Contribution to the Study of Mealy Bugs of the

Tribe Pseudococcini (Coccidae).

With Special Reference to the Genus Pseudococcus.

by.

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Birmingham University,
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<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1-4</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>5</td>
</tr>
<tr>
<td>Abbreviations to Literature</td>
<td>6-8</td>
</tr>
<tr>
<td>List of Authors, and Chief Papers</td>
<td>9-13</td>
</tr>
<tr>
<td>Methods and Technique</td>
<td>14-17</td>
</tr>
<tr>
<td>Systematic Position of Genera</td>
<td>18-34</td>
</tr>
<tr>
<td>Study of Specific Characters</td>
<td>35-46</td>
</tr>
<tr>
<td>Development of the Pseuctococcini</td>
<td>47-49</td>
</tr>
<tr>
<td>Scheme for Description, and Chart for Comparison of Species</td>
<td>50-53</td>
</tr>
<tr>
<td>Descriptions and Charts</td>
<td>54-172</td>
</tr>
<tr>
<td>Descriptions of new species</td>
<td>85 and 125</td>
</tr>
<tr>
<td>Parasites</td>
<td>173-183</td>
</tr>
<tr>
<td>Intracellular Symbionts</td>
<td>184-188</td>
</tr>
<tr>
<td>Literature dealing with the Symbionts</td>
<td>189</td>
</tr>
<tr>
<td>Catalogue of Species</td>
<td>190-207</td>
</tr>
<tr>
<td>Plates</td>
<td></td>
</tr>
</tbody>
</table>
1.

Introduction.

Mealy-bugs may, under certain conditions, become pests of the highest economic importance. This fact was well illustrated in the case of *D. filamentosus* (Ckll.) in 1909, when this insect attacked the Lebbek trees in the streets of Cairo and became so numerous that large trees were killed by their ravages in a few months. In addition to the actual loss of plants, or the damage caused to them by large numbers of the insects sucking their sap, the fruit or fruit clusters are often rendered quite unfit for market by the vast number of ♀♀ with ovisacs which infest them.

Very few tetracidologists, however, have paid particular attention to this group, and our knowledge of even the most common species is very imperfect. The only reference to many of the mealy bugs is found in the original descriptions of the species, and it is unfortunate that many of these descriptions are quite inadequate for the determination of material. This inadequacy may be due to the shortness and incompleteness of the descriptions themselves, or to the unsuitability of the characters used.

I have endeavoured to collect the most important facts concerning all the species described to the end of 1913, and to arrange the matter in a manner suitable for fur-
-ther study. To do this it has been necessary to refer to more than fifty different journals and periodicals for the original descriptions of species alone.

The only Catalogue of the Coccidae which has been published is that by Mrs. Fernald which appeared in 1903. In this work all the genera which are dealt with in the present thesis are included in the Tribe *Dactylopiini*, but since it can be shown that they are closely related to one another, and are distinct from the other *Dactylopiini* genera, a new tribe, i.e. *Pseudococcini*, has been established for them.

The genera included in the *Pseudococcini* as here constituted illustrate, I believe, a phylogenetic series, the chief line of development being illustrated by the production of additional antennal segments. Thus *Ripersia* has 6-jointed antennae, *Pseudococcus* 8-jointed, and *Phenacoccus* 9-jointed, while a new genus, which I have named *Dactopesudococcus*, contains the 7-jointed forms.

A large number of new species have been described since Mrs. Fernald's Catalogue was published, and it has been found necessary to make a number of alterations, so that a provisional list of species has been added as an attempt to bring this part up to date.

Two new species of *Pseudococcus* are here described for the first time, both from South Africa.
A suggested scheme for the full description of species is included, together with particulars of a chart which I have found of great use in the rapid comparison of those characters which are considered of the greatest specific significance. A large number of these charts are included with the original descriptions of the insects.

A careful study of the literature dealing with the parasites of the mealy bugs has been made, and the results indicate, I think, that this branch of the study would well repay scientific investigation.

The study of the intracellular symbionts of the Insecta is so recent that it is not surprising to find that very little attention has yet been paid to those of the Pseudococcini.

I am particularly indebted to Professor F.W. Gamble F.R.S. for his kindness in bringing this extremely fascinating branch of study to my notice, and for his assistance during the time I have spent with him.

It is too early to predict what the results of the study of the intracellular symbionts of animals will be, but it is a subject of the greatest interest, and one which may have far-reaching results.

My own studies on this subject are not yet complete, but it is hoped to include them in an Introduction to the
Study of the Intracellular Symbiots of the Coccidae to be published later.

I have included a brief outline of the work done on the symbiont of *Pseudococcus citri*, and a plate of drawings illustrating the chief points connected with the organism concerned. Three new words are used, one of which is adopted from the work of Dr. Büchner, while the other two are after Dr. Pierantoni. They are "mycetom", "sferule" and "sferette".

The mycetom is the particular tissue, usually modified fat-body, which always contains the symbiont. A definite mycetom is not always present throughout the Insecta as a whole, although it appears to be essential in the *Pseudococcini*.

The other two terms are explained in the section dealing with symbiots, where they first occur.
Acknowledgements.
Acknowledgements.

During the last eight years my studies in South Africa, United States, and England, have enabled me to see practically all the original descriptions of species, and a large number of slides of type, or topotype material of mealy bugs of the genus *Pseudococcus* and closely related genera.

Without the kind assistance of many friends, however, this would have been impossible, and I have pleasure in expressing my sincere gratitude to the following entomologists: Mr. C.P. Lounsbury, Chief of the Division of Entomology for the Union of South Africa, and to Messrs. C. Fuller and C.W. Hall also of that Division: to my former teacher and esteemed friend Professor Herbert Osborn of Ohio State University; Professors T.D.A. Cockerell and R.H. Pettit of Colorado and Michigan respectively; Dr. L.O. Howard, Chief of the U.S. Bureau of Entomology; Mr. E.M. Ehrhorn, Entomologist, Honolulu; Mr. E.O. Essig, Secretary of the Horticultural Commission of California; Dr. Leonardi of Portici; Dr. Marchal and M.P. Vayssière of the Department of Agriculture of France; Professor R. Newstead F.R.S. of the Liverpool School of Tropical Medicine; Mr. F.E. Green, former Entomologist of Ceylon; and finally, to whom my debt is greatest, to Professor F.W. Gamble F.R.S.
Abbreviations to Literature.
Abbreviations to Literature.

AG. Gar. N.S.W. - Agricultural Gazette of New South Wales.


Arch. f. Prot. - Archiv für Protistenkunde.


Can. Ent. - Canadian Entomologist.


Cocc. Cey. - Coccidae of Ceylon. (Green).


Deut. ent. Zeits. - Deutsche entomologische Zeitschrift.

Die Schil. - Die Schillläuse (Coccidae) Europas etc. (Lindinger), Stuttgart, 1912.

Entom. - The Entomologist.


Ent. Mon. Mag. - The Entomologists' Monthly Magazine.


Gard. Chr. - The Gardener's Chronicle.


Mem. Dept. Ag. India. - Memoirs of the Department of Agriculture in India.


N. Z. Trans. - Transactions of the New Zealand Institute.


West Am. Sci. -- The West American Scientist.


Wombat. -- The Wombat.

Vict. Nat. -- The Victorian Naturalist.
List of Authors, and Chief Papers dealing with

The Pseudococcini.
List of Authors, with Reference to the Chief Papers dealing with the Pseudococcini.

N.B. When a page reference is given it generally indicates the original description of a species, and may not denote the first page of the article.

1894.Insect Life VII, p.42.
1901.e. Psyche, IX, p.215.
Cookerell, contd.
1905. Ent. Ent. XXXVI, p. 147.
1903. Tr. Amer. Ent. Soc. XXIX, p. 112.


1911. Can. Ent. XLIII.
1912. Can. Ent. XLIII, 6, p. 279.

Ehrhorn and Cookerell.


Fernald. 1903. Catalogue.


Fullaway and Kotinsky.

1905. Trop. Agr. XXIV, p.44.

Green and Lidgett.

Hardy. 1860. Cochenille in Algeria.


King and Cockerell.

King and Tinsley.
1897. Psyche, VIII, p.150.
1898. Psyche, VIII, p.207.


Kuwana and Cockerell.


1881. Bull. Ent. Soc. Fr. (6), I,

  1912. Die Schildläuse (*Coccidae*).


  1890. *N. Z. Trans.* XXIII, p. 45.
  1891. *N. Z. Trans.* XXIV, p. 86.


Newstead and Willcocks.


Risso. 1813. Essai Hist. des Oursers.


Signoret. 1875. Essai.


Methods and Technique.
Methods of Staining and General Technique.

Specimens of mealy bugs which have been merely boiled in KOH and cleared do not make suitable mounts for purposes of study. The chitin is then too transparent and colourless; the distinction between the antennal segments and the delicate connecting membrane is not sufficiently conspicuous; and the extremely thin extremities of the anal lobe, and anal ring setae, are not distinct enough for measurement.

Picric acid in Xylo1, or beechwood creosote, is the simplest stain for chitin, giving a sulphur yellow tinge to it, but while this is quite satisfactory for the armoured scale insects, it does not give sufficient contrast for use in the Pseudococcini.

The best results have been obtained by using Ziehl-Nielsen Solution of Carbol fuchsin, full strength. After boiling the specimens in KOH they are transferred to water to which a trace of Acetic acid is added. They are then washed in distilled water and transferred to the stain. They are left in this for some hours if used cold, but are well stained in ten minutes if the solution is warmed to steaming point and then allowed to stand. They are then transferred to 70 p.c. alcohol, and on through the alcohols to Canada balsam.

I have received some excellently stained slides from
Dr. Marchal, of Paris, so I give his method too, which is a rather quicker one than the Carbol fuchsin method already given, as the specimens are not stained until they have reached the 95 p.c., or the absolute alcohol. All his slides are of hollow wood, with the specimens mounted between cover-glasses.

The method is given as follows:—

a. Ébullition dans la potasse à 10 p.c., jusqu'à éclaircissement.
b. Lavage à l'eau chaude.
c. Traitement par les alcools à 40°, 70°, 90°.
d. Coloration dans une solution de rouge de Magenta dans l'alcool absolu.
e. Lavage à l'alcool absolu. Éclaircissement au xylol et montage dans le baume de Canada entre deux lames minces, de façon à pouvoir examiner les préparations sur les deux faces avec un fort grossissement."

This is practically the same method as the one suggested by Professor P. Newstead in Vol. II, of his Monograph. For the study of the internal anatomy of the insects, or for the study of their intracellular symbionts, it is necessary to make dissections, and also to cut sections and stain for the particular organisms.

Gross dissections are best made in normal salt solution. For this purpose I find the Zeiss dissecting microscope
practically indispensable.

The experience of several years' work in the dissection of various insects shows that the most suitable dish, for use on the microscope stage, is made from an ordinary Syracuse solid watch glass. Wax is melted and poured in, sufficient being used to fill it level full. When cold it should be scraped so that the surface resembles the inside surface of an ordinary watch glass, level with the edges, but considerably lower in the middle. The killed insect for dissection is held in position by placing it in a shallow spot of melted wax which is prepared by touching the surface with a heated knife point. A little normal salt solution is placed in the dish to float out the organs on dissection.

Delicate, and fine pointed instruments are essential, and I find that one of the most useful is a fine straight Hagedorn needle, mounted in an ordinary needle holder. The cutting edge is small, and can easily be kept in good condition.

For the isolation of the mycetom, the "corpo ovale" of Berlese, a longitudinal, median cut is made on the ventral surface, when the body may be floated out with ease. For the study of this body in situ, serial sections are the most satisfactory, also for the study of the symbiont in the egg.
I obtained the best results from material which was fixed in full strength Picric-nitric solution. If used at a temperature of about 90°C. the adult ♀ insect is completely fixed in about three minutes.

From this fixative the specimens should be transferred direct to 70 p.c. alcohol, which will extract most of the picric acid in about thirty minutes if kept warm. The specimens should then be passed quickly through the stronger alcohols, into cedar wood oil, and then into paraffin.

Sections which have been stained with iron haematoxylin should be counter-stained with water-eosin or Orange G, or some such stain, as the symbionts of the Coccidae do not appear to retain much of the haematoxylin.
Systematic Position of Genera.
Systematic position of genera under consideration.

The most comprehensive scheme of classification of the Coccidae which has yet appeared is that given by Cockereell in the "Canadian Entomologist", Vol. XXXI, 1899. As we are only concerned with his Tribe Dactylopiini, I give this part in full for reference:

"& not enclosed in a hard shell or waxy or horny sac; or if enclosed (Porococcus, Cryptoripersia), antennae and legs present. Newly hatched larva without rows of dorsal spines ...................... Dactylopiini.

Dactylopiini.

<table>
<thead>
<tr>
<th>Anal ring without hairs</th>
<th>1.</th>
<th>Anal ring with hairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult ♀ with all the legs present; first four small, hind pair very large; margin with spines</td>
<td>2.</td>
<td>Adult ♀ with the antennae minute, conical; legs entirely absent; skin with many circular glands</td>
</tr>
<tr>
<td>Sphaeroococcus Ckll.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult ♀ with the antennae reduced to a mere tubercle; spiracles small, legs absent; skin tuberculate, but without conspicuous glands</td>
<td>2.</td>
<td>Adult ♀ with well formed legs and antennae</td>
</tr>
<tr>
<td>Sphaeroococcus Ckll.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult ♀ with legs and antennae absent or rudimentary</td>
<td>15.</td>
<td>Adult ♀ with legs and antennae absent or rudimentary</td>
</tr>
<tr>
<td>3. Antennae 9-jointed</td>
<td>4.</td>
<td>Antennae 8- sometimes 7-jointed</td>
</tr>
<tr>
<td>6. Antennae not more than 7-jointed</td>
<td>10.</td>
<td>4. Anal ring with 8 hairs</td>
</tr>
<tr>
<td>5. Having the aspect of a Dactylopius</td>
<td>Phenacoccus C.</td>
<td></td>
</tr>
<tr>
<td>♀ covered with waxy lamellae, like an Orthezia</td>
<td>Geroruto Sulc.</td>
<td></td>
</tr>
<tr>
<td>6. Insect with large projecting marginal tubercles</td>
<td>Tylococcus Newst.</td>
<td></td>
</tr>
<tr>
<td>Without projecting marginal tubercles</td>
<td>7.</td>
<td></td>
</tr>
</tbody>
</table>
7. Anal ring of $ with more than 8 hairs
   Anal ring of $ with 6 hairs ........................................ 8.
8. $ with 4 caudal filaments ........................................ 6.
   $ with 2 caudal filaments ........................................ 9.
9. Body very elongate; antennae 8-jointed, shorter
   and stouter than in Dactylopius; eyes present;
   mentum short ........................................ Pergandiella Ckll.
   Body oval, usually with cottony tassel
   Dactylopius Costa.
   Body subglobular, enclosed in a cottony sac
   Eriurn Crawford.
10. Antennae 6- or 7-jointed, distinguished
    from Dactylopius by the stouter legs and
    usually subterranean habitat ................................ 11.
   Antennae 5-jointed; form elongate; anal
   tubercles prominent ........................................ Rnizaecus Kunc.
11. $ apterous, with relatively short
   antennae ........................................ Fonsochromia Linn.
   Not so ........................................ 12.
12. Legs extremely thick, like crab's claws
   Pseudoripersia Ckll.
   Not so, legs ordinary ........................................ 13.
13. $ enclosed in a waxy sac ........................................ Cryptoripersia Ckll.
   Not so ........................................ 14.
   Antennae normally placed ........................................ Ripersia Sign.
15. Newly hatched larva elongate, with
   6-jointed antennae ........................................ 16.
   Newly hatched larva oval and suboval ........................................ 17.
16. Terminal segment of newly hatched larval
   antenna oval, little longer than the
   one before ........................................ Pseudolecaneum Ckll.
   This segment as long as the 3 before Chaetococcus M.
17. Larva with 5-jointed antennae; anal ring
   of adult with only 4 hairs ........................................ Cryptococcus Doug.
   Larva with 6-jointed antennae, joint 6 long; anal ring of adult with 6 hairs
   Antonina Sign.
   Larva with 7-jointed antennae, sides very
   hairy; anal ring of adult and larva with
   17 hairs ........................................ Kermicus Newst."

The genera to which I wish to refer at present are:—
Phenacoccus, Ceroponto, Tylococcus, Oudablis, Pergandiella, Dactylopius, Eriurn, Pseudoripersia, Cryptoriapersia, Ripersiella, and Ripersia.
The genus *Phenacoccus* Ckll. includes those forms in which the adult ♀ have 9-jointed antennae. The name used by Signoret for these was *Pseudococcus* Westwood. Westwood, however, based his genus on the common mealy-bug, and on the commercial cochineal. The species first cited was adonidum, which has 8-jointed antennae, so that this really belonged to the genus *Dactylopius* of Signoret.

The genus *Pseudococcus* Signoret, (non Westwood) is described in the "Essai" as follows:-

"Cette division se caractérise par la présence de neuf articles aux antennes de la femelle adulte, six à la larve et sept à la larve mâle. De plus, les tarses n'offrent pas de digitules longs comme la majeure partie des espèces, excepté dans le *Coccus hederæ*. Tous les autres caractères sont ceux des *Dactylopius*, dont ce groupe n'est qu'un démembrément pour faciliter l'étude."

A sub-genus, *Paroudablis*, was suggested by Cockerell, in *The Entomologist*, 1900, to include the forms in which the ♂ has 4 caudal filaments, but this was not generally accepted, probably because so few of the ♂ are known.

The genus *Ceromuto šulc* is in many ways unsatisfactory. It includes twelve species at present, and the chief characteristic seems to be that the female is covered with waxy lamellae, like an *Orthezia*. 
The type species is *C. pilosella* Sulo, which has, according to Lindinger (Die Schildläuse, p. 180, 1912) antennae 9- or 10-jointed. In *C. mexicanus* Kl11, the ♀ has 8-jointed antennae, and the ♂ is winged, while in *C. volynicus* Nassonow the ♀ has 9-jointed antennae and the ♂ apterous.

The genus Tylococcus was established by Newstead in 1897 for an insect received from Madagascar, where it was found in the nests of *Crematogaster Schenki* For. The type species, *T. madagascarensis* Newst. has 8-jointed antennae, anal ring with six haira, and legs well developed. The genus is defined: "♀ adult with a series of large, projecting, marginal tubercles; anal tubercles large. Anal ring and antennae as in *Dactylopius*.”

*Quablis* was created by Signoret in 1881 for the forms which differed from *Dactylopius* only in so far as the males had four caudal filaments instead of two. This was discarded by Mrs. Fernald in her Catalogue (1903) owing to the fact that so few of the males are known.

The name *Pergandiella* of Cockerell (1899), had to give way to *Trionymus* Berg., which preceded it by a few months only. Other synonyms for this are *Westwoodia* Sign., *Signoretia* Kraatz, *Bergrothia* Kraatz, and *Bergrothiella* Reit., all of which were pre-occupied.
The type species is perrisi, which was described by Signoret as *Westwoodia perrisi* (Essai, p. 337.) The characters given for the genus are:

"Nous characterisons cette division par les antennes de la femelle adulte et celles de la larve mâle composées de huit articles, la larve femelle n'en offrant que six. Menton très-court, filets rostraux très-courts, dont l'anse dépasse à peine les jambes antérieures. Le reste comme dans les *Dactylopius*. La longueur du corps de l'espèce qui sert à former cette coupe est très-marquable et dépasse de beaucoup l'ordinaire car elle est plus de trois fois plus grande que la largeur."

It is always unfortunate when a name which has become well known, by use for many years, has to be discarded or replaced by another, as happened in the case of *Dactylopius*. Signoret used the name, which he called *Dactylopius* Costa, in the following sense:

"Ce genre se distinguera par la présence de huit articles aux antennes dans la femelle, de six dans la larve, et de sept pour la larve mâle avant les métamorphoses, de quatre digitules et d'un anneau génito-anal de six poils."

This term, with others such as Dactylopiid and Dactylopiine, became general for such forms, and since no other work was used to such an extent as Signoret's *Essai*, by workers on the Coccidae, the word acquired
a world-wide significance.

Dactylopius Costa (1830) was founded (Fauna del Regno di Napoli VI, p.15) on two species, D. coccus Costa, and D. polynicus Costa. The latter belonged to the already founded genus Margarodes, the former, which is the first mentioned, is to be regarded as the type of the genus. D. coccus is said to be Coccus cacti Linn., but instead of being a synonym of that, it is the first available name for the cochineal insect. This insect has the antennae with 7 segments and the anal ring hairless, the latter character separating it at once from the form under consideration, which all agree in having the anal ring with six hairs. This genus must now be known as Pseudococcus Westwood, with the type species P. adonidum (Linn.) Westw.

Erium globosum Crawford is the type of the genus Erium. It was first described by Maskell in the N.Z.Trans. 34, p.34, 1891, under the name Dactylopius globosus.

"Adult ? enclosed in a mass of white, or sometimes greyish, rather loose cotton, which, when separate, takes a more or less globular form, but may be aggregated in large masses covering the twigs. Insect sub-globular, flat beneath and convex above; colour red, or purple, or brown; distinctly segmented: length sometimes reaching 1/8 inch. Antennae properly of 8 joints, but sometimes of 7; the 4th, 5th, 6th, and 7th the shortest,
the last the longest and cylindrical. Mentum rather large, pointed, trimerous. Feet usually normal, sometimes rather short. Ano-genital ring with six hairs. Epidermis bearing large numbers of simple circular spinnerets and fine hairs. Larva not observed.

Male pupa brown, enclosed in a sac of white cotton smaller and more elongate than that of the ♀. Adult ♂ unknown.

Hab. In Australia, on Acacia armata and A. decurrens. Another of Mr. Crawford's species, to which he originally attached the name of Erium globosum. My specimens on Acacia decurrens were sent by Mr. French."

The above is the only mention of the genus Erium Craw, which was really established by Cockerell in the Amer. Naturalist XXXI,p.590,1897. His main points seem to be the sub-globular body and the enclosing sac. These characters are found throughout the series now under consideration, and cannot, in the estimation of the writer, be given generic importance. The species given under this genus by Mrs. Fernald, in the Catalogue, are now included in the new genus Dactopseudococcus, or under Pseudococcus. Pseudoripersia was first given generic rank by Mrs. Fernald. Professor Cockerell, in his Check List of the Coccidae (1899), suggested making a sub-genus with this
name, to include the insect described by Maskell under the name of *Eriococcus turgipes*. This insect was found in Australia, and was distinguished principally by its legs which were "extremely thick, like crab's claws."
The genus *Cryptoripersia* of Cockerell, founded on the character of the ovisac, was not accepted, and was merely given as a synonym of *Ripersia* by Mrs. Fernald. In 1899 Tinsley separated a few species from the genus *Ripersia*, in which the antennae were very close together, and formed the genus *Ripersiella* to contain them.
The type was given as *R. rumicis* Mask., a New Zealand insect found underground on the roots of *Rumex acetosella*. It has 6-jointed antennae, and anal ring of 6 hairs.

*Ripersia* Signoret was described in the Essai, p.335, as follows:—

"Nous avons crée ce genre pour les espèces de *Dactylopites* qui offrent six articles aux antennes pour la larve embryonnaire et pour la femelle arrivée à l'état adulte, la larve mâle conservant le nombre sept, le plus ordinaire dans le groupe. Les autres caractères sont ceux des *Dactylopites*; cependant nous pouvons ajouter l'absence des digitules des tarses."

With the exception, possibly, of *Ceroputo*, of which our knowledge is very imperfect, I am convinced that the genera discussed above constitute a phylogenetic
series, of which Ripersia forms the stem. From this, by following very definite lines of development, the whole series may be derived.

Ripersia is not the starting point, the root, as it were, for below this we should find the more primitive types showing relationship with the Coccidae as a whole, but it is from this genus that the series is moulded.

The main line of development seems to be indicated in the production of an additional number of segments in the antennae of the adult females. The males (not considering possible variations in the genus Ceroputo) seem to have undergone comparatively little change from the usual Coccid type, and possess 10-jointed antennae. One difference found in the males has been mentioned in connection with the genera Oudablis and Paroudablis,—in the production of four instead of two caudal filaments,—but this modification is looked upon as slight.

In Ripersia the ♀ larva has 6-jointed antennae, and, for ♀ larvae, this number is normal throughout the series. During metamorphosis, however, there appear, with ecdysis, additional segments, from one to three, in all the genera except Ripersia. In this genus the original larval number, (six), persists throughout. In Phenacoccus, where the adult ♀ has 9-jointed antennae, the larva still has six, the additional segments appearing gradually with the ecdyses.
It will have been observed that the number of joints in the antennae forms the chief basis for classification in this group, and in many ways this appears to me very unsatisfactory, especially, as will be shown later, that variation in this character may be seasonal. I am not in a position, unfortunately, to suggest any single character to remedy this, but I have attempted, by utilising the comparative lengths of the setae of the anal lobes, and those of the anal ring, and also of the legs, to facilitate the determination of species. These, and the other characters used in descriptions of species are discussed in a special section, later. The number of segments in the antennae appears at first to be a simple means for determination, and while the species to be described conformed to Signoret's genera having 6-, 8-, or 9-jointed antennae it was simple enough.

Specimens were found, however, which had forms in the same generation of adults, which proved to have six or seven jointed antennae; others with six and seven jointed forms together. These are all included in the genus *Ripersia*. In the same way generations of adult forms were found, in which 7- and 8-jointed forms were found, and likewise others which exhibited 8- and 9-segmented antennae.

There is still a further class which must be mentioned
here. In *Pseudococcus agrifolii* Essig, and *P. trifolii* Forbes, we find two distinct generations, a Summer form in which all the adult females have 8-jointed antennae, and a Winter generation in which the adult females all have 7-jointed antennae.

In *Phenacoccus acercola* King we have a similar seasonal dimorphism, the Summer generation with 9-jointed antennae and the Winter form with antennae of 8 segments.

It is quite possible that this phenomenon may be much more common than is now recognised, for in the majority of cases nothing is known of the species beyond what was written concerning the type material.

It is obvious that two seasonal forms such as are mentioned above, cannot represent different species, in different genera, as would be the case if the present classification were adhered to, and I suggest the following scheme to obviate such difficulties.

**Tribe Pseudococcini** (nov.)

**Adults** -

Legs and antennae present, well developed.

Anal ring with 6 hairs.

Antennae of six, six or seven, seven, seven or eight, eight, eight or nine, or nine segments. Terminal segment long, generally the longest.

The variation in the number of antennal segments may be
seasonal and constant, as in *Dactopseudococcus trifolii* (Forbes), *P. agrifoliae* (Essig), and *Pseudococcus acer-icola* (King), or the two varieties may be found together in the same generation as in *Pseudococcus aurilanatus* (Maskell).

All the segments bear hairs more or less long, the longest being usually on the terminal segment.

Length of body varies from 1 mm to 7.5 mm (*Ps. grandis* Hempel), but 2 mm to 4 mm is the most common range.

Body usually more or less oval, or elongate, but it may be somewhat sub-globular, the segmentation showing more or less distinctly through the mealy secretion.

Mealy secretion usually white or whitish, but may be yellowish, or buff coloured. Amount of secretion varies considerably. Lateral and caudal filaments present or absent.

Colour of body, after secretion is removed, as after boiling in KOH, usually reddish, pinkish or purplish, but may be blackish or dark bluish green.

Caudal tubercoles more or less developed, each bearing a long seta and several shorter hairs, in addition to the two or more (usually two) short conical spines, and glandular pores.

Similar conical spines are usually found on the lateral margins of the segments, together with the ceriferous gland-pores. In the genus *Tylococcus* these lateral
spine areas are produced on conical or rounded tubercules.

Eyes generally present, simple, on the anterior lateral margins, slightly posterior to the insertion of the antennae.

Ovisac: A more or less complete ovisac is usually formed, which may be but loosely woven of cottony filaments, or may be densely felted; "glassy" filaments may be included in the ovisac. (e.g. P. virgatus CkI1.) Some species, especially those which are viviparous, secrete merely a thin film of wax on the ventral surface, and do not form a true ovisac.

The completed ovisac may partially, or entirely, enclose the adult ?, while other species rest upon the surface of the sac in such a manner as to suggest the appearance of a Pulvinaria. (e.g. P. vovae Nassonow.) Some adult females (P. saccharifolia Green,) are said to drop off the plant and die when the ovisac is completed, i.e. when the full complement of eggs has been deposited.

Adult ? usually stationary, but some are said to move about freely in the evenings. (Ph. aceris Sign.)

Occurrence: Commonly found on various parts of plants; on or under the bark of trees; clustered at the nodes or on the under side of leaves; in flowers or fruit clusters; on the lower stems near the surface of the
ground, or on the roots below the ground. A few species are known to inhabit galls, which may be made by the insects themselves, as in *P. subterraneus* Hempel, or by some other insect as is the case where *P. oqualatensis* Clkl. is always found in the galls constructed by the Coccid *Akermes colimae*.

Some again are only known from ants' nests, such as *P. cockerelli* King, *P. olaviger* King, etc, while forms such as *P. citri* Risso, the common mealy bug, have also been found in close relation with ants. (See King and Tinsley, *Psyche* VIII, p.297,1898.)

♂ puparium.—usually small, elongate, closely felted; often mixed up with, or hidden beneath, the masses of ♀ ovisacs.

♂.—The males of comparatively few species are known. ♂ normally winged; legs normal; antennae of 10 joints. wings (two), well developed, generally white, mealy.

Caudal filaments usually two in number, but a few forms have four, which may be equal in length, or the inner pair may be longer than the outer ones, or vice versa.


Four of these, *Ripersia*, *Dactopseudococcus*, *Pseudococcus*,
and *Phenacoccus* are established chiefly on antennal characters, while the remainder have additional striking characteristics to distinguish them. These are briefly illustrated in the following Key.

Key to Genera.

**Tribe Pseudococcini.**

1. Adult ♀ with 6- or 6- and 7-jointed antennae . .
   
   *Ripersia* Signoret.  
   Type: *P. cozystromeri* Sign.  
   Legs very thick . . . . . . *Pseudoripersia* Ckll.  
   Type: *P. turzipes* Mask.  
   Antennae very close together. *Pipersiella* Tinsley.  
   Type: *P. ruminis* Mask.  

2. Adult ♀ with 7- or 7- and 8-jointed antennae . .
   
   *Pachypseudococcus* g.n.  
   Type: *P. doesemialae* Bouché? .

3. Adult ♀ with 8- or 8- and 9-jointed antennae .
   
   *Pseudococcus* Westw.  
   Type: *P. adonidum* Westw.  
   Lateral margins with projecting tubercles .
   
   *Tylocoocus* Newstead.  
   Type: *T. radagascariensis* Nick.  

   
   Type: *P. aceris* Sign.  
   (@ covered with waxy lamellae . . *Ceroipto* Sulc.)  
   Type: *C. pilosellae* Sulc.)
It is interesting to notice that *Pseudoripersia*, *Ripersiella*, *Tyloococcus* and *Ceroputo* are not distinguished by characters which appear only in these genera, but represent rather, the extreme cases of development along the lines which are more or less common to all the series. In *Ripersia*, for instance, many of the species are subterranean, and it is in this genus that we find most cases of short, stout legs. In a few species of the genus *Pseudococcus* we find a tendency in the same direction, too, but in the genus *Pseudoripersia* the character is developed to an extreme.

The shape of the body varies greatly in all the genera. The most common shape is elongate oval, but in some species the insects are short and thick, almost circular in outline, while others taper to the extremities. The distance between the antennae varies, of course, to some extent, with the shape of the body. In the sub-globular species they are generally further apart than in those which become narrow towards the anterior extremity. *Ripersiella* represents the extreme in this particular direction. The original description of the type species, *P. rumicis* Maskell, *N.Z. Trans.*, 1891, gives the shape as irregularly elliptical, but the figure shows that the body is considerably narrowed anteriorly.

In *Tyloococcus* the case is slightly different. Anal
tubercles are present throughout the series, and are
developed to a more or less degree in the larval forms
too. The well developed lateral spinneret areas are
confined to the adult forms, and these are much better
developed in some species than in others. These areas
are furnished with numerous gland openings, and usually
bear two or more short thick spines. In Tylococcus
these areas are especially well developed, and are
produced on lateral tubercles.
A single case of still further localised glandular
areas is presented by the insect described by Mr. E.
E. Green in the Mem. Dept. Agr. India, 1908, under the
name Phenacoccus insolitus Green. The $ has 9-jointed
antennae, but the 8th and 9th segments are fused together.
The body is oblong-oval, and has "a complete marginal
and three longitudinal series of conspicuous spinous
tubercles, the median series absent on the abdominal
segments, the spines short, stout and sharply pointed..
During oviposition the insect deposits first a mass of
cottony filaments (upon which it rests), and constructs
later an elongate white ovisac." This insect will now
stand as Tylococcus insolitus (Green).
The waxy lamellae as found in the genus Ceroputo, are
easily derived from the waxy covering found throughout
the series, through an intermediate stage such as is
found in Dactypseudococcus nipae Maskell.
Study of Specific Characters.
Study of the Specific Characters used in the Pseudococcini.

In the majority of the descriptions of species of the Pseudococcini the adult only is given, and the facts recorded usually follow more or less closely the following plan:

- Size; shape; mealy covering; segmentation; lateral and caudal filaments; colour in boiling KOH; antennae, of which a formula only is given; legs, usually comparative size, not actual measurements; anal ring; host plant; locality.

I propose to deal with each of these headings separately, and endeavour to indicate the relative importance of each as a means of determination.

a. Size: As a rule, the size stated represents, I think, an average, rather than an actual measurement, as it is most often expressed in terms such as "about 3 mm long", or "from 2.6 to 4 mm long" etc. Quite often a range of variation is indicated, as in the latter example.

It may be difficult to state with any degree of accuracy the precise measurements of living insects, as they will not remain still for measuring, and the mealy covering, and caudal filaments tend to obscure the extremities.

It is desirable, of course, to be sure that the smaller specimens are really adult forms, and not merely second
stage nymphs, and for this reason only those which are
spinning ovisacs should be reckoned as adults when
dealing with the living material. In mounted specimens the
number of joints in the antennae obviate this difficulty.
(except in 6-jointed Pipersia.)

My own observations seem to show that a slight variation
in size may be caused by difference of food plant, and
also by the season of the year, so that I think it is
desirable, when describing new species, to give the
date of collection, and merely to indicate, from the
living material, the approximate size of the largest
specimens.

When dealing with old adult females which have com-
pleted oviposition, the measurements of the living
specimens may be very misleading, as the bodies are
often shrunken, and an insect which then measures 3 mm
in length may be 4 or 5 mm long when cleared and mount-
ed.

Some writers always give the length of the rostral
loop after the measurement of the insect, but this ap-
ppears to be quite useless as a character. As an illus-
tration of this point I give measurements of two ♀♀ of
Pseudococcus citri Risso, (mounted).

<table>
<thead>
<tr>
<th>Length of body</th>
<th>Length of rostral loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2 mm.</td>
<td>1.80μ.</td>
</tr>
<tr>
<td>2.6 mm.</td>
<td>3.90μ.</td>
</tr>
</tbody>
</table>
b. Shape: The descriptions of the shape of the body are generally given in such terms as elongate-oval, rounded-oval etc. which are nearly synonymous. The normal shape is elongate oval, and it is only in a few cases that there is any important variation from this. A few species are short, and more or less sub-globular, while a few others are exceptionally long, with tapering extremities. It may be seen that such variations from the normal would assist in determination, where they are constant, especially as they are found in but a few of the species.

c. Colour: The descriptions of colour apply really to three distinct phases, (1) the colour of the mealy secretion, (2) that of the body through the secretion, and (3) that of the body in boiling KOH. The colour of the mealy secretion is generally white, but it may be grayish white, or yellow, as in D. nipae Mask., D. filamentosus Ckll, and D. aurilanatus Mask., or it may be decidedly buff, as in P. iceryoides Mask. The colour of the body through the secretion varies, of course, with the colour of the body, and of the mealy covering, and also with the amount of waxy secretion. Some dark-coloured species have such a dense coat of secretion that they appear quite white on the dorsal surface, and, until the secretion is removed, their
true colour is only seen on the ventral side, where the secretion is always scant.

On first dropping into boiling KOH the true colour of the body is seen. This may change considerably in a few minutes, as some of the colours found in this group are rapidly changed by the action of any strong alkali.

By far the most common colour in the Pseudococcini is pinkish, or purplish pink, but the following variations are met with:

Light yellow, P. crawi Coq., and P. solani Ckll. etc.

Pink: P. agrifoliae Essig, P. roseotinctus Ckll. etc.

Red: P. cocotis Mask.

Reddish brown: P. claviger King and Tins., etc.

Yellowish brown: P. formicaritii Ehrh. etc.

Olive brown: D. aphyllonis Ckll., P. olivaceus Ckll., etc.

Cardinal: P. bakeri Essig.

Light brown: P. ryani Coquillet.

Greenish brown: P. quercus Ehrh.

Dark grayish brown: D. quaintancii Tins.

Gray: P. salinus Ckll.

Lead gray: P. andersoni Coleman.

Purplish gray: P. azaleae Tins.

Slate colour: P. muraltieae Brain.

Purplish black: D. filamentosus Ckll.

Dark green: D. aurilanatus Mask., etc.

Pale greenish: P. atriplicis Ckll.
In writing on the colouring matter found in the Lebbek scale, *D. perniciosus* Newst., (=*D. filamentosus* Ckl.?) Mr. Hughes, Bull. Ent. Res., p. 141, writes:

"A colouring matter of a reddish crimson is present. This can be extracted with water, or better, alcohol. In the latter solvent the absorption spectrum resembles, though it is not identical with, that of cochineal. Acids have little effect on the colour nor has ammonia. It is, however, changed to a brownish green by the addition of a large excess of alkali."

Most species clear easily by boiling in KOH, or merely leaving in a cold 10 p.c. solution for 24 hours, but some of the dark green or blackish forms are extremely difficult to clear.

As a means of determination the colour of the adult is quite inadequate, as may be illustrated by the fact that all the common forms in the British Isles are of the same pinkish hue, but, where the colour varies from the normal, it may, at least, furnish a very significant clue.

d. Segmentation: It is usual, for some reason or other, to state whether the segmentation of the body is conspicuous or not. In the majority of cases this 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, on the position of the females, as insects sheltered from the wind usually have a more complete covering of meal than those in exposed positions. As a character for determination this is quite useless.

e. Lateral and caudal filaments:
The presence or absence of lateral and caudal filaments in the species in this series is a character which may assist considerably, in a preliminary way, in the determination. It would be better, perhaps, to say that the length and thickness of the filaments often give a clue to the identity of the species. There is a relation, of course, between these filaments and the glandular spine areas, which gives the point significance. The two common species, *P. citri* Risso, and *P. adonidum* Westw., which have now a world-wide distribution, may be readily distinguished from one another by the character of these filaments. In *P. adonidum* they are more slender, and the caudal ones are very long, sometimes reaching more than the length of the body. This insect became well known in many countries under the name of *Dactylopius longispinus*. A few species are described as having caudal, but no lateral filaments.
f. Antennae:
The number of segments of the antennae is a generic character, so does not call for attention here, and I wish to draw attention to the usual practice of giving the antennal formula as a specific character. This is done in a large percentage of the original descriptions, and it is only when one has endeavoured to determine specimens with the aid of them that the impossibility of the task is realised.

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.

The formula given by Newstead, (Monograph of British Coccidae, II.) for P. adonidum Westw. is as follows:-

\[(2.3.8.)(1.4.5.6.7.\]

This indicates that joints 2, 3, and 8, are longest, and any one may be longer than the other two, or that the three are of equal length. Joint 7 is shortest, and its position outside the brackets would indicate that it is always the shortest.

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, 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.
With material which is suitably stained the task is much easier, and the results are, consequently, more reliable. Methods of staining are given in the section on Methods and Technique.
Antennal formulae, constructed from stained specimens, however, are quite unsatisfactory for the determination of species. That this is the case may best be illustrated by a few measurements with the formulae constructed from them. The following are made from specimens of *P. adonidum* Westw., collected at the Edgaston Botanical Gardens in November 1913.

Antennal segments:

<table>
<thead>
<tr>
<th></th>
<th>I.</th>
<th>II.</th>
<th>III.</th>
<th>IV.</th>
<th>V.</th>
<th>VI.</th>
<th>VII.</th>
<th>VIII.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65</td>
<td>72</td>
<td>76</td>
<td>38</td>
<td>42</td>
<td>38</td>
<td>46</td>
<td>104</td>
</tr>
</tbody>
</table>

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 will be seen that no two of the formulae are alike.
It is not an uncommon occurrence for the two antennae
of the same individual to give different formulae, and
from this one collection of material, about 40 specimens,
I constructed the given formulae of five distinct 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 plotting from camera lucida draw-
ings.
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.
I have received several letters from workers in this
group, expressing the usefulness of the scheme I used
first in my description of new South African species of
Pseudococcus, in 1912, which gives the measurements, in
$\mu$, in three lines, as follows:-
a. Range of measurements.
b. Most common measurements.
c. Average of 10, 20, or 30 measurements, according to
the amount of material available.
This method has the disadvantage of requiring a good
deal of time, but I think the results are sufficiently
useful to repay one for the time spent. The average measurements are then used by the writer in preparing the chart for determination of species, which is described later.

Legs:

The remarks concerning the uselessness of an antennal formula as a specific character apply equally well to general remarks on the legs, such as 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 scheme formulated 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.
5. Length of tibia.
7. Length of tarsus plus claw.

This scheme 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.

Considered alone, the character 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 the anal ring, it is an important factor.

h. Anal ring:
The only mention of this character in the majority of
the descriptions is to give the number of hairs which
it bears. All the series which I now include in the
Pseudococcini, however, have the anal ring with six
hairs. It was observed that the length of the anal ring
hairs remained fairly constant throughout all the ??
of the species, but this did not furnish a satisfactory
specific character in itself, because there was not
sufficient difference between the length in different
species. The anal lobes are furnished with conical
spines, glandular pores, and each bears one long seta.
These also 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 if taken in conjunction
with the antennal segments and the legs.
i. Host plant and Locality.
A few species, such as the common mealy bug, *P. citri* Risso, and the long-tailed mealy bug, *P. adonidum* Westw. are found on a great variety of host plants, and have a very wide distribution, but the majority of species yet described have only been found on a single host plant, and have only been recorded from the one locality. The species which are most common on nursery stock are the ones which have been spread most widely in recent years. An illustration of this is furnished by the conspicuous species *P. nipae* Maskell. This was first described in 1892 from Demerara, where it was found on *Nipa fruticans*. It became very common on palms of different kinds and was soon known as a nursery pest in Mexico and the United States. About 1903 it was found in Europe, and has since been sent on palms to many parts of the world. It was first noticed in greenhouses near Cape Town about 1906 or 1907, but it is quite common there now. It has also been reported recently from India, Australia and New Zealand.

Dr. Signoret established a number of species apparently on this character (i.e. host plant) alone. A number of these will be found in the synonymy of *P. citri* and *P. adonidum*. 
Development of the Pseudococcini.
Development of the Pseudococcini.

Very little attention has been given to the development of the mealy bugs. The majority of the descriptions refer only to the adult female; the males of few species are known, and the early stages of practically all the insects have been entirely ignored.

I am able to record some personal observations on the ♂ series of Pseudococcus citri Risso, but unfortunately I have not had an opportunity to observe the ♂ transformations.

Some observations on P. saccharifolii Green, which were made in India by Mr. Maxwell Lefroy, are added for comparison.

After hatching from the egg the ♂ of P. citri moults four times before the adult stage is reached, so that the following instars are passed through:

Pseudococcus citri Risso.

1. Egg, hatching in 8 to 13 days.
2. 1st larval stage, with 6-jointed antennae.
   First moult.
3. 2nd larval stage, larger, with 6-jointed antennae.
   Second moult.
4. 1st nymphal stage, with 7-jointed antennae.
   Third moult.
5. 2nd nymphal stage, antennae also 7-jointed.
Fourth moult.

6. Adult, with 8-jointed antennae.

In *P. saccharifolii* Mr Lefroy did not find the two larval stages, so that it is probable that they do not occur in that species. I observed them in *P. muraliae* in a generation which hatched from eggs on October 25, 1910, at Cape Town.

Both ♂ and ♀ were observed by Mr. Lefroy, so that I shall draw somewhat fully from his description given in the Memoirs of the Dept. of Agr. in India,II,p.124,1908. The ♂ and ♀ are alike up to the second moult, when the ♂, after the moult, enters a period of rest, during which it assumes a chrysalis form, while the ♀ passes through another instar before attaining maturity.

*P. saccharifolii* Green.

1. Eggs laid, hatching in about 11 days.

2. First instar, in which both sexes are similar and active, lasting 4 to 6 days.

3. First moult, occurring 15 to 17 days after the eggs were laid.

4. Second instar, in which both sexes are similar, and active on occasion, lasting about 4 days.

5. Second moult, 19 to 21 days after hatching.

6. Third instar; ♂ enter pupal stage; ♀ remain as before and continue feeding, lasting 6 to 7 days.

7. Third moult; ♂ emerge winged.

8. ♂ fertilise ♀, about 2 days after emerging.

9. ♂ die, usually within 2 days of emergence.
10. ♀♀ lay eggs and then die.

The total duration of life in this particular generation lasted 29 or 30 days for the ♂♂, and about 34 days for the ♀♀. This represents the period from the time the eggs were laid until the insects died as adults.

Other generations were observed in which the life of the ♀♀ occupied 41, 35, and 50 days respectively.

Mr. Lefroy considered that there would be as many as eight distinct generations in the year, but as there is a good deal of irregularity in the behaviour of the broods they overlap until all stages are found together.

Little is known as to how the different species pass the winter, but in the common forms of greenhouses, all stages may usually be found throughout the year.

In *Pseudococcus capensis*, which was extremely numerous on *Phytolacca* trees at Rosebank, (South Africa), adult females were always to be found in the cracks of the bark during the Cape winter.
Scheme for description of species, and

Chart to aid in determination.
Suggested Scheme for the full description of Species, and a suggested Chart to facilitate the Rapid Comparison of one Species with others.

The unsatisfactory nature of many of the existing descriptions of the Pseudococcini cannot be denied. The fact that I have received letters from Entomologists in other parts of the world asking if I have a "workable" scheme for the determination of species proves that this is recognised. The reason for this cannot be shown to lie with the workers themselves, but is to be found entirely in the characters which were most often used.

Characteristics which we may consider essential now were not considered at all by the early workers, who, I imagine, were not entirely satisfied, nor am I sure that any single character used now is entirely satisfactory.

All that can be done, at any time, however, is to endeavour to find the most constant characters for the species, and to consider these as the essentials for the time being. Characters such as can only be proved by breeding cannot always be awaited.

Descriptions should be made, as far as possible, on the same lines, at any rate care should be taken that all the more important characteristics are given. When given always in the same sequence the work of comparison is simplified.
A definite scheme, suited to the particular class of insects, has several advantages, one of which is that it ensures that no point of importance is omitted.

For a full scheme, to be used in the description of the Pseudococcini, I would suggest the following:

Name: ... 

Ovisac: size, shape, colour, texture, whether adult is enclosed or not.

Ova: size, shape, colour, (hatch in ... days.)

Larva: size, form, colour, waxy secretion, antennae, number of segments.

Male puparium: size, shape, colour, texture, emergence of adult♂.

Male: size, colour, wings, eyes, antennae, caudal filaments.

Female: size of largest specimens observed, shape, colour, waxy secretion, lateral and caudal filaments. colour in boiling KOH, liquid stained?.

♀. Cleared and mounted:
size, shape, method of staining, antennae: number of segments, range of measurements, most common measurements, average of 10, 20, or 30 measurements, hairs.

Legs: measurements in μ, of (a) length of coxa, (b) breadth of coxa across base, (c) length of trochanter plus femur, (d) breadth of femur, (e) length of tibia, (f) breadth of tibia, (g) length of tarsus plus claw.

Digitules:
setae of anal lobe: range of measurements in μ, mode.

Setae of anal ring: range of measurements in μ, mode.

Distribution of spines, hairs, and chief clusters of glandular pores.
(Symbiont: position of mycetom, character of organism, infection of eggs, cultural characteristics, etc.)

Parasites:

Relationship with ants:

Host plants:

Locality:

Date of collection:

Possible relationships:

Observations:

......

To obviate the necessity of referring to the descriptions of species in detail, as a preliminary step in determination, I make use of charts such as those given with the descriptions which follow.

On receipt of material I make careful notes on the living insects, noting the ovisacs, ova, larvae, etc and on the adult insects.

After clearing and staining the specimens I proceed at once on the particulars required to complete the chart, making the measurements of antennae, legs, anal lobes setae and anal ring setae, from the mounted specimens.

A curve is plotted for the antennal segments, red ink being used. This is the character which is first compared after the living material characters have been
considered. In some cases the first clue to the identity of the species is obtained from the fresh material, from its general size, colour, secretion, or perhaps the lateral or caudal filaments. Its colour in boiling KOH may give the first clue, but these are exceptional cases when dealing with species which have not been seen alive before, and most often the antennal curve is the first means of showing where the insect belongs. The similarity of antennal curves is not conclusive evidence that the insects are identical, however, but the ease with which the character may be figured, and the figures compared, makes this method extremely valuable. The anal lobe and anal ring setae should also be compared, and finally the leg characters. If all these characters are found to approximately agree the full description should be consulted for the minor points.

Unfortunately the requisite details are not supplied in most of the original descriptions to enable one to compile charts for many species, and it takes a good deal of time to secure the type, or at best toptype material, and make the necessary measurements.

I add a number of copies of original descriptions, which are indicated by the use of inverted commas, and a number of others, abbreviated, but presenting all the main points mentioned, with charts wherever possible.
Descriptions and Charts of the Pseudococcini.

"i.- Bright orange, with very little mealy powder; very convex, almost hemispherical.

Long. 2 mm, lat. 1.5 mm.

Legs and antennae reddish brown. Antennae 6-jointed, fifth joint cup-shaped; joints measuring as follows in mm: (1) 33, (2) 39, (3) 48, (4) 18, (5) 30, (6) 80.

Formula: 6.3.2.(1.5.)4.

Anal ring with six bristles; caudal tubercles not at all produced, each bearing a bristle about the size of the bristles of the anal ring.

Loc. Las Vegas, New Mexico. April. rarely with Lasius americanus.

I have seen an ant wildly rushing about with one in its jaws.

By its convex shape, together with the orange colour, this species is very different from all the others.

First found by W.P. Cockerell."
Chart for: — *Hipersia aurantia* Cockerell, 1901.

Size:— (a) Fresh material:— 2 mm long and 1.5 mm broad.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in :—

Setae of Anal lobes:— About the same length as those of the anal ring.

Setae of Anal ring:—

Host plant:— *Lasiurus americanus*.

Locality:— Las Vegas, New Mexico.
Ripersia confusella Cockerell, 1901.


"♂.- Length of body 1300 to 1550μ; antennae 660μ; wing 1150μ; cottony tails about 700μ. Dull greyish brown to pale pink, antennae and legs almost white; dorsum of thorax pale, with a yellowish tinge, no distinct vittae; wings very white; mesosternum whitish; middle of abdomen pale. Head seen from above large, triangular, broadest behind the eyes, which are small and dark crimson.

♀. pale pink, varying to pale yellowish, without lateral tassels; small caudal tassels present.

Adult (with eggs forming) about 2 mm long; antennae 6-jointed, formula 6.3.1.2.5.4.; joints (1) 33, (2) 30, (3) 45, (4) 21, (5) 27, (6) 60. Middle legs:—femur + trochanter 150μ; tibia 105; tarsus 66μ.

♀. penultimate stage, (1) 36, (2) 33, (3) 39, (4) 24, (5) 33, (6) 75. Middle legs:—femur + trochanter 132; tibia 65; tarsus 60μ. The antennae and tarsus of this stage are about as in the adult, but the femur and tibia are shorter. The antennal measurements are variable to some extent, but on the whole remarkably constant in a considerable series.

Egg: pale ferruginous, oval; 650μ long.

Hab. Las Vegas, New Mexico, about 6400 ft. in nests of *Lasius americanus*.
Chart for:— *Empisia contorta* Cockerell, 1901.

Size:— *(a)* Fresh material:— About 2 mm long.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in μ:— Mesothoracic leg:—

Femur + trochanter 132μ; tibia 65μ; tarsus 60μ. (Penultimate stage.)

150μ; 105μ; and 66μ in adult.

Setae of Anal lobes:— About 117μ long.

Setae of Anal ring:—

Host plant:— In nests of *H. aenea* and *h. laevigata*.

Locality:— Las Vegas, New Mexico, 6,400 ft.
Pipersia porteræ Cockerell, 1901.


"9.- Globose, very pale pinkish or sometimes yellowish; mounted specimen 2.4 mm long and 2.3 mm broad; enclosed in a snow-white sac just like that of Dactylopius lichtensicodes. Labium not elongated; hairs of anal ring remarkably short; legs ordinary, middle leg with femur + trochanter 135μ, tibia 70μ, tarsus 60μ. Antennae 6-jointed: (1) 35-39, (2) 39, (3) 42-45, (4) 24-27, (5) 33-36, (6) 60-66.

Hab. Las Vegas, on roots of grass, April 25. A very distinct species, with its pale colour and snow-white sac."
Chart for: — **Pipervia porteri**e Cockerell, 1901.

**Size:**
(a) Fresh material: — About 3.4 mm long and 2.3 mm broad.

(b) Mounted: —

**Antennal curve:**

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Legs: —

Measurements in \( \mu \) : —

Meso thoracic leg: —

Femur + trochanter \( 135 \mu \); tibia \( 70 \mu \);

tarsus \( 60 \mu \).

Setæ of Anal lobes: —

Setæ of Anal ring: — About \( 72 \mu \) long.

Host plant: — On roots of grass.

Locality: — Las Vegas, New Mexico.
Ripersia trichura Cockerell, 1901.


"?—Longer than usual, pinkish, but covered with white mealy secretion.
Skin unusually crowded with round glands; cephalic region somewhat bristly; caudal region very bristly; caudal lobes not prominent, their bristles are about 165μ long; six bristles on the anal ring, 135μ long; legs not unusually slender; anterior femur 105μ; middle leg with femur + trochanter 138μ (femur alone 105μ, width 36μ), tibia 84μ; tarsus 57μ.
Formulae 6.1.2.(3.5.)4. and 6.1.3.2.5.4.
Hab. Las Vegas, April 29th, (W.P.Cookerell.)
My wife brought this in with the remark that it seemed to be new; but I thought it was confusella, until I saw the extraordinary long bristles of the anal ring and caudal tubercles. The caudal bristles of confusella measure about 117μ, of trivittata 114μ. The bristles of the anal ring in most of the species are under 100μ;—for instance, 72μ in porterae, 45μ in trivittata. The legs of R. trichura are similar to those of confusella."
Chart for: *Pi ersic* trichura Cockerell, 1901.

Size:—

(a) Fresh material:—

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in µ:— Nesothoracic leg:—

Femur + trochanter 138µ; tibia 84µ;

tarsus 57µ.

Setæ of Anal lobes:— About 165µ long.

Setæ of Anal ring:— About 135µ long.

Host plant:—

Locality:— Las Vegas, New Mexico.
Ripersia trivittata Cockerell, 1901.


"J. - Body 950–1050µ long; antennae about 600µ, 10-jointed, joints cylindrical, with short whorls of hairs; wings 1100µ; two white caudal filaments, short, about 150µ.

General colour, including legs and antennae, light straw-yellow; head, prothorax, extreme base of antennae, and abdomen suffused with lilac; mesothorax with three purplish brown longitudinal stripes; sides of thorax purplish brown; eyes black, relatively large, prominent, shiny; head seen from above widest in region of eyes.

9. - About 1.5 mm long; of ordinary form. Pale yellowish, with a slight pink tinge, some decidedly pink; sparsely mealy; turning dark brownish red on boiling in KOH.

Antennae and legs pale brown; antennae 6-jointed, (1) 30, (2) 30, (3) 30, (4) 18–24, (5) 24, (6) 72.

Formula 6.(1.2.3.)5.4.

Anterior tibia about 30; tarsus 63µ.

Hab. Las Vegas, under a rock with Lasius americanus. ♂♂ and ♀♀ together in numbers, apparently copulating.

This is known from confusella by the first three antennal joints being of about equal length; but I should have thought it only a variety but for the essentially different ♂."
Chart for: — *Pipersia trivittata* Cockerell, 1901.

Size:— (a) Fresh material:— About 1.5 mm long.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in μ:—

Anterior tibia about 60; tarsus 63μ.

Setæ of Anal lobes:— About 114μ long.

Setæ of Anal ring:— About 45μ long.

Host plant:— Under a rock with *Lasius americanus*.

Locality:— Las Vegas, New Mexico.
Dactopseudococcus filamentosus (Ckll.), 1893.


"♀.—About 3 mm. long, shape of Coccus cacti, grey, but covered with white secretion. The ♀, boiled in KOH, turns black and gives off a purplish colour. By transmitted light it appears not black, but violet. The margin has a series of short hairs. The caudal tubercles emit the usual filaments, which, however, are very short. Between the tubercles, when the secretion is removed, four hairs, longer than the tubercles, can be seen.

The legs are very small. Tibia not nearly twice as long as tarsus. Claw slender with a very short knobbed digitule. Tarsus with two long knobbed hairs as usual. Inner side of tarsus with a long, rather stout hair, which extends as far as end of claw.

Femur as long, or nearly as long, as tibia and tarsus. Trochanter with a long hair. Colour of legs brownish.

Antennae very short, with only seven joints; 1 and 2 about equal; 3 and 4 equal, shorter than 2; 5 and 6 subequal, shorter still; 6 shortest; 7 long.

Larva reddish. Eggs oval, with contents partly of a verdis-green colour.

Hab. On a plant resembling a Vaccinium, Bahamas."
Chart for: — *Dactopseudococcus* filamentosus (Ckll.), 1893.

Size: — (a) Fresh material: — About 3 mm long.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in µ: —

Femur about 140µ; tibia about 100µ;
tarsus about 70µ.

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — Citrus etc.

Locality: — Japan, Mauritius, Hawaii, South Africa.
Dactopseudococcus *indecisus* (Ckll.), 1901.


*"o.p 1 2/3 mm long. Pink, varying to pale sage green; mealy; no lateral or caudal tufts; no well-defined ovisac; legs and antennae very pale. Middle leg, with femur and trochanter 174μ; tibia 108 μ, tarsus (without claw) 60μ. Antennae 8-jointed, varying to 7; one 9 full of eggs had one antenna with 8 joints, the other with 7. Formulae:- 8.1.3.(3.7.)(5.6.)4. and 8.2.1.(3.7.)6.(4.5.) Measurements of joints in μ:-


Hab. In nests of *Lasius americanus*, Las Vegas, New Mexico. April 22, (W.P. Cockerell)."
Chart for: — *Dactopseudococcus indecisus* (Ckll.), 1901.

**Size:** (a) Fresh material: — About 1.7 mm long.

(b) Mounted: —

**Antennal curve:** —

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Legs: —

**Measurements in µ:** Mesothoracic leg: —

- Femur + trochanter 174µ; tibia 108µ;
- tarsus 60µ;

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — In nests of *Lasius americanus*.

Locality: — New Mexico.
"About 2 mm long, of ordinary form. Apparently with little mealy secretion; legs stout, lively ferrugineus; antennae 7 or 8 jointed. Anal ring ordinary, with six short hairs. Females studied full of eggs, which are 275μ long and 170μ broad.

The species is especially distinguished by its small robust red legs, and small pale antennae. The following measurements are in μ:- Hind leg: length of trochanter 105μ; of femur 222; width of femur 92; length of tibia 182; of tibia 95, bristles of hind tibia 15. Apical bristle of trochanter about 62.


The 7 and 8 joints do not indicate two species; in one case a specimen was 7-jointed on one side and 8 on the other.

Hab. Santa Ana Misiones, Argentine, No.13,(Lahille)."
Chart for: *Dactopseudococcus missionum* (Ckll.), 1910.

Size:—(a) Fresh material:— About 2 mm long.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in **μ**: Mesothoracic leg:—

Trochanter 105μ; femur 222μ; tibia 182μ; tarsus 95μ.

Setae of Anal lobes:—

Setae of Anal ring:—

Host plant:—

Locality:— Argentine.
Dactopseudococcus quaintanci (Tinsley), 1898.


"Adult ?.- Length 2 mm. Width 1.5 mm. Shape, ellipsoidal, much flattened. Colour, dark grayish-brown, the body is so covered with white meal that its true colour only shows on the ventral surface, the colour of the dorsum appearing quite white. The white secretion mealy, projecting slightly on the lateral margins, but not forming well-marked filaments; posteriorly it is produced into two short, but well defined, caudal filaments; on the dorsum it is slightly raised into a longitudinal ridge. In addition to the mealy secretion, there is some waxy, threadlike secretion as in D. virgatus Ckll. They produce no well-defined ovisac, only a fluffy mass of secretion.

Boiled in caustic soda they become, at first, almost black, and on further boiling they become purplish. Legs and antennae brownish, but much lighter than the body.

Antennae 7-jointed: 7 longest, slightly longer than 2 + 3 (90 - 100μ); 2 and 3 next longest, usually subequal, but twice as long as broad; 1 and 6 next longest, often subequal, 1 sometimes the longer; 4 and 5 shortest and usually subequal. The antennae are fairly stout, espec-
ially joints 1, 2, and 3; all joints are hairy, the hairs being long and slender. Antennae of formula:–

7.(2.3.)(1.6.)(4.5.)

Legs.—Femur very stout, being only about twice as long as broad, with scattered, long, slender hairs; tibia stout, its width about 1/2 that of the femur, with a few, long, slender hairs; tarsus stout, quite hairy, bearing a pair of long, slender digitules; claw stout, bearing a pair of knobbed digitules. Leg resembles that of a Ripersia.

♂ unknown.

Hab. Lake City, Florida, Feb. 9th, 1898.

On Rhus copallina Linn., collected by Mr. A.L. Quaintance.

Remarks: The most prominent characteristics of this species are: its small size, stoutness of legs and antennae, and the comparative great length of the terminal joint of the antennae."
Chart for: *Dactopseudococcus quaintanci* (Tinsley), 1898.

Size:—

(a) Fresh material:— About 2 mm long, and 1.5 mm broad.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in μ:—

Trochanter 90μ; femur 165μ; tibia 120μ; tarsus 110μ; claw 31μ.

Setæ of Anal lobes:—

Setæ of Anal ring:—

Host plant:— *Rhus copallina*.

Locality:— Florida.
Dactopseudococcus sacchari (Ckll.), 1895.


♀ in alcohol, pale olivaceous or pinkish, sparsely mealy, plump, length 4, breadth 2 mm; segmentation distinct.
Antennae 7-jointed, sometimes 6-jointed from the obscurity of the joint (i.e. suture) between 2 and 3. Joint 7 much longest; 3, 4, 5 and 6 shortest and subequal; 2 distinctly longer than 3; 7 a little longer than 4 + 5; joints with sparse whorls of hairs.
Antennae pale brown, small. Legs small. Trochanter with three bristles; a very long hair at its tip, and a short spine behind; femur not swollen, longer than tibia. Tarsus about 2/3 length of tibia. Femur and tibia with only a few bristles. Claw large, curved, without any denticle on inner side.
Digitules of claw filiform. Tarsal digitules ordinary.
Posterior tubercles not noticeable.
Mentum dimerous.
Anogenital ring with 6 hairs.
Hab.- St. Anns, Trinidad, under leaf axils of sugar-cane."
Chart for: — Dactopseudococcus sacchari (Ckll.), 1895.

Size: — (a) Fresh material: — About 4 mm long and 2 mm broad.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in μ: — Mesothoracic leg: —

Coxa 133μ; femur + trochanter 236μ; tibia 146μ; tarsus 73μ; claw 30μ.

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — Sugarcane.

Locality: — Trinidad; Porto Rico.
Dactopseudococcus zapotlanus (Ckll.), 1902.


Fernald, Catalogue, p. 113, 1903.

♀. Gregarious on the leaves, in loose globular snow-white sacs, about 3 mm diameter, which adhere to anything they touch. Boiled in KOH turns crimson, but only slightly stains the liquid.♀ cleared and mounted about 1.8 mm long, and 1 mm broad. Anal ring with six bristles; dorsal surface with small spines (about 18μ long) in rows, far apart; sides with many minute glands; ventral surface with fewer but larger circular glands and a very few bristles.

Labium dimereous, about 100μ long, and 8μ broad; legs and antennae pale, no denticle on inner side of claw; antennae 7-jointed. Measurements of legs and antennae in μ:+ Femur + trochanter 186μ; tibia 150μ; tarsus 69μ; claw 27μ. Antennal joints (1) 30, (2) 30, (3) 33, (4) 27, (5) 25, (6) 27, (7) 66.

Hab. Zapotlan, July 7th, 1902, on "Huele de Noche."

Remarks:- Allied to Erium eriogonum Ehrh. from California, but the ♀ is of a different colour, and there are other differences obvious on close comparison."
Chart for: *Dactopseudococcus zapotianus* (Ckll.), 1902.

Size:— (a) Fresh material:—

(b) Mounted:— About 1.8 mm long, and 1 mm broad.

Antennal curve:—

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Legs:—

*Measurements in μ:—*

- Femur + trochanter 186μ; tibia 150μ; tarsus 69μ;
- claw 27μ; claw without denticle.

Setæ of Anal lobes:—

Setæ of Anal ring:—

Host plant:— "Nuele de Noche."

Locality:— Mexico.
Pseudococcus adonidum (Linn.) Westwood, 1839.

Coccus adonidum Linne, 1767, edit. XII, p. 140.
D. hoyae Sign, ibid, p. 317.
D. lilacorum Sign. ibid, p. 319.
D. robiniae Sign. ibid, p. 322.
D. tuliparum Sign. ibid, p. 323.
D. zamiae Sign. ibid, p. 328.
Boisduvalia lauri Sign, Essai, p. 338, 1875.

This species has often been confused with Ps. citri, but may usually be readily distinguished by its general appearance. The waxy secretion is more evenly distributed so that there is no dorsal band as in citri. The lateral filaments are more slender and thus have the appearance of being further apart, while the caudal ones often attain a length equal to or even greater than the length of the body. This species is viviparous, while citri is oviparous. Adult ♀. In size the adult ♀ is similar to citri; the largest specimen observed measured when alive 4.1 mm, and had caudal filaments 5.5 mm long.
The colour is purplish pink; and usually shows quite distinctly through the white secretion.

Antennae 3-jointed, the average length of the segments from 20 measurements being as follows:—
(1) 64, (2) 70, (3) 71, (4) 39, (5) 50, (6) 40, (7) 45, (8) 101.

The setae of the anal lobes vary from 110 to 130µ in length, with 124µ the most common length; those of the anal ring range from 122µ to 148µ, with 134 the mode.

Host plants: Like citri, this species has a large variety of food plants. Some of the most common are ferns, mango, guava, fig, plum, Croton spp., Cycas revoluta, Strangereia schiroden, Placourtia separia, and Nephrodium amplum.

Distribution:— The natural habitat of this species is probably Southern Europe, but it has gradually extended its range until it is now a well known pest in greenhouses and nurseries in all parts of the world.
Chart for: — *Pseudococcus adonidum* (Linn.) Westwood, 1839.

Size: — (a) Fresh material: — Largest specimen seen was 4.5 mm long, and had caudal filaments 5.5 mm long.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in μ: — Mesothoracic leg: —

Femur + trochanter 370μ; tibia 230μ; tarsus 108μ; claw 24μ.

Setae of Anal lobes: — About 13μ long.

Setae of Anal ring: — About 17μ long.

Host plant: — Ferns etc.

Locality: — Cape Town. (has world-wide distribution.)
Pseudococcus ananassae (Kuwana), 1909.

D. (Pz.) ananassae Kuwana, Journ. N. Y. Ent. Soc. XVII, 162, (Pl. X, Fig. 8-9,) 1909.

"Adult ♀. Broadly oval in form; reddish brown in colour; covered with white powder; abdominal segments distinct. Antennae very long; 8-jointed, joint 8 the longest, joint 1 always very broad; formula 8.3.(1.2.17.6.5.4.; each joint with many strong hairs. Legs sub-equal, very stout, hairy; tarsus much shorter than tibia; claw large, curved; digits of tarsus long hairs, those of claw could not be recognised by the writer. Anal lobes distinct, each lobe with one long and a few fine hairs. Anal ring with six prominent hairs. Dorsum with fine hairs and many small circular spinnerets. Length about 3 to 4 mm, width about 2 to 2.5 mm. Hab. On pineapple, Japan.

This species closely resembles in form and general characters of antennae and legs Dactylopus formosus Bouche, but the latter is smaller."
Pseudococcus alkalimus Cockerell, 1902.

Ps. neomexicanus var. alkalimus Kill, Can. Ent. XXXIV, p. 315, 1902.

"9. — About 2.5 mm long and 1.25 mm broad, covered with nearly-white secretion, with short, thick, cottony caudal tassels, and lateral tassels posteriorly; secreting a thin but dense white sac, which covers all the hind end of the insect. These sacs are often stained irregularly with bright yellow.

9 (after boiling in water and mounting in oil of cloves) bright orange; antennae and legs yellowish-brown; no produced caudal tubercles; labium 130u long and about 76u broad; eyes prominent; caudal bristles about 75u long; bristles of anal ring about 66u; legs quite stout, breadth of anterior tibia 36u; claw with no denticle on inner side; claw digitules very slender; no distinctly knobbed tarsal digitules; antennae 8-jointed.

Measurements of legs and antennae in μ: Anterior leg:—

Perur + trochanter 310u; tibia 135u; tarsus 65u; Hind leg:

Perur + trochanter 331u; tibia 174u; tarsus 76u. Antennal segments: (1) 45-54. (2) 48-54. (3) 36-41. (4) 24-30. (5) 34. (6) 22-24. (7) 24-25. (8) 66-78.

Lab. Roswell, New Mexico, on a low grass in an alkaline spot, abundant on the leaves and stems, August 24, 1902."
Chart for: *Pseudococcus alkaline* Cockerell, 1902.

Size:—(a) Fresh material:— About 2.5 mm long and 1.25 mm broad.

(b) Mounted:

Antennal curve:—

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Legs:—

Measurements in µ:— Prothoracic leg:—

Femur + trochanter 210µ; tibia 135µ;

Tarsi 70µ.

Setae of Anal lobes:— About 75µ long.

Setae of Anal ring:— About 66µ long.

Host plant:— Grass.

Locality:— Roswell, New Mexico.
Pseudococcus americanus (Cockerell), 1895.


Trionythus americanus (Ckll.), Fernald, Cat. p. 96, 1903.

Ovisac large, elongate, when complete enclosing the adult 9.

Adult 9: About 3.6 mm long, and 1.35 mm broad, eyes distinct, caudal tubercles not produced, each with many small round glands and a pair of short, stout spines, and also about 15 short hairs and one long one. This is like the hairs of the anal ring, but longer.

The derm is covered with gland pits and scattered hairs; the rostral loop reaches to about midway between the first and second pair of legs.

Penturn about 92μ long and 104μ wide. Legs very sparsely hairy.


Mesothoracic leg: coxa 116μ; femur + trochanter 240μ; tibia 168μ; tarsus 84μ; claw 32. Width of femur 72μ; of tibia 36μ.

Host plant: Ash.

Locality: Washington D.C.
Chart for: — *Pseudococcus americanus* (Cockerell), 1888.

Size: — (a) Fresh material: —

(b) Mounted: — 3.6 mm long and 1.25 mm broad.

Antennal curve: —

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Legs: —

Measurements in μ: — Neothoracic leg:

Femur + trochanter 240μ; tibia 163μ; tarsus 84μ;

claw 32μ.

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — Ash.

Locality: — Washington D.C.
Pseudococcus burneri n.sp.

On March 9th, 1914, a tree of Viburnum was found badly infested with mealy bugs at Lydenburg, Transvaal. A number of twigs were collected and packed in tissue paper, and sent to me by Mr. Claude Puller, Assistant Chief of the Division of Entomology. On arrival it was found that all the specimens were dead, and many had been devoured by parasites and predaceous larvae. Many ovisacs remained intact, but all ova had hatched and the larvae dead and dry.

The only living material found consisted of:--

Two Coccinellid larvae; two lepidopterous larvae; and a number of dipterous puparia, of apparently two species. An attempt is being made to rear this material so that determination of species may be possible.

Several large clusters of ovisacs were placed in boiling KOH and sufficient insects recovered to enable me to make up slides of many larvae, one adult ♂, and 30 ♀. The male was observed, fortunately, almost as soon as the material was placed in potash, so this was mounted at once, while the remainder was cleared and stained.

It may be mentioned that Dr. Signoret described a mealy bug from Viburnum sp. in France, in his Essai, 1875, p. 323. This insect was undoubtedly P. citri Risso, but as the Transvaal insect is entirely different I prefer not to adopt Signoret's name P. viburni.
Description of *Pseudococcus burneri* n.sp.

**Ovisac:** About 3 mm long and 2 mm broad, regular oval in shape, white, of a fine cottony texture. The adult is entirely enclosed in the completed sac.

**Ova:** No ova were found in the material received, but numbers of dried larvae were still in the ovisacs.

**Larva:** When cleared, stained, and mounted, the larvae were about 320μ long. The shape was normal, and the antennae 6-jointed.

**Male puparium:** This was not found, and only one male was seen.

**Male:** as mounted from potash, purplish red in colour. The length of the body is 1 mm, while the width of the thorax, the widest part of the body, is 320μ. There are 4 caudal setae, but as the specimen was not seen alive it is impossible to say whether these were all covered with cotton or not.

**Female:** Length of largest mounted specimens about 2.5 mm, breadth 1.8 to 2 mm. The colour of the specimens in boiling KOH was purplish pink, and the liquid became quite dark-coloured.

**Antennae:** always 8-jointed. Plate I, fig.2.

Range of measurements:

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Most common measurement:

44. 40. 40. 28. 30. 26. 34. 90.
Average of 20 measurements:--
  44. 40. 40. 26. 30. 26. 34. 90.

Legs: The measurements for the legs are as follow:--
Prothoracic leg: 72. 96. 214. 56. 130. 30. 98.
Mesothoracic leg: 80. 110. 220. 64. 160. 30. 110.
Metathoracic leg: 84. 118. 234. 68. 186. 30. 120.

Setae of anal lobes: These vary from 165μ to 200μ;
with about 190μ the most common length.

Setae of anal ring: These are usually about one half
the length of the anal lobe setae, and vary from 88μ
to 100μ. Plate I, fig. 3.

The distribution of gland pores and hairs is normal,
and regular over the body.

(Symbiont: This has not yet been investigated as the
material was not in a suitable condition.)

Parasites: Among the material sent were puparia of two
species of Diptera, two larvae of a lepidopteron, and
two Coccinellid larvae.

Host plant: Viburnum sp.

Locality: Lydenburg District, Transvaal.

Date of Collection: March 9th, 1914.

The antennal chart will be noticed to show some likeness
to that of P. irishi, P. neomexicanus, and P. steeli, but
other characters do not agree.

This species is named in honour of Miss O. Burner of
New York, whose assistance has been invaluable.
Chart for: — *Pseudococcus burneri* n.sp.

**Size:**

(a) Fresh material:

(b) Mounted: — About 2.5 mm long and 2 mm broad.

**Antennal curve:**

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**Legs:**

Measurements in μ: — Mesothoracic leg:—

80, 110, 220, 64, 160, 30, 110.

Setae of Anal lobes: — About 200μ long.

Setae of Anal ring: — About 25μ long.

Host plant: — *Viburnum sp.*

Locality: — Lydenburg District, Transvaal.
Pseudococcus calluneti Lindinger, 1912.

Ps. calluneti Ldgr. Die Schildläuse, p.90, 1912.

"Tier sehr klein, ohne Wachs rötlich, 1 mm lang, eiförmig, vor der Mitte am breitesten, ziemlich flach, an Seitenrand mit undeutlich plättchenartigen, sehr kleinen Wachsfortsätzen, anfangs freibeweglich, später in ziemlich fester, weisser, lang-elliptischer oder eiförmiger, 1 1/2 mm langer Hülle.
Unterirdisch an den Stärmen und stärkeren Wurzeln.

n. v. Deutschland.

Pseudococcus calluneti Ldgr. sp. nov. 178.

Mikro.: Seitenrand der Abdominalsegmente mit je 2 kurzen, kräftigen Dornen. Analsegment mit sehr zahlreichen, ventralen, runden, grossen Dr.m.
Unterlippe 3-gliedrig. Klaue kurz, kräftig, ziemlich stark gekrümmt, mit Zahn auf der Innenseite nahe der Spitze.
Fühler 8-gliedrig.

Auf Calluna vulgaris."
Pseudococcus capensis Brain, 1912.


Ovisacs large, 4.2 mm long and 3 mm broad, white, fibrous. Ovisacs often clustered together especially in the fruits of the host plants. This was especially noticeable in the case of Phytolacca and grapes.

Ova, about 360μ long and 180μ broad, bright orange yellow in colour.

Adult ♀: largest specimen seen was 4.2 mm long and 3.4 mm broad. Waxy secretion usually scant; lateral filaments are short and slender; caudal ones, (2), when the insect is in a sheltered position, sometimes attaining half the length of the body.

Antennae 8-jointed, the average lengths, from 20 measurements: (1) 68, (2) 81, (3) 81, (4) 42, (5) 59, (6) 69, (7) 44, (8) 105.

The setae of the anal lobes varied from 117μ to 152μ, with 128μ the most common length; those of the anal ring were 154μ to 180μ, with 160μ the mode.

The measurements of the mesothoracic leg in the type slide were 98, 129, 327, 91, 258, 38, and 121.

Host plants: Phytolacca dioica, Albizzia lebbeck, Malva parviflora, Sonchus oleraceus, Senecio vulgaris, vines, and pumpkins.

Locality: Western Province of Cape Colony.
Chart for:— *Pseudococcus capensis* Brain, 1872.

Size:—(a) Fresh material:— Largest specimen was 4.2 mm. long, and 3.4 mm. broad.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in μ: — Mesothoracic leg:—

80. 129. 327. 97. 258. 38. 180.

Setae of Anal lobes:— About 128μ long.

Setae of Anal ring:— About 160μ long.

Host plant:— *Phytolacca dialis* etc.

Locality:— Cape Peninsula, South Africa.
Pseudococcus citri (Risso), 1813.

Dorthesia citri Risso Hist. Nat. des Orangers, 1813.
.. alaterni Sign. Essai, p.309, 1875.
.. citri Sign. ibid, p.312.
.. ficus Sign. ibid, p.315.
.. indicus Sign. ibid, p.317.
.. lavandulae Sign. ibid, p.318.
.. viburni Sign. ibid, p.323.
Boisduvalia quadricaudata Sign. ibid, p.339.

Ovisac small, more or less spherical, at first covered by the body of the ♀. As the mass increases it is generally seen as a rounded mass protruding beneath, and in front of the insect.

Ova orange yellow, 320-350μ long, and about 150μ broad.
Adult ♀, with ovisac completed, may attain 4.5 mm in length and 2.7 mm broad. Colour usually purplish-pink but the colour is more or less obscured by the mealy white secretion. There is generally a distinct median dorsal band on which the secretion is less dense or finer, so that there is a longitudinal band which appears
slightly darker in colour. There are distinct lateral filaments, which are comparatively thick, and number seventeen on each side. The caudal ones are longer, but are also thick; these never attain a length of more than half the length of the body.

Antennae of 8 joints, the average length of the segments from 30 measurements, are as follows: (1) 63, (2) 64, (3) 64, (4) 40, (5) 43, (6) 43, (7) 47, (8) 106.

The setae of the anal lobes vary in length from 180μ to 225μ, with 225μ the most common length. Those of the anal ring vary from 108μ to 138μ, with 115μ the node.

Intracellular symbiont: Coelomomyces dactylopii Buchner lives in a definite mycorium, the "corpo ovale" of Berlese. The organism is elongate, usually more or less sickle-shaped, ten or twelve of which are enclosed in a cell, or "sferette". Infection of the ovum takes place by means of several "sferettes".

Host plants: Orange, lemon, citron, coffee, tobacco, ivy, oleander, and large numbers of other plants are badly infected by this insect in different parts of the world.

Distribution: Southern Europe appears to be the original home of this species, but owing to its wide range of food-plants, and the adaptability of the insect to different climatic conditions, it is now found in all countries which have temperate or sub-tropical climates.
Chart for: — *Pseudococcus citri* (Pisso), 1813.

Size:— (a) Fresh material: — Largest specimen seen was 4.4 mm long and 2.6 mm broad.

(b) Mounted: —

Antennal curve:—

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Legs:—

Measurements in μ: — Mesothoracic leg:—

Femur + trochanter 340μ; tibia 230μ; tarsus 190μ; claw 26μ.

Setae of Anal lobes:— About 22μ long.

Setae of Anal ring:— About 130μ long.

Host plant: — Oleander etc.

Locality: — Cape Town. (has world-wide distribution.)
Pseudococcus *coffeae* (Newstead), 1908.


"Adult *4* covered with densely felted plates of white secretion, but this covering was so much injured as to render it impossible to give a correct description of its arrangement. Form rather short, ovate. Antennae long, setose, of eight segments, terminal segment much the longest and some of the hairs upon it are longer and stouter than the rest. Legs normal. Margins with an equidistant series of spines, usually in pairs, each surrounded by a group of rather large spinnerets. Dermal spinnerets minute; spines few and scattered. There are two pairs of large ventral glands, the first pair are placed near the margin immediately below the insertion of the antennae, the other pair also sub-marginal, are situated a little anterior to the anal opening; each gland has a long transverse slit and a bilateral lunular patch of chitine thickly studded with spinnerets and minute hairs. Anal orifices with 6 hairs. Anal lobes normal, each with a few short spine-like hairs and a single long stout hair.

Hab. On Liberian coffee; Java, 7. I. '03.

This species may be distinguished chiefly by the densely felted plates of white secretion which cover the dorsum. In the form of the waxy covering it resembles *P. nipae*, but it is a much larger insect."
Pseudococcus comstocki (Kuwana), 1902.


The adult is long oval in outline, about 4 mm long and 2 mm broad. The colour of the body is purple, while the legs and antennae are brown.

The antennae are 8-jointed, the average lengths of four measurements being: (1) 44, (2) 56, (3) 51, (4) 31, (5) 34, (6) 34, (7) 39, (8) 101.

Headparts large; rostral long.

Legs normal; coxa longer than wide, with several spines. Trochanter as usual, bearing one long, and several short hairs; femur thick, with the outer margin convex, with many scattered hairs; tibia as long as femur, tapering posteriorly, with many hairs.

Tarsal digitules fine and knobbed; those of the claw short, gradually widening into large knobs.

Dorsum with fine scattered hairs and round pits.

Anal ring round, prominent, with six hairs.

Host plants: In cracks of the trunk of a mulberry tree, near the ground, and covered by a covering made by ants. Also similarly on the trunk of a kind of maple.

Locality: Tokyo, Japan.
Chart for: *Pseudococcus constocki* (Kwana), 1902.

Size:— (a) Fresh material:— About 4 mm long and 2 mm broad.

(b) Mounted:—

Antennal curve:—

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44. 56. 41. 34. 34. 39. 100.

Legs:—

Measurements in Tibia as long as the femur, tergus about one-third as long as the tibia.

Setae of Anal lobes:—

Setae of Anal ring:—

Host plant:— On trunk of mulberry tree.

Locality:— Japan.
Pseudococcus oualatensis Cockerell, 1903.

Ps. oualatensis Ckll., Entom. XXXVI, p. 47, 1903.

"Adult ♀ about 2 mm long, entirely covered dorsally with dense white secretion; on boiling in KOH the colour is very pale pink, and the legs and antennae are light-brown.

Dermis furnished with the usual glands and with many small hairs. The setae of the anal lobes are about 120μ in length, while those of the anal ring measure about 75μ.

Antennae 8-segmented, the measurements of the joints being as follow:- (1) 39-48, (2) 36, (3) 28-30, (4) 15-18, (5) 18-27, (6) 21-34, (7) 30-33, (8) 57-60.

The prothoracic leg measures:- femur + trochanter 198μ; tibia 90μ, tarsus 51μ.

The legs are rather stout and short, with the claws a little longer than is usual in the group; the tibia and tarsus bear numerous hairs; digitules fine hairs bearing small knobs."

This species was found inhabiting the same galls as the Coccid described by Cockerell as Akermes colimaee. Ants, Azteca longiceps, were found in association with these insects.

Locality: Cualata, Colima.
Chart for: — *Pseudococcus guatensis* Cockerell, 1903.

Size:— (a) Fresh material:— About 2 mm long.

(b) Mounted:—

Antennal curve:—

![Antennal curve graph]

Legs:—

Measurements in μ: — Prothoracic leg:—

Femur + trochanter 198μ; tibia 50μ; tarsus 50μ.

Setæ of Anal lobes:— About 120μ long.

Setæ of Anal ring:— About 75μ long.

Host plant:— In galls made by *Kermes colinae*.

Locality:— Guatata, Colina.
Pseudococcus cyperi (Signoret), 1875.

D. cyperi Signoret, Essai, p. 314, 1875.

"Pesséable et est généralement confondu avec le Candonidum. D'un brun marron clair dans les vieux individus, d'un jaune clair pour les jeunes; d'une longueur atteignant quelquefois 4 mm sur 3.25 mm de large; les antennes proportionnellement plus courtes que dans les espèces voisines, les deuxième, troisième et huitième articles les plus longs, le dernier le plus long de tous, puis le 3e et le 2e; le 4e est très-court, à peine la moitié du suivant; les 5e, 6e et 7e égaux; les pattes sont courtes et épaisses; la tarse est très-court, à peine le tiers de la longueur des tibias.

Tels sont les caractères les plus faciles à distinguer.

L'abdomen est légèrement ponctué, avec quelques rares poils; les lobes latéraux et œufs de l'extrémité corne dans Candonidum. La larve embryonnaire est comme les autres espèces, ainsi que la larve nai.

Le 4 est d'un brun jaunâtre plus clair sur l'abdomen, les articulations segmentaires plus claires.

La tête est globuleuse, pubescence, plus foncée que le reste, avec 4 yeux et 4 ocelles. Les antennes sont très-longues, le 3e article le plus long, puis le 10e, les autres à peu près égaux, très-pubescentes."

Lab. France.
Pseudococcus dasylirii (Cockerell), 1896.


"♂. Length 4 mm or slightly less, dark olivaceous, covered with white meal. No lateral tufts, but sides very mealy; thick caudal tufts like those of D. virgatus, not very long. Antennae very slender, 8-jointed. Formula 8.3.(1.2.)(4.5.6.) 7. All the joints longer than broad; 8 with three whorls of hairs; 3 very slender, nearly as long as 8; 1 longer than its breadth at base; 8 about, or nearly as long as 6 - 7. Joints with sparse whorls of long hairs. Colour of antennae brown.

Legs ordinary, small, slender, pale-brown. Tarsus about 1/2 as long as tibia. Claw short, moderately curved. Tarsal digitules extremely slender, filiform, with minute knobs. Digitules of claw about as long as claw, stout, bulbous at base. Tibia with 4 strong bristles on outer margin. Caudal tubercles low, rounded, with a rather long bristle, some short bristles, and a couple of short stout spines. The ♀ does not stain the liquid in which it is boiled.

Young larva light yellow.

Hab. Organ, New Mexico, 5,100 ft, in great numbers at bases of leaves of Dasylirion wheeleri. The larvae live at the extreme base of the leaf, which is pallid; the adults a little further up."
The adult is viviparous, and secretes a layer of white cottony matter on the ventral surface, and this gradually extends upward until the whole insect is enclosed. Adult ♀ about 4 mm long, elongate, dark olive coloured, almost black. The mealy secretion is white, and the lateral filaments are only present on the posterior segments.

Antennae 8-jointed, the measurements varying as follow:—

The anterior leg measures approximately:— Femur + trochanter 344μ; tibia 249μ; tarsus 98μ.

In the form described as a variety from Mexico, Cockerell found that the 4th antennal segment was smaller, the range being 60–75, while the 4th joint of the specimen from California measured 75μ. The mesothoracic leg of this variety measured: femur — trochanter 390μ; tibia 300μ; and tarsus without claw 100μ.

The tarsal digitules in both forms are said to be simple hairs.

Host plant: Ephedra californica.

Localities: California and Mexico.
Chart for: \textit{Pseudococcus ephedri}e (Coquillet), 1890.

Size:\((a)\) Fresh material:— About 4 mm long.

\((b)\) Mounted:

Antennal curve:

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Legs:

Measurements in \(\mu\):— Prothoracic leg:

Femur + trochanter 544\(\mu\); tibia 250\(\mu\); tarsus 100\(\mu\).

Setae of Anal lobes:

Setae of Anal ring:

Host plant:— \textit{Ephedra californica}.

Locality:— California.
Chart for: *Pseudococcus sphedricus* (Coq.) var. Ckfl.

Size: — (a) Fresh material: — About 3.5 mm long and 3 mm broad.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in μ: — Prothoracic leg: —

Femora + trochanter 515μ; tibia 250μ; tarsus 96μ.

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — Agave.

Locality: — Mexico.
Pseudococcus farnesianae (Targioni), 1888.


"Corpo della femmina minuto, rosso villoso; margini, lobi laterali, lobi anali terminati da setole.
Antennae filiformi, alla base ingrossate; 1 articolo discoidale, assai largo; 2 anulare più stretto; 3, 4 cilindrici, più lunghi del 5, 6, 7, 8 alquanto più lunghi dei precedenti, ultimo appena gradatamente ingrossato verso l'estremita, lungo quanto il 7 e l'8 insieme, tutti lateralmente, verso l'estremo terminale, guarniti di una minuta placca con peli.
Zarpe robuste, dalla 1 alla 3 gradatamente più lunghe,
Tibie, tarsi lineari, lungo il margine interno ed esterno spinulosi; tarsi circa 1/3 delle tibie.
Labro breve triangolare.
Lunghe del corpo .................. mill. 2.66.
Lunghe delle antenne .............. mill. 0.87.

Dactyl. Farnesiana (n. sp.)"
Pseudococcus formiceticola (Newstead), 1900.


D. formiceticola Newst. Ibid. XXXVII, p. 86, 1901.

"? adult viviparous, very short ovate, convex above, and flat beneath. Colour whitish, thoracic and abdominal areas with several distinct narrow, transverse, yellow brown bars, which are confluent in the middle forming a strong median line.

Antennae of 8 joints, the width of 1 about equal to the length of 8. Formula: 8.(1.2.)(6.7.) 3.(4.5.).

Derm thickly set with short stiff hairs, forming tufts at the margin of each segment; there are also numerous circular spinnerets, and near the anal opening two large eye-like glands.

Legs short and very stout, equal in length to the antennae. Anal ring of 6 long hairs. Anal lobes abnormally large, placed closely together, and thickly set with long stiff hairs and spines.

Long, 2 to 3 mm.

Larva elongate. Anal lobes very slightly indicated, and furnished with very long hairs. Antennae of 8 joints.

Hab. Matheran Hill, N. Konkan, 2,000 ft altitude, with Cremastogaster sp., ex coll. Wakeran."

Adult 9: The largest specimen, mounted, measures 4 mm long and 2.4 mm broad. The integument, hairs and spines are unusually delicate, and the antennae long. The gland-pores are scant, and the hairs few in number, but some of the latter, on the dorsal surface, near the anterior part of the body, are exceptionally long, some reaching 160μ or more.

Antennae 8-jointed, the average lengths of segments, from ten measurements being:— (1) 66, (2) 80, (3) 90, (4) 57, (5) 70, (6) 53, (7) 55, (8) 114.

The setae of the anal lobes are about 230μ in length, while those of the anal ring are about 192μ long.

The mesothoracic leg measures: 129, 167, 417, 102, 304, 38, 144.

Host plant: Orange.

Locality: Cape Peninsular, South Africa.

This material was collected by Mr. C.P. Lounsbury, and I described the species from slide material, so that I know nothing of the ovisac, and characters of the living insect, such as lateral and caudal filaments etc. I hope to complete these particulars on my return to the Cape this year.
Chart for: Pseudococcus fragilis Brain, 1873.

Size:—(a) Fresh material:

(b) Mounted:— 4 mm long, and 8 mm broad.

Antennal curve:

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Legs:

Measurements in mm: Mesothoracic leg.

129, 137, 417, 102, 374, 38, 144.

Setae of Anal lobes:— About 294 µ long.

Setae of Anal ring:— About 190 µ long.

Host plant:— Orange.

Locality:— Cape Peninsula, South Africa.
Pseudococcus glaucus (Maskell), 1878.


"This species differs from the last (P. calceolariae,) in its colour, which is light green, and in having a less regular oval line, (outline ?) ; the abdominal region runs more to a point.
The antennae, feet etc. resemble those of D. calceolariae. My specimens are from Pittosporium engenichides and Pubus australis.
I have one specimen which appears to me to be a male in an early stage. In outline it resembles a female, but the rostrum is absent, and at each side there is a protuberance which seems to me to be the rudiments of the wings.
The abdominal segments overlap each other, tending to the form of abdomen of the male Coccidae.
The antennae which are thick have 6 joints. The claw of the foot is very small."
Pseudococcus gutierreziae (Cockerell), 1896.


"Slate colour, small, (when flattened under cover glass, after boiling in KOH, 2 mm long and 1 mm broad.), forming a long firm snow-white ovisac, 4 to 6 mm long, and about 1 mm broad, on the narrow leaves of the Gutierrezia.

9. Elongate-oval, does not stain the liquid in which it is boiled; antennae and legs pale. Antennae 8-jointed, of the usual Dactylopius type. Formula 3.1.2.(3.7.)4.6.5.

9 is broader than long; 3 is conspicuously shorter than 2; 1 is very large; 8 has three whorls of hairs.

Anal ring with the usual 6 hairs. Caudal tubercles very low with the usual hairs, the longest a little longer than those of the anal ring.

Legs ordinary. Trochanter with a rather short bristle.

Tibia almost as long as femur; tarsus rather more than 1/2 as long as tibia. Claw small, not much curved. Tarsal digitules filiform, without knobs. Digitules of claw stout, but very short, shorter than claw.

Hab. Mesilla Valley, between Las Cruces and Organ, abundant on Gutierrezia sarothrae var. Also abundant on Gutierrezia sarothrae near the Tuscalore Agency, at the type locality Icerya townsendi.

It has a Chalcidid parasite."
Pseudococcus hibernicus (Newstead), 1895.


"? Adult oviparous, elongate-ovate, covered with a sac at gestation. Antennae of 8 joints, of which 8 is the longest and about equal in length to 5, 6, and 7 together; 1 and 2 about equal to 8 together; 3, 4, 5, 6 and 7 shortest and subequal; all with many fine hairs.

Mentum biarticulate; on either side of apex several (?) rather long hairs, arranged close together; rostral filaments, unexpanded, shorter than anterior legs.

Legs long, posterior pair longest; tarsi with claw about half the length of tibiae, with four slender digitules.

Anal lobes large, studded with numerous short stiff spines and hairs, each terminated with a single long hair.

Anal ring of six hairs.

Dermis with short scattered hairs; and at margin in front many scattered circular discs.

Long, 4.5 mm, wide, 1.55 mm.

Sac of ? white, closely folded and complete, but easily ruptured. Long 4.5 mm, wide 2.55-3 mm.

Hab. In the "crowns" of a species of grass in sandy soil, on a chalk cliff close to the sea, at Ballington, County Antrim, Ireland.

One specimen examined was badly parasitised, but did not differ from any of the perfect examples."
Pseudococcus irishi (Cockerell), 1900.


Eriu irishi Ewald, Catalogue, p. 113, 1903.

"P. irishi, having a very convex chalk-white ovisac about 3 mm long and 2.5 mm high, the sacs clustered on the twigs of the plants at the nodes, from two to ten at the nodes. Eggs and newly hatched larvae pale yellow. Adult 9, after being boiled and flattened on the slide, nearly circular, almost 2 mm long. The insects do not stain the liquid on boiling, but the body contains a dull crimson pigment, partly retained in boiled specimens. Skin with many small round glands, which in lateral view look like truncate spines. Dermal hairs very few and small. No lateral patches of spines. Caudal lobes completely obsolete, marked only by a pair of short stout spines on each side. Hairs on anal ring comparatively short and inconspicuous, much smaller than in D. townsendii.

Legs and antennae pale yellowish. Middle leg measuring about as follows in µ:— Coxa 111; femur + trochanter 231; tibia 180µ; tarsus 11µ; claw 30µ; width of femur 57µ.

Antennae 3-jointed, the joints measuring in µ:—


Hab. Tempe, Arizona, on Larrea tridentata, Oct., 1892."
Chart for: — *Pseudococcus irishii* (Cockerell), 1906.

Size: — (a) Fresh material: —

(b) Mounted: — About 3 mm long.

Antennal curve: —

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Lects: —

Measurements in μ: — Mesothoracic leg: —

Fraur + trochanter 230μ; tibia 180μ; claw 30μ.

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — *Lomatium tridentata*.

Locality: — Tempe, Arizona.
Pseudococcus juniperi (Ehrhorn), 1906.


"Adult ♀ oval, about 2 mm long and 1 mm broad, convex, slightly covered with secretion. Egg-sac small. Young larva reddish. Adult ♀, when boiled in KOH turns dark crimson. Derm colourless, with numerous short, straight spines on the dorsum.
Antennae 8-jointed. Joint 8 longest, I and 7 sub-equal; 4, 5 and 6 about equal, and shortest. Formula:—
8.3.2.(1.7.)(4.5.6). Also 8.3.2.7.1.(4.5.6). Legs long and slender. Femur and tibia about equal. Tarsus about 1/2 of tibia. Tarsal digitules fine knobbed hairs. Claw small, slender and curved, with curved club-like digitules reaching to end of claw. Measurements of leg-joints in μ:—
coxa 96; trochanter 48; femur 192; tibia 192; tarsus 95; claw 24. Caudal lobes rounding, with one very long, stout bristle (200-212μ) and three short stout spines on the outer and one on the inner margin.
Each lobe has numerous round gland orifices. Anal ring large, oval, about 80 by 60μ, with 6 long hairs, about 220μ.
Hab. on Juniperus virginiana, Ashforks, Arizona."
Pseudococcus kraunhiae (Kuwana), 1902.


"Adult 9. – Enclosed in a cottony sac of irregular shape; colour reddish brown. When boiled in KOH and spread out under coverglass measures 3 mm. in length and 1.5 mm in width; broad elliptical in form. There is a transverse row of spines on the dorsal aspect of each segment; ventral aspect with fine hairs; dorsum covered with small round pits. Antennae and legs large, brown in colour. Antennae 8-segmented, .5 mm long, hairy. Formula 3.4.2.1.5. (4.6.7.), measurements of joints in µ:—
(1) 69, (2) 77-80, (3) 83, (4) 55, (5) 56, (6) 53, (7) 85, (8) 111.

Mouthparts comparatively large; rostral loop long, extending down to the first or second abdominal segment. Legs subequal, hairy; coxa much wider than long; trochanters as usual, bearing a few spiny hairs; femur thick, outer margin convex; tibia slightly shorter than femur, and three times as long as tarsus; tarsal digitules fine and knobbed, digitules of claw stout, short and knobbed. Claw as usual, curved.

Each of the marginal lobes of the posterior segment bears a single long hair with two spines at the base.

Anal ring large, prominent, with 6 hairs.

Hab. On Kraunhia floribunda, Yokohama."
Chart for: — *Pseudococcus kraunhiae* (Kuwana), 1902.

Size: — (a) Fresh material:—

(b) Mounted: — 2 mm long, and 1.5 mm broad.

Antennal curve:—

![Antennal curve chart](chart.png)

Legs:—

Measurements in — Coxa wider than long; femur thick; claw curved.

Setæ of Anal lobes:—

Setæ of Anal ring:—

Host plant:— *Kraunhia floribunda*.

Locality:— *Japan*.
Pseudococcus lilacinus Cockerell, 1905.


"globose, densely covered with white meal; when mounted subglobular, about 1800μ long; after boiling in KOH the colour is lilac; legs fairly short, anterior leg with the femur + trochanter 200μ long, tibia 100μ, tarsus 65μ.
Hind leg with femur + trochanter 245μ long, tibia 150μ, tarsus 70μ; width of femur 65μ; claw stout, simple.
In one instance joint 3 measured 73μ, evidently being combined with 4.
Larva in body of 9 about 375μ long.

Hab. Jban, Tayabas, Philippine Islands, on cultivated orange.

I supposed at first that this species must be Ps. filamentosus, but that is quite different by the blue-green pigment after boiling, and the antennae are also different.

On account of the pigment it is equally excluded from Ps. albizii. By the purplish pigment and general appearance it resembles Ps. quaintancii (Tinsley).

The antennae are very variable, but the series 25, 45, 45, 22, 25, 30, 30, 80, expresses what I take to be the normal lengths of the joints."
Chart for: *Pseudococcus lilacinus* Cockerell, 1905.

Size:— (a) Fresh material:

(b) Mounted:— About 1.8 mm long.

Antennal curve:

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Legs:— Fairly short.

Measurements in μ:  
Prothoracic leg:—

Femur + trochanter 300μ; tibia 100μ; tarsus 65μ.

Claw stout, simple.

Setæ of Anal lobes:—

Setæ of Anal ring:—

Host plant:— Cultivated orange.

Locality:— Lucban, Tayabas, Philippine Islands.
Pseudococcus lobulatus (Maskell), 1893.


"Adult & yellowish-brown or sometimes reddish-brown, covered dorsally with white cotton, and having a marginal fringe of white cottony processes which are somewhat longer on the abdominal segments. Length variable; the specimens seen average 1/11 inches. Antennae of 8 joints, of which the last is fusiform and the longest, the sequence of the rest being 2.3.6.4.5.7.1.

Feet rather long: femur strong; trochanter bearing one long hair; tibia cylindrical, with several fine hairs, and with two spines at the extremity; tarsus tapering, pubescent; the tibia is 2 1/2 times as long as the tarsus; upper digitules short fine hairs; the lower pair only very short fine bristles lying along the claw. Mentum conical, dimerous; the abdomen is truncate, and terminates in four inconspicuous anal tubercles, each bearing conical spines and short setose hairs.

Anal ring large, compound, with 6 hairs.

Epidermis bearing some very small circular spinnerets and hairs; the spinnerets and hairs are more numerous near the margin.

Larva and not observed.

Hab. In Australia, under loose strips of bark of Eucalyptus globosus. My specimens were sent by Mr. Foggatt from Bendigo, Victoria. E. globosus is a Tasmanian tree."
Pseudoecococcus lounsburyi Brain, 1912.


Ovisac, when completed, entirely enclosing the adult ♀, 4.5 mm long, elongate, oval, composed of threads which, under the microscope, have a "glassy" appearance.

Ova.—Closely surrounded by fibres of the ovisac, orange-yellow, 340μ long.

Larva nearly transparent, 680μ long; antennae of 6 joints. ♀ puparium small, brownish white. Adult ♀ of the usual Pseudoecococcus type, antennae of 10 segments.

Adult ♂ about 3.7 mm long, elongate, narrow, purplish in colour. There are no lateral filaments, but four caudal ones are generally present, of which the inner pair are slightly the longer.

Antennae of 8 joints. Average of 10 measurements in μ:-
(1) 61, (2) 69, (3) 47, (4) 28, (5) 42, (6) 28, (7) 37, (8) 92.

The setae of the anal lobes are from 144 to 160μ long, while those of the anal ring are 104 to 128μ in length.

The measurements of the mesothoracic leg are as follow:

83, 121, 304, 76, 205, 40, 106.

Host plant: Agapanthus umbellatus L'Herit.

Remarks: This species was first found by Mr. C.P. Lounsbury on the leaf bases of this plant at Kenilworth, S.A.
Chart for: — *Pseudococcus loureiroi* Brain, 1912.

Size: — (a) Fresh material: — 3.7 mm long and 1.6 mm broad.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in *u*: — Mesothoracic leg: —

83, 127, 304, 76, 305, 40, 106.

Setae of Anal lobes: — About 150u long.

Setae of Anal ring: — About 120u long.

Host plant: — *Agapanthus umbellatus* L'Herit.

Locality: — Cape Peninsula, South Africa.
Psuedococcus luffi (Newstead), 1901.


"Evisac of 6 rather closely fitted, long, cylindrical, and of equal width throughout; 6 remaining uncovered at the cephalic extremity. Long. 3 to 4 mm.; diameter .75 mm.

6 adult very active, constructing evisac at period of gestation; mealy, but without marginal appendages; segmentation distinct; form rather short, ovate, and extremity emarginate. Anal lobes indicated by a single hair. Anal ring of six long hairs, intervening spaces with irregular ovate glands. Derris thickly set with circular spinnerets, forming broad bands on the abdominal segments; there are also numerous short hairs but these are fewer in number than the spinnerets.

Antennae of 9 joints, of which the last is much the longest: formula, 8.1.2.3.4.(5.6.7.) all the joints with fine hairs. Ventum biarticulate, rather pointed, joints with minute hairs on both surfaces.

Legs rather long, hairy; digitules to claw slightly dilate, those of tarsus simple.

Long. 1.5 to 2 mm.

Hab. On the lower stem and roots of Lepidopion rumpeatre, Guernsey, "near the west coast of the island", Sept. 1898. Discovered by Mr. W.A.Luff."
Pseudococcus macrozamiae (Fuller), 1897.


"Adult & active; light yellowish-brown; elongate, flattish, segmented; with dorsal meal and short lateral tassels. Antennae of 8 joints, basal wide and stout, remainder cylindrical, apical longest and almost fusiform; sequence :

8.1.2.(3.5.)4.(6.7.)

Legs ample, spined. Tubercles small.
Anal ring conspicuous with 6 strong hairs.
Dorsum clothed with many hair-like spines and with numerous multiocular pores and raised spinnerets.
Mentum conical, apex haired, monomerous (?).
Eyes sub-conical. Length 0.16 inch. Eggs yellow, deposited in thin cottony webs.
Larva yellowish-brown. Antennae 8-jointed, anal tubercles small.
On Macrozamia frazeri.
Locality: Swan River, Western Australia.
Generally found at the bases of the fronds."
Dactylopius Signoret, Essai, p. 320, 1875.
Pseudococcus Fernald, Catalogue, p. 106, 1903.

Signoret, loc. cit. writes:—
"C'est sur diverses marnillaria que l'on trouve cette espèce qui ressemble beaucoup au D. adonidum, mais en général plus petite que lui, ce qui ne suffrait certainement pas pour établir une espèce; mais nous trouvons aussi une différence dans l'antenne: ainsi, composée de huit articles comme les autres, elle diffère par le 2nd article qui est le plus long, tandis que c'est le 3e dans l'adonidum; de plus, les 5e, 6e, et 7e sont les plus petits et le 4e plus grand que ceux-ci; dans l'adonidum, ce dernier est aussi court que les autres. Cette différence de longueur du 4e article et le 2nd article plus long la distinguent aussi du D. pteridis; également le 4e article dans D. cyperi est très-petit et le 8e article le plus grand, ce qui fait qu'on ne peut les confondre ensemble. De plus, l'antenne ici est plus courte en général; le reste reste comme dans les autres Dactylopius.

Avec les auteurs qui ont parlé de cette espèce nous trouvons la sécrétion moins abondante sur les côtés.

Nous ne connaissons pas le s, que Bouché décrit comme suit:
"s. D'un brun rouge foncé; ailes blanches, nervures fortement saillantes en arrière; pattes pâles, filets blancs. Sommeable à l'adonidum, mais plus petit et plus foncé."
**Pseudococcus mesembrianthemi** n. sp.

**Ovisac**: elongate oval, but more or less irregular in outline, white, cottony, loosely felted. Under the microscope the threads have a "glassy" appearance. When the ovisac is completed it contains large numbers of ova, and also the shrunken body of the ♀.

**Ova**: elongate, oval, about 390μ long and 170μ in diameter. When seen in the ovisac they appear orange yellow, but under the microscope they are amber yellow in colour.

**Larvae**, newly emerged: about 480 to 500μ long, elongate, seen under a low power the caudal extremity appears to be rather pointed. The colour of the body is orange yellow, but the legs and antennae are paler, almost colourless, in fact, and transparent. Antennae 6-jointed.

♀ unknown.

♂ adult: when taken from the ovisac, small, about 2 mm long and 1.25 mm broad, with the two extremities curved inwards, ventrally, so that the dorsum is rounded. The colour is pinkish red and the waxy secretion scant. The lateral and caudal filaments are irregular and usually bent; they are of median length and thickness, and have a felted appearance.

When placed in boiling KOH the colour is reddish, and the liquid is only slightly stained. After boiling the body becomes distended and straightened out. The largest ♀
then measured approximately 3 mm long and 2 mm broad. The
cleared dermis shows the usual gland-pores and bristles,
but near the anterior end are a number of scattered hairs
the largest of which were found to measure 150 μ.
The caudal tubercles showed development normal for the
genus. 
Antennae 8-jointed. Plate I. fig. I.
Joints:- I. II. III. IV. V. VI. VII. VIII.
Range of measurements:-

78-82. 82-90. 82-90. 40-48. 64-76. 42-46. 46-52. 108-116.

Most common measurements:-

80. 84. 86. 42. 68. 44. 48. 112.

Average of 10 measurements:-

79. 85. 86. 43. 71. 44. 48. 111.

Setae of anal lobe: 124 to 140 μ long, with 130 μ as mode.

Setae of anal ring: - 160 to 176 μ long, with 164 μ the mode.

Legs: measurements according to the scheme given in the
Annals of the Ent. Soc. of America, V. p.181,1912:-

Prothoracic leg: - 84. 144. 304. 100. 218. 40. 120.

Mesothoracic leg: - 100. 150. 344. 112. 260. 52. 140.

Metathoracic leg: - 120. 170. 385. 118. 340. 60. 150.

Intracellular symbiont: Coccosidomyces sp. see p.188.

Host plant: Mesembrianthemum edule Linn.

Locality: Rosebank, Cape Peninsula, South Africa. The
material was collected by Mr. C.W. Hally, Feb. 21, 1914.
Chart for: **Pseudococcus mesembrianthemi** n. sp.

**Size:**
- *(a)* Fresh material:— 2 mm long and 1.25 mm broad.
- *(b)* Mounted:— About 3 mm long and 2 mm broad.

**Antennal curve:**

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**Legs:**

*Measurements in \( \mu \):*

\[
84, 144, 304, 100, 218, 40, 120,
100, 150, 744, 118, 260, 52, 140,
120, 170, 385, 118, 340, 60, 150.
\]

**Setae of Anal lobes:**— About 130\( \mu \) long.

**Setae of Anal ring:**— About 164\( \mu \) long.

**Host plant:**— *Mesembrianthes* melil. Linn.

**Locality:**— Cape Peninsula, South Africa.
*Pternocerus muralitiae* Brain, 1912.


Ovisacs spherical, 2.3 mm in diameter, white, fibrous. The ovisacs were not found singly, but aggregated in masses on the twigs of the plant.

Ova: Orange yellow in colour, oval, averaging 240μ long and 180μ broad.

Larva: Newly hatched specimens are very active, oval, of an orange yellow colour, 353μ long. Antennae of 6 joints. The Δ was not observed.

Adult & small; largest specimen seen, with completed ovisac was 1.9 mm long and 1.13 mm wide, slate-grey in colour, with a scanty covering of waxy secretion.

Lateral filaments venting, caudal ones, usually 4, short. Colour in boiling KOH black, then purple.

Antennae 8-jointed. Average length of segments from ten measurements: (1) 39, (2) 38, (3) 31, (4) 20, (5) 23, (6) 22, (7) 29, (8) 82.

Setae of anal lobes varied from 120 to 150μ, with 130μ the most common length; those of the anal ring were 90 to 120μ, with 108μ the mode.

Measurements for the mesothoracic leg in μ: -45, 76, 170, 80, 98, 30, 98.

Hab. On *Muralitiae heisteria* D.C., Cape Flats, near Cape Town.
Chart for: *Pseudococcus ruralitiae* Brain, 1972.

Size:—

(a) Fresh material:— Largest ♀ with completed ovisac was 1.0 mm long and 1.13 mm broad.

(b) Mounted:—

Antennal curve:

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Legs:—

Measurements in mm:— Mesothoracic legs:—

45. 76. 170. 60. 98. 30. 98.

Setae of Anal lobes:— About 130 mm long.

Setae of Anal ring:— About 108 mm long.

Host plant:— *Puralitiae heisteria* DC.

Locality:— Cape Peninsula, South Africa.
Pseudococcus neoexicarius (Tinsley), 1858.


Ovisac compact, elliptical, very little larger than the adult ♂, partly enclosing the ♀.

Adult ♂ about 2 mm long and 1 mm broad, ellipsoidal, and rather plump. Colour yellowish; body nearly naked, but the dorsum is sparsely reedy. Lateral and caudal filaments wanting.


Setae of anal lobes about 180 μ long, while those of the anal ring are about 200 μ in length.

Legs rather smaller than in kirii; femur 130 μ long; tibia about 140 μ long, and tarsus 75 μ.

Hairs and digitules about as in D. kirii.

Hab. On the roots of Gutierrezia sarothrae at an altitude of about 7,000 feet in the Organ Mts., New Mexico.
The insects were in all cases attended by ants.

Remarks: Cockerell states that the ovisac of D. kirii is a loose, fluffy, shapeless mass, while that of this species resembles that of an Eriococcus very much.
Chart for: — *Pseudococcus neomexicanus* (Tineley), 1898.

Size: — (a) Fresh material: — About 2 mm long and 1 mm broad.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in μ: — Mesothoracic leg: —

Femur + trochanter 180μ; tibia 180μ; tarsus 65μ.

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — *Gutierrezia sarothrae*.

Locality: — Organ Mts. New Mexico, alt. 5,000 ft.
Pseudococcus obtectus (Haskell), 1885.


"Adult ♀ sheltering itself beneath a leaf, or bud-scale of the food-plant; excreting in this position much white cotton, in which the eggs are laid. Colour red; body elliptical, convex, segmented, shrivelling after gestation; length about 1/30 in.; the last segment of the abdomen is slightly produced cylindrically, with inconspicuous setiferous anal tubercles. Mentum dimerous, with several short hairs at the tip. Antennae of 6 joints, subequal except the last, which is irregularly fusiform and longer than any two others. Arogenital ring compound, with six hairs. Spinnerets scattered all over the body — some simple circular orifices, others small cylindrical tubes. "

♀ of second stage, and larva, unknown.
♂ unknown.

Hab. In New Zealand, on Fagus fusc (black-birch), near Paftor; apparently only on the twigs."
Pseudococcus olivaceus (Cockerell), 1895.


"Long. 3.5 mm, lat. 2.5 mm, alt. 1.5 mm, (in alcohol.)

Dark olive brown, with mealy powder. Legs shorter than their distance from one another, very stout, coxa extremely large, digitules all filiform.

Antennae brown, slender, 8-jointed, 8 very long.

Formula 8. (1.2.3.) (6.7.) 5.4.

Hairs of anal ring very small.

Posterior tubercles obsolete.

On Yucca, Cintad, Perfigio Diaz, Mexico.

Rather like D. glaucus Haskell."
Pseudococcus poae (Mackell), 1878.


This species is found on the roots of the common tussock grass, or rather on the stems close to the ground. It is a rather large insect, bright pink in colour, covered with a white meal, and with a very regular outline, flat on the underside, convex above.

The mentum has a few hairs at the tip; the setae are long. The antennae are very short; the second and third joints are the longest; the last joint has a few hairs. The legs are short; the coxae thick, the femur somewhat thinner, the tibiae and tarsi still less and about equal in length. The upper digitules are not long, the lower inconspicuous, if not wanting.

There are a few hairs on the tarsus. The anal tubercles are extremely small, scarcely perceptible; each has three conical spines but no hairs and a few other spines are visible on the abdomen.

The anal ring has, I think, six hairs.

All over the body are numbers of small circular spinnerets. I have not seen the ♂ of this species, which is, I think, certainly new.

Hab. On grass. New Zealand."
Pseudococcus quercus (Ehrhorn), 1800.


" ... slightly covered with white secretion, about 2.5 mm long and 1.5 mm broad, tapering at both ends. Colour of body greenish brown, concealed more or less by secretion. Segmentation very distinct. Each segment bears a white filament on the margin. Caudal setae about 1/3 as long as the body, white and quite stout. Antennae and legs dark brown.

When placed in boiling KOH body turns crimson, derm becomes colourless after boiling. Antennae 8-jointed. Joint 8 longest, joint 7 generally shortest. Formula approximately : 8.3.3.(1.5.) 6.4.7.

Each joint has a ring of stout hairs. Joint 8 has numerous very long hairs. Legs long and stout, with numerous long fine hairs. Femur about as long as tibia; tarsus about 1/3 as long as tibia; claw slender and well curved. Digitules long fine knobbed hairs. Anal ring small, with six fine hairs. Caudal lobes well developed, with very long setae (380μ). Groups of spinnerets, conical spines and long slender hairs scattered over the dorsum.

Hab. On Quercus chrysolepis, on the leaves and in the cracks of bark, California."
Pseudocoris roseotinctus (T. and J.Cockerell), '01.


"Form and size about as in D. piri; distinctly segmented, with a slight covering of nearly powder; caudal tassels short but well developed; lateral fringe of tassels very short, irregular, but plainly visible in fresh specimens. Full of young show no signs of producing ovisacs. Antennae 8-jointed, joints measuring in µ :-


Middle leg :- Femur + trochanter 240µ; tibia 210µ; tarsus (without claw) 73µ. Breath of femur 86µ.

Labium, - length 135µ, breadth 90µ.

Caudal bristles and bristles of anal ring of the same length, 120µ.

Voiled in X0. the 99 turn bright red.

Hab. Ropererville, New Mexico, on roots of grass.

Closely allied to D. salinus Ckll. (from California), but the femora are stouter, the labium is broader, and the caudal bristles are much longer.

The antennae are variously like those of the Brazilian D. secretus Herpel. D. roseotinctus is also very similar to D. trifolii Forbes, which has a lateral fringe, but there are various small differences, and the colour is not the same."
Chart for: *Pseudococcus roseoantetus* (T. and W. Cockerell), 1901.

**Size:**

(a) Fresh material:— About 4 mm long and 2 mm broad.

(b) Mounted:—

**Antennal curve:**

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Legs:

Measurements in μ:— Mesothoracic leg.

Femur + trochanter 240μ; tibia 210μ; tarsus, without claw, 76μ.

Setae of Anal lobes:— About 120μ long.

Setae of Anal ring:— About 120μ long.

Host plant:— On roots of grass.

Locality:— Romeroville, New Mexico.
Pseudococcus salinus (Cockerell), 1902.


"9. Grey, with white secretion; 6 caudal tassels and two cephalic ones. Boiled in liquor potassa turns crimson; legs and antennae ferruginous. Mounted specimen about 2.8 mm long, and 1.35 mm broad. Skin with numerous small round glands, and a very few hairs; no distinct caudal tubercles; bristles of anal ring very short, about 49 μ long; caudal bristles very short, not, or hardly longer than the spines. Legs quite hairy; claw with no denticle on inner side; claw digitules filiform.

Middle leg: femur + trochanter 255μ; tibia 195μ; tarsus 75μ; width of femur 57μ.

Labium dimorphus, long and narrow; length 135μ, breadth 75μ. Antennae 8-jointed, about 285μ apart; measurements of joints: (1) 60. (2) 54-60. (3) 51-54. (4) 56. (5) 38-42. (6) 30-45. (7) 36-39. (8) 75-78.

Larvae in 9 very long and narrow; length 396μ, breadth 162μ. Half grown examples are still long and narrow. Length 1.5 mm, breadth .66mm.

Hab. On grass on cliffs by the sea, La Jolla, California. August 6th, 1901.

A distinct species having the shape of a Pergandiella when young."

Chart for:  *Pseudocosmus salinus* (Cockerell), 1902.

Size:—

(a) Fresh material:

(b) Mounted:— About 2.8 mm long and 1.35 mm broad.

Antennal curve:

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Legs:

Measurements in μ:— Mesothoracic leg:—

Femur + trochanter 255 μ; tibia 195 μ; tarsus 75 μ.

Setae of Anal lobes:— About 50 μ long.

Setae of Anal ring:— About 42 μ long.

Host plant:— Grass.

Locality:— Cliffs by the sea at La Jolla, California.
Pseudococcus scrobiculatus Green, 1896.

Ps. scrobiculatus: Green, Ind. Mus. Notes, IV, I, p. 8, 1896.

"In glandular pits at base of leaves of Elaeocarpus. Dark silty-gray, sparsely covered with whitish powder. Abdominal segments only with stout white processes, which protrude from the opening of the cell in which the insect lives.

Locality Punduloya."
Perniococcus segregatus (Cockerell). 1893.


"D. segregatus was found on grass in East Street, Kingston. It is very close to D. virgatus, but smaller, (the adult 9 with eggs 2.5 mm long, without counting the caudal filaments.), the back has a couple of longitudinal blackish bands, which are due to pigment, and are not, like the bands of virgatus, areas free from the mealy secretion.

Younger individuals show two or three filaments covered with white secretion, on each side of the long caudal filaments.

Antennae orange brown, 8-jointed. Joints 4, 5, 6, and 7 sub-equal, 5 a little longest. 8 about as long as 6 and 7 together; 3 and 8 about equal, but if anything 8 is a little longer; 2 shorter than 3, but longer than 4 or 5.

Tarsal knobbed hairs, and digitules of claw both very slender, with almost invisible knobs."
Pseudococcus similans (Lind.), 1893.

D. similans Lidg. The Verhot, III, p. 92, 1893.

"Adult & reddish-brown in colour, powdered with pure white meal, so thick in most cases as to obscure the ground colour and to leave the impression that the insect is pure white, body deeply and distinctly segmented, elliptical; rather flattened. A marginal fringe of cylindrical cottony filaments projects at each side, being half as long as the width of the body, one such filament springing from each segment; the two on the last abdominal segment being twice as long as the rest, and between them there is generally much cotton. Anal tubercles small and inconspicuous, forming at gestation a large white cottony ovisac containing brown oval eggs.

Feet long and slender, the second pair projecting beyond the body when walking, dark red in colour; upper digitules fine hairs, lower pair much shorter.

Antennae of 8 joints, sub-equal, each joint bearing several hairs.

Length 1/6 to 1/5 inch. Width 1/16 inch.

Hab. unknown.

Hab. In Victoria, underground on roots of Daphne, at Yarrington."

Pseudococcus simplex (Cockerell), 1893.

D. simplex Ckll., The Entom. XXVI, p. 267, 1893.

"Forming scattered patches of white secretion, quite irregular in outline, on the upper side of leaf of Pancratium caribaeum. 9. About 2 mm long, oval, brown, with mealy white secretion; segmentation distinct. No lateral processes or caudal filaments. Tibia nearly as long as femur; tarsus about 1/3 length of tibia. Claw with knobbed digitules. Legs brownish yellow, hairy; trochanter with two short hairs.

Antennae 8-jointed; 4, 5, and 6 sub-equal, and shortest; 7 next shortest, then 1, then 2, 3, and 8 longest. These differences are rather insignificant, except the decided shortness of 4, 5, and 6. Joint 8 emits several hairs, none as long as itself.

Boiled in soda they do not colour it red or brown. 9 after soda-treatment is yellowish red. The white secretion is in the form of long straight threads.

Larva. - Elongate-oval, with parallel sides; two caudal filaments, not so long as diameter of body, and joined together by secretion. Colour of larva yellowish brown.

This species was found by Dr. Strahan, in his garden in Kingston, Jamaica, August 1893."
Pseudococcus steeli (Ckll. and Towns.), 1894.


... townsendi var. steelii Ckll. ibid., p. 282, 1894.


... Fernald, Catalogue, p. 113, 1903.

Ovisac elongate, 5 to 6 mm long, felted, nearly enclosing the adult ♀.

Adult ♀ elongate, of a light reddish brown colour. Length about 4 mm; width about 2 mm.

Antennae 8-jointed, the joints measuring: (1) 42-45, (2) 40-45, (3) 36-42, (4) 21-27, (5) 24-33, (6) 27, (7) 36-40, (8) 84-87.

Derm with numerous round gland-spots. Anal ring with six hairs; mentum trinerve.

Hind legs with femur slightly longer than tibia; tarsus less than half the length of tibia. Claw fairly large, curved; trochanter with a long hair.

Posterior tubercles very inconspicuous, bearing a pair of short stout spines and a long hair.

Larvae are of the same colour as the adult, and have the antennae of six joints.

Food plant: This species was found in large numbers on the leaves of the "creosote bush", Larrea mexicana.

Locality: Las Cruces, New Mexico.
Chart for: — *Pseudococcus steelii* (Clark and Towns.), 1894.

Size: — (a) Fresh material: — Length about 4 mm, width 2 mm.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in

Setæ of Anal lobes: —

Setæ of Anal ring: —

Host plant: — *Larrea mexicana*, ("Creosote bush").

Locality: — Las Cruces, New Mexico.
Iscodococcus subterraneus (Hempel), 1901.


"♀, probably immature, oval-convex, length of prepared specimen 2.52 mm; width 1.5 mm. Antennae of 8 joints, all bearing hairs; joint 8 longest. Length of antenna about .36 mm. Length of joints in m: (1) 56, (2) 42, (3) 56, (4) 31, (5) 31, (6) 35-38, (7) 38, (8) 84-91. Approximate formula: 8.(1.3.)2.(7.6.)4.5.

Two small conical eyes present. Rostrum large, situated between the first pair of legs. Rostral loop extending half way between the 2nd, and 3rd pair of legs. Legs long. Length of joints of first pair of legs in m: coxa 91, femur + trochanter 245, tibia 140, tarsus and claw 91. Claw small, well curved; both pair of digitules small, with slightly expanded ends. Anal ring with six hairs. Anal tubercles inconspicuous, each ending in one seta. On the dorso-lateral surface of the body, including the anal tubercles, there is a series of 34 groups of spines: . . .

Gall-producing, on roots of cultivated grapes. Galls irregularly globose, 3 - 5 mm in diameter, forming a mass encircling the entire root. The interior is smooth and lined with a white powder.

Hab. La Plata, Argentine Republic."
Chart for: *Pseudococcus subterraneus* (Hempel), 1901.

Size:— (a) Fresh material:— 2.5 mm long and 1.5 mm broad.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in $\mu$:— Prothoracic leg:—

Pentur + trochanter 245$\mu$; tibia 140$\mu$; tarsus with claw 81.

Setæ of Anal lobes:—

Setæ of Anal ring:—

Host plant:— Gall-forming on roots of grape-vines.

Locality:— La Plata, Argentine Republic.
Pseudococcus syringae (Haskell), 1897.

P. syringae Haskell, N.Z. Trans., XXI, p. 266, 1897.

"Adult # enclosed in very loosely woven snow-white sacs aggregated in a mass on the plant. ♀ pupae in similar but smaller sacs.

Adult ♀ yellow; length about 1/16 inch. Antennae of 6 joints, the 6th being the longest, and fusiform; the antennal formula is 8.2.1.3.(4.5)(6.7), there are 2 or 3 hairs on each joint. Feet moderate; the trochanter bears a long seta; the tibia and tarsus have a few hairs on the inner margins; the tarsal digits are fine hairs, those of the claw very slightly dilated. Anal tubercles rather broad, but not very prominent; each bears a seta and several short conical spines; anal ring with 6 hairs. Epidermis covered with numerous small simple circular spinnerets, and with a rather dense pubescence, many of the hairs, especially on the cephalic region, being rather strong and long. In two of the specimens examined there were three transverse elongated irregular spots on the dorsum, one on each of the anterior abdominal segments.

Larva not observed.

Adult ♀ brown; wings grey; length about 1/20 in. Antennae and feet presenting no special characters. Abdominal spike short and conical; setae and cottony "tails" rather long.

Hab. In Japan, on Syringa amurensis."
Pseudococcus tayabensis Cockerell, 1905.


"... Covered with mealy secretion, distinctly segmented, looking, when dry, like minute specimens of commercial cochineal; when mounted oval, about 150μ long; after boiling, the body is seen to contain much dull crimson pigment, especially in the embryonic young; eyes well developed; anal ring with six hairs, and placed in a wide squared incision; lateral margins of segments projecting so that the margin is strongly undulated, the projecting points bear stout spines, about 12μ long; skin greatly crowded with round glands; labium long and narrow, about 150μ long and 70μ broad; legs stout, length of tibia about 125μ, tarsus 75μ; claw stout, simple.

Antennae 8-jointed, joints measuring in μ:

Larva with longitudinal rows of bristles (not spines), the middle row double; six stout hairs on anal ring; claw long, simple; antennae 6-jointed, joints measuring (1) 20, (2) 22, (3) 17, (4) 17, (5) 22, (6) 52-55.

Fab. Lucban, Tayabas, Philippine Islands, April, 1904, on cultivated cacao."
Chart for: *Pseudosoma tayabanus* Cockerell, 1905.

Size:— *(a)* Fresh material:— About 1.5 mm long.

*(b)* Mounted:—

**Antennal curve:**

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**Legs:**— Stout.

Measurements in **μ**:

Length of tibia 125μ; tarsus 75μ.

**Setæ of Anal lobes:**—

**Setæ of Anal ring:**—

**Host plant:**— On cultivated cacao.

**Locality:**— Tayabas, Philippine Islands.
Pseudococcus theobromae (Douglas), 1889.


♂ adult. Broad-short-oval, slightly narrow in front, tawid, pale-yellowish, antennae and legs concolorous; body on the upper surface covered with fine white powder, but leaving the segmentation visible; margin with short hairs and a series of long, sub-conical, granular, white projections all round; anal processes evident, rounded; hairs of anal ring normal; caudal setae (denuded) very fine, short.

Antennae short, of 8 joints, I very stout, not short; 2 and 3 longer, in length sub-equal, strong, but each consecutively thinner; 4 shortest of all; 5 and 6 each a trifle longer than 4, sub-equal; 7 a trifle longer than 6; 8 pointed, longest of all; equal to 5, 6, and 7 together, all with fine projecting hairs, the terminal ones on 8 longest.

Legs strong, with few projecting hairs; tarsi half the length of tibiae; claw short; digitules of tarsi and claw long, very fine.

Length 3 mm.

♀ unknown.


Collected by Mr. P.T. Lewis, April 1889.
Pseudococcus vovae Hassonov, 1909.

XIII, p. 484, 1909.

The adult with the completed ovisac looks very much like a Pulvinarida, owing to the similar position of the insect on the white sac.

Adult 9 about 2 mm long, brown in colour, or yelllowish brown, covered with mealy white, secretion. Glands most numerous on the four caudal segments. Eyes black, situated at the base of the antennae. Postunm biarticulate.

Antennae of 8 joints, the range of measurements, from 2 specimens being:— (1) 49-53, (2) 48-52, (3) 44-50, (4) 29-35, (5) 34-41, (6) 27-31, (7) 35-39, (8) 38-95. Newly emerged larva is oval in outline, the anterior end being somewhat truncate, while the posterior is bilobed. Length about 0.3 mm. Antennae with six joints, the formula being 3.3.1.(3.4.5.)

Fem is not known.

Host plant: On the leaves of Juniper a communis.

Locality: Skolimor, in the province of Varsoviensi.

Collected June, 1906.

**Size:**

(a) Fresh material: Length about 2 mm.

(b) Mounted:

**Antennal curve:**

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**Legs:**

Measurements in:

**Setae of Anal lobes:**

**Setae of Anal ring:**

**Host plant:** *Juniper communis*.

**Locality:** Russia.
Pseudococcus wachendorfiae Brain, 1912.


Ovisac: No definite ovisac was found although large numbers of adults were seen. There was a distinct layer of white wax on the plant beneath the insects.

Adult ♀. Largest specimen found measured 4.1 mm when living, and was 1.9 mm broad. The body was finely covered with a white powdery secretion, but segmentation was nevertheless conspicuous. Lateral filaments were absent, but there was generally a caudal tuft.

Antennae 8-jointed. The average lengths of the segments, from 10 specimens, were as follow:—(1) 64, (2) 56, (3) 43, (4) 33, (5) 36, (6) 34, (7) 31, (8) 78.

The setae of the anal lobes were from 154 to 180 μ in length with 160μ the commonest length. Those of the anal ring varied from 115 to 144μ in length, with 136μ the mode.

Mesothoracic leg: measurements in μ:—

106, 136, 342, 91, 235, 45, 98.

Hab. On Wachendorfia paniculata Linn., usually between the leaf-bases below the surface of the soil.

Newlands Flats, near Cape Town.

A small black ant was always in attendance, and built up small mounds of sand around the stems which held the insects.
Chart for: — *Pseudococcus wachendorffianus* Brain, 1912.

Size: — (a) Fresh material: — Largest specimen was 4.1 mm long, and 1.9 mm broad.

(b) Mounted: —

Antennal curve:

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Legs: —

Measurements in μ: — Mesothoracic leg: —

106. 136. 342. 91. 236. 45. 58.

Setae of Anal lobes: — About 160μ long.

Setae of Anal ring: — About 136μ long.

Host plant: — *Wachendorfia paniculata* Linn.

Locality: — Cape Peninsula, South Africa.
Pseudococcus wilmattae (Ckll.), 1901.


"9. - Brownish olivaceous; without lateral tassels; no ovipositor observed; surface sparsely mealy; length when mounted 2.5 mm; body pinkish after boiling in potash; legs and antennae pale brown; legs very sparsely hairy; middle leg with femur + trochanter 213μ, width of femur 87μ; tibia 150μ; tarsus 89μ; claw with a small denticle on inner side near tip; hind tibia 180μ long, 42μ broad; hind tarsus 75μ long, 21μ broad. Body not hairy; bristles of anal ring about 90μ long; caudal lobes not at all produced; rostral loop short, not nearly reaching to middle legs; 2nd joint of antennae conspicuously broader than 3rd, and always longer.

Antennae: 9-jointed phase, formula: 2.9.3.1.5.(4.6.7.8.) segments, (1) 39, (2) 54, (3) 45, (4) 30, (5) 36, (6) 30, (7) 30, (8) 30, (9) 48.

8-jointed phase: formula: 8.2.(1.3.)(5.7.)(4.6.) segments: (1) 42, (2) 51-60. (3) 42, (4) 27, (5) 30-33, (6) 27, (7) 27, (8) 81-87.

Hab. Beulah, New Mexico. 8000 ft. on Viola aff. pedatifida, May 11, (W.P.Ckll.)
Chart for: *Pseudococcus wilmattae* (Ckll.), 1901.

**Size:**

(a) Fresh material:

(b) Mounted: About 2.5 mm long.

**Antennal curve:**

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Legs: 39. 54. 45. 30 36. 30. 30. 30. 48.

**Measurements in μ:**

- Mesothoracic leg:
  - Femur + trochanter 213μ; tibia 150μ; tarsus 89μ.

**Setae of Anal lobes:**

**Setae of Anal ring:** About 90μ long.

**Host plant:** *Viola sp.*

**Locality:** Beulah, New Mexico.
Chart for:— *Pseudococcus andersoni* (Coleman), 1903.

Size:— (a) Fresh material:— 3.3 mm long and 1.6 mm broad.

(b) Mounted:

Antennal curve:

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Legs:— Short and stout.

Measurements in Tarsus one-third as long as the tibia.

Setae of Anal lobes:—

Setae of Anal ring:—

Host plant:— *Cupressus goveniana*.

Locality:— California.
Chart for: — *Pseudococcus aralaeae* (Tinsley), 1898.

Size: — (a) Fresh material: — About 3 mm long and 2 mm wide.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in μm: —

Femur 215μ; tibia 215μ; tarsus 112μ, claw 33μ.

Setæ of Anal lobes: — About 250μ long.

Setæ of Anal ring: — About 140μ long.

Host plant: — Aralaeae.

Locality: — In Japanese Nursery, California,
Chart for: — *Pseudococcus valdeolariae* (Maskell), 1876.

Size: — (a) Fresh material: —

(b) Mounted: —

Antennal curve: —

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Legs: —

*Measurements in μ* — *Mesothoracic leg: —*

*Femur + trochanter 330μ; tibia 233μ;*

*tarsus 90μ; claw 30μ!*

Setæ of Anal lobes: —

Setæ of Anal ring: —

Host plant: — *Sugarcane.*

Locality: — *Florida.*
Chart for: — *Pseudococcus grandis* (Herpel), 1900.

Size: — *(a)* Fresh material: — May attain 7.5 mm long and 5 mm broad.

*(b)* Mounted: —

Antennal curve: —

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Legs: —

Measurements in: —

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — One of the *lyratae*.

Locality: — Brazil.
Chart for: Pseudococcus magnolicida ("von Iher", King), 1903.

Size:—

(a) Fresh material:

(b) Mounted:

Antennal curve:

Legs:—

Measurements in μ:

Coxa I 60μ long and 24μ wide; femur + trochanter 520μ; tibia 408μ; tarsus I 40μ; claw 40μ.

Setae of Anal lobes:—

Setae of Anal ring:—

Host plant:—

Locality:— Brasil.
Chart for: — Pseudococcus pini (Kuwana), 1902.

Size: — (a) Fresh material: — About 4 mm long and 2 mm broad.

(b) Mounted:

Antennal curve: —

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73, 78, 80, 50, 58, 45, 48, 110.

Legs: —

Measurements in : —

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — Pinus pentaphylla.

Locality: — Japan.
Chart for: *Pneumococcus seoretus* (Hempel), 1900.

Size:—(a) Fresh material:— About 2.25 mm long and 1.35 mm broad.

(b) Mounted:—

Antennal curve:—

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Legs:—

Measurements in μ: — Mesothoracic leg.

Femur 191μ; tibia 182μ; tarsus with claw 103μ.

Setæ of Anal lobes:—

Setæ of Anal ring:—

Host plant:— One of the Solanaceae.

Locality:— Ypiranga, Brazil.
Chart for:— *Pseulococcus setosus* (Hempel), 1900.

**Size:**

(a) Fresh material:— Largest specimens were 5 mm long, and 2.75 mm broad.

(b) Mounted:—

**Antennal curve:**

![Antennal Curve Graph]

**Legs:**

Measurements in "— Mesothoracic leg.

Femur 333u; tibia 312u; tarsus with claw 125u.

**Setae of Anal lobes:**

**Setae of Anal ring:**

Host plant:— *Ficus* sp.

Locality:— Santo Paulo, Brazil.
Chart for: *Pseudococcus terensis* (Tinsley), 1900.

Size:—
(a) Fresh material:— Length about 3 mm, and nearly as wide as long.
(b) Mounted:—

Antennal curve:

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Legs:—

Measurements in μm:
- Femur about 182 μm long and 32 μm wide; tibia 182 μm long and 35 μm wide; tarsus 65 μm long.

Setæ of Anal lobes:—

Setæ of Anal ring:—

Host plant:— *Acacia farnesiana*, Willd.

Locality:— San Diego, Texas.
Chart for: — *Pseudococcus virgatus* (Cockerell), 1893.

Size: — (a) Fresh material: — 4.5 mm long; caudal filaments about 3 mm long.

(b) Mounted: —

Antennal curve: —

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Legs: —

Measurements in  —

Setae of Anal lobes: —

Setae of Anal ring: —

Host plant: — On leaves of a tree (sp. ined.)

Locality: — Jamaica.
Phenaecoccus cevalliae Ckll., 1902.


"? Oval, 4 to 5 mm long, pale olive green, but covered with white secretion, with lateral tassels and thick caudal tassels; placed in alcohol, they stain the liquid pale green; alcoholic specimens appear strongly segmented, with two longitudinal blackish bands, best marked in rather immature specimens. Eyes prominent; skin with many small circular glands; the lateral patches consist of about 12 glands each, but are without spines; a few rather large bristles scattered over the body; legs and antennae reddish yellow; denticle on inner side of claw rudimentary, just visible; antennae 9-jointed, the club 2-jointed.


Newly hatched larva very pale lemon-yellow, about twice as long as broad; eyes conspicuous.

Hab. In enormous numbers on Cevallia sinuata, near Lea Lake, east of Roswell, New Mexico, Aug. 31, 1902."
Chart for: *Phaeococcus cevalliae* Rockeell, 1902.

Size:—

(a) Fresh material:— 4 to 5 mm long.

(b) Mounted:

Antennal curve:

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Legs:

Measurements in µ:— Prothoracic leg:

Femur + trochanter 470µ; tibia 330µ; 
tarsus 130µ.

Setae of Anal lobes:

Setae of Anal ring:

Host plant:— *Cevallia sinuata*.

Locality:— Near Roswell, New Mexico.
Phacocerus gossypii Towns. and Ckll., 1903.


"? On leaves and bark; entirely covered by white cottony sacs about 4 mm long, not at all waxy in appearance. They look like an Eriococcus, except that the sacs are more cylindrical with broadly rounded, instead of tapering ends. Boiled in KOH does not stain the liquid; eyes large and prominent; skin transparent, colourless, with many small round glands (4–5 μ diam.) and rather numerous bristles, some fully 105μ long.

Lateral bristle patches small. Labium ordinary. Legs and antennae very pale brownish; legs quite bristly. Claw with the usual denticle on the inner side.

Femur + trochanter 360μ long, tibia 276μ, tarsus 95μ.

Antennae 9-jointed, the joints measuring in μ:- (1) 60, (2) 90, (3) 81-84, (4) 45-51, (5) 57-63, (6) 45-48, (7) 33, (8) 35, (9) 66.

Larva (after boiling) bright magenta, elongate, long .405 mm, lat. .180 mm. Legs, including femur, slender. The six bristles of the anal ring thick and yellowish brown, about 24μ long.

Hab. Zapotlan, Jalisco, Mexico, on wild guava, July 6, 1903."
Chart for: — *Phenacoccus gossypii* Towns. and Ckll., 1903.

Size:— (a) Fresh material:— About 4 mm long.

(b) Mounted:

Antennal curve:

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Legs:—

Measurements in μ =

- Femur + trochanter 360μ; tibia 276μ;
- tarsus 95μ.

Setae of Anal lobes:—

Setae of Anal ring:—

Host plant:— On wild guava.

Locality:— Zapotlan, Mexico.
Phenacoccus obtusus (Newstead), 1911.


♀ adult. Length 4, width 2.75 mm.

Segmentation strongly pronounced. Antennae (Pl. I, fig. 4.) of nine segments; proximal end of last segment narrower than distal end of the penultimate; all the segments with long fine hairs; 7th and 8th each with a strong curved spine near the articulations; 9th with two similar spines near the apex, the rest of the apical hairs considerably shorter than those on the remaining segments. Marginal spines truncated forming large conspicuous groups on the thoracic and abdominal segments, but coalescing in front from the insertion of the anterior pair of spiracles.

Anal orifice with the normal number of hairs; surrounding this organ is a conspicuous fold in the integument presenting a ringlike boundary within which are 10 similar long hairs. Legs normal, hairs extremely fine and very long.

Embryo larva: Hairs to anal lobes about two thirds the length of the body; legs and antennae furnished with very long hairs.

Hab. On Baobabrinde. German East Africa."

This species is remarkable for the truncate spines, the terminal joint of the antennae, and the anal fold.
Parasites of the Pseudococcini.
Parasites of the Pseudococcini.

The Coccidae, as a whole, are known to be preyed upon by a large number of insect enemies. A distinction must be made between the kinds which move about freely and devour the scale insects, or suck their juices, and those whose growth and development take place inside the Coccid body at the expense of the tissues or body fluids. The first class might be called "predators", and the second parasites.

The predaceous enemies have received more attention than the internal parasites, and some have been shown to be of considerable economic importance. Vedalia, (Novius cardinalis), is a good example of a Coccinellid which proved of immense importance in the control of Australian bug, Icerya purchasi. So great was the success with this insect in California, that it was later introduced into South Africa, where the results were equally satisfactory.

No other country in the world has taken such interest in the rearing and spread of beneficial insects as California has done, and the lead which this State obtained is being well maintained.

For the introduction, breeding and dissemination of beneficial predaceous and parasitic insects a special department has been created in the office of the State
Commissioner of Horticulture, known as the insectary division. The officers of this division are provided for by law, the chief of which is known as the Superintendent of the State Insectary.

The State Insectary was constructed especially for the rearing and breeding of beneficial insects, and is located in the Capitol Park at Sacramento. It is supported by appropriations of the State Legislature, and is, therefore, a free institution to all the citizens of the State.

The operations of the insectary are briefly as follows:—

Expert entomologists are maintained in the fields in California and in other states and countries, who collect the natural enemies of the destructive insects. These are sent to the insectary, where they are supplied with the proper host-insects, and are reared in large numbers, when they are distributed to sections of the country where the destructive pests, upon which they prey, are plentiful.

The work, to the present time, has been chiefly concerned with the check or control of such forms as Australian bug, San Jose Scale, the Soft and Black Scale of citrus trees etc.

Predaceous insects, chiefly Coccinellids, have received the greatest attention, possibly because of the ease with which they can be collected and bred.
Very little attention has been paid, so far, to the enemies of the Pseudococcini. While there are numerous references to parasites having been observed, these were, in the majority of cases, not determined, and no further attention given to them.

A study of these references, however, convinces me that this branch of the subject should receive attention, and my experience shows that predaceous and parasitic insects may, and do, at times, operate to control mealy bugs.

Newstead, Ent. Mon. Mag. XXXIV, p. 99, 1898, records a case in which he received specimens of the common long tailed mealy bug, *P. adonidum* Westw. from Zomba, when he found that quite 90 p.c. of the females were parasitised.

Unfortunately the parasite was not determined.

As mentioned previously, the best known species in the Pseudococcini is the common mealy bug, *P. citri* Risso, which has a very wide range of food plants, and a very wide distribution. Naturally this species has received the greatest amount of attention, so I thought it would be interesting to make a careful study of the literature, and make a list of the predaceous and parasitic insects which have been found in connection with this mealy bug.

The following is the list obtained:-
Predaceous and parasitic enemies of *P. citri* Risso.

a. Predaceous insects:

Lady-bird beetles (*Coccinellidae*).

*Cryptolaemus montrouzieri*, introduced into California by Mr. A. Koebele; also preys upon *P. adonidum* and *P. nipae*.

*Rhizobius ventralis*, which was introduced into California to combat the black scale of citrus trees, *Saissetia oleae*.

*Lindorus lophantheae*, (introduced into California).

*Scymnus guttulatus*, native of California; also preys upon *P. adonidum*.

*Scymnus sordidus*, native of California.

*Scymnus marginicollis*, native of California.

*Cryptogonus orbiculatus*, a native of the Philippine Is., introduced into California in 1910, also preys upon *P. adonidum*.

*Hyperaspis lateralis*, (California.)

*Exochomus nigromaculatus* and at least two other small species, which are native of South Africa. An attempt was made to introduce these into the U.S.A. in 1901. (See Can. Ent. for June, 1901, p. 183.)
Green lacewing.

*Chrysopa californica* Coq., in California.

Brown lacewing.

*Symphorobius angustus* Banks, in California.

b. Parasitic insects:

1. Hymenopterous insects:

*Chrysoplatycerus splendens* Howard, in California.

*Cheiloneurus dactylopii* Howard.

*Coccophagus flavoscutellum* Ashmead.

*Zarhpaalus inquisitor* Howard.

*Leptomastrix dactylopii* Howard.

2. Dipterous parasite:

*Leucopis bella* Loew. (*Fam. Acroryzidae.*)

It will be observed that no less than 18 different species are included in this list, and when it is considered that very little attention has been paid to the subject, except in California, it will be realised that this number represents, probably, only a part of a much larger number.

No other species of mealy bug has been given so much attention as the one mentioned above, but the long-tailed species, *P. adonidum* Westw. is the one which is almost equally wide spread, and well known. As one would expect, the enemies of this insect are better known than are those of any insect except *P. citri* R.
In fact it is probably for only 1 or 2 p.c. of the other species that enemies have been recorded or even men­tioned.

The following list gives the names of the predaceous or parasitic insects which have been found in relation with the Pseudococcini, as far as I have been able to ascertain. Those which have been recorded only for P. citri are not included.

Enemies of the Pseudococcini. (except P. citri.)

Predaceous insects:

Larva of Eublerra (Lepidoptera) sp. indet. preys upon D. nipae Mask. in India.

Geocoris tricolor (Lygaeidae), preys upon D. nipae Mask. in India.

Larva of fly grub sp. indet. also feeds on the eggs of D. nipae in India.

A Hemerobiid sp. indet. preys upon the larvae and adults of this species in India. (See H. Lefroy, Mem. Dept. Agr. of India, II, 7, p. 124, 1908.)

The larva of a Syrphid fly, Bacca stenogaster Williston, preys upon Phenacoccus gossypii and Ph. gossypii var. psidiarum Ckll, in Mexico. (See Cockerell, 1903.)

Coccinellidae.

Chilocorus bivulnerus Mulsant, the common "two stabbed lady beetle" of California, preys upon P. adonidum Westw.
and many other Coccids.

*Cryptogonus ornatus* Schen., a native insect of the Philippine Islands, preys upon *P. adonidum* Westw.

*Cryptolaemus montouzieri* Mulsant might be called the "Mealy bug destroyer". It preys upon a number of species, including *P. citri* Risso, *P. adonidum* Westw. and *D. nipae* Mask.

*Scymnus guttulatus* Lec. preys upon *P. adonidum* Westw.

*Scymnus nebulosus* Lec. feeds on a number of species.

*Scymnus nobilis* Mulsant, and

*Scymnus xerampelinus* Muls. both prey upon *D. nipae* Mask.

in India,

*Rhizobius ventralis* Mr. The larvae of this species are particularly beneficial, as their chief food consists of young mealy bugs of various species.

**Parasitic insects: Chalcids etc.**

*Aphycus townsendi* Howard has been bred from a species of *Phenacoccus* on cotton.(Ashmead, 1900, p.388.)

*Cheiloneurus dactylopilii* Howard,

*Signiphora dactylopilii* Ashmead, and

*Blepyrus phenacocci* Ashmead, three distinct species of Chalcids, were reared by Mr. W.H. Ashmead, from material of *Phenacoccus cevalliae* Ckll, collected at Roswell, New Mexico in October 1902. A hyperparasite, *Tetristichus*
blepyri Ashmead, was further reared from one of these parasites, (Blepyrus phenacocci Ashm.) Can. Ent. XXXIV, 2, p. 301, 1902.

Two Chalcids, one belonging to the genus Cerchysius, and the other to an apparently new genus, have been reared from Ripersia sp. (Newstead, Mon. Br. Coccidae, I, p. 32.)

Cooophagus orientalis Howard and Euomys (Enyrtus) albicocca Ashmead have been reared from P. adonidum Westw., the former from Ceylon, and the latter from North America.

Aphycus dactylopii Howard, has been bred from material of D. filamentosus Cxll, collected at Hong Kong.

Signiphora dactylopii Ashmead, was reared from specimens of P. ephedrae Coq., collected in California.

Blepyrus texanus Howard, and Aphycus texanus Howard, were reared from P. virgatus from Texas.

Perissocopterus mexicanus Howard, and Blastothrix yuccae Coquillet were bred from Ceroputo yuccae Coq., collected in Mexico and California respectively.

Cooophagus lecanii Smith, and Rhopus (Acerophagus) cocooides E.A. Smith, were obtained from Phenacoccus aceris Signoret.
From mealy bugs, probably *Pseudococcus* spp., but spp. indet. the following have been reared:—

*Coccophroctonus dactylopii* Ashmead, from Australia.
*Aphycus angelicus* Howard, from North America.
*Aphycus australiensis* Howard, from Australia.
*Tetracnemoidea australiensis* Howard, from Australia.
*Aphycus nigritus* Howard, from California.
*Chrysoplatysterus splendens* Howard, from California.

An interesting, and important characteristic of some of these insects is that they will attack more than one kind of Coccid, and this makes them especially valuable from an economic point of view. For instance, the larvae and adults of the Coccinellid, *Chilocorus bivulnerus* Muls., are voracious feeders upon the San Jose Scale, (*Aspidiotus perniciosus*), young of the black scale, (*Saissetia oleae*), mealy bugs, (*P. citri* and *adonidum*), oyster shell scale, (*Lepidosaphes ulmi*), European elm scale, (*Gossyparia spuria*), and other scale insects.

The small hymenopterous parasite, *Aphelinus mytilaspisdis* Le Baron, (Fam.*Eulophidae*), preys upon a number of scale insects, among which are the oyster shell scale, (*Lepidosaphes ulmi*), pine scale, (*Chionaspis pinifolii*), San Jose Scale (*A. perniciosus*), and *Diaspis carueli*.

The fact that so little is known concerning the predatory and parasitic insects is probably due to the
obscure manner in which they work; to the small size of most of them; and to the great resemblance between the larval forms of the Coccinellidae and many of the insects upon which they prey.

Whilst working with the Division of Entomology in Cape Colony we often received letters from farmers and fruit growers, asking that a colony of Vedalia lady-bird beetle might be sent at once, as the Australian bug, *Leerya printasi*, was becoming alarmingly numerous. This course was only adopted, however, after we had been assured that the Coccinellid was not already there, and the usual procedure was to ask that twigs bearing the pest should be sent to the office.

In many cases the result was that we obtained splendid colonies of Vedalia, which could be sent elsewhere. On several occasions I have been invited to a farm to see what splendid results had been obtained by using some particular brand of tobacco extract against mealy bugs in vines etc., to find on examination that some hundreds of Coccinellid larvae and pupae, usually *Exochomus nigromaculatus*, had been killed. These beneficial insects had already brought the mealy bugs down in number, and the waxy larvae had been mistaken for the pest they were devouring.

If good results are to be expected from predaceous and
parasitic insects they must be given an opportunity to breed, and artificial remedied must be resorted to with caution, and the time to apply such must be carefully chosen.
Intracellular Symbionts in the Pseudococcomi.
Intraoellular Symbionts of the Pseudococcini.

When we consider that it is only within the last four years that serious attention has been paid to the subject of the intracellular symbionts in the Insecta, and that this study really had its origin in the investigation of the so-called "pseudo-vitellus" in Aphides, it is not surprising that little is known relating to the symbionts of the Pseudococcini.

When it was ascertained that this "pseudo-vitellus" was of a distinctly different nature from what the earlier workers suspected, and that it was found to present an entirely new field for investigation, it was natural that other bodies which had been referred to in insect anatomy, but whose function was not clear, should be regarded in a new light.

In "Revista di Patologia Vegetale", 1893, Dr. Berlese gives an excellent account of the two common species of mealy bugs, P. citri Risso, and P. adonidum Westwood. He refers, p. 74, to a body which he names the "corpo ovale", a broadly rounded mass richly supplied with tracheae. It was upon this that Dr. Pierantoni worked in 1910. In the same year Dr. K. Sulc investigated the similar body in Phenacoccus farinosus, and the work of these two constitutes the foundation of our knowledge of the intracellular symbionts in this group.
The account given by Dr. Berlese is as follows:-
"Tutto il tubo digerente riposa (nelle fermine di qualunque stato) su un ammasso di forma ovale, di cellule rotonde di 35-36\(\mu\) di diametro, con nucleo di 11-12 \(\mu\) di diametro, ed uno o più nucleoli che però si dilatano il più delle volte notevolmente, per infiltrazione di grasso, in gocciole.
Tutti questi elementi sono racchiusi nella guaina unica, abbastanza disgregati fra loro, e imersi in detriti granulosì gialli, che col carmín si colorano intensamente, negli interstizii delle cellule.
Questo corpo ovale è collocato in contatto della epidermide del ventre, e non sembra contornato da membrana alcuna. Quale sia il suo ufficio, e cosa rappresenti, mi è ignoto. Certo è che esiste sempre, molto più grosso nel \textit{D. citri}, dove occupa gran parte del ventre, più ridotto nel \textit{D. longispinus}. Numerose trachee, provenienti dal ramo longitudinale ventrale, che parte dall'ultimo stigma, vi penetrano, e colle tinture carminiche si colora abbondantemente, più di tutti gli altri tessuti, eccetto i glandulari. Non ho osservato che quest'organo sia in rapporto con alcuna apertura, oppure col l'intestino.
Questo vi si appoggia per quasi tutto il suo decorso, ma non sembra avere altre relazioni. Quando il corpo
nella adulto e pieno d'uova, queste si infossano entro le cellule del detto corpo ovale, che in questo caso occupano i vani esistenti fra le uova stesse. È molto probabile che sia un ammasso di sostanza nutritiva, derivata dall'intestino, oppure abbia rapporti, di difficile rilievo, colla secrezione della cera. E certo, che non ne hanno temuto parola gli autori, che mi hanno preceduto in queste ricerche."

This "corpo ovale" has been studied by Dr. Pierantoni, who found it to be what Dr. Buchner terms a mycetom, in which are large numbers of elongate, sickle-shaped organisms.

The symbiont was named Coccidomyces dactylopilii Buchner in 1911. It was fully described, and figured, by Dr. Pierantoni in the Archiv fur Protistenkunde, 1913.

An organism living in a similar mycetom in Phenacoccus farinosus was described in "Sitz.d.kon.bohm.Ges.d.Wiss." for 1910, by Dr. Sulc. This was named Saccharomyces pseudococci farinosi Sulc.

It might be mentioned that Dr. Buchner named an organism which was found in the mycetom of Icerya purchasi Mask. as Coccidomyces pierantonii in 1911, but this is not similar to the one found in P. citri Risso, while the one from Ph. farinosus is quite similar, except that the nucleus was distinct in the latter symbiont.
Coccidomyces rosee Buchner, 1911, is an organism which lives in the body cavity of Lecanium corni Bouché. It does not occupy a definite mycetom, and is obviously different from those which have been found in the Pseu-
dococccini.

It appears that C. rosee is the first species described in the genus Coccidomyces so that a new genus should be made for the forms found in the Pseudococcini.

Dr. Šulc named the symbiont of Phenacoccus farinosus as Saccharomyces pseudococconi farinosi in 1910, but the facts that (a) the production of endospores is never indicated, and (b) the infection of the egg takes place by sferettes containing ten or more organisms, and not by single individuals, show that the organism is not a Saccharomyces.

The life history of a symbiont, which seems to be typical for the Pseudococcini, may be illustrated by the form found in Pseudococcus citri. Plate III refers to this species.

The mycetom is a large, roundly oval mass of tissue occupying a ventral position in usually the first five abdominal segments. When dissected out in fresh material it is generally of a greenish yellow colour, and is seen to be richly supplied with tracheae. Examined under a high power it is seen to be composed of large numbers of large rounded cells.
Figure 2, of Plate III, shows a transverse section of an adult of *P. citri*, from about the third abdominal segment. It will be seen that the mycetom is a comparatively large body, in fact it is much larger in *P. citri* than in any of the other species I have examined.

Figure 3 shows a portion of the mycetom further enlarged. The large cells, or sferules, contain a number of smaller rounded sferettes, which in turn contain a number of elongate bodies as shown in Figure 4. These sickle-shaped bodies stain readily with water eosin.

The most remarkable fact concerning this type of symbiont seems to be that the sferettes, and not the individual organisms, act as the units. It is the sferettes which infect the developing ova. (Figs. 5 and 6.)

I have made observations on the intracellular symbionts of the following species:

- *Pseudococcus citri* Risso.
- *Pseudococcus signiculatus* Testw.
- *Pseudococcus capensis* Brain.
- *Pseudococcus mesembranthemi* n.s.r.

These studies are not yet completed, but I hope to have them ready to include in a paper dealing with the symbionts of the Coccidae to be published shortly.
Literature dealing with the Symbionts of the Pseudococcini.


Catalogue of Species of the Pseudococcini.
Catalogue of Species of the Pseudococcini, giving
Host-plants and Localities.

Genus Ripersia Signoret, 1875.

*Ripersia agassizensis* Kuwana, 1909.
On Miscanthus sp. 
Japan.

*Ripersia anomala* Newstead, 1908.
Under bark, accompanied
by *Pheidole megacephala*.
Kilimandjaro.

*Ripersia arizonensis* Ehrhorn, 1899.
In nest of ants.
Arizona.

*Ripersia auranti* Cockerell, 1901.
In nest of Lasius *americanus*.
New Mexico.

*Ripersia blanchardi* King and Ckill., 1897.
In nest of Lasius *claviger*.
Massachusetts.

*Ripersia confusella* Cockerell, 1901.
With ants, sp. indet., and
In nest of *L. americanus*.
New Mexico.

*Ripersia corynophori* Signoret, 1875.
On Corynephorus *canescens*.
France.

*Ripersia donisthorpei* Newstead, 1907.
In nest of *Ponera contracta*.
England.

*Ripersia eur* Europe.
Europe.

*Ripersia fagi* Maskell, 1890.
On *Fagus menziesii*.
New Zealand.

*Ripersia festucae* Kuwana, 1901.
On Festuca *sibirica*.
California.

*Ripersia filicicola* Newstead, 1898.
On *Trichorhina spicatum*.
England.

*Ripersia fimbriatula* Ckill., and King, 1901.
In nest of *L. americanus*.
New Mexico.
Pipersia flaveola Cockerell, 1896.  
In nests of L. bulverzer, and of L. interjectus.  
Massachusetts, New Mexico.

Pipersia formicicola Masekell, 1891.  
In ants' nests.  
New Zealand.

Pipersia formicarum Newstead, 1907.  
In nests of Lasius flavus.  
England.

Pipersia glandulifera Newstead, 1912.  
On Adiantum sp.  
S.W. Africa.

Pipersia halophila (Hardy), 1860.  
On Ligusticum scoticum, Radiola linoides, Statice armoria, and Grass.  
Armeria maritima, Erica cinerea.  

Pipersia hypogea Leonard, 1908.  
On L. (underground).  
Italy.

Pipersia inquinellina Leonard, 1908.  
In nest of ants, sp. indet.  
Sardinia.

Pipersia japonica Kuwana, 1907.  
On Miscanthus sp.  
Japan.

Pipersia kingii Cockerell, 1896.  
In ants' nests.  
Massachusetts.

Pipersia lasii Cockerell, 1896.  
On roots of Asters, in the nest of ants, sp. indet.  
Canada, and Mass.

Pipersia leptospermi Masekell, 1888.  
On Leptospermum laevigatum.  
S. Australia.

Pipersia magna T. and W. Cockerell, 1901.  
?  
New Mexico.

Pipersia minima Tinsley and King, 1899.  
In nest of L. americanus.  
Massachusetts.

Pipersia montana Newstead, 1898.  
On roots of grass, and of a composite, In nest of ants.  
France. Italy.
*Pipersia myrmecophila* Maskell, 1897.
Michigan.

*Pipersia oryzae* Kuwana, 1907.
On roots of rice etc.
Japan.

*Pipersia porterae* Cockerell, 1901.
On roots of grass.
New Mexico.

*Pipersia pupifera* (Lichtenstein), 1879.
On Elm.
France.

*Pipersia sacchari* Green, 1900.
On sugarcane.
India.

*Pipersia salmonacea* Cockerell, 1901.
On roots of grass.
New Mexico.

*Pipersia sardiniae* Leonardi, 1908.
In nests of ants.
Sardinia.

*Pipersia serrata* Tinsley, 1900.
Trinidad.

*Pipersia smithii* Essig, 1910.
On *Festuca condensata*.
California.

*Pipersia sporoboli* Cockerell, 1902.
On *Sporobolus deporperatus*.
New Mexico.

*Pipersia subterranea* Newstead, 1893.
On roots of *Nardus stricta*.
In nests of *F. flava*.
England.

*Pipersia tenuipes* Cockerell, 1901.
On roots of grass.
New Mexico.

*Pipersia trichura* Cockerell, 1901.
On roots of grass.
New Mexico.

*Pipersia trivittata* Cockerell, 1901.
In nest of *L. americanus*.
New Mexico.

*Pipersia tumida* Newstead, 1897.
In nest of *Camponotus* sp.
Algeria.

*Pipersia villosa* Ehrhorn, 1899.
On Quercus *agrifolia*.
California.

*Pipersia viridula* Cockerell, 1901.
In nest of *L. americanus*.
New Mexico.
Ripersia wasmanni Newstead, 1900.
In nest of *L. alienus*. France.

Genus *Ripersiella* Tinsley, 1899.

*Ripersiella kelloggi* Ehrh., and Ckll., 1901.
On roots of bunch-grass. California.

*Ripersiella leucosoma* Cockerell, 1901.
In nest of *L. americanus*. New Mexico.

*Ripersiella maritima* (Cockerell), 1894.
On roots of *Spartina*. Long Is. N.Y.

*Ripersiella rumicis* (Maskell), 1891.

Genus *Pseudoripersia* Ckll., 1899.

*Pseudoripersia turripes* (Maskell), 1892.
On *Casuarina suberosa*. Australia.

Genus *Dactopseudococcus* n.g.

*Dactopseudococcus acaciae* (Maskell), 1891.
On *Acacia linearis*, and
*Acacia lophantha*. Australia.

*Dactopseudococcus agrifolii* (Essig), 1909.
On *Quercus agrifolia*. California.

*Dactopseudococcus albizziae* (Maskell), 1891.
On *Albizzia lophantha*. Australia.

*Dactopseudococcus aphyllonis* (Ckll.), 1895b.
Dactopseudococcus arecae (Maskell), 1889.
On roots of Areca sapida. New Zealand.

Dactopseudococcus artemisiae (Essig), 1909.
On Artemisia californica. California.

Dactopseudococcus aurilananatus (Mask.), 1889.
On Araucaria excelsa, New Zealand.
Araucaria bidwillii, California, South Africa.
Dammara ovata, and
D. vitiensis California.

Dactopseudococcus australiensis (On. and Lidg.) 1900.
On Acacia dealbata. Australia.

Dactopseudococcus boninensis (Kuwana), 1909.
On sugarcane. Japan.

Dactopseudococcus bromeliae (Bouche), 1833.
On pineapple, Canna, Zanzibar,
Mulberry and Hibiscus, India, S. Af, and Mass.

Dactopseudococcus californicus (Ehrhorn), 1911.
On Festuca sp. California.

Dactopseudococcus claviger (King and Tins.), 1897.
In nests of L. claviger, and
of L. americanus. Massachusetts.

Dactopseudococcus edgeworthiae (Chl.), 1897.
On Edgeworthia papyrifera. Japan.

Dactopseudococcus ericicola (Mask.), 1892.
On Erica autumnalis. Australia.

Dactopseudococcus eriogoni (Ehrhorn), 1899.
On roots of Eriogonum sp. California.

Dactopseudococcus filamentosus (Chl.), 1893.
On a plant resembling Vaccinium.
On Albizzia lebbek,
Gossypium sp.,
Zizyphus spina-christa,
and Acacia arabica. Egypt.

On Albizzia lebbek,
Gossypium sp.,
Zizyphus spina-christa,
and Acacia arabica. Egypt.
Dactylopseudococcus formicarii (Ehrhorn), 1899.
On the roots of Artemisia sp. in ants' nests. Arizona.

Dactylopseudococcus globosus (Maskell), 1891.
On Acacia armata, and Acacia decurrens. Australia.

Dactylopseudococcus graminis (Maskell), 1891.

Dactylopseudococcus grevilleae (Fuller), 1899.
On Grevillea bipinnatifida. Australia.

Dactylopseudococcus herbiola (Maskell), 1891.
On Aristida vagans. Australia.

Dactylopseudococcus hibbertiae (Maskell), 1891.
On Hibbertia linearis and Hibbertia virgata. Australia.

Dactylopseudococcus hymenooleae (Cookell), 1899.

Dactylopseudococcus indecisus (Cookell), 1901.
In nests of L. americanus. New Mexico.

Dactylopseudococcus libera (Leonardi), 1908.
On Grass. Italy.

Dactylopseudococcus ledi (Cookell), 1911.
On Ledum groenlandicum. New York State.

Dactylopseudococcus lichtensoides (Cookell), 1897.

Dactylopseudococcus missionum (Cookell), 1897.
On roots of grass. Argentina.

Dactylopseudococcus nanus (Cookell), 1905.
On roots of grass. Colorado.

Dactylopseudococcus nipae (Maskell), 1892.
On Nipa fruticans and Palms. Demerara.

On Guava.

Mexico, Mass., California, Europe, S. Africa, and India. California.
Dactopseudococcus orientalis (Haskell), 1897.
On grass. China.

Dactopseudococcus pseudonipae (Ckll.), 1897.b.
On Kentia and Cocos Palms. New Mexico, and California.

Dactopseudococcus quaintanci (Tinsley), 1898.
On Ficus copallina. Florida.

Dactopseudococcus sacchari (Ckll.), 1895.c.
On sugarcane. Trinidad and Porto Rico.

Dactopseudococcus theaecola (Green), 1897.
On roots of tea plants. India.

Dactopseudococcus townsendi (Ckll.), 1883.b.
On leaves of Fouquieria. New Mexico.

Dactopseudococcus trifolii (Forbes), 1885.
On clover. U.S.A.

Dactopseudococcus tumida (Newstead), 1897.
In nests of Camponotus etlii. Algeria.

Dactopseudococcus violascens (Ckll.), 1913.
On Agropyron sp. Colorado.

Dactopseudococcus viridis (Newstead), 1894.
On Hygrophylia spinosa. India.

Dactopseudococcus wheeleri (King), 1902.
In nests of Camponotus maculatus var. sansabeanus Buckton. Texas.

Dactopseudococcus zapotianus (Ckll.), 1902.b.
On "Hulele de Noche". Mexico.

Genus Pseudococcus Westwood, 1839.
Pseudococcus *adonidum* Westwood, 1839.
- On ferns; mango; guava;
- fig; plum;
- Croton sp;
- Cycas revoluta;
- Flacourtia sepialia;
- Nephrodium amplum;
- Strangeria schizodont.


Pseudococcus *affinis* (Maskell), 1883.
- On tubers of dahlia and potato. Australia.

Pseudococcus *alkalinus* Ckll., 1902.c.
- On grass.

New Mexico.

Pseudococcus *alpinus* (Maskell), 1883.
- On Veronica sp.

New Zealand.

Pseudococcus *americanus* (Ckll.), 1899.b.
- On Ash.

Washington, D.C.

Pseudococcus *ananassae* (Kuwana), 1909.
- On Pineapple.

Japan.

Pseudococcus *andersoni* (Coleman), 1903.
- On Cupressa goveniana, and Libocedrus decurrens.

California.

Pseudococcus *aridorum* Lindinger, 1911.
- On Argyranthemum frutescens,
- Cystisus prolifer var. palmensis, Grass, and Trifolium panormitanum.

Canary Islands.

Pseudococcus *armatum* (Hempel), 1901.
- ?.

South America.

Pseudococcus *atriplexis* (Ckll.), 1895.d.
- On Atriplex canescens.

New Mexico.

Pseudococcus *azaleae* (Tinsley), 1898.
- On Azalea sp.

California.

Pseudococcus *bakeri* Essig, 1910.
- On Sambucus glauca, Apple, Pear, and Juglans regia.

California.
Pseudococcus brevipes (Cockerell), 1893.

Pseudococcus burneri n. sp.
On Viburnum sp. Transvaal.

Pseudococcus calceolariae (Maskell), 1878.
On Calceolaria sp., Traversia sp., and Cassinia sp. New Zealand.

Pseudococcus californicus Ehrhorn, 1911.
On Festuca sp. California.

Pseudococcus calluneti Lindinger, 1913.
On Calluna vulgaris. Germany.

Pseudococcus capensis Brain, 1912.

Pseudococcus citri (Risso), 1813.

Pseudococcus coccineus (Newstead), 1908.
On Acacia sp. Africa.

Pseudococcus cocotis (Maskell), 1889.
On Cocos nucifera. Fiji.

Pseudococcus cockerelli King and Tins., 1858.
In nests of E. flavus. Massachusetts.
Pseudococcus coffeae (Newstead), 1908.b.  
On Liberian coffee plants. Java.

Pseudococcus comstocki (Kuwana), 1902.  
On mulberry and maple. Japan.

Pseudococcus orawi (Coquillet), 1889.  
On Audibertia polystachya. California.

Pseudococcus orotinis Green, 1905.  
On Castillea elastica, Codiaeum variegatum, Terminalia catappa, and Erythrina lithosperma etc. India.

Pseudococcus qualatensis Cookerell, 1903.b.  
In galls formed by Akermes coliae Ckll. Mexico.

Pseudococcus cyperi (Signoret), 1875.  
On cypress. Europe.

Pseudococcus dasyliri (Cookerell), 1896.b.  
On Dasylirion wheeleri. New Mexico.

Pseudococcus dearnessi (King), 1901.  
On hawthorn. Canada.

Pseudococcus dudleyi (Coleman), 1903.  
On Cupressus macnabiana. California.

Pseudococcus ephedrae (Coquillet), 1890.  
On Ephedra californica. California, and Mexico.

Pseudococcus farnesianae (Targioni), 1888.  
On Acacia farnesiana, and Olea europaea. Italy and North Africa.

Pseudococcus fragilis Brain, 1912.  
On orange trees. Cape Colony.

Pseudococcus formicetica (Newstead), 1900.  
In nests of Crematogaster sp. China.

Pseudococcus glaucus (Maskell), 1878.  
On Rubus australis and Pittosporum engenoides. New Zealand.

Pseudococcus grandis (Hempel), 1900.  
On one of the Myrtaceae. Argentine Rep.
Pseudococcus *gutierreziae* (Cockerell), 1896.b.
   On *Gutierrezia sarothrae*. New Mexico.

Pseudococcus *hibernicus* (Newstead), 1895.
   On Grass. Ireland.

Pseudococcus *hirsutus* (Newstead), 1897.
   In nests of *Cremastogaster* sp. India.

Pseudococcus *iceryoides* (Maskell), 1891.
   On *Fagus* *fusca*. New Zealand and India.

Pseudococcus *irishii* (Cockerell), 1900.

Pseudococcus *juniperi Ehrhorn*, 1906.
   On *Juniperus virginiana*. Arizona.

Pseudococcus *kraunhiae* (Kuwana), 1902.
   On *Kraunhia floribunda*. Japan.

Pseudococcus *lilacinus* Cockerell, 1905.
   On orange. Philippine Is.

Pseudococcus *lobulatus* (Maskell), 1893.
   On *Eucalyptus* *globosa*. Australia.

Pseudococcus *longipes* Leonardi, 1909.
   On *Alocasia macrorica*. Italy.

Pseudococcus *lounsburyi* Brain, 1912.

Pseudococcus *luffii* (Newstead), 1901.

Pseudococcus *macrozamiae* (Fuller), 1897.
   On *Macrozamia frazeri*. Australia.

Pseudococcus *magnolicida* (King), 1902.
   On *Mango*? Brazil.

Pseudococcus *mamillariae* (Bouche), 1844.
   On *Mamillaria* sp. Europe.

Pseudococcus *marchali Vayssière*, 1912.

Pseudococcus *maritimus* (Ehrhorn), 1900.
   On *Eriogonum latifolium*. California.
Pseudococcus mendozinicus Leonardi, 1911.
On Hyalis argentea.

Pseudococcus mesembrianthemi n. sp.
On Mesembrianthemum edule L.

Pseudococcus minor (Maskell), 1896.
On roots of grass.

Pseudococcus muraldliae Brain, 1912.
On Muraltia heisteria n.c.

Pseudococcus myrmecarius Leonardi, 1909.
In nests of Camponotus sp.

Pseudococcus neomexicanus (Tinsley), 1898.
On roots of Gutierrezia sarothrae.

Pseudococcus obscurus Essig, 1909.
On Sambucus glauca.

Pseudococcus obtectus (Maskell), 1899.
On Fagus fusa.

Pseudococcus olivaceus (Cockerell), 1895.
On Yucca.

Pseudococcus osborni (Sanders), 1902.
On Platanus occidentalis.

Pseudococcus pandani (Cockerell), 1895.
On Pandanus sp.

Pseudococcus percerosus Leonardi, 1911.
On Sourliea decorticans.

Pseudococcus perissi (Signoret), 1875.
On Calamagrostis sp. and Sphagnum sp.

Pseudococcus pini (Kuwana), 1902.
On Pinus sp. and Pinus pentaphylla.

Pseudococcus poae (Maskell), 1878.
On Grass.

Pseudococcus prosopidis (Cockerell), 1896.
On Prosopis sp.
Pseudococcus pulverarius (Newstead), 1903.
  On *Agrostis vulgaris* and *Agrostis intermedium*.
  Europe.

Pseudococcus querous (Ekman), 1900.
  On *Quercus chrysolepis*.
  California.

Pseudococcus roseotinctus (T. and W. Ckll.), 1901.
  On roots of grass.
  New Mexico.

Pseudococcus ryani (Coquillet), 1889.
  On *Cupressa macrocarpa*, *Thuja orientalis*, and *Araucaria excelsa*.
  California.

Pseudococcus saccharifolii (Green), 1908.
  On Sugarculoane.
  India.

Pseudococcus salinus (Cookerell), 1902.
  On Grass.
  California.

Pseudococcus scrobicularum Green, 1896.
  On *Eucarpacea sp.*
  India.

Pseudococcus secretus (Hempel), 1900.
  On one of the *Solanaceae*.
  Brazil.

Pseudococcus segrezatus (Cookerell), 1883.
  On Grass.
  Jamaica.

Pseudococcus sequoiae (Coleman), 1901.
  On Redwood.
  California.

Pseudococcus setosus (Hempel), 1900.
  On *Ficus sp.*
  Brazil.

Pseudococcus similans (Lidgell), 1898.
  On roots of *Daphne*.
  Australia.

Pseudococcus simplex (Cookerell), 1883.
  On *Panoratiun caribaum*.
  Jamaica.

Pseudococcus solani (Cookerell), 1894.
  On *Solanun tuberosum*.
  New Mexico.

Pseudococcus sorghiellus (Forbes), 1885.
  On *?*. in nests of *Lasius americanus* and *L. olaviger*.
  Massachusetts.

Pseudococcus steeri (Ckll. and Towns.), 1894.
  On *Lamae mexicana*.
  New Mexico.
Pseudococcus subterraneus (Hempel), 1901.
On grape vines. Argentine Pep.

Pseudococcus syringae (Maslennik), 1897.

Pseudococcus tayabanus Cockerell, 1905.
On cultivated cacao. Philippine Is.

Pseudococcus texensis (Tinsley), 1900.
On Acacia farnesiana. Texas.

Pseudococcus theobromae (Douglas), 1889.

Pseudococcus virgatus (Cockerell), 1895.
On Prosopis juliflora, Tribulus asystoides, Acalypha sp.,
Cocoonut palm, Cotton, and violets.
Jamaica, Philippine Is., Ceylon, Mexico, Mauritius, and Texas.

Pseudococcus yovae Nassonow, 1909.
On Juniperus communis. Russia.

Pseudococcus wachendorfiae Brain, 1912.
On Wachendorfia paniculata Linn. Cape Colony.

Pseudococcus walkeri (Newstead), 1901.

Pseudococcus wilmattae (Cockerell), 1901.
On "Viola aff. pedatifida". New Mexico.

Genus Tylocoococcus Newstead, 1897.

Tylocoococcus madagascariensis Newst., 1897.
In nests of Cremastogaster schenki, For. Madagascar.

Tylocoococcus cycliger (Leonardi), 1908.
In nest of ants. Italy.
Tyloococcus *insolitus* (Green), 1902.
On *Sida cordifolia*. India.

**Genus Phenacoccus**, Cockerell, 1893.

*Phenacoccus acericola* (King), 1902.
On maple, hornbeam, lime, and horse chestnut. U.S.A.

*Phenacoccus aceris* (Signoret), 1875.
On maple. Europe.

*Phenacoccus americanae* King and Ckll, 1897.
In nests of *L. americanus*. Massachusetts.

*Phenacoccus artenisiae* Ehrhorn, 1900.
On *Artemisia californica*. California.

*Phenacoccus asteliae* (Maskell), 1893.

*Phenacoccus brunnitarsis* (Signoret), 1875.
On Borage. Europe.

*Phenacoccus casuarinae* (Maskell), 1892.
On *Casuarina sp*. Australia.

*Phenacoccus cevalliae* Cockerell, 1902.
On *Cevallia simuata*. New Mexico.

*Phenacoccus colemani* Ehrhorn, 1906.
On *Rubus sp*. California.

*Phenacoccus comari* (Kunov), 1880.
On *Comarum palustre*. Germany.

*Phenacoccus farinosus* (Mööeer), 1778.
On Alder. Europe.

*Phenacoccus formicarum* Leonard, 1908.
In nests of *Pheidole pallidula*. Italy.

*Phenacoccus glacialis* (Newstead), 1900.
"Associated with ants". Italy.
Phenacoccus *gossypii* Towns. and Ckll., 1898.

On Cotton and other Malvaceous plants. Mexico.

Phenacoccus *gossypii* var. *paidiarum* Ckll., 1903.

On wild guava. Mexico.

Phenacoccus *graminis* (Reuter), 1903.

On *Phleum pratense*. Europe.

Phenacoccus *helianthi* (Cookerell), 1893.

On *Helianthus* sp. New Mexico, and Arizona.

Phenacoccus *hirsutus* Green, 1908.

?. with ants. India.

Phenacoccus *hystrix* (Bärensprung), 1849.

On *Pinus sylvestris*. Europe.

Phenacoccus *iceryoides* Green, 1908.

On mango, *Boswellia* sp., *Capparis horrida*. India.

Phenacoccus *kuwanae* Coleman, 1903.

On lichen on *Picea breweriana*. California.

Phenacoccus *mangiferae* (Green), 1896.

On *Mangifera indica*. India, and Ceylon.

Phenacoccus *mespili* (Signoret), 1875.

On medlar. Europe.

Phenacoccus *minimus* Tinsley, 1898.

On *Picea pungens*. Colorado.

Phenacoccus *obtusus* (Newstead), 1911.

On *Baobabrinde* sp. Ger.E.Africa.

Phenacoccus *parietariae* (Lichtenstein), 1881.

On *Parietaria officinalis*. Europe.

Phenacoccus *pergandei* Cookerell, 1896.

On *Diospyros kaka*. Japan.

Phenacoccus *piceae* (Loew), 1863.

On *Abies excelsa*. Austria.

Phenacoccus *ripersioides* T. and W. Ckll., 1903.

In nests of *Lasius niger*. New Mexico.
Phenaooous *rubivorus* Cookerell, 1901.
On *Pubus strigosus*. New Mexico.

Phenaooous *simplex* King, 1902.
On *Atriplex* sp. California.

Phenaooous *solenopsia* Tinsley, 1898.
In nests of *Solenopsis geminata* Fab. New Mexico.

Phenaooous *spiniferus* Kempel, 1900.
Brazil.

Phenaooous *stachyos* Ehrhorn, 1900.
On *Stachys bullata*. California.

Genus *Ceroputo* Sulc, 1897.

*Ceroputo ambigua* Fullaway, 1909.

*Ceroputo bahiae* (Ehrhorn), 1900.
On *Bahia* sp. California.

*Ceroputo barberi* (Cookerell), 1895.
On *Thunbergia grandiflora*,
*Allamanda* sp.,
*Coleus*, and
*Croton*,
Antigua, and New Mexico.

*Ceroputo calciitectus* (Cookerell), 1901.
On Grass, New Mexico.

*Ceroputo lasiorum* Cookerell, 1901.
In nests of *L. interjectus*. New Mexico.

*Ceroputo orthesioidea* Cookerell, 1903.
On roots of dockweed. Mexico.

*Ceroputo pilosellae* Sulc, 1897.
On *Hieracium pilosella*. Europe.

*Ceroputo volynicus* Nassonow, 1909.
On *Dactylidix glomerata*. Russia.
Ceropote mexicanus Coquillett, 1893.
On Yucca whipplei, Lantana, Stimulus glutinosus, Symplocos alata, Banana, orange, lime, etc. Mexico, California, Antigua.

Ceropote mexicanus (Cockerell), 1893. Mexico.
PLATES.
PLATE I.

1. Antenna of Ps. mesembrianthemi n.sp. (p. 126)

2. Antenna of Ps. burneri n.sp., same magnification as Fig. I. (p. 86).

3. Caudal extremity of Ps. burneri, showing comparative length of setae.

4. Antenna of Ph. obtusus (Newst.), showing truncate spines on derm. (p. 72).
   (Fig. 4 after Newstead.)
PLATE II.

Genus TYLOCOCCUS.
(See p. 34.)

1. Antenna of T. madagascariensis Newst.
2. Ventral view of adult ♀ of same species.
3. Marginal tubercle of same insect, further enlarged.
4. Spinous tubercle of T. insolitus (Green).
5. Antenna of T. insolitus (Green).
7. Marginal tubercle, further enlarged.
8. Antenna of T. cycliger (Leonardi).
9. Leg of adult ♀ of T. cycliger, with claw further enlarged.

(Figs. 1 - 5 after Newstead, 6 - 10 after Leonardi.)
PLATE III.

1. Pseudococcus citri (Risso), dorsal view of adult ?. X 15. (See p. 187.)

2. Transverse section through 3rd abdominal segment of Ps. citri, showing position of mycetom. ry.

3. Portion of mycetom further enlarged, showing each sferule with nucleus and sferettes.

4. Sferettes containing Coccidomyces dactylopii Büchner. (See p. 185.)

5. Early stage in the infection of the egg with sferettes.

6. Later stage; sferettes within the egg.

(Figs. 1 and 2 original, others after Pierantoni.)
PLATE III.

1.

2. my.

3. sf.

4.

5. sf.

6.