

THE *COCCIDAE* OF SOUTH AFRICA.—I

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THE COCCIDAE OF SOUTH AFRICA.—I.

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INTRODUCTION.

Material and Acknowledgments.—The material studied for this work is contained in the Coccid Collection of the Division of Entomology of the Union of South Africa. It comprises a large number of exceedingly interesting specimens, many of which were collected by Chas. P. Lounsbury and Claude Fuller when Government Entomologists of Cape Colony and Natal respectively. In addition there are many other specimens which have been collected by nursery or port inspectors or by other members of the staff.

A few Rhodesian specimens are also included. Rupert W. Jack, Government Entomologist of Southern Rhodesia, has kindly promised to send others, and the descriptions of these, together with Mr. Jack's notes on the species, will be included in this paper.

I am particularly indebted to the Chief of the Division, Chas. P. Lounsbury, for the privilege and opportunity of working over the collection and for numerous valuable records made during the past eighteen years.

To Claude Fuller, Assistant Chief of the Division, I tender my thanks for most able and willing assistance in a multitude of ways.

The Entomologist of the Cape Province, Chas. W. Mally, has taken a great interest in the work, and has supplied a large amount of useful material, collected either by himself or by his assistant, C. P. van der Merwe.

Albert Kelly, who has charge of the nursery inspection work in the Union, has submitted a large number of interesting specimens, and I am especially indebted to him for his most valuable records of host-plants.

The other members of the staff have also given willing assistance. As the collector's name is given with each species I must ask them to accept this reference as the grateful acknowledgment of my appreciation.

An Explanation.—The literature dealing with the *Coccidae* is, unfortunately, very scattered, and a large number of the older papers, which contain original descriptions, are practically unobtainable.

In South Africa those interested in this group are obliged to rely almost entirely upon their own personal collection of Coccid literature, and the number of entomologists now in the country feel the necessity for a descriptive catalogue of all the species of scale insects known to occur here.

To fulfil this purpose I feel that such a catalogue should be sufficiently comprehensive to obviate the necessity of constantly referring to other papers on the group, and for this reason I propose to include several sections which have already been treated by previous workers.

The arrangement of Subfamilies does not follow the plan usually adopted, nor is it chosen to illustrate possible phylogenetic relationships. Owing to experiments now being conducted for the control of mealy-bugs, I was asked to deal with this Subfamily (*Pseudococcinae*) first. I have also included the *Ortheziinae*, *Coccinae*, *Monophlebinae*, and *Margarodinae* because they resemble mealy-bugs—in some measure at least—in some stage of their existence. Thus, the *Ortheziinae* and *Coccinae* always resemble the *Pseudococcinae* more or less closely; this is also true of the *Monophlebinae* during their early stages, and the adult ♀♀ of *Margarodes*, after leaving the cysts, simulate subterranean mealy-bugs.

Types.—I wish to emphasize the desirability of establishing an Imperial Collection of *Coccidae* similar to the U.S. National Collection at Washington D.C.

I feel that the needs of workers in the Colonies at least demand the centralization of as many types as possible in London. They should be deposited in the British Museum (Natural History), where they would be properly stored and safeguarded, and at the same time be available for all purposes within the usual restricted sphere of type material of all kinds.

All necessary arrangements might well be left to the Imperial Bureau of Entomology.

The Imperial Collection should not be restricted to types alone, but should contain specimens of all the *Coccidae* of the different Colonies, determined by recognized authorities. This would involve the duplication of many species, but the collection would be all the more valuable, as it would illustrate the slight variations—which do occur—due to local conditions.

SIGNIFICANCE OF TERMS AS GENERALLY USED IN
DESCRIPTIONS OF COCCIDAE.

- Adult** : the stage when an insect is sexually mature and ready to reproduce normally.
- Anal lobes** : or caudal lobes : a pair of prominent rounded or conical processes, situate one on each side of the anal opening as in the *Pseudococcinae*.
- Anal plates** : a pair of small triangular processes forming a valve-like covering over the anal opening in the *Lecaniinae*.
- Anal ring** : a chitinous ring encircling the anal opening.
- Antenna -ae** : two, jointed, sensory organs, borne, one on each side of the head, commonly called "feelers."
- Antennal chart** : a curve plotted to indicate the range of variation in the lengths of the antennal segments.
- Antennal formula** : an enumeration of the antennal joints in the order of their length, beginning with the longest and bracketing together those of the same lengths.
- Anterior** : in front.
- Apodema** : a conspicuous transverse band of chitin crossing the thorax in front of the scutellum in the male.
- Apodous** : without legs.
- Apterous** : without wings.
- Article** : a joint or segment.
- Atrophied** : wasted away ; unfit for use.
- Canaliculate** : channelled, longitudinally grooved, with a deeper concave line in the middle.
- Carina** : a keel or ridge.
- Gastaneous** : chestnut-brown.
- Cauda** : the tail ; any process resembling a tail.
- Caudal** : pertaining to the posterior or anal extremity.
- Caudal process** : the conical projection, or tail of *Ceroplastes* spp., usually visible in the denuded insect only.
- Cephalic** : belonging or attached to the head ; directed towards the head.
- Chitin** : the material forming the hard parts of an insect's body.
- Chitinized** : hardened by chitin.
- Cicatrix** : a scar.
- Circumgenital glands** : small circular glands with an excretory orifice at the tip, disposed in groups about the genital orifice in *Diaspinae*.
- Coccineous** : cochineal red.
- Common** : of frequent occurrence.
- Conjunctiva** : the membrane uniting the abdominal or antennal sclerites or segments.
- Conspicuous** : striking ; easily seen at a glance.
- Costal margin** : the anterior margin of a wing.
- Coxa -ae** : the basal segment of the leg, by means of which it is joined to the body.
- Cribiform plates** : densely chitinous pitted plates which occur on the dorsal surface of some of the *Asterolecaniinae*.
- Denuded** : naked ; refers to Coccids freed from their waxy coverings.
- Dermal** : relating to the skin.
- Dermal glands** : hypodermal unicellular glands which secrete wax, setae, spines, etc.

- Digitules** : appendages on the feet of *Coccidae*.
- Dimerous** : composed of two pieces.
- Distal** : that part of a joint farthest from the body.
- Dorsal** : of or belonging to the upper surface.
- Dorsal scale** : that part of the covering scale of the *Diaspinae* that lies above the insect as opposed to the ventral scale which completes the puparium below.
- Ecdysis -es** : the process of casting the skin ; moulting.
- Exuviae** : the discarded skins cast at the periodical moults (ecdyses).
- Facets** : areas or lens-like divisions of the compound eye.
- Falciform** : curved like a sickle.
- Femur -ora** : the thigh ; usually the stoutest segment of the leg, articulated to the body through trochanter and coxa, and bearing the tibia at its distal end.
- Ferruginous** : rusty red-brown.
- Filiform** : thread-like.
- Fimbriate** : applied to a margin or process which is fringed or finely divided.
- Fulvous** : tawny ; light brown with much yellow ; nearly orange.
- Funicle** : the long terminal joint of the larval antennae of *Diaspinae*.
- Fuscous** : dark brown ; approaching black.
- Geniculate** : knee-jointed ; abruptly bent in an obtuse angle.
- Genital spike** : the sheath of the penis, which in the male of *Diaspinae* takes the form of a long mucronate spike.
- Gland pore** : the external opening through which a gland empties its secretions.
- Gland spines** : spiny appendages, each of which is supplied with a single gland whose opening is at the tip.
- Grouped glands** : circumgenital glands.
- Halteres** : a pair of small organs which replace the hind wings in the males of *Coccidae*, and in the two-winged flies (*Diptera*). In the *Coccidae* they take the form of a strap-shaped, or somewhat clubbed basal part with one or more long, stout, hooked bristles at the extremity.
- Honey-dew** : a sweet, viscid substance excreted by *Coccidae* and some other homopterous insects.
- Imago** : the adult or sexually developed insect.
- Inarticulate** : not jointed or segmented.
- Infuscated** : smoky grey-brown, with a blackish tinge.
- Instar** : the period or stage between moults in a larva.
- Invagination** : a pouch or sac formed by an infolding or indrawing of the outer surface.
- Lac** : a mixture of resinous or waxy substance produced as a protective covering by certain *Coccidae*.
- Lamella** : a thin plate.
- Line** : as a term of measurement is one-twelfth of an inch.
- Lobe** : any prominent rounded process ; the rounded prominent processes on the margin of the pygidium of the *Diaspinae*.
- Lobule** : one of the two distinct parts of which a lobe is sometimes composed.
- Mentum** : the lower part of the mouth, which in the *Coccidae* takes the form of a conical process channelled on its upper surface to receive the rostral setae or sucking-tube.
- Mesosternum** : the underside or breast of the mesothorax.
- Mesonotum** : the upper surface of the second or middle thoracic ring.
- Mesotarsus** : the tarsus of the middle leg.
- Mesothorax** : the second or middle thoracic ring ; bears the middle legs and the front wings.
- Micron** : the unit of microscopic measurement = 0.001 mm., represented by the sign μ (i.e. 1μ = one-thousandth part of 1 mm., or approximately 1/25,000 inch).

mm : = millimetre : 0.001 metre = 0.039 of an inch : roughly 25 mm. are counted to an inch in measuring insects.

Mode : in tabulating measurements is that class which occurs most often.

Moniliform : beaded like a necklace.

Mucronate : terminating in a sharp point.

Mycetom : that mass of tissue which contains symbiotic organisms.

Oblong : longer than broad.

Obovate : inversely egg-shaped ; the narrow end downwards.

Ocelli : the simple eyes as opposed to compound eyes.

Olivaceous : with a tinge of olive-green.

Opaque : without lustre ; not transparent.

Operculum : lid, cover, or covering flap ; generally used to denote the anal covering in the *Lecaniinae*.

Ovum, Ova : an egg, eggs.

Oviparous : egg-laying.

Ovoviviparous : when young are produced by the adult ♀ from eggs which are hatched within her body. (In *Coccidae* such a ♀ is quite commonly spoken of as "viviparous").

Parastigmatic glands : small, circular glands sometimes present round the spiracles.

Parthenogenesis : reproduction without intervention of a male.

Pellicles : the exuviae or cast skins. More particularly applied to the hardened larval skins attached to the scale of the *Diaspinae*.

Piceous : pitchy black.

Plates : the flattened, fimbriated or spine-like marginal processes of the pygidium in *Diaspinae*.

Pore : any small round opening on the surface.

Posterior : hinder or hindmost ; opposed to anterior.

Process : a prolongation of the surface, margin or an appendage ; any prominent portion of the body not otherwise definable.

Produced : drawn out, prolonged.

Protuberance : any elevation above the surface.

Proximal : that part of an appendage nearest the body ; opposed to distal.

Pseudo- or pseud- : as a prefix means false, or merely resembling.

Pupa : the intermediate stage between larva and adult.

Puparium : as used for *Coccidae* refers (a) to the covering case of the male before it emerges as a winged insect, and (b) the covering scale formed by the *Diaspinae*.

Pygidium : the compound terminal segment of the *Diaspinae* and *Conchaspinae*.

Pyriform : shaped like a pear.

Reticulate : like network.

Retracted : drawn back ; opposed to prominent.

Rimose : full of cracks.

Rugose : wrinkled.

Scale : a general term to distinguish *Coccidae* ; the puparium of *Diaspinae* ; the waxy covering of the male *Lecaniid*.

Sclerite : any piece of the body wall bounded by sutures.

Scutellum : a conspicuous shield-shaped piece on the dorsal surface of the metathorax of male *Coccidae*.

Secretion : matter produced by the various glands of the body. More particularly the waxy, powdery, fibrous, or cottony substances of which the coverings of *Coccidae* are composed.

Secretionary : consisting of secretion.

Seta -ae : a pointed bristle or long stiff hair.

Sordid : (of colour) dirty, dull.

- Species** : a succession of individuals similar in appearance, structure, and habit, mating freely and producing young which themselves mate freely and bear fertile offspring resembling each other and their parents.
- Spine** : a sharp process.
- Spinose** : **Spinous** : **Spined** : set with thorns.
- Spiracles** : the respiratory orifices.
- Squames** : see **Plates**.
- Stigmata** : the spiracles.
- Stoma -ata** : a breathing pore : = stigma.
- Symbiosis** : a life relationship existing between different kinds of animals or plants, or between animals and plants ; true symbiosis is where both parties to the relation benefit.
- Synonym** : a name erroneously applied to a species or genus that has been previously named and described.
- Tarsal** : relating to the tarsi or feet.
- Tegument** : a covering surface or skin.
- Tenant hair** : specialized hair for clinging or clasping.
- Terminal** : situated at the tip or extremity ; opposed to basal.
- Test** : the secretory covering of *Coccidae*, especially such as is waxy, horny, or glassy.
- Testaceous** : dull yellow-brown.
- Trachea -ae** : the spirally ringed breathing tube or tubes of insects.
- Translucent** : semi-transparent ; admitting the passage of light but not of vision.
- Translucid** : clear ; transparent enough to be seen through.
- Transparent** : so clear as not to obstruct vision.
- Trochanter** : the small joint connecting the femur with the coxa.
- Ungual** : relating to the claw.
- Venter** : under surface ; opposed to dorsum.
- Viviparous** : applied to insects which bear living young.
- Vulva** : the sexual orifice of the female.
- Wax glands** : small circular glands concerned in the secretion of waxy substances ; present on the pygidium as circumgenital glands and round the spiracles as parastigmatic glands ; occurring in other parts of the body in various families.

METHODS AND TECHNIQUE.

The methods of preparation of Coccids for study vary considerably, according to the purpose of the study, and also with the previous training of the student. The personal equation enters largely, as it does into all research, so that the final methods employed depend upon the results of personal experiment and experience. For this reason it is advisable to indicate merely, in a general way, the lines of procedure; and to leave details to the individual worker.

The process of determination should begin at the time of collection of material, and the following points should all receive due attention:—

(a) Host-plant: name if possible. If the plant is not known sufficient material should be obtained for determination, and wherever possible an attempt should be made to secure flowers or fruit and a typical twig with leaves. Position of insects on the plant and habits; whether clustered or solitary; whether on branches only or on leaves and fruit; whether more common on underside of leaves, etc.

(b) The insect itself: general colour impressions; distribution on plant; whether ♂ puparia are associated with the females or clustered on some other part of the plant. If males are not observed, and ♂ puparia not found, search should be made on fallen leaves, etc., round about. The ♂ puparia of Mammoth Scale are found on fallen leaves beneath the trees which bear the females. The males of *Aspidoproctus mirabilis*, and *tricornis*, which are closely related scale insects common in some parts of South Africa on thorn-trees, have never been observed.

(c) Care of material collected. Specimens should be collected to illustrate the life-history as far as possible. Young and male forms should be obtained whenever possible. Each twig bearing specimens should be wrapped separately in soft paper to prevent the insects from being crushed or unduly rubbed, and particularly to retain larvae, males, or parasites which may emerge before the material is studied in the laboratory. It is highly important that an adequate amount of material should be collected when found. It is a great mistake to think that because a certain insect is very plentiful at one time that it can always be obtained when required.

(d) The approximate size of adult insects; the presence or absence of secretory covering, ovisac, etc.; the nature of secretion, colour, distribution on body, etc.; the colour of the body denuded; the colour of legs and antennae, if present; the length and nature of caudal, lateral, or

dorsal filaments; the nature of the integument at maturity; the presence or absence of a covering scale; the size, colour, shape, and nature of covering scale if present the position and nature of the exuviae; the colour of the living insect without the scale.

After the above observations are complete, and notes have been made, specimens should be cleared and mounted for more detailed study.

The microscopic characters of the *Coccidae* which are utilized for the determination of species are found in the exoskeleton. In order to render this transparent it is necessary to get rid of the soft body contents, but at the same time to retain the chitinous skin of the insect, with its appendages, hairs, and spines in as perfect a condition as possible. The easiest method is to treat the specimens with a strong solution of caustic potash (KOH) or caustic soda (NaOH) which dissolves all the soft parts, but does not dissolve chitin. If used hot, or boiling, this solution acts more quickly than when cold. Small specimens, such as the armoured scales, are generally sufficiently transparent after boiling from 5 to 10 minutes in a 20 per cent. solution of KOH. Larger insects, such as mealy-bugs or cochineal insects, may require 20 to 30 minutes. The following particulars may be useful. In dealing with armoured scale insects do not scrape a stem thickly covered with insects into the KOH solution. Raise each scale separately and pick out the insect on a needle-point which has been previously moistened, and place in the KOH, taking care to keep insects from *similar* scales together, as there may be several species on the same twig. When possible boil 12 to 20 insects of the same kind, and count them as they are transferred to the different solutions. This is especially necessary when staining, as the insects are difficult to see when stained the same colour as the fluid they are in. For small specimens a shallow watch-glass is a useful staining dish, using a little stain. When about to transfer the specimens the glass is held above a mirror, placed as a reflector, when the insects are easily seen.

Larger insects, such as mealy-bugs, should be punctured with a needle before boiling. This permits of more rapid clearing. Very large, convex insects, such as *Aspidoproctus* spp., and some of the *Lecaniinae*, are too large and thick to make a single mount. These are best treated by separating the lower surface from the upper by cutting around the margin with a fine scalpel or pair of scissors before boiling. The two surfaces are then treated and mounted separately. The colour which the body assumes in boiling KOH, and whether the liquid is stained or not, should be noted.

If distilled water cannot be easily obtained, rain water which has been boiled, and preferably filtered, should be used for making up all solutions and stains, and for washing the insects between the different solutions.

After treating with boiling KOH the insects should be transferred to water containing a trace of acetic acid and through two or three changes of water. They are then ready for passing through the alcohols to stain, or, if not requiring staining, to clearing media such as oil of cloves or xylol, and thence into Canada balsam.

It has been found that the majority of scale insects are improved for study purposes by suitable staining. In fact it is practically impossible to work with unstained material of mealy-bugs and some of the *Lecaniinae*. The chitin is so delicate and transparent that the characters cannot be made out, and this difficulty increases with the age of the slides. On the other hand, some of the larger *Monophlebinae*, the more highly chitinized *Lecaniinae* (e.g. *Hemilecanium* spp.), and *Diaspinae* are so dense that staining is quite unnecessary.

After boiling specimens they become very soft and fold easily, and trouble is often experienced in transferring them from one solution to another, or in getting them to lie quite flat on the slide when mounted. This difficulty is best overcome by using a small section lifter, which may be made from thin silver or platinum wire flattened and slightly up-bent at one end. A wooden toothpick answers quite well on occasion.

When mounting the cleared specimens from xylol or oil of cloves into Canada balsam it is advisable to transfer the insect in a small drop of the clearing medium to balsam which is spread on the slide to almost the size of the coverglass used. If a drop is placed on the slide and the insects transferred to this it is likely that when the coverglass is applied the specimens will be carried to the edge of the glass, or if too much balsam is used the specimens may be found beyond the edge of the coverglass. It is a good rule to use as little balsam as practicable and to have it spread evenly before orientating the specimens and applying the coverglass.

The following methods of staining are recommended for the purposes indicated:—

(a) For small *Diaspinae* and other insects in which the characters merely require intensification.

Stain: Picric acid in xylol or beechwood creosote.

Method: After treating the specimens with KOH and washing, pass through the alcohols, 30 per cent., 70 per cent., 90 per cent., and absolute into xylol or beechwood creosote which contains a little picric acid in solution. Leave for about 1 minute and transfer to clean xylol for a few minutes, then mount in the usual manner. If not washed in xylol after staining the picric acid is liable to crystallize out after mounting.

(b) For differentiation of the more chitinized parts of the exoskeleton of *Coccidae*, e.g. for easy differentiation between the antennal segments and their conjunctiva in the *Pseudococcinae*, etc., the following stains are recommended:—

(1) *Stain* : Ziehl-Nielson solution of carbolic-fuchsin.

Distilled water	100 cc.
Carbolic acid	5 gm.
Alcohol (abs.).....	10 cc.
Fuchsin	1 gm.

Or it may be prepared by adding a 5 per cent. aqueous solution of carbolic acid to the saturated alcoholic solution of fuchsin until a metallic lustre appears on the surface of the fluid.

Method : After treating with KOH and washing, transfer direct to the stain. Leave for one hour if used cold. If heated until it steams, and then allowed to stand, the specimens will be well stained in ten minutes. Transfer direct to 70 per cent. alcohol. If over-stained wash quickly in 70 per cent. alcohol containing a trace of hydrochloric acid. Pass through 90 per cent. and absolute alcohol to oil of cloves and mount when cleared.

(2) *Stain* : (Method of Professor R. Newstead and Dr. P. Marchal).

Saturated solution of magenta in absolute (or 95 per cent.) alcohol.

Method : After treating with KOH and washing, pass through the alcohols to 90 per cent., and thence into the stain. Leave to stain for 20 to 30 minutes—or longer, wash in absolute (or 95 per cent.) alcohol, transfer to oil of cloves and mount in Canada balsam.

The following equivalents and approximations may be useful for reference :—

To make a dilution from a solution of known strength : Take the amount in cc. (or a multiple of that number) represented by the desired strength, and add water to the amount represented by the original percentage in cc. (or the same multiple of that number). Thus, to make 35 per cent. alcohol from 75 per cent., take 35 cc. of the 75 per cent. and make up to 75 cc. with water.

In using formalin it must be borne in mind that this liquid contains only approximately 40 per cent. of formaldehyde when sold, so that to make a 4 per cent. solution take 4 cc. of ordinary formalin and make up to 40 cc. with water.

1 μ = 1/1000 mm.

1 mm. = 0.0393 inch. Approximately 25 mm. = 1 inch.

1 gram = approximately $15\frac{1}{2}$ grains (15.432).

1 oz. = approximately 28 grams (28.349).

1 fluid oz. = approximately 30 cc.

1 litre = 1,000 cc. = 1.759 imperial pints; thus 4 litres = approximately 7 pints.

OUTLINE OF CLASSIFICATION OF SOUTH AFRICAN
COCCIDAE.

The family *Coccidae* is distinguished from the most nearly related families of the Hemiptera (*Phytophthires*), viz. the *Psyllidae*, *Aleurodidae*, and the *Aphididae*, by the fact that in the *Coccidae* the tarsi are normally one-jointed and bear but a single claw. In the three remaining families mentioned the tarsi are normally two-jointed and terminate in two claws. It is the rule too, in Coccids, that the females are always wingless and the males nearly always winged, possessing, however, but one pair of wings.

In the *Psyllidae*, *Aleurodidae*, and *Aphididae*, on the contrary, the normal condition is for the adults of both sexes to possess wings, and when present always two pairs. In the immature or stationary condition, however, many of the insects in these families bear a striking resemblance to scale insects. This is particularly the case with immature *Aleurodidae* and, among the *Aphididae*, with the aberrant *Cerataphis lataniae*, "the black seed scale" of English horticulturists. This peculiar aphid is common in South African greenhouses, and is known to occur on ornamental palms grown in the open at Durban.

As a matter of convenience the family *Coccidae*, which now comprises about two thousand described species, is divided into a number of Subfamilies.

Those known to be represented in South Africa may be distinguished as follows:—

FAMILY COCCIDAE.

N.B.—Adult ♀ characters used unless otherwise stated.

Adult ♂, as far as is known, with simple eyes unless otherwise stated.

I. *Anal ring bearing hairs.*

A. *Posterior extremity not cleft.*

- a. Posterior extremity with ± produced caudal lobes which normally bear two or more stout spines, one or more long setae and shorter hairs. Adults naked or ± covered with waxy secretion in the form of meal, cotton, waxy cones or plates. Insects generally free-moving until eggs are laid. Ovisac may or may not be formed, which may partly or entirely enclose the ♀. Figure-8 glands absent in all stages. E.g. mealybugs, etc. *Pseudococcinae.*

- b.* Adults free-moving. Posterior extremity rounded. Dorsum covered with well-defined waxy lamellae or plates which are produced behind the body to form an ovisac. ♂ with compound eyes. E.g. *Orthezia insignis* *Ortheziinae*.
- c.* Adult fixed, often forming shallow pits in stems of plants. Usually enclosed in a ± horny, or glassy, ± transparent test which is often supplied with a short fringe of waxy filaments. Figure-8 glands usually present in one or more stages. Legs and antennae rudimentary or absent. E.g. Pustular oak scale, etc. *Asterolecaniinae*.
- d.* Insects enclosed in a resinous cell. Adult without legs, with the caudal segments produced into a ± tail-like organ bearing at the extremity the anal orifice, which is surrounded by a broken setiferous ring. E.g. Lac insects. *Tachardiinae*.
- B. Posterior extremity cleft.**
- e.* Body not showing segmentation. Anal orifice valve-like, covered with a pair of triangular plates. E.g. Soft scale, etc. *Lecaniinae*.
- II. Anal ring hairless.**
- A. Abdomen not terminating in a definite pygidium.**
- a.* Adult free-moving until eggs are laid. Posterior extremity rounded; insects ± covered with mealy or cottony matter, or enclosed in a ± felted sac. Caudal lobes absent. Legs and antennae present or ± rudimentary. Antennae usually 7-jointed. E.g. Cochineal insects, etc. *Coccinae*.
- b.* Young stages free-moving, adults ± fixed to host-plant by secretion from tenent hairs on venter between legs. Legs, antennae, and mouth-parts present. Dorsum ± soft and covered with waxy meal or cottony matter (*Icerya*, etc.), or hardened and ± naked (Mammoth Scale). Antennae usually 10- or 11-jointed. Adult ♀ with or without ovisac. In *Aspidoproctus* spp. the eggs are deposited in a "marsupium" formed by invagination of portion of the ventral surface. ♂ with compound eyes *Monophlebinae*.
- c.* ♀, before emergence as adult, enclosed in a ± glassy cyst. During this time the insect probably passes through (*a*) a second larval or prae-pupal stage in which mouth-parts are present but legs and antennae absent, and (*b*) a pupal stage in which antennae, legs, and mouth-parts are absent. Adult ♀ with well-developed legs and antennae but without mouth-parts. Adult ♂ with compound eyes. Adult ♂ and ♀ with anterior legs fossorial. E.g. Vine Margarodes *Margarodinae*.
- B. Abdomen terminating in a definite pygidium.**
- d.* Legs and antennae present. Adults below a separate covering scale which is composed entirely of secretory matter without the admixture of exuviae. E.g. *Euphorbia Conchaspis* *Conchaspiinae*.
- e.* Legs absent. Adult below a separate covering, scale composed of secretory matter plus the exuviae. E.g. White peach scale, etc. *Diaspiinae*.

SUBFAMILY PSEUDOCOCCINAE.

From an economic standpoint this subfamily is one of the most important because it includes, among others, those common insects known as mealy-bugs.

These are of exceptional interest to entomologists, nurserymen, and fruit-growers because of (a) their general distribution, (b) their prevalence in orchards and vineyards, and (c) their resistance to ordinary control measures.

This resistance is no doubt accounted for, in some measure at least, by the powdery waxy secretion which covers the body, and earns for them the popular name "mealy"-bugs. The common species, the long-tailed mealy-bug of ferns, etc., is the type of the genus *Pseudococcus*, to which most of our South African forms belong.

It should be mentioned, however, that the subfamily *Pseudococcinae* has a much wider significance than is exhibited by this one genus, and, as it is at present constituted, appears in some ways an unnatural group.

Synopsis of South African Genera.

N.B.—Adult ♀ characters used.

A. Anal ring with 6 hairs.

I. Legs absent.

(a) Insects enclosed in felted sac. Antennae rudimentary, of two or three joints *Antonina* Sign.

II. Legs present.

(b) Body long and narrow. Antennae short, geniculate, of 5 joints. Integument with some 3-grouped glands . . . *Rhizoecus* Kunck.

(c) Body broadly elliptical. Antennae 6-jointed. Insect inhabiting cysts at root of grass *Natalensia* g. n.

(d) Body elongate oval. Antennae 7- to 9-jointed. Marginal spine areas produced on large, more or less rounded tubercles *Tylococcus* Newst.

(e) Body usually elongate oval. Antennae 7- to 9-jointed, most commonly 8-jointed. Marginal spine areas not produced on tubercles *Pseudococcus* Westw.

B. Anal ring with 8 hairs.

(f) Antennae 7-jointed. Insect enclosed in a dense sac . . . *Eriococcus* Targ.

(g) Antennae 8- or 9-jointed *Puto* (?) Sign.

THE RELATIVE VALUE OF SPECIFIC CHARACTERS USED IN THE PSEUDOCOCCINAE.

(a) *Size*.—It is difficult to state with any degree of accuracy the precise measurements of living mealy-bugs, for they are constantly moving, and

the mealy covering and lateral and caudal filaments, which many of them possess, obscure the extremities. Further, when dealing with old females which have completed oviposition the body is often shrunken and is much smaller than the mounted specimens indicate. On the whole I think it is most satisfactory to give the *approximate* size of the largest living specimens observed and an average of the size of adults when mounted. There is undoubtedly a slight variation in size of individuals of the same species caused by difference of food-plant and also by climatic conditions; for this reason the host-plant and date of collection should be given with descriptions.

(b) *Shape*.—The normal shape of the body is elongate oval, but in a few cases there is an important variation, which may be sufficiently pronounced to at least suggest generic relationship. In *Rhizoecus* the body is exceptionally long and narrow, but this character is also found in a few species of *Pseudococcus*. In some instances the shape is given as sub-globular, while in *Antonina natalensis* sp. n. the body is in the shape of half a pear, and in *Natalensis* g. n. the segments of the body are quite characteristic, as shown in the sketch (Fig. 11).

It may be seen that such variations, when constant, are of importance in the determination of species, especially as they are found in only a few cases.

(c) *Colour*.—The descriptions of colour apply really to three distinct phases: (1) the colour of the mealy secretion, (2) that of the body as seen through the secretion, and (3) that of the body when freed from secretion, as when first dropped into boiling KOH.

The mealy secretion is most often white, but it may be tinged with yellow, as in *Ps. filamentosus* Ckll.; bright yellow, as in *Ps. aurilanus* Mask.; or decidedly buff, as in *Ps. iceryoides* (Mask.) and *Ps. nipae* (Mask.). In most cases the dorsum of the insect is densely coated with a white, powdery, mealy secretion; but, in a few instances where the insects are enclosed in a cottony mass (*Ps. transvaalensis* sp. n.) the insect itself is practically free from such meal. The same may be said of the young females of *Pseudococcus flagrans* sp. n., which are embedded in a dense layer of white, powdery wax between the leaf-bases of grass; but later, when the insects ascend the grass-stems apparently to await the males, a slight mealy covering is secreted. In such cases the true body-colour may be seen, but in many others, where the dorsum is thickly covered with secretion, the true colour is only seen on the ventral surface where the meal is scant, or when the insect is rubbed, or dropped into hot KOH. The most common colour is pinkish, or purplish, but many variations have been recorded; and, just as constant variations in shape may be useful in the determination of the species, so the differences in colour may give a clue to relationship at least. Thus, while many species show

but slight difference from the most common pinkish or purplish tints *Pseudococcus stelli* sp. n., *Pseudococcus crawi* and *solani* are pale yellow; *Pseudococcus capensis* always appears slightly brownish, *claviger* reddish-brown; *formicarii* yellowish-brown; *aphyllonis* and *olivaceous* olive-brown; *quercus* greenish-brown; *salinus* grey. The *filamentosus* group appears purplish-black, and *solitarius* sp. n. shiny black, etc.

When recording the colour of specimens in boiling KOH it is important to note the shade at once, as an excess of alkali changes the colour rapidly.

(d) *Segmentation*.—It is usual, for some reason or other, to state whether the segmentation of the body is conspicuous or not. As a character for determination this is quite useless. In the majority of cases it merely amounts to whether the mealy secretion is abundant or scant. The segmentation of the body is always more distinct in the second nymphal stage than in the adult. The distinctness gradually diminishes as the adult becomes replete. It varies, too, in the same species, as it depends somewhat upon whether the insects are in sheltered or exposed positions.

(e) *Lateral and Caudal Filaments*.—The presence or absence of lateral or caudal filaments, and their nature when present, is a character which may assist, in a preliminary way, in the determination of species. In a few cases (e.g. *P. transvaalensis* sp. n.) caudal filaments are present and lateral ones absent. In *P. adonidum* all the filaments are more slender than are those of *P. citri*.

There is naturally the relation between these filaments and the dermal spine-gland areas which gives the point significance.

(f) *Antennae*.—The number of segments in the antennae is a character which is generally given generic rank, and in the majority of cases seems quite satisfactory as such. In the genera which I now include in the tribe *Pseudococcini*, however, this particular character is undoubtedly unstable, and is therefore unsuitable to retain this significance. I shall deal with this point briefly under the discussion of the genus *Pseudococcus*.

I wish to draw attention here to the practice of giving the antennal formula as a specific character.

This is done in a large number of the descriptions of the species, and it is only after one has really endeavoured to determine specimens with its aid that the impossibility of the task is realized. A formula is composed of numbers indicating the joints, the largest, i.e. longest, being given first, the shortest last, with the others in order of their length. When several segments vary so much that the sequence may be altered, the numbers are placed in brackets.

I am inclined to think that many, if not most, of the antennal formulae have been made on simple comparisons of the segments under the microscope, and not by actual measurements.

If we remember, too, that most of the descriptions are made from mounts which are merely boiled in potash, and cleared without staining, the difficulty of observing the comparative lengths of the segments will be obvious.

Under these conditions the dermis is colourless, and becomes very transparent in Canada balsam, and the exact point at which the segments begin, and terminate, is difficult to determine.

Antennal formulae, constructed from stained specimens, however, are quite unsatisfactory for the determination of species. That this is the case may be best illustrated by a few measurements with the formulae constructed from them.

The following are made from specimens of *P. adonidum* Westw., collected at the Edgbaston Botanical Gardens in November, 1913.

Antennal segments :—

I	II	III	IV	V	VI	VII	VIII
65	72	76	38	42	38	46	104
Formula :—8 3 2 1 7 5 (6 4)							
58	65	63	36	41	38	43	96
Formula :—8 2 3 1 7 5 6 4							
74	72	74	48	62	43	43	101
Formula :—8 (1 3) 2 5 4 (6 7)							

It is not an uncommon occurrence for the two antennae of the same insect to give different formulae, and from one collection of material, about 40 specimens, I constructed the given formulae of five described species. The measurements were made from specimens stained by the carbol fuchsin method, with the Zeiss microscope, obj. D, and 7.5 measuring ocular. The results are more accurate by this method than by plotting from camera lucida drawings. The lengths of the antennal segments are, nevertheless, of great importance in the determination of species if they are accurately made from stained specimens, and properly tabulated.

The most useful arrangement of antennal data seems to be arrived at by giving the range of variation in measurements of the different segments, with the addition perhaps of the mode of each. After working over a large series of slides one is impressed with the characteristic appearance of the different antennae. But this difference is difficult to express. The nearest approach is obtained by a scheme such as is used in the charts given with the different species, and this supplies a most useful aid for the preliminary location of an insect from slide specimens.

Wherever possible the range of measurement represents at least 10 measurements, 20 to 30 being made where material is sufficiently

plentiful to allow such to be done. The measurements are then plotted in the centre of each antennal column and the curve completed. Thus it appears that where any segment is constant the curve approaches a simple line, and a wide band represents a wide range of variation.

Similarity of antennal curve, whilst indicating similarity of antennal formula, does not of necessity indicate identity of species, but it does give a clue to work upon; and, possibly at times, indicates relationship. Other characters—the legs, setae of anal lobes and anal ring, and dermal characteristics—can then be compared; if the similarity still persists, the description can be referred to for other details.

It should be mentioned, while dealing with the antennae, that the measurement of the first segment is often unsatisfactory. This is due to the fact that the outer edge is much narrower than the inner, the side being hollowed out to allow lateral bending and the insertion of segment II. An intermediate length is indicated in the chart given, but slight variation in segment I may be disregarded.

The hairs and spines on the antennal segments are similar in the majority of cases, but a few striking variations occur.

In *Rhizoecus* spp. there are always 3 or 4 stout falciform spines on the terminal segment as illustrated in Fig. 10*d*, and in a few examples of *Pseudococcus* there are stouter spines which seem to indicate an intermediate stage between ordinary spines and the falciform type of *Rhizoecus*.

(*g*) *Legs*.—The remarks concerning the uselessness of an antennal formula as a specific character apply equally well to general remarks on the legs, which are commonly made in descriptions of species of *Pseudococcini*. In order to be of use, the measurements should be carefully made and tabulated, and use should be made of the three pairs of the same specimen. If only one set of measurements is to be given I would suggest that the mesothoracic leg be made use of, as this is usually a more or less reliable clue to the other two pairs.

The plan adopted by the writer (1912), gives the measurements in μ , in the following order:—

1. Length of coxa.
2. Breadth of coxa across base.
3. Length of trochanter plus femur.
4. Breadth of femur.
5. Length of tibia.
6. Breadth of tibia.
7. Length of tarsus plus claw.

This was the outcome of an endeavour to obtain measurements in direct lines from points which remain fixed although the legs are folded in different ways in mounting, and is generally used in the present paper.

Considered alone, the measurement of the legs would not form a satisfactory character for specific determination; but, taken in conjunction with the antennal segments and the comparative lengths of the setae of the anal lobes and of the anal ring, it is an important factor.

The remarks on the unsatisfactory nature of the first antennal segment, for measurement, also apply to the coxa, but, even allowing variation in this character, the leg-series of measurements is most useful. The greatest importance is attached to the comparative lengths of the femur plus trochanter and of the tibia, as (always allowing some margin for variation) these are remarkably constant for the species.

An unusual type of trochanter is recorded in the case of *Ps. natalensis* sp. n. Abnormal legs are not uncommon, and occur in the *Monophlebinae* as well as the *Pseudococcinae* (Fig. 12d).

(h) *Mentum*.—The mentum in the ♀ series of the *Pseudococcinae* is, I believe, always trimerous, consisting of a bi-lobed basal portion, which is but delicately chitinized, and forms the pivot on which the mentum proper turns. The two apical segments are heavily chitinized, and form a \pm pointed cone, the apex bearing a definite series of hairs. The two segments may be distinctly separate, or, as is often the case, more or less fused into one piece. The approximate size and shape of the mentum vary but little among specimens of the same species, but there is often only slight variation between different species of the same series. The only useful record to be made of this character seems to me to consist of the approximate length of the two apical segments, and whether it is broadly or acutely pointed as in Fig. 13a.

(i) *Length of Rostral Loop*.—Some writers give this as a specific character, but it appears quite useless. Two mounted specimens of *P. citri*, collected at the same time, show the following variation in this character: Length of body (a) 3.4 mm; (b) 2.6 mm. Rostral loop (a) 190 μ ; (b) 370 μ .

(j) *Dermal Characters*.—Very little attention seems to have been paid to the dermal glands and other dermal characters of the mealy-bugs, except to note the absence of figure-8 gland-pores in all stages. Occasional mention is made of a "sternal plate," as in the description of *Phenacoccus iceryoides* Green, and of "circular spinnerets," as in *Ps. ceriferus* Newst. (= *Ps. virgatus* Ckll.).

The absence of detailed description results, largely, no doubt, from the fact that unstained material was used, for in such slides the dermal characters are almost invisible.

The subcutaneous "tubes" which are so common in many species of mealy-bugs, are only seen in stained specimens. It may not be necessary to describe all the dermal characters in detail, but when sufficient species have been examined I think certain types can be evolved which will be of

the greatest value. For instance, the majority of species have well-defined marginal spine areas, while in a few cases such are absent (Figs. 22-33). In some again the gland-pores over the whole surface of the body are uniform in size, in others the ventral pores are small and simple, while those of the dorsum are large and disc-like. Further, some species have subcutaneous tube-glands restricted to the posterior segments, in others they may be uniformly distributed or entirely absent. In *Rhizoecus* there are peculiar grouped glands, in groups of three, crowded together and presenting a propeller-like appearance. The character of the spines and bristles on the derm varies, the conical spines of the marginal areas being stout, or slender, or entirely bristle-like, or absent.

Unfortunately I have not seen *stained* material of a sufficient number of species to be able to classify them according to the different types, but I refer to the subject in the hope that some one more favourably situated than I am may undertake to do so.

(k) *Setae of Anal Ring and Anal Lobes*.—The only mention of this character in the majority of descriptions is the number of hairs which the anal ring bears. All the series which I now include in the *Pseudococcini* have the anal ring with six hairs. It was observed that the length of the anal ring hairs remained fairly constant throughout all the females of the same species, but this did not furnish a satisfactory specific character in itself, because there was not sufficient difference between the lengths in different species. The anal lobes are furnished with conical spines and glandular pores, and each bears one long seta. These setae remain fairly constant in length for the species, so that the comparative length of the setae of the anal lobes with those of the anal ring forms, I think, quite a good character when taken in conjunction with the antennal segments and the legs.

Intracellular Symbionts.—Very little is known concerning the intracellular symbionts of the *Coccidae*; but, apart from the intense interest attached to them—owing to their relation with metabolism—they may throw a very important light on the subject of relationship. This may not indicate specific differences in many instances, but regarding the larger groups and their derivation I feel that a great deal may be anticipated.

The following seven species have been described from Coccids:—

1. *Lecaniascus polymorphus* Moniez, 1887, from *Lecanium hesperidum*.
2. *Saccharomyces apiculatus* var. *parasiticus* Lindner, 1895, from *Saissetia hemispherica*.
3. *Oospora saccardiana* Berlese, 1906, from *Ceroplastes rusci*.
4. *Saccharomyces pseudococci farinosi* Šulc., 1910, from *Pseudococcus farinosi* D.G.
5. *Coccidomyces rosae* Buchner, 1911, from *Lecanium corni*.

6. *Coccidomyces pierantonii* Buchner, 1911, from *Icerya purchasi*.

7. *Coccidomyces dactylopii* Buchner, 1911, from *Pseudococcus citri*.

Some of these are not so widely separated as their generic names would suggest, while on the other hand Nos. 5, 6, and 7, which have been placed provisionally in the same genus, are three widely divergent forms.

As a matter of fact my studies at Birmingham University under Professor F. W. Gamble, F.R.S., who brought this fascinating subject to my attention, seems to show that Nos. 1 and 2 are very closely related; Nos. 3 and 5 are probably of the same group; but 6 and 7 are entirely distinct from one another and from the rest, except possibly from No. 4.

Nos. 1 and 2 were isolated and grown on a variety of media, but never produced endospores. The forms represented by *Coccidomyces dactylopii* Buchner are probably restricted to the *Pseudococcini*. They are remarkable in that the individual organisms do not infect the ova independently. Instead of this a number together, enclosed in a "sferette," to use Dr. Pierantoni's term, acts as the infecting unit. (Plate XX., Figs. 34-39.)

It is not my intention to deal with the subject further at this point, but merely to indicate a most fascinating field for study, and at the same time one which may be instrumental in elucidating several important points of relationship in the *Coccidae*.

I am hoping to be able to deal with the subject of intracellular symbionts of the South African *Coccidae* at a later date.

TRIBE ?

GEN. ANTONINA Sign.

"Adult ♀ apodous; anal lobes rudimentary; antennae atrophied or rudimentary; anal orifice with six hairs.

Ovisac felted or solid and wax-like.

Larva with the anal lobes well developed; antennae of six joints; anal orifice with six hairs" (*Newstead*).

1. ANTONINA NATALENSIS, sp. n.

(Plate XVII., Fig. 8.)

Adult ♀ enclosed in a dense, tough, felted sac at the base of grasses.

Ovisac: At first sight the ovisacs appear spherical, but on closer inspection they are found to be somewhat produced at the anterior end, so as to be really pear-shaped, 4.5 mm. long and 3.8 to 4 mm. broad. In colour the sac is yellowish-white to buff.

Adult ♀: Purplish-black in colour, about 4 mm. long, distinctly semi-pyriform, being flattened ventrally and broadly rounded behind while the anterior end is narrowed. There is no secretory covering, but the walls of the sac are closely adherent to the body of the insect. On placing into boiling KOH a dense cochineal tint is liberated and the insect appears sooty-black. The liquid is stained very deeply with a dark dusky purple (Ridgway). When cleared, stained, and mounted the insect is about 4.5 mm. long and 4 mm. broad.

The antennae are 3-segmented, joint 2 being longest (44 μ long on the inner margin). Joint 3 is irregularly conical, 34 μ long, and has 8 to 10 hairs at its apex (Fig. 8).

The mouth-parts are normal; legs absent; and anal ring with 6 bristles. The circum-anal region is closely pitted with gland-pores of two sizes. The larger ones are about 7 μ in diameter; the small ones only about 2 μ . The latter are supplied with short, parallel-sided, subcuticular tubes. There are a number of scattered hairs around the anal groove, some of which may attain 130 μ in length. The setae of the anal ring are about 120 μ long. The dermis of the remainder of the body is clear except for scattered, small pores, some of which have bristle-like hairs. The spiracle-tubes broaden suddenly inwardly, and present a reticulated appearance.

Habitat: On grass, Pietermaritzburg, Natal.

Collected by A. Kelly, November, 1914. Description made from two ♀♀, being the only specimens found, associated with *Pseudococcus bantu*.
Collection No.: 33.

2. ANTONINA TRANSVAALENSIS, sp. n.

(Plate XVI., Figs. 1-1a. Plate XVII., Figs. 9-9c.)

Adult ♀♀ in closely felted sacs attached to the bases of stems of grasses.

Ovisacs oval, spherical, or flattened according to the position on the food-plant. When attached to the outer surfaces of grasses the ovisacs are often clustered and rounded (Fig. 1), when between leaf-sheaths circular, and disc-like (Fig. 1a). The ovisac is usually complete, white, densely felted, and brittle.

In size the ovisacs measure about 2.8 mm. in diameter. There is a distinct circular opening in the end of each, through which the white waxy caudal filaments of the ♀ project. Usually there are two such filaments almost as long as the enclosed ♀, but in a few cases (as in Fig. 1a) there are a number which appear to have been broken off or shed, and others produced. The ♀ shown in Fig. 1a was kept in a tube,

and on October 26th was found outside the ovisac. Peculiar movements were noticed, and although observed for half an hour no appreciable progress was made, but the movements looked as though a "scraping" motion was being performed with the anterior end, the bristle-like antennae being utilized for the purpose. This can hardly be looked upon as a means of locomotion, I imagine, and as the ♀ was found about $\frac{1}{8}$ inch *below* the ovisac, I think the movements were rather due to the insect having fallen out. On the dorsum were a number of very delicate waxy filaments, but these did not seem to be attached to body. They were, I think, from the inner lining of the ovisac.

Adult ♀ viviparous; when alive may attain 2.6 mm. long by 1.8 mm. broad; chestnut-brown in colour; distinctly segmented. Margins appear thin and lighter in colour.

In boiling KOH the insects become purplish and stain the liquid deeply.

When cleared and mounted the dermis is clear and colourless except around the anal end, where it is much more chitinous, much wrinkled, and brown in colour. The anal ring has 6 long bristles and lies deeply recessed in a trough-like cavity. The anal lobes are represented by several stout hairs; the circum-anal region bears many sharp, strong spines and gland-pores, and is finely rugose.

The two pairs of spiracles are conspicuous, yellow, of usual size, shape, and position (Fig. 9a).

Antennae of 3 segments, often appearing to have but 2, owing to the indistinct nature of 1. The segments are all very short, 1 being broad, 2 narrowed, and 3 irregularly conical, bearing several hairs (Fig. 9).

Larva, purplish in colour, elongate, active. Antennae of 6 segments, of which 6 is longest, being as long as 4 + 5 (Fig. 9b). Anal ring with 6 bristles. Anal tubercles produced, each bearing a very long seta and 2 shorter hairs. The setae of the anal lobes are about three times as long as those of the anal ring; the shorter hairs on the lobes are of about the same length as the latter (Fig. 9c).

Habitat: On roots of grass; Daspoort, Pretoria. Collected by the writer, October 11, 1914.

Material studied includes a number of ovisacs with ♀ ♀ and young enclosed; 16 larvae, and 15 ♀ ♀ cleared and mounted.

Collection No. : 70.

GEN. RHIZOECUS Künck.

Adult ♀ exceptionally long and narrow. Antennae short, geniculate, of 5 joints, the terminal segment bearing several falciform spines as well as the usual hairs. Anal ring with 6 hairs. Integument with some 3-grouped glands.

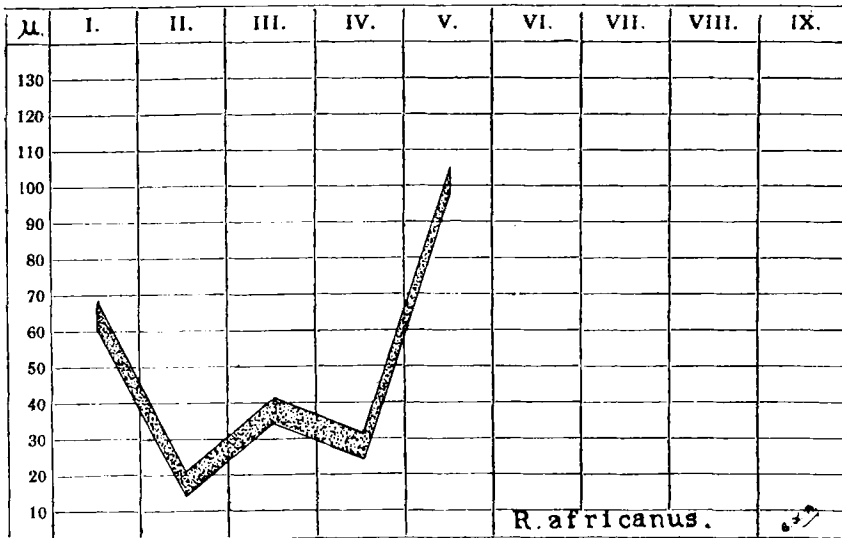
3. RHIZOECUS AFRICANUS sp. n.

(Plate XVII., Figs. 10-10e).

The material on which this species is founded consists of 15 ♀ insects which were collected on the roots of flowering plants in Mr. Ayres' nursery at Capetown in February, 1906. The specimens were kept in alcohol in the Cape Collection.

As I have never seen the insect alive, and no notes were made at the time of collection, it is impossible to give details of secretion, etc.

The spirit specimens were of a purplish-brown colour, but turned purple in boiling KOH. In size they range from 2 mm. to 3.8 mm.; are elongate and narrow, with parallel sides; the two extremities are rounded, of about equal width.



In mounted specimens the most striking characters are the extreme length of the body posterior to the legs; the prominent anal lobes (Fig. 10) with the two or more long setae and several shorter hairs; the elongate mentum; the geniculated antennae, which are short and stout (Fig. 10d); the absence of eyes; and the 3-grouped glands (Fig. 10b).

The antennae are 5-segmented, joint 5 being long, and bearing 4 stout, falciform spines in addition to the normal hairs (Fig. 10d). Joint 3 is much longer than 2, usually twice the length.

The measurements of the antennal segments give the following range: —(1) 62-68; (2) 15-22; (3) 35-42; (4) 25-32; (5) 98-106.

The legs approximate :—

I.	52	85	180	58	85	27	105
II.	52	68?	180	51	102	27	115
III.	52	85	220	68	122	34	120

There are two long stout spines on tarsus II, and one on tarsus III, the other being replaced by a spine-like hair. Tarsal digitules are apparently absent.

The anal lobes are furnished with several (2 to 5) long setae and a few shorter hairs. The longest setae measure approximately $170\ \mu$; the shorter ones $95\ \mu$. Those of the anal ring are usually about $105\ \mu$ in length.

The dermis is characterized by (a) two pairs of "eye-shaped cicatrices" (Fig. 10a); (b) small pores, some of which have longer or shorter hairs (Fig. 10b); (c) large disc-like gland pores, which are chiefly confined to the dorsum (Fig. 10c), and (d) grouped glands, with 3 elongate pores pressed together, and presenting a propeller-like appearance (Fig. 10b). These 3-grouped glands appear to be widely scattered over the body-surface, but are probably in two transverse series across each segment, about 10 such gland-groups in each row.

This insect reminds one very much of *R. terrestris* (Newst.), but obviously differs in size. The chief microscopic differences are that the grouped glands are far more numerous in *africanus* than in *terrestris*; the antennae of the latter, as figured by Newstead (Monograph II, Plate lxix., Figs. 5, 5a) show the 3rd joint shorter, or equal in length with 2, while in *africanus* joint 3 is always much longer than 2. The stout spines which are so striking on the tibia and tarsus of *africanus* (Fig. 10e) are apparently absent in *terrestris*.

TRIBE PSEUDOCOCCINI.

GEN. NATALENSIA g. n. Type: *fulleri* sp. n.

Larva elongate, of the usual *Pseudococcus* type. Antennae six-segmented, terminal joint longest. Anal ring with six hairs. Caudal lobes moderately produced; each with one long seta and several shorter hairs and spines. Adult ♀ enclosed in a double-walled cyst of felt-like substance, the two layers of similar texture, readily separated. Cysts of type species subterranean, attached to roots of grass (Fig. 2).

♀ of type species broadly elliptical, flat beneath, convex above; antennae and legs present. Anterior and posterior segments in form of rectangular plates, anterior one with median rounded projection. Mouth-parts well developed but small. Anal ring large, with six hairs. Caudal lobes not produced, but represented by caudal setae.

This genus most nearly approaches *Cryptoripersia* Ckll., but from the formation of the cysts, and the characters of the adult ♀, it is certainly quite distinct.

4. NATALENSIA FULLERI sp. n.

(Plate XVI., Fig. 2. Plate XVII., Figs. 11-11*d*.)

Adult ♀ entirely enclosed in a double-walled cyst.

Cysts (Fig. 2): Outer cyst may attain 9 mm. long by 5 mm. broad, dark-coloured owing to adherent soil; brittle when dry. As only dry material has been observed by the writer the following description of colour, etc., may have to be modified later when fresh specimens are obtained.

Texture—after boiling in KOH for 30 minutes—tough, felt-like, nearly 1 mm. in thickness, dirty brown in colour. Fragments pressed on slide below coverglass in alcohol give one the impression of the texture being waxy, not definitely fibrous.

Inner cyst pale buff-coloured. This has the appearance of being more loosely constructed. The outer shape and size are those of the interior of the outer cyst, from which it separates readily. Larvae were found intermingled with the inner layers of this cyst-like ovisac.

Larva in boiling KOH, from dry material, dark brown, elongate, 0.6 mm. long and 0.25 mm. broad; legs long; antennae normal, of 6 segments, of which 6 is much longer than any of the others. Two is next, being about one-half the length of 6. Others subequal and shorter. Caudal extremity as illustrated (Fig. 11*b*).

♂: Not observed.

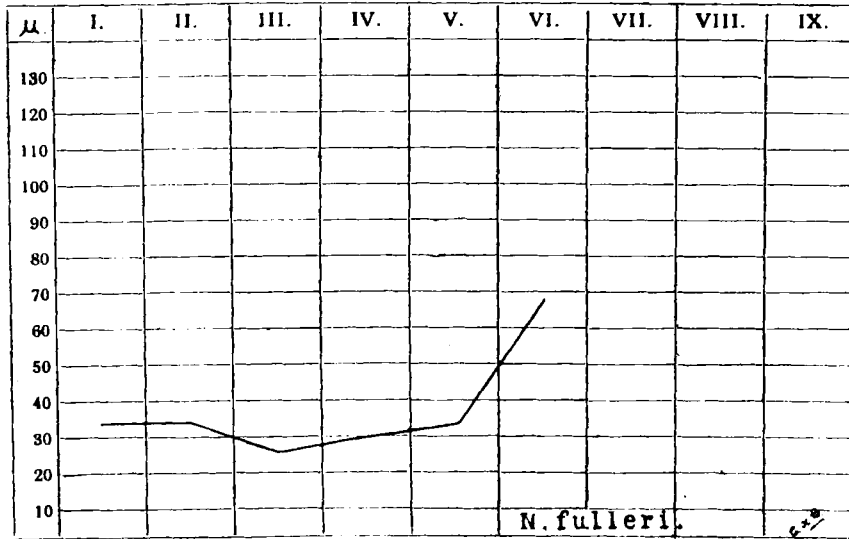
Adult ♀ (from dry material), after boiling in KOH dark brown in colour, broadly elliptical, 4 mm. long and 4.5 mm. broad, convex above and flat beneath. Segmentation very distinct. The anterior and posterior segments are rectangular and plate-like. In front the anterior segment is produced into a rounded cone, giving the insect the appearance of possessing a short rounded snout. The antennae project from below the sides of the snout as shown in the sketch (Fig. 11), which was kindly made with camera lucida by Mr. Claude Fuller.

Antennae of 6 segments, measurements in μ :—(1) 34; (2) 34; (3) 27; (4) 30; (5) 34; (6) 68.

The legs are comparatively small and delicately chitinized. They measure in the type:—

	Trochanter + Femur.		Tibia.		Tarsus + Claw.
	long.	broad.	long.	broad.	long.
I.	136	37	68	20	88
II.	122	34	85	20	72
III.	126	34	95	20	88

There are a few scattered spines at the margins, but no conspicuous gland-pores were seen. Anal ring with six bristles. Caudal lobes not produced, bearing several hairs of about same length as those of anal



ring. No long caudal setae present in the specimens studied, but such are easily displaced in working with dry material.

Collected on the roots of grass in the nests of a small red ant in the Botanic Gardens, Pietermaritzburg, Natal, by Mr. Claude Fuller, 1910.

Material examined included a number of cysts on roots, five adult ♀♀ and numerous larvae.

Collection No. : 43.

GEN. TYLOCOCCUS Newst.

Adult ♀ *Pseudococcus*-like except that the marginal spine areas are produced on ± rounded tubercles.

5. TYLOCOCCLUS CHRYSOCOMAE sp. n.

(Plate XVI., Fig. 5. Plate XVIII., Figs. 12-12f.)

Ovisac (Fig. 5): White, dense, elongate oval, may reach 5 mm. long and 2 mm. in diameter. The ovisacs may be single or clustered. The adult ♀ is found at one extremity of the ovisac and often appears as though partly enclosed owing to the median dorsal keel of white secretion.

Ova: Small, broadly oval, pale olivaceous yellow in colour.

Larva (mounted from dry material): Elongate, 0.4 mm. long. Antennae of 6 segments, 6 being longest, as long as 3 + 4 + 5 (Fig. 12e). Anal ring with six bristles. Caudal lobes very prominent, each bearing one long seta and two comparatively long stout spines (Fig. 12f).

♂: Not observed.

Adult ♀: Dark olivaceous at time of oviposition, becoming dark brown when ovisac is complete. Margins with a fringe of delicate filaments, and dorsum with a median keel of white secretion.

When cleared, stained, and mounted, the adult ♀ is 2 mm. to 2.5 mm. long. Around the margins of the body there is a series of 34 large rounded tubercles usually bearing 3 to 8 stout conical spines. In addition to these there are other series in which the tubercles are small or obsolete, their position being indicated by one or more stout spines. The median dorsal series of *insolitus* is represented, as a rule, by two single spines, separated slightly, on the median line, entirely without tubercles. The subdorsal series of *insolitus* is also represented by 1 to 3 spines, with tubercles either very small or entirely absent.

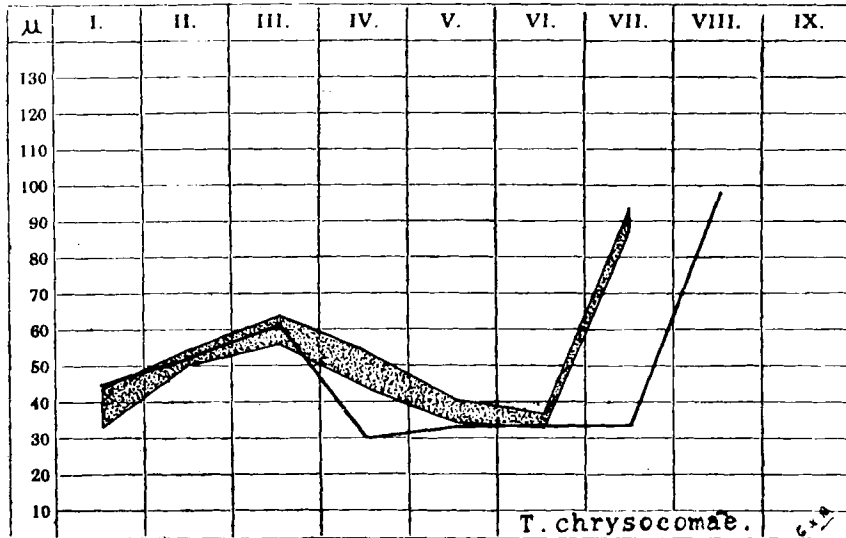
The posterior pair of marginal tubercles take the place of the caudal lobes of *Pseudococcus*. In addition to stout conical spines, of which there are usually 3 to 5, these tubercles bear the caudal setae which are about equal in length to those of the anal ring, i.e. about 90 μ long (Fig. 12b).

The eyes are prominent, roundly conical, with the apical portion transparent. Mentum about 132 μ long.

The dermis is characterized by numerous large and small gland-pores. The large form are disc-like, with very thick rings and small circular pores. These are most commonly distributed across the middle of the segments.

The antennae are remarkable in that there are forms with 7 joints, others with 8 joints, and a third class with 7 and 8 segmented forms in the same insect. The three classes are represented by adult ♀♀ with completed ovisacs. The measurements, however, are comparatively constant, the 7-jointed form ranging:—(1) 34-44 μ ; (2) 51-54 μ ; (3) 57-68 μ ; (4) 44-58 μ ; (5) 35-40 μ ; (6) 34 μ ; (7) 88-102 μ (Fig. 12).

The 8-jointed form measures approximately as follows:—(1) 44; (2) 52; (3) 61; (4) 30; (5) 34; (6) 34; (7) 34; (8) 98 μ .



Twenty-seven females were studied. Of these twenty-two had 7-segmented antennae, three had a 7-jointed antenna on one side and an 8-jointed form on the other, and two had 8-jointed antennae. In these cases the segmentation was quite distinct, not represented by a pseudo-articulation such as is often found in the antennae of *Pseudococcus* spp.

The legs are well developed, and measure in μ as follows:—

I.	68	108	245	61	190	30	112
II.	71	119	260	64	212	34	119
III.	71	119	275	61	238	34	122

A normal tarsus III is shown in Fig. 12c; the abnormal leg III from the same insect forms Fig. 12d.

Habitat: On stems of *Chrysocoma tenuifolia* Berg. Collected by Mr. C. P. Lounsbury, Tulbagh, C.P., December 20, 1906. Also on same plant at Grahamstown, C.P. Collected by Mr. A. Kelly, March 4, 1915.

Remarks: The material studied consists of numbers of dry ovisacs with ♀♀, ova, and larvae, and 27 adult ♀♀, cleared and stained (Tulbagh material). Also numerous ♀♀ with ovisacs and ova, and 4 adult ♀♀ cleared and mounted (Grahamstown material).

This is a very distinct species. The only other described insects belonging to the genus are:—*Tylococcus madagascariensis* Newst., *T. cycliger* (Leonardi), and *T. insolitus* (Green). A variety of *Pseudococcus stelli* sp. n. has been described under the name var. *tylococciformis* var. n. in this paper, but I am not yet decided as to exactly what relation it bears to that species.

Collection Nos. : 44 and 61.

6. TYLOCOCCLUS INSOLITUS (Green).

Phenacoccus insolitus Green, Mem. Dep. Agr. of India, II., 2, p. 26, 1908, Plate iii., Fig. 10.

Ovisac : White, elongate when complete, extending below and behind the adult ♀. In texture it is coarsely fibrous, composed of white cottony matter with coarse glassy filaments intermixed. Length when complete about 2 mm. ; width about 1 mm. ; upper surface slightly rounded.

Ova : Pale creamy or greenish-white ; slightly farinose, about 0.33 mm. long.

Larva : Pale yellowish or greenish-white in colour, with 4 distinct, large, black dorsal dots. Margin with fringe of delicate glassy filaments, which remind one of *Ps. virgatus* Ckll.

Freshly mounted in balsam 0.4 mm. long ; antennae 6-segmented. Marginal and dorsal tubercles conspicuous ; eyes distinct, with a small black mark below each. Anal ring large, with six hairs. Marginal glassy filaments arise from the stout spines of the rounded tubercles.

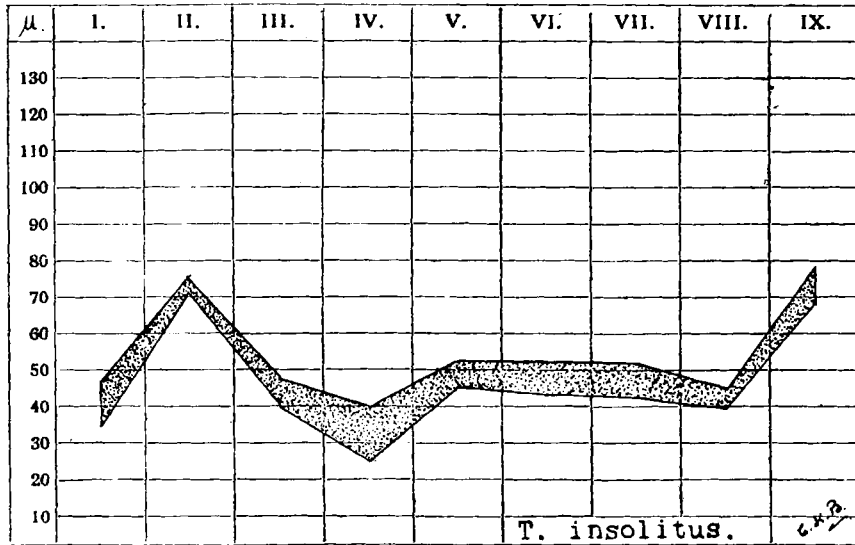
Adult ♀ : About 1.5 mm. long and 1 mm. broad, pale greenish-yellow with black dorsal markings. When seen under a pocket lens there is a central black dot, and usually five others surrounding this about half-way between the central spot and the margins. Two of these are towards the anterior end and three posterior. On the dorsum and margins are numbers of relatively stout glassy filaments. Examined under a low power it is seen that these filaments arise from rounded tubercles, and are secreted from stout conical spines, the number of filaments varies with the number of spines ; there are usually from four to twelve radiating from the same protuberance.

Instead of caudal filaments there are two comparatively short, dense, wide plates, more or less curved and compressed at the base, curving outwards, in some cases, like a vase. Insects when dead and rubbed dark purple-brown.

In boiling KOH the colour becomes brownish-red, but does not stain the liquid.

When cleared, stained, and mounted the insects average 2 mm. in length. The most striking feature is the presence of the numerous large

rounded protuberances, which are distributed as follows:—(a) Marginal tubercles thirty-four in number, seventeen on each side, the seventeenth or posterior pair bearing setae as well as stout spines. These take the place of the caudal lobes. (b) A median dorsal series of twelve tubercles extending over the whole dorsum, and not interrupted on the abdominal segments.* (c) A subdorsal series on each side about midway between the median and marginal series, each consisting of 10 tubercles, the



posterior two of the median series not represented. (d) On each of the three thoracic segments there are two further tubercles present, one on each side between the median and subdorsal series. The marginal series are the most prominent, being large, and rounded, and bearing on an average 10 very stout conical spines 30μ long. The number of spines varies from 5 to 12 on this series of tubercles, 6 or 7 being the most common number at the anterior end and 10 to 12 on the first abdominal segments. The other series are generally smaller, and possess fewer spines, the median and subdorsal series being most pronounced on the thoracic segments where 6 or 7 spines is the usual number. In all other cases 3 to 5 spines appear normal.

The dermis is characterized by (a) small gland-pores, few in number, some with subcutaneous tubes and others with bristle-like hairs; and (b)

* Although the description of *T. insolitus* states that "the median series absent on the abdominal segments" the figure l.c. Plate iii., Fig. 10, shows the distribution of tubercles exactly as in the South African insect.

large "disc" glands, most common in the abdominal region, where they are arranged in close order across the segments.

The antennae are 9-jointed, the range of measurements being:—
(1) 36–48; (2) 72–75; (3) 40–48; (4) 27–40; (5) 47–52; (6) 44–52;
(7) 44–52; (8) 40–45; (9) 68–78.

The mentum is normal, about 110 μ long. The eyes are comparatively large and conspicuous.

The legs approximate:—

I.	80	100	290	45	230	30	112
II.	85	105	300	60	245	35	120
III.	85	105	310	65	290	35	135

The tarsal digitules are slender hairs. Digitules of the claw slightly knobbed.

The setae of the anal lobes are about 140 μ long. In addition to the long setae each lobe bears a few shorter hairs and 4 or 5 stout conical spines. The setae of the anal ring are about as long as the long setae of the lobes (140 μ).

Habitat: On hibiscus, Kingwilliamstown, C.P. Coll. J. W. Hodgson, February 27, 1915.

Collection No.: 31.

GEN. PSEUDOCOCCUS Westw.

This genus comprises the well-known insects commonly known as "mealy-bugs." Their soft bodies are usually covered with a more or less dense coat of powdery secretion.

The shape of the body is generally elongate oval, and there are usually two short, rounded, caudal lobes which bear the caudal setae.

The antennae are 6- to 9-jointed, but 8 is the most common number.

As a rule the oviparous species construct a dense ovisac of white cottony material, whereas those which are viviparous make no such ovisac.

N.B.—The synonymy of this genus, as used in this paper, requires explanation, or rather justification, as it comprises forms generally included in the genus *Phenacoccus* Ckll., and encroaches upon the genus *Ripersia* Sign.

Pending further study, the results of which it is hoped to publish at a later date, a brief explanation will suffice.

I am quite convinced that the forms included by Mrs. Fernald (Catalogue, 1903) under the genera:—*Phenacoccus* (p. 89); *Ceroputo* (p. 94); *Tylococcus* (p. 95); *Trionymus* (p. 96); *Pseudococcus* (p. 96); *Erium* (p. 112); *Pseudoripersia* (p. 115); *Ripersiella* (p. 115); and *Ripersia* (p. 116) are closely related. In fact they probably represent a phylogenetic series originating in a form similar to *Ripersia* s. str. All

forms have the anal ring with 6 hairs and the caudal lobes \pm similar. The larvae of the whole series are of the same type and all have 6-jointed antennae.

Several lines of development are apparent in the series, but the most striking characteristic is illustrated by the acquisition of additional antennal segments in the adult ♀. For instance, in *Ripersia* s. str. the adult ♀ retains the original larval number, i.e. 6, but in *Phenacoccus* the adult ♀ has 9, the additional segments appearing with the ecdyses.

I have attempted to indicate the relationship between the genera by isolating them to form the tribe *Pseudococcini*.

Ripersia, *Pseudococcus*, and *Phenacoccus* are established on antennal characters; the remainder, which are the more modern genera, upon others. Strictly speaking the three first mentioned should retain their Signoret significance in which *Ripersia* Sign. has 6-jointed antennae; *Pseudococcus* Westw. (which replaces the "*Dactylopius* Costa" of Signoret) 8-jointed antennae; and *Phenacoccus* Ckll. (= "*Pseudococcus* Westw." of Signoret) 9-segmented antennae. This arrangement accommodated the insects known to Dr. Signoret very well, and the fact that there was no genus made for strictly 7-jointed forms was obviously due to the lack of the insects showing that character. Had this antennal form proved a satisfactory generic character the establishment of a genus to include those insects with 7-jointed antennae in the adult ♀ would have completed the series; and the separation of species into the four genera would have been extremely simple. In reality this could never be done with the *Pseudococcini*, for a number of different conditions influence the antennal character of the adult ♀, which must therefore be considered as an unstable character, and, as such, quite unsuitable to retain generic significance.

The majority of the species described in the genus *Ripersia* are reported from the nests of ants, and the genus has been extended to include insects with 7-jointed antennae as well as those with 6. Strangely enough other forms, with 7-jointed antennae, which are found on plants, are included in *Pseudococcus*. But the fact that insects are found below stones or in the nests of ants cannot have this influence, or else, on occasion, *P. citri* and *P. adonidum* must also be *Ripersia* spp., as they have been found in ants' nests in Massachusetts (King and Tinsley, Psyche, p. 297, 1898). If the genus *Ripersia* can be extended to include insects possessing 7-jointed antennae (because there is no special genus for the 7-jointed forms) can we still extend its bounds to include a form such as *Ps. transvaalensis* described later in this paper, which has adult females with 6-, 7-, or 8-jointed antennae?

Climatic or seasonal variations may have an effect on the antennal character of insects in this series. Thus, in *Ps. agrifoliae* Essig and *Ps. trifolii* Forbes we have two distinct generations, a summer form in which all the adult females have 8-jointed antennae, and a winter generation in which all the adult females have 7-jointed antennae. Again, in *Phenacoccus acericola* King, we apparently have a similar condition, the summer form being 9-jointed and the winter form with 8 segments. Obviously we cannot place the two generations in the last-mentioned case in two different genera (*Phenacoccus* and *Pseudococcus*).

I am inclined to associate the smaller number of antennal segments in these cases with retarded metabolism, as this is always found in the winter forms. Perhaps we can account for the new form of *Ps. citri*, which I describe later as var. *phenacocciformis* in a similar manner.

I repeat that the antennal condition in the *Pseudococcini* cannot retain generic significance and that other characters must be utilized. Throughout the whole tribe we must include in the same genus forms with 6- to 9-jointed antennae, or perhaps 6- to 10-, for *Ceroputo pilosellae* Šulc. has the antennae 9- or 10-jointed.

This must be applied to those genera which are founded upon other characters. For instance, in *Tylococcus* Newst., which is characterized by the presence of projecting marginal protuberances, the type (*T. madagascariensis* Newst.) has 8-jointed antennae,

but this genus must be extended to include *T. chrysocomae* sp.n. with 7 or 8, and *T. insolitus* (Green) which has 9. It is quite within the range of possibility that a 6-jointed form may be discovered. As a further instance we may note *Ceroputo* Šulc., which is characterized by waxy lamellae which cover the dorsum of the ♀ "like an *Orthezia*."

As already mentioned, the type species, *C. pilosellae* Šulc., has 9- or 10-jointed antennae in the adult ♀; *C. volynicus* Nassanow has 9, and *C. mexicanus* Ckll. 8.

SERIES A, WITH SEVEN-SEGMENTED ANTENNAE.

7. PSEUDOCOCCUS FILAMENTOSUS (Ckll.).

(Plate XVIII, Fig. 13.)

Dactylopius filamentosus Ckll., The Entom., xxvi., p. 268, 1893.

„ *vastator* Mask., N.Z. Trans., xxvii., p. 74, 1894.

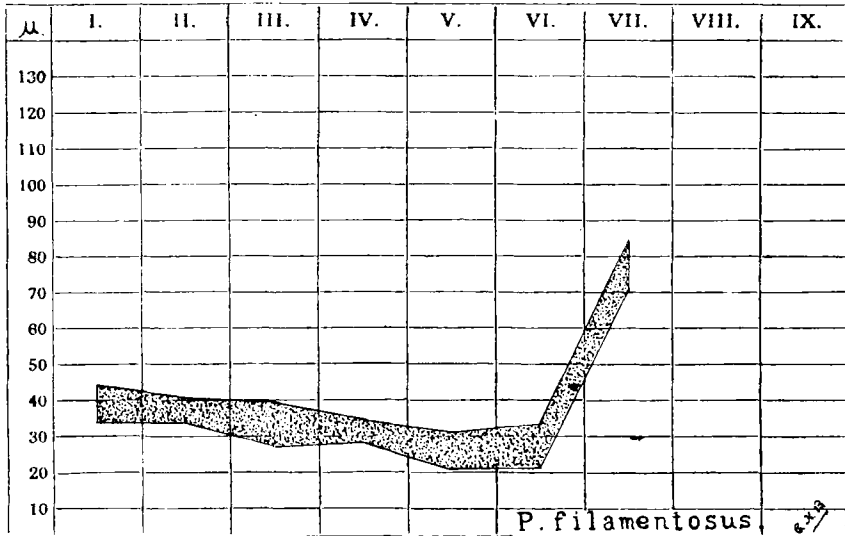
„ *filamentosus* Tins., Can. Ent., xxxii., p. 64, 1900.

„ *perniciosus* Newst. & Willcocks, Bull. Ent. Res. 1, 2, pp. 138-140, 1910.

My chart for this species is as follows:—

Adult ♀ : Size mounted may reach 4 mm.

Antennae : 7-segmented, range of measurements:—



Legs : Measurements in μ approximate:—

I.	57	88	170	54	78	27	81
II.	68	92	182	58	88	27	81
III.	68	102	195	61	108	34	81

The trochanter is normal (Fig. 13). Cf. *Ps. natalensis* (Fig. 14).

Mentum long (138 μ), acute (Fig. 13*a*).

Setae of anal lobes may reach 205 μ in length.

Setae of anal ring about 135 μ .

Host-plants: Citrus, *Grevillea robusta*, hibiscus, etc.

Habitat: Bathurst, C.P., Natal Coast, and Pretoria, T.P.

The records of this species in South Africa are:—On hibiscus from Richmond, Natal (U.S.D.A. Ent. Div. No. 7232). On orange from Natal (Cockerell); orange, Capetown (U.S.D.A. Ent. Div. No. 7706); Native tree, Sp. indet., Natal, Lounsbury, October, 1914; *Grevillea robusta*, Pretoria, Mr. K. Munro, November 9, 1914.

The Washington reference No. 7706 was in all probability recorded from Capetown because the material was sent from that town, but it is clearly recalled that it was collected in Bathurst (Lounsbury). The species has never become established in the Western Province of the Cape as far as I have been able to ascertain.

The most closely related South African species are *Ps. natalensis* and *Ps. solitarius* spp. n. q.v.

Collection No.: 57.

8. PSEUDOCOCCUS NATALENSIS sp. n.

(Plate XVIII., Figs. 14, 14*a*.)

Dactylopius filamentosus Ckll., "small variety," Entom., xxxiv., p. 224, 1901.

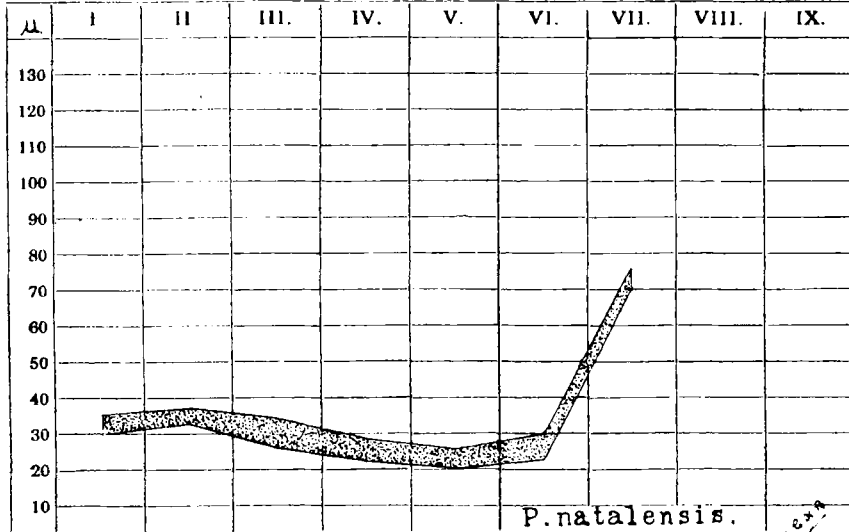
Ovisac: The ovisacs are long and narrow, and are clustered one above the other in the leaf-sheaths, often forming a row two inches in length. They are entirely closed, and have dense white walls of felted material, often roughened on the outside, and brittle when dry. They enclose the viviparous female and the larvae. It is remarkable for a truly viviparous mealy-bug to be enclosed in so dense a sac. The majority of the ♀ specimens mounted fresh by C. Fuller contain well-developed larvae.

♀. Not adult: 1.12 mm. long when mounted, has antennae 6-jointed measuring as follows:—(1) 34; (2) 34; (3) 34; (4) 18; (5) 20; (6) 68.

♀. Adult: In colour, both dry and in KOH this insect is like *filamentosus*. It also has 7-jointed antennae of very similar length, but apart from these points it is an entirely different insect. *Ps. filamentosus* Ckll. is much larger, constructs a large *cottony* ovisac which contains large numbers of eggs, but does not enclose the insect itself. But the most striking character of *natalensis* in mounted specimens is the remarkable trochanter, which is quite different from that of any other mealy-bug known to me. It is shoe-shaped and has a distinct conical protuberance, which bears a very strong, short, conical spine (Fig. 14).

Mounted specimens measure approximately 2 mm. long by 1.4 mm. broad.

The range of variation of the antennal segments is:—(1) 30–34; (2) 33–37; (3) 27–34; (4) 23–28; (5) 20–24; (6) 23–30; (7) 71–75.



The legs vary within the range indicated below:—

I.	35–44	68–72	150–164	38–42	90–102	24	75
II.	40–48	68–72	160–172	38–42	100–108	24	75
III.	46–52	70–80	174–184	38–42	105–136	24	84

Setae of anal lobe: May attain 154 μ in length.

Setae of anal ring: Average 105 μ in length.

The dermis shows single gland-pores, scattered short hairs, and marginal spines usually in groups of 2. The circum-anal region has comparatively large gland-pores which bear short subcutaneous tubes.

The mentum (Fig. 14a) is short (80 μ) and broadly conical.

♂: Of the usual *Pseudococcus* type, with 10-jointed antennae and four caudal bristles 22 mm. long. The specimens were mounted by C. Fuller in 1900, and no note was kept of living characteristics.

Length of body without antennae 0.75 mm.

Breadth across thorax 0.24 mm.

Length of wing 0.92 mm.

Length of antenna 0.6 mm.

Antennal segments approximate:—(1) 34; (2) 54; (3) 68; (4) 58; (5) 61; (6) 64; (7) 57; (8) 57; (9) 51; (10) 68.

All segments with the normal number of hairs.

Habitat: On grass at Tongaat (alt. 63 ft.) and also at Pietermaritzburg (alt. 2,200 ft.) Natal. Collected by Claude Fuller 1899 and 1900.

Collection No. : 64.

9. PSEUDOCOCCUS NIPAE (Maskell).

Dactylopius nipae Mask., N.Z. Trans., xxv., p. 230 (1892).

„ „ Newst., Ent. Mon. Mag., xxix., p. 187 (1893).

„ „ Mask., N.Z. Trans., xxvi., p. 88 (1893).

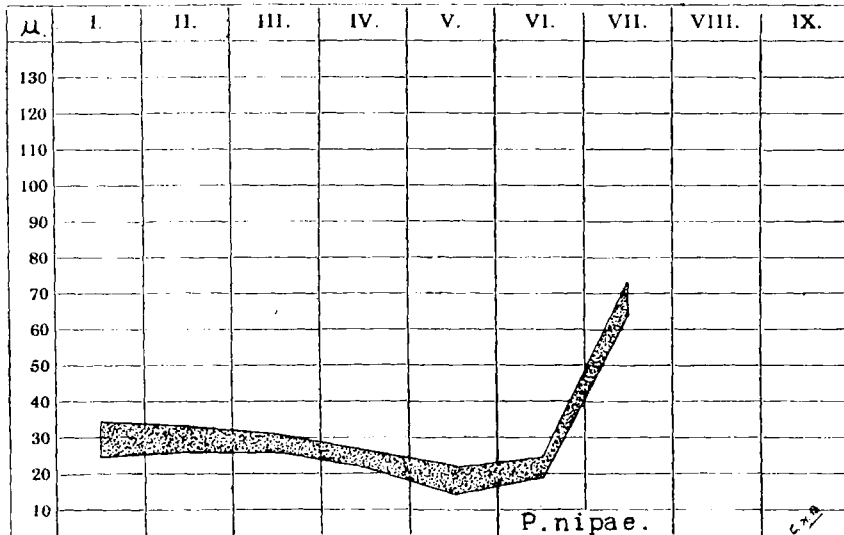
„ „ „ The Entom., xxvii., p. 45 (1894).

„ „ King, Can. Ent., xxxiv., p. 59 (1902).

Adult ♀ covered with conical masses of buff-coloured wax; hence commonly called “Spiny mealy-bug” in South African nurseries.

Size mounted about 1.5 mm. long and 1.2 mm. broad.

Antennae 7-segmented with range of measurements as indicated in diagram:—



The legs approximate:—

I.	35	67	136	40	70	24	61
II.	37	67	140	44	70	24	68
III.	36	67	152	51	75	24	68

The setae of the anal lobes may reach 75μ in length.

Those of the anal ring are about 100μ long.

Host-plants : Common on a variety of cultivated palms.

South African localities: Introduced into a nursery in the Cape Peninsula about 1906, probably from Belgium (A. E. Kelly). Now common also at Graaff Reinet (C.P.), Durban (Natal), and in Pretoria (Tr.)

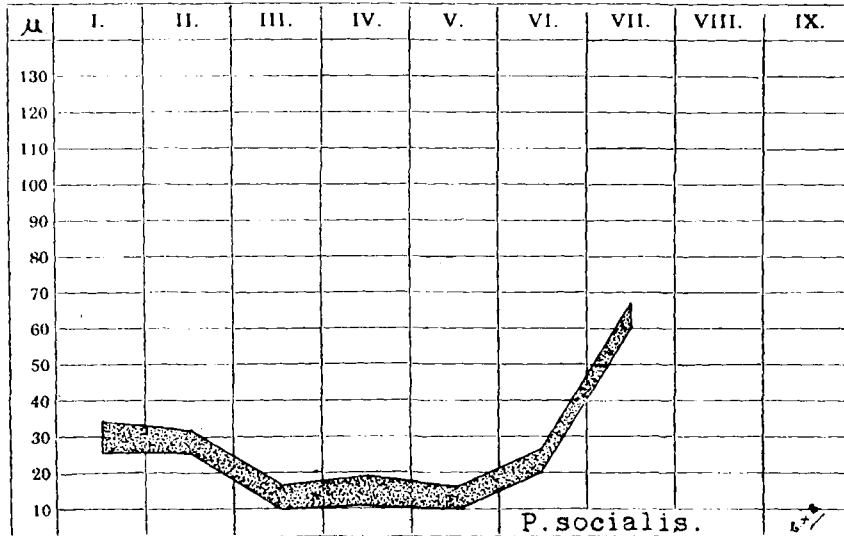
Collection No. : 58.

10. PSEUDOCOCCUS SOCIALIS sp. n.

(Plate XVIII., Fig. 15.)

Ovisac : An irregular mass of white cottony secretion, about 3 mm. in diameter, in the axil of a grass-leaf was found to cover numbers of ova and larvae, and also eight adult insects, all of which contained eggs.

The larva is of the usual type, but the caudal lobes are not produced. The antennae are comparatively long, of 6 segments, with 6 as long as $3 + 4 + 5$.



The adult ♀ is elongate, of a purplish-brown colour, the whole body being slightly powdered with white. There were no signs of lateral or caudal filaments. Below the cluster of insects there was a dense white layer of meal.

When placed into boiling KOH the insect turns black, then deep rich purple.

The average size of ♀ insects (containing ova) when mounted is 1.7 mm. long and 0.8 mm. broad.

The antennae are 7-segmented, the joints exhibiting the following range of variation:—(1) 27–34; (2) 27–31; (3) 10–17; (4) 11–19; (5) 10–17; (6) 20–27; (7) 61–65.

The eyes are comparatively small and inconspicuous.

The legs approximate:—

I.	34	51	120–136	30	71	17	58
II.	40	56	130–140	30	75	17	61
III.	40	56	140–154	34	90	17	68

The setae of the anal lobes may attain 112 μ in length; those of the anal ring average 82 μ .

The dermis is characterized by the usual gland-pores and a few scattered bristle-like hairs. The gland-pores of the venter are small and simple; those of the dorsum larger and disc-like (Fig. 15). There are no definite marginal gland areas.

Habitat: On grass in front of Union Buildings, Pretoria. Collected by the writer November 20, 1914.

Material studied consists of 8 adult ♀ ♀ and numerous larvae.

Collection No.: B 52.

11. PSEUDOCOCCUS SOLITARIUS sp. n.

(Plate XVIII., Fig. 16.)

Adult ♀ with ovisac: The adult ♀ before secreting the ovisac is active, but comes to rest on the stem of *Acacia*, either in the axil of a leaf or at the base of a short stem or thorn. Although as many as six insects have been found on the same twig, in no case have two been found forming their ovisacs at the same point.

At first a thin layer of cottony matter is secreted, and this increases in amount until it appears as a round or broadly oval disc below the insect. In a few instances the ♀ was situated towards the anterior end of the sac, so that the head was in contact with the twig and the ovisac protruded beneath and behind her. When completed the ovisac is usually spherical, nearly twice the width of the insect in diameter, with the ♀ on top. Occasionally the uppermost fibres of the sac partly or wholly enclose the ♀, but as a rule this is not the case.

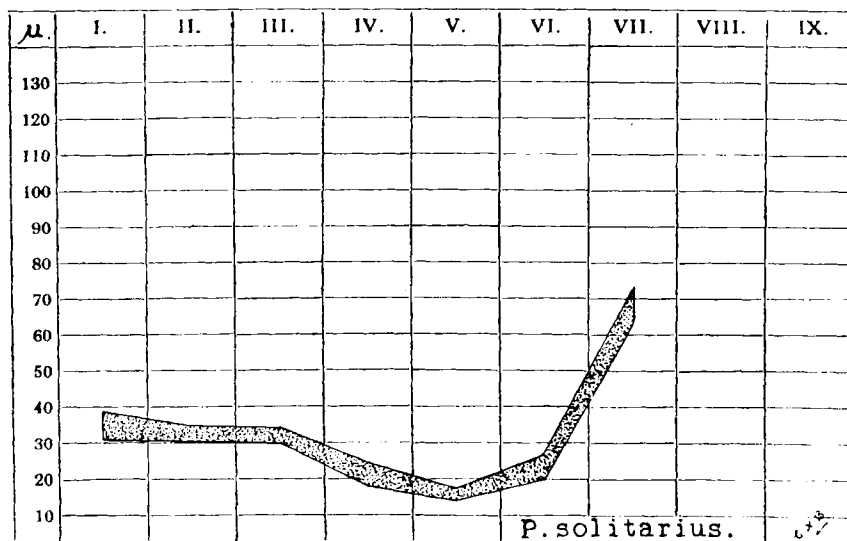
Ova: An exceptionally large number of ova are produced by the adult ♀. They are dark purplish-brown in colour, but turn black in boiling KOH.

Larva: Elongate, active, purplish in colour when alive, greenish when

mounted in Canada balsam, 0.51 mm. long, 0.21 mm. broad. Antenna with 6 segments, of which 6 is longest, being as long as 3 + 4 + 5. Segment 1 comparatively long; 2, 3, 4, 5 subequal. Anal ring with 6 hairs. Caudal lobes each with one long setae, which is about twice as long as those of the anal ring, and two slender spines.

Adult ♀: The dorsum of the ♀ is covered by a rather dense powdery secretion, usually white, occasionally yellowish. No lateral filaments observed, but in some cases two short caudal ones were present. The colour of the insect, as seen at the segments, or in old adults, is shining black. In boiling KOH the black colour is retained until the body is nearly cleared, when it has a decided green tint, and is exceedingly difficult to clear. In this it reminds one of *Ps. filamentosus* Ckll. The liquid is stained but very slightly, having a slight violet tint.

♀ Mounted, varies in size, but is most often about 3 to 3.5 mm. long and 1.8 to 2 mm. broad. The derm is clear and bears scattered solitary pores and a few scattered hairs in the anterior portions, and some spine-like bristles on the posterior segments. The antennae are 7-jointed, the segments measuring as follows:—(1) 32-38; (2) 30-34; (3) 30-34; (4) 18-23; (5) 17; (6) 20-27; (7) 64-72.



The legs measure in μ:—

I.	52	102	176	64	85	34	68 + 26
II.	58	108	187	64	88	34	68 + 26
III.	52	120	204	61	108	34	68 + 26

- Dactylopius avrilanatus* Mask., N.Z. Trans., xxix., p. 320, 1896.
 " " Frog., Dept. Ag. N.S.W., No. 175, p. 4, 1897.
 " " Full., 1st Rep. Ent. Natal, p. 105, 1901.
 Adult ♀: Size mounted about 2.5 mm.

Legs: Measurements in μ approximate:—

I.	70	68	185	40	112	27	85
II.	75	70	194	44	120	27	85
III.	75	75	208	44	136	27	85

The setae of the anal lobes are about 180 μ long; those of the anal ring 150 μ .

Host-plants: *Araucaria* spp., including *A. bidwelli*, *A. excelsa*, *A. brasiliiana*, *A. cooki*, and *A. cunninghami* (A. Kelly).

S.A. localities: Johannesburg and Pretoria (Tr.), Durban (Natal), and Graaff Reinet (C.P.).

Collection No.: 45.

14. PSEUDOCOCCUS BECHUANAE sp. n.

On December 4, 1914, mealy-bug material was received from Vryburg, Bechuanaland, accompanied by a letter stating that the insect was a great pest on geraniums.

The specimens had been badly shaken in the post, but it was clear that large patches of the stem had been completely covered with ovisacs. The white secretion appeared powdery rather than cottony.

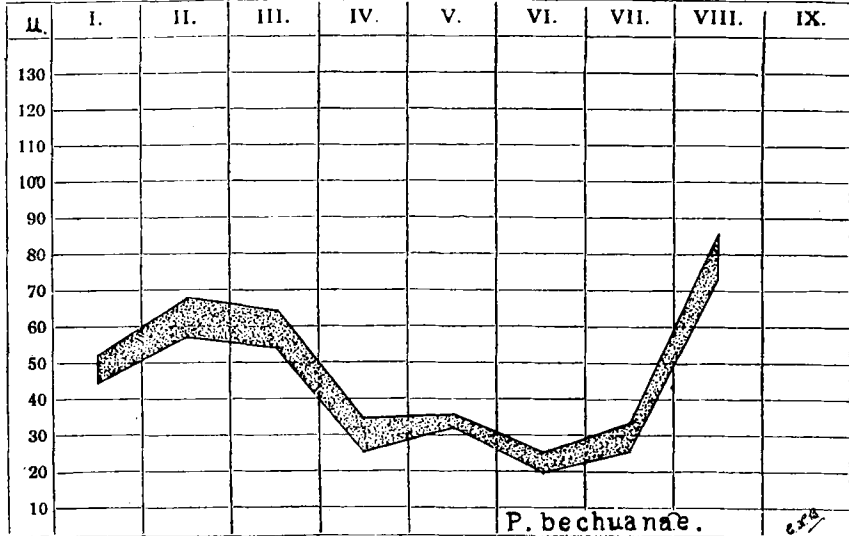
The females embedded in this were pinkish in colour when young, but purplish in older specimens. There were no lateral filaments, and only two short, blunt, caudal ones. The female when adult reaches approximately 3 mm. in length. In boiling NaOH the insect becomes very dark purple, almost black, while the liquid is stained but very slightly.

When cleared and mounted the most striking character is the absence of marginal spine areas, and the presence of scattered gland-pores of two sizes. The small ones are by far the more numerous; the larger ones have subcuticular tubes which are swollen inwardly. One of these always takes the place of the marginal spine areas, and there are often transverse lines of such across the middles of the segments.

The antennae are always 8-jointed, with 8 showing a pseudo-articulation in a few cases. The range of measurements of the segments is:—(1) 46–52; (2) 58–68; (3) 54–64; (4) 27–34; (5) 34; (6) 20–24; (7) 27–32; (8) 74–85.

The legs approximate :—

I.	68	100	248	61	185	34	85
II.	74	102	255	61	204	34	85
III.	78	102	275	61	238	34	85



The setae of the anal lobes are about 130 μ long; those of the anal ring average 95 μ in length.

Habitat : On geraniums, Vryburg, Bechuanaland. Collected by H. E. Sargent, December 3, 1914. Material studied consists of 12 adult ♀ ♀ .
Collection No. : B 53.

15. PSEUDOCOCCUS BROMELIAE (Bouché).

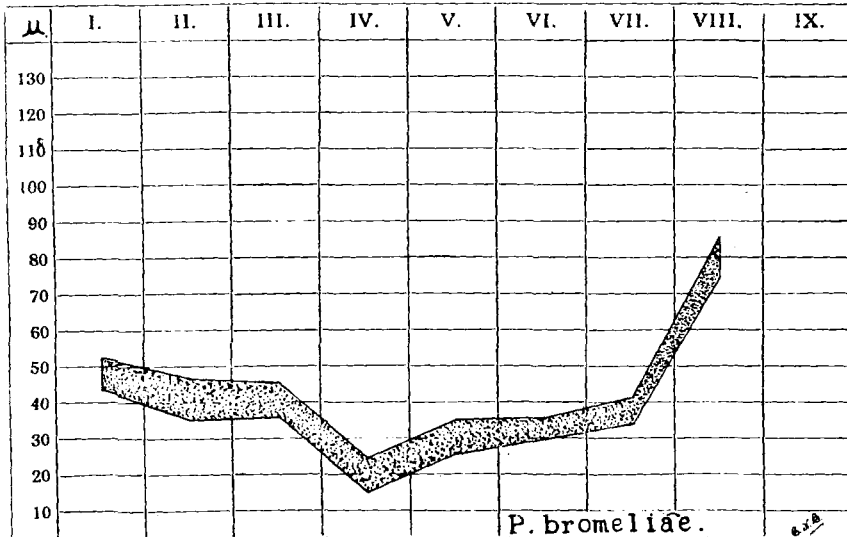
Lecanium bromeliae Bouché, Schadl. Gart. Ins., p. 49, 1833.
 „ „ „ Naturg. Ins., p. 20, 1834.
 „ „ Burm., Handb. Ent., i., p. 70, 1835.
 „ „ Curt. Gard., Chron., p. 131, 1841.
Aspidiotus „ Bouché, Stett. Ent. Zeit., v., p. 295, 1844.
Dactylopius „ Sign., Ann. Soc. Ent. Fr. (5), v., p. 310, 1875.
Lecanium „ Sign., Ann. Soc. Ent. Fr. (5), vi., p. 610, 1876.
Dactylopius theobromae Dougl., Ent. Mon. Mag., xxv., p. 317, 1889.
 „ *bromeliae* Mask., N.Z. Trans., xxvi., p. 88, 1893.
 „ „ Cotes, Ind. Mus. Notes, iii., No. 5, p. 51, 1894.
 „ „ Tryon, Queensland Agr. Journ., viii., p. 297, 1901.

I have no doubt that the common pineapple mealy-bug of the Eastern Cape Province and Natal belongs to this species, and the following measurements are included to assist in future determinations of the species:—

Specimens of adult ♀, mounted, average 2·75 mm. in length.

Adult ♀, viviparous, usually containing well-developed larvae when mounted. The larvae are 0·45 mm. in length, have 6-jointed antennae, and moderately produced caudal lobes. On the dorsal surface, between the position of legs III and the caudal lobes there are two large stomata-like pores (?) (“eye-shaped cicatrices”), which are also retained in the later stages.

The adult ♀ has 8-jointed antennae which range in size as follows (from 12 specimens):—(1) 45–52; (2) 36–47; (3) 37–44; (4) 17–23; (5) 27–35; (6) 30–34; (7) 34–41; (8) 75–85 μ .



The leg measurements approximate:—

I.	60	95	200	50	110	25	64 + claw
II.	64	100	210	54	110	25	66 + claw
III.	68	106	250	68	130	27	70 + claw

The mentum is distinctly segmented, and is about 150 μ long.

The setae of the anal lobes may attain 145 μ in length, but average 134 μ , while those of the anal ring are approximately 88 μ in length.

Regarding the antennae, Signoret, 1875, p. 310, gives the following particulars:—

“ Les antennes de la femelle mère sont de huit articles, quoique nous en ayons trouvé aussi de sept, mais l'état normal est huit. Dans ce cas, le deuxième et le troisième sont égaux et plus longs que les quatrième, cinquième, sixième et septième, qui sont les plus courts, et, dans ceux-ci, le septième est un peu plus long, le huitième le double plus long que le précédent et d'une longueur égale aux quatrième, cinquième et sixième réunis; la pubescens est rare et peu longue, celle des pattes au contraire assez longue.”

Maskell, 1893, pp. 88–89, writes:—

“ Antennae of eight joints, of which the second and third are equal, and longer than the fourth, fifth, sixth, or seventh; the eighth is about equal to the fourth, fifth, and sixth together; the hairs on the joints are short.”

In describing an insect found on *Theobroma cacao* in the gardens of the Royal Botanic Society (England) in April, 1889, Douglas, 1889, p. 317, describes the antennae in the following terms:—

“ Antennae short, of 8 joints (Fig.), 1st very stout, not short; 2nd and 3rd longer, in length subequal, strong, but each consecutively thinner; 4th shortest of all; 5th and 6th each a trifle longer than 4th, subequal; 7th a trifle longer than 6th; 8th pointed, longest of all, equal to 5th, 6th, and 7th together, all with fine projecting hairs, the terminal ones on 8th longest.”

Douglas named this species *Ps. theobromae*, but I think it was in all probability *Ps. bromeliae* (Bouché).

16. PSEUDOCOCCUS BURNERAE sp. n.

(Plate XVI., Fig. 3. Plate XVIII., Fig. 17. Plate XIX., Fig. 22.)

Adult ♀ ♀ with ovisacs usually aggregated in compact masses on the undersides of the leaves of the various host-plants (Fig. 3).

The ovisacs are white, cottony, generally more or less spherical when complete, but the exact contour often obscured by the crowding of many together. The adult female is generally visible on top of the ovisac, the sides of which are raised around the insect. It therefore looks as though it had been pushed into the soft cottony mass. In other cases the insect is found at one side of the ovisac, which protrudes behind and below it, giving a decided *Pulvinaria* effect.

Ova and larvae pale translucent brown at first; showing slightly purplish later.

Larva of the usual type, with 6-jointed antennae; joint 6 long.

Adult ♂ of the usual type.

Length of head and body 775 μ to 1 mm.

Length of wing 1 mm.

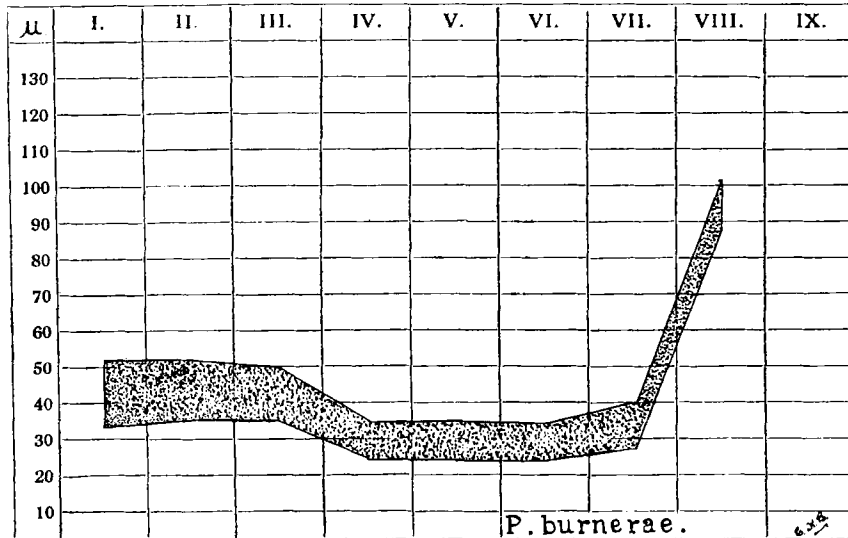
Length of caudal bristles 308 μ .

Antennae 10-segmented measuring as follows :—(1) 34; (2) 58; (3) 68; (4) 51; (5) 51; (6) 45; (7) 48; (8) 44; (9) 44; (10) 72.

The adult ♀ is so densely covered with white, powdery secretion that the general body-colour is entirely obscured. The colour impression conveyed, however, is grey—perhaps slightly purplish or brown. There is no median, dorsal, clear patch as in *citri*. All filaments are slender except the two caudal ones, which are more delicate than those of *citri*. The caudal filaments may attain one-third the length of the body. The lateral ones are similar to those of *capensis* in that they are shortest at the anterior end, and gradually increase in length towards the posterior extremity.

When mounted the adult ♀ is about 2.5 mm. long and 1.5 mm. broad.

The antennae are uniformly 8-segmented, the range presented from 25 measurements being :—(1) 34-52; (2) 36-52; (3) 36-50; (4) 24-35; (5) 24-36; (6) 24-34; (7) 28-40; (8) 88-102.



It may be of interest to record the variation in antennal range of measurements on three host-plants.

(a) On granadilla, collected December, 1914, in Pretoria :—(1) 40-52; (2) 44-52; (3) 44-50; (4) 27-34; (5) 32-36; (6) 27-34; (7) 35-40; (8) 92-102.

(b) On *Gleditschia*, Bloemfontein, October 22, 1914 (J. C. Faure):—(1) 37–45; (2) 36–44; (3) 40–47; (4) 24–30; (5) 27–34; (6) 27; (7) 30–34; (8) 90–96.

(c) On *Viburnum*, Lydenburg (Transvaal), March 9, 1914 (C. B. Hardenberg):—(1) 34–45; (2) 38–44; (3) 36–42; (4) 26–35; (5) 26–35; (6) 24–32; (7) 28–34; (8) 88–95.

The legs vary within the usual limits, but the following approximate measurements may be given as typical:—

I.	68	85	210	56	150	30	108
II.	74	94	230	64	170	30	115
III.	80	110	260	70	220	30	125

The marginal spine areas possess the usual two stout spines and a number of small gland-pores. These latter vary in number according to the position on the body, 6 to 8 being the usual number anterior to leg III.; 11 to 14 towards the posterior end (Fig. 22).

The dermis is characterized by small gland-pores scattered over the venter, many of which have slender subcuticular tubes; and large disc-like glands on the dorsum. There are also a few scattered hairs and spines.

The setae of the anal lobes are uniformly about twice the length of those of the anal ring, the most common lengths being roughly 200 μ and 100 μ respectively.

Habitat: On granadilla (*Passiflora edulis*), Pretoria, collected by D. Gunn, December, 1914.

Nerium oleander, Pretoria, collected by the writer September 23, 1914.

Sida rhombifolia and *S. longipes*, Pretoria, collected by C. Fuller, October, 1914.

Viburnum sp., Lydenburg (Transvaal), collected by Mr. C. B. Hardenberg, March 9, 1914.

Gleditschia sp., Bloemfontein, collected by J. C. Faure, October 22, 1914.

The Oleander material was remarkable for the large amount of honey-dew which covered the entire twigs, and for the "curled" effect which many of the leaves exhibited. I cannot say whether this distortion was due to the insects, but it certainly appeared that this was the case, for no curled leaves were found which did not harbour hundreds of the insects on their lower surface.

I have great pleasure in associating the name of Miss O. Burner, of New York, with this interesting species.

Collection Nos.: B 45, 47; B 50, 66, and 66a.

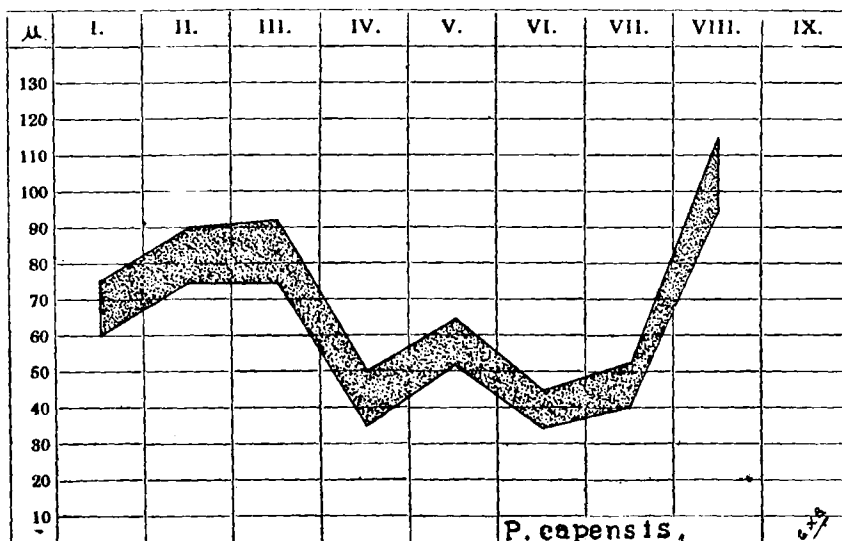
17. PSEUDOCOCCUS CAPENSIS Brain.

Ps. capensis Brain, Ann. Ent. Soc. Amer., v., 2, p. 182, 1912.

Adult ♀, usually appears distinctly brownish through the white secretion. The dorsal stripe of *citri* is absent and the insect generally appears more flattened. The lateral filaments are slender and increase in length towards the caudal end. Caudal ones may attain half the length of the insect.

Size, mounted, about 4 mm. long.

Antennal curve :—



Legs :—Measurements in μ approximate :—

I.	83	129	304	91	228	38	114
II.	98	129	327	91	258	38	121
III.	98	129	357	95	311	53	129

Setae of anal lobes :—About 152μ in length ; and setae of anal ring about 180μ long.

Since describing this species two years ago a number of new host-plants have been added to the list, chiefly through the energies of C. W. Mally, the Cape Entomologist. Up to the present time it has been determined by the writer on the following plants, all of which were collected in the Cape Peninsula or at Stellenbosch :—

Albizzia lophantha, *Anona* (custard apple), apple, *Cenia turbinata*

Pers., *Clematis vitalba*, croton, *Cryptostemma calendulaceum* R. Br., grape, lucerne (crowns of), *Malva parviflora*, *Mesembryanthemum edule*, *Oxalis cernua*, peach, pear, *Pelargonium* sp., *Phytolacca dioica*, pumpkins, red clover, *Richardia africana* (arum lily), *Rhus* sp. (between galls on), *Robinia pseudacacia*, *Rumex* sp., *Senebiera coronopus*, *Senecio vulgaris*, *Silene gallica*, *Solanum sodomaeum*, *Sonchus oleraceus*, Spanish sulla, and *Spergula arvensis*.

This insect is undoubtedly the worst pest the vine-growers in the Constantia Valley have to contend with at present, and will probably be one of the most difficult to combat. Mr. Mally is now working on fumigation methods for the species, but it is apparent that this will have to be accompanied by clean-culture methods. In July and August, 1914, *capensis* was found to be common on weeds, including *Sonchus*, *Spergula*, *Silene*, *Cenia*, and *Cryptostemma* mentioned above, in the same vineyard, and also on *Rhus* sp. in the adjoining bush, while only few insects were seen on the vines themselves. Mealy-bug was abundant in the grapes of this vineyard last season.

Collection Nos. : 49, 54, 67, 67a.

18. PSEUDOCOCCUS CITRI (Risso).

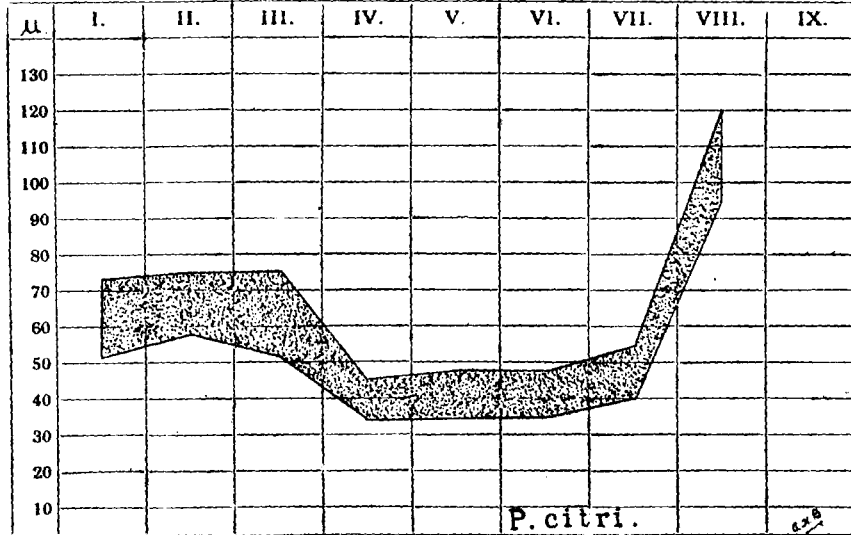
(Plate XX., Fig. 34.)

- Dortheisia citri* Risso, Essai Hist. Nat. des Orangers, 1813.
Dactylopius vitis Niediel, Bull. Soc. d'Acclim., p. 328, 1870.
D. alaterni Sign., Essai, p. 309, 1875.
D. citri Sign., p. 312. *D. ficus* Sign., p. 315.
D. indicus Sign., p. 317. *D. lavandulae* Sign., p. 318.
D. viburni Sign., p. 323.
Boisduvalia quadricaudata Sign., p. 339.
Lecanium phyllococcus Ashm., Can. Ent., xi., p. 160, 1879.
Dactylopius brevispinus Targ., Ann. di Agr., p. 137, 1881.
D. destructor Comst., Report, p. 342, 1881.
Ps. citri (Risso), Brain, Ann. Ent. Soc. Amer., v., p. 178, 1912.

Adult ♀ : The antennal range, constructed from 30 measurements, is illustrated on p. 116 for comparison.

The setae of the anal lobes are about 225 μ long; those of the anal ring average 115 μ .

This cosmopolitan species is found in all parts of South Africa, and it seems probable that it will, in time, spread to a number of our native plants. I have not yet been able to draw up a comprehensive host index



for the species, but have recently (October, 1914) received it on *Chaetachme aristata*, the "Umkovoti"-tree of Natal.

Collection No. : 48.

18a. PSEUDOCOCCUS CITRI var. PHENACOCIFORMIS var. n.

(Plate XIX., Fig. 28.)

Adult ♀ has the appearance of *Ps. citri*; the median dorsal stripe, secretion, and filaments as in that species.

The completed ovisac was in every case slightly covering the caudal extremity of the insect. Ovisac loosely constructed, cottony, irregularly oval in outline.

Antennae normally 9-segmented; one insect has its antennae 8-segmented, in one of which a distinct pseudo-articulation is visible.

Mounted specimens are about 3 mm. in length.

Range of measurement of antennal segments :—(1) 46-52; (2) 61-68; (3) 61-65; (4) 34-38; (5) 37-47; (6) 37-44; (7) 47-52; (8) 44-47; (9) 60-68.

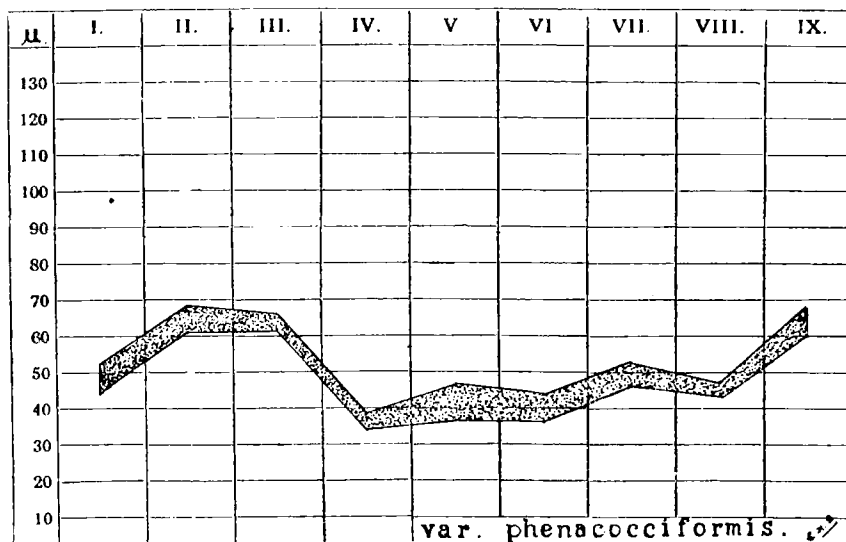
It will be observed that these measurements all fall within the range for *citri* including 8 + 9 for the terminal joint of that species.

The legs approximate :—

I.	74	120	272	58	190	30	120
II.	85	128	312	64	238	34	136
III.	85	128	340	64	276	34	136

The setae of the anal lobes average 250μ in length; those of the anal ring are about 138μ long.

On the ventral side the dermis has many small circular pores, some with bristles, and there are a number of scattered hairs; some of the latter, in the region of the antennae, are long. The dorsum has many



larger pores with a few smaller ones scattered irregularly. The marginal areas have two short stout spines and a number of small pores closely surrounding them.

Habitat: On *Bouvardia* sp. (Rubiaceae), Rosebank, C.P. Collected by C. P. van der Merwe, November, 1914.

Material studied consists of a number of ovisacs with ova and 5 ♀♀ mounted.

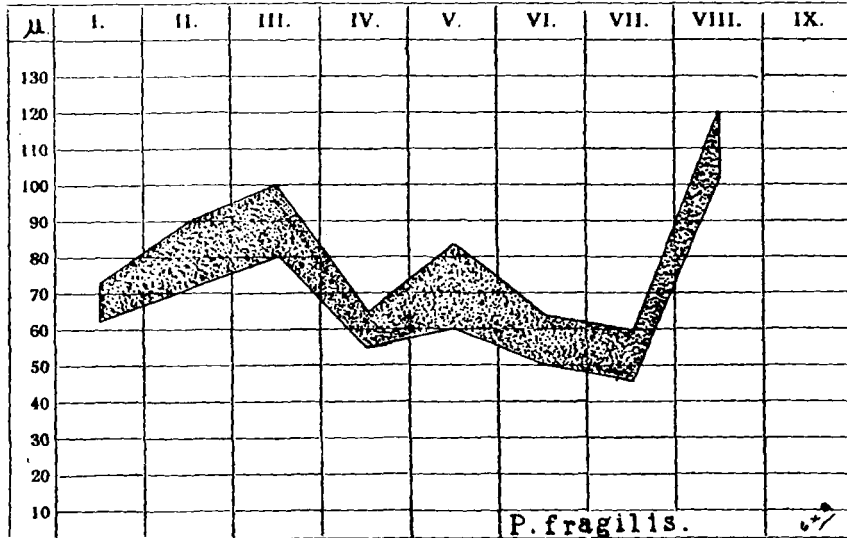
Collection No. : 35.

19. PSEUDOCOCCUS FRAGILIS Brain.

Ps. fragilis Brain, Ann. Ent. Soc. Amer., v., 2, p. 186, 1912.

Adult ♀ : Largest mounted specimen about 4 mm. long and 2.4 mm. broad.

Antennal range:—

Legs: Measurements in μ approximate:—

I.	121	167	364	106	250	38	136
II.	129	167	417	102	304	38	144
III.	129	170	432	106	342	45	144

Setae of anal lobes about 230 μ ; those of anal ring average 190 μ .

Host-plant: Citrus.

Locality: Only known from Constantia, C.P.

Collection No.: 51.

20. PSEUDOCOCCUS GRAMINIS (Mask.).

Dactylopius graminis Mask., N.Z. Trans., p. 36, 1891.

“Adult female enclosed in a sac of white felted secretion, aggregated in masses thickly covering stems of grass: the sacs are of irregularly elliptical form. Insect dark-purple, or almost black, globular, segmented: diameter about one-twentieth inch. Antennae of eight joints, the first seven subequal (the sixth perhaps shorter than the rest), the last as long as any two of the others, fusiform, and bearing a few hairs. Mentum trimerous. Feet slender; digitules all fine hairs. Anal tubercles very small and inconspicuous, each with a seta and two or three spines.

Anogenital ring with six hairs. Epidermis bearing a number of simple circular and small tubular spinnerets.

Larva and male not observed.

Habitat: On grass, Natal, South Africa."

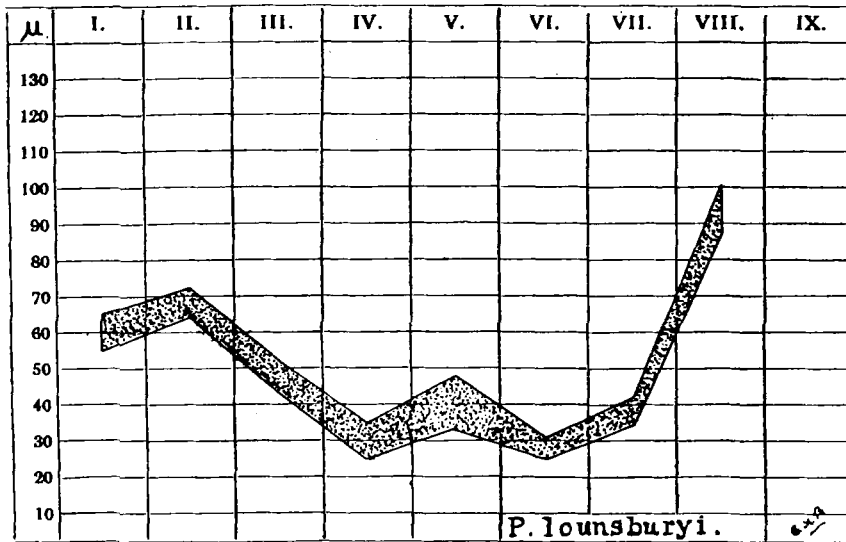
The above is Maskell's description. As far as I can ascertain the species has never again been discovered. At first I thought *Ps. natalensis* would prove to be this insect, but *natalensis* has 7-jointed antennae, and Maskell's illustrations show *graminis* to be quite distinctive in habit.

21. PSEUDOCOCCUS LOUNSBURYI Brain.

Ps. lounsburyi Brain, Ann. Ent. Soc. Amer., v., 2, pp. 179-182, 1912.

Adult ♀ (living), about 3.7 mm. long and 1.65 mm. broad.

Antennal range:—



Legs: Measurements in μ approximate:—

I.	83	129	281	76	190	38	106
II.	83	121	304	76	205	40	106
III.	90	129	334	79	243	48	121

Setae of anal lobes: To 160 μ in length; those of anal ring about 128 μ long.

Host-plant: *Agapanthus umbellatus* L'Hérit.

Locality: Cape Peninsula.

Remarks: This species was again collected by the writer in July, 1914, in the type locality. At that time it was not nearly so plentiful as when first collected in 1910.

Collection No.: 50.

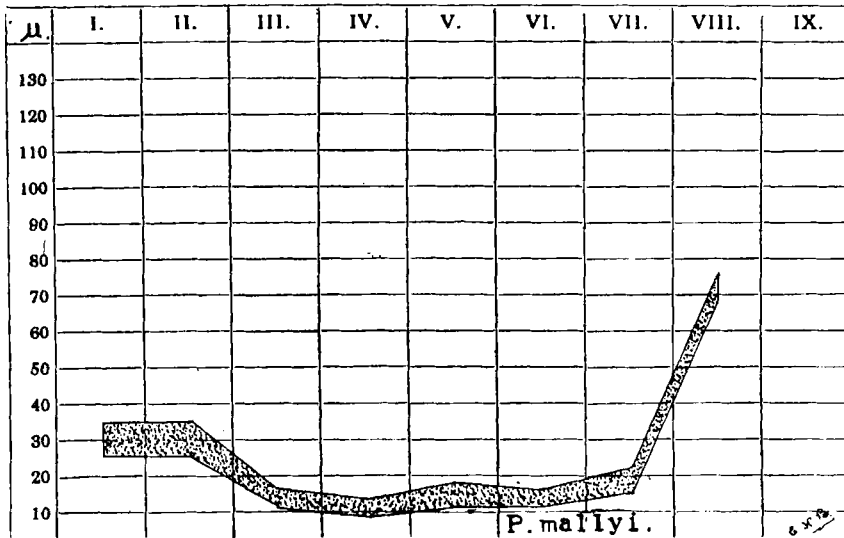
22. PSEUDOCOCCUS MALLYI sp. n.

Ovisac: No definite ovisac was seen, but adult ♀♀ and young were clustered in a white powdery secretion in the leaf-sheaths.

Adult ♀: The adult is bright rose-pink in colour, some specimens being uniformly covered with white powder. There were no traces of filaments of any kind. Legs and antennae colourless.

The insect is exceptionally long and narrow, mounted specimens averaging 2.16 mm. long by 0.75 mm. broad. The elongate appearance reminds one very much of a *Rhizoecus*.

The antennae are normally 8-segmented, with joints 3, 4, 5, and 6 very short. In one case joints 4 and 5 were fused. The range of variation in the antennal measurements from 14 specimens is as follows:—(1) 27-34; (2) 27-35; (3) 12-17; (4) 9-13; (5) 12-18; (6) 12-15; (7) 16-22; (8) 68-75.



The measurements of the antennae in which segments 4 and 5 had fused is:—(1) 27; (2) 30; (3) 13; (4) 20; (5) 13; (6) 17; (7) 74.

The legs approximate :—

I.	36	51	156	30	88	24	86
II.	38	54	156	34	108	24	95
III.	40	56	174	34	154	30	102

The setae of the anal lobes are approximately 142μ long ; those of the anal ring are 68μ in length.

Habitat : On grass (sp. indet.), Rosebank, C.P., November 25, 1914.

Material studied consists of 14 adult ♀♀ and young. I have great pleasure in associating the name of C. W. Mally, Entomologist of the Cape Province, with this species.

Collection No. : 32.

23. PSEUDOCOCCUS MIRABILIS sp. n.

(Plate XVIII., Fig. 18. Plate XIX., Fig. 23.)

A large quantity of mealy-bug material was collected on a spiny-leaved plant at Ceres, C.P., by Chas. P. Lounsbury, in October, 1898. This was stored in tins and envelopes, dry, and as no further collection of this species has been made, the following description is made entirely from dry material.

The ovisacs are creamy-white or slightly buff-coloured, and are aggregated on the leaf-cluster bases in conspicuous masses. Externally the sacs appear dense and smooth, but when disturbed they are seen to be made up of very fine cottony material.

The adult is apparently viviparous, from the fact that well-developed larvae are present in the mounted specimens (dry material).

When boiled in KOH the dried female turns a bright brown colour, and when fully distended is not more than 1.5 mm. long. Stained and mounted the adult ♀ is seen to have 8-jointed antennae ; but it is a very remarkable insect in the following particulars. The legs are short ; the dermis is very thickly covered with gland-pores, those of the dorsum being about twice as large as those of the venter ; many of the ventral pores are furnished with bristle-like hairs ; and the circum-anal region is quite unusual. The anal lobes are short and somewhat pointed, and bear the usual setae, several shorter hairs and two stout spines ; the anal ring is unlike that of any other mealy-bug known to me, as it is decidedly pointed posteriorly, with the posterior edges somewhat straightened and more heavily chitinized. The six bristles are situated on these thickened edges ; the anterior rounded arch is free (Fig. 18a).

The measurements are as follows :—

Antennal segments (Fig. 18) :—(1) 17-20 ; (2) 18-22 ; (3) 8-15 ; (4) 9-15 ; (5) 9-15 ; (6) 18-22 ; (7) 18-20 ; (8) 27-35.

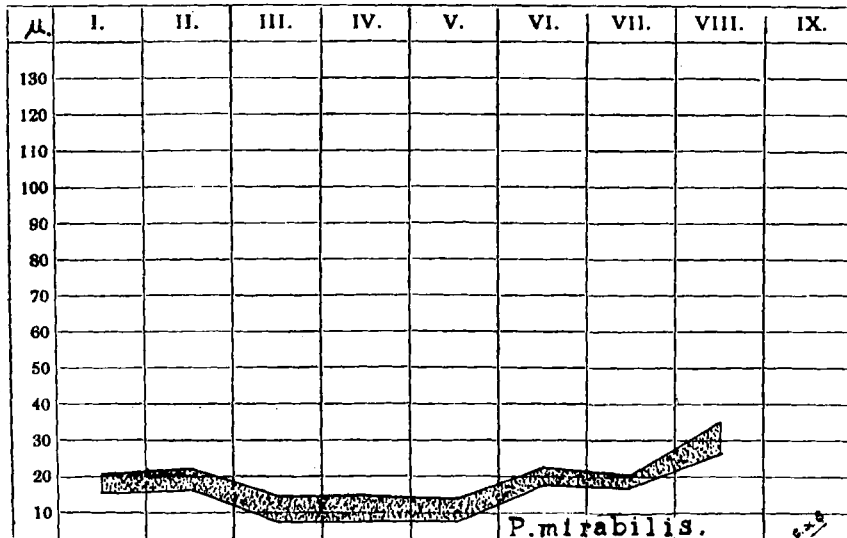
The legs in μ approximate:—

I.	30	51	88	30	51	18	51
II.	30	51	102	34	58	18	58
III.	35	51	122	38	85	24	68

The setae of the anal lobes are about 92μ long; those of the anal ring average 47μ in length.

Habitat: On spiny veld plant (*Borbonia cordata* Linn.), Ceres, C.P.
Collected by Chas. P. Lounsbury, October, 1898.

Species founded on dry material. 12 ♀♀ mounted.



Remarks: The waxy material adherent to the insects studied is quite different from the secretion generally found in the *Pseudococcini*. After boiling the specimens in a strong solution of KOH for fifteen minutes they were passed through the alcohols and stained by the magenta method, cleared in oil of cloves and mounted in Canada balsam. Every mounted specimen has some portion obscured by a more or less dense mass of waxy-looking material.

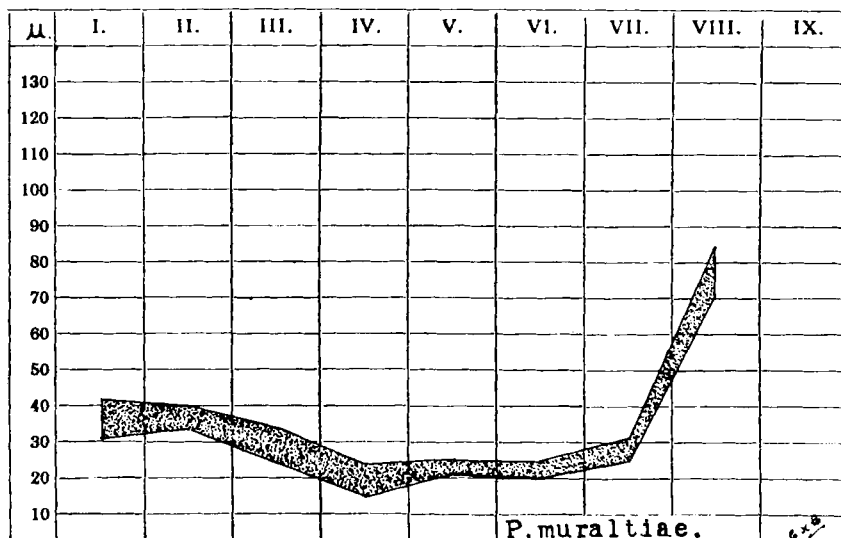
Collection No.: B 54.

24. PSEUDOCOCCUS MURALTIAE Brain.

Ps. muraltia Brain, Ann. Ent. Soc. Amer., v., 2, pp. 184-186, 1912.

Adult ♀: The largest specimen seen was 1.9 mm. long and 1.13 mm. broad.

Antennal range:—



Legs : Measurements in μ :—

I.	45	75	159	60	98	30	84
II.	45	76	170	60	98	30	98
III.	53	84	190	60	128	28	106

Setae of anal lobes : To 150 μ in length.

Setae of anal ring : To 120 μ in length.

Host-plant : *Muraltia heisteria*, D.C.

Locality : Cape Peninsula.

Collection No. : 52.

25. PSEUDOCOCCUS QUAESITUS sp. n.

(Plate XVIII., Fig. 19. Plate XIX., Fig. 24.)

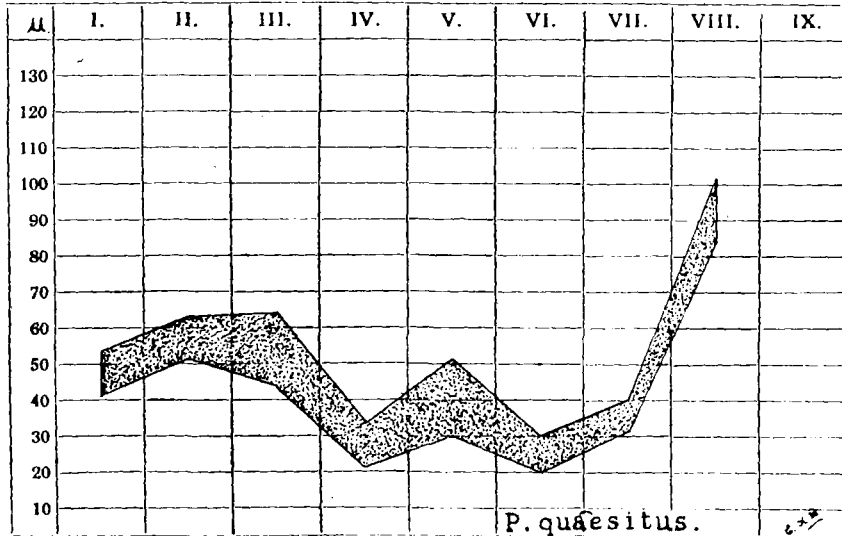
Ovisac : The ovisacs are often collected into masses which remind one of *Ps. filamentosus* Ckll., but present a pinkish tinge rather than yellow or greyish. Seen singly, as in cavities in tree-trunks, the ovisacs are usually more or less button-shaped, with straight vertical sides and a rounded top. The largest observed measured approximately 3 mm. in diameter.

Ova : Bright orange-yellow coloured, the mass showing pinkish.

Larva : 0.35 mm. long. At first orange-yellow in colour, later pinkish ;

of the usual type, with 6-jointed antennae. Eyes prominent, showing as black specks.

Adult ♀ may reach 4 mm. in length, pinkish coloured at first and later purplish, with dense, white, powdery secretion. Lateral filaments short and fragile. Caudal filaments two in number, stout, may attain one-third the length of the body. Colour in boiling KOH purplish. Clear and stained the derm has small pores with sharp spinose hairs scattered over the whole body. In addition there are in the circum-anal region numerous smaller gland-pores without spines, and scattered, single, large pores, about three times the diameter of the latter. On the venter of the antepenultimate segment in front of the caudal lobes are two long hairs ($120\ \mu$), one on each side.



Antennae: In a series of 24 mounted adult ♀ specimens all showed the eighth segment with a pseudo-articulation, but in no single case could the articulation be considered complete. The measurements of the segments are remarkably constant for the Pretoria material; the Grahams-town specimens have usually slightly longer segments. It should be mentioned that the first segment is hollowed out in an unusual manner, being much narrower on one edge than on the other (Fig. 19). Measurements of this segment might be given to range from $32\ \mu$ to $58\ \mu$, but that used is the middle measurement, i.e. that of the posterior margin.

Range of measurements of antennal segments:—(1) 42-54; (2) 52-63; (3) 44-64; (4) 22-34; (5) 30-51; (6) 20-30; (7) 32-40; (8) 85-102.

Legs : The measurements in μ for the legs approximate :—

I.	66	100	235	60	138	30	102
II.	68	108	256	75	173	34	105
III.	78	120	282	78	230	38	116

Setae of anal lobes may reach 240 μ in length.

Setae of anal ring may reach 132 μ in length.

σ : The σ puparia are apparently hidden amongst the clusters of ♀ ovisacs. A number of the latter were picked off and placed in a tube when collected on November 9th so as to obtain a quantity of larvae. By November 16th two males had emerged, and were mounted. They were of the usual type, with head and body brown in colour, but the whole insect was exceptionally densely powdered. They have two long caudal filaments, about as long as the head and body combined without the antennae. The measurements are as follows :—

Length of head and body 0.82 mm.

„ antennae 0.75 mm.

„ wing 0.6 mm.

Antenna 10-segmented :—(1) 30 ; (2) 64 ; (3) 84 ; (4) 40 ; (5) 44 ; (6) 44 ; (7) 40 ; (8) 40 ; (9) 40 ; (10) 47.

Habitat : On *Acacia caffra* and *A. robusta*, Pretoria District, collected by the writer, and on *A. horrida* Grahamstown, Cape Province, collected by C. P. Lounsbury, January, 1899.

Remarks : This species was first observed at Pretoria in September, 1914, when solitary females were observed scattered over the trees, often partly hidden beneath the ovisacs of *Ps. solitarius*. Specimens were collected and mounted, and the pseudo-articulation of the 8th segment was noticed, but as this was at the end of winter it was thought that this character was associated with the season. Some species, such as *Ps. trifolii* Forbes, and *Ps. agrifoliae* Essig, are known to have two distinct seasonal generations, the winter form with 7-jointed antennae, and the summer one with 8.

By the end of October, however, *Ps. solitarius* had almost disappeared, and large numbers of *Ps. quaesitus* were found aggregated at the bases of leaves and thorns, the clusters of ovisacs forming conspicuous masses. On November 9th many young had emerged and had collected at the bases of the leaf-stalks, their pink colour and collective habits reminding one of *Ps. sacchari* Ckll.

A week later an old acacia-tree was observed on one of the hills which surround Pretoria, in which were a number of holes, obviously from early wounds. The openings to these were nearly closed by rough bark and accumulations of resinous gum, but the vast numbers of ants entering and leaving the holes plainly showed the presence of some attraction. On

breaking away the bark and gum it was found that the whole edge of the cavity was lined with mealy-bugs and their ovisacs. These proved to be of this species. It was remarkable that although there were hundreds of female insects in the holes none were observed on the twigs of the tree itself.

Material studied: 24 ♀♀, 2 ♂♂, and numerous ova and larvae (Pretoria material), and 14 ♀♀ (Grahamstown material).

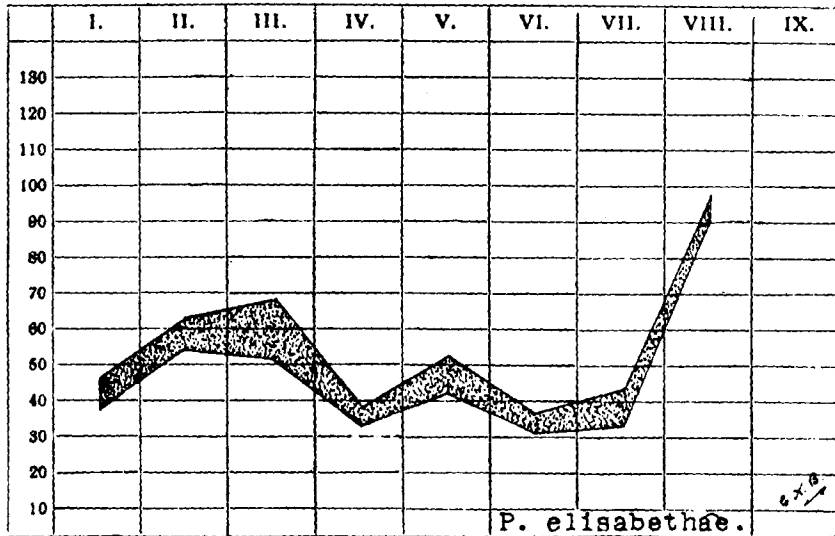
Collection Nos.: 60 and 63.

26. *PSEUDOCOCCUS ELISABETHAE* sp. n.

Ovisac: Loose, cottony, white, usually more or less spherical, sometimes slightly elongate; may attain 3 mm. in length.

Ova and larvae pale yellow.

Adult ♂ olivaceous-brown with opaque white wings. The two caudal filaments are white, slender, as long as the head and body together



without antennae. The measurements from a freshly mounted specimen are:—

Length of head plus body 0.8 mm.

„ antennae 0.6 mm.

„ wing 0.9 mm.

„ caudal setae 0.3 mm.

The antennae are 10-jointed, the approximate measurements of the

segments being:—(1) 44; (2) 68; (3) 85; (4) 68; (5) 58; (6) 68; (7) 58; (8) 58; (9) 68; (10) 58.

♀ (half-grown): About 1·3 mm. long, flesh-pink in colour, with very short lateral filaments and two short caudal ones, which in a few cases reached one-fourth the length of the body.

♀ adult; When living the ♀ is about 2 mm. long, and is pale brown to dark olivaceous-brown in colour. In boiling NaOH the colour changes to reddish-brown. The antennae are 8-jointed in the thirteen specimens studied, and present the following range of variation:—(1) 36–45; (2) 54–62; (3) 52–68; (4) 34–38; (5) 44–52; (6) 32–36; (7) 34–44; (8) 92–98.

The mentum is long and narrow; the eyes are small and inconspicuous.

The dermis has many gland-pores, which are all small. Many of these are supplied with hair-like spines, which are generally short in the posterior region, but long between the antennae. The lateral spine areas are normal, with two short conical spines and 6 to 10 small gland-pores. The legs approximate:—

I.	85	108	240	68	176	30	112
II.	85	120	265	68	220	30	125
III.	85	120	290	72	255	34	125

The tarsal digitules are clubbed hairs.

The setae of the anal lobes range from 170 to 210 μ ; those of the anal ring average 165 μ in length.

Habitat: On rhenosterbosch (*Elytropappus rhinocerotis* Less.). Collected at Newlands, C.P., January, 1915, by C. P. van der Merwe.

It gives me great pleasure to associate my mother's name with this species.

Collection No.: B 58.

27. PSEUDOCOCCUS SACCHARI (Ckll.).

Dactylopius sacchari Ckll., Jn. Trin. Nat. Club, ii., p. 195, 1895.

„ „ Green, Mem. Dept. Agr. India, II., i., p. 23, 1908.

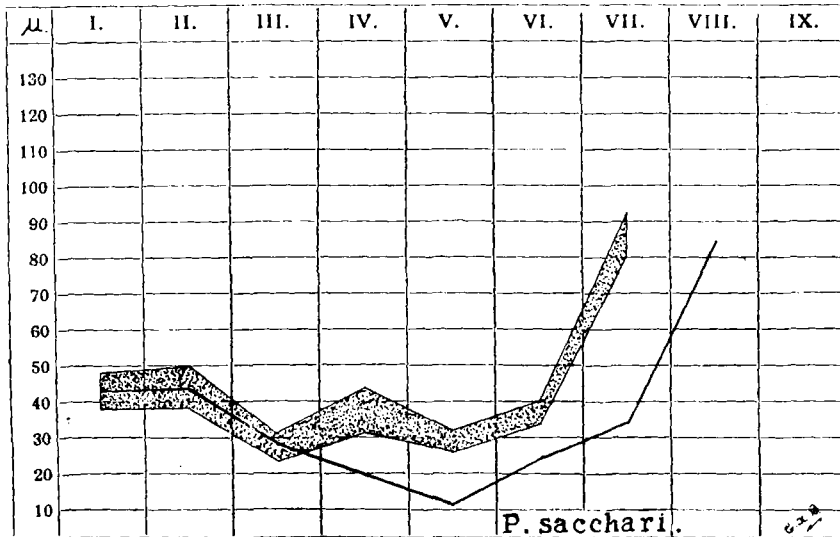
The mealy-bug which is so abundant in the sugar-cane of Natal is undoubtedly of this species. Specimens have also been received recently from Beira and Tzaneen (Tr.).

The original description by Prof. Cockerell was made from alcohol specimens, and the measurements given later, in 1899, were probably made from a limited number of females. The following details are therefore added to assist in future determination.

The living insects are clustered in the leaf-sheaths, twenty to thirty females and many young often being found at the same node. They are pink or flesh-pink in colour, sparingly powdered with coarse white meal. Some are entirely without lateral filaments; others possess them, but they are short. Caudal filaments are more commonly seen. The segmentation is distinct, and the posterior segments appear to be somewhat retracted, giving the insect a truncate appearance.

The average size of the female is about 4 mm. long, but two specimens collected by C. P. Lounsbury measured 6 mm. and 6.5 mm. respectively.

In mounted specimens the most striking characteristics are the com-



paratively short legs and antennae, the scattered (single) gland-pores, and the long hairs and setae of the posterior segments. The caudal tubercles are not produced, but each bears a long seta, which may reach 300 μ in length, and several shorter hairs. The 6 setae of the anal ring average 150 μ in length. On each side of the penultimate segment there is an area which simulates the caudal lobe, also bearing a long seta (280 μ) and several shorter hairs. The presence of this second pair of setae at once distinguishes this insect from any other yet known in South Africa, and is such a prominent characteristic that I think it could not have been present in the material examined by Prof. Cockerell. This could be accounted for by the fact that in mounting specimens from spirit material the coarse setae are often broken away. On the other hand, I may be dealing with

a different insect, but the other characters agree so well that I do not think this is the case.

The antennae are normally 7-jointed, but a very small percentage of the specimens have 8-jointed forms, while some individuals show 7- and 8-jointed forms together.

The range of variation for the normal form is as follows, from 25 insects :—(1) 38–48; (2) 38–50; (3) 24–31; (4) 32–44; (5) 27–32; (6) 34–40; (7) 80–92 μ .

The usual 8-jointed form approximates :—(1) 44; (2) 44; (3) 28; (4) 20; (5) 12; (6) 27; (7) 37; (8) 85 μ .

One specimen, apparently abnormal, had antennae which measured :—

R.	37	34	20	11	11	17	30	71 μ
L.	37	34	20	12	17	23	34	72 μ

The legs are comparatively constant, and measure approximately :—

I.	44	81	200	47	115	30	102
II.	48	98	220	51	128	32	102
III.	51	102	228	51	145	32	102

Setae of anal lobes : To 300 μ in length.

Setae of anal ring : To 154 μ in length.

Setae of penultimate segment to 288 μ long.

Collection Nos. : 59 and 59a.

28. PSEUDOCOCCUS TRANSVAALENSIS sp. n.

(Plate XIX., Fig. 25.)

Adult ♀♀ enclosed in elongate sacs attached to the roots of plants. In a few cases two females were found in the same sac.

Ovisacs elongate, white, more or less cottony, 3.5 mm. long and about 1.6 mm. broad, adherent to the roots to a depth of 15 to 18 inches in the soil.

Larvae : Yellowish in colour, of the usual type.

Adult ♀ : Purplish in colour, about 2 mm. long, with a slightly waxy secretory covering. When seen alive it is somewhat narrowed posteriorly, and has no lateral but two stout caudal filaments. The colour in boiling KOH is black and then violet. Cleared, stained, and mounted the insects average 2 mm. long by 1.5 mm. broad.

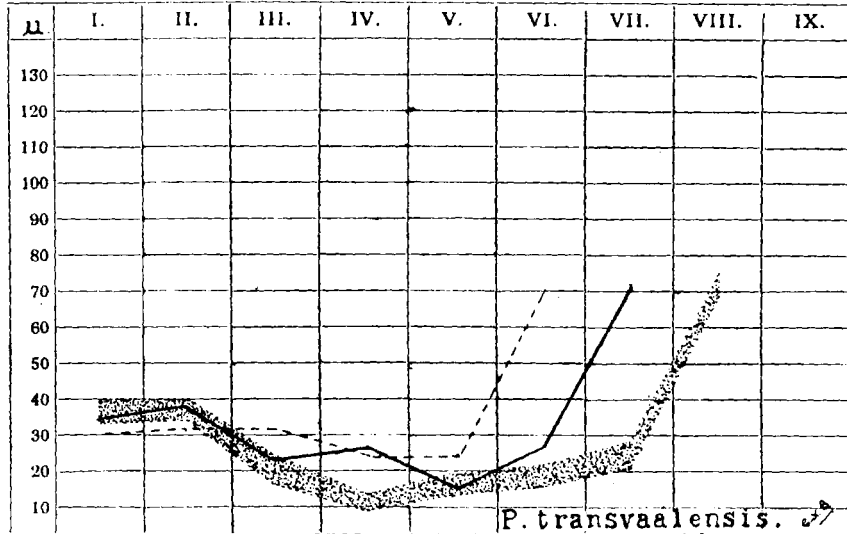
The antennae are normally 7- or 8-jointed, but occasional examples are found with 6-jointed forms, in which joints 3 and 4 are more or less fused.

The range of variation in the segments is as follows :—

(a) 8-jointed form :—(1) 34–40; (2) 35–40; (3) 17–24; (4) 9–13; (5) 13–18; (6) 17–22; (7) 22–28; (8) 68–75.

(b) 7-jointed form:—(1) 30-34; (2) 30-38; (3) 20-24; (4) 12-27; (5) 14-17; (6) 22-27; (7) (68-72).

(c) The 6-jointed form is generally:—(1) 30; (2) 32; (3) 32; (4) 25; (5) 25; (6) 70.



The legs measure approximately:—

I.	51	78	170	51	102	27	85
II.	54	85	177	54	106	27	85
III.	58	91	200	58	135	27	85

The eyes are exceptionally small and inconspicuous.

There are numerous small gland-pores scattered over the body, many of which are supplied with spine-like hairs. There are also larger circular pores which have no bristles. On the margin of each segment is a gland-pore area with usually two stout hairs like those of the caudal lobes, and also one broad subcutaneous "tube" (Fig. 25).

The setae of the anal lobes are from 120 μ to 150 μ in length; those of the anal ring 85 to 95 μ .

Habitat: On the roots of *Salvia runcinata* growing in front of Union Buildings, Pretoria; collected by the writer, October 8, 1914; on roots of aster in the office garden, October 13, 1914 (Claude Fuller), and on roots of cornflower, collected by Miss Impey, Sunnyside, Pretoria, December 28, 1914.

Material studied consists of 25 ♀ ♀, ova and larvae.

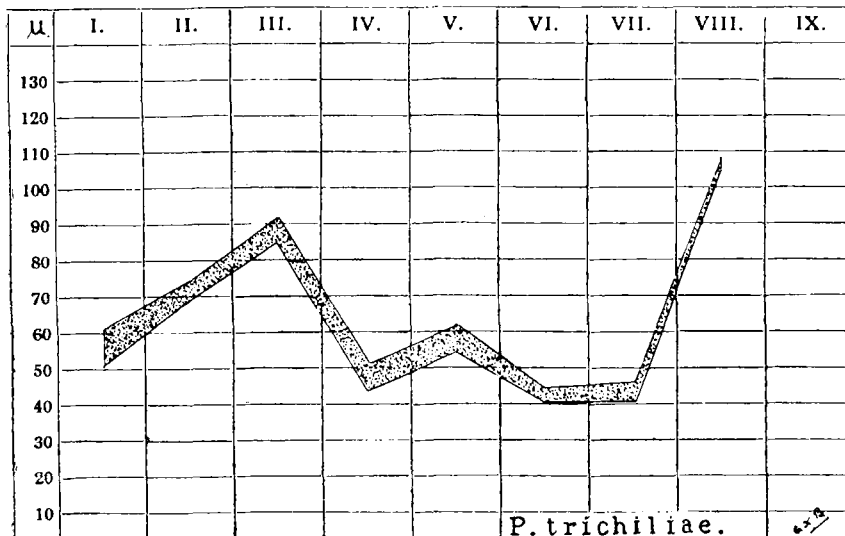
Collection Nos. : B 46, B 47, and B 47a.

29. PSEUDOCOCCUS TRICHILIAE sp. n.

(Plate XIX., Fig. 26.)

Adult ♀ spinning ovisac, approximately 4 mm. long, pale olivaceous in colour, uniformly covered with white meal. Lateral filaments absent. Caudal filaments 2; strong, white, about one-third the length of the body. In removing insects from ovisacs these are usually broken off, so that the majority appear to have no caudal filaments. Half-grown females usually have 4 to 6 caudal filaments, the two median ones longest and thickest.

Ovisac: The ovisac, when completed, is an elongate sac, which may attain 6 mm. long. It appears longer owing to the projection of the



anterior half of the insect in front. The posterior half of the ♀ is hidden by the ovisac which has parallel sides, is but slightly broader than the insect, and is broadly rounded behind. It is white and cottony, reminding one of the ovisac of a *Pulvinaria*.

Ova: The eggs are very pale yellow in colour, 0.31 mm. long by 0.15 mm. broad.

Larva: Elongate, active, pallid opaque, with comparatively long antennae. Length, 0.36 mm.; breadth, 0.18 mm. Antennae 6-jointed, with 6 longest and terminating in a distinct conical projection. Other segments subequal. Anal tubercles moderately produced, each with a long seta. Anal ring with the usual 6 hairs.

Adult ♀ : In boiling KOH the ♀ becomes light brown in colour, and the liquid after about five minutes' boiling is champagne-coloured. After fifteen minutes the liquid is clear with a distinct carmine tint, which is retained throughout the boiling.

The antennae are long, and comparatively slender, reminding one of *Ps. fragilis*, but those of the latter are even longer, and more slender.

The antennal segments of *Ps. trichiliae* vary within the following range:—(1) 51–61; (2) 68–74; (3) 85–91; (4) 44–51; (5) 54–61; (6) 41–44; (7) 41–47; (8) 108.

In 18 specimens all antennae fall into this series except one, which was obviously abnormal. Its measurements were:—(1) 61; (2) 68; (3) 85; (4) 47; (5) 61; (6) 34; (7) 58; (8) 78.

The conical apex of the terminal segment is in all cases very distinct. Hairs on antennae numerous, usual.

Legs : The measurements of the legs are also remarkably constant, showing only a slight range of variation. The approximate or average series may be stated:—

I.	120	130	320	85	248	40	120
II.	120	136	375	85	320	40	134
III.	125	150	405	85	355	50	150

The digitules of the tarsi are slender hairs; those of the claw terminate in large clubbed ends.

The dermis is transparent, but has a few single scattered gland-pores which are small, and scattered hairs. Between the antennae, on the dorsum, some of these hairs attain a length of 136 μ .

The eyes are small, conical, and appear to be exceptionally distant from, and posterior to, the insertion of the antennae.

The setae of the anal lobes and of the anal ring are, unfortunately, always bent in mounted specimens, again resembling *Ps. fragilis* in this characteristic, thus rendering their measurements difficult. The approximate lengths are:—

Setae of anal lobes : 270 μ long.

Setae of anal ring : 170 μ long.

♂ : Of the usual type, grey, with head and body darker, finely powdered. Caudal filaments two, nearly as long as insect without antennae, comparatively thick, white.

Length of head and body, 1.35 mm.; breadth across thorax, 0.38 mm.; length of antennae, 0.75 mm.; length of wing, 1.3 mm.

Antennae usual, of 10 segments, measuring:—(1) 51; (2) 71; (3) 120; (4) 88; (5) 74; (6) 71; (7) 71; (8) 68; (9) 68; (10) 81 μ .

All segments with numerous hairs.

Habitat: On *Trichilia* sp. (Meliaceae), Durban. Collected by Chas. P. Lounsbury, October 27, 1914.

On Silver-leaf tree (*Leucadendron argenteum* R. Br.) in Mr. Pillan's garden, Rosebank, Capetown, October 30, 1914. Collected by C. W. Mally.

Remarks: Senator F. G. Churchill, of Berea Park Road, Durban, wrote to Claude Fuller in November, 1913, regarding this species. He says: "My attention has been drawn to an insect blight on many of the large shady Umkuhlu-trees in the grounds and avenues in Durban—some trees looked as if seriously injured by it. It begins on the main trunk and works its way up and outwards to the young top shoots, which eventually become white with it." In the specimen I have before me the insects are clustered on the stems and flower-buds, the ovisacs forming large, conspicuous masses. Adults with ovisacs, ova and larvae are present (October 31, 1914). The larva of a coccinellid is present, but not in large numbers.

Fuller says the trees, when badly infested, are quite conspicuous, and that predaceous or parasitic insects must become numerous, for the serious infestation of the trees disappears, almost suddenly, about January.

Collection No.: B 51.

30. PSEUDOCOCCUS VIRGATUS (Ckll.).

(Plate XVI., Fig. 4.)

Dactylopius virgatus Ckll., The Entom., xxvi., p. 178, 1893.

" vars. *a, b, c, d* Ckll., The Entom., xxvi., p. 178, 1893.

" *ceriferus* Newst., Ind. Mus. Notes, iii., p. 24, 1895.

" *talini* Green, Ind. Mus. Notes, iv., No. 1, p. 7, 1896.

" *virgatus* Tins., Can. Ent., xxx., p. 22, 1898.

" " de Charmoy, Pr. Soc. Amic. Scien., p. 44, 1899.

Pseudococcus virgatus Kirkaldy, Fauna Haw., iii., 2, p. 103, 1902.

" " var. Ckll., Dav. Acad. Sci., x., p. 130, 1905.

" " *madagascariensis* Newst., Milleil. Zool. Mus. Berl., C. 2, p. 166, 1911.

The South African insect which is referred to this species was found in Natal by Claude Fuller on croton, citrus, iron weed (*Sida rhombifolia* Linn.), *Convolvulus* sp., and guava; and has recently been found by the writer on grass in Pretoria. When adult it is a striking insect owing to the dark subdorsal patches and the very long delicate filaments which adorn the body (Fig. 4). These filaments are shed and matted into a kind of nest, in which the insect sits while spinning the ovisac.

I was inclined at first to consider it as a distinct species, because no single description is adequate, but, considering the range of variation shown in other localities, and the possibility of an insect being spread with greenhouse plants, etc., I have decided rather to retain the South African form under *Ps. virgatus* Ckll., and give the measurements of legs, antennae, etc., in full, in the hope that some one who has access to a greater range of material—such as is at present in the Washington Collection—will compare the insects from different localities in detail.

In the original description of *Ps. virgatus* (Ckll.) the size of the adult ♀ is given as 4·5 mm.; var. *b* is 3·5 mm. long; var. *d* “2 mm.—not adult”; *Ps. virgatus madagascariensis* Newstead is said to be “considerably longer and broader than typical examples of *Ps. virgatus* (Ckll.)”. The South African forms are 3 to 3·5 mm. in length, i.e. identical in size with *D. ceriferus* Newst. The size is not given for *D. talini* Green (*loc. cit.*).

The references to the mealy secretion vary, but this is readily understood as the young females are lighter in colour and do not exhibit the submedian dark patches and the character of the delicate filaments and also of the caudal, waxy projections vary according to whether the insect is in a sheltered position or not. They are also easily dislodged in packing. It would be quite impossible to determine the character of these appendages from spirit material.

The dermal characteristics are not always described, so comparison is impossible, but the “circular spinnerets” mentioned by Prof. Newstead in his *Ps. ceriferus* and *Ps. virgatus madagascariensis* are present in the South African specimens.

The antennal measurements are given in μ as follows:—

Tinsley in the Canadian Entomologist, vol. xxx., 1898, p. 222, gives measurements of type material from Jamaica:—(1) 45–60; (2) 55–80; (3) 85–95; (4) 45–55; (5) 50–65; (6) 55–60; (7) 53; (8) 115–120. Ceylon material:—(1) 59–65; (2) 67–76; (3) 90–104; (4) 53–57; (5) 53–65; (6) 51–62; (7) 56–62; (8) 120–127. Mexican material:—Mr. Tinsley writes: “I have also recently examined specimens from Mexico, and find them to fall between the Jamaica and Ceylon specimens in size. It will be noticed that the Ceylon specimens are longer than those from Jamaica.”

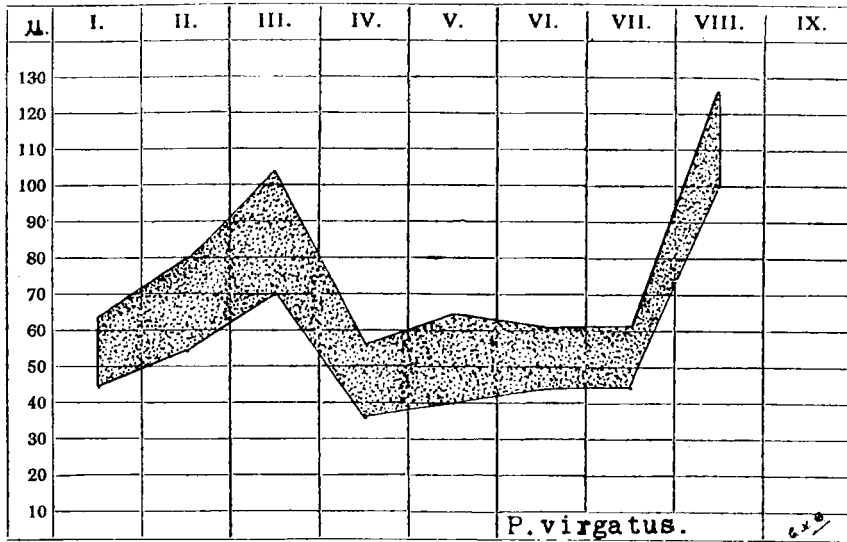
In the description of *Ps. virgatus* var. (Davenport, Academy of Science, x., p. 130, 1905) Cockerell gives the following antennal measurements:—(1) 50; (2) 63–65; (3) 70–72; (4) 37–42; (5) 40–45; (6) 43–47; (7) 45–47; (8) 100.

The South African specimens vary between the limits:—(1) 51–61; (2) 64–74; (3) 71–85; (4) 37–51; (5) 44–58; (6) 44–54; (7) 48–54; (8) 108–120.

It will be observed that this material most nearly approaches the

Phillipine specimens when considered from the standpoint of antennae.

Range from four series, viz. Jamaica, Ceylon, Philippines, and South Africa:—(1) 45-65; (2) 55-80; (3) 70-104; (4) 37-57; (5) 40-65; (6) 43-62; (7) 45-62; (8) 100-127.



Cockerell (1905, *loc. cit.*) gives some measurements of the anterior leg of his variety, but, unfortunately, the mesothoracic and metathoracic legs are not dealt with.

Tinsley (*loc. cit.*) merely mentions that the "legs agree perfectly with the published description." The measurements mentioned above, given by Prof. Cockerell, are as follows:—"Anterior leg with femur and trochanter 292 μ long, tibia 212, tarsus 89; claw rather long, simple."

The South African material is approximately:—

I.	115	136	350	85	245	43	136
II.	118	150	380	88	275	34	136
III.	150	158	440	80	340	34	136

The setae of the anal lobes average 270 μ long; those of the anal ring are about 170 μ in length (S.A. material).

I should mention that the spinnerets and their "tubes" in this material agree with the description given by Prof. Newstead in his var. *madagascariensis*. The tubes are visible only in stained preparations.

The ♂ is of the usual type; the antennae of my specimens agree with those described by Prof. Cockerell in the original description.

If I am correct in uniting all the forms mentioned above, the distribution of the species will be as follows:—

Jamaica: On tree? On *Prosopis juliflora*, *Acalypha*, *Anona*, *Trichulus cistodes*, cotton, violets, *Colocasia esculenta*, cocoanut palm, etc.

India (*ceriferus*): On croton and leaves of trees.

Ceylon (*talini*): On talinum, liliun, and croton.

Lucban, Tayabas, Philippines: On cultivated croton.

Madagascar: "On an unknown plant."

Mauritius: On "*Leucoena glauca*."

Hawaii: On (?)

Natal: On croton, citrus, *Sida rhombifolia* Linn., *Convolvulus* sp., and guava (Fuller).

Pretoria: On grass (C.K.B.).

I was surprised to find this species on grass in front of the Union Buildings. There is a nursery within 200 yards of the spot, and I think it may have escaped from crotons or other plants, although, as far as I can ascertain, the insect has not been recorded from Pretoria before.

In connection with this species I should mention an interesting observation made by C. Fuller while Entomologist of Natal. He has on many occasions observed the adults of the large Cetoniid *Macroma cognata* devouring this mealy-bug and the common soft scale *Coccus hesperidum*. He mentioned this in his First Report from Natal (p. 43, 1901), and assures me he has seen it repeatedly since that time.

Collection No.: 68.

31. PSEUDOCOCCUS WACHENDORFIAE Brain.

Ps. wachendorfia Brain, Ann. Ent. Soc. Amer., v., 2, pp. 183-184, 1912.

Adult ♀, living, may attain 4.1 mm. long and 1.9 mm. in breadth.

Legs: Measurements in μ approximate:—

I.	91	121	334	83	212	42	91
II.	106	136	342	91	235	45	98
III.	129	152	364	91	281	54	114

Setae of anal lobes: To 180 μ in length.

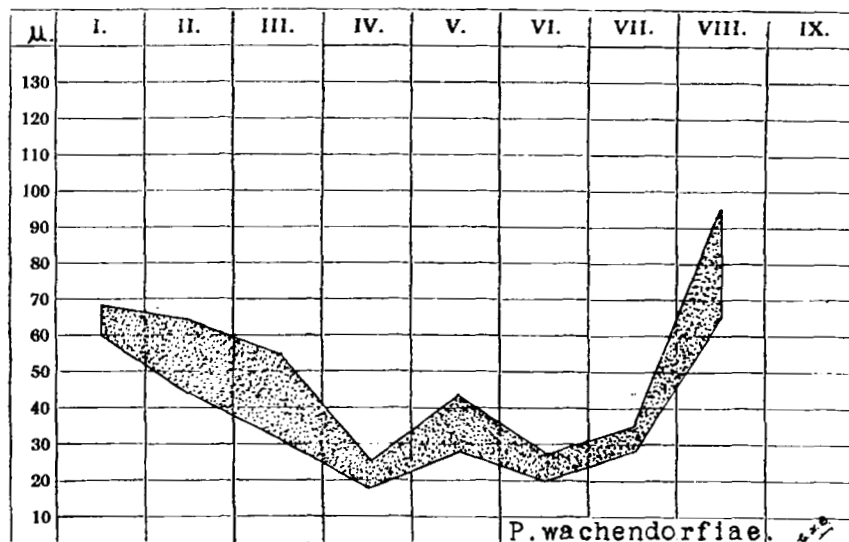
Setae of anal ring: To 144 μ in length.

Host-plant: *Wachendorfia paniculata* Linn.

Locality: Cape Peninsula.

Collection No.: 53.

Antennal range :—



SERIES C, WITH NINE-SEGMENTED ANTENNAE.

32. PSEUDOCOCCUS BANTU sp. n.

(Plate XIX., Fig. 27.)

Ovisac: Large clusters of irregular white ovisacs were found at the bases of the leaves and on the crowns of grass.

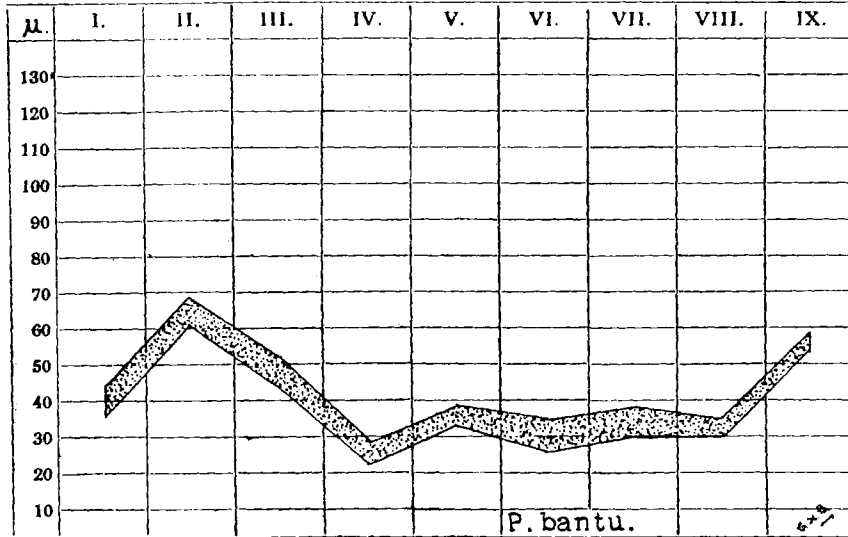
Ova and larvae: Pallid to cream-coloured.

Adult ♀: Small, orange in colour, with a very slight covering of powdery secretion, but without lateral or caudal filaments. In boiling KOH the colour turns pale brown, then yellow, while the liquid remains colourless.

The dermis is characterized by the regularity of the scattered gland-pores. Those of the dorsum are large and disc-like: the ventral pores are small; a few with spinose hairs. The marginal areas have but few additional pores surrounding the two slender spines (Fig. 27).

Mounted specimens average 2.3 mm. long by 1.8 mm. broad.

The antennal segments measure:—(1) 37-44; (2) 61-68; (3) 44-52; (4) 24-28; (5) 34-38; (6) 27-35; (7) 30-38; (8) 30-35; (9) 54-58.



Between the antennae, on the ventral side, are two long hairs, about 100μ long.

The eyes are prominent and retain the stain.

The legs approximate :—

I.	85	102	230	58	170	34	108
II.	85	102	240	62	204	34	108
III.	85	102	290	85	235	51	122

The setae of the anal lobes are about 170μ long ; those of the anal ring average 120μ in length.

Habitat : On crowns of grass (sp. indet.), Pietermaritzburg, Natal. Collected by A. Kelly, November, 1914.

Material studied consists of large numbers of ovisacs, ova and larvae, and 11 adult ♀♀ stained and mounted.

Collection No. : 34.

33. PSEUDOCOCCUS CAFFRA sp. n.

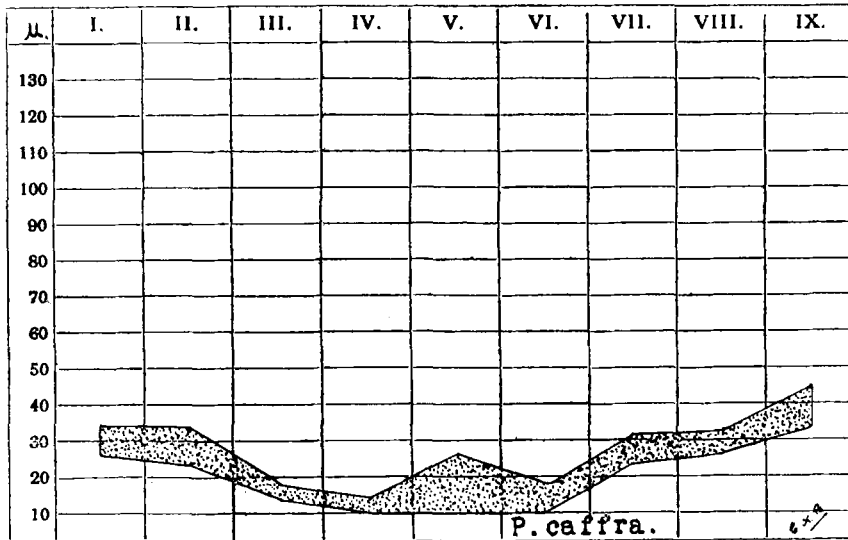
(Plate XIX., Fig. 29.)

On November 6, 1914, C. P. van der Merwe sent a few specimen mealy-bugs on grass from Rosebank, C.P. These insects were in the leaf-sheaths and appeared to have made elongate ovisacs which had been crushed or broken in transit. There was no cottony material present, but rather a dense, powdery secretion.

The adult ♀ is orange-brown in colour except at the extremities, which are decidedly pinkish. The largest specimen seen measured 2.4 mm. in length.

Mounted specimens average 1.8 mm. in length and 0.8 mm. broad.

The antennae are uniformly 9-segmented with joints 4 and 6 always very short. Joint 5 is usually twice the length of 4 or 6, but occasionally is of equal length. The range of variation is indicated below, but it should be noted that the average for 5 is about 22 μ, the short form (10 μ) being the exception. (1) 27-34; (2) 23-34; (3) 14-18; (4) 10-14; (5) 10-27; (6) 10-18; (7) 23-31; (8) 27-32; (9) 34-45.



The venter is characterized by the usual small scattered pores, many of which have bristle-like hairs. On the dorsum the gland-pores are about twice the size of those of the venter, and are without the bristles. The marginal spine area is shown in Fig. 29.

The legs approximate:—

I.	35	68	170	37	112	27	85
II.	37	68	175	40	112	27	90
III.	38	70	195	44	136	27	104

The setae of the anal lobes average 136 μ in length; those of the anal ring are about 85 μ long.

Habitat: On grass, Rosebank, C.P. Collected by C. P. van der Merwe, November 6, 1914.

Material studied consists of numerous young and 5 adult ♀ ♀.

Collection No.: 41.

34. PSEUDOCOCCUS FLAGRANS sp. n.

(Plate XVI., Fig. 6. Plate XVIII., Fig. 20. Plate XIX., Fig. 30.)

While digging in an ancient termite nest at Daspoort, a suburb of Pretoria, on October 11, 1914, my attention was drawn to some roots of grasses which had the appearance of having been recently white-washed. Small black ants were present in numbers, and an examination showed that a large pink mealy-bug, embedded in a compact, powdery, waxy secretion was the object of attraction. On pulling apart the leaf-sheaths below ground-level they were found tightly packed with this solid waxy secretion, which always appeared powdery rather than fibrous. Deeply embedded in this were female insects of different sizes (Fig. 6). When removed, the insect left a distinct cell in the wax, and was herself free from secretion. The colour of the insects—bright pink to flesh-colour—was in marked contrast with that of the secretion. Although females were present up to 4 mm. in length no trace of ova or larvae was found, so after removing a number for study the roots were planted in the insectary.

On October 20th seven insects, all large specimens, were found above the ground on the grass itself. They varied in position from half an inch to three inches above the ground. All exhibited the same phenomenon. They were hanging from the grass, head downward, with the posterior portion of the body, from the 2nd pair of legs, recurved, so that the ventral surface was exposed from above. They remained in this position throughout the day, and on October 21st all had disappeared except one, which was nearest the ground. This had secreted a very thin covering of delicate waxy filaments, and showed signs of two caudal filaments and a very delicate marginal fringe, but the colour of the body was still quite distinctly visible.

On October 24th five females were similarly observed on the grasses, all without waxy secretion of any kind. Whether these were the specimens observed on October 20th, or others, I cannot say.

Taking into consideration the entire absence of ova and larvae, and the position of the insects on the grass stems, I would suggest that this indicates a mating instinct, but males have not yet been seen.

Adult ♀: Elongate, parallel-sided, about 4 mm. long, bright pink to flesh-coloured. No lateral filaments were observed, but in two cases short caudal ones were present, while one insect indicated that there may, in certain cases, be four caudal filaments instead of two.

In boiling KOH the colour rapidly changes from pink to deep purple, but the liquid remains colourless.

In mounted specimens the most striking distinguishing character is the four median ventral "*plates*" (Fig. 20). These are large and disc-

like; they are situated near the posterior margins of the first four abdominal segments, one on the middle line of each. They have thick chitinous margins, circular, 65-68 μ in diameter. Smaller individuals exhibit plates approximately 50 μ in diameter. In a few examples there seem to be indications of a sternal plate similar to that mentioned by Green in his *Phenacoccus iceryoides*, and possibly also some smaller plates, similar to the abdominal ones on segments 5 and 6. The dermis is characterized by simple gland-pores with thin edges and numbers of hairs or bristles. In addition to the small gland-pores there are numerous disc-like glands, but they are scarcely noticeable, appearing as impressions in the derm rather than thickenings. They are indicated in Fig. 30. The dermal hairs are most numerous in the circum-anal region, where a large number are as long as the setae of the anal ring. The antennae are extremely variable, but since the majority of the large specimens have 9-jointed forms I include the insect in this series, but it should be remarked that the terminal segment is always comparatively short. In a few instances segments 8 and 9 are only separated by a pseudo-articulation. In this case they are indicated by two measurements united by a + sign and included under 8.

Example 1.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
R.	47	68	34	37	40	24	34	$\frac{88}{31 + 54}$	
L.	51	72	37	37	40	27	34	34	48

Example 2.

R.	51	51	27	34	31	27	24	27	51
L.	41?	51	27	31	23	20	18	$\frac{64}{27 + 37}$	

Example 3.

R.	51	51	34	34	34	27	24	30	48
L.	48	51	31	34	27	24	21	$\frac{64}{17 + 47}$	

Example 4.

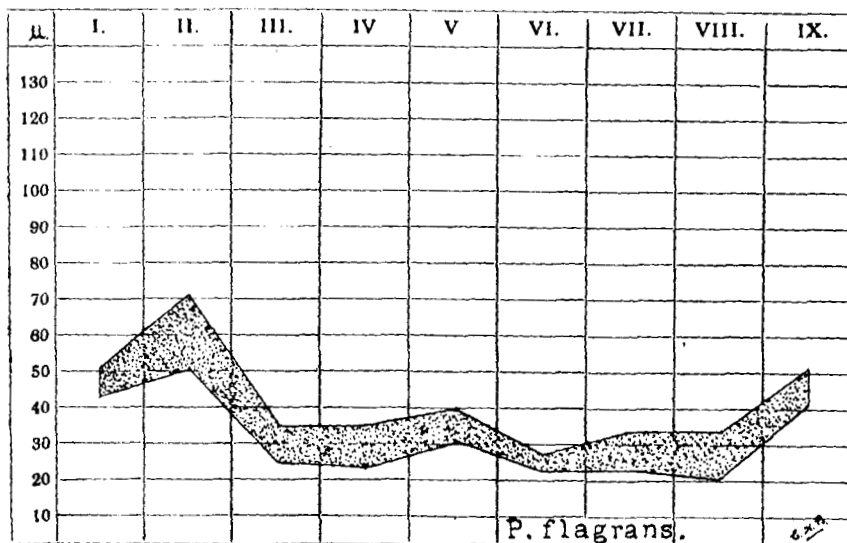
R.	41	51	30	75*	51				
L.	44	51	37	23	34	23	23	21	48

Example 5.

R.	47	51	34	23	34	27	27	23	48
L.	47	51	34	30	37	27	23	23	41

In example 4 (*) there is an indication of a pseudo-articulation about the middle.

It will be obvious that no general scheme can be given for the antennae of this species, but the 9-jointed forms do show some constancy in the relative size of the segments.



In the measurements of the legs the specimens seem to fall into two classes, of which the following are types:—

Type *a.*

I.	68	85	228	58	146	34	95
II.	81	102	248	61	176	44	102
III.	91	102	289	71	204	51	108

Type *b.*

I.	85	102	255	54	170	34	148
II.	91	102	290	68	200	40	119
III.	100	102	305	80	240	51	136

The setae of the anal lobes vary from 170 to 210 μ with 185 μ the mode; those of the anal ring vary between 135 μ and 152 μ .

The eyes are pronounced, but flattened; and the mentum is short, averaging about 85 μ in length.

Although the measurements of the antennal segments and those of the legs vary so greatly, this mealy-bug is readily distinguished from any other found in South Africa by other characters. The ventral median plates alone would separate it. I am at a loss to explain their function.

At first they look like thick-ringed pores, owing to the transparency of the derm at that point, where it is quite free from gland pores and hairs.

Collection No. : 69.

35. *PSEUDOCOCCUS NITIDUS* sp. n.

(Plate XVI., Fig. 7. Plate XIX., Fig. 31.)

Ovisac : The ovisacs are found singly in crevices in the rough bark of the old limbs of thorn-trees (*Acacia caffra*). They are closely felted, smooth, and in the majority of cases have the shape and approximate size of an adult insect (Fig. 7), being about 3 mm. long and so smoothly felted on the exterior as to look like a piece of white kid. In a few instances there is a slight indication of a fine silky ovisac protruding below this kid-like sac, but such cases are exceptional. At first the adult entirely fills the sac, but, as eggs are laid, the body shrinks until the sac appears to be filled with ova, amongst which the shrunken body of the ♀ is found.

Ova : Elongate, oval, pale brown in colour, 0.3 mm. long ; shell with numerous longitudinal wrinkles.

Larva : Pale translucent brown, 0.3 mm. long and 0.15 mm. broad, appearing truncate anteriorly. Antenna as long as the width of the body, of 6 segments, measuring : (1) 20 ; (2) 23 ; (3) 22 ; (4) 20 ; (5) 20 ; (6) 47 μ .

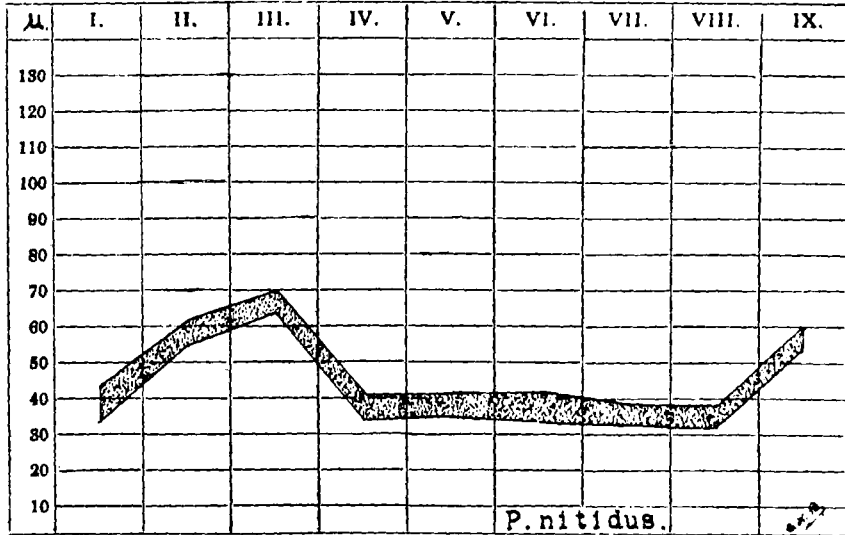
The caudal lobes are extremely conspicuous, with almost parallel sides, and are rounded apically. Eyes large, prominent, with transparent "lens."

Adult ♀ : 2.5 mm. long, translucent brown in colour ; legs and antennae of the same colour. No waxy secretion and no filaments except two extremely short caudal ones which appear as two white specks. The insect moves very slowly. In boiling NaOH the brown colour deepens slightly, but no purplish colour is produced.

Cleared and mounted the insect is characterized by its long legs and antennae and the prominent caudal lobes. The eyes are conspicuous, owing to the unusual manner in which they retain the stain. The dermis is quite free from the usual hairs except between the antennae, but has scattered, single gland-pores, from the centres of which small, acute spines project. The usual stout spines of the anal lobes are replaced by much more slender ones. In addition to the gland-pores with the short spines are a number of slightly larger openings which have distinct subcutaneous tubes. In the circum-anal region a number of the spines are longer than those of the remainder of the body, but they are always acute and spine-like, never linear and hair-like (Fig. 31).

The measurements in μ are as follows:—

Range of antennal segments:—(1) 34–44; (2) 56–62; (3) 64–70; (4) 34–42; (5) 36–42; (6) 34–42; (7) 33–38; (8) 33–38; (9) 54–60.



The legs are long and slender; although variations occur the following represent an average of measurements:—

I.	60	85	225	52	180	23	100
II.	64	85	240	52	190	23	105
III.	68	90	260	52	225	23	112

Claw with a distinct tooth one-third distance from apex.

Setae of the anal lobes: To 175 μ in length.

Setae of the anal ring: To 120 μ in length.

♂: Puparium elongate, white, felted, but with a silky gloss, 2 mm. long, 0.9 mm. broad.

♂: Pupa removed from completed silky puparium greenish-grey in colour, elongate, 1 mm. long.

♂: Head, legs, and antennae bright translucent brown; body slightly greenish; wings iridescent. Caudal filaments 4, median two as long as the head and body without antennae, two outer ones about one-third length of median.

Head and body: 1.12 mm. long.

Antenna: 0.9 mm. long, of 10 segments.

Wing: 1.35 mm. long.

Segments of antenna in μ :—(1) 110; (2) 61; (3) 159; (4) 122; (5) 115; (6) 105; (7) 88; (8) 80; (9) 71; (10) 78.

Terminal joint broadly rounded at the apex. All joints with long bristles, those of the apical whorl reaching 75μ in length.

Habitat: ♀♀ with ovisacs and ♂ puparia on rough bark of *Acacia caffra*, Pretoria, November, 1914. Collected by Miss Impey. As the earlier stages have not been observed outside the ovisac, it is impossible to say whether *Acacia* is the food plant of this species or not, as it is possible that the ♀ and ♂ migrate from grass, etc., before spinning the ovisac and puparium.

Material studied consisted of 2 ♂♂, 11 adult ♀♀, and numerous ova and larvae.

Collection No.: 39.

36. PSEUDOCOCCUS SEGNIS sp. n.

(Plate XIX., Fig. 32.)

A few twigs of native spiny-leaved veld bush were sent to this office by W. C. Winshaw, of Stellenbosch, as they were infested with adult ♀♀ and young of a species of *Ceroplastes*. The twigs were packed in a small glass sweet-bottle, the wide mouth of which was covered with muslin.

On examination it was found that there were also four specimens, apparently adult, of a dark green mealy-bug, quite different from any other known in the country. The description is as follows:—

Adult ♀: The four specimens range from 2.8 to 3.4 mm. in length, and are dark olivaceous-green in colour. There are no lateral or caudal filaments, and only a slight trace of white secretion, the insects appearing rather greasy or slug-like. This absence of secretion may be due to shaking in transit.

The insects progressed with a smooth, slow motion, which intensified the slug-like impression.

The legs and antennae are rich dark brown.

In boiling NaOH the colour becomes blackish-brown, then light brown, and the liquid is slightly stained of a similar brownish tint.

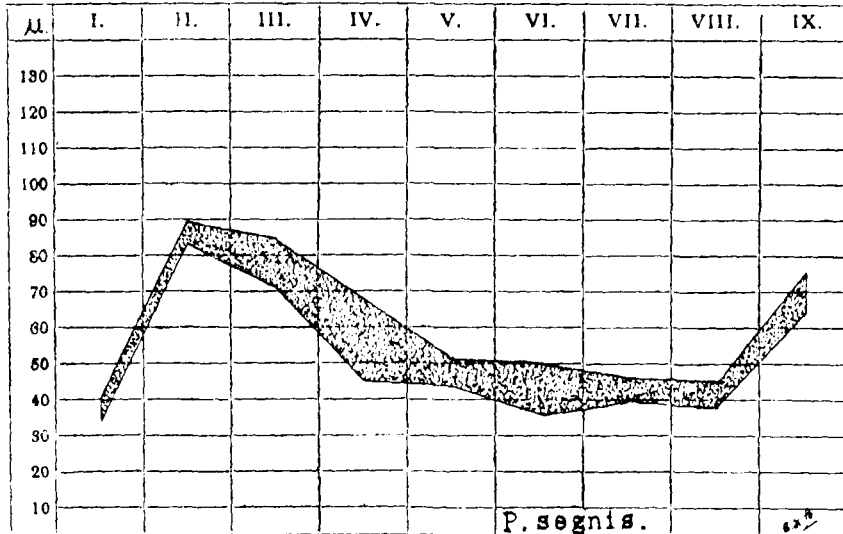
Cleared, stained, and mounted, it is noticed that the derm is clear and has scattered gland-pores—all of which are small. There are few scattered hairs, the longest being between the antennae (78μ).

The marginal spine areas comprise 2 slender spines and 5 to 8 small gland-pores (Fig. 32). There are two pairs of "eye-shaped cicatrices" in the usual position.

The eyes are comparatively small and inconspicuous. The mentum is 100μ long.

The antennae are uniformly 9-segmented, and exhibit the following

range of variation :—(1) 34–40 ; (2) 84–88 ; (3) 71–85 ; (4) 47–68 ; (5) 44–51 ; (6) 37–50 ; (7) 40–47 ; (8) 38–46 ; (9) 64–74.



The legs approximate :—

I.	100	125	335	91	238	37	136
II.	100	125	335	95	261	44	138
III.	100	125	354	102	308	44	138

Tarsal digitules fine hairs. Tooth on inside of claw quarter distance from tip.

The setae of the anal lobes are 136 μ long ; those of the anal ring 130 μ .

Habitat: On *Cliffortia ruscifolia* Linn. (*Rosaceae*). Stellenbosch, C.P.
Collected by W. C. Winshaw, December 13, 1914.

Collection No. : B 55.

37. PSEUDOCOCCUS STELLI sp. n.

(Plate XIX., Fig. 33.)

Ovisac : The ovisacs are rounded masses of cottony material usually found singly in the leaf-bases near the tips of the twigs where the leaves are closely imbricated. A number may be close together on such twigs, but in no case was more than one ovisac found to a leaf. In form they appear almost spherical, but adapted to the shape of the cavity between the leaves.

The greatest diameter averages approximately 2.5 mm. Completed ovisacs, when full of ova or emerging larvae, usually exhibit a slight yellowish tinge from the colour of the eggs or larvae within.

Ova: Pale creamy-yellow, 290 μ long and 145 μ broad.

Larva: Recently hatched is the same colour as the egg, but measures 415 μ in length. The antennae are 6-segmented with 6 about as long as 3 + 4 + 5 which are subequal. Eyes prominent, rounded. Anal lobes well produced, each bearing the usual seta.

δ puparium: The δ puparium is usually found in the bases of the leaves which contain the ovisacs, and is often partially or wholly hidden by the latter. It is a delicate, elongate, flattened, white sac, about 2 mm. long, closed and rounded in front but open behind. The four white caudal filaments and the tips of the wings are visible before the δ emerges. Males were emerging when the material was received on December 19, 1914.

δ : The living male is reddish in colour, but the colour is obscured by a fine white powdery covering. The wings are white and appear "mealy," but exhibit the usual beautiful iridescence. There are four dense white caudal filaments, the median pair being slightly the longer, about the length of head and body without antennae. The other pair arises from the margins of the next abdominal segment and projects somewhat outwards as well as backwards, so that the two pairs of filaments are quite distinctly separated. When freshly mounted in Canada balsam the body, legs, and antennae are amber-yellow in colour; the eyes are prominent, black.

Length of head + body: 1 mm.

Length of wing: 1.1 mm.

Length of antenna: 0.9 mm.

The antennae are 10-segmented, the segments measuring (as freshly mounted in Canada balsam):—(1) 40; (2) 54; (3) 153; (4) 125; (5) 108; (6) 102; (7) 95; (8) 81; (9) 75; (10) 78.

The segments bear \pm irregular whorls of hairs, the majority of which are about 60 μ long.

The posterior abdominal segments are distinctly separated at the margins, the lateral margin being produced in broad rounded projections, from which the four caudal setae arise. These latter are approximately 200 μ long.

f : The adult f is pale canary-yellow in colour, about 2 mm. to 2.5 mm. long. The lateral filaments are very short, but distinct, and gradually increase in length posteriorly. The caudal ones, two in number, are also short, about twice as long as the next pair, stout at the base and tapering towards the tip.

The waxy secretion on the dorsum is white and powdery, except that

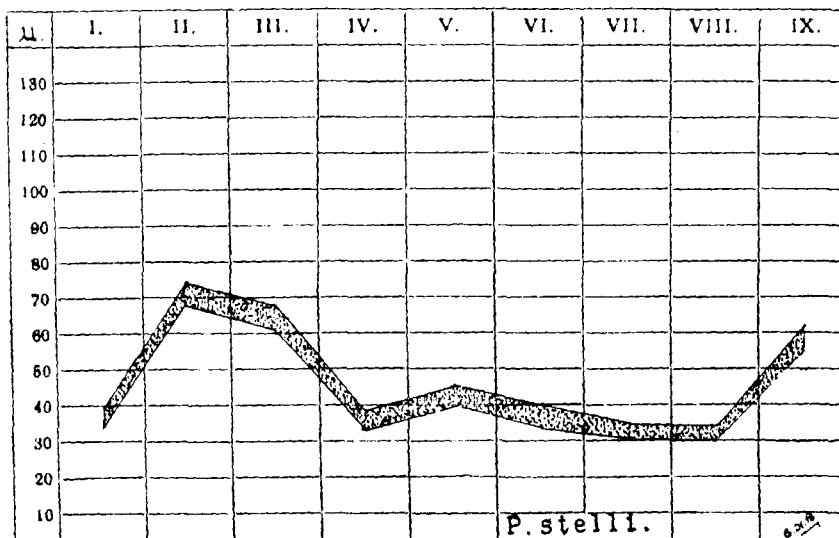
at points in the middle of the segments there appear minute cones of secretion, which form transverse lines across the dorsum.

In boiling NaOH the colour becomes reddish but the liquid remains practically colourless. When stained and mounted the dermis is almost clear, but exhibits two "eye-shaped cicatrices" between the antennae and the position of legs I., and two others about an equal distance from the posterior extremity. The gland-pores of the venter are small and few in number. Those of the dorsum are about three times the size of the ventral ones, and are most numerous in transverse rows across the segments. There are a few scattered hairs; some situated between the antennae being long (70μ). The eyes are prominent, conical, and retain the stain.

The marginal spine areas comprise 2 spines and 5- to 8-grouped gland-pores (Fig. 33).

The mentum is about 105μ long.

The antennae are uniformly 9-jointed, the measurements of the segments varying but slightly as indicated by the following range in μ :—(1) 34-40; (2) 68-74; (3) 61-68; (4) 34-38; (5) 40-46; (6) 34-40; (7) 30-34; (8) 30-34; (9) 56-62.



The most common measurements are:—(1) 40; (2) 68; (3) 64; (4) 34; (5) 44; (6) 37; (7) 34; (8) 34; (9) 58.

The leg measurements approximate:—

I.	85	85	230	54	190	25	98
II.	90	92	246	57	231	27	100
III.	102	102	270	61	261	34	104

The tarsal digitules are simple hairs, and there is a distinct tooth one-third the length from the tip of the claw. The caudal lobes are prominently produced, and bear the usual setae, which average $210\ \mu$ in length, and, in addition, two shorter hairs and three stout spines. The setae of the anal ring are about $135\ \mu$ long.

Habitat: On spiny-leaved veld bush (*Borbonia cordata* Linn.), Stellenbosch, C.P. Collected by W. C. Winshaw, December 17, 1914.

Material studied included 8 adult ♀♀ and 3 adult ♂♂.

Collection No.: B 56.

37a. PSEUDOCOCCUS STELLI var. TYLOCOCCIFORMIS sp. n. var. n.

(Plate XVIII., Fig. 21.)

On the twigs with *Ps. stelli* were a few specimens identical in appearance except that the body was beautiful rose-pink in colour instead of yellow. The waxy secretion was exactly similar, and when mounted the legs, antennae, etc., were also identical, but the lateral spine areas were produced on small truncate tubercles (Fig. 21). The insects showing this character were on an average slightly smaller than the adults of *stelli*, but the antennae were uniformly 9-segmented.

Collection No.: B 56a.

Tribe ERIOCOCCINI.

GEN. ERIOCOCCUS Targ.

“The normal characters for this genus are: Adult ♀ elongate or short ovate; segmentation more or less distinct; dorsum or margin usually spiny. Antennae of six or seven joints. Legs persistent. Anal orifice with six or eight hairs. Anal lobes conspicuous.

Ovisac of ♀ usually elliptical or elongate, more or less convex, felted, and either with or without a minute opening at the anal extremity.

Puparium of ♂ resembling that of the ♀, but much smaller.

♂♂ winged, or rarely apterous.” (*Newstead.*)

38. ERIOCOCCUS ARAUCARIAE Mask.

(Plate XXI., Figs. 40–40b.)

Eriococcus araucariae Mask., N.Z. Trans., xi., p. 218, 1879.

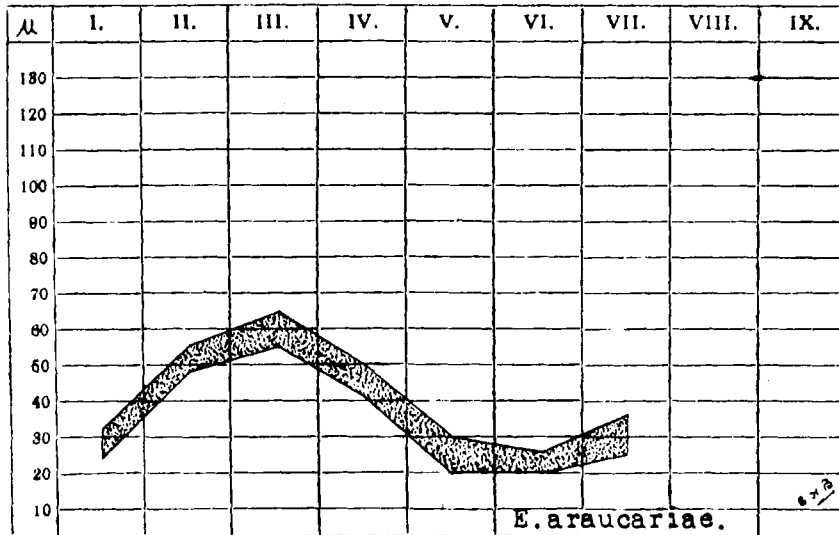
Rhizococcus ,, Comst., Rep. U.S. Dep. Ag., 1880, p. 339, 1881.

Eriococcus araucariae Lounsb., Rep. Ent. Cape Good Hope, p. 19, 1897.

„ „ Fuller, First Rep. Ent. Natal, p. 107, 1900.

The insect here referred to is not in entire agreement with Maskell's original description of *E. araucariae*, but is evidently the same as that reported from America as *Rhizococcus araucariae* (Mask.) by Comstock. It has been established in South Africa for many years, and is now widespread throughout the Union. The following measurements from South African material may be useful for comparison:—

Antennal segments vary within the range:—(1) 24–32; (2) 48–54; (3) 56–64; (4) 42–50; (5) 20–30; (6) 20–26; (7) 27–36.



The caudal lobes are long (100 μ) and narrow, and bear several strong, stout, blunt spines and a single seta which is often 200 μ long.

The hairs of the anal ring (8) are generally 135 μ long.

Collection No. : 30.

GEN. PUTO Signoret.

In his "Essai," p. 341, 1875, Dr. Signoret defines the genus as follows (figure references omitted):—

"Ce genre nouveau se basera sur les yeux proéminents dans la femelle, la présence de douze yeux, dont quatre grands, et huit ocelles dans le mâle; l'absence dans les

deux sexes de digitules à extrémité renflée ; huit poils sur l'anneau génito-anal ; deux poils sur le balancier ; antennes de neuf articles dans la femelle, de dix excessivement longs dans le mâle."

The ♀ characters may be summarized thus:—Eyes prominent, digitules not clubbed, anal ring with eight hairs, antennae with 9 segments.

The ♂ characters are remarkable; the size especially (3 mm. long without wings) compared with that of the ♀ (3.5 mm.) makes one doubtful whether the insect described is the male of that species or not.

39. PUTO (?) AFRICANUS sp. n.

(Plate XXI., Figs. 41–41f.)

Adult ♀ enclosed in a dense felted or papery sac, which is generally white or yellowish in colour. Many of the sacs, in the dry material at hand, are broken at one end, and appear as white cups attached to the stem of the host-plant.

The ovisacs, when not deformed by massing together, are regularly elongate oval about 2 mm. long and 1.2 mm. in diameter. The large number of small slender sacs beneath the larger ones suggests that either the younger ♀ form inhabits a sac, or that large numbers of males are produced.

Ova or larvae not observed.

♂ : Not known.

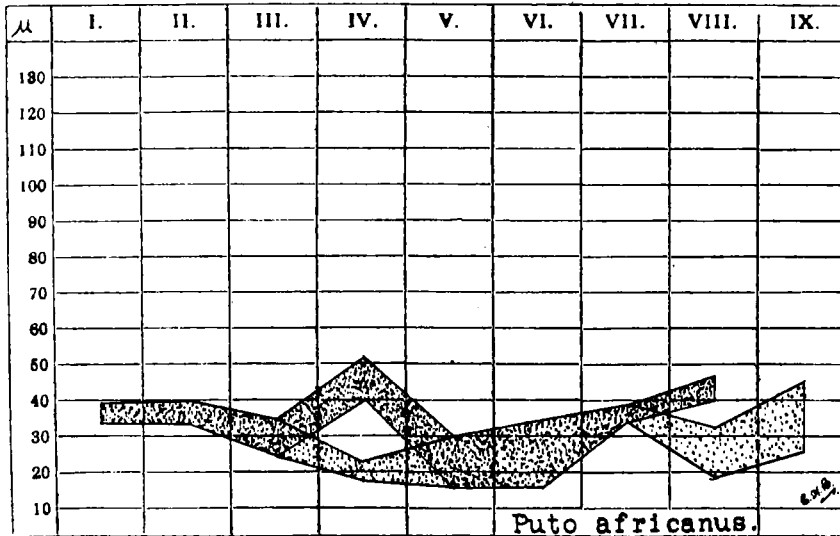
Adult ♀ : The adult ♀ as recovered from dry material is merely a black shrivelled mass without indications of secretory covering of any kind, and without lateral or caudal filaments.

In boiling NaOH the insect is restored to the usual elongate oval form of *Pseudococcus* and is at first deep black in colour. Later it simulates the insects of the *filamentosus* group of mealy-bugs, being very difficult to clear and taking on a deep green colour before clearing. When stained and mounted the insect differs from *Pseudococcus* in having antennae of a different type although they are 8- or 9-jointed (Plate XXI., Figs. 41–41a) ; in having the anal ring with 8 hairs instead of 6 ; and in having conical spines scattered over the posterior part of the body. From *Eriococcus* it differs also in the antennae ; in having the spines comparatively short and of an indefinite arrangement ; and particularly in the absence of the elongate caudal lobes.

In mounted specimens the body averages 1.7 mm. in length and 0.9 mm. in breadth. The antennae are 8- or 9-jointed, the apical segments being wider and more irregular in outline than is usual in *Pseudococcus* spp. (Plate XXI., Fig 41).

Six series of measurements are included in the table below to illustrate the inconstancy of the antennal segments :—

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
1.	?	37	24	51*	24	34	34	44	—
2.	34	40	24	44*	17	34	34	44	—
3.	34	37	24	40†	24	34	34	40	—
4.	?	34	34	18	34	23	38	18	27
5.	34	37	24	18	30	24	38	30	47
6.	38	34	24	20	23	17	34	34	37



The legs, on the contrary, are remarkably constant. The following measurements are approximate for the series :—

I.	51	84	150	52	88	27	85
II.	51	84	164	52	102	30	95
III.	51	84	180	52	135	30	95

The digitules, both of the claw and tarsus are knobbed hairs.

The dermis is characterized by numerous small gland-pores either with subcutaneous "tubes," or bristle-like hairs. When seen in optical section, as in mounted specimens, a region between the insertion of legs III. and the anal ring has numerous large pores with short, stout conical spines as shown in Plate XXI., Figs. 41*b* and 41*c*. The anal ring is broad and bears

* Without pseudo-articulation.

† With pseudo-articulation.

8 hairs, 6 in the chitinous ring and 2 posterior to this where the ring is incomplete (Fig. 41*d*). The anal lobes are rounded outwardly instead of posteriorly, and bear one long, stout seta, several shorter, more slender setae, and two stout conical spines. The large setae of the caudal lobes were in every case broken, but are at least 220 μ long, probably much longer. The smaller setae reach 136 μ in length.

The setae of the anal ring are about 110 μ long.

Habitat: On a native shrub (*Tamarix articulata* Vahl.). Collected by C. P. Lounsbury and C. Fuller, near Cape Town, January, 1898.

Remarks: This insect is tentatively included in the genus *Puto* of Signoret because of the 9-jointed antennae and the eight hairs on the anal ring.

Collection No.: B 70.

SUBFAMILY ORTHEZIINAE.

This subfamily contains comparatively few individuals which all possess a very characteristic appearance owing to the waxy plates or lamellae which adorn the bodies of the female. The males, where known, are also distinguished readily by the possession of compound eyes, and a tuft of long filaments which terminates the abdomen.

GEN. ORTHEZIA Bosc.

Orthezia Bosc., Journ. de Phys., xxiv., p. 173, 1784, etc.

Dorthesia l'Abbé d. Orthez, Journ. de Phys., xxvi., p. 207, 1785, etc.

Adult ♀ partly or wholly covered with waxy lamellae; antennae of 7, 8, or 9 joints, usually 8. Legs well developed and normal. Larva with 6-jointed antennae.

40. ORTHEZIA INSIGNIS Dougl.

(Plate XXVI., Fig. 57.)

Orthezia insignis Douglas, Jn. Q. Micr. Club, p. 169, 1887 (♀ only).

„ „ Lounsbury, 32nd Rep. Mass. Agr. Coll., p. 111, 1895
(♀ only).

„ „ Lounsbury, Rep. Ent. Cape G. Hope, p. 36, 1898.

„ „ Green, Circ. Roy. Bot. Gard. Ceylon, p. 83, 1899.

„ „ Fuller, 1st Rep. Ent. Natal, p. 109, 1901.

Orthezia insignis Newstead, Monograph, ii., pp. 236–241, 1902.

„ „ Fuller, Natal Agr. Jn., p. 1035, 1907.

Common names :—Ceylon, “Lantana bug.”
 England, “Kew bug.”
 Natal, “Sugar-iced bug” (Fuller).
 America, “White-tail Mealy-bug.”

Ovisac : Varying in length ; may attain three times the length of the body ; white, except in old individuals, when it is often dirty or covered with “sooty” fungus, parallel-sided and upturned, rounded behind and attached to the body of the ♀. The adult is active and carries the ovisac around with her until the young are hatched. Upper surface of ovisac with longitudinal furrows and median ridge flatly rounded and broad.

Larva : Active, about 0·31 mm. long and 0·26 mm. broad ; very broadly and regularly oval. Legs very long ; legs II. longer than body (0·32 mm.). Antennae long (0·24 mm.), of 6 joints, which measure approximately :—(1) 34 ; (2) 35 ; (3) 34 ; (4) 30 ; (5) 37 ; (6) 100 μ . Joint 6 with a strong blunt spine.

Adult ♂ : “A graceful little insect . . . of a slaty-grey colour, with very long slender antennae, a single pair of greyish wings, and a tuft of long white silky filaments at the end of the body. The eyes are black and divided into numerous facets.” (*Green.*)

Adult ♀ : Varies in colour according to age, and ranges from light green to dark brownish-green, and later to nearly black. Antennae and legs fulvous.

“Short-broad-oval, surrounded (except over the head) by a marginal series of snow-white, laterally connected lamellae, which, after the first three on each side, are directed backwards and downwards, gradually increasing in length, the posterior ones overhanging the marsupium ; but of these the middle three are shorter and more distinct, the median one, over the middle channel, shortest and broadest of all, either turned up vertically or horizontal, and having a median sulcation ; the dark surface of the body level, nude, the segmentation plainly discernible, but on the middle are two longitudinal, narrow, contiguous yet distinct lines of small, granulose, white, lamellate projections. These lines, beginning at the base of each antenna, extend backward for a short distance convergently, but almost immediately after each curves outward and again inward, so as to leave a small, dark, oval space between them ; then both are parallel, and close together up to the anal extremity.” (*Douglas.*)

When cleared and mounted the insect is about 1·7 mm. long and is slightly narrowed in front and broadly rounded behind. The antennae are 7- or 8-jointed, the segments varying in the 10 specimens examined as

follows:—(1) 106–120; (2) 100–115; (3) 105–125; (4) 95–105; (5) 100–124; (6) 85–95; (7) 85–95; (8) 180–200.

The 7-jointed form is unusual. One specimen, measuring 1·7 mm. when mounted, has one antenna distinctly 7-segmented and the other apparently 6-jointed owing to the failure of 6 and 7 to separate. The measurements of the 7-jointed form are: (1) 115; (2) 108; (3) 125 (4) 102; (5) 112; (6) 88; (7) 188.

The terminal spine is stout and blunt.

The legs are long and bear numerous spines. The approximate measurements in μ are:—

I.	123	200	530	123	430	50	330
II.	150	240	530	130	500	50	360
III.	150	240	550	130	525	50	385

The trochanter is quite different from the usual Coccid form in that it is quite small, narrow, and almost annular. The derm is characterized by slightly curved, bluntly pointed gland-spines with dilated bases. The distribution of these corresponds to the position of the waxy plates and the attachment of the ovisac.

The eyes are small, hemispherical, and deeply pigmented.

There are no caudal lobes and no setae; the anal ring bears 6 hairs measuring approximately 150 μ .

Habitat: On lantana, coleus, gardenia, camellia, ixora, jacaranda, cestrum, chrysanthemum, etc. Known to occur along the coast-belt from Cape Town to Natal.

I have recently (February, 1915) received this species on *Citharoxylon* sp. from Mr. James Wylie, Curator of the Municipal Botanic Gardens of Durban, who writes me that he has also seen it on *Hamelia patens*, *Thunbergia erecta*, *Ruellia* and *Lantana*.

This species was probably introduced many years ago. It was first reported as a pest in 1898 by C. P. Lounsbury, when it was exceptionally abundant on a few lantana hedges in the Cape Peninsula.

Collection No.: 12.

SUBFAMILY COCCINAE.

The subfamily *Coccinae* comprises a small number of insects which resemble the mealy-bugs (*Pseudococcinae*) very much, but differ mainly in the hairless anal ring.

As constituted at present, only two genera are included in this subfamily, the cochineal insects (*Coccus* spp.) and an aberrant group included

in the genus *Sphaerococcus*. These latter may be compared with the Pseudococcine genus *Antonina*.

GEN. COCCUS Goeze (?).

“♀: Without ciliated anal ring or anal lobes. Antenna normally with 7 joints, the number occasionally reduced by the confluence of two or more segments. Derm with irregular clusters of glandular pores and truncate spines. Eyes prominent, simple. Legs well developed. The truncate spines are cylindrical and apparently tubular. They are very numerous on the wild forms, but are generally reduced—both in number and size—on the cultivated species.” (*Green*, 1912.)

41. COCCUS CACTI Goeze 1778 (and others).

(Plate XXII., Fig. 43.)

Coccus cacti Goeze, Ent. Beitr., ii., p. 341, 1778.

Dactylopius coccus Costa, Faun. Regn. Nap., Cocc., p. 16, 1835.

Pseudococcus cacti Westw., Mod. Class. Ins., ii., p. 445, 1840.

Coccus cacti Sign., Ann. Soc. Ent. Fr., (5), v., p. 347, 1875.

„ „ Comst., Rep. U.S. Dep. Ag., 1880, p. 346, 1881.

Dactylopius coccus Fernald, Catalogue, p. 80, 1903.

Coccus cacti Green, Journ. Econ. Biol., p. 82, 1912.

“Adult female subglobular, slightly narrower behind. Purplish-red, pruinose, but without conspicuous white tomentum.

Eyes prominent, cylindrical, rugosely chitinous.

Antennae short, basal joints very broad, others narrowing successively, 7-jointed, 1st joint very irregular in form, 2nd joint represented by a broad chitinous ring, 3rd and 4th usually more or less confluent, the junction incompletely demarked by bands of translucent intersegmental tissue, 5th broad and short, 6th approximately equal in breadth and length, 7th elongate, twice as long as broad, with some stout curved hairs on the apical half, a few stout spiniform hairs on the apical margins of the other joints with the exception of the 3rd, rarely 6-jointed by suppression of the 5th or 6th joint. Length of antenna 0·2 to 0·3 mm. Breadth of basal joint 0·16 mm.

Legs stout, terminating in a slender, longish curved claw, femur and trochanter together 0·38 mm., tibia 0·16 mm., tarsus (without claw) 0·15 to 0·16 mm.

The most conspicuous feature of the derm is the presence of numerous

clusters of large, thick-rimmed pores, each with a pentagonal lumen, which occur over the whole surface, but are less pronounced on the median area. The number of pores in a cluster varies from 2 to 25, and averages 12 or 13.

The truncate spines are very inconspicuous, small and slender, tapering slightly towards the extremity, some of them almost hair-like. They are scattered very sparsely over the body, but are grouped more closely on the area surrounding the anal orifice, where they are mingled with some simple pointed hair-like spines.

Length of adult female (under compression) from 4 to 6 mm. Breadth 3 to 4.5 mm. Average dimensions 4.75×3.87 mm." (Green.)

Habitat: On *Opuntia tomentosa*, *O. decumana*, and *Nopalea cochineli-fera* in Botanic Gardens, Cape Town.

This species has been established in Cape Town for many years. It does not have the toxic effect on the host-plant which is so striking in *C. indicus*.

Collection No. : 36.

42. COCCUS CONFUSUS CAPENSIS Green.

Coccus confusus capensis Green, Journ. Econ. Biol., p. 91, 1912.

"Adult female profusely covered with white mealy secretion which more or less completely conceals the form of the individual insects. Broadly oval, usually narrowed behind.

Eyes moderately prominent; not densely chitinous.

Antennae small, basal joint very broad; 2nd joint ring-shaped; 3rd and 4th approximately equal, and twice as broad as long; 5th and 6th smaller, broader than long; 7th irregularly ovate, longer than broad, tuberculate. Total length of antennae 0.15 to 0.17 mm. Breadth of basal joint 0.07 to 0.09 mm.

Legs small, moderately stout; femur and trochanter together 0.2 to 0.23 mm.; tibia 0.08 to 0.12 mm.; tarsus (without claw) 0.1 to 0.12 mm.

Dermal pores conspicuous, in dense clusters (especially towards posterior extremity); a few single pores and small scattered groups; largest groups with 30 pores; average 15.

Truncate spines numerous and conspicuous; stout, cylindrical; proportionately shorter than in typical *confusus* or *newsteadi*; diameter of base usually much more than half the total length of spine.

Length of body (under compression) from 2.5 to 3.5 mm. Breadth 2 to 2.75 mm. An average of sixteen examples gives a dimension of 3×2.27 mm." (Green.)

Habitat: On *Opuntia monacantha*, Cape Province, Natal, and Orange Free State; common in districts where the food-plant abounds. This species has been recorded on one occasion on *Nopalea cochinelifera*, when found growing in close proximity to infested *O. monacantha* at Pretoria (1913).

Collection No. : 38.

43. COCCUS INDICUS Green.

(Plate XXII., Fig. 44.)

Coccus indicus Green, Mem. Dept. Agric. Ind., 1908, ii., 2, p. 28.

Coccus cacti var. *ceylonicus* Green, Ind. Mus. Notes, iv., 1, p. 7, 1896.

Nom. nud.

Coccus indicus Green, Journ. Econ. Biol., p. 84, 1912.

"Adult female subglobular; purplish-red, the colour concealed beneath a mass of white mealy tomentum.

Eyes moderately prominent, rounded, not densely chitinous.

Antennae short, tapering gradually to extremity; 7-jointed (rarely 6-jointed, through the complete confluence of 3rd and 4th joints); all the segments broad and short, much broader than long, with the exception of 7th, which is irregularly subglobular—the breadth approximately equal to the length; some stout curved hairs on terminal segment. Length of antenna 0.12 to 0.16 mm. Breadth of basal joint 0.06 to 0.08 mm.

Legs small, moderately stout; femur and trochanter together 0.16 to 0.2 mm.; tibia 0.06 to 0.09 mm.; tarsus (minus claw) slightly longer than tibia, 0.08 to 0.1 mm.

The dermal pores, which are such a conspicuous feature in *C. cacti*, are small and inconspicuous in this species, and are without thickened chitinous rims. They occur singly and in small clusters of 3 or 4 pores; rarely clusters of 5 or 6 occur.

The truncate spines are very numerous and conspicuous—even under a comparatively low magnification. They are short and stout, cylindrical and parallel-sided, with very broadly expanded bases which give a characteristic appearance to the spines of this species. The base is usually as broad as, and sometimes slightly broader than, the total length of the spine. They are scattered thickly and evenly over the whole dorsum and on the ventral marginal area of the abdomen. The largest spines are grouped on the abdominal margin.

Length of body (under compression) of Indian examples varies from 2.5 to 5 mm. An average of 19 examples gives a dimension of 3.93×3.16 mm. Ceylon examples are slightly smaller, ranging from

1.75 to 4 mm., with an average (from 17 examples) of 2.95×2.37 mm." (Green.)

Habitat: On *Opuntia monacantha* under experimental conditions at Rosebank Experiment Station, C.P., Natal Museum, and Division of Entomology, Pretoria.

This species was introduced by the Queensland Prickly Pear Commission in 1913. An attempt is being made to establish it in this country because of its toxic effect on its host-plant.

Collection No.: 37.

GEN. SPHAEROCOCCUS Mask.

The characters of this genus are somewhat vague, and require revision. The definition given by Maskell, in the N.Z. Trans., 1892, p. 237, is as follows: "Adult females naked, or producing cotton or wax. Anal tubercles absent; anogenital ring hairless. Antennae of usually less than seven joints, sometimes atrophied. Feet sometimes absent, sometimes atrophied, sometimes deformed. Adult ♂ unknown."

44. SPHAEROCOCCUS AFRICANUS sp. n.

Ovisac: Creamy-white to yellowish in colour, densely felted, varying in size to 3 mm. long and 2.75 in diameter; usually almost spherical, sometimes more or less elongate oval. Ovisacs generally separate and distinct, occasionally more or less clustered.

Larva: Freshly mounted, orange-yellow, broad, 0.3 mm. long. Antennae of 6 segments; eyes prominent, deeply pigmented. Mouth-parts extraordinarily broad and large. Caudal lobes not produced, but represented by one long seta on each side.

Adult ♀: Entirely enclosed in the felted sac; pale translucent brown; no secretion; colour in boiling KOH deep brown, liquid slightly coloured brownish.

Size mounted may reach 3 mm. long by 2.8 broad. Antennae short, 6- or 7-jointed, usually 7. The 6-jointed form arises from the failure of the two apical segments to divide.

The segments vary considerably in size, the range from 12 measurements being:—(1) 20-30; (2) 20-25; (3) 13-20; (4) 14-23; (5) 12-18; (6) 17-22; (7) 40-48.

The legs are small, approximating:—

I.	20	60	85	40	47	21	51
II.	22	60	95	47	51	24	64
III.	28	60	120	74	57	30	64

The dermal pores over most of the body are small and simple; some are supplied with bristles; others with long subcutaneous tubes. In the circum-anal region there are numerous, scattered, large, disc-like pores and numerous long hairs, some of the latter reaching 100 μ in length.

The anal ring is comparatively small, and hairless.

Habitat: On *Borbonia cordata* Linn. Somerset West, C.P., Nov. 26, 1906, Coll. T. F. Dreyer.

On Rhenosterbosch (*Elytropappus rhinocerotis* Less.), Stellenbosch, Nov. 1914, Coll. C. P. van der Merwe.

On *Cliffortia ruscifolia* Linn. Stellenbosch, Coll. W. C. Winshaw, December 17, 1914.

Collection Nos.: A 32, B 32, and C 32a.

SUBFAMILY MONOPHLEBINAE.

The Monophlebinae are all comparatively large insects of exceptional interest. Representatives of three genera are known to occur in South Africa, viz. *Monophlebus*, *Icerya*, *Aspidoproctus*. In the early stages of all, and in all stages of the two first-mentioned, the ♀ insects have somewhat the appearance of mealy-bugs of large size, as the bodies are covered with a more or less dense covering of waxy secretion. In *Aspidoproctus* the derm becomes very hard and dense in the older stages, and has little or no secretory covering.

GEN. MONOPHLEBUS Leach.

♀ : Body usually dark brick-red in colour, more or less obscured by a coarse granular waxy secretion; body-wall remaining thin and soft to maturity; legs and antennae well developed, dark in colour to black. Insects active and free-moving except at the ecdyses and time of oviposition, when they cling to leaves or twigs and become fixed by tenent hairs on the venter.

Antennae of 11 segments.

♂ : With two long caudal appendages to the abdomen. (In *M. fulleri* the caudal appendages are about as long as the body.)

♂ with compound eyes.

45. *MONOPHLEBUS AFRICANUS* Newst.

Schultze, Zool. u. anthro. Ergeb. einer Forsch. im. w.u.z. Sudafrika Jena, pp. 15-16, 1912.

"Female, early adult. Faintly farinose. Ovate, with a faint constriction at the thoracic area; low convex above; sides thick; segmentation marked. Colour (in alcohol) pale dull orange to dull orange-crimson; legs and antennae black. A few pale hairs are visible at the margins, under a low power, otherwise the integument appears smooth and glabrous. Under a higher magnification the derm is seen to bear slender hairs, rather widely separated, but these are more numerous and longer on the venter than on the dorsum; between the hairs there are minute circular spinnerets, some of which have a central orifice shaped somewhat like a figure-of-8. Antennae normally of eleven segments, but these organs are given to considerable variation even in examples of the same stage, and are also sometimes asymmetrical. Eyes obconical, black. Legs short and stout; anterior tarsi with a bilateral row of 3-4 stout simple spines ventrally; anterior tibiae with 3 (possibly 6) very long spinose hairs on the upper surface. The other legs are similar.

Length 8-10 mm.

Penultimate stage of female. Of the same form and colour as the adult female. Antennal segments varying in number from 7-9; the apical segment may be either pointed (rare) or broader (frequent) and longer than the preceding one.

Male: Pale orange-crimson, in alcohol. Legs, sclerites (dorsal and ventral), and eyes black. Abdominal lobes or tubercles on terminal segment two in number, these are nearly as long again as the width of the preceding segment; each with 3-4 very long stout hairs. Margin of two preceding segments faintly produced but not distinctly tuberculate; these are also furnished with one or two rather long hairs. Tip of genital armature widely rounded and faintly emarginate; base scarcely wider than the apex, sides parallel. Wings faintly infuscated. Antennae brownish-black and furnished with very long hairs; apical segments wanting.

Length from point of head to tip of the closed wings 2.50 mm.

The anal tubercles of the male, in life, would no doubt be furnished, each with a single long filamentous appendage, but these had entirely disappeared in the alcohol. I assume that there would be three pairs of these filaments present, in life: one long median pair and two short lateral ones.

These insects (the females) give off a pale dull orange stain in alcohol; which permanently stained the white paper labels a dull pale red. It is

very rarely that Coccids produce such an effect in alcohol, and may, therefore, be taken as a very marked character.

In form and colour the female looks like a very small form of *Monophlebus sjostedti*, Newst. *M. africanus* differs in being much smaller, has a much shorter terminal segment to the antenna, and has simple tarsal spines. The male may also be distinguished by its pale infuscated wings—a character which is apparently unusual in the males of this genus.

Habitat: Rooibank bei Walfischbai, Mai, 1905, in der Wurzelgeflechten der *!kuiibes*-Pflanze; Steinkopf, August, 1904, L. Schultze.

Deutsch-Sudwestafrika, Luderitzbucht, December, 1903, L. Schultze.
Kap Cross, L. Schultze."

This insect has not been seen by the writer, but the above description is given for comparison with the other known South African species.

46. MONOPHLEBUS FORTIS Ckll.

Monophlebus fortis Ckll., The Entom., xxxiv., p. 224, 1901.

" " The Entom., xxxv., p. 319, 1902.

Professor Cockerell's description is as follows:—

"♀: Dark grey, distinctly segmented, mealy, posterior end covered with cottony secretion; sides with scattered long pale bristles; legs black. Length $5\frac{1}{2}$, breadth $2\frac{1}{2}$ mm.

Boiled in liquor potassae, does not stain it. Hairy skin just as in *M. fulleri*, also legs, with the same spear-shaped processes, which are even better developed on the tibia. 'Cicatrices' as in *fulleri*. Length of tibia about 1,100 μ , tarsus (without claw) about 580. Antennae 11-jointed; measurements in μ : (1) 150; (2) 150; (3) 150; (4) 110; (5) 110; (6) 110; (7) 110; (8) 130; (9) 120; (10) 120; (11) 160.

Very close to the last (i.e. *M. fulleri* Ckll.) but smaller, though certainly adult, and without the longitudinal white keels.

Richmond, Natal, under bark of Eucalyptus; only one found."

This species has not yet been found again.

47. MONOPHLEBUS FULLERI Ckll.

(Plate XXII., Fig. 45. Plate XXIII., Figs. 49-49i).

Monophlebus fulleri Ckll., The Entom., xxxiv., pp. 223-224, 1901.

The specimen described by Prof. Cockerell, *l.c.*, was probably adult with two antennal segments missing instead of one as suggested in the description.

The following particulars are given from fresh specimens collected at Pretoria by the writer October, 1914, to January, 1915, and from spirit material collected at Queenstown, C.P., by T. F. Dreyer in 1907 (Cape No.: 1898).

The adult ♀ is viviparous, giving birth to young during an extended period. During this time the body becomes shrivelled and presents numerous folds and creases.

Larva: The newly hatched larvae are deep red coloured (like the other stages denuded of secretion) and are at first naked. They apparently soon settle down in the leaf-sheaths of grass and secrete a white waxy matter which is regularly arranged in masses very much like the covering of an *Orthezia*. The deep red colour of the body is plainly visible between the waxy matter.

The larvae are at first small, 0.316 mm. long, elongate, rather narrow behind (Fig. 49). The legs and antennae are black. Round the margins of the body are numerous short, blunt, hair-like appendages which form a regular fringe. At intervals are long bristle-like hairs arising from thickened sockets. On the dorsum of the abdominal segments are three series of similar appendages with a few longer hairs interspersed. On the anterior parts are several series of similar hairs. The eyes are conspicuous and deeply pigmented. Mentum short. The antennae are comparatively long, being half as long as the body. They are 5-jointed with III. and V. long, the others subequal. The measurements approximate: (1) 40; (2) 40; (3) 85; (4) 48; (5) 105.

♂ series: On November 18, 1914, while observing this species on the grasses in front of Union Buildings, elongate masses of cottony material were found in the axils of grass-leaves. The photograph (Fig. 45) shows the size and shape of these, as the adult ♀ on the grass above measured 7.2 mm. long. This cottony sac looked exactly like the elongate ovisac of some mealy-bug. The insect enclosed by this puparium was at first, to all external appearance, exactly like a half-grown female except that there were no mouth-parts.

Prae-Pupa: Cleared and mounted the ♂ prae-pupa is 2.8 mm. long, and 1.4 mm. broad, with legs and antennae well developed, but mouth-parts absent. The dermis is similar to that of the ♀ but the three cicatrices are shorter and more broadly oval.

The antennae (Fig. 49b) are 9-jointed, and measure:—

	1	2	3	4	5	6	7	8	9
R.	74 μ long and 150 broad	74	68	44	47	47	50	52	125
L.	74 μ long and 136 broad	64	68	48	51	51	51	52	120

The legs I., II., and III. approximate:—

108	187	431	110	385	61	230.
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Pupa proper : The pupa proper has the leg-, antenna- and wing-cases free. The antenna-case is distinctly 10-segmented (Fig. 49c). The abdomen terminates in two conical lobes; these are more highly chitinized than the remainder of the body-case and bear several stout spines (Fig. 49d). There is also a strongly chitinized median plate.

The adult ♂ : A number of ♂ puparia were collected and kept in a glass tube loosely closed with cotton-wool. On December 1st the first adult appeared, two others emerging on December 3rd. The adult ♂ is a striking insect, with deep red and black body, black legs, eyes and antennae, and smoky-black wings which have the costal margin fuscous. There are two abdominal prolongations, very much wrinkled and hairy (Fig. 49f), having the same appearance as the terminal portion of the abdomen in mounted specimens. In specimens kept alive for a day after emergence the body-colour was somewhat obscured by a slight covering of mealy white wax.

The ♂ varies slightly in length, but the middle specimen of the three, from the point of view of size, is 7.6 mm. long over antennae, head, body, and appendages, while the head and body alone measure 3.5 mm. The width across the expanded wings is 7 mm.

The antennae are 10-segmented and are 2.61 mm. long. When cleared and mounted they appear very dark brown rather than black, and are whorled with long fine bristles (about 308 μ long on basal joints) (Fig. 49g).

The segments measure :—(1) 136; (2) 136; (3) 357; (4) 290; (5) 272; (6) 246; (7) 240; (8) 220; (9) 205; (10) 250 μ .

This male is apparently very much like that of *Monophlebus africanus* Newstead in colouring and general appearance but is larger, as the wings alone are 3.15 mm. long in *fulleri*, while in *africanus* the length from point of head to tip of closed wings is given as 2.5 mm.

Adult ♀ : The insects most commonly seen are of a sordid white or buff colour, due to a coarse mealy covering. After moulting, however, the newly emerged insect is a deep rich red, with the antennae and legs black.

At the time of ecdysis the insects cling to the grass by the legs, but are also slightly glued to the stem by secretion from tenent hairs on the venter, between the three pairs of legs, exactly in the same manner that *Aspidoproctus* is attached.

Prior to the adult moult the insect is almost as large as the adult ♀, but it has 8-jointed antennae, and the legs are much smaller, the femur plus trochanter and the tibia each being about 462 μ long.

The adult ♀ is most commonly between 5 and 6 mm. in length, but occasionally insects are found which reach 7 to 8 mm. long. The legs and antennae are long, but the joints are variable in length.

One of the largest insects collected in Pretoria measured when alive 7.2 mm. long, 3.5 mm. broad, and 3.5 mm. high. When cleared and mounted the antennae measured:—

Segments	1	2	3	4	5	6	7	8	9	10	11
R.	142	146	122	68	68	74	85	85	74	64	136
L.	136	142	129	74	74	78	81	91	78	74	146

In this specimen the femur + trochanter varied from 958 to 1,000 μ ; the tibia was 816 μ , and the tarsus without claw was I. 492 μ , II. 540 μ , III. 585 μ .

A small form from Pretoria measured: Antennae:—

R.	85	85	92	58	68	68	68	68	68	68	153
L.	102	91	102	58	68	71	68	68	68	68	153

Legs:—Femur + trochanter 770 μ ; tibia I. 616 μ , II. 650 μ , III. 695 μ ; tarsus without claw I. 338 μ , II. 368 μ , III. 385 μ .

One of the Queenstown specimens which is about 6 mm. long measures: Antennae:—

R.	98	100	100	58	68	68	68	68	85	80	136
L.	120	85	100	58	68	68	68	68	76	74	140

Femur + trochanter I. 800 μ , II. 800 μ , III. 846 μ ; tibia 620 to 675 μ and tarsus without claw 340 to 380 μ . The trochanter in all cases appears to be two-segmented (Fig. 49*i*).

Habitat: On grass (sp. indet.) Natal (Coll. Fuller), Queenstown Municipal Gardens, C.P. (Coll. T. F. Dreyer), and on *Cynodon* sp. Pretoria, Transvaal, collected by the writer.

Collection No.: 4.

48. MONOPHLEBUS HIRTUS, sp. n.

(Plate XXVI., Fig. 59.)

A slide in the collection at Pretoria has on it two specimens of ♀ *Monophlebus* sent to the office in April, 1913.

The records show that these were sent in by C. C. Robertson, of the Division of Forestry, who wrote as follows:—

KOLOGHA, STUTTERHEIM, C.P.

April 23, 1913.

I am sending you by post to-day a box containing some insects found yesterday at Kubusie Plantation adhering to the bark of shoots of trees of *Pinus canariensis*, about 6 ft. high. They were seen only on shoots the tips of which were dead, and not on the surrounding healthy shoots.

The other specimens were placed upon young pine-trees in the office garden, but as no further records were made they apparently disappeared.

Claude Fuller, who saw the insects when they arrived, says that they were dark red in colour, larger and darker coloured than *M. fulleri*.

The slide shows the insect to be quite distinct from anything I have yet seen, the name *hirtus* being suggested by the appearance under the microscope.

The two mounted specimens measure:—

- (a) 8 mm. long and 4.5 mm. broad.
 (b) 6.2 mm. long and 3.5 mm. broad.

The dermis is closely crowded with slightly clubbed glandular hairs, and occasional long hairs, the latter fitting into thickened sockets.

The antennae in both insects are 11-segmented, the joints measuring:—

(a)	R.	145	170	156	70	68	68	102	102	102	102	175
	L.	?	168	154	68	68	70	98	102	102	102	175
(b)	R.	153	136	120	68	68	74	85	91	85	85	170
	L.	136	115	120	68	68	68	85	92	85	85	170

Legs:—

	Femur + trochanter.	Tibia.	Tarsus without claw.
(a)	1,078 μ	840-942 μ	430 μ
(b)	847 μ	800 μ	460 μ

Some of the marginal hairs, especially those of the posterior margin, are exceptionally long, reaching 750 μ in length.

Habitat: On shoots of *Pinus canariensis*. Kubusie Plantation, Stutterheim, C.P. Collected by C. C. Robertson, April 23, 1913.

Collection No.: 3.

GEN. ICERYA Signoret.

♀: Body usually yellow to reddish-brown in colour, densely covered with white or yellowish powdery or cottony material which may entirely obscure the body-colour, and may be separated into definite masses suggesting the appearance of an *Orthezia*.

Body remaining soft to maturity. Oviparous specimens stationary at maturity, secreting a large fluted ovisac; viviparous species usually active throughout life, not producing an ovisac.

Legs and antennae dark in colour, often black.

Antennae of 11 segments.

♂ with two short caudal appendages to the abdomen. (In *I. purchasi* the caudal appendages are one-eighth as long as the body.)

♂ with compound eyes.

49. ICERYA EUPHORBIAE, sp. n.

(Plate XXV., Fig. 56. Plate XXVI., Fig. 60.)

Adult ♀ : With waxy secretion the adult ♀ is similar in size to *I. seychellarum*, but differs in appearance chiefly in the following particulars :—

(a) The insect is viviparous and forms no ovisac.

(b) The waxy secretion is not divided into distinct masses, but appears rather to be covered with a more or less homogeneous membrane of waxy secretion which at maturity breaks away at the margins and posterior end. At these points there are indications of definite waxy masses.

The colour of the secretion is generally uniformly white, but in a few instances the covering layer shows faint indications of yellow.

The body-colour, denuded of wax, is orange-red.

Cleared and mounted the adult ♀ averages 8 mm. long. The dermis is characterized by pale hairs, long and short, and numerous small gland pores. These pores have the margin beaded and the pore itself triangular. There are no large circular beaded pores like those found in *seychellarum*.

The antennae, which are 11-jointed, are long and densely chitinized. They are thick at the base and gradually diminish in thickness towards the apex. The basal joint is comparatively short; joint II. is thick and long (110 μ), with a large basal rounded protuberance on its outer edge; joint III. is about as long as II., cylindrical; joint IV. to X. subequal (50 to 60 μ); XI. long (150 μ).

♂ puparium : "Length 3 mm., width 2 mm., and 1.5 mm. high; elongate oval, very convex, flat beneath, formed of red matter and exuviae covered with white meal: open behind." (Fuller, notes 1898.)

♂ : (From specimens mounted by Claude Fuller, 1898) The mounted insect is a large, striking creature with dark red body, smoky brown wings, and long delicate antennae. The head and body, without antennae, measure about 3.3 mm. The greatest width is across the mesothorax (0.9 mm.). The abdominal segments taper gracefully from 0.7 mm. for segment I. to 0.3 mm. at the terminal segment. The caudal processes, without the setae, measure 0.35 mm. Apically they bear a number of long setae, many of which are about 1 mm. in length. The wings are about the length of the head and body combined, the average total width across expanded wings being about 7.5 mm.

The antennae, which are about 3 mm. long, are 10-jointed. Each

segment except the basal one bears two whorls of long (0·7 mm.) hairs. The extremities of the segments appear swollen and the intermediate portion is narrower, producing a decided hour-glass effect.

Larva (mounted): About 0·86 mm. long. Antennae 6-jointed, about 0·33 mm. long without terminal setae; longest terminal seta about 1·1 mm. long.

Caudal extremity with 4 very long setae, the longest of which is about 1·2 mm. long.

The approximate length of the antennal segments is as follows: (1) 50; (2) 68; (3) 50; (4) 45; (5) 52; (6) 160 μ .

The setae around the margin of the body are about 0·415 mm. long. The dermis has a number of large disc-rosette gland-pores, with a wide beaded rim.

Habitat: On large tree *Euphorbia*, East London, C.P. Collected by Chas. P. Lounsbury, 1898; also by J. L. King, East London, January, 1915.

Remarks: The following note, which was made at the time of the first collection of material, appears in the Cape records: "Large *Icerya*-like Coccid on *Euphorbia*, East London. Occurs in small but well-defined patches on its host-plant. Has no ovisac like that of *I. purchasi*. It is preyed upon by *Rodolia chermisina*. Adult ♀ flat and naked beneath, very convex above, and coated with a thick covering of white meal. Larvae hatching 17.X.'98."

Collection No.: 7.

50. ICERYA NATALENSIS (Douglas).

Ortonia natalensis Douglas, Ent. Mon. Mag., xxv., p. 86, 1888.

" " " " " pp. 232, 233, 1889.

" " Lewis, Journ. Q. Mic. Club, iii., 2, p. 356, 1889.

Icerya " Fernald, Catalogue, p. 25, 1903.

Until a few days ago (March 16, 1915) this species had apparently been lost sight of for about eighteen years. It was originally collected by the late Rev. J. R. Ward, of Richmond, Natal, in 1888, and sent to Mr. G. Henderson, who was then editor of the *British Bee Journal*. In turn, it was given to Mr. R. T. Lewis, who passed it on to Mr. J. W. Douglas, the describer of the species.

Mr. Arnold W. Cooper, of Richmond, Natal, is the only other person known to me who has collected this species, and according to a letter just received from him, the insects were only found in the immediate neighbourhood of Richmond, i.e. on the banks of the Illovo and at Byrne. Mr. Cooper also informs me that the host-plants given for this species,

acacia, orange, and lemon (Fernald), are certainly wrong, as it was found only on a small native bush "about two or three feet high with small pinnate leaves." From a specimen sent, Miss S. Stent, of the Division of Botany, has kindly determined the plant as *Cliffortia serrulata* (Engl.) Diels.

Unfortunately I have not been able to refer to the original description of *Icerya natalensis*. Moreover, there were no specimens in the collection which could possibly represent this species, a difficulty overcome, however, by receiving notes and slides from Mr. Cooper. The following are extracts:—

"*I. natalensis* was always uncommon, and I only knew of it in two places, from both of which it disappeared before 1897, and I have not seen it since. I find I made the following notes in 1896:—

Larva, newly hatched: Colour reddish-brown; length 0.70 mm., breadth 0.37 mm. Antennae: Length 0.42 mm., 6-jointed; 6(4.3.2)5.1.

♀, 3rd stage: Antennae 9-jointed, joints of about equal length. Body covered with white cottony secretion and several long hairs.

Adult: Antennae 11-jointed; 11(1.2)3(10.9.8.7.6)5.4, clavate, cylindrical; 25 to 30 hairs, sensory on last joint, about 12 similar hairs on other joints; length about 1.78 mm.

Feet: Two upper and two lower digitules.

Ungue: End somewhat blunt and rounded on upper edge.

Body: With long hairs and numerous spinnerets; covered with white secretion; makes a long cottony ovisac from which it becomes detached.

Since writing this morning I have been able to go down to the Illovo, and found two specimens of *I. natalensis*. I cut off a small branch with one which I am sending by post, and I left the other. Neither is full grown. I find from my notes that they are mature in April; but the present stage is interesting, being just prior to making the egg-sac. There are two or three of the shrubs near each other, but both the insects were on a branch overhanging the bank. I will keep a look-out later for others. As far as I remember I have never seen more than seven at a time on these bushes, and have not found them elsewhere, and I used to search the banks for them. There was one shrub of the same plant near Byrne where there were a few, the only two places where either Mr. Ward or I ever found them."

The living specimen which accompanied this letter was a young ♀, 7 mm. long and about 4 mm. broad. It had no white waxy covering, and the body was bright orange-chrome in colour. The venter is flat, the dorsum somewhat convex with the median thoracic area raised in three rounded elevations. The grooves and depressions appear grey, with the sides lightly sprinkled with yellowish powder. The legs and antennae are fuscous.

The slides, which are dated 1895, are in excellent condition. The following particulars concerning them may be of use in the determination of slide material :—

Larva (mounted) : About 0·8 mm. long. Antennae 6-jointed about 0·46 mm. long without terminal setae.

Longest terminal setae about 0·2 mm. long.

Caudal extremity with 4 long setae, the longest of which are about 0·8 mm.

The measurements of the antennal segments of three specimens on this slide are :—

	i.	ii.	iii.	iv.	v.	vi.
A.	44	68	62	58	48	136
	48	68	68	50	48	136
B.	52	68	68	54	48	142
	40	68	62	50	48	142
C.	44	68	62	54	52	140
	48	68	65	54	52	142

The setae around the margin, on the first abdominal segments, are about 0·4 mm. long.

The derm has a number of large disc-like glands with a broad-beaded edge similar to those of *I. euphorbiae*.

Adult ♀ (mounted) : Slide A measures approximately 8 mm. long and 5 mm. broad. Slide B 10 mm. long and 5 mm. broad.

Antennae :—

	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.	ix.	x.	xi.
A.	153	146	140	80	102	92	100	90	90	102	170
	153	153	162	88	95	80	85	88	102	102	156
B.	170	180	176	102	102	118	115	130	120	120	215
	170	192	185	118	115	118	130	136	136	136	215

The antennae of slide A are somewhat shrunken, so that those of B are probably nearer the average. The derm has hairs and large and small glands all somewhat similar to those of *I. seychellarum*. The larger pores, however, are much fewer in number.

Habitat : On *Cliffortia serrulata* (Engl.) Diels. (*Rosaceae*), near Richmond, Natal. Collected by Arnold W. Cooper.

Remarks : This seems to be an extremely uncommon species which is restricted to a single host-plant. The reference given for host-plants, (Fernald, p. 25), is undoubtedly an error. Early in 1900 Claude Fuller discussed this species with the late Rev. Ward and A. W. Cooper, and in

company with them examined the bushes upon which the type specimens were originally discovered, but failed to find it. Mr. Fuller assures me that at that time there was no suggestion whatever that the insect occurred upon any other plant than the native shrub *Cliffortia*.

Collection No. : 5.

51. ICERYA PURCHASI Maskell.

(Plate XXII., Fig. 46. Plate XXV., Fig. 55. Plate XXVI., Fig. 61.)

“Australian Bug,” Report of the Commission appointed by His Excellency the Governor to inquire into and report upon the means of exterminating the insect of the family *Coccidae* commonly known as the Australian Bug, Cape Town, 1877.

„ „ Government Notice No. 113, 1877 (Letter by Mr. Roland Trimen).

Icerya purchasi Mask., N.Z. Trans., xi., p. 221, 1878.

„ „ Mask., N.Z. Scale Insects, pp. 104, 105, 1887.

„ „ Comstock, U.S. Dept. Agr. Rept., p. 347, 1881.

„ „ Lewis, Journ. Q. Mic. Club, iii., 2, p. 356, 1889.

„ „ Lounsbury, Rep. Ent. C.G.H., p. 92, 1896.

„ „ Lounsbury, Rep. Ent. C.G.H., p. 21, 1898.

„ „ Fuller, Natal Agr. Journ., 1907, p. 1035.

Common names :—Australian Bug.

Cottony Cushion Scale.

Fluted Scale.

Dorthesia.

Ovisac : White, about as broad as the body of the insect, upper surface roundly arched, and distinctly fluted. The completed ovisac may attain a length of three times that of the body of the adult ♀.

Adult ♀ : “Adult female dark, reddish-brown, covered with a thin powdery secretion of yellowish meal, and with slender glassy filaments; stationary at gestation, and gradually raising itself on its head, lifting the posterior extremity until nearly perpendicular, filling the space beneath it with thick white cotton, which gradually extends for some distance behind it in an elongated, white ovisac, longitudinally corrugated; ovisac often much longer than the insect, and becoming filled with oval red eggs. Length of female, about one-fifth inch, reaching sometimes nearly one-third inch. Body previous to gestation lying flat on the plant, the edge slightly turned up; on the dorsum a longitudinal raised ridge, forming one or more prominences. Insect covered all over with numerous minute fine hairs,

more thickly on the thoracic region; round the edge these hairs are longer, and are arranged in tufts somewhat closely set; the tufts are black, and contain from twenty to thirty hairs in each. Amongst the hairs in the tufts are several protruding tubular spinnerets, having on the outer end a kind of multiglobular ring or crown; from these proceed cylindrical, glassy, straight tubes as long as the tufts of hair. Long, fine, glassy, delicate filaments, as long as the body of the insect, radiate from the edge all round; but these, being very fragile, are often irregular, or absent. During gestation thick, short, cottony processes form at the edge of the thorax, seemingly attached to the feet. Antennae of eleven joints, very slightly tapering; each joint bearing hairs. Feet normal, somewhat thick. Rostrum not long; mentum triarticulate. Procreation commencing soon after the first formation of the ovisac, the eggs being ejected into the sac as it grows" (Maskell).

The adult ♀ (mounted) averages 5 mm. long. The dermis is characterized by numerous tufts of black hairs, and gland-pores of two sizes. Both of these have beaded edges; the larger ones are circular, the smaller broadly elliptical.

Antennae 11-jointed; joints II. and III. subequal (115μ); IV., V., VI., VII., VIII., and IX. subequal ($56-68 \mu$); X. about 90μ ; XI. comparatively short (about 135μ).

The following interesting account of the male of this species is taken from Prof. C. V. Riley's 1886 Report, pp. 480-481, 1887:—

"The adult male is a trifle over 3 mm. in length, and has an average wing expanse of 7.5 mm. The general colour is orange-red. The head above is triangular in shape, with the apex blunt and projecting forward between the bases of the antennae. The eyes are placed at the other apices of the triangle, and are large, prominent, and furnished with well-marked facets. There are no mouth-parts, but on the underside of the head is a stellate black spot with five prongs, one projecting forward on the conical lengthening of the head, one on each side to a point just anterior to the eyes and just posterior to the bases of the antennae, and the remaining two extending laterally backwards behind the eyes. The antennae are light brown in colour, and are composed of ten joints. Joint 1 is stout, almost globular, and nearly as broad as long; joint 2 is half as broad as 1 and is somewhat longer; joint 3 is nearly twice as long as 1 and slightly narrower than 2; joints 4, 5, 6, 7, 8, 9, and 10 are all of about the same length as joint 3, and grow successively a little more slender; each joint, except joint 1, is furnished with two whorls of long light-brown hairs, one near base and the other near tip; each joint is somewhat constricted between its two whorls, joint 2 less so than the others. There are no visible ocelli. The pronotum has two wavy subdorsal longitudinal black lines, and the mesonotum is nearly all black, except an oval patch on the scutum. The metanotal spiracles are black, and there is a transverse crescent-shaped black mark, with a short median backward prolongation. The mesosternum is black. The legs are also nearly black and quite thickly furnished with short hairs. The wings are smoky black, and are covered with rounded wavy elevations, making a reticulate surface a cross-section of which would appear crenulate. The costa is thick and brown above the subcostal vein, which reaches costa at a trifle more than four-fifths the length of the wing.

The only other vein (the median) is given off at about one-sixth the length of the wing, and extends out into the disk a little more than one-half the wing length. There are, in addition, two white lines, one extending out from the fork of the subcostal and the median nearly straight to the tip of the wing, and one from the base in a gradual curve to a point some distance below the tip. Near the base of the wing below is a small ear-shaped prolongation, folded slightly on itself, making a sort of pocket. The halteres are foliate, and furnished at tip with two hooks, which fit into the folded projection at base of wings. The abdomen is slightly hairy, with the joints well marked, and is furnished at tip with two strong projections, each of which bears at tip four long hairs and a few shorter ones. When the insect is at rest the wings lie flat upon the back."

Larva (mounted): About 0.6 mm. long. Antennae 6-jointed, about 0.415 mm. long without terminal setae; longest terminal seta about 0.8 mm. long.

Caudal extremity with 6 very long setae; longest of which measures about 1 mm. The antennal segments approximate in μ :—(1) 40; (2) 60; (3) 54; (4) 60; (5) 50; (6) 136.

The marginal setae are more numerous than in any of the other South African species, but are shorter, averaging about 0.1 mm.

The dermis has numerous scattered "rosette" glands.

Habitat: On citrus, acacias, roses, etc., throughout the Union.

Australian Bug was probably introduced into South Africa at Cape Town in 1872 or early in 1873. It was certainly present in the Botanic Gardens, Cape Town, in 1873. According to the Report (*l.c.* 1877) it was observed in the village of Ookiep, Namaqualand, a few months after its discovery in Cape Town, but strangely enough it was not seen in Stellenbosch until the end of 1876. In 1877 it was known to occur in Cape Town and suburbs, Simonstown, Stellenbosch (Mulder's Vlei), Paarl, Malmesbury, Wellington, Ookiep, Bredasdorp, George (Brak River), Uitenhage, and East London.

Mr. Roland Trimen (*l.c.* 1877) states that the first specimens seen by him in Cape Colony occurred in 1873, at Claremont, on blackwood (*Acacia melanoxylon*) obtained from the Botanic Gardens at Cape Town. He states: "In the course of a few months the insect increased so prodigiously in number, and the Australian acacias became so laden with them to such an extent that in the early part of 1874 the large blackwood-trees in the gardens, which were infested to a greater extent than any other plant, had to be cut down." The plants to which the insect had spread up to 1877 were given as follows: *Acacia melanoxylon*, Australian acacia, golden willow, *Casurina*, *Pittosporum*, blue gum (rarely), Australian "bottle-brush," oak, orange, vine, fig, *Laurustinus*, rose, rosemary, strawberry, verbena, plumbago, Indian jasmine, bougainvillea, hawthorn, poinsettia, and hakea.

Mr. J. C. Brown, in his paper "On the 'Australian Bug' in South

Africa," *Journal of Forestry*, vi., p. 44, May, 1882, quotes Trimen as writing under date of March 17 (1882?), that the insect had then mainly attached itself to orange-trees, "many of the finest plantations have been destroyed and others are on the high road to destruction. You will remember," he says, "how good and cheap oranges used to be here; they have lately been threepence and fourpence apiece, and often inferior in quality even at such a price."

In 1886 Miss Ormerod received specimens from Port Elizabeth (letter to C. V. Riley), and in 1888 it was collected at Richmond, Natal (Lewis, *l.c.*).

After this date the spread of the insect was probably rapid, and the list of host-plants grew with the range of distribution.

The *Vedalia* ladybird (*Novius cardinalis*) was introduced into California in the year 1888 and was sent from there to South Africa three years later. Collection No. : 6.

52. ICERYA SEYCHELLARUM (Westwood).

(Plate XXII., Fig. 47. Plate XXV., Fig. 54. Plate XXVI., Fig. 62.)

Dorthisia seychellarum Westw., *Gard. Chron.*, p. 830, 1855.

Orthezia seychellarum Targ., *Catalogue*, p. 30, 1869.

Coccus sacchari Sign., *Ann. Soc. Ent. Fr.* (4), ix., pp. 93, 94, 1869.

Icerya sacchari Sign., *Ann. Soc. Ent. Fr.* (5), v., p. 352, 1875.

„ *seychellarum* Mask., *N.Z. Trans.*, xxix., p. 329, 1897.

„ „ de Charmoy, *Pr. Soc. Amic. Scien.*, p. 47, 1899.

„ „ Ckll., *Ent. Mon. Mag.*, p. 86, 1902.

„ „ Green, *Mem. Dept. Agr. India*, ii., 2, p. 18, 1908.

Ovisac: White, usually short and broad, with posterior margin truncate. Upper surface flatly arched, faintly fluted; most common length, when completed, about as long as the body of the ♀.

Adult ♀: Size with waxy secretion, but without counting ovisac, usually about 10 mm. Waxy secretion arranged in more or less regular masses, yellow on dorsum and white at margin. Around the body are numerous fine silky or glassy filaments. The secretion of the young stages is often entirely yellow, the colour being slightly darker than in the adult.

Denuded of its waxy covering the insect is orange-red in colour.

Cleared and mounted the adult ♀ averages 8 mm. long. The derm has numerous hairs and gland-pores of two sizes; the smaller are more or less broadly oval, with a diameter of 10 μ . These have a beaded edge and an elongate elliptical pore. The larger pores are distributed around the

margin of the body. They are circular with a diameter of about $17\ \mu$. The rim of these is comparatively narrow, beaded, and encloses a large transparent pore which is circular with a slight intrusion at one point.

The antennae are 11-jointed. Joint II. is regularly cylindrical without the protuberance of *euphorbiae*, III. is usually somewhat constricted below the middle; IV., V., and VI. are about subequal ($50\ \mu$); VII. and VIII. subequal ($68\ \mu$); IX. and X. subequal ($85\ \mu$); joint XI. long, usually 170 – $180\ \mu$.

Larva (mounted): About 0.52 mm. long; antennae 6-jointed, about 0.385 mm. long without terminal setae; longest terminal seta about 0.44 mm. long.

Caudal extremity with 6 very long setae, longest of which is about 0.86 mm. long. The antennal segments approximate in μ :—(1) 44; (2) 60; (3) 64; (4) 50; (5) 50; (6) 115.

The marginal setae measure approximately 0.23 mm. The derm is characterized by numerous large, scattered, "rosette" glands.

Habitat: On rose and ficus, Natal (T. D. A. Cockerell, *l.c.*, p. 86). On palms, Durban, Natal. Collected by Chas. P. Lounsbury, October, 1914.

Remarks: This species is also recorded from the Seychelles, Mauritius, Madeira, China, New Zealand, and Formosa on a variety of host-plants, including sugar-cane, guava, palms, rose, and citrus. Prof. Cockerell suggests that it is most likely a native of South Africa.

Collection No.: B 5.

GEN. ASPIDOPROCTUS Newstead.

Walkeriana Newstead, Proc. Zool. Soc., Lond., lxii., p. 947, 1900.

s. g. *Aspidoproctus* Newst., Proc. Zool. Soc., Lond., lxii., p. 947, 1900.

Lophococcus Ckll., The Entom., xxxiv., p. 227, 1901.

Walkeriana s. g. *Aspidoproctus* Fernald, Catalogue, p. 331, 1903.

Aspidoproctus Newstead, Mitteil. a. dem. Zool. Mus. Berl., p. 158, 1911.

♀: Body densely chitinous, becoming quite hard and horny at maturity. Colour in young stages castaneous, with a slight secretory covering; later shiny, dark castaneous to nearly black, with marginal waxy appendages which are often forked; and in some cases a few dorsal appendages of similar texture. Dorsum may be smooth (*maximus*), or with short conical protuberances (*armatus*), or with one or three long "horns" (*mirabilis* and *tricornis*). Insects large, adults ranging from nearly half an inch in length (*mirabilis* and *tricornis*) to one and one-third

inches (*maximus*). Insects at maturity stationary, fixed to stems of food-plants by secretion from tenent hairs on venter.

Eggs deposited in a marsupium formed by invagination of portion of venter. (N.B.—The marsupium in the Australian genus *Calpappus* is formed by the intussusception of the terminal abdominal segments.)

Ventral orifice closed by a secretory flap.

Antennae of 10 segments.

♂: With two caudal appendages of medium length (in *A. maximus* the caudal appendages are one-fifth as long as the body). ♂ with compound eyes.

This genus, so far as is known, contains seven described species which are confined entirely to the African continent. Five of these, viz. *A. armatus*, *maximus*, *mirabilis*, *pertinax*, and *tricornis*, are known to occur in the Union of South Africa or Rhodesia.

N.B.—In his paper "On a new Scale Insect from Zomba, B.C.A.," in the Proceedings of the Zoological Society of London, pp. 947-948, 1900, Professor Newstead describes and figures an insect which he names *Walkeriana pertinax* n. sp. Certain characters, such as the secretory flap which covers the ventral opening, are given specific rank, but only provisionally so, as it was at first intended to make *pertinax* the type of a new genus with the name *Aspidoproctus*.

In the Entomologist, vol. xxxiv., p. 227, 1901, Professor Cockerell created a new genus, *Lophococcus*, from an insect sent from Natal by Claude Fuller. This became *L. mirabilis*, the type species. The generic characters are given, "*Lophococcus* n.g. A genus of Monophlebinae Coccidae, allied to *Monophlebus*, which becomes fixed in the adult female state, with a strongly chitinous skin, and has a large erect spine in the middle of the back, this spine originating as an elevated fold of the skin. No ovisac. Type *L. mirabilis*."

Since that date five other species have been described, four by Professor Newstead, viz. *A. maximus* and *A. armatus* in 1911, *A. tricornis* in 1912, and *A. giganteus* in 1914, and one by M. P. Vayssière, viz. *A. vuilleti* (Ann. des. Epiph.), 1913.

There is no doubt that all seven species are con-generic, and that according to the Law of Priority by Art. 25 of the International Code of Zoological Nomenclature the name *Aspidoproctus* should be retained for the genus. All agree, apparently, in the following particulars:—

- a. They are typically Monophlebinae in the early stages.
- b. At maturity the integument becomes dense, hard, horny, and brittle when dry.
- c. Adults attach themselves to stems of host-plants by secretion from the anterior median ventral surface.
- d. Eggs are produced in a large marsupium formed by the invagination of a portion of one of the ventral segments.
- e. The ventral orifice of the marsupium is closed by a secretory flap.
- f. Large numbers of ova are produced in the marsupium; from two to six thousand, according to the size of the species (Plate XXIV., Fig. 50b).
- g. The larvae escape from the marsupium by the ventral surface shrinking away from the posterior margin of the covering flap.
- h. The larvae are all of the same type, with 5-jointed antennae, and all secrete long glassy, waxy filaments, which assist in distribution by wind (Plate XXIV., Figs. 51a, 51b).

The section of *A. maximus* shown in Plate XXIV., Fig. 50b was made from a specimen which had been stored in 70 per cent. alcohol for six years. The marsupium in this case

did not occupy the whole body cavity, and judging by the hard condition of the walls of the cavity it did not appear that it would do so. Unfortunately, I have not been able to obtain fresh material to investigate the matter further with this species. Spirit specimens of *armatus* seem to indicate that the marsupium in this species, too, occupies part of the body cavity only.

From fresh material of *A. tricornis* collected in Pretoria in January of this year it is evident that the marsupium, when replete, occupies the whole of the body cavity except the "horns." The hard chitinous tegument was broken away, beginning from the median horn, and it was found that there was no trace of organs left between the marsupium and outer body-wall, but merely a little yellowish lymph-like fluid, streaked with blood-red. The wall of the marsupium was regularly domed, parchment-like in texture, quite soft, appearing white in colour, but stained with blood-coloured matter.

The marsupium was quite free from the general body-wall at all points, except where it was attached to the edges of the ventral orifice.

It was computed that between 2,500 and 3,000 ova were present in the marsupium, and that about 5 per cent. of the ova had hatched (January 24, 1915).

The ventral surface had begun to shrink, and there was a very narrow slit between the hind margin of the secretory flap and body. On removing the flap the orifice was found to be tightly packed with a dense white powdery substance.

The newly-hatched larvae observed among the eggs inside the marsupium had only the slightest traces of the waxy filaments which adorn the dorsum of the larvae when they emerge.

I have watched the emergence of larvae on several occasions. In all cases the slit was very narrow and the larval insects appeared to have difficulty in escaping, relying in some cases on other insects pushing them from behind. The waxy filaments were crushed down close to the dorsum, forming a smooth layer between the insect and the edge of the orifice, and giving the dorsum a glossy, finely striated appearance. On emergence, however, the filaments stand erect from the dorsum as shown in Plate XXIV., Figs. 51a and 51b. Fig. 51b shows a section of the insect shown in 51a after all the larvae had emerged, the white egg-shells remaining within the marsupium.

53. ASPIDOPROCTUS ARMATUS Newstead.

(Plate XXVI., Fig. 63. Plate XXVII., Figs. 65 and 65a.)

Aspidoproctus armatus Newstead, Mitteil, aus dem Zool. Mus. in Berlin, p. 160, 1911.

Professor Newstead's description is as follows:—

"Female adult. Elongate, narrowed posteriorly; margin in front more or less truncate; sides broadly concave and deeply and coarsely punctate. Cephalic area sloping suddenly downwards, the area defined by two widely separated and rounded ridges, most clearly defined towards the margin, each terminating with a short, stout, tooth-like waxen appendage; thoracic area with two large transverse ridges each bearing four large bluntly pointed processes, one lateral and two median; abdominal area flat, tapering more or less posteriorly; margin forming a distinct ridge along which are six small and bluntly pointed processes of which the first and last are the largest; margin with a series of blunt tooth-like waxen appendages, many of which are bifid. The whole of the dorsum bears a thin coating of greyish granular wax, but is darker and more homogeneous over the blunt processes. Venter flat or concave,

mealy. Colour in alcohol dull crimson; venter terracotta red. Derm of venter thickly studded with short stout spines, scattered between them are numerous small circular spinnerets, and at greater intervals large, clear, circular glands; besides these there are also a number of large subcutaneous bell-shaped organs (? glandular) having a finely reticulated lip; the relatively small area protected by the secretory operculum almost covered with circular spinnerets, and arising from between them many slender hairs. Thoracic spiracles large. Antennae of 10 segments, of which the terminal one is much the longest.

Length 12-17 mm.; width 8-12 mm.; height 6-8 mm."

Habitat: On M'sasa-tree (*Brachystegia randii*), Macequece, Portuguese East Africa, in association with *A. maximus*. Sent to Mr. Lounsbury, Cape Town, by E. Ross Townsend in October, 1908.

Also on M'sasa-tree in Salisbury, S. Rhodesia, in association with *A. maximus*. Coll. C. P. Lounsbury, 1908.

Collection No.: D 15.

54. ASPIDOPROCTUS MAXIMUS Newstead.

(Plate XXIV., Fig. 50. Plate XXV., Fig. 52. Plate XXVII., Fig. 64.)

Aspidoproctus maximus (Sanders MSS.) Newstead, Mitteil, a. d. Zool. Mus. Berlin, pp. 153, 159, 1911.

Larva: About 0.8 mm. long, dark reddish-brown, active, dorsum and margins with numerous long delicate erect waxy or silky-looking filaments, which no doubt aid in distribution.

♀ Young: 10 mm. long, very flat and wrinkled (Fig. 50). Antennae 10-jointed similar to those of the adult ♀.

♀ Adult: "Female adult. Castaneous when dry, pale yellowish-brown to dark brown in alcohol. Ovate, slightly narrowed in front, convex above; more or less flat ventrally; dorsum with 3 rows of deep and rather widely separated pits arranged in zones and taking the contour of the margin; within the zones on the thoracic area are several other similar pits, and the cephalic area has two more or less distinct and slightly divergent carinae. Margin with a series of large white tooth-like waxen appendages measuring on an average 3 mm. in length: 29 of these appendages were present in one individual, and this number may be taken as approximately correct; but they are rarely retained in old adults. Ventral (genital) orifice covered by an operculum or 'secretory flap' (Newstead), as in *Aspidoproctus pertinax* Newst. Legs extremely short. Antennae broken away in the examples submitted. Dorsal epidermis thickly studded with circular spinnerets and large irregular ovate, clear, glandular spaces resembling the glands in certain species of *Lecanium*; there are also numerous minute spines attached to disc-like bases; the gland-tracts corresponding to the pits in the non-macerated examples, are much more chitinized than the surrounding integument and are furnished with a number of circular spinnerets. Ventral epidermis clothed with rather long stout spines, interspersed with small circular spinnerets and large circular pores; besides these there are a number of minute compound glands surrounded by dark chitine, these are much more numerous in

the abdominal region, and are arranged more or less in lines radiating from the genital orifice towards the margin. Marginal gland-tracts much larger than those either on the venter or dorsum.

Length of old adult 33 mm.

Width of old adult 25 mm. (= 1 inch).

Height of old adult 15 mm. (= $\frac{1}{2}$ inch).'' (Newstead.)

♂ Prae-pupa : Dull rusty red, varying from 4.5 to 6 mm. long ; ven tra surface flat ; legs well developed ; mouth-parts absent. Dorsum convex, median area roundly so, margins slightly depressed. Margin with numerous pale hairs. Antennae 9-jointed, tapering, with long slender hairs (Fig. 52a). Eyes inconspicuous until mounted.

♂ Puparium : On reaching the prae-pupal stage the insect—in many cases at least—leaves the tree and seeks shelter beneath fallen leaves or other debris, and secretes a massive, white, downy puparium. This assumes a more or less regular mass 10 to 14 mm. long and about half as wide. It is composed entirely of extremely delicate, white, waxy matter, which impresses one as being softer and more downy in texture than is the ovisac of any mealy-bug known to me.

♂ Pupa (from single spirit specimen) : Dull reddish-brown or rusty red, 6 mm. long and 2.2 mm. across the abdominal segments. The appendages are quite free from the body (*pupa libera*). There are no indications of mouth-parts. The posterior extremity is cleft (Fig. 52b).

♂ Adult : Head and body about 5 mm. long, cochineal red in colour, but more or less covered with a downy secretion of wax. Antennae long, brownish or purplish in colour, with many fine, long whorled hairs. Legs brown. Wings smoky brown. Subcostal vein reddish ; costal margin fulvous. Width across expanded wings 13-15 mm. Caudal processes concolorous with body, slender, with many whorled hairs similar to those of antennae. Length of caudal processes from one-fifth to one-fourth the length of the body without antennae.

Habitat : On M'sasa-tree (*Brachystegia randii*), Salisbury, March 17, 1908. Also found in small numbers on *Grevillia robusta*, casurina, hibiscus, and flamboyant. (C. P. Lounsbury.)

Remarks : This species first attracted attention in Rhodesia in the early part of 1908. On the 17th of March of that year specimens were sent to Mr. Lounsbury at Cape Town by the Secretary for Agriculture of Southern Rhodesia, who wrote that the insects were travelling rapidly along a belt of trees on one side of the town (Salisbury), and that the affected trees were dying off at the tops. Later in the year Mr. Lounsbury visited Salisbury and made a report on the insect. This appeared in the Rhodesian Agricultural Journal for October 1908.

Trees which bear numbers of the insects are conspicuous for the amount of honey-dew below them. Concerning this Mr. Lounsbury writes (*l.c.*, p. 34) :—

"The quantity exuded is not large considering the size of the insect, yet it is this 'honey-dew' which chiefly attracts attention to the insect, and gives rise to complaints against it. It is a clear, colourless, sweet liquid, discharged through a single orifice in the back most freely when the insect is disturbed. Sometimes a thin jet is ejected for several seconds, and this may follow no greater stimulus than blowing hard with the breath. Ants gather to get the liquid, and a certain small bird which frequents the kopje is evidently very fond of it, poking the insect with its beak to get it. The ground beneath badly infested trees becomes heavily coated with it, and in consequence becomes shiny, black, and disagreeably sticky."

There is only one generation in a year. Rupert W. Jack made observations on this species in 1912, and although these are not complete he has kindly supplied the following particulars :—

October 15, 1912.—♀ ♀ nearly replete. Ova in centre of marsupium mature. Those near body-wall still immature, and the wall itself still contains the yellow offensive fluid present in immature scales.

November 20, 1912.—A few larvae emerging.

February 6, 1913.—Majority have increased from 4–5 mm. long.

March 6, 1913.—Males have moulted to a dull orange, migratory instar which leave the tree to secrete a fine white web in fallen leaves, grass, etc., at the base of the tree. Males isolated in the laboratory had finished secreting their web by 7.3.13, and emerged as adults between the 10th and 24th of April. These lived 4 to 5 days.

April 7, 1913.—Female forms moult again.

June 19, 1913.—Females flat, 10–13 mm. in length. These began to fill out in September, and reached their full size by the middle of October.

After each moult the young migrate to thicker twigs or branches.

Collection No. : C 15.

55. ASPIDOPROCTUS MIRABILIS (Ckll.).

(Plate XXV., Fig. 53. Plate XXVIII., Fig. 67.)

Lophococcus mirabilis, Ckll., *The Entom.*, xxxiv., p. 248, 1901.

Professor Cockerell's description is as follows :—

"♀ : Adult very convex, 10 millim. long, 8 broad, and 7 high, exclusive of the dorsal spine; very strong chitinized throughout, hard, tough, but brittle, blackish brown, rugose and dull, with a thin coating of granular wax; on the middle of the back is a stout erect spine about 3 millim. long, like a spike on a military helmet; on each side is a pair of short stout spines in the subdorsal region, the posterior smaller and not amounting to more than a nodule; anterior end of insect somewhat elevated, with two more or less developed blunt and thick longitudinal keels; margin nodular; on the under surface the thoracic region is firmly attached to the bark, so that when the insect is taken off a piece of bark comes with it. Anal orifices large and very little posterior to the middle of the insect, as in *Crypticeria*.

Younger ♀ : 8 millim. long, and not over 3 high (excluding spine); the protuberances of the adult all well developed, the spine about as large; there is also a protuberance just

in front of the spine; the anterior keels converge to a nodule in the middle line, forming a reversed V; and there are blunt lateral keels, including the subdorsal protuberances, crenulate posterior to them. Margin with about fourteen tooth-like dull white protuberances on each side, these being really lamellae of dense wax; from about the bases of these lamellae come some very fine silvery threads.

Still younger forms have the dorsal spine arising as a transverse fold. The cast skins of the young forms are snow-white, much as in *Icerya*, with a fringe of waxy lamellae. The legs and antennae of the young are large and ferruginous.

The legs and antennae seem to come to their full development in individuals little over 5 millim. long.

Antennae 10-jointed, the joints after the third greatly bulging on one side, the sutures therefore very deep; last joint long and falciform. Measurements in μ :—(1) ?; (2) 90; (3) 90; (4) 60; (5) 60; (6) 70; (7) 70; (8) 75; (9) 75; (10) 216 to 294. Joints 2 and 3 are broader than long. Young examples have antennae 8-jointed; club ordinary.

Legs well developed, little hairy; tarsus half length of tibia; inner side of tibia with extremely short spines. Mouth-parts well developed. Skin strongly chitinized, very densely beset with short hairs; the blunt hairs of some Monophlebids are represented by stout hairs with lanceolate heads; small round glands interspersed, not nearly so numerous as the hairs; there are also larger round or suboval brown spots, arranged more or less in rows. Below the mouth there are two large apertures in the chitinous surface, more or less connected in the middle line, and at the next suture beyond there is a large transverse aperture. Spiracles well developed."

On *Acacia* spp. Bathurst and East London (C.P.) Ladysmith (Natal), Estcourt (Natal), and Rustenburg District of the Transvaal (F. Thomsen).
Collection No.: 15.

56. ASPIDOPROCTUS PERTINAX (Newstead).

Walkerina pertinax, Newst., Proc. Zool. Soc., Lond., pp. 947-948, 1900.

Professor Newstead's description (omitting figure references) is as follows:—

"♀. Adult dark castaneous, slightly shining; form above generally highly convex and evenly rounded, forming an almost complete hemisphere, but one specimen was decidedly more elongate and less convex; cephalic area suddenly constricted, much wrinkled and furrowed at the sides, and with 4-6 large, deep, and variously shaped punctures; margin in front emarginate, and within a broad, deep, upward-sloping, central groove, surmounted on either side by a strongly-rounded ridge. Subdorsal and marginal rows of very short, stout, dusky-white, waxy processes, placed close together, and gradually lessening in size from the centre towards the extremities; there is also a double dorsal row of much smaller processes, which also lessen towards the extremities, the largest pair occupying almost a central position. Much mealy substance is scattered round the base of the waxy processes, and the hollows and wrinkles are covered with the same material. Underside flat or slightly concave, with radiating grooves, more or less covered with white mealy secretion; sides sharply raised. Antennae of 10 joints, of which the terminal one is much the longest, and, with the exception of the first, all the joints are furnished with short, fine hairs: formula 10, 1, 2, 3, (4, 5, 6), (7, 8, 9). Legs very small; digitules to claw simple. Rostral apparatus present, but owing to the density of the surrounding tissues it is impossible to make out its true character. Ventral opening very large, somewhat hexagonal and without marginal hairs, the whole aperture covered by a thin

anteriorly-hinged valve or flap of dark brown *secretionary matter* occupying approximately the area indicated by the dotted line in Fig. 4; the line of attachment being immediately beneath the insertion of the posterior legs, its exact course being indicated by large gland-tracts, the largest of which are hidden beneath the legs. Epidermis covered with minute hairs and circular glands.

Long 14-20·5, wide 11-15, high 7-10 mm.

Larva elongate ovate, above with median, subdorsal, and marginal bands of spiny hairs. Antennae of 5 joints, of which 5 is equal in length to 2, 3, and 4 together: formula 5, 3, 2, 1, 4. Legs very long and slender; digitules to claw very fine simple hairs; claws faintly tridentate. Anal ring without hairs.

6258 well-matured larvae were counted from the anterior of a single ♀.

Hab. On an unknown tree, Zomba, Central Africa. Collected by H.B.M. Commissioner A. Sharpe, C.B., 1900."

Collected by Rupert W. Jack in ants' nest, Ummati River, Rhodesia, October 30, 1911.

Collection No. : E 15.

57. ASPIDOPROCTUS TRICORNIS (Newstead).

(Plate XXIV., Figs. 51, 51a, 51b. Plate XXVII., Figs. 66 and 66a.

Plate XXVIII., Figs. 68 and 68a.)

Lophococcus mirabilis var. *tricornis*, Newstead, Schultze, Zool. u. anthro. Ergeb. einer. Forsch. im. w.u.z. Sudafrika, p. 16, 1912.

Professor Newstead's description is as follows :—

" ♀. Adult: Dark castaneous, in alcohol; external surface faintly polished. Form roughly hemispherical with three enormous horn-like projections on the dorsum, arranged transversely in the form of a trident; the middle one, the longest, measures 7 mm. from base to tip and is equal to the width of the body at the margin; lateral horns 3·5 mm. long, project considerably beyond the sides of the body; all the horns are rather flat at the base but have rounded ends; margin strongly and irregularly crenulated, the prominences being bluntly spinose; posterior margin deeply emarginate. Ventral orifice covered with a secretionary flap. Derm of venter densely clothed with strong, narrow, lanceolate spines in the mid-region between and surrounding the legs; beyond this the spines are few in number and smaller. Spinnerets at the margin of the large ventral orifice packed closely together; these present a large quatrefoil-pore. Antennae of 10 segments, the last in length equal to the three preceding ones; all the segments with fine hairs. Legs well developed and stout, resembling those of other Monophlebids. Length at base 7 mm.; width 7·50; height from base to tip of middle spine (longest axis) 10 mm.; expanse of lateral spines 11 mm."

Habitat: On *Acacia robusta*.

Collected by Miss Impey, Pretoria, November 9, 1914; also found by the writer on thorn-trees in front of the Union Buildings, Pretoria, November, 1914. Some females were collected, and larvae emerged in December, 1914, and January, 1915.

From the examination of numerous specimens of *A. mirabilis* and *A. tricornis* in the collection I have no doubt that the latter should be given specific rank.

Collection No. : B 15.

SUBFAMILY MARGARODINAE.

The *Margarodinae* are probably the most remarkable of the *Coccidae*. Both sexes possess very strong front legs which are obviously adapted to their fossorial habits. The males are winged ; the females, as with all Coccids, are wingless.

The most striking feature in the female series is the existence of prae-pupal and pupal stages which are passed in a glassy cyst before the adult proper emerges. During the early part of this period the insect has well-developed mouth-parts but no legs ; a later stage, when both mouth-parts and legs are absent, and which probably represents a true pupal stadium, is present in the case of *M. capensis*, and probably in other species too.

At maturity the female emerges from the cyst and probably moves about in the soil. The newly-hatched larva, however, is best suited by its form for locomotion below ground, and the natural distribution of the insects most likely takes place in this stage. In the four South African species which have been observed (*M. capensis*, *M. peringueyi*, *M. greeni*, and *M. ruber*) the adult female surrounds herself with a dense coat of waxy filaments before the eggs are deposited, and looks, in this stage, like a subterranean mealy-bug.

GEN. MARGARODES Guilding.

Subterranean, anterior legs of both sexes adapted for digging. Antennae 7- to 10-jointed.

Adult ♀ soft, mouth absent, legs and antennae present ; intermediate stage hard, more or less pearl-like ; globular to ovoid.

Synopsis of South African Species of Margarodes.

A. *Cyst irregular in outline, ± triangular.* Adult ♀ whitish-yellow ; antennae 7- or 8-jointed.

(a) Cyst brassy to bronze in colour.

Adult ♀ with 7- or 8-jointed antennae. Derm wrinkled *M. trimeni*.

- B. *Cyst spherical*. Adult ♀♀ whitish-yellow; antennae 8-jointed.
1. Cyst large (about 5 mm. diam.), dark in colour, outer layer wrinkled and bark-like.
 - (b) Adult ♀ with derm properly shagreened; antennae 8-jointed *M. capensis*.
 2. Cyst smaller, shining, about 2·5 mm. in diameter, outer surface not bark-like.
 - (c) Cyst amber-yellow. Adult ♀ with few scattered disc-glands in anterior part of body. Antennae 8-jointed. Lateral thoracic spine areas entirely replaced by fine hairs *M. greeni*.
 - (d) Cyst creamy yellow. Adult ♀ with numerous disc-rosette gland-pores in anterior part of body. Lateral thoracic spine area present. Antennae 8-jointed. *M. newsteadi*.
 - (e) Cyst milky white. Adult without disc-glands in anterior part of body. Lateral spine areas of thorax prominent. Antennae 8-jointed *M. peringueyi*.
- C. *Cyst spherical*. Adult ♀ carrot-red. Antennae 9- or 10-jointed.
- (f) Cyst white, translucent, red colour of body of insect showing through. Adult ♀ carrot-red with 9- or 10-jointed antennae *M. ruber*.

58. MARGARODES CAPENSIS (Giard) Brain.

(Plate XXVIII., Fig. 69.)

Margarodes (Sphaeraspis) capensis Giard. C. R. Soc. Biol., Paris (10) No. 25, p. 683, 1897.

Cyst: Large, almost spherical, may attain 7 mm. for largest diameter, very dark castaneous to black, with outer surface roughly wrinkled. Where portions have flaked off the colour is bright reddish-brown to bronze. (Spirit material.)

In some notes made by Claude Fuller from the fresh material in 1898 I note that he remarks: "Cyst shell composed of three layers: outer, red (bark-like); middle of median thickness, yellow, with thick ridges approaching outer wall; inmost thin and transparent."

Encysted stages: The encysted stages of this species are particularly suitable for study, owing to the dense condition of the tegument. In the small species found in Pretoria, on the contrary, the skin in these stages is extremely delicate, and the characters are therefore difficult to determine. I have in this collection a number of *capensis* specimens collected by C. P. Lounsbury and Claude Fuller at Waylands, C.P., in 1898, and stored in spirits, and also a number of slides made at the time of collection from fresh specimens.

There appears to be two distinct stages during the encysted period, a second larval or prae-pupal, and a pupal stage.

The main difference between the two is the entire absence of mouth-parts in the pupal stage.

In both forms the body is almost spherical, but slightly longer than broad, and slightly broader than thick. They are semi-transparent, and yellowish in colour.

The integument is smooth and shiny (in spirits), but slightly stippled when cleared and seen under the microscope. There are no traces of legs or antennae, and no signs of segmentation, except as indicated by the arrangement of the spiracles.

In the prae-pupal stage mouth-parts are present. They are comparatively small, with a very short single-jointed mentum, and a long delicate rostral loop. In both stages there is a conspicuous series of marginal spiracles which consists of 18 single pores, nine on each side. In addition to these there are two subdorsal pores, one on each side at about one-third the length from the anterior extremity; and a single ventral pore close to the mouth-parts in the prae-pupa and in same position in the pupa.

The anal opening is small and is represented in both stages. In the prae-pupa there are four glandular discs, two on each side of the anal opening, each with two to four small circular openings. In the pupa there appears to be but two of these, the outer pair being absent.

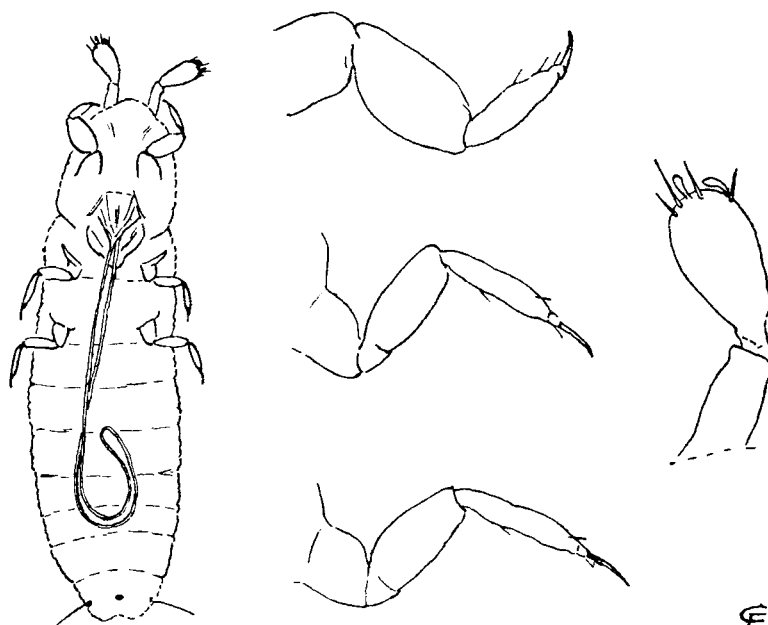
Adult ♀: The adult ♀ varies greatly in size, the largest specimens in the collection being 5 mm. long (spirit material) and 7·4 mm. (mounted). The body is sordid white to yellowish except the claws which are brownish-black. The segmentation is very distinct. On the ventral surface the segments are represented by deep transverse furrows, and appear crowded together, while those of the dorsum are broad and flatly rounded.

The antennae appear 7-jointed in unstained material, but when stained the large second joint always exhibits two whorls of hairs, and there is a distinct articulation. Joint I. is broad, and more delicately chitinized than the others; II. is very short, annular, with an apical whorl of bristles; III., broader and longer than II.; IV., V., VI., and VII. gradually diminishing in width, each with apical whorl of bristles; VIII. truncate, flatly rounded at apex (Fig. 69).

The dermis is coarsely shagreened, and is characterized by numerous bristle-like hairs and rows of short, stout, conical spines on the thoracic and abdominal segments.

Larva (from a slide made by C. Fuller, 1898): Very long and narrow (0·924 × 0·23 mm.) almost vermiform. Antennae short, close together, as far as can be determined, of two joints; basal cylindrical, slightly longer than broad; apical joint elongate, swollen, almost pyriform, apex with numerous bristles.

Legs short (about 0.16 mm. long), prothoracic legs slightly stronger than the others. Mouth-parts broad, about one-third width of body, mentum short; rostral loop very long, recurved, straightened out would extend just beyond posterior end of body. Posterior extremity slightly bilobed, the anal orifice a short distance from extremity. On margins at level of anal opening are two caudal setae, one on each side, about $180\ \mu$ long.



Larva of *Margarodes capensis* with legs and antenna further enlarged.

Habitat: At roots of vines at the following places in the south-western Cape Province: Olifantsberg, Worcester District, 1896; Waylands Farm, P. O. Darling, Malmesbury District, C. P. Lounsbury, 1897, and C. Fuller, 1898; Helderberg, Stellenbosch, C. P. Lounsbury, 1904.

Extracts from notes made by C. Fuller at time of collection:—

“Cyst stage is attached to the vine by means of a long filamentous rostrum.

- 28.12.97. Adult ♀. Length 7 mm., yellow, pilose.
 30-31.12.97. Fine cottony secretion on abdominal segments of ♀.
 3.1.98. Large numbers of white eggs deposited in strings.
 4.1.98. Still depositing eggs. Secreted matter of fine white silky nature and coming from abdominal segments dorsally, laterally, and ventrally.

16.2.98. In the hard soil of the vineyard it was found that the ♀ deposited her eggs in the shell of the cyst. This was noted in many instances, but I am inclined to think that in a suitable soil the ♀ would deposit her eggs away from the cyst. Females placed upon sand in the office invariably burrowed downwards, making true tunnels which were not filled in behind the insect as it progressed."

Material studied consists of a number of cysts, prae-pupae, 1 pupa (spirit) and 6 adult ♀ ♀ mounted from spirit, and 1 slide of larvae prepared by C. Fuller in 1898.

Collection No. : 9.

59. MARGARODES GREENI sp. n.

Cyst : Almost spherical, about 2.5 mm. in diameter, amber-yellow ; very much like those of *M. newsteadi*.

Adult ♀ : 2.5 to 3 mm. long when mounted, very like *péringueyi* in appearance except that the lateral spine areas of the thorax are entirely replaced by fine, long hairs. The dermal hairs are all comparatively longer and more slender than in any other species known in South Africa. The antennae are plainly 8-jointed, joint II. rather more than half the length of III. The hairs on the antennae are also longer than those of *péringueyi*.

Habitat : At roots of vines, collected by F. W. Pettey, Elsenberg, Stellenbosch, C.P., October, 1914.

I have pleasure in associating with this species the name of Ernest E. Green, whose excellent work on the Coccidae of Ceylon is so well known.

Material studied consists of a number of cysts and four adult ♀ ♀.

Collection No. : 10a.

60. MARGARODES NEWSTEADI sp. n.

Cyst : Almost spherical, about 2.5 mm. in diameter, creamy yellow in colour. In colour the cyst of this species is intermediate between those of *péringueyi* and *greeni*.

Adult ♀ : Slightly longer and broader than *péringueyi*, which it resembles very closely. In mounted specimens it is readily separated from all other South African species except *M. greeni* by the presence of large disc-rosette glands on the anterior portions of the body. From *M. greeni* it is easily distinguished by the presence of lateral thoracic spine areas, which are replaced by fine hairs in *greeni*.

The antennae are 8-jointed, joint II. very narrow, annular, only about one-fourth the length of III. The anterior claws are strong, densely

black in outline, inner edge thinner, red-brown in transmitted light, with the inner margin entire, not crenulate as in *péringueyi*.

Habitat: At roots of grass, Pretoria, October, 1914. Cysts collected by the writer. Material studied consists of a number of cysts and two adult ♀♀.

I have pleasure in associating the name of Prof. R. Newstead, F.R.S., with this species.

Collection No.: Y.C 10.

61. MARGARODES PÉRINGUEYI sp. n.

(Plate XXVIII., Fig. 72.)

Cyst: Almost spherical, about 2 to 2.5 mm. in diameter, milky-white in colour, translucent. Cysts collected at roots of grass by writer at Pretoria, October 4, 1914, and placed in a damp cell made by lining a deep petri dish with moist filter-paper. Adults began to emerge on October 12, 1914.

Adult ♀: 2.5 to 3 mm. long, when extended, creamy white to pale yellow in colour with a median dorsal region which sinks below the lateral areas, and through which the darker body contents are visible.

When moving the body is broadly oval in outline, slightly narrowed in front; segmentation plainly visible. The insects are positively thigmotactic, and wandered around aimlessly until they had forced their way between the edge of the filter-paper and the dish, and invariably came to rest between the paper and the bottom of the dish.

The antennae are distinctly 8-segmented (stained material) the small joint II. more distinct than in *capensis*, nearly half the length of III.

The dermal hairs and spines numerous and normal.

Habitat: Very common in Pretoria and district at roots of grass. It has been collected in large numbers in lawns and also in the veld. The characteristic odour is strongly developed in this species when first moistened. Some specimens collected in a garden in Pretoria by Miss Impey included adult ♀♀ which had left the cysts and were enclosed in white cottony secretion in small lumps of soil. Eggs were laid by these ♀♀ in January, 1915, but larvae were not observed.

Material studied consists of a number of cysts and 4 adult ♀♀ mounted.

It gives me great pleasure to associate the name of Dr. L. Péringuey, Director of the South African Museum, Cape Town, with this species. He was one of the first naturalists in the country to recognize the true nature of these interesting insects.

Collection No.: 10.

62. MARGARODES RUBER sp. n.

(Plate XXVIII., Fig. 71.)

Cyst: Almost spherical, about 2 mm. in diameter, white, translucent to semi-transparent, the red colour of the female being plainly visible before emergence.

Cysts collected in association with *M. péringueyi* at Pretoria on October 4, 1914. ♀♀ began to emerge October 21, 1914.

Adult ♀: 2 mm. to 2.5 mm. long when extended, elongate with a distinct constriction at the junction of the cephalothorax with the abdomen. Colour deep reddish-yellow to carrot colour. Two small scarlet eye-spots between the antennae. Antennae and legs pale, except the stout front claws, which are brownish-black.

Colour in boiling KOH dark red-brown, then magenta; the liquid remains colourless.

A newly emerged female was placed on a dish of loosely packed soil, and took four minutes to bury herself. The hole was quite vertical, and was made by means of the front claws. The insect did not remain in one position, but constantly turned around in a circle, the front claws being the axis.

Antennae 9- or 10-segmented, the 10-jointed form with a very small annular joint II. as in *capensis*. Those called 9-jointed are probably similar, but with the small joint II. invisible owing to unsuitability of orientation in mounting. Antennae thick at base and gradually tapering. Dermal hairs and spines comparatively long and strong, the spine areas of the sides of thorax being especially prominent. On each side of anal opening is a thickened triangular patch bearing one or two setae.

Habitat: On roots of grass, associated with *M. péringueyi*. Collected by the writer, Pretoria, October, 1914.

Material studied consists of a number of cysts and 7 adult ♀♀ mounted.

The colour of this insect, together with the tapering, annular, and 10-jointed antennae, gave me the impression that this might be the prae-pupal stage of the male of one of the common species on grass at Pretoria. Some specimens kept alive for ten days in a moist cell, however, showed no signs of pupating, and behaved in exactly the same manner as did the ♀♀.

Collection No.: 11.

63. MARGARODES TRIMENI Giard.

(Plate XXVIII., Fig. 70.)

Margarodes trimeni Giard, C. R. Biol. Paris, iv., pp. 126, 412, 712, 1894.

Cyst: Shell-like, more or less irregular in outline, but narrowed at one end. Usually the cysts are more or less triangular when seen in profile, with the base broadly rounded and the apex bluntly pointed. The surface generally exhibits a few rounded protuberances of irregular disposition. The "flakes" appear to be imbricated from the wide end, where the adult emerges.

Size: Largest specimens 5.5 mm. long and 4 mm. at greatest width.

Colour: Brassy yellow to bronze.

The empty cysts of this species are collected by children and threaded to make necklaces.

Adult ♀: In appearance this insect greatly resembles *M. capensis*, but is of slightly smaller size. The largest specimens when mounted range from 4.5 to 5.2 mm. in length. The chief differences between *trimeni* and *capensis* are:—

(a) The entirely distinctive cysts.

(b) The antennae of *trimeni* are 7- or 8-jointed, the small joint II. being absent in two out of four specimens mounted.

(c) The front claws of *trimeni* are more slender at the base than those of *capensis*.

(d) The dermal hairs of *trimeni* are shorter and much stouter than those of *capensis*, and the derm is coarsely rugose instead of shagreened.

(e) *capensis* is only known from vine roots; *trimeni* from other plants.

Habitat: The cysts of this species ("ground pearls") were found in numbers in, or near, termite nests in the south-west of the Cape Province. The real host-plants are not known. Some of the dry cysts, from which the insects had not emerged (collected in 1898), were placed in a moist cell in December, 1914, and still produced the strong soapy *Margarodes* odour.

Material studied consists of a number of cysts and ♀ ♀ (spirit material), and 5 ♀ ♀ mounted.

Collection No.: 8.

DESCRIPTION OF PLATES.

PLATE XVI.

(Figs. 1-7.)

All figures slightly enlarged.

1. *Antonina transvaalensis* sp. n. Cluster of ovisacs on crown of grass. 1a, Single specimen, flattened form, with insect exposed.
2. *Natalensia fulleri* g. and sp. n. Gall of adult ♀ on root of grass.
3. *Pseudococcus burnerae* sp. n. ♀ ♀ with ovisacs on granadilla.
4. *Pseudococcus virgatus* (Ckll.) on orange-leaf.
5. *Tylococcus chrysocomae* sp. n. Completed ovisacs.
6. *Pseudococcus flagrans* sp. n. Adult ♀ in waxy secretion on grass stem.
7. *Pseudococcus nitidus* sp. n. Completed ovisac.

PLATE XVII.

(Figs. 8-11d.)

All figures except 11 enlarged according to scale.

8. *Antonina natalensis* sp. n. Antenna of adult ♀.
9. *Antonina transvaalensis* sp. n. Antenna of adult ♀. 9a, Spiracle of ♀; 9b, antenna, and 9c, caudal extremity of larva.
10. *Rhizoecus africanus* sp. n. Anal extremity of adult ♀. 10a, "Eye-like cicatrice" of ♀; 10b, dermal characters of venter; 10c, dermal characters of dorsum; 10d, antenna of adult ♀; 10e, tibia and tarsus III. of ♀.
11. *Natalensia fulleri* sp. n. Camera lucida sketch after boiling in KOH. 11a, Antenna of adult ♀; 11b, part of caudal extremity of larva; 11c, tibia and tarsus II. of adult ♀; 11d, mentum of adult ♀.

PLATE XVIII.

(Figs. 12-21.)

All figures magnified according to scale.

12. *Tylococcus chrysocomae* sp. n. Antenna of adult ♀ (7-jointed form). 12a, Marginal tubercle, and 12b, caudal tubercle of adult ♀; 12c, normal tarsus III. of ♀, and 12d, abnormal leg III. of same insect; 12e, antenna, and 12f, caudal extremity of larva.

13. *Pseudococcus filamentosus* (Ckll.). Trochanter of ♀. 13a, Mentum of adult ♀.
14. *Pseudococcus natalensis* sp. n. Trochanter, and 14a, mentum of adult ♀.
15. *Pseudococcus socialis* sp. n. Disc-like gland-pores from dorsum of adult ♀.
16. *Pseudococcus solitarius* sp. n. Mentum of adult ♀.
17. *Pseudococcus burnerae* sp. n. Mentum of adult ♀.
18. *Pseudococcus mirabilis* sp. n. Antenna, and 18a, caudal extremity of adult ♀.
19. *Pseudococcus quaesitus* sp. n. Antennal segment I. of adult ♀.
20. *Pseudococcus flagrans* sp. n. One of the ventral "plates" of adult ♀.
21. *Pseudococcus stelli* var. *tylococciiformis* sp. and var. n. Two of the marginal tubercles from the anterior region, between the antennae of adult ♀.

PLATE XIX.

(Figs. 22-33.)

All figures greatly enlarged.

Marginal spine areas of adult ♀ of:—

22. *Pseudococcus burnerae* sp. n.
23. *Pseudococcus mirabilis* sp. n.
24. *Pseudococcus quaesitus* sp. n.
25. *Pseudococcus transvaalensis* sp. n.
26. *Pseudococcus trichiliae* sp. n.
27. *Pseudococcus bantu* sp. n.
28. *Pseudococcus citri* var. *phenacocciiformis* var. n.
29. *Pseudococcus caffra* sp. n.
30. *Pseudococcus flagrans* sp. n.
31. *Pseudococcus nitidus* sp. n.
32. *Pseudococcus segnis* sp. n.
33. *Pseudococcus stelli* sp. n.

PLATE XX.

(Figs. 34-39.)

Figs. 34 and 35 original; 36-39 after Pierantoni.

34. *Pseudococcus citri* (Risso). Adult ♀ enlarged.
35. Transverse section showing position of "mycetom" or symbiont mass (my.).
36. Portion of mycetom highly magnified. Large cells "sferules" containing a number of "sferettes."
37. Five "sferettes" containing numbers of elongate symbiont organisms (*Coccidomyces dactylopii* Buchner).
38. Early stage in the infection of the ovum by "sferettes" (sf.).
39. Later stage in which the mass of "sferettes" is rounding off to form the "polar mass."

PLATE XXI.

(Figs. 40-41f.)

All figures to larger scale except 41b

40. *Eriococcus araucariae* Mask. Antenna of adult ♀. 40a, Anal lobe; 40b, tibia and tarsus III.
41. *Puto africanus* sp. n. 8-jointed, and 41a, 9-jointed form of antennae; 41b, caudal extremity showing position of caudal lobes and spine area; 41c, portion of spine area to larger scale; 41d, caudal lobe and half anal ring; 41e, mentum; 41f, tibia and tarsus I.

PLATE XXII.

(Figs. 42-48a.)

42. *Orthezia insignis* Douglas. Adult ♀.
43. *Coccus cacti* Goeze. Adult ♀ ♀ on *Opuntia* sp.
44. *Coccus indicus* Green. Adult ♀ ♀ on *Opuntia monacantha*.
45. *Monophlebus fulleri* Ckll. Adult ♀ (7.2 mm. long) and ♂ puparium.
46. *Icerya purchasi* Mask. Adult ♀ ♀ with ovisacs.
47. *Icerya seychellarum* Westw. Adult ♀ ♀ with ovisacs.
48. *Icerya euphorbiae* sp. n. Dorsal view of ♀. 48a, Lateral view of ♀.

PLATE XXIII.

(Figs. 49-49i.)

All figures to larger scale except 49.

49. *Monophlebus fulleri* Ckll. Larva, drawn to scale given. 49a, Antenna of young ♀; 49b, antenna of prae-pupa; 49c, antenna case of pupa; 49d, caudal extremity of pupa; 49e, haltere of ♂; 49f, caudal processes of ♂; 49g, antenna of ♂; 49h, antenna of adult ♀; 49i, trochanter of ♀.

PLATE XXIV.

(Figs. 50-51b.)

50. *Aspidoproctus maximus* Newst. Half-grown ♀ ♀. 50a, Adult ♀ ♀; 50b, longitudinal section of adult ♀ showing position of "marsupium"; v.o. ventral orifice.
51. *Aspidoproctus tricornis* (Newst.). Adult ♀ on *Acacia* sp. 51a, Side view. Note waxy filaments of larva which became fixed to secretion from dorsal opening. 51b, Longitudinal section of same specimen after all young had emerged and nothing but the white egg-shells remained.

PLATE XXV.

(Figs. 52-56.)

52. *Aspidoproctus maximus* Newst. Larval antenna. 52a, Prae-pupal antenna; 52b, pupa.
 53. *Aspidoproctus mirabilis* (Ckll.). Larval antenna.
 54. *Icerya seychellarum* Westw. Larval antenna.
 55. *Icerya purchasi* Mask. Larval antenna.
 56. *Icerya euphorbiae* sp. n. Larval antenna. 52, 54, 55 and 56 \times about 70 times.

PLATE XXVI.

(Figs. 57-63.)

57. *Orthezia insignis* Dougl. ♀ antennae.
 58. *Coccus cacti* Goeze. ♀ antennae.
 59. *Monophlebus hirtus* sp. n. ♀ antenna.
 60. *Icerya euphorbiae* sp. n. ♀ antenna.
 61. *Icerya purchasi* Mask. ♀ antennae.
 62. *Icerya seychellarum* Westw. ♀ antenna.
 63. *Aspidoproctus armatus* Newst. ♀ denuded of waxy appendages, natural size.

PLATE XXVII.

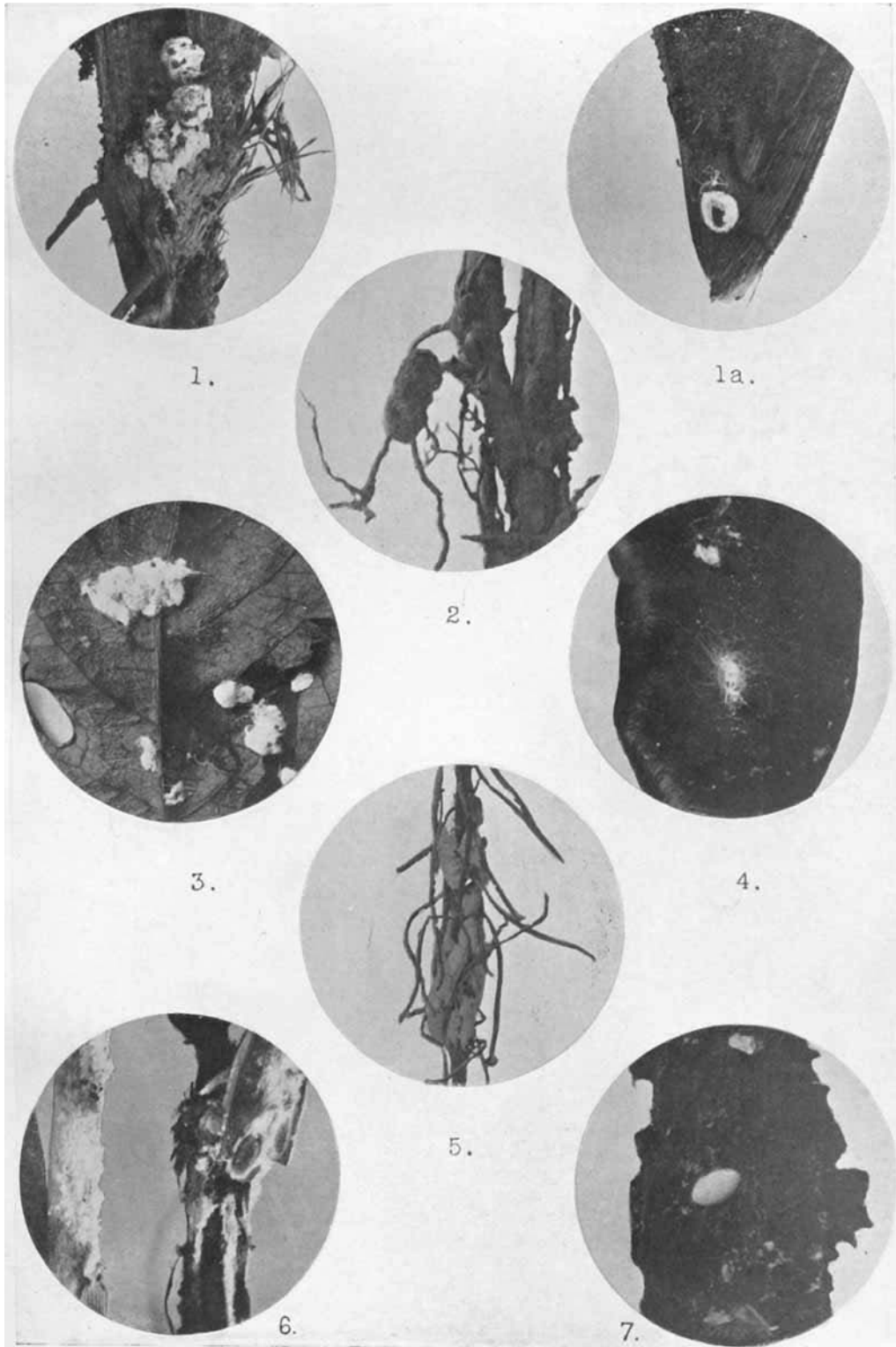
(Figs. 64-66a.)

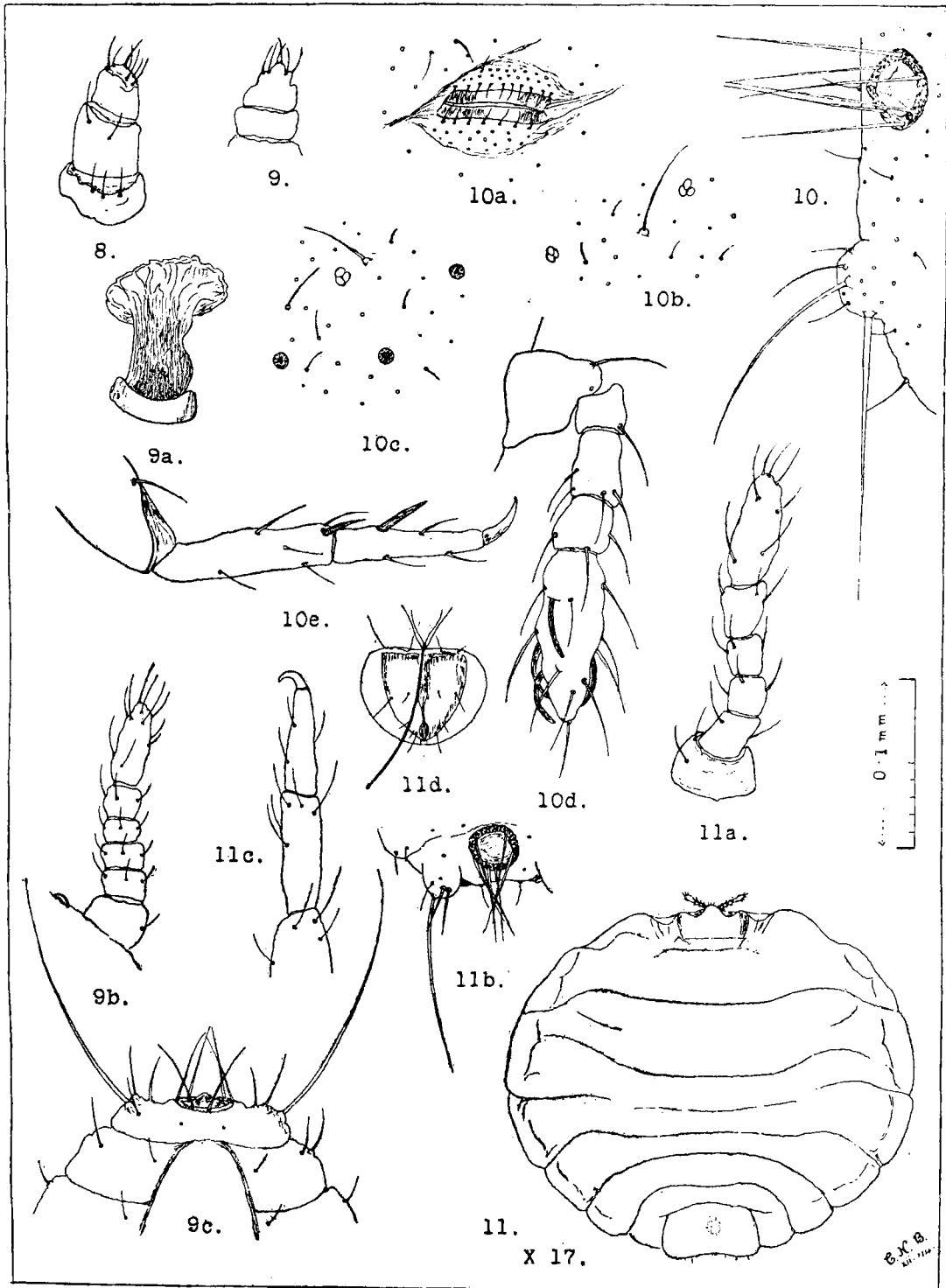
64. *Aspidoproctus maximus* Newst. Antenna and derm glands of young ♀ (10 mm. long).
 64a, Prae-pupa; 64b, derm glands around antenna of adult ♀; 64c, anal orifice of young ♀.
 65. *Aspidoproctus armatus* Newst. ♀ antenna. 65a, Portion of anterior lateral margin of adult ♀.
 66. *Aspidoproctus tricornis* (Newst.). ♀ antenna. 66a, Anal orifice of ♀.

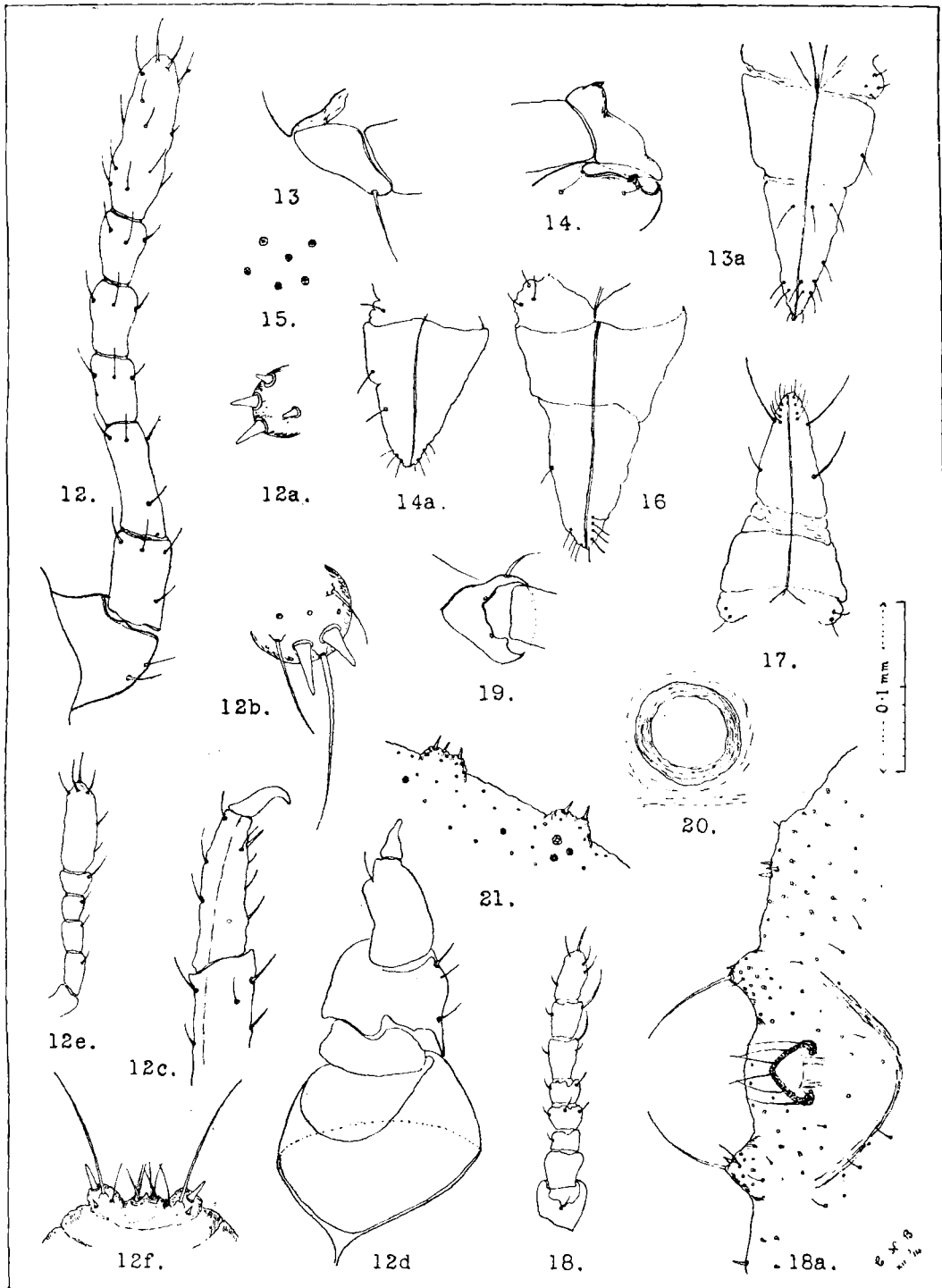
PLATE XXVIII.

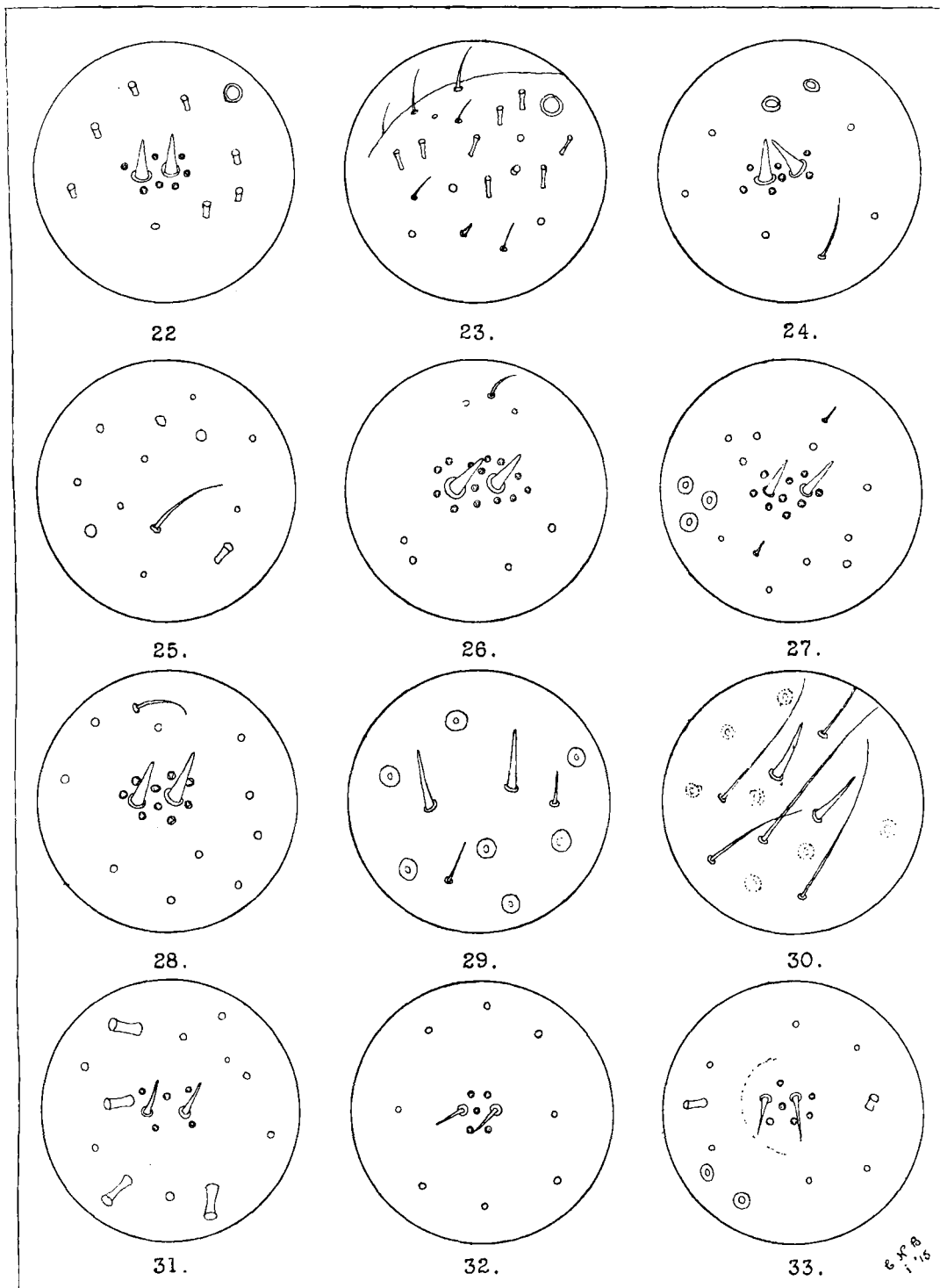
(Figs. 67-72.)

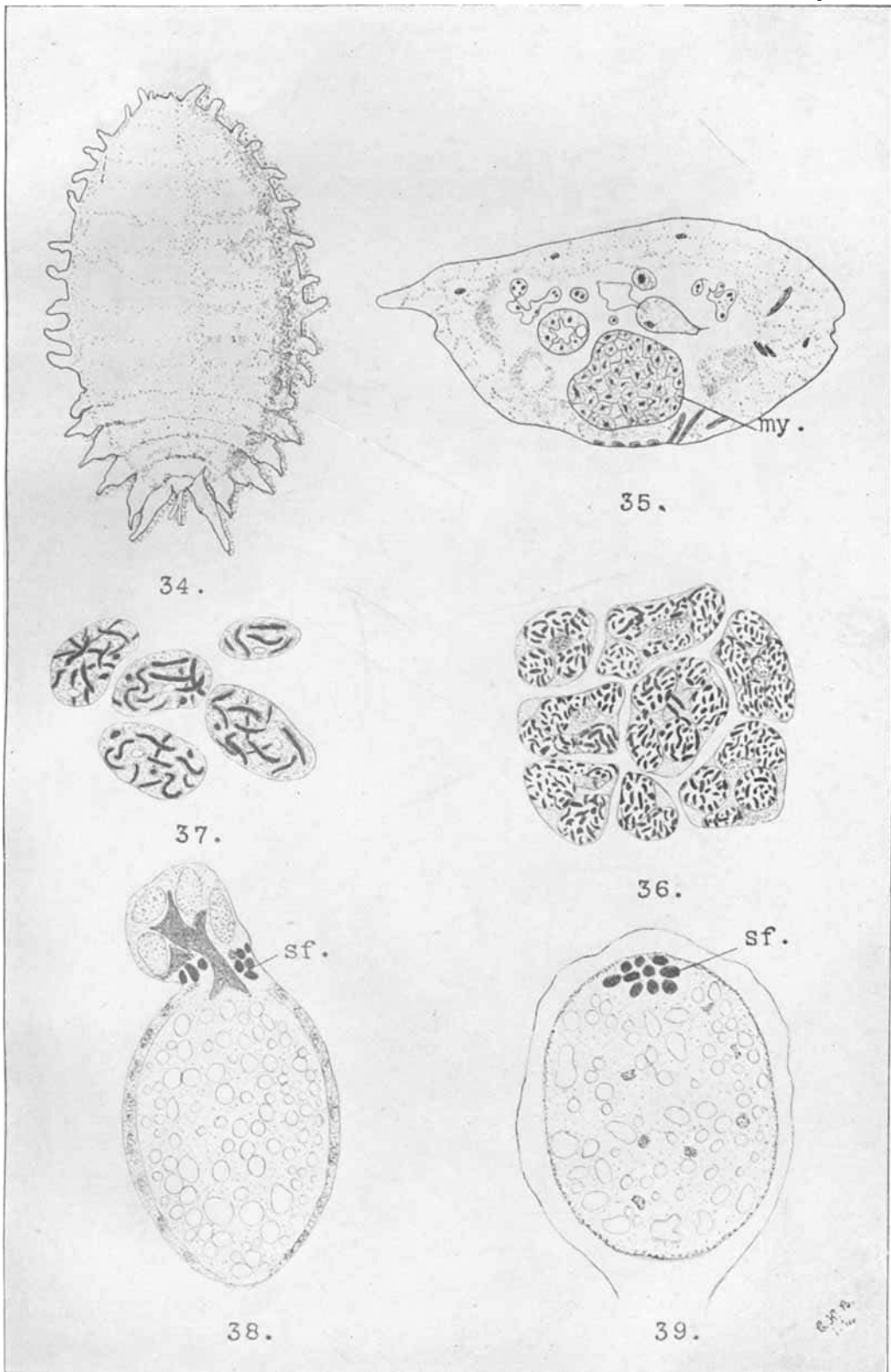
67. *Aspidoproctus mirabilis* (Ckll.). ♀ antenna. 67a, Portion of venter showing tenent hairs.
 68. *Aspidoproctus tricornis* (Newst.). One of the lateral "horns" cleared and mounted. 68a, Ventral opening.
 69. *Margarodes capensis* (Giard) Brain. ♀ antennae.
 70. *Margarodes trimeni* Giard. ♀ antennae.
 71. *Margarodes ruber* sp. n. ♀ antennae.
 72. *Margarodes peringueyi* sp. n. ♀ antennae.

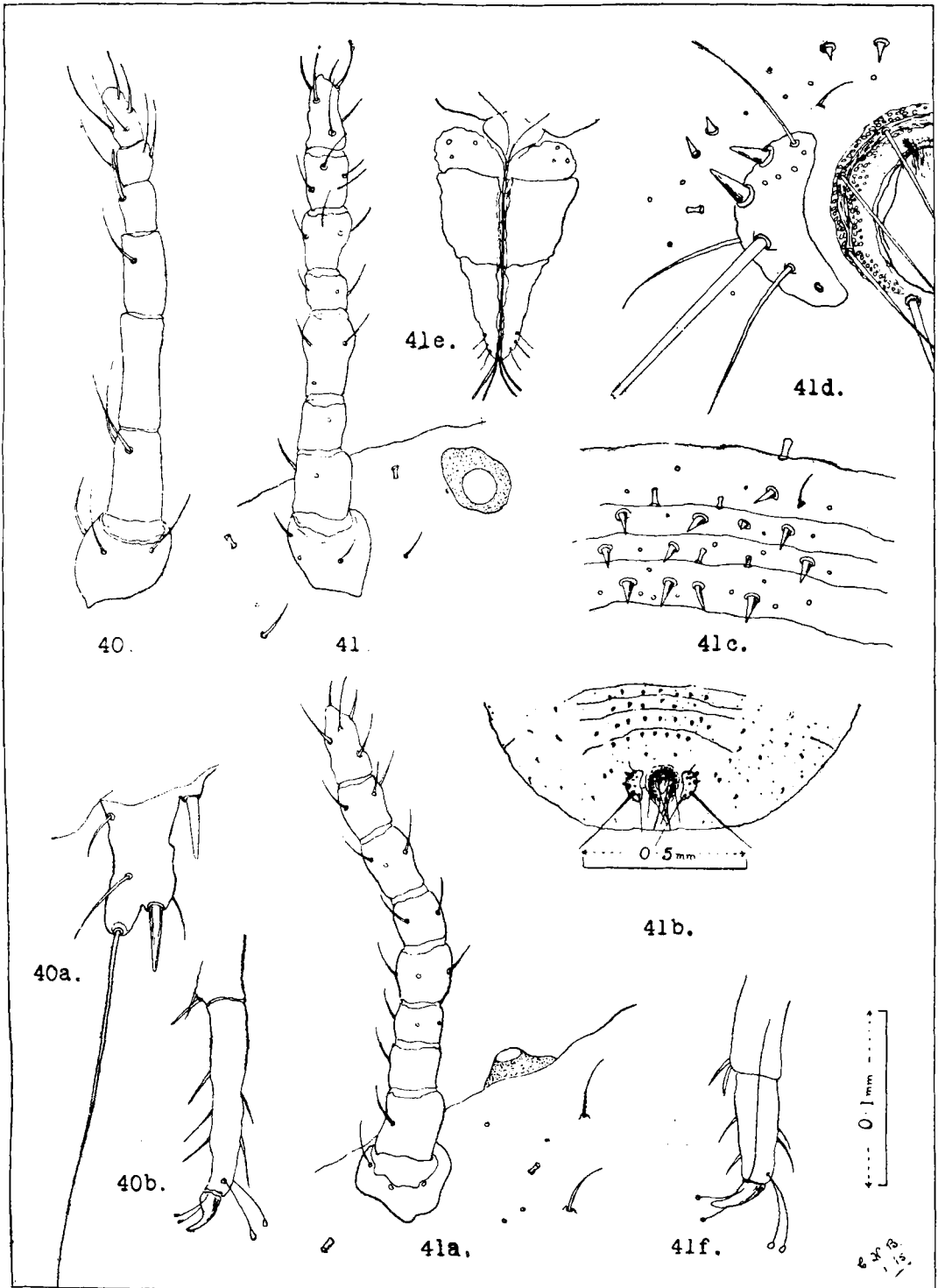


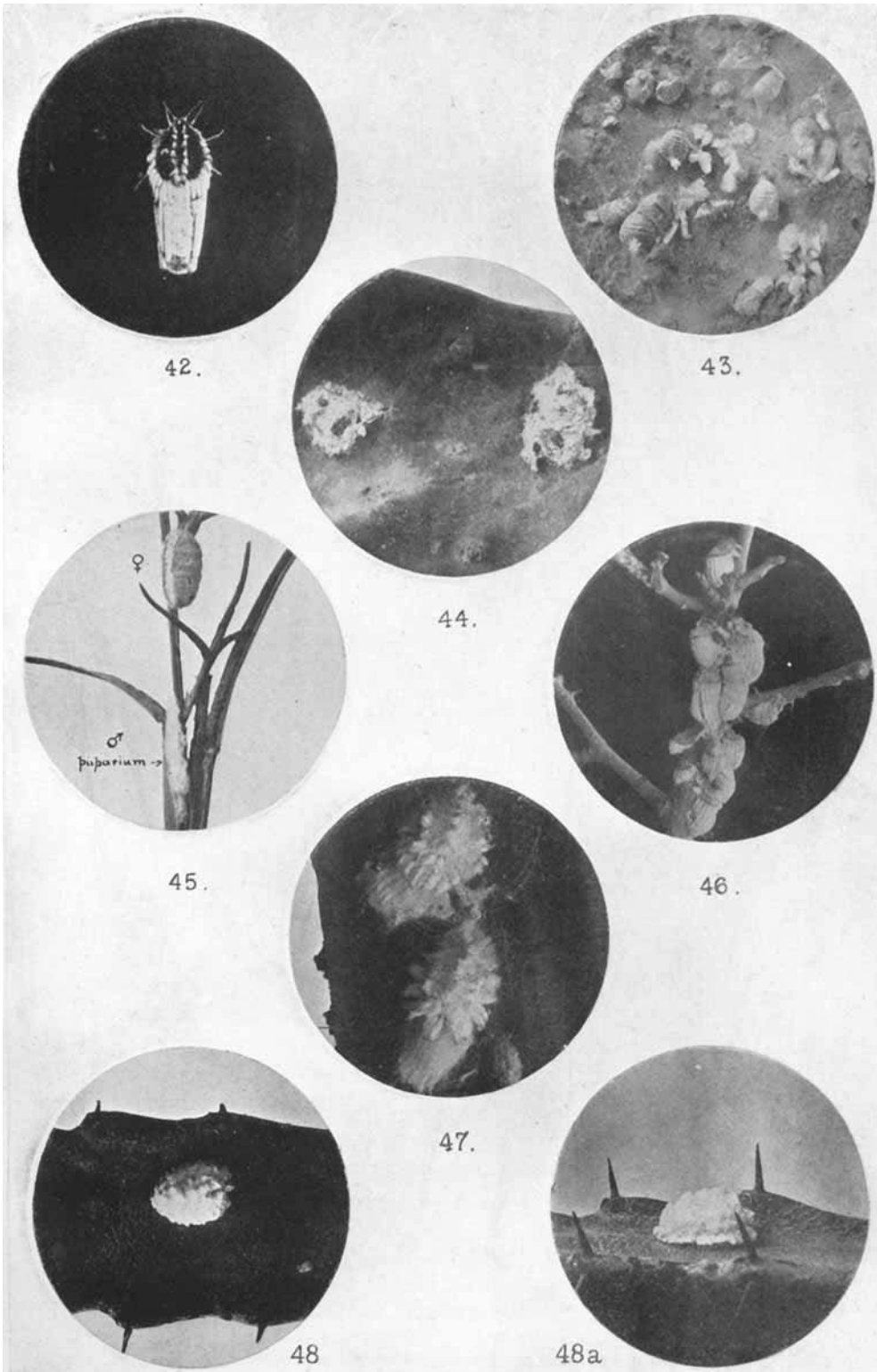


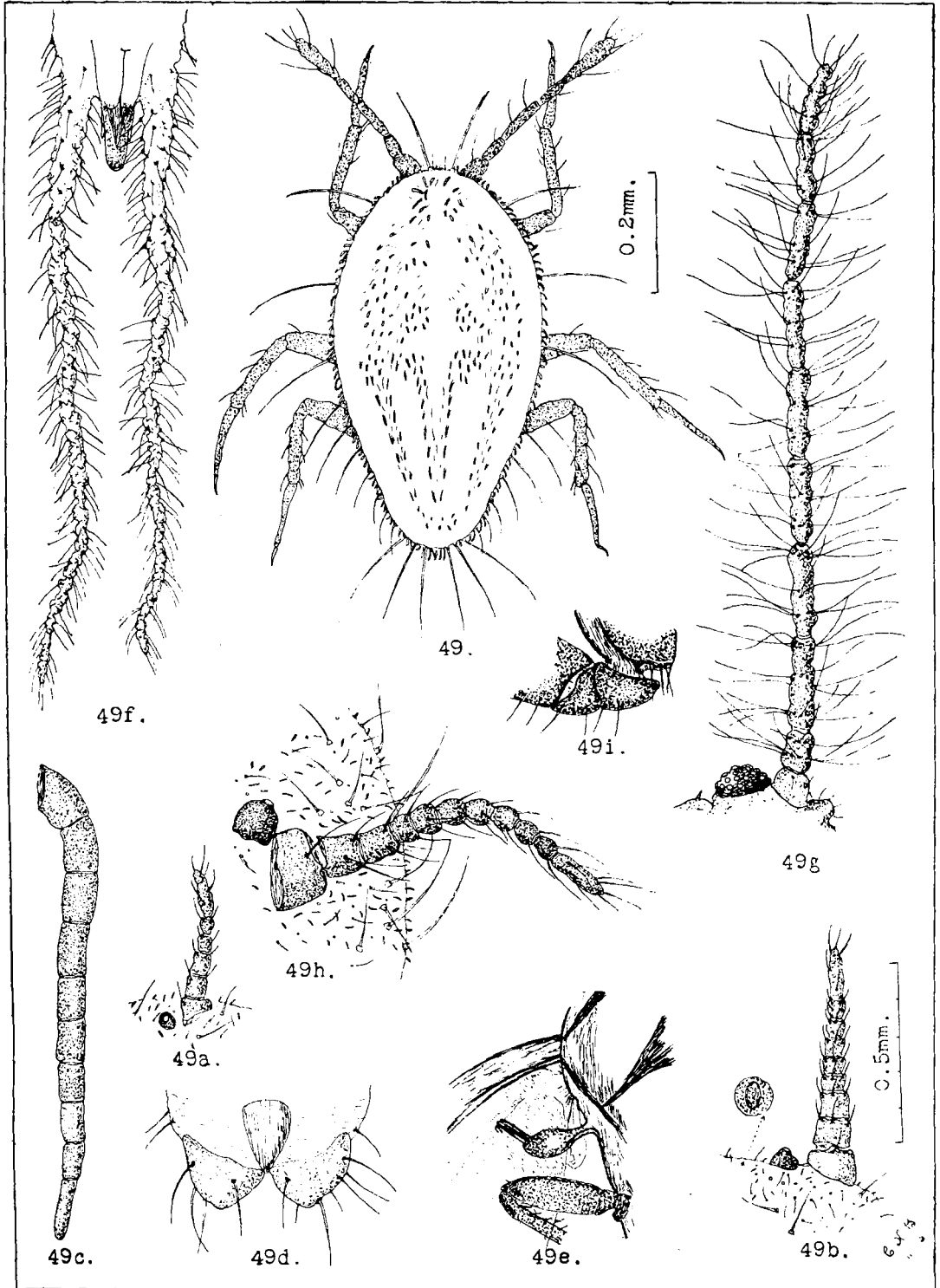


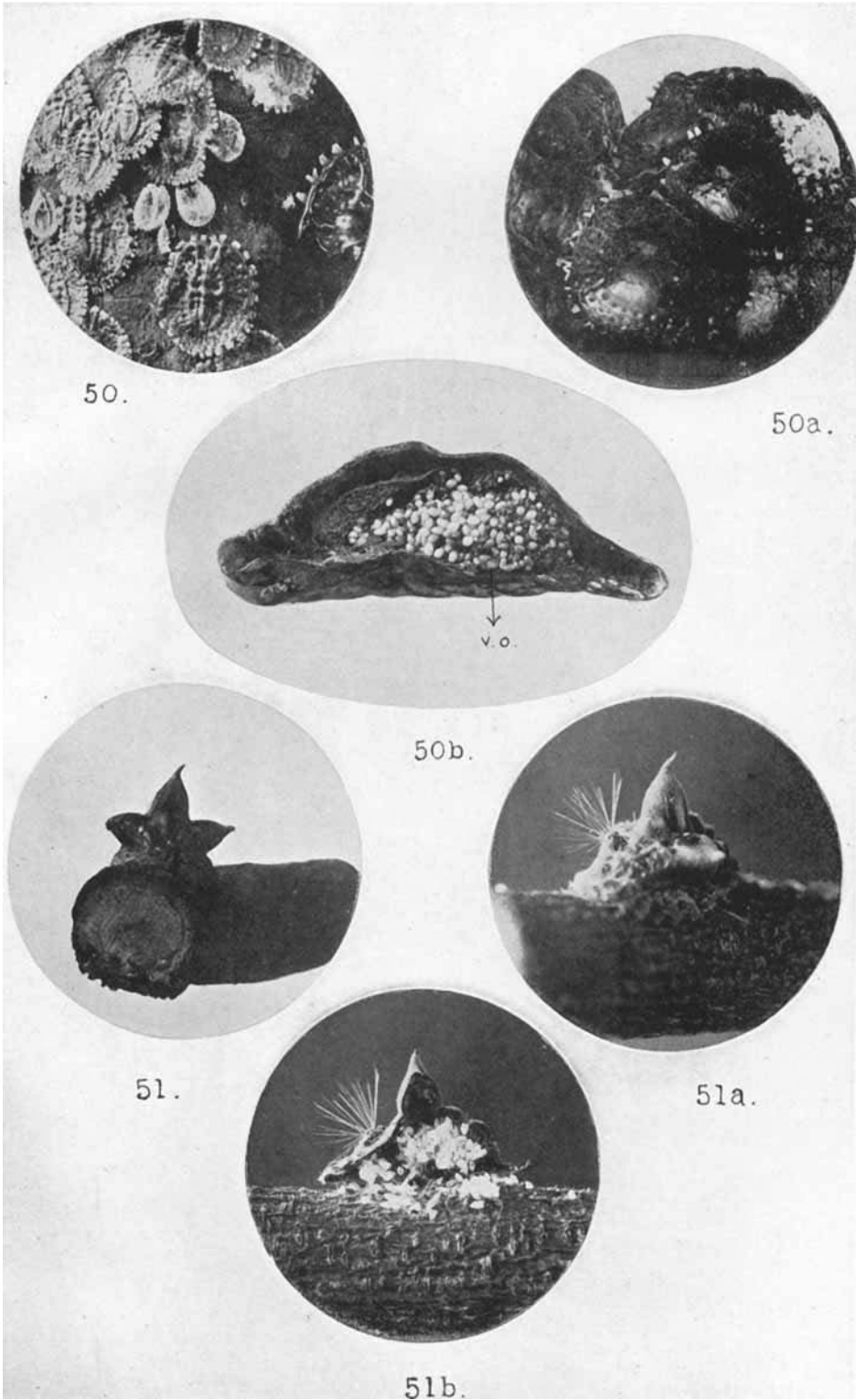


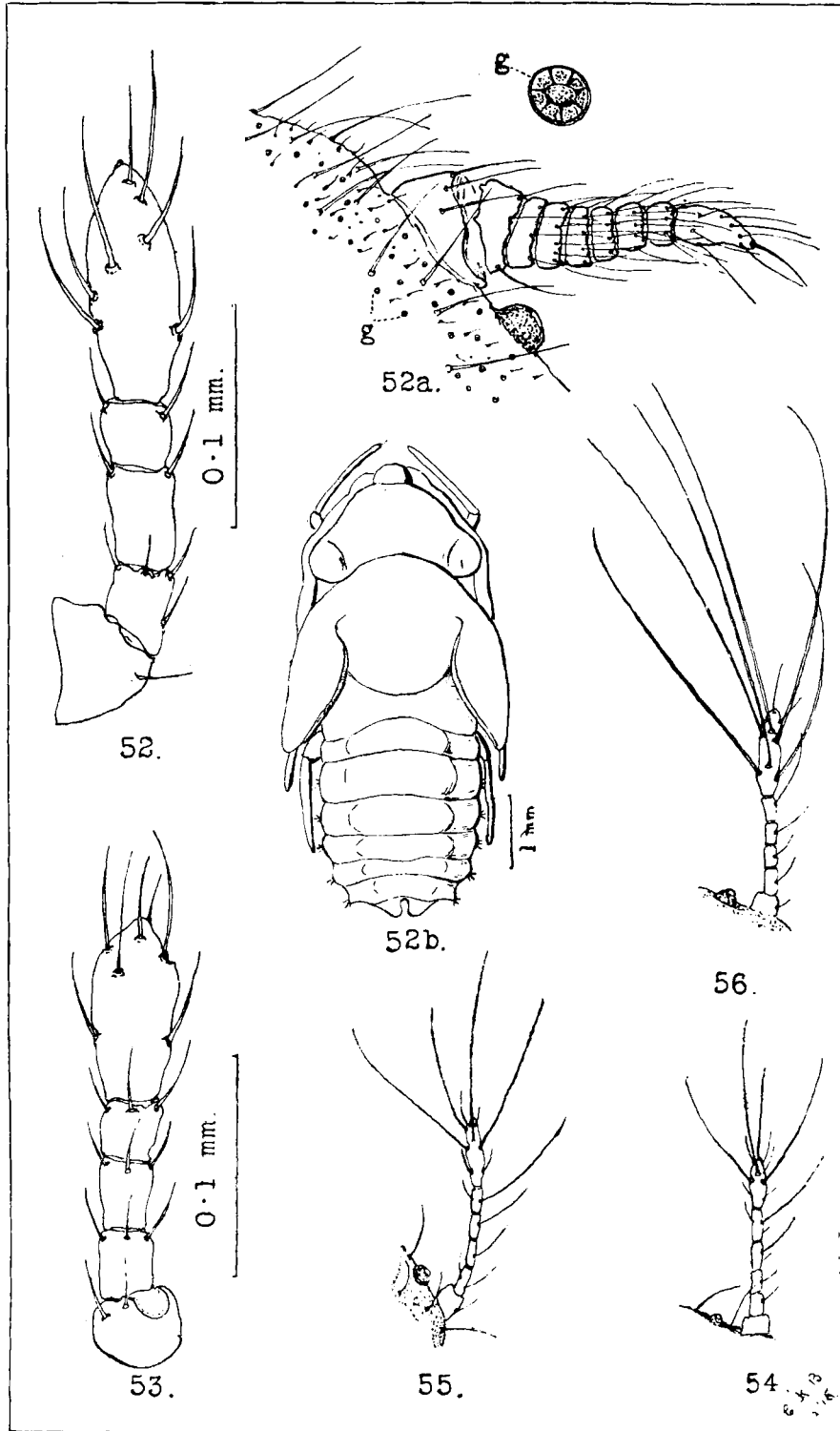


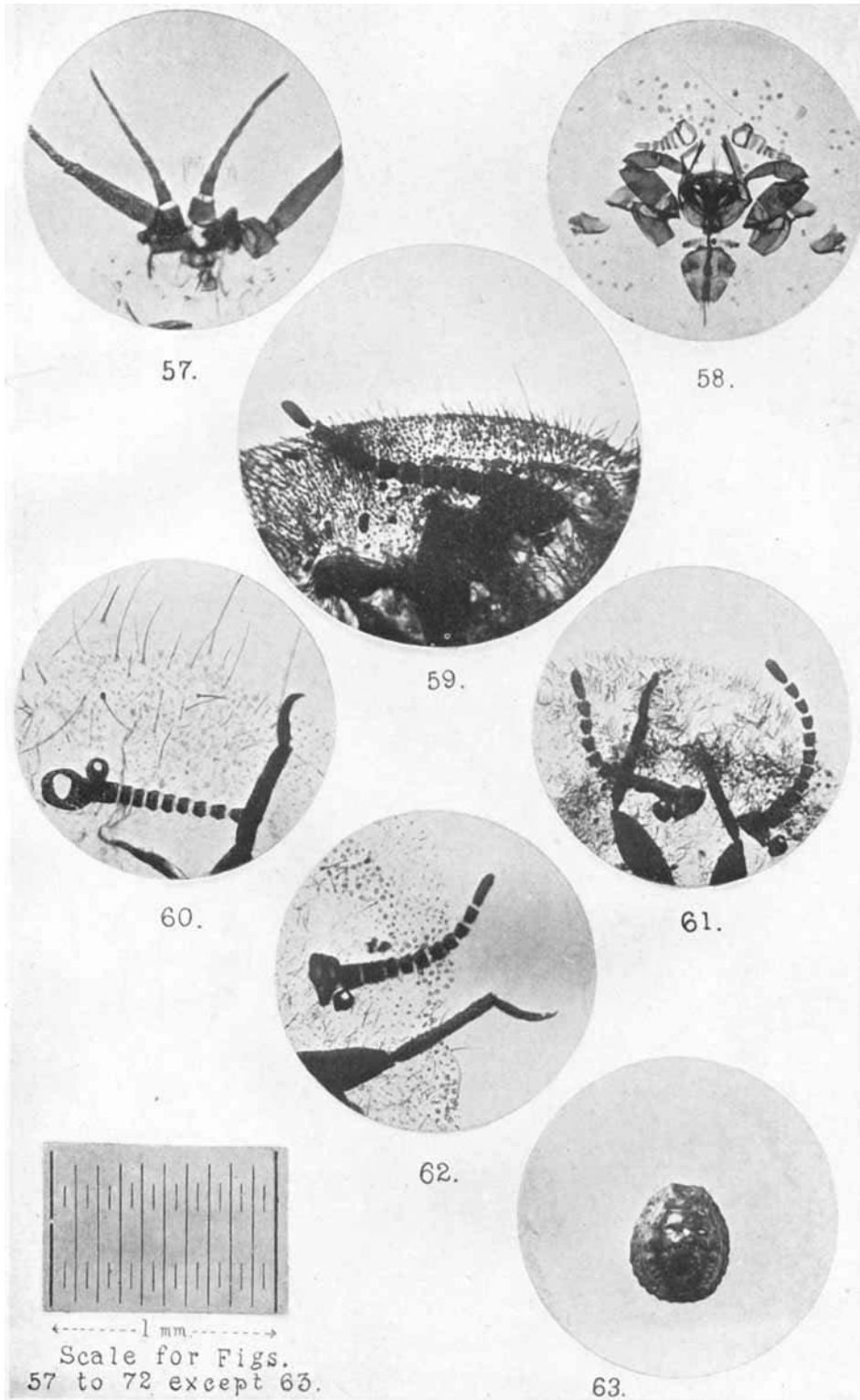


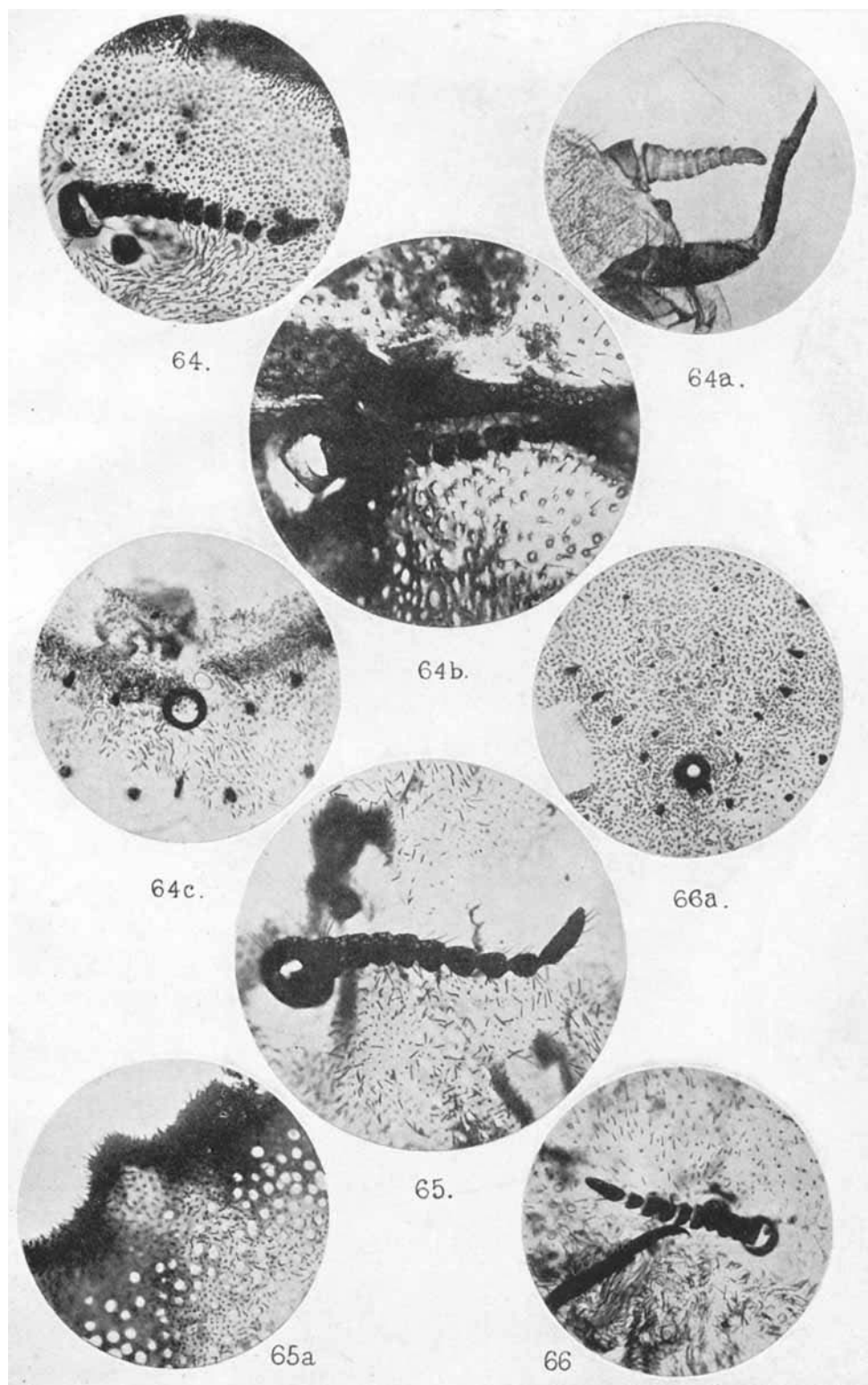


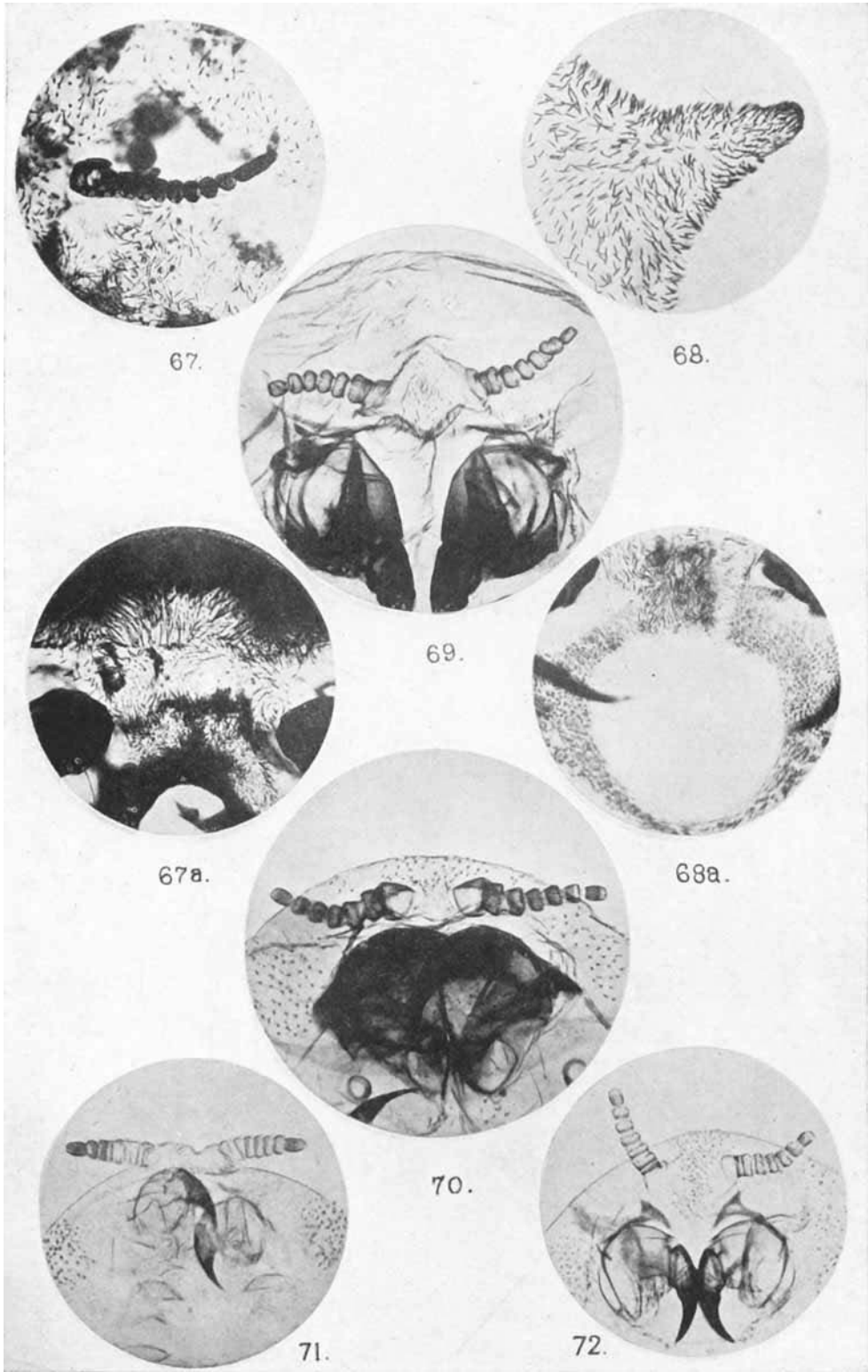


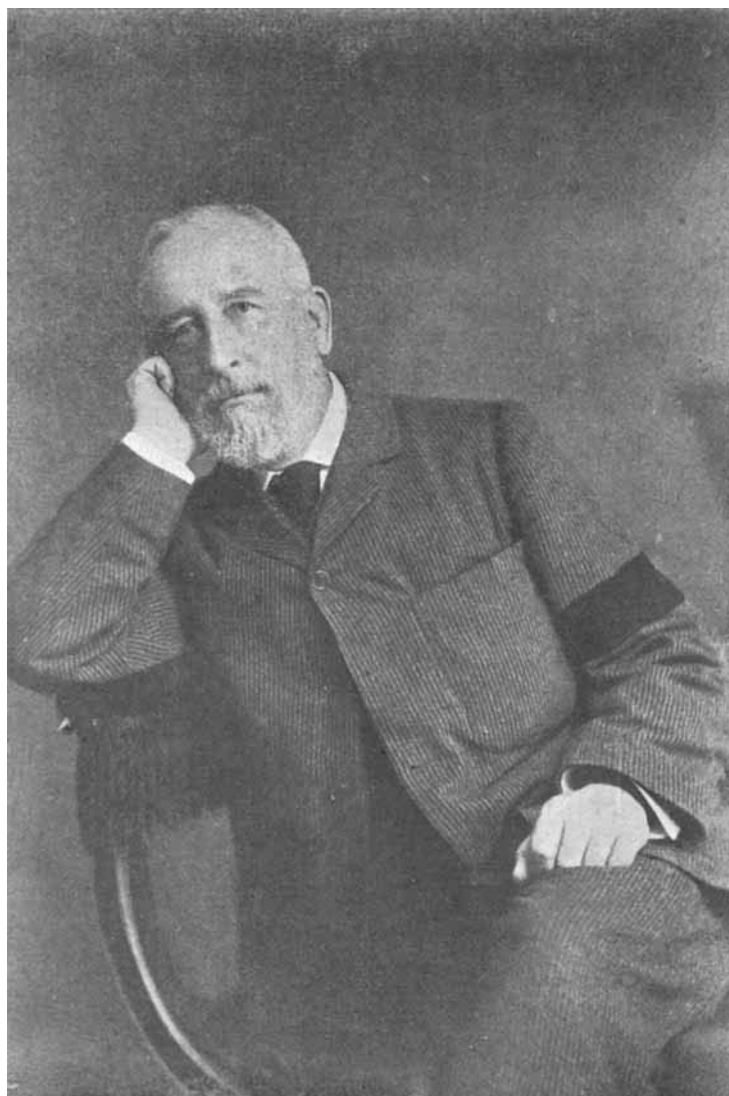












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