side-spot of second abdominal segment small, of third and fourth larger, with conspicuous black spots at the proximal side, sixth tergite almost black, seventh with conspicuous black mesial patch, proximal side-tufts with white tips, those of sixth and seventh segments tipped with yellow or tawny. Fore wing : basal area up to first antemedian line rather darker than head, interspace between the slightly curved first and the straight second antemedian lines filled in with black, the two lines as such just vestigial ; median interspace more or less russet, palest at antemedian band ; first discal line thin, more or less vestigial, second heavier, both curved costad in front, with the upper part of the interspace filled in with brown, often a vestige of another line between the two ; second line joined behind R^1 to subapical spot SC^5–R^1 and apical half-moon, a broadish black cloud from R^1 towards outer margin near angle. Yellow band of hind wing concave distally, the black border of wing almost evenly

convex. *Underside* of abdomen chestnut-hazel, side of breast and legs nearly the same, middle of breast and anterior tarsus clayish-buff. Wings cinnamon-rufous, abdominal area of hind wing more or less yellow. *Expanse* : ♂♀ 52–62 mm.

♂. Tenth tergite convex at end, obtuse ; sternite rounded at end. Clasper with friction-scales ; harpe (fig. 91 O) slender, gradually and slightly curving upwards, obtuse, feebly denticulate at end. Process of penis-sheath (fig. 91 P) relatively short, obtuse, multidentate at end, teeth at base long.

Hab. S. India and Ceylon. W H. Campbell has bred the species in the Nilgiris.

Larva.—Head dull green ; body pale yellow with faint blue transverse lines ; dorsal stripe dark blue edged with pale blue from segments 4 to 14 ; a similar coloured lateral stripe arising from two large black spots on 3 and ending just in front of two large black spots on 14 ; a broad dorso-lateral stripe, black spotted with pale blue ; horn pale blue with a black ring at base ; legs black ; claspers spotted with black (*W H. Campbell*).

Habits.—Food-plant : *Photinia lindleyana* W & Arn., family Rosaceæ.

142. **Macroglossum faro** (Cram.). (Fig. 91 Q, R, genitalia).

Sphinx faro, Cramer, 1780, p. 165, pl. cclxxxv, fig. C (Coromandel).
Macroglossum faro, Roths. & Jord., 1903, p. 665, pl. iv, fig. 14 (♂) ; Seitz, 1929, p. 561, t. 64 *f*.

Imago.—♂♀. The largest *Macroglossum* known. Resembling *passalus rectifascia* in the dark base of fore wing, prominent straight antemedian band, vinaceous-grey median area, feeble first discal line, and in the dark band-like shade extending from apex of fore wing to R^2 and then curving distad, ending at distal margin before angle. It differs from *passalus rectifascia* in the yellow abdominal side-patches being comparatively smaller, in the abdominal sternites, at least the proximal ones, bearing large pale mesial patches, in the antemedian lines of the fore wing being more distinctly separate from one another, the second discal line being much thinner, the interspace between the first and second discal lines not being filled in with black anteriorly, and the black curved submarginal shade being more distinctly band-like. In addition, the *underside* is deeper brown, base of hind wing obviously shaded with yellow, and upperside of thorax (sometimes also first abdominal tergites) green without a darker sharply defined area on the tegula. *Expanse* : ♂♀ 74–78 mm.

♂. Genital armature similar to that of *p. rectifascia*, but the harpe (fig. 91 Q) longer, with the tip more strongly recurved

and more obviously denticulate; process of penis-sheath (fig. 91 R) longer, more acute, with the patch of teeth at end near its base as in *p. rectifascia*, but the teeth smaller and the underside of process densely denticulate.

Hab. S. INDIA to Malaya and the Loo Choo Islands. Rare, and early stages unknown.

143. **Macroglossum mitchelli imperator** (Butl.). (Fig. 91 S, T, genitalia).

Macroglossa imperator, Butler, 1875, p. 243, pl. xxxvii, fig. 4 (Ceylon); Hampson, 1892, p. 118.
Rhamphoschisma imperator, Moore, 1882, p. 27, pl. xc, fig. 1; Hampson, 1891, p. 1 (Nilgiris, 6,000 ft.); id., 1892, p. 118; Dudgeon, 1898, p. 418 (Sikkim, 5,000 ft.).
Macroglossum mitchelli imperator, Roths. & Jord., 1903, p. 667 Seitz, 1929, p. 562, t. 65*f*.

Imago.—♂♀. Easily recognized by the head and thorax being marked with a very dark broad median stripe which divides the pinkish-grey surface into two stripes. Black discal band of fore wing triangularly dilated behind R^1, joining the subapical and apical black spots. Median band of hind wing deep yellow, at R^3 about as wide as the marginal border. *Expanse*: ♂♀ 70–74 mm.

♂. Tenth tergite truncate-sinuate, angle rounded; sternite incrassate at the rounded apex. Clasper with friction-scales; harpe (fig. 91 S) similar to that of *fringilla*, obtuse, somewhat curved upwards at end, not dentate. Process of penis-sheath (fig. 91 T) nearly as in *fringilla*, more curved proximad, thin apical part not quite so long.

Hab. E. HIMALAYAS, S. INDIA and CEYLON. Rare, and early stages unknown.

Genus **RHOPALOPSYCHE** Butler.

Butler, 1875, p. 239; Roths. & Jord., 1903, p. 670; id., 1907, p. 122; Jordan, 1911, p. 254.

Genotype: *nycteris* (Koll.).

Imago.—♂♀. Macroglossine in appearance. "Antenna very thin at base, strongly clubbed, proximal segments scaled also ventrally, no prolonged cilia in either sex, the antenna of ♂ being like those of ♀, only longer and rather more strongly clubbed" (Roths. & Jord., 1903, p. 670).

Larva and *pupa* closely resembling those of the genus *Macroglossum*.

Hab. INDIA and China. One Indian species.

Key to Subspecies.

Imagines.

Abdominal side-patches and band of hind wing maize-yellow . . . . . [p. 394. *R. n. nycteris* (Koll.),

Abdominal side-patches and band of hind wing deep chrome [p. 396. *R. n. bifasciata* Butl.,

The larvæ and pupæ of both forms resemble each other so closely that we are unable to construct a key.

144 *a*. **Rhopalopsyche nycteris nycteris** (Koll.). (Pl. X, figs. 12, 13, larva ; Pl. XII, fig. 3, imago).

Macroglossa nycteris, Kollar, 1848, p. 458, pl. xix, fig. 5 (Kashmir).
Rhopalopsyche nycteris, Butler, 1877 A, p. 523 (Sylhet ; N. India) ; id., 1886, p. 378 (Murree ; Campbellpore) ; Cotes & Swinhoe, 1887, p. 2 (Sikkim ; Khasi Hills ; Shillong ; Kulu) ; Swinhoe, 1892, p. 2 (Sylhet) ; Hampson, 1892, p. 111, fig. 66 (♂) ; Dudgeon, 1898, p. 417 (Sikkim ; Bhutan, 5,000–10,000 ft.) ; Roths. & Jord., 1903, p. 670.
Rhopalopsyche nycteris nycteris, Jordan, 1911, p. 254, t. 40*f* ; Seitz, 1929, p. 562.
Macroglossa volucris, Walker, 1856, p. 94 (Sylhet ; N. India).

Imago.—♂♀. Head, thorax and abdomen greyish-brown, abdomen with maize-yellow side-patches on the first three segments ; the penultimate segment fringed with white ; four lateral tufts increasing in size posteriorly, the first two white, the others black tipped with orange, anal tufts black. Fore wing greyish-brown ; some subbasal indistinct lines, an antemedian band recurved towards base at inner margin ; three postmedian curved lines ; a square brown spot on costa before apex with a black spot below it from which a waved, oblique line runs to apex. Hind wing blackish-brown with a broad, median, maize-yellow band. *Expanse* : ♂ 38–42 mm., ♀ 40–48 mm.

♂. Tenth abdominal tergite slender, pointed, of the same general form as in *Macroglossum* ; sternite rounded at end. Clasper without friction-scales ; harpe slender, pointed, somewhat grooved longitudinally on upperside. Penis-sheath with a very long pointed process, curving at least half round the sheath ; base of process projecting, with few teeth, proximal and distal edges of process denticulate ; internal rods obtuse at end, the longer one clubbed, denticulate at one edge.

Hab. W and E. Himalayas, Burma and China. We have bred it in the W Himalayas and the Khasi Hills. Very common wherever the food-plant grows, from about 3,000 to 6,000 feet or higher.

Egg.—Nearly spherical, surface smooth and shining, colour bright green.

Larva :—

1*st instar*. Head round, body short and cylindrical, horn very short, nearly cylindrical, a long bristle on each point of the bifid tip ; head and segments 2, 3 and 14 covered with bristle-like hairs, median segments with four lines of similar hairs on each side of the dorsal line—one subdorsal, one dorso-lateral, one supra- and one subspiracular ; colour greyish-green, the hairs and dots from which they rise black ; horn black. 2*nd instar*. Head, body and horn covered thickly with short hairs, finer than those of the 1st instar ; head and body green ; a whitish dorso-lateral stripe from segment 2 to base of horn ; horn and hairs black. 3*rd instar*. Horn of medium length ; hairs short except on head, horn and anal segments ; head and segments 2 and 3 apple-green, rest of body dark bluish-green dotted with white ; dorso-lateral stripe bluish ; horn dark purple, paler at base. 4*th instar*. Similar to 3rd instar, body still covered with very fine hairs ; stripe yellow on segments 2 to 7.

5*th instar*. Head round ; true clypeus with apex acute, less than half length of head ; false clypeus vestigial ; labrum one-third length of clypeus and one-quarter as broad as clypeus ; ligula kidney-shaped, as long as labrum and as broad as clypeus ; cutting-edge of mandible not toothed ; eyes with 3, 4 and 6 in a straight line, the line joining 1 and 2 at an angle of 120° with the line joining 3, 4 and 6 ; 1 and 2 and 3 and 4 one eye-diameter apart, 2 and 3 less than one diameter, 6 nearly three diameters from 4, 5 about three diameters from 4 and rather less from 6 ; surface of head dull, set sparsely with minute, shining tubercles. Body dull, macroglossine in shape ; horn of medium length, tip conical ; segment 2 with a broad saddle-shaped marking covered with small tubercles ; a transverse row of minute tubercles along each secondary ring, one tubercle of each row, on the dorso-lateral stripe, larger than the rest, these larger tubercles most prominent on segments 3 and 4, hardly noticeable on the other segments ; horn covered with large, conical tubercles directed distad ; anal flap and clasper faces covered with small tubercles.

Coloration.—Green form (Pl. X, fig. 12) : head green, with a pale stripe separating face from cheek ; labrum and ligula green ; basal segments of antenna green, end-segment rusty ; mandible green, tip narrowly dark reddish-brown. Body green, the tubercles white ; a dark green dorsal stripe from segment 2 to base of horn, bordered on each side by paler green ; the dorso-lateral stripe yellow on the anterior segments, white to base of horn ; subspiracular region tinged with yellow. Horn purple, tip yellow, tubercles black ; legs reddish ; prolegs reddish with a black band on the shank ; anal flap edged with yellow. Spiracles oval, flush with a narrow rim, reddish in colour.

In the dark-coloured form (Pl. X, fig. 13) head pale brown with a darker stripe separating face from cheek; body-colour dark purple with markings as in the green form. Length 40 mm.; breadth 7 mm.; horn 6 mm.

Pupa.—Macroglossine in shape, abdomen less flattened dorsally; tongue-sheath fairly prominent; antenna slightly longer than fore leg; no coxal piece. Surface moderately shining; head and wing-case smooth; thorax minutely shagreened; abdomen more coarsely shagreened and pitted laterally towards hind margins of segments; front bevel of segment 9 with a wide deep channel at its front margin, and the rest of bevel covered with narrow, short ridges. Spiracle of 2 indicated by a narrow oval depression almost covered by a small transverse oblong lobe projecting from the front margin of 3; other spiracles oval, flush, edges of central slit raised. Cremaster elongate-triangular, ending in a simple point, flattened dorsally and ventrally, surface shining, dorsum finely rugose, venter finely longitudinally striate, tip smooth. Colour ochreous; frons black; tongue-sheath suffused with brown; tongue black; a narrow brown dorsal stripe on thorax; tibiæ of both legs brown; wing-case suffused with brown; inner margin of wing black; hind margins of segments 5 to 7 narrowly black; hind bevels of 8 to 10 broadly brown; spiracles black lying on small black patches; cremaster black. Length 29 mm.; breadth 7 mm.; cremaster 1·5 mm.

Habits.—Food-plants: *Galium* Linn. and *Rubia cordifolia* Linn., family Rubiaceæ. Habits macroglossine.

144 *b*. **Rhopalopsyche nycteris bifasciata** Butl.

Rhopalopsyche bifasciata, Butler, 1875, p. 239, pl. xxxvi, fig. 4 (S. India); Hampson, 1891, p. 1 (Nilgiris, 6,000–7,000 ft.); id., 1892, p. 112; Roths. & Jord., 1903, p. 670.
Rhopalopsyche nycteris bifasciata, Seitz, 1929, p. 562, t. 65 *f*.

Imago.—♂♀. Head, thorax and abdomen greyish-brown; abdomen with deep chrome side-patches on the first three segments; penultimate segment fringed with white; four lateral tufts, increasing in size posteriorly, the first two white, the others black tipped with white; anal tufts black. Fore wing greyish-brown; some indistinct basal lines; a dark antemedian band (darker than in *n. nycteris*) recurved towards base at inner margin; three postmedian curved lines, the first two filled in with dark colour to form a band (not so in *n. nycteris*); a square brown spot on costa before apex, with a black spot below it from which a waved oblique line runs to apex. Hind wing blackish-brown, with a broad, median, deep chrome band extending nearly to base. *Expanse*: ♂ 38–40 mm., ♀ 38–44 mm.

Hab. S. INDIA and CEYLON. We have bred this subspecies in one locality in S. India, at an elevation of about 4,000 feet on an isolated hill. The larva and pupa closely resembled those of *n. nycteris*, and separate descriptions were not made.

Habits.—Similar to those of *nycteris*. Food-plant : *Rubia cordifolia* Linn., family Rubiaceæ.

Subfamily CHŒROCAMPINÆ Butler.

Butler, 1877 A, p. 516, 544 ; Roths. & Jord., 1903, p. 672 ; id., 1907, p. 122.

Imago.—" ♂♀. Pilifer consisting of an apical part bearing short (or vestigial) bristles and a proximal part bearing long ones. Genal process short, not much projecting. Inner surface of second segment of palpus more or less naked. End-segment of antenna elongate, but not filiform, with six or more very long bristles " (Roths. & Jord., 1903, p. 672).

The pilifer does not vary much within the subfamily, while the palpus exhibits various modifications in structure which are of generic value. Antennæ more or less clubbed, especially in the ♀♀, with an abrupt hook, or setiform with a slender gradual hook ; end-segment never very short, shortest in *Celerio*. They are always different in the sexes ; they are never dentate or pectinate. Eye lashed or not. Tongue always functional, never much reduced, often twice the length of the body.

Abdomen conical in all forms, generally long and ending in a simple pointed tuft with a rudimentary tuft on each side ; spines multiseriate ; seventh sternite without spines, obtusely triangular, membranaceous at end. Sexual armature simple ; friction-scales always present, generally large and few in number. Scent-organ of fore coxa more or less distinct. Tibiæ never spinose. Mid-tibial spurs unequal in length (except in *Cechenena*), the outer one the shorter. Hind tibia always with two pairs of spurs. Paronychium always with two pairs of lobes, but pulvillus without pad in some species (*Celerio euphorbiæ*, etc.).

The moths are mostly large or of medium size ; fore wing brownish or green, with one or more lines running from about the middle of the inner margin to the apex ; hind wing dusky or red with dark base.

Egg.—Broadly ovoid or nearly spherical, surface smooth and shining, colour green or yellowish.

Larva.—Head small and round or semi-elliptical, body tapering more or less sharply from segment 5 frontad, and slightly backwards ; horn very variable in length and shape. Surface usually smooth and dull, but sometimes shining

(*Rhagastis albomarginatus*), and the horn sometimes covered with minute tubercles. Colour green, brown or black; dorso-lateral ocelli always present, either on segment 5, or on 5 and 6, or on 5 to 11; more rarely on 3 or 4 to 12; usually a dorso-lateral stripe and often oblique stripes.

Pupa.—Tongue reaching tip of wing-case or just beyond tip, basal part often contained in a sheath projecting from the front of the head; in *Rhyncholaba acteus* tongue in a free sheath; coxal piece always present. Surface usually dull and smooth; no sculpturing on segment 4; ante-spiracular ridges not well developed. Spiracle of segment 2 often at the bottom of a funnel-shaped depression. Cremaster variable, often with hooks, and in many species of *Theretra* and in *Rhyncholaba*, *Rhagastis* and *Cechenena* there is a funnel-shaped depression under the base of the cremaster running axially into segment 14. Colour variable, but never uniform black or brown.

Habits.—The food-plants belong to many families, and are usually herbaceous, large trees being seldom selected. Several species feed on vines and arums. Eggs laid on both sides of the leaf, but usually on the underside, or on a twig or bract. The larvæ rest with the head and anterior segments contracted. When alarmed the anterior segments are still further contracted into segment 5, which is much swollen. The colour becomes darker before pupation, which takes place in a rough cocoon on the surface of the ground. The moths rest with the wings held horizontal, the costal margins at an angle of about 45° to each other, the inner margins nearly parallel and most of the abdomen exposed. They all feed at flowers, usually at dusk and later, in some cases before dusk, and many species are attracted by light.

Hab. Cosmopolitan, seven Indian genera.

Key to the Genera.

Imagines.

1.	Base of tongue exposed; second segments of palpi not contiguous . .	2.
	Base of tongue not exposed; second segments of palpi contiguous . . .	3.
2.	Second segment of palpus obviously narrower in side-view than first, more or less narrowing apically; inner surface naked . .	[Jord., p. 481. CECHENENA Roths. &
	Second segment of palpus not narrower than first, not narrowing towards end . .	[Jord., p. 465. RHAGASTIS Roths. &
3.	Scaling at apex of first segment of palpus, on inner side, dense and regular . . .	4.
	Scaling at apex of first segment of palpus, on inner side, not dense, irregular	6.

4. Second segment of palpus, on inner side, with apical tuft of scales directed proximad and ventrad — 5.
   No such tuft. .. .. — [p. 413. HIPPOTION Hübn.,
5. Scaling of first segment of palpus, on outer side, longest just below the apical cavity. — [& Jord., p. 461. RHYNCHOLABA Roths.
   Scaling longest proximally. .... — [p. 427. THERETRA Hübn.,
6. Palpus rough, with long dispersed hairs — PERGESA Walk., p. 409.
   Palpus without these hairs, or with very few — CELERIO Oken, p. 400.

Larvæ.

1. Horn straight, dorso-lateral ocelli on 5, 5 and 6, or 5 to 11 — [p. 414. HIPPOTION Hübn.,
   Horn down-curved ... — 2.
   Horn down-curved or straight — 4.
2. Ocellus on 5 only. ... . — 3.
   Large oval ocellus on 5 followed by small oval oblique ocelli on 6 to 11; horn short .. .. — [& Jord., p. 463. RHYNCHOLABA Roths.
   Ocelli on 5 and 6, pupils kidney-shaped, lying on oval black patches . .. . — PERGESA Walk., p. 410.
   Blind ocelli on 3 to 12 (sometimes replaced by a dorso-lateral stripe in *C. lineata livornica*) . . . . . — CELERIO Oken, p. 401.
3. Round subdorsal spots on 6 to 11; dorso-lateral stripe from 2 to base of horn zig-zag or waved across each segment . — [Jord., p. 482. CECHENENA Roths. &
   No subdorsal spots; dorso-lateral stripe not as above (curved slightly upwards on each segment in *confusa*) .. ... — [Jord., p. 466. RHAGASTIS Roths. &
4. Number of ocelli variable; *if ocellus on 5 only*, pupil with a pale stripe across middle (*c. clotho*; *gnoma*); or pupil black in front, red behind (*latreillei lucasi*); or pupil velvety black edged narrowly with dark ochreous and then with black (*castanea*); *if ocelli on* 5 *and* 6, horn down-curved (*nessus*); *if ocelli on* 5 *to* 11, horn down-curved (*a. alecto*; *suffusa*; *lycetus*; *pallicosta*), or if horn straight then ocelli on 5 and 6 alike, and different from those on 7 to 11 (*o. oldenlandiæ*); or ocelli increasing in size from 5 to 9, then decreasing (*p. pinastrina*). — [p. 428. THERETRA Hübn.,

Pupæ.

1. Tongue in a free sheath. .. — RHYNCHOLABA Roths.
   Tongue not in a free sheath . .. — 2. [& Jord., p. 464.
2. Base of tongue in a hollow sheath projecting more or less frontad and ventrad from front of head .... — 3.
   Base of tongue not in a hollow sheath. — 5.
3. Edge of sheath the narrowest part... .. — 4.
   Edge of sheath flattened and wider than the sides — [Jord., p. 482. CECHENENA Roths. &

4. Cremaster without spines or hooks except at tip, or without any at all	THERETRA Hübn., [p. 428.] HIPPOTION Hübn., [p. 414.]
Cremaster with spines or hooks in addition to those at tip ..	RHAGASTIS Roths. & Jord., [p. 466.] (Fabr.), p. 417. *Hippotion velox*
5. A belt of spines along front edge of segments 9 to 11 . ..	PERGESA Walk., p. 410.
No such belts of spines.	CELERIO Oken, p. 401.

Genus **CELERIO** Oken. (Fig. 101).

Oken, 1815, p. 761 ; Roths. & Jord., 1903, p. 713 ; id., 1907, p. 127 ; Jordan, 1911, p. 254.

Genotype : *gallii* (Rott.).

Imago.—Medium-sized moths, brown with whitish markings, hind wing red. " ♂♀. First segment of palpus on inner surface without regular dense scaling at apex, second segment without



Fig. 101.—*Celerio* Oken. Genitalia.
A, *C. euphorbiæ euphorbiæ* Linn., harpe ; B, penis-sheath.

apical tuft of long scales on inner side. Eye lashed. Antenna incrassate distally, club-shaped in ♀. Abdominal spines rather strong, especially on tergites, in three sizes, with some intermediate ones, generally triseriate, never uniseriate, much fewer in number than in *Pergesa*. External spines of fore tarsus more or less prolonged, always longer than the respective spines on the inner side of the tarsus ; comb of mid- and hind tarsus vestigial, the spines not being much prolonged ; first segment of hind tarsus shorter than the tibia, about twice the length of the long tibial spur, this more than twice the length of the short spur ; pulvillus present or vestigial. Distal margin of wings entire ; SC^2 and R^1 of hind wing separate or from a point, occasionally shortly stalked ; R^2 central, or a little before centre ; D^3 longer than D^4.

" ♂. Sexual armature nearly the same in all species. Tenth tergite simple, narrowing apically, convex above, feebly curved at end, almost straight in side-view, tip rounded or truncate, sometimes feebly emarginate ; sternite broader than tergite, boat-shaped, being prismatically compressed, apex

rounded or obtusely acuminate. Clasper broadly sole-shaped; friction-scales numerous and in most species small; harpe (fig. 101 A) ending in a thin, more or less curved, simple, tapering process. Penis-sheath (fig. 101 B): dorsal apical edge incrassate, dentate, produced at the left side into a short process; the length of the brim-like incrassation, as well as the dentition, slightly different in the various species.

" ♀. Eighth tergite sinuate mesially. Vaginal plate obtusely triangular, without special armature; orifice large, mesial " (Roths. & Jord., 1903).

Egg.—Nearly spherical, surface shining, colour green.

Larva.—Tapering from segment 5 frontad, but not so sharply as in other genera of the subfamily; horn of medium length, down-curved. Surface dull and smooth; horn shining and tuberculate. Colour green or blackish, with a series of blind dorso-lateral ocelli on segments 2 or 3 to 12 or a dorso-lateral stripe on the same segments.

Pupa.—Base of tongue feebly prominent in most species, more prominent in *lineata*, not keeled. Antenna and fore leg reaching to about one-half length of wing-case; a long narrow coxal piece. Surface moderately shining, wrinkled and pitted. Cremaster triangular, ending in a cylindrical, shortly bifid shaft. Colour brownish or yellowish with darker markings.

Habits.—The food-plants belong to the families Euphorbiaceæ, Rubiaceæ and Onagraceæ. The eggs are sometimes laid in small batches, and the larvæ are then gregarious. They eject fluid from the mouth when alarmed. The larvæ become darker before pupation, which takes place in a rough cocoon on the surface. The moths rest with the wings held sloping slightly downwards, and do not usually appear on the wing till dusk.

Hab. Cosmopolitan; absent from Malaya and Papuasia, but reappearing in Australia. Five Indian subspecies.

Key to the Species.

Imagines.

1. Pulvillus present . . . . . 2.
   Pulvillus vestigial, represented by a small process or flap . . . . . 4.
2. Fore wing: median band pale yellow, sharply defined; veins traversing brown post-discal band pale [(Esp.), p. 408. *C. lineata livornica*
   Veins not pale . . . . . 3.
3. Costal area of fore wing brown from base to apex, sharply defined; hind wing yellow, with a red patch behind middle . . . . [p. 407. *C. gallii gallii* (Rott.),
   Costal area of fore wing pale, with a large dark patch beyond apex of cell; a sharply defined broad basal band . . . . . [(Walk.), p. 408. *C. nicæa lathyrus*

4. Costal area of fore wing clay-colour from base to near apex, shaded with black behind; veins traversing brown post-discal band white . ... [p. 404. [Roths. & Jord., *C. euphorbiæ nervosa*

Costal area pale pink speckled with black, base and an ovate spot beyond cell dark brown [(Butl.), p. 402. *C. euphorbiæ robertsi*

Larvæ.

1. Horn black . 2.
Horn not black . . 4.
2. Subdorsal spots red or yellow .. .. .. 3. [p. 405.
3. Head black, body black spotted with yellow; subdorsal spots yellow. . [Roths. & Jord., *C. euphorbiæ nervosa*

Head pale, with a black spot on vertex of each lobe; body grey or leather-colour; subdorsal spots red or yellow [(Walk.), p. 408. *C. nicæa lathyrus*

4. Horn red with black tip; subdorsal spots enamel-white; head and saddle-mark on segment 2 red .. .. .. [(Butl.), p. 403. *C. euphorbiæ robertsi*

Horn red; subdorsal spots yellow or wanting .. . . 5.
5. Spiracles yellow; head and saddle-mark pink ... . [p. 407. *C. gallii gallii* (Rott.),

Spiracles white; head and saddle-mark pink or black; subdorsal spots sometimes wanting [(Esp.), p. 409. *C. lineata livornica*

Pupæ.

Tongue-sheath enlarged basally; a tubercle on each side above base of tongue. [(Esp.), p. 409. *C. lineata livornica*

Tongue-sheath not enlarged, and no tubercles . .. 2. [p. 407.
2. Cremaster large, bent towards venter *C. gallii gallii* (Rott.), [p. 406.

Cremaster triangular, ending in a short minutely bifid shaft { [Roths. & Jord., *C. euphorbiæ nervosa* [p. 404. *C. e. robertsi* (Butl.),

145 *a*. **Celerio euphorbiæ robertsi** (Butl.). (Fig. 102, imago; Pl. IV, figs. 18, 19, larva).

Deilephila robertsi, Butler, 1880, p. 411, pl. xxxix, figs. 9, 10 (l., p.) (Kandahar).
Celerio euphorbiæ robertsi, Roths. & Jord., 1903, p. 721; Jordan, 1911, p. 255.
Deilephila dahlii, Hampson (nec Gey.), 1892, p. 99 (Kandahar; Simla).
Deilephila euphorbiæ, Buckler, 1887, p. 30, pl. xxiii (larva).

Imago.—♂♀. Resembles *C. e. nervosa*, but darker in colour. Head, thorax and abdomen marked as in *C. e. nervosa*, but fringes of tergites pure white. Fore wing: costal area pale pink, speckled with black, base dark brown, with a white patch at extreme base; an ovate brown spot beyond cell; median area flesh-colour speckled with dark brown; veins very narrowly white across brown post-discal band; marginal band purplish-grey dotted with black. Hind wing as in *nervosa*,

but a white patch at anal angle, and marginal band paler. *Underside* of wings speckled with brown. *Expanse*: ♂ 74–78 mm., ♀ 74–80 mm.

Hab. W HIMALAYAS (Quetta, Baluchistan), Transcaspia southward to Kandahar. We have bred the subspecies at Quetta, where we obtained a few larvæ on open stony ground at an elevation of about 5,500 feet.

Larva:—

1*st instar*. Black, with a short, straight black horn.

Final instar. Similar in shape to that of *C. e. nervosa*, but more stoutly built. Head moderately shining. Body dull except for the white spots, which have an enamel-like surface. Horn rather short, down-curved, stout at base, tapering evenly to a sharp point; covered with small tubercles.

A black and a green form. In the black form (Pl. IV, fig. 19) the head is crimson, with a white dot at base of antenna; mouth-parts black. Body sooty-black; an interrupted, crimson, narrow,



Fig. 102.—*Celerio euphorbiæ robertsi* (Butl.), ♂.

dorsal stripe; a crimson saddle-shaped marking on segment 2, with some small white spots in front of and behind it; a series of subdorsal spots on 3 to 12 enamel-white, those on 3 and 4 smaller than the rest, which are co-equal, that on 12 elongate, the rest quadrate or transversely oval; smaller white spots at base of anal flap, and still smaller ones placed irregularly over the body; a crimson subspiracular stripe, continuous on 2 to 4, then appearing only as an elongate patch in the middle of 5 to 12, with a yellowish-green patch behind it on some of the segments. Horn crimson, distal third black; legs pink, each segment with a narrow black band; prolegs with shank yellowish-green, ankle and foot black; distal third of anal flap and claspers pale crimson. Spiracles white.

In the green form (Pl. IV, fig. 18) the black is replaced by bright yellowish-green except for a broad edging of black round the white spots; all the other markings as in the black form. Length 100 mm.; breadth 9 mm.; horn 5 mm.

Pupa.—Similar to that of *C. e. nervosa.*

Habits.—Food-plant: *Euphorbia* Linn., family Euphorbiaceæ. The larvæ do not appear to live gregariously as in the case of *C. e. nervosa*, the species of spurge on which they feed not growing gregariously.

145 *b*. **Celerio euphorbiæ nervosa** Roths. & Jord. (Fig. 103, imago; Pl. IV, fig. 16, larva, fig. 17, pupa).

Celerio euphorbiæ nervosa, Roths. & Jord., 1903, p. 721 (Sabathu, N.W. India); Jordan, 1911, p. 255; Seitz, 1929, p. 563; Scott, 1931, p. 373, fig. 6 (larva).

Imago.—♂♀. Head and thorax olive, scaling of antenna white; palpus white, and a white lateral stripe from palpus over eye to end of thorax, where it meets the white upper border of the tegula; abdomen olive with four alternately black and white side-patches. Fore wing: costal area clay-colour from base to near apex, broadly shaded



Fig. 103.—*Celerio euphorbiæ nervosa* Roths. & Jord., ♂.

with black behind from base to M^2, then sinuate; in this sinus an indistinct black patch; the patch beyond apex of cell merged together with costal area, edged with black behind; veins traversing brown post-discal band white; a small white patch at base of wing; median area pinkish; a broad, flesh-coloured marginal band, sometimes dotted with black. Hind wing crimson, basal area and a narrow, scalloped, submarginal band dark brown or blackish; a broad marginal band pink dotted with black. *Underside* of wings speckled with brown; cell of fore wing brown, the area ending in a blackish patch; disc of fore wing slightly pink, that of hind wing pale pink. *Expanse*: ♂♀ 68–87 mm.

♂. Harpe rather long, thin, slightly curved. The incrassate dentate rim of the penis-sheath narrow, generally dentate all along the edge.

Hab. W. Himalayas (Ladakh; foot of the Zoji-la Pass, Kashmir; Changla Gali; Sabathu). We have bred the

subspecies in the localities mentioned, except Sabathu, at elevations of from 8,000 to 9,000 feet. The larvæ are extremely local, but occur in very large numbers in a very restricted area in July and August. The closely allied *C. euphorbiæ euphorbiæ* is the Spurge Hawk-Moth of England.

Egg.—Nearly spherical, surface shining and very minutely pitted, colour pale green.

Larva :—

1*st instar*. Head and horn black, body dirty white. In later instars head and body black dotted with white, and white subdorsal spots on segments 3 to 12.

Final instar. Head broadly semi-elliptical, dorsal line very slightly depressed, the vertex of each lobe broadly rounded ; true clypeus triangular, longer than broad, apex reaching to nearly the middle of the head ; false clypeus with rounded apex reaching to middle of head ; labrum one-third length of clypeus, as broad as clypeus is long, the sides converging frontad ; ligula as long as labrum, twice as broad as long, oblong in shape with a small frontal sinus ; cutting-edge of mandible strongly toothed ; eyes 1 to 4 in a semicircle, 6 in line with 3 and 4 ; 1 and 2, 3 and 4, and 4 and 5 equidistant ; 2 and 3 closer together, 4 and 6 and 5 and 6 further apart than the above ; all the eyes of equal size and rather small. Surface of head moderately shining, smooth, covered sparsely with short hairs directed frontad. Body moderately shining, greasy-looking, a transverse row of short hairs along each secondary ring ; a saddle-shaped mark on segment 2 slightly more shining ; distal two-thirds of anal flap and outer face of base of clasper set sparsely with minute, conical tubercles. Horn short, slightly down-curved, tapering evenly to a blunt point, covered densely with spine-like, outward-directed tubercles.

Coloration.—Head black with black hairs ; labrum very pale yellow ; ligula black ; basal segment of antenna pale yellow, other segments dark chestnut with a pale yellow band between them ; mandible dark chestnut ; eyes black. Body with segment 2 black with a small, round, pale yellow subdorsal spot on the front margin, and a similar subspiracular spot sometimes present ; the saddle-mark black ; rest of body with a broad black dorsal stripe from 3 to base of horn and thence to tip of anal flap ; a longitudinally oval, pale yellow, subdorsal spot on 3 to 12, these spots increasing in size from 3 to 11, edged narrowly with black, the upper edges joined across the dorsum by a broad black band ; the area between the dorsal stripe and a narrow, black, subspiracular stripe black, with a transverse row of pale yellow dots along each secondary ring, these dots leaving the black as a fine reticulation ; below the subspiracular stripe darker yellow with

coarser reticulation of black. Horn black; legs, prolegs and claspers black, two yellow spots at base of clasper. Spiracles broadly oval, pure white with a narrow black rim, those on segment 12 larger than the rest. Length 80 mm.; breadth 10 mm.; horn 6 mm.

Pupa.—Head bluntly rounded; hind margin of segment 11 raised and undercut, 12 being slightly telescoped into 11; 8 to 10 slightly flattened dorsally; antenna equal to fore leg, both reaching to middle of wing-case; mid-leg to about three-quarters the distance to tip of wing-case; a long, narrow coxal piece. Surface slightly shining; head, thorax and wing-case smooth; abdomen coarsely, transversely wrinkled, and pitted on dorsal surface; front bevels of segments 9 to 11 wrinkled and pitted. Spiracle of 2 a narrow slit, the hind margin of 2 raised into three parallel ridges in front of it, a narrow transversely oblong lobe, sloping upwards frontad, projecting from the front margin of 3 behind it; remaining spiracles oval, slightly depressed and surrounded by concentric wrinkles. Cremaster elongate-triangular, ending in a short cylindrical shaft with two minute points. Head, thorax and wing-case bright green when fresh, duller green later, speckled with brown; tongue and antenna black; abdomen rusty-red; a darker, irregular dorsal stripe; depressions between the wrinkles dark brown; hind bevels of segments 8 to 11 dark brown; ridges in front of 2 rusty, lobe from 3 black; spiracles black; cremaster brown. Length 45 mm.; breadth 10 mm.

Habits.—Food-plant: *Euphorbia* Linn., family Euphorbiaceæ. Eggs laid in small masses on the young shoots, one on top of the other, from five to twenty or more in a cluster. The larvæ live gregariously. They feed voraciously, and when they have stripped the leaves from one plant move on to another. The food-plant itself grows gregariously, and thus large numbers of the larvæ can be found in a very small area. Their colouring makes them very conspicuous on the green stems and leaves of the food-plant, which has bright golden-yellow flowers and bracts, but they do not appear to make any attempt to conceal themselves, though when full-fed they lie stretched along the stem close to the earth. When alarmed they throw back the head and anterior segments and eject drops of green fluid from the mouth. When a large number carry out this action simultaneously the effect is most striking, and is increased by the drops of fluid pattering on the dry leaves at the bottom of the stems. This habit may suffice to protect the larvæ from insectivorous birds and other animals. Moths emerged in March from pupæ formed in the previous July and August.

146. Celerio gallii gallii (Rott.).

Sphinx gallii, Rottenburg, 1775, p. 107 (Hab. ?).
Deilephila gallii, Buckler, 1887, p. 36, pl. xxiv (larva); Hampson, 1892, p. 98 (Gurais Valley, 6,000 ft.); Dudgeon, 1898, p. 415 (Chumbi Valley, 13,000 ft.).
Celerio gallii gallii, Roths. & Jord., 1903, p. 723; Jordan, 1911, p. 256, t. 41 *d*; Mell, 1922, p. 278, pl. ix, fig. 15 (larva), pl. xiii (xiv), fig. 36, pl. xviii, figs. 43, 44 (pupa); Seitz, 1928, p. 563.

Imago.—♂♀. Closely resembles *C. e. nervosa*. Antenna white above only at end. Tegula without white upper fringe; abdominal side-patches as in *C. e. nervosa*, but dorsum of abdomen with a white spot on each segment, and white fringes of tergites broken on dorsum. Fore wing: costal area brown, sharply defined; median area yellowish; marginal band grey. Hind wing yellow, with a tinge of pink; a red patch behind middle, the red colour often extending along the black basal area and the black submarginal band. Underside with no trace of red. First protarsal segment with the external row of spines complete, double at base, the spines little prolonged. Pulvillus present. *Expanse*: 74 mm.

♂. Harpe more curved than in *C. e. nervosa*.

Hab. W Himalayas (Gurais Valley, 6,000 feet; Chumbi Valley, 13,000 feet), Palæarctic Region from Western Europe to Japan. It occurs rarely in England, where it is called the Bedstraw Hawk-Moth.

Larva:—

Final instar. Shape as in others of the genus; horn of medium length, down-curved.

Coloration.—Head pink. Body varies from greenish-olive to pale olive-brown, reddish-brown or blackish; an obscure yellowish dorsal stripe; the saddle-shaped mark on segment 2 pink; a series of large yellow subdorsal spots, edged with black, on 3 to 12, round except on 12 where the spot is elongate; horn red; legs black, prolegs and claspers pinkish; venter greyish-red. Spiracles yellow, lying on a black patch. Length 80–90 mm.

Pupa.—Tongue-sheath not prominent; antenna longer than fore leg, reaching middle of wing-case; a small coxal piece. Surface dull and smooth. Cremaster large, bent towards the venter. Colour of head, thorax and wing-case yellowish-brown with darker vermiculate markings; abdomen reddish brown; spiracles and cremaster black.

Habits.—Food-plants: *Galium* Linn., *Asperula* Linn., family Rubiaceæ; *Epilobium* Linn., *Fuchsia* Linn., family Onagraceæ. Habits similar to those of others of the genus.

147. **Celerio nicæa lathyrus** (Walk.).

Deilephila lathyrus, Walker, 1856, p. 172 (N. India).
Celerio nicæa lathyrus, Roths. & Jord., 1903, p. 727 ; Jordan, 1911, p. 256, t. 41 *d* ; Seitz, 1929, p. 563.
Deilephila euphorbiæ (Linn.), Hampson, 1892, p. 98.

Imago.—♂♀. Tegula without white upper fringe ; abdominal sternites unicolorous ; under surface of legs nearly as pale as upper surface ; pale median band of fore wing densely speckled with brown. Pulvillus present. First protarsal segment with external spines not prolonged, the row doubled or trebled at base. Spines of comb of mid-tarsus little prolonged. *Expanse* : ♂ 72–78 mm., ♀ 90 mm.

♂. Harpe more strongly curved than in *euphorbiæ*, similar to that of *gallii*.

Hab. W HIMALAYAS, as far east as Naini Tal.

Egg.—Spherical ; surface smooth and shining ; colour green.

Larva :—

Final instar. Colour pale grey or leather-coloured ; a round black spot on vertex of each lobe of head ; a series of large, round subdorsal spots, red or yellow ringed with black on segments 2 to 13, that on 12 longitudinally elongate ; a series of similarly coloured, longitudinally elongate, subspiracular spots extending on to venter ; horn black. Length 80 mm. ; breadth 11 mm.

Habits.—Food-plant: *Euphorbia* Linn., family Euphorbiaceæ.

148. **Celerio lineata livornica** (Esp.). (Pl. XII, fig. 1, imago).

Sphinx livornica, Esper, 1779, p. 88 (Hab. ?).
Deilephila livornica, Swinhoe, 1884, p. 513 (Karachi) ; id., 1885 A, p. 287 (Bombay) ; id., 1885 B, p. 346 (Quetta) ; Butler, 1886, p. 379 (Campbellpore) ; Swinhoe, 1886, p. 435 (Mhow) ; Warren, 1888, p. 293 (Campbellpore) ; Swinhoe, 1888, p. 118 (Karachi) ; Buckler, 1887, p. 42, pl. xxv, figs. 1, 1 *a* (larva) ; Hampson, 1892, p. 97, fig. 55 (♂).
Celerio lineata livornica, Roths. & Jord., 1903, p. 732 ; Jordan, 1912, p. 257, t. 41 *e* ; Seitz, 1929, p. 563.

Imago.—♂♀. Antenna brown, tip white. Head and thorax olive-green. Palpus white, and a white lateral stripe running from palpus over eye to base of thorax, met by the white upper fringe of the tegula ; abdomen pale olive-brown, with black and white side-patches as in *C. e. nervosa* ; fringe of abdominal tergites chequered black and white. Fore wing : costal area pale olive-brown, shaded behind with dark brown, and with a white patch in and another beyond cell ; discal band pale yellow, both edges sharply defined ; post-discal band brown ; marginal band purplish-grey, dotted with black ; cilia of outer and inner margin white ; veins white. Hind wing crimson, basal area and a broad

submarginal band blackish; marginal band narrow, pink dotted with black; a white patch near anal angle. Pulvillus present. Outer spines of fore tarsus prolonged, at least partly, their number often obviously reduced. *Expanse*: ♂ 52–84 mm., ♀ 60–90 mm.

Sexual armature of the ordinary type; process of harpe comparatively short, acute, curved.

Hab. W HIMALAYAS (Quetta) and S. INDIA (Mhow; Karachi; Calcutta; Campbellpore), Africa northwards to Southern Europe, eastwards to China, sometimes wandering to Central Europe and England, where it is known as the Striped Hawk-Moth.

Larva:—

Final instar. Horn stout, tapering evenly to a blunt tip, nearly straight.

Coloration.—Head and saddle-shaped mark on segment 2 black or pink. Body varying from green to blackish; a yellowish dorsal stripe, sometimes tinged with pink, from 3 to base of horn; a series of subdorsal spots, yellow tinged or centred with pink and ringed with black, round on 4 to 11, pear-shaped on 12, double on 13; these spots sometimes replaced by a yellow stripe; lateral area dotted with yellowish-green; a whitish and dull pink subspiracular stripe. Horn pink; legs and claspers black, prolegs pink with black feet; venter dull pink. Spiracles white. Length 85 mm.

Pupa.—Tongue-sheath enlarged basally, a tubercle on each side above base of tongue. Surface dull, slightly shagreened. Cremaster a short thin spike. Colour like that of *C. e. nervosa*.

Habits.—Food-plants: *Vitis* Linn., family Ampelideæ; *Galium* Linn., family Rubiaceæ; *Rumex* Linn., family Polygonaceæ, and other plants.

Genus **PERGESA** Walker.

Walker, 1856, p. 149 (part.); Roths. & Jord., 1903, p. 734; id., 1907, p. 129.

Genotype: *porcellus* (Linn.).

Imago.—♂♀. Medium-sized moths, body and underside of wings rosy-red. "Similar to *Celerio*. Palpus hairy at sides. Eye strongly lashed. Antenna very feebly incrassate distally, almost filiform in ♂, slightly clubbed in ♀, hook gradual, consisting of seven to ten segments. Spines of abdomen weak, more numerous than in *Celerio*. First row of spines of first protarsal segment double at base; pulvillus normal.

"♂. Tenth tergite slender, much narrower than the sternite; this flat, or slightly convex beneath, not keeled nor boat-shaped, rounded-truncate or rounded at end. Clasper

broadly sole-shaped, with a dozen or more friction-scales; harpe (fig. 104 B) ending in a more or less spatulate process, which is concave on the upperside and is slightly curved upwards. Penis-sheath (fig. 104 C) without apical process, but with a subapical oblique dentate ridge " (Roths. & Jord., 1903, p. 734).

Egg.—Nearly spherical, surface smooth and shining, colour bright green.

Larva.—Head small and round. Segment 2 of about the same diameter as the head, 5 swollen, body tapering sharply from 5 to 3; rest of body nearly cylindrical; horn short, down-curved, or vestigial (short but well developed in the Indian subspecies). Colour black or green, with large ocelli on 5 and 6.

Pupa.—Tongue keeled in basal fifth, head broadly rounded. Surface dull, slightly shagreened; a belt of small spines on the anterior edge of the front bevels of segments 9 to 11, except on underside. Cremaster triangular, ending in a thin polished shaft of which the tip is minutely bifid or simply pointed; dorsal surface rugose, ventral surface with a median keel and a deep channel on each side of it. Colour soiled white and pale orange, with darker markings.

Habits.—Food-plants belong to the families Rubiaceæ, Onagraceæ, Geraniaceæ, Ampelideæ and Aroideæ. Pupation in a rough cocoon on the surface.

Hab. Palæarctic Region; China; INDIA. Two Indian subspecies. The subspecies *P. elpenor elpenor*, which does not occur in India, is the Elephant Hawk-Moth of England.

Key to the Subspecies.

Imagines.

Marginal area of hind wing bright rosy red	*P. elpenor macromera* [(Butl.), p. 411.
Marginal area of hind wing red shaded with cinnamon	*P. elpenor rivularis* [(Boisd.), p. 410.

The larvæ and pupæ resemble each other so closely that a key cannot be constructed.

149 *a*. **Pergesa elpenor rivularis** (Boisd.).

Chærocampa rivularis, Boisduval, 1875, p. 280 (Simla; Darjiling).
Pergesa rivularis, Roths. & Jord., 1903, p. 738; Jordan, 1912, p. 257, t. 42 *a*; Seitz, 1929, p. 563.
Chærocampa fraterna, Butler, 1875, p. 247 (Simla; N. India); id., 1881 B, p. 7, pl. lxxix, fig. 4.
Deilephila elpenor (Linn.), Butler, 1881 A, p. 613 (Kurrachi).
Chærocampa elpenor (Linn.), Swinhoe, 1884, p. 514 (Kurachi).

Imago.—♂♀. Like *P. e. macromera*, but the rosy-red parts

of body and wings shaded over with cinnamon, being far less bright than in *macromera*, especially on the wings. *Expanse*: ♂♀ 66–82 mm.

Hab. W and E. HIMALAYAS, from Chitral to Sikkim, southwards to Karachi. We have bred the subspecies at Simla and Mussooree, where it is as common as *macromera* is in the Khasi Hills.

Egg, Larva, Pupa, Habits.—All closely resembling those of *e. macromera*.

149 *b*. **Pergesa elpenor macromera** (Butl.). (Fig. 104, imago; Pl. V, fig. 1, larva, fig. 2, pupa; Pl. XV, fig. 8, larva).

Chærocampa macromera, Butler, 1875, p. 7 (Sylhet); id., 1881 B, p. 7, pl. lxxix, fig. 3; Cotes & Swinhoe, 1887, p. 14 (Shillong).
Pergesa elpenor macromera, Roths. & Jord., 1903, p. 737; Mell, 1922, p. 279, pl. ix, fig. 16 (larva), pl. xiv, figs. 25, 26, pl. xviii, figs. 47, 48 (pupa), pl. xxxi, fig. 4 (♀); Seitz, 1929, p. 563, t. 67 *a*.
Chærocampa elpenor (Linn.), Hampson, 1892, p. 84; Buckler, 1887, p. 113, pl. xxv, fig. 3 *a–c* (larva).

Imago.—♂♀. Head and thorax bronze-green; antenna, sides of palpus and head pink; broad crimson subdorsal and lateral

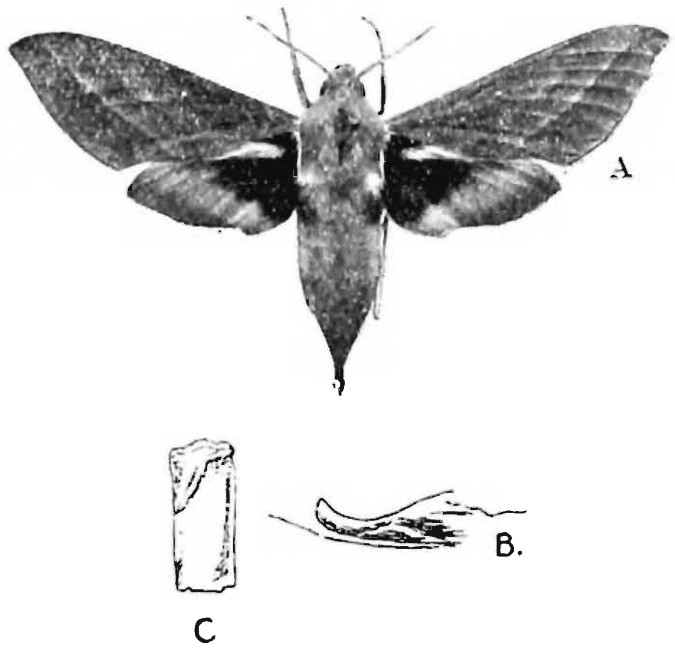


Fig. 104.—*Pergesa* Walk.
A, *P. elpenor macromera* (Butl.); B, harpe; C, penis-sheath.

stripes on thorax; abdomen crimson with a broad bronze-green subdorsal stripe, and a pink and a black lateral side-patch. Fore wing bronze-green; costa crimson; an oblique pink band from beyond cell to inner margin, and another parallel with it from apex to inner margin; a broad marginal

band bright rosy-red; a white discoidal spot. Hind wing: basal half black, distal half rosy-red shading to crimson near apex. *Underside* bright rosy-red, except the costa and part of the disc of the wings. *Expanse*: ♂♀ 60–84 mm.

Hab. E. HIMALAYAS (Khasi Hills). We have bred the subspecies at Shillong, where it is very common from April to October. The closely allied *P. e. elpenor* is known in England as the Elephant Hawk-Moth.

Larva:—

1*st instar*. Green with a short, straight, black horn. 2*nd instar*. Head and segment 2 green, rest of body bluish-green dotted with white; 5 swollen and bearing an ocellus, pale yellow above, black below; a similar but smaller ocellus on 6; a pale dorso-lateral stripe from 2 to base of horn; horn short, straight, black with reddish base. 3*rd instar*. As in 2nd instar, but ocelli shaped like a "D" with the chord of the "D" ventrad, pupil red edged with yellow above, black below. 4*th instar*. A brown and a green form, the brown form the more common.

Brown form: head black, body dark brown with reticulation of black lines on 6 to 11; a black dorsal stripe on 2 and 3; a pale dorso-lateral and a similar subspiracular stripe on 2 and 3, the latter extending on to 4 and 5 and very faintly on to 12; 5 very swollen, the ocellus large, black with a brown kidney-shaped mark, edged narrowly with white, in the middle; a similar but smaller ocellus on 6; legs pale brown, prolegs, claspers and venter black; horn long, down-curved, black.

In the green form the black head and brown body-colour is replaced by bluish-green, with markings similar to the above.

5*th instar*. Head very small, round. Body dull and smooth; segment 2 of about the same diameter as the head, the segments then increasing rapidly in diameter to 5, which is very swollen; 6 to 12 of less diameter than segment 5. Horn rather short, sharply down-curved, stout at base, tapering evenly to a sharp point.

Coloration.—Head and dorsum of segments 2 to 6 sooty-brown, rest of body darker brown with black reticulation; a dorso-lateral stripe on 2 to 4, ochreous bordered broadly with dark brown; an ochreous subspiracular stripe, narrow on 2 and 3, broader on 4 and very broad on 5, narrowing to a point just below the ocellus on 6, and continued as a faint waved stripe to 12; a large, round, dorso-lateral ocellus on 5, the upper half containing a kidney-shaped mark, greyish-purple edged narrowly with white; a similar but smaller ocellus on 6; a small round ochreous subdorsal spot on 7 to 12; traces of oblique stripes on 5 to 12. Horn: basal half brown, distal half white. Spiracles ochreous ringed with black. Length 100 mm.; breadth 13 mm.

Pupa.—Cremaster triangular, ending in a thin shaft with a simple point. Colour of head, thorax and wing-case soiled white, marbled with dark brown on dorsum; abdomen pale orange speckled with black, the hind bevels of segments 8 to 11 darker; spiracles and cremaster black. Length 47 mm.; breadth 12 mm.; cremaster 3·5 mm.

Habits.—Food-plants: *Arisæma* Mart., *Amorphophallus* Bl., family Aroideæ, and *Impatiens* Linn., family Geraniaceæ. Eggs are laid from May to September, several often being found on one plant. The larva feeds voraciously. In the last instar, when the colour is dark brown, the larva lies during the day on the stem of the food-plant close to the ground, and feeds at night. The anterior segments can be much elongated, but when alarmed the head and anterior segments are retracted into the swollen fifth segment, which becomes still more swollen, showing up the occlli to full advantage. The moths may frequently be caught when feeding at flowers after dusk, and are among the most common of those that enter lighted bungalows at night, and are also among the most beautiful in colour and form.

Genus **HIPPOTION** Hübner. (Fig. 105).

Hübner, 1822, p. 134 (part.); Roths. & Jord., 1903, p. 747.

Genotype: *celerio* (Linn.).

Imago.—♂♀. Medium- or small-sized moths, fore wing very narrow and sharply pointed, abdomen also sharply pointed;

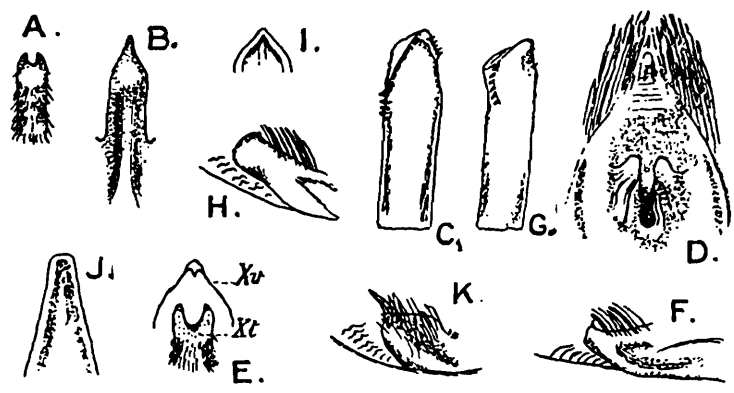


Fig. 105.—*Hippotion* Hübn. Genitalia.

A, *H. velox* (Fabr.), ♂, end of 10th segment, dorsal view; B, 10th sternite, ventral view; C, penis-sheath; D, ♀ vaginal plate. E, *H. echeclus* (Boisd.), ♂, end of 10th segment, dorsal view (x. *t*, 10th tergite, x. *v*, 10th sternite); F, harpe; G, penis-sheath. H, *H. rafflesi* (Butl.), ♂, 10th sternite; I, harpe; J, *H. boerhaviæ* (Fabr.), ♂, 10th sternite; K, harpe.

fore wing with a number of lines from apex to inner margin; hind wing red except in *velox*. Palpus simple externally, first segment densely scaled at apex on inner side, second

segment without apical tuft of scales. Antenna clubbed in ♀, not clubbed and longer in ♂.

Egg.—Broadly ovoid, surface smooth and shining, colour bright green.

Larva.—Similar to those of *Theretra* in shape, but segments 4 and 5 not so swollen and anterior segments not so strongly retractile as in *Theretra*; horn straight, of medium length or short; ocelli on 5, or on 5 and 6 or on 5 to 11; dorso-lateral and subspiracular stripes usually present, but no oblique stripes.

Pupa.—Tongue-sheath projecting more or less strongly frontad or ventrad; antenna equal to or slightly shorter than fore leg; surface moderately shining, and smooth or superficially wrinkled or corrugate; colour brown or bone-colour speckled with brown or black; cremaster variable.

Habits.—Food-plants belong to several families, and are nearly all herbaceous. Habits the same as others of the subfamily.

Hab. Old World. Five Indian species.

Key to the Species.

Imagines.

1. Hind wing upperside smoky brown	*H. velox* (Fabr.), p. 415.
Hind wing red, or partly red	2.
2. Hind wing with base and anal angle bright pink, disc blackish, outer area ochreous-brown with a black submarginal line; veins black	[p. 417. *H. celerio* (Linn.),
Hind wing not so marked	3.
3. Hind wing with base black and a large pale anal area	[p. 420. *H. echeclus* (Boisd.),
Hind wing not black at base	4.
4. First segment of palpus with conspicuous white lateral line close to eye	[p. 422. *H. rafflesi* (Butl.),
First segment of palpus without such line.	*H. boerhaviæ* (Fabr.), [p. 424.

Larvæ.

1. Ocellus on 5 only; horn short and stout	*H. velox* (Fabr.), p. 416.
Ocelli on 5 and 6 only	2.
Ocelli on 5 to 11, decreasing in size backwards, sometimes obscure on posterior segments	3.
2. Ocelli D-shaped, chord of D dorsad; horn long and thin	[p. 423. *H. rafflesi* (Butl.),
Ocelli longitudinally oval, that on 6 blind and much smaller than that on 5; horn of medium length, stout at base	[p. 418. *H. celerio* (Linn.),
3. Ocellus on 5 nearly round; horn rather short and thin	[p. 425. *H. boerhaviæ* (Fabr.),
Ocellus on 5 longitudinally oval; horn very short, stout at base and tapering sharply.	[p. 421. *H. echeclus* (Boisd.),

Pupæ.

1. Cremaster ending in two long, nearly parallel shafts, each with two hooks at tip and one on each side of middle	*H. velox* (Fabr.), p. 417.
Cremaster ending in a needle-like shaft, simply pointed; a small funnel-shaped depression under base	[p. 426. *H. boerhaviæ* (Fabr.),
Cremaster ending in a needle-like shaft with minutely bifid tip; no funnel-shaped depression under base	2.
2. Surface of pupa covered with extremely minute hairs . ..	[p. 421. *H. echeclus* (Boisd.),
Surface without hairs . . .	3.
3. Tongue-sheath not much projecting frontad	[p. 420. *H. celerio* (Linn.),
Tongue-sheath much projecting frontad	*H. rafflesi* (Butl.), [p. 424.

150. **Hippotion velox** (Fabr.). (Fig. 105 A–D, genitalia; fig. 106, imago).

Sphinx velox, Fabricius, 1793, p. 378 (Hab. ?).
Hippotion velox, Roths. & Jord., 1903, p. 749; Seitz, 1929, p. 563, t. 67 *b*.
Panacra lignaria, Walker, 1856, p. 156 (Ceylon).
Panacra vigil, Moore, 1857, p. 270; id., 1865, p. 793 (Bengal); Swinhoe, 1885 A, p. 287 (Poona; Bombay; descr. of larva); id., 1890, p. 163 (Rangoon; Mandalay).
Chærocampa vigil, Hampson, 1892, p. 86.

Imago.—♂♀. Very variable both in size and pattern. Head and thorax brown, with pale lateral streaks; abdomen



Fig. 106.—*Hippotion velox* (Fabr.), ♂.

brown, with numerous dark strigæ and pairs of pale lateral strigæ on each segment. Fore wing brown, with a whitish or pinkish band from apex to middle of inner margin, sharply defined costally; or with a conspicuous black discal band; or with scarcely any lines. Hind wing smoky-brown, with a trace of a darker submarginal line. Occasionally body and wings washed with rosy-red. *Expanse*: ♂ 54–76 mm., ♀ 54–84 mm.

♂. Tenth abdominal tergite (fig. 105 A) gradually narrowed, but apex sharply sinuate, the angles acute; sternite (fig. 105 B) suddenly narrowed distally into a triangular, pointed, slender, mesial process, curved somewhat upwards. Process of harpe slender, apex somewhat dilated, spoon-shaped. Penis-sheath (fig. 105 C) with a right apical row of teeth, and a shorter left row, which is subapical.

♀. Vaginal aperture narrow, a feebly chitinized, rather prominent lobe on each side (fig. 105 D).

Hab. E. HIMALAYAS, S. INDIA, BURMA and CEYLON. Also occurs in the Indo-Australian Region from Ceylon to Fiji. We have bred the species in S. India. It is widely spread, but local.

Larva:—

1*st instar*. Yellowish-white, becoming green after feeding, with a short, straight, black horn.

Final instar. Head small and round; clypeus triangular, one-half length of head; false clypeus with apex acute; labrum one-half length of clypeus, narrowing frontad; ligula as long as labrum, broader than front margin of labrum, kidney-shaped, the lobes rather broad; cutting-edge of mandible slightly waved; eyes 1, 2, 3 and 4 in a slight curve; 6 in line with 3 and 4; 1 about two eye-diameters from 2; 2, 3 and 4 about one-half diameter apart; 5 forming an equilateral triangle with 4 and 6, which are about 2½ diameters apart. Surface of head slightly shining, smooth with very minute hairs. Body dull and smooth; segments 4 and 5 very swollen. Horn straight, rather short and stout, evenly tapering, dull, and covered with minute, conical, setiferous tubercles.

A green and a dark form. Green form: head and body bright grass-green, body with a transverse row of obscure yellow dots along each secondary ring; a narrow, neutral-tinted dorsal stripe from segment 6 to base of horn, darker at the front margin of each segment; a longitudinally oval ocellus placed dorso-laterally near the front margin of 5, yellow irregularly centred with plum-colour. Horn violet, paler at base, darker at tip; legs: basal segment whitish, second and third dark purple, claw black; prolegs green, feet soiled whitish. Spiracles narrowly oval, whitish with a broad, diffuse brown band across the middle.

In the dark form the head is smoky-brown; body yellowish-white with short, black or dark brown, parallel lines on each secondary ring; a narrow black dorsal stripe on 2 to 4, appearing only as a black spot at the front margin of the remaining segments; a broad, pale yellow, dorso-lateral stripe on 2 to 4, appearing again on 6 to 11 as a short length only on each segment, continuous again on 12 to base of horn; the ocellus on 5 with dark brown centre, bordered narrowly with first

pale yellow, then black; pale, narrow, oblique stripes on 5 to 11; a similar subspiracular stripe, the angles between this stripe and the oblique stripe filled in with brown speckled with white. Horn blackish-brown, the tip and sides of base paler. Length 60 mm.; breadth 12 mm.; horn 7 mm.

Pupa.—Tongue-sheath projecting slightly in front of head, more projecting ventrally, semicircular in a side-view, narrow, its edge finely channelled; antenna slightly shorter than fore leg, which reaches to one-third length of wing-case, mid-leg to one-half; a short, narrow coxal piece. Surface slightly shining, head, thorax and wing-case superficially shagreened; front bevel of segment 9 with a series of ridges parallel with the margins of the bevel, bevels of 10 and 11 tuberculate; the surface of the pupa round the spiracles of 8 to 10 striate; 13 and 14 pitted as well as shagreened. Spiracle of 2 a narrow slit, the hind margin of 2 slightly raised in front of it, the front margin of 3 thickened behind it; remaining spiracles elongate-oval, flush, central slit with a narrow rim. Cremaster triangular, ending in two long, nearly parallel shafts, each shaft with two minute hooks at tip and one on each side at the middle; lower surface of cremaster deeply hollowed. Colour bone-colour, closely spotted and speckled with brown and some black dots; tongue-sheath brown, paler basally, the edge whitish; bases of legs and veins of wings dotted with black; shoulder fuscous; abdomen with a broad, greenish, dorsal stripe; a narrow, interrupted, black ventral stripe; a broad, interrupted, black latero-ventral stripe; spiracles, and a patch round each and cremaster black. Length 48 mm.; breadth 11 mm.

Habits.—Food-plants: *Pisonia morindifolia* R. Br. and *P. aculeata* Linn., family Nyctaginaceæ. These shrubs, both known locally as the "lettuce tree," owing to the leaves resembling those of the lettuce, are grown in gardens in Bombay, Belgaum and other places, where the larvæ have been found. In the last instar the larva rests on the stem and hidden among the leaves. In the resting position the horn is held horizontally, but when the larva is moving it is bent forwards over the dorsum at each forward movement of the claspers. The moth has been caught at flowers after dark, but does not appear to be attracted by light.

151. **Hippotion celerio** (Linn.). (Fig. 107, imago; Pl. V, figs. 3, 4, larva, fig. 5, pupa; Pl. XV, fig. 6, larva).

Sphinx celerio Linnæus, 1758, p. 491 (Hab. ?).
Chærocampa celerio, Moore, 1865, p. 794 (Bengal); Butler, 1881 A, p. 613 (Karachi); Swinhoe, 1884, p. 388 (Mhow, life-history); id., 1885 A, p. 288 (Poona; Bombay); Butler, 1886, p. 379 (Campbellpore); Buckler, 1887, p. 113, pl. xxv, fig. 2 (larva);

Swinhoe, 1888, p. 118 (Karachi); Hampson, 1892, p. 87; Dudgeon, 1898, p. 410 (Sikkim & Bhutan, up to 5,000 ft.); Nurse, 1899, p. 513 (Cutch).

Hippotion celerio, Moore, 1882, p. 16, pl. lxxxiv, fig. 4; Roths. & Jord., 1903, p. 751; Jordan, 1912, p. 258, t. 42 *b*; Meli, 1922, p. 280, pl. ix, figs. 17, 18 (larva), pl. xix, figs. 1, 2 (pupa); Seitz, 1929, p. 564; Scott, 1931, pl. iii, fig. 5 (larva).

Imago.—♂♀. Head and thorax brown, with a white lateral stripe; thorax wih some obscure pale streaks; abdomen brown with a broken white dorsal stripe and a white dorso-lateral spot on each segment. Fore wing paler brown; a silvery band from apex to inner margin, with a median narrow dark line all along it; behind this some ochreous and pale brown lines; a whitish submarginal line; veins beyond cell streaked with silvery and black; a black discoidal dot, with a silvery streak from it to base of wing. Hind wing: base and anal angle bright pink, disc blackish; outer area ochreous-brown with a black submarginal band and the veins between this and the cell black. *Expanse*: ♂♀, 60–80 mm.



Fig. 107.—*Hippotion celerio* (Linn.).

♂. Sexual armature similar to that of *velox*. Tenth segment shorter, stouter, the sternite much more abruptly narrowed into a sharp hook. Harpe much stouter, almost straight, compressed upperside hollowed out apically, with the edges raised. Penis-sheath with two rows of teeth as in *velox*.

♀. Vaginal aperture ovate, the edges raised to a low horse-shoe-shaped ridge; no processes.

Hab. W and E. Himalayas and S. India, and throughout the world except in the far North and New Zealand. It occurs rarely in England, where it is known as the Silver-striped Hawk-Moth. We have bred the species in many localities in India, where it is very common and widely spread, though less so in forest areas with heavy rainfall than in open country.

Larva:—

1st instar. Pale yellowish-green with a long black horn. *2nd instar*. Head and body green; a white ocellus, ringed with

black, on segment 5, and a similar but smaller ocellus on 6. *3rd instar*. Head green, body pale bluish-green ; a large ocellus on 5, yellow with an oval green pupil, edged narrowly with black above and below, green at front and back, the green pupil containing several round white spots ringed with black ; a much smaller ocellus on 6, oval, pale yellow edged narrowly with black above and below, green at front and back ; a broad dorso-lateral stripe from 6 to base of horn, pale with black specks above and below it ; body dotted with white below this stripe. Horn very long, tapering slightly to near tip, where it becomes thicker again, colour black with reddish base, and covered with small black tubercles ; legs red. *4th instar*. Green or brown ; the green form as in the 3rd instar. Brown form : head pale brown, body darker brown ; a narrow, dark dorsal stripe ; a pale dorso-lateral stripe from segment 2 to base of horn, broken at the ocelli, and continuing from base of horn to tip of anal flap ; ocellus on 5 yellow with an oval black pupil which contains some round bluish spots, the whole ringed with black ; the ocellus on 6 similar but smaller and the yellow of a darker shade ; short dark lines on the secondary rings on 7 to 11 above and below the dorso-lateral stripe ; white oblique stripes on 5 to 11. Horn as in 3rd instar.

5th instar. Head broadly semi-elliptical ; true clypeus an equilateral triangle, one-half length of head ; false clypeus forming a semi-elliptical arch over the apex of true clypeus, reaching to two-thirds length of head ; labrum one-half length of clypeus ; ligula slightly longer than labrum, lobes broadly rounded ; cutting-edge of mandible toothed ; eyes 1 to 4 in a slight curve, 6 in line with 3 and 4 ; 5 nearer to 4 than to 6 ; 1 to 4 equidistant, 6 slightly further from 4 than 3 is from 4 ; 5 much smaller than the rest. Surface of head dull and smooth. Body shaped as in others of the genus ; dull and smooth, no visible hairs. Horn straight, of medium length, stout at base, tapering evenly to a blunt tip ; covered, except at base, with small tubercles directed distad.

Green form (Pl. V, fig. 3) : head green, labrum and ligula green ; basal segment of antenna green, other segments brownish ; mandible green, tip narrowly dark reddish-brown ; eyes brown except 5, which is black. Body grass-green ; an obscure, darker green dorsal stripe ; ocellus on 5 longitudinally oval, primrose-yellow with a large oval, dark green pupil, the dark green pupil containing five or six round, bluish or pale green dots ; the whole edged narrowly with black ; the ocellus on 6 half as long and as broad as that on 5, yellow edged with black, without the green pupil ; a white dorso-lateral stripe from 6 to base of horn, this stripe sharply defined above, lower edge diffuse ; on 7 to 11 a number of short, black lines across the secondary rings ; subspiracular region sparsely dotted

with white. Horn blackish, base shortly pink; legs red, prolegs and claspers green, venter yellowish-green.

In the brown form (Pl. V, fig. 4) the head is pale chocolate-brown, mouth-parts as in the green form; body blackish-brown; dorso-lateral stripe pale pinkish-brown, running from segments 2 to 4 and from behind the ocellus on 6 to base of horn and thence to tip of anal flap; ocellus on 5 with pupil black, containing bluish spots. Length 60 mm.; breadth 10 mm.; horn 6 mm.

Pupa.—Shape the same as that of *H. velox*. Surface moderately shining; head and thorax superficially wrinkled; tongue-sheath, antenna and wing-case nearly smooth, with a metallic lustre; abdomen closely, finely transversely corrugate; front bevels of segments 9 to 11 punctate-corrugate. Spiracle of 2 a narrow slit covered by a slight, raised emargination of the front margin of 3; remaining spiracles oval, surface slightly depressed. Cremaster triangular, ending in a minutely bifid, needle-like shaft; ventral surface slightly hollow. Colour: tongue-sheath, legs, antenna and wing-case with a golden lustre; veins and legs dotted with black; head, thorax and abdomen pale russet-brown, darker on dorsum of abdomen, venter of abdomen greyish; an interrupted black ventral stripe on segments 8 to 10; a subspiracular stripe of coalescent brown dots; bevels of segments 8 to 10 brown; spiracles black surrounded by a greyish area dotted with russet; cremaster dark reddish-brown. Length 50 mm.; breadth 11 mm.

Habits.—Food-plants: *Vitis* Linn., family Ampelideæ; *Spermacoce hispida* Linn., family Rubiaceæ; *Boerhavia* Linn., family Nyctaginaceæ; *Rumex* Linn., family Polygonaceæ; *Caladium* Linn., family Aroideæ, and other plants. The larva is impatient of light, and during the day hides among leaves near the ground. The moth may be caught at flowers and is also attracted by light. Its flight is very swift.

152. **Hippotion echeclus** (Boisd.). (Fig. 105 E–G, genitalia).

Chærocampa echeclus, Boisduval, 1879, p. 65 (Philippines).
Hippotion echeclus, Roths. & Jord., 1903, p. 754; Seitz, 1929, p. 564, t. 67 *b*.
Chærocampa elegans, Butler, 1875, p. 8, pl. ii, fig. 1 (Java; Sylhet); Swinhoe, 1890, p. 163 (Bassein; Rangoon).
Chærocampa eson, Hampson (non Cram.), 1892, p. 85.

Imago.—♂♀. Head, thorax and abdomen brown; antenna, palpus and a lateral stripe on head and thorax whitish; thorax with a whitish-grey dorsal stripe. Fore wing pale brown with some dark and whitish lines from apex to inner margin. Hind wing red, base black, and a large pale anal area. *Expanse*: ♂ 64–73 mm., ♀ 84 mm.

♂. Tenth tergite (fig. 105 E) stout, sinuate, sternite triangular, narrowed to a point, apex curved upwards, almost hooked. Process of harpe (fig. 105 F) short, rounded, dorsal edge clothed with long scales. Penis-sheath (fig. 105 G) : a curved row of teeth on the left side and a few subapical teeth on the right, no process.

♀. Vaginal plate : anterior and lateral edges of aperture somewhat raised to a ridge, which gradually fades away.

Hab. E. HIMALAYAS, S. INDIA and BURMA ; also occurs in Malaya and the Philippines. We have bred the species in S. India and the E. Himalayas (Khasi Hills). It is rare in areas with a heavy rainfall, but fairly common in dry areas, and is sometimes very abundant locally.

Larva :—

Final instar. Shape as in others of the genus ; horn very short, straight, stout at base and tapering sharply to a point. Surface of body smooth and dull. Head glaucous-green ; basal segment of antenna pale green, other segments pink. Body grass-green ; dorsum of 6 to 11 marked with short, narrow, darker stripes on each secondary ring ; on 5 a large oval, dorso-lateral ocellus, the oval pupil pale green above shading to dark green below, edged broadly with yellow and narrowly with black ; an ocellus on 6 about two-thirds as long and as broad as that on 5, pupil yellow above with a dark green spot on the upper edge, green below, the whole edged narrowly with dark green ; a similarly coloured but still smaller ocellus on 7, and on 8 to 11 the dark green spot only remains ; an obscure yellowish dorso-lateral stripe from behind the ocellus on 6 to base of horn ; an indication of a similar supra-spiracular stripe. Horn yellow, the extreme tip purplish ; legs pinkish ; venter pale green. Spiracles yellowish-green, the central slit and rim brown. Length 60 mm. ; breadth 9 mm. ; horn 2 mm.

Pupa.—Slender in build ; tongue-sheath prominent, but not projecting nearly as far in front of the head as in *rafflesi*, semicircular in side-view, dorsal outline of abdomen straight or slightly concave on median segments, that of thorax bending sharply downwards to head. Surface moderately shining and smooth, covered with extremely minute hairs. Spiracle of 2 covered by a small lobe projecting from the front margin of 3 ; remaining spiracles oval, flush. Cremaster triangular, minutely bifid at tip, tip bent towards venter. Colour : head, tongue-sheath and wing-case pale pinkish-brown, wing-case whitish laterally ; a black smudge on tongue-sheath below eye ; head sparsely dotted black ; abdomen bone-colour, whitish laterally, minutely dotted with black ; a large, black dorso-lateral dot on each segment ; a darker body-colour dorsal stripe ; an interrupted, fuscous, ventro-lateral stripe ; spiracles black

with a pale fuscous patch in front of and behind each ; cremaster bone-colour, tip dark brown. Length 48 mm. ; breadth 9 mm. ; tongue-sheath projecting about 2 mm. in front of head.

Habits.—Food-plants: *Sesamum indicum* Linn., family Pedaliaceæ ; *Monochoria hastæfolia* Presler, family Pontederiaceæ. The former is the food-plant in S. India, where it is grown as a crop, and larvæ are sometimes found feeding on it in large numbers. The moth does not appear to be attracted by light.

153. **Hippotion rafflesi** (Butl.). (Fig. 105 H, I, genitalia ; fig. 108, imago ; Pl. V, figs. 6, 7, larva, fig. 8, pupa).

Chærocampa rafflesi, Butler, 1877 A, p. 556 (Java ; Canara) ; Swinhoe, 1885 A, p. 289 (Poona ; Bombay).
Isoples rafflesi, Moore, 1882, p. 19, pl. lxxxiv, fig. 3.
Hippotion rafflesi, Roths. & Jord., 1903, p. 755 ; Mell, 1922, p. 283, pl. x, figs. 1–4 (larva), pl. xiv, figs. 1, 2, pl. xviii, figs. 51, 52 (pupa) ; Seitz, 1929, p. 564, t. 67 *c*.
Chærocampa theylia, Cram. (non Linn.), Hampson, 1892, p. 85.
Chærocampa vinacea, Hampson, 1893, p. 57, pl. clvii, fig. 26, pl. clxxv, figs. 2, 2 *a* (l., p.) (Ceylon).

Imago.—♂♀. Darker and more brightly coloured than *echeclus*, body and wings washed with red ; palpus washed

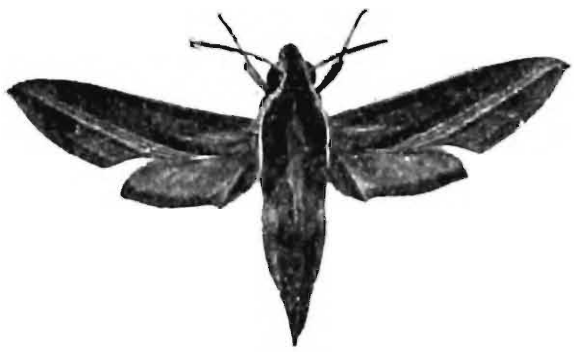


Fig. 108.—*Hippotion rafflesi* (Butl.).

with vinaceous, except a sharply marked white line on the first segment along the eye. Fore wing with discal lines 1 and 2 merged together in a band which is anteriorly more prominent than in *boerhaviæ*, the interspaces following paler, line 5 again heavier. Hind wing red, base not black, and no pale subanal patch ; base often clayish-brown. *Expanse* : ♂ 56–70 mm., ♀ 60–70 mm.

♂. Tenth tergite (fig. 105 H) sharply sinuate as in *echeclus*, the lobes rather shorter than in *boerhaviæ* ; sternite suddenly narrowed to a sharp hook. Process of harpe (fig. 105 I) short, rounded, with a short subterminal tooth nearly as in *echeclus* ; a tuft of scales as in *echeclus*. Penis-funnel short, triangular ; penis-sheath nearly as in *echeclus*, 0 to 3 teeth on right side and a row of teeth on left.

Hab. E. HIMALAYAS, S. INDIA, CEYLON and BURMA to Malaya and S. China. We have bred it in the E. Himalayas (Khasi Hills) and in S. India and Burma. It is very common in the Khasi Hills at an elevation of about 5,000 feet, and seems to prefer wet forest areas to dry open country.

Larva:—

1*st instar*. Yellow, with a straight black horn of medium length. 2*nd instar*. Green, with small ocelli on segments 5 and 6. 3*rd instar*. Head and segments 2 and 3 green, rest of body green dotted with white; an ocellus on 5, yellow edged above and below with black; a slightly smaller ocellus on 6, white edged above and below with black; a white dorso-lateral stripe from 4 to base of horn; horn straight, brown with red base. 4*th instar*. Head and body pale green, dotted with white except on head, segment 2 and anal flap; ocellus on 5 longitudinally oval, pupil yellow edged broadly above with black, below by two black lines; on 6 the pupil pale pink, edged below by a single line; horn long, slightly up-curved, tip truncate, black with the tip livid white.

5*th instar*. Head round; clypeus equilaterally triangular, basal angles slightly rounded, one-half length of clypeus; apex of false clypeus widely arched, reaching to two-thirds length of head; labrum one-half as long as clypeus, tapering slightly frontad; ligula as long as labrum and nearly as broad as long, kidney-shaped, with the lobes narrowly rounded; mandible with cutting-edge toothed; eyes 1 and 2 at right angles to the straight line joining 3, 4 and 6; 1 rather more than one eye-diameter from 2; 2, 3 and 4 about one diameter apart; 6 as far from 4 as 1 from 2; 5 and 4 at right angles to 4; 6 and 5 as far from 4 as 4 is from 6; 3 and 4 larger than the rest. Surface of head dull and smooth. Body dull and smooth, with segments 4 and 5 not much swollen. Horn straight, of medium length, thin, tapering evenly to a blunt point; minutely tuberculate.

Green form (Pl. V, fig. 7): head and body grass-green; a dorso-lateral line of small ochreous spots on segments 3 and 4; a large semicircular ocellus on 5, the chord dorsad, the pupil black with a pure white band along the top, edged broadly above, narrowly elsewhere with yellow, the whole enclosed by a black line; a smaller similarly shaped ocellus on 6, pupil maroon-red edged with yellow above, the whole enclosed by a black line; a dorso-lateral stripe from the hind edge of this ocellus to base of horn, ochreous on the front half of each segment, pale yellowish on the hinder half; above and below this, down to the supra-spiracular line, a number of short, narrow, dark green stripes across each secondary ring; just above the stripe there are two blue dots near the front margins of 7 to 11; a narrow white subspiracular stripe with some white dots round

the spiracles above it, from 5 to 12. Horn blackish, tip white; legs deep flesh-colour; venter white with a violet ventral stripe. Spiracles oval, pure white with a narrow black rim. There is also a dark-coloured form of the larva (Pl. V, fig. 6) in which the ground-colour is earthen-sepia, the dorso-lateral stripe and the area below it pinkish, other markings similar to those of the green form but darker. Length 70 mm.; breadth 10 mm.; horn 9 mm.

The description of the larva of this species given in Roths. & Jord., 1903, p. 756, is undoubtedly wrong, as it states that the larva has seven ocelli. We have bred a large number of larvæ of *rafflesi* from different localities, and they were invariably as described above, with two ocelli.

Pupa.—Rather slender in build; tongue-sheath very prominent, projecting a long way in front of the head, the head and projecting sheath together being one-sixth the length of the pupa; tip of tongue spatulate; antenna equal to fore leg and reaching to one-half length of wing-case; a long, thin coxal piece; apex of wing-case pointed. Surface moderately shining, head, thorax and wing-case shallowly, transversely corrugate; a depression below eye near base of tongue; abdomen shallowly, transversely corrugate, the front bevels and front margins of segments 9 to 14 also pitted. Spiracle of 2 a narrow slit covered by a transverse lobe projecting from the front margin of 3; remaining spiracles elongate-oval, surface rising slightly to the central slit, which has a raised edge. Cremaster triangular, ending in a needle-like, very shortly bifid shaft; ventral surface with a deep mesial channel; surface smooth and shining. Colour pale yellowish-brown, tongue and inner margin of wing dark brown; sides of tongue-sheath, and legs speckled with black; abdomen with a brown ventral stripe, interrupted at segment margins; a blackish dorso-lateral dot on each segment; spiracles black; cremaster brown, the shaft black. Length 50 mm.; breadth 10 mm.; tongue-sheath projecting 6·5 mm. in front of head.

Habits.—Food-plants: *Impatiens* Linn., family Geraniaceæ. The moths come readily to flowers and are also attracted by light.

154. **Hippotion boerhaviæ** (Fabr.). (Fig. 105 J, K, genitalia; fig. 109, imago; Pl. V, figs. 9, 11, larva, figs. 10, 12, pupa).

Sphinx boerhaviæ, Fabricius, 1775, p. 542 (E. Indies).
Hippotion boerhaviæ, Roths. & Jord., 1903, p. 756; Mell, 1922, p. 281, pl. ix, figs. 19, 20 (larva), pl. xiii, figs. 51, 52, pl. xviii, figs. 49, 50, pl. xix, figs, 1, 2, (pupa); Seitz, 1929, p. 564, t. 67 *c*.
c *Sphinx theylia*, Cramer (non Linn.), 1779, p. 58, pl. ccxxvi, fig. E (Coromandel).

Isoples theylia, Moore, 1882, p. 19, pl. lxxxiv, fig. 5.
Chærocampa theylia, Forsayeth, 1884, p. 389 (Mhow; life-history); Swinhoe, 1885 A, p. 288 (Poona; Bombay); id., 1886, p. 434 (Mhow); id., 1888, p. 118 (Karachi); Hampson, 1892, p. 85, fig. 53 (♂); id., 1893, p. 56, pl. clxxv, fig. 1 (larva); Dudgeon, 1898, p. 410 (Sikkim; Bhutan); Nurse, 1899, p. 513 (Cutch).

Imago.—♂♀. Difficult to distinguish from *rafflesi*, but usually less red; first segment of palpus paler, the white line less distinct. Hind wing red, base not black; a clayish subanal patch. *Expanse*: ♂♀ 50–68 mm.

♂. Tenth segment (fig. 105 J) as in *rafflesi*, but the apical hook of the sternite obviously longer. Process of harpe (fig. 105 K) stout, rounded at end, with a long dorso-apical tooth curved towards the clasper. Penis-funnel elongate-triangular; penis-sheath as in *rafflesi*, but the left side with more teeth, which are either simple or divided.

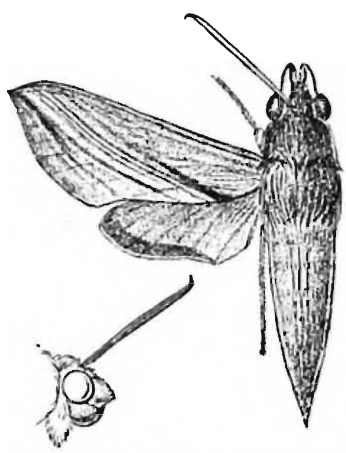


Fig. 109.—*Hippotion boerhaviæ* (Fabr.).

♀. Edges of vaginal aperture less raised than in *rafflesi*.

Hab. W and E. Himalayas, S. India and Ceylon to S. China, Malaya and the Philippines. We have bred the species in S. India, where it is common in open country, and in the W and E. Himalayas, where it is less common. Mell has bred it in S. China.

Egg.—Broadly ovoid, surface shining and smooth, colour bright green.

Larva:—

Final instar. Head round; clypeus equilaterally triangular, one-half the length of the head; false clypeus forming a fairly broad arch over apex of true clypeus, reaching to two-thirds length of head; labrum one-half length of clypeus; ligula longer than labrum, its outline square; cutting-edge of mandible coarsely toothed; eyes 1 to 4 forming a semicircle, 6 in line with 3 and 4; 1 to 4 equidistant, 6 twice as far from 4 as 4 is from 3; 5 closer to 4 than to 6. Surface of head dull and smooth. Body shaped as in others of the genus, with dull and

smooth surface. Horn straight, rather short and thin, tapering gently to a blunt tip, minutely tuberculate.

Coloration.—Head plumbeous with an olive-green tinge; labrum glassy-white; ligula opaque-white; basal segment of antenna white, other segments reddish; mandible white, tip black. Body plumbeous tinged with olive-green; segments 6 to 12 with a number of short dark lines across each secondary ring, except on venter; a narrow blue dorsal stripe; a narrow pinkish dorso-lateral stripe on 2 to 4 and from 11 to base of horn and thence to tip of anal flap; a greyish subspiracular stripe, broad and well defined on 2 to 5, then narrower and ill-defined to 12; a dorso-lateral, rounded ocellus on 5, pupil with the lower half black, shading into rusty in the upper half, in which there is a line of coalescent white dots; the whole edged broadly above, narrowly below with yellow and ringed with black; smaller ocelli on 6 to 11, decreasing in size backwards, pupil yellow shading to rusty above, ringed narrowly with black; all the ocelli with a small crescent of pale blue above the upper edge; a small round, subdorsal yellow spot mesially on 6 to 11, and a round blue supra-spiracular spot on the same segments. Horn with base pinkish, middle black, tip white; legs pink; venter sparsely dotted with white. Length 55 mm.; breadth 8 mm.; horn 4 mm.

The moths which emerged from the larva and pupa figured on Pl. V, figs. 9, 10, appear to belong to this species, but both the larva and the pupa are so different from the ordinary larva and pupa of *boerhaviæ* that we think that further investigation may show that they belong to a new species.

Pupa.—Tongue-sheath projecting nearly as much in front of head as in *rafflesi*, but directed more ventrad; semi-circular in side-view; antenna equal to fore leg and reaching to the middle of wing-case, mid-leg to two-thirds length of wing-case. Surface moderately shining; head and wing-case smooth, thorax and abdomen shallowly transversely corrugate, abdomen also pitted. Spiracle of 2 indicated by the front margin of 3 being depressed below the hind margin of 2. Cremaster triangular, broad and deep at base, ending in a needle-like shaft, simply pointed; a small funnel-shaped depression under base. Colour livid bone-colour; thorax tinted smoky laterally, and head, tongue-sheath and thorax speckled with black; inner margin of wing black; abdomen with dorsum pinkish, and an interrupted dark dorsal stripe; spiracles black, a pale area round each, pits rusty. Length 45 mm.; breadth 9 mm.; tongue-sheath projecting 5·5 mm. in front of head.

Habits.—Food-plants: *Impatiens* Linn., family Geraniaceæ; *Spermococe stricta* Linn.; *S. hispida* Linn., family Rubiaceæ;

Glossostigma spathulatum Arn., family Scrophulariaceæ; *Boerhavia repens* Linn., *B. diffusa* Linn., family Nyctaginaceæ, and other plants. The moth comes to light freely, and sometimes visits flowers before dark. We once saw hundreds come on board a ship sailing between Aden and Bombay during a cyclone.

Genus **THERETRA** Hübner. (Fig. 110).

Hübner, 1822, p. 135 (part.); Roths. & Jord., 1903, p. 762.
Hathia, Moore, 1882, p. 19.

Genotype : *nessus* (Drury).

Imago.—" ♂♀. Second segment of palpus on inner side with apical tuft of scales directed ventrad; apex of first segment (fig. 110 D, E) densely and regularly scaled on inner side, with cavity at apex on outer side " (Roths. & Jord., 1903, p. 762).

The moths vary in size from very large (*T. nessus*) to rather small (*T. griseomarginata*) species. The upperside is brown or

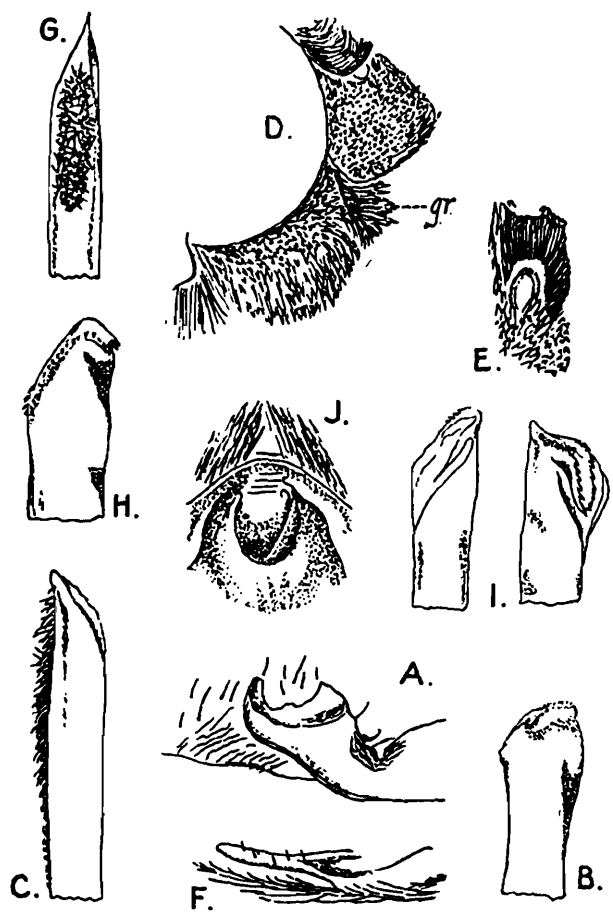


Fig. 110.—*Theretra* Hübn.

A, *T. nessus* (Drury), ♂, harpe; B, penis-sheath. C, *T. clotho* (Drury), ♂, penis-sheath, right side. D, *T. latreillei lucasi* (Walk.), ♂, palpus, external aspect (*gr*, cavity in 1st segment); E, palpus, first segment, apex from inner side; F, harpe; G, penis-sheath, lorsal side. H, *T. alecto* (Linn.), ♂, penis-sheath. I, *T. lycetus* (Cram.), ♂, penis-sheath, right and left sides; J, ♀ vaginal plate.

chestnut with at least one dark line from apex to inner margin; hind wing dusky or red. The wings are narrow and sharply pointed, and the abdomen sharply pointed.

Egg.—Broadly ovoid; surface smooth and shining; colour green or whitish. Length about 2 mm.

Larva.—Head small and round; body tapering sharply frontad from segment 5, which is swollen; rest of body nearly cylindrical; horn of medium length, down-curved or straight, short in *pinastrina*. Surface dull and smooth. Colour green or brown, with one or more dorso-lateral ocelli, in *lycetus* with nine ocelli; a dorso-lateral stripe, but oblique stripes absent or not clearly defined.

Pupa.—Tongue-sheath projecting frontad and ventrad, sometimes much projecting frontad; a coxal piece always present. Surface moderately shining, and smooth or somewhat rugose; ante-spiracular ridges usually present. Cremaster usually well developed and bifid, without hooks or spines except at tip. Colour yellowish or brownish, mottled, speckled and striped with contrasting colours.

Habits.—Food-plants varied, but often belong to the families Ampelideæ and Aroideæ. Habits the same as others of the subfamily.

Hab. Oriental and Æthiopian Regions, a few species northwards to Japan, two ranging to the Caspian Sea and Constantinople respectively. Fifteen Indian species and subspecies.

Key to the Species.

Imagines.

1.	Fore wing chestnut or reddish-brown; lines more or less erect	2.
	Fore wing not so; generally pale brown, lines oblique	3.
2.	Costa and stigma of fore wing buffish-white; hind wing bright pink; thorax with a white dorsal and lateral stripe	[p. 455. *T. pallicosta* (Walk.),
	Costa very narrowly white, no white stigma; hind wing dusky; thorax without dorsal stripe	[p. 459. *T. castanea* (Moore),
3.	Hind wing red	4.
	Hind wing not red, dusky	6.
4.	Thorax and abdomen with greyish dorsal stripe; abdomen without black side-patch	[p. 444. *T. suffusa* (Walk.),
	Thorax and abdomen without dorsal stripe; abdomen with black side-patch on first segment	5.
5.	Hind wing underside unicolorous except for the marginal band	[p. 440. *T. a. alecto* (Linn.),
	Hind wing underside with basal half wood-brown	[p. 443. *T. mansoni* Clark,
6.	Very large; thorax and abdomen green, abdomen with sides golden; costa of fore wing green	[p. 430. *T. nessus* (Drury),

	Never so large; body not green and no green on fore wing	7.
7.	Abdomen with black side-patch on first segment	8.
	Abdomen without black side-patch . . .	10.
8.	Fore wing with six lines; abdomen with five dorsal lines	[p. 433. *T. boisduvali* (Bugn.),
	Fore wing with only one distinct line; abdomen without dorsal lines . . .	9.
9.	Fore wing with apical line joining a discal line with which it forms a single line running from tip to inner margin . .	[p. 434. *T. c. clotho* (Drury),
	Apical line, if present, separate from the respective discal line, which curves costad	[p. 437. *T. gnoma* (Fabr.),
10.	Abdomen without lines; fore wing with six lines	[(Walk.), p. 438. *T. latreillei lucasi*
	Abdomen with dorsal line or lines . . .	11.
11.	Fore wing with broad grey submarginal band; abdomen with a grey dorsal stripe	[(Hamps.), p. 454. *T. griseomarginata*
	Fore wing without such a band.	12.
12.	Stigma of fore wing situated in a black or brown indistinct patch; discal band forming three black contiguous patches between SC^5 and R^3	[p. 454. *T. i. insignis* (Butl.),
	Stigma isolated, followed by a dark straight oblique band consisting of two or three distinct lines.	13. [p. 451.
13.	Abdomen with one white dorsal line	*T. p. pinastrina* (Mart.),
	Abdomen with dorsal line double . .	14.
14.	Fore wing with line 4 straight, very heavy; pale band of hind wing reddish; sides of abdomen golden	[p. 445. *T. lycetus* (Cram.),
	Fore wing with blackish-brown discal band consisting of lines 1, 2 and 3, the last heavier than line 2; abdomen with ochraceous lateral stripe	[(Fabr.), p. 448. *T. o. oldenlandiæ*

Larvæ.

1.	A dorso-lateral ocellus on 5 only	2.
	Ocelli on 5 and 6 only .	3.
	Ocelli on 5 to 11	4. [p. 446.
	Ocelli on 4 to 12 and a spot on 3	*T. lycetus* (Cram.),
2.	Pupil with a pale horizontal stripe across middle; a varying number of blind ocelli sometimes present	[p. 435.. *T. c. clotho* (Drury), [p. 437. *T. gnoma* (Fabr.),
	Pupil black in front, red behind	[(Walk.), p. 439. *T. latreillei lucasi*
	Pupil velvety black.	[p. 459. *T. castanea* (Moore),
3.	Larva very large; horn down-curved	*T. nessus* (Drury),
4.	Horn down-curved	5. [p. 432.
	Horn straight	7.
5.	Ocelli on 6 to 11 elongate-oval and set obliquely	[p. 456. *T. pallicosta* (Walk.),
	Ocelli on 6 to 11 shortly oval, longitudinal.	6. [p. 445.
6.	Horn long, blue, slightly down-curved.	*T. suffusa* (Walk.),

Horn purple or plum-colour, strongly down-curved . ... [p. 441.
7. Ocelli on 5 and 6 alike, and different from those on 7 to 11 . .. . . *T. a. alecto* (Linn.), [(Fabr.), p. 449.
Ocelli increasing in size from 5 to 9, then decreasing, all rather obscure; horn very short *T. o. oldenlandiæ* [(Mart.), p. 452.

Pupæ.

1. Cremaster ending in two teeth, the bases of which touch each other . . 2.
Cremaster ending in two teeth or shafts, the bases of which are widely separated. 5.
Cremaster not as above . 8.
2. Tongue-case much projecting in front of head . . . . [p. 443.
T. a. alecto (Linn.),
Tongue-case not much projecting frontad. 3. [p. 458.
3. Teeth of cremaster simply pointed. *T. pallicosta* (Walk.),
Teeth of cremaster minutely bifid .. 4.
4. Spiracle of segment 2 in a deep depression, and palpal depression also deep . . . [p. 436.
T. c. clotho (Drury),
Spiracle of segment 2 in a much shallower depression, and palpal depression also shallower .. .. [p. 438.
T. gnoma (Fabr.),
5. Cremaster triangular in dorsal view .. 6.
Cremaster with sides converging first gently, then more sharply. . .. [p. 448.
T. lycetus (Cram.),
6. Cremaster ending in two simple teeth. 7. [p. 460.
Cremaster ending in two bifid shafts. *T. castanea* (Moore),
7. Tongue-case much projecting in front of head . . . [p. 445.
T. suffusa (Walk.),
Tongue-case not much projecting frontad. *T. latreillei lucasi* [(Walk.), p. 440.
8. Cremaster ending in a single bifid shaft, or in two shafts close to and parallel with each other; length of pupa over 70 mm. . . [p. 433.
T. nessus (Drury),
Cremaster ending in a truncate conical bifid shaft; length about 40 mm. . [(Fabr.), p. 450.
T. o. oldenlandiæ
Cremaster ending in a triangular shaft, minutely bifid at tip; length about 47 mm. [(Mart.), p. 453.
T. p. pinastrina

155. **Theretra nessus** (Drury). (Fig. 110 A, B, genitalia; fig. 111, imago; Pl. V, fig. 16, larva, fig. 17, pupa).

Sphinx nessus, Drury, 1773, p. 46, pl. lxxvi, fig. 1, and Index (Madras).

Chærocampa nessus, Walker, 1856, p. 140 (Canara; Ceylon; Sylhet; Hong-Kong; Java); Moore, 1857, p. 276, pl. xi, figs. 2, 2 *a* (l., p.); id., 1877, p. 595 (Pt. Blair); Butler, 1881 A, p. 613 (Belgaum); Swinhoe, 1888, p. 118 (Karachi); id., 1890, p. 164 (Moulmein).

Theretra nessus, Moore, 1882, p. 22, pl. lxxxvi, fig. 1; Hampson, 1892, p. 99, fig. 56 (♂); Dudgeon, 1898, p. 412 (Sikkim; Bhutan, 2,000 ft.); Roths. & Jord., 1903, p. 765; Jordan, 1912, p. 258, t. 42 *c*; Mell, 1922, p. 290, pl. x, figs. 5–11, pl. xiv, figs. 3, 4, pl. xix, figs. 3, 4 (pupa), pl. xxxi, figs. 5, 6 (larva), 7 (♀); Seitz, 1929, p. 565, t. 67 *b*; Scott, 1931, pl. i, fig. 4.

Imago.—♂♀. Head and thorax olive-green, thorax suffused with ferruginous; a grey lateral stripe from palpus to end of thorax; a deep orange dorso-lateral streak; abdomen with a broad olive-green dorsal stripe, on each side of which is a broad, shining golden stripe. Fore wing: costa green up to SC^1, the green spreading over front half of base of wing, hinder half of base occupied by a black and a white patch; rest of wing and costal area dark olive-brown to SC^2; some dark brown lines from apex to inner margin; a broad median band, pale ochreous from apex to SC^1, then pale brown, becoming pink near inner margin; marginal area dusky brown. Hind wing: base black, shading to dusky brown at apex; an

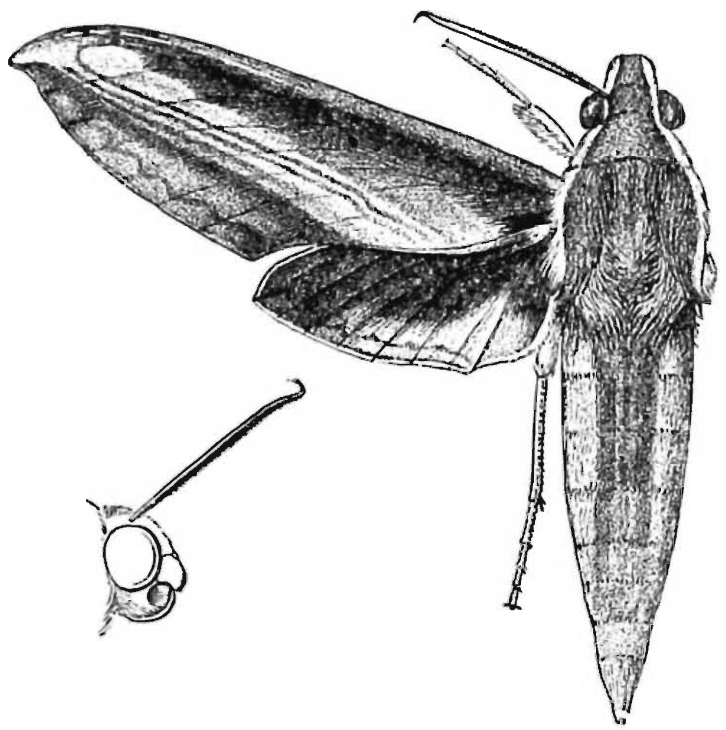


Fig. 111.—*Theretra nessus* (Drury).

ochreous band, broad at anal angle, extending towards apex as a submarginal band. *Underside* suffused with reddish ochreous. Second segment of palpus more triangular than in the other species of *Theretra*, the opening of the palpus large, some single long scales protruding from it. External row of spines of first protarsal segment doubled and trebled. *Expanse*: ♂ 90–120 mm., ♀ 94–130 mm.

♂. Tenth tergite sinuate; sternite slightly spatulate, rounded at end. Clasper with over twenty large scales; harpe (fig. 110 A) very stout, short, curved at end, the upperside somewhat concave, the interno-dorsal edge of the upperside irregularly notched, raised proximally into a broad, compressed tooth, tip of harpe acute in side-view, obtuse in subproximal view. Penis-sheath (fig. 110 B) armed with an elongate kidney-shaped, multidentate, apical lobe.

♀. Edge of vaginal cavity not obviously raised to a ridge.

Hab. W and E. HIMALAYAS, S. INDIA, BURMA and CEYLON to Japan, Malaya, Papuasia and Australia. We have bred it in S. India and the E. Himalayas. It is a common species in suitable localities, preferring hills and forest areas with heavy rainfall to open dry country, though we have seen some specimens collected at Aden.

Larva :—

Final instar. Head small; clypeus triangular, slightly longer than broad, one-half length of head, apex minutely rounded; apex of false clypeus acute and reaching to a little more than one-half length of head; labrum one-half length of clypeus; ligula semicircular in outline; cutting-edge of mandible strongly toothed; eyes 1 to 4 forming a semicircle; 6 in line with 3 and 4; 1 to 4 equidistant, 6 slightly further from 4 than 3 is from 4; 5 making an equilateral triangle with 4 and 6. Surface of head dull and smooth. Body very stoutly built, segment 5 hardly swollen, horn of medium length, stout at base, tapering evenly to a sharp point, gently down-curved.

Colour variable. In the green form, head glaucous-green; labrum greenish, ligula yellowish; basal segment of antenna green, other segments rusty; mandible yellowish, tip dark reddish-brown; eyes brown. Body glaucous-green; a double whitish dorsal stripe from segment 4 to base of horn, and 4 to 12 blotched with whitish dorsally and laterally; a small, white, dorso-lateral, obliquely oval ocellus on 5, and a still smaller one on 6, both edged narrowly with dark green, the long axes parallel with the oblique stripes; white oblique stripes on 5 to 11, running up and back to the dorsal stripe, that on 11 running to base of horn. Horn bright yellow, brownish dorsally; legs yellow. Spiracles small, oval, white with a broad glaucous-green band across the middle.

In another form of the larva (Pl. V, fig. 16) the head is pale brown; body ochreous on the dorsum, with short blue lines across the secondary rings and a large blue subdorsal patch on the front half of segments 6 to 11; a narrow brown dorsal stripe; a narrow brown dorso-lateral stripe from 3 to base of horn, edged below with white, narrowly on 3 to 5, broadly to base of horn; six or seven brown oblique stripes; the area below the dorso-lateral stripe pale brown with a number of short brown lines across the secondary rings; the ocellus on 5 pale blue above, yellow below, that on 6 white. Spiracles with a brown instead of a green band.

In some individuals the dorsum is reddish-ochreous mottled with brown. Length 90–120 mm.; breadth 15 mm.; horn 10 mm.

Pupa.—Tongue-sheath projecting considerably in front of head, the projection semicircular in side-view, ridged along its edge; antenna shorter than fore leg, which reaches to between one-third and one-half distance to tip of wing-case, mid-leg to between one-half and two-thirds. Surface dull and smooth. Spiracle of 2 a narrow slit, the hind margin of 2 slightly curved-emarginate and the edge raised in front of it, a transversely oblong lobe, its surface sightly tilted upwards frontad, behind it; remaining spiracles oval, central slit with raised edges. Cremaster large, triangular, ending in a Y-shaped bifid shaft, or in two shafts close together and parallel with each other, each shaft bent outwards near its tip; upper surface convex, lower surface slightly hollowed, the basal half with a narrow mesial channel, distal half with a double mesial ridge, the whole longitudinally rugose. Colour: head, thorax and wing-case ochreous mottled with fuscous; tongue-sheath dark brown; a pink patch below the eye; abdomen: dorsum ochreous, rest dirty white suffused with fuscous and marked with short dark lines, except the venter and an irregular patch round each spiracle, these being dirty white; spiracles and a patch round each of those on segments 6 to 8 black, the white patches mentioned above surrounding the black patches; cremaster black except the ventral hollow, which is reddish. Length 73 mm.; breadth 15 mm.; tongue-sheath projecting 5 mm. in front of head.

Habits.—Food-plants: *Pongamia glabra* Vent., family Leguminoseæ; *Barringtonia* Först., family Myrtaceæ; *Convolvulus* Linn., family Convolvulaceæ; *Dioscorea* Linn., family Dioscoreaceæ; *Amorphophallus* Bl., family Aroideæ (arums). The larva is sluggish in its movements, moving slowly and jerkily, but feeds voraciously. It turns pinkish in colour before pupation, which sometimes takes place in a cocoon made among the leaves of the food-plant.

156. **Theretra boisduvali** (Bugn.).

Sphinx boisduvali, Bugnion, 1839, p. 115 (nom. nov. pro *creticæ* Boisd., ♂).
Theretra boisduvali, Roths. & Jord., 1903, p. 767; Jordan, 1912, p. 259, t. 42 *d*; Seitz, 1929, p. 565.
Chærocampa punctivenata, Butler, 1875, p. 248 (Masuri; Sylhet); Swinhoe, 1885 A, p. 288 (Bombay).
Chærocampa butus, Hampson (non Cram.), 1892, p. 93.

Imago.—♂♀. Greyish-yellow; head and thorax with a pale lateral stripe; abdomen with five faint dorsal lines, the median one very indistinct, and a black side-patch on first segment. Fore wing with six dark lines, the one running to apex usually accentuated on the veins by dark dots. Hind wing black

at base, shading to brown apically; a greyish-yellow patch at the anal angle continued costad as a short feebly marked band. Cavity at apex of first segment of palpus large and sharply defined. *Expanse* : ♂ 84–108 mm., ♀ 98–108 mm.

Hab. E. HIMALAYAS (Sikkim ; Khasi Hills) and CEYLON, westwards to Asia Minor and Turkey (as a straggler) and eastwards to Malaya. Fairly common, but the early stages unknown.

157 **Theretra clotho clotho** (Drury). (Fig. 110 C, genitalia ; fig. 112, imago ; Pl. V, figs. 18, 19, larva, fig. 20, pupa ; Pl. XII, fig. 5, ocellus of larva ; Pl. XV, fig. 12, larva).

Sphinx clotho, Drury, 1773, p. 48, pl. xxviii, fig. 1, and Index (Madras).

Chærocampa clotho, Moore, 1865, p. 794 (Bengal) ; Swinhoe, 1885 A, p. 289 (Bombay ; Belgaum) ; id., 1890, p. 164 (Moulmein ; Mandalay).

Hathia clotho, Moore, 1882, p. 20, pl. lxxxvii, fig. 1.

Theretra clotho clotho, Roths. & Jord., 1903, p. 769, pl. xiv, fig. 9 (♂) ; Jordan, 1912, p. 259, t. 42 *d* ; Mell, 1922, p. 294, pl. xi, figs. 1–7, pl. xiv, figs. 19, 20, pl. xix, figs. 9, 10 (pupa), pl. xxxi, figs. 8, 9 (larva) ; Seitz, 1929, p. 565 ; Scott, 1931, pl. iii, fig. 3 (larva).

Deilephila cyrene, Westwood, 1848, p. 13, pl. vi, fig. 1 (Cent. India ; Ceylon).

Chærocampa aspersata, Kirby, 1877, p. 241 (Andamans) ; Waterhouse, 1882, pl. xcvii.

Chærocampa butus, Hampson (non Cram.), 1892, p. 93 (partim) ; id., 1893, p. 3, pl. clxxv, fig. 10 (larva) ; Dudgeon, 1898, p. 412 (Sikkim and Bhutan, up to 4,000 ft.) (partim).

Imago.—♂♀. Head and thorax greenish-brown, with a white lateral stripe from palpus to end of thorax ; abdomen brown with a black side-patch at base. Fore wing brown with an apical line joining a discal line with which it forms a single dark line from apex to inner margin. Hind wing black, shading to brown at apex ; a buff band along costa and a buff patch near anal angle. *Underside* ochreous. *Expanse* : ♂♀ 80–100 mm.

♂. Tenth tergite sinuate ; sternite pointed. Friction-scales of clasper numerous and narrow ; harpe without free process, truncate, dorsal edge more or less notched. Patch of teeth on penis-sheath long, the teeth pointing proximad ; the central point of each tooth much longer than the lateral ones and curved (fig. 110 C).

Hab. W and E. HIMALAYAS, S. INDIA, CEYLON, BURMA and the ANDAMAN ISLANDS to China, Malaya and the Philippines. We have bred it in many localities in India, where it is common in areas of medium and heavy rainfall.

Egg.—Broadly ovoid, surface shining and very finely pitted, colour pale green. Length 2 mm. ; breadth 1·8 mm.

Larva :—

1*st instar*. Honey-yellow, green after feeding ; horn black, long, straight, minutely bifid. 2*nd instar*. Head and body yellowish-green ; a narrow yellow dorso-lateral stripe ; a black ocellus, ringed with white, on segment 5. 3*rd instar*. Head and body pale green, with short, dark green lines ; a dark green dorsal stripe ; a pale dorso-lateral stripe from segment 6 to base of horn ; an ocellus on 5 enamel-white with a large black pupil, in the middle of which is a longitudinally elongate-oval blue spot, the whole edged narrowly with dark green above, black below ; a much smaller ocellus on 6 and ocelli of decreasing size on 7 to 11, white edged above with black ; horn long, straight, black with base orange except for a brown dorsal spot ; end red with the extreme tip white. 4*th instar*. Head green, body grass-green dotted with

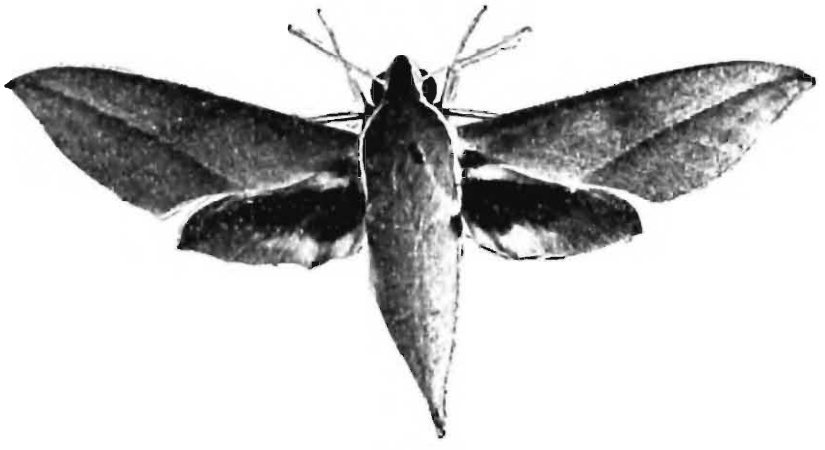


Fig. 112.—*Theretra clotho clotho* (Drury).

pale yellow ; dorso-lateral stripe yellow ; ocellus on 5 yellow with green pupil, in which is a horizontal blue line, the whole edged narrowly with black ; horn long, thin, minutely bifid, slightly up-curved, base blood-red, then fuscous shading to black, tip yellow or pink. The ground-colour varies a good deal and there may be blind ocelli on segments 6 to 11.

5*th instar*. Head slightly shining, covered sparsely with minute rounded tubercles ; clypeus one-half length of head, apex very acute, basal angles slightly rounded ; apex of false clypeus forming an arch over that of true clypeus ; labrum one-third as long as and as broad as clypeus, longitudinally corrugate ; ligula longer than labrum, elongate kidney-shaped ; cutting-edge of mandible slightly waved ; eyes 1 to 4 in a sharp curve, 6 in line with 3 and 4 ; 1 to 4 equidistant, 6 twice as far from 4 as 4 is from 3 ; 5 forming an equilateral triangle with 4 and 6 ; all of equal size. Body dull and smooth, shaped as in others of the genus. Horn of medium length, sharply down-curved, stout at base, tapering gently to near

the tip where it narrows sharply to a point; surface dull, covered sparsely with small tubercles.

Green form (Pl. V, figs. 18, 19): head glaucous-green; labrum and ligula honey-yellow; basal segment of antenna green, other segments rusty; mandible green with the tip reddish-brown; eye 1 whitish, the rest black. Body glaucous-green or yellowish-green, speckled with darker green on segments 6 to 11; a narrow interrupted dark green dorsal stripe from 6 to base of horn; a large dorso-lateral shortly-oval ocellus on 5, pupil dark green, with a pale blue stripe, edged with darker blue, running horizontally across it; the pupil edged with a broad ring of primrose-yellow, at the lower edge of which is a narrow crescent of crimson; the whole edged narrowly with dark green or black; a small dorso-lateral, longitudinally oval, pale yellow blind ocellus or spot, edged above with green, on 6 to 11, sometimes wanting, sometimes on 6 only; an obscure whitish or yellowish dorso-lateral stripe, broken by the yellow spots, from 6 to base of horn. Horn pale purple; true legs purple with a yellow band on the basal segment. Spiracles pale earth-colour, edged in front and behind for half their length with rose-colour or purple.

In the dark-coloured form the green body-colour is replaced by dull brown, and there are dark brown oblique patches on segments 6 to 11. Length 85 mm.; breadth 12 mm.; horn 9 mm.

Pupa.—Head subquadrate, shoulders rather prominent; tongue-sheath not much projecting frontad but projecting considerably ventrad, nearly semicircular in side-view, with a narrow mesial channel; antenna slightly longer than fore leg, which reaches to about the middle of the wing-case, mid-leg to two-thirds the distance to the tip; a narrow coxal piece. Surface dull and smooth; a deep palpal depression at edge of tongue-sheath below eye; front bevel of segment 9 with four or five narrow, more or less parallel, ante-spiracular ridges; similar but fewer ridges on 10 and 11. Spiracle of 2 a narrow slit lying between the slightly raised hind margin of 2 and a transverse, rounded-oblong, depressed area running back from the front margin of 3, the whole lying at the bottom of a deep depression; remaining spiracles elongate-oval, central slit with thick rim. Cremaster triangular, broad and deep at base, ending in two slightly diverging conical teeth, their bases touching, each tooth minutely bifid at tip; upper surface convex and coarsely shagreened, lower surface concave; under base of cremaster a wide, deep, funnel-shaped depression runs axially forward into 14. Head, thorax and wing-case soiled brown, with mottling of a much paler shade, except on tongue-sheath; abdomen bone-colour, suffused and lined with soiled brown except on dorsum and

round the spiracles; a broad, ill-defined, greenish dorsal stripe; a round, pale yellow subdorsal spot near the front margins of 6 to 10; hind bevels of 8 to 10 dull yellow speckled with black, front bevels of 9 to 11 pink mottled with brown; spiracles black; cremaster with basal half yellowish, distal half black. Length 60 mm.; breadth 14 mm.; tongue-sheath projecting 3 mm. in front of head.

Habits.—Food-plants: *Dillenia pentagyna* Roxb., *D. indica* Linn., family Dilleniaceæ; *Hibiscus mutabilis* Linn., family Malvaceæ; *Vitis* Linn., family Ampelideæ; *Fuchsia* Linn., family Onagraceæ; *Amorphorphallus* Bl., family Aroideæ. In the full-fed larva the anterior segments are not so strongly retractile as in others of the genus, and when in the resting position the anterior segments are more contracted ventrally than dorsally, the head being held with the face directed downwards; the larva has the peculiar power of inflating the ocelli at will, so that they become quite prominently convex. The pupa is lightly attached to one end of the cocoon by the points of the cremaster.

The moth has a very swift and powerful flight; it is sometimes attracted by light, and may often be seen visiting flowers at and after dusk. The ♂♂ do not come readily to captive ♀♀.

158. **Theretra gnoma** (Fabr.). (Pl. V, fig. 13, larva).

Sphinx gnoma, Fabricius, 1775, p. 546 (India).
Theretra gnoma, Roths. & Jord., 1903, p. 770, pl. xiv, fig. 1 (♂); Seitz, 1929, p. 565, t. 67 *d*.
Sphinx butus, Cramer, 1777, p. 88, pl. clii, fig. A (Coromandel).
Chærocampa butus, Hampson, 1892, p. 93.
Chærocampa gonograpta, Butler, 1875, p. 249 (Bombay; S. India); Swinhoe, 1885 A, p. 288 (Poona; Belgaum; Bombay); id., 1892, p. 20 (Nilgiris; Canara; Bombay).

Imago.—♂♀. Very similar to *clotho clotho*, but paler. Fore wing with one discal line, which is almost parallel with the outer margin and curves costad at SC^5, accentuated on the veins, and sometimes absent; the apical line, if present, separate from the discal line; a second line, often vestigial, situated nearer cell. Hind wing with the pale marginal area more extended than in *c. clotho*. *Expanse*: ♂ 80–96 mm., ♀ 84–108 mm.

Sexual armature as in *c. clotho*.

Hab. S. India and Ceylon. We have bred the species in S. India, where it is rather rare and local, occurring in open country with moderate rainfall up to 4,000 feet elevation.

Egg.—Similar to that of *c. clotho*.

Larva.—Very closely resembles that of *c. clotho* in all instars. Moths of *gnoma* were sometimes obtained from eggs and larvæ which we had taken to be those of *c. clotho*, and when, after many years, we succeeded in isolating a batch of *gnoma*

eggs we were unable to distinguish any difference between the larvæ from these and larvæ of *c. clotho* with an ocellus on segment 5 only.

Pupa.—Very similar to that of *c. clotho*, but differs in the following respects: tongue-sheath not more prominent ventrad than frontad; mid-leg not so long; front bevel of segment 9 with about twelve ante-spiracular ridges more or less parallel but anastomosing in places, 10 and 11 with less prominent ridges; spiracle of 2 in a shallower depression, and the palpal depression also shallower; the depression under base of cremaster much deeper; wing-case not so dark in colour, but with black streaks along R^1 and R^2, and black dots on bases of veins and along costa.

Habits.—Food-plant: *Vitis* Linn., family Ampelideæ. Habits similar to those of *c. clotho.*

159. **Theretra latreillei lucasi** (Walk.). (Fig. 110 D, E, palpus, F, G, genitalia; Pl. V, fig. 14, larva, fig. 15, pupa).

Chærocampa lucasi, Walker, 1856, p. 141 (N. India; Sylhet); Moore, 1857, p. 277, pl. xi, figs. 3, 3 *a* (l., p.) (Java; Canara); id., 1865, p. 794 (Bengal); Swinhoe, 1885 A, p. 288 (Bombay); id., 1890, p. 164 (Rangoon); Hampson, 1892, p. 92 (syn. part.).
Hathia lucasi, Moore, 1882, p. 20, pl. lxxxvi, fig. 3.
Theretra latreillei lucasi, Roths. & Jord., 1903, p. 773; Mell, 1922, p. 297, pl. xi, figs. 2–5 (8–11), pl. xiv, fig. 22, pl. xix, figs. 11, 12 (pupa), pl. xxxi, figs. 10–12 (larva); Seitz, 1929, p. 566.
Chærocampa tenebrosa, Moore, 1877, p. 595 (Pt. Blair).
Hathia tenebrosa, Moore, 1882, p. 20, pl. lxxxvi, figs. 2, 2 *a* (l., p., i.).

Imago.—♂♀. Head and body drab, antenna, front of head and sides of thorax paler; abdomen with no black side-patches and no stripes. Fore wing drab with six discal lines, the first nearly always dilated near apex of cell; a black basal patch at inner margin more or less vestigial; a black speck at end of cell. Hind wing smoky-black, paler towards anal angle. Underside buff or vinaceous-buff. Cavity at end of first segment of palpus (fig. 110 D, E) partly concealed by irregular scaling. External row of spines of first protarsal segment double, at least at base. *Expanse*: ♂ 64–86 mm., ♀ 78–86 mm.

♂. Tenth abdominal tergite long and slender; apex of sternite rounded-truncate. Clasper with a patch of about ten enlarged scales, in two or three oblique rows, nearer apex than base; harpe (fig. 110 F) prolonged into a free, straight, obtuse, somewhat tapering process. Tip of penis-sheath (fig. 110 G) acute, the teeth mostly three-pointed.

Hab. E. Himalayas, S. India, Ceylon, Burma and the Andaman Islands to Malaya and the Philippines. We have bred it in S. India, where it is very common in the Kanara District, and may be found at all times of the year.

Egg.—Broadly ovoid, surface smooth and shining, colour bright grass-green. Length 1·5 mm.; breadth 1·3 mm.

Larva:—

1*st instar*. Head yellow, body greenish-yellow; horn very long, straight, shining black in colour. 2*nd instar*. Head yellowish-green, body shining green; a small dull purplish dorso-lateral ocellus on segment 5; a whitish dorso-lateral stripe from 5 to base of horn; horn black with red base. 3*rd instar*. Green dotted with yellow; dorso-lateral stripe yellow. 4*th instar*. Dorsum with white dots; the ocellus with pupil black in front, red behind, the red portion containing a yellow inverted comma-shaped marking, the whole edged narrowly with blue and then black; the dorso-lateral stripe edged above with purple on segments 11 and 12; horn pale greenish-brown dorsally, still paler ventrally, with small black tubercles.

5*th instar*. Head with dorsal line slightly depressed on vertex; clypeus one-half length of head, apex acute, basal angles rounded; apex of false clypeus forming a wide gothic arch over apex of true clypeus, reaching to two-thirds length of head; labrum nearly half as long as clypeus, tapering frontad, longitudinally ridged; ligula as long as labrum; cutting-edge of mandible obscurely toothed; eyes 1 to 4 equidistant in a slight curve; 6 in line with 3 and 4 and twice as far from 4 as 4 is from 3; 5 forming an equilateral triangle with 4 and 6. Surface of head dull, under a lens seen to be transversely wrinkled. Body as in others of the genus, dull and smooth, segments 5 and 6 not much swollen. Horn of medium length, stout at base, tapering gently till near the tip, where it suddenly narrows to a point, basal half of horn straight and rising vertically, distal half bent sharply downwards; surface dull and covered with small tubercles.

Green form: head green, labrum, ligula and basal segment of antenna green, other segments of antenna soiled white; mandible green with tip narrowly brown; eyes brown. Body grass-green with a transverse row of coalescing dots, whitish above the dorso-lateral stripe, yellow below it, along each secondary ring on segments 5 to 12; a narrow black dorsal stripe on 2 to 5; a dorso-lateral ocellus on 5 coloured as in the 4th instar, but when nearly full-fed the yellow comma-shaped mark disappearing; a yellow suffusion between the ocelli over the dorsum; a narrow white dorso-lateral stripe from 6 to base of horn. Horn green; legs red. Spiracles elongate-oval, fuscous, the ends shortly yellow, the whole edged narrowly with black and then yellow.

In the dark-coloured form the head is dark brown dotted with paler brown; labrum and ligula brown; basal segment of antenna whitish, other segments reddish; mandible yellow,

tip shortly brown. Body dark chocolate-brown, the transverse dots paler brown with black dots between them ; the ocellus as in the green form ; the dorso-lateral stripe formed of pink dots on segments 4 and 5, wanting on 6 to 10, pink on 11 and 12 ; horn dusky black, the tip shortly yellowish ; legs yellow with a black patch on each segment and a black line down the outer side ; venter of 2 to 4 pale brown edged broadly with dark brown. Length 60 mm. ; breadth 11 mm. ; horn 5 mm.

Pupa.—Tongue-sheath not very prominent, semicircular in side-view ; antenna slightly longer than proleg, which reaches to about one-third the distance to tip of wing-case, mid-leg to two-thirds ; a narrow coxal piece. Surface dull, head, thorax and wing-case slightly shining ; head and thorax very shallowly, irregularly corrugate ; abdomen finely transversely wrinkled ; front bevel of segment 9 transversely lined. Spiracle of 2 a narrow slit lying between the hind margin of 2 and the straight, slightly raised front margin of 3 ; from the raised front margin of 3 a small area shaped like a segment of a circle projects posteriad, its surface depressed posteriad ; remaining spiracles elongate-oval, the central slit lying in a narrower, raised oval. Cremaster triangular, flattened, tip broadly truncate, ending in two short, widely separated teeth ; segment 14 shallowly axially hollowed under base of cremaster. Colour pinkish bone-colour, wing-case paler, head and thorax suffused with greenish and speckled profusely with brown except on a broad dorsal stripe, which is only lightly speckled ; a broad dark brown dorsal stripe from segment 4 to 12 ; abdomen with a broad brown spiracular and a narrow brown ventral stripe,the sides and venter speckled with brown ; the segment of a circle behind spiracle of 2 black, other spiracles bone-colour, the central slit with a dark reddish-brown rim ; cremaster brown. Length 50 mm. ; breadth 11 mm. ; tongue-case projecting 2 mm. in front of head.

Habits.—Food-plants : *Saurauja tristyla* DC., family Ternstrœmiaceæ ; *Impatiens* Linn., family Geraniaceæ ; *Vitis* Linn., family Ampelideæ ; *Lagerstrœmia flos-regina* Retz., family Lythraceæ ; *Begonia* Linn., family Begoniaceæ. The pupa is not attached to the inside of the cocoon. The moth starts feeding before dark and frequently comes to light.

160. **Theretra alecto alecto** (Linn.). (Fig. 110 H, genitalia ; fig. 113, imago ; Pl. V, figs. 21–23, larva ; Pl. XII, fig. 6, pupa).

Sphinx alecto, Linnæus, 1758, p. 492 (India) ; Drury, 1773, p. 48 and Index, pl. xxvii, fig. 4 (Madras).

Chærocampa alecto, Moore, 1857, p. 275, pl. x, figs. 4, 4 *a* (l., p.) (Java ; Darjiling) ; id., 1865, p. 794 (Bengal) ; Swinhoe,

1885 A, p. 288 (Poona; Bombay); Butler, 1886, p. 379 (Murree); Swinhoe, 1886, p. 434 (Mhow); id., 1888, p. 118 (Karachi); Hampson, 1892, p. 85.

Theretra alecto, Dudgeon, 1898, p. 412 (Sikkim and Bhutan, up to 8,000 ft.).

Theretra alecto alecto, Roths. & Jord., 1903, p. 776; Jordan, 1912, p. 259, t. 42*f*; Mell, 1922, p. 299, pl. x, figs. 22–28 (larva), pl. xiv, figs. 5–8, pl. xix, figs. 5–6 (pupa); Seitz, 1929, p. 566; Scott, 1931, pl. iii, fig. 6 (larva).

Chærocampa cretica, Butler (non Boisd.), 1880, p. 411, pl. xxxix, fig. 8 (Kandahar; descr. of larva).

Imago.—♂♀. Head and thorax dark brown, abdomen pale brown; antenna and sides of head and thorax whitish; abdomen with a black side-patch on first segment and three dark dorsal lines, sometimes absent. Fore wing pale brown, with a dark speck at end of cell; six or seven dark lines from apex to inner margin, line 5 heavy, sometimes 1 also, 2 and 4

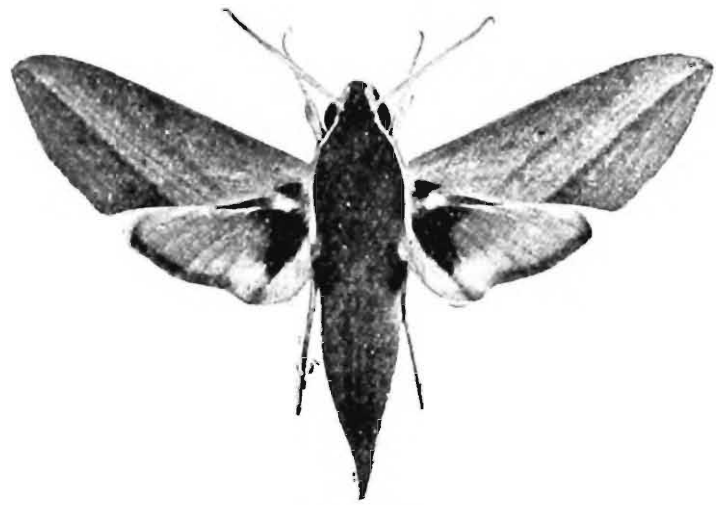


Fig. 113.—*Theretra alecto alecto* (Linn.).

weak, 6 and 7 vestigial or absent. Hind wing pink, black at base, anal angle flesh-colour. *Underside* flesh-colour. *Expanse*: ♂ 84–92 mm., ♀ 75–106 mm.

For detail of penis-sheath see fig. 110 H.

Hab. W and E. Himalayas, S. India and Burma, northward to Formosa, eastward to the Key Islands.

Egg.—Broadly ovoid, surface smooth and shining, colour bright green.

Larva:—

1st instar. Pale yellow, with a long st raight black horn *2nd instar*. Green, horn black. *3rd instar*. Head and body green; a dark green dorsal stripe; a white dorso-lateral stripe; ocelli on segments 5 to 11, that on 5 larger than the rest, either reddish or blue, ringed with black; horn long, thin, base red or orange, rest black. In this and the succeeding instars there is also a dark-coloured form of the larva. *4th instar* (Pl. V, fig. 21). Green speckled with yellow, except on head

and segments 2 to 5; a narrow dorsal stripe, black and sharply defined on 2 to 5, then brown and diffuse to 11; the dorso-lateral stripe edged above by a dark green shade; the ocellus on 5 large and round, pupil black above, shading to red or brownish-purple, the pupil edged broadly below with bright yellow, narrowly above with white, and then with black; remaining ocelli longitudinally oval, pupil purple or red above, yellow below, the whole ringed with black; horn of medium length, straight or curved gently up or down, base dull red, rest shining black, sometimes with a white tip, the whole with self-coloured small tubercles.

5th instar. Head dull and smooth; true clypeus equilaterally triangular, about one-half length of head; false clypeus broadly arched over apex of true clypeus, reaching to slightly more than one-half length of head; labrum one-half length of clypeus, not quite as broad as clypeus, narrowing frontad; longitudinally lined; ligula longer than labrum, kidney-shaped, sinus very deep and rounded; eyes 1 to 4 in a slight curve, equidistant; 6 in line with 3 and 4, twice as far from 4 as 4 is from 3, 5 making an equilateral triangle with 4 and 6; eye 1 smaller than the rest. Body dull and smooth, with segments 4 and 5 considerably swollen. Horn of medium length, stout at base, tapering evenly to a point, slightly down-curved; surface dull and covered with small tubercles.

Green form (Pl. V, fig. 23): head grass-green; labrum and ligula green; antenna green, second and third segments tinged with pink; mandible green, tip reddish-brown, extreme tip black. Body dark green above the dorso-lateral stripe, with short, broad, yellow stripes across each secondary ring of segments 6 to 11; paler green below the stripe, closely dotted with whitish; a narrow, dark green dorsal stripe; a broad, pale yellow dorso-lateral stripe from 2 to base of horn, interrupted by the ocelli; ocellus on 5 longitudinally oval, pupil with a black, pear-shaped marking at the top, below this green or purplish-brown, the pupil edged broadly below, narrowly elsewhere, with yellow of the same shade as the dorso-lateral stripe, the whole edged narrowly with brown or green; ocelli on 6 to 11 longitudinally elongate-oval, the upper half green or purplish, paler above, the lower half yellow, and contiguous with the dorso-lateral stripe, the whole edged narrowly with brown or green. Horn plum-colour or purple; legs red, the distal edge of each segment narrowly yellow. Spiracles lilac with a narrow brown rim.

Dark form (Pl. V, fig. 22): the green colour is replaced by olive-brown or brownish-pink; ocelli as in the green form, but of a darker shade; seven broad dark brown oblique stripes, the area round them pinkish. Length 80 mm.; breadth 11 mm.; horn 10 mm.

Pupa.—Tongue-sheath much projecting in front of head; fore leg reaching to about the middle of wing-case, antenna slightly longer; mid-leg to about three-quarters the distance to tip of wing-case; a narrow coxal piece; the hind margin of segment 11 slightly undercut and overlapping the front margin of 12. Surface moderately shining; tongue-sheath with a narrow mesial channel, sides with wide radial corrugations; head and thorax coarsely, superficially shagreened, wing-case smooth; abdomen more finely corrugate; segment 9 with about twelve ante-spiracular ridges, more or less parallel, but anastomosing in places; 10 and 11 with fewer and less prominent ridges; dorsum of 14 deeply pitted. Spiracle of 2 a narrow slit nearly covered by a transverse oblong lobe projecting from the front margin of 3, the front edge of the lobe raised, hind edge depressed; remaining spiracles oval, with very thick raised rims. Cremaster triangular, ending in two short, conical, divergent teeth, their bases touching; upper surface convex and longitudinally, irregularly ridged, lower surface with a broad mesial ridge and lateral extensor-ridges, the whole very rugose; segment 14 shallowly hollowed under base of cremaster. Colour dull ochreous; tongue-sheath reddish-brown; head, thorax and wing-case mottled with blackish in lateral area; abdomen with a very obscure greenish dorsal stripe; hind bevels of segments 8 to 11 chocolate, front bevels of 9 to 11 pinkish; spiracular and ventral regions speckled and striped with brown; spiracles and cremaster black. Length 69 mm.; breadth 13 mm.; tongue-sheath projecting 8 mm. in front of head.

Habits.—Food-plants: *Dillenia indica* Linn., family Dilleniaceæ; *Saurauja nepalensis* DC., family Ternstrœmiaceæ; *Vitis* Linn., *Leea* Linn., family Ampelideæ; *Psychotria* Linn., *Rubia cordifolia* Linn., family Rubiaceæ. The head and anterior segments of the larva are more strongly retractile than in the previous species. The pupa is not attached to the inside of the cocoon. The moths are frequently caught visiting flowers, and are also attracted by light.

161. **Theretra mansoni** Clark. (Fig. 114, imago).

Theretra mansoni, Clark, 1924, p. 18, ♀ (Sikkim).

Imago.—♀. Nearly related to *T. alecto* and *T. suffusa*, closer to the former species. Head and thorax dark brown with no dorsal line; side-stripe on head and thorax as in *alecto*, but duller in colour, with a pink tinge. Fore wing wood-brown; a darker marginal band from apex to hind angle, widening evenly to this angle, where it is 9 mm. in width; this band formed from three lines, the distal wider

than the other two, and the three separated by pale brown lines; basad of the marginal band the colour becomes paler in tone; an inconspicuous pale brown stigma with a dark dot in its centre; cilia pink with brown tips. Hind wing as in *alecto* but of a deeper shade of pink at anal angle; cilia white. *Underside*: thorax grey ventrally, pink laterally. Fore wing: basal half wood-brown, this colour extending along costa to apex; marginal band as in *alecto* but of a much darker shade; between the basal wood-brown area and the marginal band a pale pink area, very narrow between SC^5 and R^2, much broader between R^2 and SM^2; cilia pink. Hind wing differs markedly from *alecto*; basal half and marginal band wood-brown, the pink tone broad towards anal angle, narrow towards costa. *Expanse*: 96 mm.



Fig. 114.—*Theretra mansoni* Clark, ♀.

Hab. BURMA. Described from one badly damaged specimen, a ♀, collected by Fellowes Manson. Early stages unknown. There is a good female specimen in the British Museum (fig. 114); the label bears the locality "Sikkim (*O. Möller*)."

162. **Theretra suffusa** (Walk.).

Chærocampa suffusa, Walker, 1856, p. 146 (Hong-Kong); Butler, 1879, p. 1, pl. xli, fig. 1.
Theretra suffusa, Roths. & Jord., 1903, p. 778; Mell, 1922, p. 302, pl. x, figs. 12–21, pl. xiv, figs. 9, 10, pl. xix, figs. 7, 8 (pupa), pl. xxxi, figs. 13, 14 (larva); Seitz, 1929, p. 566, t. 67 *d*.

Imago.—♂♀. Closely allied to *alecto*. A greyish mesial band from mesonotum to end of abdomen; the latter brown above, without black basal patch, an obscurely marked greyish dorso-lateral stripe from segment 3 backwards. Fore wing with lines 1 and 5 heavy, 2 fused with 1, lines 6 and 7 also rather heavy, interspaces between 1 and 5 pale, between 5 and 6 dark. Hind wing with black basal area much more restricted than in *alecto*, not dilated distad before abdominal margin. *Expanse*: ♂ 80–90 mm., ♀ 102 mm.

Genital armature as in *alecto*, but tenth sternite rather broader, more obtuse, less curved ; process of harpe less slender, somewhat spoon-shaped, twisted.

Hab. E. HIMALAYAS (Assam) to China and Malaya. Mell has bred the species in S. China, in open country, and the descriptions which follow have been taken from his work.

Egg.—Broadly ovoid, surface smooth and shining, colour grass-green. Length 2 mm. ; breadth 1·4 mm. ; height 1·4 mm.

Larva :—

Final instar. Shape as in others of the genus ; horn long, slightly down-curved. Surface dull and smooth. Colour green ; ocelli on segments 5 to 11, rounded dorsad, flattened ventrad, that on 5 green or blue above, yellow below, the green or blue portion edged narrowly with yellow ; the ocelli on 6 to 11 similar, but the green or blue upper half replaced by pale greyish-brown ; horn sky-blue ; true legs reddish. Length 88 mm. ; breadth 12 mm. ; horn 11 mm.

Pupa.—Similar in shape to that of *alecto* ; tongue-sheath in side-view shaped like a duck's bill seen from above ; antenna slightly longer than fore leg, which reaches to about one-third the wing-case, mid-leg to about middle ; a small coxal piece. Surface dull and smooth except for sides of tongue-sheath, which are rugose. Cremaster a dorsally convex, ventrally concave, truncate prolongation of the dorsal surface of segment 14, ending in a short spine at each dorso-lateral angle of the truncation. Colour pale reddish-brown ; head, tongue-sheath and wing-case dotted and mottled with brown ; abdomen with a dark dorsal stripe and a subdorsal row of dark dots ; venter bone-colour dotted and shaded with brown. Length 63–68 mm. ; breadth 12–14 mm. ; tongue-sheath projecting 6 mm. in front of head.

Habits.—Food-plant : *Melastoma sanguineum* Sims, family Melastomaceæ.

163. **Theretra lycetus** (Cram.). (Fig. 110 I, J, genitalia ; Pl. VI, figs. 1, 2, larva, fig. 3, pupa).

Sphinx lycetus, Cramer, 1775, p. 96, pl. lxi, fig. D (Bengal ; Coromandel ; Ceylon).
Chærocampa lycetus, Horsf. & Moore, 1857, p. 277 (N. India) ; Hampson, 1892, p. 87.
Theretra lycetus, Dudgeon, 1898, p. 412 (Sikkim, 1,800 ft.) ; Roths. & Jord., 1903, p. 779 ; Seitz, 1929, p. 567, t. 68 *d*.
Chærocampa rosina, Butler, 1875, p. 248, pl. xxxvii, fig. 6 (Masuri).
Chærocampa prunosa, Butler, 1875, p. 622 (Ceylon) ; Moore, 1882, p. 18, pl. lxxxiv, fig. 2.

Imago.—♂♀. Head, thorax and abdomen olive-brown ; a greyish-purple lateral stripe from head to base of costa of fore wing, continuing as a white stripe to end of tegula ;

a broad greyish-purple dorsal stripe on thorax, continued on abdomen as a double whitish stripe, indistinct posteriad; a bronze-gold stripe down middle of tegula; abdomen with a broad golden dorso-lateral stripe. Fore wing pale brown with a pink tinge, with seven or eight oblique lines from apex to inner margin; the brown discal band formed of two separate lines, lines 1 and 2 being fused together; lines 5 and 7 prominent, pinkish-white. Hind wing fuscous, cilia pale, and a diffuse reddish submarginal band of varying width from anal fold to near apex; if the reddish scaling is extended basad, one or two, seldom three, brown lines become visible. *Underside* ochreous, palpus, breast and middle of abdomen pinkish, sides of abdomen golden; outer margin of both wings chalky-pink. *Expanse*: ♂ 70–74 mm., ♀ 70–76 mm.

♂. Tenth tergite stout, rather strongly curved at end, apex sinuate; sternite pointed, broadly triangular, sides obliquely rounded. Process of harpe horizontal, apically slightly dilated. Armature of penis-sheath (fig. 110 I): right process enlarged, with two ridges of teeth, the left lobe reduced to a long pointed process which bears traces of teeth.

♀. Vaginal armature asymmetrical (fig. 110 J), the ridge in front and at sides of vaginal cavity at the right side gradually fading away, while at the same time another ridge extends into the cavity.

Hab. W and E. HIMALAYAS, S. INDIA, CEYLON and BURMA, eastwards to Java. We have bred it in the E. Himalayas, S. India and Burma. It is fairly common in areas of heavy rainfall during the wet months.

Egg.—Broadly ovoid, surface smooth and shining, colour pale green.

Larva:—

1*st instar*. Lemon-yellow when first hatched, later head orange, body green, segments 12 to 14 yellow; horn long, slightly up-curved, shining black with reddish base. 2*nd instar*. Head, anal flap and claspers orange; body very pale olive-green, segments 9 to 13 with a pink tinge owing to a series of pink transverse lines lying very close together on these segments; dorso-lateral ocelli on 3 to 12, those on 3 and 12 black spots, that on 4 white edged broadly with black above and below; that on 5 the same but double the size; those on 6 to 11 smaller, pupil a white oblique band running up and back right across each, edged narrowly above, broadly below, with black; horn black with base orange. 3*rd instar*. Horn long, strongly up-curved; head, anal flap and claspers orange; segment 2 paler orange; rest of body ferruginous; a narrow black dorsal stripe on 2 and 3, continued as a faint dark stripe to base of horn; ocelli as in 2nd instar, except that those on 3 and 12 are also white-pupilled. 4*th instar*. Horn still long,

thin and up-curved throughout its length ; segments 4 and 5 tumid ; head, anal flap and claspers bright orange ; body terra-cotta, segments 6 to 12 closely sprinkled with paler dots ; a narrow black dorsal stripe on 2 to 5 ; ocellus on 3 a velvety-black spot ; on 4 transversely oval, pupil primrose-yellow edged narrowly above and below with black, outside which is a crescent of lilac above and below, the whole edged broadly with velvety-black ; on 5 much larger transversely oval, the round pupil black, edged broadly with yellow all round and narrowly with blackish above and below ; outside the black a crescent of lilac above and below, the whole edged broadly with velvety-black ; on 6 to 11 slightly smaller, decreasing in size backwards, pupil primrose-yellow running obliquely up and back to nearly reach end of the ocellus, this edged narrowly above and below by blackish followed by the lilac crescent, the whole edged broadly with velvety-black ; horn black, base very shortly orange.

5th instar. Head dull and smooth ; true clypeus less than one-half length of head, apex acute ; apex of false clypeus widely arched over apex of true clypeus, reaching to a little more than one-half length of head ; labrum one-half length of clypeus ; ligula kidney-shaped ; cutting-edge of mandible obscurely, broadly toothed ; eyes 1 to 4 in a sharp curve, 6 in line with 3 and 4 ; the distance between 1 and 2 four times that between 2 and 3, and the distance between 3 and 4 twice that between 2 and 3 ; eye 5 forming an equilateral triangle with 4 and 6, the sides more than twice the distance between 3 and 4. Body dull and smooth, shaped as in others of the genus. Horn rather short, thin, tapering evenly to a point, slightly down-curved ; slightly rough, but not tuberculate.

Green form : head glaucous-green ; labrum brownish-yellow ; ligula, antenna and mandible green, the latter with tip brown. Body glaucous-green, segments 6 to 11 with a transverse row of brownish-green dots along each secondary ring ; a narrow black dorsal stripe from 2 to base of horn ; the ocellus on 3 a small black spot ; on 4 the small round yellow pupil edged above and below with black ; on 5 the ocellus large and nearly round, the longitudinally elongate oval black pupil edged narrowly with blue, then narrowly with dark green, then more broadly with primrose-yellow ; a crescent of lilac above and below, the whole edged narrowly with black ; ocelli on 6 to 11 smaller, decreasing in size backwards, elongate-oval in shape and placed obliquely in continuation of very obscure oblique stripes, pupils primrose-yellow with a crescent of lilac at top and bottom, the whole edged narrowly with black ; ocellus on 12 similar but much smaller. Horn dark purplish ; legs flesh-colour. Spiracles oval, white suffused with degraded purplish in the middle.

Dark-coloured form: the green colour is replaced by orange on the head, terra-cotta on the body; the oblique stripes, formed of yellow dots, more conspicuous than in the green form; horn black; other markings as in the green form. Length 86 mm.; breadth 12 mm.; horn 5 mm.

Pupa.—Tongue-sheath prominent, semicircular in side-view, directed somewhat ventrad; the frons rising sharply from base of tongue-sheath to a rounded transverse ridge running from eye to eye; antenna slightly shorter than fore leg, which reaches to middle of wing-case, mid-leg to three-quarters the distance to the tip; a small coxal piece. Surface dull; tongue-sheath with a mesial channel and a palpal depression; head, thorax and abdomen lined like cracked lacquer, abdomen sparsely pitted and transversely striate; wing-case minutely rugose, veins prominent with a series of low tubercles; narrow, parallel ante-spiracular ridges on 9. Spiracle of 2 in a deep triangular depression formed by a sunken lobe projecting from the front margin of 3, the hind edge of the lobe steeply rising; remaining spiracles oval, surface rising gently to the central slit. Cremaster large, broad at base, sides converging first gently, then more rapidly, tip squarely, broadly truncate, with a very small straight spine at each lateral angle of the truncation, the spines directed straight back and their bases widely separated; upper surface convex and coarsely irregularly longitudinally ridged, lower surface concave; segment 14 deeply axially hollowed under base of cremaster. Colour soiled bone-colour, tongue-sheath, wing-case and segments 12 to 14 suffused with blackish; abdomen suffused with rust-colour dorsally, venter brownish-pink; a narrow black ventral stripe on 9 and 10; lobe of segment 3 rusty; spiracles and cremaster black, the tips of the spines minutely white. Length 48 mm.; breadth 13 mm.; tongue-sheath projecting 2 mm. in front of head.

Habits.—Food-plants: *Dillenia pentagyna* Roxb., family Dilleniaceæ; *Vitis* Linn.; *Leea* Linn., family Ampelideæ.

The horn is movable in a vertical plane in all the instars. We have not seen the moth in its natural state.

164. **Theretra oldenlandiæ oldenlandiæ** (Fabr.). (Fig. 115, imago; Pl. VI, fig. 4, larva, fig. 5, pupa).

Sphinx oldenlandiæ, Fabricius, 1775, p. 542 (India).

Chærocampa oldenlandiæ, Moore, 1857, p. 278, pl. xi, fig. 4 *a* (larva); Butler, 1877 A, p. 559, pl. xci, fig. 1 (larva); id., 1881 A, p. 613 (Kurachi); Forsayeth, 1884, p. 390 (Mhow; life-history); Swinhoe, 1884, p. 514 (Kurachi); id., 1885 A, p. 289 (Poona; Bombay; Belgaum); id., 1886, p. 434 (Mhow); id., 1890, p. 163 (Thyetmyo); Hampson, 1892, p. 87; Nurse, 1899, p. 513 (Cutch).

Xylophanes oldenlandiæ, Moore, 1882, p. 17, pl. lxxxv, figs. 1, 1 *a* (l., p., i.).
Theretra oldenlandiæ, Dudgeon, 1898, p. 412 (Sikkim, 1,800 ft.; Bhutan, 2,500–3,000 ft.).
Theretra oldenlandiæ oldenlandiæ, Roths. & Jord., 1903, p. 782; Jordan, 1912, p. 259, t. 42 *b*; Mell, 1922, p. 308, pl. xi, figs. 6–11 (figs. 12–16), pl. xiv, figs. 14–16, pl. xix, figs. 17, 18 (pupa), pl. xxxii, fig. 1 (larva); Seitz, 1929, p. 567.
Chærocampa puellaris, Butler, 1875, p. 623 (Rawul Pindi).

Imago.—♂♀. Head and thorax brown; a pale lateral stripe from palpus to end of thorax; a broad, pale, irregular dorsal band and a white dorso-lateral streak on thorax; abdomen greyish-brown with a double silvery-white dorsal stripe, the two stripes sometimes partly fused together; an ochraceous lateral stripe. Fore wing greyish-brown; lines 1, 2 and 3 forming a dark brown discal band, line 4 distinct, interspace between 4 and 5 not quite so pale as that between 3 and 4, which is more or less silvery; line 5 heavy, 6 thin but distinct. Hind wing dusky with a pale submarginal band not reaching apex. *Expanse*: ♂ 54–74 mm., ♀ 80 mm.

Hab. W and E. Himalayas, S. India, Ceylon and Burma to Japan and New Guinea. We have bred the subspecies in many localities. It is common and widely distributed.

Egg.—Broadly ovoid, surface smooth and shining, colour green.

Larva:—

1*st instar*. Pale yellowish-green, with a short straight black horn. 2*nd instar*. Head yellowish-green, body dark green; ocelli on segments 5 to 11 black above, yellow below; horn short, black with base yellow. 3*rd instar*. Head and body slate-colour; a dorso-lateral line of yellow spots on 3 and 4 on a background of deep black; ocelli with a round yellow pupil edged broadly with black, decreasing in size backwards; horn black, a yellow spot on each side of its base. 4*th instar*. Head slate-colour, body black; a saddle-shaped shield on segment 2 slaty-black, with a pale yellow dorso-lateral spot on the front edge; spots on 3 and 4 as in 3rd instar; ocelli on 5 and 6 with a round black spot in the middle of the yellow, on 7 to 11 of a darker shade of yellow; horn long, thin, straight, black with a white tip and a yellow ring near the base.

5*th instar*. Head small, dull and smooth. Body dull and smooth, tapering first gently then more sharply forwards from 8 and gently backwards from 8; segments 4 and 5 not much swollen; horn straight, of medium length, thin, nearly cylindrical, tip truncate with a minute, low tubercle at each lateral angle; surface shining, covered with very minute tubercles.

Coloration.—Head black; labrum canary-yellow; ligula black; basal segment of antenna canary-yellow, other segments whitish; mandible black. Body velvety-blackish on segments

2 to 4, rest of body plumbeous with short black stripes across the secondary rings ; a dorso-lateral line of spots on 2 to 4, some yellow, some orange, continuing as a stripe formed of small grey dots, interrupted by the ocelli, to base of horn ; a broad, soiled, pale yellow subspiracular stripe from 2 to 12, dotted with small black rings on 6 to 12 ; ocelli on 5 and 6 with a round black pupil in which lie two narrow, irregularly concentric rings of electric blue ; this pupil edged narrowly above, more broadly elsewhere with orange, at the top and bottom of which is a crescent of electric blue ; the whole edged broadly with velvety-black ; on 7 to 11 rather larger, pupil deep purple above shading to reddish-brown below, edged above and below with a crescent of electric blue, the whole edged broadly with velvety-black ; a broad yellow band, crossed by black lines, lying along the front margin of segments 5 to 11, and passing over the dorsum from the dorso-lateral stripe. Horn black with the tip narrowly yellow or white ; legs red ;



Fig. 115.—*Theretra oldenlandiæ oldenlandiæ* (Fabr.).

prolegs and claspers black. Spiracles elongate-oval, white with a broad fuscous band across the middle, and a narrow black rim. Length 80 mm. ; breadth 11 mm. ; horn 8 mm.

Pupa.—Tongue-sheath not much projecting, semicircular in side-view, directed somewhat ventrad ; hind margin of segment 11 slightly undercut and overlapping the front margin of 12. Surface shining, head, thorax and wing-case nearly smooth, abdomen shagreened and minutely pitted ; front bevels of segments 9 to 11 transversely corrugate. Spiracle of 2 a slit lying between the forward-curved, slightly raised, hind margin of 2 and the straight front margin of 3, behind which is a short rounded transverse ridge ; remaining spiracles oval, surface convex, central slit with narrow raised rim. Cremaster elongate-triangular, ending in a short, stout, truncate-conical polished shaft, tip shaped like the tail of a whale, the flukes formed of short conical highly polished teeth directed outwards ; upper surface convex and pitted,

lower surface slightly hollowed, wrinkled, with a rounded mesial ridge from base to shaft. Colour pale yellowish-brown; legs dotted with black; abdomen dotted with black, these dots forming an obscure dorsal and similar latero-ventral stripe; a narrow interrupted ventral stripe; spiracles black, the ridge behind that on 2 dark brown, and the rims round the slits reddish-brown; cremaster dark reddish-brown, shaft and points black. Length 40 mm.; breadth 11 mm.; tongue-sheath projecting 3 mm. in front of head.

Habits.—Food-plants: *Corchorus capsularis* Linn., family Tiliaceæ; *Impatiens* Linn., family Geraniaceæ; *Vitis* Linn., family Ampelideæ; *Careya arborea* Roxb., family Myrtaceæ; *Jussiæa suffruticosa* Linn., family Onagraceæ; *Oldenlandia corymbosa* Linn., family Rubiaceæ; *Ipomæa batatus* Lamk., and many plants of the family Aroideæ (arums). The thin horn is movable in a vertical plane in all instars. The moth is often caught feeding at flowers at dusk, and is also attracted by light.

165. **Theretra pinastrina pinastrina** (Mart.). (Pl. VI, fig. 6, larva, fig. 7, pupa).

Sphinx pinastrina, Martyn, 1797, pl. xxix, fig. 81, pl. xxx, fig. 85 (Hab. ?).
Xylophanes pinastrina, Moore, 1882, p. 18, pl. lxxxvii, fig. 2.
Theretra pinastrina pinastrina, Roths. & Jord., 1903, p. 784; Mell, 1922, p. 310, pl. xi, figs. 12–18 (figs. 18–24) (larva), pl. xiv, figs. 11–13, pl. xix, figs. 19–21 (pupa), pl. xxxi, figs. 15, 16 (♀); Seitz, 1929, p. 567 (non t. 68 *c*).
Chærocampa silhetensis, Walker, 1856, p. 143 (partim); Butler, 1877 B, p. 560, pl. xcii, fig. 8 (larva, pupa); id., 1881 B, p. 8, pl. lxxix, fig. 6; Hampson, 1892, p. 88.
Chærocampa bisecta, Moore, 1857, p. 278, pl. xi, figs. 5, 5 *a* (Java; N. India); id., 1865, p. 794 (Bengal).

Imago.—♂♀. Similar to *oldenlandiæ*, but much paler; abdomen with a single dorsal line. Fore wing with a brown oblique discal band as in *oldenlandiæ*; interspace between lines 3 and 4 more or less silvery, line 4 distinct; interspace between 4 and 5 broad, not silvery; line 5 heavier than 6. The amount of black on hind wing variable; there is sometimes a narrow discal band consisting of two indistinct lines, besides the marginal band. *Expanse*: ♂ 60–70 mm., ♀ 72 mm.

♂. Tenth tergite slender, slightly curved, subcarinate above, apex compressed, rounded-truncate; sternite: upperside transversely ribbed at the margin, apical margin notched. Harpe long and slender. Armature of penis-sheath narrow, ribbon-like.

Hab. E. Himalayas, S. India, Ceylon and Burma to Japan and Malaya. We have bred it in S. India, where it is common in open country with moderate rainfall.

Egg.—Broadly ovoid ; surface smooth and shining ; colour pale grass-green. Length 1·4 mm. ; breadth 1·3 mm. ; height 1·3 mm.

Larva :—

1*st instar*. Head and body very pale green ; horn short, straight, black. 2*nd instar*. Head and body pale yellowish-green ; an indistinct dark dorsal stripe ; dark-coloured ocelli on segments 5 to 11 ; horn short, pale rose-colour. 3*rd instar*. Head green, body green dotted with yellow, dorsal stripe violet, ocelli black ; horn short, pink in colour. 4*th instar*. Head pale pinkish-brown speckled with darker dots ; body pale pinkish-brown dotted with yellow ; a narrow, dark, dorsal stripe on segment 2 ; a slightly fuscous dorso-lateral stripe ; ocellus on 5 small, round, pupil greyish-blue touched with pale orange below, edged narrowly with first white and then black ; a larger, longitudinally oval, similarly coloured ocellus on 6, the oval flattened below ; a slightly larger ocellus on each of 7 to 10, smaller on 11, the pale orange rather more extended but the colour otherwise the same ; horn short, coloured like the body.

5*th instar*. Head smooth and dull ; true clypeus nearly equilaterally triangular, less than one-half length of head ; false clypeus with rounded apex reaching to one-half length of head ; labrum about three-quarters as long as clypeus ; ligula as long as labrum, slightly narrower, rounded kidney-shaped ; cutting-edge of mandible with small triangular teeth ; eyes with the line joining 1 and 2 forming an angle of about 105° with the straight line joining 3, 4, 6 ; eyes 2 to 6 equidistant at one eye-diameter apart, eye 1 slightly further from 2 ; 5 forming an equilateral triangle with 4 and 6 ; eyes 1, 2, 5 smaller than 3, 4, 6. Body smooth and dull, shaped as in others of the genus, segments 4 and 5 not much swollen ; horn smooth and shining, very short, thick at base and tapering sharply to a point, the horn rising from a fleshy cone, of which it forms a regular continuation.

Green form : head green with a bluish tinge, obscurely dotted with groups of dark-coloured dots ; labrum and ligula greenish ; basal segment of antenna green, second segment paler, end segment rusty ; mandible green, tip shortly reddish-brown ; eyes 1 and 5 green with black pupils, 3, 4 and 6 rusty, 2 whitish. Body grass-green ; a number of short, yellow stripes across the secondary rings in the dorsal and lateral area, and yellow dots below the spiracular line ; a narrow bluish dorsal stripe ; a narrow obscure yellowish dorso-lateral stripe from 2 to base of horn, broken by the ocelli ; a similar subspiracular stripe from 5 to 12 ; a small, inconspicuous dorso-lateral ocellus on 5, green edged with yellow ; a similar, slightly larger ocellus on 6, edged narrowly above with black ;

a similar, still larger ocellus on each of 7 to 10; on 11 the ocellus as large as that on 5, but edged with black above; all the ocelli longitudinally oval, the dorsal curve more convex than the ventral; the pupils sometimes bluish instead of green. Horn yellow, tip orange. Spiracles oval, white with a broad purplish band across the middle, leaving the ends only shortly white, the whole with a narrow, yellowish, shining rim.

In the dark-coloured form the green is replaced by pinkish-chocolate; the dorso-lateral stripe and the subspiracular stripe broad and dark chocolate; ocelli with pale chocolate pupils. Length 55 mm.; breadth 10 mm.; horn 2 mm.

Pupa.—Tongue-sheath not projecting much in front of head; antenna slightly shorter than fore leg, which reaches to one-third the distance to the tip of wing-case, mid-leg to two-thirds that distance; a long, narrow coxal piece. Surface slightly shining; edge of tongue-sheath shining and mesially channelled; head, thorax and sides of tongue-sheath coarsely, superficially wrinkled; wing-case with the veins broadly prominent, the surface more minutely wrinkled; segment 3 with some pits behind the spiracle of 2; abdomen very finely transversely wrinkled and shallowly pitted; hind bevels of 8 to 10 smooth, front bevels of 9 to 11 minutely pitted. Spiracle of 2 a narrow slit lying between the slightly raised, shallowly emarginate hind margin of 2 and a narrow, transverse, oblong lobe, its front edge raised, hind edge depressed, projecting from the front margin of 3; remaining spiracles oval, the surface rising gently to the central slit, which has a narrow, shining rim. Cremaster triangular, sharply pointed, tip seen under a lens to be minutely bifid; ventral surface keeled, with a channel on each side of the keel. Colour pinkish bone-colour; sides of tongue-sheath, head and fore leg dotted with black; wing-case fuscous-grey, the veins edged narrowly with soiled yellow; a narrow brownish-green dorsal stripe from 2 to 13; a similar dorso-lateral stripe; a narrower spiracular stripe; abdomen with a broad blackish ventral stripe and a broad, obscure latero-ventral stripe; the whole pupa marked with short, obscure, olive-green stripes; spiracles black; cremaster dark reddish-brown. Length 47 mm.; breadth 10 mm.

Habits.—Food-plants: *Jussiæa repens* Linn., family Onagraceæ; *Boerhavia* Linn., family Nyctaginaceæ; Aroideæ (arums of various species). We have caught the moths feeding at flowers after dark, but have not known of them coming to light.

166. **Theretra insignis insignis** (Butl.). (Fig. 116, imago).

Panacra insignis, Butler, 1882, p. 432 (Andamans).
Theretra insignis insignis, Roths. & Jord., 1903, p. 786; Seitz, 1929, p. 567 (non t. 68 c).

Imago.—♂. Mesothoracic tegula with pale middle stripe. Discal band of fore wing forming three black contiguous patches between SC^5 and R^3; the pale interspace distally of it narrow



Fig. 116.—*Theretra insignis insignis* (Butl.), ♂.

and sharply marked; a narrow pale sharply marked band from near apex to middle of hind margin, forming an obtuse angle in the middle. *Expanse*: 60 mm.

Hab. The ANDAMAN ISLANDS. One ♂ in the British Museum. Early stages unknown.

167. **Theretra griseomarginata** (Hamps.). (Fig. 117, imago).

Chærocampa griseomarginata, Hampson, 1898, p. 281, pl. A, fig. 12 (♀) (Sikkim); Dudgeon, 1898, p. 411 (Sikkim, 1,800 ft.).
Theretra griseomarginata, Roths. & Jord., 1903, p. 786; Seitz, 1929, p. 567.

Imago.—♀. Head grey; palpus brown at sides; thorax olive-green with a grey dorsal line, the collar and patagia

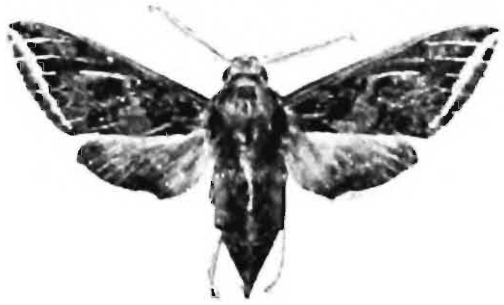


Fig. 117.—*Theretra griseomarginata* (Hamps.), ♀.

outlined with grey; abdomen greyish-brown above, pink at sides, the segments edged with brown; a grey dorsal stripe and a lateral series of paired white spots. Fore wing grey with diffuse patches of olive-brown and black; a blackish

patch at base of median vein; an oblique grey streak near base of inner area; three very obscure, waved, black antemedian lines; a black speck in cell, with a grey streak from it to beyond end of cell on R^2; three indistinct, dentate, black postmedian lines; grey streaks on veins of outer area crossing a nearly straight whitish submarginal band which narrows to apex and to just above tornal angle. Hind wing fuscous, basal and inner areas greyish; traces of a postmedian band; cilia grey. *Underside* suffused with pink, the outer area greyish; an indistinct waved black postmedian line. *Expanse*: 62 mm.

Hab. E. HIMALAYAS (Sikkim, at light, 1,800 feet). Very rare; the early stages unknown. A ♀ in the British Museum; a ♂ in coll. Charles Oberthür.

168. **Theretra pallicosta** (Walk.). (Fig. 118, ♂; Pl. VI, fig. 12, larva, fig. 13, pupa).

Chærocampa pallicosta, Walker, 1856, p. 145 (Sylhet; Hong-Kong); Butler, 1879, p. 1, pl. xlii, fig. 2; Hampson, 1892, p. 94.
Gnathothlibus pallicosta, Moore, 1882, p. 21, pl. lxxxiv, fig. 6.
Theretra pallicosta, Roths. & Jord., 1903, p. 788; Mell, 1922, p. 313, pl. xii, figs. 4–12, pl. xiv, figs. 17, 18, pl. xix, figs. 22, 23 (pupa), pl. xxx (xxxii), fig. 2 (larva), pl. xxxii, fig. 3 (♂); Seitz, 1929, p. 567, t. 68 *b*.

Imago.—♂♀. Head and thorax chestnut-brown; thorax with a white dorsal stripe and a similar lateral stripe from tip of palpus to end of thorax; abdomen with first two segments chestnut-brown, rest brownish-pink, paler on the sides. Fore wing chestnut-brown, costa buff-white; inner margin narrowly white from tornal angle, the thin white edge curving on to disc and becoming broader there; a buff-white stigma; lines straight, nearly parallel with margin, one only distinct and this dentate. Hind wing bright pink, base pale yellowish, cilia yellowish-white. *Underside* of thorax and abdomen the same colour as the upperside; wings brownish-pink, fore wing with costa and inner margin pale, a dusky dot at end of cell; hind wing with a post-discal and a median dotted line, anal margin broadly yellowish. Opening of palpus partly covered by single long scales of the first and second segments. External row of spines of first protarsal segment doubled and trebled. *Expanse*: ♂ 70–86 mm., ♀ 78–90 mm.

♂. Tenth abdominal segment of the ordinary shape, tergite feebly sinuate, sternite rather narrow and pointed. Clasper with over 10 large scales; harpe long, slender, horizontal, apex rounded in dorsal view, flattened. Penis-sheath: apical edge dorsally rounded-produced, symmetrical; on right and left side a dentate process pointing proximad, left process the longer and more slender.

Hab. E. HIMALAYAS (Sylhet, Assam ; Khasi Hills), S. INDIA, CEYLON and BURMA to Hong-Kong. We have bred the species in S. India and Burma, where it is fairly common in wooded hills with a heavy rainfall.

Egg.—Similar to others of the genus.

Larva :—

1*st instar*. Head and body yellowish-green, dorsum of segments 2 to 4 dark green ; horn long, thick at base, tapering gently to a strongly bifid tip, the two arms thick at base and shortly conical, shining black with small black tubercles. Towards the end of this instar the whole body pale grass-green ; dorso-lateral ocelli on 5 to 11, that on 5 large, round, white with a crescent of black below ; ocelli decreasing in size

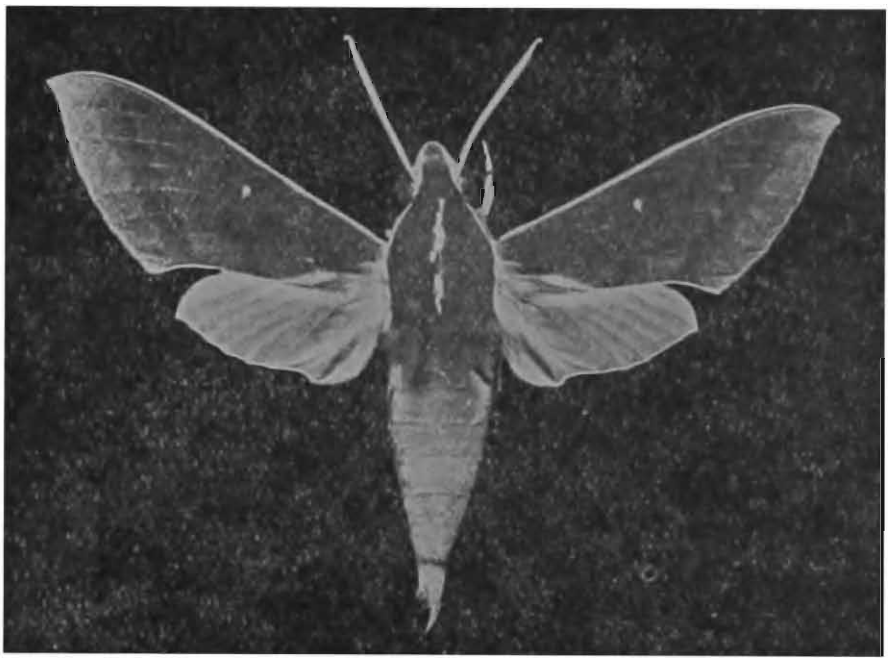


Fig. 118.—*Theretra pallicosta* (Walk.), ♂.

backwards, the white reduced in size in each successive ocellus till it has disappeared altogether on that of 11. 2*nd instar*. Head orange, and an orange band along front margin of 2, rest of body yellowish-green ; ocellus on 5 nearly round, pupil enamel-white with a narrow crescent of purple below, the whole edged fairly broadly above and below, narrowly at sides, with black ; remaining ocelli smaller, longitudinally oval, colour the same as that on 5, but the white pupil oval and oblique. 3*rd instar*. Segments 4 and 5 slightly tumid ; head grass-green ; body bluish-green dotted obscurely with yellow on 6 to 12 ; a narrow, obscure, dark bluish-green dorsal stripe ; a faint yellowish subdorsal stripe on 3 and 4 ; a large round ocellus on 5, its pupil sap-green with broad yellow iris edged narrowly with dark green ; the pupil bears a longitudinal oval marking of electric-blue edged narrowly with paler blue,

and within the yellow iris are two crescents, one at the top of electric-blue, and a purple one at the bottom; remaining ocelli smaller, oval, the oblique, very pale blue pupil edged narrowly above with dark green, below by a purple crescent and then dark green; these ocelli lying on obscure pale yellowish oblique stripes; horn long, thin, tapering gently to near tip where it thickens slightly to a bifid tip, the two arms shortly conical. *4th instar.* Segments 4 and 5 much swollen; head grass-green; body pale grass-green covered with a chalk-like bloom; segments 6 to 11 with short thick grass-green stripes across the secondary rings; a narrow dark green dorsal stripe; ocellus on 5 large, nearly round, coloured as in the 3rd instar, but the pupil of a darker shade; other ocelli smaller, elongate-oval, very oblique, lying at the same angle as the oblique stripes, pale yellow with a crescent of purple below, the whole edged narrowly above and below with sap-green; obscure yellowish oblique stripes interrupted by the oblique ocelli, except that on 11 and 12, which runs forwards and downwards from base of horn. Horn long, thick at base, tapering evenly to tip, which is slightly thickened, basal two-thirds straight, distal third gently up-curved; basal third orange, rest translucent pale green; surface shining and covered with self-coloured, spine-like tubercles.

5th instar. Head with vertex depressed; true clypeus between one-third and one-half length of head, triangular; false clypeus hardly visible; labrum and ligula large, ligula broad kidney-shaped; surface of head smooth and dull. Body smooth and dull, shaped as in others of the genus, segment 5 much swollen. Horn short, tapering gently to near tip, then abruptly to a blunt point, gently down-curved; surface dull and sparsely tuberculate.

Green form: head dull green; labrum green; ligula brownish; basal segment of antenna green, other segments claret-colour; mandible green, a bright yellow band before tip which is reddish-brown. Body greyish-green, segments 5 to 12 with many short brown stripes across the secondary rings, closer together in lateral area, developing into spots below the spiracles; a narrow, dark blue dorsal stripe on 2 to 5, continuing diffuse and paler to base of horn; a large round dorso-lateral ocellus on 5, with a longitudinal, irregularly oval black pupil, edged narrowly with electric-blue, then broadly with green of the body-colour; the green edged broadly below, narrowly elsewhere, with primrose-yellow; above and below this a narrow white crescent separated from the yellow by a narrow line of the body-colour; the whole edged fairly broadly with black; this ocellus closely resembles that on segment 5 of *T. lycetus*; ocelli on 6 to 11 elongate-oval, placed obliquely in the same line with the oblique stripes, primrose-yellow edged narrowly with green; ill-defined whitish oblique

stripes, interrupted by the oblique ocelli, excepting that on 11 and 12, which runs from the base of horn through the spiracle on 11. Horn dull pink, extreme tip yellowish; legs claret-colour. Spiracles oval, the ends somewhat pointed, pale yellow with a broad central band of violet-green and a narrow, pale brown rim.

There are also dark-coloured forms of the larva in which the green is replaced by pinkish-chocolate and dark chocolate, or by purplish; the ocelli of the same colour but darker in shade; those on 6 to 11 sometimes indistinct; horn brown with yellowish tip; spiracles fuscous with a broad border of pale dull ochreous. Length 85 mm.; breadth 12 mm.; horn 5 mm.

Pupa.—Tongue-sheath projecting somewhat frontad and more ventrad, the edge flattened; antenna equal to fore leg, which reaches to more than one-half the distance to tip of wing-case, mid-leg to three-quarters that distance; a narrow coxal piece. Surface dull; sides of tongue-sheath, head and thorax coarsely irregularly transversely corrugate; a very shallow palpal depression; costa of fore wing tumid and, together with the veins, set with lines of rounded tubercles; abdomen finely shagreened; front bevels of 9 to 11 superficially pitted; five narrow ante-spiracular ridges on 9; hind margin of 11 tumid and undercut, the front margin of 12 fitting into it telescopically. Spiracle of 2 at the bottom of a very deep triangular depression; remaining spiracles slightly convex ovals, the central slit widening at the ends and with a thick rim. Cremaster with the sides nearly parallel in basal half, then curving inwards, ending in two conical simply pointed diverging teeth, their bases touching; dorsal surface convex and coarsely striate, ventral concave with an irregular mesial ridge; under the base of cremaster a deep funnel-shaped depression running forwards into 14, the surface of the hollow very rugose.

Colour of head, tongue-sheath and wing-case nearly black; segments 2 and 3 dark wood-brown, 3 and dorsum of abdomen paler wood-brown; abdomen with a broad faint greenish dorsal stripe; sides bone-colour mottled and speckled with brown; hind bevels of 8 to 10 greenish; front bevels of 9 to 11 rusty; 12 to 14 blackish ventrally, 13 and 14 also blackish dorsally; venter pale with a narrow black ventral stripe; spiracles and cremaster black, the tips of the teeth white. Length 50–60 mm.; breadth 13 mm.

Habits.—Food-plants: *Aporosa lindleyana* Baill.; *A. roxburghii* Baill.; family Euphorbiaceæ. The egg is usually found on small bushes, close to the ground, and even on seedlings with only a few leaves showing above the ground. The larva is also found close to the ground or among the thicker parts of the foliage, near the stem. In S. India the moth does not

emerge and lay its eggs till the monsoon is well established, about July, but in Burma eggs and larvæ were found before the end of April. We have not seen the moth feeding or coming to light.

169. **Theretra castanea** (Moore). (Pl. VI, fig. 11, larva).

Pergesa castanea, Moore, 1872, p. 566 (Bombay); Waterhouse, 1881, pl. lvi; Swinhoe, 1885 A, p. 288 (Sattara).
Chærocampa castanea, Hampson, 1892, p. 92.
Theretra castanea, Roths. & Jord., 1903, p. 788; Seitz, 1929, p. 568, t. 68 *d*.
Chærocampa hyporhoda, Hampson, 1900, p. 39 pl. B, fig. 12 (Karwar).

Imago.—♂♀. Head, thorax and abdomen bright reddish-brown; antenna and legs white; shoulder and outer edge of patagia with a greyish-white stripe. Fore wing bright reddish-brown; costal edge very narrowly white, base and basal half of inner margin grey; outer edge of basal half of sub-costal and median veins grey; an indistinct, oblique, pale discal band from cell to inner margin; a black stigma; traces of three somewhat oblique postmedian lines; a greyish marginal area, widest at R^2 and coming to a point at apex. Hind wing dark tawny-olive or blackish, cilia white between M^2 and SM^2.

Underside varying from orange-rufous to pale tawny; both wings with two indistinct curved lines just beyond middle and a greyish terminal band with waved inner edge. Opening of palpus partly covered by single long scales of the first and second segments. External row of spines on first protarsal segment single except at base, where there are some additional spines. *Expanse*: ♂♀ 50–80 mm.

Hab. S. India. We have bred it in the Kanara District and in the Nilgiris up to 6,000 feet. The larvæ are common during the monsoon months.

Egg.—Broadly ovoid, surface smooth and shining, colour whitish.

Larva:—

1*st instar*. Head very large and round; head and body very pale yellow; horn long, very shortly bifid, black. 2*nd instar*. Head yellow, body pale bluish-green, segment 5 slightly swollen; horn straight, black with yellow base and white tip. 3*rd instar*. A green and a dark-coloured form. Green form: head pale orange, body green dotted with white, anal segments yellowish-white; segments 4 and 5 swollen, 5 with a round white dorso-lateral ocellus; horn shining black, base pale orange, tip white, the whole covered with small tubercles. In the dark-coloured form the green is replaced by pale maroon-red, on segments 2 to 4 by blood-red. 4*th*

instar. Green form : head pale yellowish-green, body very pale green dotted with white ; ocellus on 5 with a black pupil edged broadly with enamel-white, suffused with blue at the edge of the pupil, the whole edged narrowly with black behind ; horn as in 3rd instar. Dark-coloured form as in 3rd instar.

5th instar. Head dull and smooth ; true clypeus one-half length of head, apex acute, sides curved outwards near base ; false clypeus narrow, apex narrowly arched ; labrum one-half length of clypeus and as broad as clypeus ; ligula circular except for the sinus ; surface longitudinally furrowed ; mandible with cutting-edge toothed and furrows running back from the intervals between the teeth ; eyes 1 to 4 in a quarter circle, 1 to 3 equidistant, 3 and 4 a little further apart ; 6 in line with 3 and 4 and slightly further from 4 than 4 is from 3 ; 5 and 4 making a right angle with 4 and 6, and 5 as far from 4 as 4 is from 6. Body shaped as in others of the genus, segments 4 and 5 much swollen ; surface dull and smooth, but looking somewhat greasy. Horn of medium length, stout at base, tapering gently to near tip, then narrowing sharply to a point ; gently down-curved ; surface dull and covered with very small tubercles, except the tip, which is smooth and shining.

A dark-coloured form only. Head brownish-black ; labrum and ligula fuscous ; basal segment of antenna the same, other segments pale rusty. Body : segments 2 to 4 and front half of 5 pale brown in dorsal area, dark brown in lateral area, 4 and front half of 5 speckled and mottled with pinkish-brown ; hind half of 5 and 6 to 12 plumbeous or pale purple, with numerous short dark purple stripes across the secondary rings above the line of the spiracles, marked with grey and black patches below that line ; a narrow dark brown dorsal stripe from 2 to 6 ; an ochreous or pale pinkish-brown dorso-lateral stripe on 2 to 5 ; a broad ochreous subspiracular stripe on 4 and 5 ; a shortly oval, slightly oblique dorso-lateral ocellus on 5, the oval, velvety-black pupil edged narrowly with dark ochreous and then with black ; a small black patch above and touching each spiracle on 6 to 12 ; seven pale pinkish-brown oblique stripes on 5 to 11, starting at the spiracle and running up and back to the dorso-lateral line. Horn plumbeous with black tubercles ; legs pale yellowish ; pro-legs, anal flap, claspers and venter black. Spiracles oval, slightly pointed at each end, dull yellowish-white suffused with fuscous patches. Length 70–80 mm. ; breadth 10 mm. ; horn 5 mm.

Pupa.—Shape similar to that of others of the genus, but the eye-case very prominent laterally ; head small, segment 2 becoming suddenly of greater diameter ; tongue-sheath prominent frontad and ventrad, semicircular in side-view ; antenna reaching to about one-half, fore leg to between one-

third and one-half, mid-leg more than one-half distance to tip of wing-case ; a small shortly triangular coxal piece. Surface of head, thorax and sides of tongue-sheath rugose ; tongue-sheath with a very deep palpal cavity ; wing-case very rugose with flattened tubercles, the veins very prominent, costa raised into a coarse zigzag ridge: tongue flatly depressed between the zigzag edges of costa from its tip to tip of mid-leg, then rising gradually into a rounded ridge which becomes the edge of the projecting tongue-case ; tongue-case with a mesial channel ; abdomen shallowly, transversely corrugate. Spiracle of 2 a narrow slit lying behind the slightly curved hind margin of 2, and covered by a transversely oblong lobe projecting from the front margin of 3, the surface of the lobe rising slightly from behind forwards ; remaining spiracles elongate-oval, central slit with a raised rim, each spiracle lying on a larger oval with a smooth shining surface. Cremaster equilaterally triangular, dorsal surface slightly convex, basal third tumid, tip squarely truncate, a polished cylindrical shaft at each lateral angle of the truncation, these shafts diverging slightly and each dividing into two arms, shorter than the common shaft ; these arms sometimes dividing again into two short hooks ; segment 14 with a deep funnel-shaped depression under base of cremaster, running forward axially. Colour pale chestnut, tongue-sheath and wing-case fuscous, costal zigzag ridges pale brown ; abdomen with segments 9 to 14 darker than anterior segments ; an area round each spiracle, and venter, speckled with blackish and whitish ; spiracles of the body-colour, the lobe of segment 3 black ; cremaster with main shafts shining black, bifurcations transparent reddish or whitish. Length 46 mm. ; breadth 10 mm.

Habits.—Food-plants : *Impatiens* Linn., family Geraniaceæ ; *Knoxia mollis* W & Arn., family Rubiaceæ, and arums, family Aroideæ. The horn of the larva is movable in a vertical plane in all but the last instar, and the anterior segments are strongly retractile. The pupa is very stiff. We have not seen the moth in its natural state.

Genus **RHYNCHOLABA** Rothschild & Jordan. (Fig. 119).

Roths. & Jord., 1903, p. 789.

Genotype : *acteus* (Cram.).

Imago.—♂♀. " Second segment of palpus triangular ; the joint widely open, some dispersed long scales on the naked space of the opening ; scaling of first segment longest just below the opening, the palpus thus differing in outline from that of every other sphingid. Mid- and hind tibia short-scaled ; basal spines of mid-tarsal comb prolonged, longer

than the segment is thick ; hind tarsus also with prominent comb " (Roths. & Jord., 1903, p. 789).

Hab. Indo-Malayan Subregion. One species only, *R. acteus*. For the early stages see under that species.

170. **Rhyncholaba acteus** (Cram.). (Fig. 119, genitalia ; Pl. VI, figs. 8, 9, larva, fig. 10, pupa ; Pl. VII, fig. 13, imago).

Sphinx acteus, Cramer, 1779, p. 93, pl. ccxlviii, fig. A (Java).
Pergesa acteus, Moore, 1857, p. 272, pl. x, figs. 1, 1 *a* (l., p.) (Java ; N. India) ; id., 1865, p. 794 (Bengal) ; id., 1877, p. 595 (Pt. Blair) ; Butler, 1881 A, p. 613 (Belgaum) ; Moore, 1882, p. 23, pl. lxxxviii, figs. 1, 1 *a* (l., p., i.) ; Swinhoe, 1885 A, p. 288 (Poona ; Belgaum ; Bombay) ; id., 1890, p. 162 (Moulmein).
Therctra actea, Hampson, 1892, p. 100 ; Dudgeon, 1898, p. 412 (Sikkim & Bhutan, up to 6,000 ft.).
Rhyncholaba acteus, Roths. & Jord., 1903, p. 789 ; Mell, 1922, p. 316, pl. xii, figs. 13–19, pl. xiv, figs. 23, 24, pl. xix, figs. 24, 25 (pupa), pl. xxix, fig. 14, pl. xxxii, figs. 4, 5 (larva), fig. 6 (♂) ; Seitz, 1929, p. 568, t. 68 *d*.

Imago.—♂♀. Head, thorax and abdomen purplish-grey ; vertex of head and a dorso-lateral stripe on thorax and



Fig. 119.—*Rhyncholaba acteus* (Cram.), penis-sheath.

abdomen green. Fore wing purplish-grey ; a green oblique central area from below apex to inner margin, with some indistinct lines on it ; an irregular dark outer area with some yellow inside it. Hind wing fuscous with an anal patch and submarginal band ochreous. *Expanse* : ♂ 64–76 mm., ♀ 70–80 mm.

♂. Tenth abdominal tergite as in most *Theretra*, gradually narrowed to end, truncate, feebly sinuate, the edge rounded ; sternite as long as the tergite, gradually narrowed to a point, apex somewhat curved upwards. Clasper with more than twelve large scales ; harpe elongate, subcylindrical, horizontal, very feebly curved, apex concave on upperside, slightly spoon-shaped in dorsal view. Penis-sheath with a single dentate process (fig. 119).

Hab. W and E. HIMALAYAS, S. INDIA, CEYLON and BURMA to the Moluccas and S. China. We have bred it in many

localities in India and in Burma. Very common and widely spread.

Egg.—Broadly ovoid, surface smooth and shining, colour bright green.

Larva :—

1*st instar*. Yellow with a straight black horn. 2*nd instar*: Head yellow, body bluish-green; a dorso-lateral ocellus on 5 blue above, black below; horn long, straight, shining black with base orange, tip white and translucent. 3*rd instar*: Segment 5 tumid, ocellus blue with black pupil, the whole edged with black; smaller ocelli on 6 to 11, white edged with black; horn straight, long and tapering, translucent green with base orange, a black ring near tip, tip white. 4*th instar*. Green form: head yellowish-green, body pale green, suffused with yellow above the spiracles, dotted with white below them; ocellus on 5 large, obliquely oval, the long axis running up and back, pupil black in front shading to deep blue and then mustard-yellow, the yellow obscurely dotted with white; the pupil edged narrowly with white, olive-green and dull yellow; ocelli on 6 to 11 much smaller, obliquely elongate-oval, blue edged narrowly with dark green. Horn long, gently up-curved, basal third black with reddish-orange base, central third translucent greenish-white, end third black with the tip greenish-white; the orange base smooth and shining, rest minutely tuberculate and shining. In the dark-coloured form (Pl. VI, fig. 8) the green is replaced by ochreous-chocolate, markings the same as in the green form.

5*th instar*. Head dull and smooth, small, nearly round, slightly higher than broad; true clypeus about one-half length of head, equilaterally triangular; false clypeus with acute apex reaching to two-thirds length of head; labrum one-half as long as clypeus, longitudinally corrugate; ligula kidney-shaped; mandible with cutting-edge strongly toothed, eyes 1 to 4 equidistant in a gentle curve, 6 in line with 3 and 4, and slightly further from 4 than 4 is from 3; eye 5 forming an isosceles triangle with 4 and 6, about twice as far from both as 4 is from 3. Body dull and smooth, of the same shape as those of the genus *Theretra*, segments 4 and 5 swollen. Horn very short, stout at base, tapering sharply to a point, slightly down-curved, surface shining, covered with minute tubercles.

Green form (Pl. VI, fig. 9): head rich grass-green; labrum green, ligula whitish; basal segment of antenna green, other segments honey-yellow; mandible green, tip dark reddish-brown; eyes brown. Body with segments 2 to 5 pale bluish-green, rest of body rich pale grass-green above the dorso-lateral stripe, pale bluish-green with short, dark green or brown longitudinal stripes across the secondary rings below it;

a very narrow black dorsal stripe from 2 to middle of 5; a narrow white subdorsal stripe on 3 and 4, stopping at the ocellus on 5 near its upper front edge; a large oval dorso-lateral ocellus on 5, its front edge extending on to 4, its long axis running up and back at an angle of about 45°, pupil deep blue in front, sap-green dotted with white behind, the pupil edged narrowly with white, olive-brown and ochreous; a much smaller, more elongate oval, more obliquely placed ocellus on 6, the narrow pupil yellow dotted with white and edged narrowly with pale blue, then olive-brown and then ochreous; similar ocelli on 7 to 11, pupils yellow dotted with white, edged narrowly with pale blue and then with dark blue; a broad bluish-white dorso-lateral stripe from the ocellus on 6 to base of horn; similarly coloured broad very oblique stripes on 5 to 11, each starting at the front latero-ventral edge of each segment, running through the spiracle on that segment and stopping at the front edge of the ocellus on the segment behind; that on 10 running into the dorso-lateral stripe at the ocellus of 11, and thence running back to base of horn; that on 11 stopping at the hind margin of 11, and not running to the base of horn as in most previously described species. Horn orange; true legs pale red, prolegs and claspers bluish-green. Spiracles small, oval, white with brown rim.

In the dark-coloured form the green is replaced by rich brown or ochreous-chocolate, the markings as in the green form, the ocelli a little darker in shade. Length 70 mm.; breadth 11 mm.; horn 3 mm.

Pupa.—Rather slender in build; tongue in a free sheath which bends ventrad in a semicircle to which is added the strongly bulbous tip which touches the venter at the junction of the head with segment 2; antenna shorter than fore leg, which reaches to one-third the distance to tip of wing-case, mid-leg to two-thirds; surface moderately shining; tongue-sheath obscurely annulate, with a narrow mesial channel; head, thorax and abdomen minutely shagreened; round the spiracle of 8 finely striate; front bevel of 9 with about twelve small ante-spiracular ridges, fewer on 10. Spiracle of 2 lying in a funnel-shaped hollow, the slit nearly covered by a rounded lobe projecting from the front margin of 3; other spiracles broadly oval, flush, the slit with a narrow rim. Cremaster elongate wedge-shaped, sides nearly parallel in basal half, then curving inwards, tip widely, shallowly notched, with a small conical tooth at each lateral angle of the notch, and two or three small sharply pointed teeth on each side; sometimes a small median tooth in the notch; upperside with basal half strongly pitted, distal half longitudinally striate; underside longitudinally striate and with lateral extensor ridges; under the base of the cremaster there is a cup-shaped depression.

running axially into segment 14. Colour of head and thorax dull pale yellow suffused with fuscous ; the yellow also extends ventrally to tip of wing-case ; tongue-sheath darker yellow, fuscous at sides ; rest of wing-case pale orange ; antenna with four lines of black dots ; larger brown dots along veins of wings ; abdomen reddish-brown dorsally, with a broad fuscous dorsal stripe ; laterally fuscous, with irregular white patches round the spiracles ; ventrally pinkish, with broad interrupted ventral and latero-ventral stripes ; spiracles black ; cremaster dull orange. Length 50 mm. ; breadth 10 mm. ; cremaster 3 mm.

Habits.—Food-plants : *Vitis* Linn., family Ampelideæ ; *Begonia* Linn., family Begoniaceæ ; *Commelina* Linn., family Commelinaceæ ; *Arisæma* Mart. ; *Amorphophallus* Bl., *Colocasia* Linn. ; *Caladium bicolor* Vent., and others of the family Aroideæ. Habits the same as those of the genus *Theretra*.

Genus **RHAGASTIS** Rothschild & Jordan. (Fig. 120).

Roths. & Jord., 1903, p. 791.

Genotype : *velata* (Walk.).

Imago.—" ♂♀. Differs from *Theretra* in the second segments of the palpi not touching one another, the base of the tongue

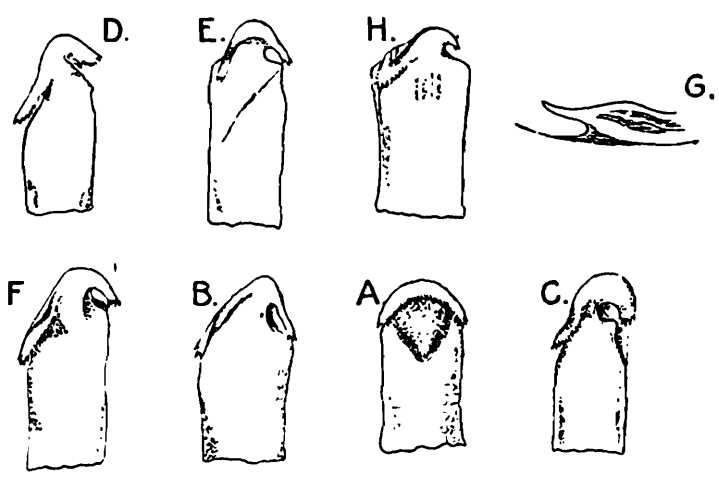


Fig. 120.—*Rhagastis* Roths. & Jord. Genitalia.

A, *R. velata* (Walk.), penis-sheath. B, *R. acuta* (Walk.), penis-sheath. C, *R. aurifera aurifera* (Butl.), penis-sheath. D, *R. confusa* Roths. & Jord., penis-sheath. E, *R. lunata lunata* (Roths.), penis-sheath. F, *R. olivacea* (Moore), penis-sheath. G, *R. albomarginatus albomarginatus* (Roths.), harpe ; H, penis-sheath.

remaining visible ; from *Cechenena* in these segments not being so narrow, bearing a large apical tuft on the inner side, and having a much smaller naked area " (Roths. & Jord., 1903, p. 791).

Egg.—Nearly spherical in shape, surface smooth and shining, colour green or yellow. Length about 2 mm.

Larva.—Shape the same as those of the genus *Theretra*; anterior segments retractile; horn of medium length, down-curved, sometimes flattened laterally or with clubbed tip; surface smooth and either dull or shining; colour green or brown; a large dorso-lateral ocellus on 5, and a dorso-lateral stripe and oblique stripes present.

Pupa.—Tongue-sheath projecting slightly (*velata*) or considerably frontad and ventrad. Surface dull, and smooth except on tongue-case and wing-case. Colour brown or yellowish, with paler markings.

Habits.—Food-plants: Ampelideæ; Geraniaceæ; Saxifragaceæ; Aroideæ.

Hab. Oriental Region, northwards to China and Japan, eastwards to Malaya. Nine Indian species and subspecies.

Key to the Species and Subspecies.

Imagines.

1. Hind wing underside with conspicuous black stigma . . . . . [(Roths.), p. 478. *R. a. albomarginatus*
   Hind wing underside without a black stigma . . . . . 2.
2. Second segment of palpus strongly narrowed to base . . [p. 470. *R. acuta* (Walk.),
   Second segment of palpus not narrowed to base . . . . . 3.
3. Upperside of thorax flushed with red, underside of wings and body including palpus rosy-red . . . . . [p. 478. *R. gloriosa* (Butl.),
   Upperside of thorax not flushed with red. 4.
4. Fore wing upperside with a single series of sharply defined white submarginal lunules . . . . . 5.
   Fore wing upperside with two series of white spots, or a broad ill-defined band, or without white submarginal markings . 6.
5. Metanotum with a reddish-tawny lateral spot. . . . . [p. 475. *R. l. lunata* (Roths.),
   Metanotum without reddish-tawny spot. . *R. l. sikhimensis* Roths. [& Jord., p. 474.
6. Fore wing upperside with a series of white submarginal spots, preceded by a straight white line from apex to R^2 and by a lunate line between R^3 and SM^2; underside of body and wings ochreous [p. 475. *R. olivacea* (Moore),
   Not so coloured . . . . . 7.
7. Underside of wings densely speckled with brown, marginal band of fore wing not joined to brown basal area; no white submarginal scaling on fore wing upperside; abdomen without yellow lateral stripe . . . . . [p. 467. *R. velata* (Walk.),
   Underside less densely speckled with brown; marginal band of fore wing joined to basal area between R^2 and R^3 . . 8.

8. Costal half of cell of fore wing underside of the reddish colour of the disc; abdomen without yellowish lateral stripe; costal edge of fore wing very pale, creamy .... [Jord., p. 473. *R. confusa* Roths. &

Cell brown; abdomen underside buffish-white; the stripe connecting basal area with marginal band of fore wing heavier. [p. 471. *R. a. aurifera* (Butl.),

Larvæ.

1. Always dark-coloured in last instar; ocellus on 5 round, pupil dark brown; horn evenly tapering, not flattened laterally. .... [p. 468 *R. velata* (Walk.),

Both green and dark-coloured forms in last instar; ocellus rounded, pupil dark blue in front, green behind, the green containing some white dots 2.

Always green in last instar . .. 3.

2. A bright yellow patch on dorsum between the ocelli; horn slightly bulbous and flattened laterally . .... [p. 471. *R. a. aurifera* (Butl.),

No such patch; horn not bulbous nor flattened laterally .... [p. 476. *R. olivacea* (Moore),

3. Ocellus conical, pupil blue; horn blue, tip clubbed .. .. [(Roths.), p. 479. *R. a. albomarginatus*

Ocellus flush, pupil dark blue in front, green behind, the green containing a line of white dots; horn evenly tapering, not flattened laterally .. [Jord., p. 474. *R. confusa* Roths. &

Pupæ.

1. Cremaster with dorso-lateral spines 2.

Cremaster without dorso-lateral spines 3.

2. Cremaster wedge-shaped, ending in two conical, widely separated, parallel bifid shafts; a dorso-lateral spine near base . [p. 469. *R. velata* (Walk.),

Cremaster triangular, ending in two shafts coalescing at base, each ending in two curved spines; a dorso-lateral spine near base and another halfway to tip, each ending in two minute hooks [(Roths.), p. 480. *R. a. albomarginatus*

3. Cremaster triangular, ending in two cylindrical shafts, each ending in two spines; two or three bifid spines on edge of cremaster near tip .. .. . . [p. 472. *R. a. aurifera* (Butl.),

Cremaster triangular, ending in two sharply pointed shafts, each with a spine projecting outwards from near its base [p. 477. *R. olivacea* (Moore),

171. **Rhagastis velata** (Walk.). (Fig. 120 A, genitalia; fig. 121, imago; Pl. VI, fig. 14, larva).

Pergesa velata, Walker, 1866, p. 1853 (Darjiling); Butler, 1881 B, p. 3, pl. lxxviii, fig. 5.

Chærocampa velata, Hampson, 1892, p. 91 (part.).

Theretra velata, Dudgeon, 1898, p. 413 (Sikkim & Bhutan, up to 4,000 ft.).

Rhagastis velata, Roths. & Jord., 1903, p. 793, pl. xiv, fig. 4 (♂); Seitz, 1929, p. 568, t. 68 *d*.

Imago.—♂♀. Olive-brown ; head and thorax with a greyish lateral stripe, no black mesial dot on metanotum ; abdomen with paired dark dorsal dots on each segment, no ochreous-tawny lateral stripe, or rarely the stripe vestigial on the last segments. The four discal lines of the fore wing, of which two or three are generally strongly dentate, form at internal margin a conspicuous patch, which is often continued costad, joining the patch situated near stigma, this latter patch sometimes wanting. Hind wing smoky-brown with a narrow clayish-buff submarginal band ; this band is best marked in individuals which have the distal part of the disc of fore wing upperside buffish and the marginal border distinct, while it is vestigial or absent from the more evenly coloured individuals. It is peculiar that *aurifera*, *acuta* and *velata* each have two forms differing in the same way. *Underside* of both wings much mottled with brown scales, forming mostly short transverse lines ; the brown border of fore wing widened before R^3,



Fig. 121.—*Rhagastis velata* (Walk.).

sometimes almost extended to basal area. Second segment of palpus not narrower towards base, longer than broad but not so long as in *aurifera*, cavity of first segment distinct. External row of spines of first protarsal segment simple, or doubled only at base. *Expanse* : ♂ 66–70 mm., ♀ 74 mm.

♂. The large scales of the clasper stand in pairs ; harpe as in *acuta*, rather more curved. Penis-sheath (fig. 120 A) symmetrical, both processes with several irregular rows of small teeth at proximal edge. Tenth sternite long, sides parallel, apex obtusely rounded.

Hab. E. Himalayas (Sikkim ; Bhutan ; Assam). We have bred the species in the Khasi Hills, where the larva is common at an elevation of about 5,000 feet, in well-wooded areas, from May to September.

Egg.—Very pale yellowish-green.

Larva :—

1*st instar*. Pale yellow when first hatched, after feeding head yellow, body green, horn black, straight, of medium

length. *2nd instar*. Head pale green, body pale bluish-green ; horn of medium length, straight, black with base reddish, tip white ; covered with small tubercles. *3rd instar*. Head and segments 2 and 3 green, rest of body pale bluish-green with short dark longitudinal stripes ; a narrow dark green dorsal stripe from 2 to base of horn ; a dorso-lateral stripe pale yellow on 2 to 4, pale blue edged above with green from 6 to base of horn ; seven dark green oblique stripes ; an ocellus on 5, which is swollen, pupil dark blue in which are one or two white spots, edged broadly with white and then narrowly with dark blue ; horn long, curved slightly upwards, basal third red, middle third black, end third white, with black tubercles.

4th instar. A green and a dark-coloured form. Green form : head and body bluish-green, body with short alternate pale and dark longitudinal stripes across the secondary rings ; other stripes as in 3rd instar ; ocellus with pupil dark blue in which are one large and several small white dots, this edged with green, the whole edged narrowly with white in front, yellow elsewhere ; horn with basal two-thirds reddish, distal third white. In the dark-coloured form the head is reddish-brown, body a beautiful crimson ; dorso-lateral stripe pale crimson, with a white dot above it on each secondary ring, and edged above with dark crimson ; ocellus with pupil dark greenish-brown with white dots, edged narrowly with white above, yellow elsewhere, the whole edged narrowly with dark brown.

5th instar. Surface of head dull. Body smooth, with a velvety texture ; horn rather short, slightly down-curved, tapering evenly to a point ; surface covered with small tubercles.

Coloration.—Head pale brown. Body very dark brown above the dorso-lateral stripe, pale brown below it, without the short longitudinal stripes of the earlier instars ; a narrow black dorsal stripe on segments 2 to 4 and from 6 to base of horn ; a pale yellowish-brown dorso-lateral stripe from 2 to base of horn, broken by the ocellus ; just below the upper edge of this stripe a round white dot on each secondary ring of segments 5 to 12 ; ocellus on 5 round, the large pupil dark brown edged narrowly with white behind and reddish-brown elsewhere, the whole edged narrowly with black ; oblique stripes on 5 to 11 formed of brown reticulations. Horn dark brown ; legs reddish. Spiracles pale brown edged with black. Length 70 mm. ; breadth 11 mm. ; horn 3 mm.

Pupa.—Tongue-sheath not much projecting. Surface dull and slightly rugose. Cremaster wedge-shaped, the sides inclined slightly inwards, the tip broadly rounded and bearing two conical, polished shafts, widely separated and nearly parallel with each other, each shaft dividing near tip into

two short diverging arms; upper surface rugose, underside deeply concave; a dorso-lateral spine near base. Colour of head, thorax and wing-case very dark brown, rest of body pale brown with numerous short longitudinal lines; spiracles black, cremaster brown, the shafts black. Length 50 mm.; breadth 10 mm.

Habits.—Food-plants: *Arisæma* Mart.; *Amorphophallus* Bl., family Aroideæ. The larva when in the later instars often rests on the stem of the plant, low down among the surrounding herbage. The anterior segments are not so strongly retractile as in others of the genus. The colour becomes darker, with a greasy appearance, before pupation. The pupa is very sluggish and rigid, the only perceptible movement made when handled being a quivering which can be detected by pressing gently on the bevels of the free abdominal segments. The moths visit flowers after dark, but we have not known them to come to light. There are probably several broods in the season, as the moths emerge about three weeks after pupation, except when the pupa is formed late in the season.

172. **Rhagastis acuta** (Walk.). (Fig. 120 B, genitalia).

Zonilia acuta, Walker, 1856, p. 195 (Hindostan).
Rhagastis acuta, Roths. & Jord., 1903, p. 794, pl. xiv, fig. 13 (♂); Seitz, 1929, p. 568, t. 68 *e*.
Chærocampa velata, Hampson (non Walk.), 1892, p. 91.
Theretra spec., Dudgeon, 1898, p. 414, n. 137, *c*, *a*. (Sikkim; Bhutan; up to 4,000 ft.).

Imago.—♂♀. In colour resembling *R. aurifera*, the subdorsal tawny-ochreous stripe of the abdomen at least vestigial. *Underside* of thorax and abdomen buff, less white than in *aurifera*, the discal dot of fore wing smaller, the marginal area not joined to the basal one; marginal area of hind wing narrower, not so much dilated before R^3. Two forms; in one the ochreous-buff band of the hind wing upperside is reduced, being often just indicated near anal angle; the fore wing has scarcely a yellow tint, and the underside of both wings is dull clayish-ochraceous with a tint of brick-red. In the other form the fore wing upperside has here and there an olive-yellow tone; band of hind wing vestigial between SC^2 and M^1, underside of both wings brighter reddish and ochreous. The marginal border of the underside of the fore wing often appears above in both forms. Second segment of palpus strongly narrowed towards base, triangular, entirely different from the segment of *velata*, *aurifera* etc.; cavity of first segment large. External row of spines of first protarsal segment doubled and trebled. *Expanse*: ♂♀ 66–72 mm.

♂. Large scales of clasper (5 to 7) in two irregular rows, appearing as one row ; harpe longer and more slender than in *aurifera*. Penis-sheath (fig. 120 B) asymmetrical, right process long, multidentate at end, rather broad, somewhat hand-shaped, left process narrow, often very short.

Hab. E. HIMALAYAS (Sikkim ; Bhutan ; Assam) and Penang. Early stages unknown.

173. **Rhagastis aurifera aurifera** (Butl.). (Fig. 120 C, genitalia ; Pl. VI, fig. 15, larva, fig. 16, pupa).

Pergesa aurifera, Butler, 1875, p. 7 (Sikkim) ; id., 1881 B, p. 2, pl. lxxviii, fig. 4.
Theretra aurifera, Dudgeon, 1898, p. 413 (Sikkim & Bhutan, up to 4,000 ft.).
Rhagastis aurifera, Roths. & Jord., 1903, p. 795, pl. xiv, fig. 7 (♂).
Rhagastis aurifera aurifera, Seitz, 1929, p. 569, t. 68 *e*.
Chærocampa velata, Hampson (non Walk.), 1892, p. 91.

Imago.—♂♀. Metanotum with black mesial dot. Abdomen with a distinct ochre-buff lateral stripe from segments 4 to 7, the stripe often extending basad to 3. Wings more elongate than in *velata* and *acuta*. *Underside* of abdomen and meso-metasternum creamy-white ; fore wing with marginal area joined to basal area by a streak behind R^2, the row of dots of the same wing heavy. In some individuals disc of fore wing upperside buffish distally near apex of wing and posterior angle, and the brown marginal area of the underside becomes also clearly marked above. Cavity of first segment of palpus distinct ; second segment broadest at base, longer than broad. Black apical scaling of antenna extending over 10 and more segments. External row of spines of first protarsal segment double. *Expanse* : ♂♀, 70–84 mm.

For detail of penis-sheath see fig. 120 C.

Hab. E. HIMALAYAS (Sikkim ; Bhutan ; Assam). We have bred the subspecies in the Khasi Hills, where the larvæ are common at an elevation of about 5,000 feet, in forest country with heavy rainfall.

Egg.—Green when first laid, yellow before hatching.

Larva :—

1*st instar*. Pale yellow with a short straight black horn ; after feeding median segments green. 2*nd instar*. Head yellow, body green ; an ocellus on segment 5 black edged with white ; horn black with red base. 3*rd instar*. Head green, body bluish-green ; a white dorso-lateral stripe on 2 to 4 ; ocellus with pupil dark blue in front, green behind, edged broadly with white and narrowly with black ; seven white oblique stripes forming a waved line. 4*th instar*. Head and segments 2 and 3 dark green, rest of body bluish-green ; a dark green dorsal

stripe; a narrow dorso-lateral stripe on 2 to 4; the ocellus with some white dots in the green portion of the pupil, the pupil edged narrowly with first white and then green; oblique stripes on 6 to 10, pale blue crossed by short dark blue lines; horn of medium length, somewhat square in cross-section, straight to near tip, then bent downwards, hardly tapering, upper surface dark purple, lower surface brown.

5th instar. Shape similar to that of larvæ of the genus *Theretra*, with segment 5 considerably swollen. Head smooth and moderately shining. Body smooth and dull. Horn held at an angle of about 45° to body, of medium length, somewhat flattened laterally, tapering gently to a slightly bulbous tip, tip bent slightly downwards; surface dull and smooth except for small round tubercles on the dorsal surface.

Coloration.—Head and segments 2 to 5 pale sap-green, rest of body pale yellow dorsally, becoming pale blue dorso-laterally and pale grass-green dotted with darker green laterally and ventrally; a very narrow, dark green dorsal stripe, disappearing in the middle of each segment, from 2 to base of horn; a narrow white dorso-lateral stripe on 2 to 4; a large oval ocellus on 5, the front edge encroaching on to 4, long axis inclined backwards and slightly upwards, pupil dark blue in front, sap-green behind, the green containing one large and several small white spots, the pupil edged broadly below, narrowly elsewhere with pure white, this again edged narrowly with sap-green; a bright yellow patch on dorsum between the ocelli, and running forward on to 4; broad, pale chalky-bluish oblique stripes on 6 to 10, that on 10 running through the spiracle on that segment and crossing 11 and 12 to base of horn, all edged above with sap-green; a dorso-lateral lunule formed of pale bluish spots ringed with dark green on 6 to 10, the lunules curved convexedly dorsad and forming backward extensions to the upper edges of the oblique stripes. Horn reddish-purple, the tubercles black; legs pink. Spiracles white edged with dark green. Length 85 mm.; breadth 11 mm.; horn 5 mm.

Pupa.—Tongue-sheath projecting considerably in front of head, semicircular in side-view; head with frons sloping steeply downwards, and between it and upper edge of base of tongue-case there is a sharp transverse dorsal ridge; from the lower edge of the tongue-case the ventral surface is concave to the middle of wing-case, then convex to tip of wing-case, the curves being more strongly developed than in others of the genus. Surface dull, tongue-sheath coarsely rugose, veins of wings and legs prominent and set with tubercles; rest of body smooth. Spiracles white with a broad black band across the middle. Cremaster triangular, upper surface

rugose, underside deeply hollowed, ending in two cylindrical shafts, each of which branches into two spines ; two or three double-pointed spines on lateral edge of cremaster near tip. Colour of head, thorax and wing-case dark brown speckled and streaked with black, especially on dorsum ; abdomen pale brown dorsally and ventrally, sides black with large, irregular, white patches round the spiracles ; wing-case separated from abdomen by a conspicuous white line from base to near tip ; bevels of free abdominal segments pink. Length 50 mm. ; breadth 10 mm.

Habits.—Food-plants : *Vitis* Linn., family Ampelideæ ; *Amorphophallus* Bl., family Aroideæ. Anterior segments of larva more retractile than in *velata*. The larva, when alarmed, adopts the snake-like attitude of *Theretra* larvæ, retracting the head and anterior segments into the swollen segment 5, and waving the head and anterior segments from side to side. The pupa when handled moves the abdominal segments freely. We have not seen the moth in its natural state. There appear to be several broods in the year.

174. **Rhagastis confusa** Roths. & Jord. (Fig. 120 D, genitalia ; Pl. VI, fig. 19, larva ; Pl. XV, figs. 9, 10, larva).

Rhagastis confusa, Roths. & Jord., 1903, p. 795, pl. xiv, fig. 12 (♂) (Khasia Hills) ; Seitz, 1929, p. 569, t. 68 *e* ; Scott 1931, pl. iii, fig. 1 (larva).

Theretra velata var. *albomarginata*, Hampson (non Roths.), 1900, p. 39, pl. B, fig. 4.

Imago.—♂♀. Head and thorax brown with a sharply defined whitish-pink lateral band, which is shaded with brown near base of fore wing. Metanotum with indistinct black mesial dot. No tawny-ochreous subdorsal stripe on abdomen. Wings broader than in *aurifera*. Fore wing as in *aurifera*, but darker in tint, costal margin pale ; fringe of hind margin white in middle, continuous with the pinkish-white, longitudinal, subbasal line indicated in *aurifera* and other species. Hind wing : pale band more pinkish and broader than in *aurifera*. *Underside* : middle of sterna and abdomen buff-pink, dusted with a few black scales. Fore wing : anterior half of cell reddish, not brownish-black, of the same colour as the disc ; the brown discal band just outside the basal area absent or only vestigial at costal margin of fore and hind wing ; the discal dots as large as in *aurifera* ; marginal band of fore wing and the stripe connecting it with basal area less prominent than in *aurifera*. Palpus as in *aurifera*. External row of spines of first protarsal segment double only at base. *Expanse* : ♂ 84 mm., ♀ 90 mm.

♂. Penis-sheath (fig. 120 D) differing from that of *aurifera* in being more asymmetrical, and in the right process being broader and having teeth along the proximal and apical edges.

Hab. W and E. HIMALAYAS (Mussooree ; Sikkim ; Assam). We have bred the species in Mussooree in the W Himalayas at an elevation of 7,000 feet, and in the Khasi Hills at 5,000 feet. The larvæ are rather rare, and are found only in densely wooded areas with a heavy rainfall.

Larva :—

Final instar. Very similar to that of *aurifera* ; horn tapering evenly to a point, sides not flattened. Surface as in *aurifera.*

Coloration.—Head and segments 2 to 5 green with a yellowish tinge on dorsum, rest of body very pale bluish, nearly white ; a narrow green dorsal stripe from 2 to base of horn ; a broader white dorso-lateral stripe from 3 to base of horn, broken by the ocellus on 5, and on 6 to 10 broken before the hind margin of each segment, curved convexedly dorsad and edged above with green, from 11 running straight across 12 to base of horn ; ocellus on 5 longitudinally elongate-oval, pupil elongate-oval, deep blue in front, sap-green behind, the green part bearing two or three large white dots placed longitudinally ; the pupil edged broadly above, less broadly elsewhere, with white, the whole edged narrowly with sap-green ; front edge of ocellus encroaching on to 4 ; broad, pale blue oblique stripes on 6 to 10 running into the dorso-lateral stripe above. Horn purple ; legs pink. Spiracles whitish with a brown patch on each side of the central slit, and a narrow dark green rim. Length 90 mm. ; breadth 11 mm. ; horn 7 mm.

Pupa.—Very similar to that of *aurifera.*

Habits.—Food-plants : *Vitis* Linn., family Ampelideæ.

175 *a.* **Rhagastis lunata sikhimensis** Roths. & Jord.

Rhagastis lunata sikhimensis, Roths. & Jord., 1903, p. 797 (Sikkim); Seitz, 1929, p. 569.

Imago.—♂. Differs from *R. l. lunata* in the following respects : metanotum without reddish-tawny spot ; lateral stripe of abdomen less red. Wings broader ; pale band of hind wing with six brown dots, the last upon M^2 distinct, fringe without white scales between R^1 and M^2. *Underside* of wings more distinctly ochreous distally, the brownish-black basal area of fore wing just entering cell, continuous with the black discal dash situated between R^2 and R^3.

Left process of penis-sheath longer and more hand-shaped than in *R. l. lunata.*

Hab. E. HIMALAYAS (Sikkim). One ♂ in Tring Museum, ♀ and early stages unknown.

175 *b*. **Rhagastis lunata lunata** (Roths.). (Fig. 120 E, genitalia).

Chærocampa lunata, Roths., 1900, p. 274 (Khasia Hills).
Rhagastis lunata lunata, Roths. & Jord., 1903, p. 797, pl. vi, fig. 8 (♂); Seitz, 1929, p. 569, t. 47 *h*.

Imago.—♂. Metanotum with a black mesial dot and a reddish-tawny lateral spot; sides of abdomen with a broad blackish stripe, broadest and most distinct at base, dorsally bordered on segments 3 to 7 by a rufous-red stripe. Fore wing with a single white submarginal line, which consists of half-moons, the horns of which point discad. Hind wing with a sharply defined buff band, reaching to SC^2, indented at R^2, with four brown dots, the last two, on M^2 and M^1, touching the black basal area or fused with it; fringe with white scales at least between M^1 and M^2, besides the white scaling at anal angle. *Underside* pinkish-red, the black basal area of fore wing reduced to a streak or patch behind cell, not entering cell; wings showing distally traces of the ochreous ground-colour. Second segment of palpus not narrowed towards base; cavity of first segment distinct but not large. External row of spines of first protarsal segment simple or irregularly doubled at base. Antenna longer and thicker than in *velata*, *acuta* etc., the black apical scaling confined to the last two to six segments. *Expanse*: ♂♀ 72–86 mm.

Harpe nearly as in *olivacea*. Penis-sheath (fig. 120 E) also as in that species, but the left process reduced to a few teeth.

Hab. Khasi Hills. Rare; the ♀ and early stages unknown.

176. **Rhagastis olivacea** (Moore). (Fig. 120 F, genitalia; fig. 122, imago; Pl. VI, fig 17, larva, fig. 18, pupa; Pl. XV, fig. 7, larva).

Pergesa olivacea, Moore, 1872, p. 566 (Simla).
Chærocampa olivacea, Hampson, 1892, p. 91.
Rhagastis olivacea, Roths. & Jord., 1903, p. 797; Mell, 1922, p. 324, pl. xii, figs. 23–27 (larva), pl. xiv, figs. 31, 32, pl. xix, figs. 29, 30 (pupa), pl. xxxii, fig. 10 (♀); Seitz, 1929, p. 569, t. 68 *e*.
Theretra sp., Dudgeon, 1898, p. 413, n. 137, B, *a* (Sikkim and Bhutan, 3,000 ft.).

Imago.—♂♀. Head, body and fore wing of a peculiar greenish-yellow colour. Fore wing with a round black stigma, a white submarginal line consisting of more or less straight bars, preceded by another white line, which is broadened from tip of wing to R^2, and then luniform between the veins; discal lines reddish-tawny, antemedian lines obscure, olivaceous. Hind wing smoky-black; a diffuse ferruginous submarginal band. *Underside* orange-ochraceous, the three discal lines distinct on both wings, except the second, which is often barely vestigial. *Expanse*: ♂ 72–78 mm., ♀ 92 mm.

Structurally nearly the same as *gloriosa*; harpe shorter and stouter, right process of penis-sheath (fig. 120 F) more curved, left process longer and more slender.

Hab. W and E. HIMALAYAS and BURMA, and S. China. We have bred the species in several localities in the W and E. Himalayas, where the larva is common at an elevation of from 5,000 to 7,000 feet in forests with heavy rainfall.

Egg.—Pale green.

Larva:—

1st instar. Pale yellowish-green, with a long, straight, black horn. *2nd instar.* Head and segments 2 to 4 green, rest of body green dotted with white; a pale dorso-lateral stripe on 2 to 4; an ocellus on 5, blue edged with yellow; seven pale oblique stripes; horn straight, base reddish, tip black. *3rd instar.* A narrow dark dorsal stripe; ocellus with pupil blue in front, green dotted with white behind, the



Fig. 122.—*Rhagastis olivacea* (Moore).

whole edged narrowly with white in front, yellow behind; oblique stripes white, horn orange. *4th instar.* Little change, but the oblique stripes bluish.

5th instar. Shape as in others of the genus, segment 5 considerably swollen. Head moderately shining and smooth. Body dull and smooth; horn of medium length, stout at base, tapering gently and evenly to a blunt point, gently down-curved; surface dull and covered with small tubercles.

Green form (Pl. VI, fig. 17): head and body bright grass-green, body with short, dark green longitudinal stripes across the secondary rings, more numerous on segments 6 to 11 than on the remaining segments; a narrow, dark green dorsal stripe from 2 to base of horn, broken in the middle of each segment; a white dorso-lateral stripe from 2 to the middle of 4, formed of coalescing white dots increasing in size backwards; a large irregular-rounded ocellus on 5, encroaching on to 4, the large pupil deep blue in front, sap-green behind, the green part bearing some large white dots, the pupil edged broadly with pale ochreous above, pale blue in front and white behind, the whole

edged very narrowly with black ; oblique stripes on 5 to 10, that on 5 formed of a series of round white spots, one on each of the last three secondary rings and extending on to the first two rings of 7, the first very small, others increasing in size backwards ; those on 6 to 9 broad, white, on the last secondary ring of each segment broken by a transverse green line into a transverse, oval spot, and extending as smaller white spots edged with dark green on to the anterior two or three rings of the segment behind ; that on 10 running across 11 and 12 to base of horn, white edged above and below with dark green. Horn reddish-brown or purplish, the tubercles brown ; legs red. Spiracles yellow edged with green.

In the dark-coloured form the green colour is replaced by a rich brown, markings the same as in the green form. Length 90 mm. ; breadth 14 mm. ; horn 8 mm.

Pupa.—Very similar to that of *aurifera* in shape and surface ; tongue-sheath radially striate. Cremaster triangular, tip with two sharply pointed polished shafts, each with a short spine projecting outwards from near its base ; upper surface rugose, lower deeply grooved. Tongue-sheath brownish-red ; head, thorax and wing-case dark brown in dorsal area, brownish-red with dark brown streaks and lines elsewhere ; lines of brown tubercles along veins of wing-case ; wing-case separated from abdomen by a soiled whitish line, not so conspicuous as in *aurifera* ; abdomen yellowish-brown, the sides with numerous short blackish longitudinal lines ; spiracles black, those on 6 and 7 lying on small black patches round which the line dividing wing-case from abdomen runs ; the others lying on small whitish patches ; cremaster dark brown. Length 55 mm. ; breadth 10 mm.

Fellowes Manson, in " Rare and little known Sphingidæ," Journ. Bombay Nat. Hist. Soc. xxvii, 1921, p. 753, describes a larva and pupa which he states to be those of *R. olivacea*, but his description of the larva agrees with that of *R. albomarginatus albomarginatus*, and he must have confused the two species, especially as he gives the food-plants as *Vitis vinifera* Linn. and *Hydrangea* Linn., the former being the food-plant of *aurifera* and *confusa* and the latter of *a. albomarginatus*.

Habits.—Food-plants : usually *Impatiens* Linn., family Geraniaceæ, but also feeds on plants of the family Aroideæ. Anterior segments of larva strongly retractile ; the dorsum becomes suffused with greyish (in the green form) and all the markings darker before pupation. Other habits the same as those of *aurifera*. Eggs and larvæ may be found from May to October, and there are probably several broods in the season.

177. **Rhagastis gloriosa** (Butl.).

Pergesa gloriosa, Butler, 1875, p. 246 (Darjiling); id., 1877 A, p. 549, pl. xcii, fig. 3; id., 1881 B, p. 3, pl. lxxviii, fig. 6.
Chærocampa gloriosa, Hampson, 1892, p. 91.
Rhagastis gloriosa, Roths. & Jord., 1903, p. 798; Seitz, 1929, p. 569, t. 47 *g*.

Imago.—♂♀. Head, and thorax and abdomen mesially, olive-green; antenna, palpus and sides of thorax and abdomen crimson. Fore wing olive-green; costa, antemedian, median, postmedian and submarginal maculate irregular bands crimson; outer margin darker olive; a marginal pale pink line; cilia crimson; a black speck at end of cell. Hind wing smoky-black suffused with blood-red towards outer margin. *Underside* of palpus, head, body and wings rosy-red, fore wing with a black patch towards base; both wings with three transverse waved lines. Second segment of palpus not narrowed towards base; cavity of first segment distinct. First protarsal segment with a simple external row of spines. *Expanse*: ♂ 82–86 mm., ♀ 92 mm.

♂. Tenth tergite feebly dilated at apex, which shows traces of a sinus; sternite narrow, obtusely pointed. Clasper with about six very large scales; harpe slender, horizontal, slightly spatulate in dorsal view, feebly curved at end. Penis-sheath resembling that of *olivacea*, the left process broad and short.

Hab. E. Himalayas (Sikkim; Bhutan; Khasi Hills). Rare; the early stages unknown.

178. **Rhagastis albomarginatus albomarginatus** (Roths.). (Fig. 120 G, H, genitalia; Pl. VII, figs. 1, 2, larva, fig. 3, pupa; Pl. XII, fig. 9, imago; Pl. XV, fig. 11, larva).

Metopsilus albomarginatus, Roths., 1894 A, p. 78 (Khasia Hills).
Rhagastis albomarginatus albomarginatus, Roths. & Jord., 1903, p. 798, pl. xiv, fig. 8 (♂); Seitz, 1929, p. 569, t. 47 *e*; Scott, 1931, pl. i, fig. 2 (♀), pl. ii, fig. 7 (larva).
Chærocampa velata, Hampson (non Walker 1866), 1898, p. 453.
Rhagastis olivacea, Manson (non Moore), 1921, p. 753 (larva).

Imago.—♂♀. Head and thorax dark brown; a pale pink lateral stripe from palpus to end of thorax; metanotum with a black mesial spot and a conspicuous tawny subdorsal patch; abdomen paler brown on dorsum shading to yellowish on sides; a pair of black dots on the dorsum of each segment. Costal edge of fore wing creamy-white, at least partly; base dark olive-brown, median area greyish, turning to olive-green near apex; an irregular pink patch near anal angle and a black spot on inner margin near anal angle; a pink marginal

band speckled with black ; the inner edge not sharply defined ; a large black stigma and large brown dots beyond cell. Hind wing blackish, the distal halves of the veins and an ill-defined patch near anal angle ochreous. *Underside* : the dots beyond cell of fore wing large. Hind wing with a conspicuous stigma.

Antennal scaling pinkish-white, not brown or black on anterior side from near base to near hook as it is in the preceding species, the black distal patch rather long ; basal cilia slightly prolonged in ♀. Second segment of palpus not narrowed to base ; cavity of first distinct. External row of spines of first protarsal segment simple, with or without a very few additional spines at the base. *Expanse* : ♂ 76–86 mm., ♀ 87 mm.

♂. Clasper very broadly rounded at end ; process of harpe slender (fig. 120 G). Penis-sheath (fig. 120 H) with a short paucidentate right process, and a more proximal left process dentate at the proximal and apical edges and bearing also one or two teeth at distal edge, the right process or both sometimes absent.

Hab. E. HIMALAYAS (Sikkim ; Khasi Hills). We have bred the subspecies in the Khasi Hills at an elevation of about 5,000 feet. Larvæ and moths are extremely common in the station of Shillong, but we did not find any away from the station itself.

Egg.—Pale yellowish.

Larva :—

1*st instar*. Pale honey-yellow, with a short straight black horn ; surface of body very smooth and shining. 2*nd instar*. Head pale blue ; body green, with a shining and translucent appearance ; segment 5 tumid ; an ocellus on 5 black edged with white ; horn pale blue. 3*rd instar*. Body dotted with yellow ; a dorso-lateral and a subspiracular stripe on 2 to 4, and oblique stripes on 6 to 11, pale blue ; an ocellus on 5, which is very tumid, pupil pale blue edged broadly with white and narrowly with black ; ocellus shining and conical ; horn dark blue. 4*th instar*. A dark blue dorsal stripe ; horn down-curved, smooth and shining, clubbed at the tip.

5*th instar*. Shape the same as others of the genus. Head dull and smooth. Body shining as though enamelled, including the ocelli and horn. Horn of medium length, thick at base, proximal half tapering sharply, then cylindrical to near the slightly bulbous tip, bent slightly downwards in the middle.

Coloration.—Head pale blue. Body pale yellowish in dorsal area, lateral area pale grass-green or bluish-green with a number of short, longitudinal, dark green lines across the secondary rings, turning to bluish dots below the spiracles and on venter ; a narrow, broken, dark green dorsal stripe from 2 to base of

horn; a broad, pale blue or whitish dorso-lateral stripe on 2 to 4; a similar subspiracular stripe on 2 to 4, meeting at a sharp angle the lower end of the oblique stripe on 5; ocellus on 5 round or obliquely oval, conical in shape, the small pupil, at the apex of the cone, deep blue; it is edged broadly with very pale blue, this again edged broadly with white, the whole edged narrowly with black; broad pale blue oblique stripes on 5 to 12, each running through the spiracle and forwards on to the segment in front and back on to the segment behind, that on 11 running across 12 to base of horn, that on 12 narrower than the rest and stopping just behind the spiracle. Horn dark blue with a series of darker blue, narrow rings from near base to tip; legs, prolegs, anal flap and claspers pale blue. Spiracles ochreous. Length up to 100 mm.; breadth up to 15 mm.; horn 8 mm.

There is no dark-coloured form, though some individuals are of a darker shade of green than others.

Pupa.—Tongue-sheath more prominent ventrad than frontad. Surface dull and smooth except for rounded tubercles on veins of wing-case and legs. Cremaster triangular, ending in two shafts which are broad and coalescing at base, each shaft ending in a weak incurved spine and a longer, stronger outcurved spine; there is a dorso-lateral spine near base of cremaster and another about half-way between base and tip, each ending in two minute hooks; upper surface of cremaster shagreened, lower surface deeply longitudinally grooved. Head, thorax and wing-case pale brown, darker on dorsum; the tubercles on legs and veins dark brown; abdomen ochreous with paler patches above and below the spiracles, which are dark brown; bevels of free abdominal segments reddish; shaft and spines of cremaster black. Length 55 mm.; breadth 11 mm.; cremaster 3 mm.

Habits.—Food-plant: *Hydrangea* Linn., family Saxifragaceæ. The subspecies bred by Mell in S. China feeds on *Dichroa febrifuga* Lour., of the same family, so it is probable that plants of this family are always chosen for the food of the various subspecies. The larvæ are very voracious feeders, and being extremely common in Shillong hydrangea-bushes there are frequently stripped of all their leaves. One bush which we kept under observation was so stripped three times in one season, eggs being laid on the fresh shoots as soon as they appeared. Every season immense numbers of larvæ are destroyed by gardeners and numbers by ants, when, having stripped one bush they are compelled to come to the ground to seek other food. In spite of this annual destruction we have not noticed any diminution in the numbers of the larvæ during a period of ten years. They appear to be singularly immune from attacks by parasitic wasps and flies. When

alarmed the anterior segments are strongly retracted into 5, which is then very swollen. The bright colouring, the shining enamel-like surface and the protruding conical ocelli, looking like a pair of staring eyes, give the larva a very striking appearance. The moths visit flowers after dark, and are also attracted by light. There are several broods in the season.

Genus **CECHENENA** Rothschild & Jordan. (Fig. 123).

Roths. & Jord., 1903, p. 799.

Genotype : *helops* (Walk.).

Imago.—" ♂♀. Second segments of palpi divergent, narrower in side-view than first segment, not covering base of tongue, the apical tuft of inner surface small, the naked space longer than broad.

" There are three types of development in this genus, which perhaps represent each a separate genus.

" *a*. Abdomen and fore wing striped, the external stripes of the latter converging apicad ; bristles of comb of mid-tarsus numerous and long ; first segment of hind tarsus as

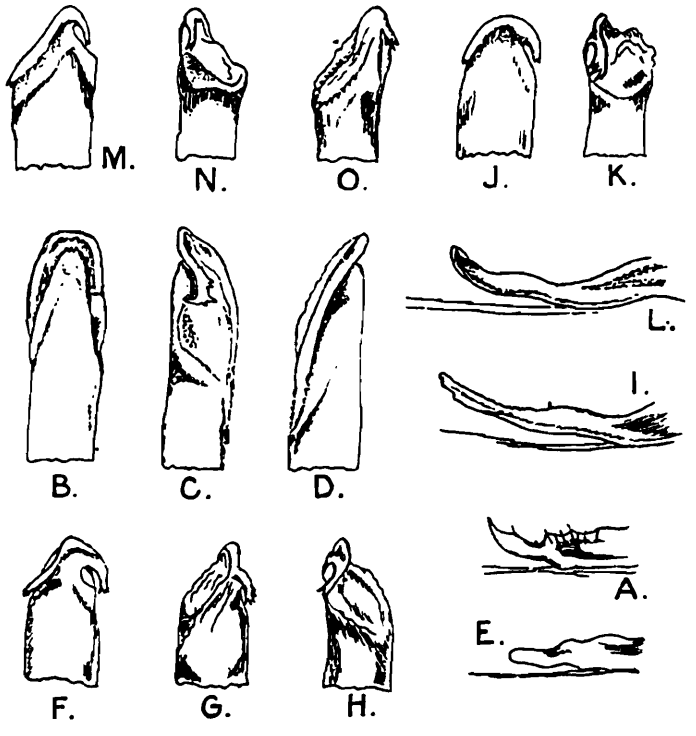


Fig. 123.—*Cechenena* Roths. & Jord. Genitalia.

A, *C. ægrota* (Butl.), harpe ; B, penis-sheath, dorsal side ; C, penis-sheath, right side ; D, penis-sheath, left side. E, *C. helops* (Walk.), harpe ; F, penis-sheath, dorsal side ; G, penis-sheath, right side ; H, penis-sheath, left side. I, *C. minor* (Butl.), harpe ; J, penis-sheath, right side ; K, penis-sheath, left side. L, *C. lineosa* (Walk.), harpe ; M, penis-sheath, dorsal side ; N, penis-sheath, right side ; O, penis-sheath, left side.

long as tibia and as segments 2 to 5. Mid-tibial spurs equal, outer one often longer than inner. Here belong *lineosa*, *minor* and *pollux*.

" *b*. Abdomen without lines ; markings of fore wing transverse ; bristles of comb of mid-tarsus rather short and stout, less numerous ; first segment of hind tarsus as before ; antenna of ♀ incrassate distally. Mid-tibial spurs unequal. Resembles *Rhagastis gloriosa* in the style of coloration and in shape. One species : *mirabilis*.

" *c*. Eye large ; antenna not incrassate distally in either sex ; spines of comb of mid- and hind tarsus long, thin and numerous ; first segment of hind tarsus as long as segments 2 to 4 only, shorter than tibia ; prothorax long, mesothorax also projecting more than usually beyond the fore wing, stout. It reminds one by the robustness of the body of *Pholus* and *Rhagastis gloriosa*. Two species : *helops* and *ægrota* " (Roths. & Jord., 1903, p. 799).

Egg.—Green or pale ivory-colour.

Larva.—Similar to *Theretra* and *Rhagastis* in shape, segments 4 and 5 somewhat dilated ventro-laterally except in *C. mirabilis* ; horn down-curved or bent sharply downwards, laterally flattened except in *mirabilis* ; an oval ocellus on segment 5, the surface shining as though enamelled ; pale subdorsal spot or spots on 6 to 11 ; when full-fed a dark-coloured form only except in *mirabilis*, which has also a green form.

Pupa (of *C. minor*, *C. l. lineosa* and *C. l. scotti*).—Tongue-sheath projecting considerably frontad, edge of sheath flattened and wider than the sides. Tongue reaching tip of wing-case. Surface dull, veins of wings set with pointed tubercles. Cremaster triangular, tip truncate, a long straight spine at each lateral angle and one or two dorso-lateral spines ; colour brown with darker and paler markings.

Habits.—Food-plants : Ampelideæ, Ternstrœmiaceæ and Aroideæ. The moths rest with the wings held nearly horizontal. Flight very swift.

Hab. Oriental Region. Six Indian species and subspecies.

Key to the Species.

Imagines.

1. Fore wing upperside with seven or eight almost straight lines in outer half, abdomen striped above .. .. .. 2.
   Fore wing upperside without these lines, abdomen not striped above .... 4.
2. Mesonotum without a pale mesial band, fore wing with seven lines (inclusive of the feebly marked submarginal one) [p. 487. *C. m. minor* (Butl.),
   Mesonotum with a pale mesial band . 3.

3. Fore wing green with eight lines, there being an additional line between lines 6 and 7 ..... *C. l. lineosa* (Walk.), [p. 490.
Fore wing pinkish buff-grey, basal half below stigma rosy-pink; the median lines heavy, the others faint and ill-defined . *C. l. scotti* Roths., [p. 489.
4. Fore wing upperside with a broad subbasal umber- or mummy-brown band or patch ... *C. h. helops* (Walk.), [p. 486.
Fore wing without that band ..... 5.
5. Fore wing upperside dark green in basal area like thorax, underside red . . . . *C. mirabilis* (Butl.), [p. 483.
Fore wing upperside clayish with a black spot near base *C. ægrota* (Butl.), [p. 485.

Larvæ.

1. Horn rather short, slightly down-curved, tapering evenly to near tip, where it abruptly narrows to a blunt point. .. *C. mirabilis* (Butl.), [p. 484.
Horn of medium length, flattened laterally. 2. [p. 487.
2. Horn tapering evenly to a blunt point. .. *C. m. minor* (Butl.),
Horn first increasing in depth, then decreasing; in dorsal view first increasing in breadth, then decreasing to near the slightly bulbous tip { *C. l. lineosa* (Walk.), [p. 491. / *C. l. scotti* Roths., [p. 489.

Pupæ.

Cremaster with a dorso-lateral spine near base. *C. m. minor* (Butl.), p. 488.
Cremaster with two dorso-lateral spines near tip { *C. l. lineosa* (Walk.), [p. 492. / *C. l. scotti* Roths., [p. 489.

179. **Cechenena mirabilis** (Butl.). (Pl. XV, fig. 13, larva).

Chærocampa mirabilis, Butler, 1875, p. 248 (N.W. Himalayas); id., 1877 A, p. 554, pl. xcii, fig. 1; Hampson, 1892, p. 93.
Cechenena mirabilis, Roths. & Jord., 1903, p. 800; Seitz, 1929, p. 570, t. 68 *b*.

Imago.—♂♀. Head, thorax and first two segments of abdomen olive-green; sides of head and thorax white; tegula with a long pale pink apical fringe; distal segments of abdomen ruddy-brown. Fore wing olive-green, base darker; a dark green antemedian waved line and postmedian curved line; a dark speck at end of cell. Hind wing ruddy-brown with traces of a submarginal line. *Underside*: fore wing brown at base and outer margin, postmedian area pink; an oblique postmedian brown line; hind wing pink, outer margin brown; a median curved brown line. Antenna incrassate distally in ♀. External row of spines on first protarsal segment double at base; short spur of mid-tibia shorter than in the following species, spines of comb of mid-tarsus stout and rather short, those of comb of hind tarsus very little prolonged. *Expanse*: ♂♀ 80–94 mm.

♂. Tenth abdominal segment of the ordinary form as in *Rhagastis velata* etc. Process of harpe much longer than in *R. a. albomarginatus* but of the same shape. Penis-sheath resembling that of *R. l. lunata*, the right process rather long, the left short and paucidentate. The number of large scales on clasper larger than in *R. velata* and allies.

Hab. W Himalayas (Simla). We have bred the species in Simla, where the larvæ are rather rare at an elevation of about 7,000 feet in forests with medium rainfall.

Egg.—Bright green in colour.

Larva :—

1*st instar*. Head and body pale yellow, horn of medium length, straight, black. 2*nd instar*. Head distinctly bilobed ; body rather thick for its length, segments 4 and 5 slightly tumid ; horn of medium length, thick at base and evenly tapering, slightly up-curved ; head green, body bluish-green with a transverse row of whitish dots along each secondary ring, the dots larger behind 5 ; an indistinct narrow dorsal stripe on 2 to 4 ; an ocellus on 5, oval and oblique, very pale yellow edged narrowly with black except at the upper end ; horn with basal half crimson, rest black with a white tip. 3*rd instar*. Head degraded orange covered with paler tubercles ; body greenish-brown in dorsal area, dull crimson in lateral area, dotted with white, these dots turning to a triangular patch of large white spots above the spiracles of 6 to 11, the apex of the triangle dorsad ; a white subdorsal spot near the front margin of each of these segments ; ocellus with pupil bright yellow with a brownish spot inside it touching the middle of its front edge and shading into the yellow, the pupil edged narrowly with blue, then more broadly with very dark blue ; horn thick at base, tapering first sharply then more gently, up-curved. 4*th instar*. Head pale green ; segments 2 to 5 of body pale yellowish-brown in dorsal area, degraded pale green dotted with paler green in lateral area, with a narrow dark dorsal stripe and a yellowish subdorsal stripe ; rest of body dull crimson, with white dots and spots as in the 3rd instar ; ocellus as in 3rd instar ; horn with basal two-thirds crimson, then black with the tip translucent white.

5*th instar*. Shape as in the genus *Rhagastis*. Head dull, covered with small round tubercles. Body smooth and dull except for the ocellus, which is shining as though enamelled ; horn short or of medium length, slightly down-curved, tapering evenly to near the tip, where it abruptly narrows to a blunt point ; surface dull, covered sparsely with shining pointed tubercles directed distad, except on the extreme tip.

Green form : head dark green, eyes brown. Body : segment 2 green, 3 and 4 pale yellow in dorsal area, green in lateral area : dorsum of 5 yellowish-green, pale yellow between the

ocelli, lateral area bright green ; rest of body very pale green with short stripes across the secondary rings, alternately very pale blue and very dark green ; two large subdorsal pale blue spots on each segment from 6 to 11 ; a narrow dark green dorsal stripe from front margin of 3 to near base of horn ; an ill-defined pale green dorso-lateral stripe on 3 and 4 ; ocellus on 5 rather small, oval, the long axis inclined backwards and upwards at an angle of about 30°, lower front part of pupil very deep blue, upper hind part yellow, the pupil edged above and below with dark olive-green dotted with pale yellow, the whole edged narrowly with white and then dark green ; broad ill-defined very pale blue zigzag dorso-lateral stripe from 6 to base of horn, edged above with short dark green stripes. Horn pale yellow with self-coloured tubercles, the extreme tip black ; legs flesh-colour. Spiracles ochreous with a dark green rim.

In the dark-coloured form the head is brown, segment 2 degraded yellowish-brown, 3 to 5 muddy-brown, dorsum pale ochreous ; a greenish-ochreous dorso-lateral stripe, edged above with dark brown, from 3 to ocellus ; subdorsal spots as in the green form ; ocellus with lower front part of pupil dark blue, upper hind part brown spotted with yellow, pupil edged narrowly with pale blue in front, more widely with white behind, the whole edged narrowly with dark brown ; a zigzag dark brown dorso-lateral stripe from 6 to base of horn, the body above it marked with short stripes across the secondary rings, alternately dark brown and degraded white, below it degraded white with a few dark stripes ; broad ill-defined dark brown oblique stripes on 5 to 10. Spiracles ochreous with the slit edged with brown on each side and the rim brown. Length 98 mm. ; breadth 11 mm. ; horn 5 mm.

Pupa.—Not recorded.

Habits.—Food-plant : *Vitis* Linn., family Ampelideæ. Habit the same as those of *Theretra* and *Rhagastis*. We have only seen bred specimens of the moth.

180. **Cechenena ægrota** (Butl.). (Fig. 123 A–D, genitalia).

Pergesa ægrota, Butler, 1875, p. 246 (Sylhet) ; id., 1877 A, p. 549, pl. xcii, fig. 2.
Cechenena ægrota, Roths. & Jord., 1903, p. 800, pl. x, fig. 10 (♂) ; Seitz, 1929, p. 570, t. 68 *b*.
Chærocampa velata, Hampson (non Walk.), 1892, p. 91 (partim).

Imago.—♂♀. Similar to *C. mirabilis*, but considerably larger and the fore wing brown instead of green, the dark bands duller and less distinct. Hind wing black with a curved, proximally notched, dull ochreous submarginal band. Abdomen with a black lateral line widening towards base, not

distinctly marked on the first segment, thin on the posterior segments ; two rows of dorsal dots as in the allies of *Rhagastis velata*. Cavity of palpus almost closed. *Expanse* : ♂ 80–100 mm.

♂. Tenth abdominal segment of the same type as in *R. velata*, *acuta* etc. Harpe (fig. 123 A) compressed, dorsal margin notched, apex acute, curved upwards. Penis-sheath (figs. 123 B, C, D) : apical edge produced at both sides into a dentate process, the right process irregularly toothed, the teeth prominent, the left process long, with minute teeth at both edges at end.

Hab. E. HIMALAYAS (Sylhet) to Borneo and Java. Rare ; early stages unknown.

181. **Cechenena helops helops** (Walk.). (Fig. 123 E–H, genitalia).

Philampelus helops, Walker, 1856, p. 180 (" Natal," err. ; Moulmein, teste Boisduval).
Chærocampa helops, Hampson, 1892, p 92 (partim).
Cechenena helops helops, Roths. & Jord., 1903, p. 801 ; Seitz, 1929, p. 570 (non t. 68 *a*).

Imago.—♂♀. Head, thorax and abdomen olive-brown ; sides of metanotum tawny, centre grey, this grey patch extended on to mesonotum and abdomen ; first and second segments of latter with black side-patches. Fore wing greyish-brown ; a broad subbasal umber- or mummy-brown patch with pale edge ; a black stigma preceded by another small spot ; area beyond cell suffused with brown ; a black broken apical line borders a tawny olive-brown costal band which stops sharply at R^1. Hind wing smoky-black with a pale patch at anal angle. *Underside* ochreous suffused and speckled with black. Cavity of palpus sharply defined. *Expanse* : ♂ 104–112 mm., ♀ 126 mm.

♂. Tenth tergite flat at end, truncate, very feebly sinuate ; sternite compressed, outline of under surface strongly curved in lateral view. Process of harpe (fig. 123 E) almost cylindrical, apex obtuse, rounded. The two processes of penis-sheath (figs. 123, F, G, H) much shorter than in *ægrota*, of nearly equal length, dentate, somewhat projecting away from sheath.

♀. Side-edges of vaginal plate rather sharply raised ; vaginal cavity large, the edge feebly raised, lyre-shaped.

Hab. E. HIMALAYAS (Sikkim ; Khasi and Jaintia Hills) to Malaya. Early stages unknown.

182. **Cechenena minor minor** (Butl.). (Fig. 123 I–K, genitalia).

Chærocampa minor, Butler, 1875, p. 249 (Masuri).
Cechenena minor, Roths. & Jord., 1903, p. 802, pl. x, fig. 11 (♂).
Cechenena minor minor, Jordan, 1912, p. 260, t. 42 *e*; Mell, 1922, p. 327, pl. xii, figs. 28–33, pl. xiii (xiv), fig. 33, pl. xix, figs. 32, 33 (pupa), pl. xxxi, fig. 11 (larva), pl. xxxii, fig. 12 (♂); Seitz, 1929, p. 570.
Chærocampa lineosa, Hampson (non Walk.), 1892, p. 93 (partim).
Theretra lineosa, Dudgeon (non Walk.), 1898, p. 412 (Sikkim and Bhutan).

Imago.—♂♀. Head, thorax and abdomen olive-brown. Thorax without pale mesial band; lines of abdomen less prominent than in *lineosa*. Fore wing olive-brown with a black patch at base of inner margin; *seven* lines in outer half, the short line 6—or line 3 counting from outer margin—completely merged with 7, the latter generally blacker behind and somewhat undulate; a black dot at end of cell. Hind wing black with a diffuse pale submarginal band. Exterior spur of mid-tibia generally equal to inner one, but often longer and sometimes a little shorter. *Expanse*: ♂♀ 90–98 mm.

♂. Tenth sternite less triangular at end than in *lineosa*. Large scales of clasper asymmetrical, the proximal side of each scale enlarged, longitudinally folded or ribbed, darker than the distal side; process of harpe (fig. 123 I) with indications of teeth. Penis-sheath (figs. 123 J, K) almost symmetrical, apex rounded in a dorsal view; right process somewhat widened at end, dentate, left process vestigial only, there being but a few teeth on that side and no free projecting process.

Hab. W Himalayas (Dharmsala; Simla) and E. Himalayas (Sikkim; Bhutan; Khasi Hills) to China, Japan and Siam. We have bred the species in the W Himalayas and the Khasi Hills, where the larvæ are found rather rarely at an elevation of about 7,000 feet and 5,000 feet respectively, and Mell has bred it in S. China.

Larva:—

1*st instar*. Pale yellow with a long black horn. 2*nd instar*. Green with a long straight black horn. 3*rd instar*. A very faint pale dorso-lateral stripe; an ocellus on 5, blue in front, yellow behind; horn long, base reddish, tip pure white, rest black with black tubercles. 4*th instar*. Head green; body paler green with transverse rows of yellowish dots; a narrow dark green dorsal stripe from 2 to base of horn; dorso-lateral stripe from 2 to base of horn very pale bluish-green edged above with dark green; ocellus with pupil blue in front, green behind, edged broadly with yellow and narrowly with dark blue; horn long, straight, cylindrical, thick at base and tapering evenly to a point, its surface shining, basal half degraded reddish-brown becoming gradually darker, tip narrowly white.

5th instar. Very similar to that of *C. l. lineosa*, but much paler. Head dull and smooth. Body dull and smooth; ocellus shining as though enamelled; segment 5 swollen and both 4 and 5 somewhat dilated ventro-laterally; horn of medium length, slightly flattened laterally, tapering slightly to a blunt point, down-curved; surface shining and covered with bluntly pointed tubercles.

Coloration.—Head brown dotted with paler brown. Body: dorsal area coloured like the head, lateral area pinkish; a narrow black dorsal stripe on 2 to 5; a broader dorso-lateral stripe from 2 to base of horn, pale brown on anterior segments, nearly white on posterior segments, broken by the ocellus on 5 and edged above with dark brown; ocellus with pupil deep indigo-blue dotted with yellow in the posterior half, edged narrowly with yellow and still more narrowly with black; a round whitish subdorsal spot in the posterior half of 6 to 11; oblique stripes on 5 to 10 pale pink edged above with dark brown which shades into the body-colour, these stripes reaching the dorso-lateral stripe, that on 10 running across 11 and 12 to base of horn. Horn brown; legs reddish. Spiracles pink with a brown suffusion on each side of the slit. Length 85 mm.; breadth 11 mm.; horn 8 mm.

Pupa.—Tongue-sheath projecting considerably frontad, but not so much as in *C. lineosa*; antenna slightly longer than fore leg, which reaches to beyond middle of wing-case, mid-leg to three-quarters length of wing-case. Surface dull, head and thorax slightly shagreened; wing-case with lines of pointed tubercles along the veins. Cremaster nearly equilaterally triangular, tip squarely truncate; a long thin spine at each lateral angle of the truncation and a short spine mid-way between them, all straight and pointing directly backwards; from the base of each of the longer spines a spine of equal length, bifid at the tip, projects directly outwards; a dorso-lateral spine with three or four points near base; all the spines polished and shining; upperside of cremaster rugose, underside deeply hollowed. The pupæ obtained in the Khasi Hills were similar to the above except for the cremaster, in which the long terminal spines are curved inwards instead of being straight, and the dorso-lateral spine is replaced by a simple steel-blue pointed spine. The cremaster of the pupæ obtained by Mell in S. China agrees with that of those from the Khasi Hills. The difference may be individual or may point to the existence of two subspecies. Head, thorax and wing-case dark brown; a broad dorsal stripe paler brown; tubercles on wing-case black; abdomen with a dark brown dorsal stripe, and a broader degraded ochreous stripe on each side of it, lateral area dark grey with short whitish stripes; spiracles black, those on segments 6 to 12 lying on a larger black patch;

cremaster black. Length 56 mm.; breadth 12 mm.; tongue-sheath projecting 6 mm. in front of head.

Habits.—Food-plants: *Saurauja punduana* Wall., family Ternstrœmiaceæ; *Vitis* Linn., family Ampelideæ; *Amorphophallus* Bl., family Aroideæ.

Habits the same as those of *C. l. lineosa*.

183 *a*. **Cechenena lineosa scotti** Roths. (Pl. VII, figs. 4, 5, larva, fig. 6, pupa; Pl. XII, fig. 4, imago).

Cechenena scotti, Roths., 1920, p. 481 (Mussoorie); Seitz, 1929, p. 570.

Cechenena lineosa pundjabensis, Gehlen, 1931, p. 363, fig. 3 (Mt. Kufri, Simla).

Imago.—♂♀. Antenna above milky-white shading into pink basad; palpus orange-buff, third segment pale olive; head deep green, patagia bordered with silver-grey and with an obsolescent orange streak in the centre; centre of thorax pale pinkish-grey. Abdomen: basal two segments deep green, rest of abdomen slightly paler and more olive, mixed here and there with bronze; dorsum with two broad pinkish silver-grey lines, within which are two narrow hair-lines of the same colour and a broad median band dark green on basal one-third and bronze for rest of its length; anal tuft olive-green mixed with grey. Fore wing: ground-colour pinkish buff-grey, basal half below stigma rosy-pink; basal one-fifth of costa and basal three-fifths of wing above median vein dark green, within which is a black stigmatic dot. Below the green area from inner margin to costa before apex run two indistinct, partially obliterated, faint olive oblique lines; from inner margin beyond these to apex a heavy double oblique dark green band, and beyond this and between it and the termen several ill-defined waved dark green lines and cloudings; Hind wing: basal half irregularly black, rest of wing pale pinkish-buff suffused with black, which suffusion forms a broad outer terminal band, leaving tornal half of disc almost without suffusion. *Expanse*: ♂ 74–96 mm., ♀ 108 mm.

Hab. W Himalayas (Mussooree; Dharmsala; Simla). We have bred the subspecies in the first two localities mentioned, at an elevation of about 7,000 feet. The larvæ are common in some years, very rare in others.

The early stages closely resemble those of *C. l. lineosa*, but the larva and pupa are smaller. The description of the green form of the larva in the 5th instar in 'The Annals and Magazine of Natural History,' v, no. 30, 1920, p. 481, is incorrect, owing to an error on our part. There is a dark-coloured form only in the 5th instar.

Habits.—Food-plant: *Vitis* Linn., family Ampelideæ. Habits the same as others of the genus.

183 *b*. **Cechenena lineosa lineosa** (Walk.). (Fig. 123 L–O, genitalia ; fig. 124, imago ; Pl. VII, fig. 7, larva).

Chærocampa lineosa, Walker, 1856, p. 144 (Sylhet) ; Moore, 1857, p. 276 (Darjiling) ; id., 1865, p. 794 (Bengal) ; Butler, 1881 B, p. 9, pl. lxxix, fig. 7 ; Cotes & Swinhoe, 1887, p. 19 (Cherrapunji ; Sylhet ; Sikkim) ; Hampson, 1892, p. 93 (partim).
Theretra lineosa, Roths., 1894 A, p. 75 ; Dudgeon, 1898, p. 412 (Sikkim and Bhutan).
Cechenena lineosa, Roths. & Jord., 1903, p. 803, pl. x, fig. 3 (♂) ; Mell, 1922, p. 330, pl. xii, fig. 34, pl. xiv, fig. 34, pl. xix, figs. 34, 35 (pupa), pl. xxxii, fig. 13 (larva), fig. 14 (♂).
Cechenena lineosa lineosa, Seitz, 1929, p. 570, t. 68 *a*.
Chærocampa major, Butler, 1875, p. 249 (Darjiling ; Sylhet).

Imago.—♂♀. Head, thorax and abdomen green ; a whitish lateral stripe on head and thorax to costa of fore wing ; thorax with a pale mesial band ; abdomen with four pale



Fig. 124.—*Cechenena lineosa lineosa* (Walk.).

dorsal lines, the two outer lines broader and better marked than the two inner lines. Fore wing green, with *eight* lines in outer half, third line from distal margin short, more or less undulate, abbreviated in front, or here joining the preceding line ; the three proximal lines of the same distinctness, or the middle one indistinct, which is generally the case when the interspaces are very pale. Hind wing black with a pale submarginal band of varying width. *Underside* ochreous suffused with red and speckled with black ; some black in cell of fore wing and postmedian dark lines. Mid-tibial spurs as in *minor*. *Expanse* : ♂♀ 94–120 mm.

For details of genitalia see figs. 123 L, M, N, O.

Hab. E. Himalayas (Sikkim ; Bhutan ; Khasi Hills) to Malaya and S. China. We have bred the subspecies in the Khasi Hills, where it is fairly common at an elevation of about 5,000 feet, and Mell has bred it in S. China.

Egg.—Broadly ovoid, surface smooth and shining, colour pale ivory.

Larva :—

1*st instar*. Honey-yellow with a long, straight black horn. 2*nd instar*. Head yellow, body green, long and thin, segments 4 and 5 tumid, surface shining ; horn brown turning black towards the tip, which is white. 3*rd instar*. Head and body, except segment 5, green ; 5 very swollen, crimson, ocellus with a green pupil edged with first white, then black ; claspers and venter pale crimson ; horn purple. 4*th instar*. Head green ; body, except 5 and claspers, a curious shade of yellowish-green ; a narrow dorsal stripe from 2 to base of horn, a dorso-lateral stripe on 2 to 4 and oblique stripes on 6 to 10, all brick-red, the dorso-lateral sometimes continuing to base of horn as a series of dots ; segment 5 and claspers crimson, ocellus with pupil blue in front, reddish dotted with yellow behind, the whole edged with first white and then black ; surface of body and horn smooth and dull ; horn long, thick at base, tapering gently to a point, flattened laterally, yellow speckled closely with black.

5*th instar*. Head dull and smooth. Body dull and smooth except for the ocelli, which are shining as though enamelled ; segment 5 much swollen, and both 4 and 5 somewhat dilated ventro-laterally. Horn of medium length ; when seen in side-view first increasing in depth, then decreasing, distal third tapering very slightly to a blunt tip ; in dorsal view, laterally flattened, first increasing in breadth, then decreasing, then again increasing to form a slightly bulbous tip ; basal third rising at an angle of about 45° to the body, distal two-thirds then bent sharply downwards, or the horn down-curved throughout its length ; the dorsal and ventral surfaces covered with small rounded tubercles, and the sides longitudinally grooved.

Coloration.—Head brown with a darker stripe separating face from cheek. Body brown or reddish-brown above the dorso-lateral stripe, with numerous short dark stripes across the secondary rings ; reddish with darker spots below the dorso-lateral stripe ; a pink or reddish dorso-lateral stripe, edged above with dark brown, from 2 to base of horn, broken by the ocellus on 5 and waved dorsally on each segment ; a narrow pale subspiracular stripe on 2 to 4 ; ocellus on 5 obliquely oval, pupil dark brown dotted with minute white dots in front half and with large yellow dots in posterior half, the whole edged with bright blue in front, yellow behind, and then narrowly with dark brown ; a round whitish sub-dorsal spot in the posterior half of each of segments 6 to 11, and the spiracles on the same segments surrounded by an ochreous patch bounded in front by the dark brown oblique

stripes on 5 to 10. Horn dark brown. Spiracles dark brown edged with ochreous. Length 100 mm.; breadth 12 mm.; horn 8 mm.

Pupa.—Tongue-sheath much projecting frontad, in side-view shaped like a duck's bill seen from above; the frons rises sharply from the base of the tongue-case to a transverse ridge running from eye to eye. Surface of head, tongue-sheath, thorax and wing-case coarsely shagreened; edge of tongue-sheath, legs and veins set with pointed tubercles; abdomen finely shagreened. Cremaster triangular, tip truncate, a long straight spine directed backwards at each lateral angle of the truncation, and a straight, equally long spine directed outwards from its base; two dorso-lateral spines near the tip, the proximal one ending in two hooks; all the spines and hooks polished and shining. Head, thorax, tongue-sheath and wing-cases very dark brown, head and thorax with paler patches on dorsum, venter brownish-pink; the tubercles on tongue-case, legs and veins black; abdomen pale brownish-pink with short, dark brown lines forming dorsal, lateral and ventral stripes; bevels of free abdominal segments darker; spiracles and cremaster black. Length 70 mm.; breadth 12 mm.

Habits.—Food-plants: *Saurauja tristyla* DC., family Ternstrœmiaceæ; *Impatiens* Linn., family Geraniaceæ; *Vitis* Linn., family Ampelideæ; and *Polygonum chinensis* Linn., family Polygonaceæ. Habits similar to those of *Theretra* and *Rhagastis*. The moth visits flowers after dusk, and is attracted by light. The flight is very swift.

BIBLIOGRAPHY.

BOISDUVAL.

1836. *Spec. Gén. Lép.*, i.
1875. *Spec. Gén. Lép. Hét.*, i.

BREMER & GRAY.

1852. In Motsch., *Et. Ent.*, i.

BUCKLER.

1887. *Larvæ Brit. Butt. & Moths.*

BUGNION.

1839. *Ann. Soc. Ent. France*, viii.

BUTLER.

1875. *Proc. Zool. Soc. Lond.*
1876. *Proc. Zool. Soc. Lond.*
1877 A. *Trans. Zool. Soc. Lond.*, ix.
1877 B. *Proc. Zool. Soc. Lond.*
1878 A. *Ent. Mo. Mag.*, xiv.
1878 B. *Illustr. Typ. Spec. Lep. Het. B. M.*, ii.
1879. *Illustr. Typ. Spec. Lep. Het. B. M.*, iii.
1880. *Proc. Zool. Soc. Lond.*
1881 A. *Proc. Zool. Soc. Lond.*
1881 B. *Illustr. Typ. Spec. Lep. Het. B. M.*, v.
1881 C. *Trans. Zool. Soc. Lond.*, v.
1881 D. *Papilio*, i.
1882. *Ann. Mag. Nat. Hist.*, (5) x.
1883. *Proc. Zool. Soc. Lond.*
1885. *Cist. Ent.*, iii.
1886. *Proc. Zool. Soc. Lond.*
1889. *Illustr. Typ. Spec. Lep. Het. B. M.*, vii.

CLARK.

1924. *Proc. New Engl. Zool. Club*, ix.

COTES & SWINHOE.

1887. *Cat. Moths of India*, i.
1889. *Cat. Moths of India*, Appendix.

CRAMER.

1776. *Pap. Exot.*, i.
1777. *Pap. Exot.*, ii.
1779. *Pap. Exot.*, iii.
1780. *Pap. Exot.*, iii.

DRUCE.
1882. *Ent. Mo. Mag.*, xix

DRURY.
1773. *Illustr. Exot. Ins.*, ii.

DUDGEON.
1898. *Journ. Bomb. Nat. Hist. Soc.*, ix.

ESPER.
1779. *Schmett.*, ii.

FABRICIUS.
1775. *Syst. Ent.*
1793. *Ent. Syst.*, iii, 1.
1798. *Ent. Syst.*, Suppl.

FELDER.
1874. *Reise Novara Lep.*, ii.
1930. *Journ. Bomb. Nat. Hist. Soc.*, xxxiv.

FORSAYETH.
1884. *Trans. Ent. Soc. Lond.*

GEHLEN.
1930. *Ent. Zeitschr. Frank.*, xliv, nos. 9, 17.
1931. *Ent. Zeitschr. Frank.*, xliv, no. 24.

GOTT.
1877. *Ent. Mo. Mag.*, xiv.

GROTE & ROBINSON.
1865. *Proc. Ent. Soc. Philad.*, v.

GUÉRIN.
1843. In Delessert, *Voy. Ind. Or.*

HAMPSON.
1891. *Illustr. Typ. Spec. Lep. Het. B. M.*, viii
1892. *Fauna Brit. Ind., Moths*, i.
1893. *Illustr. Typ. Spec. Lep. Het. B. M.*, ix.
1896. *Fauna Brit. Ind., Moths*, iv.
1898. *Journ. Bomb. Nat. Hist. Soc.*, xi.
1900. *Journ. Bomb. Nat. Hist. Soc.*, xiii.
1903. *Journ. Bomb. Nat. Hist. Soc.*, xv.
1904. *Journ. Bomb. Nat. Hist. Soc.*, xvi.
1907. *Novitates Zoologicæ*, xiv.
1910. *Journ. Bomb. Nat. Hist. Soc.*, xx.
1911. *Journ. Bomb. Nat. Hist. Soc.*, xx.
1912. *Journ. Bomb. Nat. Hist. Soc.*, xxi

HEARSEY.
1864. *Proc. Ent. Soc. Lond.*, (3) 1.

HÜBNER.
1822. *Verz. bek. Schmett.*

HUWE.

1895. *Berl. Ent. Zeit.*, xl.

JOICEY & KAYE.

1917. *Ann. Mag. Nat. Hist.*, (8) xx.
1924. *Bulletin Hill Museum*, i, 3.

JORDAN.

1911. In Seitz's *Macrolep. Fauna Pal.*, ii, pp. 229–256.
1912. In Seitz's *Macrolep. Fauna Pal.*, ii, pp. 257–260.
1915. *Novitates Zoologicæ*, xxii.
1923. *Novitates Zoologicæ*, xxx.
1926. *Novitates Zoologicæ*, xxxiii.
1929. *Novitates Zoologicæ*, xxxv.
1930. *Novitates Zoologicæ*, xxxvi.

KIRBY.

1877. *Trans. Ent. Soc. Lond.*
1880. *Proc. Roy. Dublin Soc.*, (2) ii.
1892. *Cat. Lep. Het.*, i.

KOLLAR.

1848. In Hügel, *Kaschmir*, iv.

LASPEYRES.

1809. *Jen. Allg. Litt.-Zeit.*, iv.

LATREILLE.

1802. *Hist. Nat. Crust. Ins.*, iii.

LINNÆUS.

1758. *Syst. Nat.*, ed. x.
1767. *Syst. Nat.*, ed. xii.
1771. *Mant. Plant.*

MANSON.

1907. *Journ. Bomb. Nat. Hist. Soc.*, xvii.
1921. *Journ. Bomb. Nat. Hist. Soc.*, xxvii, iv (early stages and phenology).

MARTYN.

1797. *Psyche.*

MELL.

1922. *Biol. u. System. der Südchin. Sphing.*

MOORE.

1857. In Horsf. & Moore, *Cat. Lep. Ins. Mus. E. I. C.*, i.
1865. *Proc. Zool. Soc. Lond.*
1867. *Proc. Zool. Soc. Lond.*
1872. *Proc. Zool. Soc. Lond.*
1875. *Proc. Zool. Soc. Lond.*
1877. *Proc. Zool. Soc. Lond.*
1879 A. *Proc. Zool. Soc. Lond.*
1879 B. In *Rep. Sec. Yark. Miss.*
1882. *Lep. Ceylon*, ii.
1884. *Journ. As. Soc. Beng.*, iii, 2.
1886. *Journ. As. Soc. Beng.*, iv.
1887. *Lep. Ceylon*, iii.
1888. *Proc. Zool. Soc. Lond.*

DE NICÉVILLE.
1900. *Journ. Bomb. Nat. Hist. Soc.*, xiii.

NURSE.
1899. *Journ. Bomb. Nat. Hist. Soc.*, xii.

OBERTHÜR.
1886. *Et. d'Ent.* xi.
1904. *Bull. Soc. Ent. France.*

OCHSENHEIMER.
1816. *Schmett. Eur.*, iv.

OKEN.
1815. *Lehrb. Naturg.*, 3 (1).

PIEPERS.
1897. *Tijdschr. Ent.*, xl, p. 48, n. 120, p. 101, pl. iii, fig. 10.

ROTHSCHILD.
1894 A. *Novitates Zoologicæ*, i.
1894 B. *Iris*, vii.
1895. *Novitates Zoologicæ*, ii.
1896. *Novitates Zoologicæ*, iii.
1898. *Novitates Zoologicæ*, v.
1900. *Novitates Zoologicæ*, vii.
1920. *Ann. Mag. Nat. Hist.*, (9) v.

ROTHSCHILD & JORDAN.
1903. *Revision of Sphingidæ.*
1907. In Wytsman, *Gen. Ins.*, 57.
1915. *Novitates Zoologicæ*, xxii.
1916. *Novitates Zoologicæ*, xxiii.

ROTTENBURG.
1775. *Naturf.*, vii.

SCHWARZ.
1810. *Nomencl. Roes. & Kleem*, ii.

SCOPOLI.
1777. *Intr. Hist. Nat.*

SCOTT.
1931. *Journ. Bomb. Nat. Hist. Soc.*, xxxv, 2, pp. 362–381 pls. i–iii.

SEITZ.
1928. In Seitz's *Macrolep.*, x, pp. 523–544.
1929. In Seitz's *Macrolep.*, x, pp. 545–576.

STAUDINGER.
1887. In Rom. *Mém. Lép.*, iii.
1901. In Stgr. & Reb., *Cat. Lep.*, ed. iii.

STOLL.
1790. In Cramer, *Pap. Exot.*, Suppl.

SWAINSON.
1821. *Zool. Illustr.*

SWINHOE.

1884. *Proc. Zool. Soc. Lond.*
1885 A. *Proc. Zool. Soc. Lond.*
1885 B. *Trans. Ent. Soc. Lond.*
1886. *Proc. Zool. Soc. Lond.*
1888. *Journ. Bomb. Nat. Hist. Soc.*, iii.
1890. *Trans. Ent. Soc. Lond.*
1892. *Cat. Lep. Het. Oxf.*, i.
1894. *Trans. Ent. Soc. Lond.*
1897. *Ann. Mag. Nat. Hist.*, (6) xix.
1908. *Ann. Mag. Nat. Hist.*, (8) i.

WALKER.

1856. *List Lep. Ins. B. M.*, viii.
1864. *List Lep. Ins. B. M.*, xxxi.
1866. *List Lep. Ins. B. M.*, xxxv.

WALLENGREN.

1858. *Oefv. Vet. Ac. Förh.*, xv.

WARREN.

1888. *Proc. Zool. Soc. Lond.*

WATERHOUSE.

1881. *Aid Ident. Ins.*, i.
1883. *Aid Ident. Ins.*, ii.

WESTWOOD.

1848. *Cab. Or. Ent.*

APPENDIX A.

THE KANARA DISTRICT OF SOUTHERN INDIA: ITS TOPOGRAPHY AND FLORA IN RELATION TO THE DISTRIBUTION OF THE SPHINGIDÆ.

Topographical Distribution in Kanara.

	Above 1,000 ft.	Under 1,000 ft.	Forest country.	Open country.	Local.	Ubiquitous.	Rare.	Common.	Heavy rainfall.	Light rainfall.	Bred.
HERSE.											
convolvuli	+	+		+		+		+		+	+
ACHERONTIA.											
lachesis	+	+	+	+		+		+	+		+
styx	+	+		+		+		+		+	+
MEGANOTON.											
nyctiphanes		+	+		+		+		+		+
PSILOGRAMMA.											
menephron	+	+	+	+		+		+	+	+	+
DOLBINA.											
inexacta		+	+		+		+		+		+
COMPSOGENE.											
panopus	+	+	+	+	+		+		+		+
OXYAMBULYX.											
belli		+	+	.		+	.	+	+		+
subst. aglaia		+	+		+		+		+		+
matti		+	+		+		+		+		+
CLANIS.											
phalaris	+	+	+	+		+		+	+	+	+
bilineata	+	+	+	+		+	.	+	+	+	+
titan		+	+		+		+	.	+		+
LEUCOPHLEBIA.											
lineata	+			+		+		+		+	
emittens	+			+		+		+		+	+
POLYPTYCHUS.											
trilineatus		+	+		+		+		+		+
dentatus	+			+		+		+		+	+
MARUMBA.											
dyras	+	+	+			+		+	+		+
nympha		+	+		+		+		+		+
poliotis		+	+		+		+		+		+
indicus		+	+	+	+		+		+		+
AGNOSIA.											
orneus	.	+	+	?	+		+		+	?	
CEPHONODES.											
hylas	+	+	+	+		+		+	+	+	+
picus	+	+	+	+		+		+	+	+	+

Topographical Distribution in Kanara (cont.).

	Above 1,000 ft.	Under 1,000 ft.	Forest country.	Open country.	Local.	Ubiquitous.	Rare.	Common.	Heavy rainfall.	Light rainfall.	Bred.
SATASPES.											
infernalis	+	+	+		+		+		+		+
DEILEPHILA.											
nerii	+	+	+	+		+		+	+	+	+
hypothous	+		?	+	+		+		+		
minima		+	+	?	+		+		+	?	+
ACOSMERYX.											
anceus	+	+	+		+		+		+		+
socrates	+	+	+			+		+	+		+
PANACRA.											
busiris		+	+		+		+		+		+
ANGONYX.											
testacea	?	+	+			+		+	+		+
CIZARA.											
sculpta	+	+	+		+		+		+		+
NEPHELE.											
didyma	+	+	+	+		+		+	+		+
GURELCA.											
hyas	+			+	+		+			+	+
MACROGLOSSUM.											
regulus	+		+		+			+	+		+
gyrans	+			+		+				+	+
affictitia		+	+		+			+	+		+
particolor	+	+		+	+			+	+	+	+
belis	+	+	+			+		+	+		+
assimilis		+	+		+			+	+		+
insipida	+	+	+	+		+		+	+		+
vicinum	+		+		+		+		+		+
fringilla	+		+		+			+	+		+
corythus	+			+		+				+	+
CELERIO.											
lineata	+			+		+		+		+	
HIPPOTION.											
velox	+	+		+	+		+		+		+
celerio	+	+	+	+		+		+	+	+	+
echeclus	+	+		+	+		+		+	+	
rafflesi	+	+	+					+	+		+
boerhaviæ	+	+	+	+		+		+	+	+	+
THERETRA.											
nessus	+	+	+	+		+		+	+		+
clotho	+	+	+	+		+		+	+	+	+
gnoma	+	+		+	+		+		+	+	+
latreillei	+	+	+	+		+		+	+	+	+
alecto	+	+	+	+		+		+	+	+	+
lycetus	+	+	+		+			+	+		+
oldenlandiæ	+	+	+	+		+		+	+	+	+
pinastrina	+	+	+	?	+			+	+	?	+
pallicosta	+	+	+		+			+	+		+
castanea	+	+	+		+			+	+		+
RHYNCHOLABA.											
acteus	+	+	+	+		+		+	+	+	+

The geographical distribution of the Hawk-Moths has, as already mentioned, been fully dealt with by previous writers. The *topographical* distribution, on the other hand, has been neglected by many authors. Rudolph Mell was the first to specify, so far as he was able, the kind of country, altitude, climate, &c., which each species is found to frequent.

The reason for this neglect in the past was due to the fragmentary knowledge of the Hawk-Moth fauna of any particular district and to ignorance of the early stages and their food-plants. No area in the Old World, outside Europe, had been worked intensively enough to provide the necessary data. Mell has now worked South China more or less thoroughly, and we have studied the Kanara District of the Bombay Presidency for an even longer period. We have caught or bred every sphingid species known to occur in the district with the exception of *Agnosia orneus* and *Leucophlebia lineata*. We propose, therefore, to give a description of the general features of the Kanara District and the characters that distinguish it topographically and botanically. This should be studied in connection with the distribution list given above, showing the preferences of the different species in the matter of elevation, climate, &c., and whether they are local, rare or otherwise. In nearly every case we have reliable information regarding the caterpillar, and the imagines must of course occur in the same places. Their distribution is, most probably, chiefly controlled by the food-plants of the caterpillars. It is so controlled, certainly, within small areas where the differences of elevation do not exceed two or three thousand feet, though in areas with greater differences elevation is bound to be a more dominant factor.

The Kanara District is 3,600 square miles in extent, and is situated between 13° 45′ and 15° 0′ north latitude and 74° 10′ and 75° 10′ east longitude. It is irregularly triangular in shape, coming to a point in the south, and has a sea-coast on the west, for some 80 miles, on the Indian Ocean. There is a strip of more or less flat coast-land, and then the scarp of the Western Ghats rises sharply to an average height of 1,500 feet above sea-level. The ground then rises gradually to the east to an elevation of 2,600 feet through very hilly country covered with forest and small areas of terraced rice-fields, two hills in the north reaching an elevation of over 3,000 feet. The largest river in the district, the Kalinadi, rises in Goa territory and flows into the sea at Karwar, the headquarters of the district, after a course of about 100 miles. Three other rivers have perennial water, on one of which, the Shiravati, are the Gersoppa Falls, with a sheer drop of 834 feet, the finest falls in India. Between the river-valleys the country is hilly, spurs from the crest of the Ghats

running westwards towards the coast, and in some places reaching the sea.

The average rainfall on the coast varies from about 200 inches in the south to 120 inches at Karwar. On the crest of the Ghats it may reach 360 inches, and has, in extremely wet years, been known to approach 500 inches, and it then diminishes rapidly eastwards. Even ten miles may show a decline to 50 inches in a year, and in the extreme east it may fall to 20 or 30 inches. The months of monsoon, or heavy rain, are from June to October.

Thunderstorms come in April and May, and small falls may occur in any month during what is called the "fair season." The average temperature on the coast is about 78° Fahrenheit, the highest rarely exceeds 90° and the lowest is in the vicinity of 60°, though it occasionally sinks to 55°. Above the Ghats on the eastern confines the average would be about 70°, the maximum rarely reaching over 100°, the minimum in the cold weather (December–January) being about 50° at nights. We once, during a residence of forty years, experienced as low a temperature as 46° in the jungles on the Ghats, but this is very rare; further inland, in the open country, it has been known to go down to 40° with hoar-frost.

The main rocks in the District are granite and laterite, the latter covering the flat parts and tops of plateaux. Granite appears along the hill-tops in large masses, sometimes taking the form of great piled boulders, and occurs as outcrops and isolated blocks upon many hill-sides. Large granite boulders also occur along the sea-shore on the tops and round the bases of the spurs, but the flat parts here are also formed of laterite, which may end in low cliffs round coves and inlets. The beds of the rivers are of basalt, black and polished often by the action of the water until its surface resembles glass for smoothness. On the slopes of the river-valleys there are occasionally found great dyke-like masses of sandstone and talc-schists, flint and other rocks. In only one place do we find limestone; it forms a peculiarly weathered mass of turrets and spires, resembling a giant cathedral, in the middle of the jungles, quite isolated from any related formation.

More than 75 per cent. of the District is forest, and the chief timber-tree is teak (*Tectona grandis* Linn.). The cultivated fields are under rice, and hardly any other grain is grown. In favoured spots there is some sugar-cane. The areca-nut palm (betel-nut) is extensively grown in the damp valleys of the evergreen forests, chiefly in the south, and these plantations (called "garden-lands") are one of the main characteristics of the country. Spices are cultivated under the shade of the palms, the commonest being Cardamum.

Another grain, an inferior species of millet called ragi (*Eleusine coracana* Gaertn.), is grown on many hill-sides by a more or less nomad population, by which it is consumed in preference to any other.

This crop is grown by the shifting system of cultivation known locally as *kumri*. A patch of forest is cut down, the trees burnt, and the grain sown broadcast amongst the ashes just before the monsoon rains are due. The following year another patch is treated in a similar manner, with the result that the hill-tops along the Western Ghats are now bare and clearings in the forest are dotted about all over the hills. The areas cleared and burnt are never allowed to recover, as they are burnt annually to make grazing-grounds for the village cattle. When they are situated on steep hill-sides the wash of the torrential monsoon rains gradually disintegrates the soil, carrying it into the valleys and down the streams, leaving bare rock and stony ground incapable of growing anything at all. In clearings situated on less steep ground all that now remain are stunted trees of inferior species unfit for timber, many of them badly charred and most of them hacked about by cattle-boys, and growths such as dwarf palms, large ferns and inferior species of grasses. Some of the clearings are covered by species of gregarious *Strobilanthes*, acanthaceous shrubby plants, the larger species of which form impenetrable thickets amongst which grow stunted trees of *Terminalia chebula* and *Terminalia tomentosa* (Combretaceæ), *Olea dioica* (Oleaceæ) and euphorbiaceous *Glochidion*, shrubs of *Wendlandia* and small trees of *Randia* (Rubiaceæ) and others. In addition to all this damage the garden holders in the damp valleys lop the forest trees for green manure for their palms and spices, and have gradually also cleared large areas of timber-growth to provide grazing for their cattle. These grazing-grounds are also burnt annually in the hot weather to give early grass, and have, by degrees, become useless even for that purpose. And so the damage goes on.

On the coast all who can do so grow cocoanut-palms in their village compounds; a few have larger plantations of them, so that there is a more or less continuous belt of these palms from north to south. There are some strips of mangrove-swamps along many of the creeks too, but none are of any large extent, and the species of trees that grow in them are chiefly Rhizophoraceæ. The few salt marsh-lands that exist near the mouths of the rivers are characterized by such species as *Acanthus ilicifolius* Linn., a bush with large, mauve, lipped flowers and holly-like, prickly leaves, and the verbenaceous *Avicennia officinalis* Linn. There are narrow belts of sand along the sea upon which we get *Clerodendron inerme*

Gaertn., *Premna integrifolia* Linn., *Vitex negundo* Linn. (Verbenaceæ), *Anacardium occidentale* Linn., the cashew-nut tree (Anacardiaceæ), *Calophyllum inophyllum* Linn., locally known as Undi (Guttiferæ), and the convolvulaceous goat's-foot creeper *Ipomæa biloba* Forsk. ; *Cassytha filiformis* Linn., of the Laurineæ, is also common, a leafless, yellowish, thin-stemmed parasite infesting *Premna* and *Ipomæa*, &c.

The vegetation in Kanara is mainly of the Malayan type. Below the Ghats on the coast, on the Ghats themselves, and for some distance eastward it is altogether so. On the eastern boundaries it is of the Deccan type, passing gradually into the Malayan westwards. The Malayan type is largely evergreen and semi-evergreen, the trees being often very large both in height and circumference. The Deccan vegetation is composed of deciduous species, and the trees are much smaller. The main characteristics of the Malayan forest area are a heavy rainfall and laterite soil with a strong admixture of granite.

The evergreen forest is generally found above 1,000 feet elevation, all below that is semi-evergreen or deciduous. The evergreen type is more extensive in the southern half of the district than in the northern ; in the lower foot-hills along the coast the forest is deciduous, though there may be a slight mixture of evergreen species along the streams and in the moister valleys. The crest of the Ghats is all evergreen, and this type of vegetation reaches well to the east as long as the hills, valleys and streams continue. The evergreen forests are characterized by very large trees, many reaching 200 feet in height, dense undergrowth, canes, ferns and various species of palms. Among the timber-trees we get *Dipterocarpus turbinatus* Gaertn., several species of *Calophyllum* (Guttiferæ), *Cedrela toona* Roxb., the toon, of the Meliaceæ ; many members of the families Myrtaceæ, Ebenaceæ (ebony) and Laurineæ (laurels) ; various figs and jackfruit-trees (Urticaceæ) ; these are the most conspicuous. The underwood is largely composed of *Murraya* Linn., *Glycosmis* Corr. (Rutaceæ) ; cinnamon, *Litsæa* Lamk., *Actinodaphne* Nees (Laurineæ), and gregarious *Psychotria* Linn. of various species ; *Chasalia curviflora* Thw. and many species of *Ixora* (Rubiaceæ). Herbaceous and semi-herbaceous species are represented by various Acanthaceæ, climbing peppers, orchids, arums, Zinziberaceæ and ferns.

In the Malayan type of deciduous forests there are very large trees of the families Meliaceæ (*Amoora* Roxb., *Chikrassia tabularis* (Adr. Jussieu) ; Sapindaceæ (*Schleichera* Willd. and *Sapindis* Linn.) ; Anacardiaceæ (the wild mango and *Spondias* Linn., the hog-plum, *Holigarna* Ham., &c.) ; Leguminosæ (*Dalbergia* Linn., *Bauhinia* Linn., *Xylia* Benth., *Albizzia* Durazz) ; Datiscaceæ (*Tetrameles nudiflora* R. Br.) ;

Rubiaceæ; Combretaceæ; Lythraceæ; Sapotaceæ; Apocynaceæ; Bignoniaceæ and Verbenaceæ (teak, the most valuable timber tree of all). The lower story is made up of Bixineæ (*Hydnocarpus* Gaertn., from the fruits of which is extracted Chalmogra oil, a supposed cure for leprosy); *Flacourtia* (Comm.) L'Hérit.; many Malvaceæ, Sterculiaceæ, Tiliaceæ and Meliaceæ (*Heynea* Roxb.; *Walsura* Roxb.; *Lansium* Rumph.); Olacineæ; Celastraceæ; Rhamnaceæ; Leguminosæ; a number of Rubiaceæ; Oleaceæ; Verbenaceæ; the thorny, apocynaceous *Carissa* Linn. and numerous bamboos. Herbaceous growth is chiefly acanthaceous, and there are numerous vines, *Leea* Linn. (Ampelideæ) that are practically herbs; many arums and Scitamineæ (*Curcuma*, *Zinziber*); *Vernonia* Schreb. of many species; *Blumea* DC., also of many kinds; *Elephantopus* Linn.; *Ageratum* Linn.; *Emilia* Cass. and various *Senecio* Linn. (Compositæ); a large number of Asclepiadaceæ, twining "shrubs," very thin and nearly herbaceous. There are many stout, woody Convolvulaceæ of the genera *Ipomæa* Linn., *Argyreia* Lour., and a large climber, *Erycibe paniculata* Roxb., is very common. There are many *Solanum* Linn. (Solanaceæ). Various species of *Strobilanthes* Blume form extensive thickets of close, stiff undergrowth, often reaching 20 feet high. There are balsams (Geraniaceæ), a number of small Euphorbiaceæ and, of course, many kinds of sedges and grasses.

The Deccan type of vegetation is characterized by the following deciduous trees, very few of which reach 60 feet in height:—Many Capparideæ (capers); *Flacourtia ramoutchi* L'Hérit. (Bixineæ); *Balanites roxburghii* Delile (Simarubeæ); *Boswellia serrata* Roxb. and *Garuga pinnata* Roxb. (Burseraceæ); *Melia azadirachta* Linn., *Soymida febrifuga* Adr. Juss. and *Chloroxylon swietenia* DC., the satinwood (Meliaceæ); *Gymnosporia montana* Roxb. (Celastraceæ); *Buchanania latifolia* Roxb. and *Semecarpus anacardium* Linn., the marking-nut tree (Anacardiaceæ); *Erythrina suberosa* Roxb., the Indian coral tree; *Butea frondosa* Roxb., known as the "Flame of the Forest"; *Dalbergia paniculata* Roxb., often with wood and bark in alternate layers; *Pongamia glabra* Vent., the Indian beech, along nallas and streams; *Hardwickia binata* Roxb., rather a local species; *Bauhinia racemosa* Lamk., the rounded, two-divided leaves of which are used for the manufacture of native "bidis" or cigarettes; many *Acaciæ*: *arabica* Willd., *leucophlœa* Willd., *suma* Kurz, *sundra* DC., *latronum* Willd., etc.; *Albizzia amara* Boiv (all Leguminosæ). *Lagerstrœmia parviflora* Roxb. (Lythraceæ); *Casearia tomentosa* Roxb. (Samydaceæ); *Alangium lamarckii* Thw. (Cornaceæ); some Rubiaceæ, such as *Gardenia* Linn. of several species and *Morinda tinctoria* Roxb.; *Bassia latifolia* Roxb., the Mohwa from which liquor is brewed, and *Mimusops hexandra*

Roxb. (Sapotaceæ); *Diospyros montana* Roxb. (Ebenaceæ); *Schrebera swietenioides* Roxb. (Oleaceæ); *Wrightia tinctoria* Br. (Apocynaceæ); *Cordia obliqua* Willd., *wallichii* G. Don and *rothii* Roem. & Schul. and *Ehretia* Linn. (Boraginaceæ); *Heterophragma roxburghii* DC. and *Stereospermum suaveolens* DC. (Bignoniaceæ); *Gmelina arborea* Linn. (Verbenaceæ) and *Santalum album* Linn., the sandalwood (Santalaceæ); there are several Euphorbiaceæ, as *Phyllanthus emblica* Linn. and *Macaranga roxburghii* Wight, that occur occasionally, and *Streblus asper* Lour., as well as many species of *Ficus* Linn. or figs (Urticaceæ). There are practically no wild palms, though the cultivated date-palm is common, and there is hardly any bamboo. The capers are all really more shrubs than trees, and a good many are climbers or of scandent habit. Other shrubs are: many *Hibiscus* Medik. and *Urena* (Malvaceæ); many *Grewia* Linn. (Tiliaceæ), and three or four species of thorny *Zizyphus* Juss. (Rhamnaceæ); several vines (Ampelideæ); *Rhus mysorensis* Heyne (Anacardiaceæ); numerous *Crotolaria* Linn.; various thorny climbing *Cæsalpinia* Linn.; *Dichrostachys cinerea* W & A. (Leguminosæ) with *Combretum ovalifolium* Linn. (Combretaceæ); *Salvadora persica* Linn., the mustard tree of Scripture, and *Azima tetracantha* Lamk. (Salvadoraceæ); *Strychnos potatorum* Linn., the fruit of which is used for clearing water (Loganiaceæ); *Rivea* Chois. and *Lettsomia* Roxb. (Convolvulaceæ); the verbenaceous pest *Lantana* Linn., everywhere a scourge; *Fluggea* Willd., *Jatropha* Linn., a wild castor-oil plant (Euphorbiaceæ). The commonest herbaceous plants are *Cocculus villosus* DC. (Menispermaceæ); the genus *Cleome* Linn., belonging to the capers; *Portulaca oleracea* Linn., a small, fleshy-leaved and decumbent plant used as a spinach (Portulacaceæ); the malvaceous *Abutilon* Tournef., having several species; *Urena* Linn.; several *Hibiscus* Linn.; *Corchorus* Linn. (Tilicaceæ); many leguminous *Indigofera* Linn., *Tephrosia* Pers., *Astragalus* Linn., *Alysicarpus* Neck., *Abrus precatorius* Linn., of which the Praying Bean is used by goldsmiths as a weight; *Phaseolus* Linn.; *Atylosia* W & A.; *Rhynchosia* Lour.; *Cassia pumila* Lamk., *kleinii* W & A. and *mimosoides* Linn.; various Cucurbitaceæ and Umbelliferæ; *Heydotis* Linn., *Oldenlandia* Linn., *Anotis* DC. of various species and *Spermacoce hispida* (Rubiaceæ); many species of Compositæ; *Heliotropum* Linn. of various species (Boraginaceæ); some Convolvulaceæ; various species of *Striga* Lour. (Scrophulariaceæ); *Barleria cuspidata* Heyne, *Neuracanthus sphærostachys* Dalz., several *Justicia* Linn. and the ubiquitous *Peristrophe* Nees (Acanthaceæ). We also always find various Labiatæ (*Ocimum* Linn., *Leucas* R. Br. and *Salvia* Linn.); the genus *Boerhavia* Linn., of the Nyctaginaceæ, is always represented, as well as the amaranthaceous *Ærua* Forsk. There

are some small species of *Euphorbia* Linn. and *Phyllanthus* Linn. (Euphorbiaceæ); some epiphytic as well as terrestrial species of orchids; a *Dioscorea* Linn. or two; some Liliaceæ (*Gloriosa* Linn., *Scilla* Linn., *Dipcadi* Medik. and *Chlorophytum* Ker.); some *Commelina* Linn., *Aneilema* R. Br. and *Cyanotis* Don (Commelinaceæ); a few arums and many grasses.

APPENDIX B.

FOOD-PLANTS OF THE INDIAN HAWK-MOTHS.

The food-plants of 135 forms of the SPHINGIDÆ listed in this volume are known, but out of these 23 are not yet recorded from the Indian area, being known only from China or England.

The initial letters entered against each species of food-plant denote the authority for the record. These are :

(B.) T. R. Bell.
(M.) Mell, 1922, all records from China.
(S.) F B. Scott.
(P.) Agricultural Research Institute, Pusa.
(R.) Rothschild and Jordan, 1903.
(FM.) Fellowes Manson.

In cases where the food-plant is not recorded from the Indian area the country from which it is known is added in parenthesis, *e. g.* (In China).

I. List of Species of Sphingidæ, with Food-plants.

(These are arranged in the order followed in this volume).

Acherontia lachesis (Fabr.).

LEGUMINOSÆ. *Erythrina* spp. (S., M.)
OLEACEÆ. *Jasminum* spp.; *Nyctanthes abor-tristis* Linn. (B., S.)
CONVOLVULACEÆ. *Ipomæa* spp. (S.)
SOLANACEÆ. *Solanum* spp.; *Nicotiana tabacum* Linn.; *Datura* Linn. (R., S.)
BIGNONIACEÆ. *Tecoma grandiflora* Loisel.; *Stereospermum* Cham.; *Spathodea campanulata* Beauv. (B., S., P.)
VERBENACEÆ. *Lantana camara* Linn.; *Stachytarpheta indica* Vahl.; *Tectona grandis* Linn.; *Vitex negundo* Linn.; *Clerodendron* spp.; *Callicarpa arborea* Roxb. (B., S.)
LABIATÆ. *Coleus* Lour.; *Colebrookia oppositifolia* Sm.; *Anisomeles ovata* Br. (S.)
EUPHORBIACEÆ. *Antidesma* Linn. (R.)

Acherontia styx styx (Westw.).

LEGUMINOSÆ. *Dolichos lablab* Linn. (P.)
MYRTACEÆ. *Eugenia jambolana* Lamk. (S.)
CUCURBITACEÆ. *Coccinia* W & Arn. (R.)
OLEACEÆ. *Jasminum* spp. ; *Nyctanthes* Linn. (S., P.)
SOLANACEÆ. *Solanum* spp. ; *Datura* Linn. (P., S., R.)
BIGNONIACEÆ. *Bignonia megapotamica* Spreng. ; *Tecoma stans* Fuss. (S.)
PEDALINEÆ. *Sesamum indicum* DC. (P., S.)
VERBENACEÆ. *Vitex negundo* Linn. ; *Clerodendron* spp. ; *Citharexylum subserratum* Sw. (S., P.)
LABIATÆ. *Coleus* Lour. (S.)

Herse convolvuli convolvuli (Linn.).

LEGUMINOSÆ. *Phaseolus* spp. ; *Dolichus lablab* Linn. ; *Arachis hypogæa* Linn. (P.)
COMPOSITÆ. *Helianthus* spp. (M., S., P.)
CONVOLVULACEÆ. *Ipomæa* spp. ; *Convolvulus* spp. (B., M., R., S.)

Meganoton analis (Feld.).

LAURACEÆ. *Sassafras tzumu* Hemsl. (In China).

Meganoton nyctiphanes (Walk.).

VERBENACEÆ. *Symphorema involucratum* Roxb. (B.)

Meganoton rufescens rufescens (Butl.).

Food-plant not known, but the subspecies occurring in China feeds on *Melodorum oldhami* Hemsl., family ANONACEÆ.

Psilogramma menephron menephron (Cramer).

SABIACEÆ. *Meliosma fordii* Hemsl. (In China).
OLEACEÆ. *Jasminum* Linn. ; *Ligustrum robustum* Bl. ; *Nyctanthes abor-tristis* Linn. ; *Olea dioica* Roxb. (B., S., R.)
BIGNONIACEÆ. *Spathodea campanulata* Beauv. (S.)
VERBENACEÆ. *Tectona grandis* Linn. ; *Clerodendron tunatum* Linn. ; *Vitex negundo* Linn. ; *Callicarpa inforarborea* Roxb. (B., S., P.)

Apocalypsis velox Butl.

VERBENACEÆ. *Callicarpa arborea* Roxb. (S.)

Pseudodolbina fo fo (Walk.).

ACANTHACEÆ. *Strobilanthes* Blume. (S.)

Pseudodolbina fo celator Jordan.

ACANTHACEÆ. *Strobilanthes dalhousianus* C. B. Clarke ; *Strobilanthes alatus* Nees. (S.)

Dolbina inexacta (Walk.).

OLEACEÆ. *Linociera malabarica* Wall. ; *Olea dioica* Roxb. ; *Ligustrum robustum* Bl. (B., S.)

Compsogene panopus panopus (Cramer).

GUTTIFERÆ. *Calophyllum inophyllum* Linn. (B., M.) ; *Garcinia* Linn. (In China).

ANACARDIACEÆ. *Mangifera indica* Linn. (B., M.) : *Rhus vernicifera* DC. ; *Dracantometum mangiferum* Bl. (In China).

Oxyambulyx sericeipennis sericeipennis (Butl.).

JUGLANDACEÆ. *Juglans regia* Linn. (S.)

Oxyambulyx sericeipennis agana Jordan.

TILIACEÆ. *Elæocarpus chinensis* Hk. f. ex B. (In China).
ANACARDIACEÆ. *Rhus insignis* Hk. f. (S.)
JUGLANDACEÆ. *Juglans regia* Linn. ; *Engelhardtia spicata* Bl. (S.)
MYRICACEÆ. *Myrica nagi* Thunb. (S., M.)
BETULACEÆ. *Betula alnoides* Ham. (S.)
FAGACEÆ. *Quercus* Linn. (In China).

Oxyambulyx belli Jordan.

LEGUMINOSÆ. *Xylia xylocarpa* Taub. (B.)

Oxyambulyx ochracea (Butl.).

ANACARDIACEÆ. *Poupartia fordii* Hemsl. = *Spondias axillaris* Roxb. (In China).

Oxyambulyx liturata liturata (Butl.).

BURSERACEÆ. *Canarium album* Raeush. (In China).
ANACARDIACEÆ. *Poupartia fordii* Hemsl. = *Spondias axillaris* Roxb. (In China).
FAGACEÆ. *Quercus* Linn. ; *Castanopsis* Spach. (In China).

Oxyambulyx substrigilis aglaia Jordan.

MELIACEÆ. *Aglaia littoralis* Talbot. (B.)

Oxyambulyx substrigilis substrigilis (Westw.).

DIPTEROCARPACEÆ. *Dipterocarpus tuberculatus* Roxb. (R.)

Oxyambulyx matti Jordan.

COMBRETACEÆ. *Terminalia tomentosa* Bedd. (B.)

Oxyambulyx subocellata (Feld.).

BURSERACEÆ. *Canarium album* Raeush. (In China).
ANACARDIACEÆ. *Odina wodier* Roxb. (B.)

Clanis phalaris (Cramer).

LEGUMINOSÆ. *Pongamia glabra* Vent.; *Xylia xylocarpa* Taub.; *Cassia stula* Linn. (B., S.); *Macuna pruriens* DC. (In China); *Millettia atropurpurea* Benth. (FM.).

Clanis undulosa undulosa (Moore).

LEGUMINOSÆ. *Lespedeza* spp. (S., M.)

Clanis deucalion (Walk.).

LEGUMINOSÆ. *Robinia pseud-acacia* Linn. (S.)

Clanis bilineata bilineata (Walk.).

LEGUMINOSÆ. *Pterocarpus marsupium* Roxb.; *Pongamia glabra* Vent. (B., S.); *Millettia atropurpurea* Benth.; *Mucuna* Adans.; *Pueraria* DC. (In China).

Clanis titan titan Roths. & Jord.

LEGUMINOSÆ. *Pterocarpus marsupium* Roxb.; *Derris platyptera* Baker; *Millettia atropurpurea* Benth. (In China); *Dalbergia latifolia* Roxb. (B.).

Leucophlebia lineata Westw.

GRAMINEÆ. *Saccharum* Linn. (B., P.)

Leucophlebia emittens Walk.

GRAMINEÆ. *Bambusa* Linn. (FM.) and other Gramineæ (B., S.)

Polyptychus trilineatus sonanthis Jordan.

BORAGINACEÆ. *Cordia obliqua* Willd.; *Ehretia lævis* Roxb. (B.)

Polyptychus trilineatus trilineatus Moore.

BORAGINACEÆ. *Ehretia lævis* Roxb. (S.)

Polyptychus trilineatus undatus Roths. & Jord.

BORAGINACEÆ. *Cordia obliqua* Willd. (S.)

Polyptychus dentatus (Cramer).

BORAGINACEÆ. *Cordia* spp.; *Ehretia* spp. (B., S.)

Marumba gaschkewitschi fortis Jordan.

ROSACEÆ. *Prunus* Linn.; *Pyrus* Linn.; *Cratægus* Linn.; *Eriobotrya japonica* Lindl. (In China).

Marumba cristata cristata (Butl.).

LAURACEÆ. *Litsæa elongata* Hook.; *Machilus ichangensis* Rehd. & Wils.; *Phœbe* Nees. (In China).

Marumba spectabilis spectabilis (Butl.).

SABIACEÆ. *Meliosma pungens* Wall. (In China).

Marumba dyras dyras (Walk.).

MALVACEÆ. *Bombax malabaricum* DC.; *Kydia calycina* Roxb. (B., S.)

STERCULIACEÆ. *Sterculia* spp. (S., M.); *Helicteres isora* Linn.; *Pterospermum* Schreb.; *Buettneria* Linn. (In China).

TILIACEÆ. *Grewia* spp. (B., S.)

SAPINDACEÆ. *Schleichera trijuga* Willd. (B.)

EUPHORBIACEÆ. *Bridelia* spp. (S.)

Marumba nympha Roths. & Jord.

LAURACEÆ. *Alseodaphne semicarpifolia* Nees. (B.)

Marumba sperchius gigas (Butl.).

JUGLANDACEÆ. *Juglans regia* Linn. (In China).

FAGACEÆ. *Quercus* spp. (M., S.)

Marumba indicus (Walk.).

MALVACEÆ. *Bombax malabaricum* DC. (B.)

STERCULIACEÆ. *Sterculia urens* Roxb.; *Helicteres isora* Linn. (B.)

TILIACEÆ. *Grewia tiliæfolia* Vahl. (B.)

Daphnusa ocellaris ocellaris Walk.

SAPINDACEÆ. (In China).

Langia zenzeroides zenzeroides Moore.

ROSACEÆ. *Pyrus* spp.; *Prunus* spp. (S.)

Rhodoprasina floralis (Butl.).

SAPINDACEÆ. *Acer campbellii* Hook. f. & T. (FM.)

Rhodoprasina callantha Jordan.

FAGACEÆ. *Quercus fenestrata* Roxb. (S.)

Clanidopsis exusta (Butl.).

LEGUMINOSÆ. *Indigofera* Linn. (S.)

SALICACEÆ. *Populus* Linn. (R.)

Agnosia orneus (Westw.).

TILIACEÆ. *Grewia asiatica* Linn. (S.)

Parum colligata (Walk.).

MORACEÆ. *Broussonetia papyrifera* Vent. (S.)
URTICACEÆ. (In China).

Cypa pallens enodis Jord.

BETULACEÆ. *Betula alnoides* Ham. (S.)
FAGACEÆ. *Quercus fenestrata* Roxb. (S.)

Smerinthulus perversa (Roths.).

FAGACEÆ. *Castanopsis* Spach. (S.)

Degmaptera mirabilis (Roths.).

FAGACEÆ. *Quercus fenestrata* Roxb. (S.)

Smerinthus kindermanni obsoleta Staud.

SALICACEÆ. *Salix* Linn. (In China).

Phyllosphingia dissimilis Bremer.

JUGLANDACEÆ. *Juglans* Linn. (R.)

Hæmorrhagia fuciformis fuciformis (Linn.).

CAPRIFOLIACEÆ. *Lonicera* Linn. (In England). (R.)
RUBIACEÆ. *Galium* spp. (R.); *Rubia cordifolia* Linn. (In England).

Hæmorrhagia saundersi (Walk.).

CAPRIFOLIACEÆ. *Lonicera quinquelocularis* Hardw. (S.)

Cephonodes hylas hylas (Linn.).

RUBIACEÆ. *Wendlandia* spp.; *Randia dumetorum* Lamk.; *Gardenia* Linn.; *Ixora brachiata* Roxb.; *Pavetta indica* Linn.; *Coffea bengalensis* Roxb.; *Adina cordifolia* B. & Hook. f.; *Hymenodictyon excelsum* Wall. (B., S.)

Cephonodes picus (Cramer).

RUBIACEÆ. *Adina cordifolia* B. & Hook. f.; *Randia dumetorum* Lamk.; *Pavetta indica* Linn.; *Gardenia* Linn. (B., S.)

Sataspes infernalis (Westw.).

LEGUMINOSÆ. *Dalbergia volubilis* Roxb. (B.); *Lespedeza* Mich.; *Albizzia lebbek* Benth. (In China).

Sataspes tagalica Boisd.

LEGUMINOSÆ. *Dalbergia* Linn. (In China).

Sataspes scotti Jordan.

LEGUMINOSÆ. *Dalbergia sissoo* Roxb. (S.)

Deilephila nerii nerii (Linn.).

APOCYNACEÆ. *Vinca* spp.; *Holarrhena antidysenterica* Wall.; *Ervatamia heyneana* Wall.; *Nerium odorum* Soland.; *Tabernæmontana* spp. (B., S., P.)

Deilephila hypothous hypothous (Cramer).

RUBIACEÆ. *Uncaria* Schreb. (M., S.); *Wendlandia paniculata* DC. (In China); *Cinchona* Linn. (R.).

Deilephila placida placida (Walk.).

APOCYNACEÆ. *Tabernæmontana* Linn. (R.)

Deilephila minima minima (Butl.).

CORNACEÆ. *Alangium lamarckii* Thw. (B.)

Dahira rubiginosa Moore.

ILICINEÆ. *Ilex rotunda* Thunb. (In Japan).

Ampelophaga rubiginosa fasciosa Moore.

AMPELIDEÆ. *Vitis* spp. (S.)

Ampelophaga rubiginosa harterti Roths.

TERNSTRŒMIACEÆ. *Saurauja* spp. (S.)
AMPELIDEÆ. *Vitis* spp. (S.)

Ampelophaga khasiana khasiana Roths.

TERNSTRŒMIACEÆ. *Saurauja nepalensis* DC. (S.)
AMPELIDEÆ. *Vitis* spp. (S.)

Acosmerycoides leucocraspis leucocraspis (Hampson).

AMPELIDEÆ. *Vitis cantoniensis* Seem. (In China).

Acosmeryx naga (Moore).

TERNSTRŒMIACEÆ. *Saurauja* spp. (S.)
AMPELIDEÆ. *Vitis* spp. (S.)

Acosmeryx anceus subdentata Roths. & Jord.

AMPELIDEÆ. *Leea* Linn.; *Vitis* spp. (B.)

Acosmeryx socrates Boisd.

DILLENIACEÆ. *Dillenia pentagyna* Roxb. (B.)
AMPELIDEÆ. *Leea* Linn.; *Vitis* spp. (B.)

Acosmeryx sericeus sericeus (Walk.).

TERNSTRŒMIACEÆ. *Actinidia fulvicoma* Hance. (In China).

AMPELIDEÆ. *Vitis cantoniensis* Seem. (In China).

Panacra busiris atima Roths. & Jord.

AROIDEÆ. *Pothos scandens* Linn. (B.)

Panacra metallica anfracta Gehl.

AROIDEÆ. *Arisæma curvatum* Kunth. (S.)

Panacra mydon mydon Walk.

AROIDEÆ. *Arisæma consanguineum* Schott; *Amorphophallus* spp.; *Colocasia* spp. and other AROIDEÆ. (S.); *Pothos* Linn. (In China).

AMPELIDEÆ. *Vitis tenuifolia* W & Arn. (In China).

Angonyx testacea testacea (Walk.).

LOGANIACEÆ. *Strychnos nux-vomica* Linn. (B.)

Cizara sculpta (Felder).

RUBIACEÆ. *Randia dumetorum* Lamk. (B.)

Nephele didyma (Fabr.).

APOCYNACEÆ. *Carissa* spp. (B., P., S.)

Gurelca hyas hyas (Walk.).

RUBIACEÆ. *Morinda* spp.; *Pæderia fœtida* Linn. (B., S.)

Gurelca masuriensis (Butl.).

RUBIACEÆ. *Leptodermis lanceolata* Wall. (S.)

Gurelca himachala himachala (Butl.).

RUBIACEÆ. *Pæderia fœtida* Linn. (S.)

Sphingonæpiopsis pumilio (Boisd.).

RUBIACEÆ. *Hedyotis uncinella* Hk. & Arn. (S.); *Galium* Linn. (R); *Oldenlandia* Linn. (In China).

Rhodosoma triopus (Westw.).

RUBIACEÆ. *Adina globifera* Salisb. (In China).

Macroglossum stellatarum (Linn.).

RUBIACEÆ. *Galium* spp.; *Rubia* spp. (In England). (R.)

Macroglossum bombylans (Boisd.).

RUBIACEÆ. *Rubia cordifolia* Linn. (S., M.)

Macroglossum regulus (Boisd.).
RUBIACEÆ. *Rubia cordifolia* Linn. (B.)

Macroglossum gyrans (Walk.).
RUBIACEÆ. *Morinda* spp. (B.)

Macroglossum affictitia (Butl.).
LOGANIACEÆ. *Strychnos nux-vomica* Linn. (B.)

Macroglossum particolor Roths. & Jord.
RUBIACEÆ. *Morinda citrifolia* Linn. (B.)

Macroglossum belis (Linn.).
RUBIACEÆ. *Hamiltonia suaveolens* Roxb.; *Saprosma indicum* Dalz. & Gibs. (B., S.)
LOGANIACEÆ. *Strychnos nux-vomica* Linn. (B.)

Macroglossum assimilis Swains.
MELASTOMACEÆ. *Memecylon edule* Roxb. (B.)

Macroglossum pyrrhosticta pyrrhosticta (Butl.).
RUBIACEÆ. *Pæderia* spp. (S., M.)

Macroglossum troglodytus (Boisd.).
RUBIACEÆ. *Hedyotis* spp. (S.)

Macroglossum insipida insipida (Butl.).
TILIACEÆ. *Corchorus capsularis* Linn. (B.)

Macroglossum vicinum Jordan.
RUBIACEÆ. *Chasalia curviflora* Thw. (B.)

Macroglossum sitiene (Walk.).
RUBIACEÆ. *Morinda umbellata* Linn.; *Pæderia tomentosa* Linn. (In China).

Macroglossum fringilla (Boisd.).
RUBIACEÆ. *Psychotria dalzelli* Hook. (B.); *Morinda* Linn. (FM.).

Macroglossum variegatum Roths. & Jord.
RUBIACEÆ. *Hedyotis* Linn. (In China).

Macroglossum saga (Butl.).
EUPHORBIACEÆ. *Daphniphyllum* Bl. (In China).

Macroglossum corythus luteata (Butl.).

RUBIACEÆ. *Morinda citrifolia* Linn. var. *bracteata* Hook.; *Pæderia fœtida* Linn. (B., S.)
LOGANIACEÆ. *Strychnos nux-vomica* Linn. (B.)

Macroglossum passalus rectifascia (Felder).

ROSACEÆ. *Photinia lindleyana* W & Arn. (In China).
EUPHORBIACEÆ. *Daphniphyllum calycinum*? (In China).

Rhopalopsyche nycteris nycteris (Kollar).

RUBIACEÆ. *Rubia cordifolia* Linn.; *Galium* Linn. (S.)

Rhopalopsyche nycteris bifasciata Butl.

RUBIACEÆ. *Rubia cordifolia* Linn. (S.)

Celerio euphorbiæ nervosa Roths. & Jord.

EUPHORBIACEÆ. *Euphorbia* Linn. (B., S.)

Celerio euphorbiæ robertsi (Butl.).

EUPHORBIACEÆ. *Euphorbia* Linn. (S.)

Celerio gallii gallii (Rottenburg).

ONAGRACEÆ. *Epilobium* Linn. (In England).
RUBIACEÆ. *Asperula* Linn.; *Galium* Linn. (In England).
EUPHORBIACEÆ. *Euphorbia* Linn. (In England).

Celerio nicæa lathyrus (Walk.).

EUPHORBIACEÆ. *Euphorbia* Linn. (R.)

Celerio lineata livornica (Esper).

PORTULACEÆ. *Portulaca* Linn. (In England).
AMPELIDEÆ. *Vitis* spp. (In England).
ROSACEÆ. *Prunus* Linn. (In England).
ONAGRACEÆ. *Œnothera* Linn. (In England).
RUBIACEÆ. *Galium* Linn. (In England).
POLYGONACEÆ. *Rumex* Linn. (In England).

Pergesa elpenor macromera (Butl.).

GERANIACEÆ. *Impatiens* spp. (S.)
AROIDEÆ. *Arisæma* spp.; *Amorphophallus* spp., and other AROIDEÆ. (S.)

Pergesa elpenor rivularis (Boisd.).

AROIDEÆ. *Arisæma curvatum* Kunth. (S.)

Hippotion velox (Fabr.).

NYCTAGINACEÆ. *Pisonia alba* Spanogue. (B.)

Hippotion celerio (Linn.).

AMPELIDEÆ. *Vitis* spp. (S., P., R.)
RUBIACEÆ. *Spermacoce hispida* Linn. (S.)
NYCTAGINACEÆ. *Boerhavia* Linn. (B., S.)
CHENOPODIACEÆ. *Beta* spp. (M., P.)
POLYGONACEÆ. *Rumex* spp. (M., S.)
AROIDEÆ. *Cryptocoryne* Fisch.; *Caladium bicolor* Vent. (S.)

Hippotion echeclus (Boisd.).

PEDALINEÆ. *Sesamum indicum* Linn. (In China).
PONTEDERIACEÆ. *Monochoria* spp. (S.)

Hippotion rafflesi (Butl.).

GERANIACEÆ. *Impatiens* spp. (B., S.)

Hippotion boerhaviæ (Fabr.).

GERANIACEÆ. *Impatiens balsamina* Linn. (B.)
RUBIACEÆ. *Knoxia mollis* W & Arn.; *Spermacoce* spp. (S.)
SCROPHULARIACEÆ. *Glossostigma spathulatum* Arn. (P., M.)
NYCTAGINACEÆ. *Boerhavia* spp. (P., M., S.)

Theretra nessus (Drury).

LEGUMINOSÆ. *Pongamia glabra* Vent. (B.)
MYRTACEÆ. *Barringtonia* Forst. (R.)
PASSIFLORACEÆ. *Passiflora* Linn. (S.)
DIOSCORACEÆ. *Dioscorea* spp. (B., R., S.)
AROIDEÆ. (Many species.) (B.)
CONVOLVULACEÆ. *Convolvulus* Linn. (In China).

Theretra clotho clotho (Drury).

DILLENIACEÆ. *Dillenia* spp. (B., S.)
MALVACEÆ. *Hibiscus mutabilis* L. (In China).
AMPELIDEÆ. *Vitis* spp. (B., P., S.)
ONAGRACEÆ. *Fuchsia* Linn. (S.)
BEGONIACEÆ. *Begonia* Linn. (S.)
AROIDEÆ. *Amorphophallus* Bl. (S.)

Theretra gnoma (Fabr.).

AMPELIDEÆ. *Vitis* spp. (S., P.)
AROIDEÆ. *Colocasia antiquorum* Schott. (S.)

Theretra latreillei lucasi (Walk.).

TERNSTRŒMIACEÆ. *Saurauja tristyla* DC. (In China).
GERANIACEÆ. *Impatiens* Linn. (In China).
AMPELIDEÆ. *Vitis* spp. (B.)
LYTHRACEÆ. *Lagerstrœmia flos-reginæ* Retz. (B.)
BEGONIACEÆ. *Begonia* Linn. (In China).

Theretra alecto alecto (Linn.).

DILLENIACEÆ. *Dillenia indica* Linn. (S.)
TERNSTRŒMIACEÆ. *Saurauja nepalensis* DC. (S.)
AMPELIDEÆ. *Vitis* spp. ; *Leea* Linn. (B., S.)
RUBIACEÆ. *Psychotria* Linn. (R.) ; *Rubia cordifolia* Linn. (S.).

Theretra suffusa (Walk.).

MELASTOMACEÆ. *Melastoma sanguineum* Sims. (In China).

Theretra lycetus (Cramer).

DILLENIACEÆ. *Dillenia pentagyna* Roxb. (B.)
AMPELIDEÆ. *Leea sambucina* Willd. ; *Vitis* spp. (B., S.)

Theretra oldenlandiæ oldenlandiæ (Fabr.).

TILIACEÆ. *Corchorus capsularis* Linn. (B.)
GERANIACEÆ. *Impatiens* spp. (B., S., P.)
AMPELIDEÆ. *Vitis* spp. (P.)
ONAGRACEÆ. *Jussiæa suffruticosa* Linn. (In China).
MYRTACEÆ. *Careya arborea* Roxb. (B.)
RUBIACEÆ. *Oldenlandia corymbosa* Linn. (B.)
CONVOLVULACEÆ. *Ipomæa* spp. (M., P.)
AROIDEÆ. *Cryptocoryne* Fisch. ; *Arisæma* spp. ; *Colocasia fallax* Schott ; *Caladium bicolor* Vent. (B., S.)

Theretra pinastrina pinastrina (Martyn).

ONAGRACEÆ. *Jussiæa repens* Linn. (S.)
NYCTAGINACEÆ. *Boerhavia* Linn. (R.)
AROIDEÆ. *Colocasia antiquorum* Schott ; *Caladium bicolor* Vent., and other Aroideæ. (B., S.)

Theretra pallicosta (Walk.).

AMPELIDEÆ. *Vitis vinifera* Linn. (P.)
EUPHORBIACEÆ. *Aporosa* spp. (B., S., M.)

Theretra castanea (Moore).

GERANIACEÆ. *Impatiens cuspidata* Wight. (S.)
RUBIACEÆ. *Knoxia mollis* W & Arn. (S.)
AROIDEÆ. *Arisæma* spp. ; *Ariopsis peltata* Nimmo, and other AROIDEÆ. (B., S.)

Rhyncholaba acteus (Cramer).

AMPELIDEÆ. *Vitis* spp. (B., S.)
BEGONIACEÆ. *Begonia* Linn. (In China).
COMMELINACEÆ. *Commelina bengalensis* Linn. (P., M.)
AROIDEÆ. *Arisæma* spp. ; *Amorphophallus* Bl. ; *Colocasia* Linn. ; *Caladium bicolor* Vent., and other species of AROIDEÆ. (B., S., P.)

Rhagastis velata (Walk.).

AROIDEÆ. *Arisæma consanguineum* Schott ; *Amorphophallus* spp. (S.)

Rhagastis aurifera aurifera (Butl.).

AMPELIDEÆ. *Vitis* spp. (S.)
AROIDEÆ. *Amorphophallus* spp. (S.)

Rhagastis confusa Roths. & Jord.

AMPELIDEÆ. *Vitis* spp. (S.)

Rhagastis olivacea (Moore).

GERANIACEÆ. *Impatiens* spp. (S.)
AMPELIDEÆ. *Vitis vinifera* Linn. (In China).
AROIDEÆ. *Arisæma consanguineum* Schott ; *Amorphophallus campanulatus* Bl. (S.)

Rhagastis albomarginatus albomarginatus (Roths.).

AMPELIDEÆ. *Vitis vinifera* Linn. (In China).
SAXIFRAGACEÆ. *Hydrangea* Linn. (P., S.) ; *Dichroa febrifuga* Lour. (In China).

Cechenena mirabilis (Butl.).

AMPELIDEÆ. *Vitis himalayana* Brand. (S.)

Cechenena minor minor (Butl.).

TERNSTRŒMIACEÆ. *Saurauja punduana* Wall. (S.)
AMPELIDEÆ. *Vitis* spp. ; *Leea* Linn. (M., S.)
AROIDEÆ. *Amorphophallus* Bl. (In China).

Cechenena lineosa lineosa (Walk.).

TERNSTRŒMIACEÆ. *Saurauja tristyla* DC. (In China).
GERANIACEÆ. *Impatiens* spp. (S.)
AMPELIDEÆ. *Vitis* spp. (S.)
POLYGONACEÆ. *Polygonum chinensis* Linn. (S.)

Cechenena lineosa scotti Roths.

GERANIACEÆ. *Impatiens* Linn. (S.)
AMPELIDEÆ. *Vitis* spp. (S.)

II. List of known Food-plants, with the Species which feed upon them.

(These are arranged according to Hooker's ' Flora of India ').

DILLENIACEÆ. *Dillenia* spp.

Acosmeryx socrates Boisd. (B.)
Theretra clotho clotho (Drury). (B., S.)
Theretra alecto alecto (Linn.). (S.)
Theretra lycetus (Cramer). (B.)

ANONACEÆ. *Melodorum oldhami* Hemsl.
A subspecies of *Meganoton rufescens* (Butl.). (In China).

PORTULACEÆ. *Portulaca* Linn.
Celerio lineata livornica (Esper). (In England).

GUTTIFERÆ. *Garcinia* Linn. (In China); *Calophyllum inophyllum* Linn. (B.).
Compsogene panopus panopus (Cramer).

TERNSTRŒMIACEÆ. *Actinidia fulvicoma* Hance.
Acosmeryx sericeus sericeus (Walk.). (In China).
Saurauja spp.
Ampelophaga rubiginosa harterti Roths. (S.)
Ampelophaga khasiana khasiana Roths. (S.)
Acosmeryx naga Moore. (S.)
Theretra latreillei lucasi (Walk.). (In China).
Theretra alecto alecto (Linn.). (S.)
Cechenena minor minor (Butl.). (S.)
Cechenena lineosa lineosa (Walk.). (In China).

DIPTEROCARPACEÆ. *Dipterocarpus tuberculatus* Roxb.
Oxyambulyx substrigilis substrigilis (Westw.). (R.)

MALVACEÆ. *Kydia calycina* Roxb.
Marumba dyras dyras (Walk.). (S.)
Bombax malabaricum DC.
Marumba dyras dyras (Walk.). (B.)
Marumba indicus (Walk.). (B.)
Hibiscus mutabilis Linn.
Theretra clotho clotho (Drury). (In China).

STERCULIACEÆ. *Sterculia* spp.; *Helicteres isora* L.
Marumba dyras dyras (Walk.). (B., S.)
Marumba indicus (Walk.). (B.)
Pterospermum Schreb.; *Buettneria* Linn.
Marumba dyras dyras (Walk.). (In China).

TILIACEÆ. *Grewia* spp.
Marumba dyras dyras (Walk.). (B., S.)
Marumba indicus (Walk.). (B.)
Agnosia orneus (Westw.). (S.)
Corchorus capsularis Linn.
Macroglossum insipida insipida (Butl.). (B.)
Theretra oldenlandiæ oldenlandiæ (Fabr.). (B.)
Elæocarpus chinensis Hk. f. ex B.
Oxyambulyx sericeipennis agana Jordan. (In China).

GERANIACEÆ. *Impatiens* spp.

Pergesa elpenor macromera (Butl.). (S.)
Hippotion rafflesi (Butl.). (B., S.)
Hippotion boerhaviæ (Fabr.). (B.)
Theretra latreillei lucasi (Walk.). (In China).
Theretra oldenlandiæ oldenlandiæ (Fabr.). (B., S., R.)
Theretra castanea (Moore). (S.)
Rhagastis olivacea (Moore). (S.)
Cechenena lineosa lineosa (Walk.). (S.)
Cechenena lineosa scotti Roths. (S.)

BURSERACEÆ. *Canarium album* Raeush.

Oxyambulyx liturata liturata (Butl.). (In China).
Oxyambulyx subocellata (Feld.). (In China).

MELIACEÆ. *Aglaia littoralis* Talbot.

Oxyambulyx substrigilis aglaia Jordan. (B.)

ILICINEÆ. *Ilex rotunda* Thunb.

Dahira rubiginosa Moore. (In Japan).

AMPELIDEÆ. *Vitis* spp.

Ampelophaga rubiginosa fasciosa Moore. (S.)
Ampelophaga rubiginosa harterti Roths. (S.)
Ampelophaga khasiana khasiana Roths. (S.)
Acosmeryx naga (Moore). (S.)
Acosmeryx anceus subdentata Roths. & Jord. (B.)
Acosmeryx socrates Boisd. (B.)
Celerio lineata livornica (Esper). (In England).
Hippotion celerio (Linn.). (R., S., P.)
Theretra clotho clotho (Drury). (B., S.)
Theretra gnoma (Fabr.). (S.)
Theretra latreillei lucasi (Walk.). (B.)
Theretra alecto alecto (Linn.). (B., S.)
Theretra lycetus (Cramer). (B.)
Theretra oldenlandiæ oldenlandiæ (Fabr.). (P.)
Theretra pallicosta (Walk.). (P.)
Rhyncholaba acteus (Cramer). (B., S.)
Rhagastis aurifera aurifera (Butl.). (S.)
Rhagastis confusa Roths. & Jord. (S.)
Rhagastis olivacea (Moore). (In China).
Rhagastis albomarginatus albomarginatus (Roths.). (In China).
Cechenena mirabilis (Butl.). (S.)
Cechenena minor minor (Butl.). (M., S.)
Cechenena lineosa lineosa (Walk.). (S.)
Cechenena lineosa scotti Roths. (S.)

Vitis tenuifolia W & Arn.
Panacra mydon mydon Walk. (In China).
Vitis cantoniensis Seem.
Acosmerycoides leucocraspis leucocraspis (Hampson). (In China).
Acosmeryx sericeus sericeus (Walk.). (In China).
Leea Linn.
Acosmeryx anceus subdentata Roths. & Jord. (B.)
Acosmeryx socrates Boisd. (B.)
Theretra alecto alecto (Linn.). (S.)
Theretra alecto alecto (Linn.). (S.)
Theretra lycetus (Cramer). (B., S.)
Cechenena minor minor (Butl.). (M., S.)

SAPINDACEÆ.
Daphnusa ocellaris ocellaris Walk. (In China.)
Schleichera trijuga Willd.
Marumba dyras dyras (Walk.). (B.)
Acer campbelli Hook. f.
Rhodoprasina floralis (Butl.). (FM.)

SABIACEÆ. *Meliosma fordii* Hemsl.
Psilogramma menephron menephron (Cramer). (In China).
Meliosma pungens Wall.
Marumba spectabilis spectabilis (Butl.). (In China).

ANACARDIACEÆ. *Rhus insignis* Hook. f.
Oxyambulyx sericeipennis agana Jordan. (S.)
Rhus vernicifera DC. ; *Dracontomelum magniferum* Bl.
Compsogene panopus panopus (Cramer). (In China).
Mangifera indica Linn.
Compsogene panopus panopus (Cramer). (B., R.)
Odina wodier Roxb.
Oxyambulyx subocellata (Feld.). (B.)
Poupartia fordii Hemsl.=*Spondias axillaris* Roxb.
Oxyambulyx ochracea (Butl.). (In China).
Oxyambulyx liturata liturata (Butl.). (In China).

LEGUMINOSÆ. *Millettia atropurpurea* Benth.
Clanis phalaris (Cramer). (FM.)
Clanis bilineata bilineata (Walk.). (In China).
Clanis titan titan Roths. & Jord. (In China).
Indigofera Linn.
Clanidopsis exusta (Butl.). (S.)
Lespedeza spp.
Clanis undulosa undulosa (Moore). (S., M.)
Sataspes infernalis (Westw.). (In China).

Mucuna spp.
Clanis phalaris (Cramer). (In China).
Clanis bilineata bilineata (Walk.). (In China).
Erythrina spp.
Acherontia lachesis (Fabr.). (S., M.)
Pueraria DC.
Clanis bilineata bilineata (Walk.). (In China).
Phaseolus spp. ; *Arachis hypogæa* Linn.
Herse convolvuli convolvuli (Linn.). B., P.)
Dolichos lablab Linn.
Acherontia styx styx Westw. (B.)
Herse convoluli convoluli (Linn.). (P.)
Dalbergia spp.
Clanis titan titan Roths. & Jord. (B.)
Sataspes infernalis (Westw.). (B.)
Sataspes tagalica Boisd. (In China).
Sataspes scotti Jordan. (S.)
Pterocarpus marsupium Roxb.
Clanis bilineata bilineata (Walk.). (B.)
Clanis titan titan Roths. & Jord. (B)
Pongamia glabra Vent.
Clanis phalaris (Cram.). (B., S.)
Clanis bilineata bilineata (Walk.). (B., S.)
Theretra nessus (Drury). (B.)
Derris platyptera Baker.
Clanis titan titan Roths. & Jord. (B.)
Cassia fistula Linn.
Clanis phalaris (Cram.) (S.)
Xylia xylocarpa Taub.
Oxyambulyx belli Jordan. (B.)
Clanis phalaris (Cramer). (B.)
Albizzia lebbek Durazz.
Sataspes infernalis (Westw.). (In China).
Robinia pseud-acacia Linn.
Clanis deucalion (Walk.). (S.)

ROSACEÆ. *Prunus* spp. ; *Pyrus* spp.
Marumba gaschkewitschi fortis Jordan. (In China).
Langia zenzeroides zenzeroides Moore. (S.)
Celerio lineata livornica (Esper). (In England).
Eriobotrya japonica Lindl.
Marumba gaschkewitschi fortis Jordan. (In China).
Photinia lindleyana W & Arn.
Macroglossum passalus rectifascia (Felder). (In China).
Cratægus Linn.
Marumba gaschkewitschi fortis Jordan. (In China).

SAXIFRAGACEÆ. *Hydrangea* Linn.
Rhagastis albomarginatus albomarginatus (Roths.). (S.)
Dichroa febrifuga Lour.
Rhagastis albomarginatus albomarginatus (Roths.). (In China).

COMBRETACEÆ. *Terminalia tomentosa* Bedd.
Oxyambylux matti Jordan. (B.)

MYRTACEÆ. *Eugenia jambolana* Lamk.
Acherontia styx styx Westw. (S.)
Barringtonia Forst.
Theretra nessus (Drury). (R.)
Careya arborea Roxb.
Theretra oldenlandiæ oldenlandiæ (Fabr.). (B.)

MELASTOMACEÆ. *Memecylon edule* Roxb.
Macroglossum assimilis Swains. (B.)
Melastoma sanguineum Sims.
Theretra suffusa (Walk.). (In China).

LYTHRACEÆ. *Lagerstrœmia flos-reginæ* Retz.
Theretra latreillei lucasi (Walk.). (B.)

ONAGRACEÆ. *Epilobium* Linn.
Celerio gallii gallii (Rottenburg). (In England).
Jussiæa repens Linn.
Theretra pinastrina pinastrina (Martyn). (S.)
Jussiæa suffruticosa Linn.
Theretra oldenlandiæ oldenlandiæ (Fabr.). (In China).
Fuchsia Linn.
Theretra clotho clotho (Drury). (S.)
Œnothera Linn.
Celerio lineata livornica (Esper). (In England).

PASSIFLORACEÆ. *Passiflora* Linn.
Theretra nessus (Drury). (S.)

CUCURBITACEÆ. *Coccinia* W & Arn.
Acherontia styx styx Westw. (R.)

BEGONIACEÆ. *Begonia* Linn.
Theretra clotho clotho (Drury). (S.)
Theretra latreillei lucasi (Walk.). (In China).
Rhyncholaba acteus (Cramer). (In China).

CORNACEÆ. *Alangium lamarckii* Thw.
Deilephila minima minima (Butl.). (B.)

CAPRIFOLIACEÆ. *Lonicera* Linn.

Hæmorrhagia fuciformis fuciformis (Linn.). (In England).

Lonicera quinquelocularis Hardw.

Hæmorrhagia saundersi (Walk.). (S.)

RUBIACEÆ. *Adina cordifolia* Hook.; *Gardenia* Linn.; *Pavetta indica* Linn.

Cephonodes hylas hylas (Linn.). (B., S.)

Cephonodes picus (Cramer). (B., S.)

Adina globifera Salish.

Rhodosoma triopus (Westw.). (In China).

Uncaria Schreb.; *Cinchona* Linn.

Deilephila hypothous hypothous (Cramer). (R., S.)

Hymenodictyon excelsum Wall.; *Ixora brachiata* Roxb.; *Coffea bengalensis* Roxb.

Cephonodes hylas hylas (Linn.). (S.)

Wendlandia spp.

Cephonodes hylas hylas (Linn.). (S.)

Deilephila hypothous hypothous (Cramer). (In China).

Hedyotis spp.

Sphingonæpiopsis pumilio (Boisd). (S.)

Macroglossum troglodytus (Boisd.). (S.)

Macroglossum variegatum Roths. & Jord. (In China).

Oldenlandia spp.

Sphingonæpiopsis pumilio (Boisd.). (In China).

Theretra oldenlandiæ oldenlandiæ (Fabr.). (B.)

Randia dumetorum Lamk.

Cephonodes hylas hylas (Linn.). (B., S.)

Cephonodes picus (Cramer). (B.)

Cizara sculpta (Felder). (B.)

Knoxia mollis W & Arn.

Hippotion boerhaviæ (Fabr.). (S.)

Theretra castanea (Moore). (S.)

Morinda spp.

Gurelca hyas hyas (Walk.). (B.)

Macroglossum gyrans (Walk.). (B.)

Macroglossum particolor Roths. & Jord. (B.)

Macroglossum sitiene (Walk.). (In China).

Macroglossum fringilla (Boisd.). (F.M.)

Macroglossum corythus luteata (Butl.). (B.)

Psychotria Linn.

Theretra alecto alecto (Linn.). (R.)

Psychotria dalzelli Hook.

Macroglossum fringilla (Boisd.). (B.)

Chasalia curviflora Thw.

Macroglossum vicinum Jordan. (B.)

Saprosma indicum Dalz. & Gibs.
Macroglossum belis (Linn.). (B.)
Pæderia spp.
Gurelca hyas hyas (Walk.). (S.)
Gurelca himachala himachala (Butl.). (S.)
Macroglossum pyrrhosticta pyrrhosticta (Butl.). (S.)
Macroglossum sitiene (Walk.). (In China).
Macroglossum corythus luteata (Butl.). (S.)
Hamiltonia suaveolens Roxb.
Macroglossum belis (Linn.). (S.)
Leptodermis lanceolata Wall.
Gurelca masuriensis (Butl.). (S.)
Spermacoce sp.
Hippotion celerio (Linn.). (S.)
Hippotion boerhaviæ (Fabr.). (S.)
Rubia cordifolia Linn.
Hæmorrhagia fuciformis fuciformis (Linn.). (In England).
Macroglossum stellatarum (Linn). (In England).
Macroglossum bombylans (Boisd.). (S.)
Macroglossum regulus (Boisd.). (B.)
Rhopalopsyche nycteris nycteris (Kollar). (S.)
Rhopalopsyche nycteris bifasciata Butl. (S.)
Theretra alecto alecto (Linn.). (S.)
Galium spp.
Hæmorrhagia fuciformis fuciformis (Linn.). (In England).
Sphingonæpiopsis pumilio (Boisd.). (R.)
Macroglossum stellatarum (Linn.) (In England).
Rhopalopsyche nycteris nycteris (Kollar). (S.)
Celerio gallii gallii (Rottenburg). (In England).
Celerio lineata livornica (Esper). (In England).
Asperula Linn.
Celerio gallii gallii (Rottenburg). (In England).

COMPOSITÆ. *Helianthus* spp.
Herse convolvuli convolvuli (Linn.). (S., M.)

OLEACEÆ. *Jasminum* Linn. ; *Nyctanthes abor-tristis* Linn.
Acherontia lachesis (Fabr.). (S.)
Acherontia styx styx Westw. (R.)
Psilogramma menephron menephron (Cramer). (R.)
Linociera malabarica Wall.
Dolbina inexacta (Walk.). (B.)
Olea dioica Roxb. ; *Ligustrum robustum* Bl.
Psilogramma menephron menephron (Cramer). (B., S.)
Dolbina inexacta (Walk.). (B., S.)

APOCYNACEÆ. *Carissa* spp.
Nephele didyma (Fabr.). (B., S., P.)
Vinca spp. ; *Holarrhena antidysenterica* Wall. ; *Ervatamia heyneana* Wall. ; *Nerium odorum* Soland. ; *Tabernæmontana* spp.
Deilephila nerii (Linn.). (B., S.)
Deilephila placida Walk. (R.)

LOGANIACEÆ. *Strychnos nux-vomica* Linn.
Angonyx testacea testacea (Walk.). (B.)
Macroglossum affictitia (Butl.). (B.)
Macroglossum belis (Linn.). (B.)
Macroglossum corythus luteata (Butl.). (B.)

BORAGINACEÆ. *Cordia obliqua* Willd.
Polyptychus trilineatus sonanthis Jordan. (B.)
Polyptychus trilineatus undatus Roths. & Jord. (S.)
Polyptychus dentatus Cramer. (B.)
Ehretia lævis Roxb.
Polyptychus trilineatus sonanthis Jordan. (B.)
Polyptychus trilineatus trilineatus Moore. (S.)
Polyptychus dentatus Cramer. (B., S.)

CONVOLVULACEÆ. *Ipomæa* spp.
Acherontia lachesis (Fabr.). (B., S., P.)
Herse convolvuli convolvuli (Linn.). (B., S., P.)
Theretra oldenlandiæ oldenlandiæ (Fabr.). (B., S., P.)
Convolvulus spp.
Herse convolvuli convolvuli (Linn.). (B., R., S.)
Theretra nessus (Drury). (In China).

SOLANACEÆ. *Solanum* spp. ; *Datura* Linn.
Acherontia lachesis (Fabr.). (B., R., S., P.)
Acherontia styx styx Westw. (B., R., S., P.)
Nicotiana tabacum Linn.
Acherontia lachesis (Fabr.). (R.)

SCROPHULARIACEÆ. *Glossostigma spathulatum* Arn.
Hippotion boerhaviæ (Fabr.). (P., M.)

BIGNONIACEÆ. *Tecoma* spp.
Acherontia lachesis (Fabr.). (P.)
Acherontia styx styx Westw. (S.)
Stereospermum Cham.
Acherontia lachesis (Fabr.). (B.)
Bignonia megapotamica Spreng.
Acherontia styx styx Westw. (S.)
Spathodea campanulata Beauv.
Acherontia lachesis (Fabr.). (S.)
Psilogramma menephron menephron (Cramer). (S.)

PEDALINEÆ. *Sesamum indicum* DC.
Acherontia styx styx Westw. (S., P.)
Hippotion echeclus (Boisd.) (In China).

ACANTHACEÆ. *Strobilanthes* spp.
Pseudodolbina fo fo (Walk.). (S.)
Pseudodolbina fo celator Jordan. (S.)

VERBENACEÆ. *Lantana camara* Linn. ; *Stachytarpheta indica* Vahl.
Acherontia lachesis (Fabr.). (B., S.)
Callicarpa arborea Roxb.
Acherontia lachesis (Fabr.). (S.)
Psilogramma menephron menephron (Cramer). (S.)
Apocalypsis velox Butl. (S.)
Tectona grandis Linn.
Acherontia lachesis (Fabr.). (B.)
Psilogramma menephron menephron (Cramer). (B., P.)
Vitex negundo Linn. ; *Clerodendron* spp.
Acherontia lachesis (Fabr.). (B., S., P.)
Acherontia styx styx Westw. (B., S., P.)
Psilogramma menephron menephron (Cramer). (B., S., P.)
Symphorema involucratum Roxb.
Meganoton nyctiphanes (Walk.). (B.)
Citharexylum subserratum Sw.
Acherontia styx styx Westw. (S.)

LABIATÆ. *Coleus* Lour.
Acherontia lachesis (Fabr.). (S.)
Acherontia styx styx Westw. (S.)
Colebrookia oppositifolia Sm. ; *Anisomeles ovata* Br.
Acherontia lachesis (Fabr.). (S.)

NYCTAGINACEÆ. *Boerhavia* spp.
Hippotion celerio Linn. (B., S.)
Hippotion boerhaviæ (Fabr.). (P., S., M.)
Theretra pinastrina pinastrina (Martyn). (R.)
Pisonia alba Spanogue.
Hippotion velox (Fabr.). (B.)

CHENOPODIACEÆ. *Beta* spp.
Hippotion celerio (Linn.). (P., M.)

POLYGONACEÆ. *Rumex* spp.
Celerio lineata livornica (Esper). (In England).
Hippotion celerio (Linn.). (M., S.)
Polygonum chinensis Linn.
Cechenena lineosa lineosa (Walk.). (S.)

LAURACEÆ. *Machilus ichangensis* Rehd. & Wils.; *Phœbe* Nees; *Litsæa elongata* Hook.

Marumba cristata cristata (Butl.). (In China).

Alseodaphne semicarpifolia Nees.

Marumba nympha Roths. & Jord. (B.)

Sassafras tzumu Hemsl.

Meganoton analis (Feld.). (In China).

EUPHORBIACEÆ. *Euphorbia* spp.

Celerio euphorbiæ nervosa Roths. & Jord. (B., S.)

Celerio euphorbiæ robertsi (Butl.). (S.)

Celerio gallii gallii (Rottenburg). (R.)

Celerio nicæa lathyrus (Walk.). (R.)

Bridelia spp.

Marumba dyras dyras (Walk.). (S.)

Aporosa spp.

Theretra pallicosta (Walk.). (B., M., S.)

Daphniphyllum Bl.

Macroglossum saga Butl. (In China).

Macroglossum passalus rectifascia (Felder). (In China).

Antidesma Linn.

Acherontia lachesis (Fabr.). (R.)

MORACEÆ. *Broussonetia papyrifera* Vent.

Parum colligata (Walk.). (S.)

URTICACEÆ. *Parum colligata* (Walk.). (In China).

JUGLANDACEÆ. *Juglans regia* Linn.

Oxyambulyx sericeipennis sericeipennis (Butl.). (S.)

Oxyambulyx sericeipennis agana Jordan. (S.)

Marumba sperchius gigas (Butl.) (In China).

Phyllosphingia dissimilis Bremer. (R.)

Engelhardtia spicata Bl.

Oxyambulyx sericeipennis agana Jordan. (S.)

MYRICACEÆ. *Myrica nagi* Thunb.

Oxyambulyx sericeipennis agana Jordan. (S.)

BETULACEÆ. *Betula alnoides* Ham.

Oxyambulyx sericeipennis agana Jordan. (S.)

Cypa pallens enodis Jordan (S.)

FAGACEÆ. *Quercus* spp.

Oxyambulyx sericeipennis agana Jordan. (In China).

Oxyambulyx liturata liturata (Butl.). (In China).

Marumba sperchius gigas (Butl.). (M., S.)

Quercus fenestrata Roxb.
Rhodoprasina callantha Jordan. (S.)
Cypa pallens enodis Jordan. (S.)
Degmaptera mirabilis (Roths.). (S.)
Castanopsis Spach.
Oxyambulyx liturata liturata (Butl.). (In China).
Smerinthulus perversa (Roths.). (S.)

SALICACEÆ. *Salix* Linn.
Smerinthus kindermanni obsoleta Staud. (In China.)
Populus Linn.
Clanidopsis exusta (Butl.). (R.)

DIOSCOREACEÆ. *Dioscorea* spp.
Theretra nessus (Drury). (B., R., S.)

PONTEDERIACEÆ. *Monochoria* spp.
Hippotion echeclus (Boisd.). (S.)

COMMELINACEÆ. *Commelina bengalensis* Linn. (P., M.)
Rhyncholaba acteus (Cramer).

AROIDEÆ. *Cryptocoryne* Fisch.
Hippotion celerio (Linn.). (S.)
Theretra oldenlandiæ oldenlandiæ (Fabr.). (S.)
Arisæma spp.
Panacra metallica anfracta Gehl. (S.)
Panacra mydon mydon Walk. (S.)
Pergesa elpenor macromera (Butl.). (S.)
Pergesa elpenor rivularis (Boisd.). (S.)
Theretra nessus (Drury). (B.)
Theretra oldenlandiæ oldenlandiæ (Fabr.). (S.)
Theretra castanea (Moore). (S.)
Rhyncholaba acteus (Cramer). (S., P.)
Rhagastis velata (Walk.). (S.)
Rhagastis olivacea (Moore). (S.)
Amorphophallus spp.
Panacra mydon mydon Walk. (S.)
Pergesa elpenor macromera (Butl.). (S.)
Theretra nessus (Drury). (B.)
Theretra clotho clotho (Drury). (S.)
Rhyncholaba acteus (Cramer). (S.)
Rhagastis velata (Walk.). (S.)
Rhagastis aurifera aurifera (Butl.). (S.)
Rhagastis olivacea (Moore). (S.)
Cechenena minor minor (Butl.). (In China).
Ariopsis peltata Nimmo.
Theretria castanea (Moore). (B.)

Colocasia spp.
Panacra mydon mydon Walk. (S.)
Theretra gnoma (Fabr.). (S.)
Theretra oldenlandiæ oldenlandiæ (Fabr.). (S.)
Theretra pinastrina pinastrina (Martyn). (S.)
Rhyncholaba acteus (Cramer). (S.)
Caladium bicolor Vent.
Hippotion celerio (Linn.). (S.)
Theretra oldenlandiæ oldenlandiæ (Fabr.). (S.)
Theretra pinastrina pinastrina (Martyn). (B.)
Rhyncholaba acteus (Cramer). (B.)
Pothos scandens Linn.
Panacra busiris atima Roths. & Jord. (B.)
Panacra mydon mydon Walk. (In China).

GRAMINEÆ. *Saccharum* Linn.
Leucophlebia lineata Westw. (P., R.)
Bambusa Linn. and other GRAMINEÆ.
Leucophlebia emittens Walk. (B., S., FM.)

ALPHABETICAL INDEX.

[All names printed in *italics* are synonyms. When a species is mentioned on more than one page, the page on which the description occurs is indicated by thickened numerals.]

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EXPLANATION OF PLATES.

NOTES.

(1) Plates I–VII are two-thirds natural size.

Plates VIII–XII are life size.

Plates XIII–XV are five-eighths natural size.

(2) The names entered in brackets after explanations of figures are the names of artists who drew them :—

(Bell).—Miss Bell.

(Scott).—F B. Scott.

(Pusa artist).—An Indian artist attached to the Agricultural Research Institute, Pusa.

(Indian artist).—An unknown Indian artist.

(3) The photographs are by F. B. Scott.

(4) Where the instar is not mentioned the figure is that of the full-fed larva.

PLATE I.

Larvæ of Sphingidæ.

Fig. 1. *Acherontia lachesis* (Fabr.), 5th instar, green form (Scott).

2. ,, ,, ,, ,, dark form (Scott).

3. *Pseudodolbina fo celator* Jord. (Scott).

4. *Psilogramma menephron menephron* (Cram.), green form (Scott).

5. ,, ,, ,, ,, dark form (Indian artist).

6. *Oxyambulyx sericeipennis agana* Jord., dark form (Scott).

7. ,, ,, ,, green form (Scott).

8. ,, *belli* Jord. (Indian artist).

9. ,, *sericeipennis sericeipennis* (Butl). (Scott).

10. *Clanis phalaris* (Cram.), yellow form (Scott).

11. *Compsogene panopus panopus* (Cram.) (Indian artist).

SPHINGIDÆ

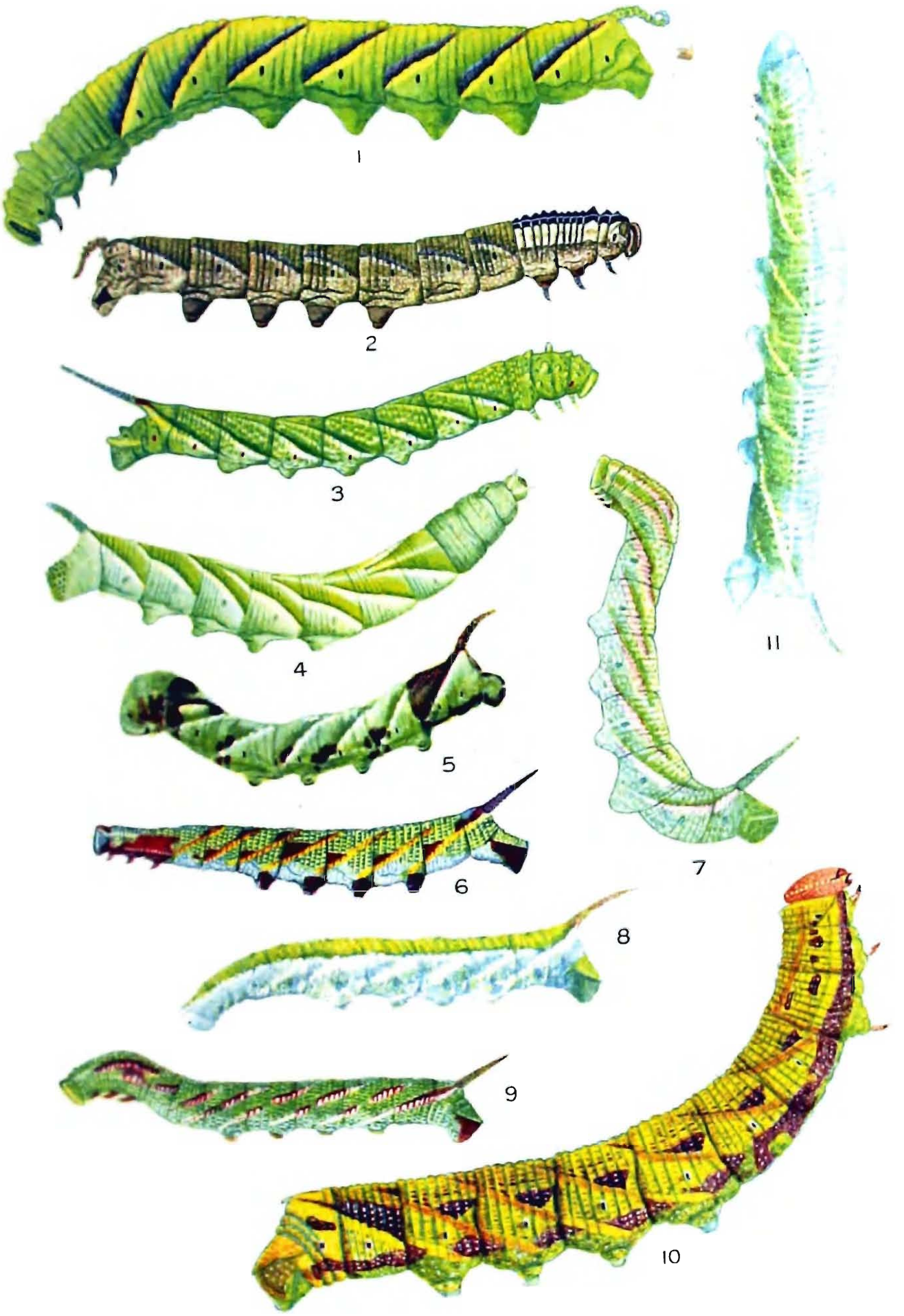


PLATE II.

Larvæ of Sphingidæ.

Fig. 1. *Oxyambulyx belli* Jord. (Indian artist).
2. ,, *substrigilis aglaia* Jord. (Bell).
3. ,, sp. (Scott).
4. *Clanis undulosa undulosa* (Moore) (Scott).
5. ,, *bilineata bilineata* (Walk.), green form (Bell).
6. ,, ,, ,, ,, yellow form (Bell).
7. *Polyptychus dentatus* (Cram.), 6th instar (Scott).
8. ,, ,, ,, 5th ,, ,,
9. ,, ,, ,, 6th ,, (Pusa artist).
10. ,, ,, ,, pupa (Pusa artist).
11. *Clanis titan titan* Roths. & Jord., pupa (Bell).
12. ,, ,, ,, ,, (Bell).
13. *Leucophlebia lineata* Westw., green form (Pusa artist).
14. ,, ,, ,, dark form (Pusa artist).
15. ,, ,, ,, pupa (Pusa artist).
16. ,, *emittens* Walk., dark form (Bell).
17. *Polyptychus trilineatus sonanthis* Jord. (Bell).

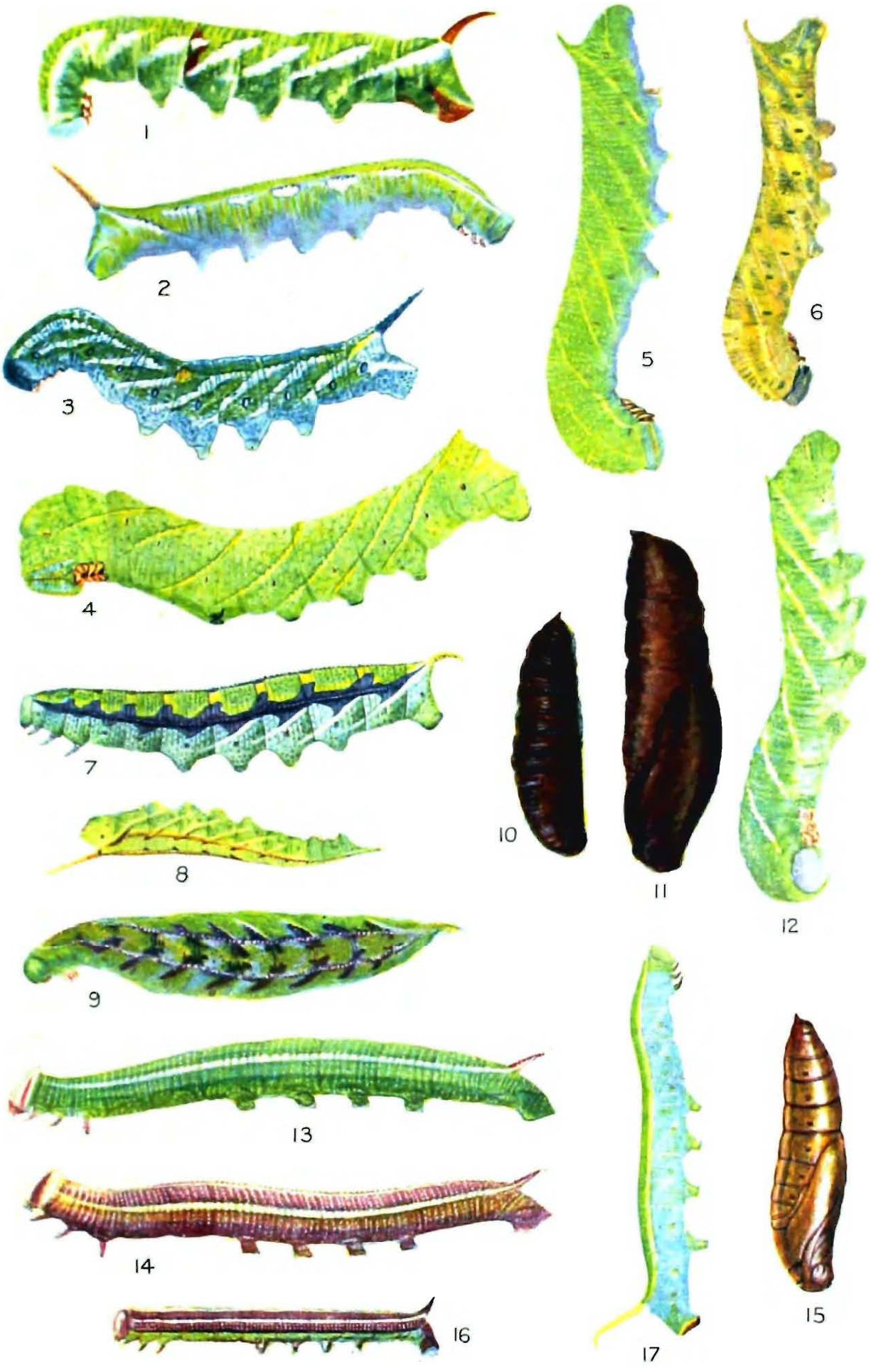

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PLATE III.

LARVÆ OF SPHINGIDÆ.

Fig. 1. *Marumba nympha* Roths. & Jord. (Bell).
2. ,, ,, ,, pupa (Bell).
3. ,, *dyras dyras* (Walk.) (Bell).
4. *Langia zenzeroides zenzeroides* Moore (Scott).
5. ,, ,, ,, ,, pupa (Scott).
6. *Cypa pallens enodis* Jord. (Scott).
7. *Rhodoprasina callantha* Jord., 5th instar (Scott).
8. *Cephonodes hylas hylas* (Linn.), dark form (Scott).
9. ,, ,, ,, ,, green form (Scott).
10. *Deilephila nerii* (Linn)., green form (Scott).
11. ,, ,, ,, pupa (Scott).
12. ,, *minima minima* (Butl.) (Indian artist).
13. ,, ,, ,, ,, pupa (Indian artist).
14. *Degmaptera mirabilis* (Roths.) (Scott).
15. *Ampelophaga rubiginosa fasciosa* Moore (Scott).
16. *Agnosia orneus* (Westw.) (Scott).
17. *Ampelophaga khasiana khasiana* Roths., dark form (Scott).

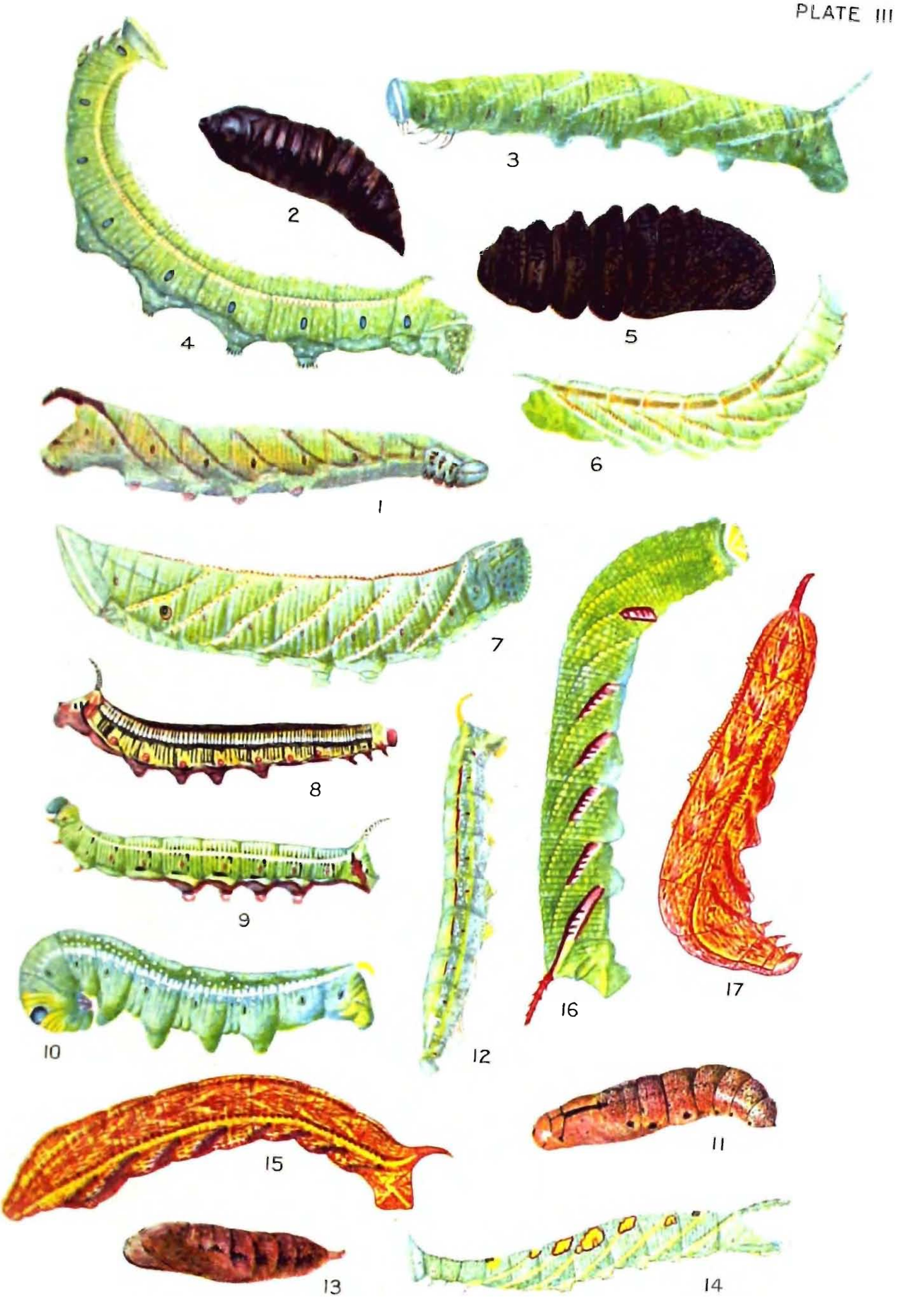

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PLATE IV

LARVÆ OF SPHINGIDÆ.

Fig. 1. *Acosmeryx naga* (Moore), green form (Scott).
2. ,, ,, ,, pupa (Pusa artist).
3. ,, *anceus subdentata* Roths. & Jord. (Indian artist).
4. ,, *socrates* Boisd. (Bell).
5. ,, ,, ,, pupa (Bell).
6. *Panacra busiris atima* Roths. & Jord. (Bell).
7. ,, ,, ,, ,, pupa (Bell).
8. ,, *metallica anfracta* Gehl. (Scott).
9. ,, *mydon mydon* Walk., dark form (Scott).
10. ,, ,, ,, ,, pupa (Scott).
11. *Cizara sculpta* (Feld.) (Indian artist).
12. ,, ,, ,, (Bell).
13. *Nephele didyma* (Fabr.) (Scott).
14. ,, ,, ,, pupa (Bell).
15. *Macroglossum bombylans* (Boisd.) (Scott).
16. *Celerio euphorbiæ nervosa* Roths. & Jord. (Scott).
17. ,, ,, ,, ,, pupa (Scott).
18. ,, ,, *robertsi* (Butl.), green form (Scott).
19. ,, ,, ,, ,, dark form (Scott).

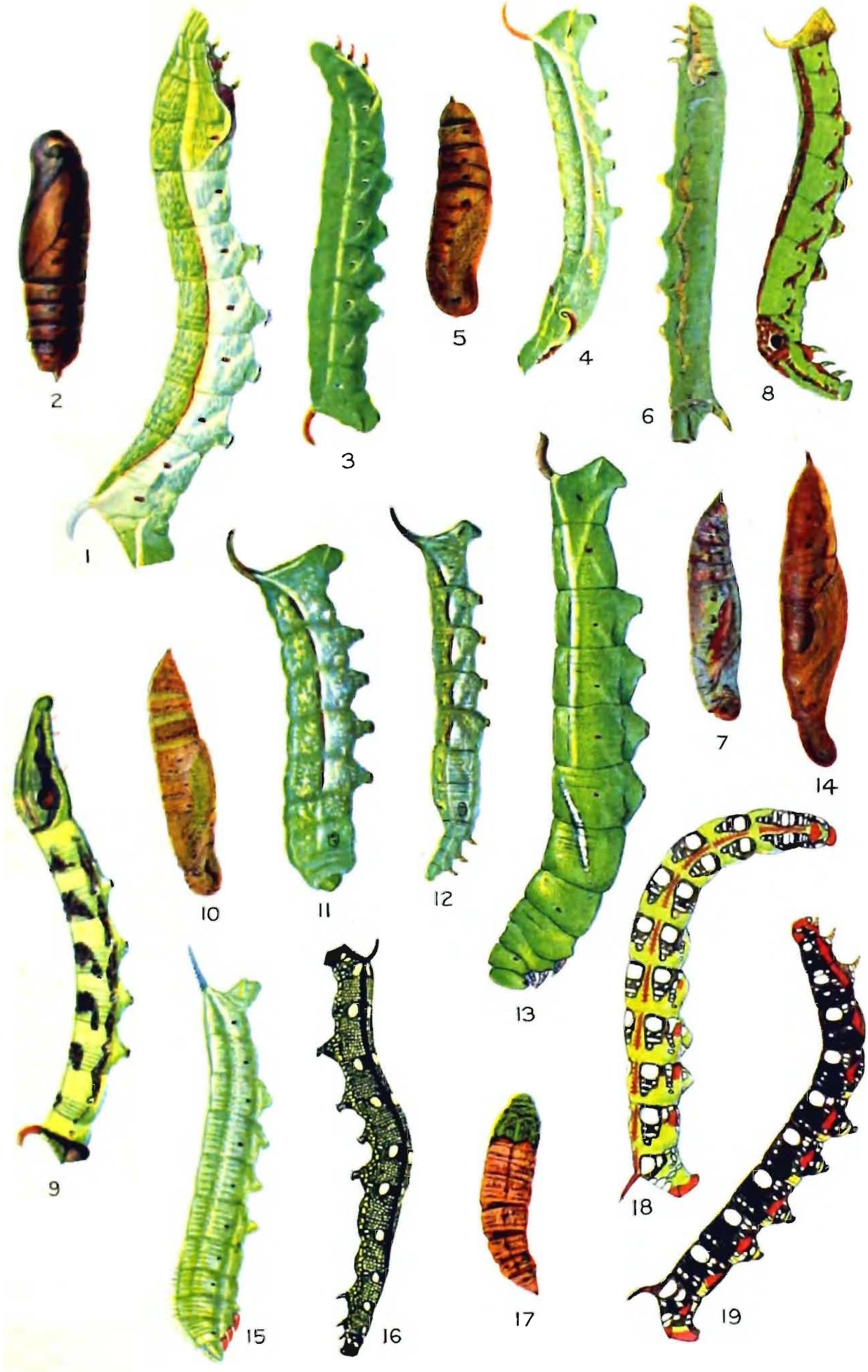

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PLATE V

Larvæ of Sphingidæ.

Fig. 1. *Pergesa elpenor macromera* (Butl.) (Scott).

2. ,, ,, ,, ,, pupa (Pusa artist).

3. *Hippotion celerio* (Linn.), green form (Bell).

4. ,, ,, ,, dark form (Bell).

5. ,, ,, ,, pupa (Bell).

6. ,, *rafflesi* (Butl.), dark form (Scott).

7. ,, ,, ,, green form (Scott).

8. ,, ,, ,, pupa (Pusa artist).

9. ,, *boerhaviæ* (Fabr.), black form (Scott).

10. ,, ,, ,, pupa (Pusa artist).

11. ,, ,, ,, brown form (Bell).

12. ,, ,, ,, pupa (Bell).

13. *Theretra gnoma* (Fabr.) (Scott).

14. ,, *latreillei lucasi* (Walk.) (Indian artist).

15. ,, ,, ,, ,, pupa (Indian artist).

16. ,, *nessus* (Drury), dark form (Scott).

17 ,, ,, ,, pupa (Scott).

18. ,, *clotho clotho* (Drury), green form (Bell).

19. ,, ,, ,, ,, green form (Scott).

20. ,, ,, ,, ,, pupa (Scott).

21. ,, *alecto alecto* (Linn.), 4th instar, green form (Scott).

22. ,, ,, ,, ,, 5th instar, dark form (Scott).

23. ,, ,, ,, ,, 5th instar, green form (Scott).


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PLATE VI.

Larvæ of Sphingidæ.

Fig. 1. *Theretra lycetus* (Cram.), dark form (Bell).

2. ,, ,, ,, green form (Bell).

3. ,, ,, ,, pupa (Bell).

4. ,, *oldenlandiæ oldenlandiæ* (Fabr.) (Scott).

5. ,, ,, ,, ,, pupa (Pusa artist).

6. ,, *pinastrina pinastrina* (Mart.), dark form (Scott).

7. ,, ,, ,, ,, pupa (Scott).

8. *Rhyncholaba acteus* (Cram.), 4th instar, dark form (Bell).

9. ,, ,, ,, 5th instar, green form (Scott).

10. ,, ,, ,, pupa (Scott).

11. *Theretra castanea* (Moore) (Scott).

12. ,, *pallicosta* (Walk.) (Indian artist).

13. ,, ,, ,, pupa (Indian artist).

14. *Rhagastis velata* (Walk.) (Scott).

15. ,, *aurifera aurifera* (Butl.), green form (Scott).

16. ,, ,, ,, ,, pupa (Scott).

17. ,, *olivacea* (Moore), green form (Scott).

18. ,, ,, ,, pupa (Scott).

19. ,, *confusa* Roths. & Jord. (Scott).


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PLATE VII.

Larvæ of Sphingidæ.

Fig. 1. *Rhagastis albomarginatus albomarginatus* Roths. (Scott).

2. ,, ,, ,, ,, ,,

3. ,, ,, ,, ,, pupa (Scott).

4. *Cechenena lineosa scotti* Roths., 4th instar (Scott).

5. ,, ,, ,, ,, 5th instar (Scott).

6. ,, ,, ,, ,, pupa (Scott).

7 ,, ,, *lineosa* (Walk.) (Scott).

8. *Acherontia lachesis* (Fabr.), pupa (Indian artist).

9. *Degmaptera mirabilis* (Roths.), pupa (Pusa artist).

Imagines.

10. *Langia zenzeroides zenzeroides* Moore (Scott).

11. *Oxyambulyx sericeipennis agana* Jord., ♀ (Scott).

12. *Marumba sperchius gigas* (Butl.) (Scott).

13. *Rhyncholaba acteus* (Cram.) (Scott).

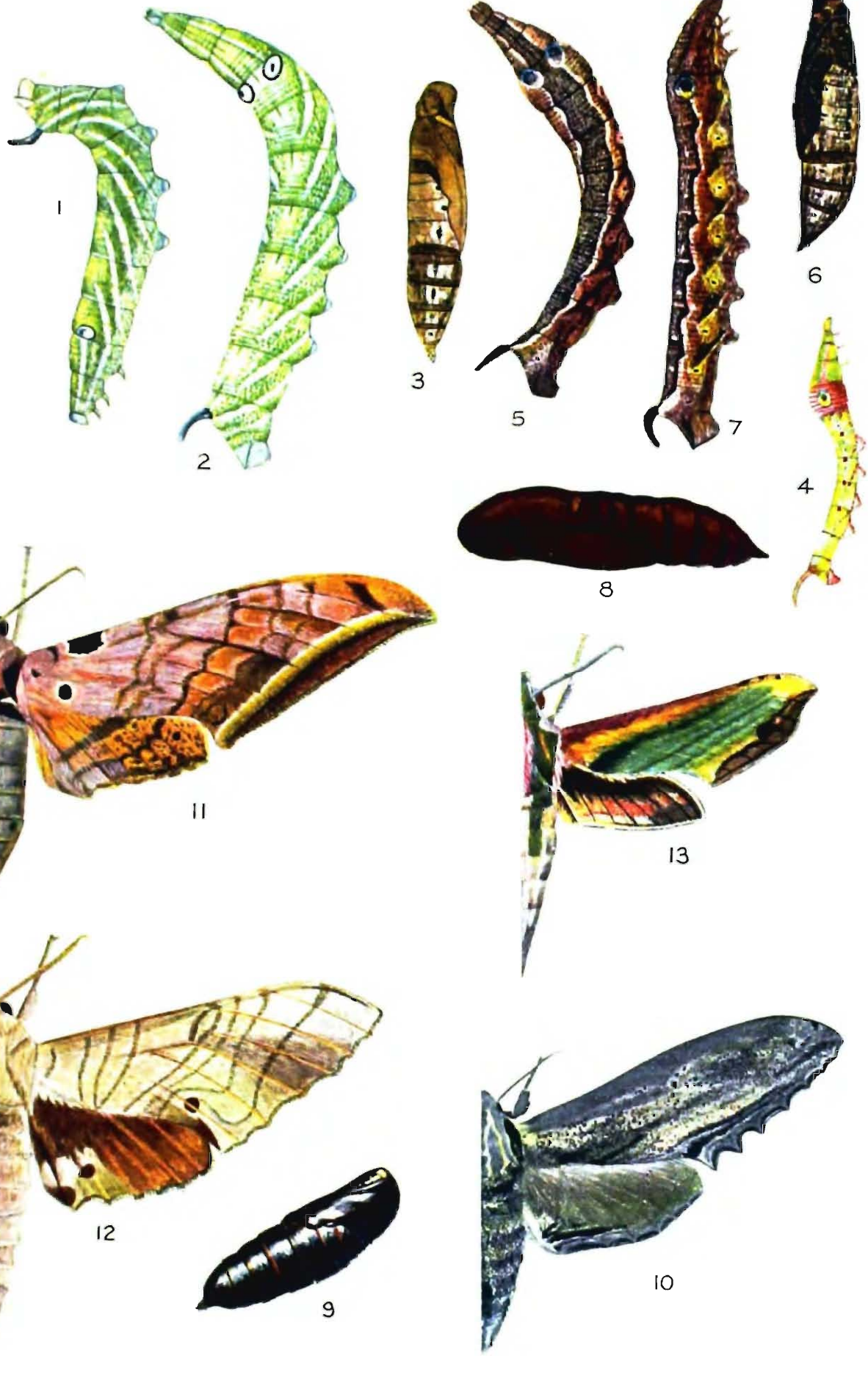

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PLATE VIII.

Larvæ of Sphingidæ.

Fig. 1. *Acherontia styx styx* (Westw.), 5th instar, green form (Scott).

2. ,, ,, ,, ,, ,, ,, form (Scott).

3. *Compsogene panopus panopus* (Cram.), pupa (Indian artist).

4. *Dolbina inexacta* (Walk.) (Scott).

5. *Psilogramma menephron menephron* (Cram.), pupa (Indian artist).

6. *Oxyambulyx belli* Jord., pupa (Indian artist).

7 ,, *subocellata* (Feld.), 3rd instar (Bell).

8. ,, ,, ,, 5th instar (Bell).

9. ,, ,, ,, pupa (Bell).

SPHINGIDÆ

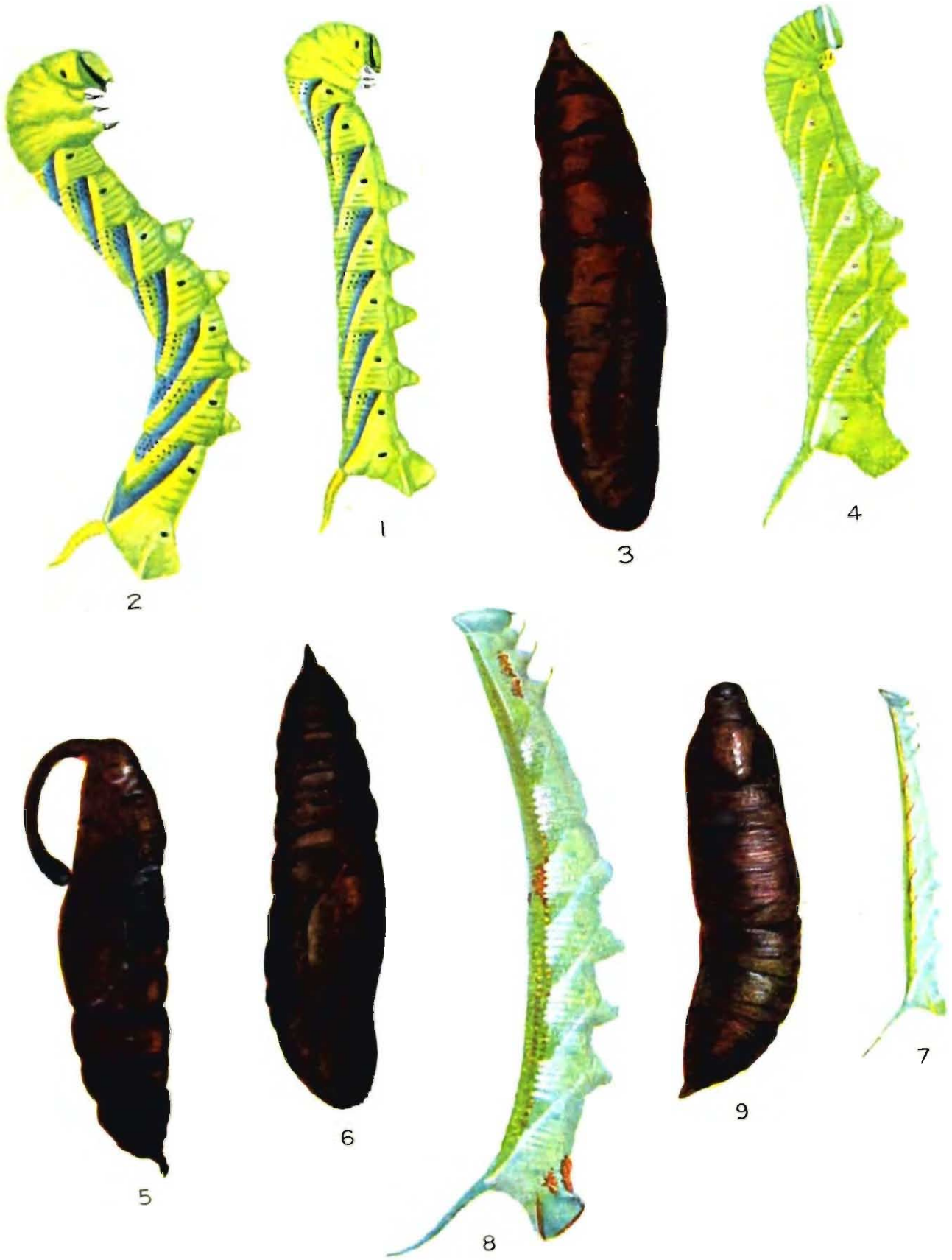


PLATE IX.

Larvæ of Sphingidæ.

Fig. 1. *Herse convolvuli* (Linn.), 3rd instar, dark form (Scott).

2. ,, ,, ,, 4th ,, ,, ,, ,,

3. ,, ,, ,, 5th ,, ,, ,, ,,

4. ,, ,, ,, 5th ,, ,, ,, ,,

5. , ,, ,, 5th ,, ,, ,, (Bell).

6. ,, ,, ,, 5th ,, green form (Scott).

7. ,, ,, ,, pupa (Scott).

8. *Meganoton nyctiphanes* (Walk.) (Bell).

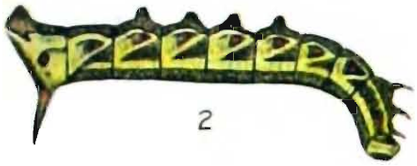
9. ,, ,, ,, pupa (Bell).



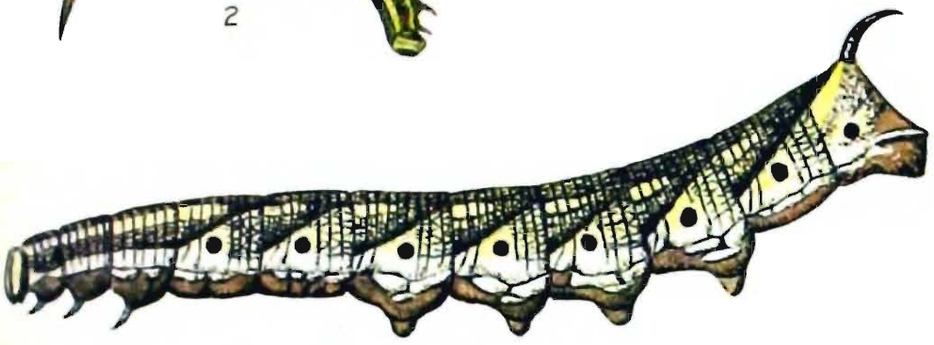
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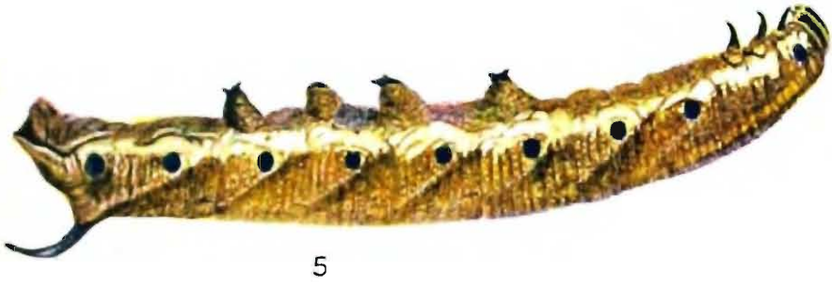
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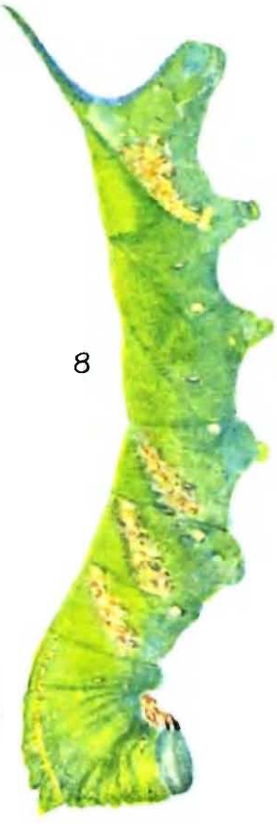
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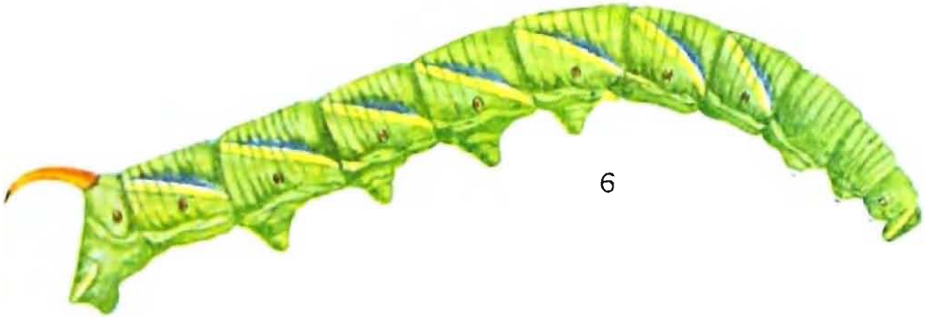
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PLATE X.

Larvæ of Sphingidæ.

Fig. 1. *Rhodoprasina callantha* Jord., 4th instar (Scott).

2. *Cephonodes picus* (Cram.), dark form (Bell).

3. *Hæmorrhagia saundersi* (Walk.) (Scott).

4. *Sataspes infernalis* f. *infernalis* (Westw.) (Bell).

5. ,, ,, ,, ,, (Bell).

6. ,, ,, ,, ,, pupa (Bell).

7 *Gurelca masuriensis* (Butl.), dark form (Scott).

8. ,, *hyas hyas* (Walk.) (Scott).

9. *Angonyx testacea testacea* (Walk.) (Indian artist).

10. ,, ,, ,, ,, pupa (Indian artist).

11. *Cizara sculpta* (Feld.), pupa (Bell).

12. *Rhopalopsyche nycteris nycteris* (Koll.), green form (Scott).

13. ,, ,, ,, ,, dark form (Scott)

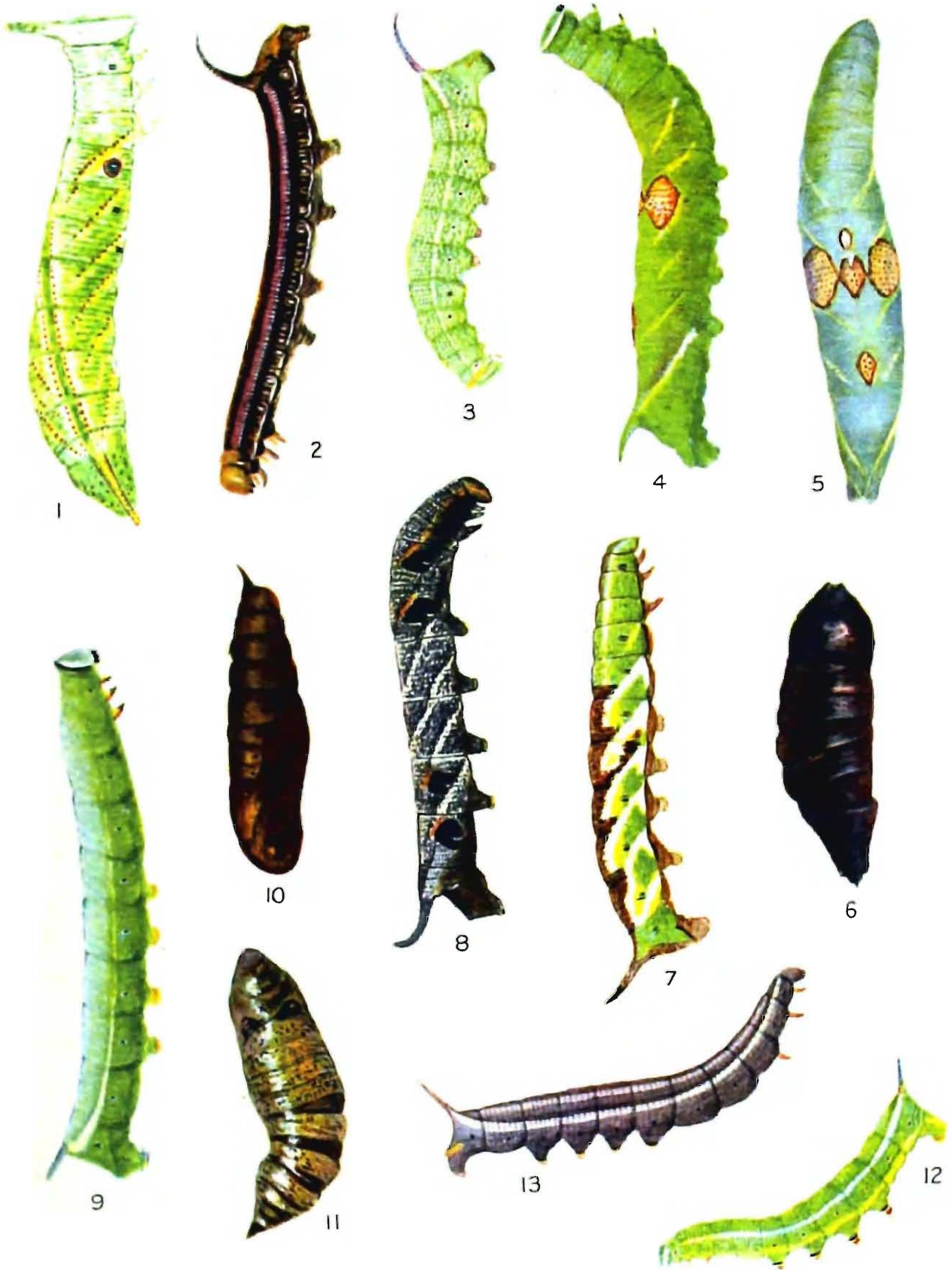

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PLATE XI.

LARVÆ OF SPHINGIDÆ.

Fig. 1. *Macroglossum regulus* (Boisd.) (Bell).
2. ,, ,, ,, ,,
3. ,, *affictitia* (Butl.), dark form (Bell).
4. ,, ,, ,, green form (Bell).
5. ,, ,, ,, pupa (Bell).
6. ,, *particolor* Roths. & Jord., green form (Bell).
7 ,, ,, ,, dark form (Bell).
8. ,, ,, ,, pupa (Bell).
9. ,, *belis* (Linn.) (Bell).
10. ,, ,, ,, pupa.
11. ,, *assimilis* Swains. (Bell).
12. ,, ,, ,, pupa (Bell).
13. ,, *pyrrhosticta pyrrhosticta* (Butl.), green form (Scott).
14. ,, ,, ,, (Butl.), pupa (Pusa artist).
15. ,, *insipida insipida* (Butl.) (Indian artist).
16. ,, ,, ,, ,, pupa (Indian artist).
17. ,, *vicinum* Jord. (Bell).
18. ,, ,, ,, pupa (Bell).
19. ,, *fringilla* (Boisd.) (Bell).
20. ,, ,, ,, pupa (Bell).

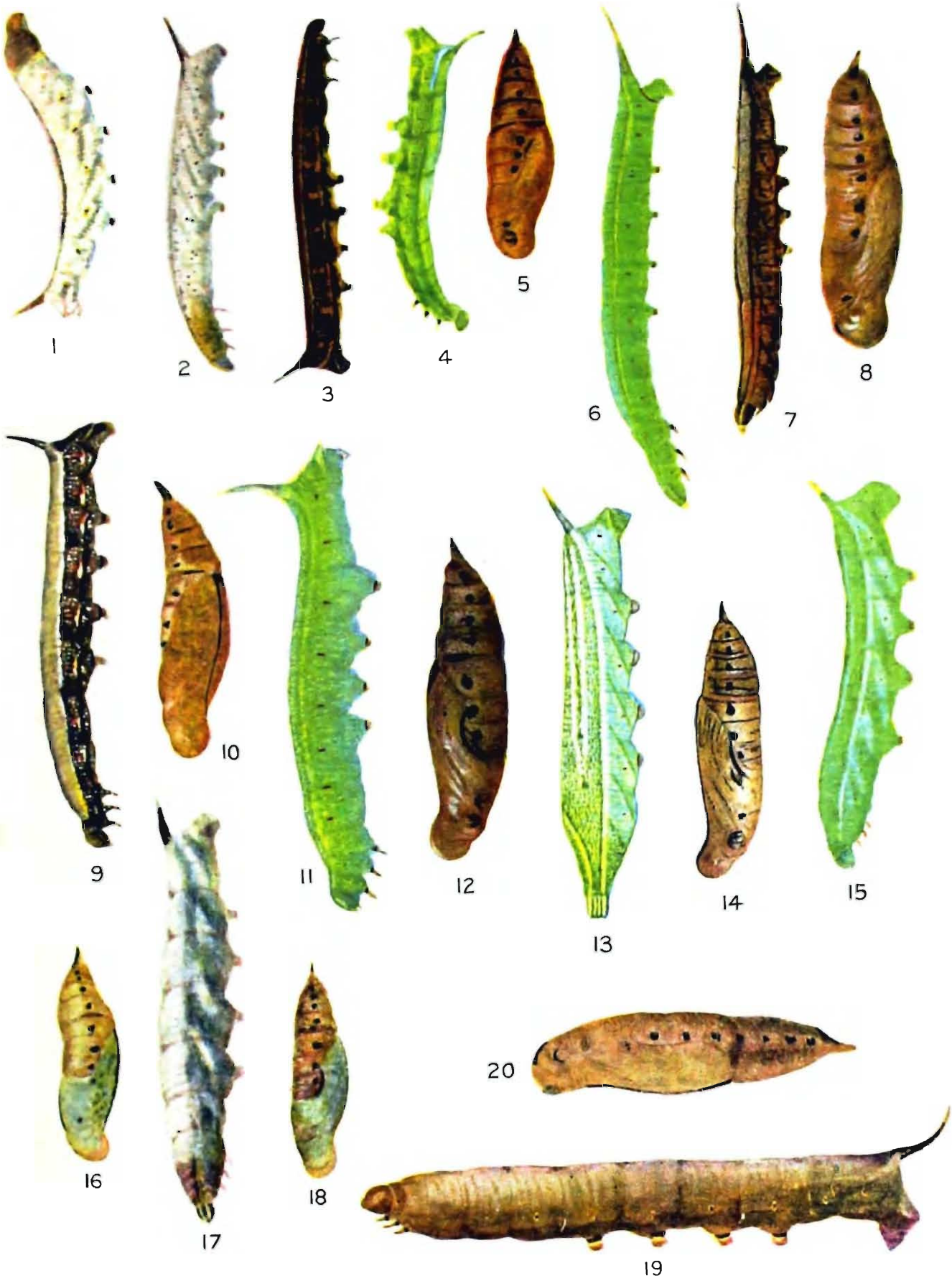

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PLATE XII.

Fig. 1. *Celerio lineata livornica* (Esp.) (Scott).

2. *Hæmorrhagia saundersi* (Walk.) (Scott).

3. *Rhopalopsyche nycteris nycteris* (Koll.) (Scott).

4. *Cechenena lineosa scotti* Roths. (Scott).

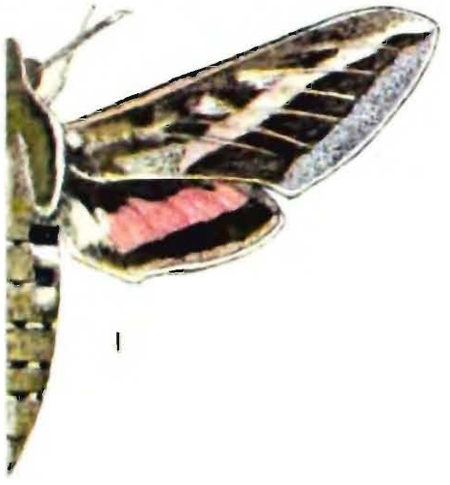
5. *Theretra clotho* (Drury), larval ocellus.

6. ,, *alecto alecto* (Linn.), pupa (Scott).

7 *Degmaptera mirabilis* (Roths.), ♀ (Pusa artist).

8. *Cizara sculpta* (Feld.) (Bell).

9. *Rhagastis albomarginatus albomarginatus* (Roths.) (Scott).



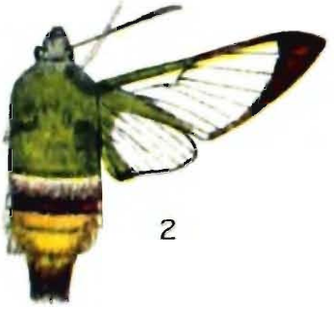
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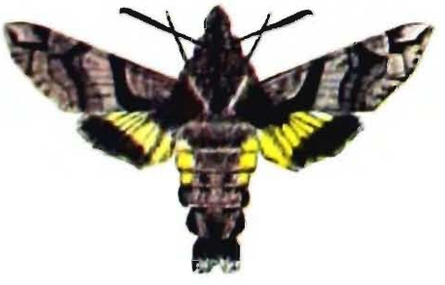
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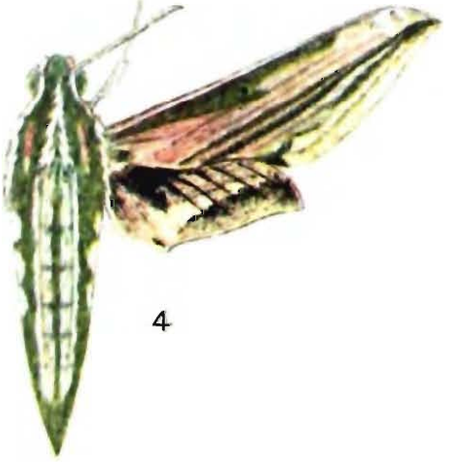
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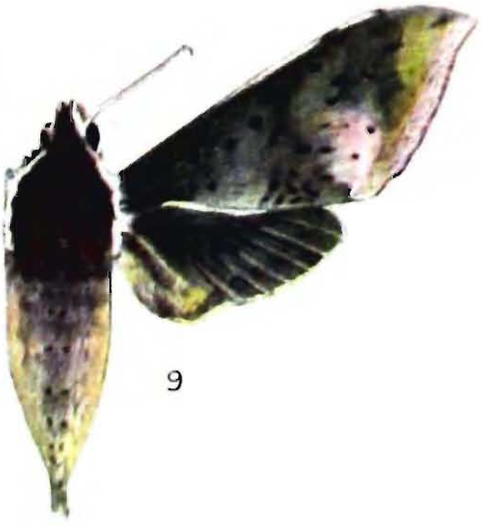
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PLATE XIII.

LARVÆ OF SPHINGIDÆ.

Fig. 1. *Acherontia lachesis* (Fabr.).

2. *Psilogramma menephron menephron* (Cram.).

3. *Apocalypsis velox* Butl.

4. ,, ,, ,,

5. *Pseudodolbina fo fo* (Walk.).

6. ,, ,, ,, ,,

7. *Polyptychus dentatus* (Cram.).

8. *Marumba sperchius gigas* (Butl.).

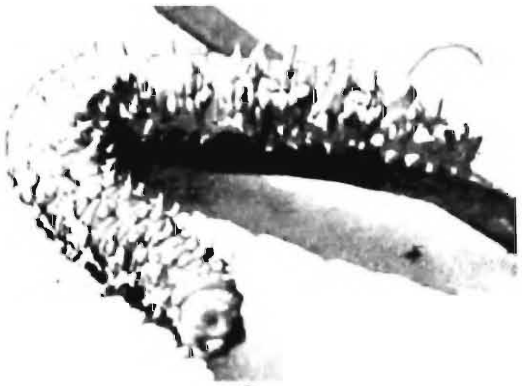
9. *Oxyambulyx sericeipennis agana* Jord.



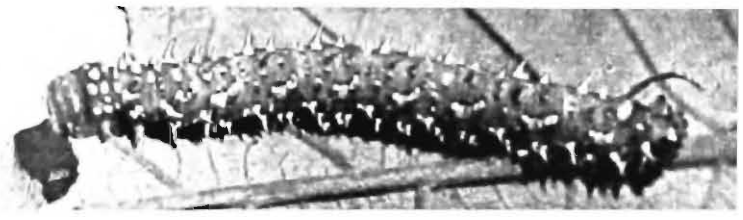
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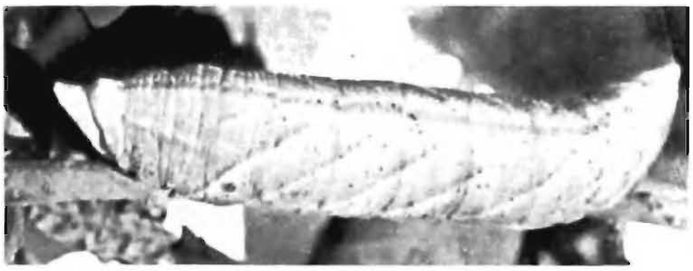


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PLATE XIV

LARVÆ OF SPHINGIDÆ.

Fig. 1. *Rhodoprasina callantha* Jord.
2. *Degmaptera mirabilis* (Roths.).
3. *Clanidopsis exusta* (Butl.).
4. ,, ,, ,,
5. *Ampelophaga khasiana khasiana* Roths.
6. *Cypa pallens enodis* Jord.
7 *Panacra busiris atima* Roths. & Jord.
8. *Deilephila hypothous* (Cram.).
9. *Cizara sculpta* (Feld.).
10. ,, ,, ,, pupa.
11. *Panacra mydon mydon* Walk.
12. ,, *metallica anfracta* Gehl.
13. ,, ,, ,, ,,
14. *Acosmeryx naga* (Moore).



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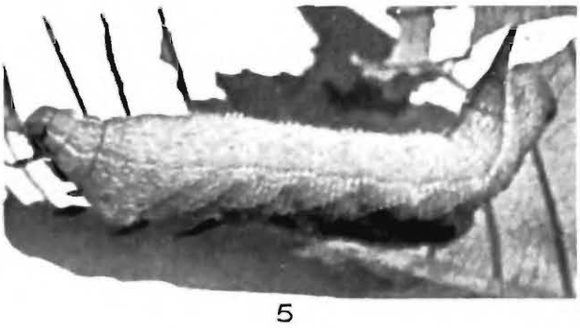
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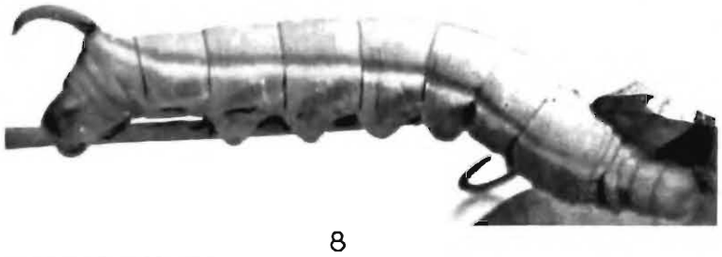
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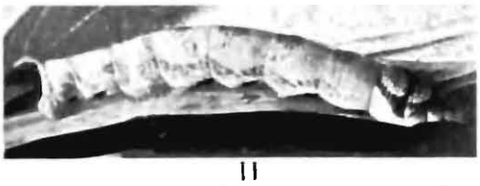
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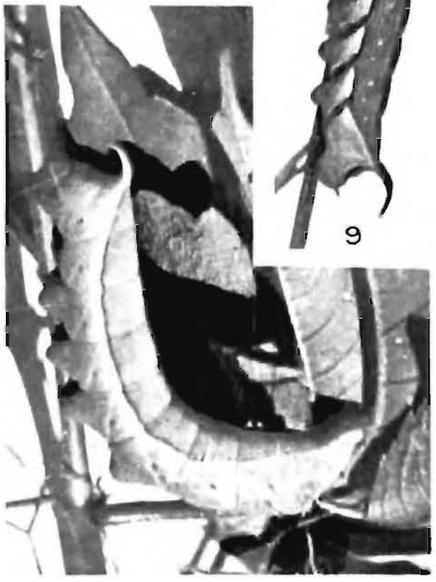
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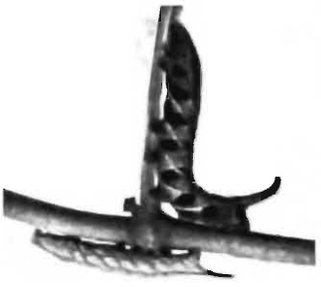


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PLATE XV

LARVÆ OF SPHINGIDÆ.

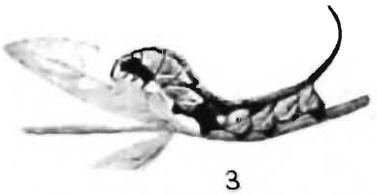
Fig. 1. *Gurelca hyas hyas* (Walk.).
2. ,, *masuriensis* (Butl.).
3. ,, *himachala himachala* (Butl.).
4. *Macroglossum pyrrhosticta pyrrhosticta* (Butl.).
5. ,, *troglodytus* (Boisd.).
6. *Hippotion celerio* (Linn.).
7. *Rhagastis olivacea* (Moore).
8. *Pergesa elpenor macromera* (Butl.).
9. *Rhagastis confusa* Roths. & Jord.
10. ,, ,, ,,
11. ,, *albomarginatus albomarginatus* (Roths.).
12. *Theretra clotho clotho* (Drury).
13. *Cechenena mirabilis* (Butl.).



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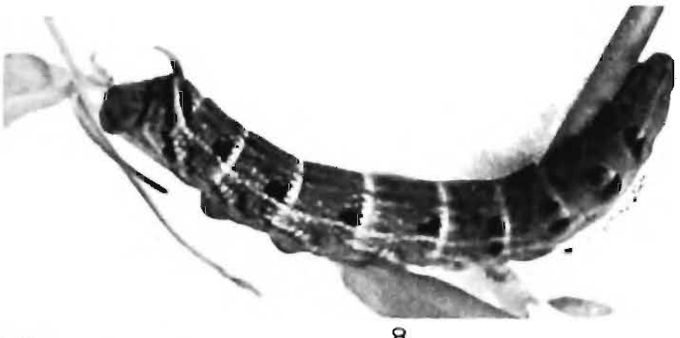
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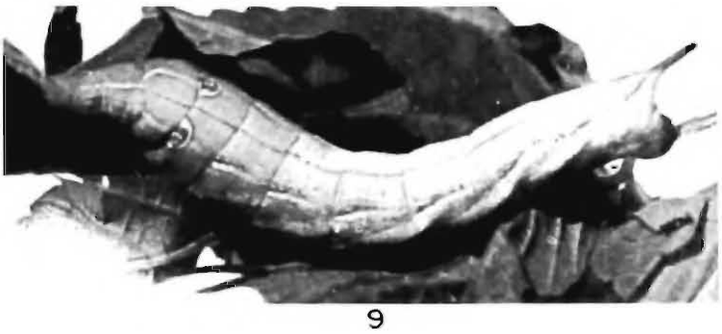
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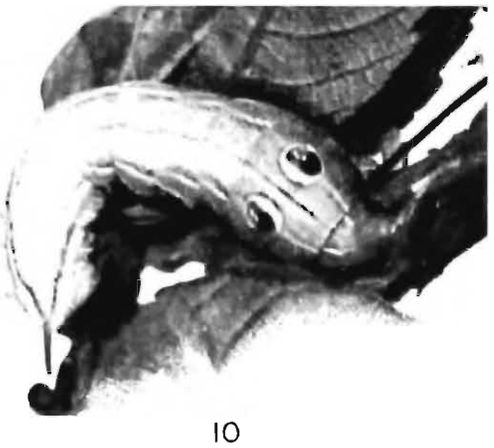
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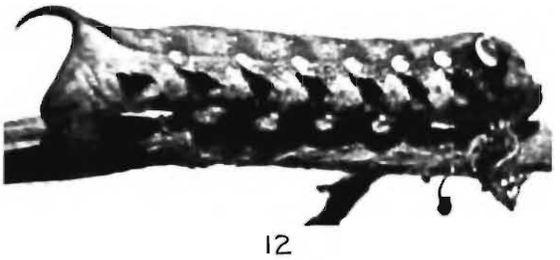
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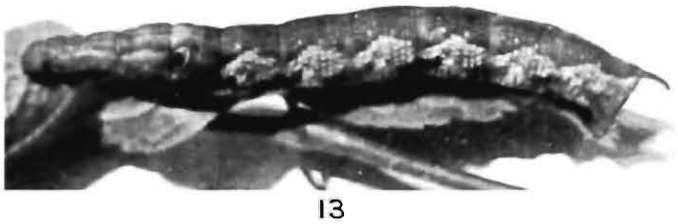
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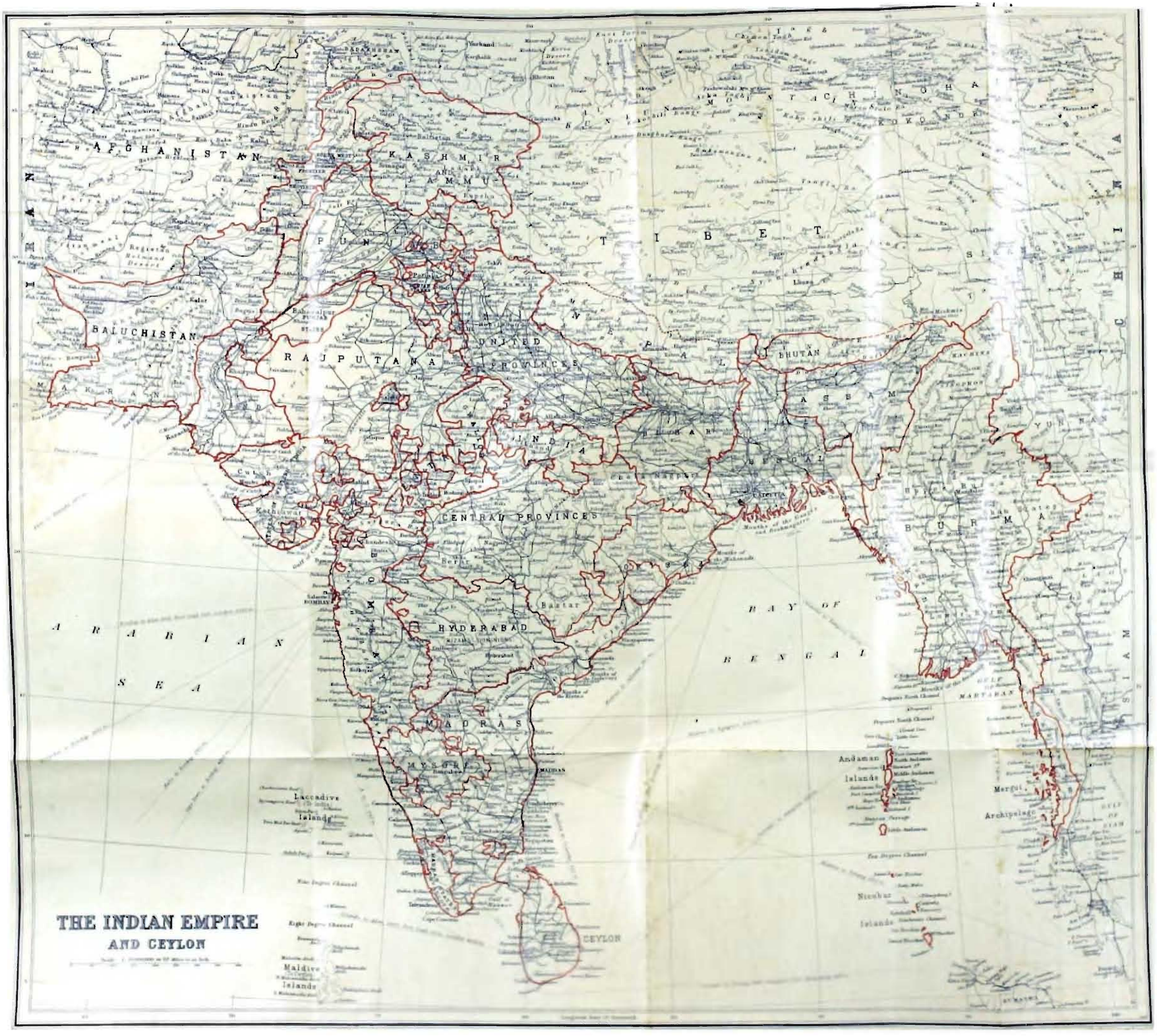
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