

## II.—ZOOLOGY.

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ART. XVI.—*On some Coccidæ in New Zealand.* By W. M. MASRELL.

[*Read before the Philosophical Institute of Canterbury, 6th June, 1878.*]

Plates V., VI., VII. and VIII.

THE Coccidæ—Scale or Gale insects—are a family of the order Homoptera. They are exceedingly common in all parts of the world, and I may say that in New Zealand I have scarcely come across a single plant or tree that is not in some way attacked by them. In many instances plants are found with several species of Coccidæ living on them together, and sometimes the number of insects on a leaf is so great as entirely to cover the surface, rendering the plant very unsightly.

Notwithstanding, however, the enormous number of these insects and the undoubted damage which they do, there is not much known about them. I believe I am correct in stating that in this colony nobody has yet attempted to study them: probably the very great incentives to research in other branches of natural history have diverted attention from these little pests. It is, however, curious that in older countries scarcely more knowledge has been attained regarding the Coccidæ. Books and papers respecting them are certainly not few in number. I have a list of more than a hundred authors who have written something upon the subject. But, with the exception of the insects yielding cochineal, gum-lac, and other articles of commercial value, and a few whose peculiarities of form attracted special notice, hardly any of the genera or species have, until lately, been satisfactorily described. Most of the authors referred to seem to have contented themselves either with indefinite accounts or with copying the phrases of those who preceded them.

An application to the Librarian of the British Museum, last year, made known to me a work by M. V. Signoret, a member of the Entomological Society of France, giving a monographical account of the known species of Coccidæ. After some months' delay I have succeeded in procuring this work, and I have to express my thanks to Dr. von Haast and to Professor Milne-Edwards of Paris, the former of whom wrote for, the latter of whom forwarded, a copy of M. Signoret's book to me,

The chief difficulty under which I have laboured has been that of being unable to compare my specimens of New Zealand scale-insects with those of other countries. The work just mentioned has, therefore, come most opportunely to me as a text-book.

Not professing any degree of entomological science, I may, perhaps, in my descriptions of these insects, fail sometimes in properly expressing myself. I must take my chance of this, declaring myself quite open to correction.

The Coccidæ are, as I said, a family of insects of the order Homoptera. The chief distinguishing features dividing them from all the other families are, 1st, the absence of wings or elytra in the females, and, 2nd, the absence of a mouth or rostrum in the males.

The damage done by these insects, which attach themselves to different trees, is very great. Everybody must know the scale on the apple and pear trees, which covers the trunk and branches and eventually kills the tree. Every gardener knows how destructive they are to his flowers and choice plants, whether in the open air or in green-houses. It is stated that, in France, different species of *Coccus* and *Lecanium* have destroyed whole forests of almond, orange, and olive trees; in Mauritius and in Brazil the sugar-cane, and in Ceylon the coffee-plant, has been ravaged by them. Sir Wyville Thomson, in the volumes just published of the voyage of the "Challenger," states that in the Azores the cultivation of oranges was for a time almost stopped by a small species of *Coccus*; and we all know how the oranges and lemons which come to us from Sydney are covered with innumerable insects of the same family. In Christchurch a good example of their work may be seen in the holly hedge round the Christchurch Club, where *Lecanium hesperidum* reduced the plants a few years ago to a miserable state. In Auckland, I saw a month or two ago a fine hedge of the kangaroo *Acacia* being rapidly destroyed by colonies of an insect which appears to be a new species of *Coccus*, allied to *Icerya*.

There is an immense variety in the appearance of the different species of Coccidæ, and this variety is rendered still greater by the fact that the insects themselves are by no means the same as a rule in all the stages of their existence, and by the difference between the sexes. There are, however, certain characters which belong to all the species, and with which I may fitly begin my description of those that I have observed:—

1st. In the first stage, after leaving the egg, there is no appreciable difference between the male and the female. The change in form does not take place until the insect discards its second pellicle.

2nd. The males of all species have two wings, six legs, two antennæ (generally pretty long), two proper eyes, and in some species two other eyes placed further back on the head,

3rd. The males, in their perfect state, are absolutely destitute of mouth or beak, the place of this organ being apparently taken by the two last eyes just mentioned.

4th. The females of all species are wingless.

5th. The mouth of the female, in all species, consists of a beak or rostrum, usually jointed, from which start long tubular setæ or bristles, apparently retractile, sometimes longer than the insect itself. Westwood, and after him Signoret, says that there are four of these setæ. This is certainly the case in some species, but in many instances I have been unable, though carefully watching, to see more than three, and in some specimens there would seem to be no doubt on the matter.

The above characters are constant in all the species. The differences observable will be noticed as I go on.

I may say here that, in the majority of instances, the males are extremely rare and difficult to find; in fact, for some species, such as *Mytilaspis pomorum* (the common apple scale), I believe that the male insect has never been found.

The whole family may be divided, according to Signoret, into four great groups:—

1. The Diaspidæ, of which we may take as the type the apple scale, *Mytilaspis pomorum*.

2. The Brachyscelidæ: these appear to be chiefly Australian species, and have been described by M. Schrader, in the Proceedings of the Zoologico-Botanical Society of Vienna for 1868.

3. The Lecanidæ, type *L. hesperidum*, common on our hollies.

4. The Coccidæ: our type for this will be an insect found on the Norfolk Island pine and on native trees in Riccarton Bush.

The species which I shall have to describe as being, in my opinion, new, will not, as far as I know at present, require the creation of a new group.\*

I propose to take the above groups in order, and for the present shall confine myself to the first. I shall begin by giving an account of the features characteristic of the whole group; then pass on to the distinguishing features of the various genera, and lastly describe the species which I have observed.

#### 1. DIASPIDÆ.

This group includes those scale insects which cover themselves with separate shields, composed partly of the discarded pellicles of the earlier stages, partly of a fibrous secretion more or less independent of the body of the insect.

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\* *Powellia* (*vide post*) seems to belong to none of the above groups, but I have not yet been able to make out where to place it.

We are all familiar with the appearance of the outer shell or shield of the apple scale. The shield varies considerably in different genera: sometimes it is round, sometimes long, sometimes white, sometimes brown, but it invariably exhibits, in some part or other of its extent, when taken from the adult female insect, the two pellicles which she has discharged in her earlier transformations. In my plate V., fig. 1a, is shown part of the shield of the apple scale, mounted to show the pellicles. In the shield of the male insect, in certain species, only one pellicle appears, the insect undergoing only one transformation before the pupa stage.

The female insect, having arrived at her full growth, fills her shield with eggs. A figure of its appearance is given in plate V., fig. 1b, for the apple scale.

The young insect shows no sexual differences. It is oval in shape (plate V., fig. 1c), with six legs, two antennæ, and two eyes.

The female, discarding her first skin, throws off also at the same time all external organs except the mouth or rostrum. In the first pellicle attached to her shield the remains of the antennæ may almost always be seen. The legs are not to be found, and I cannot say what becomes of them. The insect, thus debarrassed of her limbs and eyes, becomes only an inert mass. She remains thus for some time, merely feeding and growing, still retaining an oval shape, as shown by the second pellicles in the shield. Throwing off this pellicle, she appears in her adult stage, a description of which must be left till I come to each species, as they differ considerably.

What I have just said as to the discarding of the limbs is, like every rule, subject to some exception. In one or two species, chiefly of the genus *Mytilaspis*, a pair of minute protuberances, which M. Signoret states are rudimentary antennæ, are visible on the head.

The adult female, whatever her shape, oval or round, is much corrugated, in fact made up of rolls of fat, with the exception of the head—which is usually smooth, and of the abdomen—which is peculiarly shaped and marked. The colour of the insect as a whole varies—being sometimes whitish, sometimes pale yellow, sometimes red.

In all cases that I have observed the abdominal region is of a bright yellow colour, and it is from the markings of this portion of the body that the specific differences of the genera of Diaspidæ are taken. My plate V., fig. 1d, gives the appearance of the abdomen of *Mytilaspis pomorum*, the apple scale, which I have taken as the type of the group. It will be seen that the corrugations of the body end a short distance from the posterior extremity, which has a curved outline, broken by numerous small lobes, intermixed with scaly hairs. The anal opening is at what might be termed

the focus of the curve (this does not hold good for all genera), and it is surrounded by groups of minute circular marks, arranged like bunches of grapes, whilst other marks are scattered singly over the abdominal region. These marks, which are in reality the open ends of tubes, are supposed to be a kind of spinnerets from which the insect builds round itself the shield of which I spoke just now. Some of the chief characters upon which the specific differences of Diaspidæ are founded, are the presence or absence of these spinnerets, the number of the groups, their continuity or separation, and the number of openings in each group. There are other features, such as difference of outline in the body, difference of shape of shield, difference of form of the male, difference of length in the thoracic band of the male. But these are often more properly generic than specific differences; moreover, the excessive rarity of the male insects renders it very difficult to arrive at certainty from them; whereas the abdominal markings of the females are in general so distinctly clear that they offer an excellent means of distinguishing between individuals.

The mouth is, as I said above, absent entirely in the male insect in its perfect state. The mouth of the female consists of a rostrum, or beak, on the underside of the head, some little way from its anterior edge. It appears in the Diaspidæ to have no joints, and from its interior start three (or in some cases four) very long, thin tubular bristles, which, I suppose, the insect inserts into the stomata or minute orifices of the plant on which it lives, for the purpose of withdrawing thence its food. My plate V., figs. 1e and f, show this rostrum (which is, with modifications, common to all Coccidæ), as it appears on the insect, and as it shows after mounting for the microscope.

So much for the general features of the female. The male differs a good deal in shape in various species, but, as far as it is known, has always two wings, six legs terminated by a single claw, antennæ usually of ten joints, and, at the posterior end of the abdomen a long double spike, sometimes nearly equal in length to the whole body. The insect undergoes three transformations. From the egg it emerges as an oval insect similar in all respects to the female; in some species it surrounds itself with a shield like that of the female, in others the shield is much longer and narrower. After a time it discards its first pellicle and remains in the shield, gradually changing into the pupa stage. During this process, according to M. Signoret, the successive formation of the eyes, wings, antennæ, and abdominal spike may be observed. I have specimens of pupæ of *Aspidiotus epidendri*, in which this formation is apparent. The first pellicle is the only one which remains attached to the shield, as the insect emerges from the pupa stage, winged and perfect; consequently, in some species it is possible to distinguish between the shields of the two sexes simply from the presence in one of two pellicles, in the other of only one.

Having thus briefly enumerated some of the characters which are common to all the Diaspidæ, I proceed to particulars.

The group is divisible into several genera, but I need now only mention those of which I have obtained specimens in this country. Considering the immense number of plants, imported or native, whether in greenhouses, gardens, or the bush, which are attacked by scale insects, and the multitudinous variations of form and markings which distinguish the individuals, it is likely that future research will discover, if not new families and genera, at any rate many new species.

The genera known to me at present are the following :—

1. *MYTILASPIS*. This includes the apple scale and many others. The shield, or puparium, is elongated; the two discarded pellicles are seen at the smaller end.

2. *ASPIDIOTUS*. Shield of the female round, or nearly so; that of the male somewhat oval; discarded pellicles in the centre.

3. *DIASPIS*. Shield of the female round, as in the last genus; the discarded pellicles usually near the side; shield of the male elongated.

#### Subsection I.—*MYTILASPIS*, Linn.

The females in many species of this genus, as a rule, resemble each other in form. The number and disposition of the groups of spinnerets offer a means of distinguishing the species. The males, in most cases, are unknown.

1. *Mytilaspis pomorum*, the apple scale.

Plate V., figs. 2a, b, c, d.

This species is not indigenous. The shield, which may be seen covering the trunks and branches of our apple, pear, and other trees, is elongated, mussel-shaped, brown or grey (I have seen some white). It is open underneath, adhering to the tree with its edges; it has considerable consistency; length averaging  $\frac{1}{10}$  inch, breadth nearly  $\frac{1}{30}$  inch. The discarded pellicles are at its smaller end, and, when mounted in balsam, the rest of the shield is seen to be composed of transverse interlacing curved fibres.

In the spring, a close inspection of a branch of apple tree will show a number of extremely minute yellowish specks intermingled with the adult puparia. These specks are the young of the insect, hatched and beginning to travel on their own account. Plate V., fig. 1c, shows the form at this stage. It is oval, flattish, yellow-coloured, with two antennæ, each with six joints (of which the last is the longest); the antennæ have longish hairs on each joint. The head is smooth, rather darker in colour than the body, with four hairs on its anterior edge. The body is corrugated, each corrugation having a spine. The anal extremity is yellow, with several hairs, of which two are of some length. The legs have short femora, tibiæ rather

longer and very thick, tarsi somewhat longer and thin, and a single claw at the tip. Just above the claw spring two long hairs each ending in a knob.

After fixing upon a suitable resting-place the young insect remains in the same state for some time, and then undergoes its first transformation. The result of this is seen in the puparium, where the oval pellicle overlying what is evidently the pellicle of the young one shows that it becomes merely an oval inert mass. The antennæ and legs disappear, the skin of the former remaining attached to the first pellicle. The mouth only survives the change. In this second stage the insect begins to spin its shell, or puparium, and after another interval undergoes another transformation appearing at length in the shape shown in plate V., fig. 2*b*, or as the perfect female.

The body is here seen to have lost its former regularly oval shape and to have become longer. The cephalic end and about half the rest are smooth, the remainder much corrugated. There are no legs, or antennæ proper, but in some specimens may be seen two extremely minute protuberances on the head, each with a few attached hairs, which are said to be rudimentary antennæ. Some of the corrugations near the abdomen have three or four spines. The mouth, or rostrum, which is of the same general character as in all Coccidæ, exhibits three very long setæ.

The abdominal region, as in all Diaspidæ, is bright yellow. Plate V., fig. 2*c*, shows its outline, which is a pretty regular curve broken by a number of small triangular and foliated lobes. Two of these lobes, in the middle, are the largest, and have on each side of them one smaller lobe. Between the lobes are several strong spines. The anal orifice is situated at what might be called the focus of the curve of the abdomen; it is oval and hairless.

Forming an arch around the anus are five groups or bunches of minute circular openings, which are the spinnerets used in building up the puparium. In the uppermost group are 17 openings, in each of the two upper side groups 17, and in each of the two lower groups 14. Plate V., fig. 2*d* shows the appearance of these spinnerets, magnified 700 diameters. A few single spinnerets are scattered about the abdominal region, and near the edge of the abdomen is a row of egg-shaped openings, larger than the others, the narrow ends of the eggs pointing outwards; these are arranged in pairs.

I am inclined to think that the whole abdomen is covered with extremely minute fine hairs, for it usually presents a velvety appearance, with very fine parallel striæ.

When in its perfect stage the female insect occupies nearly the whole puparium. Later on, however, she begins laying her eggs, with which she gradually fills the shield, shrivelling up herself into the narrow end of it,

The eggs, according to my observations, are usually from thirty to fifty in number, oval in shape, of a white or opaline colour, changing to yellow as spring comes on.

The males of this species have yet to be discovered.

I have often found amongst the eggs of *Mytilaspis pomorum* a minute white *Acarus*. It is to be hoped that it feeds largely on the eggs.

Several cures for this pest of the apple tree have, I believe, been tried. Mr. A. Carrick, of Park Terrace, showed me last year a tree of his which he had painted over with a mixture of kerosene and linseed oil. Inspection of the puparia showed that the fluid had thoroughly penetrated them and surrounded the eggs; and I understand that the cure has been complete.

*Mytilaspis pomorum* attacks in this country the pear and plum trees as well as the apple. Indeed, I have found specimens identical in almost every respect on the following trees:—plum, peach, apricot, pear, lilac, cotoneaster, thorn, sycamore, ash, and many others. That these are all the same or different species, I do not like to affirm. Yet in the numbers of their spinnerets they differ. M. Signoret states that in Europe *Mytilaspis pomorum* is found only accidentally on the pear tree, sometimes on the plum; and he names scarcely any other trees. Here all those which I mentioned appear to be indiscriminately attacked by them. The scale on the ash is perhaps a little smaller. I give, however, as an indication for comparison the spinnerets of insects on a few of these trees:—

—	Uppermost Groups.	Upper side Groups.	Lower side Groups.
Apple .. ..	17	17	14
Plum .. ..	20	17	17
Lilac .. ..	17	19	16
Ash.. ..	10	12	9
Cotoneaster ..	7	15	10

## 2. *Mytilaspis pyriformis*, sp. nov.

Plate V., fig. 3.

The puparium is broadly pearshaped, the discarded tests occupying the smaller end; the tests are of a pretty regular oval shape; the pellicle of the second stage reaches to about the middle of the puparium. Colour of shield light brown; texture thinner than in *Mytilaspis pomorum*, and form flatter; length about  $\frac{1}{12}$  inch; greatest breadth about  $\frac{1}{20}$  inch. Plate V., fig. 3a, shows the appearance of the puparium.

This species in the shape of its shield and a few other particulars resembles *Mytilaspis buxi* of Bouché; but there are differences which authorise me, I believe, in considering it as new.



The adult female is deeply corrugated except (as in every *Mytilaspis*) on the cephalic portion. The corrugations bear a few strong spiny hairs. The abdominal pygidium shows an almost continuous arch of spinnerets over the anal orifice. In *Mytilaspis buxi* the groups are distinct. The spinnerets of *Mytilaspis pyriformis* run in a double ring round the anus, with here and there an outlying opening. Altogether there may be from 60 to 70 openings in the arch. There are many single spinnerets scattered about, a large number of them more or less oblong; and they may be traced up the sides of the body as far as the corrugations extend. Plate V., figs. 3b and c, show the appearance of the female and the arrangement of the spinnerets.

The abdomen, including all that is tinted yellow, does not show a continuously curved outline. On each side, next to the last corrugation of the body, is a large triangular lobe, the apex furnished with scaly, triangular, serrated hairs. The rest of the abdomen shows a curve broken by small lobes, of which the two middle ones are the largest, the next two on each side smaller, and the rest inconspicuous. Between the lobes are scaly hairs, and near the edge runs a row of large oblong openings.

I have a specimen of a scale from *Dysoxylum spectabile*, which seems to resemble much more nearly *Mytilaspis buxi*; and this is not unlikely, as the specimen came from a greenhouse.

3. *Mytilaspis cordylinidis*, sp. nov.

Plate V., fig. 4.

This scale, which appears to be also new, I have found on a great number of New Zealand plants, such as *Cordyline*, *Asplenium*, *Phormium*, *Gahnia*, *Drimys*, *Astelia*, and many others. I have also seen it on *Eucalyptus globulus*, but only in the vicinity of New Zealand trees. It is perhaps more abundant on the cabbage tree than on others; hence I have named it as above.

The puparium is very long and narrow, generally straight, sometimes curved, semi-cylindrical. Length about  $\frac{1}{8}$  inch; breadth  $\frac{1}{30}$  inch. Colour pure white, except at the end where the discarded tests are; these are bright yellow. The tests are oval; the second more elongated than the first, and the two together generally occupy rather more than a quarter of the length of the puparium. The eggs are small, oval, and of a bright yellow colour.

The adult female is pale golden, about three times as long as broad; the cephalic end a little flattened anteriorly, and above the rostrum are often seen the two minute hairy protuberances called rudimentary antennæ. The body is somewhat corrugated, but less so than in *M. pomorum*; the corrugations show a very few fine hairs.

The abdomen exhibits a curve almost continuous and regular, broken only by very small lobes except in the middle, where there is a deepish depression with a large lobe on each side. Between the lobes are scaly serrated hairs, some of which are pretty long.

There are five groups of spinnerets of which the middle has 7 to 8 openings, the two upper-side ones 14 to 20, the two lower 20 to 25.

There are a great number of single spinnerets, a few oval or circular, the majority oblong. They are placed in curved lines arching round the pygidium, each arch lining the groove of a corrugation, and are visible on the sides of the body nearly to a level with the rostrum.

The male insect is very minute and difficult to find. I succeeded in procuring one specimen, though not in good order. I could observe that the antennæ were short and the tibiæ excessively large.

Plate V., fig. 4*a*, is the puparium; fig. 4*b*, the adult female; fig. 4*c*, the pygidium.

4. *Mytilaspis drimydis*, sp. nov.

Plate V., fig. 5.

I have found this species on a great many native plants, but more often perhaps on *Drimys colorata*, whence I give it its name.

The puparium is straight, long and narrow, but not so much so as in *M. cordylinidis*. Average length  $\frac{1}{2}$  inch; breadth  $\frac{1}{30}$  inch; colour generally a dirty white, sometimes brown, yellow at the end with the discarded pellicles, which are oval, narrowing somewhat at the tip.

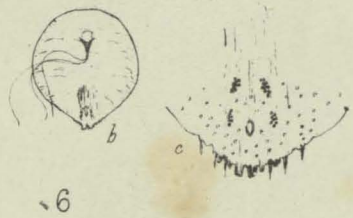
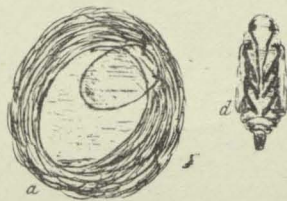
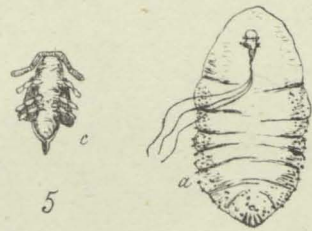
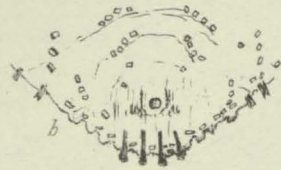
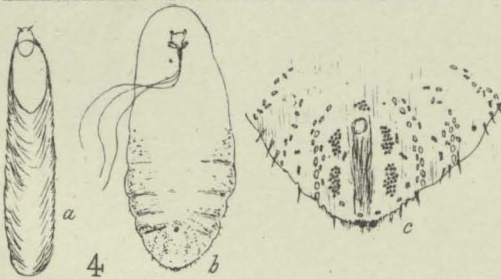
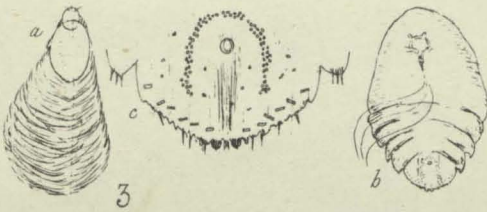
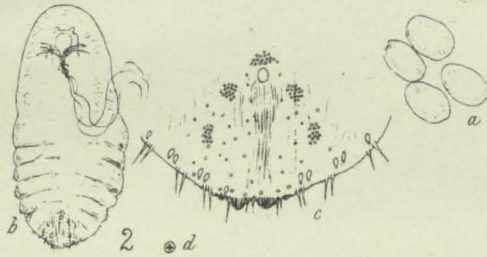
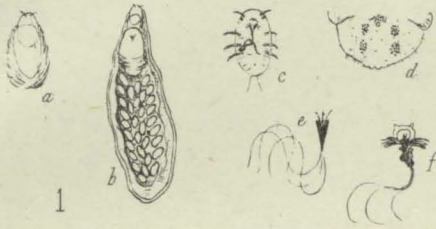
The adult female is of a dull red colour, about twice as long as broad; the widest part is about two-thirds of the length from the head. It is less corrugated than *M. pomorum*; the head and thoracic portion of the body are smooth and round, the anterior edge not so much flattened as in *M. cordylinidis*. The remainder of the body, on the corrugations, has a row of short, thick, tubular bristles extending down the edge as far as the commencement of the abdominal pygidium; these are cylindrical, some with a circular top, some forked, some appearing like bundles of parallel fibres. It is probable that they are spinnerets protruding further than is usual in other species.

There are no groups of spinnerets on the abdomen, but a number of single ones, mostly oblong, scattered about.

The abdomen ends in a number of very small lobes of which four are conspicuous in the centre. Between the lobes fine hairs.

On the cephalic region are a few scattered spines and the two rudimentary antennæ.

I have no adult male, but pupæ showing long antennæ, a very long body, short wings and the usual abdominal spike peculiar to the Diaspidæ.



COCCIDÆ



Males of this species are not so rare as in some others, and I hope before long to have a perfect specimen.\*

Subsection 2.—*ASPIDIOTUS*, Bouché.

This genus is characterised by a round, or nearly round, puparium; the discarded pellicles are in the middle, and usually their major axes are inclined to each other. Several species are known in Europe.

1. *Aspidiotus epidendri*, Bouché.

This is a well-known species. In Mr. Duncan's hothouses it may be found in abundance upon the *Seaforthia* palm, upon *Lælia anceps* and other orchids, and on several other plants.

The puparium is round, flat, of a dirty white colour, sometimes (as on the wattle) brownish; the pellicles in the centre are yellow; the fibres run in interlacing circles.

The eggs are yellow; the young insect is oval, somewhat broader than in *Mytilaspis pomorum*, and has at the posterior extremity two protruding lobes with a pair of very minute lobes between them.

As a rule, the insects are found in considerable numbers, in colonies, the puparia of the females intermingled with the young and with the cocoons of the males.

The pellicle of the second stage is oval, tapering to the posterior extremity.

The adult female is almost round, or rather in the shape of a peg-top. Plate V., figs. 6a and b, show the insect and its puparium. The curve of the cephalic portion is circular and smooth; no hairs are visible, but the two rudimentary antennæ can be seen. The abdominal region is yellow, ending in lobes of which the two middle ones are the largest; between the lobes are very fine hairs. The pygidium has four groups of spinnerets; the two upper groups have from eight to ten openings, the two lower from six to eight. Many single spinnerets.

The puparium of the male is elongated, cylindrical. At one end is seen the pellicle of the first stage. The male escapes from this cocoon, when perfect, backwards. This mode of egress is, as I understand, not uncommon amongst the Coccidæ.

In the pupa stage the male (plate V., fig. 6d) exhibits the wings, legs and abdominal spike coiled up to fit the cocoon.

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\* Since writing this paper I have obtained a specimen of the adult male. The wings are about equal in length to the body. The antennæ have ten joints, of which the two first are very short and thick, the rest very long and thin, covered with hairs and equal to each other with the exception of the last which is spindle-shaped. These antennæ resemble those of the male of *Diaspis gigas* described below. The thoracic band is inconspicuous. The legs have a rather large tarsus and are hairy.

In its perfect state the male has a roundish head with two globular eyes on its anterior portion, and further back, in the place where the rostrum should be, two other eyes (?) filled with a mass of pigment. The antennæ are long, hairy, ten-jointed. The wings are a little longer than the body. The thorax is somewhat broad, with a band crossing it near the middle; this band (seen I believe in all species of Diaspidæ) does not in this species reach across the whole thorax. The abdomen, smaller than the thorax, is oval, and ends in a tubular sheath from which start the two long spikes characteristic of the Diaspidæ. The legs exhibit a few hairs; the femora are thick; the tibiæ not very long, narrow; the tarsi end in the usual single claw.

2. *Aspidiotus budlæi*, Signoret.

On the silver wattle, in Nelson, last year, I found specimens which I believe to belong to this species. I have had one or two from a tree of the same kind in Christchurch. My specimens are all females.

The difference between this and the last species is, for the female, in the number of the spinnerets. These are in four groups, the two upper ones having only five or six openings, the two lower only three or four.

It is possible that these specimens may be *Aspidiotus aloes*. It requires an examination of the male to distinguish clearly.

3. *Aspidiotus atherospermæ*, sp. nov.

I take this to be a new species; I have it from an indigenous tree, *Atherosperma novæ-zealandiæ*. The puparium resembles that of *Aspidiotus epidendri*, but is somewhat darker in colour. The adult female is much more corrugated, and the corrugations overlap the abdominal region. The pygidium has four groups of spinnerets; the upper pair have 15 openings, the lower 9 or 10. The abdomen ends in several lobes, of which the four middle ones are the largest. The rest of the lobes are sharply pointed. Between the lobes are scaly serrated hairs.

Plate VI., figs. 7a and b, shows the adult female and the abdomen.

4. *Aspidiotus dysoxylæ*, sp. nov.

Plate VI., fig. 7.

The puparium is brown, somewhat convex, the underside white. The female in the middle is bright yellow, corrugated, the corrugations overlapping the abdominal region which is comparatively small. There are four groups of spinnerets—the upper pair with ten openings, the lower with nine, many scattered oval and oblong spinnerets. The abdomen ends in six lobes, of which only the two median are conspicuous; between the lobes fine, serrated hairs. The abdomen is very velvety.

In the second stage, shown in plate VI., fig. 7c, the body is more oval and less corrugated, and the rostral setæ are exceedingly long.

With the exception of the abdominal lobes and the numbers of spinnerets in the groups, the adult female resembles *Aspidiotus atherospermæ*.

5. *Aspidiotus aurantii*, sp. nov. (?)

Plate VI., fig. 8.

This is not an indigenous species, being found in immense numbers upon the oranges and lemons in our shops, imported from Sydney. As, however, it occurs on orange trees growing at Governor's Bay, I introduce it here.

M. Signoret describes, under the name of *Parlatoria zizyphi*, or *aurantii*, an insect infesting orange trees in Europe. Its form, as given in his plate V., fig. 9, bears certainly great general resemblance to the insect I am describing, but it differs altogether in the shape and colour of the puparium, and the abdominal lobes are also different.

The puparium of *Aspidiotus aurantii* is round, yellowish, flat. The insect, in the centre, is curiously shaped. It has a generally spherical outline, but looks as if, from rich feeding, rolls of fat were produced, making the corrugations of the body very largely overlap the abdomen. It is yellow, the abdomen being the deepest coloured. The curve of the body and head is regular and smooth; the rudimentary antennæ are absent; the abdominal region, very small in comparison with the rest, ends in six lobes of which the two middle ones are the largest. There are no groups of spinnerets.

The young insect (second stage) is somewhat different, being of a nearly regular oval shape, without the rolls of fat.

The male is very small, brown in colour; the antennæ have ten joints. The two first joints are very small, round and smooth; the third, fourth, fifth and sixth equal in length, the seventh, eighth and ninth half as long, the tenth somewhat shorter still and pointed. All the last eight joints show numerous hairs. The thorax is short and thick, the thoracic band occupying more than one-half the width; the abdomen short, the double spike of some length. The wings are oval, about as long as the body. The legs are hairy, femora thick, tibiæ longer, thicker at the end next the tarsus than at the other end; tarsi broad at the top, tapering gradually down to the usual single claw. The hairs on the femora are much fewer than those on the tibiæ and tarsi.

This insect does not correspond in any particular with the species described by M. Signoret, except in the general outline of the adult female, resembling *Parlatoria*. Nevertheless, as it is manifestly not a species indigenous to New Zealand and must be known to entomologists, I give it the name of *Aspidiotus aurantii* only in default of better information than I have at present. M. Schrader, in the work above cited, mentions an insect

attacking orange trees in Sydney, which, he says, "appears to be an *Aspidiotus*." I take it that this is my *Aspidiotus aurantii*; but it would seem from his expression that hitherto no detailed description has been given of it.

[NOTE.—*Aspidiotus limonii*, Signoret, cannot be this species.]

*Aspidiotus camelliæ*, Boisduval, attacks camellias in our greenhouses. It somewhat resembles *Aspidiotus nerii*, but there are no groups of spinnerets.

### Subsection 3.—*Diaspis*, Costa.

In this genus, as in the last, the puparium of the female is round and flat, but the discarded pellicles are usually at the side instead of in the centre. The female is generally rather more elongated than in *Aspidiotus*. The puparium of the male is long and narrow; the perfect insect does not differ from *Aspidiotus*, except that the space between the first and second pair of legs appears disproportionately long.

#### 1. *Diaspis boisduvalii*, Signoret.

Plate VI., fig. 9.

This is an European species. I have found it in abundance upon orchids in Mr. Duncan's hot-houses. The female is somewhat pear-shaped, the cephalic region smooth, with a protruding lobe at each side on a level with the rostrum, distinguishing it from all the other species. There is sometimes a cottony fluff on the body. The widest portion is a little below the lateral protuberances; from thence it tapers gradually to the posterior extremity, where the abdomen ends in two lobes with a depression between them. The abdominal curve is broken by small serrations with a few spiny hairs amongst them. The pygidium has five groups of spinnerets; the uppermost group has from five to eight openings, the two upper side ones twenty to twenty-five, the two lower somewhat less. There are a few scattered single spinnerets, mostly oblong.

The male is very small; its cocoon is white, cylindrical, with the discarded pellicle (similar to that of the female) at one end. As in *Aspidiotus epidendri*, the perfect insect escapes from its cocoon backwards (Plate VI., fig. 9b. The head is transverse, grooved in front, with four eyes, of which the two occupying the position of the rostrum are full of pigment. The antennæ spring from the anterior region; they are very long, having ten joints, of which the two first are short and thick, without hairs, the remainder twice as long but narrower, and covered with fine hairs. The last joint (which possibly may consist of two or three soldered together) is spindle-shaped.

The thorax is long; the thoracic band conspicuous, but occupying only about half the width of the body. The wings, which appear to have only a



single nervure, are oval, and extend far beyond the extremity of the abdomen. The abdominal spike, which has a tubular sheath of larger size and length than in *Aspidiotus*, is double and long, but does not reach the tip of the wings.

The legs are hairy; femora and tibiæ about the same length, but the former thicker than the latter; tarsi thick and spindle-shaped, ending in the usual single claw. The great distance between the first and second pair of legs gives the insect a peculiar appearance.

2. *Diaspis rosæ*, Sandberg.

Plate VI., fig. 9c.

This also is European. It occurs here on rose trees at Governor's Bay, in Mr. Potts's garden. The puparium is flat and white, and the discarded pellicles on one side. The adult female is of a deep red colour, elongated in form, distinguishable from all other species by the size of the cephalic region and the deep corrugations of the body. Its appearance is more striking than that of any other species of the Diaspidæ, and the contrast of the blood-red head and thorax with the bright yellow abdominal region is curious.

The cephalic region, mushroom-shaped, is quite smooth. There is no appearance of rudimentary antennæ. The body has four large corrugations, nearly equal in size, and on the last two are a few spiny hairs. The abdomen, broken by serrations, ends in two lobes with a depression between them. The pygidium has five groups of spinnerets, but the side groups are almost continuous. The upper group has about 20 openings, the side ones 50 or 60; there are no single spinnerets but on each side 3 or 4 rows of large oval openings forming arches.

The young insect is brown, oval, with the head a little flattened anteriorly; the legs and antennæ and abdominal hairs as in other species.

The cocoon of the male is white, cylindrical. I have not yet a specimen of the perfect insect.

3. *Diaspis gigas*, sp. nov.

Plate VI., fig. 10.

I found this species on *Atherosperma novæ-zealandiæ*, a North Island tree, of which Mr. Armstrong gave me a branch some months ago. I believe it best, as a rule, to use the name of the tree on which a scale-insect lives as its specific name, but as I have already used this particular name in the case of an *Aspidiotus*, I prefer, in order to avoid confusion, to call the present species by a descriptive title. I have lately found it in abundance on a species of *Astelia*, in Riccarton Bush. It is the largest of the Diaspidæ which has yet come under my notice; the puparium of the female is sometimes more than  $\frac{1}{8}$  inch long and  $\frac{1}{16}$  inch wide; the female reaches  $\frac{1}{2}$  inch in length.

The puparium is yellowish-brown or dirty white, flat, roughly pear-shaped, thin in texture. The discarded pellicle of the first stage occupies the broad end of the pear; that of the second nearly fills the puparium. This second pellicle is different in shape from those of other species. Instead of being oval in shape with a regularly curved outline, it is nearly identical with the form of the adult female. Its cephalic and thoracic portions are very large, oval, and smooth; at the point corresponding to the metathorax are two prominent lobes, triangular, with rounded angles, the apex of each turned slightly outwards. The outline then descends with three or four other smaller lobes to the extremity of the abdomen. Plate VI., fig. 10*b*, shows the appearance of this pellicle.

The adult female would appear to be, in its earlier state, as large as the second pellicle, that is, filling the puparium or nearly so. In the specimens which I obtained the female had begun in every instance to lay her eggs, and was gradually shrivelling up. Her appearance is shown in plate VI., fig. 10*a*. It will be seen that the lobes visible in the pellicle are here absent, but I am not sure whether this is not the effect of the shrivelling of the body.

The cephalic region is still proportionately very large. The abdomen is conical, the sides broken to within a short distance of the extremity by sharp serrations, between which are triangular scaly hairs. There are no groups of spinnerets, and only a few scattered single ones.

The puparium of the male is long, narrow, whitish, and with the appearance of a semi-cylinder lying upon a plane base. The perfect insect, in general appearance, resembles the male of *Diaspis boisduvalii*; but the abdomen is not nearly so long, and the tubular sheath of the abdominal spike is much smaller, being nearly globular. The antennæ are much the same as in *D. boisduvalii*. The thoracic band occupies about half the width.

This species appears to be very subject to fungoid growth. In dealing with the succeeding families of Lecanidæ and Coccidæ, we shall find that very many of their species are subject to fungus; but in the Diaspidæ, so far as I have been able to observe, this is not the case. *Diaspis gigas*, however, on the branch of *Atherosperma*, which I received, was in several instances entirely overgrown by a fungus which appeared to me to belong to the Physomycetous Order and family Antennariei. In one instance this growth, which was clearly attached to the puparium, extended nearly an inch in every direction round it.

#### 4. *Diaspis* — (?)

Plate VI., fig. 10*e*.

On the same tree, *Atherosperma*, I found a *Diaspis* which may perhaps be an abnormal form of the last species, perhaps distinct. The puparium

was oval; the adult female, somewhat resembling *Mytilaspis pomorum*, was dark yellow in colour, irregular in shape, having three prominent lobes on each side. The male puparium was oval; the enclosed pupa was not to be clearly made out, but seemed to resemble *Diaspis gigas*.

The above include all the species of Diaspidæ which I have as yet observed. There are doubtless many more in the country, and I hope at some future time to be able to procure new specimens. Meanwhile I shall go on to the next family of scale insects, the Lecanidæ.

Since writing the above I have found three other Diaspidæ, which may be new species, but which I have not had time to thoroughly examine.

The first, a *Mytilaspis*, is found on a small *Leucopogon* growing on dry soil in the hills. It is yellowish, with a puparium somewhat pear-shaped, quite white, and rather tough. It is very minute, averaging only about  $\frac{1}{10}$  inch in length. The puparium of the male seems to be narrower, if the specimens I have looked at are the cocoons of males. The abdominal region of the female has a pygidium with eight groups of spinnerets; the lower groups have from twenty to thirty openings in each, the upper only from four to six. There are a great number of cylindrical protruding tubes. The abdomen ends with six spines. The lobes are inconspicuous, with a medial depression.

Another *Mytilaspis*, found on a very small *Mesembryanthemum* growing moss-like in our river-beds, appears to differ from the last only in its colour, which is dull red. I am not sure how far mere colour may be taken as constituting a specific difference.

The third insect, growing on the Wild Irishman (*Discaria toumatou*), seems to me a species of *Diaspis*; but the only specimens I found were a number of discarded pellicles of the female mixed up in a mass of white cottony fibre as in *Diaspis rosæ*.

I hope shortly to be able to identify all these insects.

I HAVE now to pass from the first group of Scale Insects to the second group, the Lecanidæ. In investigating this group it will be necessary first of all to divide it into several classes, because otherwise it will be impossible to avoid confusion. The number of genera and species of the Lecanidæ is so great, the plants infested by them are so various, and their specific differences so slight in many instances, that it is easy, I should say, to fall into errors concerning them. I have, however, no intention of dwelling at length upon those species which, although attacking plants in this country in gardens or greenhouses, are European, and described by other observers. Of these, as far as my experience goes, we have in New Zealand several; but, with one exception, which I take as the type of the group, I shall pass lightly over them and go on to the genera and species which I believe to be new and indigenous.

The Lecanidæ affect the most varied forms and habits. Some are flat, some are globular; some are naked, some covered with a test which may be cottony, or glassy, or waxy; some are viviparous, some form cocoons or nests for their eggs. But there are two characters which very clearly distinguish them all from the Diaspidæ. These are the presence of a mentum or under lip, and an abdomen cleft at its posterior extremity, with two triangular lobes above the cleft.

In the Diaspidæ the rostral setæ are clear of the body from the moment they leave the tip of the rostrum. In the Lecanidæ the setæ pass some little way down the body, and then, returning towards the rostrum, pass through a second tube, or mentum, as shown in plate VI., fig. 11a. This mentum is also visible in the next group, the Coccidæ proper; but it is there articulate, whereas in the Lecanidæ it has but one segment.

The rostral setæ appear to be generally three, but in some instances I can observe that one of them is double.

The abdominal cleft and its lobes are shown in plate VI., fig. 11b. There are of course specific differences in the size and shape of these lobes, in the hairs on the abdomen, and in the spines surrounding the anal ring.

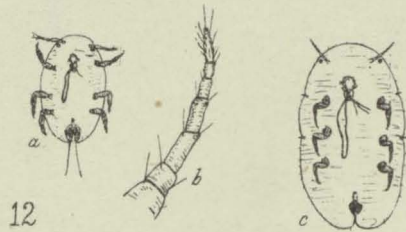
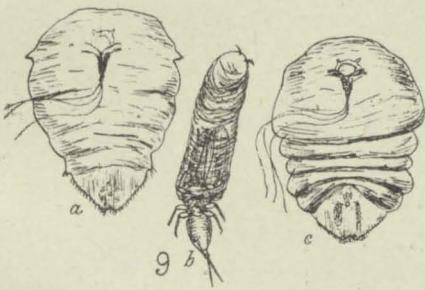
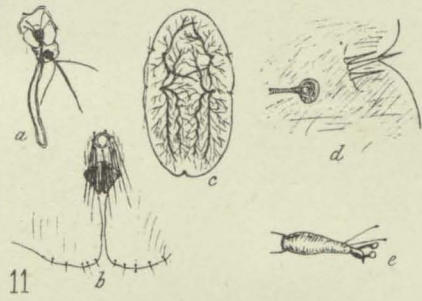
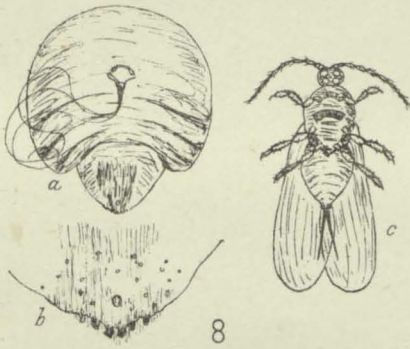
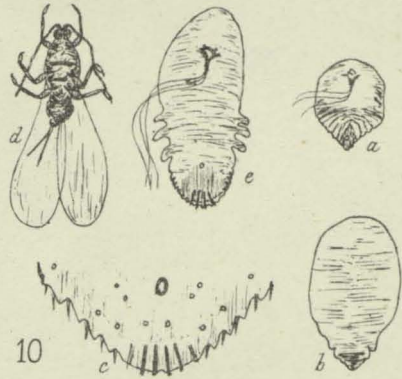
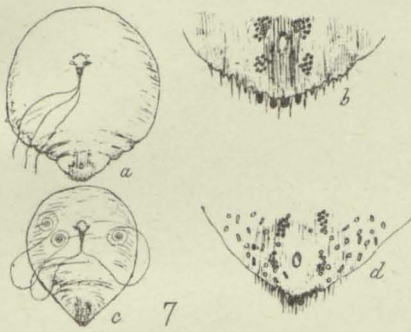
In plate VI., fig. 11c, I give a representation of the respiratory system of a *Lecanium*, the arrangement of which does not greatly differ in the species which I have observed. It will be seen that there are four stigmata, from each of which start large tracheæ covering the body with their ramifications. Fig. 11d gives a magnified figure of a stigma, mounted in balsam, with the stigmatic spines.

The antennæ in the young insect have usually six or seven joints; in the adult female seven or eight. The feet end in a single claw; just above the claw spring four hairs, of which the two uppermost are long, ending in a small knob, the lower pair generally shorter and broader, swelling out into a club at the end. See plate VI., fig. 11e.

The males of most of the Lecanidæ are, I believe, unknown. I have been fortunate enough to procure specimens of males of one indigenous species.

The two distinguishing characters just mentioned, the uni-articulate mentum and the bi-lobed abdomen, are best observed in the young insect. The former, indeed, is often not to be made out in the adult, but the latter is generally conspicuous enough to prevent mistaking one of the Lecanidæ for an insect belonging to another group.

All the Lecanidæ are very much infested by a fungus, apparently of the order Coniomycetes. No doubt most people have observed that plants attacked by scale, such as for instance the holly, or the ivy, have also their leaves much blackened. The blackening is due to the fungus just mentioned.



COCCIDÆ



My subsections of this group, after having said so much of its general characteristics, are as follows :—

1. *Lecanieæ*, for the species having the body of the female naked, often viviparous.

2. *Pulvinariæ*, for the species having the body naked, but forming cottony nests for the eggs.

3. *Lecanio-diaspidæ*, for the species having the body covered with a test; sometimes viviparous.

Of course, I am here only paying attention to such classes as contain genera known to me in New Zealand. There are many other divisions, but they do not come within my scope.

Subsection I.—*LECANIÆ*.

All the species which I have observed in this class are European, and I might therefore, according to my intention expressed just now, pass them over without entering into details. But there is one species which has become so widely spread and so noxious in this country, and which is moreover so excellent a type of the whole group, that I am constrained to dwell more particularly upon it. This species, which infests in our green-houses a vast number of plants, and in our gardens the holly, ivy, ilex, bay, Portugal laurel, orange and other trees, is, I suppose, tolerably well known, as far as its outside appearance goes, to most amongst us. It is

1. *Lecanium hesperidum*; auctorum.

Plate VI., fig. 12.

The young insect, in outline, is not much different from that of *Mytilaspis pomorum*, with the exception of the abdominal cleft. In colour it is reddish brown; it is flat and very active. The antennæ have six joints, but the fifth joint looks as if it were composed of two soldered together; the third joint is the longest. The last joint has a few hairs. The tibiæ and tarsi are of about equal length; the upper pair of hairs, or digitules, above the claw long, the lower pair short and narrow. The abdominal lobes end in two very long setæ. Plate VI., fig. 12a.

The adult female is figured by Westwood (vol. 2), but not large enough for detail. M. Signoret gives only a brief description. The insect is flat, oval, brown in colour, sometimes as much as  $\frac{1}{2}$  inch long. The abdominal lobes are not, in the live animal, so apparent as in the young; but when mounted for the microscope they are plainly seen to be without the two long hairs characterising the young insect; as shown in plate VI., fig. 11b. The anal ring is surrounded by six long hairs. The lobes are triangular, with rounded angles, or heart-shaped.

The antennæ, which do not, as in the Diaspidæ, disappear with age, have seven joints; fig. 12b. The first and second joints are the thickest;

the third, fourth, and seventh the longest, and about equal to one another ; the fifth and sixth somewhat shorter. There are a very few hairs on most of the joints, but the seventh has a good number.

The feet are moderately long ; the coxa thick, the femur moderately large and about the same length as the tibia which is somewhat thinner, the tarsus still narrower, tapering to the claw. The upper pair of digitules above the claw are pretty long, ending in a very small knob ; the lower pair are about twice the length of the claw, very broad.

The general outline of the body (fig. 12c) is oval, but varying in eccentricity. On the holly and ivy in our gardens it forms a pretty regular ellipse ; on the Portugal laurel it is more elongated ; on the orange nearly circular. It is covered with minute specks, and a row of small hairs, not very close together, runs round the edge. There are four stigmata, as shown in plate VI., fig. 10c, and opposite each, at the edge, is a depression with three strong spines, of which the middle one is much longer than the other two. At certain stages of the life of the insect, on lifting it from the leaf, cottony trails may be seen on the plant marking the position of these stigmata, an appearance usual, according to Signoret, amongst the *Lecanidæ*.

The male of this species is unknown.

*Lecanium hesperidum* is said to be always viviparous. In the *Diaspidæ*, the female lays her eggs in a prepared nest ; in the *Lecaniæ* she becomes herself the nest of her young. About April, in this country, on turning over one of the females, it will be seen that on the under side of the body, there is a broad deep-red cavity, between which and the leaf numerous young ones run briskly about. Inserting the insect into some transparent fluid, such as glycerine or balsam, the body is seen to be full of eggs ; but, with the exception of some minute white objects amongst the brown young ones which might be remains of shells, no eggs are visible outside her. I am unable to account for the blood-red colour of the cavity. Signoret speaks of it as "a mortified spot ;" but it sometimes occupies nearly half the under surface of the body, and at the same time the insect is not dead. The interior substance, which, in mounting for the microscope, is pressed out of the body, is not red but yellowish brown.

This insect is becoming a veritable pest in this country. Hollies, ivies, Portugal laurels, and many other trees in our gardens are every year becoming more and more infested with it. Whatever may be the chances of keeping it down in greenhouses, it is to be feared that a cure for plants out of doors is next to impossible.

## 2. *Lecanium depressum*, Targioni.

This is an European species, occurring here in our greenhouses. The adult female is oval, not so flat as *Lecanium hesperidum*, and with the skin curiously marked with a mosaic pattern,



3. *Lecanium hibernaculorum*, Targioni.

Also European; the body, in its later stages becomes quite rounded or bag-shaped, the open mouth of the bag downwards on the leaf. The bag becomes filled with eggs and young. The skin is marked with small spots at pretty regular distances. It is common in our greenhouses.

4. *Lecanium maculatum*, Signoret.

European; occurring here on a hothouse plant, *Bavardia*. The species is distinguished by a row of oval spots commencing above the abdominal lobes and extending up the centre of the dorsal region as far as the rostrum.

I need not dwell longer on the species of Lecaniæ; there are others here, but European. Nor shall I dwell upon the next subsection on my list.

II.—PULVINARIÆ.

As far as my observation has extended, this subsection is confined here to one species, namely, the *Camellia* scale.

5. *Pulvinaria camellicola*, Signoret.

The insect, which is European, differs from *Lecanium hesperidum* chiefly in its mode of propagation. Instead of producing the young beneath itself it forms elongated cocoons of white cottony fibre in which it encloses its eggs. I have not been fortunate enough to procure a male, although, as I understand, it is not rare.

III.—LECANIO-DIASPIDÆ, Targioni.

I come now to my third subsection, containing in this country only genera and species which are, as I believe, new to science. The subsection itself has been created by Professor Targioni-Tozzetti, of Florence, in order to include those genera of Coccidæ which partake of the characters of the Lecanidæ and of the characters of the Diaspidæ. They have the mentum and abdominal lobes of *Lecanium*, but they are surrounded by a shell, shield or test, as in *Diaspis*. This test or carapace is therefore a character clearly distinguishing them from the other Lecanidæ which have the body naked in all its stages; at the same time the abdominal lobes forbid their entrance into any other group.

It would appear that Professor Targioni makes one of the distinguishing characters of this subsection the fact that the insects lose their limbs like the Diaspidæ, "becoming apodous in the adult stage." Now the genera and species which I have to describe do not all entirely agree with this account. The feet and antennæ are preserved at least until the female has propagated her young and sometimes still later, although in other instances I have been unable to detect the limbs in the later stages. To the naked eye, indeed, or even with a low power of the microscope, all the insects appear apodous; but a higher power often reveals the limbs as if buried in the fat body. It seems to me that I have therefore only two alternatives;

either to create a new subsection, or to attach so much elasticity to the existing classification as to allow these species to belong to the *Lecanio-diaspidæ*. I am loth to take the former course, because in their other characters they present little difficulty; moreover, the context of the expression quoted above is not entirely free from doubt. I shall therefore proceed upon the second course.

I have already said that the insects in this subsection combine the mentum and lobes of *Lecanium* with a test or carapace as in the *Diaspidæ*. In the species before me this test is whitish, glassy, and transparent in the earlier stages, often waxy on the old insects. A fringe more or less broad, and divided into segments more or less large, is seen in most species; and the old female, after having produced her young, is generally found shrivelled up at the cephalic end of the test.

Spinnerets are not to be made out in the earlier stages, but when the insect is fully grown there may be seen, all round the edge of the body, a row of numerous circular openings, and, especially in *Ctenochiton viridis*, other rows of minute oval marks disposed along the borders of scales like those of a tortoise. I imagine that these marks are the spinnerets.

In this subsection I have two genera, both of which I believe to be new.

CTENOCHITON, gen. nov.

Four genera are included by Signoret in the subsection *Lecanio-diaspidæ*:—

1st, *Pollinia*, in which the test is globular, and the young insect presents, instead of the abdominal lobes of *Lecanium*, the anal tubercles of *Coccus*.

2nd, *Asterolecanium*, in which the fringe is double, and the females in most cases apodous.

3rd, *Planchonia*, in which the test is felted, the adult female without feet or antennæ.

4th, *Lecanio-diaspis* in which the test is also felted, but the female retains her antennæ.

It will be seen that my genus *Ctenochiton* does not agree with any of these. The young insect has the abdominal lobes; the test is glassy and transparent, becoming waxy at a later period and, in one species, felted at the latest stage; the females preserve their feet and antennæ at least until after producing the young.

6. *Ctenochiton perforatus*, sp. nov.

Plate VII., figs. 13, 14.

This species is very common upon native trees and shrubs near Christchurch. *Pittosporum*, *Drimys*, *Coprosma*, *Rubus*, *Panax* and many others are attacked by it, sometimes so much so that the underside of the leaves is scarcely to be seen for the number of insects covering them.

The young, on leaving the parent, resembles that of *Lecanium hesperidum*; in fact I can see no difference except that perhaps one of the hairs on the last joint of the antennæ is longer in this species. The antenna has six joints, on the last of which are eight fine hairs.

In its next stage the female insect is extremely thin, appearing on the leaf like a translucent blueish film; so thin indeed that some care is necessary to detach it unbroken from the plant. Sometimes so many of these films are seen together as to give quite a slimy appearance to the under side of the leaf. Plate VII, fig. 13a, shows the appearance of the insect at this stage. The toothed fringe is here seen as closely attached to the body; it is very difficult, if not impossible, to detach it mechanically at this stage. Upon immersion, however, in turpentine or spirits of wine and then in Canada balsam the test seems to become dissolved, and with it disappears the fringe, leaving the insect as shown in fig. 13b.

It will be seen that the outline of the body is elliptical, but instead of presenting a regular curve as in *Lecanium hesperidum* the edge shows a number of re-entering curves, giving a wavy appearance. This peculiarity is noticeable to a greater or less extent in all the species of the present subdivision which I have observed; and I am somewhat inclined to think that it might be taken as a distinguishing characteristic of the New Zealand *Lecanio-diaspidæ*.

The rostrum and mentum are of the usual kind. The antennæ have seven joints (fig. 13c); the third much the longest, the two first short and broad, the fourth rather less than the fifth which is again rather less than the sixth, the sixth about equal to the seventh which has a few long hairs. The legs have the coxæ very thick, the femora thick and not very long, the tibiæ and tarsi narrow and of about equal length. The claw (fig. 13d) has the upper digitules very long, with a minute knob, the lower pair shorter, and not nearly as broad as in *Lecanium hesperidum*. The abdominal lobes are as usual, and the anal ring has six or eight long hairs.

Opposite the stigmata are spines, as in all Lecanidæ, and several short hairs are placed all round the edge.

The eyes appear as small red granular spots placed in front of the antennæ.

It is not until the female insect has entered upon a later stage that the character of the test or carapace can be made out. An insect taken towards the end of summer, say in February, can be easily detached from its test; and in the autumn and winter a large number of tests, empty, may be seen on the leaves. The female herself does not, I think, undergo a change, except that she has increased in size and thickness and is full of eggs. She appears circular in outline, somewhat convex, with an average diameter of

$\frac{1}{8}$  inch. A rather broad edge runs round the body, on the interior of which are seen the numerous circular openings of the spinnerets. The antennæ and feet do not seem to have changed. There is a small quantity of white cottony fibre visible on the under side, but the general appearance is rather leathery.

The test, detached from the insect, is seen to have become thicker and more solid than on the young female. It has now the appearance not of a translucent film but of a thin cake of cloudy wax. It is still extremely brittle, but it does not dissolve when immersed in Canada balsam. The whole of the central space, as shown in fig. 13e, is seen to be divided into segments, irregular in shape, of which the row along the middle may be said to be roughly hexagonal, having next to it on each side a row of elongated pentagons with apices turned outwards and then a third row of pentagons with their bases outwards, with a few triangular segments filling up the spaces. The divisions between the segments are somewhat thickened, and along each runs a line of very small oval marks, possibly spinneret orifices. I have not, in this species, observed any symmetrical markings on the interior segments, a feature which, I think, distinguishes the next species on my list.

The apices of the first row of pentagons reach nearly to the edge of the solid part of the test. The bases of the second row form the edge itself, and are in juxtaposition to the segments of the fringe, which are much the same as in the earlier stage. In this outer row of pentagons, however, and in the fringe are observable certain peculiar markings, shown in figs. 13e and 13f. I am not aware of the use of these, which appear to be produced by rows of perforations containing air. The effect of them is not without beauty.

In autumn the female is seen in her last stage. Having produced all her young she becomes shrivelled up at the cephalic end of the test in a shapeless mass, in which the legs, antennæ and abdominal lobes can be distinguished with difficulty.

The male of this species is by no means uncommon. In the spring a large proportion of males will be found under tests similar to those of the female. The insect is shown in plate VII., fig. 14a.

The head is somewhat rounder than those of the Diaspidæ. The eyes are small and granular, and there are four pairs of them. The antennæ, fig. 14a', are placed at the anterior part; they are long, having nine joints, of which the first is very short and thick, the second thin and rather longer, the three next each about twice as long as the second, the remainder equal to the second and to each other. Every joint has numerous hairs.

The coxæ are thick, the femora longer and more slender, the tibiæ still longer and thinner, broadening a little to the tarsus which is not quite half

as long, and tapers slightly to the claw. All the joints are hairy. The upper digitules are not long, and the knobs small; the lower pair are only hairs.

The thoracic band occupies nearly the whole width; the wings are broad and elliptical, with a single nervure of two branches. The abdomen, somewhat long, ends in a single spike shorter than that of the Diaspidæ.

This species is very much infested by a hymenopterous parasite which takes advantage of its test to lay therein its eggs. A very large number of tests will be found to contain, not their proper insects, but pupæ of this parasitic fly which might possibly be mistaken for males of *Ctenochiton*. I have been able to follow the transformation of the parasite, which appears to be one of the Proctotrupidæ and which I have described in a short paper read before you to-night.\*

7. *Ctenochiton viridis*, sp. nov.

The differences between this and the last species are not, I think, noticeable in the earlier stages, except that the insect when first appearing on the leaf with its fringe has not so much of the filmy look of *C. perforatus*, but is yellower and somewhat more solid. The divergence is more apparent in the stage of propagation, when *C. viridis* attains a much larger size. The female insect has then a bright green colour, is sometimes  $\frac{1}{2}$ -inch long and  $\frac{1}{4}$ -inch wide and pear-shaped, acuminate at the cephalic end. It has a repulsive appearance on the underside of the leaf where it forms a depression corresponding to its body. I have found it abundant on *Coprosma*, *Panax*, and *Rubus*, near Christchurch, in Riccarton Bush.

The test, in the earlier stage, resembles that of *C. perforatus*, being glassy, with a fringe of broad segments. At the later stage the fringe disappears, and the test, instead of being easily removable as in the last species, becomes intimately attached to the insect, so that in order to examine it one has to tear and wash away the body and internal organs. When this is done it is seen that the rows of segments are more numerous than in *C. perforatus*, the segments themselves smaller, and the oval markings on the dividing lines in double rows. Moreover, each segment is marked by radiating straight lines crossed by wavy curves, giving it an appearance something like the scale of a fish. These lines are not clearly to be made out after immersion in a fluid, such as glycerine or Canada balsam.

The fringe is absent at this stage, and there is no sign of the lines of perforations characteristic of the last species.

The appearance of a segment of the test is shown in plate VII., fig. 14b.

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\* Vide Art. XVII.

The antennæ and feet do not, as long as the fringe is present, differ from those of *C. perforatus*. In the later stage, when the insect has attained its full size, they become very small proportionately, indeed almost atrophied, and difficult to make out. Maceration in potash shows them as existing, but they can be of no use to the insect. I cannot detect any difference between them and the antennæ and feet of *C. perforatus*, except their comparative smallness.

The edge of the female in the earlier stages presents the usual wavy outline which I referred to just now.

In its last stage the female is enclosed in a thick coat of whitish-cottony felted fibre. The feet and antennæ are only to be made out after prolonged maceration in potash. The whole mass inside the felted matter is dirty-brown in colour, leathery in texture, preserving the acuminate pear-shape of the last stage.

When arrived at this condition the insect appears on leaves of *Panax*, *Rubus*, *Coprosma*, etc., like splashes of birds' dung, giving the leaf a peculiarly nasty look.

I have not found the male insect.

8. *Ctenochiton elongatus*, sp. nov.

Plate VII., fig. 14.

I obtained this species in Auckland, on *Geniostoma ligustrifolium*. I have only the female, in one stage. The body is very much more elongated than in the last species, the width being not more than a quarter of the length; the edge of the body is, as usual, wavy; the stigmatic spines very prominent.

The antennæ and feet resemble those of *C. perforatus*, but I can detect no lower digitules.

The fringe, which disappears in Canada balsam, differs from that of *C. perforatus* in the absence of the perforations and in the shape of the segments. Instead of the perforations there seem to be transverse wrinkles, and the segments are not roundly triangular but quadrate outwardly, their inner apices pointed; see plate VII., fig. 14*d*. The remainder of the test is divided into quadrangular scales. The whole test is extremely delicate and transparent.

9. *Ctenochiton spinosus*, sp. nov.

Plate VII., fig. 15.

I have this species from *Atherosperma novæ-zealandiæ*. The female is brown, oval, about  $\frac{1}{30}$  inch long, the edge slightly wavy. The antennæ are thick, with seven joints, all nearly equal in length; the third joint is somewhat the longest; the seventh has a few hairs; plate VII., fig. 15*a*. The

feet are long; the coxa thick, femur thick and twice as long, tibia and tarsus narrow but equal in length to the femur; upper digitules short; I have not seen the lower pair. Fig. 15*d*.

The abdominal lobes, rostrum and mentum as usual.

The body, fig. 15*b*, is edged with a row of strong bristly spines, seemingly hollow, starting each from a distinct tubercular root, and set close together. Each spine is slightly curved, and the whole row gives the insect something of the look of *Dactylopius citri*, Signoret, a similarity which is at once seen to be deceptive on comparing the species.

The test is thin and waxy, and does not appear to be subdivided into segments as in *C. perforatus*; but my specimens are so much covered with fungoid growth that I cannot make this out with certainty. The fringe is composed of feather-like segments, much narrower than in the other species. Each feather corresponds to, and covers, a spine of the body. See figs. 15*b* and 15*c*.

I have not a specimen of the male.

I COME now to another genus, which I believe to be also new. It was brought to me first by Mr. J. Inglis, from whom I have named it; but I have since found it on *Coprosma* in Riccarton Bush.

I include this genus in the Lecanio-diaspidæ, on account of the test and the presence of the abdominal lobes, but it differs from *Ctenochiton* in the shape of the test and the absence of segmental fringe.

INGLISIA, gen. nov.

I have as yet only one species of this genus, which presents one or two remarkable characters. Exteriorly it resembles very much in shape a limpet, from which I have given it the specific name of

10. *Inglisia patella*, sp. nov.

Plate VII., fig. 16.

The test is whitish, glassy, limpet-shaped, marked with radiating striæ; the striæ, on examination, prove to be composed of rows of oval perforations containing air. They give to the test, which is composed of several corrugations, a very elegant appearance—fig. 16*a*. The insect, test and all, reaches  $\frac{1}{12}$  to  $\frac{1}{15}$  inch in diameter. The height is about one-third of the length.

The female insect, fig. 16*f*, corresponds in shape to the test, filling it entirely. In this state the antennæ and feet are scarcely to be made out, but on maceration in potash and subsequent pressure the underside presents the appearance shown in fig. 16*b*. The wavy edge spoken of above is here visible, and it is seen that the curves of the body correspond with the corrugations of the test. The antennæ are very short, and, as far as I have observed, have only six joints, but I may be in error in this, as the *Lecanidæ*

have almost all seven-jointed antennæ in the adult. The second joint, fig. 16c, is very short, the third the longest, the fourth, fifth and sixth about equal in length; the last three have some hairs. The feet, fig. 16e, have the femur thick and strong, tibiæ rather longer and thick, tarsus still longer and thin; the upper digitules very long, the lower pair narrow, about twice as long as the claw. The edge of the body is surrounded with a row of small spines, of which each alternate spine is pointed (fig. 16d), the remainder club-shaped. The abdominal lobes of the *Lecanidæ* are present, but the cleft is different from that of any other species. The abdomen, as shown in figs. 16b and 16d, ends in a pair of narrow curved protuberances, nearly meeting at their ends, but separated above by a broad open space in which the two abdominal lobes are seen protruding. The row of alternate spines does not extend round this space. The anal ring has eight long hairs.

The edge of the body shows a double line, like a ribbon, in which are set the alternate spines. Inside this is a row of spinnerets with, on the inner side, a line of short curves. The edge itself is crenated.

The female in the stage immediately preceding that which I have described, and before covering itself with the test, resembles somewhat the female of *Ctenochiton*, as given in plate VII., fig. 13b. The outline of the body is much the same, with the four spiracular spines, and the alternate pointed and clubbed spines are absent. But, on close examination, it cannot be mistaken for *Ctenochiton*, as the antennæ are shorter and thicker, and the abdominal cleft already shows signs of the peculiar shape assumed in the later stage. Moreover, a commencement of the test may usually be detected, and this is quite different from that of the *Ctenochiton*.

I have not yet found the male of this interesting species which, in outward appearance, has some similarity to *Fairmairia bipartita*, Signoret, but is certainly not the same.

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I ought now to proceed to the description of the third great group of Scale Insects, the Coccidæ proper. But I must first give an account of a genus which perhaps should have come into my last paper, but which I had not, at the last meeting of the Institute, made out sufficiently for description.

This genus is somewhat anomalous. It is clearly not belonging to *Lecanium*, nor does it come under the subdivision *Lecanio-diaspidæ*, as the abdominal lobes are wanting, or rather different. At the same time it has so much likeness to the *Lecanidæ* that I cannot connect it with any other group. I imagine, then, that the genus is new, and typical, in fact, of a new subdivision, to which I give the name of

ASTEROCHITON, gen. nov.

The genus is characterised by *enclosure* in a test which is so intimately attached to the insect that it cannot be removed without injury. The



specimens which I have obtained from Canterbury, Wellington, and Auckland, although taken at different seasons, in October, July, February, March, and April, show only two forms. The one is the young insect before it becomes covered by the test; the other is apparently an intermediate stage prior to appearance as a perfect insect. In July, on fronds of *Polypodium billardieri*, I have collected great numbers of empty tests, and intermixed with them tests with enclosed insects. It might be assumed that this fact points to the emergence of insects in the perfect state leaving their pupæ-cases behind them. But so many of these cases contained the pupæ or the remains of the pupæ of parasitic flies, that it is equally probable that the scale-insect had been devoured. I hope to obtain, ere long, specimens of other stages of this insect; meanwhile, as there is no doubt that, in the stages which I have observed, it differs considerably from any other genus, I shall proceed to describe it.

In the Lecanio-diaspidæ the test does not entirely enclose the insect, which is, on the underside, free. *Ctenochiton viridis*, which I described in my last paper, becomes in its later stages closely attached to its test, and in its last form of all enveloped in a cottony mass. But this last takes place when the insect is practically dead, or dying; indeed, I am inclined to think that the white mass is not the usual cottony web of the Coccidæ but fungoid. *Asterochiton*, on the other hand, in the specimens I have seen, is entirely shut up in its test; even the feet are useless to it, being enclosed. All that emerges is the mentum with its suctorial setæ; and it is this which prevents me from considering the insect as being in a pupa state. If it were a pupa I imagine that it would not require to feed, and the mentum would be enclosed like the other organs.

This genus, I may observe, cannot well belong to any of those described by M. Signoret, under his subdivision Lecanio-diaspidæ, such as *Pollinia*, *Asterolecanium*, as in those the young insect has the abdomen ending in two protruding tubercles, which in this genus is not the case.

I have two species of the genus.

1. *Asterochiton lecanioides*, sp. nov.

Plate VII., fig. 17.

Common near Christchurch, on *Pittosporum eugenoides* and *Polypodium billardieri*.

The young insect is extremely minute, and requires great care to mount. It is oval (plate VII, fig. 17a), greenish gray in colour, the outline smooth, with the four spiracular spines of the Lecanidæ; at the posterior end are six long hairs, of which the two middle ones are the longest. The eyes are red, comparatively large, granular, and set somewhat far back; the anal marks resemble those of the adult. I have not been able to make out the antennæ and feet.

With a very high power of the microscope the commencement of the test may be observed, which in the next stage envelopes the insect. Here, as shown in fig. 17*b*, the outline is still oval, but the edge is slightly crenated; there are now only four hairs at the posterior end and these are short. The insect is evidently quite enclosed in the test. There is an indication of the abdominal cleft, but it is only a sort of groove, and the abdominal lobes are replaced by a sort of vase-shaped organ. It is possible sometimes to mount a specimen so that the sight is not wholly impeded by the test, and it is then seen that the antennæ are short and the legs thick, but I have not been able to make out the joints of either satisfactorily. Round the edge runs a row of cup-shaped spinnerets, and a number of others, sometimes protruding in form of tubes, are scattered over the body.

Later on, although the insect appears not to have entered any further stage, the tests are very frequently found empty. This may be attributed to the action of parasitic flies, for the tests commonly enclose either the pupæ or the pellicles of these, the scale insect having disappeared. The tests are white and glassy, and over them are scattered, chiefly round the edge, tubular appendices corresponding to the spinnerets on the body of the insect. Sometimes these tubes are set so close together that they are straight and have the appearance of a fringe, but as a rule they are irregularly set and curled in different directions.

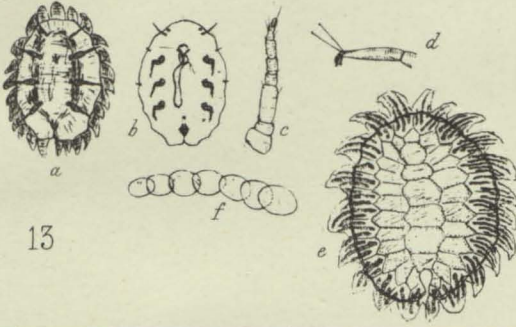
2. *Asterochiton aureus*, sp. nov.

Plate VII., fig. 17.

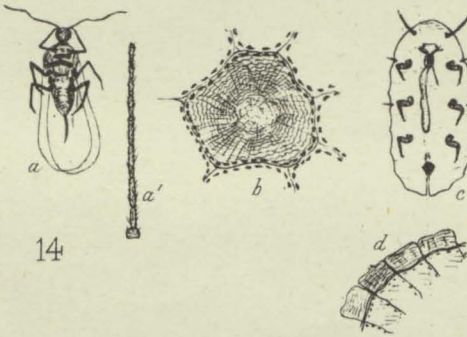
I have this species from *Melicytus ramiflorus* at Auckland. It differs from the last in being of a golden or orange colour, the insect in the middle being purple. The outline is also more inclined to be circular, the size is larger, the test is somewhat thinner and allows the insect to be better seen, the groove at the posterior end is deeper, and the rows of spinnerets more numerous. I have not observed in this species any protruding tubes. The antennæ and legs, so far as I have been able to make them out, seem to resemble those of *A. lecanioides*. Fig. 17*d*.

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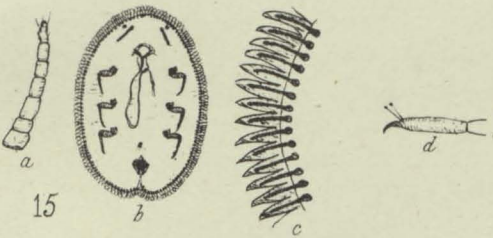
I pass now to the description of the Coccidæ proper. This group contains several subdivisions, but, as heretofore, I shall confine myself to those which appear to me to be indigenous. The differences between many of the subdivisions are not to be detected without the microscope, depending as they do upon the number of joints of the antennæ, number of anal hairs, number of digitules, etc. As for the species which I have collected here I have had a good deal of difficulty in deciding sometimes whether they differ or not from European species; and even now I am not, in some cases, certain.



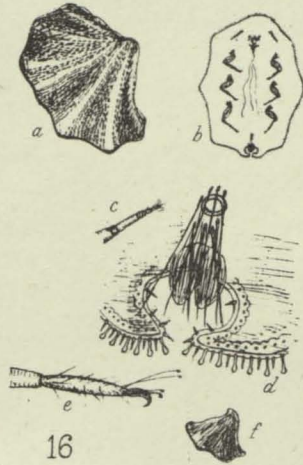
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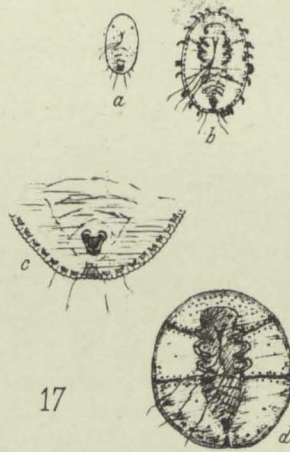
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16



17

# COCCIDÆ



The general characteristics of the group are as follows :—the females are of all shapes and colours, usually covered with a mass, more or less thick, of cottony or waxy secretion, but not, as a rule, enveloped in glassy tests like the Lecanio-diaspidæ. The mentum differs from that of the Lecanidæ in being bi- or tri-articulate. The abdominal lobes of *Lecanium* are absent, and the posterior end is not cleft; but the body ends in two protuberances, more or less developed and prominent, which I shall call the "anal tubercles." These tubercles usually terminate in fine hairs, sometimes long, sometimes short. The tubercles are not always easily detected, but close examination reveals them. The segments of the body are much more visible than in the Lecanidæ, and the insect has altogether a more woolly appearance. In some genera the female envelopes herself in a cottony sac, white or yellow.

The males are not uncommon; but I have not been able to procure many specimens. They do not greatly differ from those of the Lecanidæ, but in my specimens the abdominal spike is accompanied by a shorter curved spike at the side.

The subdivisions of this group to which my specimens belong are :—

1. *Acanthococcus*, of which I have specimens from the common broom plant and from *Budlæa*.
2. *Eriococcus*, from the Norfolk Island Pine.
3. *Dactylopius*, from *Rubus australis*, *Pittosporum*, *Calceolaria* and other plants.
4. *Icerya*, from the Kangaroo *Acacia*.

All these contain species known in Europe, from which mine, I believe, differ.

#### I. ACANTHOCOCCUS, Signoret.

The subdivision is characterised by an elongated sac, usually brownish yellow, enveloping the female, by the prominence of the anal tubercles, and by the number of rows of conical spines distributed over the body. One species is known in Europe. I give to my specimen the name of

*Acanthococcus multispinus*, sp. nov. (?)

Plate VIII., fig. 18.

The sac, fig. 18*a*, is dull yellow, nearly cylindrical, one end closed with a curve, the other open. It is composed of interlacing cottony fibres. The female insect, fig. 18*b*, is of an elongated oval form, the widest part being near the posterior end. It is dull pink in colour, covered thinly with whitish meal. The segments of the body are not very distinct. The anal tubercles are plainly visible, and between them is a pencil of white meal glueing together the long hairs of the anal ring.

After mounting for the microscope and expressing the interior substance, the insect is seen, as in fig. 18*c*, to have several rows of large conical spines,

which distinguish it from the next genus which has but two or three rows, and from the European species which has six. Besides these there are a number of spinnerets secreting the cottony meal, and many of these protrude as tubes of peculiar shape, as shown in fig. 18*d*. The antennæ, fig. 18*e*, have six joints, the third the longest, the fourth and fifth equal to each other and nearly round. The legs have the tibia somewhat shorter than the tarsus, the upper digitules are pretty long, the lower only short hairs.

The male insect is orange red, with long wings, undergoing its transformations in a sac resembling that of the female. The antennæ have ten joints, of which the fourth, fifth, sixth, and seventh are long; the second, third, eighth, and ninth wider and globular; the tenth globular but smaller. The hook of the foot is long; the abdominal spike, fig. 18*f*, is short and thick, with a curved appendage.

## II.—*ERIOCOCCLUS*, Targioni.

This subdivision also has a sac, but it is usually less elongated than in the last, and white in colour. My species, to which I give the name of

*Eriococcus araucariæ*, sp. nov. (?)

is found on the Norfolk Island pine at Governor's Bay, but I am by no means certain that it is indigenous. The female insect differs from the last described only in the number of the conical spines, of which there is usually only one row round the edge, though in some specimens a few scattered spines may be seen elsewhere. It appears to resemble greatly *E. buxi*, Signoret, and I doubt whether it is a new species; at the same time, the anal hairs are only six in number as against eight in *E. buxi*, and the lower digitules appear to be much smaller. I therefore provisionally consider it a distinct species.

I have a specimen of the male, not in its perfect state but as a pupa upon the point of undergoing transformation. It appears to differ somewhat from that of *Acanthococcus*, but I am unable to say how far it differs from *E. buxi*.

## III.—*DACTYLOPIUS*, Signoret.

The females of this subdivision have eight-jointed antennæ, the anal tubercles less prominent than in the two foregoing, and usually a series of cottony appendages running all round the edge of the body, increasing in length at the posterior end.

The differences between my species and those described in Europe are not, in some cases, great, yet they are such as induce me to set down my New Zealand specimens as distinct species.

*Dactylopius calceolaria*, sp. nov. (?)

Plate VIII., fig. 19.

This insect is effecting great destruction in the public gardens in Christchurch amongst the calceolarias, and upon several native plants such as

*Traversia*, *Cassinia*, etc. I am glad to say that the gardener, Mr. Armstrong, has seen the little white-eyes (*Zosterops*) busily engaged in picking them off the plants.

The general form of the female is shown in plate VIII., fig. 19a. It is pink in colour, covered with white meal. It resembles in several particulars some of the *Dactylopii* described by M. Signoret, but, either in the antennæ, or in the feet, or in the appendages, differs from them all. The body is pretty regularly oval, the segments very distinct; the appendages are short except at the posterior end where there are two very long, with, on each side of them, another somewhat shorter. The two longest surround the hairs of the anal tubercles, which are inconspicuous, and between them is visible the white pencil of meal surrounding the anal setæ.

The interior substance of the body, expressed for mounting, appears to be very oily, at least containing great numbers of oil globules. The antennæ, in the adult female, have eight joints, fig. 19b, of which the 3rd and 8th are the longest, the 6th and 7th the shortest. Each joint has several hairs. The mentum appears to be tri-articulate, and has a few hairs at its tip; the rostral setæ are long. On the legs the coxa and femur are thick; the tibia, much thinner, is more than twice as long as the tarsus; the upper digitules, fig. 19c, are not very long; the lower are narrow and about equal to the claw.

The anal tubercles are inconspicuous; each has a few hairs, of which one is longer than the others, and two conical spines. The anal ring has six hairs. These details are shown in fig. 19d.

The young insect differs slightly. The antennæ have six joints, the sixth much longer than any of the others, which are about equal. The tibia is shorter than the tarsus. (According to M. Signoret, this character affords the means of judging the age of any insect of the group Coccidæ. Whenever the tarsus is longer than the tibia the insect is in an early stage). The anal tubercles are somewhat more prominent than in the adult, giving the insect an appearance of having been cut off square at the end.

I have not the male of this species.

*Dactylopius glaucus*, sp. nov. (?)

This species differs from the last in its colour, which is light green, and in having a less regularly oval line; the abdominal region runs more to a point. The antennæ, feet, etc., resemble those of *D. calceolaria*. My specimens are from *Pittosporum engenioides* and *Rubus australis*.

I have one specimen which appears to me to be a male in an early stage. In outline it resembles a female, but the rostrum is absent, and at each side there is a protuberance which seems to me to be the rudiments of the wings.

The abdominal segments overlap each other, tending to the form of abdomen of the male Coccidæ. The antennæ, which are thick, have six joints. The claw of the foot is very small.

*Dactylopius poæ*, sp. nov.

Plate VIII., fig. 19.

This species is found on the roots of the common tussock grass, or rather on the stems close to the ground.

It is a rather large insect, bright pink in colour, covered with a white meal, and with a very regular oval outline; flat on the underside, convex above. The mentum has a few hairs at the tip; the setæ are long.

The antennæ are very short; the second and third joints are the longest; the last joint has a few hairs. Fig. 19e.

The legs are short; the coxa thick, the femur somewhat thinner, the tibiæ and tarsus still less and about equal in length. The upper digitules, fig. 19f, are not long, the lower inconspicuous, if not wanting. There are a few hairs on the tarsus.

The anal tubercles are extremely small, scarcely perceptible; each has three conical spines but no hairs, and a few other spines are visible on the abdomen. The anal ring has, I think, six hairs; fig. 19g. All over the body are numbers of small circular spinnerets.

I have not the male of this species, which is, I think, certainly new.

#### IV.—*ICERYA*, Signoret.

My specimens of this subdivision were found on a hedge of the kangaroo acacia, in Auckland, in March last. I understood from Mr. Cheeseman and Dr. Purchas, who kindly brought the insect under my notice, that it had only lately appeared in Auckland, and that it was only, as yet, to be found upon that one hedge. The plants, I may say, were nearly destroyed by the insects, which covered them in great numbers; and the large size and peculiar appearance of the pest were very striking.

The genus *Icerya* belongs to the Monophlebidae, a family of Coccidæ, which has eleven joints in the antennæ of the female, and ten in the antennæ of the male. There are several genera of these, but the insect before me seems certainly to belong to *Icerya*. There is but one feature, the absence of which in my species may perhaps relegate it to some new genus. M. Signoret says that, after treatment with potash, a tube may be seen above the anal orifice forming a sort of folded ring; this tube he takes to be the oviduct. I have not been able to observe this tube although I have examined several specimens. At the same time all the other features correspond to the description of the genus *Icerya*; and I am not inclined to attempt the formation of a new genus simply on account of the absence of a feature which perhaps I ought to have been able to make out.



Only one species of this genus seems to be known, and that is *Icerya sacchari*, an insect which, in Mauritius, does great injury to the sugar-canes. M. Signoret describes this species, which differs from the one I am describing in a few particulars. First, its general colour is yellow; secondly, its cottony fibres appear to envelope it more completely than in my species; thirdly, the segments of the body are more clearly defined; fourthly, the young insect is more hairy, and the hairs are not similarly arranged; fifthly, the abdomen ends in a trifoliated lobe, which is not the case in my species. I imagine, then, that the insect from Auckland is new, and I take the liberty of naming it after the Rev. Dr. Purchas who, I believe, first found it.

*Icerya purchasi*, sp. nov.

Plate VIII., figs. 20 and 21.

The eggs of this species resemble those of the other Coccidæ; they are red in colour. The young insect emerging from the nest is reddish, inclining to brown. The body, fig. 20a, is oval, hairy, with a quantity of cottony down beginning to cover it. The antennæ have six joints, fig. 20f, the first wide and short, the next four a little longer and about equal to each other, the sixth much larger, club-shaped, having apparently four segments joined together. All the joints have a few hairs; on the sixth are several, of which four are very much longer than the rest. The legs are brown, thin. The coxa and femur moderately large, the tibia and tarsus long and thin. The tibia and tarsus have several long hairs. The claw is somewhat long. I am not sure about the upper digitules, but they seem to be only hairs; the lower pair are a little wider, bent like a hook.

The eyes are prominent, tubercular, set behind the antennæ. The mentum, which is broad and thick, seems to be bi-articulate. The rostral setæ are not long.

The abdomen ends in a smooth curve, but at each side of the centre are three small lobes from which start six very long hairs, as long or longer than the body of the insect.

Six rows of spinnerets are seen on the body, four along the middle and one at each side. Alternating with these are rows of hairs.

In its next stage the female insect becomes somewhat altered. Its outline is still oval, but not so regular, and its colour is a darker red, nearly brown, under the white curly cotton which covers it. The six hairs of the abdomen are still visible, but they are much shorter than in the young insect, scarcely appearing beyond the other hairs of the body. Maceration in potash and subsequent mounting get rid both of the interior substance and of the cotton, and the insect is then seen to be much more hairy than the young. The hairs are short, and distributed pretty thickly over the thoracic portion of the body, less thickly on the abdomen; but all round the edge they are placed in tufts close together, each tuft containing twenty or thirty hairs; fig. 20b.

The spinnerets are not arranged in rows, but scattered in great numbers over the whole body. The vast majority of them are small and circular, but round the edge of the body, amongst the tufts of hairs, runs a row of others much larger. These protrude some distance from the body; their lower end being brown, with a sort of crown encircling it, from which springs a long glassy tube. Some of these spinnerets and a tuft of hairs are shown in fig. 20*c*.

The feet and digitules, fig. 20*e*, resemble those of the young insect, but the antennæ have now nine joints, all nearly equal, the last joint smaller, comparatively, than in the young; the hairs of the antennæ are also shorter.

In its third stage (fig. 21), the insect acquires its very peculiar appearance and afterwards changes no more. The feet are much the same as before; the antennæ have now eleven joints, tapering slightly to the tip, and all somewhat more hairy than in the last stage; fig. 20*d*. The tufts of hairs are still at the edge; the spinnerets are still more numerous than in the earlier stages.

The general colour of the insect is now a rusty brown, but it is so covered with cottony down as to seem, in the latest period, nearly white. All round the edge, especially at the abdominal end, runs a row of black marks (the tufts of hair spoken of above), and just within it a fainter line. At the commencement of this stage the insect lies flat on the leaf or twig, but its edge is slightly raised all round, whilst along the middle of the upper side of the thoracic portion is a raised hump, or rather a prominence divided into three humps. A white meal covers the back, and all round the edge is seen a narrow ring of white felted cotton. This is the commencement of the large ovisac or nest, in which the young insects are enveloped.

Later on the female begins to procreate. The body becomes full of eggs, and these are ejected into the ovisac, which is gradually becoming larger. The insect now begins to be raised up; the cephalic end still remains attached to the plant, but the abdominal end is elevated, and the space left is filled with the cottony down of the ovisac. At the same time, white cottony processes form at the edge of the thorax, over the feet, looking, in fact, to the naked eye, as if they were actually attached to the legs. Long, fine, translucent white hairs or spines radiate from the body in every direction. The general colour of the insect is still brown, powdered with white.

The female at length reaches her full development. Now the abdominal end is still more raised, so that the insect has the appearance of standing on its head. The ovisac attains its full size, and extends for some distance behind the body, filling also the space between it and the plant, as shown

in fig. 21*b*. In fact the insect is now, as it were, resting on a bed of cottony down, its head downward to the twig. The ovisac, in its upper portion, is divided by regular grooves; the under side is flat, having several short cottony processes radiating from its edge. It is now full of eggs, and these, rapidly hatching, produce the young insects which emerge through the cotton and go to seek their fortunes on the plant. I think the ovisac usually contains from 60 to 70 young insects. The extreme length, from the head of the female to the extremity of the ovisac, is sometimes nearly  $\frac{1}{3}$  of an inch, the height being about  $\frac{1}{4}$  inch.

I have not been able to find a male insect of this, which is certainly the most curious species of the Coccidæ with which I am acquainted. The male of *Icerya sacchari* is also, I believe, unknown.

I have now completed the description of the species Coccidæ proper, and in fact of all the insects which I am as yet able to relegate to well-defined genera. I have still to describe one species whose position I cannot determine with certainty. It is by no means the least beautiful of the family. My specimens have come from *Pittosporum engenioides* and *Discaria toumatou*. I am constrained to form from it a new genus, which I dedicate to my friend Dr. Powell who was the first to find it.

POWELLIA, gen. nov.

The genus is certainly not one of the Diaspidæ; it does not belong to the Lecanidæ, for it has not the abdominal cleft and lobes and the mentum is tri-articulate, nor to the Coccidæ proper, for there are no anal tubercles, and the feet are clearly different. In some of its characters it bears a resemblance to an Aphidian insect which is very common here upon the young leaves of very young *Eucalypti*, although I do not think that *Powellia* belongs to the Aphides. Is it not possible that it may be a link between the two families *Aphis* and *Coccus*?

*Powellia vitreo-radiata*, sp. nov.

Plate VIII, fig. 22.

The female insect is shown in fig. 22*b*. It is at once apparent that, in some respects, it has the characters of the Lecanio-diaspidæ; there is the test covering the body and there is the fringe. But further examination shows that it differs a good deal from that group. First, there is an evident division between the test over the thorax and the test over the abdomen; the fringe of the latter is seen to overlap that of the former. Moreover, the eyes are faceted, which is not the case in the Lecanidæ. Again, there is no abdominal cleft.

The first peculiarity of the species is that it seems to have four well defined wings. If this were really the case, as the insect is undoubtedly a female (for it has a mouth), it could not belong to the Coccidæ. But I am

not able to consider these lateral appendages as wings; first, because they start from the head itself and not from the thorax; secondly, because tracheæ may be seen ramifying from the thoracic spiracles through them; thirdly, because in the discarded tests which, in November, can be found pretty numerous, these appendages are very clearly portions of the test itself; fourthly, because the fringe runs round their edges in the same way as on the rest.

The second peculiarity is in the different size of the thoracic and abdominal regions and the clear line of demarcation between them. In the other species of *Coccidæ* it is difficult, if not impossible, to tell where the thoracic portion of the female ends and the abdominal portion begins. In *Powellia* the division is as distinct as in the males of the other genera.

A third peculiarity is in the feet, which I shall describe presently.

The eggs of this species are bright yellow, tapering to a point at one end; the point appears to be somewhat hooked; fig. 22a. They are seen attached in clusters to twigs of *Discaria* and *Pittosporum*.

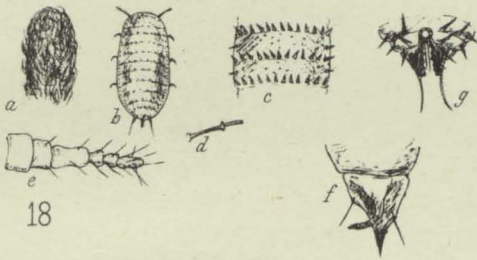
The young insect is extremely minute, not so large as the dot over the letter *i* in small type. Its colour is brown; the winglike appendages are not distinguishable. The abdomen, which is similar in outline to that of the adult, is marked by six transverse dark bands and a dark patch at the extremity, fig. 22c. From each band, at the edge, spring long transparent tubes, in form of fringe, but they are not set so closely together as in the later stages. The antennæ, I think, have only four joints, of which the third is the longest; the fourth joint has two long hairs. The legs are short and very thick; I saw no coxa; the foot resembles that of the adult.

In the next stage the general form is not altered. The bands of the abdomen have become fainter, and the tubes of the fringe are set closer together.

Still later, the insect appears as in fig. 22b. This is the last stage which I have been able to observe. The four wing-like appendages are now clearly defined, but, as shown in the figure, five tracheæ ramify from the body through them, and they cannot be considered as wings. The head, thorax and abdomen are distinct. The head, transverse, is oval; the eyes are large, faceted, red in colour. The mentum, tri-articulate, ends in brown toothlike processes. The antennæ have six joints; the first and second very broad and short, the third narrower and longer, the fourth and fifth still narrower and shorter than the third, the sixth very long, somewhat fusiform, with two small spikes at the tip and just above the spikes a long hair.\* See fig. 22d. The legs are thick and long, set equi-distant on the thoracic region; the coxa and femur very thick, the tibia and tarsus some-

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\* This long hair is not distinguishable in all specimens.



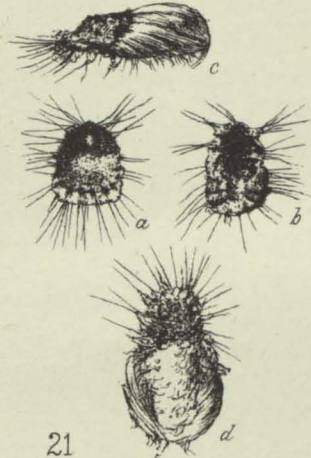
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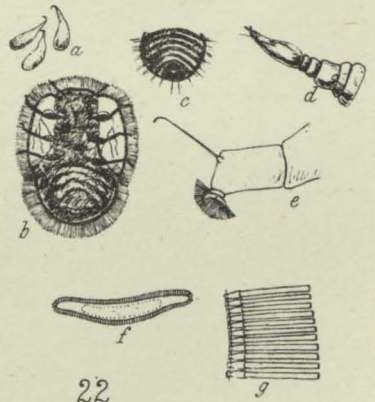
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20



21



22

COCCIDÆ



what thinner and of about equal length. The tarsus does not taper to the claw as in the other Coccidæ, but is cylindrical, ending, as in fig. 22e, as if suddenly compressed and bent downwards. The claw, in which this insect differs from all other Coccidæ, is double, opening like the hooks on the foot of the housefly; it does not spring directly from the tarsus but is set in a sort of ring or socket. At the root of the claw, and spreading over it, is a fan-shaped translucent appendage which is not observable in any other species of the Coccidæ. Above the claw, near the abrupt angle of the end of the tarsus, is a long stiff bristle, slightly curved at the end.

The abdomen, divided clearly from the thorax, is nearly round. The transverse bands seen in the young insect are not now distinct, but may be traced. The anal markings, fig. 22f, differ from those of all other Coccidæ. They form an elongated ring on the abdomen, not unlike an Australian boomerang in outline; the outer edge marked like a fine comb, and with a row of small circular spots following the inner contour. I cannot detect any hairs or cilia.

The fringe of this species, which borders the whole test, is very delicate and pretty. It is quite white, glassy and transparent; the threads, very fine, are set close together, and their great length gives to the insect a peculiarly elegant appearance. Under the microscope they are seen to be composed of three parts; a small socket in which is set a vase or cup, and springing from this a long cylindrical glassy tube, apparently open at the end. Very great care is needed in handling the insect, to avoid breaking this very delicate fringe. The cups will remain attached, but the long glass tubes fall off with almost the slightest touch; see fig. 22g.

This genus, *Powellia*, presents so many anomalies, in its general shape, in the wing-like appendages, in the divisions of the body, in the shape of the antennæ, the peculiar foot and the abdominal markings, that it scarcely seems related to the members of the family of the Coccidæ. On the other hand it has many affinities with the family, and it will fitly conclude the series of papers which I have been able to draw up this year. I feel sure that there must be many species of Coccidæ yet to be discovered in New Zealand; perhaps at some future time I may be able to describe them.

#### DESCRIPTION OF PLATES, V.—VIII.\*

Coccidæ.—Plate V., figure, 1.—DIASPIDÆ.

Fig. a, *Mytilaspis pomorum*: portion of puparium, showing discarded tests of first two stages: magn. 40 diams.

b, *Mytilaspis pomorum*: puparium, female with eggs: magn. 25 diams.

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\* The measurements are one-third less than stated, the original drawings having been reduced.

Fig. c, Young insect: magn. 60 diams.

d, *Mytilaspis pomorum*: abdominal region: magn. 60 diams.

e, Rostrum of Diaspidæ, natural state: magn. 60 diams.

, Rostrum, mounted: magn. 60 diams.

Coccidæ.—Plate V., figure 2.—DIASPIDÆ.

Fig. a, *Mytilaspis pomorum*: eggs: magn. 60 diams.

b, ,, ,, adult female: magn. 60 diams.

c, ,, ,, pygidium of female: magn. 200 diams.

d, a pinneret: magn. 700 diams.

Coccidæ.—Plate V., figure 3.—DIASPIDÆ.

Fig. a, *Mytilaspis pyriformis*: puparium: magn. 25 diams.

b, ,, ,, adult female: magn. 60 diams.

c, ,, ,, pygidium: magn. 200 diams.

Coccidæ.—Plate V., figure 4.—DIASPIDÆ.

Fig. a, *Mytilaspis cordylinidis*: puparium: magn. 25 diams.

b, ,, ,, adult female: magn. 60 diams.

c, ,, ,, pygidium: magn. 200 diams.

Coccidæ.—Plate V., figure 5.—DIASPIDÆ.

Fig. a, *Mytilaspis drimydis*: adult female: magn. 60 diams.

b, ,, ,, pygidium: magn. 200 diams.

c, ,, ,, pupa of male: magn. 25 diams.

Coccidæ.—Plate V., figure 6.—DIASPIDÆ.

Fig. a, *Aspidiotus epidendri*: puparium of female: magn. 60 diams.

b, ,, ,, adult female: magn. 60 diams.

c, ,, ,, pygidium of female: magn. 200 diams.

d, ,, ,, pupa of male from cocoon: magn. 60 diams.

Coccidæ.—Plate VI., figure 7.—DIASPIDÆ.

Fig. a, *Aspidiotus atherospermæ*: adult female: magn. 60 diams.

b, ,, ,, extremity of abdomen: magn. 200 diams.

c, ,, *dysoxyli*: female, 2nd stage: magn. 60 diams.

d, Abdomen of adult female: magn. 200 diams.

Coccidæ.—Plate VI., figure 8.—DIASPIDÆ.

Fig. a, *Aspidiotus aurantii*: adult female: magn. 60 diams.

b, ,, ,, extremity of abdomen: magn. 200 diams.

c, ,, ,, male: magn. 60 diams.

Coccidæ.—Plate VI., figure 9.—DIASPIDÆ.

Fig. a, *Diaspis boisduvalii*: adult female: magn. 60 diams.

b, ,, ,, cocoon, with male emerging: magn. 40 diams.

c, ,, *rosæ*: adult female: magn. 60 diams.

Coccidæ.—Plate VI., figure 10.—DIASPIDÆ.

Fig. a, *Diaspis gigas*: female shrivelled after egg laying: magn. 40 diams.

b, ,, ,, pellicle of 2nd stage of female: magn. 40 diams.

c, ,, ,, abdomen of adult female: magn. 200 diams.

d, ,, ,, male: magn. 40 diams.

e, *Diaspis* ———? : female: magn. 90 diams.



Coccidæ.—Plate VI., figure 11.—LECANIDÆ.

- Fig. a, Rostrum and mentum of Lecanidæ: magn. 90 diams.  
 b, Abdominal cleft, and lobes, and anal ring of ditto: magn. 60 diams.  
 c, Respiratory organ of *Lecanium*.  
 d, Stigma, and stigmatic spines of ditto: magn. 200 diams.  
 e, Foot and digitules of ditto: magn. 200 diams.

Coccidæ.—Plate VI., figure 12.—LECANIDÆ.

- Fig. a, *Lecanium hesperidum*: young insect: magn. 90 diams.  
 b, " " antenna of adult: magn. 200 diams.  
 c, " " adult female: magn. 15 diams.

Coccidæ.—Plate VII., figure 13.—LECANIDÆ.

- Fig. a, *Ctenochiton perforatus*: female, 2nd stage: magn. 40 diams.  
 b, " " ditto without the test: magn. 40 diams.  
 c, " " antenna: magn. 200 diams.  
 d, " " foot: magn. 200 diams.  
 e, " " test of adult female: magn. 20 diams.  
 f, " " perforations of fringe: magn. 200 diams.

Coccidæ.—Plate VII., figure 14.—LECANIDÆ.

- Fig. a, *Ctenochiton perforatus*: male: magn. 25 diams.  
 a', " " antenna of male: magn. 60 diams.  
 b, *Ctenochiton viridis*: segment of test: magn. 40 diams.  
 c, *Ctenochiton elongatus*: adult female: magn. 40 diams.  
 d, " " portion of fringe of test.

Coccidæ.—Plate VII., figure 15.—LECANIDÆ.

- Fig. a, *Ctenochiton spinosus*: antenna of female: magn. 200 diams.  
 b, " " adult female.  
 c, " " spines, with fringe: magn. 200 diams.  
 d, " " foot of female: magn. 200 diams.

Coccidæ.—Plate VII., figure 16.—LECANIDÆ.

- Fig. a, *Inglisia patella*: test, or shield: magn. 60 diams.  
 b, " " adult female, after treatment with potash: magn. 60 diams.  
 c, " " antenna: magn. 200 diams.  
 d, " " abdomen, showing alternate spines: magn. 200 diams.  
 e, " " foot: magn. 200 diams.  
 f, " " adult female, external appearance: magn. 25 diams.

Coccidæ.—Plate VII., figure 17.—LECANIDÆ.

- Fig. a, *Asterochiton lecanioides*: young insect: magn. 60 diams.  
 b, " " female in test: magn. 40 diams.  
 c, " " abdomen of female: magn. 90 diams.  
 d, *Asterochiton aureus*: female in test: magn. 40 diams.

Coccidæ.—Plate VIII., figure 18.—Coccidæ.

- Fig. a, *Acanthococcus multispinus*: sac: magn. 25 diams.  
 b, " " female: magn. 40 diams.  
 c, " " part of female, with spines: magn. 60 diams.  
 d, " " a spinneret: magn. — diams.  
 e, " " antenna of female: magn. 200 diams.  
 f, " " anal spike of male: magn. 200 diams.  
 g, " " anal tubercles of female: magn. 100 diams.

## COCCIDÆ.—Plate VIII., figure 19.—COCCIDÆ.

- fig. a, *Dactylopius calceolaria*: female; magn. 20 diams.  
 " " antenna: magn. 60 diams.  
 " " foot: magn. 60 diams.  
 d, " anal region: magn. 90 diams.  
*Dactylopius poæ*: antenna: magn. 60 diams.  
 " " foot: magn. 60 diams.  
 g, " anal region: magn. 200 diams.

## COCCIDÆ.—Plate VIII., figure 20.—COCCIDÆ.

- Fig. a, *Icerya purchasi*: young insect: magn. 40 diams.  
 b, " " female, 2nd stage: magn. 20 diams.  
 c, " " hairs and spinnerets: magn. 200 diams.  
 d, " " antenna, 3rd stage: magn. 40 diams.  
 e, " " foot, 3rd stage: magn. 90 diams.  
 " " antenna of young: magn. 90 diams.

## COCCIDÆ.—Plate VIII., figure 21.

- Fig. a, *Icerya purchasi*: female, commencement of last stage, viewed from above: magn. 6 diams.  
 b, *Icerya purchasi*: ditto, under side: magn. 6 diams.  
 c, " " female, end of last stage: magn. 6 diams.  
 d, " " ditto, under side.

## COCCIDÆ.—Plate VIII., figure 22.

- Fig. a, *Powellia vitreo-radiata*: eggs: magn. 150 diams.  
 b, " " female: magn. 25 diams.  
 c, " " abdomen of young: magn. 90 diams.  
 d, " " antenna: magn. 100 diams.  
 e, " " foot: magn. 200 diams.  
 f, " " anal marking: magn. 200 diams.  
 g, " " fringe: magn. 200 diams.

## ART. XVII.—On a Hymenopterous Insect parasitic on Coccidæ.

By W. M. MASKELL.

[Read before the Philosophical Institute of Canterbury, 4th July, 1878.]

## Plate IX.

SOME of the Coccidæ are much troubled by parasites. In this country I have not found this to be the case upon the naked-bodied species, *Lecanium*, etc. But some of the Diaspidæ, particularly *Mytilaspis pomorum*, have often in their shells minute white *Acari*; and as in these cases many of the enclosed eggs have been shrivelled or empty, I imagine that the *Acarus* may devour them.

The insect I am now describing attacks some of the indigenous test-bearing Coccidæ. When in June, 1877, I found my first specimens of *Otenochiton perforatus*, I did not at first understand the nature of an object