

# A REDESCRIPTION OF THE TYPE SPECIES OF THE GENERA OF COCCIDAE BASED ON SPECIES ORIGINALLY DESCRIBED BY MASKELL.<sup>1</sup>

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## INTRODUCTION.

As may be noted from the appended bibliography, W. M. Maskell, registrar of the University of New Zealand, began the publication of papers on the family Coccidae in the year 1879, and from that date until his death in 1898, an almost uninterrupted series of studies on the species of this family was produced by him, one or more articles, usually of considerable length, appearing annually except in the years 1881, 1883, 1886, and 1888, to the number of more than 40. The earlier work was confined to the Coccid fauna of New Zealand, but before long specimens from Australia began to come to Maskell for determination, and before his work ended he had described numerous new species from that continent, from various Polynesian islands, from China, Japan, and India, from South Africa, and even from North and South America. In the course of these studies Maskell brought together a large collection of insects of this family, amounting to 597 numbers, most of which represent unduplicated species. This collection includes unstained slide mounts of nearly all the species present, and in most cases unmounted material of the same species. Unfortunately Maskell had or retained only very small quantities of unmounted material in his own collection with a majority of the species.

Recognizing the absolute necessity for a reexamination of this collection in the light of modern concepts if the classification of the Coccidae was to develop properly, Dr. C. L. Marlatt, Assistant Chief of the Bureau of Entomology, instituted negotiations looking to its loan for study purposes in 1906. These were continued between Doctor Marlatt, Dr. L. O. Howard, Chief of the Bureau, and Mr. T. W. Kirk, at present director of the horticultural division of the

<sup>1</sup>This paper was completed and presented for publication before the appearance of MacGillivray's "The Coccidae," and in consequence makes no attempt to discuss the genotypes of some seventeen new Diaspine genera established in that work for various species described by Maskell.

New Zealand Department of Agriculture,<sup>2</sup> and the generous recommendations made by the last to the New Zealand authorities so resulted that the final consignment of the collection reached Washington in 1909. Studies on the collection were begun under the direction of Doctor Marlatt immediately after its arrival, and various notes were made and photographs taken of the more important species, but uncontrollable circumstances have, up to the present, prevented the extended critical study of the species which is much needed to further the classification of the Coccidae, and have also prevented the preparation for publication of such notes and studies as had been made previously.

When an opportunity recently presented itself to the writers to undertake definite work on this collection, it was decided, after some consideration, that the redescription and redefinition of the different genera based on Maskellian species was the most immediately important work which could be done, in spite of the fact that it required studies of genera scattered promiscuously through the whole family, and gave little or no opportunity for correlative classification in any group. These studies have certainly opened up more questions than they have been able to settle; however, it is hoped and believed that they will further the beginning which is being made in the study of the classification of this difficult family along lines leading away from the superficial and conspicuous characters heretofore depended upon to indicate relationships, and toward those fundamental similarities and differences, often minute, in the structure and biology of the species, which must sooner or later be relied upon if a true classification is to be developed.

In the following descriptions, and particularly in the diagnoses of the genera, the writers have, in all probability, overemphasized many structural details which will be found on extended comparative study of the different groups to have little value for generic differentiation. The field is so large that a thorough knowledge of the comparative anatomy of the members of the family can only come in piecemeal fashion, and it has in consequence been considered preferable to err through the inclusion of unnecessary details rather than through the omission of possibly important facts.

The studies of the type species have been confined almost entirely to the various stages of the female, and principally to the adult and the first-stage larva. While there is no reason for believing that a study of every stage of both sexes of a species will not contribute something to a knowledge of its relationships, practical considerations, chiefly the question of the volume of this paper, the fact that the two stages emphasized are the ones most frequently obtained in collections, and the fact that in the case of the male sex there is no

<sup>2</sup> Recently retired.

definite basis for description or diagnosis, have influenced the limitation noted. As Maskell has in most cases described the superficial appearance of the insects named by him quite fully, this phase of each species has also been very largely ignored, and special emphasis has been laid on the morphological characteristics in the following descriptions, which are to that extent supplemental to those of Maskell.

Many of the opinions regarding the classification of the Coccidae expressed by Maskell in the course of his work appear to be excellent, and it can only be regretted that he did not correlate such ideas with a much higher degree of accuracy in the course of his descriptive studies. It is certainly safe to state that a majority of the Maskell descriptions which have been examined in the course of this work contain actual errors, not of omission, but of statement of anatomical fact, these occurring so frequently that it has not been considered desirable to call attention in the body of a description to the fact that Maskell described a structure as having certain characteristics, while these prove on reexamination to be different. Therefore, where the following descriptions differ in detail from those of Maskell it may be accepted as a rule that due consideration has been given to Maskell's statements and that the differences result from a study of specimens of the species involved. Besides this, as will be noted in the cases of *Erium* and *Anoplaspis*, Maskell has confused other coccidologists by misidentifying specimens examined by him, and by sending out such incorrectly determined specimens as examples of species described by him.

In some instances the Maskell material has been so scant that it has been necessary to rely upon recent redescriptions of the species in question for more or less of the information given. In other cases, from the same cause, it has been necessary to supplement the Maskell specimens with others evidently of the same species from other sources. Wherever it has been possible, however, the following descriptions and figures have been prepared from Maskell's type material. The genera and species described here are listed in the order given in the Fernald Catalogue of the World, 1903, although in many cases a different position within the family from that given in this catalogue has been indicated. For compactness no references given in that catalogue are repeated, and only those subsequent to it that appear to have a definite bearing on the genus involved.

It is hoped that this paper will be the first of a series discussing the species of this very important collection.

Thirty-seven genera and subgenera are described and discussed in the following pages, besides which it has been necessary to describe one new species. Wherever possible, the writers have added notes on the species other than the type which have been included in a genus,

have expanded the generic diagnoses accordingly, and have also made suggestions as to the possible relationships of the genus. Unfortunately little or nothing of this sort could be contributed with far too many of the genera.

The text figures showing the structural characteristics of the various species have been prepared by the junior author.

#### DESCRIPTIONS OF GENERA AND SPECIES.

### Family COCCIDAE.

#### Subfamily MONOPHLEBINAE.

#### Genus MONOPHLEBULUS Cockerell.

##### Plate 1, fig. 1.

*Genotype*.—*Monophlebus fuscus* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 19.

This genus was established by Prof. T. D. A. Cockerell in 1902, on the basis of the presence of 7-segmented antennae in the adult female, and with only the single included species, which must therefore be the type species.

This species is now represented in the Maskell collection by three slides, two each with a single larva, one dated 1892, the other 1894, and one with an antenna, a leg, and a portion of the derm of the adult female dated 1892, and by a single unmounted female with the Maskell No. 286. It is possible to obtain a little light on the characteristics of this species from the larvae and the pieces of the adult female, but few structures may be described in detail.

*Adult female*.—Elongate ovate, much shriveled when dry, body more or less covered by white secretion and with numerous glassy threads protruding from this secretion, especially along the margin where they form small bundles; antennae 7-segmented, varying from the normal monophlebine type only in a reduction of the number of segments from that usually present and in the shortening of the individual segments; legs normal monophlebine type, tarsal digitules represented only by the stubs; mentum not available for examination; spiracles not available for examination; derm, so far as can be determined from the very small piece available, with at least three types of pores, two circular, one smaller, apparently flat, with trilobed center and an oval pore between each two lobes and the surrounding ring, the other larger, apparently more heavily chitinized, normally with a larger center surrounded by a circle of several somewhat smaller pores, but this arrangement variable, so there may be one large pore and two or three smaller pores in the center of the pore circle, the third pore type large, heavy, trilocular tubular ducts, these

secreting the glassy threads; derm with two types of setae and scattered stout lanceolate spines, some of the setae slender with a definite basal collar, others, more numerous, relatively stout at base, then tapering gradually to a very slender tip, the basal collar on these

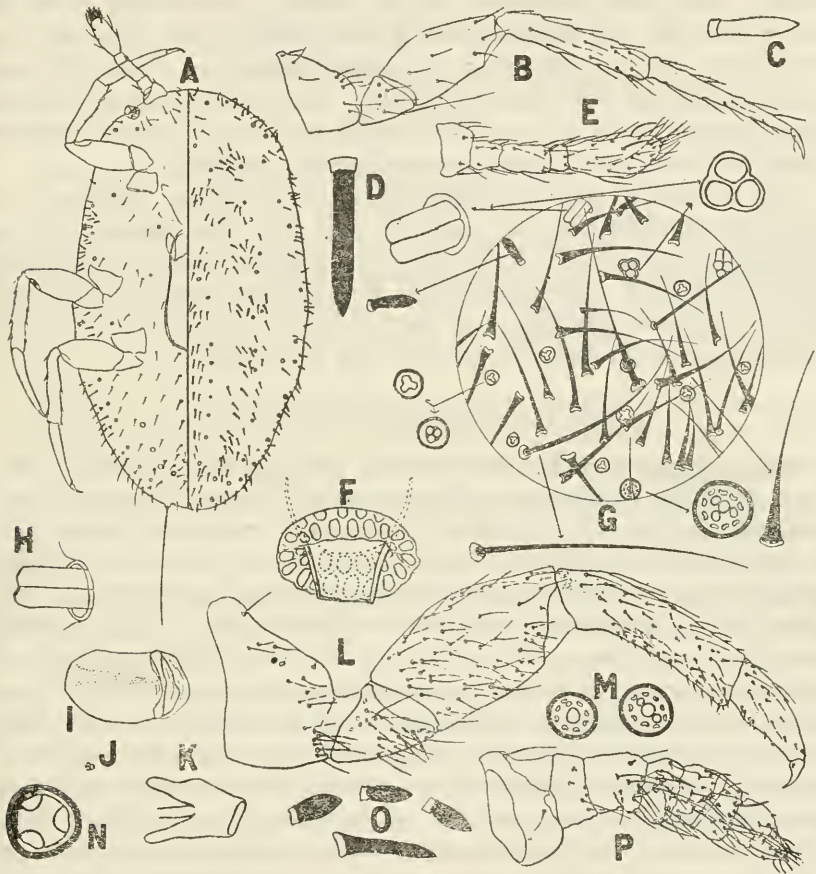


FIG. 1.—*MONOPHLEBULUS FUSCUS* (MASKELL). A. LARVA, OUTLINE,  $\times 57.5$ ; B. LARVA, MIDDLE LEG,  $\times 115$ ; C. AND D. LARVA, DORSAL SPINES,  $\times 640$ ; E. LARVA, ANTENNA,  $\times 115$ ; F. LARVA, ANAL RING,  $\times 335$ ; G. ADULT FEMALE, SECTION OF DERM,  $\times 230$ , WITH ENLARGED DETAILS OF SETAE,  $\times 335$ , AND OF SPINES, PORES, AND DUCTS,  $\times 640$ ; H. LARVA, TRILOCULAR DUCT,  $\times 640$ ; I. LARVA, THORACIC SPIRACLE,  $\times 335$ ; J. LARVA, ABDOMINAL SPIRACLE,  $\times 335$ , SHOWING DIFFERENCE IN SIZE; K. LARVA, ABDOMINAL SPIRACLE,  $\times 1500$ ; L. ADULT FEMALE, LEG,  $\times 50$ ; M. ADULT FEMALE, DERM PORES,  $\times 640$ ; N. LARVA, TRILOCULAR DISK PORE,  $\times 1500$ ; O. ADULT FEMALE, DERM SPINES, SHOWING VARIATION,  $\times 335$ ; P. ADULT FEMALE, ANTENNA,  $\times 57.5$ .

very small; anal opening not available for examination; ventral cicatrices not available for examination.

*Intermediate stages.*—None available for examination.

*Larva.*—Elongate oval, antennae rather stout, 5-segmented, the terminal largest; legs normal, claw with digitules and denticle; with two thoracic and seven abdominal pairs of spiracles, the latter simple;

derm with trilocular center circular pores arranged in four longitudinal rows dorsally and two rows ventrally, and in addition with thirteen pairs of the heavy short-tubular marginal ducts, each duct trilocular and giving off three glassy filaments which form a single thread; derm with five more or less distinct double rows of stout spines dorsally, one median, one on each margin, the other two intermediate, each accompanied by slender setae, and ventrally with rather numerous but scattered slender setae; anal opening a short tube surrounded by a pore collar; with four small circular ventral cicatrices on each half, these curving forward and out.

The following generic diagnosis has been drawn up from the preceding description, and includes only the type species, as the writers are unable at this writing to cite any other species as belonging definitely with *M. fuscus*, although *Monophlebus crawfordi* Maskell and var. *pilosior* Maskell seem very closely related and may prove on thorough study to be congeneric with *M. fuscus*.

#### GENERIC DIAGNOSIS OF MONOPHLEBULUS.

Monophlebine coccids; adult female elongate ovate, covered with loose secretion containing numerous glassy threads; probably not secreting an ovisac; antennae 7-segmented, legs well developed, normal; with two pairs of thoracic and seven pairs of abdominal spiracles; derm with two sorts of circular multilocular disk pores, and large trilocular tubular ducts; with slender setae, large tapering setae, and stout lanceolate spines; condition of anal opening and ventral cicatrices not known; intermediate stages not known; larva elongate oval, antennae 5-segmented; legs normal, claws with digitules and denticle; with two pairs of thoracic and seven pairs of abdominal spiracles; body with longitudinal rows of trilocular disk pores and with a marginal row of large trilocular tubular ducts around the whole body; derm with dorsal and marginal rows of stout spines, and with slender setae dorsally and ventrally; anal tube short, surrounded by a pore collar; four pairs of ventral circular cicatrices, and a single pair of long differentiated terminal setae.

This genus appears, on the basis of such study of other Monophlebine genera and species as has been possible, to be more closely related to the group including *Walkeriana*, *Lophococcus*, and *Aspidoproctus*, than to any others, although it does not possess so great a variety of either glands or spines in its derm as do these other genera, and there appears to be no tendency towards the development of the internal pouch or marsupium, which is also found in the latter genera.

Besides the type, one other species, *M. townsendi* Cockerell, has been proposed for inclusion in this genus, but this has already been

shown to have been placed on the basis of an antenna having two terminal segments broken off, giving the appearance of 6-segmented antennae, when in reality eight were originally present, and it has in consequence been removed to *Drosicha*.<sup>3</sup>

### Subfamily MARGARODINAE.

#### Genus COELOSTOMIDIA Cockerell.

Plate 1, fig. 2.

*Genotype*.—*Coelostoma zealandica* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 30.

*Coelostomidia* is a new name proposed by Professor Cockerell as a substitute for *Coelostoma* Maskell, the latter genus being preoccupied. The genus was first established under the latter name by Maskell in 1880 with the single included species *C. zealandicum*, which therefore stands as the type.

This species is at present represented in the Maskell collection by seven slides, one of "young insects from Muhlenbeckia, Dec. 1879," one of "under side of female, 3d stage from Muhlenbeckia, Feb. 4, 1880," one of "female 2d stage from Muhlenbeckia Feb. 7, 1880," one of "female 2d stage 1889," one of "antenna of female, Apr. 1890," one of "adult female, 1891," and one of "intermediate stage of male, 1891," and by a number of unmounted specimens, including males, females, and a number of the tests of immature stages, all of the latter bearing the Maskell No. 98.

If the statement of the published original description to the effect that it was read June 5, 1879, is correct, none of these specimens can be considered as true type specimens of the species, but it does seem quite probable that the specimens on slides dated 1879-80 represent individuals from the same colony as those on which Maskell based his original description, and consequently will be satisfactory for redescriptive purposes.

*Adult female*.—Elongate oval, broadest behind the middle; antennae 11-segmented, stout, tapering, the intermediate segments wider than long; legs normally developed, stout; mouthparts wanting; with two pairs of thoracic and seven pairs of large tubular abdominal spiracles, the later without the pore collar found in the intermediate stage, the posterior pair placed behind and at some distance from the anal ring; derm thin and transparent, the setae relatively much more numerous than the pores, in contrast to the condition in the second stage, with only the multilocular disk type of pore present, and these of only one sort, with a chitinized outer band, a circle of numerous loculi, and a cluster of unequally developed central loculi; derm setae

<sup>3</sup> See Philippine Journ. Sci., vol. 17, 1920, p. 157.



FIG. 2.—*COELOSTOMIDIA ZEALANDICA* (MASKELL). A. LARVA, PORE, ONE TYPE,  $\times 640$ ; B. LARVA, PORE, SECOND TYPE,  $\times 1500$ ; C. LARVA, OUTLINE FROM BENEATH,  $\times 57.5$ ; D. LARVA, MIDDLE LEG,  $\times 115$ ; E. INTERMEDIATE STAGE FEMALE, DERM SETA AND SPINE,  $\times 335$ ; F. LARVA, ANTENNA,  $\times 115$ ; G. LARVA, THIRD TYPE OF PORE, IN TWO PLANES,  $\times 1500$ ; H. INTERMEDIATE STAGE FEMALE, VENTRAL PORE,  $\times 640$ ; I. SAME STAGE, ANAL TUBE, WITH DETAILS,  $\times 640$ ; J. ADULT FEMALE, PORTION OF DERM,  $\times 165$ , WITH DETAIL OF SETAE,  $\times 335$ , AND OF PORES,  $\times 1500$ ; K. LARVA, ANAL TUBE,  $\times 335$ ; L. LARVA, POSTERIOR ABDOMINAL SPIRACLE,  $\times 500$ ; M. INTERMEDIATE STAGE FEMALE, ABDOMINAL SPIRACLE,  $\times 165$ ; N. SAME STAGE, THORACIC SPIRACLE,  $\times 165$ ; O. LARVA, LATERAL ABDOMINAL SPIRACLE,  $\times 500$ ; P. LARVA, THORACIC SPIRACLE,  $\times 500$ ; Q. INTERMEDIATE STAGE FEMALE, MULTICELLULAR DISK PORE, TWO VIEWS,  $\times 1500$ ; R. ADULT FEMALE, ANAL TUBE,  $\times 57.5$ ; S. ADULT FEMALE MIDDLE LEG,  $\times 80$ ; T. ADULT FEMALE, ANTENNA,  $\times 30$ ; U. INTERMEDIATE STAGE FEMALE, DISK PORE, SECOND SORT,  $\times 1500$ ; V. ADULT FEMALE, SPIRACLES, THORACIC TO LEFT, ABDOMINAL TO RIGHT,  $\times 115$ ; W. INTERMEDIATE STAGE FEMALE, ANTENNA,  $\times 115$ ; X. SAME STAGE, SMALL SIMPLE PORE, TWO VIEWS,  $\times 1500$ ; Y. SAME STAGE, MIDDLE LEG,  $\times 115$ ; Z. SAME STAGE, THIRD SORT OF DISK PORE,  $\times 1500$ .



of two types, quite similar in appearance, the size varying only slightly, with the notable exception that a little behind the antennae ventrally is a pair of long slender setae, perhaps 6-8 times the length of the adjacent derm setae; anal tube, as represented in the preceding stages, present only as a short, somewhat chitinized simple tube tapering anteriorly; no ventral cicatrices observed.

*Intermediate stage female.*—Shape nearly globular; antennae very short and stout, conical, apex rounded, composed of nine segments; legs much reduced, stout, tapering, the tarsal claw normally with a minute denticle, the trochanter, though greatly reduced, present and bearing a seta nearly as long as the remainder of the leg; mentum apparently two-segmented, not with three; with two pairs of thoracic and seven pairs of abdominal spiracles, each with the inner end invaginated and with a collar of pores, two deep, around it, posterior abdominal pair set very close to the anal opening, the openings of the thoracic and abdominal spiracles approximately the same size, but the former with a long chitinous bar attached; derm rather thickly set with pores, all circular, including small clear pores surrounded by a chitinized ring, multilocular disk pores, varying somewhat in size, shape, and internal composition, as shown in figures, and relatively much larger simple clear disks surrounded by a chitinous ring, the first two types numerous but scattered over both surfaces of the body, the third type placed in more or less evident transverse rows ventrally and laterally; derm with fairly numerous, small, slender setae both dorsally and ventrally, these mostly larger and stouter in the chitinized area surrounding the anal opening; anal tube opening in a large, roughly circular, chitinized area at the posterior apex of the body, long, heavily chitinized, the opening surrounded by a slight chitinous ring and immediately within this a band of heavily chitinized short-tubular pores, immediately below this a band with numerous pores presenting a sievelike appearance, below this a band of large, irregularly circular pores of indeterminate structure, then a tube of plain chitin, and finally at the inner end a band of heavy, irregular-shaped, multifaceted wax secreting plates; without traces of the ventral cicatrices of the larva, unless the numerous, large, circular ventral disk pores, already described, are derivatives of these larval structures.

*Larva.*—Body somewhat elongate oval; antennae well developed, compact, and stout, the apical segment much the largest, but not conspicuously so, 6-segmented; legs normal, the claw with a large denticle, and a pair of slightly knobbed digitules that surpass the tip; with 7 pairs of large abdominal spiracles and two pairs of differently shaped thoracic spiracles; body, both dorsally and ventrally, with numerous circular, heavy disk gland pores, the central loculi of which vary in number from 3-6; derm with rather numerous small

slender setae, each set in a collar; anal tube distinctly chitinized, the end with a double collar of pores; apex of abdomen with a single pair of long differentiated setae, these perhaps a fourth the length of the body; with three rather large, circular, ventral cicatrices, the median slightly larger than the laterals.

*Cotype*.—Cat. No. 24755, U. S. N. M.

Besides the slides already listed the Maskell collection contains one other, marked "from R. Raithby, Reefton, 1891," an adult female which appears to be identical with the adults of *C. zealandicum*, except that it has a small thickening or tubercle between the anterior legs that strongly resembles a much reduced mentum. That this might easily be such a structure is shown by some recently published observations on the variability in the extent of the development of the mouth parts in certain related species.

Of the four other species left in this genus, according to the arrangement in the Fernald Catalogue, *C. assimilis* (Maskell) has been made the type of a subgenus, and will be discussed next. *C. wairoensis* (Maskell) is known only from the male, and a comparison of this male with that of the type indicates that its assignment to the genus is questionable, particularly in view of the great increase in the number of the tarsal digitules, as many as 24 being present on each tarsus, according to Maskell. An examination of the type slides of *C. compressa* (Maskell) shows that its placing in this genus is likewise questionable; the larval antennae are 7-segmented and of a different type from those of *C. zealandica*; the multilocular disk pores of the immature stages are of a very different sort from any found in the genotype; the anal tube is wanting in the intermediate stage of the female, and the antennae of the adult female are 10-segmented, to mention some of the more conspicuous differences. A similar uncertainty is evident with regard to the remaining species, *C. pilosam*, and the following generic diagnosis has therefore been limited quite closely to the characters exhibited by the type species of the genus.

#### GENERIC DIAGNOSIS OF COELOSTOMIDIA.

Coccids of the Monophelbine-Margarodine series; adult female elongate oval, secreting a mass of cottony substance at oviposition, antennae stout, 11-segmented; legs normal; mouth parts wanting; with two pairs of differentiated thoracic and seven pairs of large simple abdominal spiracles; derm with a single type of multilocular disk pore and two types of slender setae, all abundant; anal tube short, simple; ventral cicatrices wanting; intermediate stage female globular, enclosed in a heavy protective cell; antennae and legs much reduced; mouth parts present and functional; with seven pairs of

abdominal and two pairs of thoracic spiracles, all with collars of wax pores; derm with numerous multilocular disk pores, variable in detail, small simple pores, and large circular disk simple pores ventrally, these probably the ventral cicatrices; with one type of small, slender setae; anal tube large and long, with three collars of secreting pores of different types; larva elongate oval, antennae normal, 6-segmented; legs normal; spiracles rather large, with same number as in other stages, each without pore collar, but with one or two pores; anal tube small, with double pore collar; derm with rather numerous multilocular disk pores, varying in details, and with smaller circular simple pores; derm setae simple, slender, rather numerous; with a single pair of long differentiated posterior setae; with three ventral cicatrices in transverse curved row; adult male with 10-segmented antennae set on prominent tubercles, the hairs not arranged in definite whorls; head with a prominent lamina between antennae; abdomen without caudal or lateral tassels, the sheath of the penis long conical, tapering almost to a point.

Genus **ULTRACOELOSTOMA** Cockerell.

*Genotype*.—*Coelostoma assimile* Maskell.

*Reference*.—Cockerell, *The Entomologist*, vol. 35, 1902, pp. 114, 258.

This was established by Professor Cockerell with the single included species on the basis of the stated absence of legs in the adult female. No other species have been added subsequent to its establishment.

The type species is represented in the Maskell collection by five slides, one of "larva, Feb. 4, 1890," one of "2nd Stage female, Sept. 1889," one of "antenna of 2nd stage female, Feb. 4, 1890," one of "adult female, Apr. 2, 1890," and one of "adult female, 1891."

*Adult female*.—Nearly globular; antennae much reduced, short and stout, composed of five segments; legs present, but much reduced, each appearing as a stout triangle with claw at apex; mouth parts wanting; with two pairs of thoracic spiracles, each with a long chitinized bar, and with seven pairs of abdominal spiracles, each with large opening, nearly as large as that of thoracic spiracles, simple, the posterior pair placed quite close to the anal tube; derm with numerous multilocular disk pores of one type, but varying in details, the centers circular to trilocular; derm with numerous rather large but delicate setae, many of which appear swollen just at base; anal opening a simple ring joined by a simple chitinized tube; no ventral cicatrices observed.

*Intermediate stage female*.—Nearly globular, somewhat more heavily chitinized than is the adult; antennae smaller and stouter than in adult, 5-segmented; legs present but even more reduced than

are those of adult; mentum long triangular, apparently 2-segmented; with two pairs of thoracic and seven pairs of abdominal spiracles, the former with chitinous bar as in adult, all with one or two pores, the

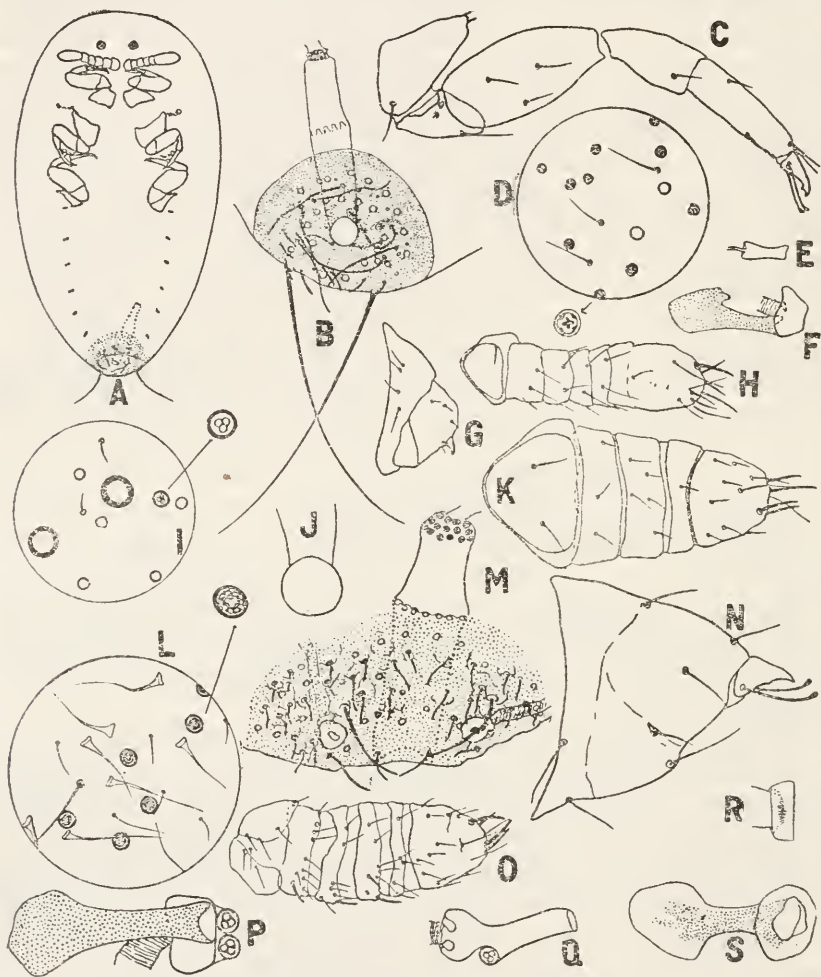


FIG. 3.—*ULTRACOELOSTOMA ASSIMILE* (MASKELL). A. LARVA, OUTLINE FROM BENEATH,  $\times 57.5$ ; B. SAME, APEX OF ABDOMEN,  $\times 165$ ; C. LARVA, LEG,  $\times 220$ ; D. LARVA, VENTRAL DERM BETWEEN LEGS,  $\times 335$ , WITH DETAIL OF PORE,  $\times 640$ ; E. LARVA, ABDOMINAL SPIRACLE,  $\times 500$ ; F. LARVA, THORACIC SPIRACLE,  $\times 500$ ; G. INTERMEDIATE STAGE FEMALE, LEG,  $\times 335$ ; H. LARVA, ANTENNA,  $\times 220$ ; I. INTERMEDIATE STAGE FEMALE, PORTION OF DERM BETWEEN HIND LEGS,  $\times 335$ ; J. ADULT FEMALE, ANAL TUBE,  $\times 165$ ; K. INTERMEDIATE STAGE FEMALE, ANTENNA,  $\times 335$ ; L. ADULT FEMALE, PORTION OF DERM,  $\times 165$ , WITH DETAIL OF PORE,  $\times 640$ ; M. INTERMEDIATE STAGE FEMALE, APEX OF ABDOMEN,  $\times 165$ ; N. ADULT FEMALE, MIDDLE LEG,  $\times 440$ ; O. SAME, ANTENNA,  $\times 165$ ; P. INTERMEDIATE STAGE FEMALE, THORACIC SPIRACLE,  $\times 500$ ; Q. SAME, ABDOMINAL SPIRACLE,  $\times 500$ ; R. ADULT FEMALE, ABDOMINAL SPIRACLE,  $\times 165$ ; S. SAME, THORACIC SPIRACLE,  $\times 165$ .

posterior abdominal pair much enlarged and placed close to the opening of the anal tube; derm with numerous large circular clear pores, small circular clear pores, quadri or trilocular center pores, and multi-

locular disk pores with simple centers; derm with a few fairly short, stout setae, the circular chitinized disk at apex of abdomen bearing a pair of large setae, and a number of smaller threadlike setae; anal tube large and stout, bearing a single circle of clear pores a little nearer inner than outer end, and a band of irregular wax plate pores about three deep at inner end; no ventral cicatrices observed.

*Larva*.—Oval, somewhat narrowed behind; antennae 6-segmented, short and stout, the club not especially conspicuous; legs normal, but rather short and stout, claw with denticle and slender somewhat knobbed digitules; mentum long triangular, 2-segmented; with two pairs of thoracic spiracles, with chitinous bar attached, and presumably with seven pairs of abdominal spiracles, these much smaller and simple; derm with rather numerous disk pores with the loculi varying from two to four, and with fewer clear pores; derm setae not numerous, fairly large, but slender; posterior apex of body with a circular chitinized area bearing a pair of long apical setae, a number of long slender, thread-like setae, slightly knobbed at tips, and a number of clear pores; anal tube well developed, opening in the middle of this chitinous area, long, striate longitudinally, with a single circle of cylindrical pores nearer inner end than outer, and a double collar of wax pores at inner end.

If it were not for Maskell's extended description of the habits and appearance of the adult of this insect, there would be some doubt as to whether the stage described by him was really adult. As was noted in the body of the description, the legs, although greatly reduced, are present in both of the late stages of the female examined, and the genus is therefore based on a morphological inaccuracy. The practical loss of the legs, together with some other structural modifications, seems to give sufficient grounds for the retention of the genus as a valid zoological unit. In this connection, mention may be made of a Japanese species, *Xylococcus alni* Oguma (not *X. alni* Florence), recently described in detail by Oguma,<sup>4</sup> which is said to have the legs entirely wanting and the antennae reduced to one-segmented stubs in the adult female, and which may prove on comparative study to be related to *U. assimile* (Maskell).

The generic diagnosis following is based wholly on the type species.

GENERIC DIAGNOSIS OF ULTRACOELOSTOMA.

Coccids belonging to the Monophlebinae-Margarodinae series; adult female enclosed in a heavy test placed in the twig axils of the host; nearly globular, antennae and legs very much reduced, the first 5-segmented; mouth parts wanting; with 7 pairs of abdominal and two pairs of differentiated thoracic spiracles, all without pores;

<sup>4</sup>Jour. Col. Agr. Hokkaido Imp. Univ., Sapporo, Japan, vol. 8, pt. 3, Mar. 1919, pp. 77-109.

derm with one type of multilocular disk pore and simple slender setae; anal opening a short simple tube; ventral cicatrices wanting; intermediate stage female nearly globular with apex of abdomen chitinized; antennae and legs reduced as in adult; mentum long triangular, 2-segmented; derm with bi- to quadrilocular disk pores, large and small clear circular pores, these ventrally at least, and comparatively few slender setae; with spiracles as in adult, but each with one or two pores; anal tube long and stout, with median and interior rows of pores; chitinized apical area bearing threadlike setae, one pair of large setae and the posterior spiracles in addition to the anal tube; no ventral cicatrices; larva oval; antennae short and stout, 6-segmented; legs stout, normal, claw with denticle and digitules; mentum as in intermediate stage; spiracles as in preceding stages, but simple; derm with bi- to quadrilocular disk pores and simple pores, and with some slender setae; apex of abdomen chitinized, this area bearing threadlike setae, one pair of long apical setae, and some pores; anal opening in center of this; anal tube long and stout, with pores as in intermediate stage but less developed; no ventral cicatrices.

The present confusion among the genera in this group is so great that it is practically impossible to place this genus with any degree of certainty. Except for the reduction of the legs and antennae and the failure of the adult to become active at maturity, other structural characters and habit indicate a closer relationship to *Xylococcus* than to any other genus at present known to the writers.

### Subfamily PHENACOLEACHIINAE.

#### Genus PHENACOLEACHIA Cockerell.

Plate 1, fig. 3.

*Genotype*.—*Leachia zealandica* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 38.

This is another one of Professor Cockerell's genera based on a single species. It is represented in the Maskell collection by eight slides, one of "larva, 1889," one of "adult female, 1889," one of "antenna of female, 1889," one of "foot of female, 1889," one of "adult male, 1889," one of "semi-apterous male, 1890," and two of "adult female," one marked "Capleston, 1891, R. W. Raithby."

As the species has been described in detail by Maskell, the following descriptive notes may be regarded as supplemental to his work.

*Adult female*.—Elongate, the ends of the body tapering and rounded; antennae with a single stout sickle-shaped seta on a number of the terminal segments besides the pair on the apical one; legs with the chitinous attachment piece very long and slender, claws

with a pair of digitules, one short and flat, the other threadlike, knobbed at tip; tarsal digitules not differentiated, claw with denticle near apex; anal ring with a single interior band of more heavily chitinized pores, surrounded by a band, several pores deep, of more

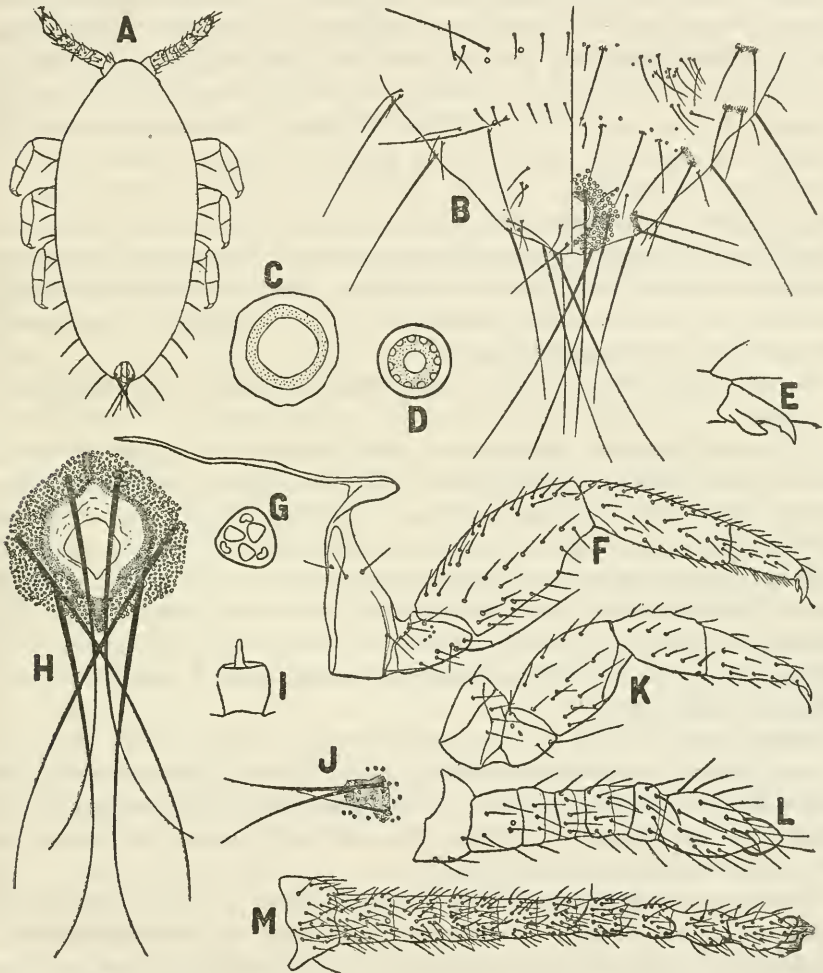


FIG. 4.—*PHENACOLEACHIA ZEALANDICA* (MASKELL). A. LARVA, OUTLINE, DORSAL,  $\times 63$ ; B. LARVA, APEX OF ABDOMEN,  $\times 115$ ; C. ADULT FEMALE, HEAVY CLEAR PORE,  $\times 1500$ ; D. SAME STAGE, MULTILOCULAR DISK PORE,  $\times 1500$ ; E. ADULT FEMALE, DETAIL OF CLAW,  $\times 165$ ; F. ADULT FEMALE, LEG,  $\times 57.5$ ; G. ADULT FEMALE, TRIANGULAR PORE,  $\times 1500$ ; H. SAME, ANAL RING,  $\times 115$ ; I. SAME, EVAGINATED STRUCTURE,  $\times 1500$ ; J. ADULT FEMALE, GROUP OF SETAE AND EVAGINATED STRUCTURES ON CHITINIZED BASE,  $\times 115$ ; K. LARVA, MIDDLE LEG,  $\times 115$ ; L. LARVA, ANTENNA,  $\times 115$ ; M. ADULT FEMALE, ANTENNA,  $\times 57.5$ .

lightly chitinized circular pores, and within this band a set of six large anal ring setae; without the smaller hairs described by Maskell; derm dorsally with three types of gland pores, and some peculiar evaginated structures possibly representing a fourth type, these three

large, heavily chitinized, simple, clear pores, multilocular disk pores similar in appearance to those found in *Pseudococcus*, triangular pores, similar in appearance to those of *Pseudococcus* under low magnification, but showing three additional, smaller, loculi when greatly enlarged, and finally the evaginated cylindrical tubes, constricted and with a very much smaller finger-like prolongation of the apex, these last grouped with the large submarginal setae; derm both dorsally and ventrally with numerous setae, varying greatly in size, and in the abdominal region, at least, arranged in transverse segmental bands, with a much larger seta on each margin, then setae not quite so large, in transverse groups of about three or four placed just within the margin and united by a small chitinized patch, and finally slightly smaller setae singly to the number of two or three on each half of each segment; mentum distinctly 3-segmented, but the two basal segments not so conspicuously separated as indicated by Maskell's figure.

*Intermediate stages.*—None available for study; apparently unknown.

*Larva.*—Elongate, tapering at ends; antennae 7-segmented with two curved setae on apical segment and one on preapical; legs rather stout, claw with denticle and two digitules; tarsal digitules not differentiated; mentum 3-segmented; anal ring and setae much as in adult; long marginal and dorsal setae present as in adult, but the latter less numerous; these accompanied by the tiny tubular protuberances of the adult; dorsum, so far as can be determined, only with triangular pores; venter, so far as can be determined, only with multilocular disk pores.

*Male adult.*—While the eyes of this stage are aggregated into two linear groups, as described and figured by Maskell, there seems to be some doubt as to the propriety of characterizing them as compound; from the specimens available, little or nothing can be added to Maskell's description of this stage.

This very peculiar species has no near relatives, so far as the writers are aware, and in spite of a careful study of the limited material available, it has not been possible to link it definitely with any of the larger groups now known to exist in the family. There is much in the general appearance, the kinds of pores, the development and character of the anal ring, and the development of what may be termed pseudo-cerarii, in that they serve as supports for lateral tassels, to suggest a relationship with the *Pseudococcus* group of genera. The number of antennal segments, the absence of dorsal ostioles, and the absence of definite cerarii seem to be sufficient to eliminate any close relationship with the mealy-bugs, however. Similarly, the number of antennal segments, the dense hairiness of these, as well as of the



legs and body, the absence of differentiated tarsal digitules and the development of the large circular clear pores would seem to indicate some connection with the Monophlebinae-Margarodinae series of genera, but here again, the presence of the anal ring with setae and pores and the absence of abdominal spiracles, are sufficient to eliminate close relationship with this group as well. It has therefore been necessary to continue to consider this single species and genus as the sole representative of a distinct subfamily in the Coccidae, for which the following generic diagnosis has been prepared.

GENERIC DIAGNOSIS OF PHENACOLEACHIA.

Coccids of uncertain relationships, probably representing a distinct subfamily; adult female elongate oval, tapering at ends, covered with secretion and with lateral abdominal tassels in life; antennae 11-segmented, with numerous setae and, relatively, spines; legs well developed, with numerous small setae, tarsal claw with denticle and two differentiated digitules; tarsal digitules not differentiated from other setae; mentum 3-segmented; anal ring circular, with six large setae and a broad band of pores; derm pores of three types, triangular, with three large and three small loculi, multilocular disk, and larger heavy clear disk; with small cylindrical projections with apical nipple, in clusters, especially submarginally; body setae numerous, slender, varying greatly in size, with a few larger hairs grouped transversely; intermediate stages not known; larva elongate oval, tapering before and behind; antennae 7-segmented, the terminal segments with differentiated spines, all with numerous setae; legs rather short and stout, the claw and digitules as in adult; mentum 3-segmented; anal ring as in adult, but less developed; derm pores fewer, but much as in adult; setae as in adult, except less numerous; adult male with 10-segmented antennae, eight ocelli on each side, arranged in a curved continuous row; legs long and slender, tarsal claw nearly straight, with denticle and digitules as in female; penis sheath long-conical, rounded; apex of abdomen with a large circular group of multilocular disk pores on each side of penis, and in center of these about 4 long, slender setae.

Subfamily DACLYLOPIINAE.

Genus FRENCHIA Maskell.

Plate 1, fig. 4.

*Genotype*.—*Frenchia casurinae* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 39.

This genus was originally described with one included species, which therefore stands as the type. Maskell later added another

species, but these two are all that have ever been placed in the genus.

The Maskell collection contains seven slides of the type species, one of "rostrum of female, 1890," one of "larva, 1891," one of "larva to show spinnerets, 1891," one of "cephalic surface of female, 1891," one of "abdomen of female, 1891," one of "female 2nd stage, 1891," and one of "adult female, 1891." Besides, there is a quantity of unmounted material, including some galls split open to show the female in position, all under the No. 125. In addition, the National

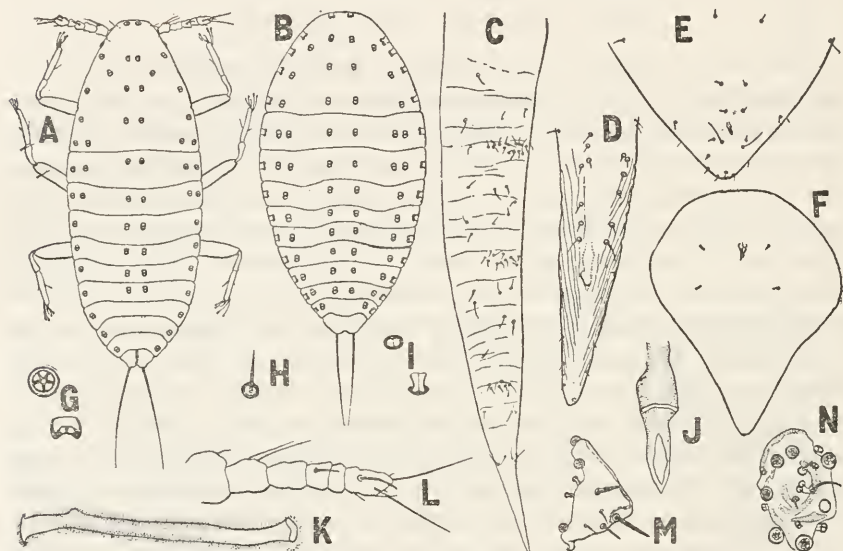


FIG. 5.—*FRENCHIA CASUARINAE* MASKELL. A. LARVA, OUTLINE FROM ABOVE, SHOWING PORES, ETC.,  $\times 116$ ; B. THE SAME, SHOWING A DIFFERENT ARRANGEMENT OF THE 8-SHAPED PORES,  $\times 116$ ; C. "TAIL" OF ADULT FEMALE,  $\times 7.5$ ; D. THE SAME, DETAIL OF CHITINIZED APEX, WITH ANAL TUBE DOTTED IN,  $\times 115$ ; E. INTERMEDIATE STAGE FEMALE, TIP OF ABDOMEN,  $\times 335$ ; F. THE SAME, OUTLINE OF BODY SHOWING SHAPE,  $\times 12$ ; G. ADULT FEMALE, QUINQUELOCLULAR DISK PORE,  $\times 640$ ; H. SAME, BODY SPINE,  $\times 640$ ; I. SAME, 8-SHAPE PORE,  $\times 640$ ; J. INTERMEDIATE STAGE FEMALE, ANAL TUBE,  $\times 640$ ; K. ADULT FEMALE, TUBULAR DUCT,  $\times 640$ ; L. LARVA, ANTENNA,  $\times 335$ ; M. ADULT FEMALE, ANTENNA FROM SIDE,  $\times 335$ ; N. SAME, FROM ABOVE,  $\times 335$ .

Collection of Coccidae contains a quantity of material of this species from which supplementary mounts that have aided greatly in re-description have been made.

Before proceeding to a description of the different stages of the insect, the writers desire to call attention to the following important errors in Maskell's description: 1, the tubular gall or test which Maskell describes as being excreted by the female is unquestionably woody, and a product of the plant, not of the insect; 2, the second stage as described by Maskell is in reality a first-stage larva about to molt; Maskell apparently failed to differentiate the real second

stage and the adult female, both of which occur within the gall. The following descriptive notes are directly supplementary to Maskell's extended description:

*Adult female*.—Of a peculiar disk-like shape, with slender tail-like abdomen; derm clearing completely when boiled in potassium hydroxide; antennae not wanting, but represented by minute cones, placed anterior to the strongly developed framework of the mouth parts; no traces of legs observed; derm with three types of gland pores, at least dorsally; with long, slender, tubular ducts angulate near bottom, with large multilocular disk pores, these, so far as noted, all quinquelocular, and with smaller, broad, somewhat obscure 8-shaped gland pores set in the bottom of a short tube, all these types more or less localized, but the arrangement not determinable due to distortion of the body on mounting; the first two types appearing very numerous and closely crowded before the development of the eggs, but much more widely scattered after the stretching of the derm due to egg development; ventrally probably with only the tiny 8-shaped pores, except for multilocular disk pores in the spiracular region; derm setae small, fairly stout, scattered in the head and thoracic regions, becoming very much larger and arranged in transverse rows in the middle of the "tail" and then quite small and spiny at its apex; gland pores apparently entirely lacking throughout most of the "tail"; anal ring represented by a chitinized tube without setae, opening a short distance before the apex of the "tail"; the latter quite heavily chitinized.

*Intermediate stage female* (not of Maskell's description).—Occurring, so far as noted, within the half-formed gall of the species; maximum length mounted on a slide about 2.5 mm.; turbinate or top-shaped, but somewhat flattened on the longitudinal vertical axis; antennae even more minute than in adult; no trace of legs; spiracles shaped much as in adult; mouthparts as in adult; gland pores apparently of only two types, multilocular disk and minute 8-shaped set at the bottoms of small tubes, both as described for the adult, both much less numerous than in that stage; derm setae very few, small, scattered, except on the conical apex of the abdomen, where they are more numerous and larger; anal tube small, swollen in the middle, without setae.

*Larva*.—Elongate oval, antennae apparently 6-segmented, the terminal segment with a long apical and another subapical seta, and a stout curved spine, the second segment from the last with a similar spine, the second segment with two long setae; legs rather slender, claw slender with tip strongly curved, no denticle, the two claw digitules exceeding the claw, the two tarsal digitules even longer, all these slender, slightly knobbed at apex; apex of abdomen with two

long slender setae and between these a conical invaginated tube showing at the inner end a hairless anal ring; derm dorsally and along the margin with large and prominent 8-shaped pores, each set at the bottom of a short tube, and present in two different sorts of arrangement, as shown in figure; no further evidence available to indicate whether such difference is connected with different sexes or what is responsible for it; spiracles small, each accompanied by a single multilocular disk gland pore.

One other species, *F. semioculta* Maskell, has been placed in this genus. The mounts of this species in the Maskell collection are in such condition that it is not possible to be certain regarding the correctness of this placing. It appears to have been properly assigned to *Frenchia*, however, and may readily be separated from the type species by the fact that the "tail" is much shorter, stouter, and semicircularly rounded at apex.

The following generic diagnosis is based principally on the type species, with such modifications as would seem to include the other described species.

#### GENERIC DIAGNOSIS OF FRENCHIA.

Asterolecanine coccids producing peculiar woody galls on or in the host, the adult female disk-shaped, with a long tail-like prolongation of the apex of the abdomen, chitinized at tip; antennae very much reduced; legs wanting; mentum 1-segmented; anal ring developed into a short tube and without setae; derm with circular multilocular disk pores, long tubular ducts, and minute 8-shaped pores; derm setae few, small and scattered, larger and more numerous on the abdomen; no traces of spiracular spines or thickenings around anal ring; intermediate stage female flattened turbinate; antennae very much reduced; legs wanting; only multilocular disk pores and minute 8-shaped gland pores present; otherwise much as in adult; larva elongate oval; antennae apparently 6-segmented; legs slender, digitules all normal, slender, knobbed, claw without denzicle; body with two long apical setae; anal ring minute, without setae, placed at bottom of invaginated tube; dorsum and sides of body with rows of large 8-shaped pores.

As indicated in the generic description, this genus is placed without question in that group of genera containing *Asterolecanium* and others, a position which has already been suggested by Mr. E. E. Green.<sup>5</sup> The gall-making habit and the development of the long "tail" are the only characters showing any connection with the so-called Brachyscelini while all of the morphological characters available for study indicate a definite relationship with the Asterolecaninae.

<sup>5</sup> Cocc. Ceylon, pt. 4, 1909, p. 295.

## Genus SOLENOCOCCUS Cockerell.

Plate 1, fig. 5.

*Genotype*.—*Solenophora fagi* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 58.

Maskell originally described this genus, using the preoccupied name *Solenophora*, and including two species. Cockerell later changed the name to that given above, but the type does not appear to have been fixed until its publication in the Fernald Catalogue in 1903.

The type species is represented in the Maskell collection by three slides, one of "larvae on *Fagus menziesii*, Sept., 1889," one of "female 2nd stage, on *Fagus menziesii*, Aug., 1889," one of "adult female on *Fagus menziesii*, Aug., 1889," and by a few unmounted specimens under No. 107. The National collection of Coccidae contains a portion of the type material, and additional mounts have been secured from it. The appearance and habit of the insect have been satisfactorily described and figured by Maskell.

*Adult female*.—Body oval, somewhat tapering behind, with a large lobe projecting out over the anal ring and lobes<sup>o</sup>; antennae minute tubercles bearing about 5-6 setae, and possibly very obscurely segmented; legs entirely wanting; without spiracular spines; mentum short triangular, perhaps obscurely 2-segmented; body with long-tubular ducts and 8-shaped and multilocular pores of two sizes, tubular ducts most abundant along margin of body, but also present, widely scattered, dorsally, 8-shaped pores quite variable in size, rarely appearing trilocular and all more or less deeply set into cups, the largest in a group on each half of the posterior body lobe, and joined to these groups a continuous but irregular ventral band of these pores, varying considerably in size and several deep, running clear around the body margin without interruption, and finally with numbers of these same pores, mostly quite small, scattered over the ventral surface or in more or less distinct rows on the abdomen; with clusters of small, apparently quinquelocular disk pores accompanying each spiracle, these scattered among the submarginal 8-shaped pores for some distance opposite each spiracle; also with minute circular disk pores accompanying the band of 8-shaped pores, their internal structure not determinable, but possibly tri- to quinquelocular; dorsally, near the posterior apex of the body, with two clusters of small cribriform plates, each group composed of two to three separate plates; body dorsally apparently without setae, ventrally, particularly on the posterior lobe, with a few, small, stout setae; anal ring small,

<sup>o</sup>The relative positions of the different structures as given in this description have been studied very carefully and are believed to be correct, but it has not been possible to segregate dorsal and ventral structures absolutely from the material at hand.

with a single row of pores and six rather short setae; anal lobes well developed, but small, elongate, rather slender, tapering, with a stout apical spine a little longer than the lobe, and three small stout setae on the inner face of each; anal ring surrounded by a simple, somewhat chitinized tube, continuous with the lobes, this produced dorsally into a median cauda, about as long as an anal lobe, tapering, and with the apex rounded.

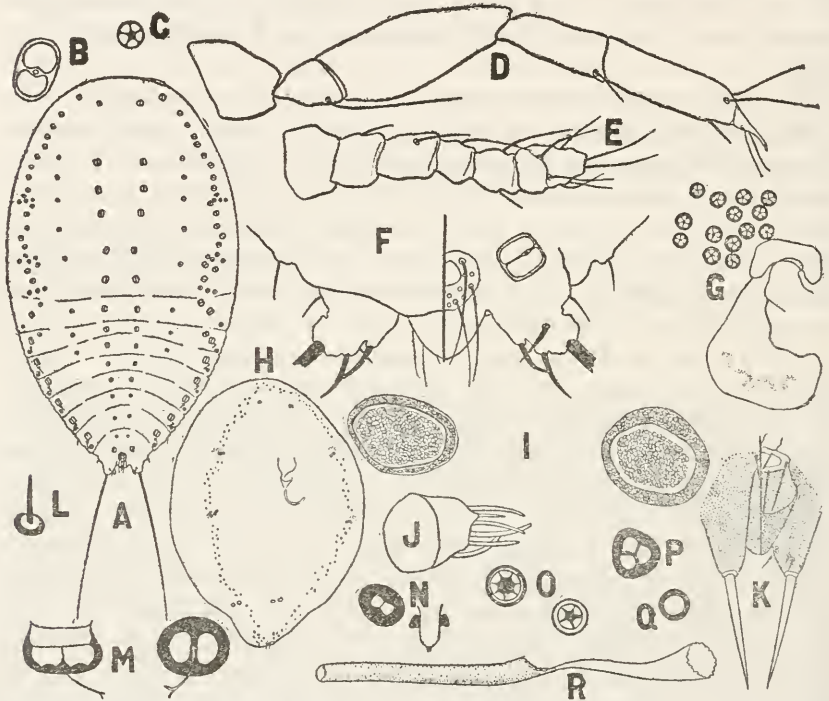


FIG. 6.—*SOLENOCOCCUS FAGI* (MASKELL). A. LARVA, OUTLINE, DORSAL,  $\times 115$ ; B. LARVA, 8-SHAPED PORE,  $\times 640$ ; C. LARVA, QUINQUELOCLULAR PORE,  $\times 640$ ; D. LARVA, MIDDLE LEG,  $\times 335$ ; E. LARVA, ANTENNA,  $\times 335$ ; F. LARVA, APEX OF ABDOMEN,  $\times 440$ ; G. ADULT FEMALE, SPIRACLE,  $\times 640$ ; H. ADULT FEMALE, OUTLINE OF BODY SHOWING POSITION OF STRUCTURES,  $\times 30$ ; I. ADULT FEMALE, DORSAL CRIBRIFORM PLATES,  $\times 880$ ; J. ADULT FEMALE, ANTENNA,  $\times 640$ ; K. SAME, ANAL LOBES AND RING, SHOWING TERMINAL SETA AND DORSAL TRIANGULAR CAUDA,  $\times 335$ ; L. SAME, BODY SETA,  $\times 1500$ ; M-R. VARIOUS TYPES OF PORES FOUND ON BODY OF ADULT FEMALE,  $\times 1500$ .

*Intermediate stage female.*—(from Maskell slide only) Apparently differing from the adult only in having the antennae a little more developed, in having more 8-shaped pores, occurring dorsally as well as ventrally, and in lacking the cribriform plates.

*Larva.*—(Maskell slide only) Oval, legs and antenna normally developed, the latter 6-segmented, body with a marginal row of large, 8-shaped pores set at the bottoms of short tubes and doubled up, each in the abdominal region accompanied by a quinquelocular disk pore, also with a dorsal median double row of the same 8-shaped pores, these diverging anteriorly and becoming much reduced in size

on the posterior abdominal segments, and between the median and marginal rows with still another row of smaller pores on each side of the body; anal lobes present, with a long terminal seta, two small spines and two setae on each; anal ring with pores and six setae; cauda present, rounded; no body spines noted; mentum 2-segmented, with indications of a second joint close to the base.

*Cotype*.—Cat. No. 24756, U. S. N. M.

There are 10 species besides the type that are included in this genus at present. No careful study of all of them has been possible, but from such notes as have been made, it seems probable that their inclusion in this genus is correct.

The following generic diagnosis has been based primarily on the type species, but should also cover other species which may properly be included with it.

#### GENERIC DIAGNOSIS OF SOLENOCOCCUS.

Asterolecanine coccids forming a horny or tough waxy test usually with a posterior tube or spout; adult female membranous, antennae reduced to tubercles; legs wanting; without spiracular spines, with dorsal cribriform plates, with well developed anal tubercles, with a median cauda above the anal ring, the latter with pores and six setae, derm setae relatively few and inconspicuous; derm with numerous 8-shaped pores, sometimes more or less definitely arranged, rather large quinquelocular pores and long tubular ducts, and finally minute clear or faintly multilocular pores; intermediate stage female quite similar to adult, but without cribriform plates; larva with 6-segmented antennae, normal legs, 8-shaped pores in longitudinal rows both dorsally and laterally, some large quinquelocular disk pores, well developed anal lobes, setae, a median cauda, and an anal ring with pores and six setae.

This genus appears to have a distinct and valid place within its subfamily, in so far as the character of the included species is concerned. The writers have had no opportunity to study the type of Comstock's genus *Cerococcus*, and are therefore unable to verify Green's indication that *Solenococcus* is a synonym of this genus, although from an examination of the available literature his conclusions appear to have been correct.<sup>7</sup>

#### Subgenus THEKES Maskell.

Plate 2, fig. 1.

*Genotype*.—*Eriococcus eucalypti* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, pp. 70, 74.

As Mr. Crawford's only connection with the name given above was to place it as a label on some of the specimens in his collection, it

<sup>7</sup> See Green, Cocc. Ceylon, pt. 4, 1909, p. 305.

seems to the writers impossible to justify the crediting of this generic name to him. In view of Maskell's statement that *E. eucalypti* "by the characters of its sac and of its dorsal conical spines, belongs to that section of the genus of which the New Zealand *E. multispinosus* may be taken as the type," it would seem to follow that if Maskell is to be credited with the authorship of the subgenus, then this latter species should be taken as the type. Actually the first definite state-



FIG. 7.—*ERIOCOCCLUS* (*THEKES*) *EUCALYPTI* MASKELL. A. LARVA, LEG,  $\times 440$ ; B. LARVA, ANTENNA,  $\times 440$ ; C. ADULT FEMALE, TUBULAR DUCT NEAR ANAL LOBES VENTRALLY,  $\times 1500$ ; D. ADULT FEMALE, HIND LEG,  $\times 165$ ; E. SAME, ANTENNA,  $\times 185$ ; F. SAME, VARIOUS SPINES FROM BODY,  $\times 640$ ; G. LARVA, ANAL LOBES,  $\times 440$ ; H. LARVA, ANAL PLATES,  $\times 220$ ; I. ADULT FEMALE, ANAL PLATES,  $\times 640$ ; J. LARVA, OUTLINE FROM ABOVE,  $\times 185$ ; K. ADULT FEMALE, QUINQUELOCULAR DISK PORE,  $\times 1500$ ; L. SAME, TUBULAR DUCT,  $\times 1000$ .

ment concerning the use of the name *Thekes* to designate a group higher than a species is that of Professor Cockerell,<sup>8</sup> as follows: "(2) *Rhizococcus* (?) *devonensis* Green, Ent. Record, 1896, p. 260. I should certainly prefer to call this *Eriococcus devoniensis*. We already know several species of *Eriococcus* with 7-jointed antennae; the subgeneric name *Thekes* Crawford ms. is available for them." As this statement stands, it certainly implies the designation of *E.*

<sup>8</sup> American Naturalist, vol. 31, 1897, p. 589.



*devoniensis* (Green) as the type of *Thekes*. Finally the Fernald Catalogue definitely assigns the subgenus *Thekes* to Maskell and places *eucalypti* as the type. The confusion outlined above represents a condition which the writers do not desire to comment on at present, and they have therefore followed the assignment of the type as given in the Fernald Catalogue, as well as its designation of the authorship of the genus.

The type species is represented in the Maskell collection by four slides, one of "adult female (Australia), 1891," one of "details of female (Australia), 1891," one of "larvae (Australia), 1891," and one of "male pupa in sac (Australia), 1891." In addition there are three separate lots of unmounted material, all bearing No. 205 as the only data connected with them, of which two seem to be *E. eucalypti*, while the third represents some other species of the genus *Eriococcus*, which we have not attempted to place.

*Adult female*.—Sac and external appearance much as described by Maskell; a brownish color given off by the body when treated with potassium hydroxide; antennae of normal eriococcine form, usually 7, rarely 8-segmented; legs of normal eriococcine form, hind coxae with numerous pores, mostly on the basal half; spiracles small, not unusual; mentum very short and stout, apparently 1-segmented; derm with numerous small, long-tubular ducts with cup-shaped bases and threadlike continuation, both dorsally and ventrally, some, near the posterior apex and apparently ventral, with flat heavy bases and the threadlike continuation seemingly wanting; ventrally anterior to the anal lobes with transverse bands of tiny disk pores, apparently quinquelocular; no pores accompanying the spiracles; derm ventrally with small setae in transverse rows in abdominal region, scattered in thoracic region; dorsally and laterally with numerous very short, conical spines, these approximately uniform in diameter of base, mostly of a peculiar nipple-like shape, tending to become longer and stouter at the margins near the posterior end; anal lobes broad and stout, heavily chitinized in decided contrast to the transparent derm, the inner face strongly notched where two of the spines attach, bearing these two stout spines on the inner upper face, one basal, one about the middle, and a third sub-basally and dorsally, a long apical seta, a smaller subapical, and a still smaller basal seta ventrally; anal ring small, of normal eriococcine type, with eight setae and a double row of pores, the inner row smaller and incomplete.

*Intermediate stage*.—Not available for study.

*Larva*.—Oval, antennae 6-segmented, legs normal, digitules long and slender, slightly knobbed, claw with denticle close to apex; derm dorsally, at least at end of abdomen, with a longitudinal row of trilocular pores on each side near margin, and with long-tubular

ducts alternating with the marginal spines; margin of body with a continuous series of stout conical spines, each constricted beyond the middle, dorsally with a submarginal row of smaller spines paralleling the margin, and in the mid-thoracic region about three pairs of similar spines; ventrally with a few slender setae; anal lobes not prominent, mostly invaginated into the posterior apex of the body, broadest behind the middle, dorsally with a stout spine at base, another near middle, and a third at outer angle, apically with a long seta about two-fifths the length of the body; ventrally with two rather large setae on the inner face; anal ring with pores and six setae, these about half as long as the anal lobe setae.

*Cotype*.—Cat. No. 24757, U.S.N.M.

The following generic description has been prepared from the preceding:

GENERIC DIAGNOSIS OF THEKES.

Eriococcine forms, adult female enclosed in a sac with posterior opening; body oval, convex, narrowed behind; antennae 7-8-segmented; legs normal, digitules slender, slightly knobbed, claw with denticle, hind coxae with pores; derm with numerous tubular ducts with cup-shaped bases both dorsally and ventrally and with multilocular disk pores ventrally in abdominal region; dorsally and at margins with numerous very short-conical, nipplelike spines, some of these near posterior end of body more elongate; ventrally with setae in transverse rows; anal lobes well developed, but rather short and broad, each bearing three stout dorsal spines and two ventral setae in addition to the long apical seta; anal ring with pores and eight setae; young larva oval, with 6-segmented antennae, normal legs, stout marginal and dorsal spines, trilocular pores and tubular ducts; anal lobes with spines and setae as in adult, anal ring with six setae.

The writers consider it very doubtful if this subgenus has any valid standing, and at present regard it as representing nothing more than a possible key or table section within the genus *Eriococcus* which may break down entirely when the species of that genus are better known.

Genus CYLINDROCOCCUS Maskell.

Plate 2, fig. 2.

*Genotype*.—*Cylindrococcus casuarinae* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 84.

Maskell established this genus with two included species, and the first definite designation of type appears to have been made in the Fernald Catalogue, as referred to above.

The type species of this genus is represented in the Maskell collection by three slides, one of "larvae, 1891," one of "adult female,

1891"; one of "feet of female, 1891"; and by one unmounted female and two galls under No. 226. The National collection of Coccidae fortunately contains a few lots of this species, received from various entomologists in Australia, and from these it has been possible to prepare additional mounts for study. The following descriptions have been obtained from all the material available; as Maskell's description and figures of the gall seem quite satisfactory nothing is added on this.

*Adult female*.—Elongate, parallel-sided; derm clearing on boiling in potassium hydroxide, except the posterior lobe of the body, this remaining somewhat chitinized; antennae acute conical, the segmen-

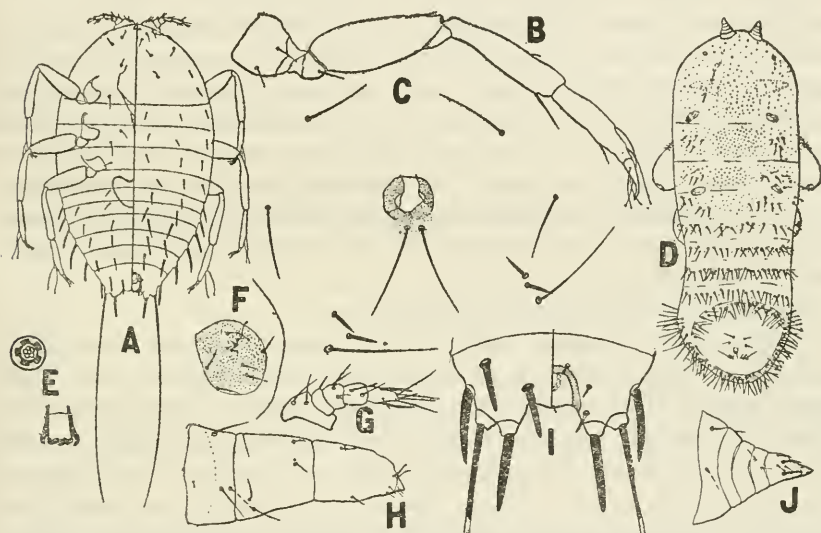


FIG. 8.—CYLANDROCOCCUS CASUARINAE MASKELL. A. LARVA, OUTLINE,  $\times 115$ ; B. LARVA, MIDDLE LEG,  $\times 335$ ; C. ADULT FEMALE, ANAL RING AREA,  $\times 115$ ; D. ADULT FEMALE, OUTLINE FROM ABOVE,  $\times 17.5$ ; E. ADULT FEMALE, DISK PORE, TWO VIEWS,  $\times 640$ ; F. ADULT FEMALE, TIP OF MIDDLE LEG,  $\times 115$ ; G. LARVA, ANTENNA,  $\times 335$ ; H. ADULT FEMALE, ANTERIOR LEG,  $\times 115$ ; I. LARVA, APEX OF ABDOMEN,  $\times 335$ ; J. ADULT FEMALE, ANTENNA,  $\times 115$ .

tation incomplete, but perhaps 5-segmented; with two small, inconspicuous eye-spots near the antennae; anterior legs stout, fingerlike, the tibio-tarsal articulation very incompletely indicated, the trochanter apparently fused with the femur; intermediate legs represented by large evaginated pouches or sacs at the apex of which are small, somewhat chitinized plates, each bearing the rudiments of a claw, digitules and some setae; posterior legs represented by smaller lobes with the apices even less developed than in the intermediate pair; the prominence of these sacs apparently varying inversely in proportion to the extent of the distension of the body through ovarian development; mentum apparently 1-segmented, the additional seg-

ment described by Maskell not located, very short and stout triangular; spiracles not accompanied by any circular multilocular pores; anal lobes entirely lacking, their presence indicated only by two pairs of short spines, each pair accompanied by a slender seta, and each set diagonally behind the anal ring; anal ring simple, but apparently bearing two setae, placed close together just outside of the ring proper, and morphologically the lower pair; posterior apex of body more heavily chitinized, forming a somewhat circular disk bearing numerous long setae, and, in the center, the anal ring, the setae arranged in two roughly circular irregular bands at the outside, in three transverse rows anterior to the anal ring, and in an irregular circular cluster around the ring; the anterior body segments with similar setae along the margins, these in transverse rows on each side in the abdominal segments, but irregularly scattered along the margins of the thoracic and head segments, gradually averaging smaller anteriorly; derm. so far as noted, with only a single type of pore, this multilocular disk with 5-7 loculi, set at the bottom of a short tube, fairly numerous, but scattered, over the whole anterior portion of the body, less numerous on the chitinized apical disk, wanting in the immediate vicinity of the anal ring, present both dorsally and ventrally.

*Intermediate stage female.*—Not known.

*Larva.*—(The Maskell slides of this stage show the larva of *C. spiniferus*, not of *casuarinae*, but this fact modifies the description given by him only in regard to the body spines.) Oval, somewhat narrowed behind, antennae 5-segmented, not with six; legs normal; mentum apparently 1-segmented; body, at least in the abdominal region, with five rows of large spines on each side, two dorsal, one marginal, and two ventral, the spines in the latter smaller, all stout and long, but pointed at apex; the spines in *spiniferus* considerably longer than in true *casuarinae*, flattened and incised at apices, not pointed; anal lobes well developed, each with a stout apical spine and a long apical seta, also bearing two smaller spines; anal ring apparently simple, with a chitinized flange above, beneath this two widely separated short spines, and at the bottom two more short spines set close to each other; spines of head reduced to small, relatively slender setae.

Three species besides the type have been placed in this genus. The writers have no information at present in regard to *C. gracilis* Fuller. As noted by Maskell when describing it, *C. amplior* Maskell is very difficult to separate from *C. casuarinae*. *C. spiniferus* Maskell shows some conspicuous differences from the type and is possibly not congeneric with it. In the adult of this species the body, legs, antennae, spiracles, and derm pores appear to be of the same general character

as those found in *casuarinae*. The derm bears stout spines as well as slender setae; the posterior apex of the body is more chitinized and bears in the middle of its disk a pair of heavily chitinized plates, these together forming nearly a circle, and fused along their inner edges with the outer margins of each bearing 4-5 large stout spines; these plates obscuring the anal ring so that its structure can not be determined definitely, but apparently it is entirely without setae. In the larva only the differences in the body spines have been noted.

In the following generic diagnosis an attempt has been made to include both species discussed above within the limits indicated.

GENERIC DIAGNOSIS OF CYLINDROCOCCUS.

Coccids forming woody galls, possibly Eriococcine, adult female with cylindrical body, membranous derm with posterior apex more heavily chitinized in form of a more or less circular disk; antennae short-conical, indistinctly segmented, legs abnormal, much reduced or represented by evaginated pouches; spiracles without multilocular disk pores; mentum 1-segmented; anal lobes wanting, position indicated by grouped spines and setae or fan-shaped spined plates; anal ring simple, setae much reduced in number or wanting; body with setae or spines and setae, the setae long, rather stout, much more abundant at apex of abdomen; with only one type of derm pore, these multilocular, usually quinquelocular disk pores, set at bottom of small tube; larva oval, tapering posteriorly, antennae 5-segmented, set close together, legs normal, abdomen with rows of long, stout setae dorsally and ventrally; anal lobes well developed, each with an apical spine and seta; anal ring simple, with some spines or setae set close to it.

The genus was not assigned to any higher coccid group by Maskell when he originally described it, but was placed by Cockerell in the tribe Eriococcini in his Tables for the Determination of the Genera of Coccidae.<sup>9</sup> The writers have no further changes to suggest at present.

Genus SPHAEROCOCCOPSIS Cockerell.

Plate 2, fig. 3.

*Genotype*.—*Sphaerococcus inflatipes* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 85.

This genus was established by Cockerell on the basis of the presence of legs in the adult female, as contrasted with the condition in *Sphaerococcus*; actually the two genera, as represented by the type species, are very remotely related, if at all. Only the single type species, with its variety, was known when the genus was established, and none have been added subsequently.

<sup>9</sup> Can. Ent., vol. 31, 1899, p. 277.

The Maskell collection contains two slides of this species, both of "adult female, 1892," and a strip of bark bearing a number of the tests of the insect. From the latter it has been possible to obtain mounts of the adult, cast skins believed to be of the second stage female, and very young larvae, and the following description has been prepared principally from these mounts. The unmounted material bears No. 294.

Before proceeding further it may be well to note that the previous generic characterization is fundamentally wrong, in that the type species possesses a well developed anal ring bearing six large and a few smaller setae.

*Adult female*.—Test and body about as figured and described by Maskell; antennae reduced, of 6 segments; with three pairs of legs, the two anterior pairs reduced, about half the size of the posterior pair, and appearing more or less deformed; all legs with few setae, the tarsal claws short, the digitules apparently normal, slender, knobbed, but usually injured, posterior tibia and tarsus nearly as thick as femur; mentum apparently 1-segmented, no second segment observed, short and broad conical; spiracles not unusual; without anal lobes, these replaced by a group of large heavy spines, fringing the dorsal area and standing above the anal ring, there being four such spines close together in the middle, then a large seta on each side, then about four more large spines; the region around the anal ring and between it and the spines with numerous slender setae, mostly small, but varying in length; anal ring medium in size, circular, and very stout, set at the inner end of a short tube, with about 10 setae, of which six are larger than the remainder, the ring itself with pores only in circles around the bases of these setae; no traces of eyespots observed; dorsum with a flattened circular area, bordered by stout spines, in a single row continuous with those above the anal ring posteriorly, but considerably smaller and several deep laterally and anteriorly, and also scattered over the dorsal area anteriorly, this area crowded with "cells" of unknown function, but possibly glandular, these circular to irregularly oval in shape, very close together in the center, somewhat more scattered around the margin, mostly appearing as small tubercles or hemispherical nodules, which are continued onto the sides in less completely developed form; only one type of definitely developed gland pore noted, these quinquelocular disk pores, occurring in transverse bands ventrally; body with the stout spines already mentioned, these of two sorts, acutely tapering and pointed on the posterior portion of the body and much more bluntly pointed on the anterior portion; in addition with only slender, hairlike setae, varying considerably in size, a few scattered through the circular dorsal area, others occurring rather thickly ventrally, particularly in the abdominal region.

*Intermediate stage female*.—A cast skin, possibly of this stage but more probably of the larva, shown in the figure.

*Larva*.—Oval, tapering somewhat behind; antennae 5-segmented, legs normal but rather stout except the claw, this long and slender; with a marginal row of spines around the body, supplemented on the abdomen by a submarginal row of smaller spines and a median paired row on thorax and a second submarginal row on abdomen; dorsum of anterior part of body with numerous hemispherical tubercles, these continued onto the abdomen in a median paired row and

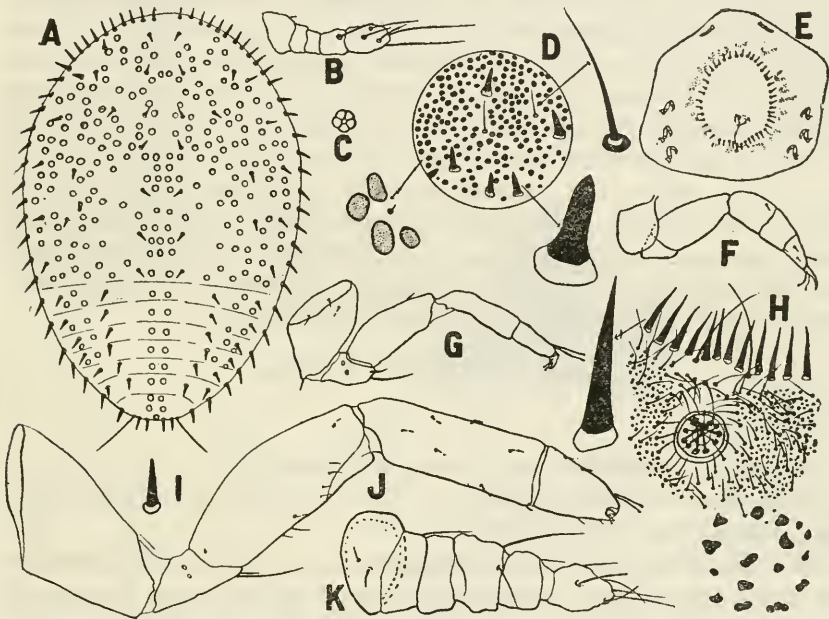


FIG. 9.—*SPHAEROCOCCOPSIS INFLATIPES* (MASKELL). A. LARVA, OUTLINE FROM ABOVE,  $\times 230$ ; B. LARVA, ANTENNA,  $\times 335$ ; C. ADULT FEMALE, QUINQUELOCULAR PORE,  $\times 640$ ; D. ADULT FEMALE, PORTION OF ANTERIOR DORSAL DERM SHOWING SPINES, SETAE AND "PORES,"  $\times 165$ ; E. CAST SKIN OF, POSSIBLY, SECOND STAGE FEMALE, BUT PROBABLY LARVA,  $\times 57.5$ ; F. LARVA, MIDDLE LEG,  $\times 335$ ; G. ADULT FEMALE, FORE LEG,  $\times 115$ ; H. ADULT FEMALE, ANAL RING AREA, WITH FRINGE OF SPINES ABOVE IT,  $\times 115$ , WITH DETAIL OF SPINE AND OF DERM,  $\times 335$ ; I. LARVA, MARGINAL SPINE,  $\times 640$ ; J. ADULT FEMALE, HIND LEG,  $\times 115$ ; K. SAME, ANTENNA,  $\times 220$ .

two submarginal rows on each side; anal ring small, circular, apparently with pores, but no setae observed.

*Cotype*.—Cat. No. 24758, U. S. N. M.

After an examination of Maskell's slides of the variety described by him the writers are of the opinion that it is clearly a distinct species, the differences pointed out by Maskell in his description as well as a number of others being quite pronounced. The generic diagnosis which follows has been modified to include this species as well.

## GENERIC DIAGNOSIS OF SPHAEROCOCCOPSIS.

"Dactylopiine" coccids of the Fernald Catalogue, of uncertain location, possibly Eriococcine, but evidently not closely related to the Pseudococcus group of genera; adult female secreting a firm, compact, waxy test, almost horny externally, with spongy inner layer and with circular median dorsal opening, the test more or less sunken in a depression in the bark of the host; adult female circular, like a flattened globule, with a circular to oval dorsal chitinized area; antennae more or less reduced; all legs present, more or less abnormal, the posterior pair much larger than the others; mentum 1-segmented. anal lobes wanting, represented by a pair of long setae and a fringe of large tapering spines above the anal opening; anal ring stout and circular, with setae, and with or without pores, these when present in circles around the setae of the ring; body with dorsal area bearing numerous hemispherical nodules and surrounded by a circle of spines, also with numerous slender setae ventrally and laterally; only a single type of derm pore present, these quinquelocular disk pores; larva oval, antennae 5-segmented, legs normal but stout, with rows of dorsal and lateral spines and numerous hemispherical nodules dorsally; anal ring circular, without setae, and lobes not developed.

## Genus CALLOCOCCUS Ferris.

Plate 2, fig. 4.

*Genotype*.—*Sphaerococcus pulchellus* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, p. 87.—Ferris, Can. Ent., vol. 50, Oct., 1918, p. 328.

This genus has only recently been established by Ferris to include the single type species. Except for what is believed to be the second stage female, which is described here for the first time, the descriptions of Maskell and Ferris have covered the species rather thoroughly, and the writers have noted only a few apparent discrepancies in these descriptions.

The Maskell collection includes three slides of the type species, one labeled "adult female, 1896," one "adult female, side view, 1896," and one "late 2nd stage female, 1896," and a small amount of unmounted material under No. 504, from which it has been possible to obtain additional mounts of the different stages. It may be noted that if the writers have correctly identified and described the intermediate stage female, then Maskell's "late 2nd. stage ♀" actually represents an early adult form.

*Adult female*.—Somewhat elongate oval, sac-like; derm transparent except for a longitudinal median, dorsal, perforated, chitinized band, continuing around both apices of the body onto the venter, and



supplemented in the middorsal region by two short additional bands, one on each side of and close to the median and paralleling it; antennae reduced to minute unsegmented tubercles bearing 2-3 short setae; without any traces of legs; mentum apparently 1-segmented; spiracles not unusual; with no traces of spiracular spines; body both dorsally and ventrally with scattered tubular ducts with cup-shaped bases and long slender terminal tubes, these more numerous near the

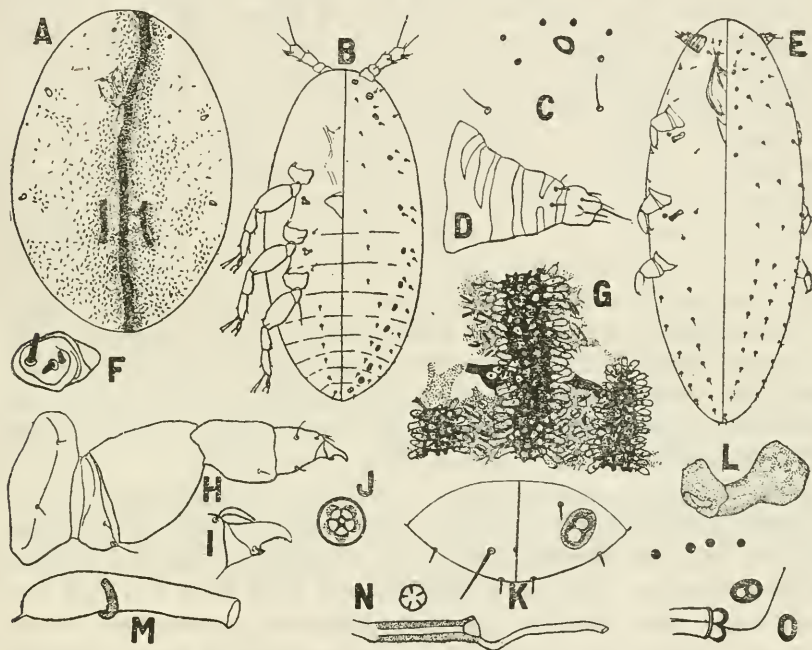


FIG. 10.—*Callococcus pulchellus* (Maskell). A. ADULT FEMALE, OUTLINE,  $\times 26.5$ ; B. LARVA, OUTLINE,  $\times 115$ ; C. ADULT FEMALE, ANAL RING AND ADJACENT PORES AND SETAE,  $\times 335$ ; D. INTERMEDIATE STAGE FEMALE, ANTENNA,  $\times 335$ ; E. INTERMEDIATE STAGE FEMALE, OUTLINE,  $\times 57.5$ ; F. ADULT FEMALE, ANTENNA FROM ABOVE,  $\times 640$ ; G. ADULT FEMALE, DETAIL OF DORSAL PORE BAND IN ANTERIOR ABDOMINAL REGION,  $\times 115$ ; H. INTERMEDIATE STAGE FEMALE, MIDDLE LEG,  $\times 335$ ; I. SAME, CLAW,  $\times 640$ ; J. ADULT FEMALE, DISK PORE ADJACENT TO SPIRACLE;  $\times 1500$ ; K. LARVA, APEX OF ABDOMEN,  $\times 640$ ; L. ADULT FEMALE, SPIRACLE,  $\times 335$ ; M. ADULT FEMALE, TUBULAR DUCT OF SORT FOUND IN HEAVY BAND,  $\times 1000$ ; N. SAME, TYPE FOUND OVER THE BODY,  $\times 1000$ ; O. ADULT FEMALE, 8-SHAPED PORE FOUND IN HEAVY BAND, TWO VIEWS,  $\times 1500$ .

median chitinous band; with the 8-shaped pores reduced to an irregular double row running along the center of the chitinized band, and all set at the bottom of short tubercles; with a single row of large tubular ducts, perhaps modifications of the first type mentioned, strongly swollen, with an inverted cup near the middle, and another large swollen portion beyond this terminating in a short cylindrical thread; finally with a few quinquelocular disk pores in the vicinity of each spiracle; derm with only a very few widely separated, tiny,

spine-like setae, these most frequent in the area surrounding the anal ring; anal ring a minute ovate chitinous ring placed beyond the posterior end of the recurved dorsal chitinized band, and so located ventrally.

*Intermediate stage female*<sup>10</sup> (not of Maskell).—About 1 mm. long, elongate, slender, tapering and rounded at each end, the head more broadly; antennae 5-6-segmented, semirudimentary; broad and stout at base, and tapering strongly to a rounded point, the terminal two segments with some stout spines and setae; legs similarly reduced, stout, claw stout, with two large teeth at base, to which the digitules may possibly attach in perfect specimens, tarsal digitules normal, threadlike, apices slightly knobbed, not extending beyond the apex of the claw; mentum apparently 1-segmented; spiracles not unusual, with a single quinquelocular disk pore immediately adjacent; with a few similar pores dorsally in the thoracic region; derm both dorsally and ventrally thickly set with small knoblike protuberances, these largest dorsally in the anterior portion of the body, progressively decreasing in size to a finely granular condition in the abdominal region; derm with occasional little groups of stout spines each set in a ringlike base on the head, these in more or less distinct rows dorsally and ventrally on the remainder of the body, and somewhat larger posteriorly; anal ring small, simple, located at the posterior end of the body, without traces of anal lobes.

*Larva*.—Elongate oval, antennae with four stout segments, all bearing setae, and the last two with a short spine on each; legs normal, the claw long and slender, both pairs of digitules long and slender, knobbed at apices, the tarsal attached well back from the apex and much longer than the claw digitules; body with a marginal row of 24 large 8-shaped pores extending clear around the body; spiracles tiny, each bearing one quinquelocular pore; apex of abdomen without traces of anal lobes, but with a pair of relatively large and stout setae, between these the minute, simple anal ring, and above this a smaller pair of setae; each 8-shaped pore with a tiny seta above and below it, in addition with submedian rows of tiny setae both dorsally and ventrally on each half of the body; the median caudal lobe figured by Ferris not discernible in the limited material available for study.

*Cotype*.—Cat. No. 24759, U.S.N.M.

Both the second stage female and the young larvae were taken from a test which also enclosed an adult female. No species other than the type has been included in this genus, and in view of its peculiarities it is quite probable that it will continue to stand alone.

<sup>10</sup> Subsequent examination of various stages of related species suggests that the writers have possibly been mistaken in considering this as the second stage female, but no definite conclusion has been reached as to the stage it really represents.

The following generic diagnosis has been based on the preceding description.

GENERIC DIAGNOSIS OF CALLOCOCCUS.

Asterolecanine coccids with the adult female enclosed in a striated waxy test of peculiar form; adult female an elongate oval sac with a median dorsal chitinized stripe containing numerous pores and ducts; antennae reduced to tiny disks; legs wanting; mentum 1-segmented; spiracles not unusual; derm with minute 8-shaped pores at bottoms of short ducts, large tubular ducts with swollen inner ends, slender tubular ducts with cup-shaped bottoms and thread-like tube, and quinquelocular disk pores, with only the slender tubular ducts numerous; derm with a few small stout setae and no differentiated anal setae; anal lobes completely wanting, anal ring a minute ovate ring without setae; intermediate stage female elongate, slender, tapering, antennae semirudimentary, 6-segmented, legs reduced, claw digitules if present placed on teeth at base of claw, derm pores reduced to the quinquelocular type only, derm setae much as in adult, anal ring simple, at apex of body; larva elongate oval, with a marginal row of 8-shaped pores and a single quinquelocular pore attached to each spiracle, with small setae dorsally and ventrally in rows, antennae short and stout, 4-segmented, legs normal, digitules normal, anal ring simple, without traces of anal lobes, but with a pair of larger and stouter anal setae.

The writers at present incline to the belief that this genus will find its nearest known relative in the genus *Frenchia*, in spite of the occurrence of a considerable number of divergences.

Genus SPHAEROCOCCUS Maskell.

*Genotype*.—*Sphaerococcus casuarinae* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, p. 85.—Ferris, Can. Ent., vol. 51, Nov., 1919, p. 249.

This genus has just recently been redescribed and more correctly located by Ferris (1919), who has also called attention to some errors in Maskell's description. As *S. casuarinae* was the only species included by Maskell at the time he established the genus, it remains the type, and, as noted by Ferris, it is in all probability the only species of all that have been placed in the genus *Sphaerococcus* that can legitimately remain under that name.

The Maskell collection contains five slides of this species, all dated 1891, one of larva, two of second stage female, and two of adult female. There is also a single gall of *Cylindrococcus casuarinae*, under No. 221, which is supposed to bear a specimen of *S. casuarinae*, but the specimen is no longer present, and probably became detached while the gall was still mounted on a pin.

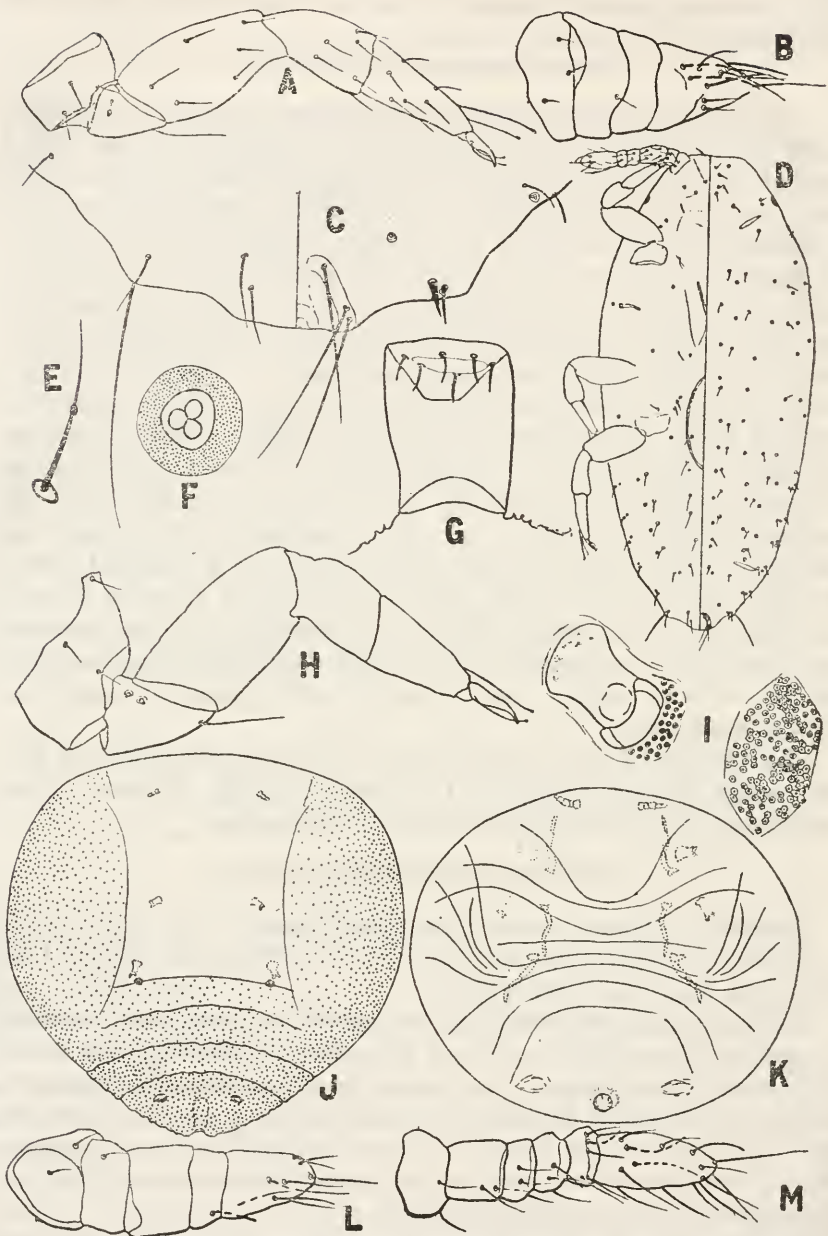


FIG. 11.—*SPHAEROCOCCUS CASUARINAE* MASKELL. A. LARVA, MIDDLE LEG,  $\times 335$ ; B. ADULT FEMALE, ANTENNA,  $\times 500$ ; C. LARVA, APEX OF ABDOMEN,  $\times 500$ ; D. LARVA, OUTLINE,  $\times 115$ ; E. ADULT FEMALE, DERM SETA,  $\times 1500$ ; F. ADULT FEMALE, ANAL RING,  $\times 165$ ; G. ADULT FEMALE, ANTERIOR LEG,  $\times 440$ ; H. INTERMEDIATE STAGE FEMALE, ANAL RING,  $\times 165$ ; I. ADULT FEMALE, POSTERIOR SPIRACLE AND ADJACENT PORE PATCH,  $\times 220$ ; J. ADULT FEMALE, OUTLINE,  $\times 30$ ; K. INTERMEDIATE STAGE FEMALE, OUTLINE,  $\times 57.5$ ; L. ANTENNA OF INTERMEDIATE STAGE FEMALE,  $\times 440$ ; M. LARVA, ANTENNA,  $\times 335$ .

Only the Maskell slide mounts have been available for study, and as these have not proven entirely satisfactory the following descriptions have been confined largely to notes on certain points.

*Adult female*.—This stage much as described by Maskell, except for the anal ring, this having six short stout setae, as noted by Ferris; the multilocular pores of Maskell's description, so far as can be noted, all trilocular, set at the bottom of short tubes, these appearing rifled as a gun barrel and their openings each surrounded by a circular chitinized plate; disk pores at the spiracular openings also apparently, but not certainly, trilocular; the exact character of the two glandular patches close to the posterior spiracles not determinable, but apparently made up of large simple pores, each surrounded by a chitinized circle and set in a polygonal area; only one type of body seta noted, these rather short and fairly stout.

*Intermediate stage, female*.—Differing from the adult, as noted by Maskell, in the smaller size, the presence of the legs, and in other particulars; both the tarsal and claw digitules present, not wanting as suggested by Maskell; with six anal ring setae, not two, and the ring set at the inner end of a tube as in the adult; body pores and setae apparently much as in the adult, but without the glandular patches behind the posterior spiracles as in the adult.

*Larva*.—Quite as described and figured by Maskell and Ferris.

With regard to the species placed in this genus by Maskell, a number have already been removed to other genera, and for the remainder it is possible to confirm the suggestion made by Ferris in discussing this genus, to the extent that none of the Maskell species now referred to the genus are congeneric with the type species, although such peculiar and diverse forms are included under this name that it is impossible to reassign them without extended study.

The following generic diagnosis is given for the sake of completeness in this paper.

#### GENERIC DIAGNOSIS OF SPHAEROCOCCUS.

Pseudococcine forms having dorsal ostioles, adult female globular, naked, antennae rudimentary, legs wanting, posterior spiracles accompanied by a large poriferous tract, anal ring set at the inner end of an invaginated tube, with pores and six setae, anal lobes wanting, derm with only one type of seta, and with only trilocular pores; intermediate stage, female, similar to adult, but smaller, lacking the poriferous patches and with the legs present and the antennae more developed; larva long oval, with 6-segmented antennae, normal legs, anal ring with pores and six setae, anal lobes slightly produced, with one pair of cerarian spines, one slender, and a long apical seta on each, and with some longitudinal rows of trilocular pores and slender setae.

As is noted by Ferris, this genus is separable from *Antonina* Signoret (as represented by the American and some other species) only by the retention of the legs in the stage preceding the adult, and by having the derm pores of the trilocular type only, all the species of *Antonina* available for examination (six in all) having large multilocular disk pores in addition to the triloculars.

Genus EREMOCOCCUS Ferris.

Plate 2, fig. 5.

*Genotype*.—*Sphaerococcus pirogallis* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, p. 87.—Ferris, Can. Ent., vol. 51, 1919, p. 252.

This is another genus recently described by Ferris, and so characterized that but little needs to be added to the previous descriptions. It has been possible to make certain corrections and additions, notably with respect to the curious invaginated character of the antennae in the adult female. Only the type species has been placed in this genus thus far.

The Maskell collection contains six slides of this species, one labeled "2nd stage female, 1893," two labeled "adult female, 1893," and three labeled "adult male, 1894," and a lot of material under Maskell No. 364, including a numerous cluster of the galls of the species. The following descriptive notes have been prepared from this material.

*Adult female*.—Enclosed in a pear-shaped gall as described by Maskell; body an oval sac, flattened above, with an oval, somewhat chitinized dorsal disk, corresponding to the flattened area, occupying most of the dorsum and presenting a rather nodulose appearance; with a wide band, consisting of numerous scattered, long, slender setae and large 8-shaped pores around the margin of this area, venter apparently without pores; with a few scattered setae anteriorly, and a rather numerous cluster around the vaginal opening; antennae of peculiar structure, the number of segments not exactly determinable, consisting of a short evaginated tubercular collar, and a long invaginated tube passing through the collar and far within, with about 5-6 large, stout setae of varying lengths lying at the bottom and pointing up through the tube toward its opening, the longest fully half the length of the tube; spiracles peculiar only in their lack of the multilocular disk pores that usually accompany these structures; legs entirely lacking; internal framework of mouthparts, as noted by Ferris, large and heavily chitinized; mentum apparently indistinctly 2-segmented; derm pores apparently only of the large 8-shaped type already mentioned, none of the loculi indicated by Ferris in his figure of these pores visible in specimens examined by the writers; derm setae of one type, as already described; anal ring

small, simple, circular, set in a small, circular, more heavily chitinized plate on the dorsal surface close to the posterior end of the body.

*Intermediate stage female*.—Differs from the adult chiefly in degree, the size smaller, the number of pores and setae very much less, and the antennae only a little invaginated, the antennal setae

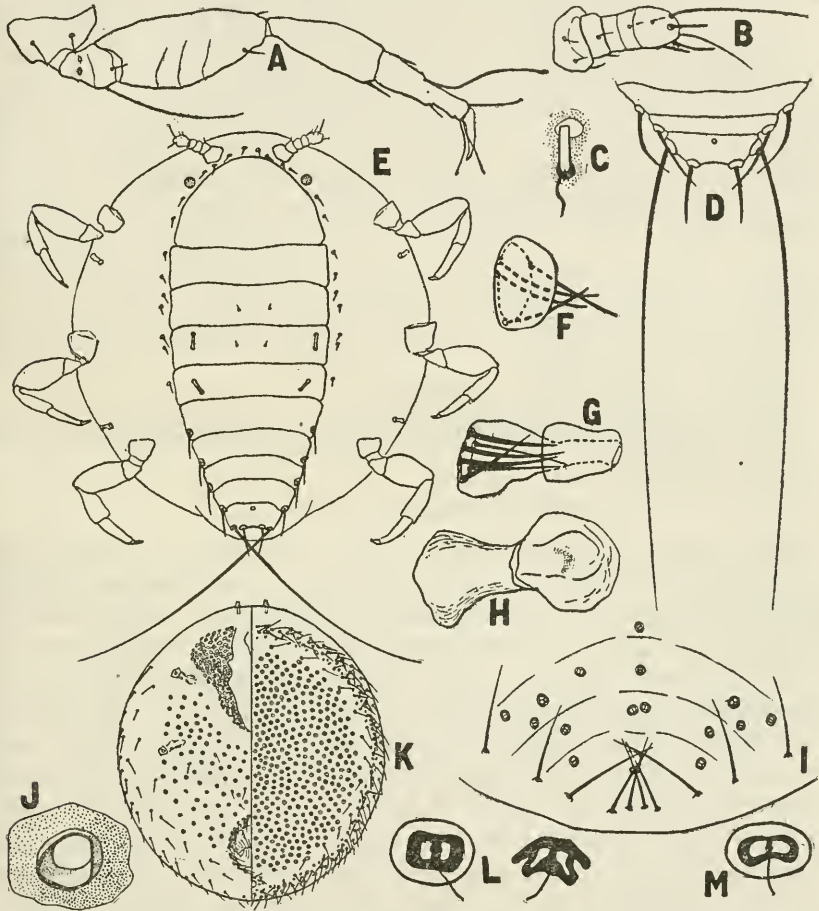


FIG. 12.—*EREMOCOCCUS PIROGALLIS* (MASKELL). A. LARVA, LEG,  $\times 440$ ; B. LARVA, ANTENNA,  $\times 440$ ; C. LARVA, TUBULAR DUCT,  $\times 640$ ; D. LARVA, APEX OF ABDOMEN,  $\times 440$ ; E. LARVA, OUTLINE, PROBABLY OF CAST SKIN,  $\times 165$ ; F. INTERMEDIATE STAGE FEMALE, ANTENNA,  $\times 640$ ; G. ADULT FEMALE, ANTENNA,  $\times 640$ ; H. ADULT FEMALE, SPIRACLE,  $\times 335$ ; I. INTERMEDIATE STAGE FEMALE, ANAL RING REGION,  $\times 230$ ; J. ADULT FEMALE, ANAL RING,  $\times 640$ ; K. ADULT FEMALE, OUTLINE OF BODY,  $\times 57.5$ ; L. AND M. 8-SHAPED PORES, DIFFERENT VIEWS, ADULT FEMALE,  $\times 1500$ .

protruding distinctly from the collar; the long setae near the anal ring in a more or less distinct single row (this not the 2nd stage female of Maskell).

*Larva*.—(2nd stage of Maskell) (cast skins only) Broad oval, rather pointed at posterior extremity, dorsum more heavily chitinized, forming an elongate oval area marked by distinct transverse seg-

mental divisions; antennae with two distinct basal segments and a long and large third one indistinctly divided into three segments, making a possible total of five segments; body with a few setae along the margin, these very small anteriorly, but much larger, stouter, and with one curved pair to each abdominal segment posteriorly, the apical segment with anal lobes very slightly indicated, and bearing a stout setae inside and a slender, hair-like, much longer one, perhaps two-thirds the body length outside, on each half; dorsally with a pair of small submedian spines on at least the anterior segments; gland pores, so far as can be observed, confined to two pairs, one pore located on the margins of, apparently, the first and second abdominal segments, these long tubular, with slightly swollen bottom, and apparently possessing a median dividing wall in the bottom portion of the tube; legs well developed, moderately heavy, the femora imbricated, the tarsal digitules attached peculiarly, as noted by Maskell; eye spots showing as small, round disks just behind the antennae.

*Cotype*.—Cat. No. 24760, U.S.N.M.

The following generic diagnosis has been prepared from the preceding description.

#### GENERIC DIAGNOSIS OF EREMOCOCCUS.

Gall making coccids belonging in the subfamily Dactylopiinae of the Fernald Catalogue; adult female an oval membranous sac, flattened and more heavily chitinized dorsally in a disk; antennae invaginated, segmentation indefinite, legs wanting, internal framework of mouth parts very large and heavy, mentum indistinctly 2-segmented; spiracles normal, not accompanied by disk pores; derm pores of one type only, large, heavy, 8-shaped; derm setae of one type only, stout, tapering; anal ring minute, simple, placed dorsally near posterior apex of body; no traces of anal lobes; intermediate stage female similar to adult, except smaller, body not chitinized dorsally, hairs and pores fewer, with an occasional pore trilobed; antennae less invaginated; larva oval, pointed behind, more chitinized dorsally, antennae distinctly 3-segmented, perhaps 5-segmented, legs well developed, one tarsal digitule placed about midway between the base and apex of tarsus, derm pores reduced to two pairs of long, heavy tubular ducts located on basal abdominal segments, body margin with setae, these stouter posteriorly, apex of abdomen without distinct anal lobes, but with one long slender seta; anal ring minute, simple.

The writers are not able to place this genus any more definitely than did the describer. The heavy 8-shaped pores suggest a possible connection with the Asterolecaninae, but there seems to be little else to bear this out.



## Genus EPICOCCUS Cockerell.

Plate 3, fig. 1.

*Genotype.*—*Coccus acaciae* Maskell.

*Reference.*—Fernald, Cat. Cocc. World, 1903, pp. 88, 89.

This genus as established by Professor Cockerell included only the type species, and none have been added to it subsequently.

There is a small number of unmounted specimens with the Maskell No. 505, one slide labeled "adult female, 1896," one "antenna and feet of female, 1896," and one "larva, 1896," under this name in the Maskell collection. It has been possible to obtain an additional mount of an adult female and a larva from the unmounted material, and these have proven to be of considerable assistance in preparing the following description.

*Adult female.*—Body, as stated by Maskell, dark red, usually much wrinkled, more or less globular or somewhat conical above, naked except for some ventral secretion, resembling some *Antonina* species in this respect; fully mature form, when boiled in potassium hydroxide expanding to an almost spherical sac, with the ventral surface slightly flattened; antennae small, 6-segmented, typically Pseudococcine in appearance; legs small but otherwise normal, claw without denticle, digitules normal, slender, knobbed, hind coxae with numerous pores; mouthparts small, mentum apparently 2-segmented; dorsal ostioles obscure; with only the two posterior pairs of cerarii present as such, the remainder of the margin of the ventral surface with a continuous band of trilocular pores and short, slender, tapering but blunt-tipped spines, together with an occasional slender seta, the cerarian spines slender, acute at apices, somewhat lanceolate, and considerably larger than those of the band; spines of band clustered more or less, although very indistinctly, into small groups with only pores intervening; anal lobe cerarii set on small protuberances, each accompanied by a slight chitinized area and each composed of from 10–15 lanceolate spines, accompanied by a somewhat larger number of small triangular pores; with a relatively large and stout apical seta below, but this shorter and more slender than the anal ring setae; without ventral chitinized thickenings; anal ring small, with pores in an inner and an outer row on each half, with six relatively large, stout setae, placed dorsally quite a distance from the apical cerarii, as compared with other Pseudococcine forms, and at the inner end of a short delicate membranous tube which is much longer below than above: with the two long setae usually occurring below the anal ring in *Pseudococcus* and related forms placed directly between the two apical cerarii and at a distance from the ring; derm, so far as noted, with three types of pores, the usual trilocular, triangular pores, occurring in the cerarii, the marginal band and widely

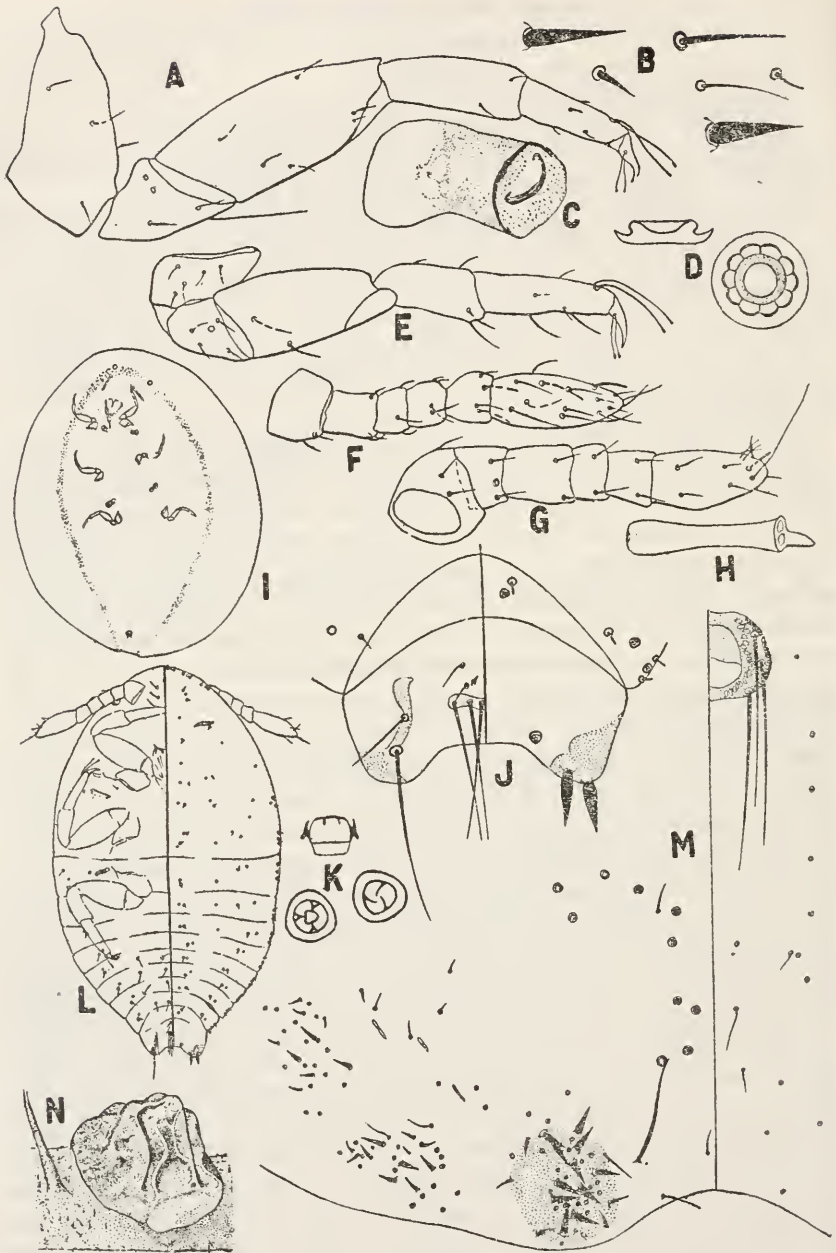


FIG. 13.—*EPICOCCLUS ACACIAE* (MASKELL). A. ADULT FEMALE, MIDDLE LEG,  $\times 115$ ; B. ADULT FEMALE, BODY SPINES, THE LARGEST FROM CERARII,  $\times 500$ ; C. ADULT FEMALE, SPIRACLE,  $\times 115$ ; D. ADULT FEMALE, VENTRAL DISK PORE, TWO VIEWS,  $\times 1500$ ; E. LARVA MIDDLE LEG,  $\times 335$ ; F. LARVA, ANTENNA,  $\times 335$ ; G. ADULT FEMALE, ANTENNA,  $\times 115$ ; H. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ ; I. ADULT FEMALE, OUTLINE OF BODY FROM BELOW,  $\times 17.5$ ; J. LARVA, APEX OF ABDOMEN,  $\times 440$ ; K. ADULT FEMALE, TRILOCULAR PORE, THREE VIEWS,  $\times 1500$ ; L. LARVA, OUTLINE OF BODY,  $\times 115$ ; M. ADULT FEMALE, APEX OF ABDOMEN SHOWING CERARII, ANAL RING, ETC.,  $\times 165$ ; N. HABIT SKETCH, ADULT FEMALE,  $\times 7.5$ .

scattered over the dorsum, these larger in the anterior portion of the band, the large multilocular disk pores, occurring ventrally in the abdominal region, and the short cylindrical tubular ducts, these occurring rarely in or adjacent to the marginal band; possibly with tiny quinquelocular pores near the spiracle, but the structure of these not determinable with certainty; with large, lanceolate cerarian spines, smaller, more slender, blunt-tipped spines in the marginal band, and scattered widely on the dorsum, slender tapering peglike spines; with slender setae of varying sizes in the marginal band and widely scattered on the body.

*Intermediate stages*.—None available for examination.

*Larva*.—Oval, slightly pointed behind, abdominal segmentation distinct; antennae 6-segmented, the last much the longest; legs normal, claw simple, digitules normal; mentum indistinctly 2-segmented; anterior dorsal ostioles set back well behind the anterior border of the framework of the mouthparts, posterior between the fifth and sixth (visible) abdominal segments; anal lobes somewhat produced, short triangular, more heavily chitinized than the derm, chitinization continued anteriorly beneath as a narrow strip bearing the ventral setae, with a pair of large lanceolate spines above, one apical, the other just before it, and a long slender, subapical ventral seta and a shorter basal one; anal ring overlapped above by the dorsal derm, open beneath, set in rather deeply between the anal lobes, cellular and with six long setae, the longest extending beyond the apex of the anal lobes; with two pairs of slender setae, the upper about twice the length of the lower, just beneath the anal ring; upper surface with trilocular pores and slender, peg-like spines, these mostly paired together and on the abdomen in three longitudinal rows on each half of the body, the outer row marginal, the inner submedian, ventral surface with a submedian row of slender setae, and three rows of peg-like spines, similar to but longer and more slender than the dorsal ones, on each half of the abdomen, the outer row nearly marginal.

*Cotype*.—Cat. No. 24761, U.S.N.M.

The following generic diagnosis has been prepared from the preceding description.

#### GENERIC DIAGNOSIS OF EPICOCCLUS.

Pseudococcine forms, having dorsal ostioles, triangular pores, cerarii and other structures normal to that group; adult female globular or nearly so, antennae 6-segmented, normal, legs normal, mentum obscurely 2-segmented. only the two posterior pairs true cerarii, rest represented by continuous marginal band of spines and pores, the former somewhat grouped, each cerarius composed of a cluster of lanceolate spines and triangular pores, the apical pair slightly chitinized beneath, no ventral chitinous thickening. anal ring placed dors-

ally, well separated from lobe area, with six setae and two rows of pores, apical seta of lobes smaller than anal ring setae; derm with three distinct pore types, triangular, multilocular disk and cylindrical tubular, and with lanceolate spines (cerarian), slender peg-like spines and slender pointed setae of varying sizes; larva oval, antennae 6-segmented, legs normal, dorsum with triangular pores and slender peg-like spines, anal ring normal, with six setae, anal lobes developed, each with a pair of large lanceolate spines dorsally and a subapical and subbasal seta, only the anal lobes with indications of cerarii.

As will be noted from the preceding description, this species was incorrectly described by Maskell, and consequently very inaccurately placed. Cockerell in creating the genus *Epicoccus* for this species placed it more correctly, stating that it was "Dactylopiid," which presumably meant that he followed his key to the genera of Coccidae in placing it, and so referred to what is called the subfamily Dactylopiinae of the Fernald Catalogue. In this catalogue the genus is placed just before *Phenacoccus*, which locates it still more correctly. The genus is actually a member of the group, probably a subfamily, of which *Pseudococcus* may be looked upon as the typical genus. The writers are not sufficiently familiar with this group of genera to state whether or not this genus is synonymous with any other previously or subsequently described genus, nor to place it with any accuracy in the series, although from present knowledge its affinities appear to lie with *Ripersia* and its relatives.

#### Genus LACHNODIUS Maskell.

*Genotype*.—*Dactylopius eucalypti* (Maskell).

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 95.

Maskell included three species in this genus, one previously described and two new, at the time he originally established it, and the type does not appear to have been fixed until the publication of the Fernald Catalogue, in which *eucalypti* is indicated as the genotype.

There are six slides of this species in the Maskell collection, one of "adult female, Australia, 1886," one of "adult female, 1893," one of larvae, Australia, 1886," one of "larvae, 1894," one of "adult male, Australia, 1886," one of "antennae and feet of male, Australia, 1886." The 1886 slides are evidently the types of the species. In addition there is a very small amount of material in position on the host, under Maskell No. 206. From this material the following description, supplementary to that given by Maskell, has been prepared.

*Adult female*.—Body of mounted female nearly circular, antennae 7-segmented, similar to the *Eriococcus* type rather than to the *Pseu-*

*dococcus* type, the two basal segments each with a long seta; and the apical segment with several fairly long setae; legs not very long, fairly stout, the tibia and tarsus thick, tarsal claw short and stout, without denticle, digitules normal, threadlike, with swollen tips; coxae without pores, but with two long setae at apex below; eyespots

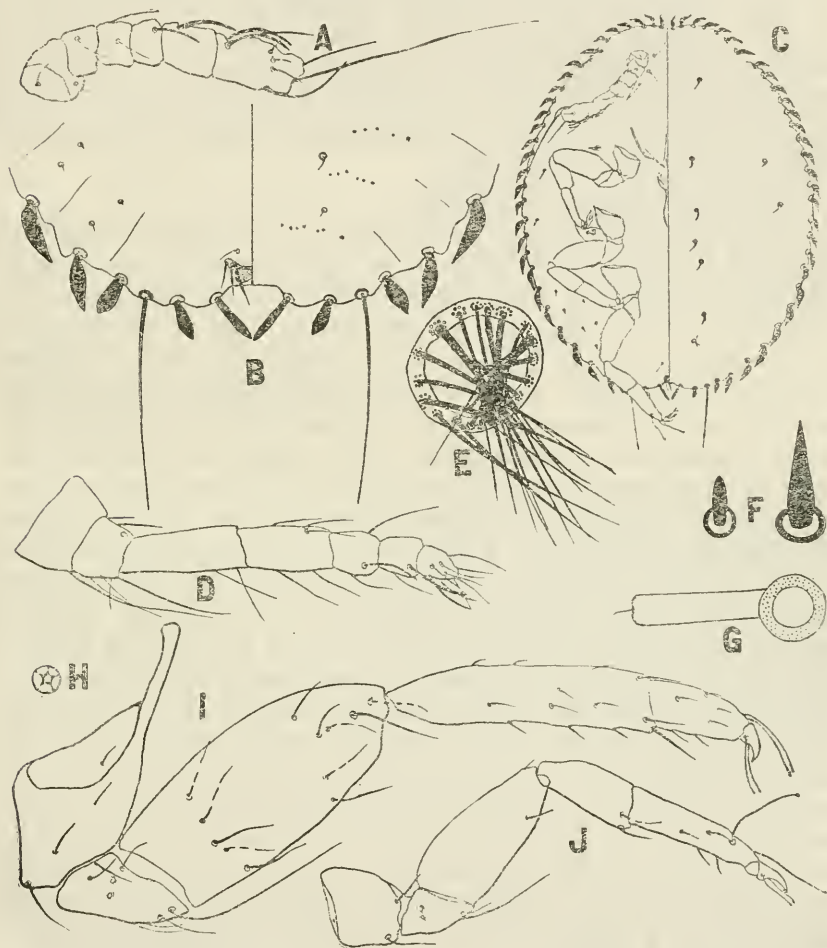


FIG. 14.—*LACHNODIUS EUCALYPTI* (MASKELL). A. LARVA, ANTENNA,  $\times 440$ ; B. LARVA, APEX OF ABDOMEN,  $\times 440$ ; C. LARVA, OUTLINE OF BODY,  $\times 165$ ; D. ADULT FEMALE, ANTENNA,  $\times 115$ ; E. ADULT FEMALE, ANAL RING,  $\times 220$ ; F. ADULT FEMALE, TYPES OF SPINES,  $\times 1500$ ; G. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ ; H. ADULT FEMALE, QUINQUELOCULAR PORE,  $\times 1500$ ; I. ADULT FEMALE, LEG,  $\times 115$ ; J. LARVA, LEG,  $\times 440$ .

not observed; mentum small, short-triangular, 1-segmented, apex rounded; no traces of dorsal ostioles noted; margin of body with a single row of short, sharp conical spines and much longer setae alternating, or more frequently with two spines and then one seta; body elsewhere with occasional short sharp spines, and small blunt spines,

and more numerous slender setae, the latter varying considerably in size; so far as can be noted, with only two types of derm pores, quinquelocular disk and large tubular, the latter opening into a somewhat chitinized circle and with the inner end appearing slightly bilobed from some angles at least; anal lobes completely wanting, no traces of apical spines or setae evident; anal ring set well in from the margin, circular, bearing about 20 setae, mostly large, but some slightly but distinctly smaller, and with pores, these not in continuous rows as in *Pseudococcus* and its relatives, but with a circle of pores around the base of each seta, an arrangement similar to that already described for *Sphaerococcopsis*.

*Intermediate stage*.—Not known.

*Larva*.—Small, broad oval, flat, margin of body with a continuous series of flat, pointed flabellate spines, these shorter and broader anteriorly, longer and more slender posteriorly, the continuous row interrupted only a little on each side of the head at the eyespots; with a total of 31–32 pairs of these around the body, the three posterior pairs smaller and very frequently broken off more or less at the apices; antennae 6-segmented, cylindrical, the apical segment longest, with a seta at apex about as long as the whole antenna and with the three apical segments each with one or more slender curved spines; legs rather stout, the tibia noticeably shorter than the tarsus, the digitules slender with a slight knob at apex, the tarsal about twice the length of the claw, claw without denticle; mentum small, short triangular, apparently 1-segmented; dorsal ostioles wanting, anal lobes not developed, the apex of the body with only an incision for the anal ring; lobes indicated by the presence of a long slender seta on each side of the ring, between the second and third flabellate spine; anal ring small, vertical, so far as can be observed with six setae, of which the lower two are distinctly larger than the others, the presence or absence of pores in ring not determinable; body apparently without derm pores; dorsally with a submedian row of slender setae each set in a large ring base, with an additional pair of these on each side of the thorax; ventrally with a submarginal row of minute spines, one to a segment, and on the posterior abdominal segments with an inner similar row.

*Cotype*.—Cat. No. 24762, U.S.N.M.

All of the three species described by Maskell as members of this genus can probably be properly retained in it. It is doubtful if any of the others subsequently placed here are properly assigned, since it seems apparent that later writers have confused certain Pseudococcine forms with this genus on account of the numerous anal ring setae. The writers can not relocate these species definitely, but suggest the possibility that the genus *Lachnodiella* Hempel (origi-

nally proposed without description by von Ihering) will fit them more correctly than any other described genus. The larvae of Maskell's three species can easily be separated, as those of both *lectularius* and *hirtus* have conical marginal spines, instead of the swollen ones found in *eucalypti*, while the *lectularius* larva is even broader oval than *eucalypti*, and that of *hirtus* is much more slender, and tapers strongly behind, and as compared with *lectularius*, bears numerous body setae. The adults may also be readily differentiated, that of *lectularius* having a closely set continuous marginal row of long conical, slender tipped, and rather delicate spines, while, as stated, *eucalypti* has short, stout conical spines, alternating with slender setae, and *hirtus* has undifferentiated marginal spines, and the whole dorsum with numerous but scattered slender, long, and rather delicate spines. The differences in *hirtus*, both in larva and adult, are such that it may prove desirable to remove it to a distinct genus after it has been studied more thoroughly.

An effort has been made to cover the three Maskell species in the following generic diagnosis:

GENERIC DIAGNOSIS OF LACHNODIUS.

"Dactylopiine" coccids, occurring free or protected by the bark of the host, naked or more or less covered by secretion; adult female circular, flattened, antennae normally 7-segmented, tending to be long and slender, the terminal segment smallest, legs rather stout, the tibia much longer than the tarsus; mentum 1-segmented; dorsal ostioles wanting, derm with two types of pores, quinquelocular disk and large tubular opening into chitinized ring (based on *eucalypti* only); derm with spines and slender setae more or less definitely arranged along the margin and dorsally, anal lobes wanting, no anal cleft, no cerarii, anal ring dorsal, some distance from margin, circular, complete, bearing numerous (about 20) setae of varying lengths, each of these with a circle of pores around its base; intermediate stages of female not known; larva elongate to very broad oval, margin with an almost continuous series of stout spines, lanceolate or conical, with a single pair of apical setae, antennae 6-segmented, the apical largest; legs normal, mentum 1-segmented, no dorsal ostioles, anal lobes not developed, derm pores wanting, body setae, except marginal, small, slender, more or less numerous, anal ring with six setae.

The writers are unfortunately able to offer no definite suggestions as to the proper position of this genus within the "subfamily" Dactylopiinae. Its possible connection with *Sphaerococcopsis* has already been indicated in the specific description. It does seem

obvious that it is not closely related to the *Pseudococcus* group of genera as has been believed by authors subsequent to Maskell.

Genus *ERIUM* Cockerell.

*Genotype*.—*Dactylopius globosus* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, p. 112.—Morrison, Proc. Ent. Soc. Wash., vol. 21, 1919, p. 74.

The confusion which already exists in regard to this genus has been still further complicated by the discovery, as will be evident from the following description, that a serious error has been made as to the species that is really the type of the genus. From the context of Maskell's comments on the species *D. globosus* following his description, it is evident that he regarded the material received from Crawford some years before the publication of the description as the true type specimens of the species. A careful examination of Maskell's slides and material shows plainly that the specimens he mentions as having come from Mr. French are a different species from those received from Crawford, and that it is specimens of Mr. French's species which Maskell has sent out to other coccidologists, thus giving to other entomologists an incorrect conception of the genus. The group of species placed under *Erium* in the Fernald Catalogue will therefore, if they represent a valid generic group, require a new genus name, while *E. globosum* of authors (Maskell in part only) will need a new specific name. The writers therefore propose the name *Amonostherium*, new genus, for the group of species formerly included under *Erium*, propose the specific name *confusum*, new species, for the species *globosum* of authors and Maskell in part, and designate the common American species *lichtensioides* (Cockerell) as the type of this new genus, but for the present do not attempt to indicate definitely the disposition of all the species formerly placed under *Erium*.

This species is represented in the Maskell collection by a single slide labeled "adult female, Australia, 1886." There is also another, labeled "adult female, 1891," representing *Amonostherium confusum*. There is also some unmounted material, divided into three lots, under No. 82, one of which represents true *Erium globosum*, while the other two are the previously unnamed species. The following descriptions and figures have been taken from Maskell's true type material.

*Adult female*.—Oval, stout, strongly convex, enclosed in a fluffy white sac; antennae 7-segmented, rather stout and short, the terminal segment longest; legs short and stout, otherwise normal, the digitules knobbed, the claw pair stouter; every part of hind legs except tarsus with numerous small clear pores, not definitely grouped; mentum rather long triangular, distinctly 2-segmental;



spiracles large, normal; cerarii probably numerous, but those anterior to the last four pairs represented only by a pair of slender setae so widely separated that they can not be definitely characterized as cerarii, posterior cerarius with two fairly stout, conical

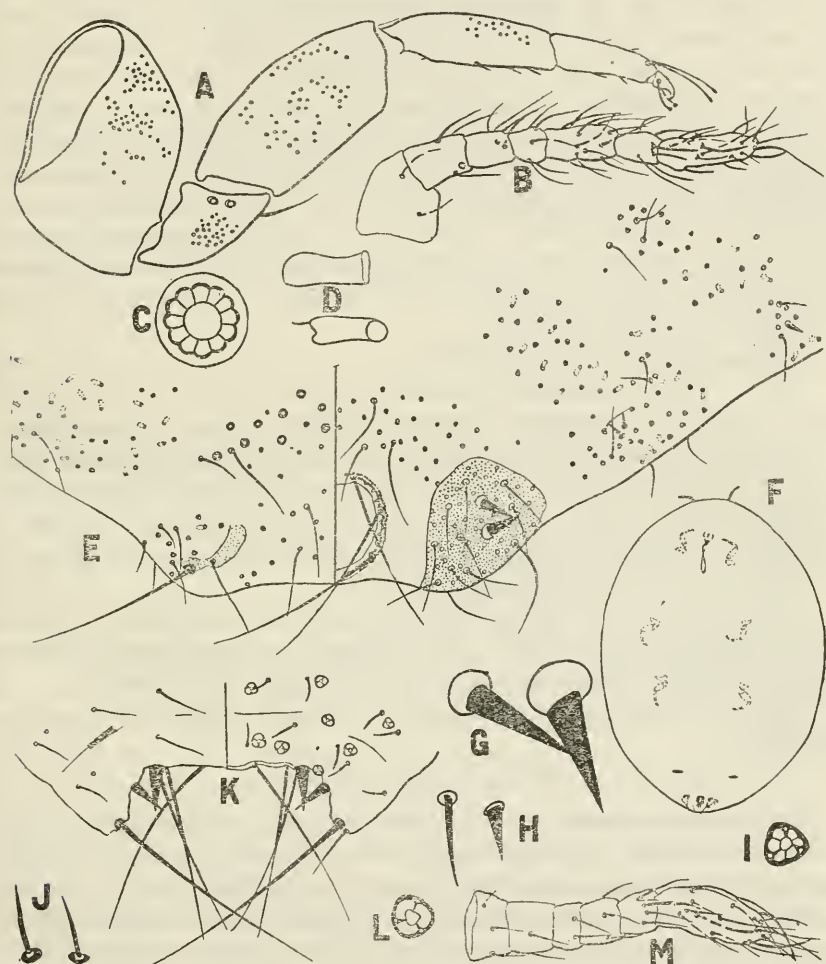


FIG. 15.—*ERIMUM GLOBOSUM* (MASKELL). A. ADULT FEMALE, HIND LEG,  $\times 165$ ; B. SAME, ANTENNA,  $\times 165$ ; C. SAME, VENTRAL DISK PORE,  $\times 1500$  D. SAME, TUBULAR DUCTS,  $\times 1500$ ; E. SAME, APEX OF ABDOMEN,  $\times 165$ ; F. SAME, OUTLINE OF BODY,  $\times 12$ ; G. SAME, POSTERIOR CERARIAN SPINES,  $\times 600$ ; H. SAME, PAIR OF CERARIAN SPINES THIRD FROM POSTERIOR APEX,  $\times 500$ ; I. TRIANGULAR PORE, ADULT FEMALE,  $\times 1500$ ; J. LARVA, SETAE,  $\times 1500$ ; K. LARVA, APEX OF ABDOMEN,  $\times 500$ ; L. LARVA, TRIANGULAR PORE,  $\times 1500$ ; M. LARVA, ANTENNA,  $\times 335$ .

spines accompanied by a group of about 8–10 slender setae and a widely scattered cluster of triangular pores; penultimate cerarius with two considerably smaller spines, about three setae and only a few pores; antepenultimate cerarius with two spines, one more

slender than the other, as long as but more slender than those of penultimate cerarius, two setae and a few pores; fourth cerarius similar to third; remainder of cerarii, so far as can be determined, represented only by slender, almost hairlike setae, possibly occurring in pairs, but the members of such pairs widely separated; anal lobes obsolete, their location indicated by an apical seta about as long as the anal ring setae, by a chitinized thickening of slight density surrounding the apical cerarius, and by a small, narrow, diagonal ventral thickening; derm dorsally with an occasional triangular pore, still less frequently with a long, slender, hairlike seta, and still more rarely with small tubular ducts; anal ring compound, with a double row of pores and six rather large setae; posterior dorsal ostioles distinct; ventral surface in abdominal region with rather numerous circular multilocular disk pores and hairs arranged in transverse rows.

*Intermediate stage*—not known.

*Larva*—(from embryonic specimens within body of adult only) oval, antennae 6-segmented, terminal largest; legs not determinable; with a pair of somewhat developed anal lobes bearing an apical seta, and on the inner face, the only pair of cerarian spines that are plainly developed, these relatively large, conical; anal ring with six setae, dorsum with triangular pores and setae, venter with slender setae.

*Cotype*.—Cat. No. 24763, U.S.N.M.

The status of the species formerly included in the genus *Erium* has already been discussed. It is sufficient to repeat here that none of them appears congeneric with the true type of the genus.

The following generic diagnosis is based on the preceding description.

#### GENERIC DIAGNOSIS OF ERIUM.

Pseudococcine forms, having dorsal ostioles and triangular pores; adult female oval, approaching globular, enclosed in a fluffy sac, antennae 7-segmented, normal, legs normal, claw without denticle, definite cerarii reduced to not more than four pairs, cerarian spines conical, posterior pair underlaid by thickening, with slight ventral thickening, apical seta about as long as those of anal ring, derm with setae, but no spines, derm with triangular pores, multilocular disk pores, and short tubular ducts; anal ring compound, with two rows of pores and six setae; larva oval, antennae 6-segmented, derm with setae and triangular pores, with only the apical pair of cerarian spines developed, anal ring with six setae.

This genus, as based on the type species, appears to offer no distinct characters to separate it from the genus *Trionymus* Berg, as the latter has recently been emended by Ferris,<sup>11</sup> although it certainly

<sup>11</sup> Calif., Species Mealy Bugs, 1918, pp. 35, 66.

differs prominently in shape from the type of that genus, *T. perrisi* (Signoret). The writers incline to place *Erium* as a synonym of *Trionymus*, but leave a definite statement of transfer to some time when the group can be studied as a whole.

Genus PSEUDORIPERSIA Cockerell.

Plate 3, fig. 2.

*Genotype*.—*Eriococcus turgipes* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 115.

This was first established as a subgenus, with only the type species included, and while later raised to generic standing, no other species have been added to it.

The Maskell collection contains five slides of the type, one of "adult female, dorsal view, 1892," one of "adult female, ventral view, 1892," one of "anal ring, 1892," one of "larvae, 1892," and one of "larva, 1896." There is also some unmounted material bearing the Maskell No. 267.

*Adult female*.—Enclosed in a sac, body subglobular, slightly flattened dorsally, etc., as described by Maskell in detail; dorsal surface more heavily chitinized, somewhat brownish, head and thoracic regions very large, occupying fully three-fourths of the whole body and bringing the posterior legs far back; antennae small and inconspicuous, 6-segmented, the third and last segments about equal in length; legs relatively very large, short and stout, so arranged as to give the appearance of six equidistant stout spikes projecting from the circular body, the parts fused so that only two distinct segments and a claw are visible, the outer segment with a cluster of tiny spines beneath at the apex, this segment in the hind legs also with a cluster of numerous tiny circular pores above, claw of peculiar shape, probably comprising both tarsus and claw, claw digitules tiny acute hairs; mentum long, tapering, but with apex rounded, distinctly 2-segmented; only the posterior cerarii isolated, each surrounded by a heavily chitinized half-oval plate, extending down and beyond the apical seta, the cerarius made up of a cluster of lanceolate or sublanceolate spines and triangular pores in about equal numbers; apical seta shorter than anal ring setae; with the penultimate cerarius beginning an almost continuous marginal row of triangular pores, accompanied by more scattered and fewer lanceolate spines of varying sizes, this row wandering irregularly around the whole body margin from cerarius to cerarius, and paralleled by a less conspicuous and less well-developed inner band, the pores in the bands set off from the numerous similar surrounding pores by their larger size and closer grouping, the spines accompanying this band becoming fewer and more scattered anteriorly; dorsally, in addition to the

pores and spines already mentioned, with numerous lanceolate spines of various sizes, these in transverse rows on the abdominal segments



FIG. 16.—*PSEUDORIPERSIA TURGIPES* (MÁSKELL). A. LARVA, APEX OF ABDOMEN,  $\times 335$ ; B. ADULT FEMALE, TRIANGULAR PORE,  $\times 1500$ ; C. ADULT FEMALE, MULTILOCULAR DISK PORE,  $\times 1500$ ; D. LARVA, OUTLINE OF BODY,  $\times 115$ ; E. LARVA, TRIANGULAR PORE,  $\times 1500$ ; F. ADULT FEMALE, APEX OF ABDOMEN,  $\times 165$ ; G. LARVA, MIDDLE LEG,  $\times 230$ ; H. LARVA, ANTENNA,  $\times 230$ ; I. ADULT FEMALE, POSTERIOR LEG,  $\times 165$ ; J. ADULT FEMALE, ANTENNA,  $\times 165$ ; K. ADULT FEMALE, CERARIAN AND BODY SPINES,  $\times 500$ ; L. PORE, ADULT FEMALE,  $\times 1500$ ; M. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ .

just anterior to the anal ring, but scattered elsewhere, and with many small tubular ducts and triangular pores; ventrally with numerous

long, slender setae, larger tubular ducts and, near the anal ring, a few multilocular disk pores.

*Intermediate stages*.—Not known.

*Larva*.—Rather elongate oval, antennae large, 6-segmented, terminal segment much the largest and tapering to an acute point; legs normal, rather slender, tarsus longer than tibia, digitules all long, slender, slightly knobbed, one of tarsus placed basad of the other, claws with a tiny denticle near the apex; mentum 2-segmented, tapering, apex almost conical and with a number of long setae; anal lobes slightly developed, each with a chitinized area dorsally, this bearing a single triangular pore placed between a pair of lanceolate spines, ventrally and subapically with a long, stout seta, slightly longer than the anal ring seta; body ventrally with two tiny, circular submarginal rings on each segment and six longitudinal rows of slender setae; dorsally with three more or less complete rows of slender spines with similar but stouter spines along the margin, and with five more or less complete rows of triangular pores; with two pairs of dorsal ostioles, both distinct; anal ring circular, with six setae and some pores.

*Cotype*.—Cat. No. 24764, U.S.N.M.

The following generic diagnosis has been drawn from the preceding description.

#### GENERIC DIAGNOSIS OF PSEUDORIPERSIA.

Pseudococcine forms having the adult female enclosed in a thin, tough, globular sac attached to the twigs of the host; adult female globular, somewhat flattened; dorsum and sides, except posterior apex, more heavily chitinized, antennae small and short, 6-segmented; legs large, very stout and short, the posterior pair attached very far back, the three pairs radiating from the circular body at about equal distances from each other, segments fused so that only two segments and a claw remain; mentum 2-segmented; with at least the posterior dorsal ostioles present, with the posterior cerarii only developed, placed on a half oval chitinized area, remainder of cerarii represented by a continuous row of pores and lanceolate spines, accompanied by a less distinct inner row, cerarii made up of lanceolate spines and triangular pores, but no setae; dorsal derm with lanceolate spines, triangular pores and tubular ducts, ventral derm with long slender setae and multilocular disk pores; anal ring large, circular, with six setae and numerous pores of two sorts; larva elongate oval, antennae 6-segmented, legs normal, mentum 2-segmented, dorsal ostioles present, anal cerarius developed, with chitinized area, two spines and a triangular pore, body with row of setae and triangular pores, anal ring with six setae.

In the remarkable structure of the body and the legs, this genus seems to possess characters which make it stand alone among the *Pseudococcine* forms, and to fully justify its isolation as a distinct genus.

Genus *RIPERSIELLA* Tinsley.

*Genotype*.—*Ripersia rumicis* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 115.

This genus name was first published by Professor Cockerell, with a sufficient indication of Tinsley's authorship, and included two species, but the type was subsequently designated by Professor Cockerell as Maskell's species.

This species is represented in the Maskell collection by two slides, one of "adult female, 1890," the other of "head and abdomen of

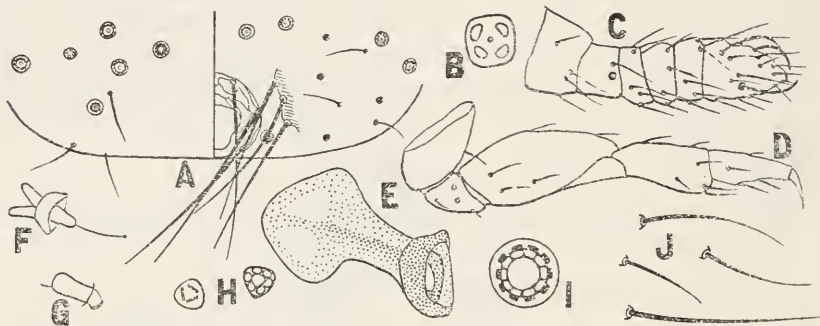


FIG. 17.—*RIPERSIELLA RUMICIS* (MASKELL); ALL FIGURES OF ADULT FEMALE. A. APEX OF ABDOMEN,  $\times 335$ ; B. QUADRILOCULAR PORE, (PROBABLY A FREAK),  $\times 1500$ ; C. ANTENNA,  $\times 335$ ; D. MIDDLE LEG,  $\times 335$ ; E. SPIRACLE,  $\times 1500$ ; F. DOUBLE TUBULAR DUCT (PROBABLY A FREAK),  $\times 1500$ ; G. TUBULAR DUCT,  $\times 1500$ ; H. TRIANGULAR PORE, TWO VIEWS,  $\times 1500$ ; I. NORMAL MULTILOCULAR DISK PORE,  $\times 1500$ ; J. BODY SETAE,  $\times 1500$ .

adult female, 1890," and by a few unmounted specimens under No. 170.

*Adult female*.—Practically naked, elongate oval when mounted; antennae short and stout, placed very close together at the anterior apex of the head, 6-segmented, the first and last longest, the last with three stout spines; legs small, stout, the tibia and tarsus about equal in length, claw long, slender, only slightly curved near apex, without denticle, claw digitules slender, apparently acute at apices, tarsal digitules not observed, hind coxae without pores; mentum rather long triangular, indistinctly 2-segmented; spiracles small, not abnormal; with four pairs of dorsal ostioles; anal ring small, stout, with six well-developed setae, without pores of the type found in the ring of *Pseudococcus*, for example, but with some relatively large, faint, uneven areolation; cerarii wholly wanting, the anal lobes not developed, their location indicated by a group of three setae about as long as those of the anal ring and placed on each side of this;

body elsewhere with scattered setae of varying lengths, both dorsally and ventrally; these, in general, longer posteriorly and toward the margin; derm with three and possibly more, distinct types of pores (see figures), somewhat triangular pores, but apparently with six loculi, corresponding to the usual trilocular, occurring both dorsally and ventrally; relatively large multilocular disk pores also both dorsal and ventral, and most abundant near posterior apex, and very rarely tubular ducts; also a large quadrilocular pore, probably a modified multilocular disk pore, and a very peculiar double tubular duct, possibly a modification of the normal type noted; body beneath, some distance behind the posterior legs with a pair of tiny truncate conical structures the exact nature and function of which can not be determined.

*Immature stages.*—None available.

*Cotype.*—Cat. No. 24765, U.S.N.M.

The writers have not had access to satisfactory study material of any of the other species which have been placed in this genus, all of which are American, and are therefore unable to comment on their status with relation to the type. The following genus diagnosis has been prepared only from the preceding description.

#### GENERIC DIAGNOSIS OF RIPERSIELLA.

Pseudococcine forms, probably altogether root inhabiting; adult female elongate oval, antennae short and stout, 6-segmented, placed very close together at the apex of the body, legs stout and short, with acute claw digitules and no denticle, mentum 2-segmented, two pairs of dorsal ostioles present, no cerarii developed, posterior pair and apical seta represented by three long setae, no specialized body spines, anal ring with six setae and large, faint areolations, without the usual rows of pores, derm with large multilocular disk pores, small somewhat triangular pores and tubular ducts, perhaps with other sorts, and with slender setae.

#### Genus CHAETOCOCCUS Maskell.

Plate 3, fig. 3.

*Genotype.*—*Sphaerococcus bambusae* Maskell.

*Reference.*—Fernald, Cat. Cocc. World, 1903, p. 120.

This genus was established by Maskell for a species he had formerly included in his genus *Sphaerococcus* because it had been discovered by Mr. E. E. Green that the type, *bambusae* had setae on the anal ring, while Maskell was of the opinion that *casuarinae*, the type of *Sphaerococcus*, had no anal ring setae; actually these two type species status with relation to the type. The following genus diagnosis has been discussed in detail previously in this paper and elsewhere.

This species is represented in the Maskell collection by five slides, one of "adult female, 1892," one of "2nd stage female, 1892," one of "antennae of female, 1892," and two of "larvae of female, 1892." There is also a small quantity of unmounted material bearing No. 221.

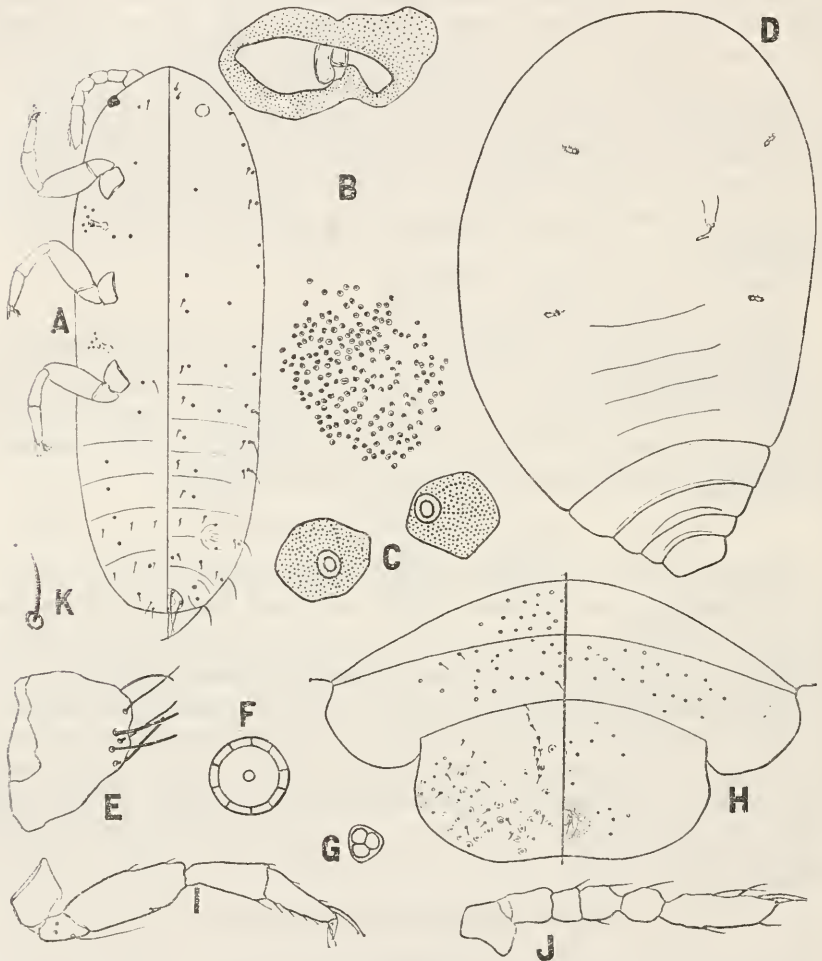


FIG. 18.—CHAETOCOCCUS BAMBUSAE (MASKELL). A. LARVA, OUTLINE,  $\times 115$ ; B. ADULT FEMALE, POSTERIOR SPIRACLE (ABOVE) AND PORE PLATE (BELOW),  $\times 115$ ; C. ADULT FEMALE, DETAILS OF PORES IN PLATE,  $\times 1500$ ; D. ADULT FEMALE, OUTLINE OF BODY, SHOWING SHAPE,  $\times 115$ ; E. ADULT FEMALE, ANTENNA,  $\times 440$ ; F. ADULT FEMALE, MULTILOCULAR DISK PORE,  $\times 1500$ ; G. SAME, TRIANGULAR PORE,  $\times 1500$ ; H. SAME, APEX OF ABDOMEN,  $\times 440$ ; I. LARVA, LEG,  $\times 220$ ; J. LARVA, ANTENNA,  $\times 220$ ; K. DERM SETA OF ADULT FEMALE,  $\times 1500$ .

*Adult female*.—Occurring well down in the leaf sheaths in the midst of dense white waxy secretion, this surrounding but not covering the strongly flattened insect; body oval, pointed, and more or less strongly tapering behind, usually somewhat distorted and asymmetrical; derm at maturity heavily chitinized, brown, the abdominal seg-



ments strongly marked by lateral and dorsal constrictions; antennae reduced to minute unsegmented tubercles, placed at the anterior end of the body and each bearing about six small spines; legs entirely wanting; spiracles large, each set in a deep pocket in the chitinized derm, with a patch of small tubular glands behind each posterior spiracle; derm with numerous clear pores scattered over both surfaces, at the bottom of which are small triangular pores or tubular ducts; in addition with circular multilocular disk pores at the posterior end of the body; body setae all rather stout and short, a few at the posterior margin of the apical segment longer and more slender, the setae very rare except on the apical abdominal segments, where they are rather numerous ventrally, especially along the middle line; apical abdominal segment sometimes faintly bilobed; anal ring a heavy band placed a little dorsally and at the inner end of a short tubular invagination, ring bearing numerous small pores and six setae, slender and projecting a little beyond the circular opening of the tube.

*Intermediate stage female* (possibly adult before maturity).—Oval with the posterior apex of the body, only, chitinized and brown, the apical segment very broadly rounded, the remainder of the derm clear and membranous; antennae, mentum, legs and anal region as in adult, derm pores and setae along the margin of the body apparently much more numerous than in adult in proportion to size.

*Larva*.—Body elongate, parallel-sided, the ends rounded; antennae 6-segmented, the apical segment as long as the three preceding together; legs normal, rather slender, claw simple, digitules all long, slender, slightly knobbed; mentum short and stout, obscurely 2-segmented; derm with marginal rows of large triangular pores, dorsally with a submedian row of smaller but similar pores and an additional submarginal row anteriorly, ventrally also with a row of much smaller pores, this row submarginal posteriorly and submedian anteriorly, finally with a group of such pores at each spiracular opening; posterior dorsal ostioles conspicuous, anterior not noted; the abdominal segments with a pair of rather stout spine-like setae on each margin, one larger, one smaller, those on the apical segment large, the remainder gradually decreasing in size anteriorly, apical segment also with a pair of much longer, slender anal lobe setae; anal lobes developed only as very slight protuberances, with a few pores and six short slender setae.

Maskell placed one other species, first described by him as a *Sphaerococcus*, and now known as *Antonina graminis* (Maskell), in this genus in 1898. This species closely resembles *Sphaerococcus casuarinae* Maskell in size and shape, and when the intermediate stages are known may require a modification of the statement under *Sphaero-*

*coccus* that probably no other species originally included in that genus are really congeneric with the type, as *Sphaerococcus* is at present isolated on the basis of the presence of legs in the second stage of the female.

The following generic diagnosis is based on the preceding description.

GENERIC DIAGNOSIS OF CHAETOCOCCUS.

Modified Pseudococcine forms living partly surrounded by secretion in protected situations on the host; adult female large, oval, tapering, and somewhat pointed behind, flattened, heavily chitinized at maturity, antennae reduced to tiny tubercles, legs wanting, mentum indistinctly 2-segmented, dorsal ostioles obscure, no cerarii developed, body with spines, particularly posteriorly, and with multilocular disk pores, triangular pores, and tubular ducts, with a pore plate behind each hind spiracle, anal ring with pores, placed at inner end of invaginated tube, and with six setae protruding somewhat; larva elongate, parallel-sided, antennae 6-segmented, the apical long, legs normal, derm with longitudinal rows of trilocular pores and small slender setae, no definite cerarii, at least posterior dorsal ostioles present, with a pair of apical setae but no evident anal lobes, anal ring with pores and six slender setae.

This genus very obviously belongs with the group of modified Pseudococcine forms of which *Antonina* is the oldest described genus, and which also includes *Sphaerococcus* and possibly other, misplaced, genera. The writers consider *Chaetococcus* to be doubtfully distinct from *Antonina*, as this latter genus is commonly understood, the only apparent difference occurring in the very heavy thickening of the derm which develops all over the body of *Chaetococcus* at maturity, instead of merely on the posterior abdominal segments as in *Antonina*.

Genus KUWANINA Cockerell.

*Genotype*.—*Sphaerococcus parvus* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, p. 121.—Green, Ent. Month. Mag., vol. 51, 1915, p. 181.—Ferris, Can. Ent., vol. 50, Oct. 1918, p. 324.

This genus was established by Cockerell in the Fernald Catalogue on the basis of the larval characteristics only, and with a single included species. One other species, *Sphaerococcus obscuratus* Maskell has recently been added to the genus by Ferris, but the writers have had no opportunity to study satisfactory material of this last species, and in view of the doubt expressed at the time of its reassignment, have decided to confine the generic diagnosis which follows to the type species.

The type species is represented in the Maskell collection by two slides, one of "adult female, 1897," and one of "larvae, 1897." There appears to be no unmounted material of the species.<sup>12</sup> It has fortunately been carefully redescribed by Green, and also discussed by Ferris (see reference), so the writers have limited their work on this species to the preparation of some illustrations and to giving a generic diagnosis.

GENERIC DIAGNOSIS OF KUWANINA.

Dactylopiine coccids (of the Fernald Catalogue) of uncertain position; adult female oval, posterior end somewhat more heavily chitinized and faintly nodulose, antennae tiny unsegmented tubercles with apical setae, legs wanting, mentum apparently 1-segmented, with small cribriform plate behind each posterior spiracle, derm

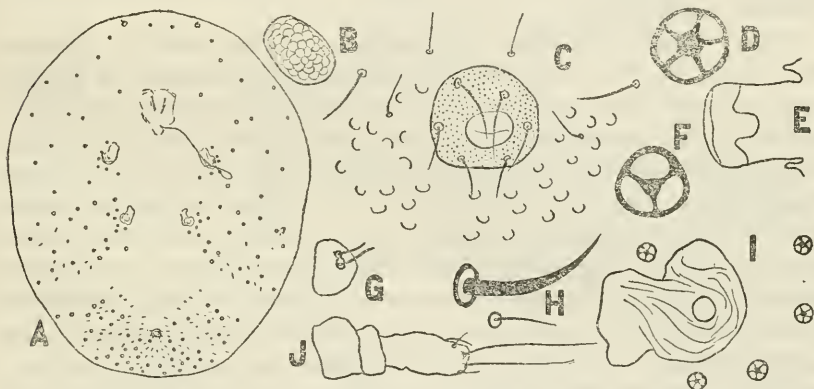


FIG. 19.—KUWANINA PARVUS (MASKELL). A. ADULT FEMALE, OUTLINE OF BODY,  $\times 50$ ; B. CRIBRIFORM PLATE OF ADULT FEMALE,  $\times 640$ ; C. ADULT FEMALE, ANAL RING REGION,  $\times 640$ ; D. ADULT FEMALE, QUINQUELOCULAR PORE,  $\times 1500$ ; E. SAME, SIDE VIEW,  $\times 1500$ ; F. ADULT FEMALE, TRILOCULAR PORE,  $\times 1500$ ; G. ADULT FEMALE, ANTENNA,  $\times 640$ ; H. ADULT FEMALE, SETAE,  $\times 1500$ ; I. ADULT FEMALE, SPIRACLE,  $\times 640$ ; J. LARVA, ANTENNA,  $\times 640$ .

setae spine-like, small, scattered, more numerous posteriorly, derm pores normally quinquelocular, but varying from 3-7, also varying in size, set in bottoms of short tubes, anal ring small, heavy, entire, without pores, with six short setae; intermediate stage (from Green), body short oval, antennae 2-segmented, legs wanting, mentum 1-segmented, derm pores, etc., in general similar to those of adult; larva (from Green), rather elongate oval, antennae short, stout, 3-segmented, apical segment relatively very long, legs small, rather stout, derm pores sparse and irregularly scattered, anal ring simple, incomplete, with six short setae, body with a pair of apical setae.

The writers are able to contribute nothing new in regard to this genus.

<sup>12</sup> Unmounted and unlabeled material of this species has subsequently been located in the Maskell Collection under lot No. 560. *Cotype*.—Cat. No. 24766, U.S.N.M.

## Subfamily COCCINAE.

## Genus CERONEMA Maskell.

Plate 3, fig. 4.

*Genotype*.—*Ceronema banksiae* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 127.

At the time of original description, Maskell included only the type species in this genus, although he later added another to it.

*Ceronema banksiae* is represented in the Maskell collection by three slides, one of "adult female, 1894," one of "2nd stage female, 1894," and one of "larvae, 1894," and by a single unmounted adult female specimen, two ovisacs and a male puparium bearing No. 421. Maskell appears to have described the different stages with considerable accuracy, so the following notes are to some extent a repetition of his work.

*Adult female*.—External appearance as described by Maskell. body elongate oval, more or less asymmetrical, flattened, or slightly convex, dorsal derm heavily chitinized except along margin of body, punctured by numerous pores, anal plates placed close to the posterior apex; antennae 6-segmented, third very long; legs normal. small, rather slender, claw stout, with denticle, digitules slender, long, knobbed at apices; mentum not discernible; spiracles normal for the group; marginal spines rather long, slender, acute setae, usually separated by several times the length of one; spiracular spines about 5-7 in each group, all stout and bluntly rounded, but varying greatly in size, the end of the spiracular groove marked by a curved chitinized thickening; dorsal derm with an occasional tiny spine set at the end of a clear pore; dorsally with three types of pores, small simple circular pores, larger tubular ducts and much larger tubular ducts, these at intervals along the margin and apparently corresponding to the marginal tubercles so conspicuous in some Lecanine species, the first two numerous over most of the surface, except in a median longitudinal area, the last with about 33 around the body margin, with similar, but less developed and smaller pores intervening between many of the larger ones, to the number of 20; ventrally along the body margin with numerous long tubular ducts, similar to but much smaller than the second type described for the dorsum, and with two sorts of multilocular disk pores, the larger with, usually, six loculi, in the anal region, the others, somewhat smaller and usually with five loculi, between spiracles and margin of body; anal plates each more than twice as long as wide, the anterior halves of the pair almost forming a semicircle, but the posterior half of each tapering, slender, forming almost a rounded point at the apex, plates without dorsal setae, with four

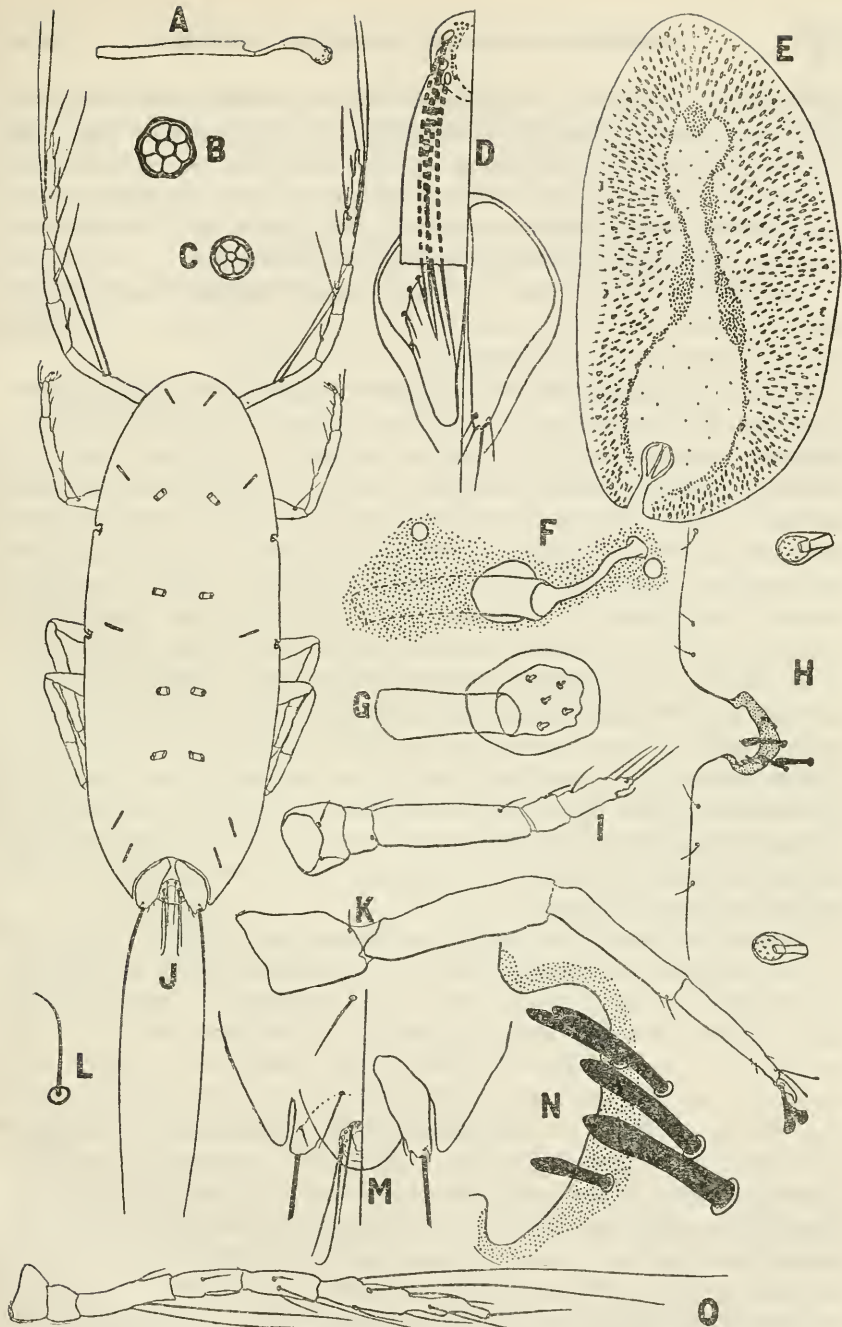


FIG. 20.—*CERONEMA BANKSIAE* MASKELL. A. ADULT FEMALE, VENTRAL TUBULAR DUCT,  $\times 500$ ; B. SAME, MULTILOCLAR DISK PORE NEAR ANAL PLATES,  $\times 1500$ ; C. SAME, MULTILOCLAR DISK PORE BETWEEN SPIRACLES AND MARGIN,  $\times 1500$ ; D. SAME, ANAL PLATES,  $\times 115$ ; E. SAME, DORSAL VIEW,  $\times 17.5$ , SHOWING SHAPE, ARRANGEMENT OF PORES AND SUBMARGINAL TUBERCLES; F. SAME, DORSAL TUBULAR DUCT,  $\times 500$ ; G. SAME, "SUBMARGINAL TUBERCLE,"  $\times 500$ ; H. SAME, PORTION OF MARGIN OPPOSITE SPIRACLE,  $\times 165$ ; I. SAME, ANTENNA,  $\times 165$ ; J. LARVA, OUTLINE FROM ABOVE,  $\times 115$ ; K. ADULT FEMALE, HIND LEG,  $\times 165$ ; L. SAME, MARGINAL SPINE,  $\times 650$ ; M. LARVA, ANAL PLATES,  $\times 220$ ; N. ADULT FEMALE, SPIRACULAR SPINES,  $\times 640$ ; O. LARVA, ANTENNA,  $\times 220$ .

apical setae, unequal in length, but one much longer, on each, ventral ridge placed along the outer edge of each plate, curving with the outline, bearing four setae at wide intervals, the two anterior ones quite long; apparently without fringe or hypopygial setae; anal ring placed some distance anterior to the plates, small, oval, stout, bearing pores and apparently eight large setae.

*Intermediate stage female*.—No material available (Maskell's 2nd stage female, in the opinion of the writers, nothing more than a badly parasitized adult female).

*Larva*.—Elongate, broadest in thoracic region, head rounded, tapering gradually behind, apex of abdomen rounded; antennae long and slender, 6-segmented, the terminal segment very long; legs very slender, digitules slender, knobbed, one of the tarsal inserted much above the other, the latter smaller, claw with denticle near tip; mentum very short triangular, 1-segmented; spiracular spines in threes, the median larger, all stout, bluntly rounded at apices; marginal spines very minute if present at all; with five long, slender submarginal tubular ducts on each side of the body, and with three or four pairs of much larger and relatively stouter tubular ducts in a median row, one pair before the mouthparts, one pair behind, and one or two pairs on the anterior portion of the abdomen, all dorsal; anal plates slender, not reticulated, bearing a long apical seta about half the length of the body, one outer and two inner curved and two ventral straight much smaller slender setae; also with a pair of much larger submedian ventral setae anterior to the anal ring; anal ring with pores and six setae.

Besides the type, four species have been placed in this genus. Of these, *Ceronema dryandrae* Fuller is described as being very similar to *banksiae*, and can probably remain in the genus; *C. caudata* Froggatt might from its similar superficial appearance, and from the analogy of identical general distribution, easily be congeneric with *banksiae*, but the description gives only the external appearance of the insect, omitting morphological details entirely, so no definite statement on its proper position is possible. An examination of the type specimens (slides) of *C. japonica* Maskell shows that the double anal plates remarked on by the describer are due to his having prepared mounts from preadult individuals just ready to moult. On account of the condition of these specimens, it is difficult to comment accurately on the generic affinities of the species. It does not appear to be congeneric with *C. banksiae* in morphological characters, the chief differences lying in the marginal and spiracular spines and the anal plates, in the older stages, and in the more oval shape, the much shorter and stouter legs and antennae and the absence of large tubular ducts in the larva of *C. japonica*. A similar comment appears to apply to *C. koebeli* Green, in so far as this can be determined from

Green's elaborate figures and description. *C. africana* McFie also differs in morphological characters from the type of the genus, and can hardly be included in it on such grounds. The writers are not able to suggest any other genus location for the last three species discussed, but do believe that, at most, only the three Australian species can be legitimately included in the genus *Ceronema*.

The following generic diagnosis is based almost wholly on the type species:

GENERIC DIAGNOSIS OF CERONEMA.

Coccine forms (of Fernald Catalogue), female at maturity surrounded by a heavy secretion of waxy threads covering all of the body except a portion of the dorsum; adult female with heavily chitinized dorsal derm with numerous pore canal punctures, 6-segmented antenna, normal legs, normal spiracles, slender acute marginal setae, numerous, stout, bluntly rounded spiracular spines in the usual four groups, each accompanied by a chitinized plate, with minute setae dorsally, derm pores dorsally of three types, minute simple pores, large tubular ducts and "submarginal tubercles," all numerous, ventral pores small tubular ducts and two sizes of multi-ocular disk pores, anal plates slender, tapering posteriorly, no dorsal setae on these, some apical setae, a few ventral setae, no fringe setae apparently, no hypopygial setae, anal ring placed anterior to plates, small, with pores and eight setae; larva elongate, tapering posteriorly, legs and antennae very long and slender, spiracular spines subequal in length, all stout, blunt, with submarginal and submedian large conspicuous tubular ducts, anal ring with 6 setae, anal plates slender, not reticulated, bearing an apical seta about half as long as body.

The characters presented by the type of this genus seem quite sufficient to justify its retention.

Genus *ERIOCHITON* Maskell.

Plate 3, fig. 5.

*Genotype*.—*Eriochiton hispidus* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 127.

The type of this genus was automatically set by Maskell in describing it with only the single included species, although the first definite statement regarding a type species appears to be that in the Fernald Catalogue.

The Maskell collection contains only a single slide of the species labeled "adult female from Olearia, 1880." and a few unmounted specimens in different stages under No. 59. From the latter it has been possible to obtain mounts of the larva.

*Adult female*.—Short oval, almost elliptical, slightly convex, derm clearing completely on boiling in potassium hydroxide; antennae

7-segmented, rather slender; legs small, normal, digitules slender, slightly knobbed, claw with a denticle, tarsus considerably longer than tibia; ventral surface between anterior and intermediate legs and around mentum more heavily chitinized, bulging into symmetrical

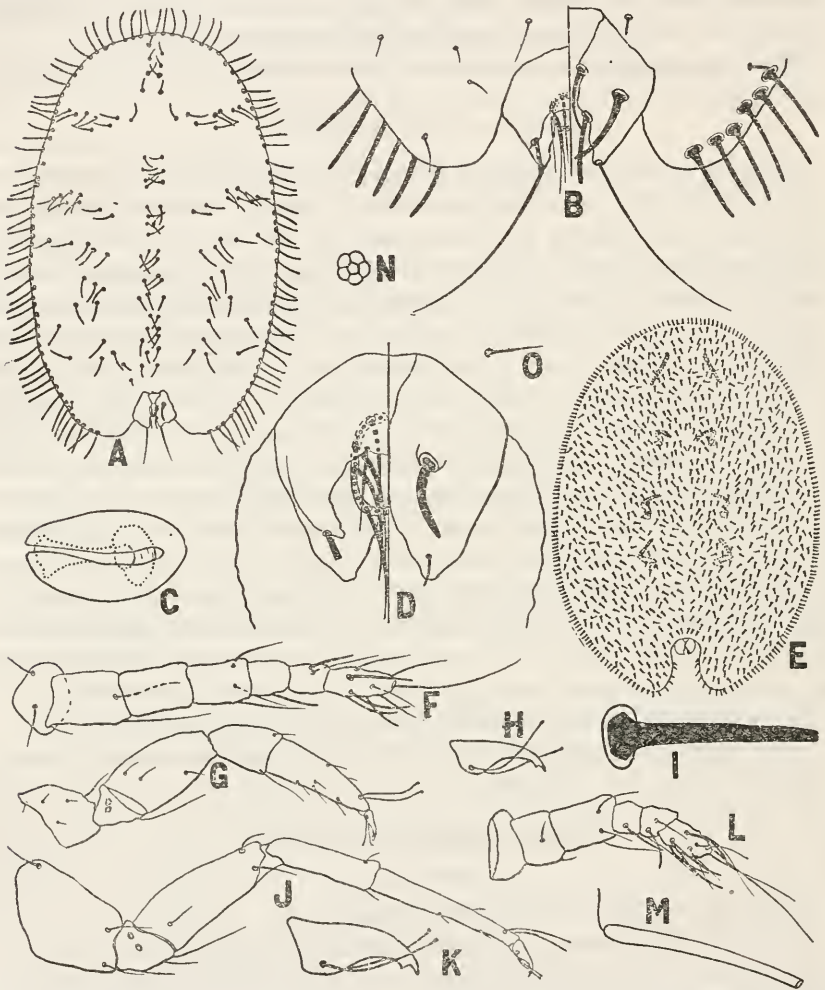


FIG. 21.—*ERIOCHITON HISPIDUS* MASKELL. A. LARVA,  $\times 115$ ; B. LARVA, APEX OF ABDOMEN,  $\times 335$ ; C. ADULT FEMALE, SPIRACLE,  $\times 335$ ; D. ADULT FEMALE, ANAL PLATES,  $\times 220$ ; E. ADULT FEMALE, OUTLINE OF BODY, DORSAL,  $\times 17.5$ ; F. ADULT FEMALE, ANTENNA,  $\times 165$ ; G. LARVA, LEG,  $\times 220$ ; H. SAME, CLAW SHOWING DIGITULES AND DENTICLE,  $\times 640$ ; I. ADULT FEMALE, BODY SPINE,  $\times 500$ ; J. ADULT FEMALE, MIDDLE LEG,  $\times 165$ ; K. SAME, CLAW,  $\times 640$ ; L. LARVA, ANTENNA,  $\times 220$ ; M. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ ; N. ADULT FEMALE, QUINQUELOCULAR PORE,  $\times 1500$ ; O. ADULT FEMALE, VENTRAL SETA,  $\times 500$ .

folds partly overlapping the mentum below, the latter apparently 1-segmented; whole dorsal surface with numerous long, but fairly slender, somewhat tapering truncate spines, these more numerous in a row along the margin; spiracular spines not differentiated; dorsal



surface with some small, slender setae in addition to the spines; ventral derm with some larger slender setae; with only tiny, long-tubular ducts occasionally near the margin, and with tiny quinquelocular pores near the spiracles, and a few similar but slightly larger beneath the anal plates; these stout broad, each about half or a little more as wide as long, broadest before the middle, tapering behind, both the inner and outer margins curving so the tips are well separated, dorsally with a large stout spine before the middle and a subapical seta, apparently without apical setae, ventrally with a strong seta, flattened and expanded apically, at the posterior end of the ventral ridge, and with a single large fringe seta on each side; anal ring placed within the plates, rather large, oval, slender, with a single row of pores and eight stout setae; hypopygial setae wanting.

*Intermediate stages.*—None available for examination.

*Larva.*—Body oval, broadest at or before the middle, the two ends bluntly rounded, whole margin of the body with a single row of long, slender, blunt-tipped spines; with a median longitudinal double row of similar but smaller spines, three transverse rows of similar spines on head and thorax, and an additional longitudinal double row on each half of the abdomen; spiracular spines not differentiated; dorsum without other setae, ventrally with an occasional tiny slender seta; with slender tubular ducts along the body margin, no other pores noted; antennae 6-segmented, legs normal, rather stout, claw with denticle; anal plates more or less invaginated within margin, stout, irregular in shape, bearing a slender hair at apex, a stout blunt spine of unusual shape, expanded at apex, latero-ventrally, and still a third anterior to this, and much smaller, dorsally with a large stout, blunt-tipped spine, similar to the marginal spines mid-dorsally, and two similar but smaller spines arising from the inner margin of each plate; anal ring apparently with six setae.

*Cotype.*—Cat. No. 24767, U. S. N. M.

Two other species have been included in this genus, one of which, *E. spinosus* (Maskell), is quite obviously congeneric with the type, differing conspicuously only in the fact that the dorsal truncate spines are very few in number and are confined largely to the median longitudinal area. The other species, *E. theae* Green, differs so decidedly from the type species in certain morphological characters, notably the conspicuous differentiation of the spiracular spine groups and the development of longitudinal submedian clusters of conical spines, as to make its elimination from the genus desirable. As has already been noted, Maskell's specimens of *Ceronema japonica* are apparently pre-adult, so it is not possible to state definitely that Mr. Green's intimation at the time he described *theae*, that his species might be the same as *C. japonica* is correct. However, from a comparison of Green's care-

ful description with Maskell's types, it is possible to state that the two are very plainly congeneric, and that of the differences suggested by Green,<sup>13</sup> only that of the number of antennae segments stands, and even this can be accounted for on the basis of immaturity. The early stage of the Maskell specimens would preclude the formation of a complete test, and the anal ring actually has six setae, such as Green described for *E. theae*, instead of eleven as figured by Maskell. As a matter of opinion, the writers consider the two to be the same species.

The following generic diagnosis has been based upon the two Maskell species from New Zealand.

#### GENERIC DIAGNOSIS OF ERIOCHITON.

Coccine forms of the Fernald Catalogue, the adult female enclosed in a test composed of compact felted secretion, this test more or less complete; adult female elliptical, antennae 7-segmented, legs small, normal, claw with denticle, mentum 1-segmented, margin and dorsum of body with long, slender, blunt-tipped spines more or less numerous developed, spiracular spines not differentiated, dorsal and ventral surfaces with some slender setae, only small, slender, long-tubular ducts and tiny quinquelocular disk pores present on body, anal plates stout, broad, with a large stout, blunt dorsal spine and some setae, with one large fringe seta on each side, hypopygial setae wanting, anal ring with pores and eight setae; larva stout, antennae 6-segmented, legs stout, normal, claw with denticle, at least the margin of the body with a fringe of long, slender, blunt-tipped spines, spiracular spines not differentiated, only long tubular ducts present, at margin, anal plates more or less retracted, stout, with stout spines and setae, anal ring with pores and six setae.

#### Genus MALLOCOCCUS Maskell.

Plate 4, fig. 1.

*Genotype*.—*Mallophora sinensis* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 142.

*Mallococcus* is a new name substituted by Maskell for the genus name *Mallophora*, established by him for the single species *sinensis*, a name which proved to be preoccupied.

There are four slides of the type of this genus in the Maskell collection, one of "adult female, 1896," one of "abdomen of female, 1896," one of "antenna of female, 1896," and one of "larva, 1896." There is in addition a little unmounted material under No. 512.

*Adult female*.—"Covered by a closely-felted secretion"—(Maskell), this, in the dried material a dense but brittle, almost homogeneous test; body stout, elliptical, almost circular, shriveling into a

<sup>13</sup> Ind. Mus. Notes, vol. 5, 1900, p. 11.

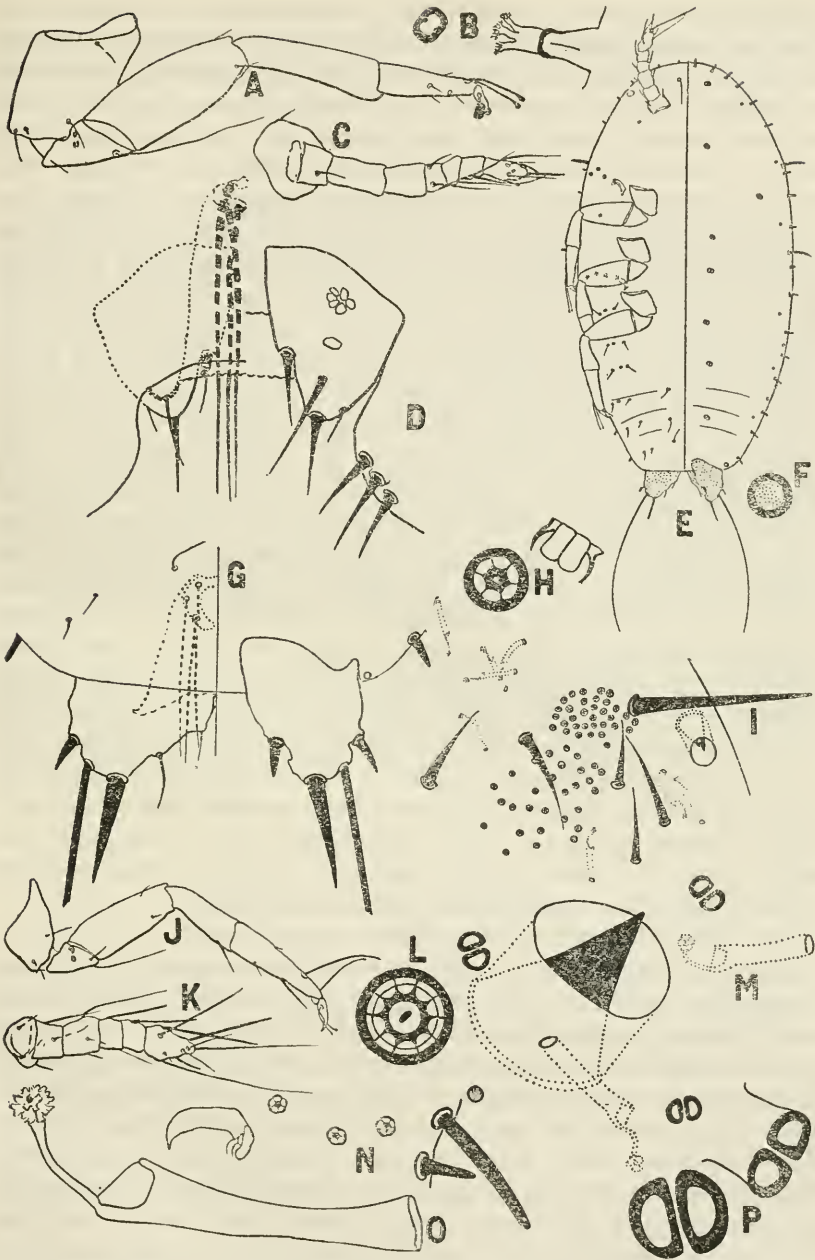


FIG. 22.—*MALLOCCOCUS SINENSIS* (MASKELL). A. ADULT FEMALE, LEG,  $\times 165$ ; B. ADULT FEMALE, SMALL 8-SHAPED PORE,  $\times 1500$ ; C. ADULT FEMALE, ANTENNA,  $\times 115$ ; D. ADULT FEMALE, ANAL PLATES (FROM SPECIMENS LOANED BY PROF. G. F. FERRIS, NOT FROM TYPE MATERIAL),  $\times 440$ ; E. LARVA,  $\times 115$ ; F. ADULT FEMALE, DISK PORE,  $\times 1500$ ; G. LARVA, "ANAL PLATES,"  $\times 440$ ; H. ADULT FEMALE, SPIRACULAR DISK PORE,  $\times 1500$ ; I. ADULT FEMALE, SPIRACULAR SPINE REGION,  $\times 165$ ; J. LARVA, MIDDLE LEG,  $\times 220$ ; K. LARVA, ANTENNA,  $\times 220$ ; L. ADULT FEMALE, DISK PORE NEAR ANAL RING,  $\times 1500$ ; M. ADULT FEMALE, DETAIL OF DORSAL SPINE AND ADJACENT AREA,  $\times 640$ ; N. LARVA, SPIRACLE TO MARGIN,  $\times 640$ ; O. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ ; P. ADULT FEMALE, 8-SHAPED PORE, TWO VIEWS,  $\times 1500$ .

small distorted mass at the anterior end of and free from the test after producing young; venter of abdominal segments more heavily chitinized; antennae, 7-8-segmented, the third usually somewhat the longest; legs rather slender, claw stout, without denticle; tarsal digitules slender, long, with stout knob, claw digitules large and broad, with large knob; spiracles short and stout, strongly constricted; mentum stout, short triangular, 2-segmented; body dorsally with fairly numerous, but scattered, large, stout, conical spines, invaginated their whole length within the body, arranged in indefinite transverse rows and more numerous near the margin; body along margin with a single to triple row of slender, very acutely pointed spines; spiracular spines represented by a single one, about twice as long as the marginal, slender, but stouter near the tip than the marginal, and bluntly rounded at apex, opposite each spiracle; ventrally with pairs of long hairs on the segments anterior to the anal ring; dorsally with numerous 8-shaped pores, these clustered in indefinite fashion around the large conical invaginated spines, with a few small circular pores, and with numerous slender tubular ducts with deep, cup-shaped bottoms, and slender prolongations scattered promiscuously; ventrally with similar ducts, with transverse rows of larger multilocular-disk pores, and, finally, with some small tubular ducts, the disk pores with about eleven loculi placed anterior to the anal ring; those, about half as large, with five or six loculi, scattered between each spiracle and its marginal spine, each row of these terminating in a dense cluster at the base of the spine; anal ring small and stout, with pores and six setae, surrounded by a pair of curved plates, flat, short, and deep—that is, long dorso-ventrally, somewhat pitted above, each bearing four setae, and one ventral ridge seta; a single fringe seta on each side.

*Intermediate stages.*—Not available for examination.

*Larva.*—Elongate oval, somewhat broader anteriorly; antennae 6-segmented, terminal segment longest, legs normal, claw with denticle, all digitules slender, knobbed, one tarsal digitule inserted above the other and slightly longer; mentum stout triangular, apparently 1-segmented; with a single long, cylindrical, blunt-tipped spiracular spine opposite each spiracle; margin of body with a row of short, blunt, tapering spines, about one to a segment, and a submarginal row of tiny, apparently simple pores, dorsally with a submedian longitudinal row of 8-shaped pores on each side, ventrally with two or three longitudinal rows of slender setae and a single row of tiny pores on each half, also with two or three multilocular disk pores between each spiracle and its spine; anal plates protruding, each chitinized, bearing one apical spine, two smaller spines, one slender apical seta, and a smaller seta; anal ring with pores and six setae.

*Cotype.*—Cat. No. 24768, U.S.N.M.

One other species, *M. lanigerum* (Hempel.) was doubtfully included in this genus according to the Fernald Catalogue, but it is obviously not related to the type at all, and the following generic diagnosis is therefore based wholly on the type species.

GENERIC DIAGNOSIS OF MALLOCOCCUS.

Apparently Coccine forms having the adult female enclosed in a test composed of waxy threads, ovate, with well-developed legs and antennae, the latter 7-8 segmented, 2-segmented mentum, a single spiracular spine opposite each spiracle, slender, acutely pointed marginal spines, numerous large, conical dorsal spines, invaginated their whole length into the derm, numerous small 8-shaped pores dorsally, small slender tubular ducts and minute circular pores both dorsally and ventrally, and two sizes of multilocular disk pores ventrally, anal ring with pores and six setae, surrounded by a pair of "plates united below, free above; larva elongate oval; antennae 6-segmented, legs normal, claw with denticle, spiracular spines single, margin with small but stout spines, with a dorsal submedian row of 8-shaped pores on each side, anal lobes protruding, bearing an apical seta and stout spines.

In certain respects this genus resembles some members of the subfamily Asterolecaniinae so much that it stands either as a remarkable example of parallel modification or as a connecting unit indicating a relationship between the two groups of genera.

Genus LECANOCHITON Maskell.

Plate 4, fig. 2.

*Genotype*.—*Lecanochiton metrosideri* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 147.

*Lecanochiton* was established by Maskell with a single included species, which therefore stands as the type. The small amount of material available for examination and the peculiar nature of the species has made this type a most difficult and unsatisfactory one to study, and fresh, and perhaps living material is much needed to straighten out some points in its anatomy and to verify statements made here.

The Maskell collection contains a single slide of "tests of adult from Rata, Jan. 1881," and a little unmounted material bearing No. 31.

*Adult female*.—Circular, convex, shaped like an inverted basket, covered by a test having the cast second stage skin in the middle of the dorsum (Maskell); anal cleft relatively long, dorsum heavily chitinized, venter slightly so, both clearing somewhat in potassium hydroxide so the venter becomes transparent; antennae apparently

3-segmented, legs apparently wanting; mentum apparently 1-segmented, spiracles small; marginal setae and spiracular spines apparently wanting; no dorsal or ventral surface setae noted; dorsally with scattered, small, slender tubular ducts penetrating the chitin through small clear openings, and a row of small closely set pores through the chitin running forward from the anal plates on each side of the median line for a short distance; ventrally with only tiny quinquelocular disk pores, these a few near the spiracles,

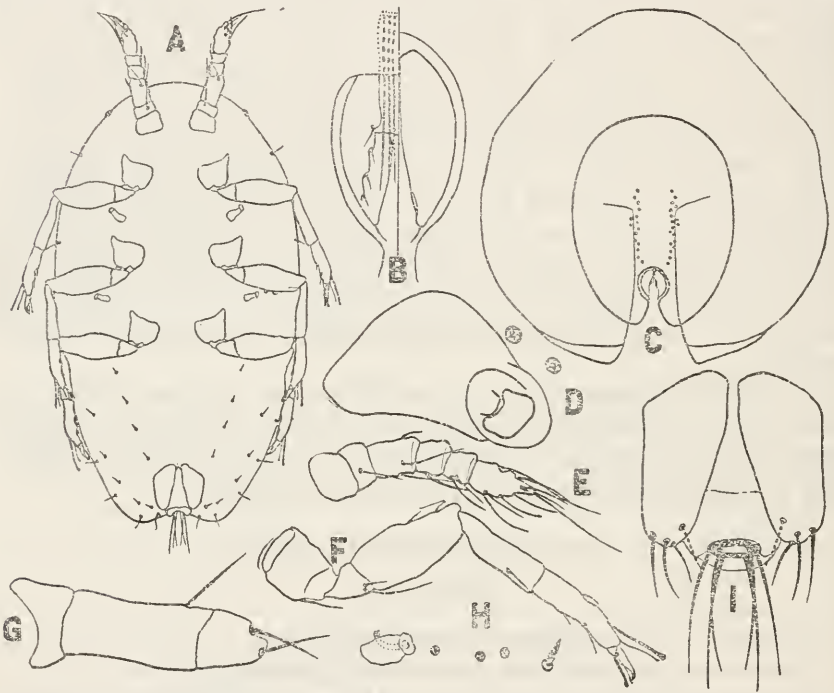


FIG. 23.—*LECANOCHITON METROSIDERI* MASKELL. A. LARVA, OUTLINE, VENTRAL,  $\times 165$ ; B. ADULT FEMALE, ANAL PLATES,  $\times 220$ ; C. ADULT FEMALE, OUTLINE FROM ABOVE,  $\times 32$ ; D. ADULT FEMALE, SPIRACLE,  $\times 640$ ; E. LARVA, ANTENNA,  $\times 335$ ; F. LARVA, LEG,  $\times 335$ ; G. ADULT FEMALE, ANTENNA,  $\times 440$ ; H. LARVA, SPIRACLE AND SPINE,  $\times 500$ ; I. LARVA, ANAL PLATES,  $\times 640$ .

continued into a row of widely scattered pores running to the body margin, around this, and for some distance onto the dorsal surface; no similar pores noted near the anal plates; anal plates small, slender, tapering, with a short, stout apical seta, one or two dorsal setae placed behind the middle, with three ventral ridge setae and with a single fringe seta on each side; anal ring set just anterior to the plates, small, with pores and apparently six setae.

*Larva*.—Elongate oval, antennae 6-segmented, legs normal, all digitules knobbed at apices, one of the tarsus longer and stouter than the other, one of the claw stouter than the other, claw without den-

ticle; margin of body with a single row of rather long, slender setae, spiracular spines stout, short, apices rounded, occurring singly, shorter than marginal setae, the latter accompanied by ventral submarginal and submedian rows of much smaller setae; anal plates each half-oval, with three apical and subapical setae, all short, and one ventral seta; anal ring small, with pores and six setae.

*Cotype*.—Cat. No. 24769, U.S.N.M.

In 1890 Maskell described another species in this genus, an examination of a specimen of which shows that it is very closely related to the type, although on the basis of the scant material available apparently distinct. This species is *L. minor* Maskell. The following generic diagnosis has been prepared from both these species, but even then is incomplete in many respects, and is subject to revision on the basis of the study of more satisfactory material.

#### GENERIC DIAGNOSIS OF LECANOCHITON.

Coccine forms (of Fernald Catalogue), adult female with the exuvium of the preceding stage remaining attached to the middle of the dorsum, at least appearing as if covered by a hard test; dorsal derm heavily chitinized, body circular, convex, antennae present, size and number of segments reduced, legs wanting, mentum 1-segmented, spiracular spines wanting, marginal setae wanting, no dorsal or ventral derm setae, with slender tubular ducts dorsally and quinquelocular pores of one size ventrally adjacent to the spiracles, anal plates slender, with dorsal, apical, and ventral setae, one pair of fringe setae, no hypopygial setae, anal ring small, with pores and six setae; larva oval, antennae 6-segmented, legs normal, marginal setae slender, spiracular spines single, stout, rounded at apex, anal plates half-oval, with apical setae, anal ring with pores and six setae.

Between the uncertainty in regard to some of the structural characters of the included species and the confusion existing in the generic classification of the subfamily in which the genus belongs the writers are unable to offer any suggestions as to its relationships; the apparent retention of the exuvium of the preceding stage by the adult female appears to provide a distinguishing identification character which can be used until the true relationships of the genus have been determined.

#### Genus CTENOCHITON Maskell.

Plate 4, fig. 3.

*Genotype*.—*Ctenochiton viridis* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, pp. 159, 161.

In spite of the fact that this genus was described in 1879, the first designation of a type species for it does not appear to have been made

until the publication of the Fernald Catalogue in 1903, at which time *viridis* was indicated as the type.

The Maskell collection contains three slides of the type species, one of "old females from Rubus, June, 1877," one of "Female, early 3d stage, Jan. 1890," and one of "Adult male, 1890," and some unmounted specimens under No. 33. It has been possible to obtain additional mounted specimens from this latter material, and most of the following descriptive notes have been obtained from these later mounts. There is no positive evidence, however, that the unmounted specimens were from the original type lot of material.

*Adult female*.—Bright green in life (Maskell); very flat in dried state, broadest behind, somewhat acuminate and asymmetrical anteriorly; test incomplete and broken in old forms; derm not very heavily chitinized; antennae small, slender, 6-segmented, the third very long; legs small, normal, the claw very short and stout, the tarsal digitules slender, knobbed, the claw digitules more flattened and expanded through their whole length; mentum very short, broad, apparently 1-segmented; margin of body with a row of widely separated, small, conical spines, placed about 4-5 times their own length apart; spiracular spines represented by a single long spine opposite each spiracle; no dorsal setae observed; ventrally with long hairs near the antennae, and in pairs anterior to the anal plates, and also with some small scattered hairs; dorsally with tiny tubular ducts, widely scattered and each surrounded (in stained specimens) by a small, circular, clear area, also with a short transverse row of tiny disk pores some distance anterior to the anal plates and a few similar along the body margin; ventrally with a scattered row of quinquelocular disk pores between each spiracle and the margin, and with numerous larger multilocular disk pores in transverse and encircling bands anterior to and around the anal plates; these latter circular to oval with as many as eleven to twelve loculi and oval centers, also with the tubular ducts ventrally, at least near the margin; anal plates, when flattened, broad and stout, tapering to a blunt point posteriorly, with a slender apical spine, two similar, subapical, on the inner face of each plate, and (probably) a much larger subapical dorsal seta (represented only by the clear spot in the chitin to which the base was presumably attached), with two ventral setae near the base of the ridge, fringe setae apparently wanting; anal ring with six setae, one pair larger and longer than the others, and a double row of pores, placed a little anterior to the anal plates.

*Intermediate stages*.—Not available.

*Larva*—(embryonic only). Broad ovate, slightly narrowed behind; antennae 6-segmented; legs normal, claw without denticle, tarsal digitules knobbed, one much stouter than the other, the more slender inserted a little above the other, claw digitules similar, one much



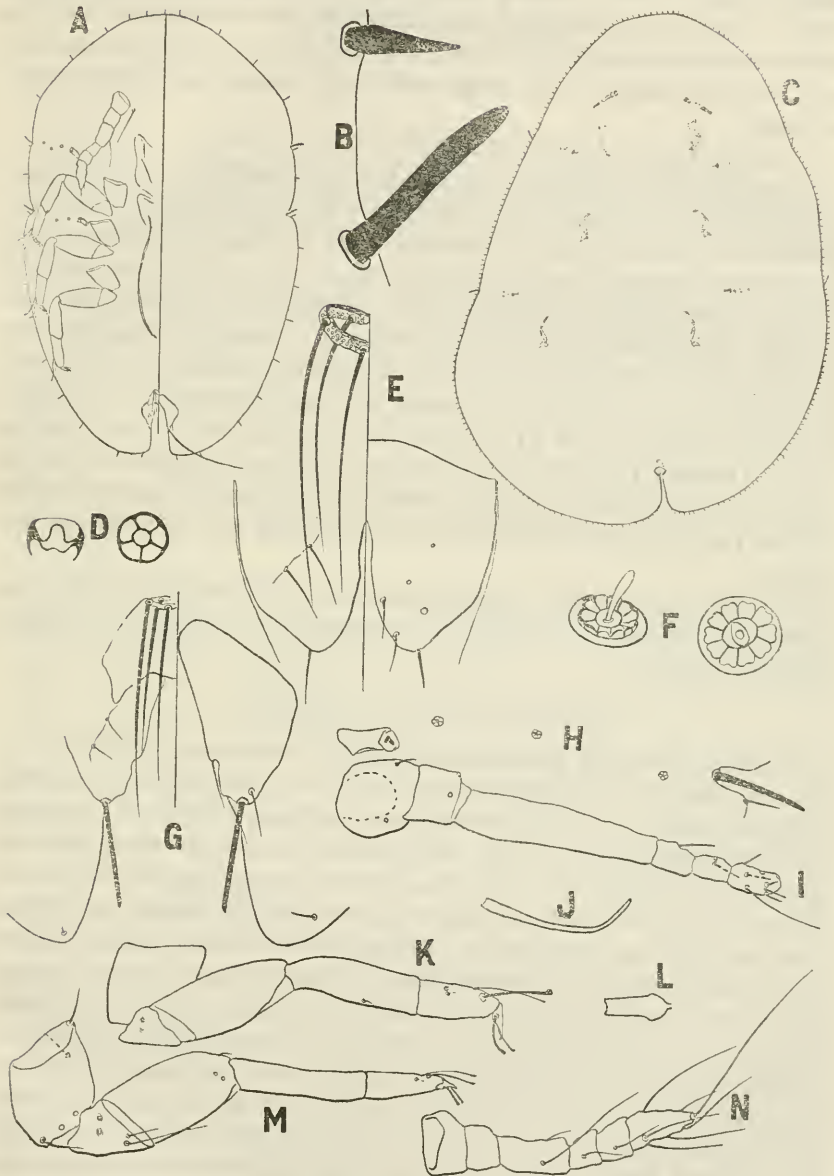


FIG. 24.—*CTENOCHITON VIRIDIS* MASKELL. A. LARVA,  $\times 115$ ; B. ADULT FEMALE, SPIRACULAR AND MARGINAL SPINES,  $\times 500$ ; C. ADULT FEMALE, OUTLINE,  $\times 12$ ; D. ADULT FEMALE, SPIRACULAR DISK PORE,  $\times 1500$ ; E. ADULT FEMALE, ANAL PLATES,  $\times 165$ ; F. ADULT FEMALE, DISK PORES ANTERIOR TO ANAL PLATES, TWO VIEWS,  $\times 1500$ ; G. LARVA, ANAL PLATES,  $\times 640$ ; H. LARVA, SPIRACLE TO MARGINAL SPINE,  $\times 640$ ; I. ADULT FEMALE, ANTENNA,  $\times 165$ ; J. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ ; K. LARVA, LEG,  $\times 335$ ; L. ADULT FEMALE, DUCT,  $\times 1500$ ; M. ADULT FEMALE, LEG,  $\times 165$ ; N. LARVA, ANTENNA,  $\times 335$ .

stouter than the other; spiracular spines single, relatively large and stout, margin with a widely separated row of small slender setae; with 2-3 tiny quinquelocular disk pores between each spiracle and its spine, no other pores noted; anal plates triangular, with a long apical seta, not reticulated; anal ring small, with pores, and, apparently, six setae.

*Cotype*.—Cat. No. 24770 U.S.N.M.

A considerable number of species has been included in this genus, and while it is not possible to comment accurately regarding the disposition of most of these, on account of the confusion existing in this and related genera, it seems probable that most of the New Zealand species now included here are rather closely related to the type and may be left in the genus for the present; *C. eucalypti* Maskell and *C. rhizophorae* Maskell do not appear to be congeneric with the type, but we can not indicate their proper location at present; *C. cellulosa* Cockerell appears to be a *Ceroplastodes* in the sense of *Ceroplastodes cajani* (Maskell), which in turn is probably not congeneric with the type of *Ceroplastodes*. Beyond these, no suggestions can be offered at this time as to the remainder of the species now included in the genus.

The following generic diagnosis has been prepared chiefly from the description of the type species, with reference to some of the other included species.

#### GENERIC DIAGNOSIS OF CTENOCHITON.

Coccine forms (of Fernald Catalogue); adult female more or less convex, usually very slightly so, covered in life with glassy, whitish, or transparent wax plates, these often fragile and broken or wanting, projecting beyond the body margin like saw teeth when perfect; antennae 6-8-segmented, the third usually long; legs and spiracles normal, the claw digitules somewhat swollen, claw with or without denticle, mentum 1-segmented, marginal setae small, conical spines set variably from very close together to some distance apart, according to the species, spiracular spines single, large, strongly differentiated, dorsal setae wanting or very small, dorsal spines present in a definite pattern in some species, ventral setae few, not conspicuous, derm with tiny tubular ducts and, ventrally, with two sizes of multi-ocular disk pores, with or without other types of pores, anal cleft short, plates small, tapering behind, with apical and subapical setae and a large dorsal pore (or hair base), with ventral ridge setae, without fringe setae, without hypopygial setae, anal ring placed anterior to plates, with six setae and double row of pores; larva ovate, antennae 6-segmented, legs normal, spiracular spines occurring singly, marginal setae small, slender, spiracular disk pores present, anal

plates triangular, with long apical seta, anal ring small, with pores and six setae.

Genus *INGLISIA* Maskell.

Plate 4, fig. 4.

*Genotype*.—*Inglisia patella* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, pp. 162, 163.

*Inglisia* was first described by Maskell in 1879, and originally included only the single species *patella*, which consequently stands as the type.

This species is represented in the Maskell collection by a single slide of "rostrum, antennae, foot, and spiracle, June, 1881," and by a very few unmounted specimens under No. 46. There is thus no indication that Maskell retained in his collection the specimens he studied when describing the species and genus, and it seems probable that they are no longer in existence. The species is so distinct in certain structural characters, however, that there would seem to be no question as to the identity of the later material with that originally described.

*Adult female*.—The glassy external covering, as described by Maskell, that is limpet-shaped; body indistinctly eight-sided, anal cleft very short, derm clearing completely in potassium hydroxide, convex above, but flattening without injury on mounting; antennae small and short, indistinctly 7-segmented; legs small, short, normal, joint between tibia and tarsus somewhat indistinct, tarsal digitules slender, knobbed, but one larger than the other, claw digitules enlarged, both swollen at tips, claw small and stout, without denticle; mentum 1-segmented, small; spiracles small, not strongly constricted in middle; marginal spines small, short, of two distinctly different sorts, one stout, clavate, the other slender, tapering, straight, both set in cup-shaped sockets and normally alternating; spiracular spines not differentiated, their location indicated only by a slight marginal indentation and a few quinquelocular pores; both dorsally and ventrally with a few tiny, slender setae, especially near the margin, and with a transverse row of the same some distance anterior to the anal plates; with only slender tubular ducts, mostly along the margin, probably dorsally and with a few tiny quinquelocular pores, all of one size, between each spiracle and the body margin, and around the anal plates; dorsally, just behind the conical apex of the body, with a pair of large somewhat quadrate compound cribriform plates; submarginal tubercles apparently wanting; anal plates small, short triangular, the inner face of each from a little anterior to the middle to the apex with five large "pores," presumably the insertions for short spines, with a similar pore dorsally about a third

of the plate length from the posterior end, the presence or absence of ventral fringe or hypopygial setae not determinable; anal ring

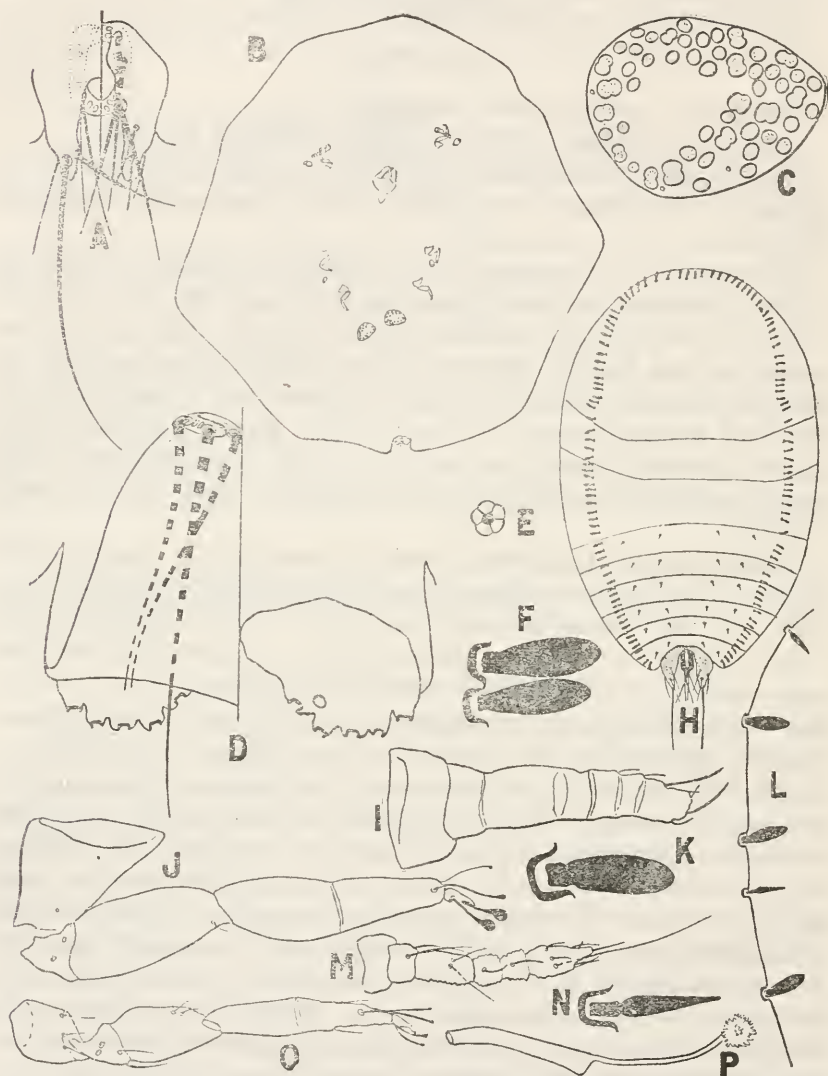


FIG. 25.—INGLISIA PATELLA MASKELL. A. LARVA, ANAL PLATES,  $\times 640$ ; B. ADULT FEMALE, OUTLINE OF BODY,  $\times 17.5$ ; C. ADULT FEMALE, DORSAL CRIBRIFORM PLATE,  $\times 220$ ; D. ADULT FEMALE, ANAL PLATES,  $\times 500$ ; E. ADULT FEMALE, SPIRACULAR PORE,  $\times 1500$ ; F. LARVA, MARGINAL SPINE,  $\times 1500$ ; G. EMBRYONIC LARVA,  $\times 335$ ; H. ADULT FEMALE, ANTENNA,  $\times 165$ ; I. ADULT FEMALE, ANTENNA,  $\times 335$ ; J. ADULT FEMALE, LEG,  $\times 335$ ; K. ADULT FEMALE, MARGINAL SPINE, ONE SORT,  $\times 1500$ ; L. ADULT FEMALE, PORTION OF MARGIN OPPOSITE SPIRACLE,  $\times 500$ ; M. LARVA, ANTENNA,  $\times 335$ ; N. ADULT FEMALE, MARGINAL SPINE, SECOND SORT,  $\times 1500$ ; O. LARVA, LEG,  $\times 335$ ; P. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ .

relatively large, placed a little before the plates, with pores and six setae—not eight.

*Intermediate stages.*—Not available.

*Larva* (embryonic).—Elongate oval, antennae 6-segmented, legs normal, claw with denticle, digitules slender, one tarsal longer and larger than the other, inserted above it, one of the claw similarly enlarged; mentum very short, 1-segmented; body margin with a continuous closely set row of clavate spines, some slightly smaller than others, accompanied above and below by more widely separated tiny submarginal setae; with a pair of long slender hairs ventrally anterior to the anal ring; body apparently without gland pores; anal plates slender, tapering, with a long apical seta and six other slender setae; anal ring small, with pores and six setae.

*Cotype*.—Cat. No. 24771, U.S.N.M.

Eleven species besides the type have been included in this genus by various writers. After an examination of specimens or descriptions of all of these, the conclusion that no one of them is congeneric with the type is unavoidable. The peculiar character of the marginal spines and the complete lack of differentiation of the spiracular spines in both adult and larva, and the development of the unusual compound cribriform plates in the adult all serve to separate the type species sharply and widely from the other species included in the genus, and similarly from the other species and genera of the group in which the genus has been placed, in so far as the latter are known to the writers.

The following generic diagnosis is therefore confined to the type species.

#### GENERIC DIAGNOSIS OF INGLISIA.

Coccine forms (of Fernald Catalogue) covered, in the older stages at least, by a glassy, vertically striated test or shell, conical in the type; body of adult female delicate, convex above, short and the margin angular, anal cleft very short, antennae indistinctly 7-segmented, legs normal, mentum 1-segmented, marginal spines of two sorts, tapering and slender, and stout clavate, alternating, spiracular spines not differentiated, dorsal and ventral setae present, mostly very few and scattered, with only long tubular ducts and small quinquelocular disk pores (ventral), anal plates small, triangular, with several stout setae along inner margin of each, anal ring with pores and six setae; larva elongate oval, antennae 6-segmented, legs normal, body margin with continuous series of closely set clavate spines, spiracular spines not differentiated, anal plates slender, tapering, with long apical seta and several others, anal ring with pores and six setae.

Some of the structural characters of this genus suggest a relationship to the subfamily Asterolecaninae, notably the dorsal cribriform plates, the peculiarly shaped anal plates, and the glassy external covering, but other characters do not bear out this suggested rela-

tionship, so the genus appears actually to be rather anomalous among the Coccinae and may stand alone as a distinct tribe when the generic classification of this subfamily is reorganized.

Genus *PARALECANIUM* Cockerell.

Plate 4, fig. 5.

*Genotype*.—*Lecanium frenchii* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 199.

The type of this genus was specifically designated as being *Lecanium frenchii* Maskell at the time Professor Cockerell erected the subgenus *Paralecanium*, which he later raised to generic standing.

The Maskell collection includes three slides of the type species, one of "adult female, Aug. 1890," one of "antenna of female, Aug., 1890," and one of "2nd stage female, Aug., 1890," besides which there are a few unmounted specimens under No. 131.

*Adult female*.—Flat, broad oval, dorsal derm heavily chitinized, dark brown; derm clearing only a little when boiled in potassium hydroxide; body with clear radial lines extending part way in toward the center all the way around the margin, these continued as large areolations in the middorsal region; antennae small, slender, 8-segmented; legs small, slender, normal, claw apparently without denticle, digitules slender, knobbed at apex; spiracles small, slender in middle; mentum small, short, 1-segmented; marginal flabella small, faintly striate, triangular with rounded corners, not overlapping; spiracular spines in threes, the middle one somewhat longer, all slightly clavate; dorsal surface with an occasional small slender hair, ventral surface with two pairs of relatively large setae anterior to the anal ring, and with scattered minute setae; derm with occasional clear pores through the chitin dorsally, probably representing the openings of tubular ducts, although details of such can not be made out, ventrally with a row of tiny quinquelocular pores between each spiracle and its marginal spines, similar pores in all probability present in the ventral anal region, although here again they are not observable; anal plates elongate, triangular, postero-lateral margin somewhat longer than antero-lateral; anal plate setae very few, only a single submedian one observed dorsally, apparently without apical setae, and with only a single fringe seta ventrally, these very small, and possibly with a few more present; anal ring small, stout, normally placed anterior to the plates, with pores and six long setae.

*Intermediate stages*.—None available for examination. (Maskell's 2nd stage female apparently a late first stage larva.)

*Larva*.—(Maskell's 2nd stage female.) Only one specimen badly attacked by fungus, so that nearly all the characters are obscured, those visible shown in figure.

*Cotype*.—Cat. No. 24772, U. S. N. M.

Between fifteen and twenty species and varieties besides the type have been placed in this genus, all of which, with the possible exception of *P. marianum* Cockerell appear to be correctly placed. Nearly all the published work on the included species has been done by Mr. E. E. Green.<sup>14</sup>

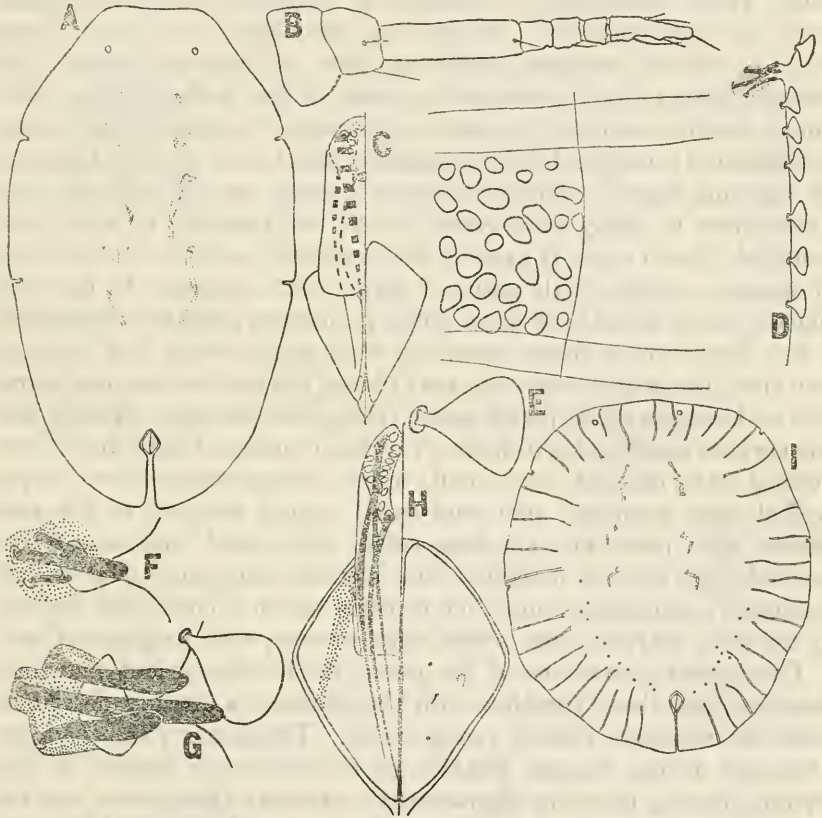


FIG. 26.—*PARALECANIUM FRENCHII* (MASKELL). A. LATE LARVA, OUTLINE OF BODY,  $\times 165$ ; B. ADULT FEMALE, ANTENNA,  $\times 220$ ; C. LATE LARVA, ANAL PLATES,  $\times 220$ ; D. ADULT FEMALE, PORTION OF BODY MARGIN,  $\times 165$ ; E. ADULT FEMALE, MARGINAL FLABELLA,  $\times 640$ ; F. LATE LARVA, SPIRACULAR SPINES,  $\times 640$ ; G. ADULT FEMALE, SPIRACULAR SPINES,  $\times 640$ ; H. ADULT FEMALE, ANAL PLATES,  $\times 220$ ; I. ADULT FEMALE, OUTLINE OF BODY FROM ABOVE,  $\times 17.5$ .

In the following generic diagnosis an attempt has been made to cover all of the included species, with the single exception noted above.

#### GENERIC DIAGNOSIS OF *PARALECANIUM*.

Coccine forms (of the Fernald Catalogue), normally leaf inhabiting; adult female with body flat, circular to oval, medium in

<sup>14</sup> Chiefly in his *Coccidae of Ceylon* (pt. 3, 1904, pp. 235-247).

size, covered by a thin film of transparent wax, usually with margin indented at anal cleft and opposite spiracles, the cleft short, derm heavily chitinized at maturity, usually some shade of brown, at least after death, derm usually with large quadrate or polygonal depressed areas in rows in the middorsal area, with numerous large faint areolations in groups or clusters, with the dorsum more or less distinctly divided up into plates by clear lines, with a ventral marginal chitinous zone of varying width; antennae present, well developed or more or less reduced; legs present, reduced or wanting; spiracles not unusual; mentum short, stout, 1-segmented; marginal spines enlarged into broad, flattened flabella of varying shapes; spiracular spines present, set in incisions with from three to many to a group, stout, not tapering to apex, tips rounded; dorsal setae, if present, few, scattered, minute; ventral setae, if present, similar with pairs of larger setae anterior to the anal plates; dorsal specialized derm pores, if present, probably confined to a few long tubular ducts, ventrally with multilocular disk pores of two sizes, the larger below the anal plates, the smaller between spiracles and margin; anal plates small, triangular, the sides straight and the corners usually sharp, with a varying number of both dorsal and ventral setae, these all very small; minute fringe setae present, hypopygial setae wanting; anal ring small, placed anterior to the anal plates, with pores and six long setae; larva oval, antennae 6-segmented; legs normal, marginal setae slender, individual setae widely separated; spiracular spines one to three set on a chitinized incision of the body margin; anal plates long, slender, with long apical seta.

The salient characters of the genus lie in the curious marginal flabellae, and these, together with the characters already described, make its members readily recognizable. The genus *Platylecanium* Cockerell is the nearest relative of *Paralecanium* known to the writers, having the same characteristic external appearance, but the marginal spines slender, seta-like, and not expanded into flabellae.

#### Genus CRYPTES Cockerell and Parrott.

Plate 5, fig. 1.

*Genotype*.—*Lecanium baccatum* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 209.

This genus, which is credited to "Crawford" in the Fernald Catalogue, is a parallel case to that of *Erium* in so far as the proper assignment of an author name is concerned. Crawford merely used the name as a specimen label in his collection; Maskell simply records the fact that Crawford did this, and goes further, in describing the species as a *Lecanium*, and shows his own conviction that the new generic name used by Crawford is not necessary. The first definite



use of the name as a unit in the classification of the Coccidae is by Cockerell and Parrott.<sup>15</sup>

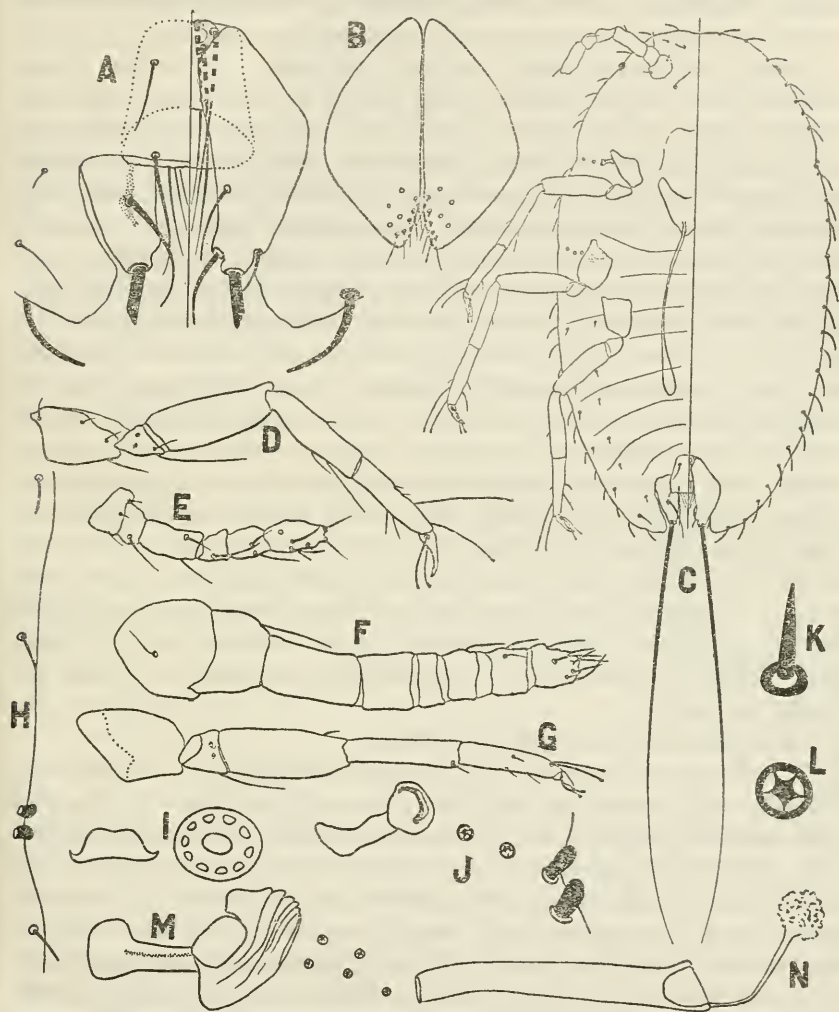


FIG. 27.—*CRYPTES BACCATUS* (MASKELL). A. LARVA, ANAL PLATES,  $\times 440$ ; B. ADULT FEMALE, ANAL PLATES,  $\times 165$ ; C. LARVA, OUTLINE OF BODY,  $\times 115$ ; D. LARVA, MIDDLE LEG,  $\times 220$ ; E. LARVA, ANTENNA,  $\times 220$ ; F. ADULT FEMALE, ANTENNA,  $\times 220$ ; G. ADULT FEMALE, LEG,  $\times 115$ ; H. ADULT FEMALE, SPIRACULAR SPINE REGION,  $\times 220$ ; I. ADULT FEMALE, ABDOMINAL VENTRAL DISK PORE,  $\times 1500$ ; J. LARVA, SPIRACLE TO MARGIN,  $\times 640$ ; K. ADULT FEMALE, BODY SPINE,  $\times 1500$ ; L. ADULT FEMALE, SPIRACULAR PORE,  $\times 1500$ ; M. ADULT FEMALE, SPIRACLE WITH PORES,  $\times 220$ ; N. ADULT FEMALE, TUBULAR DUCT,  $\times 1500$ .

The Maskell collection contains two slides of this species, one of "rostrum, antenna, and foot of female, Australia, 1891," and one of "larvae, 1891." There is also a considerable quantity of unmounted

<sup>15</sup> The Industrialist, 1899, p. 162.

material, evidently from different collections, bearing No. 64, and from the latter it has been possible to obtain additional mounts for study, although it has not been possible to determine with certainty which unmounted lot of material represents the type lot.

*Adult female*.—Strongly convex, globular, or, when closely crowded, even higher, usually pale yellow in color, anal cleft completely fused, the anal plates placed in a slightly chitinized plate high up on the posterior face of the body; derm clearing completely in younger specimens, more or less chitinized in the older, more fully matured forms; antennae small, 8-segmented; legs small, slender, normal, all digitules slender and knobbed at apices, claw with denticle; spiracles normal; mentum short, 1-segmented; marginal setae small, entire, scattered, not in a distinct row; spiracular spines very stout, short, blunt tipped, normally with two opposite each anterior and one opposite each posterior spiracle; derm with occasional tiny setae, especially beneath; dorsally with an occasional long tubular duct with threadlike continuation, ventrally with small quinquelocular disk pores between spiracles and margin and numerous much larger multilocular pores over the ventral surface of the abdomen; anal plates half oval, outer angle rounded off, the ends pointed, with about four dorsal setae, near posterior apex, and one apical seta, ventral ridge with five large setae; no fringe setae as such noted; no hypopygial setae; anal ring placed below and within the plates, small, oval, apparently without pores, but with numerous (about 16) closely set setae.

*Intermediate stages*.—Not recognized.

*Larva*.—Body elongate oval; antennae 6-segmented, slender; legs slender, long, normal, all digitules slender, threadlike with knobbed tips, one tarsal digitule smaller than the other and inserted above it, claw with denticle at apex; body margin with a series of rather long setae, blunt-tipped and mostly bent or curved backwards; spiracular spines very short, stout, and bluntly rounded, normally with two opposite each anterior spiracle and one opposite each posterior, rarely with two opposite the latter; without dorsal setae or pores; ventrally with two submarginal rows of small setae on each side, paralleling the marginal, of which the setae of the outer row are about twice the length of those of the inner row; derm pores confined to the small quinqueloculars, in rows of from two to four, between the spiracles and the margin; anal plates half oval, pointed posteriorly, with a long apical seta as much as two-thirds the body length, but usually broken off more or less; with two subapical and one dorsal setae, with one ventral ridge seta; apparently with one fringe seta; hypopygial setae wanting; anal ring small, placed just below the anterior end of the plates, with six setae.

*Cotype*.—Cat. No. 24773, U.S.N.M.

Besides the type species, a variety has been described by Fuller, but the writers are able to contribute nothing regarding the latter. The following generic diagnosis has been based to the description of the type species.

GENERIC DIAGNOSIS OF CRYPTES.

Coccine forms (of the Fernald Catalogue), adult female naked, globular, with anal cleft completely fused, antennae 8-segmented, legs, spiracles and mentum normal, the latter 1-segmented, marginal setae small, tapering, irregularly arranged, spiracular spines very short, stout, and blunt, not more than two opposite any spiracle, dorsal body setae few and scattered, derm pores confined to long tubular ducts and multilocular disk pores of two sizes, anal plates half oval with large dorsal, subapical and apical and ventral ridge setae, no fringe setae, no hypopygial setae, anal ring located below and within anal plates, small, oval, with numerous (about 16) setae; larva elongate, antennae 6-segmented, legs, mentum and spiracles normal, marginal setae large, blunt-tipped, curved or bent backwards, spiracular spines stout, very short, blunt-tipped, two opposite anterior, normally one opposite posterior spiracles, anal plates with very long apical setae and large dorsal, subapical and ventral ridge setae, no hypopygial setae, anal ring with six setae.

The form of the male pupa case and the structural characters of the female and larva as given above are quite sufficient to isolate this species generically, and the male pupa case, as described and figured by Maskell and commented on by Cockerell, at least indicates the possibility that *C. baccatus* digresses widely from the normal Coccine type. To the best of the writer's belief, *Kermes acaciae* Maskell represents a mixture of this species and of some species of *Eriococcus*, the immature stages, as described by Maskell being of the larva and adult of the *Eriococcus*, while the adult of Maskell is the adult of *Cryptes baccatus*. In view of the known host habits of *Kermes*, this is a logical expectation, and the writers propose the synonymy indicated, subject to future revision.

Genus ALECANOPSIS Cockerell.

Plate 5, fig. 2.

*Genotype*.—*Lecanopsis filicum* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, p. 211.

This genus has never included more than the single, type species.

The Maskell collection of Coccidae contains a single unmounted specimen bearing the No. 300, and two slides, one of "adult female, 1893," and one of "antennae of female, 1893." The United States

Bureau of Entomology collection possesses a few specimens taken from the roots of grass, Yorke Peninsula, South Australia, collected by A. Koebele, which from a careful comparison with Maskell's specimens appear to be the same species, and owing to the unsatisfactory condition of Maskell's mounts, some of the description and the figures given below have necessarily been taken from the South Australian specimens.

*Adult female*.—Body strongly convex, wrinkled, dark reddish brown, etc., as described by Maskell; derm clearing after treatment with potassium hydroxide; antennae small and short, 6-segmented; legs much reduced, semi-rudimentary, the joints very indistinct, the claw stout and short, both pairs of digitules present, slender, knobbed; spiracles large, stout and heavily chitinized, considerably more developed than in the normal coccine forms; mentum very

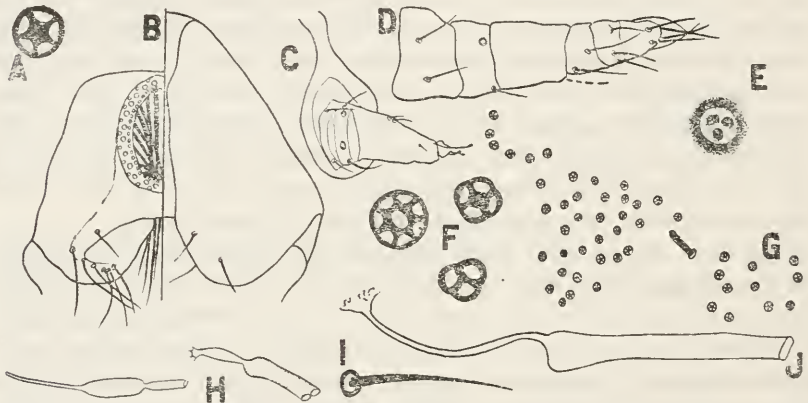


FIG. 28.—*ALECANOPSIS FILICUM* (MASKELL), ADULT FEMALE. A. SPIRACULAR DISK PORE,  $\times 1500$ ; B. ANAL PLATES,  $\times 165$ ; C. LEG,  $\times 220$ ; D. ANTENNA,  $\times 220$ ; E. DERM PORE ABOVE ANAL PLATES,  $\times 1500$ ; F. VENTRAL ABDOMINAL MULTILOCULAR DISK PORES,  $\times 1500$ ; G. SPIRACULAR SPINE AND ADJACENT PORES,  $\times 165$ ; H. SMALL TUBULAR DUCTS,  $\times 1500$ ; I. DERM SETA,  $\times 500$ ; J. LARGE TUBULAR DUCT,  $\times 1500$ .

short and broad, small, 1-segmented; derm with tubular ducts, large and small, scattered rather uniformly throughout, and ventrally with multilocular disk pores, all of approximately one size, normally with about seven loculi, but variable, as shown in figure, in transverse rows anterior to the anal plates, with pores of similar size, but normally quinquelocular, in rather heavy bands between the spiracles and the margin, dorsally anterior to the anal plates with some circular indistinctly trilocular disk pores; marginal setae stiff, tapering, entire, rather long, scattered and not in a single row in one plane and sometimes two deep, not continuous clear up to the spiracular spines; the latter short, stout, somewhat clavate, with one, or rarely

two, opposite each spiracle, placed in the midst of a group of disk pores; dorsal derm with an occasional small stiff seta, these much more numerous and larger in the area around the anal plates, ventral derm with an occasional large stiff seta anteriorly, and a number of the same in transverse rows, one to each abdominal segment, posteriorly; anal plates stout triangular, the antero-lateral margin longer than the postero-lateral, the apices rounded, bearing three or four subapical and apical setae dorsally, and about five to seven larger ventral setae, mostly subapical, but probably continuous with a row of fringe setae which was not observable in the Maskell mount on account of its condition; no hypopygial setae noted; anal ring relatively large, not very heavy, with a double row of pores and numerous (perhaps as many as 24) rather long, stout setae.

*Immature stages.*—None available for examination.

The following generic diagnosis has been based wholly on the preceding description.

#### GENERIC DIAGNOSIS OF ALECANOPSIS.

Coccine forms of the Fernald catalogue, having a subterranean habit; adult female strongly convex, wrinkled, derm not heavily chitinized, antennae reduced, 6-segmented, legs much reduced, joints indistinct, mentum very short, 1-segmented, spiracles considerably larger than normal, and more heavily chitinized, derm pores including tubular ducts of two distinct sizes, somewhat variable multilocular disk pores, those opposite spiracles with five loculi, those anterior to anal plates with seven, and dorsally with obscurely trilocular disk pores anterior to anal plates, all derm setae slender, but stiff, the marginal scattered, entire, not in continuous row, the spiracular spines stout, clavate, one or two opposite each spiracle, dorsal setae small, ventral larger, but still small, anal plates broad triangular, with a few dorsal apical and subapical setae, a number of larger ventral ridge setae, and some large fringe setae, anal ring rather slender, with pores and very numerous (over 20) setae.

The writers have no specimens of *Lecanopsis* available for examination, and are therefore unable to make a critical comparison of it with *Alecanopsis*. Professor Cockerell established the genus in 1901 on the very superficial characters of the shape of the body, the color, and the reduction of the legs and antennae. This reduction, in connection with the enlargement of the spiracles, the habit and the great increase in the number of anal ring setae are probably quite sufficient to separate this genus from all of the other genera now included in the Coccinae of the Fernald catalogue.

## Subfamily DIASPINAE.

## Genus POLIASPIS Maskell.

Plate 5, fig. 3.

*Genotype.*—*Poliaspis media* Maskell.

*Reference.*—Fernald, Cat. Cocc. World, 1903, p. 243.

Maskell established this genus on the basis of the type species only, although a number of additional species have been placed in it subsequently.

The species is represented in the Maskell collection by a single slide, presumably the type one, labeled "female, 2 stages from Veronica, Jan. 1879." There is also some unmounted material in the Maskell collection under No. 27, while the National Collection of Coccidae also contains some material received from Maskell through Cockerell, and supposed to be a portion of Maskell's type material. Such slides as have been prepared from this last and from Maskell's unmounted specimens appear to represent a different species from that mounted by Maskell in 1879. The following specific description has therefore been confined to the material on the type slide, and on account of its condition certain details of structure have necessarily been omitted.

*Adult female.*—Scale as described by Maskell: body elongate oval, tapering somewhat posteriorly, membranous, except a portion of the pygidium; antennae small, flattened tubercles with one or two long spines; spiracles slender, each accompanied by a close group of pores, the anterior with about 15-20, the posterior with about 12-15; margin of head with a few small setae; margins of thorax and abdominal segments with a few small setae and with short, small tubular ducts and slender gland spines with broadly expanded bases, these latter extending in from the margin ventrally; hind margin of posterior abdominal segments with a definite row of tubular ducts on each side and another similar row about midway between center and margin, these dorsal; pygidium not especially large nor prominent, not sharply separated from remainder of body, rounded at apex, median lobes large, not contiguous, more or less protruding, strongly diverging, the margins rounded off and finely crenulate in part, lobes joined by a heavy chitinized thickening, and with a pair of sharp, converging setae between the lobes; inner lobule of second lobes smaller, somewhat asymmetrical, the apex rounded, the outer lobule broadly triangular, inconspicuous, the two lobules of the third lobes represented only by inconspicuous marginal projections; margin beyond lobes broken, but without distinct teeth or crenulations; gland spines relatively long and slender, one outside each median lobe, one beyond the second lobes, one beyond the rudi-

ments of the third lobes, then one more near the basal angles of the pygidium; marginal setae, dorsally one anterior to outer angle of median lobe, one above outer lobule of second lobes, then two more at increasing intervals, ventrally the median pair and one approxi-

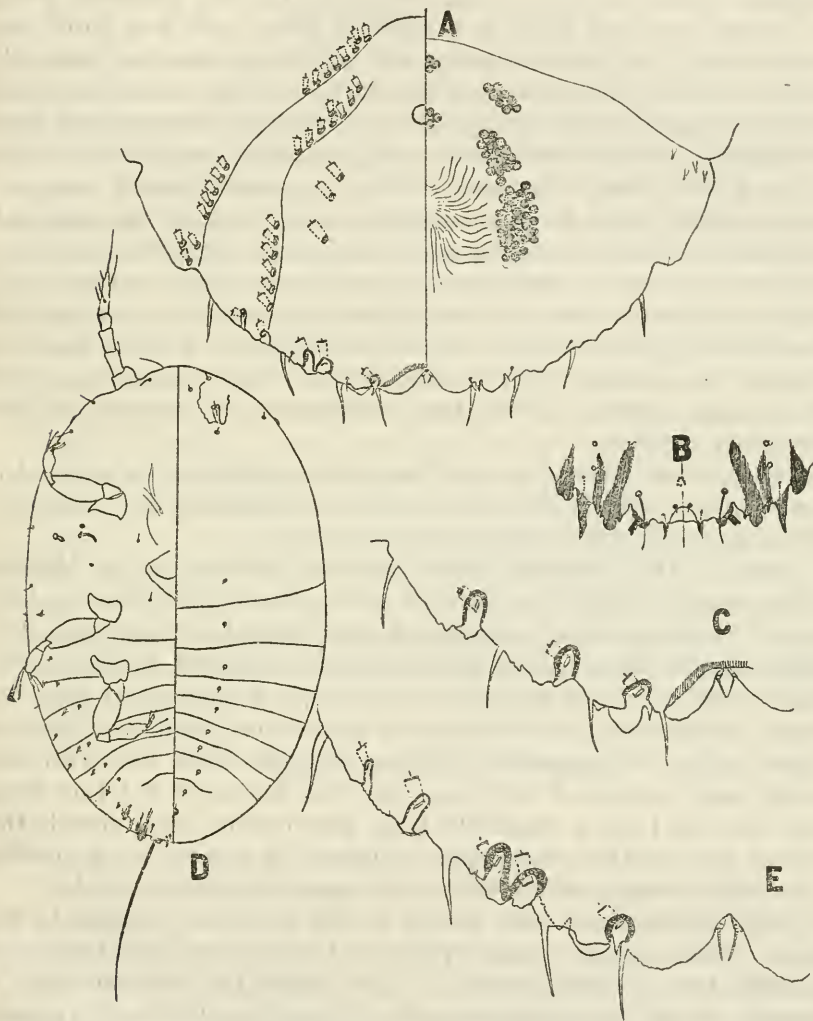


FIG. 29.—*POLIASPIS MEDIA* MASKELL. A. ADULT FEMALE, PYGIDIUM,  $\times 220$ ; B. *POLIASPIS*, SPECIES, LARVA, APEX OF ABDOMEN,  $\times 500$ ; C. *POLIASPIS MEDIA*, INTERMEDIATE STAGE, FEMALE, MARGIN OF PYGIDIUM,  $\times 500$ ; D. *POLIASPIS*, SPECIES, LARVA, OUTLINE OF BODY,  $\times 230$ ; E. *POLIASPIS MEDIA*, ADULT FEMALE, MARGIN OF PYGIDIUM,  $\times 500$ .

mately just below each of the dorsal setae; without incisions or paraphyses; anal opening rather small, placed much nearer anterior margin of the pygidium; paragenitals in eight groups, the median 6-7, supplementary median 6-8, antero-laterals 14-22, supplementary antero-laterals 5-10, postero-laterals 25-35; marginal pores

short tubular, of moderate size, one opening just inside second lobe, and with a short spinelike marginal projection opposite it, then with two in a group, one inside, one anterior to the rudimentary third lobes, and after an interval two more; dorsal pores placed in definite closely set rows, inner with three to four, posterior group of second row with about 6-8, anterior group with 5-6, third row with about 7 in posterior group and 6-7 in the anterior; ventrally with a number of micropores, the ducts of these rather short and stout, the exact number and position of these not determinable from Maskell's type slide; with two widely separated, small, dorsal setae on each side, these above and within the postero-lateral paragenitals; ventrally with small submarginal setae opposite the marginal, and with a pair of smaller setae within and opposite each space between the antero- and postero-lateral paragenitals; perhaps with others anterior to these, but not definitely discernible in the material examined; pygidium, while somewhat chitinized, without basal or ventral thickenings; with faintly defined, long triangular, dorsal thickenings running in from the posterior margin opposite the first two pairs of lobes.

*Intermediate stage female*.—Essentially similar to the adult, differing principally in the absence of the paragenitals and in the reduced size and development of the pores, etc.

*Larva*.—(Of *Poliaspis*, species, but not included in the Maskell slide mount; included for the sake of the greatest possible completeness.) Oval, antennae 5-segmented, the terminal not annulate; dorsally at apex with a pair of double, heavily chitinized, tubular ducts; legs normal; apex of abdomen with a pair of long apical setae between which are a pair of triangular projections, similar in shape to gland spines, but apparently without internal ducts, and with two small setae, outside of which are two well-developed but tiny lobes and between these a relatively large gland spine, then outside the second lobe another gland spine, followed by several much smaller ones on the margin of the abdominal segments, a pair to each.

Eight species have been placed in this genus in addition to the type. These appear to the writers to belong to at least three and possibly four different groups. *P. pini* Maskell is quite obviously a member of the *Lepidosaphes* series. *P. carissae* Cockerell appears to have its relationships with the group represented by *Dinaspis* Leonardi. The status of *P. exocarpi* Maskell, *P. nitens* Fuller, and *P. intermedia* Fuller is more doubtful, but the writers at present consider their inclusion in this genus as open to question. It is not possible to comment definitely on *P. casuarinae* Lidgett. So far as may be determined from available material and descriptions, *P. argentosis* Brittain, *P. cycadis* Comstock, and *P. kiggelariae* Brain may be properly included with *P. media* Maskell. In examining



these species, no attention has been given to the question of possible specific synonymy.

The following generic diagnosis has been based largely on the specific description preceding.

GENERIC DIAGNOSIS OF POLIASPIS.

Diaspine forms, probably belonging in the generic group containing *Aulacaspis pentagona* (Targioni); scale of male elongate, Chionaspis-like, but without carinae; scale of female elongate pyriform, exuviae terminal; body of adult female membranous, elongate oval, antennae tiny tubercles, spiracles normal, all accompanied by a closely set cluster of pores, margins of thoracic and abdominal segments with small short tubular ducts, gland spines and tiny setae, pygidium rounded, median lobes large, more or less protruding, not contiguous, with an intermediate pair of setae, second and third lobes more or less developed, divided into two lobules where distinct, gland spines present, the posterior ones arranged singly, marginal setae normal, without incisions or chitinous thickenings, anal opening moderate, circular, nearer base than apex of pygidium, paragenitals present, in eight groups, marginal pores present, axis longitudinal, inner single, remainder in pairs, dorsal pores in distinct linear rows, split into two groups, axis longitudinal, pygidium with some indistinct thickenings running cephalad from margin, with ventral micropores and both dorsal and ventral setae; intermediate female in general similar to adult, but without paragenitals and less developed; young larva oval, with 5-segmented antennae, a pair of large cephalic tubular ducts, apex of abdomen with long setae, two pairs of lobes and gland spines.

Genus PHAULASPIS Leonardi.

Plate 5, fig. 4.

*Genotype*.—*Aspidiotus hakeae* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, pp. 251, 260.

Leonardi first established the genus *Phaulaspis* in 1897, designating *hakeae* as the type. Later, in 1900, he substituted *Cryptaonidia*, with the same type, for *Phaulaspis*, but without an explanation of his action. There appears to be no question but that the first name has precedence over the later one.

The Maskell collection contains eight slides of this species, two of "adult female, 1895," one of "male, 1895," one of "male pupa, 1895," one of "larva, 1895," one of "1st pellicle ♀, 1895," one of "2nd pellicle ♀, 1895," and one of "pellicles ♀ 1895." There is also some unmounted material under No. 483.

*Adult female.*—Scale as described by Maskell; body normally nearly circular, with the pygidium slightly protruding, often appearing oval, broader than long, due to the failure of the abdominal segments to expand during treatment; derm membranous, pygidium slightly chitinized; antennae tiny tubercles pointed at tip, but without setae; spiracles small, stout, not accompanied by pores; abdominal segments rather indistinct, with little clusters of short tubular ducts and tiny spines set in rings, beneath and at the margins of segments, the ducts more numerous; pygidium without lobes or plates, the margin somewhat undulating, with a small median ventral, marginal, chitinized thickening, this with a tiny seta on each side; dorsally with four small setae on each half of the pygidium, the first two, one anterior to the other, not far beyond the chitinous thickening, the third and fourth widely separated, and much beyond the first two, all submarginal; ventrally with the same number, but of smaller setae, and with the pair at the outer end of the row, instead of the inner; with a few scattered, tiny, tubular ducts ventrally close to the margin; paragenitals wanting; anal opening large, circular to triangular, placed rather close to the posterior apex of the pygidium, with distinct internal tube; apparently without dorsal setae or pores; ventrally with a single seta on each side anterior to and diagonally outside of the anal ring and three more in a group in the same direction near the anterior edge of the pygidium; nearly all of the posterior margin of the pygidium broadly but faintly thickened.

*Intermediate stage female.*—Cast skin large, very convex, covering the adult, approximately circular, margin of pygidium of this stage with lobes and spines as shown in figure; body itself nearly circular, antennae short tubercles bearing two rounded knobs and three spines; margin of abdominal segments with a very few setae and tubular ducts; pygidium with two pairs of well-developed lobes, the median largest, protruding strongly, deeply notched at apices, with the outer tooth shorter than inner, second lobes similar in shape, but much smaller and less prominent, and with a blunt tooth beyond these, probably corresponding to third lobe; marginal setae, dorsal, one small, on outer edge of median lobe, one, large, outside of second lobe, one, large, beyond marginal tooth, and one more, large, near end of pygidium, ventral, possibly one on median lobes, one beneath and beyond each of the other three dorsal setae, all small; with an incision with more or less distinctly thickened edges between the median and second lobes and traces of another outside of the second lobes; no marginal paraphyses; anal opening median, circular, fairly close to apex of pygidium; dorsal marginal tubular pores one or two opening into first incision, two or three in the rudimentary second incision, and one beyond each of the three large dorsal marginal setae; with a micropore tube between the median lobes and another

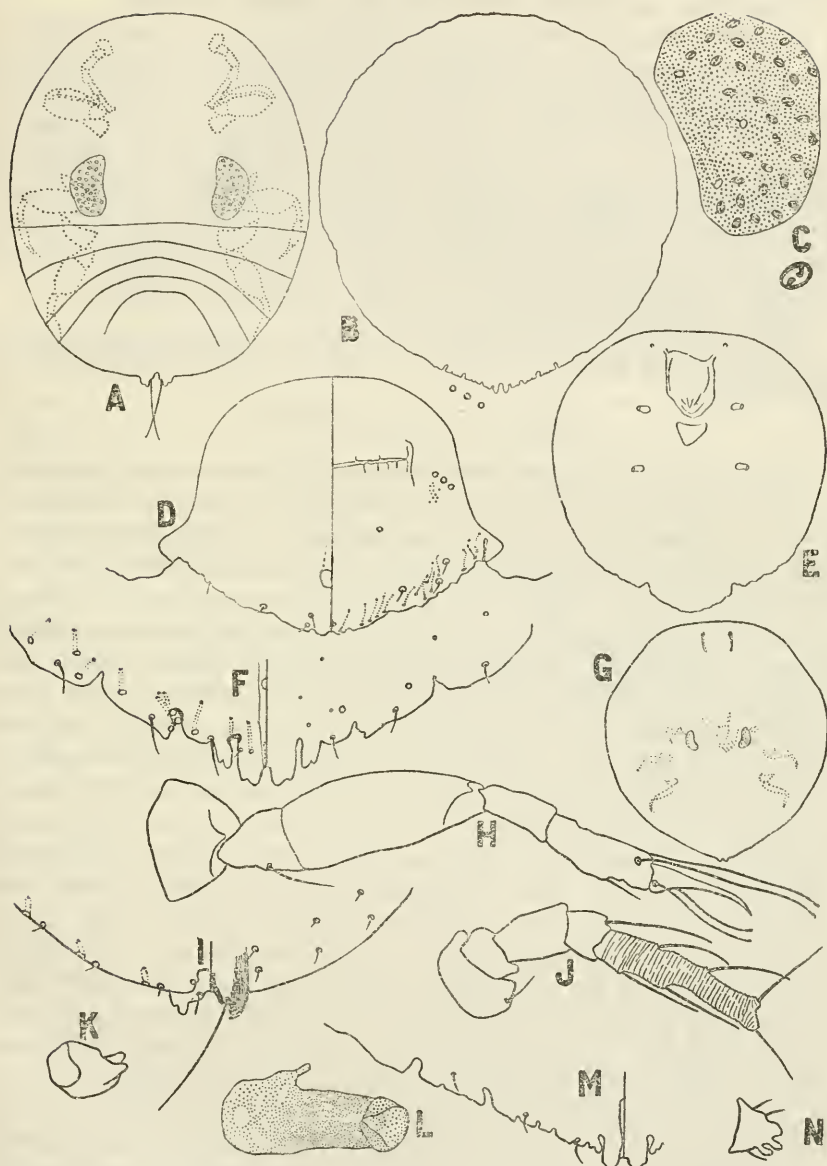


FIG. 30.—*PHAULASPIS HAKEAE* (MASKELL). A. LARVA, OUTLINE,  $\times 165$ ; B. INTERMEDIATE STAGE, CAST SKIN,  $\times 57.5$ ; C. LARVA, DORSAL PORE PLATE,  $\times 640$ , WITH DETAIL OF ONE OF INCLUDED PORES,  $\times 1500$ ; D. ADULT FEMALE, PYGIDIUM,  $\times 220$ ; E. ADULT FEMALE, OUTLINE,  $\times 57.5$ ; F. INTERMEDIATE STAGE FEMALE, APEX OF PYGIDIUM,  $\times 335$ ; G. LARVA, CAST SKIN,  $\times 57.5$ ; H. LARVA, LEG,  $\times 640$ ; I. APEX OF LARVA,  $\times 335$ ; J. LARVA, ANTENNA,  $\times 640$ ; K. ADULT FEMALE, ANTENNA,  $\times 640$ ; L. SAME, SPIRACLE,  $\times 640$ ; M. INTERMEDIATE STAGE FEMALE, MARGIN OF PYGIDIUM OF CAST SKIN,  $\times 220$ ; N. INTERMEDIATE STAGE FEMALE, ANTENNA,  $\times 640$ .

opening on each median lobe; with long but indistinct thickenings running from the median lobes far past the anal opening.

*Larva*.—Cast skin nearly circular, slightly narrowed behind, showing the two pore plates near center of body, and the remains of the appendages; embryonic larva broad oval, antennae 5-segmented, the last very long, legs slender; with a pair of large poriferous plates in the mid-dorsal region, these with a few tubular ducts and numerous S-shaped center pores; margin of body with tubular ducts and tiny setae; pygidium with anal opening close to apex; a median chitinized notch, long apical setae, then the median lobes, well developed and notched, and outside of these a few setae and tubular ducts.

*Cotype*.—Cat. No. 24774, U.S.N.M.

The following generic diagnosis is based on the preceding species description:

GENERIC DIAGNOSIS OF PHAULASPIS.

Diaspine forms, probably related to the *Aspidiotus* series, the adult female covered by and more or less enclosed within the convex cast skin of the preceding stage, the secretory covering thin, usually destroyed, body circular, membranous, pygidium slightly chitinized, antennae tubercles without any long setae, spiracles small, without pores, with small clusters of short tubular ducts and tiny spines along margin of abdomen, pygidium without lobes or plates, margin undulating, with a few tiny marginal and submarginal setae, with some small tubular ducts at margin, anal opening large, with internal tube, placed near apex, paragenitals wanting, dorsal pores wanting; intermediate stage female puparium strongly convex, reddish brown, circular, body circular, antennae longer than in adult, with setae, abdominal segments with a few setae and pores at margin, pygidium with two pairs of lobes, *Diaspidiotus*-like, no plates, dorsal and ventral spines, more or less developed marginal incisions with thickened edges, no paraphyses, anal opening near apex, with dorsal marginal pores, a few micropores; larva broad oval, developed within the body of the adult, antennae 5-segmented, terminal annulate, legs long, slender, normal, with a pair of large chitinized poriferous plates dorsally near mouthparts, each bearing two types of pores, pygidium with anal opening close to apex, median chitinized notch, long apical setae, one pair of lobes and a few setae and tubular ducts.

According to the Fernald catalogue, this genus is synonymous with *Aspidiotus*, and its identity with *Anonidia* has also been suggested. It is the present view of the writers, after a rather limited study of supposedly related species, that the genus *Phaulaspis* is valid, and is entitled to generic rank, this view being largely based on the, apparently, unique development of the large dorsal poriferous areas in the larva, and on the absence of marginal pygidial plates in

all stages. No other species deserving inclusion here are known to the writers.

Genus *CHENTRASPI* Leonardi.

*Genotype*.—*Aspidiotus unilobis* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, pp. 251, 280.

This is another genus which was established with only a single included species, so that only it can be the type.

The Maskell collection contains a single slide of this species, labeled "adult female, 1894," and a small amount of material under No. 419.

*Adult female*.—Scale as described by Maskell and Leonardi; body nearly circular, the posterior apex slightly protruding and pointed; derm anterior to pygidium wholly membranous, the thoracic and abdominal segmentation indistinct; antennae tiny tubercles, each bearing a long stout seta; spiracles small, without pores; margins of head, thoracic and abdominal segments, both dorsally and ventrally with little groups of two or more relatively long slender setae and, usually, one or more tiny tubular ducts; posterior abdominal segments with a longitudinal row of tiny setae and a row of large tubular ducts on each half dorsally, ventrally at margin with a number of small tubular ducts on each side, with more of these in submarginal areas and with two more or less distinct longitudinal rows of tiny setae; anterior portion of pygidium hyaline, central portion more or less chitinized; median lobes only present, these fused to form one lobe, with a faint median notch, and usually two lateral notches; second and third lobes represented by tiny spine-like triangles; no lateral teeth or crenulations, but the margin outside of the plates somewhat irregular; plates present, strongly branched, two outside the median lobes, then the tiny second lobe, then three more plates, then the tiny third lobe, and one to four more plates, the last two, in the latter case, simple; with three or four very short incisions in the margin, these with more or less thickened bottoms and edges; marginal setae relatively very large, as long or somewhat longer than the plates, the median pair quite stout, but becoming gradually more slender toward the outer margin of the pygidium, dorsally with one just outside the base of the median lobes, one above the tiny second lobes, one above the third lobes, one well beyond the last group of plates, and one well beyond this; ventrally with one opposite each of these except the first; without marginal chitinous paraphyses; anal opening oval, medium in size, placed fairly close to the apex of the pygidium; paragenitals wanting; dorsal marginal pores two between first and second dorsal spines; two, separated, between second and third spines; two, well separated, between third and fourth spines; two, widely separated, between fourth and fifth spines; dorsal pores all near margin, about six in number; ventrally with a number of

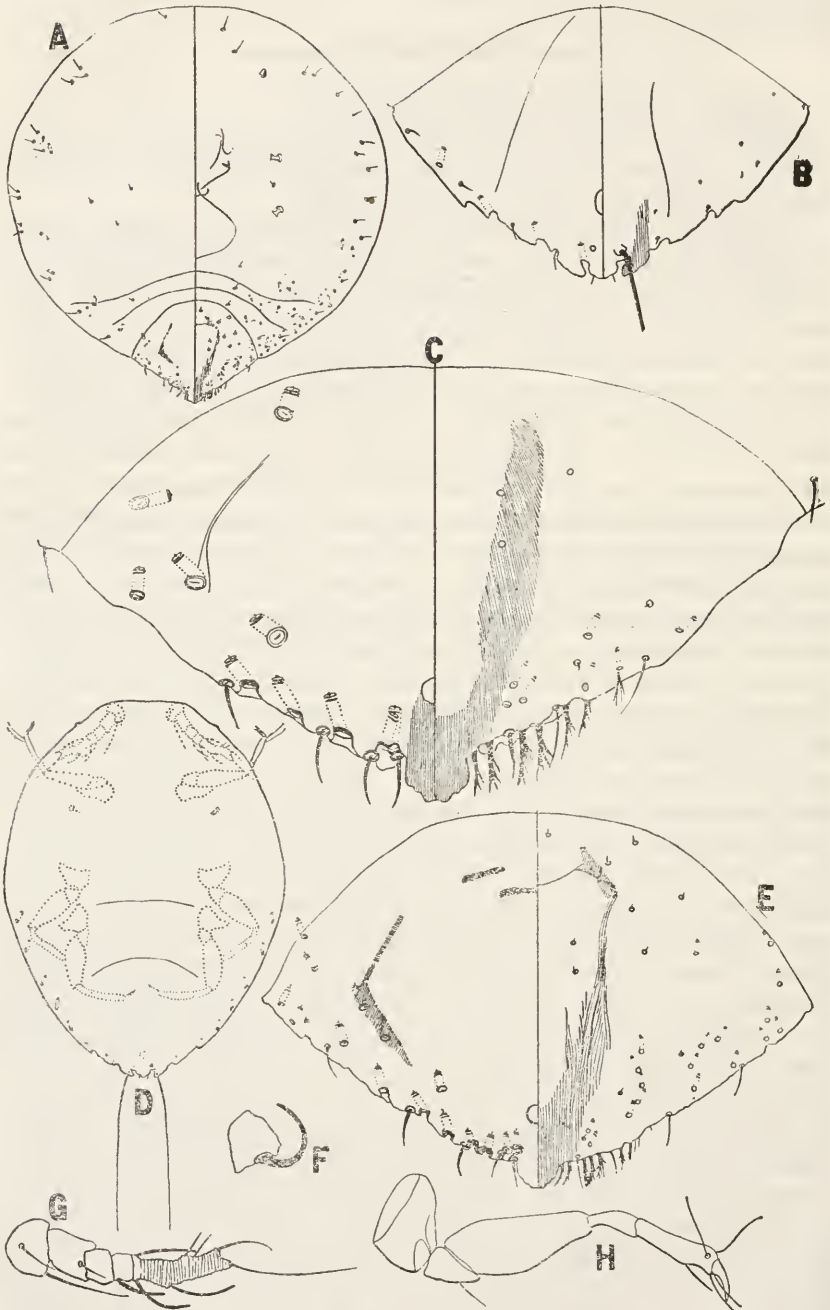


FIG. 31.—*Chientraspis unilobis* (Maskell). A. ADULT FEMALE, OUTLINE OF BODY,  $\times 57.5$ ; B. LARVA, PYGIDIUM,  $\times 500$ ; C. INTERMEDIATE STAGE FEMALE,  $\times 440$ ; D. LARVA, OUTLINE OF BODY,  $\times 220$ ; E. ADULT FEMALE, PYGIDIUM,  $\times 220$ ; F. ADULT FEMALE, ANTENNA,  $\times 640$ ; G. LARVA, ANTENNA,  $\times 640$ ; H. LARVA, LEG,  $\times 640$ .

submarginal micropores, two between two ventral spines, 3-5 between the second and third ventral spines, and about four or five between the third and fourth ventral spines; without setae dorsally; with a submarginal row of four small ventral setae and with about five more on each half of the anterior median portion of the pygidium; with three transverse linear basal thickenings, one median, and with one long, somewhat indistinct thickening running from the median plates out and back past these transverse thickenings.

*Intermediate stage female*.—Body differing from that of adult only in the smaller size and in the reduced numerical development of the pores and setae.

*Larva*.—Broad oval, somewhat more pointed behind; antennae slender, 5-segmented, terminal annulate; legs slender, normal, spiracles small, slender, without pores, pygidium more or less developed, margin with a median quadrate protuberance bearing two tiny setae, outside this with an incision with a tubular duct, then with the median lobe, the outer margin curved and crenulate, then a seta, followed by an incision with pore, and beyond this a succession of setae and pores; ventrally below the first incision with the long apical seta about a third the body length; anal opening medium, oval, near apex of abdomen.

*Cotype*.—Cat. No. 24775, U.S.N.M.

Besides the type, one other species, *Aspidiotus extensus* Maskell, was subsequently included in the genus by Leonardi. This species certainly can not be looked upon as being congeneric with the type. The generic diagnosis which follows has been based on the type species only.

#### GENERIC DIAGNOSIS OF CHENTRASPIIS.

Diaspine forms, probably more closely related to the group containing *Aspidiotus camelliae* Signoret (*rapax* Comstock) than to any other; adult female with body nearly circular, derm membranous, antennae tiny with a single long seta, spiracles small, without pores, margin of body with some setae and small tubular ducts in clusters, pygidium somewhat chitinized, median lobes only well developed, protruding, fused into a single lobe, marginal plates present, grouped near the middle line, strongly branched, both dorsal and ventral marginal setae present, relatively large and long, with marginal incisions with thickened edges, no paraphyses, anal opening medium in size, placed near the apex of pygidium, paragenitals wanting, dorsal marginal pores present, some opening in incisions, dorsal pores present, few in number, tubes short, axis transverse, with ventral micropores with short tubes and with tiny ventral setae, with basal thickenings; intermediate stage female similar to adult, differing only in smaller size and numerical reduction of ducts and

setae; larva oval, antennae 5-segmented, terminal annulate, legs slender, normal, margin of body with a few ducts and setae, pygidium somewhat developed, anal ring near apex, median lobes only developed, separated by a rectangular projection bearing setae, apical setae long, no traces of plates, but with incisions and marginal ducts and setae.

This genus was placed as a synonym of *Aspidiotus* in the Fernald catalogue, and its identity with *Targionia* has been suggested. As already noted, the type species seems, except for the question of the size and the position of the anal opening and the fused median lobes, to resemble *A. camelliae* Signoret (*rapax* Comstock) quite closely. The writers prefer not to comment on the question of the zoological validity of this genus at present.

#### Genus AONIDIELLA Berlese and Leonardi.

*Genotype*.—*Aspidiotus aurantii* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, pp. 285, 287-8.

This genus was established for the single type species. The Maskell collection contains two slides marked as collected in 1877, and therefore presumably the type slides. This species has been shown to be extremely widespread and common, and has been described and illustrated with elaborate detail by Berlese,<sup>10</sup> because of which no attempt is made here to redescribe or figure it. The writers are not able to comment definitely on its generic validity, and have in consequence done nothing more than record its right to a place in the series of genera discussed in this paper.

The four following units have been variously designated by Leonardi, who described them, as genera or subgenera of the genus *Lepidosaphes* (*Mytilaspis*). While their standing is in most cases uncertain, they have been placed as genera in this paper.

#### Genus PHAULOMYTIUS Leonardi.

Plate 5, fig. 5.

*Genotype*.—*Mytilaspis striata* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, pp. 304, 314.—Leonardi, Ann. R. Sc. sup. agr. Portici, ser. 2, vol. 5, 1904, p. 5.

This genus has never included more than the single type species.

The Maskell collection contains a single slide of "adult female, 1894" and a small quantity of unmounted material of this species, the latter bearing the No. 409.

*Adult female*.—Scale as described by Maskell and Leonardi; body elongate, broadest behind the middle, sides of cephalothorax tapering strongly anteriorly, this apex rounded; cephalothorax in fully ma-

<sup>10</sup> Riv. Path. Veg., vol. 4, 1895, pp. 125-137.



tured individuals tending towards chitinization, and becoming slightly distended and hardened; abdomen, including nearly all of

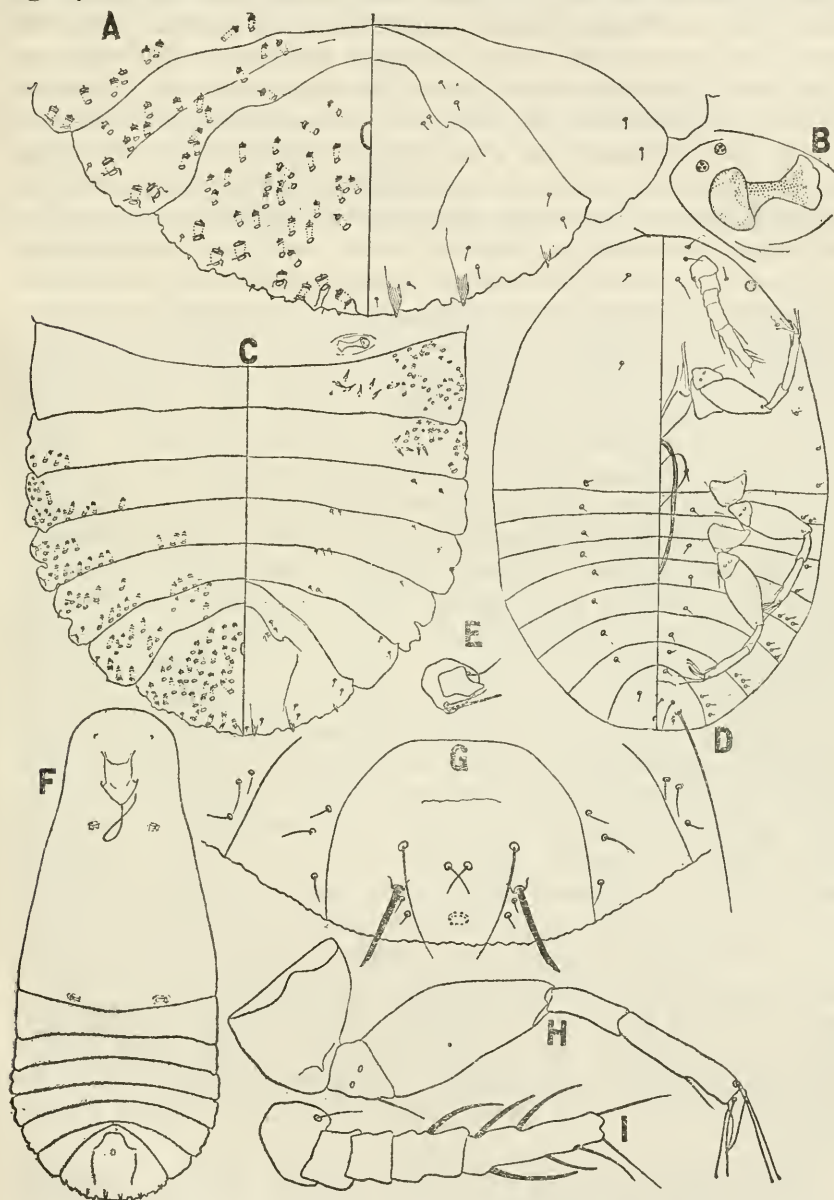


FIG. 32.—*PHAULOMYTILUS STRIATUS* (MASKELL). A. ADULT FEMALE, PYGIDIUM,  $\times 220$ ; B. ADULT FEMALE, ANTERIOR SPIRACLE,  $\times 64$ ; C. ADULT FEMALE, ABDOMEN,  $\times 115$ ; D. LARVA, OUTLINE OF BODY,  $\times 220$ ; E. ADULT FEMALE, ANTENNA,  $\times 640$ ; F. ADULT FEMALE, OUTLINE OF BODY,  $\times 57.5$ ; G. LARVA, APEX OF ABDOMEN,  $\times 640$ ; H. LARVA, MIDDLE LEG,  $\times 640$ ; I. LARVA, ANTENNA,  $\times 640$ .

the pygidium remaining membranous, and wrinkled when dried; antennae very small tubercles bearing two medium and one longer

stout setae; spiracles small, anterior placed just behind the mouth parts, accompanied by 2-3 small disk pores, posterior placed far back, fully one-third the body length from the anterior, about the same size but without pores; eye spots represented by faint marginal protuberances a little behind the antennae; with a few tiny tubular ducts around the margin of the cephalothorax; first two abdominal segments with a considerable cluster of small tubular ducts and a few small slender gland spines with expanded bases ventrally at margin, remaining segments with similar but fewer ducts at margin and dorsally, including one or two large ducts to a segment and no gland spines; each segment ventrally with a slender submarginal seta and one or two others, smaller, inside this on each side; pygidium only faintly chitinized, lobes small, triangular, pointed, normally not or only very slightly protruding beyond the irregular margin, median lobes slightly smaller than the second pair, widely separated by a quadrate protuberance bearing two slender ventral spines at its base and having a large short-tubular duct between it and each lobe, second lobe placed well beyond the first, also triangular pointed, third still farther beyond the second, and considerably smaller; margin with a large triangular indentation beyond the third lobe; without gland spines; dorsal marginal setae, one outside of each lobe, ventral the same, and with one beyond the marginal notch, all slender, not very long; ventrally with submarginal setae, considerably larger than marginal and anterior to these, as follows: 1, 2, 2, 2; without incisions with thickened edges, but with dorsal marginal incisions into which short tubular ducts open, these ducts one inside the first lobes, two between the first and second lobes, one just inside and above the second lobe, two between the second and third lobes, one behind third lobe, and three beyond marginal notch; without chitinous paraphyses; anal opening fairly large, oval, much nearer base than apex of pygidium; paragenitals wanting; dorsal pores numerous, not arranged in definite rows of closely set pores, although in indefinite rows, about three in first, four in second, 7-8 in third, 5-7 in fourth, and about five in fifth, with some corresponding inner groups of about three each; without thickenings except those running in from the "lobes"; with a few ventral micropores and several small setae in the genital opening region.

*Intermediate stage female*—(From exuviae only). Apparently differing from the adult only in the reduction in size and numbers of the structures described for the latter stage.

*Larva*—(Embryonic). Oval, antennae 5-segmented, the fourth segment so constricted as to give somewhat the appearance of another segment; legs slender, normal, apex of abdomen not at all chitinized, with no traces of lobes or gland spines; with two long apical setae,

two very small, close together between these, one larger on each side near and below the base of the large apical seta, and two more, small, above each apical seta; each margin of each of at least the abdominal segments with three small setae, one above the other, of which the median is the longest, anal ring small, circular, somewhat invaginated, placed near the apex of the abdomen; body with dorsal and ventral rows of small setae, one on each half, as shown.

*Cotype*.—Cat. No. 24776, U.S.N.M.

The following generic diagnosis has been based on the preceding description.

#### GENERIC DIAGNOSIS OF PHAULOMYTIUS.

Diaspine forms of uncertain affinities, superficially resembling *Lepidosaphes*; the secreted covering mytilaspiform, adult female with elongate body, somewhat chitinized cephalothorax, very small antennae with three setae, spiracles with or without pores, these never numerous, abdominal segments with groups of tubular ducts and short slender gland spines with greatly enlarged bases at margins, pygidium with small triangular widely separated more or less projecting lobes, without gland spines or plates, marginal setae present, approximately normal in arrangement, without incisions with thickened edges, with slight incisions for marginal pores, without chitinized paraphyses, anal opening oval, placed much nearer base than apex of pygidium, paragenitals wanting, marginal ducts present, large, axis longitudinal or approximately so, dorsal pores present, fairly numerous, axis not uniform but approximately longitudinal, pores not arranged in definite and conspicuous rows, without internal pygidial thickenings except from base of lobes, with some ventral micropores and surface setae; intermediate stage similar to adult but less developed; larva oval, antennae 5-segmented, terminal not annulate, legs normal, apex of abdomen not chitinized, without traces of lobes or gland spines, with a pair of long apical setae and other small setae, anal ring small, circular, near apex of abdomen.

As may be noted from the preceding description, the writers consider that Leonardi's interpretation of the triangular projecting marginal structures is incorrect and that they are really poorly developed pygidial lobes, instead of gland spines. There is no evidence that they are connected with internal ducts, as are the true gland spines. The morphological modifications of the type species appear to be quite sufficient to separate the genus widely from *Lepidosaphes*, as represented by the type, *L. ulmi* (Linnaeus) and to establish it as a unit of full generic rank. The writers are not able to say whether or not the genus thus established is identical with any other described

genus, or whether it should remain in the group of species of which *Lepidosaphes* is typical.

Genus COCCOMYTIUS Leonardi.

Plate 6, fig. 1.

*Genotype*.—*Mytilaspis convexa* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, pp. 304, 307.—Leonardi, Ann. R. Sc. sup. agr. Portici, ser. 2, vol. 5, 1904, p. 4, 9.

Leonardi apparently failed to designate a type species for this genus, and it seems to have first been set in the Fernald catalogue.

The Maskell collection contains a single slide of "adult female, 1892" and a small quantity of unmounted material of this species, the latter under No. 347.

*Adult female*.—Scale as described by Maskell and Leonardi; body elongate, broadest about the middle, narrowed anteriorly; cephalothorax and anterior abdominal segments in fully matured individuals hardened, chitinized, and brittle, remainder of abdomen, except portions of the pygidium, membranous; antennae small tubercles bearing two setae of unequal length and some conical protuberances; spiracles small, anterior with 3-5 pores, posterior with 2-3 pores; head with some pairs of small setae around margin; margins of thoracic and abdominal segments with clusters of numerous tubular ducts, some ventral, some dorsal; with a cluster of conical gland spines with somewhat enlarged bases ventrally posterior to each spiracle; with similar gland spines ventrally on the second and third abdominal segments near margin; with a few marginal setae and straight, tapering gland spines on remaining segments; pygidium somewhat chitinized, the margin uniformly curved, with three pairs of lobes, all protruding, the median large, prominent, the apical border rounded and more or less distinctly notched at each side, second lobes about half as long and wide, the posterior margin nearly straight, somewhat crenulate, third lobes well beyond second, obtusely triangular, the outer face longest, margin beyond this irregularly toothed and incised developing projections resembling the third pair of lobes but not chitinized; gland spines present, two between median lobes, two between these and second lobes, first two, then one, between second and third lobes, two outside of third lobes and two more beyond two toothlike projections of the margin, all small but gradually enlarging from the median out; marginal setae present, dorsally one inside, one outside each median lobe, one outside each second and third lobe, one beyond marginal projection, ventrally one outside each median lobe, and one below and beyond each of the remaining dorsal setae, these all fairly large; no incisions with thickened edges; no chitinous paraphyses; anal opening rather small, approximately circular, placed near the base of the pygidium;

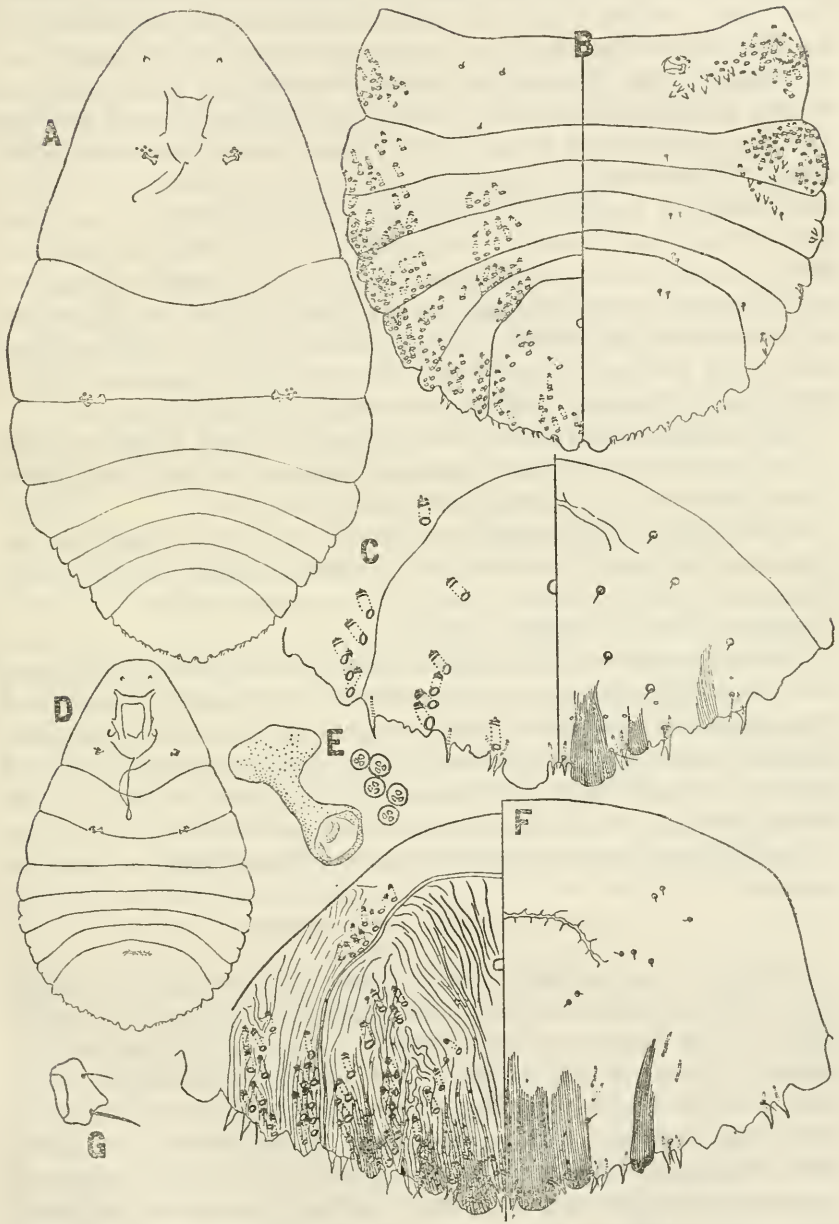


FIG. 33.—*Coccoxymylus convexus* (MASKELL). A. FULLY DISTENDED AND CHITINIZED ADULT FEMALE,  $\times 57.5$ ; B. ADULT FEMALE, ABDOMEN,  $\times 115$ ; C. INTERMEDIATE STAGE FEMALE, PYGIDIUM,  $\times 335$ ; D. ADULT FEMALE BEFORE DISTENSION,  $\times 57.5$ ; E. ADULT FEMALE, SPIRACLE, ANTERIOR,  $\times 220$ ; F. ADULT FEMALE, PYGIDIUM,  $\times 220$ ; G. ADULT FEMALE, ANTENNA,  $\times 640$ .

paragenitals wanting; marginal and submarginal pores present, arranged as follows: three, one median, between median lobes, one behind each median lobe, one behind outer margin of same, two between first and second lobes, one or two behind second lobe, three, in a more or less distinct row, between second and third lobes, one behind third lobe, about five in and just anterior to both the first and second marginal teeth; dorsal pores rather numerous, indistinctly differentiated from marginal, chiefly marked by position and somewhat smaller size, arranged in fairly distinct rows, about five in inner row, three in both posterior and anterior group of next row, two in the following row, about five in posterior group and 5-7 in anterior group of next row; ventrally with a few micropores and some setae, the latter mostly around the vaginal opening; anterior to two median pairs of lobes and around anal opening slightly more heavily chitinized than in remainder of pygidium.

*Intermediate stage female.*—Resembling the adult, differing chiefly in the reduction in size and numerical quantity of the lobes, pores, gland spines, etc., as already described for the adult.

*Larva.*—Very unfortunately no larvae seem to be present in the type material, and it has not been possible to make out the larval characters from the exuviae available for examination.

*Cotype.*—Cat. No. 24777, U.S.N.M.

From a comparison of the adult females of the species which have been included in this genus, the writers consider that the inclusion of *C. bambusicola* (Cockerell) and *C. argentata* (Cockerell) is probably entirely incorrect. The position of the remaining species assigned here by Leonardi appears to be debatable, and can probably not be settled until a revision of *Lepidosaphes* is undertaken.

The following generic diagnosis has been based chiefly on the type species.

#### GENERIC DIAGNOSIS OF COCCOMYTIUS.

Diaspine forms probably closely related to *Lepidosaphes*, apparently differing from that genus, as represented by the type species chiefly in the absence of paragenitals in the adult female, and the tendency of the anterior portion of the body to become heavily chitinized at maturity; body mytilaspiform, antennae very small tubercles with setae, spiracles with a few pores, cephalothorax with small setae, with small tubular ducts, and some gland spines, margins of abdominal segments with the same; pygidium somewhat chitinized, lobes present, gland spines present, marginal setae normal, without incisions with thickened edges or chitinous paraphyses, anal opening located near base of pygidium, small, circular to oval, paragenitals wanting, marginal pores present, axis longitudinal, dorsal pores present, fairly numerous, in rather distinct rows, axis more or less longi-

tudinal, with micropores and some setae ventrally, without internal basal thickenings; intermediate stage in general resembling adult, but less developed; larva not known.

As noted in the generic diagnosis, the chief basis for separating this genus from *Lepidosaphes* appears to lie in the absence of paragenitals, a doubtful generic character. The writers prefer not to comment definitely on the status of this genus at present.

#### Genus TRICHOMYTIUS Leonardi.

Plate 6, fig. 2.

*Genotype*.—*Mytilaspis formosa* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, pp. 304, 309.—Leonardi, Ann. R. Sc. sup. agr. Portici, ser. 2, vol. 5, 1904, pp. 4, 23.

Only the single-type species has ever been included in this genus.

The Maskell collection includes two slides of this species, one of "adult females, 1893," and one of "puparia with females and male, 1893," and besides this a small quantity of unmounted material under No. 337.

*Adult female*.—Scale as described by Maskell and Leonardi; body mytilaspiform; antennae small, cylindrical tubercles with invaginated apices and two slender setae protruding slightly and with a stout short spine on the lip; spiracles slender, posterior without pores, anterior with two trilocular pores; head with a few small tubular ducts and setae; body segment between spiracles and that posterior to hind spiracles with a triangular cluster of small tubular ducts running from opposite the spiracle to and around each margin, and with a few conical gland spines with expanded bases at the inner apex of each, next two segments (abdominal) with similar clusters, but denser and with the gland spines more numerous, gland spines of the following abdominal segment reduced to two large, long tapering ones at margin; pygidium with three pairs of small protruding lobes, the median largest, spatulaform, with faint traces of notches on inner and outer faces, not contiguous, but united by a thickening, and with a tiny triangular tubercle just inside of each and a median pair of ventral setae, second lobes smaller and more slender than median, very faintly notched, third stouter and larger than second, usually nearly straight within and distinctly notched without, margin beyond third lobes somewhat notched; gland spines present, unusually large and long, the first three double—that is, with two ducts leading into a single spine—one present outside of each of the lobes, the fourth either double or with two separate spines, the fifth group of two spines; marginal setae, dorsally two, small, just outside of median lobes, one long, slender, anterior to both the second and third lobes, another similar, anterior to the second toothlike projection



FIG. 34.—*TRICHOMYTIUS FORMOSUS* (MASKELL). A. ADULT FEMALE, PYGIDIUM,  $\times 220$ ; B. LARVA, LEG,  $\times 640$ ; C. ADULT FEMALE, APEX OF ABDOMEN,  $\times 115$ ; D. ADULT FEMALE, OUTLINE OF BODY,  $\times 57.5$ ; E. ADULT FEMALE, ANTERIOR SPIRACLE,  $\times 500$ ; F. ADULT FEMALE, MARGIN OF PYGIDIUM,  $\times 335$ ; G. INTERMEDIATE STAGE FEMALE, MARGIN OF PYGIDIUM,  $\times 335$ ; H. LARVA, ANTENNA,  $\times 640$ ; I. LARVA, OUTLINE OF BODY,  $\times 220$ ; J. LARVA, CAST SKIN,  $\times 115$ ; K. ADULT FEMALE, ANTENNA,  $\times 1500$ ; L. LARVA, APEX OF ABDOMEN,  $\times 640$ .



beyond the third lobes, and still another, smaller, near the base of pygidium, ventrally with those between the median lobes, already mentioned, a small one beneath the first dorsal pair, and similar ones, all small, corresponding to the remaining dorsal setae; with a sub-marginal ventral row of smaller setae, each anterior to a marginal seta, except the first, and each accompanied by a micropore; without incisions with thickened edges, but with the openings of the marginal pores set in slightly, the rim chitinized and with a rather prominent lobelike marginal projection below each, these pores one inside second lobe, one inside third lobe, two between third and fourth gland spine groups and three near base of pygidium; anal opening of medium size, circular, close to base of pygidium; paragenitals present, in five groups, median 6-7, anterio-laterals 13-17, postero-laterals 19-23 (one group with 10), these averages from four specimens; dorsal pores present, in fairly distinct rows, the pores set rather close together, inner row posterior group 1-3, anterior 2, second row, posterior group variable, 3-5, anterior 3-5, then with supplementary posterior row of two, third row, posterior group about four, anterior about four; without internal pygidial thickenings; with two pairs of tiny setae dorsally near anal opening and similar setae ventrally near the genital opening.

*Intermediate stage female.*—(exuvium only) apparently resembling the adult female, differing chiefly in the reduced development of the various pygidial structures and in the gland spines being single and isolated.

*Larva.*—Oval, antennae slender, 5-segmented; legs slender, normal, the claw long, very slender, curved; anterior apex of body with a pair of large and long slender tubular ducts; the tiny circular anal ring near body apex; apex of abdomen with long and short setae, one pair of lobes, marginal ducts and two pairs of gland spines.

*Cotype.*—Cat. No. 24778, U. S. N. M.

The following generic description is based on the preceding description.

#### GENERIC DIAGNOSIS OF TRICHOMYTIUS.

Diaspine forms, with female scale elongate, mytilaspiform, exuviae terminal, body of adult female similar, antennae cylindrical invaginated tubercles with setae, spiracles slender, with or without pores, margin of cephalothorax and abdominal segments with tubular ducts, gland spines and small setae, in rather definite arrangement, pygidium rounded, with well developed entire lobes, large and long double gland spines, normal dorsal and ventral setae at margin, no incisions with thickened edges, no paraphyses, anal opening fairly large, near base of pygidium, paragenitals present, in five groups, marginal pores present, dorsal pores present, in fairly distinct rows,

with both dorsal and ventral surface setae, with ventral micropores, without distinct internal thickenings; intermediate stage similar to adult, but less developed; young larva oval, antennae 5-segmented, legs normal, anteriorly with a pair of large tubular ducts, apex of body with a pair of large apical setae, lobes, gland spines and other smaller setae.

No other species has been included in this genus, which was based wholly on the development of a supplementary fluffy secretion covering the female scale to some extent, a character which would seem to be of very little value. In the opinion of the writers this genus should be included in the *Chionaspis* series, instead of the *Lepidosaphes* group, this view being based on the characters of the pygidium, such as the absence of a median pair of gland spines and the presence of a double pair of setae dorsally near each median lobe, and on the character of the male scale, this being a felted sac of the type found in *Chionaspis* but without traces of dorsal carinae, and not similar to that of the female in the sense in which this is true of the male scale of *Lepidosaphes*. As will be noted, the present interpretation of the pygidial marginal structures differs quite materially from that of Leonardi.

#### Genus ALLANTOMYTILUS Leonardi.

Plate 6, fig. 3.

*Genotype*.—*Mytilaspis maideni* Maskell.

*Reference*.—Fernald, Cat. Cocc. World, 1903, pp. 304, 311.

Only the type species has ever been placed in this subgenus which was first erected by Leonardi in 1897 wholly on the basis of the strongly transversely corrugated covering scale of the female, and which appears to have been abandoned completely by him subsequently, as no other reference to it on his part has been located, not even in his Monograph of the genus "*Mytilaspis*."

The Maskell collection contains three slides of this species, one of "adult female, 1896," one of "male, 1896," and one of "♂ and ♀ puparia." There is also a small quantity of unmounted material under No. 520, while the National Collection of Coccidae contains a quantity of material from the type lot, received from Mr. W. W. Froggatt.

*Adult female*.—Scale as described by Maskell; body short mytilaspiform, broadest behind the middle, the cephalothoracic region somewhat chitinized, the abdomen membranous except the pygidium; antennae represented by a circle with three setae; anterior spiracles with two to seven pores, posterior without pores; thoracic and abdominal segments at and near margin ventrally with clusters of rather numerous tubular ducts, cephalothorax with occasional small setae;

posterior abdominal segments with stout gland spines and dorsal tubular ducts; pygidium short, very broad, posterior margin almost truncate; with three pairs of lobes, all small, all widely separated, the third pair a little smaller, not very strongly projecting, rounded conical, the first two pairs indistinctly notched on inner and outer

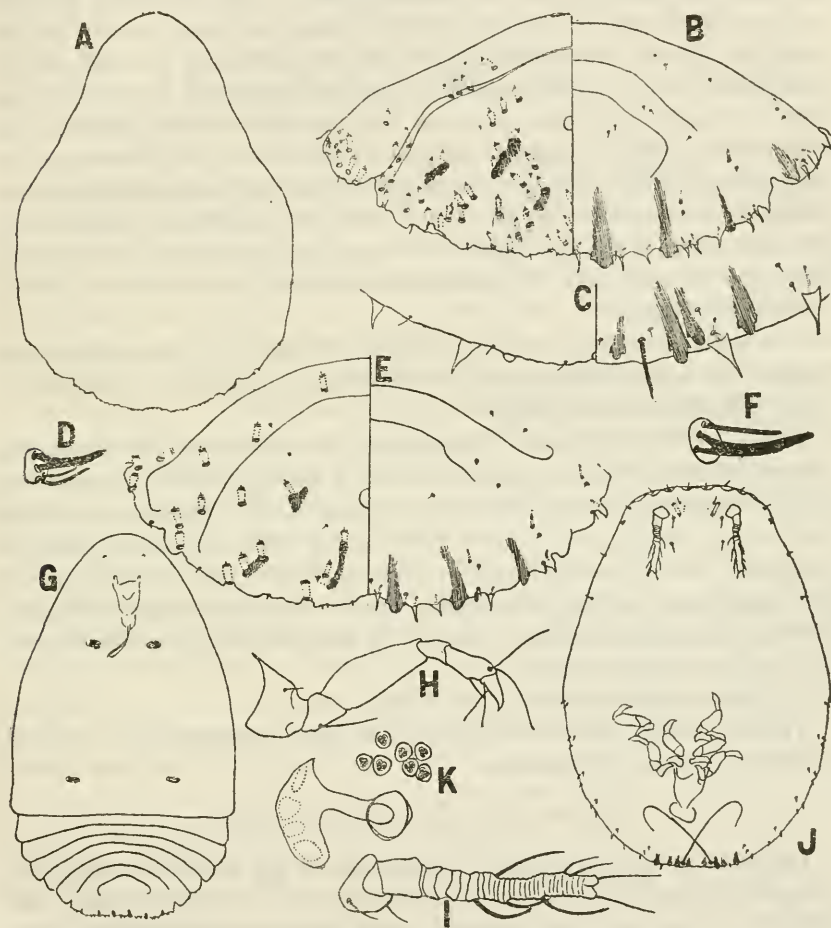


FIG. 35.—*ALLANTOMYTIUS MAIDENI* (MASKELL). A. INTERMEDIATE STAGE, CAST SKIN, OUTLINE,  $\times 180$ ; B. ADULT FEMALE, PYGIDIUM,  $\times 220$ ; C. LARVA, APEX OF ABDOMEN,  $\times 640$ ; D. INTERMEDIATE STAGE FEMALE, ANTENNA,  $\times 640$ ; E. INTERMEDIATE STAGE FEMALE, PYGIDIUM,  $\times 335$ ; F. ADULT FEMALE, ANTENNA,  $\times 640$ ; G. ADULT FEMALE, OUTLINE OF BODY,  $\times 57.5$ ; H. LARVA, LEG,  $\times 640$ ; I. LARVA, ANTENNA,  $\times 640$ ; J. LARVA, CAST SKIN,  $\times 165$ ; K. ADULT FEMALE, SPIRACLE,  $\times 640$ .

sides; with a number of small tapering gland spines as follows: two median, two between first and second lobes, three between second and third lobes, two or three outside of third lobes, the largest of these at most only a little longer than the lobes; marginal spines present, small, inconspicuous, dorsally with one inside and one outside the first

lobe, and one outside the second and third lobes, ventrally with a similar spine corresponding to each of these except the median; without marginal incisions with thickened edges or chitinous paraphyses; anal opening nearly circular, placed close to the anterior apex of the pygidium; paragenitals wanting; marginal pores present, one above and anterior to the first and second lobes, sometimes with another between these two, two inside the third lobes and one just within the marginal notch ending the pygidium; dorsal pores present, rather numerous, more or less definitely grouped, but not in conspicuous rows of closely set pores, three or four anterior to and between median lobes, perhaps fourteen altogether anterior to and between first and second lobes, perhaps four or six between second and third lobes, about five or six next to notch terminating pygidium; without any distinct internal thickenings; no ventral micropores noted, this perhaps due to condition of specimens examined; with some small ventral surface setae.

*Intermediate stage female.*—Differing from the adult chiefly in the smaller size and in the reduced development and numbers of the structures described for the adult.

*Larva.*—Oval, antennae 6-segmented, the terminal annulate, legs normal, slender, with a pair of large long tubular double gland tubes near the anterior end of the body; margins of the abdominal segments with small single gland spines alternating with tiny setae; apex of abdomen with a median pair of tiny lobe-like protuberances, then the apical seta and a gland spine, then a relatively large lobe, then a rather large gland spine, followed by another lobe, and well beyond this another gland spine.

*Cotype.*—Cat. No. 24779, U.S.N.M.

The following generic diagnosis has been prepared from the description of the type species:

GENERIC DIAGNOSIS OF ALLANTOMYTILUS.

Diaspine forms most closely related to, if not identical with, *Coccomytilus* and *Lepidosaphes*; scales elongate, exuviae terminal, scale strongly corrugated transversely; adult female mytilaspiform, with minute antennae; margins of cephalothorax and abdominal segments with tubular ducts and small setae; abdominal segments also with some marginal gland spines; pygidium very short, apical margin nearly truncate; with small, widely separated lobes, gland spines, normal marginal setae, no incisions or chitinous paraphyses, anal opening nearly circular, near anterior edge of pygidium, marginal and dorsal pores present, axis longitudinal; intermediate stage similar but with structures less developed; young larva oval, antennae 6-segmented, terminal annulate, legs normal, slender, anterior apex

of body above with a pair of large tubular ducts, margin of abdomen with small gland spines and setae, apex of abdomen with large apical setae, definitely developed lobes and gland spines and marginal setae.

Genus ANOPLASPIS Leonardi.

Plate 6, fig. 4.

*Genotype*.—*Mytilaspis metrosideri* Maskell.

*References*.—Fernald, Cat. Cocc. World, 1903, p. 311.—Ferris, Can. Ent., vol. 52, 1920, pp. 63-4.

The confusion created by Leonardi in regard to the type species of this genus has been fully discussed by Ferris (1920), and is not commented on here further than to say that *M. metrosideri* stands as the type. Curiously enough, a still greater degree of confusion was found to exist when Maskell's specimens of this type species were examined, as it was found that Maskell had confused two distinct species, apparently congeneric, and from the same host, and had sent specimens not the type species to other coccidologists as specimens of *metrosideri*. It has consequently been necessary to redescribe the second species in the Maskell collection. The writers are indebted to the note on the genus by Mr. Ferris for the information that *Mytilaspis metrosideri* Maskell and not *Aspidiotus bambusarum* Cockerell is the true type species.

The Maskell collection contains two slides bearing the name "*Mytilaspis metrosideri*," one of "female and puparium, July, 1890," and one of "adult female, 1891," and a small amount of unmounted material under No. 17. The slide mounts are really an undescribed species, and will be discussed later under the description of this new species. From the material still unmounted, it has been possible to obtain a mount of a female from the true type material, as determined by a comparison with Maskell's original description and figures, and it is this mount which is redescribed below. Material presented to the Bureau of Entomology collection by Maskell proves to be the undescribed species. What Leonardi had before him when he first established the genus it is impossible to state, but the species sent to Cockerell and, as stated, to the Bureau of Entomology by Maskell was incorrectly determined and favors the inference that Leonardi also had incorrectly determined specimens before him.

*Adult female*.—Scale white, elongate, pyriform, the anterior apex slender, the exuviae apical, yellowish brown; body elongate, broadest behind the middle, somewhat pyriform, but with the pygidium large, prominent and triangular, and the anterior body apex rounded; derm membranous, antennae placed in small pits in the head, tiny tubercles with a single large seta; eyespots represented by clear

circles, one to each side of the head near antennae; spiracles slender, anterior with 3-4 pores, posterior without pores; head region with a few small setae; margins of posterior thoracic and the abdominal segments with clusters of short tubular ducts and tiny setae, but no gland spines; abdominal segments with similar clusters of smaller pores in line behind the posterior spiracles; pygidium large, strongly triangular; median lobes present, large, contiguous, the inner edges fused, at least at tips, the two outer margins forming a well-defined

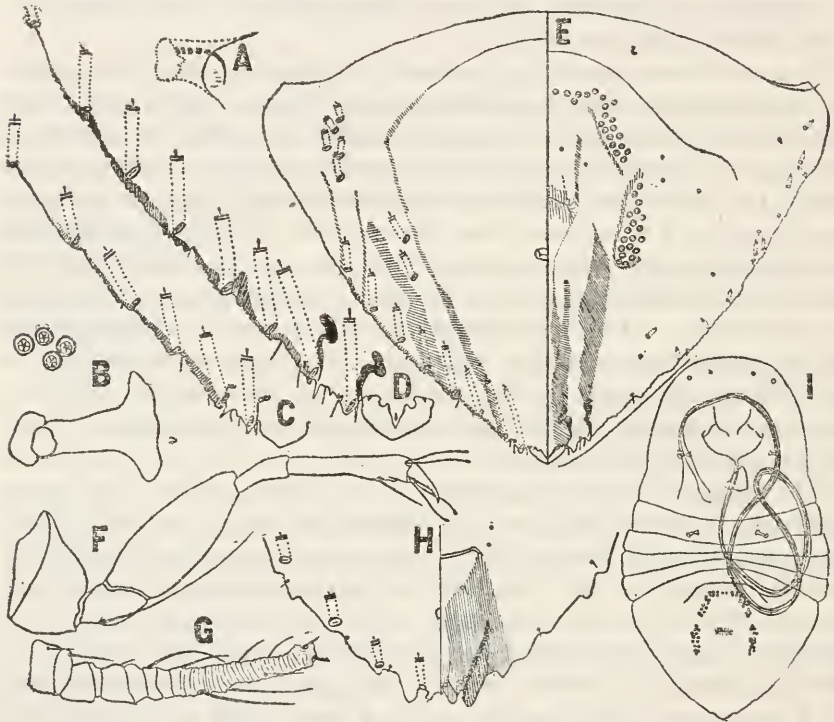


FIG. 36.—*ANOPLASPIS METROSIDERI* (MASKELL). A. ADULT FEMALE, ANTENNA,  $\times 640$ ; B. ADULT FEMALE, SPIRACLE,  $\times 640$ ; C. INTERMEDIATE STAGE FEMALE, PYGIDIAL MARGIN,  $\times 335$ ; D. ADULT FEMALE, PYGIDIAL MARGIN,  $\times 335$ ; E. ADULT FEMALE, PYGIDIUM,  $\times 165$ ; F. LARVA, LEG,  $\times 640$ ; G. LARVA, ANTENNA,  $\times 640$ ; H. LARVA, APEX OF ABDOMEN,  $\times 335$ ; I. ADULT FEMALE, OUTLINE OF BODY,  $\times 57.5$ .

obtuse triangle, second lobes represented by a small, slender, asymmetrically tapering lobe closely applied to the large protruding tubular duct opening lying just within it, third and any additional lobes represented by heavy, almost continuous serration and denticulation of the pygidial margin, running nearly to the base of the pygidium; gland spines small and inconspicuous, two only on each side, one just outside each median lobe, and one just inside the second long marginal tubular duct, each apparently connected with a long, slender internal structure that gradually expands anteriorly and is strongly clubbed and bent inwards at its inner end, these

probably representing very heavily chitinized ducts of the type usually attached to the gland spines; marginal setae, dorsally, with one tiny seta at the outer basal angle of each median lobe, one large and stout one above the reduced second lobe, one large and stout one just outside of the second marginal tubular duct, one large one just outside the fourth marginal tubular duct, ventrally all large and stout, one outside of second lobe, one just inside of third tubular marginal duct, one, small, half-way between fourth and fifth tubular ducts; without incisions with thickened edges or chitinous paraphyses as in some *Aspidioti*; anal opening medium, circular, a very little nearer to base than to apex of pygidium; paragenitals numerous, in five groups, linear, and often indistinctly segregated, median 5-6, antero-laterals 16-22, postero-laterals 16-19; marginal tubular ducts of two sizes, the normal ones large and very long, one outside of first gland spine, one outside of second gland spine, then three at intervals about equal to the space between the first two, then three more at wider intervals; with much smaller tubular ducts, possibly corresponding to those opening into the gland spines when these are present, beginning opposite the fifth large duct, with four between the fifth and ninth large duct; and 6-8 along the margin anterior to the ninth large duct; with dorsal ducts, these nearly as large and long as the marginal, few in number, two to three in first group, opposite posterior end of postero-lateral paragenital group, five to six in the anterior group, opposite the anterior portion of the paragenital arch; pygidium without basal thickenings but with broad thickenings running in from the posterior margin dorsally, the median pair of these continuing to well beyond the anal ring, the two laterals on each side nearly as far.

*Intermediate stage female*.—Similar to the adult, apparently differing only in the smaller size, the somewhat reduced development of the different glands, etc., and in the absence of paragenitals.

*Larva*.—(Cast skin only.) Antennae 5-segmented, the terminal annulate; legs normal; apex of abdomen with a pair of tiny diverging median lobules, one pair of well developed lobes between which are two tubular ducts, two pairs of ventral setae, one large (apical) and wanting in specimens studied; with a dorsal and ventral seta, then a tubular duct, then a marginal lobe, then another dorsal seta, and a ventral seta, a tubular duct, etc., outside of the median lobe; with a few scattered ventral surface setae.

*Cotype*.—Cat. No. 24780, U.S.N.M.

The presentation of the generic diagnosis is deferred until the description of the following new species has been given, as both species are covered in the genus description.

## ANOPLASPIS MASKELLI, new species.

Plate 6, fig. 5.

*Adult female*.—Scale white, flat or nearly so, broadly pyriform to sometimes almost circular, exuviae apical; body of female elongate turbinate; derm membranous; pygidium somewhat chitinized; antennae small tubercles placed in a pocket as in preceding species, each with a single large seta; spiracles slender, anterior with about 15 pores, posterior without pores; head with a few setae, thoracic

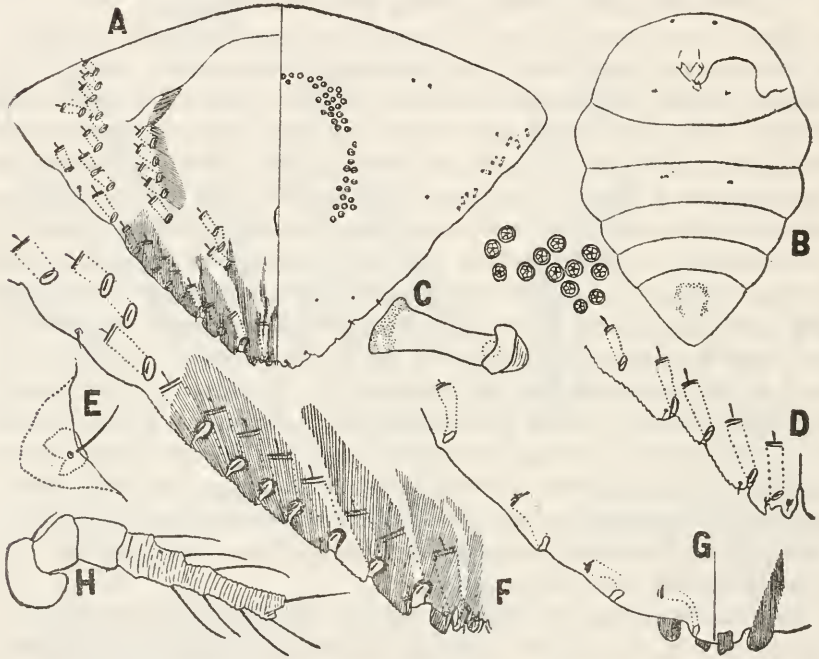


FIG. 37.—ANOPLASPIS MASKELLI, NEW SPECIES. A. ADULT FEMALE, PYGIDIUM,  $\times 165$ ; B. ADULT FEMALE, OUTLINE OF BODY,  $\times 30$ ; C. ADULT FEMALE, SPIRACLE,  $\times 640$ ; D. INTERMEDIATE STAGE FEMALE, PYGIDIAL MARGIN,  $\times 325$ ; E. ADULT FEMALE, ANTENNA,  $\times 640$ ; F. ADULT FEMALE, PYGIDIAL MARGIN,  $\times 335$ ; G. LARVA, APEX OF ABDOMEN,  $\times 640$ ; H. LARVA, ANTENNA,  $\times 640$ .

and abdominal segments with groups of medium sized short tubular ducts at margins, without gland spines; abdominal segments with groups of small, short tubular ducts in a row behind each posterior spiracle; pygidium strongly triangular, but with the extreme apex rounded; median lobes present, small, short-spatulate, placed close together, but separated by two small gland spines, second lobes larger and broader, the inner apical angle much more prominent, the outer margin parallel to the pygidium, third and any other lobes represented by almost continuous serrated and notched thickenings of the pygidial margin; with the two median gland spines already men-



tioned, with a small one outside of each median lobe, and another small one outside each second lobe; marginal setae, dorsally one above median lobe, one above inner corner of second lobe, one above inner end of beginning of chitinized margin, one just beyond fourth marginal tubular duct and one beyond ninth tubular duct, ventrally with one beneath the outer edge of the median lobe, one just outside the second lobe, one just within the third marginal duct, one beneath the fifth duct and one beyond the ninth duct; without incisions with thickened edges or paraphyses, but the edges of some of the marginal duct openings more or less thickened, and apparently with faint chitinized thickenings connected with at least the second pair of gland spines; anal opening elongate ovoid, placed about half way between base and apex of pygidium; paragenitals in five linear groups, the anterior three more or less confused, median 7-9, anterio-laterals 14-22, postero-laterals 14-19; marginal pores large, fairly long, one opening into a pointed projection between first and second lobes, and seven or eight more, at approximately equal intervals, except the last one or two more widely separated, all these opening within the margin and the openings with thickened edges; dorsal pores large, in three rows, the inner with 2-4 pores, the intermediate with about five and the outer with about 7-9; without micropores, but with a few small tubular ducts ventrally near the margin; with a few small setae ventrally.

*Intermediate stage female*.—(Cast skin only.) So far as can be determined, differing from the adult only in the smaller size and reduced development of the different structures.

*Larva*.—(Cast skin only.) Antennae apparently 4-segmented, the terminal annulate; posterior apex of body with two small tubercles, a pair of marginal tubular ducts, a pair of lobes and at least three more ducts at intervals.

*Holotype and Paratypes*.—Cat. No. 24781, U.S.N.M.

This species has been described from seven specimens as follows: holotype from specimens in the Department of Agriculture Collection received from Maskell directly, paratypes from same collection, from the Cockerell collection now included in the National Collection, and from Maskell's slides, all labeled *M. metrosideri* Maskell. The holotype and some paratypes of this species are therefore in the National collection of Coccidae, and some paratypes are in the Maskell collection. The species was collected on *Metrosideros* in New Zealand, presumably by Maskell, and in 1890 or 1891.

The following generic diagnosis has been prepared to include both of the preceding species.

## GENERIC DIAGNOSIS OF ANOPLASPID.

Diaspine forms of somewhat uncertain affinities, possibly to be included in the *Lepidosaphes* group of genera;<sup>17</sup> scale of adult female nearly circular to pyriform, exuviae apical; adult female elongate turbinate to somewhat pyriform, membranous except portions of the pygidium; antennae minute tubercles with a single seta, each set in a small pit in head; spiracles slender, anterior with pores, posterior without; head with tiny setae but no pores; thorax and abdomen with tubular ducts and setae at margin, but no gland spines; pygidium large, prominent, strongly triangular, lobes present, the median fused or separate, the lateral margin beyond the lobes heavily chitinized and serrate or denticulate, with one or two pairs of small and very inconspicuous gland spines accompanying the lobes, marginal setae normal and occurring singly, without incisions or chitinous paraphyses, anal opening moderate, approximately half-way between base and apex of pygidium, paragenitals present, numerous, in five linear groups, marginal ducts large, numerous, not grouped, axis longitudinal, dorsal ducts large, in three definite rows, a single group to each row, without micropores, with a few ventral setae, without basal thickenings, with large, conspicuous, broad thickenings extending in from the posterior margin; intermediate stage female essentially similar to adult; larva with 4-5-segmented antennae, the terminal annulate, apex of body with a median projection, a pair of lobes and several pairs of marginal tubular ducts, the inner pair within the lobes.<sup>18</sup>

In spite of the differences noted, chiefly with relation to the rather conspicuous divergence in the character of the median lobes, and to the shape of the body in the two species discussed herewith, the writers believe them to be congeneric, since the resemblance in practically all of the remaining comparative characters is close.

It is not possible at present to give any more definite indication of the relationships of the genus than that suggested in the generic diagnosis.

<sup>17</sup> The writers believe that the male scale of both these species was observed in the Maskell material, and that it was similar in shape and appearance to that of the female. The material was so limited, however, that the preceding can not be stated positively.

<sup>18</sup> The similarity in the apex of the abdomen of the larva in these two species is noteworthy, in contrast to the marked differences in the adults. While a careful effort was made to keep all stages of these two species separate, it is possible, since they were both enclosed in the same package, that the larva became scattered before new mounts were made, and that as a result the larva of the same species has been described twice. The material available for study does not permit an attempt to verify this possibility, and it is therefore necessary to let the larval descriptions stand as distinct, pending the examination of additional material. In this connection it may be noted that the difference of one segment in the number found in the antennae may also prove to be more apparent than actual when an abundance of good material is available for examination.

## BIBLIOGRAPHY OF MASKELL PUBLICATIONS ON COCCIDAE.

The following list, arranged chronologically, is believed to be a complete record of the papers published by Maskell on the scale insects:

1879. On Some Coccidae in New Zealand. *Trans. New Zealand Inst.*, vol. 11, for 1878, pp. 187-228, pls. 5-8.
1880. Further Notes on New Zealand Coccidae. *Trans. New Zealand Inst.*, vol. 12, for 1879, pp. 291-301, pl. 7.
1882. Further Notes on Coccidae in New Zealand, with descriptions of new species. *Trans. New Zealand Inst.*, vol. 14, for 1881, pp. 215-229, pls. 15-16.
1884. Further Notes on Coccidae in New Zealand. *Trans. New Zealand Inst.*, vol. 16, for 1883, pp. 120-144, pls. 1-2.
1885. Chermes or Kermes. *Trans. New Zealand Inst.*, vol. 17, for 1884, pp. 17-18.
- . Further Notes on Coccidae in New Zealand. *Trans. New Zealand Inst.*, vol. 17, for 1884, pp. 20-31, pl. 8.
1887. On the Honeydew of Coccidae and the Fungus Accompanying these Insects. *Trans. New Zealand Inst.*, vol. 19, for 1886, pp. 41-45, pl. 1.
- . Further Notes on New Zealand Coccidae. *Trans. New Zealand Inst.*, vol. 19, for 1886, pp. 45-49, pl. 2.
- . An Account of the Insects Noxious to Agriculture and Plants in New Zealand, The Scale Insects (Coccidae). Wellington, 1887, 116 pp., 23 pls.
1889. On Some new South Australian Coccidae. *Trans. Royal Soc. South Australia*, vol. 11, for 1888, pp. 101-111, pls. 12-14.
- . On the Distinction between Lecanidinae, Hemicoccidinae and Coccidinae. *Ent. Month. Mag.*, vol. 25, 1889, pp. 405-409.
1890. Further Notes on Coccidae, with Descriptions of New Species from Australia. *Trans. New Zealand Inst.*, vol. 22, for 1889, pp. 133-156, pls. 4-9.
- . *Icerya purchasi* and its Insect Enemies in New Zealand. *Ent. Month. Mag.*, vol. 26, 1890, pp. 17-19.
- . On a New Australian Coccid. *Proc. Linnean Soc. New South Wales*, ser. 2, vol. 5, 1890, pp. 280-282, pl. 15.
- . How do Coccids Produce Cavities in Plants. *Ent. Month. Mag.*, vol. 26, 1890, pp. 277-280.
- . New Zealand Coccidae exhibited by W. M. Maskell at the meeting of the Entomological Society of London (published letter). *Proc. Ent. Soc. London*, for 1890, pt. 2, pp. xiv-xvi.
1891. Descriptions of New Coccidae. *Indian Museum Notes*, vol. 2, 1891, pp. 59-62.
- . Description of a New Scale Insect Infesting Grass. *Agricultural Gazette, New South Wales*, vol. 2, no. 6, 1891, pp. 352-353.
- . Further Coccid Notes, with Descriptions of New Species from New Zealand, Australia and Fiji. *Trans. New Zealand Inst.*, vol. 23, for 1890, pp. 1-36, pls. 1-7.
1892. Further Coccid Notes with Descriptions of New Species and Remarks on Coccidae from New Zealand, Australia, and Elsewhere. *Trans. New Zealand Inst.*, vol. 24, for 1891, pp. 1-64, pls. 1-13.

1892. Migrations and New Localities of some Coccids. Ent. Month. Mag., vol. 28, 1892, pp. 69-71.
- A new *Icerya* and Some Other New Coccids from Australia. Ent. Month. Mag., vol. 28, 1892, pp. 183-184.
1893. Further Coccid Notes, with Descriptions of New Species from Australia, India, Sandwich Islands, Demerara and South Pacific. Trans. New Zealand Inst., vol. 25, for 1892, pp. 201-252, pls. 11-18.
- A few Remarks on Coccids. Ent. Month. Mag., vol. 29, 1893, pp. 101-105.
- Notes on Coconut palm Coccidae. Indian Museum Notes, vol. 3, 1893, pp. 66-67, fig.
1894. Further Coccid Notes with Descriptions of Several New Species and Discussion of Various Points of Interest. Trans. New Zealand Inst., vol. 26, for 1893, pp. 65-104, pls. 3-8.
- The Egyptian *Icerya* in Australia. Insect Life, vol. 6, 1894, p. 268.
- On a New Coccid on Fern Roots. Proc. Linnean Soc. New South Wales, ser. 2, vol. 8, for 1893, pp. 225-226, pl. 7.
- Remarks on Certain Genera of Coccidae. The Entomologist, vol. 27, 1894, pp. 44-46, 93-95, 166-168.
1895. Synoptical List of Coccidae Reported from Australia and the Pacific Islands up to Dec. 1894. Trans. New Zealand Inst., vol. 27, for 1894, pp. 1-35.
- Further Coccid Notes, with Descriptions of New Species from New Zealand, Australia, Sandwich Islands and Elsewhere, and Remarks on many Species Already Reported. Trans. New Zealand Inst., vol. 27, for 1894, pp. 36-75, pls. 1-7.
- Notes on Some Genera and Species of Coccidae. Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, pp. 129-138.
- (?). *Aspidiotus perniciosus* and *Aonidia fusca*, Their Probable Identity and Genus. Agricultural Gazette, New South Wales, vol. 6, no. 12, for 1895, pp. 868-870.
1896. Further Coccid Notes, with Descriptions of New Species and Discussions of Questions of Interest. Trans. New Zealand Inst., vol. 28, for 1895, pp. 380-411, pls. 16-23.
- *Aspidiotus perniciosus* Comst. and *Aonidia fusca* Mask.: A question of identity or variation. Ent. Month. Mag., vol. 32, 1896, pp. 33-36.
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- Notes on Coccidae. Ent. Month. Mag., vol. 32, 1896, pp. 223-226.
1897. Further Coccid Notes, with Descriptions of New Species and Discussion of Points of Interest. Trans. New Zealand Inst., vol. 29, for 1896, pp. 293-331, pls. 18-22.
- On a Collection of Coccidae Principally from China and Japan. Ent. Month. Mag., vol. 33, 1897, pp. 239-244.
1898. Further Coccid Notes, with Description of New Species, etc. Trans. New Zealand Inst., vol. 30, for 1897, pp. 219-252, pls. 23-27.

## EXPLANATION OF PLATES.

The photographic illustrations of the habit characteristics of the various species shown in these plates have, with the single exception noted, been prepared by Mr. J. G. Pratt, photographer for the Bureau of Entomology. No attempt has been made to photograph the insects to a definite scale of enlargement, and the text of this paper or Maskell's publications should be consulted for information as to the actual size of each species. Due either to the poor condition or the lack of material of a number of Maskell's species, it has not been possible to obtain photographs of them, and in consequence the series is not complete.

### PLATE 1.

- FIG. 1. *Monophlebulus fuscus* (Maskell), adult female.  
2. *Coelostomidia zealandica* (Maskell), tests of intermediate stage females.  
3. *Phenacoleachia zealandica* (Maskell), adult male and adult female.  
4. *Frenchia casuarinae* Maskell, adult females, from above and in position within gall.  
5. *Solenococcus fagi* (Maskell), tests of adult females. (J. G. Sanders, photo.)

### PLATE 2.

- FIG. 1. *Ericoccus eucalypti* Maskell, sacs of adult females on twigs.  
2. *Cylindrococcus casuarinae* Maskell, adult female galls.  
3. *Sphaerococcopsis inflatipes* (Maskell), female tests on bark.  
4. *Callococcus pulchellus* (Maskell), female tests on twig.  
5. *Eremococcus pirogallis* (Maskell), female galls.

### PLATE 3.

- FIG. 1. *Epicoccus acaciae* (Maskell), adult females on twigs.  
2. *Pseudoripersia turgipes* (Maskell), adult female sacs on twigs.  
3. *Chaetococcus bambusae* (Maskell), adult females.  
4. *Ceronema banksiae* Maskell, adult female on leaf.  
5. *Eriochiton hispidus* Maskell, female tests on leaf.

### PLATE 4.

- FIG. 1. *Mallococcus sinensis* (Maskell), female tests on twig.  
2. *Lecanochiton metrosideri* Maskell, female tests on twig.  
3. *Ctenochiton viridis* Maskell, adult females.  
4. *Inglisia patella* Maskell, female tests.  
5. *Paralecanium frenchii* (Maskell), adult females (not Maskell specimens).

### PLATE 5.

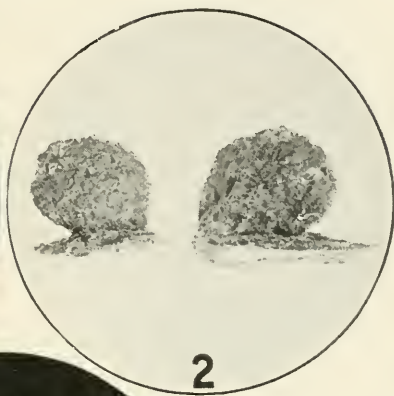
- FIG. 1. *Cryptes baccatus* (Maskell), male puparia and females.  
2. *Alecanopsis flicum* (Maskell), adult female.  
3. *Poliaspis media* Maskell, female scale (probably not true *media*).  
4. *Phaulaspis hakeae* (Maskell), female scales on bark.  
5. *Phaulomytilus striatus* (Maskell), female scales on host.

## PLATE 6.

- FIG. 1. *Coccomytilus convexus* (Maskell), female scales on host.  
2. *Trichomytilus formosus* (Maskell), female and male scales on leaf.  
3. *Allantomytilus maideni* (Maskell), female scales on leaf.  
4. *Anoplaspis metrosideri* (Maskell), female scales.  
5. *Anoplaspis maskelli*, new species, female scales on leaf of host.



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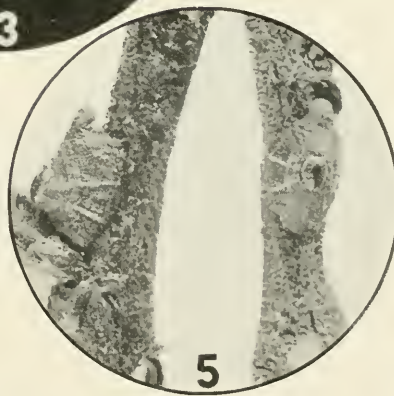
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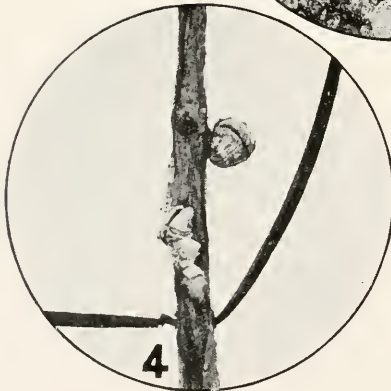
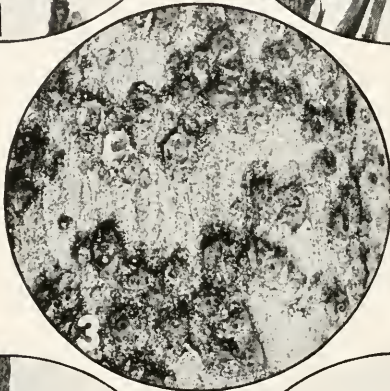
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5

MASKELL'S GENERA OF COCCIDAE

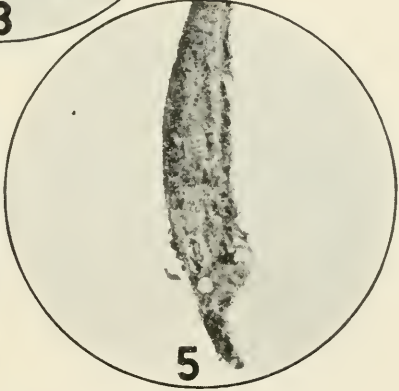
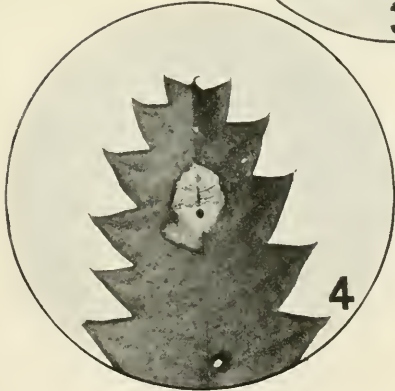
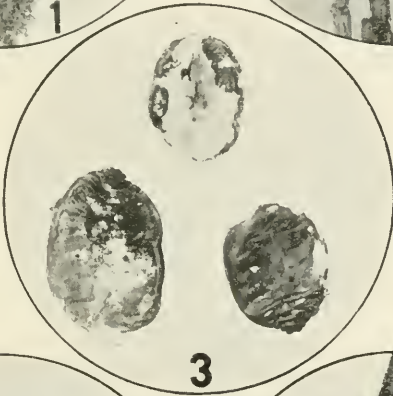
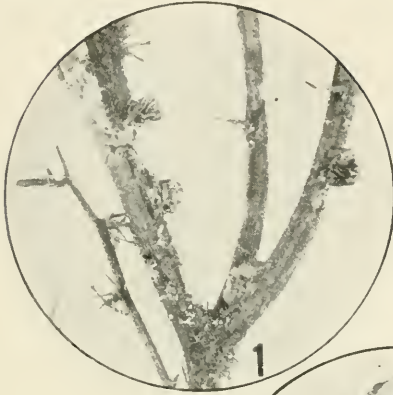
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MASKELLS GENERA OF COCCIDAE

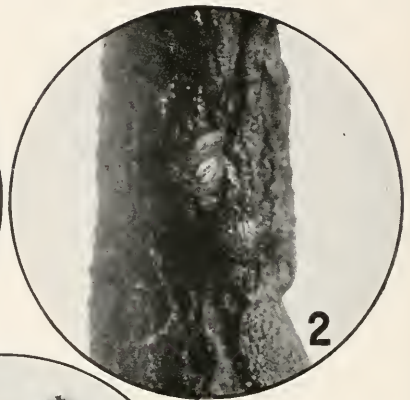
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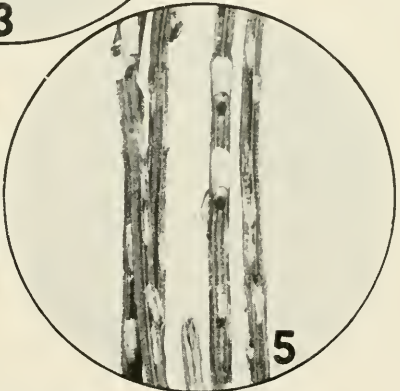
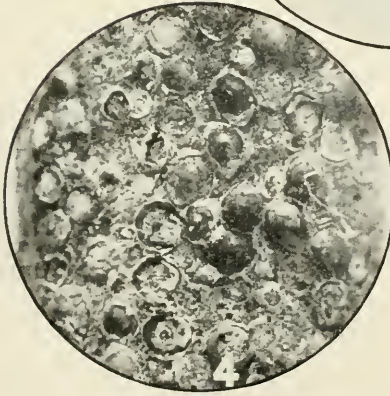
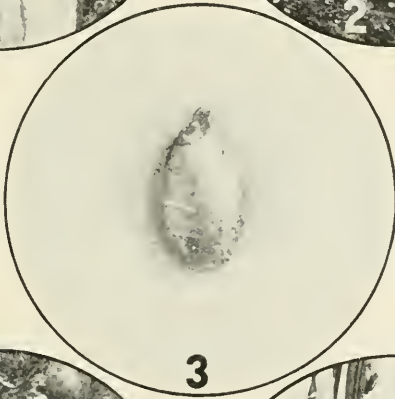
MASKELLS GENERA OF COCCIDAE

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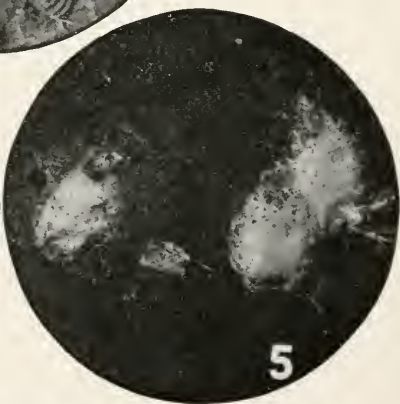
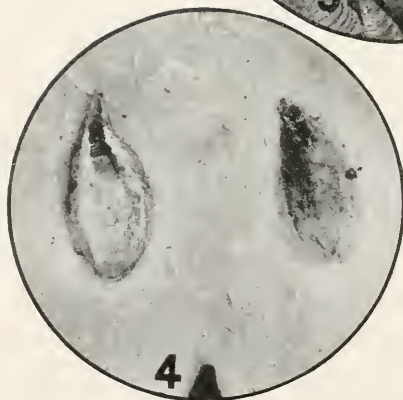
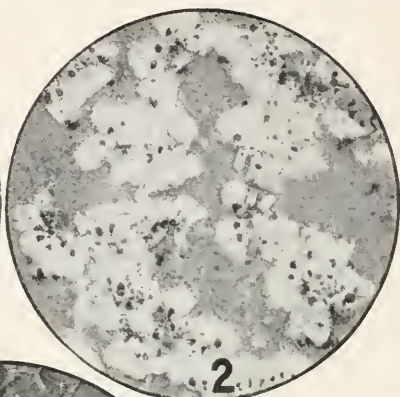
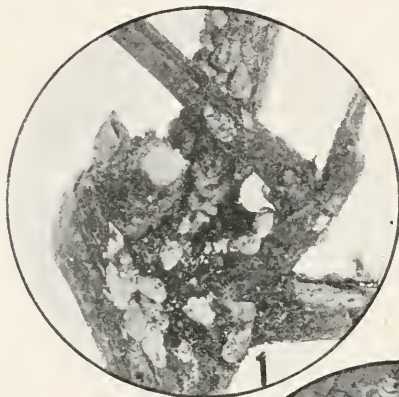
MASKELLS GENERA OF COCCIDAE

FOR EXPLANATION OF PLATE SEE PAGE 117.



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MASKELLS GENERA OF COCCIDAE

FOR EXPLANATION OF PLATE SEE PAGE 118.

## INDEX TO GENERA AND SPECIES.

[In the following index valid generic names are indicated in boldface type; valid specific names in roman, and synonyms in italics.]

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