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**THIRD TAXONOMIC STUDY OF CALIFORNIA  
MEALYBUGS, INCLUDING ADDITIONAL  
SPECIES FROM NORTH AND  
SOUTH AMERICA  
(Homoptera: Coccoidea: Pseudococcidae)**

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**THIS COMPLETES VOLUME 32**

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## **THIRD TAXONOMIC STUDY OF CALIFORNIA MEALYBUGS, INCLUDING ADDITIONAL SPECIES FROM NORTH AND SOUTH AMERICA (Homoptera: Coccoidea: Pseudococcidae)<sup>1</sup>**

**HOWARD L. MCKENZIE<sup>2</sup>**

### INTRODUCTION

ORIGINALLY, the main objective of the taxonomic project on Pseudococcidae was to describe and delineate new California species, and to comment, if necessary, on the systematic status of other named forms occurring in the state. It has been necessary, for obvious reasons, to consider species beyond the California boundaries. Even in the first study<sup>3</sup> of this series it was desirable to recast and revise the key to North American genera of Pseudococcidae because of changes in the classificatory status of certain generic categories. This key also included two new genera described at that time, which further justified its alteration. In addition, keys to species of certain North American groups were modified to include the 28 new California segregates. The second study<sup>4</sup> of this series presented the description of an additional 13 new California mealybugs, and, like the first publication, keys were altered to accept them.

This study includes the descriptions of two new North American pseudococcid genera, one discovered in Arizona, the other in Texas. With the discovery of these two new genera, it seemed advisable once again to revise the generic key to North American Pseudococcidae; the key follows at the conclusion of this introduction. Sixteen new species of mealybugs are described from the following areas: 3 from Arizona, 3 from California, 4 from Mexico, 4 from Nevada, 1 from Peru, and 1 from Texas. Specific keys to certain of these groups, particularly where two or more new forms are involved, are amended to include the new North American species herein described. Since the new *Puto* described in this paper is South American in origin, no attempt was made to revise the key to North American components of this group. The number of new species for California described in the series of three studies now totals 44.

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<sup>3</sup> *Hilgardia* 29(15):681-770, 1960. (Illustrated.)

<sup>4</sup> *Hilgardia* 31(2):15-52, 1961. (Illustrated.)

Recent taxonomic investigations conducted by R. F. Wilkey, Systematic Entomologist for the California State Department of Agriculture, and the author, on the so-called *Pseudococcus maritimus-malacearum* complex (see footnote 11 for citation) are included in this study. A re-examination and a systematic appraisal of type material of all North American and certain European members of this mealybug complex were made by the authors. The results of these efforts are discussed under the following mealybug species: *Pseudococcus comstocki* (Kuwana), *P. maritimus* (Ehrhorn), and *P. obscurus* Essig.

## KEY TO GENERA OF NORTH AMERICAN PSEUDOCOCCIDAE

1. Trilocular pores absent ..... 2
- Trilocular pores present at least somewhere on body ..... 3
- 2 (1). Antennae 9-segmented, claws denticulate; both quinquelocular and multilocular disk pores present ..... *HETEROCOCCUS* Ferris
- Antennae 6-segmented, claws without denticle; only multilocular disk pores present ..... *MISERICOCCUS* Ferris
- 3 (1). Dorsum with cerarian spines and some body setae enlarged, stout, and in form of truncate cones ..... *STEMMATOMERINX* Ferris
- Dorsum with cerarian spines conical, body setae basically lanceolate ..... 4
- 4 (3). Legs entirely absent ..... 5
- Legs present, though sometimes considerably reduced in size ..... 6
- 5 (4). Anal ring completely exposed on dorsal body surface, not at all invaginated, bearing setae which are shorter than diameter of ring itself ..... *PALUDICOCCUS* Ferris
- Anal ring at least slightly and usually deeply retracted into end of abdomen, bearing setae which are longer than diameter of ring itself ..... *ANTONINA* Signoret
- 6 (4). With at least a few enlarged and elongated tubular ducts, the orifices of which are borne at the apex of sclerotized, projecting tubercles ..... *HELIOCOCCUS* Sule
- Tubular ducts of this type absent ..... 7
- 7 (6). Dorsal multilocular disk pores present and arranged in groups of 3 to 6 pores, each group with a tubular duct at its center ..... *PELIOCOCCUS* Borkhsenius
- Dorsal multilocular disk pores if present not so arranged, without a tubular duct in center ..... 8
- 8 (7). Posterior coxa either enlarged and flattened into a plate or area beset with small pores, or coxa normal in size and lying in an enlarged area beset with small pores ..... *PSEUDANTONINA* Green
- Posterior coxa not enlarged into a plate or area beset with small pores, or if normal in size not lying in an area beset with pores ..... 9
- 9 (8). Each cerarius, including those anterior to anal lobe pair, formed upon a sclerotized plate bearing from 6 to 20, or perhaps even more, enlarged setae or spines ..... *PUTO* Signoret
- Cerarii anterior to anal lobe pair not formed upon a sclerotized plate; if certain cerarii have associated sclerotization these never with more than 3 to 4 cerarian setae or spines ..... 10
- 10 (9). Tubular ducts on dorsum comparatively large and conspicuous, with orifice surrounded by a sclerotized area from which there arise 1 or more setae ..... *FERRISIA* Fullaway\*
- Tubular ducts on dorsum with orifice not surrounded by such a sclerotized area ..... 11

\* The genus *Ferrisia*, erected by Fullaway in 1923, is here considered distinct from the *Ferrissia* described by Walker in 1903 (see International Code of Zoological Nomenclature, adopted by the XV International Congress of Zoology [1961], Article 56a).

- 11 (10). Spiracles enlarged, moderately sclerotized, with a dense curved band of pores of two kinds across opening of spiracle . . . . . *ANTONINOIDES* Ferris  
Spiracles not abnormally enlarged, only moderately sclerotized, but without a dense curved band of pores of two kinds across spiracle opening. . . . . 12
- 12 (11). Oral rim tubular ducts present somewhere on body . . . . . 13  
Oral rim tubular ducts absent . . . . . 18
- 13 (12). Anal ring simplified, abortive, accompanying cellular pores either absent, or present in numbers not exceeding 12 . . . . . 14  
Anal ring well developed, with more than 12 cellular pores . . . . . 15
- 14 (13). Antennae 8-segmented . . . . . *DISTICHLICOCOCUS* Ferris  
Antennae 5- to 7-segmented; part of . . . . . *HUMOCOCCUS* Ferris
- 15 (13). With from 6 to 18 pairs of recognizable cerarii . . . . . 16  
With from 0 to 4 pairs of recognizable cerarii . . . . . *CHORIZOCOCCUS* McKenzie
- 16 (15). Each cerarius composed of from 5 to 10, or perhaps more, enlarged conical setae or spines . . . . . *CIRCAPUTO* McKenzie  
Each cerarius with not more than 3 or 4, usually 2, enlarged conical setae or spines . . . . . 17
- 17 (16). Cerarii without slender auxiliary setae accompanying the enlarged cerarian setae or spines, except for the anal lobe pair . . . . . *SPLOCOCCUS* Ferris  
Slender auxiliary setae accompanying enlarged cerarian setae or spines, present in at least one-third, usually all, marginal cerarii . . . . .  
. . . . . *PSEUDOCOCCUS* Westwood
- 18 (12). Dorsal tubular ducts always with a small adventitious cell adjoining main orifice . . . . . *ANISOCOCCUS* Ferris  
Dorsal tubular ducts never with an adventitious cell joined to main orifice . . . . 19
- 19 (18). Denticle or tooth present on the plantar surface of claw, well developed or very tiny . . . . . 20  
Denticle or tooth absent on plantar surface of claw . . . . . 22
- 20 (19). Dorsal ostioles absent . . . . . 21  
At least posterior pair of ostioles present . . . . . 23
- 21 (20). One or more circuli present . . . . . *CUCULLOCOCCUS* Ferris  
Circulus absent . . . . . *EIRHORNIA* Ferris
- 22 (19). The 3 terminal segments of abdomen each with a dorsal sclerotization which extends nearly or quite across the abdomen . . . . . *POROCOCCUS* Cockerell  
Terminal abdominal segments without such dorsal sclerotization . . . . . 24
- 23 (20). Cerarii present only on anal lobes, or completely absent . . . . .  
. . . . . *AMONOSTHERIUM* Morrison and Morrison  
Normally with 18 pairs of cerarii, sometimes reduced to 5 or 6 pairs . . . . .  
. . . . . *PHENACOCCUS* Cockerell
- 24 (22). With 18 pairs of cerarii . . . . . *PLANOCOCCUS* Ferris  
With from 0 to 17 pairs of cerarii . . . . . 25
- 25 (24). Dorsal body setae of the abdomen nearly or quite as large as those of the cerarii or anal lobe cerarian areas . . . . . 26  
Dorsal body setae slender, smaller in size as compared to setae of the cerarii (if cerarii are present) or of the cerarian areas . . . . . 27
- 26 (25). Anal lobe cerarii with but 2 stout setae or spines . . . . . *NIPAEOCOCCUS* Sulc  
Anal lobe cerarii with more than 2 stout setae or spines. . . . . *HYPOGEOCOCCUS* Rau
- 27 (25). Each spiracle borne within the arms of a crescentic area of sclerotization which bears a few pores . . . . . 28  
Spiracles with their openings not thus borne within the arms of a crescentic sclerotized area . . . . . 29
- 28 (27). Anal ring broadly sclerotized and bearing large setae which are considerably longer than the diameter of the ring itself; posterior dorsal ostioles present . . . . . *SYRMOCOCCUS* Ferris  
Anal ring very narrowly sclerotized and bearing very small setae which are shorter than the diameter of the ring itself; dorsal ostioles entirely lacking . . . . . *DISCOCOCCUS* Ferris
- 29 (27). Anal lobe cerarii with at least 5 to 6, usually many more, conical setae present . . . . . *CATAENOCOCCUS* Ferris

- Never with more than 3 or 4 conical setae in anal lobe cerarii, if cerarii are present ..... 30
- 30 (29). Circulus distinctive in shape, unusually large and more or less hourglass-shaped ..... *SACCHARICOCCUS* Ferris
- Circulus, if present, not shaped as above ..... 31
- 31 (30). Anal lobes with a very distinct, narrow, sclerotized bar on venter extending in from base of anal lobe seta; anal lobe seta longer than anal ring setae ..... *CRISICOCCUS* Ferris
- Anal lobes without ventral thickening, or if sclerotization present, shaped otherwise; anal lobe seta shorter than anal ring setae ..... 32
- 32 (31). Anal lobes with their cerarii represented by paired, conical setae ..... 40
- Anal lobes with their cerarii represented by a pair of slender, distinctly paired setae, or with no recognizable cerarii ..... 33
- 33 (32). With invaginated tubular ducts, rounded or dome-shaped at inner ends; adult female at maturity extremely small, measuring not more than 0.75 mm. in length ..... *PYGMAEOCOCCUS* McKenzie
- Tubular ducts variously shaped but not rounded or dome-shaped at inner ends; adult female at maturity measuring not less than 1.00 mm. in length... 34
- 34 (33). Body setae evident in considerable numbers ..... 35
- Body setae completely lacking, except 2 pairs which mark position of anal lobes ..... *RADICOCCUS* Hambleton
- 35 (34). Distinctive bi- or tritubular pores present ... *RHIZOECUS* Künckel d'Herculeis
- Distinctive bi- or tritubular pores absent ..... 36
- 36 (35). Antennae 5-segmented ..... *NEORHIZOECUS* Hambleton
- Antennae 6- to 8-segmented ..... 37
- 37 (36). Anal ring abortive, simplified, may be without cellular pores, or having not more than 12 of these structures; part of ..... *HUMOCOCCUS* Ferris
- Anal ring well developed, with more than 12 cellular pores ..... 38
- 38 (37). Dorsum without tubular ducts of any kind ..... *EUBYOCCUS* Ferris
- Dorsum with tubular ducts, although at times these quite small ..... 39
- 39 (38). At least 1 circulus, usually more, present ..... *TRIDISCUS* Ferris
- Circulus absent ..... *CRYPTORIPERSIA* Cockerell
- 40 (32). With 6 or more pairs of cerarii present, including frontal ones ..... *DYSMICOCCUS* Ferris
- With 5 or fewer pairs of cerarii present, including frontal ones ..... 41
- 41 (40). Body form at maturity normally elongate and slender<sup>a</sup>; circulus, if present, always quite small, circular or oval, normally not capable of folding along intersegmental line of segments across which it lies<sup>b</sup> ..... *TRIONYMUS* Berg
- Body form at maturity broadly oval or rotund; circulus, if present, extending across the fold between the fourth and fifth abdominal segments ..... 42
- 42 (41). Cerarii confined to anal lobe pair ..... *CHNAUROCOCCUS* Ferris
- At least 4 to 5 pairs of cerarii present on abdomen ..... 43
- 43 (42). Multilocular disk pores present on both surfaces of abdomen .. *ORACELLA* Ferris
- Multilocular disk pores absent on both surfaces of abdomen ..... *PARADOXOCOCCUS* McKenzie

## DESCRIPTIONS OF NEW SPECIES AND OTHER RECORDS

The descriptions of new species of mealybugs will follow the keys to the species of the groups involved. Remarks on the distributional and economic status of certain other pseudococcids are also included.

<sup>a</sup> *Trionymus magnus* (Cockerell and Cockerell) is one exception, although its circulus is very small and undivided, and all other characters are typical of *Trionymus*.

<sup>b</sup> *Trionymus haancheni* McKenzie and *T. modocensis* (Ferris) are exceptions here, although their body shape and all other features are characteristic of *Trionymus*.

### Genus *Circaputo* McKenzie, new genus

**Genotype.** This genus is here established for the reception of a single species, *Circaputo hirsutus* McKenzie, described as new in this paper.

**Recognition characters.** Length of single adult female, approximately 2.6 mm.; width, 1.9 mm. Body broadly oval. Anterior and posterior ostioles present. Dorsal cerarii appear basically in 17 or 18 pairs; this arrangement, however, interrupted by division of individual cerarii or interpolation of others, but always displaying a certain distinctive character, being composed of several to many conical setae never borne on sclerotized areas; trilocular pores on cerarian areas more numerous than conical setae. Dorsal body setae slender and numerous, some obviously larger than others, occurring in irregular transverse bands on abdominal segments and covering thoracic segments and head. Dorsum thickly beset with trilocular pores; multilocular disk pores and tubular ducts absent, except for 2 or 3 very small, short ducts with a slight oral rim which may be present on anterior area of head. If correctly interpreted, minute, circular pores, each approximately three-fourths the diameter of a trilocular pore, generally distributed over dorsal surface of body. Anal ring well developed, cellular, with 6 enlarged setae, situated at extreme apex of abdomen.

On the venter, multilocular disk pores absent. Venter beset with numerous long and slender setae, some of which appear larger than others, giving appearance of being extremely hairy (hence the specific name "*hirsutus*"). A few small, short ducts with a slight oral rim present submarginally on body. Tubular ducts of oral collar type present in considerable numbers on abdominal segments, a few scattered on thorax and head. A limited number of minute, circular pores, similar in size to those on dorsum, evident on entire venter. Trilocular pores extremely numerous on venter, although possibly less so than on dorsum.

Circulus present, rather large, transversely oval, divided by segmental line across which it lies. Antennae long, slender, 8-segmented. Mouthparts large, well developed, as long as, or longer than, clypeus. Legs proportionately large and well developed, slender; claws exhibiting a weakly developed denticle or tooth on plantar surface; very small, translucent dots or pores scattered along hind tibiae, a few on femora.

**Notes.** This new genus appears to be related to *Criniticoccus* Williams, *Cataenococcus* Ferris, and *Paraputo* Laing. It differs from *Criniticoccus* in possessing extremely long and slender setae on the ventral body surface, whereas in *Criniticoccus* the dorsum is beset with the longest setae. It resembles *Cataenococcus* and *Paraputo*, but in both of these genera the anal ring is removed by at least its length from the apex of the abdomen, whereas in *Circaputo* this structure is situated at the apex of the abdomen.

Both Dr. Harold Morrison and Dr. D. J. Williams have kindly examined this pseudococcid and offered comments about its systematic status. They concur with the author that no described genus will comfortably receive this species.

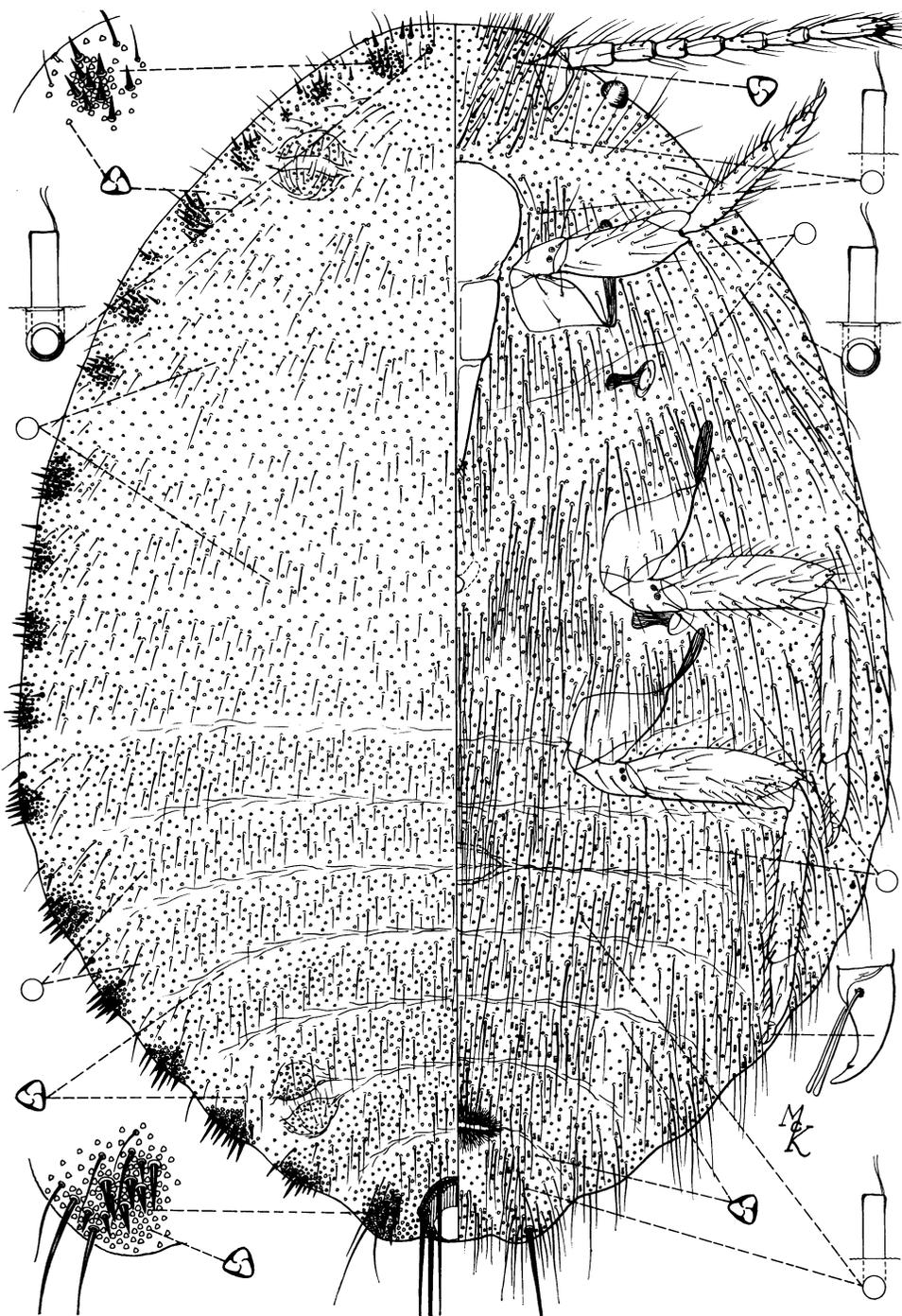


Fig. 1. *Circaputo hirsutus* McKenzie, new species, collected under a rock in the nest of an ant, *Acanthomyops interjectus arizonicus* Wheeler, at the Southwestern Research Station, American Museum of Natural History, Portal, Cochise County, Arizona.

***Circaputo hirsutus* McKenzie, new species**

(Figure 1)

**Suggested common name.** Hairy circaputo mealybug.

**Hosts and distribution.** Holotype adult female and more than 100 last-stage nymphs of this mealybug were collected under a rock at the Southwestern Research Station, American Museum of Natural History, Portal, Cochise County, Arizona, March 4, 1961, by J. W. MacSwain.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) has been deposited in the museum of the University of California, Davis.

**Habit.** This mealybug was found under a rock in the nest of an ant, *Acanthomyops interjectus arizonicus* Wheeler, associated with another undescribed pseudococcid<sup>7</sup> and a few immatures of an unrecognized margarodid. The ants apparently were attending only the margarodids.

**Recognition characters.** The description of the genus will apply as the description of this species.

**Notes.** This species resembles *Criniticoccus ficus* Williams, but the presence of extremely long and slender setae on the ventral surface of its body, as compared to longer body setae on the dorsum of *C. ficus*, precludes confusion.

**Genus *Dysmicoccus* Ferris**

Two species of *Dysmicoccus* are described as new in this paper. Ferris' 1953 key to the North American species of *Dysmicoccus* is here modified to include them. Now assigned to the genus are 22 species for North America, 5 of which occur in California.

**Key to Species of *Dysmicoccus* in North America**

- 1. Dorsal multilocular disk pores present ..... *desertorum* McKenzie
- Dorsal multilocular disk pores absent ..... 2
- 2 (1). Circulus present ..... 9
- Circulus absent ..... 3
- 3 (2). All cerarii, except perhaps those of the head region, with two conical setae .... 4
- Most of the cerarii with three or more conical setae of various sizes ..... *obesus* (Lobdell)
- 4 (3). Tubular ducts few, scarcely more than a total of ten distributed over the venter of the abdomen; anal lobe cerarius surrounded by a large and definite sclerotized area ..... *acicululus* Ferris
- Tubular ducts more numerous, many more than a total of ten on the venter of the abdomen; anal lobe cerarius not surrounded by a sclerotized area .... 5
- 5 (4). Anal lobes sclerotized posterior to the cerarius ..... *diodium* (McConnell)
- Anal lobes not sclerotized posterior to the cerarius ..... 6
- 6 (5). Lateral ventral areas of all the segments of the body, except the head, with large clusters of tubular ducts ..... *medanicli* (Hollinger)
- Lateral ventral areas of the body with fifteen or fewer, usually fewer, tubular ducts, or even with none, these confined to abdominal segments .... 7
- 7 (6). Abdomen with ventral clusters of from 3 to 15 tubular ducts on the lateral areas of the last four abdominal segments ..... 8
- Abdomen with not more than a single tubular duct or even with none in the lateral ventral areas of any of the abdominal segments ..... *imbriatulus* (Cockerell and King)

<sup>7</sup> See *Pseudococcus macswaini* McKenzie, herein described as new.

- 8 (7). With seventeen pairs of cerarii ..... *lasii* (Cockerell)  
Cerarii recognizable only on abdominal segments, absent on thorax and  
head ..... *junceus* (McConnell)
- 9 (2). With seventeen pairs of cerarii ..... 13  
With less than seventeen pairs of cerarii ..... 10
- 10 (9). At least ten recognizable pairs of cerarii ..... 12  
Not more than seven recognizable pairs of cerarii including, at times, the  
frontal pair ..... 11
- 11 (10). Circulus small, circular, not divided by intersegmental line near which it  
lies ..... *merrilli* (Ferris)  
Circulus large, oval, divided by intersegmental line of fourth and fifth seg-  
ments ..... *boninsis* (Kuwana)
- 12 (10). Not more than two conical setae in any cerarius except in the head region  
..... *ryani* (Coquillett)  
At least three conical setae in most of the cerarii ..... *difficilis* (Lobdell)
- 13 (9). Tubular ducts absent on the dorsum ..... 14  
At least a few tubular ducts present on the dorsum ..... 19
- 14 (13). Anal lobe cerarii surrounded by a large, definite sclerotized area .....  
..... *cuspidatae* (Rau)  
Anal lobe cerarius with no surrounding sclerotized area ..... 15
- 15 (14). Dorsal flat discoidal pores of variable size present anterior to anal ring;  
some abdominal cerarii with three or more conical setae. *brevipes* (Cockerell)  
Dorsal flat discoidal pores absent; no cerarii, other than those of the head  
region, with more than two conical setae ..... 16
- 16 (15). Few or no tubular ducts on the abdominal venter .....  
..... *roseotinctus* (Cockerell and Cockerell)  
Numerous tubular ducts on the abdominal venter ..... 17
- 17 (16). Ventral multilocular disk pores present on abdomen from apical to pos-  
terior margin of segment 5 ..... *hurdi* McKenzie  
Ventral multilocular disk pores present on abdomen from apical to pos-  
terior margin of segment 7 or 8 ..... 18
- 18 (17). Numerous tubular ducts in the lateral ventral areas of all abdominal seg-  
ments ..... *salmonaceus* (Cockerell)  
Tubular ducts only in the lateral ventral areas of the morphologically  
sixth to eighth abdominal segments ..... *texensis* (Tinsley)
- 19 (13). With a definite sclerotized area surrounding the anal lobe cerarius ..... 20  
With no sclerotized area surrounding the anal lobe cerarius .....  
..... *morrisoni* (Hollinger)
- 20 (19). Dorsum with multilocular disk pores ..... *timberlakei* (Cockerell)  
Dorsum without multilocular disk pores ..... 21
- 21 (20). Dorsum with tubular ducts scattered over entire body ..... *patulae* (Rau)  
Dorsum with tubular ducts only on the abdomen ..... *quercicolus* (Ferris)

### *Dysmicoccus desertorum* McKenzie, new species

(Figure 2)

**Suggested common name.** Desert dysmicoccus mealybug.

**Hosts and distribution.** Type and paratype adult females of this species were collected on *Chrysothamnus greenii* (Compositae) at Panaca, Lincoln County, Nevada, August 30, 1961, by F. D. Parker.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and paratypes of the same sex have been deposited in the museum of the University of California, Davis. Paratypes have also been placed in the United States National Collection of Coccoidea, Washington, D.C., and in the collection of the California State Department of Agriculture, Sacramento.



**Habit.** According to the collector, Mr. F. D. Parker, this mealybug was found associated with plant roots. The body contents of specimens of this species appeared to form into blue-black fat globules during treatment in lactophenol.

**Recognition characters.** Length of largest adult female, approximately 2.1 mm. On the dorsum, cerarii appear reduced in number, there being normally 7 or 8 pairs on abdomen counting forward from anal lobes; second and third abdominal pairs often difficult to discern because cerarian setae are quite small, slender, situated farther apart, with no auxiliary setae, and without, or with only a very small cluster, of accompanying trilocular pores; no apparent definite cerarii on thorax and head. Anal lobe cerarius with 2 moderately large, conical setae, several long, slender, auxiliary setae, and numerous, but not crowded, trilocular pores. Anterior to this, cerarian setae become quite small, suggested merely by a pair of slender setae set rather close together. Body dorsum with quite numerous multilocular disk pores, occurring mostly in rows along posterior margin of abdominal segments, except the last, scattered on thorax and head. Body surface with quite numerous tubular ducts of oral collar type, these about equal in diameter to a trilocular pore and slightly more than twice as long as wide. Mingled with these ducts are a few minute, circular pores. Otherwise dorsum beset throughout with small, slender, body setae and trilocular pores. Anal ring of normal size and form for genus, its 6 setae about twice as long as greatest diameter of ring.

On the ventral side, multilocular disk pores quite numerous on all abdominal segments (extending to body margin), thorax, and head. Tubular ducts of same size and type as those on dorsum occur in small numbers in midregion of abdominal segments, quite abundantly so in lateral areas of these segments, also in similar groups in lateral and sternal areas of thorax and on anterior area of head.

Circulus absent. Antennae normally 7-segmented. Legs moderately large, well developed; hind coxae with cluster of translucent dots or pores at base; hind tibiae with characteristic irregular cluster or two of clear dots or pores, these evident on apical half of segment; denticular swelling or tooth absent on plantar surface of claw.

**Notes.** This species differs from all known North American *Dysmicoccus* by the presence of dorsal multilocular disk pores; these structures are absent on other segregates of this group. It shares with *Dysmicoccus boninsis* (Kuwana), *D. patulae* (Rau), and *D. quercicolus* (Ferris) the presence of dorsal oral collar tubular ducts. These are normally absent in species of this genus.

### *Dysmicoccus hurdi* McKenzie, new species

(Figure 3)

**Suggested common name.** Hurd dysmicoccus mealybug.

**Hosts and distribution.** Type adult female collected on undetermined host at Tecolutla, state of Veracruz, Mexico, June 19, 1951, by P. D. Hurd.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) has been deposited in the museum of the University of California, Davis.

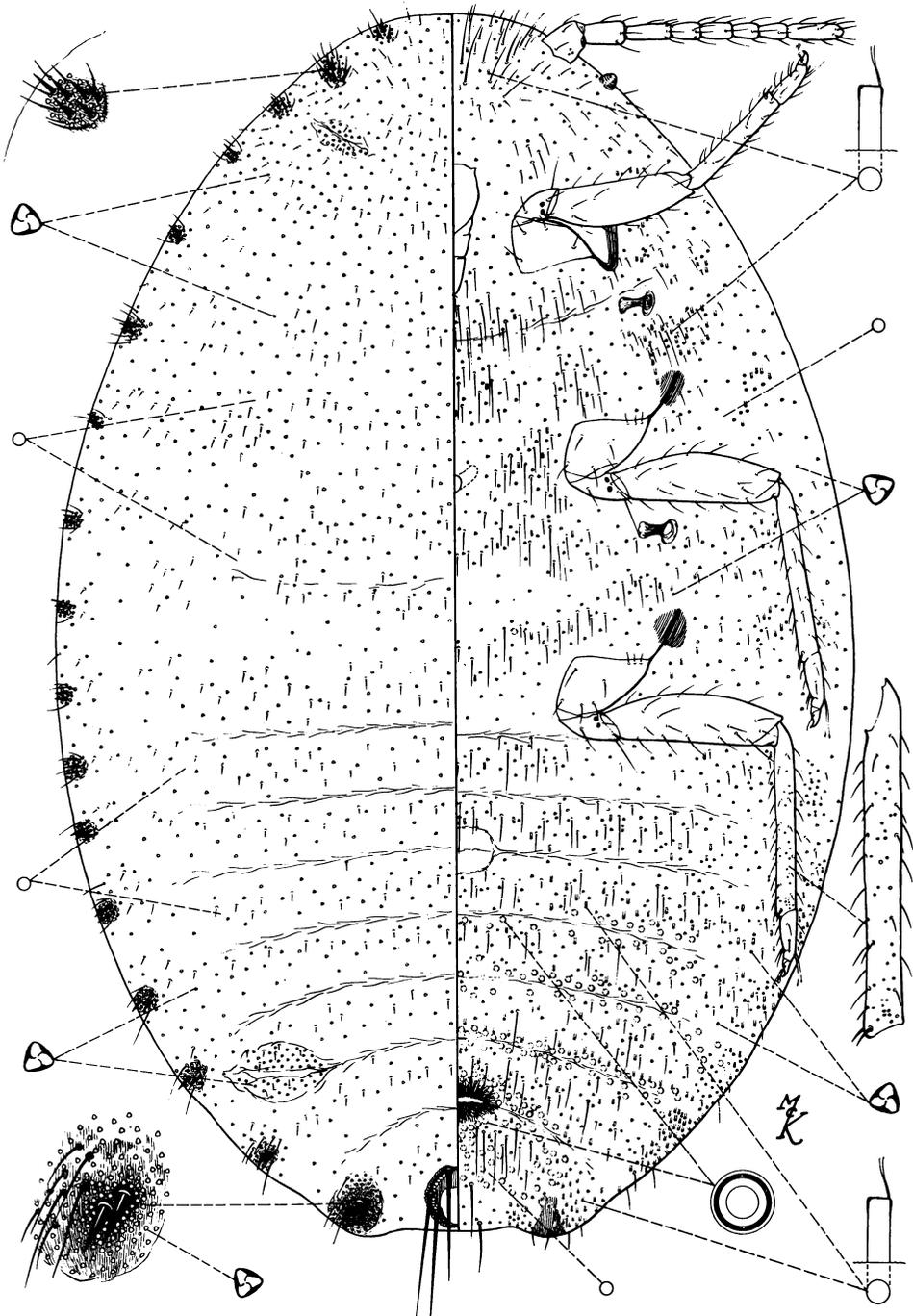


Fig. 3. *Dysmicoccus hurdi* McKenzie, new species, collected on an undetermined host at Tecolutla, state of Veracruz, Mexico.

**Habit.** No available information.

**Recognition characters.** Length of single available specimen, approximately 3.3 mm. On the dorsum, cerarii appear in 17 pairs, all with 2 conical setae, except those of head which may have from 3 to 7 of such structures. Anal lobe cerarii with 2 large, conical setae and numerous, but not crowded, trilocular pores, and if specimen is well stained, a slight degree of sclerotization. Penultimate cerarii with conical setae slightly smaller, and others with these setae still smaller, for the most part accompanied by a few pores, 2 or more slender auxiliary setae, a small cluster of trilocular pores, and if well stained, a slight sclerotization noted about posterior 5 or 6 pairs of cerarii. Dorsum beset throughout with small, slender body setae and trilocular pores. Mingled with these, especially on the abdomen, are moderately numerous, minute, circular pores. Anal ring of normal size and form for the genus, its 6 setae about twice as long as greatest diameter of ring.

On the ventral side, multilocular disk pores quite numerous about vulva, and in bands along anterior and posterior borders of abdominal segments 8 to 6; 1 or 2 of these structures occur in sternal area near hind coxae. Tubular oral collar ducts occur in small numbers on all abdominal segments; also in small groups scattered on head and other parts of thorax, particularly near anterior spiracles.

Circulus present, moderately large, distinctly divided by intersegmental furrow across which it lies. Antennae 8-segmented. Legs large, well developed; hind tibiae with 32 to 35 translucent dots or pores distributed along entire length; denticular swelling or tooth apparently absent on plantar surface of claw.

**Notes.** In Ferris' 1953 key to North American species of *Dysmicoccus*, this species will key fairly well to the couplet including *D. salmonaceus* (Cockerell) and *D. texensis* (Tinsley). It resembles *D. salmonaceus* to some degree, but the more numerous ventral multilocular disk pores on all abdominal segments, except the third and fourth in *D. hurdi*, as compared to these structures restricted to the last two abdominal segments in *D. salmonaceus*, preclude confusion.

I take pleasure in naming this mealybug after Dr. P. D. Hurd, who not only made available this species for study purposes, but also collected several other samples of pseudococcids which have proved to be most interesting.

### Genus *Paradoxococcus* McKenzie, new genus

**Genotype.** This genus is here established for the reception of a single species, *Paradoxococcus mcdanieli* McKenzie, herein described as new.

**Recognition characters.** Length of adult female, approximately 2.25 mm.; width, 2.1 mm. Body form broadly ovate, rotund. Dorsal ostioles strongly developed. On the dorsum, cerarii appear in 5 pairs on abdomen (2 or 3 examples exhibit 4 cerarii on one side and 5 cerarii on the other), counting forward from the anal lobes. If correctly interpreted, cerarii anterior to anal lobe pair appear situated on ventral surface, although this is possibly due to body distention at maturity. Anal lobe cerarii each with 2 enlarged, conical, somewhat lanceolate setae, 1 or 2 long, slender auxiliary setae, and surrounded by a cluster of trilocular pores; remaining cerarii similar in

shape and size to those of anal lobes, except with from 0 to 5 or 6 long, slender auxiliary setae, and an obvious cluster of accompanying trilocular pores. Dorsal body setae small and slender, occurring in irregular transverse bands on abdominal segments, scattered on thoracic segments and head. Trilocular pores quite numerous. Minute, circular, tubular ducts present in considerable numbers. Precise character of these minute ducts is difficult to discern even under oil immersion, except that they appear tubular, and approximately one-third the size of an average trilocular pore. Anal ring well developed, with 6 enlarged setae, situated at apex of abdomen.

On the ventral side of body, multilocular disk pores absent. Body setae on venter slender and generally slightly longer than those on dorsum. Anal lobe area with varying amounts of sclerotization. Conspicuous transverse row of quite large, oral collar tubular ducts (apparently an outstanding characteristic of the species) present on sixth abdominal segment, 1 or 2 of these structures present submarginally on last three abdominal segments, and 3 or 4 present submarginally on the head. Trilocular pores particularly numerous around vulva on venter of last two abdominal segments; these structures fairly numerous on remaining segments of abdomen, and on thorax and head. Minute, circular, tubular ducts, similar to those on dorsum, evident in considerable numbers on ventral body surface.

Circulus absent. Antennae slender, 8-segmented. Mouthparts broad, well developed. Legs large and fully formed; denticle or tooth absent on plantar surface of claw.

**Notes.** Actually, very little comment is possible at this time relative to the relationship of the new genus, *Paradoxococcus* McKenzie, to other pseudococcid groups. The type species has been examined by both Dr. Harold Morrison and Dr. D. J. Williams. Each has indicated that it does not fit comfortably into any known pseudococcid genus. Dr. Morrison has suggested the possibility that the species may have come to North America with Johnson grass, and he suspects that it may be present somewhere in Europe. So far, however, attempts to secure examples of certain grass-infesting species described by Leonardi from Italy have been unsuccessful. For the reasons just stated, it is desirable at present to describe this mealybug as a genus and species new to science.

### *Paradoxococcus mcdanieli* McKenzie, new species

(Figure 4)

**Suggested common name.** Johnson grass mealybug.

**Hosts and distribution.** Holotype adult female and paratypes of this species were collected on roots of Johnson grass, *Sorghum halepense* (Gramineae), at College Station, Brazos County, Texas, July 23, 1959, by Burrus and Shirley McDaniel. Additional paratype slides of this species, represented in the National Collection of Coccoidea, were kindly made available to the author for examination by Dr. Harold Morrison. The data accompanying these slides are recorded as follows: On *Sorghum halepense*, 1 mile south Sugar Land, Fort Bend County, Texas, November 18, 1948, collected by P. T. Riherd (USDA No. 48-2086); on the same host, Navasota, Grimes

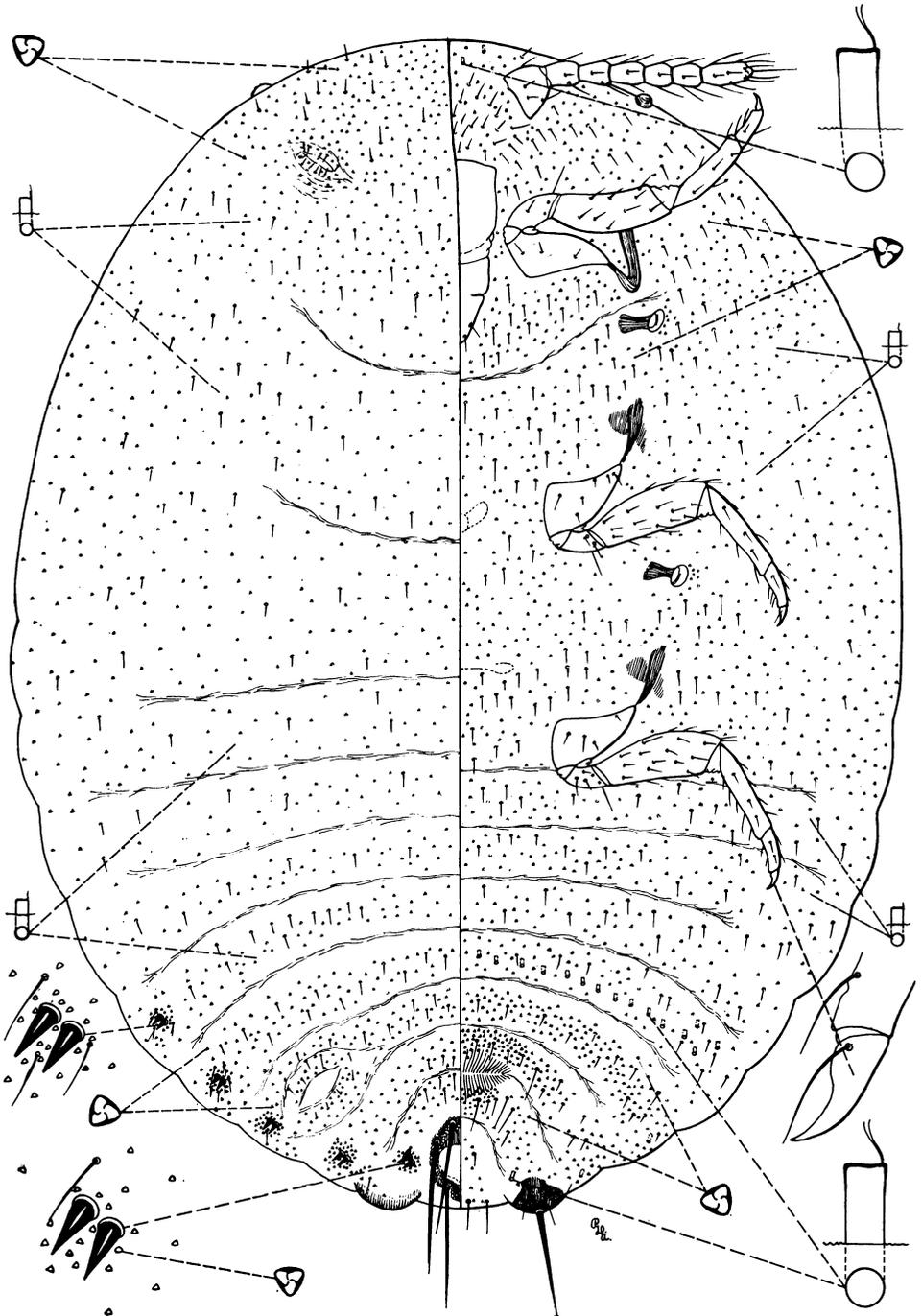


Fig. 4. *Paradoxococcus mcdanieli* McKenzie, new species, collected on roots of Johnson grass, *Sorghum halepense* (Gramineae), at College Station, Brazos County, Texas.

County, Texas, December 16, 1948, collected by Arriola and Douthitt (Houston-12) (USDA No. 48-2305); on undetermined host, Handsboro, Harrison County, Mississippi, June 5, 1945, collected by Rau (Special Survey No. 26919) (USDA No. 50-222); on undetermined host, Mobile, Mobile County, Alabama, October 6, 1949, collected by J. M. Coarsey (Acc. No. 32323) (USDA No. 49-1931); on *Sorghum halepense*, Leon County, Florida, June 3, 1950, collected by H. L. Chada (Wes-62) (USDA No. 50-1967); and on grass, Norfolk, Norfolk County, Virginia, June 23, 1945, collected by Rau (Special Survey No. 26665) (USDA No. 45-1907).

**Type Material.** Holotype adult female (1 specimen mounted on 1 slide) and paratypes have been deposited in the museum of the University of California, Davis. Paratypes of this species have been sent to the National Collection of Coccoidea, Washington, D.C., and also placed in the private collection of Mr. Burrus McDaniel.

**Habit.** According to Mr. McDaniel, this mealybug was found on roots of Johnson grass.

**Recognition characters.** The description of the genus will apply as the description of the species.

**Notes.** So far as our current knowledge is concerned, this species appears to be quite distinct from any other previously described pseudococcid.

Specimens of this interesting species were made available to the author by the collector, Mr. Burrus McDaniel, Instructor in Biology, Texas College of Arts and Industries, Kingsville, Texas. Appreciation is here expressed to Mr. McDaniel for making these specimens available; and, as a further indication of gratitude, the species is named for him.

### Genus *Phenacoccus* Cockerell

One new species is here added to those in Ferris' *Atlas*, Volumes V and VI, and in the author's second taxonomic study of California mealybugs published in *Hilgardia*. Under the section "Notes" in the description of the new species (*P. infernalis*), mention is made of the couplet to which this mealybug would run in the revised *Phenacoccus* key.<sup>8</sup> Data on a new locality and host for *P. echeveriae* McKenzie, as well as certain additional morphological characters distinguishing this species, are also presented. To the genus there are now assigned 27 species for North America, 17 of which occur in California.

### *Phenacoccus echeveriae* McKenzie

This mealybug was collected at Oak Spring Summit, Lincoln County, Nevada, August 31, 1961, on roots of *Lupinus* sp. (Leguminosae) by F. D. Parker. An examination of these specimens showed a small, irregular cluster of translucent dots or pores on the apical half of the hind tibiae, as well as a group of ventral oral collar tubular ducts between the anterior spiracle and body margin. A re-examination of type and paratype adult females of *P. echeveriae* also displayed these characteristics. The original drawing of this species has been modified to include these morphological details. The corrections should be noted on the original description of the species, pp. 715-17 of 1960 paper (see footnote 3).

<sup>8</sup> *Hilgardia* 31 (2):26-28, 1961.

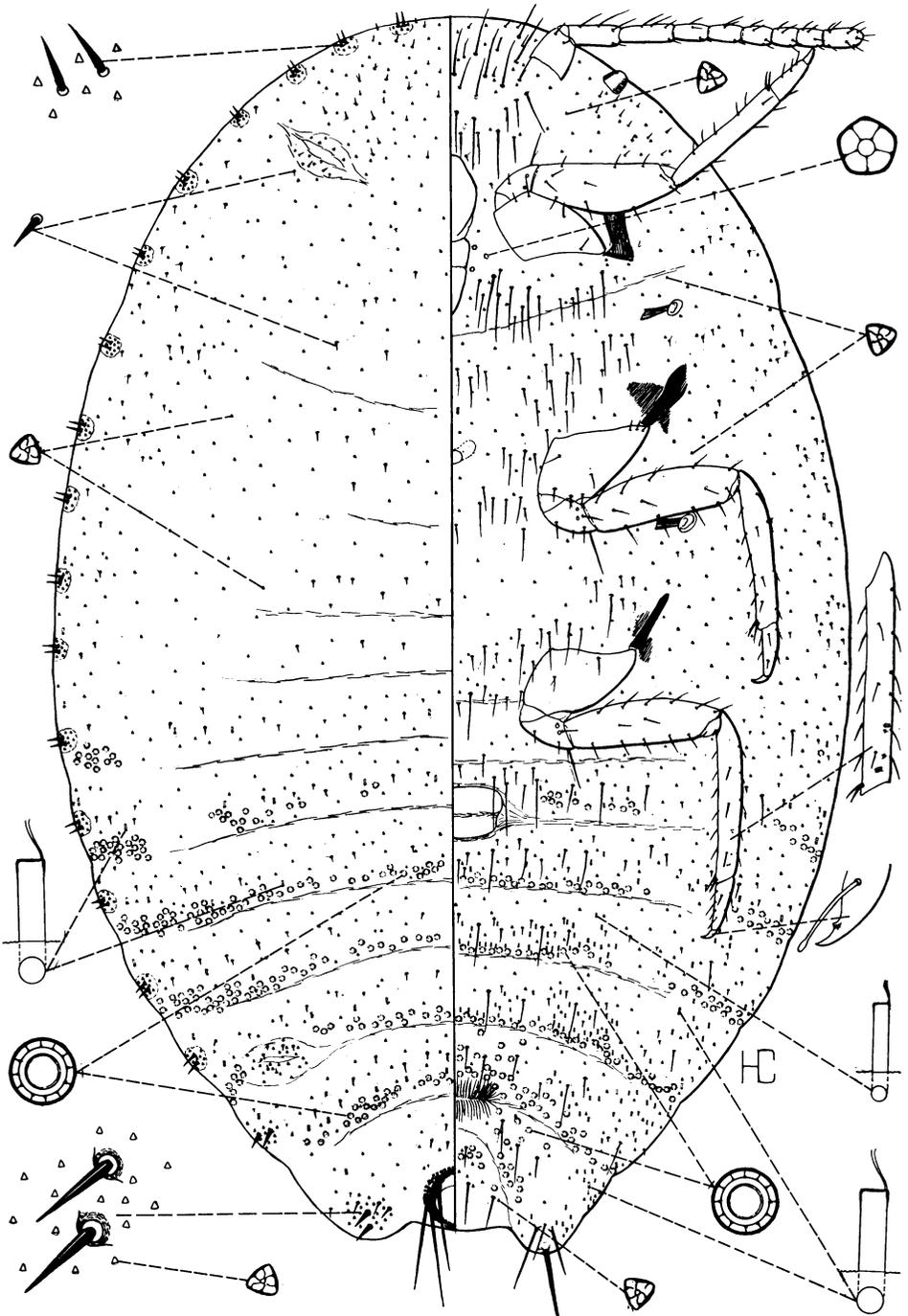


Fig. 5. *Phenacoccus infernalis* McKenzie, new species, collected on leaves and stems of ocotillo, *Fouquieria splendens* (Fouquieriaceae), at Tombstone (Boothill Cemetery), Cochise County, Arizona.

***Phenacoccus infernalis* McKenzie, new species**

(Figure 5)

**Suggested common name.** Infernal mealybug.**Hosts and distribution.** Type and paratype adult females of this species were collected on ocotillo, *Fouquieria splendens* (Fouquieriaceae), at Tombstone (Boothill Cemetery), Cochise County, Arizona, September 2, 1960, by S. W. Brown and W. A. Nelson-Rees.**Type material.** Holotype adult female (mounted on 1 slide) and paratypes have been deposited in the museum of the University of California, Davis. Paratypes have also been placed in the United States National Collection of Coccoidea, Washington, D.C., and in the collection of the California State Department of Agriculture, Sacramento.**Habit.** According to the collectors, this species was found feeding on the leaves and stems of the host.**Recognition characters.** Length of largest available adult female approximately 3.75 mm., noted range 2.25–3.75 mm. On the dorsum, usually 18 pairs of cerarii present, there being a pair between the frontal and ocular pairs, each normally with but 2 cerarian setae, these generally quite small, except the anal lobe pair which, in addition to the 2 larger conical setae, exhibit 3 or 4 smaller setae; remaining cerarii with slight concentration of trilocular pores, never with accompanying slender auxiliary setae. Dorsal multilocular disk pores present in considerable numbers on all abdominal segments, except second, last, and intermediate area of third; absent on thorax and head. Dorsal body setae sparse, all small and slender. Trilocular pores rather sparse, evenly beset over entire dorsum, each pore appearing with numerous irregular lines. Tubular ducts with a slight oral collar are sparsely distributed on dorsum of abdomen, absent on thorax and head. Anal ring of normal form and size for genus, with 6 setae, these about twice as long as greatest diameter of ring.

On the venter, multilocular disk pores present in considerable numbers on all abdominal segments except the second, these extending across segment to lateral margins, except on segment 3 where 1 or 2 pores may occur submarginally; absent on thorax and head. Quinquelocular pores occur in small numbers near mouthparts. Small, rather elongate tubular ducts with slight oral rim are situated in considerable numbers on last 5 or 6 abdominal segments, sparsely so anterior to these. Ventral body setae slender, considerably longer than those on dorsum. Trilocular pores rather evenly distributed on venter.

Circulus quite large, normally appearing broadly oval, capable of folding along intersegmental line of the segments across which it lies. Antennae moderately long, normally 9-segmented. Legs comparatively large and long; apical half of hind tibiae sometimes with few small translucent dots or pores; plantar surface of claw with a prominent denticle or tooth.

**Notes.** This species is closely related to *Phenacoccus graminosus* McKenzie. It differs mainly in lacking dorsal multilocular disk pores on thorax and head; it does not have the large numbers of ventral quinquelocular pores on

thorax; and it has a much larger circulus. It is also related to *P. eremicus* Ferris, differing principally in the possession of dorsal multilocular disk pores on fourth and fifth abdominal segments and fewer ventral quinquelocular pores on thorax.

A portion of the author's revised (1961) key to North American components of *Phenacoccus* (see footnote 8) is modified as follows to include the new species, *P. infernalis*, starting with couplet 12 (11):

- 12 (11). Dorsal multilocular disk pores present on thorax and head, circulus quite small, transversely oval, occurring on fourth abdominal segment, not divided by segmental line; as far as known occurring only on Gramineae .....*graminosus* McKenzie
- Dorsal multilocular disk pores absent on thorax and head, circulus quite large, broadly oval, occurring on segmental line between fourth and fifth abdominal segments .....12a
- 12a(12). Dorsal multilocular disk pores present in considerable numbers on all abdominal segments, except the last; with only a few ventral quinquelocular pores on thorax near mouthparts, absent on abdominal segments . . . . .*infernalis* McKenzie
- Dorsal multilocular disk pores occurring for the most part along posterior border of segments 6 and 7; ventral quinquelocular pores present in sternal region of thorax, and on abdominal segments 3 to 6. . . .*eremicus* Ferris

**Genus *Pseudococcus* Westwood**

Four new North American species of *Pseudococcus* are described in this paper, two of which were collected in California, one in Arizona, and one in Nevada. These species show evidence of a reduced number of cerarii, some of which definitely lack auxiliary setae. This character suggests that they may not actually belong in *Pseudococcus*. At the moment, however, it seems advisable to refer them to this group until a comprehensive study of the genus for the world suggests a different arrangement.

In addition, it has seemed advisable to include in the following revised *Pseudococcus* key another recently described North American species. This species, *P. agavis* MacGregor,<sup>9</sup> was found infesting *Agave americana* (Amaryllidaceae) on the Mexican plateau, Federal District and states of Hidalgo and Tlaxcala, Mexico. The species is discussed further on page 658.

Comment has been made in this paper under the heading "Introduction" to recent taxonomic investigations pertaining to the so-called *Pseudococcus maritimus-malacearum* complex. The principal species involved in this study are discussed under the following headings: *Pseudococcus comstocki* (Kuwana), *P. maritimus* (Ehrhorn), and *P. obscurus* Essig. (See footnote 11 for citation.)

To the genus there are now assigned 15 species for North America, 9 of which occur in California. A revised key follows.

**Key to Species of *Pseudococcus* in North America**

- 1. Circulus small, transversely oval, normally located on fourth abdominal segment, or if situated across fold of fourth and fifth abdominal segments, not divided by segmental line. . . . .*microcirculus* McKenzie

<sup>9</sup> MacGregor, R. 1958. Notas sobre cóccidos. I. Una nueva especie de piojo harinoso de México (Homoptera: Pseudococcidae). Ciencia: Revista Hispanoamericana de Ciencias Puras y Aplicadas 18(7-8):131-34. (Illustrated.)

- Circulus normally quite large, and even if small, always extending across fold of fourth and fifth abdominal segments, and divided by segmental line ..... 2
- 2 (1). With not more than 1 dorsal oral rim tubular duct near each of most of the cerarii ..... 3
- With 2 or 3, usually 3, dorsal oral rim tubular ducts near each of most of the cerarii ..... *adonidum* Linnaeus
- 3 (2). With an oral rim tubular duct dorsally, just posterior to each frontal cerarius ..... 4
- Never with an oral rim tubular duct in this position ..... *gahani* Green<sup>10</sup>
- 4 (3). With 4 or fewer dorsal oral rim tubular ducts on entire abdomen. .... 5
- With 6 or more, usually more, dorsal oral rim tubular ducts on entire abdomen. 7
- 5 (4). Oral rim tubular ducts on dorsum confined to a single one near the two anterior, cephalic (head) cerarii, absent elsewhere on body. . . . . *agavis* MacGregor
- Dorsal oral rim tubular ducts sparsely scattered on head, thorax and abdomen. 6
- 6 (5). With only 13 pairs of cerarii present; ventral oral rim tubular ducts present near spiracles ..... *aberrans* McKenzie
- Normally 16 pairs of cerarii present; ventral oral rim tubular ducts absent near spiracles ..... *importatus* McKenzie
- 7 (4). Last 3 or 4 abdominal segments only with ventral multilocular disk pores ..... 8
- Ventral multilocular disk pores normally present on all abdominal segments ..... 9
- 8 (7). 40 or more ventral multilocular disk pores present along anterior and posterior margins of eighth abdominal segment; ventral oral rim tubular ducts absent on thorax near anterior spiracles. .... *dispar* McKenzie
- 25 or fewer ventral multilocular disk pores present on anterior and posterior margins of eighth abdominal segment; a few ventral oral rim tubular ducts present near anterior spiracles. .... *sparsus* McKenzie
- 9 (7). With 16 to 17 pairs of cerarii. .... 10
- Cerarii reduced in number, with only 9 to 13 recognizable pairs. .... *macswaini* McKenzie
- 10 (9). Translucent dots or pores present on hind coxae. .... 11
- Translucent dots or pores absent on hind coxae. .... 12
- 11 (10). Translucent dots or pores present on hind coxae and trochanters. .... *sorghivellus* (Forbes)
- Translucent dots or pores present on hind coxae, but absent on trochanters ..... *comstocki* (Kuwana)
- 12 (10). Dorsal body setae strikingly long, some as long as or longer than the length of the segment on which they arise ..... *longisetosus* Ferris
- Dorsal body setae all small and short, none as much as half the length of the segment to which they belong ..... 13
- 13 (12). Discoidal pores absent near eyes ..... 14
- Discoidal pores present near eyes ..... *obscurus* Essig<sup>11</sup>
- 14 (13). With more than 20 dorsal oral rim tubular ducts on entire thorax and head ..... *maritimus* (Ehrhorn)
- With fewer than 10 dorsal oral rim tubular ducts on entire thorax and head ..... *kingii* (Cockerell)

<sup>10</sup> The author is aware of the recorded synonymy of *Pseudococcus gahani* Green, described in 1915 (= *P. fragilis* Brain, described in 1912). See De Lotto, Bul. Brit. Mus. (Nat. Hist.), Ent. 7(3):96, 1958. However, until it is possible to examine types of these species, and compare, among other things, the number and distribution of translucent pores on segments of hind legs, it is preferable to retain *P. gahani*.

<sup>11</sup> For further information about *Pseudococcus obscurus* and other closely related species, see: Wilkey, R. F., and Howard L. McKenzie. 1961. Systematic status of the *Pseudococcus maritimus-malaccarum* complex of mealybugs. Calif. Dept. Agr. Quart. Bul. 50(4):245-49. (Illustrated.)

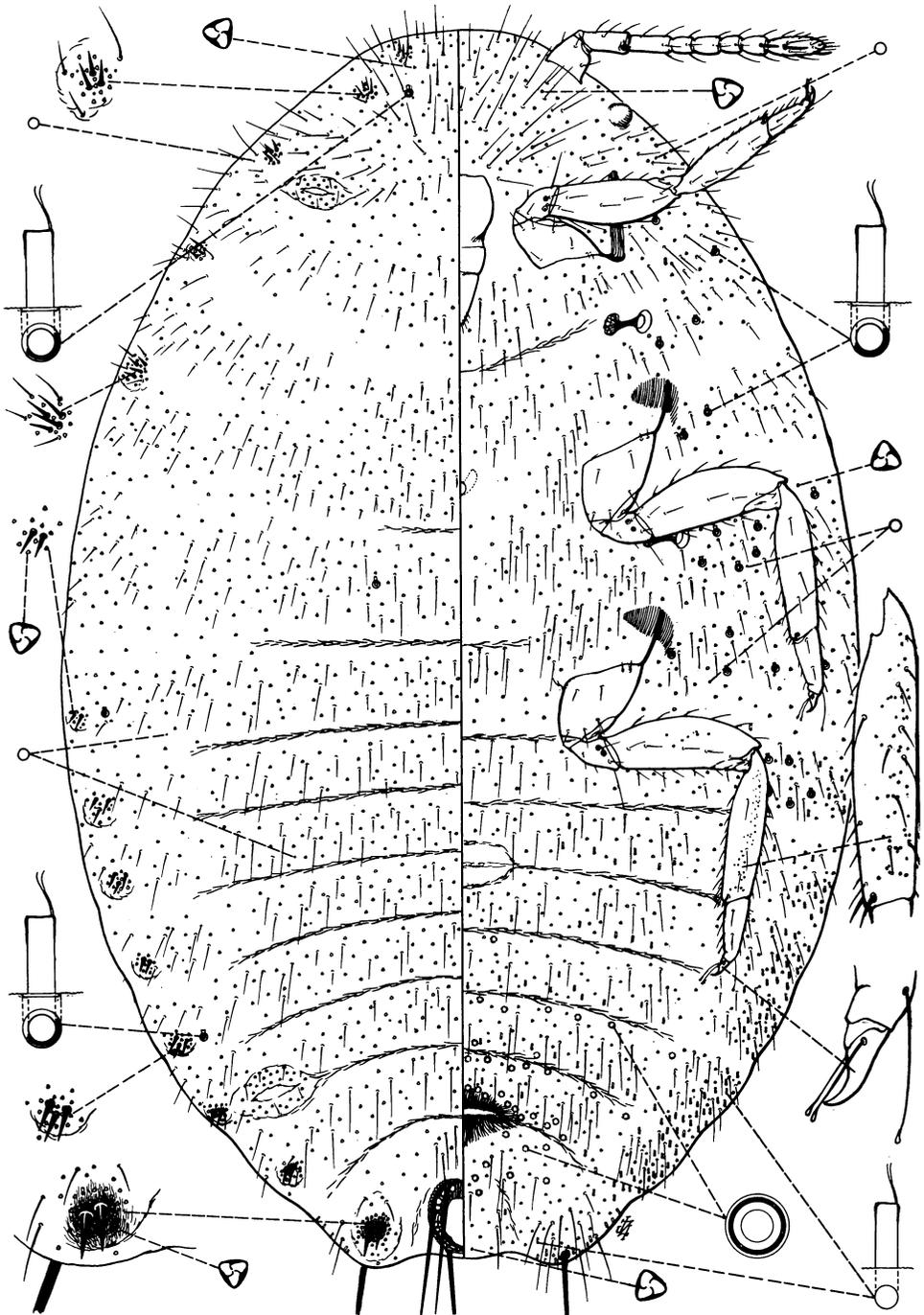


Fig. 6. *Pseudococcus aberrans* McKenzie, new species, collected on *Juniperus torulosa* (Cupressaceae) at Compton, Los Angeles County, California.

***Pseudococcus aberrans* McKenzie, new species**

(Figure 6)

**Suggested common name.** Aberrant mealybug.**Hosts and distribution.** Type and paratype adult females of this species were collected on *Juniperus torulosa* (Cupressaceae) at Compton, Los Angeles County, California, November 2, 1961, by J. H. Caldwell (CSDA No. 61K6-71). Two additional paratype adult females have been taken from the type locality. These were collected from the type host by the original collector on June 8, 1960 (CSDA No. 61B1-1).**Type material.** Holotype adult female (1 specimen mounted on 1 slide) has been deposited in the collection of the California State Department of Agriculture, Sacramento. Paratypes have been placed in the museum of the University of California, Davis, and in the United States National Collection of Coccoidea, Washington, D.C.**Habit.** No available information.**Recognition characters.** Length of adult female as mounted, approximately 2.5 mm. Body form, broadly oval as mounted. On the dorsum, cerarii reduced in number for members of this group, 12 to 13 pairs observed, the tendency being for cerarii to disappear along thoracic area. Anal lobe cerarius with pair of conical setae, quite large and stout, surrounded by concentrated cluster of numerous trilocular pores, accompanied by 2 or 3 slender auxiliary setae, and very slight suggestion of sclerotization. Penultimate cerarius with conical setae smaller, accompanied by 1 or 2 slender setae and few pores, without sclerotization. Anterior to this, conical setae become progressively smaller, auxiliary setae may be absent, and accompanying trilocular pores much reduced in number. Many cerarii may possess 3 or 4 conical setae (especially anterior ones), 1 or 2 auxiliary setae, and a few obviously associated trilocular pores. Dorsal body setae slender, proportionately longer than usual, practically as long as those in same area on venter. Moderately large oral rim tubular ducts sparsely distributed over dorsum (fig. 6), only 2 or 3 of these structures observed on abdomen. Trilocular pores evenly distributed over entire dorsum. Minute circular pores scattered on body. Anal ring of normal form and size for genus, its 6 setae about twice as long as greatest diameter of ring.

On the ventral side, multilocular disk pores fairly numerous, occurring on last four abdominal segments, absent on thorax and head. Oral collar tubular ducts essentially one size, appearing quite abundantly along submargins of abdomen and along posterior margin of most abdominal segments. Oral rim tubular ducts fairly numerous submarginally between middle and hind legs, a few present near anterior spiracle and submarginally on third abdominal segment, absent on head. Ventral body setae slender, appearing slightly longer than those of dorsum. Trilocular pores fairly evenly distributed on venter. Small circular pores scattered on body, as indicated in figure 6.

Circulus quite large, normally appearing broadly oval, capable of folding along intersegmental line of the segments across which it lies. Antennae

slender and 8-segmented. Legs relatively large, well developed, femora and tibiae appear moderately swollen; entire length of hind tibiae with quite numerous translucent dots or pores, 41 to 50 of these structures observed; denticle or tooth absent on plantar surface of claw.

**Notes.** This species appears related to *Pseudococcus sparsus* McKenzie, new species, but differs from it mainly in the paucity of oral rim tubular ducts on the dorsum. More of these structures occur submarginally on the venter between middle and hind legs. The dorsal setae on abdomen are practically as long as those in same area on the venter, and there are minute circular pores on both surfaces of the body. On the other hand, *P. sparsus* has numerous oral rim tubulars on the dorsum, and only a few of these structures occur submarginally on venter between middle and hind legs. The dorsal body setae on abdomen are noticeably shorter than those in corresponding area on the venter. Minute circular pores are absent on both body surfaces.

### *Pseudococcus agavis* MacGregor

Fortunately, the original description of this species is good, and the illustration is excellent in detail. (See footnote 9 for citation.) In addition, five paratype specimens of this species have been available for study. The species appears to have all the genuine qualifications for inclusion in *Pseudococcus*. It differs from other species of this group principally in the reduced number of oral rim tubular ducts. There is only one of these ducts near the two anterior cephalic (head) cerarii, and they are absent elsewhere on the body (except on one specimen, where a single such structure was noted on the thorax). The reduced number of oral rim tubulars places *P. agavis* near *P. aberrans* McKenzie (herein described as new), and *P. importatus* McKenzie.

### *Pseudococcus comstocki* (Kuwana)

**Synonym.** *Dactylopius comstocki* Kuwana. There are probably other synonyms, but the author is unable to make a definite statement relative to this at the present time.

Recent taxonomic investigations on the so-called *Pseudococcus maritimus-malacearum* complex have indicated, more than ever, the close similarity of *P. comstocki* to those species. (See footnote 11.) As a matter of fact, it was observed that aside from a degree more of anal lobe sclerotization; a slight tendency for a dispersed group of trilocular pores in anal lobe cerarii; and the occurrence of possibly more numerous ventral multilocular disk pores in the midregion of the abdomen, from about the vulva to fourth segment (some of these characters obviously affected by staining technique), there was difficulty in distinguishing *P. comstocki* from the other species. However, it was discovered that the presence of translucent dots or pores on hind coxae of *P. comstocki*, these lacking in *P. maritimus* and *P. obscurus* (*P. malacearum* is now a synonym of the last-mentioned species), presented a "key character" separating it from the species just cited. In addition, these pores are extremely numerous and cover practically the entire femora in *P. comstocki*, whereas in *P. maritimus* they generally number not more than 27, and in *P. obscurus* not more than 81 on the same leg segment.

*Pseudococcus dispar* McKenzie, new species

(Figure 7)

**Suggested common name.** Dispar mealybug.

**Hosts and distribution.** Type and paratype adult females of this species were collected on poplar, *Populus* sp. (Salicaceae), at Tuttle Creek, Owens Valley, Inyo County, California, May 6, 1961, by M. E. Irwin.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and paratypes of this species have been deposited in the museum of the University of California, Davis. A single paratype example has also been placed in the United States National Collection of Coccoidea, Washington, D.C.

**Habit.** This mealybug was collected under bark of a poplar, in association with a species of ant (*Camponotus*).

**Recognition characters.** Length of largest adult female as mounted, approximately 5.25 mm.; range, 4–5.25 mm. Body form, as mounted, is rotund. On the dorsum, cerarii reduced in number, this number variable as between opposite sides of same specimen, maximum observed on one side of body is 16 (1 specimen shows 17 on both sides), with total reduced to 14 or 15 in some instances, the tendency being for cerarii to disappear along thoracic area. Anal lobe cerarius with pair of conical setae quite large and stout, surrounded by concentrated cluster of trilocular pores, accompanied by 5 or 6 auxiliary setae without sclerotization. Penultimate cerarius with conical setae smaller, accompanied by 2 or 3 slender setae, a few obviously associated pores, and without sclerotization. Anterior to this, the conical setae tend to become progressively smaller, auxiliary setae may be absent, and accompanying trilocular pores reduced in number. Certain cerarii possess 3 or 4 conical setae, 1 or 2 auxiliary setae, and a few associated trilocular pores. Dorsal body setae small and slender. Moderately large oral rim tubular ducts distributed over dorsum, there being usually 1 near each cerarius or site of cerarius, others scattered about on abdomen, thorax, and head. Trilocular pores evenly distributed over entire dorsum. Minute circular pores scattered on body surface. Anal ring of normal form and size for genus, its 6 setae about twice as long as greatest diameter of ring.

On the ventral side, multilocular disk pores fairly numerous, occurring on last three abdominal segments, absent on thorax and head. Majority of oral collar tubular ducts, as here interpreted, appear modified, with an irregular, loose, expanded rim, all essentially of one size, more abundant along submargins of most abdominal segments, scattered across abdominal segments, thorax, and head. Oral rim tubular ducts absent. Ventral body setae small and slender, although generally longer than those of dorsum. Trilocular pores fairly evenly distributed on venter. Small circular pores scattered on venter of body.

Circulus quite large, normally appearing broadly oval, capable of folding along intersegmental line of the segments across which it lies. Antennae slender, 8-segmented, apical segment frequently appears divided by an irregular lighter band, suggesting an additional ninth segment. Legs fairly large and well developed; hind tibiae with very small, translucent dots or

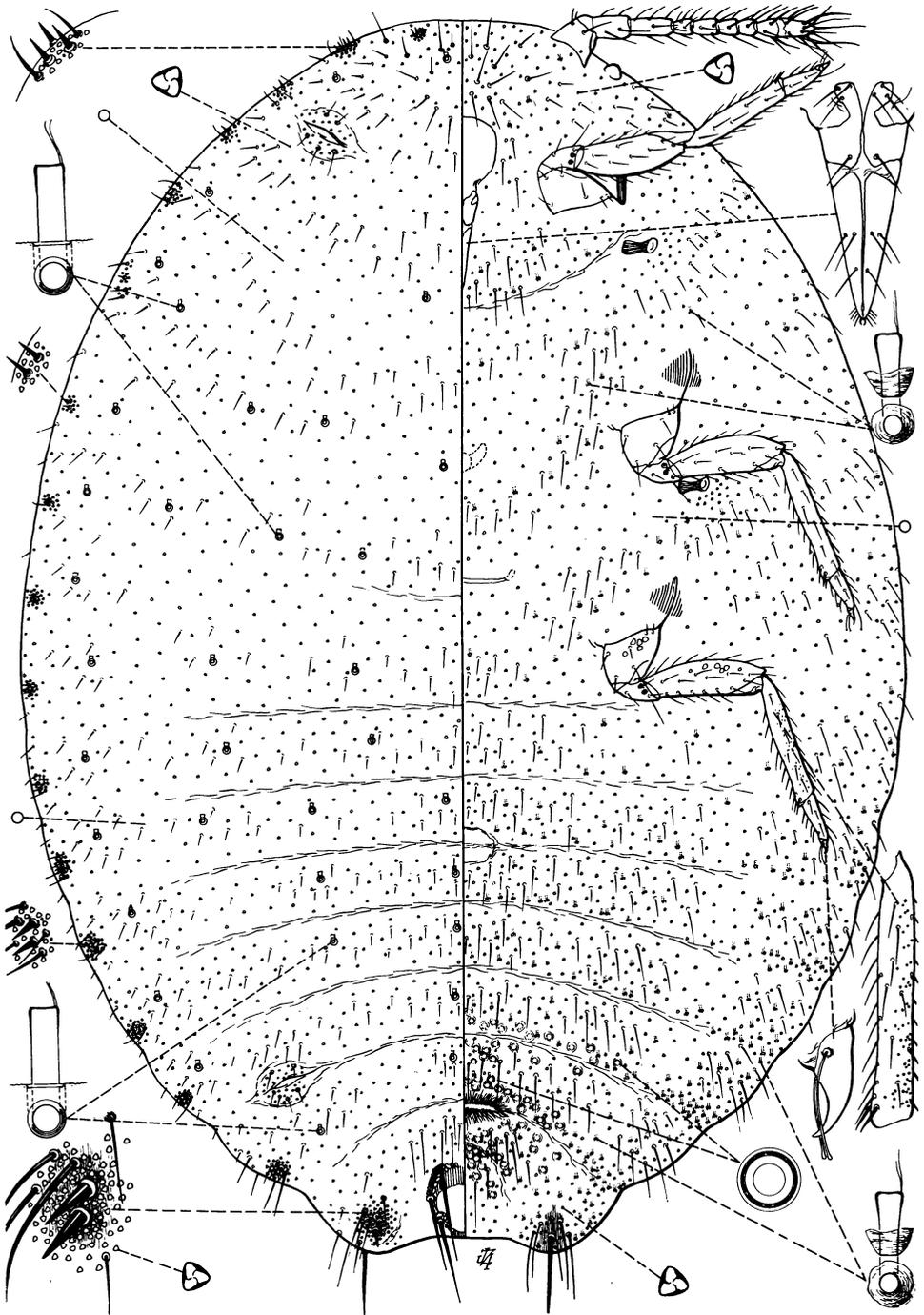


Fig. 7. *Pseudococcus dispar* McKenzie, new species, collected under bark of a poplar, *Populus* sp. (Salicaceae), associated with an ant (*Camponotus* sp.), at Tuttle Creek, Owens Valley, Inyo County, California.

pores along entire segment; observed range, from 43 to 62; average, 53.2; denticle or tooth absent on plantar surface of claw.

**Notes.** The tendency for the species to have a reduced number of cerarii, some of which may lack auxiliary setae, suggests that it may not actually belong in *Pseudococcus*. The assignment to *Pseudococcus* is, therefore, provisional.

*Pseudococcus dispar* most resembles *P. sparsus* McKenzie, new species. However, it is more rotund and has almost twice as many ventral multiloculars on the last three abdominal segments. It also lacks ventral oral rim tubulars on the thorax and has translucent dots or pores along entire length of hind tibiae. *P. sparsus*, on the other hand, is less rotund, possesses only half as many ventral multiloculars on the last three abdominal segments, exhibits ventral oral rim tubulars on thorax, and normally has translucent dots or pores restricted to the apical fourth of the hind tibiae.

*Pseudococcus dispar* also seems to be related to *P. macswaini* McKenzie, new species, but the presence of ventral multilocular disk pores on the thorax and all abdominal segments in the latter species precludes confusion.

### *Pseudococcus importatus* McKenzie

Specimens only tentatively identified as *P. importatus* were collected in a nursery on *Odontoglossum grande* (Orchidaceae) at Compton, Los Angeles County, California, April 10 and 12, 1961, by W. A. Edwards (CSDA No. 61D11-1 and No. 61D19-18). An apparent difference between these specimens and the two type examples of *P. importatus*, also taken on an orchid, seems to lie in the number of dorsal oral rim tubular ducts on entire body surface. In the types of *P. importatus*, there are not more than 7 or 8 of these ducts, whereas in the Compton specimens, approximately 30 or more are evident. Also in *P. importatus* types, there appear to be more translucent dots or pores on the hind tibiae (approximately 41 counted), whereas in the Compton specimens, the number of these structures is around 33. In other morphological details, they appear to be nearly identical. It is believed that more material than is now available needs to be assembled before an accurate appraisal of variation of these morphological structures in *P. importatus* is possible.

### *Pseudococcus macswaini* McKenzie, new species

(Figure 8)

**Suggested common name.** MacSwain mealybug.

**Hosts and distribution.** Type and paratype adult females were collected at the Southwestern Research Station, American Museum of Natural History, Portal, Cochise County, Arizona, March 4, 1961, by J. W. MacSwain. Only four examples were recovered from this collection.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and paratypes have been deposited in the museum of the University of California, Davis. A single paratype has been placed in the United States National Collection of Coccoidea, Washington, D.C.

**Habit.** This mealybug was found under a rock in the nest of an ant, *Acanthomyops interjectus arizonicus* Wheeler. It was also associated with an



undescribed pseudococcid<sup>12</sup> and an immature margarodid. According to Dr. MacSwain, the ants were interested only in the immature margarodids.

**Recognition characters.** Length of largest adult female, approximately 4 mm. Body form as mounted, broadly oval. On the dorsum, cerarii reduced in number for members of this group, with 9 to 13 pairs observed, the tendency being for cerarii to disappear along thoracic area. Anal lobe cerarius with a pair of conical setae which are quite large and stout, surrounded by a concentrated cluster of trilocular pores, accompanied by 5 to 7 slender auxiliary setae, and with a suggestion of sclerotization. Penultimate cerarius with conical setae smaller, accompanied by 3 or 4 slender setae, a cluster of trilocular pores, and slight sclerotization. Anterior to this, the conical setae appear about the same size as those of the penultimate cerarius, except those in thoracic area, one of which may be quite long and slender, auxiliary setae may be absent, and the accompanying trilocular pores reduced in number. Certain of anterior cerarii may possess 3 or 4 conical setae, 1 or 2 auxiliary setae, and a few obviously associated trilocular pores. Dorsal body setae quite long and slender, some practically as long as those in same area on venter, with tendency for a slight degree of basal sclerotization. Oral rim tubular ducts present, these arranged in a single row of from 2 to 6 across each abdominal segment except the last, and scattered over thoracic segments and head. Oral collar tubular ducts of approximately same size present in clusters along lateral margin of last 5 or 6 abdominal segments, absent on thorax and head. Trilocular pores evenly distributed over entire dorsum. Minute circular pores scattered on dorsal body surface. Anal ring of normal form and size for genus, its 6 setae about twice as long as greatest diameter of ring.

On ventral side, multilocular disk pores numerous, occurring on all abdominal segments, scattered in sternal region of thorax, absent on head. Oral collar tubular ducts essentially one size, abundant in groups along submargins of abdomen, scattered across most abdominal segments, thorax, and head. A few oral rim tubulars present on head and submarginally on thorax, but absent on abdomen. Ventral body setae quite long and slender, appearing slightly longer than those of dorsum. Trilocular pores evenly distributed on venter. Small circular pores scattered on ventral body surface.

Circulus quite large, broadly oval, capable of folding along intersegmental line of the segments across which it lies. Antennae slender and 8-segmented. Legs relatively large and well developed; very small translucent dots or pores present in considerable numbers along entire length of hind tibiae; observed range from 66 to 90, average 81.8; denticle or tooth absent on plantar surface of claw.

**Notes.** *Pseudococcus macswaini* is a close relative of *P. dispar* McKenzie, new species. The main difference between the two species is the possession of ventral multilocular disk pores on the thorax and all abdominal segments of *P. macswaini*, whereas in *P. dispar*, these structures are confined to the last three abdominal segments and are totally absent on thorax.

<sup>12</sup> See *Circaputo hirsutus* McKenzie, herein described as new.

### *Pseudococcus maritimus* (Ehrhorn)

**Synonyms.** *Pseudococcus bakeri* Essig and *P. omniverae* Hollinger.

A recent re-examination and a taxonomic appraisal have been made of type or near equivalent of all the North American and certain European components of the so-called "*Pseudococcus maritimus-malacearum*" complex. (See footnote 11 for citation.) Heretofore, taxonomic uncertainties and vagaries have surrounded this group of very closely related species.

These investigations have revealed the presence of very small, translucent dots or pores evident on the hind tibiae, and at times present on other leg segments, these structures appearing more on one surface (here considered to be dorsal) than on the other. Small and unimportant as these tiny pores appear to be, they definitely seem to provide a rather convenient taxonomic tool in segregating species in the complex.

Examination of the type and numerous topotypes of *P. maritimus* (Ehrhorn), described in 1900, shows a range of variation of the pores on the hind tibiae of from 15 to 30, with an average of approximately 23. These structures on the hind femora range from 12 to 27, with an average of 17.88. They are absent on the hind coxae and trochanters of this species. *Pseudococcus bakeri* Essig, described in 1909, and *P. omniverae* Hollinger, described in 1917, fall definitely within this range, and, as far as can be determined, within the normal variation of other characters used to identify this species.

The data presented above indicate that the number of translucent dots or pores on the hind tibiae of *P. maritimus* are far fewer, with an observed range of from 15 to 30, average approximately 23, compared to those of *P. obscurus* Essig (*P. malacearum* Ferris is now a synonym of this species), with a range of from 97 to 151, average of 117. Furthermore, *P. maritimus* may be distinguished from *P. comstocki* (Kuwana) by the absence of such structures on the hind coxae, these present in the second species mentioned. It may also be distinguished from *P. sorghiellus* (Forbes) by the absence of these structures on both the hind coxae and trochanters, while they are definitely present in *P. sorghiellus*.

### *Pseudococcus microcirculus* McKenzie

This is an orchid-infesting species, established in certain California nurseries. It recently became the object of a state-wide eradication program conducted by the California State Department of Agriculture, Bureau of Entomology, Sacramento. It was intercepted on orchids from Miami, Florida, in quarantine at Temple City, Los Angeles County, California, July 25, 1961, D. R. Newby and H. E. Records, collectors (CSDA No. 61G26-9).

### *Pseudococcus obscurus* Essig

**Synonyms.** *Pseudococcus capensis* Brain, *P. longispinus* var. *latipes* Green, and *P. malacearum* Ferris.

In 1950, Ferris, in his *Atlas of the Scale Insects of North America*, Volume V, pages 185-6, figure 69, described *P. malacearum*, a species occurring on pear in central California, and often associated with what unquestionably seemed to be *P. maritimus*. *Pseudococcus malacearum* has since caused con-

siderable systematic confusion, mainly because the morphological characters used to describe it were so variable that positive identification was often impossible. It has been very difficult to distinguish it from *P. maritimus*, as well as certain other species in this complex.

Recent studies (see footnote 11 for citation) have revealed the presence of very small, translucent dots or pores on the hind tibiae, which are also present at times on other leg segments, the structures appearing more on one surface (here considered to be dorsal) than the other. These structures have proved quite helpful in segregating the mealybug species in question.

Examination of the type and cotypes of *P. obscurus* Essig, described in 1909, shows a range of variation of the pores on the hind tibiae of from 97 to 151, with an average of 117. On the femora, these structures range from 55 to 81, with an average of 64.33. They are absent on the hind coxae and trochanters of this species. Type and paratype specimens of *P. obscurus* were limited, and it is believed that a true range of variation of translucent pores on hind tibiae and femora was not positively determined. For example, a few specimens here considered to be *P. obscurus*, collected from various hosts and localities, particularly in California, show generally fewer pores on the hind tibiae and femora than in the type lot (i.e., as few as 44 on the hind tibia, and 36 on the hind femur). However, all other characters used to identify this species agree in detail with those of the type.

Two specimens designated by Essig in the original description as the same as, or a variety of, *P. obscurus*, collected at Santa Paula, Ventura County, California, on elderberry, *Sambucus glauca* (Caprifoliaceae) (syn. *S. caerulea*), have been recently examined in the National Collection of Coccoidea. These individuals agree in detail with *P. obscurus*.

*Pseudococcus capensis* Brain, described in 1912, *P. longispinus* var. *latipes* Green, described in 1917, and *P. malacearum* Ferris, described in 1950, fall within this range of variation and also well within the variation of other characters used to identify *P. obscurus*.

The statistical data presented above indicate that the number of translucent pores on the hind tibiae of *P. obscurus* is normally four or five times as great as in *P. maritimus*. The same general comparison is noted regarding the femoral pores, with at least three and one-half times as many of these structures in *P. obscurus* as in the case of *P. maritimus*. These differences appear significant in segregating the two species. *Pseudococcus obscurus* is easily differentiated from both *P. comstocki* (Kuwana) and *P. sorghiellus* (Forbes) by the absence of these tiny pores on the hind coxae, while such structures are present on the hind coxae of the last two species mentioned.

Present observations indicate that *P. obscurus* is by far the most common and widespread species in California, and that numerous earlier identifications of *P. maritimus* are actually of this species.

### *Pseudococcus sorghiellus* (Forbes)

Through the kindness of Dr. Harold Morrison, it has been possible to examine the type adult female of *Pseudococcus sorghiellus*, as well as three other adult females which have been compared with the type of this species and are here considered equivalent to it. The principal differences between this species,

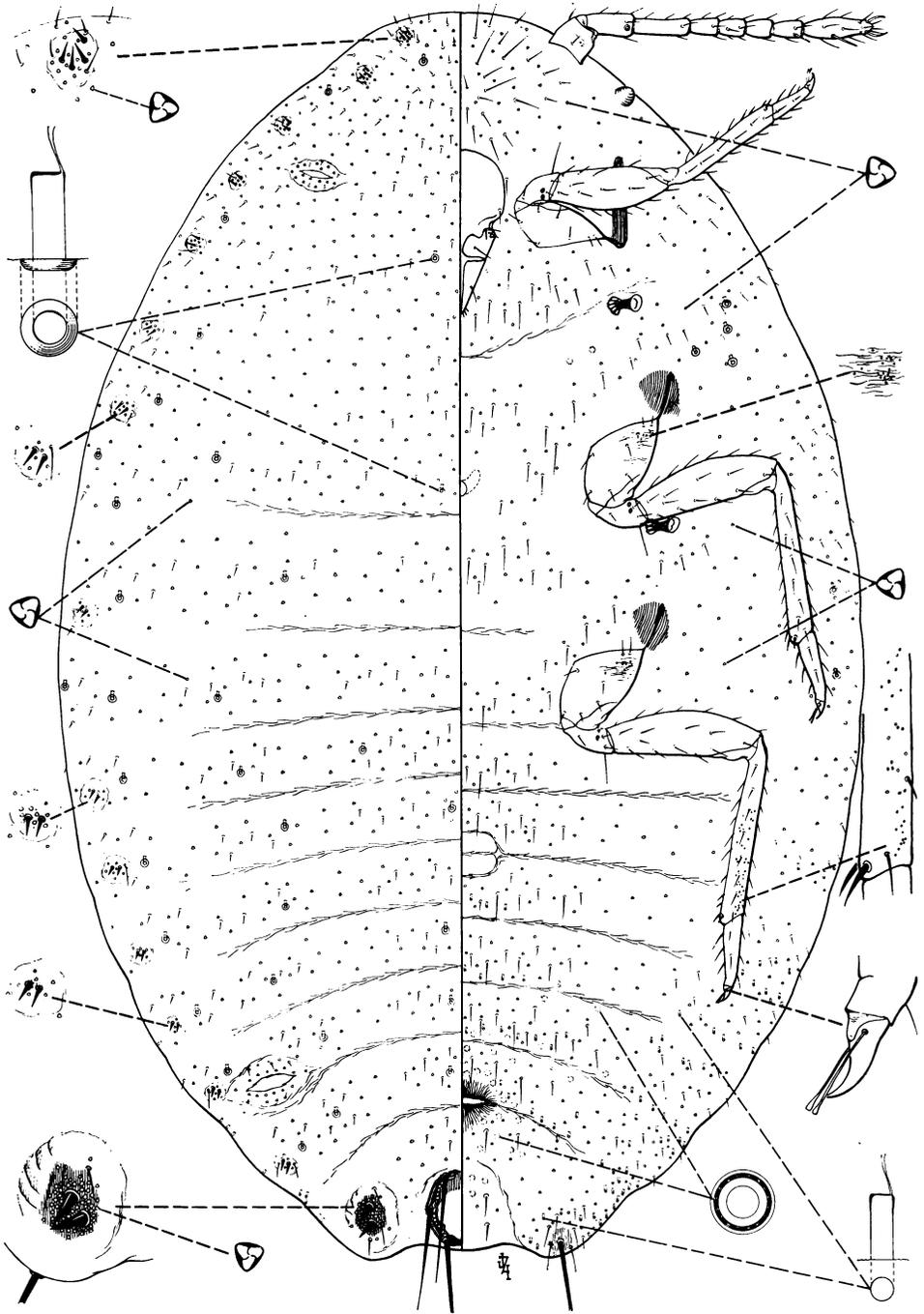


Fig. 9. *Pseudococcus sparsus* McKenzie, new species, collected on *Juniperus* sp. (Cupressaceae) at base of gall cluster, eighteen miles south of Ely (Charcoal Owens State Park), White Pine County, Nevada.

*P. maritimus*, and *P. obscurus* (*P. malaccarum* Ferris is now a synonym of *obscurus*) lies in the presence of numerous translucent dots or pores on the hind coxae and trochanters of *P. sorghiellus*, such structures being absent on these segments in the two other species. It shares with *P. comstocki* the presence of these pores on the hind coxae, but differs from it in having them also present on the trochanters. The middle pair of legs of *P. sorghiellus* show the pores on the femora and tibiae. The observed range of pores on the hind coxae of the three adult females compared with type of *P. sorghiellus* is from 18 to 52, with an average of 29.42 (type *P. sorghiellus*, with one hind leg lost, is poorly stained, and only 12 of these pores can be clearly seen on this segment); hind trochanters from 4 to 15, with an average of 8.85 pores; hind femora from 14 to 36, with an average of 23.42 pores; and the hind tibiae with from 8 to 30, with an average of 15 (single hind tibia of type female has 30 pores). Pore counts made on all segments of hind leg, except coxae and tibiae, in type *P. sorghiellus* adult female, fall well within the range of variation of those made on the three adult female specimens mentioned above. In addition, the over-all leg shape of *P. sorghiellus* is proportionately stouter and shorter than in *P. maritimus*, *obscurus*, or *comstocki*.

### *Pseudococcus sparsus* McKenzie, new species

(Figure 9)

**Suggested common name.** Sparse mealybug.

**Hosts and distribution.** Type and paratype adult females were collected on *Juniperus* sp. (Cupressaceae), 18 miles south of Ely (Charcoal Ovens State Park), White Pine County, Nevada, July 4, 1960, by T. R. Haig (CSDA No. 60G29-12).

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and a paratype of this species have been deposited in the collection of the California State Department of Agriculture, Sacramento. Paratypes have also been placed in the museum of the University of California, Davis, and in the United States National Collection of Coccoidea, Washington, D.C.

**Habit.** According to the collector, this mealybug was found at the base of gall clusters on juniper. He reports that it was covered with a light-gray, powdery secretion, and that the lateral filaments were short and stubby.

**Recognition characters.** Length of largest available specimen approximately 2.75 mm., range 1.65–2.75 mm. Body form, broadly oval as mounted. On the dorsum, cerarii reduced in number for members of this genus, 14 to 15 pairs observed on one side of body, the tendency being for cerarii to disappear along thoracic area. Anal lobe cerarius with a pair of conical setae which are quite large and stout, surrounded by a concentrated cluster of trilocular pores, accompanied by 2 or 3 auxiliary setae, and with a slight suggestion of sclerotization. Penultimate cerarius with conical setae smaller, accompanied by 1 or 2 slender setae and a few pores, but without sclerotization. Anterior to this, conical setae tend to become progressively smaller, auxiliary setae may be absent, and accompanying trilocular pores much reduced in number. Frontal and ocular cerarii may possess 3 or 4 conical setae, 1 or 2 auxiliary setae, and only a few obviously associated trilocular

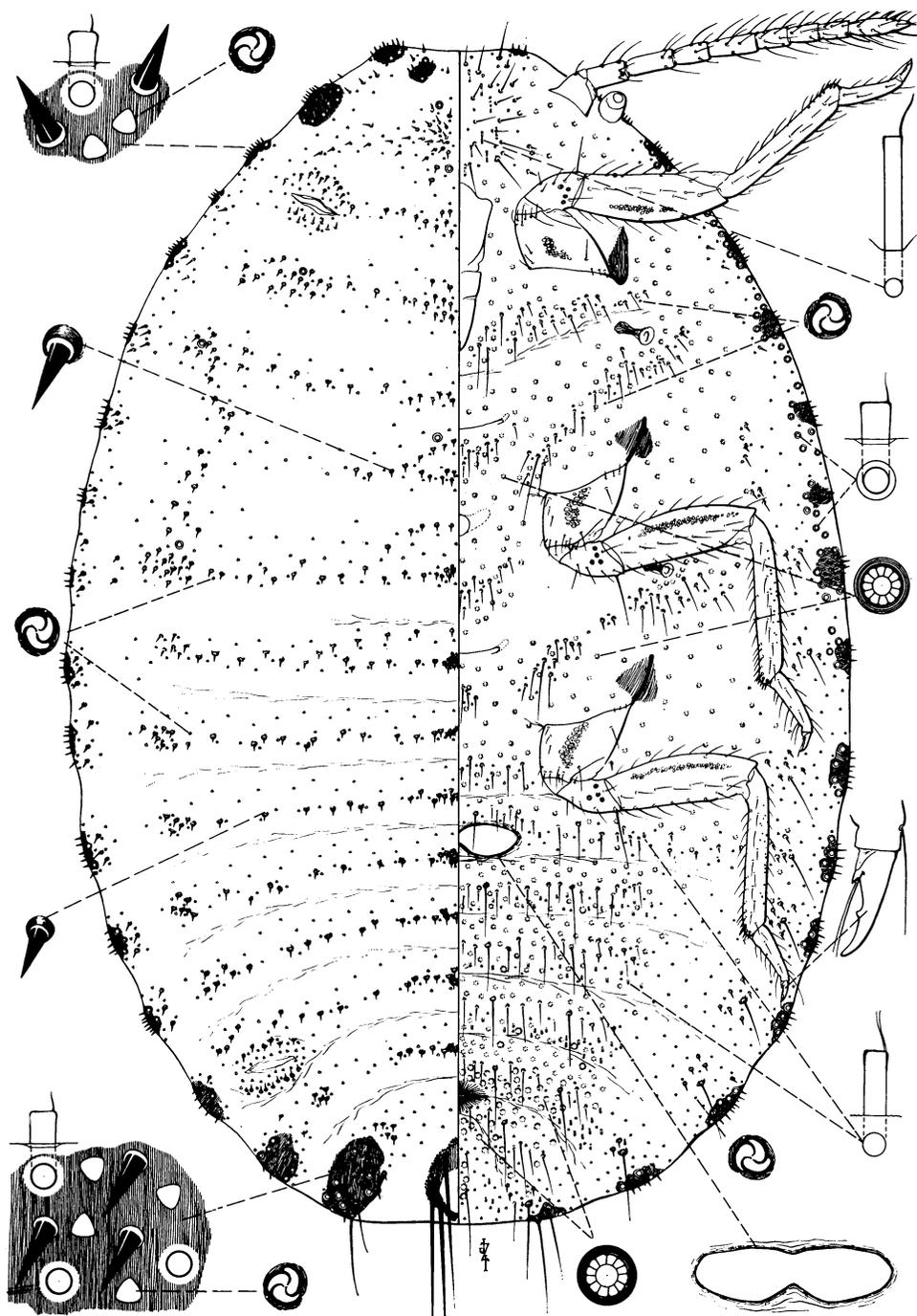


Fig. 10. *Puto usingeri* McKenzie, new species, collected under a rock near Chanapata Stream, one mile from Cuzco, Peru, at 12,000 feet elevation.

pores. Dorsal body setae all small and slender. Moderately large oral rim tubular ducts distributed over dorsum, there being usually 1 near each cerarius or site of a cerarius, others scattered about on abdomen, thorax, and head. Trilocular pores evenly distributed over entire dorsum. Anal ring of normal form and size for genus, its 6 setae about twice as long as the greatest diameter of ring.

On the ventral side, multilocular disk pores relatively few, occurring for the most part on last three abdominal segments, absent on thorax (one specimen showed 2 such structures near anterior spiracle) and head. Oral collar tubular ducts essentially one size, appearing more abundant along submargins of most abdominal segments, and along posterior margins of certain abdominal segments. A few oral rim tubular ducts present near anterior spiracle and along body margin between middle and hind legs, absent on head. Ventral body setae small and slender, although usually slightly longer than those on dorsum. Trilocular pores evenly distributed on venter.

Circulus quite large at times, normally appearing broadly oval, capable of folding along intersegmental line of the segments across which it lies. Antennae slender, 8-segmented, eighth segment often slightly constricted near tip to form a small projection. Legs relatively large, well developed. Middle and hind coxae with faint suggestion of pores at base (at times these are completely absent); hind tibiae with from 14 to 39 (average of approximately 30) translucent dots or pores unevenly distributed on apical three-fourths of segment; denticle or tooth absent on plantar surface of claw.

**Notes.** This species is related to *Pseudococcus aberrans* McKenzie, new species, but it has many more dorsal oral rim tubular ducts on the abdomen and fewer of these structures submarginally on the venter between middle and hind legs. The dorsal body setae on the abdomen are noticeably shorter than those in corresponding area on the venter, and both body surfaces have no minute circular pores. *Pseudococcus aberrans*, on the other hand, exhibits only a few oral rim tubular ducts on the dorsum, and more of these structures submarginally on venter between middle and hind legs. The dorsal setae on the abdomen are practically as long as those in corresponding area on venter. Minute circular pores occur on both body surfaces.

*Pseudococcus sparsus* is also closely related to *P. dispar* McKenzie, but has approximately one-half as many ventral multilocular disk pores on last three abdominal segments, and only a few ventral oral rim tubulars on thorax.

### Genus *Puto* Signoret

One new species of *Puto* from Peru is described here. Since the species is South American, no attempt will be made to revise the key to the North American components of the genus to include it. Its position in that key will be discussed under "Notes."

### *Puto usingeri* McKenzie, new species

(Figure 10)

**Suggested common name.** Usinger mealybug.

**Hosts and distribution.** Type and paratype adult females of this species were collected near Chanapata Stream, one mile from Cuzco, Peru (12,000

ft. elevation), June 30, 1957, by R. L. Usinger. Another collection of this mealybug is represented in the United States National Collection of Coccoidea at Washington, D.C., taken on an unknown host at Pisuquia, Peru, June 22, 1948, by E. J. Hambleton (USDA No. 48-1361). Slide mounts of these specimens have been observed through the courtesy of Dr. Harold Morrison.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and paratypes have been deposited in the museum of the University of California, Davis, and paratypes have been sent to the United States National Collection of Coccoidea at Washington, D.C.

**Habit.** According to the collector, Dr. R. L. Usinger, this mealybug was simply found beneath a rock at a rather high altitude near Cuzco, Peru.

**Recognition characters.** Adult female broadly oval, length from 4 to 5.1 mm. On the dorsum, cerarii appear basically in 18 pairs, this arrangement, however, interrupted by division of individual cerarii or by interpolation of others; each cerarius formed upon a sclerotized plate bearing 5 to 23, or perhaps more, enlarged conical setae, these setae apically pointed, slightly lanceolate; most cerarian plates bearing from 1 or 2 to as many as 8 enlarged tubular ducts (some cerarii along ventral part of body entirely lack these ducts); trilocular pores on cerarian plates usually about as numerous as conical setae, sometimes more so. A few scattered, enlarged tubular ducts evident near some cerarian plates and on thorax and head. Dorsal body setae similar in form to those of cerarii, numerous, arranged in transverse bands on abdominal segments, thorax, and head; many borne upon a well-developed basal sclerosis. Trilocular pores sparsely distributed over entire dorsum. Anal ring normally with 6 large, elongate setae.

On ventral side of body, multilocular disk pores of two distinct sizes present in considerable numbers, especially in midregion, on all abdominal segments, those on ninth, posterior margin of eighth, and a very few on posterior margin of two or three segments anterior to these, larger than others; those on thorax and head of smaller type. A few tubular ducts of oral collar type present on most abdominal segments, some slender, elongate ones situated in cephalic region anterior to mouthparts. Trilocular pores sparingly distributed over venter with exception of certain "clear areas" in sternal region, where they appear to be entirely lacking.

Circulus present, constricted medially, or, as in one specimen, entirely divided medially into two parts. Antennae long, slender, normally 9-segmented. Legs large, slender; coxae and femora exhibiting a characteristic area of reticulation; claws with a well-developed denticle or tooth on plantar surface.

**Notes.** This species will key to *Puto ulter* Ferris, couplet 6 (3) in the author's 1961 key to North American members of this genus (see footnote 4). The new species differs from *P. ulter* mainly in having smaller but more numerous tubular ducts in the cerarii. It is very closely related to *P. antioquiensis* (Murillo), but differs principally in the distribution and character of the ventral multilocular disk pores on the seventh and eighth abdominal segments. These are of two distinct sizes, the larger of which are situated on the posterior half of the eighth segment, and a few of these are associated

with smaller ones in the same area on the seventh segment. In *P. antioquiensis*, the large-sized pores cover the entire surface of the eighth and most of the seventh abdominal segments. *Puto usingeri* also normally possesses more of the large tubular ducts in the anal lobe cerarius, with an observed range of from 6 to 11, average 8.3, while *P. antioquiensis* exhibits a range of only 2 to 5, with an average of 3.9. In addition, these structures appear proportionately smaller in *P. usingeri* as compared to *P. antioquiensis*.

A single slide mount of four adult females of *P. antioquiensis* was made available to the author through the kindness of Dr. Harold Morrison. These specimens were collected from the type host and locality, on coffee roots, at Fredonia, Antioquia, Colombia, by Professor F. Luis Gallego, and sent to the United States Department of Agriculture, Entomology Research Division, on October 13, 1947. The slide mount carries Federal Accession No. 47-2176.

### Genus *Rhizoecus* Künckel d'Herculais

Three new species of *Rhizoecus* from Mexico are described in this paper. The author's 1961 key to North American species of this genus has been revised to include them (see footnote 4). To the genus there are now assigned 27 species for North America, 15 of which occur in California.

#### Key to Species of *Rhizoecus* in North America

- 1. Without a circulus .....15  
     With at least 1 circulus ..... 2
- 2 (1). Tritubular pores definitely present, although at times quite small and inconspicuous ..... 3  
     Tritubular pores definitely absent..... 8
- 3 (2). Antennae 5-segmented .....*californicus* Ferris  
     Antennae 6-segmented ..... 4
- 4 (3). Tubular ducts of oral collar type absent ..... 5  
     With at least a few tubular ducts of oral collar type, both dorsally and ventrally, usually very small ..... 6
- 5 (4). Multilocular disk pores absent ventrally on abdomen.....*leucosomus* (Cockerell)  
     Multilocular disk pores present ventrally on abdomen.....*sonomae* McKenzie
- 6 (4). Multilocular disk pores absent ventrally on abdomen..... 7  
     Multilocular disk pores present ventrally on abdomen.....*browni* McKenzie
- 7 (6). Digitules long and slender, setose, extending practically to tip of claw....  
     .....*cacticans* (Hambleton)  
     Digitules short, setose, not extending beyond middle of claw.....  
     .....*maritimus* (Cockerell)
- 8 (2). With 3 to 5 circuli .....*campestris* Hambleton  
     With not more than 2 circuli..... 9
- 9 (8). Multilocular disk pores present ventrally on thorax....*bituberculatus* McKenzie  
     Multilocular disk pores absent on thorax venter.....10
- 10 (9). With 2 circuli .....*kondomis* Kuwana  
     With but 1 circulus .....11
- 11 (10). Entire eighth abdominal segment with 35 or more multilocular disk pores on venter .....*spinus* McKenzie  
     Entire eighth abdominal segment with 25 or fewer multilocular disk pores on venter .....12
- 12 (11). Tarsal claws with digitules as long as or longer than claw itself, digitules apically knobbed or swollen .....*gracilis* McKenzie  
     Tarsal claws with digitules shorter than claw itself, apically acute.....13

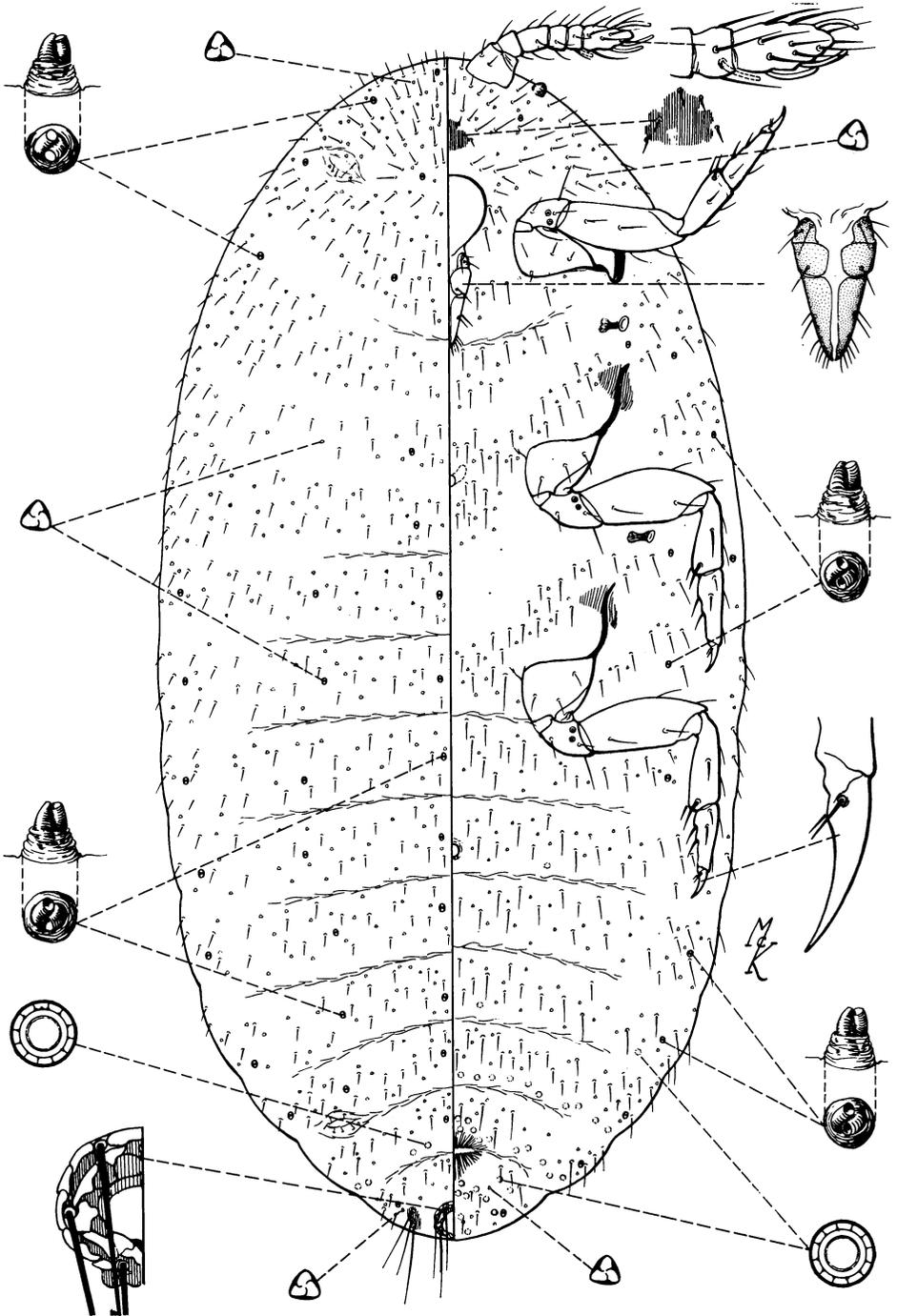


Fig. 11. *Rhizococcus menkei* McKenzie, new species, collected in soil one mile north of Tepic, state of Nayarit, Mexico.

- 13 (12). Multilocular disk pores present on dorsum of eighth abdominal segment. . . . .14  
 Multilocular disk pores absent on eighth abdominal segment. . . . .  
 . . . . .*toticopanus* Hambleton
- 14 (13). With paired tubular pores, the openings of which are set close together, the  
 ducts parallel or somewhat divergent. . . . .*solani* Hambleton  
 Bitubular pores seemingly formed of a sclerotized cone, from the apex of  
 which arise two curving ducts or tubes. . . . .*menkei* McKenzie
- 15 (1). Dorsum of most abdominal segments with a transverse row of tritubular  
 pores, these rows having 10 to 16 pores; antennae 5-segmented. . . . .  
 . . . . .*falcifer* Künckel d'Herculeais  
 Dorsum of abdominal segments with tritubular pores, if tritubulars are  
 present, not thus arranged, or if rows can be detected, they include not  
 more than 6 to 7 pores . . . . .16
- 16 (15). Anal lobes terminate in a small but distinct area of sclerotization. . . . .17  
 Anal lobes without such a sclerotization . . . . .19
- 17 (16). Bitubular pores present somewhere on body . . . . .*boharti* McKenzie  
 Bitubular pores absent on body . . . . .18
- 18 (17). Inner row of pores of the anal ring clouded. . . . .*associatus* (Hambleton)  
 Inner row of pores of the anal ring not clouded. . . . .*distinctus* (Hambleton)
- 19 (16). Multilocular disk pores present only on venter of abdomen. . . . .20  
 Multilocular disk pores—even if very few—present dorsally and ventrally. . . . .24
- 20 (19). Abdominal segments 6 and 7 ventrally each with a transverse row of small  
 trilobular pores extending across median region. . . . .*mayanus* (Hambleton)  
 No abdominal segment with transverse row of trilobular pores in median  
 region . . . . .21
- 21 (20). Eyes absent . . . . .*eluminatus* McKenzie  
 Eyes present . . . . .22
- 22 (21). A very few small ventral tubular ducts present posterior to vulva. . . . .23  
 Small ventral tubular ducts absent anywhere on body. . . . .*pritchardi* McKenzie
- 23 (22). Each anal lobe area with 2 elongate setae and 2 or 3 smaller auxiliary  
 setae; 1 to 4 body setae associated with each tritubular pore. . . . .  
 . . . . .*cyperalis* (Hambleton)  
 Each anal lobe area with 3 elongate setae and 5 to 8 smaller auxiliary  
 setae; body setae not associated with tritubular pores. . . . .*nemoralis* (Hambleton)
- 24 (19). Dorsal multilocular disk pores form distinct rows on all segments from  
 mesothorax to abdominal segment eight. . . . .*graminis* (Hambleton)  
 Dorsal multilocular disk pores very few and scattered, not in rows. . . . .25
- 25 (24). Entire venter of eighth abdominal segment with 18 or fewer, usually fewer,  
 multilocular disk pores . . . . .*neomexicanus* McKenzie  
 Entire venter of eighth abdominal segment with 28 or more multilocular  
 disk pores . . . . .26
- 26 (25). Entire venter of seventh and eighth abdominal segments with 20 or more  
 tritubular pores . . . . .*stangei* McKenzie  
 Entire venter of seventh and eighth abdominal segments with 10 or fewer  
 tritubular pores . . . . .*americanus* (Hambleton)

### *Rhizoecus menkei* McKenzie, new species

(Figure 11)

**Suggested common name.** Menke rhizoecus mealybug.

**Hosts and distribution.** Type and paratype adult females collected from soil 1 mile north of Tepic, state of Nayarit, Mexico, August 27, 1959, by A. S. Menke and L. A. Stange.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and single paratype of the same sex, similarly mounted, have been deposited in the museum collection of the University of California, Davis.

**Habit.** Only information available is that the mealybug occurs in the soil.

**Recognition characters.** Length of largest available specimen, approximately 1.1 mm. On the dorsum, cerarii entirely lacking, anal lobes with several (usually 3) slender setae of various lengths, these set in a distinct but small area of sclerotization. Tubular pores of the bitubular type scattered over dorsum, rather numerous, as many as 62 observed. Dorsum beset with rather numerous trilocular pores and small setae. Tubular ducts of oral collar type lacking. Multilocular disk pores lacking on dorsum, except for a few along posterior border of eighth abdominal segment. Anal ring borne at apex of abdomen, its 6 setae approximately twice as long as diameter of ring, some of its pores clear and open, others with varying amounts of pigmentation. Dorsal ostioles well developed.

Ventrally, multilocular disk pores present in some numbers from apical to posterior margin of sixth abdominal segment (a single pore observed on posterior margin of fourth abdominal segment), apparently absent on thorax and head. With only a few bitubular pores on abdomen, confined mostly to a series of 6 or 7 along abdominal margin, a few submarginal ones on thorax and head. Trilocular pores distributed as on dorsum except, on thorax, they are confined to isolated patches, along with setae, showing as rather marked "clear areas." Oral collar tubular ducts absent on venter of body.

On the ventral side, a single, small, round circulus present on the fourth morphological abdominal segment. Eyes present. Antennae 6-segmented, with a quite short, stout, apical segment bearing 3 sensory setae, fifth segment with 1 sensory seta; interantennal space equal to almost twice the width of basal segment. Legs proportionately large and long for members of this genus; claw with short, apically acute digitules. Mouthparts short, moderately broad. Sclerotized patch present anterior to mouthparts.

**Notes.** This species keys to *Rhizoecus spinosus* McKenzie in the author's 1961 revised key (see footnote 4). However, it differs from *R. spinosus* in having 6-segmented antennae, fewer ventral multilocular disk pores on the apical and eighth abdominal segments, and ventral submarginal bitubular pores present on thorax and head. *Rhizoecus spinosus*, on the other hand, possesses 5-segmented antennae, has numerous ventral multilocular disk pores on the apical and eighth abdominal segments, and lacks ventral bitubular pores on thorax and head.

### *Rhizoecus neomexicanus* McKenzie, new species

(Figure 12)

**Suggested common name.** Mexican rhizoecus mealybug.

**Hosts and distribution.** Type and paratype adult females collected at Alazán, state of Veracruz, Mexico, 35 miles northwest of Tuxpan, August 15, 1959, by A. S. Menke and L. A. Stange.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and paratypes of the same sex, similarly mounted, have been deposited in the museum collection of the University of California, Davis.

**Habit.** Occurring in the uppermost 6 inches of soil in the jungle.

**Recognition characters.** Length of largest available specimen, approximately 1.0 mm. On the dorsum, cerarii entirely absent, anal lobes with one

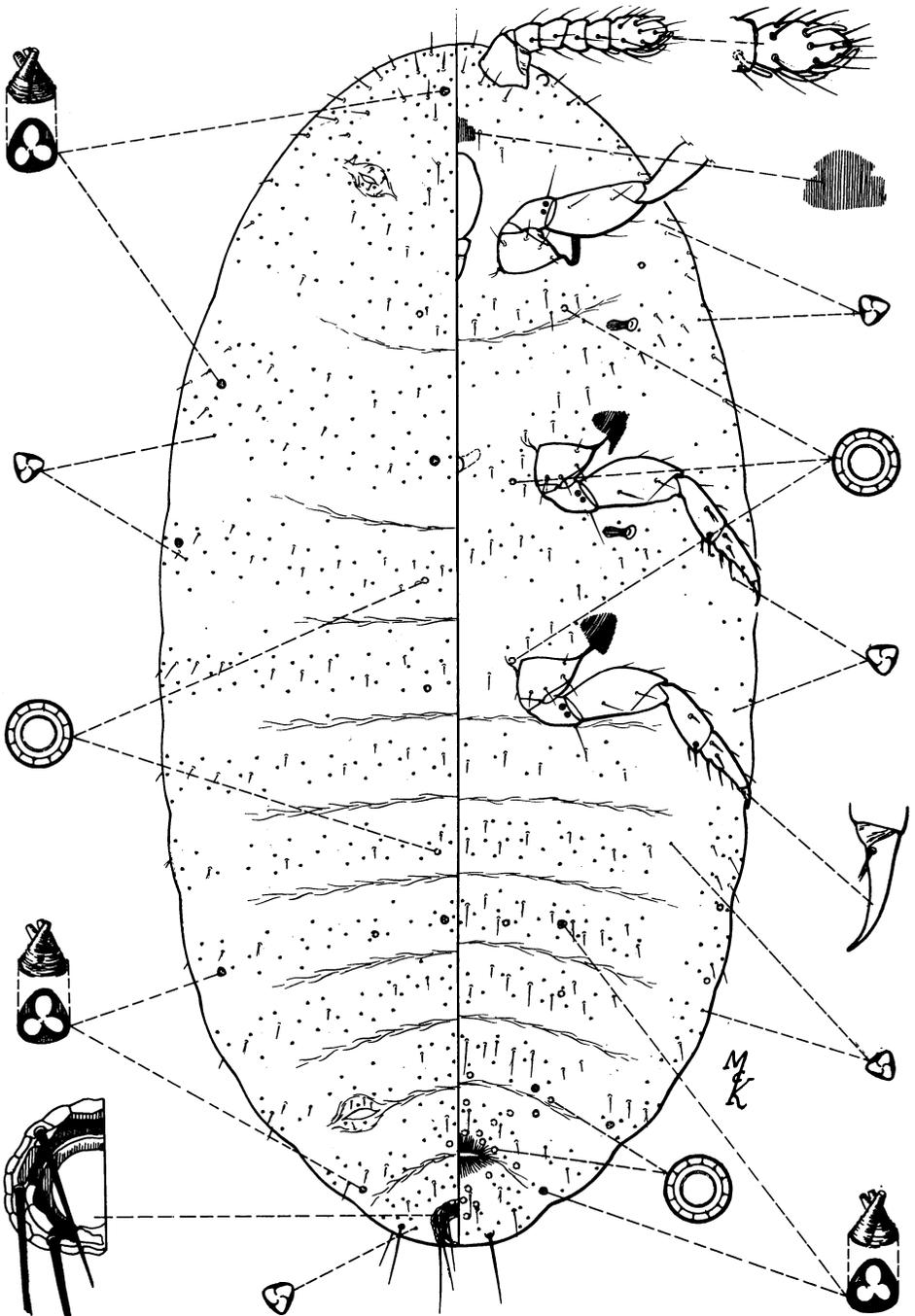


Fig. 12. *Rhizoecus neomexicanus* McKenzie, new species, collected from uppermost six inches of soil in jungle near Alazán, state of Veracruz, Mexico, thirty-five miles northwest of Tuxpan.

or two slender setae of various lengths. Tubular pores of the tritubular type scattered over dorsum, sparse, only 14 or 15 observed over entire surface. Dorsum beset with relatively few trilocular pores and small setae. Tubular ducts of oral collar type absent. Dorsal multilocular disk pores present in limited numbers, a few scattered on abdomen, 2 or 3 on thorax. Anal ring borne at apex of abdomen, its 6 setae approximately twice as long as diameter of ring, some of its pores clear and open, others with varying amounts of pigmentation. Dorsal ostioles well developed.

Ventrally, multilocular disk pores present in some numbers from apical to posterior margin of seventh abdominal segment, 1 or 2 present on segments anterior to these, with the possible exception of third segment, a few scattered on thorax, absent on head. Only a few tritubular pores on abdomen, lacking on thorax and head. Trilocular pores distributed very much as on dorsum except on thorax and head, where they are confined to isolated patches, along with setae, showing as rather marked "clear areas." Oral collar tubular ducts absent on venter of body.

On the ventral side, circulus absent. Eyes present. Antennae 6-segmented, quite short, stout, apical segment bearing 3 sensory setae, fifth segment with 1 sensory seta; interantennal space approximately equal to the width of basal segment. Legs moderately large and long; claw with short, apically acute digitules. Mouthparts short and broad. Sclerotized patch present anterior to mouthparts.

**Notes.** In the author's 1961 revised key, this species runs to *Rhizoecus americanus* (Hambleton). (See footnote 4.) It differs from the latter, however, in possessing fewer ventral multilocular disk pores on entire abdomen (28 to 35 observed), whereas *R. americanus* has nearly 100 of these structures. The new species also has fewer, probably not more than half as many, ventral tritubular pores on the abdomen.

### *Rhizoecus stangei* McKenzie, new species

(Figure 13)

**Suggested common name.** Stange rhizoecus mealybug.

**Hosts and distribution.** Type and paratype adult females collected 1 mile north of Tepic, state of Nayarit, Mexico, August 21, 1959, by L. A. Stange and A. S. Menke.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and single paratype of the same sex, similarly mounted, have been deposited in the museum collection of the University of California, Davis.

**Habit.** This mealybug was collected from the soil.

**Recognition characters.** Length of largest available specimen, approximately 1.2 mm. On the dorsum, cerarii entirely lacking, anal lobes with several, usually 3, slender setae of various lengths, arising from a small area of sclerotization. Tubular pores of tritubular type scattered over dorsum, as many as 21 observed. Dorsum beset with numerous trilocular pores and small setae. Tubular ducts of oral collar type lacking. A few multilocular disk pores present along posterior border of eighth to sixth abdominal segments.

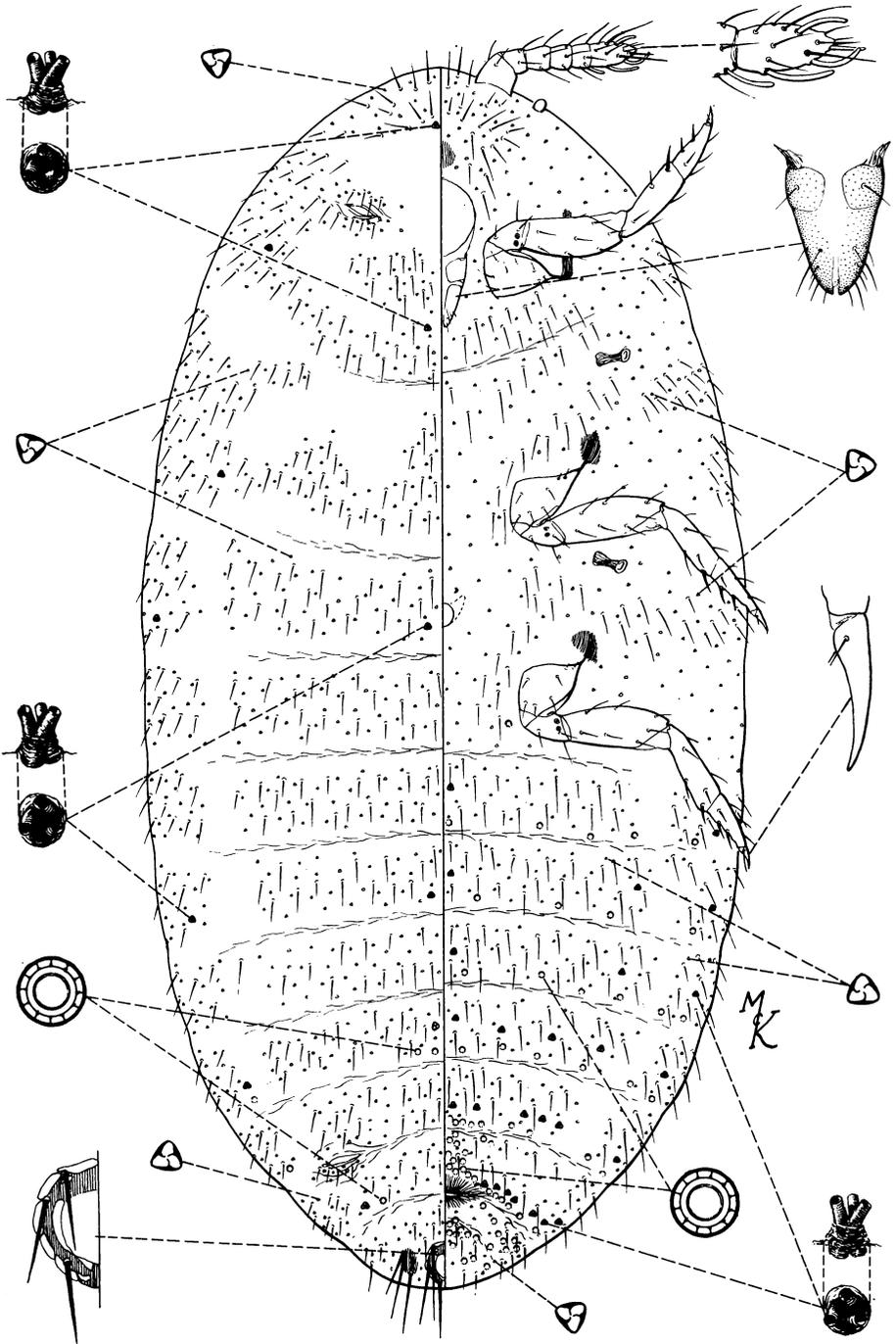


Fig. 13. *Rhizoecus stangei* McKenzie, new species, collected from soil one mile north of Tepic, state of Nayarit, Mexico.

Anal ring borne at apex of abdomen, its 6 setae perhaps less than twice as long as diameter of ring, some of its pores clear and open, others with varying amounts of pigmentation. Dorsal ostioles well developed.

Ventrally, multilocular disk pores present in considerable numbers from apical to posterior margin of third abdominal segment, and, with exception of apical and eighth segments, these structures situated along posterior margin of each segment; absent on thorax. Ventral tritubular pores numerous on abdomen, absent on thorax and head. Trilocular pores distributed much as on dorsum. Oral collar tubular ducts absent on body venter.

On the ventral side, circulus absent. Eyes present. Antennae 6-segmented, quite short, stout, apical segment bearing 3 sensory setae, fifth segment with 1 sensory seta; interantennal space equal to approximately twice the width of basal segment. Legs moderately large and long; claw with short, apically acute digitules. Mouthparts short and broad. Sclerotized patch present anterior to mouthparts.

**Notes.** In the author's 1961 revised key to *Rhizoecus* (see footnote 4), this species will key to *R. americanus* (Hambleton), but *R. stangei* has more ventral tritubular pores on the seventh and eighth abdominal segments, more ventral multilocular disk pores on the fifth and sixth abdominal segments, and no ventral multilocular disk pores on the thorax.

### Genus *Spilococcus* Ferris

Three new species of *Spilococcus* are described in this paper, one of which was collected in California, the other two in Nevada. One of the Nevada species has been assigned to *Spilococcus* with some degree of uncertainty. On the whole, it appears to belong more nearly with this genus than with any other, and is placed here at least for the present. A further discussion of this subject is presented under "Notes" in the description of *S. haigi* McKenzie, which follows the key. To the genus there are now assigned 18 species for North America, 15 of which occur in California. A modification of the author's 1960 key to species of this group has been made to include these new species. (See footnote 3.)

### Key to Species of *Spilococcus* in North America

1.    Circulus present ..... 2  
       Circulus absent ..... 12
- 2 (1). Dorsum with oral rim tubular ducts present in substantial numbers, at least over the abdomen and at times over the entire surface ..... 3  
       Dorsum with no oral rim tubular ducts, or with these confined to a single submarginal series ..... 9
- 3 (2). With a complete series of 16 to 17 pairs of dorsal cerarii ..... 4  
       Dorsal cerarii present in a series of not more than 12 to 15 recognizable pairs ..... 5
- 4 (3). Frontal cerarius definitely developed, with 2 to 3 conical setae set close together ..... *larreae* Ferris  
       Frontal cerarii indefinite, represented by a scattered group of 3 or more widely separated conical setae ..... *steeli* (Cockerell and Townsend)
- 5 (3). Circulus situated on fourth abdominal segment, not divided by segmental line; denticle or tooth absent on plantar surface of claw ..... 6  
       Circulus extending across the fold between fourth and fifth abdominal segments; small denticle or tooth present on plantar surface of claw ..... 7

- 6 (5). Circulus small, oval, its transverse axis scarcely longer than greatest diameter of eye; with from 6 to 10 dorsal oral rim tubular ducts on each of abdominal segments 4, 5, 6, and 8; cerarii absent on thorax and head ..... *parvicirculus* McKenzie  
 Circulus comparatively large, oval, its transverse axis 2 to 3 times longer than greatest diameter of eye; with from 13 to 20 dorsal oral rim tubular ducts on each of abdominal segments 4, 5, 6, and 8; at least 1 or 2 recognizable cerarii on thorax and head..... *parkeri* McKenzie
- 7 (5). With not more than 6 recognizable pairs of cerarii, these confined to abdomen ..... *haigi* McKenzie  
 With 9 to 15 pairs of recognizable cerarii, including those on thorax and head ..... 8
- 8 (7). Dorsal oral rim tubular ducts numerous on abdomen, each entire segment with 20 or more such ducts; ventral multilocular disk pores present on fourth abdominal segment ..... *quercinus* McKenzie  
 Dorsal oral rim tubular ducts few on abdomen, each entire segment with less than 10 such ducts; ventral multilocular disk pores absent on fourth abdominal segment ..... *cactearum* McKenzie
- 9 (2). Dorsal oral rim tubular ducts entirely absent .....10  
 Dorsal oral rim tubular ducts present in a submarginal series, at least on the abdomen .....11
- 10 (9). Ventrolateral areas of the body with clusters of small tubular ducts of oral collar type from the eighth abdominal segment to the mesothorax; as far as known occurs only on *Fouquieria* in southwestern United States. ...  
 ..... *touscendi* (Cockerell)  
 Ventrolateral areas of the body with merely a few scattered tubular ducts of oral collar type; as far as known occurs only on *Juniperus*.....  
 ..... *juniperi* (Ehrhorn)
- 11 (9). With about 15 pairs of definite cerarii; occurs on Cupressaceae and Taxodiaceae ..... *andersoni* (Coleman)  
 With scarcely more than 6 definite cerarii, these confined to the abdominal segments; occurs on *Prosopis*..... *prospoidis* (Cockerell)
- 12 (1). Ventrolateral areas of the body with clusters of multilocular disk pores. ...  
 ..... *sequoiae* (Coleman)  
 Ventrolateral areas of the body without clusters of multilocular disk pores.....13
- 13 (12). Dorsum without oral rim tubular ducts, except for an occasional duct in the head region ..... *implicatus* Ferris  
 Dorsum with numerous oral rim tubular ducts.....14
- 14 (13). Oral rim tubular ducts of the thoracic and head areas distinctly larger than those of abdominal areas ..... *gutierreziae* (Cockerell)  
 Oral rim tubular ducts all of the same size.....15
- 15 (14). With at least 15 pairs of recognizable dorsal cerarii ..... *atriplexis* (Cockerell)  
 With 13 or fewer pairs of dorsal cerarii .....16
- 16 (15). Oral rim tubular ducts present on ventral side of head and in the sternal regions of the thoracic segments ..... *criogoni* (Ehrhorn)  
 Oral rim tubular ducts lacking in these areas .....17
- 17 (16). Multilocular disk pores on venter very numerous, as many as 50 to 70 on some abdominal segments ..... *keiferi* McKenzie  
 Multilocular disk pores on venter very few, scarcely more than 30 on any one abdominal segment ..... *prcssus* Ferris

### *Spilococcus haigi* McKenzie, new species

(Figure 14)

**Suggested common name.** Haig spilococcus mealybug.

**Hosts and distribution.** Type and paratype adult females collected on *Malacothrix sonchoides* (Compositae) at Fernley, Lyon County, Nevada, May 27, 1960, by T. R. Haig (CSDA No. 60E31-59).

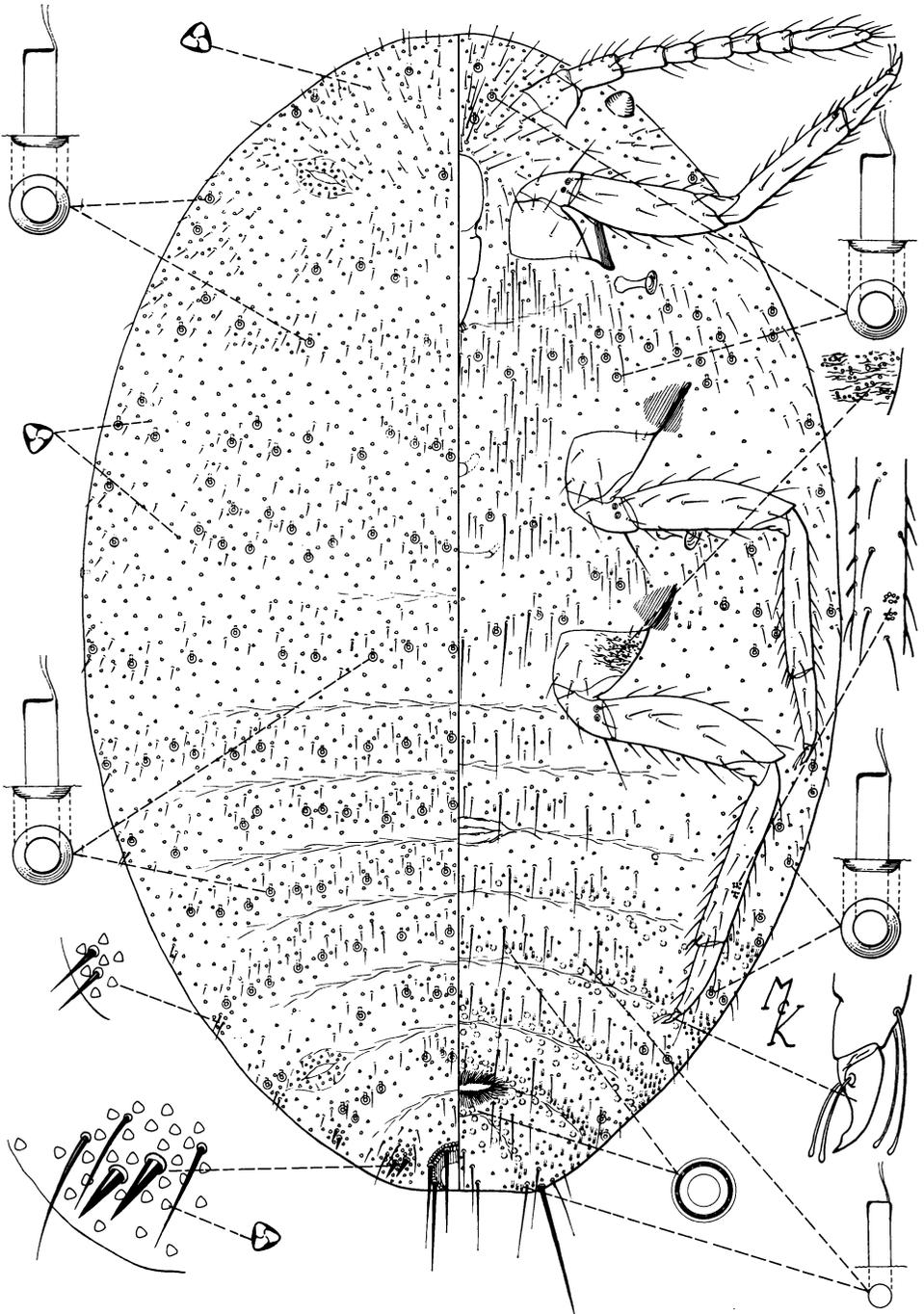


Fig. 14. *Spilococcus haigi* McKenzie, new species, collected on *Malacothrix sonchoides* (Compositae) at Fernley, Lyon County, Nevada.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) has been deposited in the collection of the California State Department of Agriculture, Sacramento. The single paratype of the same sex, similarly mounted, has been deposited in the museum collection of the University of California, Davis.

**Habit.** According to the collector, this species was found in the crown of the plant, at leaf axils.

**Recognition characters.** Length of largest adult female is 1.5 mm. On the dorsum, number of cerarii reduced, there being 5 or 6 recognizable pairs on abdomen (one specimen with 5 cerarian pairs, the second example with 5 cerarii on one side and 6 on the other) counting forward from the anal lobes, lacking on thorax and head. Anal lobe cerarius with 2 rather slender, conical spines or setae, 3 or 4 longer and more slender auxiliary setae, and a few scattered trilocular pores; remaining cerarii along abdominal margin with 2 slender cerarian spines, these progressively smaller, no auxiliary setae and with scarcely any concentration of trilocular pores. Dorsal body setae small and slender. Dorsum with oral rim tubular ducts quite numerous, as many as 10 to 20 per segment, except the last, scattered over thoracic segments and head. Trilocular pores situated over entire dorsum. Anal ring of normal form and size for genus, its 6 setae about twice as long as greatest diameter of ring.

On the ventral surface, multilocular disk pores present in considerable numbers, extending across abdominal segments from apical to posterior margin of fifth segment (occasionally 1 or 2 pores present on anterior margin of fifth abdominal segment). Oral collar tubular ducts present in considerable numbers along posterior margin of eighth to fifth abdominal segments. Oral rim tubular ducts of same size as those of dorsum occur in small numbers in lateral areas of abdomen, more abundant on thorax, sparsely on head. Ventral body setae slender and generally longer than those on dorsum. Trilocular pores rather numerous and generally distributed over venter.

Circulus present, comparatively large and lax, basically transversely oval, apparently divided by segmental line occurring between fourth and fifth segments. Antennae slender, 8-segmented. Legs well developed, quite long; hind coxae with cluster of translucent dots or pores at base; hind tibiae with irregular cluster or two of clear dots or pores (particularly noticeable on apical half); slight suggestion of denticular swelling on inner face of claw.

**Notes.** This species has created some confusion relative to generic placement. Due to variable number of abdominal cerarii (5 or 6 recognizable pairs in evidence), it would seem to lie approximately between *Chorizococcus* McKenzie and *Spilococcus* Ferris, thus providing a bridge of sorts to fill the gap between *Chorizococcus*, having 4 or fewer pairs of cerarii, and *Spilococcus*, with its 6 or more pairs. However, since *Spilococcus haigi* so closely resembles *S. cactearum* McKenzie, even to the similarity of translucent dots or pores on apical half of hind tibiae, and a slight suggestion of denticular swelling on inner face of the claw, the author is inclined to assign it to this group. As indicated above, one of the two specimens of *S. haigi* does appear to have six cerarii on one side of the body, and this feature, along with the morphological characters previously mentioned, seems to justify its inclusion

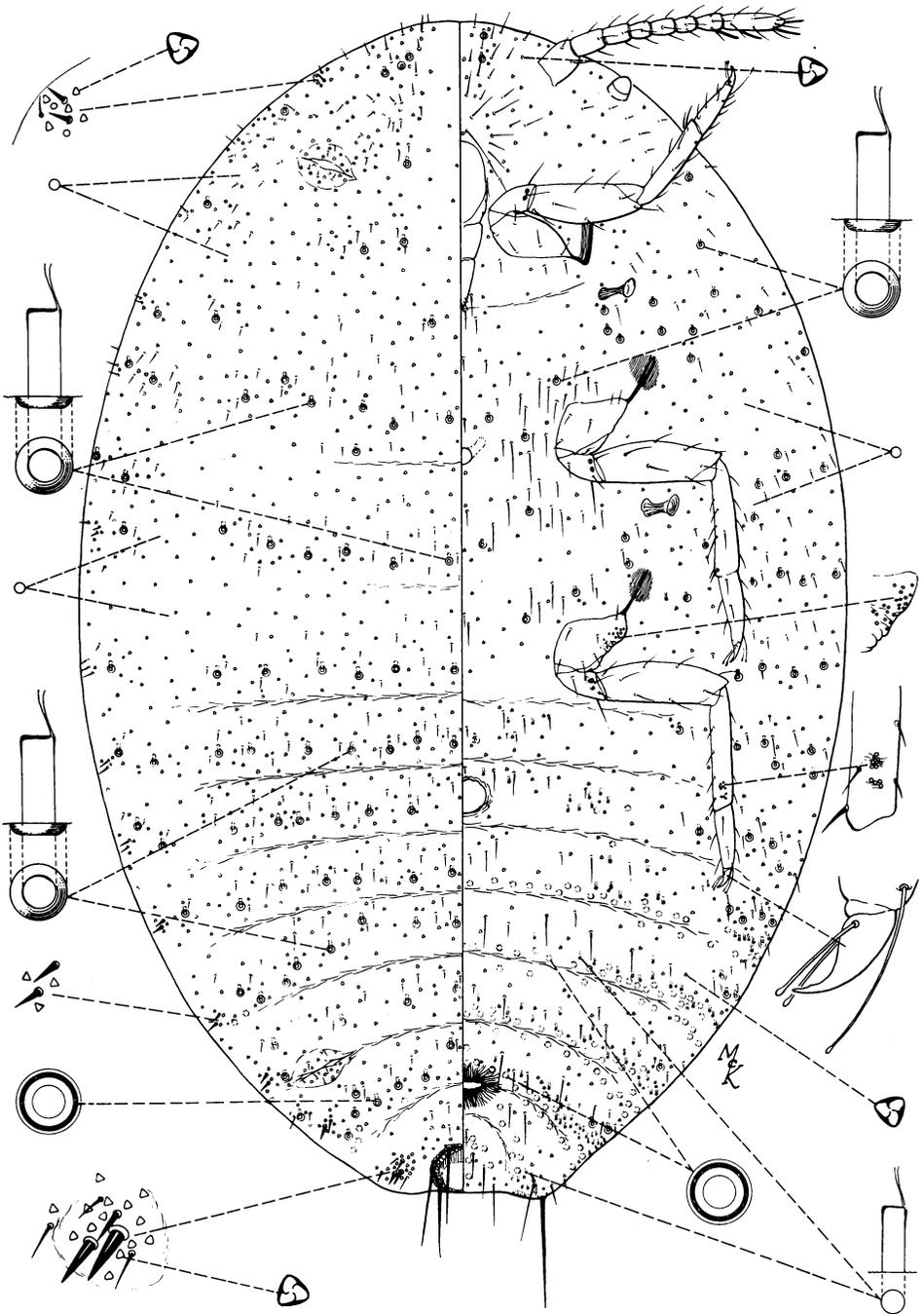


Fig. 15. *Spilococcus parkeri* McKenzie, new species, collected on roots of *Gutierrezia microcephala* (Compositae) at Pioche, Lincoln County, Nevada.

in *Spilococcus*. The author takes pleasure in dedicating *S. haigi* to T. R. Haig, who collected this and several other mealybugs which have proved to be very interesting.

*Spilococcus parkeri* McKenzie, new species

(Figure 15)

**Suggested common name.** Parker spilococcus mealybug.

**Hosts and distribution.** Type and paratype adult females were collected on the roots of *Gutierrezia microcephala* (Compositae) at Pioche, Lincoln County, Nevada, August 30, 1961, by F. D. Parker.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) and paratypes of the same sex have been deposited in the museum of the University of California, Davis. Paratypes have also been placed in the United States National Collection of Coccoidea, Washington, D.C., and in the collection of the California State Department of Agriculture, Sacramento.

**Habit.** According to the collector, the mealybug was covered with a fine, white, waxy secretion. This species was found associated with the plant roots. The body contents of the specimens appeared to form into blue-black fat globules during treatment in lactophenol.

**Recognition characters.** Length of largest adult female, approximately 2.1 mm. On the dorsum, number of cerarii appears reduced, normally 7 or 8 pairs on abdomen counting forward from anal lobes, and possibly 4 or 5 on thorax and head, these difficult to discern because cerarian conical setae are usually much more slender and generally situated farther apart, the total recognizable cerarii running as high as possibly 13 or 14 pairs. Anal lobe cerarius with 2 or 3 rather slender, conical setae, 2 or 3 more slender auxiliary setae, a rather concentrated group of trilocular pores, and no sclerotization; remaining cerarii along body margin with normally 2 slender cerarian setae, these progressively smaller anterior to anal lobe pair, no auxiliary setae, and with scarcely any concentration of trilocular pores. Dorsal body setae small and slender. Dorsum with numerous oral rim tubular ducts, 13 to 20 observed, average 16.1, on the fourth, fifth, sixth and eighth abdominal segments, absent on the ninth, scattered over thoracic segments and head. Trilocular pores situated over entire dorsum. Usually 2 or 3 dorsal, submarginal, multilocular disk pores present on the sixth and eighth abdominal segments. Minute, circular pores scattered over body surface. Anal ring of normal form and size for the genus, its 6 setae about twice as long as greatest diameter of ring.

On the ventral surface, multilocular disk pores present in considerable numbers, extending across abdominal segments from apical to fifth segment, with usually a few (3 or 4 pores only) present on fourth segment. Oral collar tubular ducts present in considerable numbers, usually along posterior margin of ninth to third abdominal segments, a few scattered on thorax, absent on head. Oral rim tubular ducts of same size as those on dorsum occur in small numbers in lateral areas of eighth to sixth abdominal segments, more numerous on anterior abdominal segments and thorax, a few situated in sternal region and on head. Minute, circular pores generally scattered on ventral body surface.

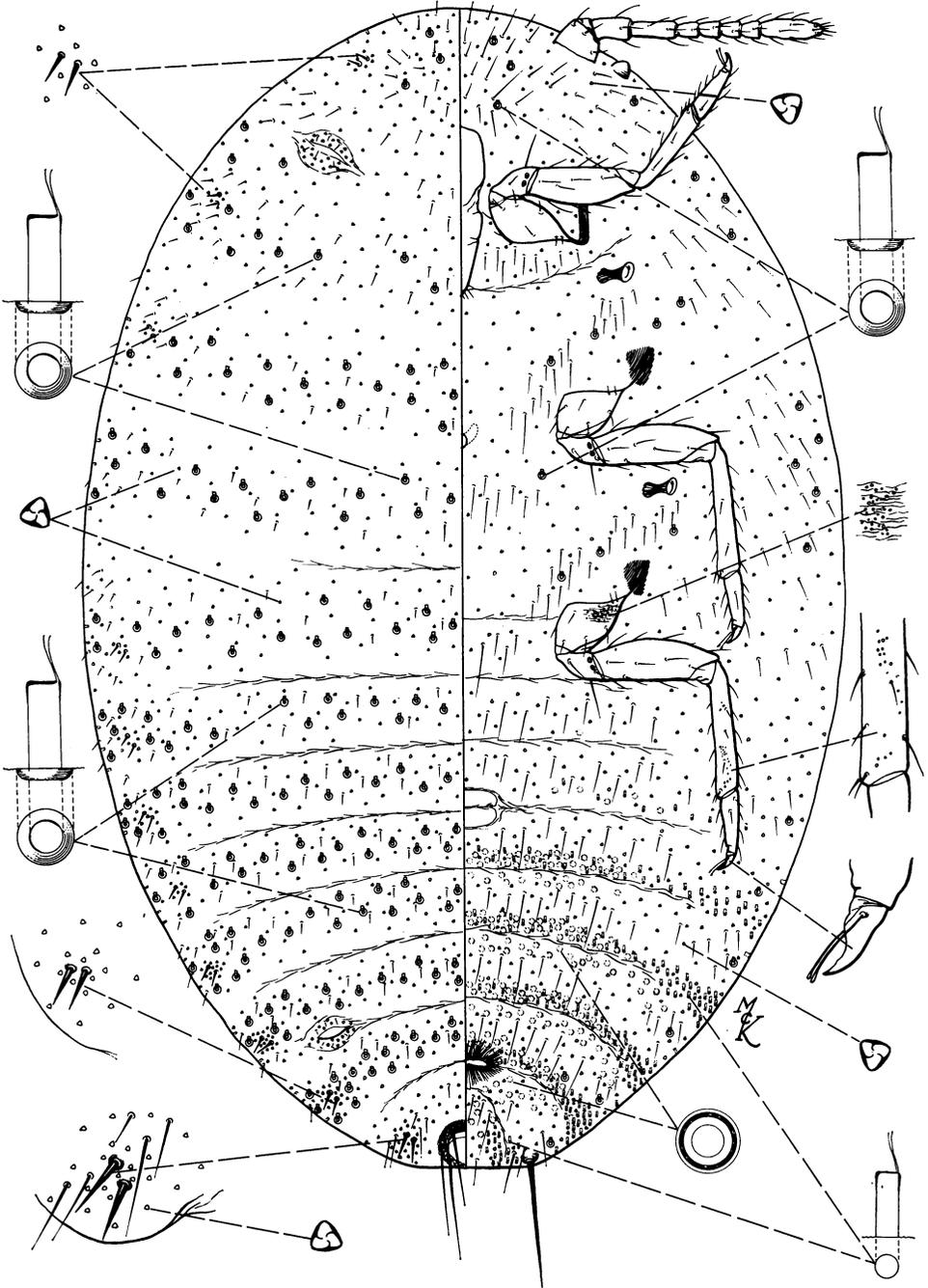


Fig. 16. *Spilococcus quercinus* McKenzie, new species, collected on an oak, *Quercus* sp. (Fagaceae), Big Rock Creek, San Gabriel Mountains, Los Angeles County, California.

Circulus present, comparatively large, transversely oval, situated on fourth abdominal segment, normally not divided by segmental line across which it lies. Antennae slender, 8-segmented. Legs well developed, quite long; hind coxae with a cluster of translucent dots or pores at base; hind tibiae with irregular cluster or two of clear dots or pores, evident on apical half of segment; denticular swelling or tooth absent on plantar surface of claw.

**Notes.** This species appears to be quite close to *Spilococcus parvicirculus* McKenzie. *S. parkeri* differs mainly in possessing a larger circulus, more numerous dorsal oral rim tubular ducts (13 to 20, average 16.1) on each of the fourth, fifth, sixth, and eighth abdominal segments, and by having at least a few marginal cerarii on the head and thorax. *Spilococcus parvicirculus*, on the other hand, has a very small circulus (perhaps not half as large as this structure in *S. parkeri*); usually not more than 6 to 10, average 8.3, dorsal oral rim tubulars on each of the fourth, fifth, sixth, and eighth abdominal segments; and has no marginal cerarii on the head and thorax.

### *Spilococcus quercinus* McKenzie, new species

(Figure 16)

**Suggested common name.** Oak spilococcus mealybug.

**Hosts and distribution.** Holotype adult female of this species collected on an oak, *Quercus* sp. (Fagaceae), Big Rock Creek, San Gabriel Mountains, Los Angeles County, California, in April 1926, by J. C. Chamberlain. Unfortunately, the slide containing this individual represents the only known specimen of the species. It was found in a collection belonging to Dr. R. C. Dickson, Entomologist, University of California, Riverside, and was made available to the author for study.

**Type material.** Holotype adult female (1 specimen mounted on 1 slide) of this species has been deposited in the museum of the University of California, Davis.

**Habit.** It is suspected that this mealybug feeds aboveground on the host tree.

**Recognition characters.** Adult female broadly oval, measuring 4 mm. long and 3 mm. wide. On the dorsum, cerarii rather poorly developed, there being normally 8 pairs on abdomen, and only 2, or possibly 3, pairs on thorax and head, these difficult to discern because cerarian conical setae are usually more slender and often situated farther apart, the total recognizable cerarii for the single specimen, 9 on one side of body, 11 on the other. Anal lobe cerarius with 2 rather small and slender setae, usually 4 or 5 slender auxiliary setae, and a few scattered trilocular pores; remaining cerarii along body margin with but 2 conical setae, these more slender and, at times, more widely separated than anal pair, no auxiliary setae, and scarcely any concentration of trilocular pores. Dorsal body setae small and slender. Dorsum with numerous oral rim tubular ducts, these arranged in a broken double row of from 30 to 38, or perhaps even more, across each abdominal segment except the last, fairly numerous on thoracic segments, and a few scattered ones on head. Trilocular pores evenly distributed over entire dorsum. Anal ring of normal form and size for the genus, its 6 setae about twice as long as greatest diameter of ring.

On the ventral side, multilocular disk pores present in considerable numbers, predominantly in midregion of abdomen, from apical to second segment (usually only 1 or 2 pores present on third segment), these pores absent on thorax and head. Small tubular ducts of oral collar type occur in same region, except on second and third segments, and in considerable numbers in lateral areas of ninth to fifth abdominal segments. Oral rim tubular ducts of same size as those on dorsum occur in small numbers submarginally on abdomen, thorax, and head, and in area about spiracles. Ventral body setae slender and generally longer than those on dorsum. Trilocular pores evenly distributed over venter, except in certain areas of thorax and head, where they appear more sparse.

Circulus well developed, normally appearing broadly oval, capable of folding along intersegmental line of the segments across which it lies. Antennae slender, normally 8-segmented. Legs moderately slender in relation to length; femora quite stout; hind coxae with cluster of pores at base; apical half of hind tibiae with small, irregularly arranged, translucent dots or pores (20 to 24 pores counted); plantar surface of claw with very small denticle or tooth.

**Notes.** This species is perhaps most closely related to *Spilococcus cactearum* McKenzie, but differs from it chiefly in the greater number of dorsal oral rim tubular ducts on abdominal segments, and by the presence of ventral multilocular disk pores on the fourth abdominal segment. These are absent in *S. cactearum*.

The accompanying illustration (fig. 16) of *Spilococcus quercinus* was made from a single, rather unsatisfactory, specimen. It is possible that an examination of more material, when available, may show some departures in detail from the figure.

### Genus *Tridiscus* Ferris

California locality records, in addition to those mentioned in Ferris' *Atlas*, are listed below for a species of this genus. In addition, attention is called to variation in a principal character used to identify it.

#### *Tridiscus distichlii* (Ferris)

Several collections of this mealybug have been submitted for identification to the California State Department of Agriculture, Bureau of Entomology. These collections are listed as follows: (1) Lancaster, Los Angeles County, California, July 28, 1957, on *Distichlis* sp. (Gramineae), K. C. Stephens, collector (CSDA No. 57H1-22). (2) Cambria Pines, San Simeon Creek, San Luis Obispo County, California, June 8, 1961, on *Distichlis spicata*, G. G. Beever, collector (CSDA No. 61F9-26). (3) Somis, Ventura County, California, August 28, 1961, on *Distichlis spicata*, W. M. Jones, collector (CSDA No. 61H31-54).

The specimens collected at Cambria Pines exhibit 4 median ventral circuli instead of the usual 3.

## SUMMARY

The majority of new mealybugs described in this study were collected outside of California. It has been deemed advisable to include them in a study of California species because they broaden our concepts of this important family of Coccoidea. The key to genera of North American Pseudococcidae has been revised to include two new genera. Revised keys to certain North American species have also been prepared. Comments have been made on the taxonomic and economic status of certain other named species which occur in California.

Two new pseudococcid genera, *Circaputo* and *Paradoxococcus*, have been described.

The sixteen new mealybugs described are: *Circaputo hirsutus* (Arizona), *Dysmicoccus desertorum* (Nevada), *D. hurdi* (Mexico), *Paradoxococcus mcdanieli* (Texas), *Phenacoccus infernalis* (Arizona), *Pseudococcus aberrans* (California), *P. dispar* (California), *P. macswaini* (Arizona), *P. sparsus* (Nevada), *Puto usingeri* (Peru), *Rhizoecus menkei* (Mexico), *R. neomexicanus* (Mexico), *R. stangei* (Mexico), *Spilococcus parkeri* (Nevada), *S. haigi* (Nevada), and *S. quercinus* (California).

Additional locality, host, and taxonomic notes are presented for the following species: *Phenacoccus echeveriae* McKenzie, *Pseudococcus agavis* MacGregor (Mexico), *P. comstocki* (Kuwana), *P. importatus* McKenzie, *P. maritimus* (Ehrhorn), *P. microcirculus* McKenzie, *P. obscurus* Essig, *P. sorghiellus* (Forbes), and *Tridiscus distichlii* (Ferris).

## ACKNOWLEDGMENTS

Dr. Harold Morrison, Coccidologist, United States Department of Agriculture, Agricultural Research Service, Entomology Research Division, Washington, D.C., has examined most of the new species described in this paper and has offered pertinent suggestions about their systematics. As usual, his remarks have proved to be extremely helpful, and his assistance is gratefully acknowledged.

Dr. D. J. Williams, Coccidologist, British Museum, London, has also given valuable comments relative to the taxonomic status of two of the pseudococcid genera herein described. The author is grateful to Dr. Williams for this help.

Eleven of the sixteen new mealybugs described in this paper were collected by various University of California personnel. Four of the new species were made available to the author by the California State Department of Agriculture, Bureau of Entomology, Sacramento, again mainly through the efforts of Mr. R. F. Wilkey, Taxonomist. One of the new species, representing a new genus, was kindly sent to the author by Mr. Burrus McDaniel, Instructor in Biology, Texas College of Arts and Industries, Kingsville, Texas. To these individuals and agencies, a sincere note of appreciation is here expressed.

Several delineators have assisted in the preparation of certain illustrations, and their initials appear on some of them. These individuals are: Mrs.

Julia Z. Iltis, Mrs. Helen Court, and Mrs. Patricia D. Andersen. Their help with this work is much appreciated.

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