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CHAPTER VI.

LECANIINÆ.

THE *Lecaniinæ* are distinguished from those other families that have males with simple eyes and females with setiferous anal ring by the following characters:—Females with posterior extremity cleft. Anal orifice closed above by an operculum consisting typically of a pair of triangular hinged plates (the anal plates or anal scales) forming a valve. Mentum usually monomerous. Body unsegmented.

The posterior cleft is always present in the early stages, and usually so throughout life, though in some species its edges become more or less fused together in the adult insect. In the aberrant genus *Aclerda*—at present included amongst the *Lecaniinæ*—the anal operculum consists of a single undivided plate, formed by the fusion of the usual hinged plates.

The body may be naked, as in *Lecanium;* partially concealed beneath a woolly or felted sac, as in *Signoretia* or *Lichtensia;* completely enclosed in a felted sac, as in *Eriopeltis;* covered with a glassy test, as *Inglisia;* or a waxy test, as *Ceroplastes;* with various intermediate modifications. There may be a conspicuous ovisac, as in *Pulvinaria.*

The derm may be densely chitinous, or soft: the limbs well developed, rudimentary, or entirely wanting. The margin of the body has usually a well-defined fringe of hairs or spines, and the stigmatic clefts are armed with modified spines.

The young larva is always active; with well-developed legs and antennæ, the latter having six distinct joints. The posterior extremity is cleft to the anal aperture, and each of the anal plates supports a longish stout seta at its apex.

The female insect, in its second stage, is sometimes termed the nymph. This stage differs from the larval form principally in size in the naked forms, or by an increase of the secretionary covering in other genera.

The adult female insect may eventually differ very greatly

from that of the previous stage, though in some genera, *e.g.*, *Lecanium*, the change is not at first very marked. In *Eriopeltis* and *Lecanochiton*, and in individual species of some other genera, the final stage is indicated by an apodous condition. Usually, but not invariably, there is an increase of the number of antennal joints. The limbs, when present, are firmer, and there is often a marked thickening and hardening of the chitinous derm. The formation of a definite sac (separable from the insect) is usually characteristic of the adult stage only. In *Eriochiton*, however, the sac is said to appear in the second stage. The four spiracles open on the ventral surface, usually at some distance from the margin. The posterior extremity is normally deeply cleft, though, in some cases, the margins of the cleft become confluent. The anal orifice opens at the base of this cleft, and is guarded above by a valvular operculum composed of two hinged plates. At the extremity of the rectum is an eversible sac, containing the so-called anal ring, which bears six or more stout hairs. This sac is usually retracted; but, during the evacuation of the excreta, which are of a liquid saccharine nature, it is everted and exserted between the chitinous plates of the operculum, when the hairs of the anal ring form a support for the globule of excrement. The globule finally bursts, and the excreta are projected in the form of a fine spray. The anal ring sometimes secrets a fine waxy tube, which enables the excreta to be carried still further away from the body of the insect. The genital orifice opens on to the under surface, at the base of the anal cleft. Its aperture is very inconspicuous.

The male insect does not become in any way differentiated until after the first ecdysis. Even in the second stage it is often extremely difficult to distinguish the sexes until the formation of the puparium. In the greater number of genera the male puparium consists of a glassy test, symmetrically divided by raised lines into well-defined plates. In the genus *Ericerus*, however, the puparia are said to be enveloped in a mass of wax. In *Cryptes* the puparium is subcylindrical and felted. In *Inglisia* the plates are often highly sculptured. In several genera the male has not been recognised in any stage.

After the formation of the puparium, a second ecdysis takes place, revealing the pupa in which the limbs of the future imago are now plainly indicated.

The adult male differs from that of the *Diaspidinæ* chiefly in the more marked separation of the head from the thorax by a

narrow neck. The caudal extremity often bears a pair of conspicuous waxy filaments.

The number of stages, separated by the casting of the skin, is believed to be three in the female; but as the process of moulting in this family is very obscure, the point requires confirmation. I have myself observed the shedding of the skin in the genus *Lecanium*. The exuvium is very thin and delicate, becoming twisted up into a minute formless shred as it is pushed off the body. The old skin may sometimes be seen still adhering to the posterior extremity of a recently transformed female *Lecanium*. It is difficult to understand how such genera as *Ceroplastes* or *Vinsonia*, in which the waxy test is closely adherent to the body of the insect throughout life, can get rid of their exuvia. It is possible that the cast skins may become incorporated into the waxy test. The fact that in *Ceroplastes* the pad of opaque wax that covers the dorsum of the larva may always be recognised as a central spot on the test of the adult, and that the pointed lateral processes of the larval test can be distinguished at intervals on the submarginal area of the fully formed test lends colour to this theory of incorporation.

While in the female only two changes of skin are known, in the male there are certainly three moults before the emergence of the winged adult. The first of these takes place before the formation of the puparium. The second signifies the transformation to the pupal stage. The third reveals the imago. The two last exuvia are thrust out from beneath the posterior extremity of the puparium.

Union of the sexes takes place immediately after the shedding of the second skin in the female while the insect is still quite small. After impregnation the female usually increases very greatly in size until—when ready to deposit eggs—it may be many times the bulk of the sexually mature insect. A want of appreciation of this fact has led some authors to mistake the early adult female for the nymph (or female of second stage), and to describe it as such.

The family includes several well-marked genera, *e.g.*, *Lecanium*, *Pulvinaria*, *Ceroplastes*, *Vinsonia*, *Inglisia*, &c.; but it also contains numerous other genera that lend themselves with difficulty to any clear synopsis, and some that are doubtfully separable from their allied genera. The presence or absence of test, and the nature of that test when present, are usually taken as synoptical characters;

but these characters are very relative, and occur in all degrees of modification. It is often difficult to decide whether the test of a particular genus should be classed as waxy, or nacreous, or even glassy, especially when individual species vary considerably in their characters. Even the presence or absence of a test is relative. For instance, the genus *Pulvinaria* is usually classed as naked; but the body of the female is sometimes more or less completely concealed beneath a loose woolly covering. Then *Eriochiton* may have a complete test in the adult female, or it may be incomplete or entirely wanting. The following attempt at a synopsis will therefore be only a rough guide. More careful details of the generic characters will be found under the headings of the several genera. Some of the more obscure genera (of those not occurring in the Indian region) have been omitted from the synopsis, but are mentioned in a supplementary paragraph. Those genera included in brackets have not yet been recorded from Ceylon.

SYNOPSIS OF GENERA.

A. Adult ♀ naked; without definite sac or test.
  (*a*) ♀ without ovisac.
    (a^1) ♂ puparium glassy, flat; divided into distinct plates.
      (a^2) superterranean ..... LECANIUM, Burm.
      (b^2) subterranean ..... (LECANOPSIS, Targ.)
    (b^1) ♂ puparium subcylindrical; felted; with glassy operculum ..... (CRYPTES, Crawf.)
  (*b*) ♀ with concealed or rudimentary ovisac; apparent externally as a mere fringe of white secretion.
    PROTOPULVINARIA, Ckll.
  (*c*) ♀ with distinct ovisac.
    (a^1) ♂ puparia isolated.
      (a^2) ovisac horizontal ..... PULVINARIA, Targ.
      (b^2) ovisac conical (Cockerell)...(PULVINELLA, Hempel.)
    (b^1) ♂ puparia coalescing; enclosed in a mass of wax.
      (ERICERUS, Guer.)

B. Adult ♀ with partial cottony or felted sac.
  (*a*) sac elongated; with anterior aperture revealing part of insect.
    (a^1) ♀ elongate, narrow ..... (SIGNORETIA, Targ.)
    (b^1) ♀ oval ..... (LICHTENSIA, Sign.)
  (*b*) sac consisting of waxy filaments springing from the margin and recurved over the sides of the insect.
    CERONEMA, Mask.

C. Adult ♀ with complete sac, free from body of insect.
  (*a*) ♀ without legs ... . (ERIOPELTIS, Sign.)
  (*b*) ♀ with legs.
    (a^1) tarsi normal; sac felted ..... (FILIPPIA, Targ.)
    (b^1) tarsi normal; sac glassy ..... CEROPLASTODES, Ckll.
    (c^1) tarsi normal; sac felted; always present in second stage, sometimes absent in adult.
      (ERIOCHITON, Mask.)
    (d^1) tarsi of front legs dimerous; sac felted.
      (EXÆRETOPUS, Newst.)

D. Adult ♀ with waxy, horny, nacreous, or glassy test, attached to body of insect.
  (*a*) test waxy, opaque, thick ..... CEROPLASTES, Gray.
  (*b*) test waxy, thin; with marginal fringe of tooth-like processes ..... (CTENOCHITON, Mask.)
  (*c*) test waxy, with radiating glassy processes, giving the insect a star-like appearance ..... VINSONIA, Sign.
  (*d*) test brittle; glassy or nacreous; divided into distinct plates and striated with air-cells ..... INGLISIA, Mask.
  (*e*) test glassy, flat; divided into two parts (hardly separable from *Inglisia*) ..... (PLATINGLISIA, Ckll.)
  (*f*) test nacreous; divided into two conical halves.
    (PARAFAIRMAIRIA, Ckll.)
  (*g*) test nacreous or glassy; single; conical; striated.
    (EDWALLIA, Hempel.)
  (*h*) test glassy; without air-cells ..... (PSEUDOKERMES, Ckll.)
  (*i*) test horny; including pellicle of second stage; insect apodous ..... (LECANOCHITON, Mask.)

E. Adult ♀ naked; apodous; terminal segments pygidiform.
  ACLERDA, Sign.

The following new genera have been proposed recently; but, having no personal acquaintance with the species concerned, I can only quote the characters given by their founders:—

Alecanopsis, Ckll.—'Adult ♀ dark red-brown, very convex, abdominal region conspicuously segmented; antennæ short and thick, six-jointed; legs very short, rudimentary; Australian.' (Cockerell, *Canadian Entomologist*, Feb. 1901.) [Apparently a geographical genus. With difficulty separable from *Lecanopsis*.—E. E. G.]

Toumeyella, Ckll.—Similar to *Alecanopsis*, but adult ♀ not conspicuously segmented. (Cockerell, *Canad. Entom.*, Feb. 1901.)

Myxolecanium, Beccari.—'Mentum of ♀ prolonged, forming a transversely corrugated sheath.' (Cockerell, *Canad. Entom.*, Feb. 1901.)

Alichtensia, Ckll.—'♀ scale elongate, with a glassy covering, much like the male scales of *Lecaniinæ;* a little felted matter, in threads, is visible on the underside of the glassy scale. No rows of air-cells. No ovisac. Antennæ and legs well developed.' (Cockerell, *Ann. and Mag. of Nat. Hist.*, June, 1902.

Austrolichtensia, Ckll.—'♀ enclosed in a sac which has an elongated dorsal aperture. Margin of ♀ with very long bristles. Antennæ and legs well developed. Skin with numerous tubular glands. Anal ring with six hairs.' (Cockerell, *Ann. and Mag. of Nat. Hist.*, June, 1902.)

Philephedra, Ckll.—'Body of ♀ soft, not chitinous, pink in front, greenish on dorsum, with some black specks: back with patches of white secretion.' (Cockerell, *Canad. Entom.*, Nov. 1899.) 'Margin with fringe of sharp spines.' (*Ann. and Mag. of Nat. Hist.*, June 1902.) [Originally proposed as a subgenus of *Pulvinaria*, but now considered, by Prof. Cockerell, to be more nearly allied to *Lichtensia*. The introduction of colour characters into generic diagnoses, more especially when founded upon a single species, seems rather a dangerous innovation.—E. E. G.]

Neolecanium, Parrott.—'Adult ♀ covered with a more or less distinct glassy test: skin covered with large glands.' (Cockerell, *Canad. Entom.*, Feb. 1901.)

Tectopulvinaria, Hempel.—'Adult ♀ secreting an ovisac as in *Pulvinaria*. Entirely covered with white secretion resembling felt.' (Hempel, *Coccidæ of Brazil*, 1900.)

Cardiococcus, Ckll.—'Legs and antennæ small or rudimentary; insect covered by a brittle waxy scale, with a dorsal pit or foramen.' (Cockerell, *Ann. and Mag. of Nat. Hist.*, Feb. 1903.) [Scarcely separable from *Inglisia*.—E. E. G.]

LECANIUM,* *Burmeister.*

Adult female naked, or covered with inconspicuous laminæ of wax, or slightly dusted with powdery wax. Without definite sac or test. Oviparous or ovoviviparous. The eggs or young larvæ covered by the body of the insect, no external ovisac being formed. Form very variable; contour ranging from almost linear (*acutissimum*) to circular (*hemisphericum*); flat to hemispherical, or rarely almost globular. Derm soft and shrivelling after death; or hard and rigid, forming a protective covering for the ova. Limbs usually fully developed, but small and inconspicuous; concealed beneath the body of the insect.

Antenna with from six to eight joints. When the smaller number occurs, the third joint is always very long, and often bears indications of incomplete subdivision into two or three false joints in the form of pale spaces or scars extending partially across the segment (*pl.* LXI. *fig.* 8). Sometimes these scars almost encircle the joint, but never show any sharply defined boundary line, such as is noticeable at the normal divisions. The terminal joint bears from eight to twelve stout hairs, and one (or two) similar hairs spring from a point near the distal extremity of each

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* The name *Lecanium* has, until quite recently, been constantly referred to Illiger, on the authority of Burmeister (*Handbook of Entomology*, vol. ii., p. 69, 1835). But the recent researches of Mrs. C. H. Fernald (*Canadian Entomologist*, 1902, p. 177) have shown that this name was never formally published by Illiger, but occurs either in some unpublished manuscript or existed only on a label. It would appear, therefore, that Burmeister, as the first publisher of the name, must be credited as the author of the genus. Apart from the question of authority, there appears to be some doubt as to whether the name *Calypticus* (of Costa) has not precedence of *Lecanium*. (*Vide* Mrs. Fernald, *loc. cit.*, p. 178.) As the question of priority is still unsettled, and—as far as I can see—likely to remain a matter of dispute for some considerable time, it seems right that the better known and more generally accepted name (*Lecanium*) should be given the benefit of the doubt and allowed to stand. I should personally consider any unnecessary interference with such a long-established name a grave misfortune.

[Since the above was written, Mrs. Fernald's *Catalogue of the Coccidæ of the World* has been published. In this work many radical alterations in the nomenclature of the Coccidæ are propounded. Amongst other changes, *Lecanium* gives place to the much earlier name *Coccus*, Linn. See also Supplementary Note, p. 248.]

of the other joints. But when more than six joints occur, the third (*fig.* 9), or third and fourth (*fig.* 10), are often without subapical hairs. These facts seem to indicate a primitive six-jointed antenna, as is typical in the early stages. At the extremities of each joint there is usually a pale band, where the chitin is less dense, to allow of flexion ; but, in some cases, these bands are absent, the two joints being immovably fused.

A series of four small hairs are usually present between the bases of the antennæ (*pl.* LXI. *fig.* 1-*b*).

The mouth parts (*pl.* LXI. *fig.* 2) are of normal type, and differ but little from those of the *Diaspidinæ*. The *rostrum* (A) consists of a chitinous cradle, closed in front and behind by a thin membranous plate, the ventral half of which is supposed to represent the clypeus, or clypeus and labrum combined (Berlese). In the upper part are four large apertures, viz., an anterior (ventral) and posterior (dorsal), and two lateral apertures. The *mentum* (B) is monomerous, consisting of a single piece, infolded till the edges meet to form a groove, at the apex of which is an orifice through which the rostral setæ are exserted. The bases of the four setæ are separate, and arise in the large lateral apertures of the chitinous cradle (*pl.* LXI. *fig.* 2-*a*). They meet, near the extremity of the clypeus, as fine contiguous hairs. When retracted, they rest in a loop in a sac (*c*) in the body cavity below the mentum. A strap-shaped process (*b*) [the hypopharynx, according to Berlese] projects upwards from between the setæ through the anterior aperture of the cradle.

The legs are usually completely developed, with distinct joints; though a few species (*e.g.*, *expansum*) are apodous. The trochanter commonly bears a single longish stout hair. Foot with four digitules, of which the tarsals (*fig.* 13-*b*) are fine knobbed hairs, and unguals (*fig.* 13-*d*) spatulate or broadly dilated.

The spiracles open on the under surface, at some distance from the margin. The first pair (*fig.* 1-*d*), just exterior to the coxæ of the anterior legs. The second pair (*fig.* 1-*e*), at a pair about half way between the coxæ of the median and posterior legs.

The stigmatic clefts (*fig.* 1-*f*) are marginal, shallow: usually containing three or more stout spines.

An irregular row of small glandular pores (or spinnerets) (*fig.* 1-*c*) extends from the stigmatic cleft to the corresponding spiracle.

There is usually a pair of stout hairs, near the median line, on each of three or four abdominal segments immediately above the genital orifice (*fig.* 1-*g*).

The margin of the body bears a more or less distinct fringe of hairs or spines (each arising from a definite tubercle), which may be simple and pointed (*fig.* 6); dilated and frayed or fimbriate (*figs.* 4, 5); spiniform (*fig.* 3); or flabelliform (*fig.* 7). These differences may serve as characters for the separation of this somewhat unwieldy genus into sections.

The stigmatic spines (usually three) are attached dorsally at the base of each stigmatic cleft. They may be sharply pointed or bluntly rounded. The median spine is often considerably longer and stouter than the other two.

There is often a widely separated submarginal series of small tubercles, which appear to be of a glandular nature (*pl.* LXXX., *fig.* 3).

The eyes are of a very rudimentary character, usually consisting of a small black pigmented spot situated in an ill-defined clear space (*pl.* LXI. *fig.* 1-*a*). In old examples the eye-spots may be obliterated by the thickening and darkening of the chitinous derm. Their position may be close to, or at some distance from, the margin.

The plates of the anal operculum are typically triangular (*fig.* 11), though occasionally they assume a semicircular outline (*fig.* 12). Their form and size afford good specific characters. These characters do not vary with the size of the individual, but are practically constant for each of the several stages. For convenience of description, the line of attachment of each scale may be called its *base* (*fig.* 11-B): the *inner edge* being the side of the triangle that is normally in apposition with the corresponding edge of the opposite scale (*fig.* 11-C): while the third side may be termed the *outer edge* (*fig.* 11-A). The angle formed by the inner and outer edges may be known as the *apex* (*fig.* 11-*a*); the *outer*, (*b*), and *inner* (*c*) *angles* being formed by the base with the outer and inner edges respectively (*pl.* LXI. *fig.* 11). In the semicircular form of plate, the base and outer edge form a continuous curve, and the outer angle is lost. The apex of each plate usually bears three small hairs or spines.

The action of the setiferous anal ring has been described amongst the characters of the family *Lecaniinæ*. The so-called anal ring consists of a pair of curved chitinous plates encircling the actual anus, which is situated at the inner end of an eversile sac. Each of these plates bears three or four long stout hairs, so that the anal ring is said to bear six or eight hairs, as the case may be.

When the number is eight, two of them are usually much shorter and finer than the remainder, which project beyond the mouth of the sac. The ventral lip of the sac often bears four short hairs, which are sometimes confused with those of the anal ring, giving rise to the statement that certain species possess ten hairs on the setiferous ring. Another common cause of error originates in the fact that the eversile sac is itself delicately fluted, producing the appearance of a number of parallel hairs springing from the anal ring (*pl.* LXXXI. *fig.* 9). The ring also bears a number of glandular pores secreting a waxy material which coats the hairs, and is sometimes produced into long curling filaments, as in *L. caudatum*. Some scattered spinnerets are usually noticeable on the venter, around the genital orifice (*pl.* LXI. *fig.* 1-*h*).

The dorsum often exhibits a more or less definite pattern, formed by cells in the thickness of the derm. These dermal cells may be scattered and rounded, or densely packed and polygonal. They communicate with the surface by a minute pore. When no definite cells occur, the minute translucent pores are still nearly always present. They are probably concerned in the secretion of a varnish-like surface film. It should be noted that the distinctness of the dermal cells varies very considerably in different individuals. In the older and more chitinous individuals, they are usually more clearly defined than in the early adult insects. The cells, in some species, can be demonstrated only after careful preparation and adjustment of light. Staining will sometimes distinctly show cell-markings that were indistinguishable in an unstained preparation. On this account it is important that determination of species should be made only after study of a long series of examples. In the soft-bodied species, such as *L. hesperidum* and *L. viride*, the dermal cells are particularly difficult to bring into good definition. Even in such strongly marked species as *L. nigrum* or *L. hemisphæricum*, I have seen preparations of the early adult female in which all traces of cell-markings had been lost. Too long immersion in boiling potassium hydrate in the course of preparation may bring about this result. Besides the derm cells, there are often lighter and darker spaces formed by differences in the density of the derm. These are often particularly conspicuous on the area surrounding the anal operculum. In a few species (*e.g.*, *L. antidesmæ*) circumscribed glandular depressions occur on the dorsum. In many of the flatter species, and particularly in the section with flabelliform

marginal hairs (*Paralecanium*), there are definite series of angular (usually pentagonal or hexagonal) depressed spaces, in which may be seen several superimposed concentric transparent laminæ of waxy matter.

Both oviparous and ovoviviparous species occur within the genus. The former condition is found more particularly amongst those species in which the dorsum becomes densely chitinous, thus forming a shelter for the ova. The eggs are ovoid, and thinly dusted with a waxy powder.

In the ovoviviparous species a normal egg is formed, but remains in the body of the parent until the embryo is fully developed and ready to emerge. Then, during the passage through the oviduct, or, more usually, during the process of extrusion, the egg membrane is ruptured and the young larva appears. The empty egg-shell is extruded at the same time. Very occasionally, in normally ovoviviparous species, eggs may be prematurely deposited and remain for a short period beneath the body of the parent before the emergence of the larva.

The young larva is oval, flat, with well-developed limbs. The antennæ are six-jointed, the third and sixth joints longest. The plates of the anal valve are somewhat divergent, and each supports a long stout seta (*pl.* LXXII. *fig.* 2).

The second or nymphal stage differs from the larva, chiefly in size. The body is usually broader in proportion to its length. The antennæ are still six-jointed. The setæ of the anal plates are reduced to small hairs.

Until after the first moult the two sexes are indistinguishable. But towards the end of the second stage the male larva commences to secrete the glassy test which finally covers and protects the pupa. This test (*pl.* LXII. *fig.* 10), as in most *Lecaniid* genera, is divided into well-defined plates, which range in number from nine to nineteen, the junctions of the several plates being marked by raised lines. The number nineteen is exceptional, and occurs in only one species (*zonatum*) in Ceylon. In one other species (*marsupiale*) only twelve plates can be distinguished. All our other species have either nine or eighteen plates. In the former case, two are medial and seven circumferential; while in the latter, three are medial and fifteen circumferential. In *zonatum*, the extra plate occurs by a subdivision of one of the medial plates. There is, in addition, a small operculum covering the anal aperture.

Before the second ecdysis the test becomes completely separated

from the body of the insect; and, after the ecdysis, the small reddish pupa can be seen lying loosely beneath the test. The male imago frees itself from the pupa and fully expands its wings while still under cover. The long caudal filaments also (when present) are secreted before the emergence of the insect. The imago escapes backwards from beneath the hinder extremity of the test.

The adult male (*pl.* LXII. *figs.* 1, 2) of *Lecanium* differs from that of the *Diaspidinæ* principally in the more marked separation of the head from the thorax by a narrow neck. The thorax itself is more compact, with the notal and sternal plates better defined. The extremity of the body usually bears a pair of long white waxy filaments, but in some species these are wanting.

The terminal joint of the antenna (*pl.* LXII. *fig.* 5) is blunt and bears at its extremity 3 or more knobbed hairs. The eyes (*fig.* 4-*b*) are rudimentary, minute, and inconspicuous: the ocelli (*fig.* 3-*b* and 4-*a*), large and prominent, four to eight in number. The prothorax is comparatively short and is almost concealed above by the prominent notal plates of the mesothorax. The scutellum (*fig.* 2-*g*) is large, its posterior half more or less covered by the softer parts of the segment. The sternal parts have not the markedly backward inclination noticeable in the males of the *Diaspidinæ*. The segments of the abdomen are ill-defined and their boundaries not easily distinguishable. The first pair of spiracles (*fig.* 1-*d*) opens on the under surface, exterior to the coxæ of the first pair of legs. The second pair (*fig.* 1-*e*) opens laterally, immediately behind the second pair of legs.

The wings (*fig.* 7) are ample; broadly rounded at the apex. I have been unable to distinguish halteres in any of the species that I have examined, though Signoret shows these organs in his figure of the male of *L. genevense*. There is, moreover, no well-developed fold or pocket near the base of the inner margin of the wing where the hook of the haltere would naturally engage.

The legs are slender: the tibia (*fig.* 8-*d*) greatly elongated, and the tarsus (*fig.* 8-*e*) comparatively short.

The genital sheath (*fig.* 1-*f*) is moderately long and stout, but relatively shorter than in the *Diaspidinæ*, with a sharply pointed extremity. The caudal filaments, when present, spring from a group of circular pores situated in a funnel-shaped pit on each side of the penultimate segment (*fig.* 6). Each filament is partially supported by a pair of slender setæ. There is often, on each side, a pair of short, fleshy tassels or tubercles (*pl.* LXXXII. *fig.* 5).

A number of subgenera have been suggested for the subdivision of this large genus: but, with a few exceptions, their characters are vague and ill-defined. There are certain well-marked groups — such as those species having flabelliform marginal hairs, and those possessing a submarginal series of glandular pits — that may deserve subgeneric or even generic rank. Prof. Cockerell is now studying the genus, and will publish the final results of his labour in the *Genera Insectorum*. His widely recognised knowledge of the family, and the immense amount of study that he has bestowed upon it, especially qualify Prof. Cockerell for the execution of the much-needed work—a general classification of the Coccidæ of the world. Until the appearance of that work, it will be convenient to retain our Ceylonese forms in the single genus *Lecanium*.

In the following synopsis the primary characters are founded upon the general form: the secondary characters, on the structure of the marginal hairs: and the tertiary characters on the number of antennal joints. This arrangement must not be taken as indicating any close affinity between the neighbouring species, but merely as a convenient aid to identification.

Synopsis of Species.

A. ♀ flattish or moderately convex; skin soft, wrinkled when dry; usually ovoviviparous.

(a) Marginal hairs simple, pointed:

(a^1) Antenna with six joints ..... Capparidis, p. 187.

(b^1) Antenna with seven joints..... Hesperidum, p. 188.

(c^1) Antenna with eight joints:

(a^2) Derm-cells conspicuous (occurring only in ants' nests) ..... Formicarii, p. 190.

(b^2) Derm-cells inconspicuous:

(a^3) Anal operculum as broad as, or broader than, long .... Frontale, p. 192.

(b^3) Anal operculum longer than broad. Ophiorrhizæ, p. 193.

(b) Marginal hairs dilated or frayed:

(a^1) Antenna with six joints .. .. Acuminatum, p. 195.

(b^1) Antenna with seven joints:

(a^2) Under-surface of abdomen with deep purplish stain. Signiferum, p. 197.

(b^2) Under-surface without purplish stain;
(a^3) Marginal hairs short, deeply frayed. VIRIDE, p. 199.
(b^3) Marginal hairs longish, slightly frayed.
DISCREPANS, p. 204.
(c^1) Antenna with eight joints ... PUNCTULIFERUM, p. 205.

B. ♀ flattish; skin hard, retaining its form when dry; marginal hairs not flabelliform:
(a) Marginal hairs simple, pointed:
(a^1) Antenna with six joints ... SUBTESSELLATUM, p. 206.
(b^1) Antenna with eight joints;
(a^2) Dorsum divided into distinct plates.
TESSELLATUM, p. 207.
(b^2) Dorsum not tessellated: submarginal glandular pits.
ANTIDESMÆ, p. 209.
(c^2) Dorsum with conspicuous median and two transverse ridges ..... PIPERIS, p. 210.
(b) Marginal hairs spiniform; stigmatic cleft without median spines ..... MARSUPIALE, p. 212.
(c) Marginal hairs dilated or frayed:
(a^1) Antenna with six joints; hairs dilated and falcate.
BICRUCIATUM, p. 214.
(b^1) Antenna with eight joints; hairs frayed.
MANGIFERÆ, p. 216.

C. ♀ moderately convex; skin hard; form elongate, narrow.
(a) Marginal hairs simple, pointed:
(a^1) Antenna with six joints; extremities of body acute;
(a^2) A single pointed stigmatic spine.
ACUTISSIMUM, p. 218.
(b^2) Three blunt stigmatic spines. ARUNDINARIE, p. 220.
(b^1) Antenna with eight joints; extremities of body rounded.
LONGULUM, p. 221.

D. ♀ strongly convex; skin hard; usually oviparous.
(a) Marginal hairs dilated or frayed;
(a^1) Antenna with seven joints;
(a^2) Hairs of anal ring long, stout, and conspicuous.
CAUDATUM, p. 223.
(b^2) Hairs of anal ring inconspicuous..... PSIDII, p. 225.
(b^1) Antenna with eight joints;
(a^2) Derm with large polygonal cells;
(a^3) Dorsum with conspicuous longitudinal and transverse carinæ ..... OLEÆ, p. 227.

(b^3) Dorsum without conspicuous carinæ.
NIGRUM, p. 229.
(b^2) Derm with large rounded cells.
HEMISPHÆRICUM, p. 252.

E. ♀ flat; skin hard; marginal hairs flabelliform; margin of venter with well-defined chitinous zone. Adult ♂ without caudal filaments (*Paralecanium*).

(a) Legs wanting..... EXPANSUM, p. 255.
(b) Legs present:
(a^1) Width of marginal zone, at posterior extremity, half or more than half-length of anal cleft;
(a^2) Length of body less than 3 mm.
MARGINATUM, p. 237.
(b^2) Length of body 3 mm. or more;
(a^3) Marginal zone recurrent along anal cleft.
GEOMETRICUM, p. 239.
(b^3) Marginal zone not recurrent.
CALOPHYLLI, p. 240.
(b^1) Width of marginal zone, at posterior extremity, less than half-length of anal cleft;
(a^2) Length of body 3.50 to 4 mm.
PERADENIYENSE, p. 241.
(b^2) Length of body not more than 3 mm.
(a^3) Margin with numerous (9–10) indentations between flabellæ ..... PLANUM, p. 243.
(b^3) Margin with few (3–4) indentations between flabellæ;
(a^4) A broad translucent submarginal zone.
ZONATUM, p. 245.
(b^4) No translucent submarginal zone.
MARITIMUM, p. 246.

EXPLANATION OF PLATE LXI.

Structural Characters of Female Lecanium.

Fig. 1. Ventral aspect of typical *Lecanium*.
(*a*) eye; (*b*) interantennal hairs; (*c*) parastigmatic glands; (*d*) anterior spiracle; (*e*) posterior spiracle; (*f*) stigmatic cleft; (*g*) abdominal hairs; (*h*) circumgenital glands.

2. Rostral apparatus. (A) clipeus; (B) mentum; (*a*) bases of rostral filaments; (*b*) hypopharynx; (*c*) sac for reception of retracted loop of rostral filaments.
3. Spiniform marginal hairs of *L. marsupiale*.
4. Dilated and divided hairs of *L. oleæ*.
5. Divided hairs of *L. mangiferæ*.
6. Simple marginal hairs of *L. frontale*.
7. Flabelliform marginal hairs of *L. expansum*.
8. 6-jointed antenna, showing partial subdivision of third joint.
9. 7-jointed antenna.
10. 8-jointed antenna.
11. Plates of anal operculum of *L. punctuliferum*.
(A) outer edge; (B) base; (C) inner edge; (*a*) apex; (*b*) outer angle; (*c*) inner angle.
12. Anal operculum of *L. oleæ*.
13. Foot of *Lecanium*. (*a*) tarsus; (*b*) tarsal digitules; (*c*) claw; (*d*) ungual digitules.

EXPLANATION OF PLATE LXII.

Structural Characters of Male Lecanium.

Fig. 1. Adult ♂ of *L. marsupiale*, ventral aspect. (*a*) basal joints of antenna; (*b*) ocelli; (*c*) rudimentary eye; (*d*) anterior spiracle; (*e*) posterior spiracle; (*f*) genital sheath; (*g*) penis.

2. Adult ♂ of *L. marsupiale*, dorsal aspect. (*a*) basal joints of antenna; (*b*) ocelli; (*c*) rudimentary eye; (*d*) apodema; (*e*) posterior spiracle; (*f*) base of wing; (*g*) scutellum; (*h*) penultimate segment of abdomen, bearing caudal setæ.
3. Head of *L. maritimum*, ventral aspect. (*a*) basal joint of antenna; (*b*) ocelli.
4. Head of *L. maritimum*, dorsal aspect. (*a*) ocellus; (*b*) rudimentary eye.
5. Terminal joint of antenna of *L. maritimum*.
6. Part of penultimate abdominal segment of male *L. marsupiale* showing pit at root of caudal setæ.
7. Wing of adult male of *L. marsupiale*.
8. Leg of male *L. maritimum*. (*a*) coxa; (*b*) trochanter; (*c*) femur; (*d*) tibia; (*e*) tarsus.
9. Foot of male *L. maritimum*.
10. Typical puparium of male *Lecanium*.

LECANIUM CAPPARIDIS, *sp. nov.*

(PLATE LXIII.)

Adult ♀ (*figs.* 1, 2), pale bright green, malpighian tubes showing through the dorsum as an indistinct chain of reddish spots; flattish, very slightly convex above; deltoid, pointed in front, broadly rounded behind; an indistinct median carina above anterior extremity. Stigmatic clefts shallow. Anal cleft rather less than one-fourth total length of insect. Eyes inconspicuous. Antenna (*fig.* 3), six-jointed, the third as long as the terminal three together; fourth and fifth shortest, equal. In one example (*fig.* 4) two incomplete divisions occurred in the long third joint. Legs (*fig.* 5) small but well developed; femur (with trochanter) one and a half times length of tibia; tibia one and one-third times length of tarsus. Foot with four digitules; the tarsals slender, the unguals spatulate; both extending well beyond the claw. Scales of anal operculum (*fig.* 7) acutely pointed; inner edge longest; base shortest; two or three small hairs at extremity. Anal ring with eight stout hairs, two of them considerably shorter than the others. Stigmatic spines, three; the median one long and curved; the other two very short, about quarter the length of median one (*fig.* 7). Marginal hairs finely pointed, simple. Submarginal tubercles, three or four on each side. Derm with obscure and indefinite oval pores on the flattened marginal area After gestation the ventral area becomes slightly concave, forming a shelter for the young larvæ, which are produced ovoviviparously, and extruded with the egg-skin still attached to the posterior extremity.

Length 2·75 to 3·50 mm. Breadth 2 to 2·50 mm.

Young larva, pale green. No other stages observed.

Habitat on the under-surface of leaves of *Capparis moonii*. Pundaluoya.

EXPLANATION OF PLATE LXIII.

LECANIUM CAPPARIDIS.

Fig. 1. Leaf of *Capparis*, with insects, nat. size.
2. Adult ♀, dorsal view, × 10.
3. „ antenna, × 150.
4. „ „ with incomplete segmentation of third joint.
5. „ leg.
6. „ anal operculum.
7. „ stigmatic spines and marginal hairs.

LECANIUM HESPERIDUM, *Lin.*

(PLATE LXIII.)

Coccus hesperidum, Linn. Syst. Nat. II. 1735.
Calymmatus hesperidum, Costa, Nuovo Osserv. 1835.
Calypticus lævis, Costa, Faun. Ins. Nap. Gallius, 1837.
Lecanium hesperidum, Blanchard, Hist. Nat. Ins. 1840.
Calypticus hesperidum, Lubbock, Proceed. Roy. Soc. 1858.
? Lec. lauri, Boisd. Ent. Hort. 1867.

Adult ♀ (*fig.* 8) bright yellow or greenish yellow, minutely specked with red-brown, the specks sometimes agglomerated into transverse bars, especially on the median abdominal region: in other parts tending to form dotted lines radiating from centre to margin. In older examples the ground colour may be ochreous or pale fulvous; and the maculation may form a broad median fascia. Under surface of older examples with a deep purple-brown or red patch covering the median abdominal area, becoming concave and forming a shelter for the young larvæ. Dried specimens straw-coloured and much wrinkled. Form oblong-oval, often very irregular in outline; narrowest in front: more or less convex above, according to age. In some few individuals, generally on those protected by some shelter, I have noticed a double median dorsal longitudinal series of raised glassy points; but they appear to be very brittle and easily lost. Eyes minute, black, marginal. Stigmatic cleft (*fig.* 12) with three spines; the median one very long and pointed, projecting well beyond margin. Marginal hairs simple, pointed: rarely a few—more particularly at posterior extremity, divided or frayed at tip. Submarginal tubercles, four to five on each side. Scales of anal operculum (*fig.* 11) with outer edge slightly longer than base; the latter slightly concave in outline. Derm cells scattered, small, circular, inconspicuous. Antenna (*figs.* 9, 10) with seven joints: third and seventh usually equal and longest, but fourth sometimes as long as, or longer than, third: average formula (3, 7), 4, 2, 1, 6, 5. Legs normal. Anal ring with eight stout hairs. Length 2·25 to 3·50 mm. Breadth 1·25 to 2·50 mm.

The insect is ovoviviparus; living larvæ are usually found beneath the body of the parent.

The male has not been definitely recognised in any stage, though the species has been studied by entomologists all over the world. It is true that a supposed male insect was reputed to have been discovered by Mons. R. Moniez,* existing as a kind of internal parasite within the ovaries of the female; but this observation has never been confirmed and there is some doubt of its accuracy.†

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* Moniez, R., 'Les mâles du Lecanium hesperidum.' C. R. Ac. Sci. (Paris), t. civ. 1887. See also *Entomologist's Monthly Magazine*, xxiv. p. 25, and *Jour. R. Micr. Soc.*, 1887, p. 383.

† Mr. R. Newstead has recently reported (*Entomologist's Monthly Magazine*, March, 1903) the discovery of the male insect, undergoing the normal transformations.

Habitat on leaves and young branches of tea, *Citrus*, Ivy, *Begonia*, *Amaranthus*, various palms, and probably on many other plants. Punda-luoya, Watagoda, Dickoya, Kandy, Kurunagalla, Balangoda.

This species, though a troublesome pest in many parts of the world, seems to do little harm in Ceylon. I have found it in small colonies only, and always severely infested with hymenopterous parasites. As the insect occurs not uncommonly on the tea plant, we should congratulate ourselves upon its being so effectively kept in check by its natural enemies.

Lecanium hesperidum is widely distributed throughout the world. It occurs commonly throughout Southern Europe, both in plant-houses and in the open. In England typical examples are confined to plant-houses; but the form *lauri*—which is morphologically indistinguishable from *hesperidum*—occurs in the open. The species is a pest of oranges in South Africa; it is recorded as common in Australia and the Sandwich Islands, and is well known in the United States of America and the West Indies. It is recorded also from Mexico. *Lec. alienum*, Dougl. (*Ent. Mo. Mag.* Sept. 1866) is with difficulty separable from *hesperidum*, and may perhaps be merely a colour variety.

EXPLANATION OF PLATE LXIII.

LECANIUM HESPERIDUM.

Fig. 8. Adult ♀, dorsal view, × 12.
9, 10. Antenna, × 150.
11. Anal operculum, × 150.
12. Stigmatic cleft and spines, × 650.

LECANIUM FORMICARII, *Green.*

(PLATE LXIV.)

Lec. formicarii, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*figs.* 3, 4) greyish fulvous, afterwards darkening to deep castaneous, the colour disappearing in the dried insect. Marginal zone pale ochreous; four or more longitudinal series of pale ochreous spots on the disc. Surface smooth and shining; derm thin and soft, shrivelling when dry. Form broadly oval, sometimes almost circular; median area highly convex, hemispherical; anal operculum situate on a raised area distinct from the median convexity. Median abdominal area concave below (*fig.* 5), forming a shelter for the young larvæ. Eyes black, marginal. Antenna eight-jointed (*fig.* 6); or seven-jointed through imperfect division of fourth and fifth (*fig.* 7); third joint longest. Legs (*fig.* 8) rather slender; tarsus as long as or longer than tibia; digitules normal. Stigmatic spines 3, median longest, projecting beyond margin, situate in a shallow marginal depression (*fig.* 9). Marginal hairs simple, finely pointed. No submarginal tubercles. Derm with numerous conspicuous oval or circular cells, irregularly disposed over median area. Scales of anal operculum (*fig.* 11) broad, base equal to outer edge, together approximately quadrate; three small hairs near apex on dorsal surface, and two stout hairs from extremity of chitinous paraphysis beneath each scale. Anal ring (*fig.* 10) with six hairs, and a pair of stout hairs on each side on rim of retractile tube. Length 2 to 3·50 mm. Breadth 1·50 to 2·50 mm.

Early adult ♀ (*fig.* 2) oblong oval; flattish, with a rounded median ridge. Pale ochreous, sometimes minutely reticulated with brown lines.

Male unknown.

Young larva pale reddish; caudal setæ about one-third length of body.

The insect is distinctly ovoviviparous. I have watched the larvæ being extruded, each with the delicate skin of the ovum still attached to its posterior extremity.

Habitat enclosed in nests of an ant, *Cremastogaster dohrni*; on Tea, *Cinchona*, *Macaranga*, *Elæocarpus*, and various shrubs; never found outside the nests of this ant. Pundaluoya, Balangoda, Kandy.

EXPLANATION OF PLATE LXIV.

LECANIUM FORMICARII.

Fig. 1. Section of ant's nest, with insects *in situ*, nat. size.
2. Early adult female, × 12.
3. Adult female, dorsal view, × 10.
4. „ side view, × 10.
5. „ ventral view, × 10.
6. Antenna, × 150.
7. „ with imperfect joint, × 150.
8. Leg.
9. Stigmatic spines, marginal hairs, and dermal cells.
10. Anal operculum from below, with anal ring, &c., × 100.
11. „ dorsal view, × 150.

LECANIUM FRONTALE, *sp. nov.*

(PLATE LXV.)

Adult ♀ (*figs.* 1, 2) reddish-ochreous; median area marbled with brown, the markings sometimes taking the form of broad transverse fasciæ.

Eyes small, black. Form oblong, more or less acuminate at each extremity. Flattish; with a slight median longitudinal ridge, a broad marginal zone transversely striated with fine raised lines. Antenna (*figs.* 3, 4) eight-jointed; somewhat variable in size; formula:—3 (2, 4), 8, 5, 1 (7, 6), or 3, 4, 5, 2, 8, 1 (7, 6). Legs normal; tarsus shorter than tibia. Stigmatic clefts small and inconspicuous; spines three (*fig.* 5), the median nearly three times length of others, and projecting beyond margin. Marginal hairs (*fig.* 5), moderately long and fine, simple, pointed. Submarginal tubercles comparatively large, five to six on each side. Scales of anal operculum (*fig.* 6) broad; outer edge slightly longer than base, outer angle somewhat falcate, apical angle acuminate. Derm cells minute, circular, scattered. Length 3 to 5 mm. Breadth 1·50 to 2·25 mm.

Other stages not observed.

Habitat on under surface of leaves of 'Kina' (*Calophyllum sp.*). Pundaluoya.

The specific name is suggested by the unusual extension of the pre-antennal area. It resembles, in this respect and in general form, *L. chirimoliæ*, Mask.; but differs in the number of antennal joints (seven in *Chirimoliæ*), and in the character of the stigmatic spines which—in Maskell's species—are said to be not longer than the marginal hairs.

EXPLANATION OF PLATE LXV.

LECANIUM FRONTALE.

Fig. 1. Adult ♀, dorsal view, × 10.
2. ,, ventral view, × 15.
3, 4. Antenna, × 150.
5. Stigmatic spines and marginal hairs, × 650.
6. Anal operculum, × 150.

LECANIUM OPHIORRHIZÆ, *Green*.

(PLATE LXVI.)

Lec. ophiorrhizæ, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*fig.* 12) irregularly oblong oval, slightly acuminate in front; widest across the median area at about the level of the second stigmatic clefts; moderately convex above, with more or less well-defined median and stigmatic ridges. In older examples the ridges are less prominent. Colour olivaceous fulvous; the whole dorsal surface symmetrically reticulated with dark lines composed of reddish-brown spots, the spots confluent on the median and stigmatic ridges. The reticulation disappears after treatment with potash, but the submarginal area is then seen to be finely-marked with delicate radiating lines of striæ (*fig.* 17), these striæ appearing under a high magnification as aggregations of minute dark specks (*fig.* 18) embedded in the substance of the derm. The striation is most marked in specimens that have been dried before preparation. Stigmatic clefts conspicuously marked by opaque white mealy tufts. Stigmatic spines (*fig.* 16) three, slender, pointed: the median one more than twice as long as the other two. Marginal hairs simple, pointed, small, rather distant except on the posterior margin. Submarginal tubercles, four on each side. Eyes situated close to the margin; black in the living insect; inconspicuous in dried samples; appearing, after preparation, as small, colourless, semi-opaque, globular bodies just within the margin. Antennæ (*fig.* 14) with eight joints, of which the 3rd is always the longest, equalling the fifth and sixth together; sixth and seventh equal, shortest: formula 3 (2, 4, 8), 5, 1 (6, 7). No hairs on third and fourth joints. Legs moderately large: tarsus three-quarter length of tibia: ungual digitules broadly spatulate, twice length of claw: tarsal digitules slender knobbed hairs (*fig.* 15). Scales of anal operculum (*fig.* 13) reddish, triangular, pointed; base straight or slightly concave, shorter than outer edge, which is slightly convex. Anal cleft about one-quarter total length of insect. Anal ring situated considerably anterior to base of anal scales, bearing six long, stout, pointed hairs. Length 2·50 to 3 mm. Breadth 1·25 mm.

Female of second stage, with inconspicuous reticulations.

Adult ♂ (*fig.* 1) bright castaneous; apodema dark brown. Wings ample, iridescent, with pale pink costal nervure. Legs and antennæ yellowish. Extremity of abdomen with a pair of thin opaque white caudal filaments, not as long as the body. Antenna (*fig.* 4) shorter than body: ten-jointed, fourth longest, tenth with three knobbed hairs at extremity and several stout curved spines besides the usual short hairs (*fig.* 8). Foot with four knobbed hairs (*fig.* 7). Genital sheath (*fig.* 8) moderately long and stout. A small blunt tubercle on each side of terminal segment of abdomen.

Male puparium (*fig.* 10) glassy; finely rugose; divided into nine plates. A marginal series of prominent oblong vesicles, and a median dorsal row of glassy tubercles—one on anterior, six on median, and two on posterior median plate. Length 2 mm. Breadth 0·85 mm.

Male larva (*fig.* 11) olivaceous yellow; usually with a deep reddish median dorsal stripe. A median series of prominent glassy processes.

Habitat on leaves of *Ophiorrhiza pectinata.* Pundaluoya, December 1893. Found only on a single plant.

EXPLANATION OF PLATE LXVI.

Lecanium ophiorrhizæ.

Fig. 1. Adult male, dorsal view.
2. „ „ head, from above.
3. „ „ head, from below.
4. „ „ antenna.
5. „ „ „ terminal joints.
6. „ „ leg.
7. „ „ foot.
8. „ „ abdominal extremity, from below.
9. Leaf of *Ophiorrhiza*, with insects, nat. size.
10. Male puparium, from above.
11. Male larva, side view.
12. Adult female, dorsal view.
13. „ „ anal operculum.
14. „ „ antenna.
15. „ „ foot.
16. „ „ stigmatic cleft and spines.
17. „ „ posterior margin, showing striation.
18. Some of the striæ, very highly magnified.

LECANIUM ACUMINATUM, *Signoret*.

(PLATE LXVII.)

Lec. acuminatum, Sign. *Essai sur les Cochenilles*, 1873, p. 397 (227), Pl. XII. *fig.* 1.

Adult ♀ (*fig.* 1) very pale green; flat, pointed in front, broadly rounded behind; broadest across a line cutting the anal scales. Eyes small, lateral. Antennæ rather small; number and length of joints variable; normally with six joints, of which the third is much the longest, as long as the terminal three together (*fig.* 6); sometimes with a more or less complete joint cutting off a distal portion of the third, when the antenna becomes seven-jointed, with the third joint still the longest (*fig.* 5): sometimes with the extra joint nearer the base of the normal third, forming a seven-jointed antenna with the fourth joint longest (*fig.* 7). Legs rather large, especially the second and third pairs, which have abnormally large coxæ (*fig.* 4). Tarsus very short, less than half length of tibia. Tibia and tarsus together shorter than united femur and trochanter. Marginal hairs (*fig.* 3) very closely set, each surmounting a conspicuous chitinous tubercle, the extremities deeply divided into four or five divergent points. Submarginal tubercles, four to six on each side. Stigmatic spines three, the median one long, curved, and pointed; the others very short (*fig.* 3). Skin of dorsum with small inconspicuous ill-defined circular pores, and some scattered minute spines. Scales of anal operculum (*fig.* 2) somewhat rounded behind; base considerably longer than outer edge; five small pores at apex of each scale. Length 3 to 3·25 mm. Breadth, at widest part, 2 to 2·50 mm.

Male not observed.

Habitat—on leaves of *Jasminum* sp. Pundaluoya; *May*.

I think I am justified in my identification of this insect as *acuminatum* of Signoret. Signoret's description, which I append in full, does not enter into minute detail upon such points as the marginal hairs or anal scales, but, as far as it goes, it agrees very closely with my Ceylon insect. Signoret writes:—

'Cette espèce est facile à distinguer par la forme de son corps ovale court, acuminée vers le sommet, arrondi, très-large vers l'extrémité. Les antennes sont de sept articles avec le quatrième le plus long, le troisième égal aux cinquième et sixième réunis, ceux-ci les plus courts, le septième aussi long que les deux précédents. Les pattes, larges, aplaties offrent un tarse court, à peine de moitié aussi long que le tibia; le reste comme dans les *Lecanium* en général. La longueur est de 2 and 3 millimètres.'

The type was described from examples found in greenhouses in France. It will be observed that the form of the body and the size of the leg, with its unusually short tarsus, are in complete agreement with the description. The seven-jointed antenna with the long fourth joint, occurs as one of the variations (*fig* 7) in the antennal formula of my insect.

The present species may be distinguished from *mangiferæ* by the smaller number of antennal joints ; by the exceptionally short tarsus, and by the absence of the well-defined dermal pores that form such a conspicuous feature in *mangiferæ*.

Lec. acuminatum may be sufficiently separated from *capparidis* by the deeply-divided marginal hairs, those of the latter species being simple.

EXPLANATION OF PLATE LXVII.

LECANIUM ACUMINATUM.

Fig. 1. Adult female, ventral view, × 15.
2. Anal operculum, × 150.
3. Marg nal hairs and stigmatic spines, × 650.
4. Leg, × 100.
5, 6, 7. Antenna, × 150.

LECANIUM SIGNIFERUM, *sp. nov.*

(PLATE LXVIII.)

Adult ♀ (*figs.* 3, 4), bright yellowish green. A conspicuous reddish-brown maculate mark on the middle of the dorsum, in the form of a broad longitudinal stripe, tapering in front and terminating a little anterior to the anal scales; with two broad transverse bands, sometimes separate from the median stripe and then appearing as two large irregular blotches on each side; the anterior band directed towards the second stigmatic cleft; the second band half-way between this and the anal scales; sometimes the whole median area spotted with red-brown. Anal operculum yellow. Eyes black. Median ventral area dark brown (*fig.* 3). After death this marking disappears more or less completely, and the dried insect assumes a uniform ochreous tint. Form strongly convex above; bluntly pointed in front, rounded behind. Living insect smooth above. Dried examples show traces of a median longitudinal and two transverse ridges. On the median ventral (coloured) area is a deep cavity, forming a receptacle for the young larvæ which are produced ovoviviparously. Antenna (*fig.* 7) seven-jointed; fourth longest; fifth and sixth shortest, subequal; sixth and seventh together equal to fourth; formula: 4, 3 (2, 7), 1 (5, 6). Legs well developed; claw stout, curved; ungual digitules stout, dilated at extremity, twice as long as claw; tarsal digitules fine knobbed hairs, extending beyond unguals. Scales of anal operculum (*figs.* 8, 9) triangular, inner edge longest; base barely shorter than outer edge, extremity bluntly pointed. In examples from *Caryota* the outer edge is more evenly rounded to the extremity (*fig.* 9), and the apical angle is more obtuse. Anal ring with eight hairs, two of which are much finer than the others (*fig.* 10). And cleft from one-sixth to one-eighth length of body. Stigmatic clefts shallow, inconspicuous. Stigmatic spines three, the median one three to six times the length of the others. Marginal hairs very slightly dilated, frayed at extreme tip, rarely simple, both forms occasionally occurring on the same individual. Submarginal tubercles three or four on each side. Derm with scattered very small circular pores. Length 2·50 to 3 mm. Breadth 1·75 to 2 mm.

Male unknown.

Female of second stage pale green, immaculate or with some indistinct specks on median area.

Young larva very pale green. Antenna (*fig.* 2) with six joints. Under pressure the anal tube is everted and the six hairs of anal ring turned backwards (*fig.* 6).

Habitat—on several varieties of cultivated Begonias (*fig.* 1), the insects crowded on the stems and both sides of the leaves. Occurs also on under surface of leaves of *Alpinia nutans*, and upon the fronds of the Kitul Palm (*Caryota urens*).

Very closely allied to *Lec. hesperidum*, L. It differs principally in the coloration, and may perhaps be merely a well-marked variety.

EXPLANATION OF PLATE LXVIII.

LECANIUM SIGNIFERUM.

Fig. 1. Begonia leaf, with insects, nat. size.
2. Antenna of young larva.
3. Adult ♀, from below, × 15.
4. „ dorsal view, × 15.
5. Immature ♀, dorsal view.
6. Abdominal extremity of young larva, after maceration.
7. Adult ♀, Antenna, × 150.
8. „ anal operculum of example from *Begonia*, × 150.
9*b*. „ „ „ „ „ *Caryota*, × 150.
10. „ anal ring, × 150.

LECANIUM VIRIDE, *Green.*

(PLATE LXIX.)

Lecanium viride, Green. 'Observations on the Green Scale Bug in connection with the Cultivation of Coffee,' 1886 : *Entomologist's Monthly Magazine*, April 1889, p. 248.

Adult ♀ (*fig.* 2) bright pale green, with an irregular, but very distinct loop of blackish spots on the middle of the dorsum (the contents of the malpighian tubules).* During treatment with potash, the colour changes to dull orange. Dried examples become dull fulvous, and lose the chain of dark spots. Eyes conspicuous, black, close to margin. Anal scales minute, yellowish. Form oval ; rounded behind, subacuminate in front ; sometimes asymmetrical, the development on one side suppressed by contact with a prominent vein of the leaf. Moderately convex above, more particularly in females containing ripe ova. Margin very thin. Skin soft ; never strongly chitinised. In old individuals the dorsum is almost smooth ; but, before the body becomes tense with eggs, a slight median longitudinal, and two transverse ridges are noticeable, the latter above the stigmatic areas. Above the abdomen are three series of shallow depressions on each side of median ridge, defined by indistinct transverse and longitudinal ridges. Stigmatic clefts small and inconspicuous. Stigmatic spines 3 : (*fig.* 4) ; stout, pointed ; the median one twice as long as the others and curved at the extremity. Anal cleft from one-sixth to one-fifth total length. Margin with short curved hairs, the extremities divided into several points (*fig.* 5), set at rather long intervals. Submarginal tubercles, three or four on each side Antenna (*fig.* 7), seven-jointed ; third and fourth longest, subequal ; seventh nearly equal to previous two together. Antennal formula : (3, 4), (1, 2, 7), (5, 6) ; or 4, 3, (1, 2, 7), (5, 6) ; or 3, 4, (1, 2, 7), (5, 6) ; sometimes an incomplete division on the fourth joint. Legs well developed, moderately stout ; claw stout, curved ; ungual digitules broad and spatulate, extending well beyond claw ; tarsal digitules long and slender, dilated at extremity, extending beyond unguals (*fig.* 3). Scales of anal operculum (*fig.* 6), triangular ; base shortest, concave ; inner edge longest, approximately straight ; outer edge slightly shorter than inner, convex. Anal ring with eight hairs, two of them much more slender than the remainder. A scattered arch of circular wax glands (with multilocular orifices, as in *Diaspidinæ*) enclosing the genital orifice. Derm (*fig.* 4) with large scattered—rather indefinite—round or broadly oval translucent spots. These spots are rather difficult to demonstrate, and can only be made out in a good preparation. Length 2.50 to

* The dark colour seen in the malpighian tubes is not due to any real pigmentary matter, but is partly optical, resulting from diffraction through the mass of minute greenish yellow circular bodies that distend the tubes at intervals. With higher magnification the colour fades, first to dull olive green and then to greenish yellow. Under pressure, which thins out the mass, the same disappearance of colour is observed.

3.25 mm. Breadth 1.50 to 2 mm. Male unknown in any stage. The species appears to be reproduced, in this country, by an asexual process (parthenogenesis) alone : though it is quite possible that, in its native country, sexual reproduction may be normal.

The insect is ovoviviparous, the eggs being hatched at the time of, or immediately after exclusion. Under an adult female, a mass of empty egg-skins will be found, with usually some half dozen or more active larvæ. Occasionally one or two pale green eggs are found, but this is the exception rather than the rule. A constant succession of larvæ is produced during the life of the insect.

The newly hatched larva (*fig.* 9) is very pale green, of normal form, rather broadly oval and very flat : posterior extremity broadly cleft, the sides of the cleft occupied by the triangular anal scales, between which projects a pencil of white waxy matter supported by the hairs of the anal ring. The caudal setæ spring from the tips of the anal scales and are nearly half the length of the body of the insect. Antennæ six-jointed. Feet with four knobbed hairs (digitules) ; the tarsals longest, and one of these much stouter than the other. Marginal hairs of body simple. Eyes conspicuous, black. Length 0·35 mm.

Female of second stage (*fig.* 8) similar to adult, but smaller and flatter, and without the conspicuous black loop noticeable on the back of the adult.

Habitat.—Originally noticed on coffee (both Liberian and Arabian), but now almost omnivorous. Some of the better known plants upon which it occurs are—*Cinchona succirubra* and *officinalis*, *Citrus* (various species), Tea (occasionally), *Psidium guyava* ('guava'), *Manihot ceara*, *M. para*, ('Para rubber'), *M. utilissima* ('tapioca'), *Gardenia*, *Ixora*, *Plumiera*, and numerous garden shrubs. Amongst indigenous plants, *Antidesma bunius*, *Hiptage madablota*, *Callicarpa lanata*, *Moesa indica*, and several species of *Loranthus*, may be mentioned. The insects, in all stages, are crowded on—usually the under surface of—the leaves and on the young shoots of the plants, more frequently along the midrib and veins.

'Green Bug' has proved such a scourge in Ceylon, being practically responsible for the final abandonment of coffee cultivation over the greater part of the planting districts, that a short account of its origin and ravages must be added to the bare description given above.

Lecanium viride, popularly termed 'Green Bug,' first attracted attention in Ceylon in the year 1882, when it was already doing considerable damage to coffee in the Matale district. The pest rapidly extended its area, and spread through all the districts of the Central Province within three years. In 1886 it completed its conquest by appearing in the Badulla district of the Province of Uva.

The bug attacks with indifference both vigorous and weakly trees, but its effect is markedly different in the two cases ; for, though leaves of robust trees become thickly infested by the insects, and blackened by the consequent fungus, they do not fall off, but the plant continues to make fresh growth and retains a fairly healthy appearance. Weakly trees, on the contrary, are almost completely denuded, none but the two or three terminal leaves on each twig remaining. The shoots become dry and hide-bound, and no fresh wood is formed. Naturally such a condition results in a total loss of crop.

Unfortunately, at the time of the invasion, our coffee had been weakened by long-continued attacks of 'leaf disease' (*Hemileia vastatrix*). Moreover, the prevailing system of cultivation resulted in the loss of the surface soil, so essential to the health of the coffee plant, in all but the most favoured situations. The further tax upon its strength induced by these myriads of sap-imbibing insects proved too great for the plant, with the result that thousands of acres of coffee-land were abandoned or replaced by tea. Some idea of the collapse of the coffee industry may be obtained by comparing the annual export of coffee during the period of attack. In 1881, 452,000 cwts. were shipped from Ceylon. In 1891 this figure had fallen to 88,780 cwts. While, during the past year (1902), the total scarcely exceeded 10,000 cwts.

It must not be supposed that no efforts were made to check the invasion. When the pest first appeared on any estate, individual plants and small patches of affected trees were frequently cut out and burnt. But nothing stayed the progress of the invader. The fact is, the insect being an inconspicuous one, by reason of its colour and small size, it was not noticed until it had established itself in sufficient force to defy all efforts at extermination. All the old remedies that had obtained a (usually spurious) reputation as effective against the old brown bug were tried without success. Affected trees were swathed in freshly freshly cut 'Mana grass' (*Andropogon nardus*). They were dusted with dry lime and wood ashes. But all to no effect. Following out some previous experiments with coal-tar applied to the roots, the writer applied dilute phenol and carbolic powder to the soil below the trees. The former application was at first thought to have proved successful (see *Report on Green Scale Bug*, 1886, footnote to page 3). But subsequent and more extensive experiments, carried out in the same way, negatived the earlier result. The original experiment was on too small a scale to provide a proper test. Lime and water, applied as a thin whitewash, by hand, killed every bug with which it came in contact; but it was found impossible to apply it in a sufficiently thorough manner, and the process was too costly in labour, when large acreages were to be treated. The same remark applies to all other liquid applications. They were both costly and inefficient. Many fancied cures owed their reputation to the death of the insects from natural causes. For, quite from the commencement, the pest had its periods of increase and decrease. These periods vary in different parts of thes island according to the prevailing weather. The bug flourishes best during the time of fine weather interspersed with light showers. It objects to extremes, and usually decreases both in the very wet weather and during times of excessive drought. In districts subject to a heavy south-west monsoon, the pest is at its height from the middle of March to the middle of June, when it is checked by the continuous rains. There is a recrudescence from September to January, when it again decreases during the dryest months. On the other side of Newera Eliya, I am informed that the bug usually appears towards the end of April, and reaches a climax in October or November. If there is any very wet weather in the mean time, it temporarily declines, but flourishes in times of light rain with intermediate sunshine, and disappears almost completely from December to April.

The periods of decrease are marked by the death of fully 90 per cent. of the

insects from an epidemic fungal disease. The scales shrivel and become covered with a greyish-white fungus, which extends as a delicate filmy fringe all round them (*fig.* 10). Dr. A. Zimmermann, then of the Botanic Gardens, Buitenzorg, Java, described this fungus under the provisional name of *Cephalosporium lecanii* in one of the circulars of his department. Dr. Zimmermann informs me that he has been experimenting with this fungus with a view to obtaining a culture that can be applied as a spray, but I have not yet heard whether success has attended his attempts. In Ceylon the fungus seems to be widely distributed, but depends upon climatic conditions for its proper development. It appears to be readily communicable by direct contagion in Ceylon. But material sent to Mr. Newport, in Southern India, failed to induce the disease in 'Green Bug' there. The weather in India at the time was not favourable for the experiment. I am inclined to think that this grey fungus has been gradually increasing, and that its effect in reducing the numbers of the bug is more marked year by year.

Other natural enemies that attack the bug are several species of small 'Ladybird Beetles' (*Coccinellidæ*), and numerous minute chalcid wasps that breed inside the body of the *Lecanium*. Dr. L. O. Howard, Director of the State Entomological Department, Washington, U.S.A., has identified the following species bred by me from *Lecanium viride: Coccophagus orientalis*, How; *Encyrtus flavus*, How; and *Ceraptocerus ceylonensis*, How.

But these local parasites of the bug have their own natural enemies, which keep them in check and prevent them from increasing to a sufficient extent to cope with the disease. It was thought that by introducing ladybird beetles from some other country, minus their proper natural enemies, we might succeed in raising up an army capable of fighting this (probably introduced) scale pest on more even terms. This method was adopted with complete success when the Australian beetle, *Vedalia cardinalis* was naturalised in California, resulting in the rapid extermination of the destructive 'Fluted Scale' (*Icerya purchasi*, Mask.). Accordingly, living specimens of *Exochomus nigropunctatus*, a ladybird known to feed upon allied scale insects, were obtained from the Cape of Good Hope through the good offices of Mr. C. P. Lounsbury, the Government Entomologist of that Colony. These little beetles fed freely upon *Lecanium viride* in captivity, and multiplied to a certain extent. Their increase was, however, not sufficiently rapid to offer hopes of any practical benefit to be derived from the introduction of this particular species. Small numbers of the beetles were liberated in some of the few remaining coffee districts, but apparently failed to establish themselves. I have also received, through the kindness of Professor W. W. Froggatt, several parcels of Australian ladybirds. Though a few of these survived the journey, I have been unable to breed from them. They fed very sparingly upon such scale-insects as I was able to give them, but died one by one without laying eggs. My experiments in this direction have so far failed, but this may be due to the fact that I have not yet found the proper species to suit the particular conditions. It is hoped that other efforts may eventually prove more successful.

From the sudden appearance of the pest and its rapid extension, it is almost certain that the insect is an introduced species, and it seems probable

that the Liberian coffee plant may have been the vehicle of introduction. *Lecanium viride* has recently been recorded from Africa by Mr. R. Newstead* from Lagos, West Africa. It is true that Mr. Newstead considers that the African insect is a distinct variety, but scarcely sufficient material was examined to establish that fact.

EXPLANATION OF PLATE LXIX.

LECANIUM VIRIDE, *Green.*

Fig. 1. Insects *in situ* on leaf and branch of coffee.
2. Adult female, dorsal view, × 15.
3. „ foot.
4. „ margin of scale, showing stigmatic cleft and spines and dermal pores.
5. „ marginal hairs.
6. „ anal operculum.
7. „ antenna.
8. Female of second stage, dorsal view.
9. Young lava, dorsal view.
10. Diseased insect, with fringe of mycelium of parasitic fungus.

* *Ent. Mo. Mag. Ap.* 1898, p. 95.

LECANIUM DISCREPANS, *sp. nov.*

(PLATE LXX.)

Differs from *L formicarii* principally in having marginal hairs fimbriate at extremities (*fig.* 4), and in the presence of submarginal tubercles. Scales of anal operculum (*fig.* 3) narrower; outer edge sinuate and distinctly longer than base. Antennæ relatively and actually longer; seven-jointed (*fig.* 2); formula, 4 (3, 7), (1, 2), (5, 6), or (3, 4, 7), (1, 2), (5, 6); sometimes obscurely eight-jointed from an imperfect division in 4th (*fig.* 1). Dermal cells less numerous and conspicuous. Other characters as in *formicarii*. Length 2 to 3 mm. Breadth 1·75 to 2·25 mm.

Male unknown.

Habitat—either in nests of *Cremastogaster dohrni*, or exposed and attended by other ants. On tea plant. Pundaluoya, Yatiyantota, Passara.

It is difficult to separate these two species except by minute microscopical characters, but the structural difference in the marginal hairs seems to me to be of specific importance.

EXPLANATION OF PLATE LXX.

LECANIUM DISCREPANS.

Fig. 1. Antenna, with partial division of fourth joint, × 150.
2. „ with normal number of seven joints, × 150.
3. Anal operculum, × 150.
4. Marginal hairs and stigmatic spines, × 650.

LECANIUM PUNCTULIFERUM, *sp. nov.*

(PLATE LXX.)

Adult ♀ (*fig.* 6) irregularly oval, narrowed in front; moderately convex, with a thinner marginal area. Colour varying from reddish-green or reddish-yellow to reddish ochreous, the marginal area usually paler and transparent, often minutely specked with brown, the spots sometimes coalescing into two curved longitudinal fasciæ. Eyes black, minute, close to margin. Stigmatic cleft small; spines three (*fig.* 9), the median one very long and stout and projecting beyond margin (in one example the long median spine was replaced by two shorter and more slender spines); marginal hairs slightly dilated and fimbriate at extremity, intermingled (and sometimes alternated) with simple pointed hairs; submarginal tubercles rather large, five or six on each side. Derm mottled in darker and lighter tints, with small circular or oval cells (*fig.* 12), sharply defined and conspicuous on the darker parts, inconspicuous on the paler spots. Antenna (*fig.* 8) with eight joints; formula: 3, 8 (2, 4, 5), 1 (6, 7), or 3 (2, 8), (1, 4, 5), (6, 7). Legs normal, well developed; tarsus considerably shorter than tibia (*fig.* 11). Scales of anal operculum (*fig.* 10) together approximately square, base equal to outer edge, lateral angle rectangular. Length 3 to 3·75 mm. Breadth 2 to 2·50 mm.

Male puparium (*fig.* 7) glassy, transparent, minutely and irregularly rugose, divided into nine plates. Length 2 mm. Breadth 1 mm.

Male larva pale green, with a median longitudinal dark brown line.

Adult ♂, pale red or reddish yellow; apodema castaneous; notal plate of metathorax dull brown, with pale circumscribed median spot. Caudal setæ fine, a little shorter than body. Antenna about half length of body. Genital sheath (*fig.* 13) stout, more than half length of abdomen; a recurved tubercle on each side at its base. Length 1·75 mm.

Habitat on upper surface of leaves of 'Sappu' (*Michelia champaca*) and mango (*fig.* 5). Peradeniya, December. Attended by ants (*Œcophylla smaragdina*), which had fastened the leaves together, forming a shelter. Received also from Iranativu, on *Ærua lanata*. July.

EXPLANATION OF PLATE LXX.

LECANIUM PUNCTULIFERUM.

Fig. 5. Piece of mango leaf, with insects *in situ*, nat. size.
6. Adult ♀, ventral view, × 15.
7. Male puparium, × 10.
8. Antenna, × 150.
9. Stigmatic spines and marginal hairs, × 650.
10. Anal operculum, × 150.
11. Leg (median), × 150.
12. Dermal cells, × 150.
13. Extremity of abdomen of adult male.

LECANIUM SUBTESSELLATUM, *sp. nov.*

(PLATE LXXI.)

Adult ♀ (*fig.* 1) dark castaneous; broadly oval, narrowed in front, flat Derm with paler reticulating lines forming a tessellated pattern as in *tessellatum*; the reticulation (in examples under observation) obsolescent on median area. Eyes submarginal. Derm cells (*fig.* 2) numerous, small, irregularly oval; conspicuous only on the marginal series of plates, where the chitin is more dense; the plates outlined by minute translucent pores as in *tessellatum* var. *perforatum*. A series of larger translucent spots (five on each side) above the abdominal region, situate on the submarginal series of plates, each spot showing a coarsely cellular structure (*fig.* 3). A few nucleated translucent spots scattered irregularly over the dorsum. Stigmatic cleft small, with three pointed spines (*fig.* 4). Marginal hairs small, finely pointed, simple. Submarginal tubercles, three to four on each side. Scales of anal operculum (*fig.* 5), together forming a rhombus; base equal to outer edge, lateral angle obtuse, apical angle acute. Antenna (*fig.* 6) with six joints, of which the third is nearly as long as the terminal three together; formula: 3, 6, 1, 2 (4, 5). Legs rather small; tarsus a little shorter than tibia. Length 2·50 to 3 mm. Breadth 1·75 to 2 mm.

Habitat on leaves of undetermined tree. Kandy.

This species closely approaches *tessellatum* var. *perforatum* in general appearance and structure, but can be distinguished by the six-jointed antennæ. Other differences are the less distinct tessellation, the narrower and more angular anal operculum, and the smaller marginal hairs.

EXPLANATION OF PLATE LXXI.

LECANIUM SUBTESSELLATUM.

Fig. 1. Adult ♀, dorsal view, showing pattern of tessellation, × 15.
2. Part of margin (surrounding eye), showing derm cells, × 150.
3. Cellular spot, × 650.
4. Stigmatic spines and marginal hairs, × 650.
5. Anal operculum, × 150.
6. Antenna, × 150.
7. Foot, × 150.

LECANIUM TESSELLATUM, *Sign.*, VAR. PERFORATUM, *Newst.*

(PLATE LXXII.)

Lec. tessellatum, Signoret, *Essai sur les Cochenilles*, p. 231, pl. XI., fig. 4, 1873.

Lec. perforatum, Newstead, *Entomologist's Monthly Magazine*, October, 1894, p. 233.

Adult ♀ (*figs.* 4, 5) irregularly oval, bluntly acuminate in front, broadly rounded behind; sometimes almost deltoid; usually asymmetrical; flattish, median area very slightly convex, margins very thin. Under surface flat; a small hollow on each side of abdomen (*fig.* 4). Colour dark castaneous, paling to fulvous or greenish yellow at margin. Dorsal area divided into numerous irregular plates, forming an intricate marqueterie pattern, more conspicuous after treatment with potash. The pattern is roughly, but not absolutely, symmetrical on the two sides of a median line. The number of separate tesseræ varies slightly in different individuals by the confluence of adjoining plates, but the main plan is constant, viz., four series on each side of the median line (*fig.* 5), indicated on the surface by a series of depressed irregularly polygonal spaces, divided by slight carinæ. Dermal cells numerous but ill defined, irregularly oval, groups of them often forming irregular rosettes; there is also, near the margin of each plate, more particularly on those of the median series, a series of minute translucent pores (*fig.* 10), bearing a fanciful resemblance to rivet holes for the attachment of armour plates. Eyes minute, black, marginal. Marginal hairs small, simple. Submarginal tubercles 5 to 7 on each side. Stigmatic cleft (*fig.* 9) with three (rarely four) stout spines, the median one longest and projecting beyond the margin. Anal cleft rather more than one-quarter the total length of the insect. Scales of anal operculum (*fig.* 8) together forming a square, their extremities rather acutely pointed. Anal ring with six hairs, two (sometimes three) stout hairs, each surmounting a small conicle tubercle on each side of ventral aperture (*fig.* 7). Antenna (*fig.* 6) with eight joints, the divisions between third and fourth often very indistinct, division between seventh and eighth usually diagonal; formula variable, eighth always considerably the longest, sixth and seventh shortest, second to fifth subequal. Legs rather small but well developed; tarsus shorter than tibia; digitules normal. Length 3 to 4·75 mm. Breadth 2 to 3 mm.

Young larvæ crowded beneath the body of the parent, which is apparently ovoviviparous. Foot of young larva (*fig.* 3) with four unequal digitules, the unguals particularly asymmetrical, one being a stout knobbed hair, while the other is broadly dilated; the tarsals are both knobbed hairs, but one is much stouter than the other.

Male unknown in any stage.

Habitat commonly on fronds of the palm *Caryota urens*; also on *Cocos nucifera*, *Cinnamomum*, *Litsea*, *Moesa indica*, and *Hiptage madablota*. Widely

distributed throughout the island. Common in European plant-houses. I have examples from the West Indies and from Java. The species is reported from many localities in the United States (Professor Cockerell and G. B. King), from Mauritius (De Charmoy), and from Australia (Maskell and Froggatt).

This is the insect described and figured by Newstead (*loc. cit.*) as *Lec. perforatum*. He founds the distinction between it and *tessellatum* of Signoret upon the eight-jointed antennæ, the presence of a median division in the dorsal tessellation, and the pores (simulating perforations) on the margins of the dorsal tesseræ. Signoret certainly does not mention the latter, but it does not follow that they were not present in his type. In Signoret's time descriptions of Coccidæ were not so minutely drawn up as they now are, and many inconspicuous characters were overlooked. As for the antennæ, it seems possible that Signoret may have missed the division between the third and fourth joints, which is (as pointed out above) often very indistinct. The same may be said of the median division of the dorsal plates. In old examples the plates of the median area may become confluent, showing scarcely any divisions. Under the circumstances, I do not consider that these discrepancies in the original description, the other (and more remarkable) characters being identical, can constitute more than a varietal difference.

Signoret records his type from a palm which he calls *Caryota ursus*. I cannot find any such name in the *Index Kewensis*, and suppose it to be an error for *Caryota urens*, the plant upon which the species most commonly occurs in Ceylon.

EXPLANATION OF PLATE LXXII.

LECANIUM TESSELLATUM, *var.* PERFORATUM.

Fig. 1. Leaf of *Caryota urens*, with insects, nat. size.
2. Posterior extremity of larva, dorsal view.
3. Foot of larva.
4. Adult female, ventral view, × 10.
5. „ pattern of dorsal tessellation, × 12.
6. „ antenna, × 150.
7. „ ano-genital aperture, from below, × 100.
8. „ anal operculum, × 100.
9. „ stigmatic cleft and marginal hairs, × 150.
10. A single dorsal plate, showing submarginal pores, × 80.

LECANIUM ANTIDESMÆ, *Green.*

(PLATE LXXIII.)

Lec. antidesmæ, Green, *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*fig.* 2), flat above, slightly tumescent below, with a cavity behind abdomen for reception of eggs; irregularly oval, no stigmatic clefts. Colour dark purplish brown paling at margins. Dorsal surface covered with a thin greyish powdery film. A submarginal dorsal series of about twenty-four short, fine, opaque, white, cottony filaments springing from glandular spots. Skin opaque, thickly sprinkled with small irregular oblong pale spots in more or less definite groups, and some small round translucent pores marking the interspaces between the groups. Glandular marginal spots (*fig.* 3) dark in a pale area, with twelve or more translucent orifices. Stigmatic spines (*fig.* 6) three, small, marginal. Marginal hairs pointed, rather long and stout. Submarginal tubercles three or four on each side; inconspicuous. Scales of anal operculum (*fig.* 5) small, base equal to outer edge, outer angle obtuse. Anal cleft extending nearly one-third length of insect. Anal ring with six hairs. Eyes inconspicuous. Antenna (*fig.* 7) with eight joints, third longest; antennal formula: 3, 8 (2, 4, 5), 1 (6, 7). Foot (*fig.* 4) with the usual four digitules. Tarsus two-thirds length of tibia. Length 3·75 mm. Breadth 2·75 mm.

Eggs pale green.

No other stages observed.

Described from a single specimen found on under surface of leaf of *Antidesma bunius*. Pundaluoya, December, 1893.

(Other examples, subsequently found in Kandy, are of a more deltoid form, with broadly rounded angles, narrowed in front. The filmy dorsal covering broken up into polygonal plates of thin brittle wax.)

The only other species of *Lecanium* known to possess such a series of glandular marginal spots is *L. patersoniæ*, Mask.; but that insect differs in having distinct longitudinal and transverse ridges, and has only seven joints in the antennæ. Otherwise the description of *patersoniæ* agrees very closely with my Ceylon insect. I have not had an opportunity of examining the Australian species.

EXPLANATION OF PLATE LXXIII.

LECANIUM ANTIDESMÆ.

Fig. 1. Leaf of *Antidesma*, with insect, nat. size.
2. Adult female, dorsal view, × 10.
3. Part of margin showing dermal cells and glandular spot.
4. Foot.
5. Anal operculum, × 150.
6. Stigmatic spines and marginal hairs.
7. Antenna.

LECANIUM PIPERIS, *Green.*

(PLATE LXXIV.)

Lec. piperis, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*fig.* 2) broadly oval, broadest across median area; bluntly pointed in front, rounded behind. Moderately convex above, with sharply defined median longitudinal and two transverse ridges, the median ridge touching the margin in front and terminating at the anal aperture, the anterior transverse ridge meeting the margin between the stigmatic clefts, the posterior ridge extending to a point about midway between the second stigmatic and the anal cleft. Flat below, with abdominal cavities for reception of young larvæ. Colour bright reddish yellow to reddish brown, ridges and margin paler, a few irregular dark brown radiating lines or chains of spots more or less distinct in different examples. The whole dorsal surface covered with a thin transparent waxy or glassy coating, which can be flaked off in large pieces. Eyes black, prominent, distinctly defined even after preparation; at some distance from margin. Scales of anal operculum (*figs.* 4, 4*a*) reddish-brown, together forming an oval, the base and outer edge meeting in a curve without any definite angle; recurved below. In the living insect there is a small brown spot immediately anterior to the anal scales. Anal ring with eight stout hairs. Anal cleft rather more than one-fifth total length of insect. No definite dermal cells, but some irregular translucent mottlings near the margins, more pronounced at the posterior extremity, and from six to eight clusters of minute circular glands on the dorsum anterior to the anal aperture. Stigmatic clefts (*figs.* 6, 7, 8) deeply incised and expanded internally, forming semilunar openings with a sharply defined chitinous rim. Stigmatic spines four to six, stout, with rounded extremities, one of them considerably longer and stouter than the others. Marginal hairs small, simple, pointed. No submarginal tubercles. Antenna with eight joints, the divisions between fourth and fifth usually incomplete and varying in position; third and fourth without hairs. Antennal formula: 4 (3, 8), (1, 2, 5), 6, 7, or 5, 4 (1, 2, 8), 3, 6, 7. Legs (*fig.* 5) slender; tarsus equal to tibia; tarsal digitules long and broadly dilated; ungual digitules fine knobbed hairs. Length 3·75 to 4·50 mm. Breadth 3 to 3·50 mm.

Young larva dull reddish. No eggs observed, but adult females usually cover a number of young larvæ, amongst which are seen the collapsed egg-capsules.

Adult ♂ (*fig.* 10) dark reddish brown to purplish brown; apodema dark brown or black; legs and antennæ pale straw colour. Wings hyaline, iridescent; costal nervure bright crimson. Antenna with three knobbed hairs at extremity. A pair of thin white caudal filaments, about as long as the abdomen. Length 1·25 mm.

Male puparium (*fig.* 9) oblong, narrow, convex above colourless, glassy, transparent; composed of eighteen plates, those of the median series with raised thickened rims. Length 2·25 mm.

Male larva brownish-purple, oblong, slightly convex above.

Habitat on upper surface of leaves of *Piper sp.*, and *Psychotria*. Pundaluoya. The male puparia usually attached to the extreme margin of the leaf.

EXPLANATION OF PLATE LXXIV.

LECANIUM PIPERIS.

Fig. 1. Leaf of wild pepper, with insects *in situ*, nat. size.
2. Adult female, dorsal view, × 7.
3, 4. Anal operculum of female.
5. Leg.
6, 7, 8. Stigmatic cleft, spines, and marginal hairs.
9. Male puparium, × 12.
10. Adult male, × 24.
11, 12. Antenna of adult female.

LECANIUM MARSUPIALE, *sp. nov.*

(PLATE LXXV.)

Adult ♀ (*figs.* 1, 2), very flat and broad; posterior half widest; extremities either rounded or bluntly pointed. Median area deep reddish brown, mottled with darker brown. A broad, greenish, marginal zone, sharply demarked from the median reddish area. Eyes minute, black, close to inner edge of marginal zone. Marginal hairs, spiniform, sharply pointed. Stigmatic clefts (*fig.* 5) conspicuous; the margin densely chitinous and vertically thickened, its edge closely studded with glandular pores. There are no spines in the centre of the cleft; but a single stout-pointed spine guards the cleft on each side. A dermal fold from the ventral part projects beyond the dorsal margin, its edges incurved and indurated, forming a chitinous lip on each side of the cleft. Scales of anal operculum (*fig.* 6) pointed at extremity; the outer angle evenly rounded; outer edge longer than base. The operculum is surrounded by a sharply defined densely chitinous zone. Derm with small scattered translucent pores, and some irregular nebulous pale streaks on the marginal area. Under surface (*fig.* 3) with a deep pouch on each side of abdomen, in which the young larvæ are sheltered for some time after birth. Limbs so closely pressed into surface of body as to be practically invisible on the living insect. Antenna (*fig.* 7) obscurely eight-jointed, the division between fourth and fifth joints usually incomplete. Antennal formula 3, (1, 8), 6, (2, 4, 5, 7), or 3 (1, 6, 8), (2, 4, 5, 7). Length of well-grown example 9 mm. Breadth 6 to 6.50 mm.

The early adult female, before gestation (*fig.* 4), is very thin and transparent, the median area mottled with pale reddish brown. When in position on the leaf, it is scarcely visible, except by its glistening surface. Delicate glassy filaments are secreted from the marginal hairs.

Adult ♂ (*fig.* 10) of normal form: comparatively large. Thorax dark castaneous, highly polished, except mesal notal plate and scutellum which are dull. Head blackish brown. Ocelli large, purplish black: four on upper and four on under surface of head (*fig.* 11). Eyes minute, lateral. Abdomen dull reddish purple, bearing a pair of very long fine opaque-white caudal filaments. Antennæ and legs brownish purple. Wings ample; highly iridescent; costal nervure and costal area purplish pink. Length (including genital sheath) 2.25 mm.

Male puparium (*fig.* 9) oval: median area convex, covered by a broad opaque-white elevated pad; marginal zone opaque-white, except at posterior extremity, where it is glassy and translucent; a narrow space between marginal and median areas tinged with brownish purple; scale divided into 12 plates. Length 3.50 mm. Breadth 2.25 to 2.50 mm.

Fully grown male larva (*fig.* 8) bright reddish fulvous, with a dense cushion of opaque-white wax on the median longitudinal area. Raised white lines—

four on each side and one behind—radiate from the waxy cushion to the margin, indicating the divisions of the future puparium.

Habitat on upper surface of leaves of *Piper nigrum* and other species of pepper, on *Pothos scandens*, and occasionally on *Anona sp.*: Peradeniya, Rambukkana, Matale.

Occurs also in the Wynaad, S. India, on cultivated pepper vines.

EXPLANATION OF PLATE LXXV.

LECANIUM MARSUPIALE.

Fig. 1. Leaf of *Piper nigrum*, with ♂ and ♀ scales, nat. size.
2. Adult ♀, dorsal view, × 5.
3. „ ventral view, × 5.
4. Early adult ♀, dorsal view, × 5.
5. Stigmatic cleft of ♀, dorsal view, × 150.
6. Anal operculum of ♀, × 150.
7. Antenna of ♀, × 150.
8. Male larva, dorsal view, × 6.
9. Puparium of male, dorsal view, × 6.
10. Adult ♂, dorsal view, × 12.
11. Head of male (diagrammatic), viewed from in front.

LECANIUM BICRUCIATUM, *sp. nov.*

(PLATE LXXVI.)

Adult ♀ (*figs.* 1, 2), ochreous; median area suffused with bright castaneous; margin narrowly brown. Form oval or subdeltoid; anterior extremity usually more or less acuminate. Flattish; with a prominent median longitudinal and two transverse carinæ; the longitudinal ridge obsolescent posteriorly to the second transverse ridge. Eyes black; at some distance from margin. Derm with small irregularly oval cells, not very sharply defined; forming broken transverse lines on the marginal zone, and collected into irregular circles and rosettes on the median area (*fig.* 5). A well-defined clear space marking position of the eyes, after treatment with potash. Stigmatic clefts with a dark coloured chitinous rim (*fig.* 6). Stigmatic spines three, stout, with rounded extremities; moderately long, but barely reaching the margin. Marginal hairs (*figs.* 6, 7, 8) falcate, flattened at extremity; varying in size in examples from different plants; those from *Memecylon* (*fig.* 7) smaller and more slender; those from *Eugenia* (*fig.* 8) stouter and strongly curved. No submarginal tubercles. Scales of anal operculum (*fig.* 4) with base and outer edge approximately equal, together forming a more or less continuous curve; a minute tubercle bearing a fine hair at extremity. Antenna (*fig.* 3) six-jointed; third joint very long, usually with an imperfect division near its extremity; formula very constant: 3, (1, 6), 2, 4, 3. Anal ring with eight hairs, two of them considerably smaller than the others. Length 3·50 to 4·75 mm. Breadth 2·50 to 3·50 mm.

Male puparium (*fig.* 9) transparent, glassy; divided into eighteen plates; the median area thickened and raised. Length 2 mm. Breadth 1·25 mm.

Adult ♂ unknown.

Habitat singly, on under-surface of leaves of *Memecylon umbellatum*. *Nothopegia colebrookiana*, *Elæagnus latifolia*, *Calophyllum sp.*, and *Eugenia sp.* Peradeniya, Pundaluoya, Watawella, Nuwera Eliya. Widely distributed, but comparatively rare in any locality.

The peculiar form of the marginal hairs distinguishes this species from any other known to me.

Very closely allied to *piperis*, from which it differs only in number of antennal joints and form of marginal hairs.

It is possible that intermediate forms, showing gradual subdivision of the long third joint of antenna, with a simplification of the marginal hairs, may occur.

EXPLANATION OF PLATE LXXVI.

LECANIUM BICRUCIATUM.

Fig. 1. ♀ insect, on *Memecylon*, nat. size.
2. Adult ♀, dorsal view, × 6.
3. Antenna, × 150.
4. Scales of anal operculum, × 150.
5. Dermal cells, × 150.
6. Stigmatic cleft and marginal hairs (from *Elæagnus*), × 650.
7. Marginal hairs (from *Memycylon*), × 650.
8. Marginal hair (from *Eugenia*), × 650.
9. ♂ puparium, × 16.

LECANIUM MANGIFERÆ, *Green.*

(PLATE LXXVII.)

Lecanium mangiferæ, Green, *Entomologist's Monthly Magazine*, April, 1889, p. 249.

Adult ♀ (*figs.* 1, 4, 5), pale yellowish green, the malpighian tubules showing through the skin of the dorsum as an indistinct chain of oblong fulvous spots. Deltoid, bluntly pointed in front, broadly rounded behind, usually asymmetrical. Very thin; margin broadly flattened, with slight ridges above the stigmatic areas, and some conspicuous translucent lines marking the obliterated junctions of the abdominal segments. Median dorsal area smooth and very slightly convex in fully mature examples. Eyes marginal, minute, black. Anal cleft more than one-third total length of the insect. In some examples the anal aperture is approximately central. Scales of anal operculum (*fig.* 6) narrowly triangular, elongate; inner edge longest, more than twice length of outer edge; outer edge shortest; base twice length of outer edge. On the ventral abdominal area is a broad cavity in which the eggs are retained after deposition (*fig.* 5). Antenna (*fig.* 11) with eight joints; second and eighth equal and longest, seventh always shortest. Legs well developed; tarsus more than half length of tibia. Foot (*fig.* 10) with four digitules; the tarsals in the form of knobbed hairs; the unguals broad and spatulate, twice length of claw. Margin closely set with curved hairs, the extremities of which are divided into from three to four points (*fig.* 9). Submarginal tubercles five on each side. Stigmatic clefts with three stout spines, the middle one long and curved, the other two very short, straight, and bluntly rounded at extremity (*fig.* 8). Anal ring with eight hairs, six of which are long and stout, and two quite short and slender. Derm with numerous well-defined small oval or round pores, narrowly surrounded by a darker zone (*figs.* 6, 7). Length 3 to 4 mm. Breadth 2·50 to 3·50 mm.

Adult ♂, unknown.

Egg, pale green.

Young larva (*fig.* 2) very pale yellowish-green; broadly oval. Eyes dull red. Anal setæ half as long as body, springing from the points of the anal scales (*fig.* 3). Marginal hairs curved, simple.

Half-grown female very thin and transparent, similar in outline to adult.

Habitat on under surface of leaves of mango and *Litsea zeylanica.* Pundaluoya. Recorded also from the West Indies on orchids, cinnamon, and *Jambosa.* Reported also from the West Indies.

Mr. J. W. Douglas, in a note to the original description, points out the resemblance of this insect to *Lecanium acuminatum* of Signoret. But besides the discrepancy in the number of antennal joints, the present species (if Signoret's figure is reliable, *Essai sur les Cochenilles*, 1873, Pl. 12, *fig.* 1) has the anal cleft much longer, and consequently the anal scales situated much nearer the centre.

EXPLANATION OF PLATE LXXVII.

LECANIUM MANGIFERÆ.

Fig. 1. Mango leaf with insects *in situ*, nat. size.
2. Newly hatched larva, from below.
3. Abdominal extremity of young larva.
4. Adult female, dorsal view, × 8.
5. „ ventral view, × 8.
6. „ anal operculum and pores of skin.
7. „ dermal pores, more enlarged.
8. „ stigmatic spines, × 650.
9. „ marginal hairs, × 650.
10. „ foot.
11. „ antenna, × 150.

LECANIUM ACUTISSIMUM, *Green.*

(PLATE LXXVIII.)

Lec. acutissimum, Green, 'Catalogue of Coccidæ, *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*figs.* 1, 3, 4, 5) long and narrow, acutely pointed at each end, (of the form of a carraway seed); convex above. Colour varying from creamy-white in the early adult to deep chocolate-brown in older examples (*fig.* 3). Intermediate stages ochreous with a median reddish stripe (*fig.* 5), and bright castaneous. There is always a pale ochreous patch immediately anterior to the anal valve. Eyes black, visible only in the paler forms. There is a well-defined but narrow thin marginal zone, more apparent when viewed from below (*fig.* 4). Stigmatic cleft small and inconspicuous. A single slender stigmatic spine in each cleft with—on each side of it—a minute chitinous tubercle or rudimentary spine (*fig.* 6). Marginal hairs simple, slender, finely pointed. Submarginal tubercles eight on each side; conspicuous on early adult. Two longitudinal series of minute blunt spines (*fig.* 12) on the subdorsal area. Scales of anal operculum (*fig.* 7) with outer edge considerably longer than base. Limbs closely adpressed to the body, very small and inconspicuous. Antenna (*fig.* 8) with the two basal joints only distinguishable; lighter transverse marks faintly apparent in some examples suggest an original division into six (or possibly seven) joints; a few longish hairs at extremity. Legs minute, but relatively stout; tibio-femoral and tibio-tarsal articulations distinguishable only in anterior pair (*fig.* 9); in second and third pairs (*figs.* 10, 11) a slight constriction indicates the division between femor and tibia, but tibio-tarsal division quite indistinguishable. Claw minute; digitules usually wanting; occasionally one (rarely two) can be demonstrated (*fig.* 11). Derm with minute scattered translucent pores on the median dorsal area; and large suboval, subcircular, or irregular cells on submarginal zone, becoming elongate and linear at margin (*fig.* 6). Length 5 to 6 mm. Breadth 1 to 1·50 mm.

Male unknown.

Eggs not observed. The older females are concave below (*fig.* 4), and usually cover a few living larvæ.

Young larva (*fig.* 2) elongate, very pale green.

Habitat on *Cocos nucifera* (cocoanut palm); *Areca catechu* and *A. triandra; Cycas sp.*; *Piper nigrum* (pepper); *Nephelium litchi; Mangifera indica* (mango); *Litsea zeylanica; Musa paradisaica* (banana), and various other trees, shrubs, and plants. Usually on under surface of the leaves. Pundaluoya, Kandy, Colombo. Peculiar to Ceylon.

EXPLANATION OF PLATE LXXVIII.

LECANIUM ACUTISSIMUM.

Fig. 1. Piece of cocoanut leaf with insects *in situ*, nat. size.
2. Newly hatched larva.
3. Adult ♀, dorsal view, × 8.
4. „ ventral view, × 8.
5. Early adult ♀, × 8.
6. Stigmatic spine and marginal hairs, × about 300.
7. Anal operculum, × 150.
8. Antenna, × 410.
9. Anterior leg, × 410.
10. Median leg, × 410.
11. Posterior leg, × 410.
12 Dorsal spines, × 650.

LECANIUM ARUNDINARIÆ, *sp. nov.*

(PLATE LXXIX.)

Adult ♀ (*figs.* 1, 2) ochreous ; median area slightly suffused with red, the malpighian tubes showing through the derm as a broken chain of elongated spots. Eyes black, prominent, distant from margin. In the living insect there are many short white waxy filaments scattered over the median dorsal area (*fig.* 1). Form elongate, narrow ; extremities acute. Marginal zone thin and translucent ; median area raised, with a sharply defined median longitudinal ridge. Derm cells inconspicuous and difficult to define ; traces of large oval cells are suggested on parts of the median area. (Scales of anal operculum missing in the single example examined.) Stigmatic cleft (*fig.* 3) with semicircular chitinous rim ; spines three to five, the outer ones—when present—small and fine, the normal three very stout, with rounded extremity, the central one reaching to or beyond the margin. Marginal hairs fine, simple, pointed. Antenna (*fig.* 4) with six joints, the third almost as long as the terminal three together. Formula : 3, 6, 1, 4 (2, 5). Legs well developed ; tarsus as long as, or longer than, tibia (*fig.* 5). Length 7 mm. Breadth 2·25 mm.

Ovoviviparous ; the young larvæ elongate, pale reddish fulvous.

Described from a single example found on upper surface of leaf of *Arundinaria sp.* Pundaluoya (July.)

EXPLANATION OF PLATE LXXIX.

LECANIUM ARUNDINARIÆ.

Fig. 1. Leaf of *Arundinaria* with insect, nat. size.
2. Adult ♀, dorsal view, × 6.
3. Stigmatic cleft and spines, × 650.
4. Antenna, × 150.
5. Leg (median), × 150.

LECANIUM LONGULUM, *Douglas*.

(PLATE LXXX.)

Lec. longulum, Douglas, *Entomologist's Monthly Magazine*, October, 1887, p. 97.

Lec. chirimoliæ, Maskell, *Trans. New Zealand Institute*, Vol. XXII. 1889, p. 137.

The following is Mr. Douglas's description, which answers closely to Ceylonese examples of the insect :—

'♀ scale dingy pale yellowish-grey, elongate, narrow, ends broadly rounded, side margins slightly curved out, not recurved; surface smooth, transversely arched, longitudinally level semi-cylindric, not carinate, a band of faintly dark reticulation along the sides, whence, in some examples, faint dark lines radiate to the margin; the disc occupied with a long, pale, clear, oval spot; or in some mature specimens the scale is unicolorous yellow-brown, the dorsal spot partly or wholly covered, and on the sides minute pale dots in place of reticulations. Under side all pale, a broad space all round the insect, a conspicuous blackish eye-spot above each antenna. Antennæ of eight joints: the first short; the second longer, about the same length as the fourth; the third longest of all; the fifth longer than the fourth, but not so long as the third; the sixth, seventh, and eighth shortest, the eighth longest of the three, which (especially the terminal) have all gradated sides. The eighth, indeed, simulates two joints, but the graduated structure and the want of colour make it impossible to determine with certainty whether or not there is a real articulation. Young larva under the scales. A scale remarkable for its length, narrowness, and semi-cylindric form.'

To the above description, the following particulars may be added. The darker tint of the sides consists of a nebulous reticulation of closely set dark specks enclosing irregular pale spots, the pale spots forming longitudinal series on abdominal region (*fig.* 2). The small black eye-spot is submarginal and distinctly visible on the upper as well as the under surface. The eighth antennal joint, in my Ceylonese examples, is sometimes no longer than the sixth. I have noticed the following two formulæ: 3, (2, 5), (1, 4, 8), 6, 7; and 3, 5, (2, 4), 1, (6, 8), 7. The excess of the fifth over the fourth joint is noticeably constant in all examples. The eye-spot, in macerated examples, is enclosed in a well-defined irregular clear space (*fig.* 6). The derm is thickly sprinkled with small oval and subglobular translucent cells, which are more conspicuous towards the margins. Stigmatic cleft (*fig.* 7) small and inconspicuous; stigmatic spines three, the median about three times length of laterals. Marginal hairs simple, pointed, curved (*fig.* 8). Anal operculum reddish. Scales of anal operculum (*fig.* 4) broad, with acute angles, the angle formed by the base and outer edge slightly falcate; outer edge a little longer than base. Submarginal tubercles comparatively large (*fig.* 3) and numerous; ten to twelve on each side. Legs normal, tarsus shorter than tibia. Hairs of anal ring eight, two of them much shorter and more slender than the others.

Anal cleft less than one-fifth total length of insect. Length 4 to 6 mm. Breadth 2·50 to 3·50 mm.

Male unknown.

The insect is ovoviviparous ; the young larvæ pale pinkish-orange.

Habitat on twigs and branches of *Albizzia sp.*, *Acacia dealbata*, *Grevillia*, *Loranthus*, 'Cherimoya' (*Anona sp.*). Pundaluoya, Bogawantalawa, Kandy.

The species has been widely distributed on cultivated plants, and its original home is not known. In Europe it is found chiefly in plant-houses. Mr. Douglas's examples were from *Acacia catechu*, *Anona muricata*, *Myrica fragifera*, *Averrhoa carembola*, and *Spathophyllum blandum*. It occurs in Germany on *Ficus sp.* and *Latania borbonica*. Maskell recorded it from New Zealand, Australia, and the Sandwich Islands, upon *Psidium*, *Bambusa*, *Acacia*, and *Citrus*. De Charmoy found it on *Cherimolia* in Mauritius. Professor Cockerell and other American entomologists record the species from Mexico, Panama, Jamaica, and Antigua.

EXPLANATION OF PLATE LXXX.

Lecanium longulum.

Fig. 1. Insects on branch of *Albizzia*, nat. size.
2. Adult ♀, dorsal view, × 10.
3. „ submarginal tubercle, × 650.
4. „ anal operculum, × 150.
5. „ antenna, × 150.
6. „ dermal cells, eye-spot, &c., × 150.
7. „ stigmatic spines and marginal hairs, × 300.
8. „ a single marginal hair, × 650.

LECANIUM CAUDATUM, *Green.*

(PLATE LXXXI.)

Lec. caudatum, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*figs.* 1 to 4) oval, narrower in front, broadly rounded behind; strongly convex above, with slightly flattened margin. Faint median longitudinal ridge and transverse corrugations. Colour bright castaneous, with a broad marginal zone of a deeper tint; usually a dark median fascia and several irregular transverse dotted bands; older examples deep castaneous. Early adult (*fig.* 4) greenish yellow to bright orange yellow; a pale reddish marginal zone enclosing paler specks; a deep red-brown median longitudinal stripe, and transverse dotted bands of same colour, those on the thoracic area more conspicuous—the first band curving forwards towards the eyes, the second directed towards the anterior stigmatic cleft, the third and fourth meeting near the posterior stigmatic cleft. Eyes black, submarginal. Anal valve black. The malpighian tubes sometimes visible through the derm as a looped chain of dark spots (*fig.* 2). Examples living under shelter secrete three or four long white waxy threads from the anal aperture (*figs.* 2, 4), extending—in the earlier stages—for more than twice the length of the body of the insect; but, where the insects are in exposed situations or are attended by ants, these filaments are lost as fast as they are formed. Derm with numerous oval or subglobular translucent cells (*fig.* 11), more conspicuous near the margin, each surrounded by a darker areola; many irregular deep-seated oblong spots which are pale near the margin, but become darker than the surrounding parts towards the median area. Under favourable conditions of illumination, a faint hexagonal reticulation can be demonstrated on the median dorsal area (*fig.* 10). Stigmatic cleft (*fig.* 12) with three small stout spines, the median about twice length of laterals, scarcely projecting beyond margin. Marginal hairs (*figs.* 11, 12) broadly dilated and irregularly dentate. No submarginal tubercles. Scales of anal operculum (*fig.* 7) with outer edge sinuous, only slightly longer than base; apex narrowly truncate. Antenna (*fig.* 5) seven-jointed, third longest; antennal formula very constant: 3, 4, (2, 7), 1, 5, 6. Foot (*fig.* 6) with stout claw and strongly dilated ungual digitules. Anal ring (*fig.* 9) with six long stout and deeply coloured hairs. The parts of the anal ring and its connection with the anal valve can be more readily demonstrated in this species than in any other *Lecanium* with which I am acquainted. Length 3 to 4 mm. Breadth 2 to 3 mm.

Male unknown in any stage.

Young larva (*fig.* 8) very pale pink.

Eggs pale pink; deposited beneath the body of the parent, which dries up and forms a protective covering for them.

Habitat on upper surface of leaves of *Passiflora*, *Coffea arabica*, *Loranthus*, *Memecylon umbellatum*, *Pergularia odoratissima*, *Pavetta*. Pundaluoya, Kandy.

Known only from Ceylon.

EXPLANATION OF PLATE LXXXI.

LECANIUM CAUDATUM.

Fig. 1 Leaf of *Passiflora*, with insects, nat. size.
2. Adult ♀, dorsal view, × 10.
3 „ side view, × 10.
4. Early adult ♀, dorsal view, × 10.
5. Antenna, × 150.
6. Foot, × 300.
7. Anal operculum, × 150.
8. Young larva.
9. Anal ring, ventral aspect, × 150.
10. Portion of derm, with reticulate markings, × 150.
11. Margin of scale, showing stigmatic spines, marginal hairs, and dermal cells, × 150.
12. Stigmatic cleft, marginal hairs, &c., × 650.

LECANIUM PSIDII, *sp. nov.*

(PLATE LXXXII.)

Adult ♀ (*fig.* 1) bright red-brown to deep brown; living insects usually smooth, shining; dried examples often more or less pitted and corrugated. The paler examples often with darker bars projecting inwards from the margin, but not meeting in the centre. Oval; highly convex; sometimes narrowed in front; margin pitted, and slightly out-turned (*fig.* 10). Antenna (*fig.* 9) normally with seven joints; seventh and fourth longest. Formula: (4, 7), (2, 3), 1 (5, 6), or 4 (2, 3, 7), 1 (5, 6); sometimes becoming eight-jointed by elongation and subdivision of third joint (*fig.* 8). Legs (*fig.* 7) rather small, tarsus only slightly shorter than tibia. Stigmatic spines three, the median one scarcely longer than the marginal hairs (*fig.* 9), the other two less than half as long. Marginal hairs dilated and finely frayed at the extremity. Submarginal tubercles four or five on each side. Scales of anal operculum (*fig.* 6) bluntly pointed, base twice as long as outer edge. Anal ring with eight stout hairs. Derm with numerous minute oval pores, which are arranged more or less in lines inclosing irregular blank spaces. Size very variable. Length 2·50 to 3·75 mm. Breadth 2 to 3 mm.

Female of second stage (*fig.* 4) and early adult pale green or yellow, with a median longitudinal series of deep reddish-brown spots, and a submarginal series of dark brown lines and spots, the former extending to the margin.

Adult ♂ (*fig.* 2) pale reddish; apodema darker. Legs and antennæ yellowish. Wings hyaline; costal nervure very pale pink. No caudal filaments, but a small fleshy tubercle, surmounted by a few hairs, on each side of the genital sheath (*fig.* 5). Genital sheath three-quarters length of abdomen, moderately stout. Antennæ as long as body; three knobbed hairs at extremity. Eyes and ocelli black. Length 1 mm.

Male puparium (*fig.* 3) colourless, transparent, glassy, divided into nine plates, with an indistinct median tubercular ridge. Length 1·50 mm.

Pupa green, turning reddish shortly before the emergence of the imago.

Habitat on under surface of leaves of 'guava' (*Psidium guyava*), on *Magnifera indica*, 'jak' (*Artocarpus integrifolia*), *Eugenia sp.*, *Fagræa*, and on the young shoots of the cultivated nutmeg (*Myristica moschata*). Kandy, Peradeniya, Colombo, Balangoda (December, January). Always attended by ants. The large 'red ant' (*Œcophylla smaragdina*) often encloses colonies of this bug in its nests.

EXPLANATION OF PLATE LXXXII.

LECANIUM PSIDII.

Fig. 1. Guava leaf, with insects, nat. size.
2. Adult male, dorsal view, × 25.
3. Male puparium, × 12.
4. Female, immature.
5. Extremity of abdomen of male, from below.
6. Anal operculum of adult female, × 100.
7. Leg of „ × 150.
8. Antenna of „ with eight joints, × 150.
9. „ „ seven „ × 150.
10. Adult female, side view, × 12.
11. Stigmatic spines and marginal hairs.

LECANIUM OLEÆ, *Bernard.*

(PLATE LXXXIII.)

Chermes oleæ, Bernard, *Mem. d'Hist. Nat. Acad.*, 1782.

Coccus oleæ, Olivier, *Encycl. Method.*, 1791.

Lecanium oleæ, Walker, *List of Homopt. in Coll. British Museum*, Part IV., 1852.

Adult ♀ (*figs.* 1, 2) densely chitinous; dull purplish-brown, surface roughened and minutely specked with small greyish or colourless waxy granules. In smal examples these granules are close together; in larger, well-fed specimens they become more widely separate, owing to the expansion of the intermediate tissues. Form highly convex; usually distinctly angular, with prominent median longitudinal and two transverse ridges; a smaller longitudinal raised line connects the transverse ridges on each side. In some examples the ridges are almost obsolete, and the insect nearly hemispherical. Eyes inconspicuous. Scales of anal operculum (*fig.* 4) pointed at extremity; outer edge rounded; base straight or slightly concave; outer edge twice length of base. Marginal hairs (*fig.* 5) rather long; extremity dilated and often deeply divided. Submarginal tubercles six on each side. No stigmatic cleft. Stigmatic spines three (*fig.* 7), prominent and sharply pointed, the median spine nearly four times the length of the others. Antenna (*fig.* 6) with eight joints, of which the third is always the longest; relative length of other joints rather variable: fourth equal to fifth, sixth usually equal to seventh. In one example examined the antenna on one side had seven joints only, while that on the opposite side was normal. Legs rather slender; tarsus about three-quarters length of tibia; digitules of claw rather long. Dermal cells (*fig.* 3) large, irregularly polygonal, with rounded angles; the margin of each cell distinctly marked on the surface. There is a deeper seated reticulation which follows the interspaces between the cells, but this is not always clearly defined. On the denser marginal area the cavities of the cells are filled with a dark brown deposit, and—in very old scales—all the cells may be similarly darkened.

Early adult female and female of second stage dull pale brownish yellow.

Male puparium not observed in Ceylon, but examples from Europe (*fig.* 8) are oblong oval; divided into nine plates; glassy, colourless; studded with irregular waxy flakes, those on the median line more prominent and well defined. A submarginal series of minute raised spots. Pupa green, with a dark brown longitudinal stripe.

Adult ♂ not observed in Ceylon. Figures of the insect in an American publication show it to be of normal form.

Habitat in Ceylon on *Antidesma bunius*, *Grewia orientalis*, and *Duranta* (Pundaluoya); on *Thespesia populnea* (Jaffna); and on *Cajanus indicus* (Peradeniya). Though widely distributed, in point of numbers *Lec. oleæ* is distinctly a scarce species in Ceylon. It is probably kept in check by parasites. It occurs in nearly all countries of the world, and is a serious pest in parts of Europe, the United States, and South Africa, where it attacks many kinds of fruit-trees, particular olive and various species of citrus.

EXPLANATION OF PLATE LXXXIII.

LECANIUM OLEÆ.

Fig. 1. Insects on twig of *Antidesma*, nat. size.
2. Adult ♀, side view, × 5.
3. „ derm cells, × 150.
4. „ anal operculum, × 150.
5. „ marginal hairs, × 650.
6. „ antenna, × 150.
7. „ stigmatic spines, × 650.
8. Male puparium, × 20 (after drawing in *Ent. Mo. Mag.*, Mar. 1897, p. 72).

LECANIUM NIGRUM, *Nietner.*

(PLATE LXXXIV.)

Lec. nigrum, Nietner, *Enemies of the Coffee Tree*, p. 9, 1861.
Lec. depressum, Targioni-Tozzetti, *Stud. sulle Coccinigliе*, 1867.
Lec. begoniæ, Douglas, *Ent. Mo. Mag.*, Aug. 1892, p. 209.

Adult ♀ (*figs.* 2, 3) variable in size, form, and colour, such variation depending considerably upon the host-plant. The typical form is irregularly oval, usually asymmetrical, narrowed in front; strongly convex, the dorsum above the abdominal region sometimes forming a pronounced hump. Neither the stigmatic nor anal clefts are conspicuous. There is often a slight median longitudinal carina and some shallow foveæ on the sides. On some plants (*e.g.*, *Mussænda* and *Canthium*), I have found examples almost circular in outline; while on the narrow leaves of *Asparagus* the scales are elongate and narrow, with the margins concealed beneath the protuberant sides. On leaves of *Agave*, *Maranta*, and *Canna*, the scales are usually much less convex and of a much more regular oval form. The colour of the mature insect varies from bright castaneous to deep purple black, the tint usually deepening with age; but examples on *Agave* and *Canna* appear to remain castaneous even when fully mature. Surface smooth, but not highly polished, faintly papillose. During oviposition the ventral parts shrink upwards, leaving a cavity completely filled with eggs. Eyes inconspicuous, submarginal, visible only in macerated specimens. Antenna (*fig.* 12) with eight joints, of which the third is always much the longest, the eighth next longest, and the ninth the shortest; the relative lengths of the remaining joints variable. Legs well developed, slender; tarsus and claw together nearly equal to tibia; digitules normal. Anal ring with six stout hairs and two finer ones. Scales of anal operculum (*fig.* 11) with outer edge slightly convex, base slightly concave; outer almost as long as inner edge; base shortest. Anal cleft almost obsolete, the two edges firmly united. Stigmatic spines acutely pointed, three, the median one about three times as long as the other two; approximately marginal in the early adult (*fig.* 5); sunk in a small cleft in older examples (*fig.* 6). Marginal hairs dilated and flattened at extremity, the flattened edge deeply emarginate (*figs.* 5, 6). Being set edgeways, the flattening is not always apparent and may be overlooked. Submarginal tubercles, about five on each side, inconspicuous. Derm closely covered with a conspicuous tessellation of irregularly polygonal cells, each with a median pale oval spot and a minute translucent pore in the centre. The appearance of these cells varies considerably in different individuals and even on different parts of the same scale. In less mature scales the cells are separate (*fig.* 8); in more advanced scales the sides of the cells become thickened (*fig.* 9); later, the cells themselves appear to increase in

size until their walls become contiguous and confluent (*fig.* 11). In very densely chitinous examples the cell walls may become so dark that the tessellated appearance is more or less obscured and the pale spots only are conspicuous. A vertical section through the derm (*fig.* 13) affords an explanation of the tessellation and median spot. It is due to a complicated involution of the cuticle between each cell, the involuted parts forming, in fact, the walls, and spreading out below to form the floor of the cell. The floor is incomplete, the interrupted portion (*fig.* 13*a*) appearing as the pale median spot. The roof of each cell is pierced by a minute pore (*fig.* 13*b*). Length 3 to 5 mm. Breadth 2 to 3 mm.

Female of second stage (*fig.* 4) flattish, or very slightly convex above; pale greenish yellow with a reticulated pattern of dull reddish brown lines formed by seven longitudinal stripes crossed by eleven or twelve transverse bands, the points of intersection dilated. These markings vary in intensity and are sometimes obsolete. Eyes black, submarginal. Anal valves fulvous. In sheltered situations these immature females secrete, at intervals along the margin, delicate twisted glassy filaments. The filaments spring from a submarginal series of points corresponding with the extremities of the transverse coloured bands. The passage of countless ants, which usually attend the insects, soon wears off these filaments.

Young larvæ dull red.

Eggs purplish.

Adult ♂ (*fig.* 15) reddish brown above, yellowish beneath; head, sternal plates, anterior and lateral notal plates, antennæ and legs, olive brown; apodema black, polished; a dark vertical line on head; margin of abdomen reddish. Wings ample, hyaline and iridescent; costal nervure bright pink. Antenna ten-jointed, fourth longest; three knobbed hairs at apex. A pair of long white waxy caudal filaments. Penultimate segment of abdomen with a pair of prominent fleshy pilose processes, directed backwards; and a recurved (eversible?) process on each side at base of style. Style flattened, lanceolate, acutely pointed, half length of abdomen. Length 1 mm.

Male puparium (*fig.* 14) transparent, glassy; divided into nine plates, of which two are central and seven marginal; junctions of the plates raised and more opaque; a submarginal series of minute raised spots. Length 1·50 mm.

Male larva (*fig.* 17), when fully grown, yellowish green; with a slight median longitudinal carina of a chocolate-brown colour, obscurely broken into quadrate spots. Shortly before pupating, the plates of the puparium are plainly demarked on the dorsum of the larva. Length 1·50 mm.

Habitat on stems and leaves of numerous plants. Widely distributed throughout the world. In Ceylon it occurs commonly, in injurious numbers, on *Hibiscus rosa-sinensis* (see *fig.* 1), on various species of *Anona*, and on *Croton tiglium*. I have observed it also on the following plants: *Coffea arabica* and *C. liberica*, *Cinchona succirubra* and *C. officinalis*, *Ficus sp.*, *Begonia sp.*, *Asparagus falcatus*, *Manihot utilissima* (tapioca), *Thespesia populnea* (suriya), *Agave americana*, *Mussænda frondosa*, *Canna*, *Canthium parviflorum*, *Maranta zebrina*, *Abutilon sp.*, *Cobæa scandens*, *Graptophyllum Poinsettia*, *Jatropha*, *Vitis sp.*, and many uncultivated plants.

I have never bred any parasites from this species. Nietner (*Enemies of*

the Coffee Tree) was equally unsuccessful. Under these circumstances it is remarkable that the insect has not assumed more importance as a pest. It is kept in partial check by a greyish fungus (*Cephalosporium sp.*), which kills off large numbers of the immature insects.

EXPLANATION OF PLATE LXXXIV.

LECANIUM NIGRUM.

Fig. 1. Stem of *Hibiscus*, with insects, nat. size.
2. Adult ♀, dorsal view, × 8.
3. Adult ♀, side view, × 8.
4. Immature ♀, dorsal view, × 8.
5. Stigmatic cleft and spines of immature ♀.
6. Stigmatic cleft and spines of adult ♀.
7. Foot of adult ♀, × 150.
8, 9, 10. Dermal cells, × 150.
11. Anal operculum, × 150.
12. Antenna, × 150.
13. Section through derm, × 650.
(*a*) Pale median spot.
(*b*) Central pore.
14. Puparium of male, × 25.
15. Adult ♂, × 35.
16. Terminal segments of adult ♂, × 200.
17. Male larva, × 25.

LECANIUM HEMISPHÆRICUM, *Targ.*

(PLATE LXXXV.)

Lec. hemisphæricum, Targioni-Tozzetti, *Studi sulle Cocciniglie*, 1867, p. 27.
Lec. filicum, Boisduval, 1867, 336.
Lec. coffeæ, Walker.
? *Lec. anthurii*, Boisduval.
? *Lec. hibernaculorum*, Boisduval.

Adult female (*fig.* 6, 7), varying in colour from pale brownish fulvous to deep chestnut brown; all intermediate shades being represented—often on a single plant. The paler forms are often marbled with brown. There is usually a darker submarginal zone, but this is not always apparent. The common form on tea and coffee is bright castaneous, with deep castaneous submarginal zone. Even with a hand lens the derm is seen to be closely specked with minute translucent cells. A few small raised waxy patches, arranged in more or less regular rows, on the median dorsal area. Form oval, hemispherical; the margin usually outturned and slightly flattened, but often concealed by the bulging sides. In the early adult there is a distinct median longitudinal crest and two transverse ridges (*fig.* 5); but these generally disappear during gestation, though traces of them sometimes remain, especially in starved examples. The dorsal surface is highly chitinous and polished. During gestation the ventral area shrinks upwards, until the scale forms simply a chitinous shell filled with innumerable pale pink eggs (*fig.* 2). At this time the inner marginal surface is dusted with white mealy powder, and where a scale has been detached from the plast, an oval white ring marks its former position. Antenna (*fig.* 15) with eight joints, of which the third is always the longest, and eighth next longest, sixth and seventh always shortest, and equal; first, second, fourth, and fifth subequal, sometimes one, sometimes another, slightly the longer; the fourth dilated at distal extremity and without any hairs. Leg (*fig.* 16) with tarsus about two-thirds length of tibia. Signoret states that this section of *Lecanium* is distinguished from all others by a 'true articulation in the tarsus.' If by this he infers that there are two distinct tarsal joints, I have failed to observe them. There is a slight constriction at the middle of the tarsus; but this is noticeable in many species. Scales of anal operculum (*fig.* 14) irregularly triangular; both inner and outer sides somewhat sinuous; outer side considerably longer than base. Anal ring with eight stout hairs. Stigmatic spines (*fig.* 12) three, median spine long and curved, more than three times length of other two. Marginal hairs numerous, long, distinctly dilated and fringed at apex (*fig.* 13). Submarginal tubercles, five to six on each side; obscured in old examples. Dorsal area (*fig.* 12) closely studded with numerous well-defined oval translucent cells, each with a smaller concentric ring in a deep layer of the derm, and a minute central pore on the surface. The cells

towards the margin sometimes appear larger, owing to a paler outer zone rendered conspicuous by the darker ground colour of the margin (*fig.* 12). The cells of the median area are actually rather larger than those of the margin. Derm of ventral area with numerous minute circular pores communicating with cylindrical ducts. Size very variable, even on the same plant. Length 2 to 3 mm. Breadth 1·25 to 2 mm.

The early stages of the female show a gradual progression from the elongate oval to the broadly oval ; the ridges becoming more marked until the adult stage is reached when, after gestation, they become obliterated as the insect assumes its final hemispherical form. The colour of the early stages varies considerably. On the tea plant, the young larva is of a pale straw colour (*fig.* 2). After a time three diffused crimson transverse bands usually make their appearance (*fig.* 3). By their gradual extension they eventually cover the dorsal surface with the exception of the ridges which remain pale (*fig* 4.). On *Adiantum* and other ferns, the crimson forms seldom occur, the immature insect remaining throughout of a pale ochreous colour. In other examples there may be a brownish or blackish suffusion, commencing in the form of transverse bands.

The male insect, in any stage, is at the present time extremely rare, though some forty years ago, when Nietner was investigating the life history of the Brown Coffee Bug, it appears to have been quite common. I have myself found them only on a single occasion, on the under surface of a coffee leaf, in 1889. The drawings then made (and reproduced herewith) do not show as much detail as is required for accurate comparison with other species.

Male puparium (*fig.* 10) colourless, glassy, transparent, divided into nine plates.

Adult male (*fig.* 11), minute, reddish, wings strongly iridescent, with crimson costal nervure. Antennæ rather short, reaching to scutellum. Genital sheath long and slender. A pair of slender white caudal filaments, equal to total length of body ; and a pair of moderately long fleshy tubercles, exterior to the caudal filaments.

Habitat on leaves, twigs, and branches of coffee, cinchona, tea, and innumerable other plants, amongst which may be mentioned *Adiantum* and other ferns, asparagus, gardenia, guava (*Psidium guyava*), *Cobæa*, *Anthurium*, *Loranthus*, bamboo, etc. In fact, the species may be considered as omnivorous as it is cosmopolitan. It has been recorded from almost every country in which Coccidæ have been collected in both hemispheres.

This insect was formerly known in Ceylon as the 'Brown Bug' of the coffee plant and, before the advent of the 'Green Bug' (*Lec. viride*), was considered the most serious insect pest of that plant. Nietner (*The Coffee Tree and its Enemies*, second edition, p. 6) describes the species under its synonym of *Lecanium coffeæ*, and makes the following remarks about its occurrence in Ceylon : 'Although the coffee has been known in Ceylon for about two hundred years, and although systematically worked estates have existed since 1825, the bug does not appear to have attracted attention—that is to say, not to have appeared in large quantities till about 1845 when, however, it began to spread with such rapidity, that in 1847 a very general alarm was taken by the planters.' Nietner's first edition appeared in 1861. In a second

edition he adds the following note: 'I may add that now (1872) there is not nearly as much said about the bug as fifteen or twenty years ago, and although we shall probably never get free from it, it is to be hoped we shall gradually hear less and less of it. Meanwhile, I have had letters from Honolulu complaining of the same bug on coffee trees there.' Nietner's prediction came true, and for some years before coffee failed, the bug—as a pest—had practically disappeared. Since the cultivation of the tea plant has become general, *Lec. hemisphæricum* occasionally asserts itself on individual bushes, but I have never heard of its extending over any considerable area. As existing at present, it may be easily controlled by spraying with Strawson's mixture or MacDougall's Insecticide wash. (See Part II. p. xxxix.)

Many minute hymenopterous parasites prey upon the insect, and probably tend to keep it in check. Nietner mentions the following species bred from the 'Brown Bug': *Scutellista cyanea*, *Encyrtus nietneri*, *E. paradisicus*, *Cephaleta purpureiventris*, *C. brunneiventris*, *C. fusciventris*, *Cirrhospilus coccivorus*, and *Marietta leopardina*. Dr. L. O. Howard, of the United States Department of Agriculture, has determined the following species bred by me from this same bug: *Comys rufescens* (Motschulsky), *Coccophagus orientalis* (Howard), and *C. flavescens* (Howard).

Prof. Cockerell refers this species, and the section to which it belongs, together with *L. oleæ* and its allies, to the genus *Saissetia*, Deplanches. (See *Entom. Student*, May 15th, 1901.)

EXPLANATION OF PLATE LXXXV.

LECANIUM HEMISPHÆRICUM.

Fig. 1. Insects on tea stem, nat. size.
2. Young larva.
3. Larva, further advanced.
4. Early female, dorsal view.
5. „ „ side view.
6. Adult female, side view, × 12.
7. „ „ before oviposition, dorsal view, × 12.
8. „ „ „ „ ventral view, × 12.
9. „ „ after oviposition, ventral view, × 12.
10. Male puparium.
11. Adult male.
12. Portion of derm of adult female, showing stigmatic spines, marginal hairs, and dermal cells, × 150.
13. Marginal hairs, × 650.
14. Anal operculum, × 150.
15. Antenna, × 150.
16. Leg, × 150.

LECANIUM (PARALECANIUM) EXPANSUM, *Green.*

(PLATE LXXXVI.)

Lec. expansum, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*figs.* 1, 2) very broadly oval, narrower anteriorly, flat, or very slightly convex above; margin indented at anal and stigmatic clefts. Below with a shallow cavity on each side of abdomen. Colour of living insect reddish or brownish yellow; a narrow dark brown marginal zone with well-defined inner border; a submarginal pellucid zone, merging into a yellowish area; an irregular median pellucid patch, through which the movements of the internal organs can be distinguished. The dorsal surface is coated with a delicate transparent waxy layer which is thickened in definite polygonal plates arranged in curved longitudinal series; each waxy plate with concentric markings, as of superimposed smaller plates (*fig.* 8), probably indicating periods of growth. During treatment with potash the whole waxy layer becomes opaque and brittle, and can be removed in flakes. The whole dorsal surface, but more particularly the submarginal zone, with scattered circular translucent pores, sometimes narrowly bordered with a darker areola. On each side of anal aperture, on dorsal surface, is a curved pellucid patch enclosing groups of smaller pores (*figs.* 3, 5), and a similar patch on each side nearer the centre of dorsum. On the submarginal area are more or less distinct small oval epidermal cells radiating towards the margin, and median area closely studded with very indistinct oval or polygonal cells. Scales of anal operculum pointed (*fig.* 4); base shorter than outer edge. Stigmatic cleft (*fig.* 7) with from three to nine stout blunt spines. Margin (*fig.* 9) with complete series of overlapping flabelliform flattened hairs; the margin itself minutely and irregularly indented, with three main indentations between each point of attachment of the flabellæ. Eyes black; at a considerable distance from the margin. Antenna (*fig.* 10) with incomplete divisions, though a terminal and two basal joints can usually be distinguished. Legs wanting. Genital orifice surrounded by some eight groups of minute multilocular spinnerets (*figs.* 3, 6). Length 5 to 7 mm. Breadth 4·50 to 6·50 mm.

Immature female thin and colourless. Marginal hairs slightly dilated at extremity (*fig.* 11).

Adult ♂ (*fig.* 15) bright castaneous; apodema black. Costal nervure of wing pink. Terminal joint of antenna with three knobbed hairs (*fig.* 20). No caudal setæ. Length (including genital sheath) 1·50 mm.

Male puparium (*fig.* 14) oval, glassy, transparent; median area convex; divided into eighteen plates, of which three are central and fifteen marginal. Length 2 mm.

Male larva with a marginal series of stout curved hairs (*figs.* 12, 13), their extremities dilated and fringed on one side.

Young larva reddish. Caudal setæ about half length of body.

Egg brownish red.

Habitat on upper surface of leaves of *Dalbergia* and *Litsea:* Pundaluoya. On an undetermined shrub : Elephant Pass.

Occurs also in Java, on various plants; and in Queensland, Australia ; on *Ficus;* probably an introduced insect in the latter country, as it has been found there only on ornamental trees in parks.

LECANIUM EXPANSUM, *Green*, VAR. QUADRATUM, N. VAR.

Differs from type in the smaller and blunter scales of anal operculum ; their base and outer edge about equal in length, together approximately forming a square (compare *pl.* lxxxvi., *figs.* 4 and 19). The antenna also is more stunted in this form. In all other characters it agrees with the type.

Habitat on leaves of the cultivated nutmeg : Balangoda. On an undetermined tree : Kalutara.

I have also received this variety from Java, where it occurs on *Myristica fragrans* ('nutmeg') and several other plants.

The size and form of the anal scales of the adult female are usually so constant in any one species of *Lecanium* that such a marked difference as is found in the present instance must be looked upon as varietal. I do not find any intermediate forms.

EXPLANATION OF PLATE LXXXVI.

LECANIUM EXPANSUM.

Fig. 1. Adult ♀, *in situ*, nat. size.
2. „ dorsal view, × 7.
3. „ anal operculum and surrounding parts
4. „ anal operculum, × 100.
5. Group of spinnerets from dorsal surface.
6. A single ventral spinneret.
7. Stigmatic cleft and spines.
8. Waxy plate from dorsum.
9. Marginal scales, dorsal view, × 650.
10. Antenna.
11. Marginal hairs of immature female.
12. Marginal hairs of male larva.
13. A single marginal hair of male larva.
14. Male puparium.
15. Adult male, dorsal view.
16. Head of male, from below.
17. Terminal joint of antenna of male.

LECANIUM EXPANSUM, *var.* QUADRATUM.

18. Antenna of adult female.
19. Anal operculum, × 100.

LECANIUM (PARALECANIUM) MARGINATUM (*Green*).

(PLATE LXXXVII.)

Lec. marginatum, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*fig.* 2) oval, bluntly pointed in front; flat, or very slightly convex above; under surface with a large shallow cavity on each side, extending almost to the anterior border of the mesothorax (*fig.* 3). Colour bright reddish fulvous; a well-defined pale (almost colourless) zone between the median and marginal areas, bordered on each side by a narrow yellowish line, and demarked from the marginal zone by a thin brown line; a thin reddish line bordering the median area in front, converging behind towards the centre, enclosing a paler area. Derm without conspicuous cells. Eyes minute, black, situated on the outer edge of the colourless zone. Marginal flabellæ transversely oval (*fig.* 4). Margin crenulate; from four to six indentations in each interval. Stigmatic cleft (*fig.* 7) with three (rarely five) stout spines. Scales of anal operculum (*fig.* 6) pointed; base almost equal to outer edge; outer angle rounded. Antenna (*fig.* 8) with six joints; third very long, nearly as long as terminal three together; sixth as long as or longer than previous two together, a deep incision near its proximal end. Leg (*fig.* 9) small, tarsus scarcely more than half length of tibia. Length 2 to 2·25 mm. Breadth 1·50 mm.

Adult ♂ (*fig.* 12) pale reddish to dark purplish brown. Wings strongly iridescent; costal nerve bright pink. Head (*fig.* 13) broadly dilated at sides. Antenna (*fig.* 14) shorter than body, ten-jointed; third longest; subsequent joints decreasing in length, three knobbed hairs at apex of tenth (*fig.* 13). Genital sheath slender, sharply pointed; about one-fifth length of body. Caudal filaments long and slender; opaque white. Length 12·5 mm.

Male puparium (*fig.* 10) glassy, colourless; oblong oval; divided into eighteen plates, the divisions marked by raised white lines. Length 1·60 mm.

Male larva very pale green; an interrupted diffused reddish median dorsal stripe. Shortly before pupating the dorsal plates are distinctly demarked (*fig.* 11).

Eggs and young larvæ pale pink.

Habitat on upper surface of leaves of *Pyschotria thwaitesii*; the male puparia attached to extreme edge of leaf. Pundaluoya.

EXPLANATION OF PLATE LXXXVII.

Lecanium marginatum.

Fig. 1. Leaf of *Psychotria*, with insects *in situ*, nat. size.
2. Adult ♀, from above, × 17.
3. „ from below, × 17.
4. Marginal flabellæ, from above, × 320.
5. „ „ from below, × 650.
6. Anal operculum, × 150.
7. Stigmatic spines.
8. Antenna.
9. Leg.
10. Male puparium, dorsal view, × 17.
11. Male larva, shortly before pupating.
12. Adult ♂, dorsal view, × 17.
13. „ head, from below.
14. „ antenna.
15. „ side view.
16. „ foot.
17. „ terminal joint of antenna.

LECANIUM (PARALECANIUM) GEOMETRICUM, *Green.*

(PLATE LXXXVIII.)

Lec. geometricum, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*figs.* 1, 2) broadly oval, sometimes almost circular; flattish, thin, very slightly convex above; dorsal area with a median longitudinal and two transverse moderately prominent carinæ, and some intermediate smaller ridges dividing the dorsum into polygonal spaces, of which there are four median and a complete marginal series, the spaces occupied by concentrically marked waxy plates. The dorsum coated with a thin colourless secretion which is difficult to remove without injury to the body of the insect. Eyes prominent, at some distance from margin. Margin with a fringe of overlapping flabelliform hairs (*figs.* 5, 6); the margin itself evenly crenulate, with four to five small indentations between each point of attachment of the flabellæ (*fig.* 7). Stigmatic clefts (*figs.* 5, 6), with from three to five spines not reaching the margin. Scales of anal operculum (*fig.* 8) acutely pointed, base shorter than outer edge. Antenna (*fig.* 3) with six joints; third longest, almost as long as fourth and fifth together. Legs small; tarsus as long as or longer than tibia (*fig.* 4). Dermal cells obscure, oval, arranged in radiating series; submarginal zone with radiating darker lines (*fig.* 5); a few very minute translucent pores on the median area. Length 3 to 3·50 mm. Breadth 2·25 to 2·75 mm.

Male puparium (*fig.* 9), oblong oval, rather broader behind, convex above; colourless, glassy, transparent; divided into eighteen distinct plates, the divisions marked by opaque white lines. Margin ragged. Median area obscurely marked with polygonal plates as in the female. Length 2 mm.

Pupa olivaceous yellow.

Habitat on upper surface of leaves of *Glycosmis pentaphylla*. Pundaluoya.

EXPLANATION OF PLATE LXXXVIII.

LECANIUM GEOMETRICUM.

Fig. 1. Leaf, with insects *in situ*, nat. size.
2. Adult ♀, dorsal view, × 12.
3. Antenna of female.
4. Leg.
5. Margin of scale and stigmatic cleft, × 215.
6. Stigmatic cleft and spines.
7. Margin, dorsal view, × 650.
8. Anal operculum, × 150.
9. Male puparium, × 12.

LECANIUM (PARALECANIUM) CALOPHYLLI, *sp. nov.*

(PLATE LXXXIX.)

Adult ♀ deep reddish brown. Flat; broadly oval; margin slightly sinuous (*fig.* 1). Dorsum with a slight median ridge and several series of quadrangular depressed spaces, sometimes occupied by thin waxy laminæ; surface coarsely punctate. Stigmatic clefts deep but inconspicuous (*fig.* 2), with three stout blunt spines not reaching the margin. Marginal hairs flabelliform (*figs.* 2, 3), attached dorsally within the margin, but in older examples almost concealed by an outward extension of the dorsum (*fig.* 4); margin beneath each flabella produced into a quadrate process (*fig.* 3). Derm with scattered minute translucent pores (*fig.* 4). Scales of anal operculum (*fig.* 5) acute; base much shorter than outer edge; outer edge slightly emarginate at middle, lateral angles rounded. In old examples there is a sharply defined broad chitinous marginal zone on the under surface, not carried upwards along the anal cleft. Legs and antennæ missing in all examples under examination (probably devoured by Acari). Length 3·50 mm. Breadth 2·75 to 3 mm.

Other stages unknown.

Habitat on leaves of *Calophyllum sp.* Newera Eliya.

EXPLANATION OF PLATE LXXXIX.

LECANIUM CALOPHYLLI.

Fig. 1. Adult ♀, dorsal view, × 15.
2. Stigmatic cleft, spines and marginal flabellæ, × 650.
3. Marginal flabellæ, from below, × 650.
4. Posterior extremity dorsal view, × 80.
5. Anal operculum, × 150.

LECANIUM (PARALECANIUM) PARADENIYENSE, *sp. nov.*

(PLATE XC.)

Adult ♀ (*fig.* 4) deep reddish brown; ovate, narrower in front, evenly rounded at each extremity; very slightly convex above; with a broad median cavity below the abdomen forming a shelter for the newly hatched larvæ. A very indistinct median longitudinal ridge, on each side of which are three longitudinal series of impresssed polygonal spaces with concentric markings. Marginal area with many short transverse carinæ. Surface, except in polygonal spaces, minutely and closely punctate. Scales of anal operculum (*fig.* 6) acutely pointed at apex; outer edge almost straight; base and outer edges nearly equal in length, the intervening angle rounded. Stigmatic cleft (*fig.* 5) with three stout blunt spines. Margin (*fig.* 8) supporting a fringe of overlapping flabellæ; the margin itself unequally crenulate, the larger crenulations being above the points of attachment of the flabellæ, with two or three smaller points between them, each point corresponding with a small dark cuneiform mark. There is a distinct marginal zone, not apparent in the living insect, but very conspicuous in macerated examples. Eyes conspicuous in prepared specimens as translucent spots at a considerable distance from the margin. Derm with a few scattered conspicuous translucent pores, chiefly on the submarginal area; many less conspicuous small oval and circular derm-cells, largest towards the margin, where they tend to form series parallel with the marginal carinæ. Antenna (*fig.* 7) with six joints, of which the third is much the longest, and equal to fifth and sixth together. Antennal formula: 3, 6, 1 (2, 4), 5, or 3, 6, 1 (2, 4, 5). Legs rather small, but well developed; tibia and tarsus of about equal length, the joint very inconspicuous. Anal ring with six stout hairs. Length 3·50 to 4 mm. Breadth 2·50 to 3 mm.

Adult ♂ (*fig.* 3) reddish brown. Wings hyaline; costal nervure purplish pink. Form rather broad and depressed. No caudal setæ. Antenna with the usual three knobs at apex. Length, including genital sheath, 1·25 mm.

Male puparium (*fig.* 2) oblong oval; glassy; divided into eighteen plates, of which three are central and fifteen marginal. Length 2 mm. Breadth 1·25.

Young larva pale brick red; broadly oval.

Only living larvæ and egg pellicles are seen beneath the female, which is probably ovoviviparous.

Habitat on upper surface of leaves of the cultivated pepper, *Piper nigrum*. Peradeniya (November).

This species is the largest of its group, with the exception of *L. expansum*, from which it differs in the possession of well-developed legs.

EXPLANATION OF PLATE XC.

LECANIUM PERADENIYENSE.

Fig. 1. Leaf of pepper, with insects *in situ*, nat. size.
2. Male puparium, × 18 diam.
3. Adu't male, × 17.
4. „ female, dorsal view, × 10.
5. „ Stigmatic cleft and spines, × 325.
6. Anal operculum, × 150.
7. Antenna, × 150.
8. Margin of adult female, × 650.

LECANIUM (PARALECANIUM) PLANUM, *Green.*

(PLATE XCI.)

Lec. planum, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*figs.* 1, 3, 5) dull reddish brown to dark blackish brown, according to age. Irregularly deltoid; broadly rounded behind, rather pointed in front; asymmetrical, the side that impinges upon the midrib of the leaf straight, the other bluntly angulated in the middle; dorsal area flattish or even slightly concave before gestation (*fig.* 3), slightly convex after gestation (*fig.* 4); a slight median dorsal elevation and two transverse raised bands; abdominal area marked by an indistinct tessellation enclosing shallow depressions; margin abruptly sloped. The dorsal area is completely covered by a transparent colourless waxy layer, which becomes apparent only after treatment with potash, and can be removed in flakes. Margin abruptly sloped; with an overlapping fringe of minute fan-shaped hairs, the scale showing pale bands running inwards from the points of attachment (*fig.* 7). Extreme edge of scale, between the fan-like hairs, minutely crenulate, almost colourless, with darker points separating the crenulations (*fig.* 8). Epidermis very hard and chitinous. Epidermal cells of several forms; a marginal zone of oblong linear pale spots, a submarginal zone of small oval translucent spots (*fig.* 11) (appearing dark on a pale ground in immature examples), larger indistinct nucleated cells following the depressed areas of dorsum, and a curved series of oval translucent cells on each side of the anal aperture. Scales of anal operculum (*fig.* 10) together approximately rhombic; outer edge rounded; apices sharply pointed; base and outer edge approximately equal. Stigmatic spines (*fig.* 9) three, not projecting beyond margin, median spine considerably longer than the others. Stigmatic cleft inwardly dilated, inconspicuous. Body beneath with a large central cavity (*fig.* 5) for reception of eggs and young larvæ. Antenna (*fig.* 8) with six joints; first and second short; third very long, as long as or longer than the terminal three together; fourth and fifth short, together about equal to sixth. Foot with four digitules; unguals broadly dilated; tarsals long knobbed hairs. Tarsus about equal to tibia; tibia and tarsus together a little longer than femur. Eyes visible, after maceration, as transparent circular spots at some distance from margin. Anal cleft fused, about one-sixth length of body. Length averaging 2·50 mm. Breadth at widest part 2·50 mm.

Male puparium (*fig.* 12) oval; convex above; glassy; divided into eighteen plates, of which three are central and fifteen marginal.

Adult ♂ (*fig.* 13) dull reddish or purplish brown; thoracic plates and scutellum paler; antennæ and legs pale purplish. Costal nervure of wing pale pink; discal nervure pale yellow. Eyes and ocelli black. Head pointed at apex, broadly rounded below. Body rather stout. Genital sheath long and slender,

slightly dilated near extremity. No caudal setæ. Antenna shorter than body; ten-jointed, fifth longest, tenth with three knobbed hairs (*fig.* 14). Length 1 mm.

Eggs pale pink; rarely observed.

Young larva (*fig.* 2) pale pink or pinkish yellow. Caudal setæ unusually short.

The females of second stage are very thin and transparent; pale greenish or brownish yellow. All the markings of the leaf upon which they rest can be plainly distinguished through their bodies.

Habitat on upper surface of leaves of *Nothopegia colebrookiana:* Pundaluoya. Females arranged on each side of midrib, their heads usually directed towards base of leaf (*fig.* 1). After removal of the insect a distinct whitish scar, of the exact shape of the scale, remains on the leaf. Male puparia placed irregularly on surface of leaf.

EXPLANATION OF PLATE XCI.

LECANIUM PLANUM.

Fig. 1. Leaf, with insects, nat. size.
2. Young larva.
3. Adult female, dorsal view, × 14.
4. „ lateral view, × 14.
5. „ ventral view, × 14.
6. „ antenna.
7. „ margin of scale, from above.
8. „ „ „ from below, × 650.
9. „ stigmatic spines.
10. „ anal operculum.
11. „ epidermal cells, marginal and submarginal zone.
12. Male puparium.
13. Adult male, dorsal view, × 45.
14. „ terminal joints of antenna.

LECANIUM (PARALECANIUM) ZONATUM, *sp. nov.*

(PLATE XCII.)

Adult ♀ flat, with a narrow abruptly sloping margin and an inconspicuous narrow median longitudinal ridge, on each side of which is a series of polygonal scars, followed by lines radiating towards the margin. Median area dark purple-brown, followed consecutively by a reddish, a whitish, and a narrow transparent greenish zone and a dark purple-brown marginal area (*fig.* 2). After treatment with potash the median area remains reddish brown, the marginal zone dark brown, and the intermediate area becomes colourless and transparent. Eyes small but distinct, at some distance from margin. Antennæ (*fig.* 5) very small; six-jointed, third and sixth equal and longest, second shortest; formula: (3, 6), 1 (4, 5), 2. Legs small and inconspicuous, but well formed; tarsus slightly longer than tibia. I have been unable to make out any digitules. Scales of anal operculum (*fig.* 4) elongate, sharply pointed; inner edge longest, nearly two and a half times length of base. Stigmatic spines (*fig.* 3) three, bluntly pointed, set in an oval depression within the dorsal margin; median spine shorter than the other two. Dermal cells obscure and confined to the dark marginal zone, where some indistinct paler oval cells can be distinguished. A few minute translucent pores are scattered over the ventral surface. Margin crenulate, closely set with approximately circular flabelliform hairs (*fig.* 6). Length 3 mm. Breadth 2·50 mm.

Adult ♂ not observed.

Male puparium (*fig.* 7) of usual form; glassy, transparent, colourless; divided into nineteen plates, of which four are central and fifteen marginal. It is noticeable that all the fringed species of *Lecanium* have this large number of plates in the male puparium, the usual number being nine only. Length 2 mm.

Habitat on under surface of leaves of *Garcinia spicata* (an indigenous tree). Peradeniya (February).

Alied to *Lec. marginatum*, but much larger.

EXPLANATION OF PLATE XCII.

LECANIUM ZONATUM.

Fig. 1. Adult females on leaf of *Garcinia*, nat. size.
2. Adult female, dorsal view, × 14.
3. Stigmatic spines of female, × 410.
4. Anal operculum of female, × 100.
5. Antenna of female, × 150.
6. Marginal scales of female, × 600.
7. Male puparium, × 19.

LECANIUM (PARALECANIUM) MARITIMUM, *sp. nov.*

(PLATE XCIII.)

Lec. planum, var. *maritimum*, Green, 'Catalogue of Coccidæ,' *Ind. Mus. Notes*, Vol. IV. No. 1 (1896).

Adult ♀ (*fig.* 9) oval or irregularly deltoid, bluntly pointed in front, broadly rounded behind; flat above, or slightly convex after gestation; more or less distinct median longitudinal and two transverse ridges, with lesser curved transverse and longitudinal ridges enclosing concentrically marked thin scaly plates forming an indistinct tessellation. Surface glossy. The whole dorsal surface coated with a colourless layer of secretion which, during treatment with potash, swells into a tough covering which can be peeled off, often in a single piece. Colour varying with age from pale reddish or brownish yellow to deep chocolate-brown above; a narrow submarginal zone and broad median area usually darker; a pale patch surrounding anal scales. Surface minutely punctate. Ventral surface purplish in mature examples. A shallow central cavity in which the larvæ remain for a short time (*fig.* 8). Eyes small, black, slightly prominent, at some distance from margin. Margin (*fig.* 13) with a complete fringe of overlapping subcircular fan-shaped hairs. The margin itself slightly crenulate, three to four crenulations between each point of attachment of the hairs; a dark cuneiform mark crossing the middle of each crenulation (*fig.* 15). Stigmatic cleft (*fig.* 14) small, wtth three blunt spines not reaching to margin; the median spine longest. Median area with minute circular, translucent pores, rather widely separate. Epidermal cells of marginal zone larger and more crowded, of irregular outline (*fig.* 13). Scales of anal operculum (*fig.* 12) narrow, acutely pointed; outer edge longer than base. Antenna (*fig.* 10) with six joints, of which the third is very long; sixth next longest, as long as or longer than the previous two together. Legs rather small; tarsus equal to tibia. Ano-genital ring apparently with six hairs. Length 2·50 mm. Breadth 2 mm.

Female of second stage very thin, transparent, and colourless. Young larva oval, flat, with deep anal cleft and short caudal setæ.

Male puparium (*fig.* 7) glassy, colourless; divided into eighteen plates, of which three are central and fifteen marginal; an indistinct median ridge. Length 1·50 mm.

Adult ♂ (*fig.* 2) bright reddish brown, with three darker longitudinal stripes. Wings hyaline; costal nervure very pale pink. No caudal filaments. On each side, at base of genital sheath, is a small setiferous tubercle (*fig.* 5). Head pointed at apex, widened below (*fig.* 3); flattened or slightly concave in front (*fig.* 4). Eyes and ocelli black. Antenna ten-jointed, the terminal joint with three longish knobbed hairs (*fig* 6). Length 1 mm.

Habitat on both surfaces of leaves of a small shrub (*Carissa ?*) growing on seashore at Bentota, almost within reach of the surf. Also on leaves of *Ixora coccinea*, close to sea, Colombo.

Closely allied to *L. planum*; but flatter, thinner and more glossy. Crenulations of margin differently arranged (compare *plates* xci. *fig.* 8, and xciii. *fig.* 15).

EXPLANATION OF PLATE XCIII.

LECANIUM MARITIMUM.

Fig. 1. Leaf, with insects, nat size.
2. Adult male, dorsal view, × 24.
3. „ „ head, from above, × 18.
4. „ „ „ lateral view.
5. „ „ extremity of abdomen.
6. „ „ terminal joint of antenna.
7. Male puparium.
8. Adult female, from below, × 10.
9. „ „ dorsal view, × 10.
10. „ „ antenna.
11. „ „ leg.
12. „ „ anal operculum.
13. „ „ marginal scales and epidermal cells, from below.
14. „ „ stigmatic spines.
15. „ „ portion of margin, from above, × 650.

SUPPLEMENTARY NOTE.

In the recently published 'Catalogue of the Coccidæ of the World,' by Mrs. M. E. Fernald (Hatch Experiment Station of the Massachusetts Agricultural College, Bulletin No. 88), the genus *Lecanium* has been extinguished, giving place to the older name *Coccus* (type *L. hesperidum*). The genus (as formerly defined) has also been broken up into a number of subgenera, proposed principally by Prof. Cockerell. According to this catalogue the species described in the present part would be known by the following names:

Coccus capparidis.
Coccus hesperidum.
Saissetia formicarii.
Coccus frontale.
Coccus ophiorrhizæ.
Coccus acuminatus.
Coccus signiferus.
Coccus viridis.
Saissetia discrepans.
Saissetia punctuliferum.
Eucalymnatus subtessellatus.
Eucalymnatus tessellatus.
Coccus antidesmæ.
Coccus piperis.
Coccus marsupialis.
Coccus bicruciatus.
Coccus mangiferæ.
Coccus acutissimus.
Coccus arundinariæ.
Coccus longulus.
Coccus caudatus.
Saissetia psidii.
Saissetia oleæ.
Saissetia nigrum.
Saissetia hemisphæricum.
Paralecanium expansum.
Paralecanium marginatum.
Paralecanium geometricum.
Paralecanium calophylli.
Paralecanium peradeniyense.
Paralecanium planum.
Paralecanium zonatum.
Paralecanium maritimum.

Other subgenera, not represented in Ceylon, are:

Stictolecanium, Ckll. (type *S. ornatum*, Hempl.)
Mesolecanium, Ckll. (type *M. nocturnum*, Ckll. and Parr.)
Neolecanium, Parr. (type *N. imbricatum*, Ckll.)
Akermes, Ckll. (type *A. bruneri*, Ckll.)
Toumeyella, Ckll. (type *T. mirabilis*, Ckll.)
Eulecanium, Ckll. (type *E. tiliæ*, Linn.)
Megasaissetia, Ckll. (type *M. inflata*, Ckll. and Parr.)
Platysaissetia, Ckll. (type *P. castilloæ*, Ckll.)

There is no doubt that the genus *Lecanium* had become unwieldy and required sub-division; but it is doubtful whether all of the proposed subgenera represent really natural divisions.

The abolition of the long-established name *Lecanium* may be strictly according to recognised rules of nomenclature; but the result is somewhat catastrophic. With the typical generic name, the name of the sub-family (*Lecaniinæ*) also disappears, becoming *Coccinæ*. But *Coccinæ* had, hitherto, been assigned to a different sub-family containing the cochineal insect (universally known as *Coccus cacti*) and its allies. The cochineal insects are now referred to the genus *Dactylopius* (hitherto accommodating the mealy-bugs which have now to move on and take shelter under the genus *Pseudococcus*, the *Pseudococcus* of old being renamed *Phenacoccus*). And so on, until most of the names familiar by long usage seem to have been engaged in an elaborate game of 'general post.' The extinction of such well-known names as *Lecanium* and *Mytilaspis* (which now appear as *Lepidosaphes*), and the shuffling of the genera *Coccus*, *Dactylopius*, and *Pseudococcus* will, I fear, entail considerable confusion for many years to come.

EXPLANATION OF PLATE LXI.

Structural Characters of Female Lecanium.

Fig. 1. Ventral aspect of typical *Lecanium*.
(*a*) eye; (*b*) interantennal hairs; (*c*) parastigmatic glands; (*d*) anterior spiracle; (*e*) posterior spiracle; (*f*) stigmatic cleft; (*g*) abdominal hairs; (*h*) circumgenital glands.

2. Rostral apparatus. (A) clipeus; (B) mentum; (*a*) bases of rostral filaments; (*b*) hypopharynx; (*c*) sac for reception of retracted loop of rostral filaments.

3. Spiniform marginal hairs of *L. marsupiale*.

4. Dilated and divided hairs of *L. oleæ*.

5. Divided hairs of *L. mangiferæ*.

6. Simple marginal hairs of *L. frontale*.

7. Flabelliform marginal hairs of *L. expansum*.

8. 6-jointed antenna, showing partial subdivision of third joint.

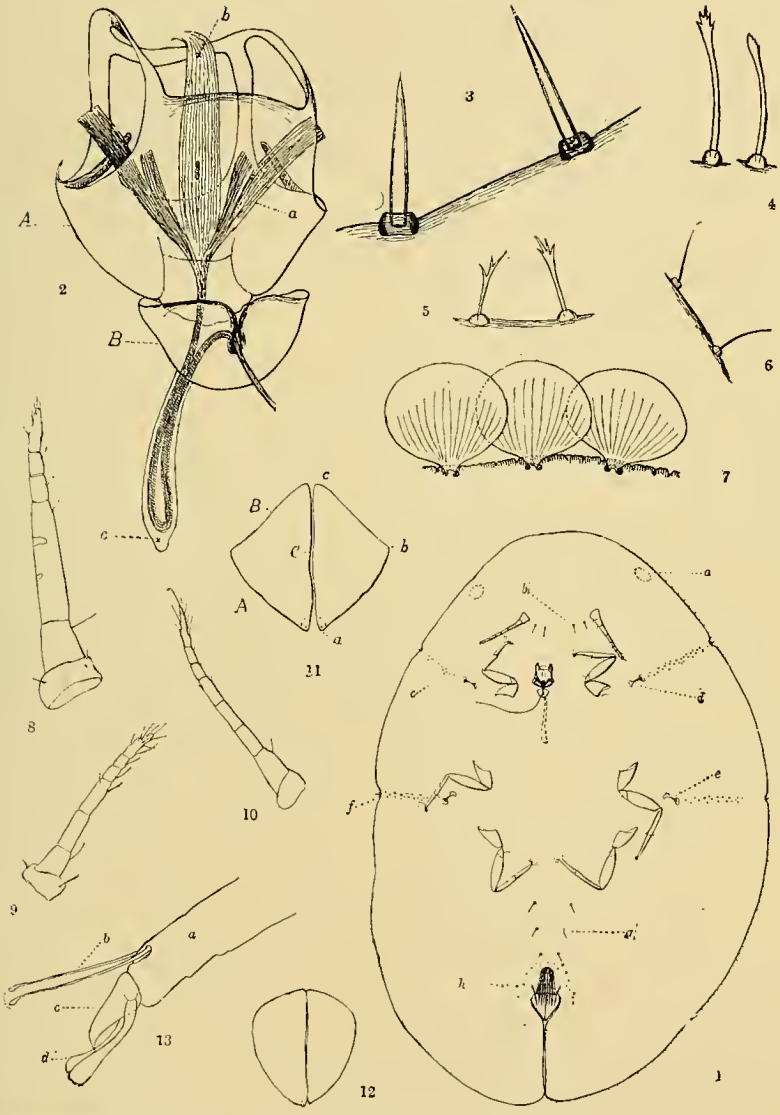
9. 7-jointed antenna.

10. 8-jointed antenna.

11. Plates of anal operculum of *L. punctuliferum*.
(A) outer edge; (B) base; (C) inner edge; (*a*) apex; (*b*) outer angle; (*c*) inner angle.

12. Anal operculum of *L. oleæ*.

13. Foot of *Lecanium*. (*a*) tarsus; (*b*) tarsal digitules; (*c*) claw; (*d*) ungual digitules.



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STRUCTURAL CHARACTERS OF FEMALE LECANIUM.

EXPLANATION OF PLATE LXII.

Structural Characters of Male Lecanium.

Fig. 1. Adult ♂ of *L. marsupiale*, ventral aspect. (*a*) basal joints of antenna ; (*b*) ocelli ; (*c*) rudimentary eye ; (*d*) anterior spiracle ; (*e*) posterior spiracle ; (*f*) genital sheath ; (*g*) penis.

2. Adult ♂ of *L. marsupiale*, dorsal aspect. (*a*) basal joints of antenna ; (*b*) ocelli ; (*c*) rudimentary eye ; (*d*) apodema ; (*e*) posterior spiracle ; (*f*) base of wing ; (*g*) scutellum ; (*h*) penultimate segment of abdomen, bearing caudal setæ.

3. Head of *L. maritimum*, ventral aspect. (*a*) basal joint of antenna ; (*b*) ocelli.

4. Head of *L. maritimum*, dorsal aspect. (*a*) ocellus ; (*b*) rudimentary eye.

5. Terminal joint of antenna of *L. maritimum*.

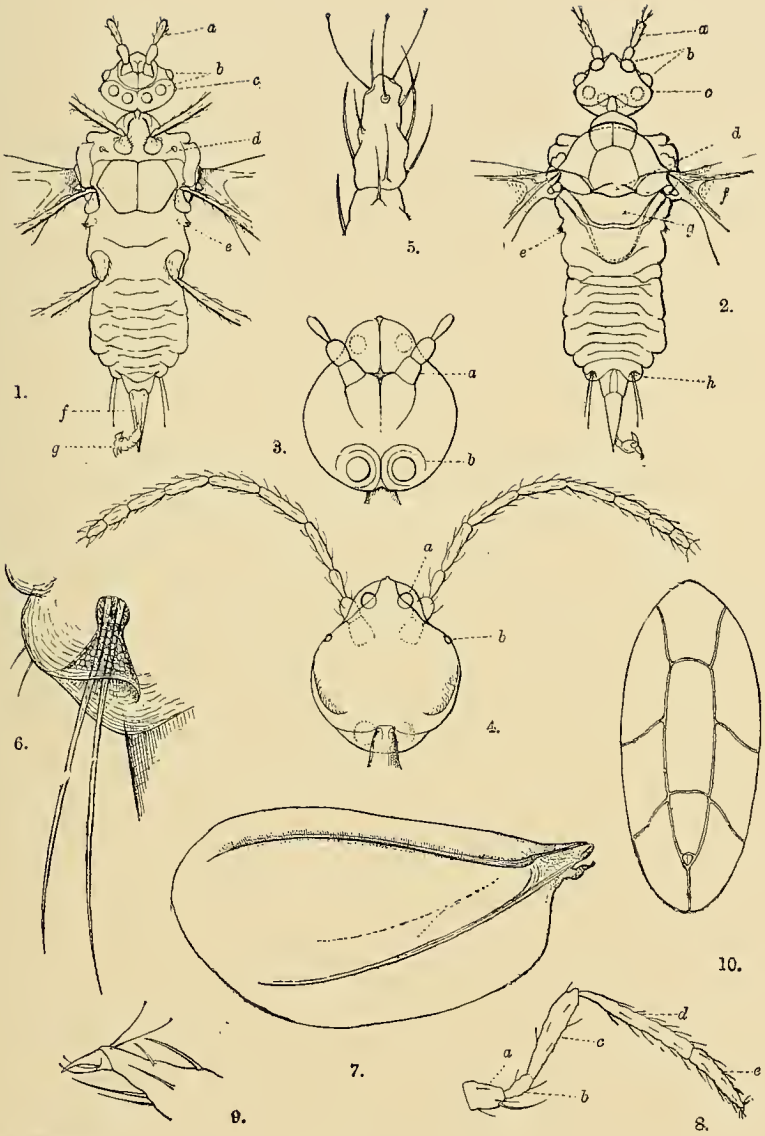
6. Part of penultimate abdominal segment of male *L. marsupiale* showing pit at root of caudal setæ.

7. Wing of adult male of *L. marsupiale*.

8. Leg of male *L. maritimum*. (*a*) coxa ; (*b*) trochanter ; (*c*) femur ; (*d*) tibia ; (*e*) tarsus.

9. Foot of male *L. maritimum*.

10. Typical puparium of male *Lecanium*.



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STRUCTURAL CHARACTERS OF MALE LECANIUM.

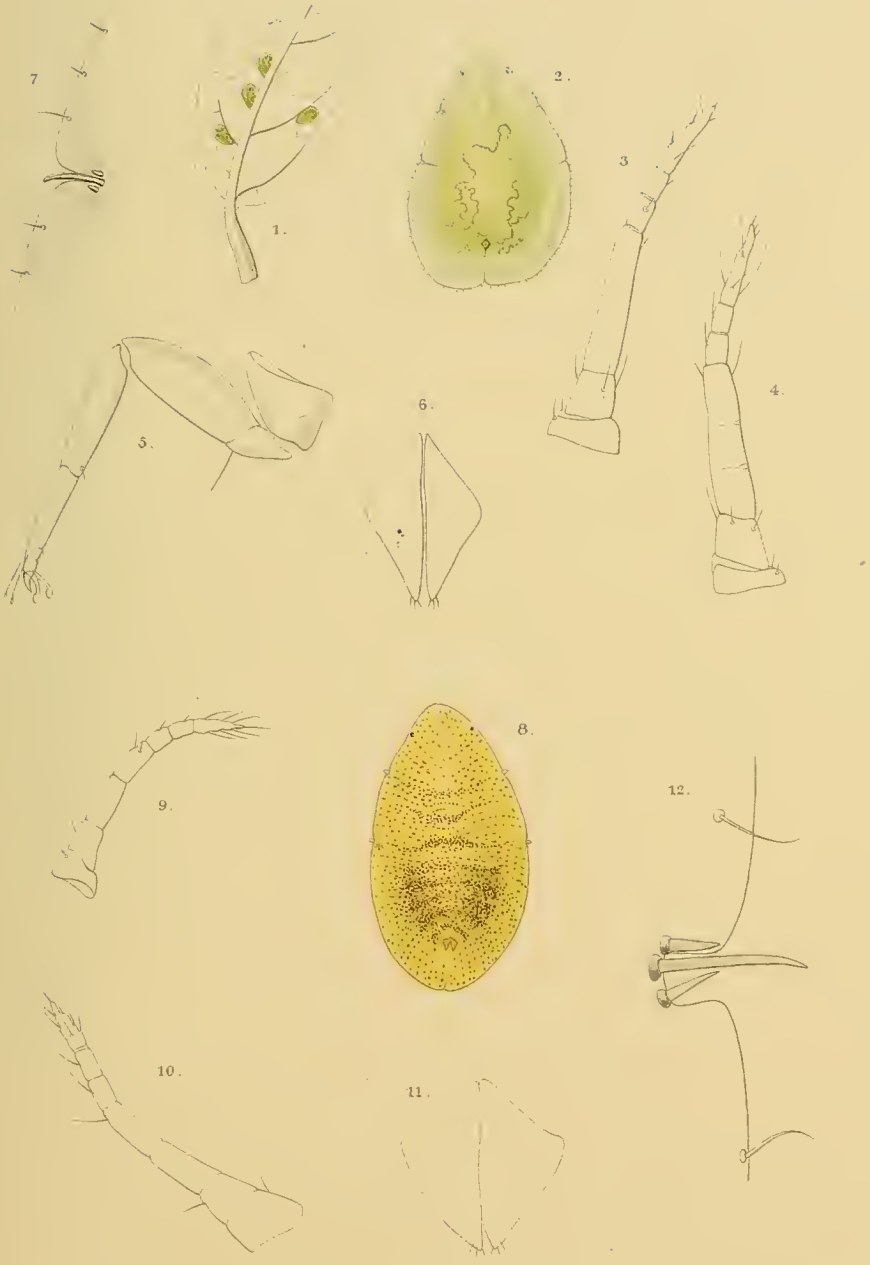
EXPLANATION OF PLATE LXIII.

LECANIUM CAPPARIDIS.

Fig. 1. Leaf of *Capparis*, with insects, nat. size.
2. Adult ♀, dorsal view, × 10.
3. „ antenna, × 150.
4. „ „ with incomplete segmentation of third joint.
5. „ leg.
6. „ anal operculum.
7. „ stigmatic spines and marginal hairs.

LECANIUM HESPERIDUM.

Fig. 8. Adult ♀, dorsal view, × 12.
9, 10. Antenna, × 150.
11. Anal operculum, × 150.
12. Stigmatic cleft and spines, × 650.



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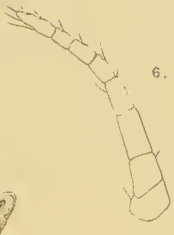
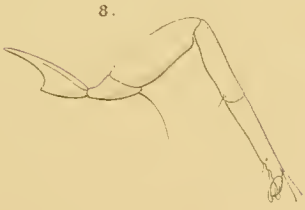
1-7. LECANIUM CAPPARIDIS, 8-12. L. HESPERIDUM.

EXPLANATION OF PLATE LXIV.

Lecanium formicarii.

Fig. 1. Section of ant's nest, with insects *in situ*, nat. size.
2. Early adult female, × 12.
3. Adult female, dorsal view, × 10.
4. „ side view, × 10.
5. „ ventral view, × 10.
6. Antenna, × 150.
7. „ with imperfect joint, × 150.
8. Leg.
9. Stigmatic spines, marginal hairs, and dermal cells.
10. Anal operculum from below, with anal ring, &c., × 100.
11. „ dorsal view, × 150.





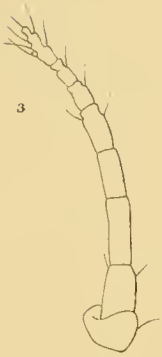
LECANIUM FORMICARII.

EXPLANATION OF PLATE LXV.

LECANIUM FRONTALE.

Fig. 1. Adult ♀, dorsal view, × 10.
2. „ ventral view, × 15.
3, 4. Antenna, × 150.
5. Stigmatic spines and marginal hairs, × 650.
6. Anal operculum, × 150.

1.



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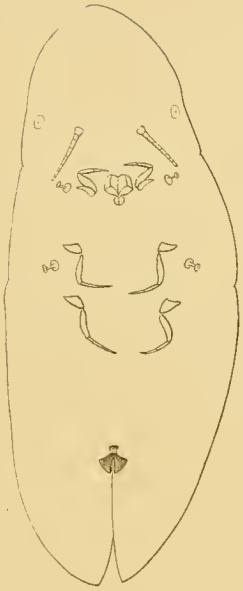

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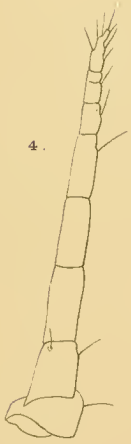

4.

5.

6.

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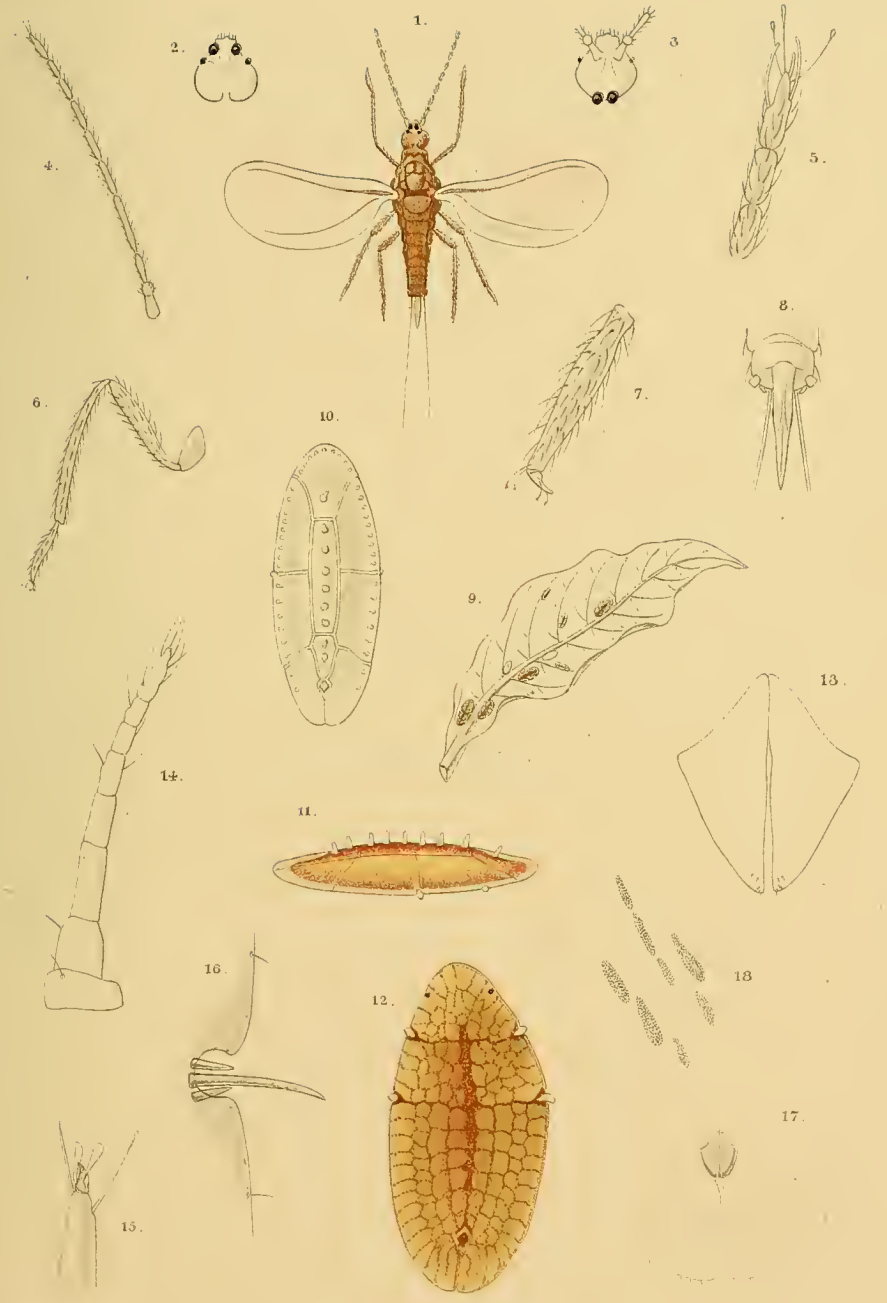
LECANIUM FRONTALE.

EXPLANATION OF PLATE LXVI.

Lecanium ophiorrhizæ.

Fig. 1. Adult male, dorsal view.
2. „ „ head, from above.
3. „ „ head, from below.
4. „ „ antenna.
5. „ „ „ terminal joints.
6. „ „ leg.
7. „ „ foot.
8. „ „ abdominal extremity, from below.
9. Leaf of *Ophiorrhiza*, with insects, nat. size.
10. Male puparium, from above.
11. Male larva, side view.
12. Adult female, dorsal view.
13. „ „ anal operculum.
14. „ „ antenna.
15. „ „ foot.
16. „ „ stigmatic cleft and spines.
17. „ „ posterior margin, showing striation.
18. Some of the striæ, very highly magnified.

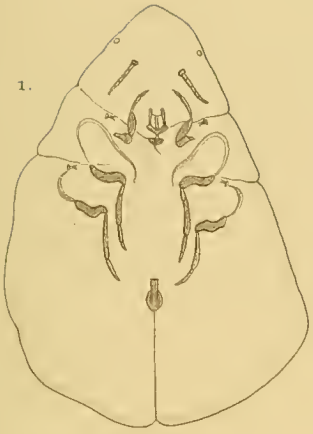


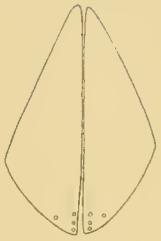
LECANIUM OPHIONHIZÆ.

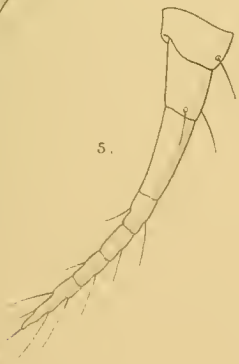
EXPLANATION OF PLATE LXVII.

LECANIUM ACUMINATUM.

Fig. 1. Adult female, ventral view, × 15.
2. Anal operculum, × 150.
3. Marg nal hairs and stigmatic spines, × 650.
4. Leg, × 100.
5, 6, 7. Antenna, × 150.







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LECANIUM ACUMINATUM.

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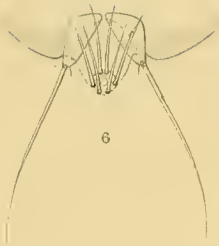
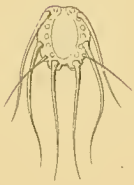
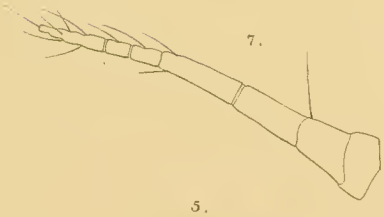
EXPLANATION OF PLATE LXVIII.

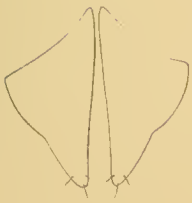
Lecanium signiferum.

Fig. 1. Begonia leaf, with insects, nat. size.
2. Antenna of young larva.
3. Adult ♀, from below, × 15.
4. „ dorsal view, × 15.
5. Immature ♀, dorsal view.
6. Abdominal extremity of young larva, after maceration.
7. Adult ♀, Antenna, × 150.
8. „ anal operculum of example from *Begonia*, × 150.
9*b*. „ „ „ „ „ *Caryota*, × 150.
10. „ anal ring, × 150.









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R.W.M.T. impr.

LECANIUM SIGNIFERUM.

EXPLANATION OF PLATE LXIX.

LECANIUM VIRIDE, *Green.*

Fig. 1. Insects *in situ* on leaf and branch of coffee.
2. Adult female, dorsal view, × 15.
3. „ foot.
4. „ margin of scale, showing stigmatic cleft and spines and dermal pores.
5. „ marginal hairs.
6. „ anal operculum.
7. „ antenna.
8. Female of second stage, dorsal view.
9. Young lava, dorsal view.
10. Diseased insect, with fringe of mycelium of parasitic fungus.

LECANIUM VIRIDE.

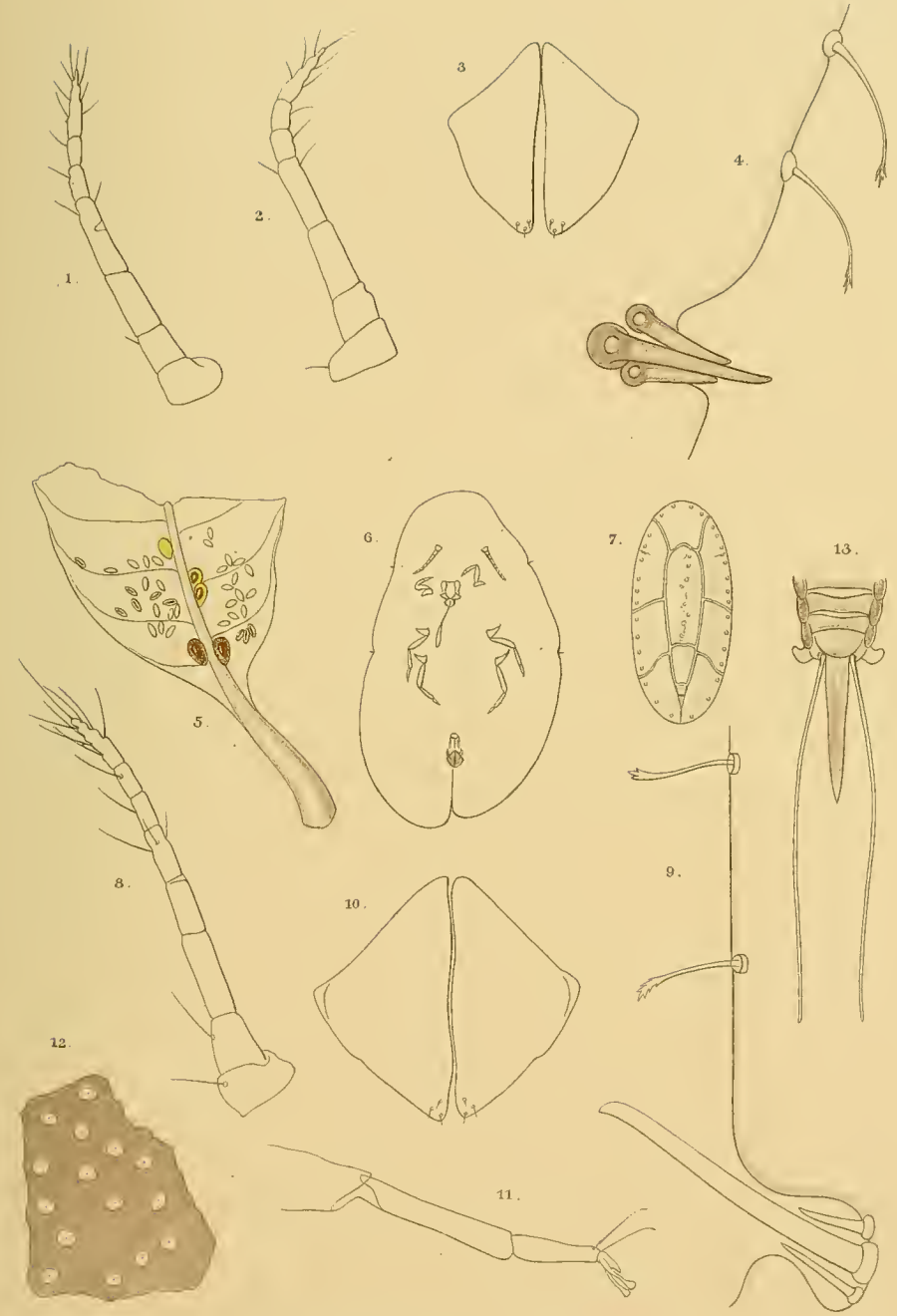
EXPLANATION OF PLATE LXX.

Lecanium discrepans.

Fig. 1. Antenna, with partial division of fourth joint, × 150.
2. „ with normal number of seven joints, × 150.
3. Anal operculum, × 150.
4. Marginal hairs and stigmatic spines, × 650.

Lecanium punctuliferum.

Fig. 5. Piece of mango leaf, with insects *in situ*, nat. size.
6. Adult ♀, ventral view, × 15.
7. Male puparium, × 10.
8. Antenna, × 150.
9. Stigmatic spines and marginal hairs, × 650.
10. Anal operculum, × 150.
11. Leg (median), × 150.
12. Dermal cells, × 150.
13. Extremity of abdomen of adult male.



E E Green del

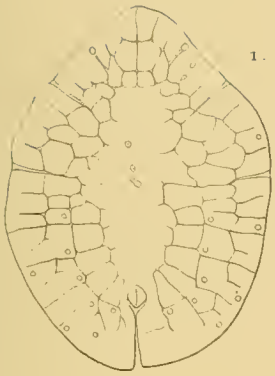
P W M T. impr.

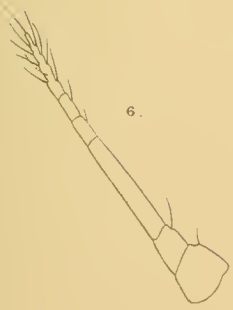
1-4. LECANIUM DISCREPANS. 5-13. L PUNCTULIFERUM.

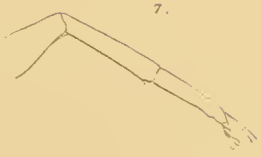
EXPLANATION OF PLATE LXXI.

Lecanium subtessellatum.

Fig. 1. Adult ♀, dorsal view, showing pattern of tessellation, × 15.
2. Part of margin (surrounding eye), showing derm cells, × 150.
3. Cellular spot, × 650.
4. Stigmatic spines and marginal hairs, × 650.
5. Anal operculum, × 150.
6. Antenna, × 150.
7. Foot, × 150.







E.E. Green del

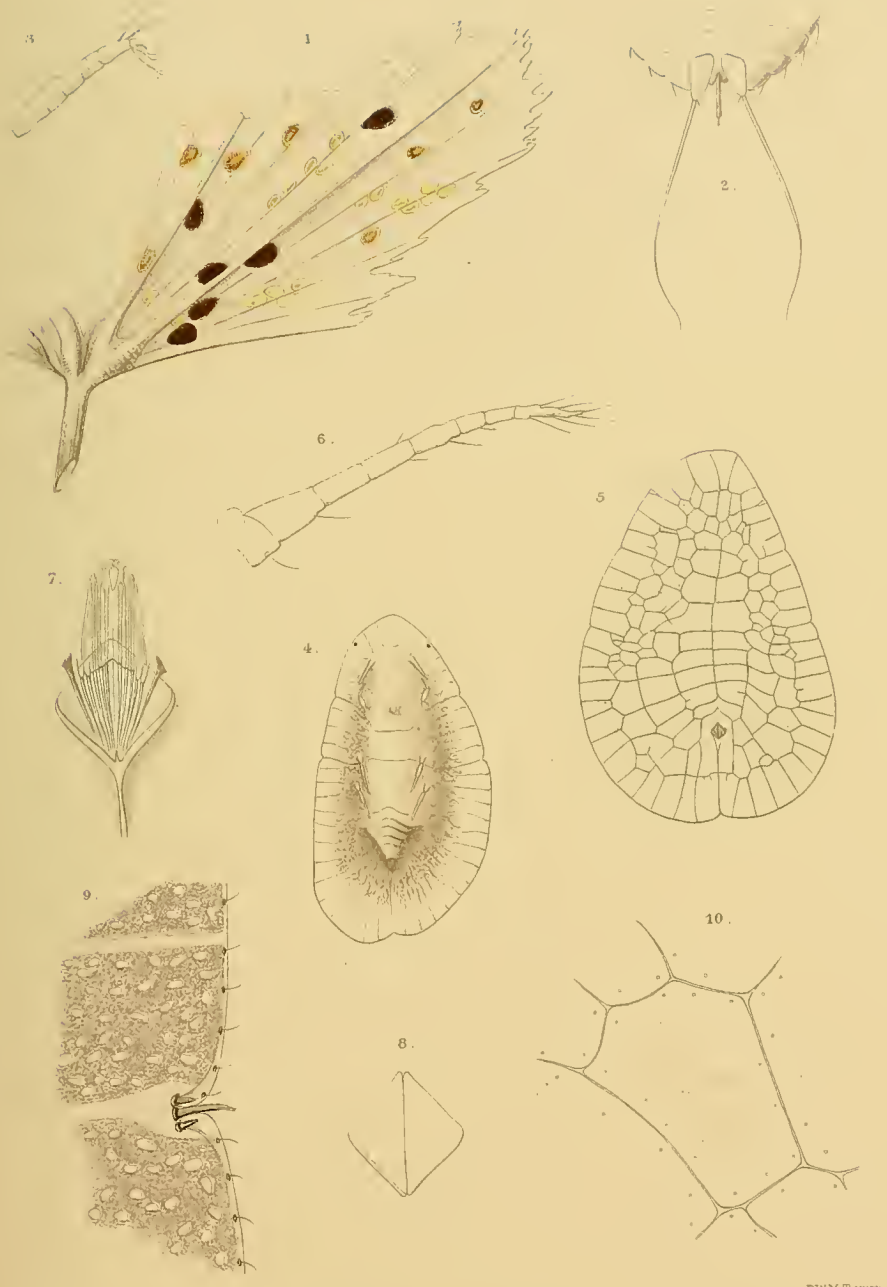
P.W.M.T. imp.

LECANIUM SUBTESSELLATUM.

EXPLANATION OF PLATE LXXII.

LECANIUM TESSELLATUM, *var.* PERFORATUM.

Fig. 1. Leaf of *Caryota urens*, with insects, nat. size.
2. Posterior extremity of larva, dorsal view.
3. Foot of larva.
4. Adult female, ventral view, × 10.
5. „ pattern of dorsal tessellation, × 12.
6. „ antenna, × 150.
7. „ ano-genital aperture, from below, × 100.
8. „ anal operculum, × 100.
9. „ stigmatic cleft and marginal hairs, × 150.
10. A single dorsal plate, showing submarginal pores, × 80.



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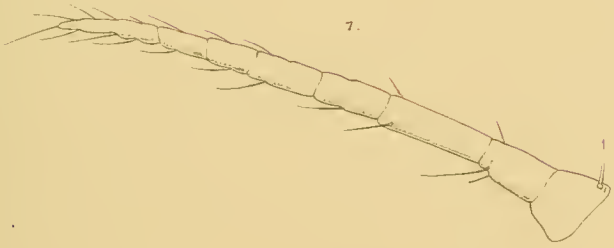
P.W.M.T. impr.

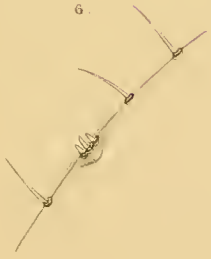
LECANIUM TESSELLATUM.

EXPLANATION OF PLATE LXXIII.

LECANIUM ANTIDESMÆ.

Fig. 1. Leaf of *Antidesma*, with insect, nat. size.
2. Adult female, dorsal view, × 10.
3. Part of margin showing dermal cells and glandular spot.
4. Foot.
5. Anal operculum, × 150.
6. Stigmatic spines and marginal hairs.
7. Antenna.





E.Green del

LECANIUM ANTIDESMÆ.

P.W.M.T.imp.

EXPLANATION OF PLATE LXXIV.

LECANIUM PIPERIS.

Fig. 1. Leaf of wild pepper, with insects *in situ*, nat. size.
2. Adult female, dorsal view, × 7.
3, 4. Anal operculum of female.
5. Leg.
6, 7, 8. Stigmatic cleft, spines, and marginal hairs.
9. Male puparium, × 12.
10. Adult male, × 24.
11, 12. Antenna of adult female.

E.E.Green del

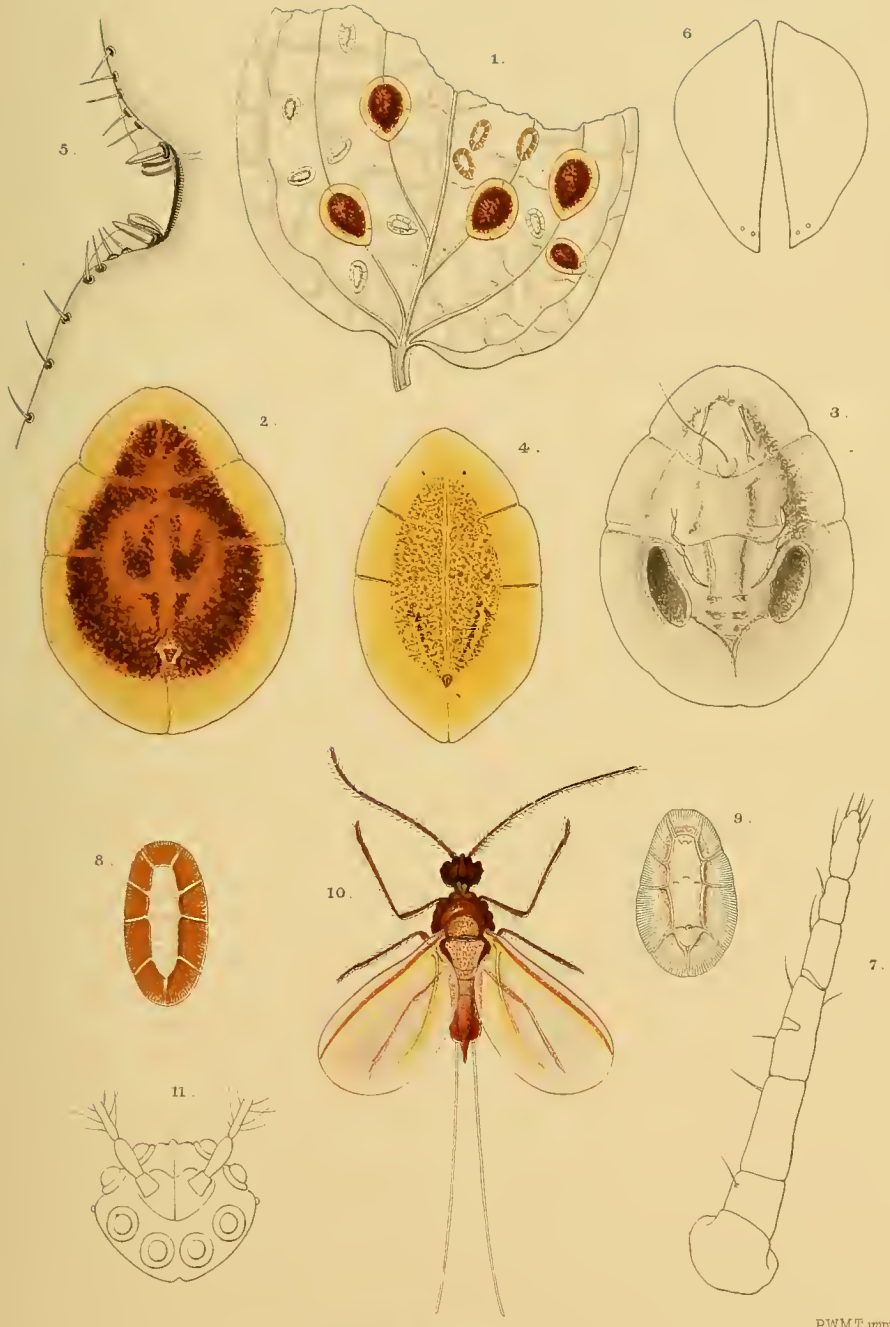
P.W.M.Tampr.

LECANIUM PIPERIS.

EXPLANATION OF PLATE LXXV.

Lecanium marsupiale.

Fig. 1. Leaf of *Piper nigrum*, with ♂ and ♀ scales, nat. size.
2. Adult ♀, dorsal view, × 5.
3. ,, ventral view, × 5.
4. Early adult ♀, dorsal view, × 5.
5. Stigmatic cleft of ♀, dorsal view, × 150.
6. Anal operculum of ♀, × 150.
7. Antenna of ♀, × 150.
8. Male larva, dorsal view, × 6.
9. Puparium of male, dorsal view, × 6.
10. Adult ♂, dorsal view, × 12.
11. Head of male (diagrammatic), viewed from in front.



E.E Green del.

P.W.M.T. impr.

LECANIUM MARSUPIALE.

EXPLANATION OF PLATE LXXVI.

Lecanium bicruciatum.

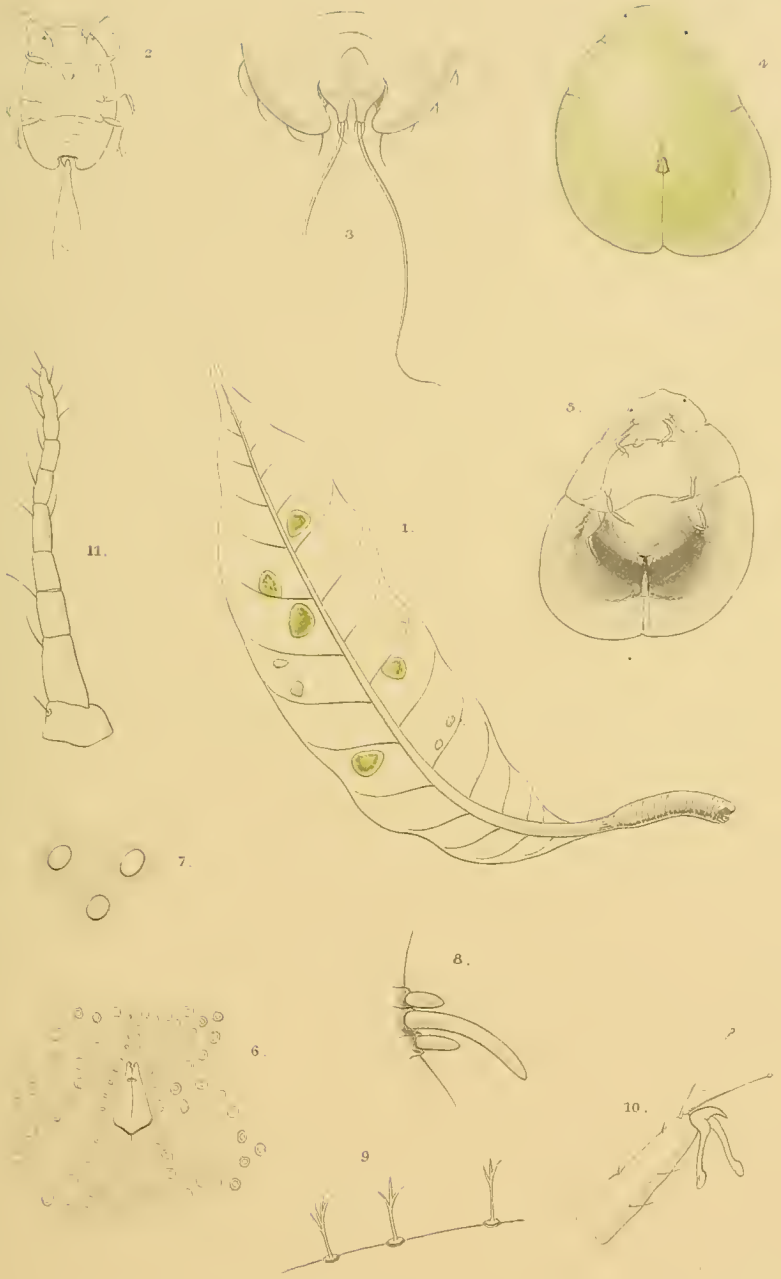
Fig. 1. ♀ insect, on *Memecylon*, nat. size.
2. Adult ♀, dorsal view, × 6.
3. Antenna, × 150.
4. Scales of anal operculum, × 150.
5. Dermal cells, × 150.
6. Stigmatic cleft and marginal hairs (from *Elæagnus*), × 650.
7. Marginal hairs (from *Memycylon*), × 650.
8. Marginal hair (from *Eugenia*), × 650.
9. ♂ puparium, × 16.

LECANIUM BICRUCIATUM.

EXPLANATION OF PLATE LXXVII.

LECANIUM MANGIFERÆ.

Fig. 1. Mango leaf with insects *in situ*, nat. size.
2. Newly hatched larva, from below.
3. Abdominal extremity of young larva.
4. Adult female, dorsal view, × 8.
5. „ ventral view, × 8.
6. „ anal operculum and pores of skin.
7. „ dermal pores, more enlarged.
8. „ stigmatic spines, × 650.
9. „ marginal hairs, × 650.
10. „ foot.
11. „ antenna, × 150.



E.E.Green del.

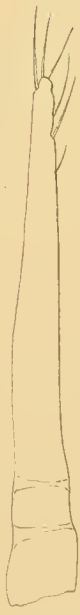
LECANIUM MANGIFERÆ.

E.W.M.T. impr.

EXPLANATION OF PLATE LXXVIII.

Lecanium acutissimum.

Fig. 1. Piece of cocoanut leaf with insects *in situ*, nat. size.
2. Newly hatched larva.
3. Adult ♀, dorsal view, × 8.
4. „ ventral view, × 8.
5. Early adult ♀, × 8.
6. Stigmatic spine and marginal hairs, × about 300.
7. Anal operculum, × 150.
8. Antenna, × 410.
9. Anterior leg, × 410.
10. Median leg, × 410.
11. Posterior leg, × 410.
12 Dorsal spines, × 650.



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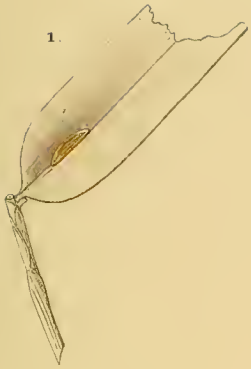
P.W.M.T. impr

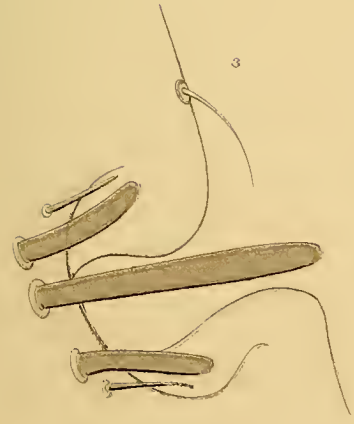
LECANIUM ACUTISSIMUM.

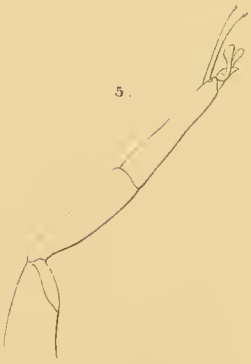
EXPLANATION OF PLATE LXXIX.

LECANIUM ARUNDINARIÆ.

Fig. 1. Leaf of *Arundinaria* with insect, nat. size.
2. Adult ♀, dorsal view, × 6.
3. Stigmatic cleft and spines, × 650.
4. Antenna, × 150.
5. Leg (median), × 150.







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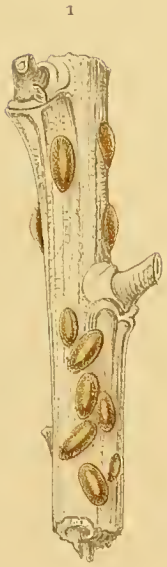
P.W.M.T. impr.

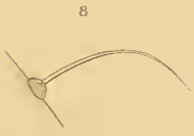
LECANIUM ARUNDINARIÆ

EXPLANATION OF PLATE LXXX.

Lecanium longulum.

Fig. 1. Insects on branch of *Albizzia*, nat. size.
2. Adult ♀, dorsal view, × 10.
3. „ submarginal tubercle, × 650.
4. „ anal operculum, × 150.
5. „ antenna, × 150.
6. „ dermal cells, eye-spot, &c., × 150.
7. „ stigmatic spines and marginal hairs, × 300.
8. „ a single marginal hair, × 650.





E.E. Green del

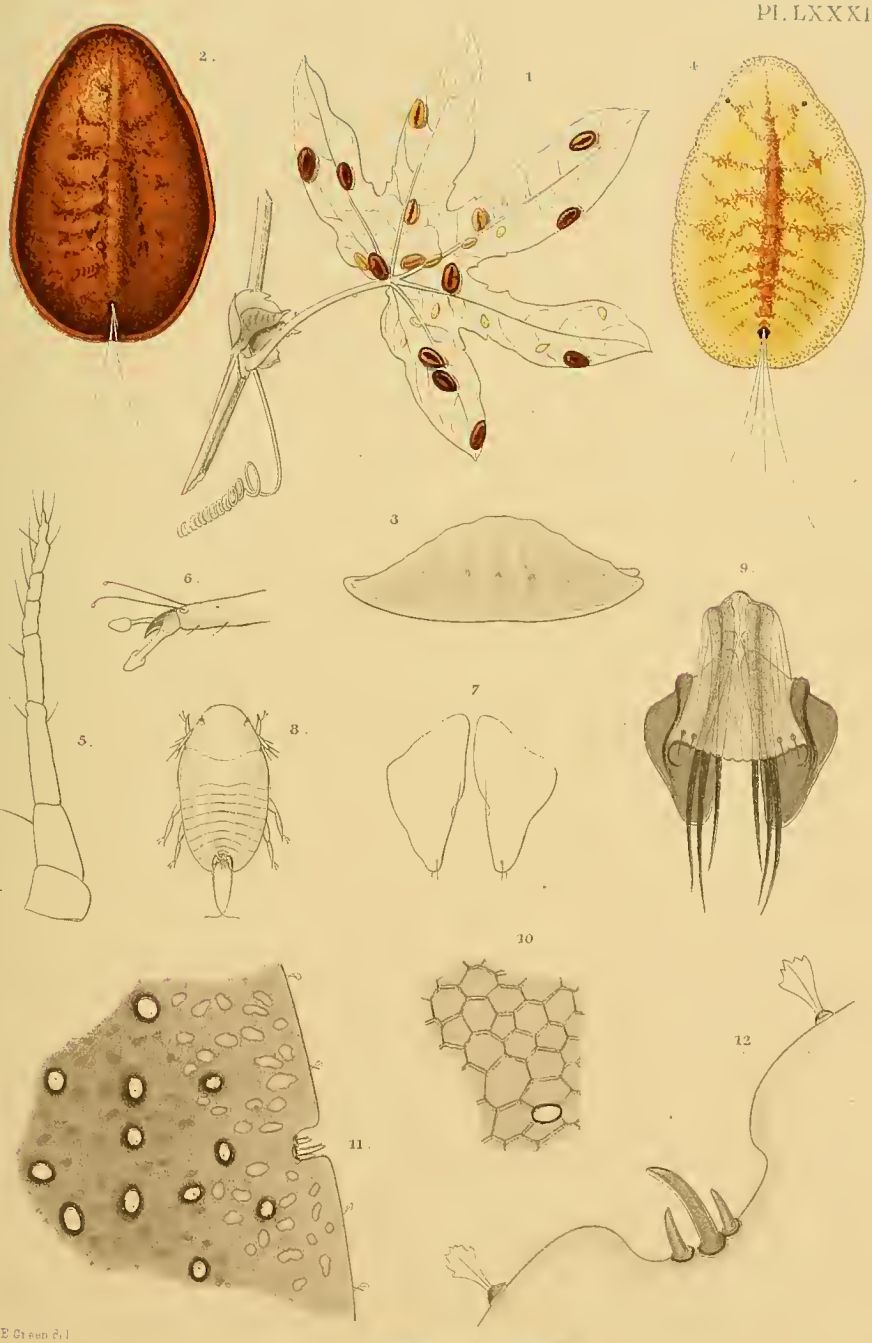
LECANIUM LONGULUM.

P.W.M.T. impr.

EXPLANATION OF PLATE LXXXI.

LECANIUM CAUDATUM.

Fig. 1 Leaf of *Passiflora*, with insects, nat. size.
2. Adult ♀, dorsal view, × 10.
3 „ side view, × 10.
4. Early adult ♀, dorsal view, × 10.
5. Antenna, × 150.
6. Foot, × 300.
7. Anal operculum, × 150.
8. Young larva.
9. Anal ring, ventral aspect, × 150.
10. Portion of derm, with reticulate markings, × 150.
11. Margin of scale, showing stigmatic spines, marginal hairs, and dermal cells, × 150.
12. Stigmatic cleft, marginal hairs, &c., × 650.



E.E. Green del.

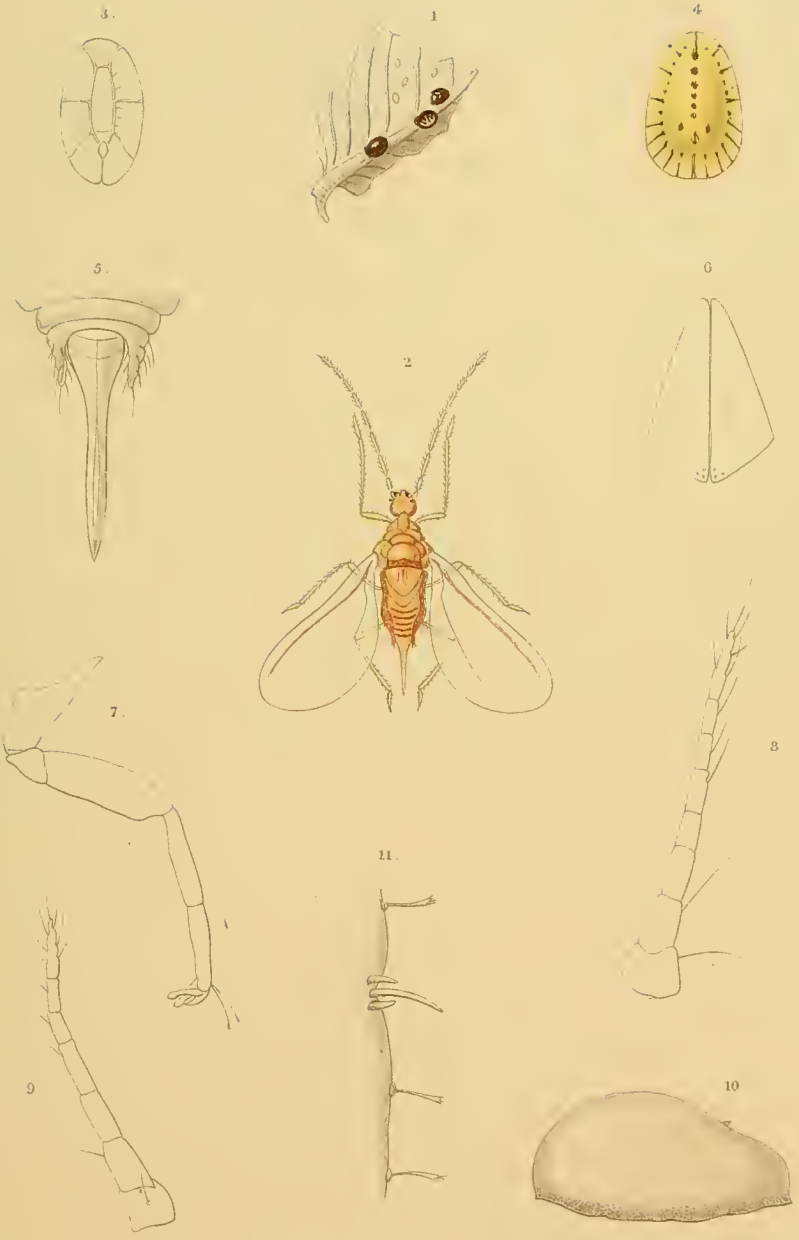
LECANIUM CAUDATUM.

P.W.M.T. imp.

EXPLANATION OF PLATE LXXXII.

LECANIUM PSIDII.

Fig. 1. Guava leaf, with insects, nat. size.
2. Adult male, dorsal view, × 25.
3. Male puparium, × 12.
4. Female, immature.
5. Extremity of abdomen of male, from below.
6. Anal operculum of adult female, × 100.
7. Leg of „ × 150.
8. Antenna of „ with eight joints, × 150.
9. „ „ seven „ × 150.
10. Adult female, side view, × 12.
11. Stigmatic spines and marginal hairs.



EE Green del

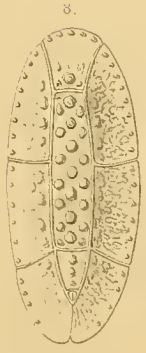
LECANIUM PSIDII.

P.W.M.T. impr.

EXPLANATION OF PLATE LXXXIII.

LECANIUM OLEÆ.

Fig. 1. Insects on twig of *Antidesma*, nat. size.
2. Adult ♀, side view, × 5.
3. „ derm cells, × 150.
4. „ anal operculum, × 150.
5. „ marginal hairs, × 650.
6. „ antenna, × 150.
7. „ stigmatic spines, × 650.
8. Male puparium, × 20 (after drawing in *Ent. Mo. Mag.*, Mar. 1897, p. 72).

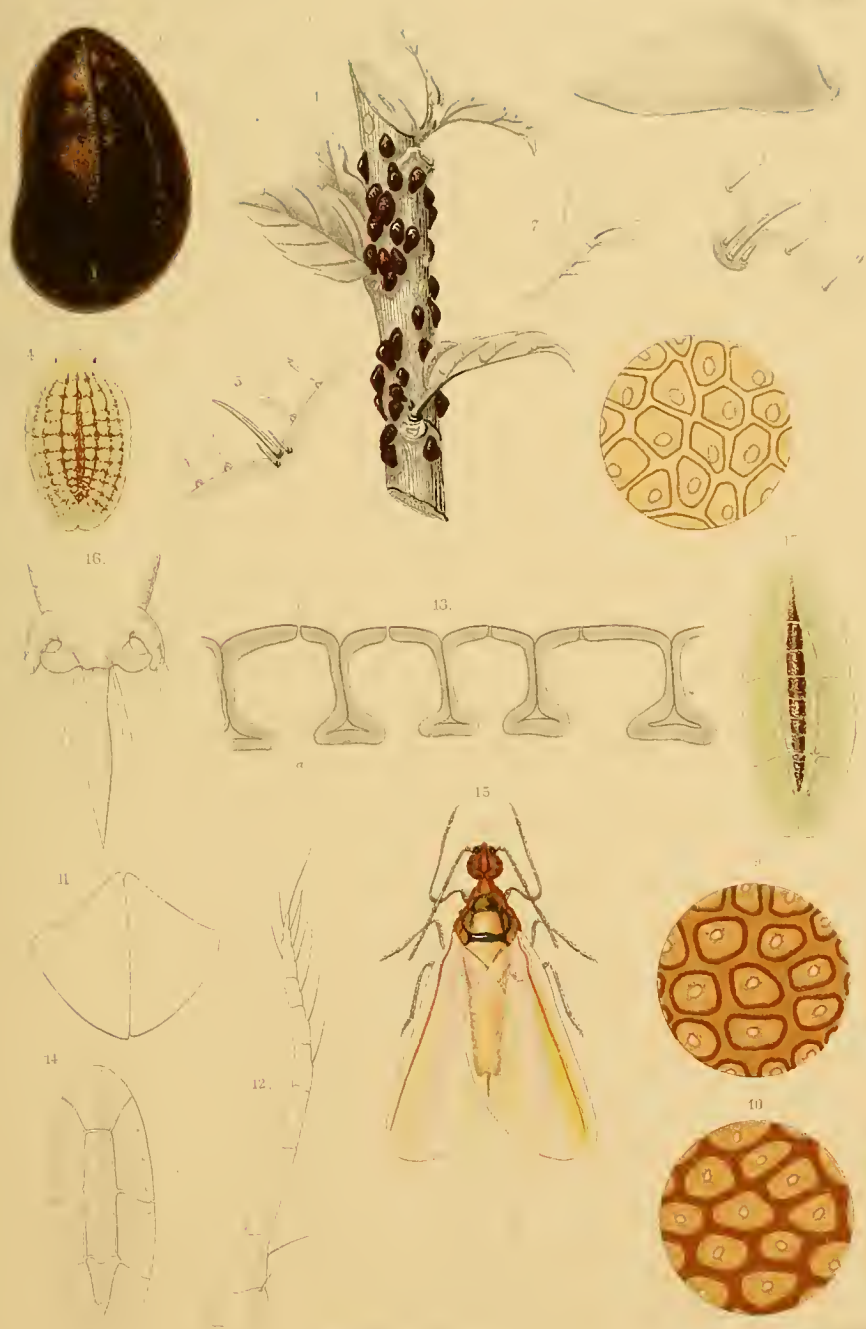


LECANIUM OLEAE.

EXPLANATION OF PLATE LXXXIV.

LECANIUM NIGRUM.

Fig. 1. Stem of *Hibiscus*, with insects, nat. size.
2. Adult ♀, dorsal view, × 8.
3. Adult ♀, side view, × 8.
4. Immature ♀, dorsal view, × 8.
5. Stigmatic cleft and spines of immature ♀.
6. Stigmatic cleft and spines of adult ♀.
7. Foot of adult ♀, × 150.
8, 9, 10. Dermal cells, × 150.
11. Anal operculum, × 150.
12. Antenna, × 150.
13. Section through derm, × 650.
(*a*) Pale median spot.
(*b*) Central pore.
14. Puparium of male, × 25.
15. Adult ♂, × 35.
16. Terminal segments of adult ♂, × 200.
17. Male larva, × 25.



LECANIUM NIGRUM.

EXPLANATION OF PLATE LXXXV.

Lecanium hemisphæricum.

Fig. 1. Insects on tea stem, nat. size.
2. Young larva.
3. Larva, further advanced.
4. Early female, dorsal view.
5. „ „ side view.
6. Adult female, side view, × 12.
7. „ „ before oviposition, dorsal view, × 12.
8. „ „ „ „ ventral view, × 12.
9. „ „ after oviposition, ventral view, × 12.
10. Male puparium.
11. Adult male.
12. Portion of derm of adult female, showing stigmatic spines, marginal hairs, and dermal cells, × 150.
13. Marginal hairs, × 650.
14. Anal operculum, × 150.
15. Antenna, × 150.
16. Leg, × 150.

E.E. Green del.

P.W.M. imp

LECANIUM HEMISPHÆRICUM.

EXPLANATION OF PLATE LXXXVI.

LECANIUM EXPANSUM.

Fig. 1. Adult ♀, *in situ*, nat. size.
2. „ dorsal view, × 7.
3. „ anal operculum and surrounding parts
4. „ anal operculum, × 100.
5. Group of spinnerets from dorsal surface.
6. A single ventral spinneret.
7. Stigmatic cleft and spines.
8. Waxy plate from dorsum.
9. Marginal scales, dorsal view, × 650.
10. Antenna.
11. Marginal hairs of immature female.
12. Marginal hairs of male larva.
13. A single marginal hair of male larva.
14. Male puparium.
15. Adult male, dorsal view.
16. Head of male, from below.
17. Terminal joint of antenna of male.

LECANIUM EXPANSUM, *var.* QUADRATUM.

18. Antenna of adult female.
19. Anal operculum, × 100.

LECANIUM EXPANSUM.

EXPLANATION OF PLATE LXXXVII.

LECANIUM MARGINATUM.

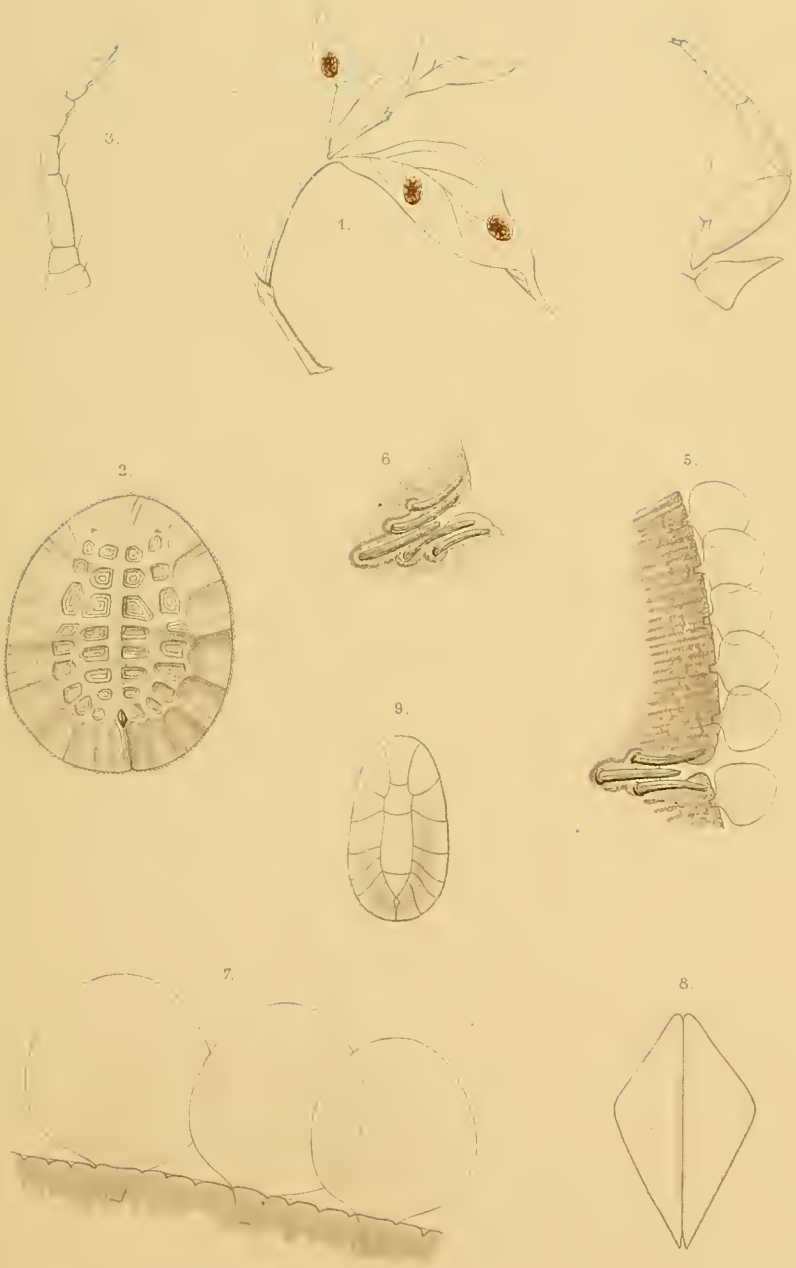
Fig. 1. Leaf of *Psychotria*, with insects *in situ*, nat. size.
2. Adult ♀, from above, × 17.
3. „ from below, × 17.
4. Marginal fiabellæ, from above, × 320.
5. „ „ from below, × 650.
6. Anal operculum, × 150.
7. Stigmatic spines.
8. Antenna.
9. Leg.
10. Male puparium, dorsal view, × 17.
11. Male larva, shortly before pupating.
12. Adult ♂, dorsal view, × 17.
13. „ head, from below.
14. „ antenna.
15. „ side view.
16. „ foot.
17. „ terminal joint of antenna.

LECANIUM MARGINATUM.

EXPLANATION OF PLATE LXXXVIII.

LECANIUM GEOMETRICUM.

Fig. 1. Leaf, with insects *in situ*, nat. size.
2. Adult ♀, dorsal view, × 12.
3. Antenna of female.
4. Leg.
5. Margin of scale and stigmatic cleft, × 215.
6. Stigmatic cleft and spines.
7. Margin, dorsal view, × 650.
8. Anal operculum, × 150.
9. Male puparium, × 12.

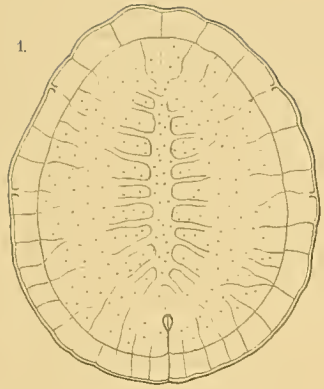


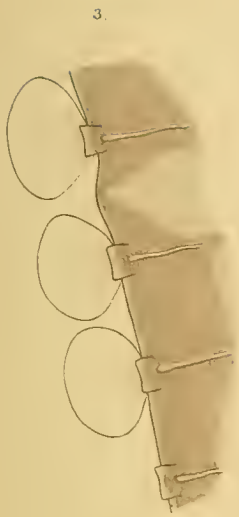
LECANIUM GEOMETRICUM.

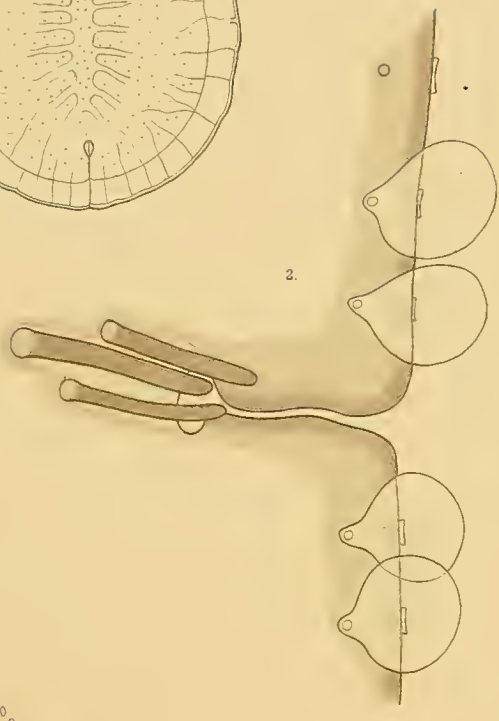
EXPLANATION OF PLATE LXXXIX

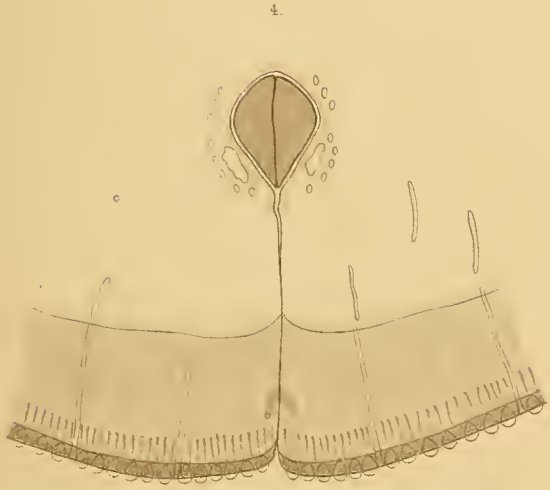
Lecanium calophylli.

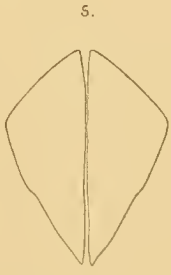
Fig. 1. Adult ♀, dorsal view, × 15.
2. Stigmatic cleft, spines and marginal flabellæ, × 650.
3. Marginal flabellæ, from below, × 650.
4. Posterior extremity dorsal view, × 80
5. Anal operculum, × 150.











F.E. Green del.

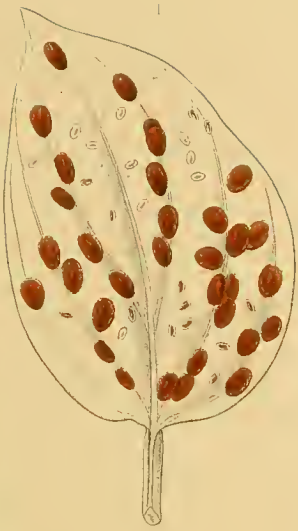
F.W.M. Trap imp.

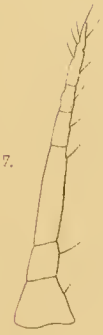
LECANIUM CALOPHYLLI.

EXPLANATION OF PLATE XC.

LECANIUM PERADENIVENSE.

Fig. 1. Leaf of pepper, with insects *in situ*, nat. size.
2. Male puparium, × 18 diam.
3. Adult male, × 17.
4. ,, female, dorsal view, × 10.
5. ,, Stigmatic cleft and spines, × 325.
6. Anal operculum, × 150.
7. Antenna, × 150.
8. Margin of adult female, × 650.





E.E. Green del.

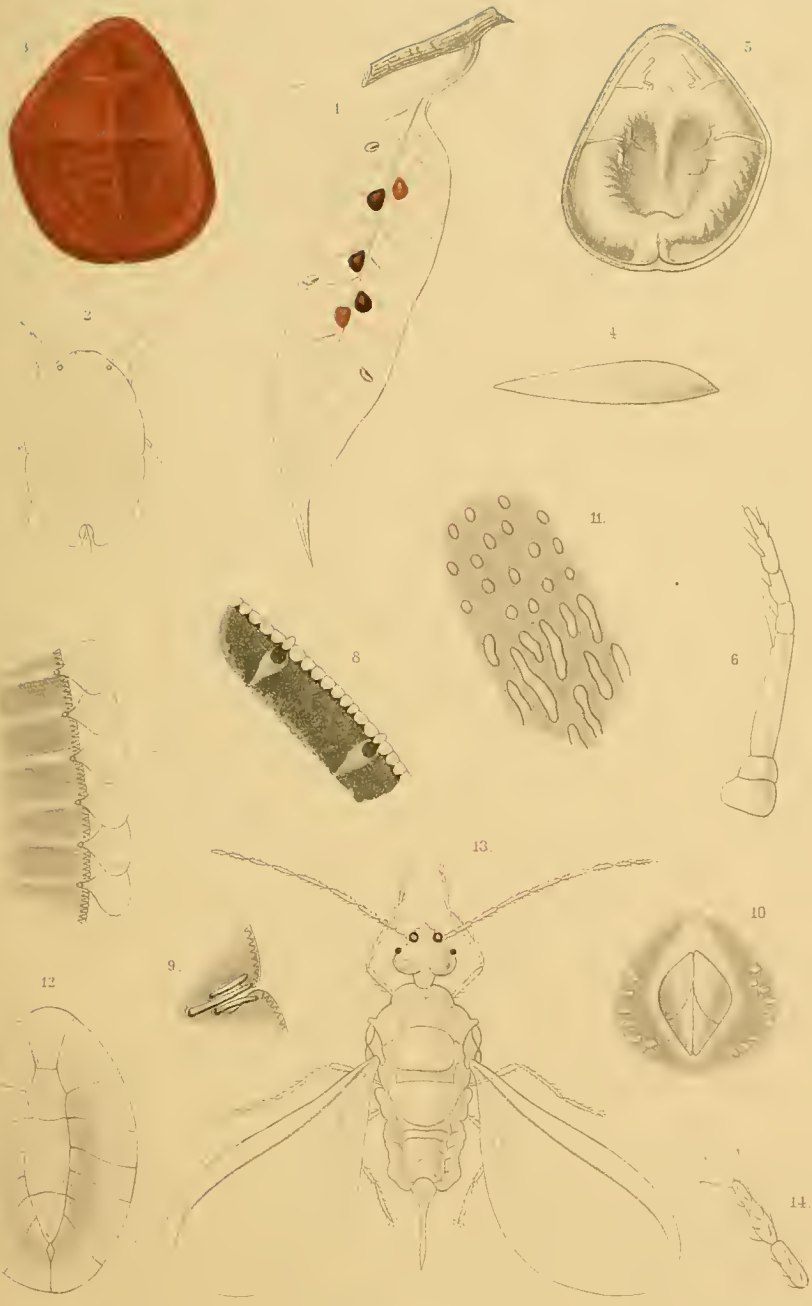
P.W.M. Trap. imp.

LECANIUM PERADENIYENSE.

EXPLANATION OF PLATE XCI.

LECANIUM PLANUM.

Fig. 1. Leaf, with insects, nat. size.
2. Young larva.
3. Adult female, dorsal view, × 14.
4. „ lateral view, × 14.
5. „ ventral view, × 14.
6. „ antenna.
7. „ margin of scale, from above.
8. „ „ „ from below, × 650.
9. „ stigmatic spines.
10. „ anal operculum.
11. „ epidermal cells, marginal and submarginal zone.
12. Male puparium.
13. Adult male, dorsal view, × 45.
14. „ terminal joints of antenna.



LECANIUM PLANUM.

EXPLANATION OF PLATE XCII.

Lecanium zonatum.

Fig. 1. Adult females on leaf of *Garcinia*, nat. size.
2. Adult female, dorsal view, × 14.
3. Stigmatic spines of female, × 410.
4. Anal operculum of female, × 100.
5. Antenna of female, × 150.
6. Marginal scales of female, × 600.
7. Male puparium, × 19.

J.F. Green. del.

P.W.M. Trap imp.

LECANIUM ZONATUM

EXPLANATION OF PLATE XCIII.

LECANIUM MARITIMUM.

Fig. 1. Leaf, with insects, nat size.
2. Adult male, dorsal view, × 24.
3. „ „ head, from above, × 18.
4. „ „ „ lateral view.
5. „ „ extremity of abdomen.
6. „ „ terminal joint of antenna.
7. Male puparium.
8. Adult female, from below, × 10.
9. „ „ dorsal view, × 10.
10. „ „ antenna.
11. „ „ leg.
12. „ „ anal operculum.
13. „ „ marginal scales and epidermal cells, from below.
14. „ „ stigmatic spines.
15. „ „ portion of margin, from above, × 650.

LECANIUM MARITIMUM.

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