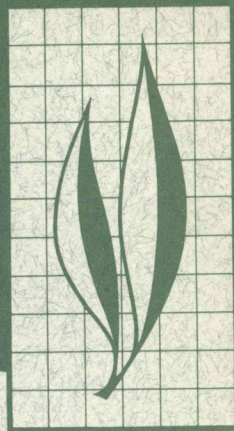


HILGARDIA

A JOURNAL OF AGRICULTURAL SCIENCE PUBLISHED BY
THE CALIFORNIA AGRICULTURAL EXPERIMENT STATION



Volume 40, Number 17 • June, 1971

**Sixth Taxonomic Study
of North American Mealybugs,
with Additional Species
from South America
(Homoptera: Coccoidea: Pseudococcidae)**

Douglass R. Miller and Howard L. McKenzie



CONTENTS

INTRODUCTION	565
CHANGES IN TECHNIQUE	566
KEYS AND DESCRIPTIONS	566
Genus <i>Cataenococcus</i> Ferris	566
<i>Cataenococcus mexicanus</i> Miller and McKenzie, new species	566
Genus <i>Chorizococcus</i> McKenzie	569
<i>Chorizococcus coniculus</i> Miller and McKenzie, new species	569
Genus <i>Dysmicoccus</i> Ferris	571
<i>Dysmicoccus brachydactylus</i> Miller and McKenzie, new species	571
<i>Dysmicoccus dactylus</i> Miller and McKenzie, new species .	573
<i>Dysmicoccus polymeris</i> Miller and McKenzie, new species	575

(Continued inside back cover)

THE AUTHORS:

Douglass R. Miller was formerly Research Assistant in Entomology, Davis. He is now with the Systematic Entomology Laboratory, Agricultural Research Service, U. S. Department of Agriculture, Washington, D.C.

The late Howard L. McKenzie was Entomologist in the Experiment Station, Davis.

Douglass R. Miller
and Howard L. McKenzie

Sixth Taxonomic Study of North American Mealybugs, with Additional Species from South America (Homoptera: Coccoidea: Pseudococcidae)^{1, 2}

ABSTRACT

One new pseudococcid genus, *Prorhizococcus*, and 15 new species are described and illustrated in this paper. Only three of the new species were collected in California: *Dysmicoccus polymeris*, *Pseudococcus beardsleyi*, and *Spilococcus nototrichus*. Other new North American species were collected as follows: *Trionymus strongylus*, Arizona; *T. idahoensis*, Idaho; *Cataenococcus mexicanus*, *Hypogeococcus othnius*, *Prorhizococcus atopoporus*, *Rhizococcus neostangei*, *Spilococcus villanuevai*, *Trionymus coronus*, Mexico; and *Chorizococcus coniculus*, New Mexico. Four Central and South American species are described: *Dysmicoccus brachydactylus* and *D. dactylus*, Chile; *Hypogeococcus othnius*, Costa Rica, Guatemala, Nicaragua, and Venezuela; *Mammicoccus balachowskyi*, Peru.

Revised keys to North American species are given for the genera *Cataenococcus*, *Chorizococcus*, *Dysmicoccus*, *Hypogeococcus*, *Pseudococcus*, *Rhizococcus*, *Spilococcus*, and *Trionymus*. In addition, a key to the two species of *Mammicoccus* is presented.

INTRODUCTION

THROUGH THE EFFORTS of G. F. Ferris and H. L. McKenzie the mealybug species of California have become relatively well known. Although three new California species are treated in this paper, discovery of undescribed species is becoming increasingly difficult. Our studies have therefore taken a new direction. With a larger number of available specimens, we are now better able to understand the amount of intraspecific variation that occurs. We are beginning to formulate more comprehensive chronological and geographical distribution

patterns and host ranges. With this new information our species concepts have become somewhat broader.

In addition to studying California mealybugs, we have recently turned our attention to those of the western United States and, to a limited extent, Mexico.

This paper includes descriptions of one new genus, and 15 new species as follows: three different species from California; one each from Arizona, Idaho, and New Mexico; five different species from Mexico; two from Chile; one from Peru; and one with specimens from

¹ Submitted for publication December 10, 1969.

² National Science Foundation Grant No. GB-5847 to the junior author provided the funds necessary for the completion of this paper.

Costa Rica, Guatemala, Mexico, Nicaragua, and Venezuela. Revised keys are also presented, which include one new genus and 10 new North American species. No keys are given for the South American species.

Type specimens and other slides are in the following depositories, hereafter abbreviated as shown: British Museum (Natural History), London (BM); California State Department of Agriculture,

Sacramento (CDA); Instituto Nacional de Investigaciones Agrícolas, Chapingo, Mexico (INIA); Collection of Coccoidea, University of California at Davis (UCD); University of Chile, Santiago (UCS); University of Hawaii (UH); National Collection of Coccoidea, United States National Museum, Washington, D.C. (USNM); Virginia Polytechnic Institute, Blacksburg (VPI); Zoological Institute, Academy of Sciences of USSR, Leningrad (ZAS).

CHANGES IN TECHNIQUE

We have made three changes in the technique used in the five previous studies in this series. (1) In the description of a new species, only the holotype is discussed under "Recognition characters." The illustration is based solely on the type. Any differences in the rest of the type series are discussed under "Variation." (2) The enlargements of selected leg parts presented

along the margin of each illustration are of the dorsal leg surface only. The ventral surface is shown on the main drawing. (3) Discoidal and minute circular pores are no longer distinguished as separate entities since they often intergrade into each other. Therefore, we have called them all discoidal pores, and have indicated small or large where necessary.

KEYS AND DESCRIPTIONS

Genus *Cataenococcus* Ferris

This genus, with the single species herein described as new, and the species recently described by Williams (1969), contains six species for North America. To accommodate the new species, the

key presented by Ferris (1953) under *Farinococcus* (which he later (1955) discovered was distinct from the genus *Cataenococcus*) should be revised as follows:

- 3. Cerarii arranged in 17 or 18 distinct pairs 4
 "Cerarii arranged in an almost continuous band about the margins of the body, this band broken into an indeterminable number of small groups of conical setae*olivaceus* (Cockerell)"
- 4. Dorsal multilocular disk pores present*mexicanus* Miller and McKenzie
 Dorsal multilocular disk pores absent 5
- 5. Multilocular disk pores present on thorax*cualatensis* (Cockerell)
 Multilocular disk pores absent on thorax*larai* Williams

Cataenococcus mexicanus Miller
and McKenzie, new species
(Figure 1)

Suggested common name. Dense-pored mealybug.
Collection data. Adult females on

unidentified Compositae, collected at Apizaco, Tlaxcala, Mexico, July 16, 1967, by D. R. Miller and J. Villanueva B.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. Two adult female para-

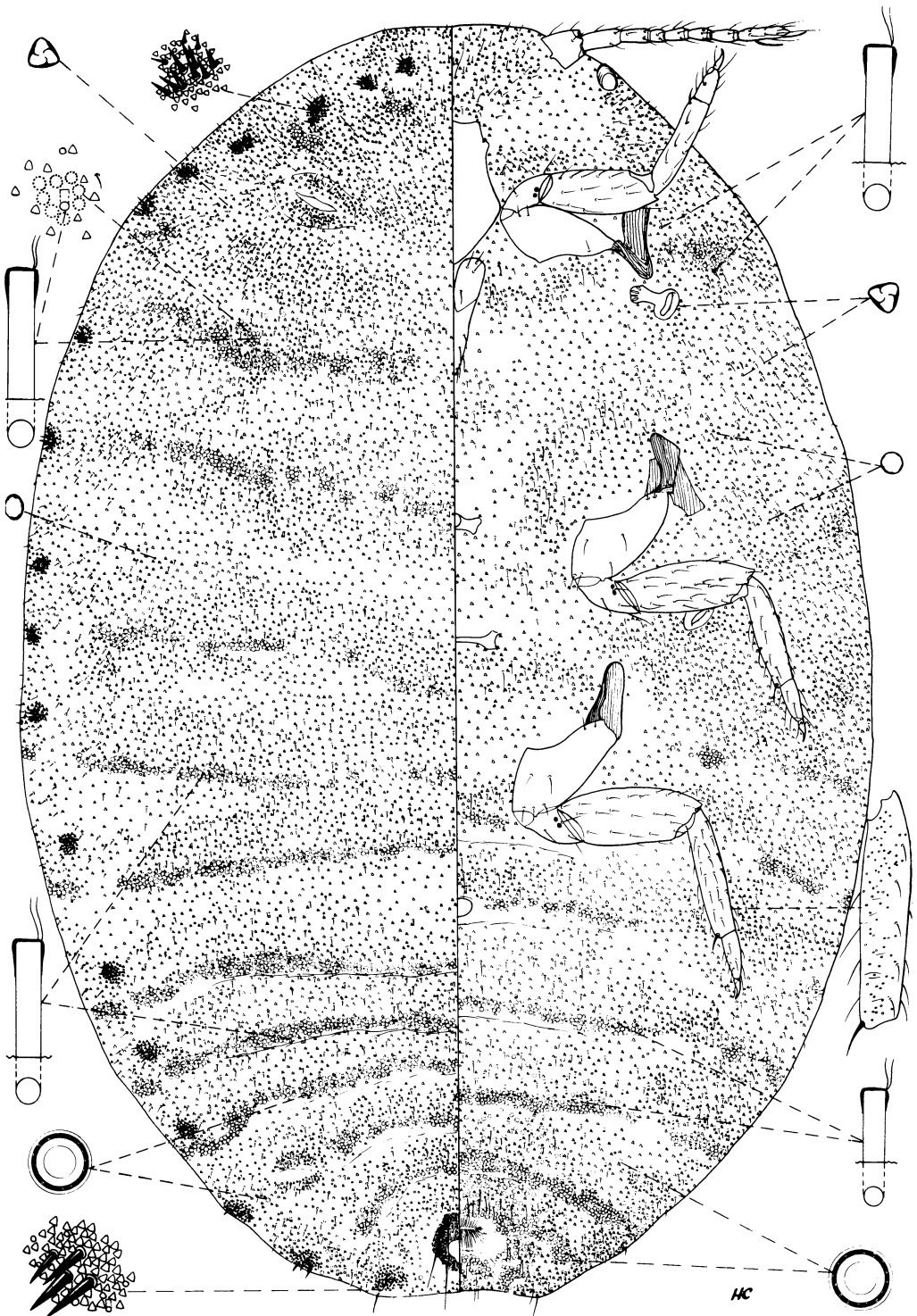


Fig. 1. *Cataenococcus mexicanus* Miller and McKenzie, new species, collected at Apizaco, Tlaxcala, Mexico, July 16, 1967, on unidentified Compositae.

types and three immature paratypes on three slides (UCD, USNM).

Gross external features. This mealybug is yellowish-orange. It is lightly dusted with a smooth, white secretion. Unusually broad filaments were present around entire body margin. A filamentous ovisac is produced, which encloses the adult female.

This species occurs on the roots of its host.

Recognition characters. Adult female holotype, mounted, 2.80 mm long, 1.79 mm wide (paratypes, 1.86 to 2.30 mm long, 1.30 to 1.69 mm wide); body rotund.

Dorsum with 18 pairs of cerarii. Anal-lobe cerarii each with 4 and 5 conical setae, zero and 1 oral-collar tubular ducts, 4 or 5 large discoidal pores, large cluster of trilocular pores, no basal sclerotization. Remaining cerarii each with 4 to 9 conical setae, large cluster of trilocular pores. Anterior cerarii tend to have more conical setae than do those on abdomen. Trilocular pores abundant over surface. Multilocular disk pores present in transverse bands on posterior margins of abdominal segments 8 through 2, also present on posterior margins of each thoracic segment, absent on head except in clusters near cerarii. Within clusters and rows of multilocular disk pores there are frequently elongate, oral-collar tubular ducts. Oral-collar tubular ducts with traces of rims similar to *Phenacoccus gossypii* Townsend and Cockerell. Large-sized discoidal pores scattered over surface, slightly smaller than trilocular pores. Body setae short and conical, noticeably smaller than cerarian setae.

Anal ring dorsal, removed approximately one-half diameter of ring from abdomen apex, unusually broad, with 3 rows of pores; each of its 6 setae slightly longer than greatest diameter of ring.

Venter with multilocular disk pores on posterior margin of each abdominal segment and in lateral areas on thorax,

absent on head. Trilocular pores numerous. Large-sized discoidal pores scattered over surface. Oral-collar tubular ducts of two sizes: larger size present in clusters and rows of multilocular disk pores as on dorsum; smaller size present in transverse-medial rows on each abdominal segment. Body setae unusually short.

Circulus small, oval, not divided by intersegmental line. Legs large; hind femora dorsally with 3 and 28 small translucent pores (not illustrated) (paratypes, 9 to 26); hind tibiae dorsally with 86 translucent pores (paratypes, 39 to 50); tarsal digitules setose, not extending to tip of claw; claw digitules weakly capitate, extending to tip of claw; claw with denticle absent. Antennae 8-segmented.

Variation. The paratypes differ as follows: one specimen with 17 pairs of cerarii; some cerarii may possess 12 conical setae; anal ring on one specimen with five pairs of setae; apical antennal segment sometimes partially divided into ninth segment.

Notes. The generic placement of this species is a problem since it may, at times, possess only 4 cerarian setae in each anal-lobe cerarius. Possession of this character in McKenzie's (1967) key to genera would bring this species out at *Dysmicoccus* rather than *Cataenococcus*. This reduced number of cerarian setae also occurs in *C. cualatensis* (Cockerell), another Mexican species. Since both species possess numerous setae in all other cerarii and since both have the characteristic rotund body shape, they are retained in *Cataenococcus*.

This species is most closely related to *Cataenococcus cualatensis*, but differs from it in possessing dorsal multilocular disk pores; clusters of multilocular disk pores which frequently surround an oral-collar tubular duct; and two sizes of ventral oral-collar tubular ducts—none of which are found in *C. cualatensis*.

Genus *Chorizococcus* McKenzie

This genus, with the single species herein described as new, contains 26 species for North America. To accom-

modate the new species, the key presented by McKenzie (1967) should be revised as follows:

- 12(11). Cerarii on anal lobes only A
 Cerarii on at least last 2 or 3 abdominal segments 13
- A(12). Oral-collar tubular ducts present on dorsomedial areas of abdomen;
 occurring on grasses *coniculus* Miller and McKenzie
 Oral-collar tubular ducts absent on dorsomedial areas of abdomen;
 occurring on *Abronia* *abroniae* McKenzie

Chorizococcus coniculus Miller and McKenzie, new species

(Figure 2)

Suggested common name. Conical-seta mealybug.

Collection data. Adult females on unidentified grass (Gramineae), collected in canyon above Alamogordo, Otero Co., New Mexico, August 4, 1966, by D. R. Miller.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. Five adult female paratypes on five slides (BM, CDA, UCD, USNM, VPI).

Gross external features. This mealybug is pink, with translucent legs. The derm is lightly dusted with a smooth, white bloom. No marginal filaments were observed. A loose, filamentous ovic, produced within the grass sheath, encloses the entire female in addition to many yellow eggs. It is approximately twice the length of a fully mature, adult female.

This species infests the leaf sheaths of its host.

Recognition characters. Adult female holotype, mounted, 3.90 mm long, 2.53 mm wide (paratypes, 2.81 to 4.23 mm long, 1.79 to 2.43 mm wide); body elongate.

Dorsum with single pair of cerarii (anal lobe), each with 2 conical setae, 3 or 4 auxiliary setae, small cluster of trilocular pores, 3 or 4 discoidal pores, and no basal sclerotization. Triloculars

extremely numerous over entire surface. Multilocular disk pores in small numbers from abdominal segment 9 through 4. Discoidal pores approximately same size as trilocular pores, scattered over entire surface. Oral-rim tubular ducts small, with small rim, present in reduced numbers over surface. Oral-collar tubular ducts of two sizes: large size most abundant, present over entire surface, most numerous on anterior abdominal segments, least numerous on head; small size uncommon, associated with transverse rows of body setae. Body setae slender, only slightly shorter than ventral body setae.

Anal ring dorsal, touching apical margin of abdomen, with 2 rows of conspicuous pores; each of its 6 setae nearly equal in length to greatest diameter of ring.

Venter with multilocular disk pores on posterior and anterior margins of abdominal segments 9 through 5; rows restricted to posterior margins on segments 4 and 3, with a few such pores scattered on thorax and head. Trilocular pores numerous. Discoidal pores same as on dorsum, scattered over surface. Oral-rim tubular ducts same as on dorsum, present in small numbers along lateral margin of thorax. Oral-collar tubular ducts same two sizes as on dorsum, present on posterior and lateral margins of abdominal segments, restricted to lateral and sublateral areas of thorax and head. Body setae abnormally short.

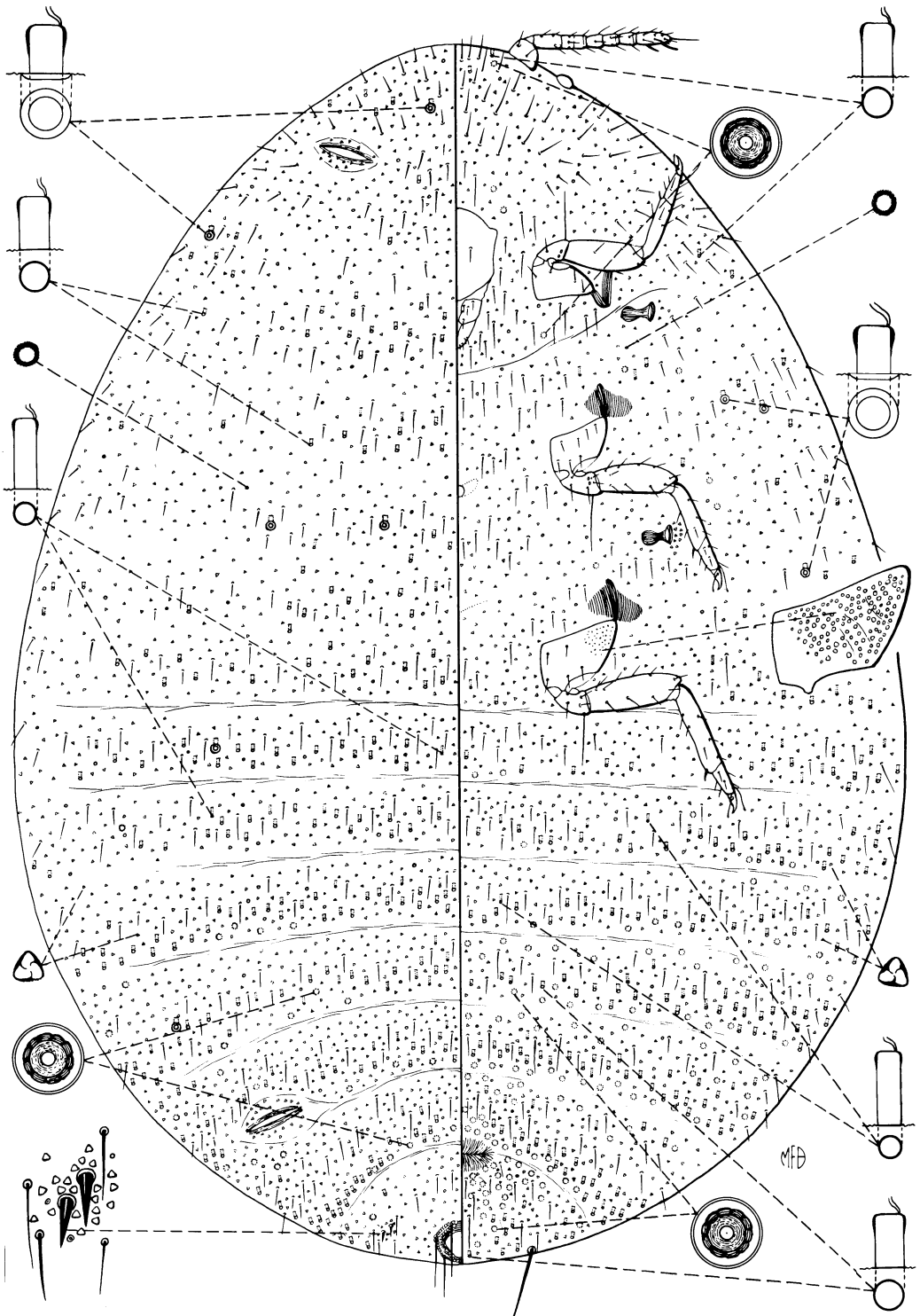


Fig. 2. *Chorizococcus coniculus* Miller and McKenzie, new species, collected at canyon above Alamogordo, Otero County, New Mexico, August 4, 1966, on unidentified grass (Gramineae).

Circulus absent. Legs moderate in size; hind coxae abnormally expanded, dorsally with 49 and 50 translucent pores, ventrally with 115 to 127 (paratypes, dorsally with 124 to 154, ventrally with 23 to 71); tarsal digitules capitate, extending beyond tip of claw; claw digitules capitate, extending beyond tip of claw; claws with no denticle. Antennae 8-segmented.

Variation. Paratypes remarkably similar to holotype. Occasionally, 1 or 2 dorsal multilocular disk pores present on medial portion of thorax.

Notes. The generic placement of this species is a definite problem. Although it keys to *Chorizococcus*, the body form and grass-infesting habit make it atypical for the genus.

It is most closely related to *Chorizococcus rostellum* (Hoke), but differs in possessing dorsal multilocular disk pores; discoidal pores; dorsal oral-collar tubular ducts of two sizes—all of which are absent in *C. rostellum*. It has no circulus, whereas *C. rostellum* has a small, distinctive circulus.

Genus *Dysmicoccus* Ferris

This genus, with the one species herein described as new, contains 31 species for North America. In addition,

three new species are described from South America. McKenzie's (1967) key should be revised as follows:

- A(11). Ventral multilocular disk pores either absent or fewer than 10 in number *polymeris* Miller and McKenzie
 Ventral multilocular disk pores more than 20 in number 13
- 13(A). "Ventral multilocular disk pores distributed from posterior apical segment of abdomen forward to thorax and head . . . *racemus* McKenzie"
 "Ventral multilocular disk pores distributed from posterior segment of abdomen forward to segment 6 or 7, absent on thorax and head . . . 14"

Dysmicoccus brachydactylus Miller and McKenzie, new species

(Figure 3)

Suggested common name. Short-digitule mealybug.

Collection data. Adult females on *Taraxacum officinalis* (Compositae), collected at Caupolicán, Valdivia, Chile, January 11, 1964, by L. Duran.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. Two adult female paratypes on two slides (UCS, USNM).

Gross external features. No information.

Recognition characters. Adult female holotype, mounted, 1.88 mm long, 1.45 mm wide (paratypes, 2.29 to 2.31 mm long, 1.85 to 1.91 mm wide); body rotund.

Dorsum with 17 pairs of cerarii. Anal-lobe cerarii each with 2 conical

setae, 3 auxiliary setae, cluster trilocular pores, and no basal sclerotization. Remaining cerarii each with 1 to 6, usually 3, conical setae, zero to 4 auxiliary setae, cluster trilocular pores, and usually 1 or 2 discoidal pores. Multilocular disk pores absent. Dorsum with light scattering of trilocular and discoidal pores. Oral-collar tubular ducts absent. Dorsal body setae short, except on medial areas of abdominal segments 9, 8, and 7 where conspicuously longer than on rest of surface.

Anal ring dorsal, situated near abdominal apex, with 2 rows of pores, outer row weakly sclerotized; each of its 6 setae slightly longer than greatest diameter of ring.

Venter with multilocular disk pores present in small numbers from abdominal segment 9 through 5, with one such pore anterior to hind pair of legs. Trilocular and discoidal pores lightly scat-

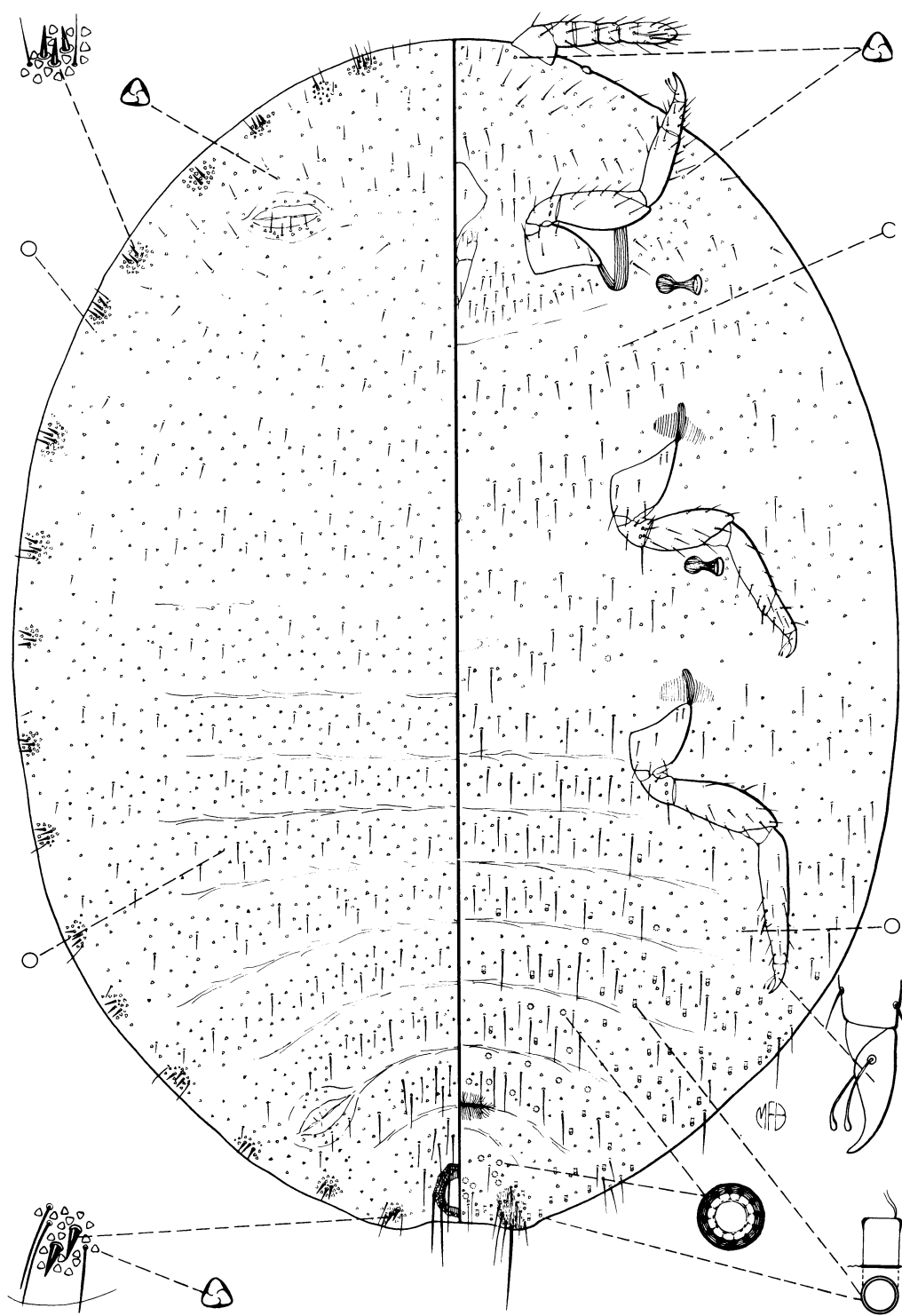


Fig. 3. *Dysmicoccus brachydactylus* Miller and McKenzie, new species, collected at Caupolicán, Valdivia, Chile, January 11, 1964, on *Taraxacum officinalis* (Compositae).

tered over surface. Oral-collar tubular ducts noticeably short, with large dermal orifice, present on abdominal segments 9 through 4, most numerous on sublateral areas of segments 8, 7, and 6. Body setae conspicuously longer than those on dorsum. Anal lobe with large, heavily sclerotized area bearing 6 or 8 long body setae.

Circulus absent. Legs small with no translucent pores; tarsal digitules with acute apices not reaching tip of claw; claws with digitules short, not extending to claw apex; claws without denticle. Antennae 6-segmented. Eye small, nearly absent, with no discoidal pores in association.

Variation. Normally with 17 pairs of cerarii, rarely with 16. Multilocular disk pores on venter sometimes absent on abdominal segment 5, rarely present on thorax. Oral-collar tubular ducts usually absent on abdominal segment 4.

Notes. This species is closely related to *Dysmicoccus obesus* (Lobdell) in that it has multiple-seta cerarii and dorsal, posterior abdominal segments with a patch of elongate body setae. It differs, however, in possessing 6-segmented antennae; 16 or 17 pairs of cerarii; and large oral-collar tubular ducts, in contrast to *D. obesus*, which has 8-segmented antennae; 12 or 13 pairs of cerarii; and small tubular ducts.

This species is also closely related to *Dysmicoccus lasii* (Cockerell), but has bispinose cerarii only, in contrast to the multiple-seta cerarii of *D. brachydactylus*.

Dysmicoccus dactylus Miller and McKenzie, new species

(Figure 4)

Suggested common name. Digitule mealybug.

Collection data. Adult females on unidentified plant, collected at "Quebrada Lo Rojas" (Quebrada Las Rosas?), La Cruz, Chile, March 15 and April 21, 1961, by L. M. Smith.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. One adult female paratype (UCS).

Gross external features. No information.

Recognition characters. Adult female holotype, mounted, 1.68 mm long, 0.82 mm wide (paratype, 1.36 mm long, 0.61 mm wide); body elongate.

Dorsum with 6 or 7 pairs of definite cerarii on abdomen, those on thorax with setae widely separated. Anal-lobe cerarii each with 2 conical setae, 3 or 4 auxiliary setae, diffuse cluster of trilocular pores, 2 or 3 small discoidal pores, and large, conspicuous area of basal sclerotization. Remaining cerarii with their setae anteriorly becoming progressively more slender and farther separated; these cerarii with weak cluster of trilocular pores, and no area of basal sclerotization. Multilocular disk pores scattered in small numbers over entire surface, most abundant on abdomen and posterior thorax. Dorsum evenly beset with trilocular pores. Small discoidal pores present in moderate numbers over surface. Oral-collar tubular ducts of one size, scattered over surface, loosely associated with dorsal multiloculars. Body setae slightly more robust than normal, shorter than those on venter; without elongate body setae on posterior abdominal segments.

Anal ring dorsal, situated near abdomen apex, with 3 rows of pores, outer row more weakly sclerotized than other two; each of its 6 setae approximately twice as long as greatest diameter of ring.

Venter with multilocular disk pores on posterior and anterior margins of abdominal segments 9 through 6, these rows restricted to posterior margins on segments 5 and 4, with a few such pores on remaining abdominal segments and lateral margins of posterior thorax. Trilocular pores scattered over surface. Small discoidal pores uncommon, lightly distributed over surface. Oral-

collar tubular ducts of two sizes: larger size same as on dorsum, most abundant, present primarily on posterior margins of abdominal segments, also along margin of thorax and head and near mouthparts; smaller size closely associated with transverse rows of body setae on most abdominal segments. Body setae normal for genus.

Circulus absent. Legs moderate in size; dorsal surface hind coxae with 54 and 57 minute, translucent pores, ventral surface with 27 and 24 (paratype, 34 and 22 dorsally, 23 and 23 ventrally); hind tibiae with these structures absent; tarsal digitules capitate, extending to tip of claw; claw digitules with unusually bulbous apex, extending beyond tip of claw; claws with denticle absent. Antennae 8-segmented. Eyes large, with discoidal pores in association.

Variation. Paratype differs in having fewer dorsal multilocular disk pores, these present on abdomen and posterior thorax only; 2 rows of pores on anal ring; no ventral multilocular disk pores anterior to abdominal segment 4; antennae either 7- or 8-segmented.

Notes. The generic placement of this species is a problem. With the presence of more than 5 pairs of cerarii, it falls well within the present limits of *Dysmicoccus*; the body form and anal-lobe cerarii, however, suggest a possible affinity with *Trionymus*.

If included in *Dysmicoccus*, it seems closest to *D. timberlakei* (Cockerell), another possible *Trionymus* candidate. This species differs from *D. timberlakei* in possessing, at most, 10 pairs of cerarii, and in having no circulus; *D. timberlakei*, on the other hand, has a full complement of 17 pairs of cerarii and a well-developed circulus.

***Dysmicoccus polymeris* Miller and McKenzie, new species**

(Figure 5)

Suggested common name. Multilocular mealybug.

Collection data. Adult females on *Lithocarpus densiflora echinoides* (Fagaceae), collected 15 mi. N. E. of Nevada City, Nevada Co., California, July 14, 1966, by D. R. Miller.

Type material. Holotype adult female (on left side of slide; single female paratype on right), deposited at UCD. Eight adult female paratypes (excluding paratype on slide with holotype) on seven slides (excluding holotype slide) (BM, CDA, UCD, USNM, VPI, ZAS).

Gross external features. This mealybug is pink with translucent legs. The derm is heavily dusted with a fluffy white secretion. From 6 to 8 thin, moderately long filaments are produced on the caudal and lateral areas of the abdomen. A loose filamentous ovisac is produced beneath and behind the body of the female. The ostiole secretion is light gray.

This species inhabits the roots of its host.

Recognition characters. Adult female holotype, mounted, 3.05 mm long, 2.10 mm wide (paratypes, 1.59 to 3.39 mm long, 0.99 to 2.54 mm wide); body broadly oval.

Dorsum with 12 and 13 cerarii, 8 cerarii on abdomen and 4 or 5 on anterior thorax and head. Anal-lobe cerarii each with 4 or 5 conical setae, 6 slender auxiliary setae, large cluster of approximately 25 trilocular pores, and unusual, partially sclerotized basal area; next 3 cerarii each with 3 or 4 conical setae, small cluster of trilocular pores. Trilocular and discoidal pores scattered over surface. Multilocular disk pores absent. Oral-collar tubular ducts present only near anterior margin of abdominal segment 9. Body setae slender, noticeably shorter than those on venter, not noticeably elongate on posterior abdominal segments.

Anal ring dorsal, situated near apical margin of abdomen; with 2 rows of pores, outer row inconspicuous and lightly sclerotized; each of its 6 setae

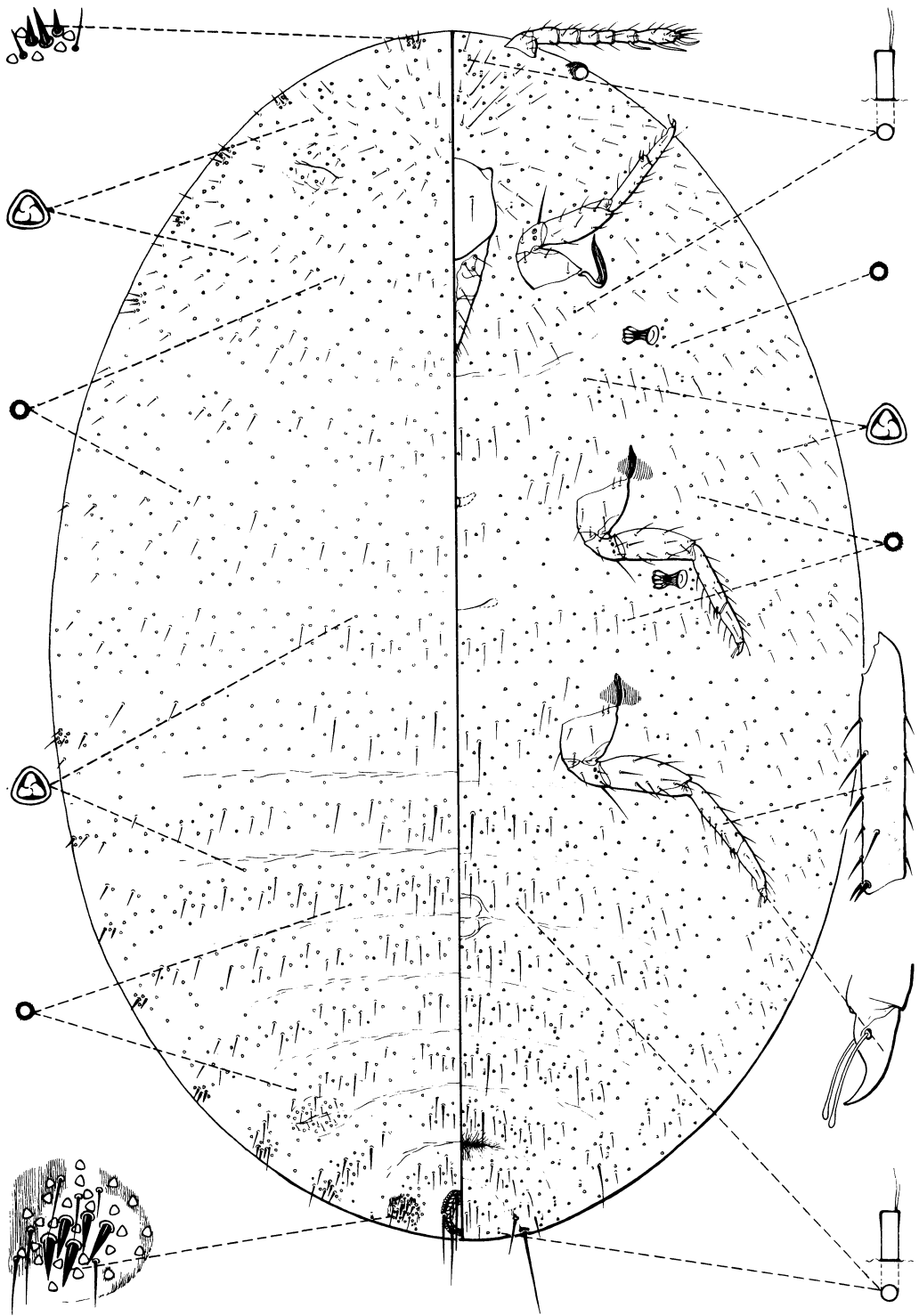


Fig. 5. *Dysmicoccus polymeris* Miller and McKenzie, new species, collected 15 miles northeast of Nevada City, Nevada County, California, July 14, 1966, on *Lithocarpus densiflora echinoides* (Fagaceae).

approximately one and one-half times as long as greatest diameter of ring.

Venter with multilocular disk pores absent. Trilocular pores present over entire surface. Discoidal pores same as on dorsum, scattered over surface. Oral-collar tubular ducts sparsely scattered over entire venter, most abundant on abdomen where distributed segmentally in transverse rows near body setae. Body setae noticeably elongate. Anal lobes with thin, sclerotized anal bar.

Circulus large and rectangular, divided and folded along intersegmental line. Legs moderate in size; hind tibiae dorsally with 8 and 10 inconspicuous translucent pores (paratypes, 0 to 13); tarsal and claw digitules capitate, extending beyond claw apex; claws with denticle absent. Antennae 7-segmented. Eyes normal for genus; no discoidal pores in association.

Variation. Paratypes differ from holotype as follows: cerarii varying in number from 11 to 13 with 6 to 8 on abdomen and 4 to 6 on anterior thorax and head; cerarian setae short and conical to slender and elongate; anal-lobe cerarii each with 2 to 5 conical setae; five out of nine paratypes possess several distorted "multilocular disk pores" near vulva; translucent pores on tibiae so inconspicuous that at times not noticeable; antennae on one paratype 6-segmented, normally 7-segmented with segment 4 showing indication of division.

Notes. The generic placement of this species is a problem. The presence of a sclerotized anal-lobe bar would place it in the tribe Planococcini, and the presence of cerarii with more than 2 conical setae would place it in the genus *Ferrisicoccus* Ezzat and McConnell. At present, it is difficult to know how much weight should be placed on the character of the anal-lobe bar. Many species of both *Dysmicoccus* and *Pseudococcus* show a broad area of ventral anal-lobe sclerotization, with a heavy bar passing through it. In some instances, the pe-

ripheral sclerotization could possibly disappear and leave only an anal bar.

The most closely related species is *Dysmicoccus difficilis* (Lobdell). Both species have multiple-seta, anal-lobe cerarii (*D. difficilis* has 2 larger conical setae and 1 or 2 smaller ones); a reduced number of cerarii, many containing more than 2 conical setae; dorsum of posterior abdominal segments without elongate body setae; no dorsal oral-collar tubular ducts or dorsal multilocular disk pores; and a large circulus.

They differ as follows: *Dysmicoccus polymeris* either completely lacks multilocular disk pores, or has a few aberrant multiloculars near the vulva; it normally possesses from 3 to 5, nearly equal conical setae on each anal-lobe cerarius; the anal-lobe cerarii are only partially sclerotized; the ventral anal lobe has a slender, sclerotized bar; and the antennae are 6- or 7-segmented; *D. difficilis*, on the other hand, has several ventral multilocular disk pores; 2 large conical setae and 1 or 2 smaller setae on each anal-lobe cerarius; completely sclerotized anal-lobe cerarii; ventral anal lobe with broad sclerotized area; and 8-segmented antennae.

Dysmicoccus polymeris is also similar to *D. obesus* (Lobdell), but differs in possessing no multilocular disk pores; normally from 3 to 5 conical setae in each anal-lobe cerarius; partially sclerotized anal-lobe cerarii; no elongate body setae on dorsum of posterior abdominal segments; ventral anal-lobe bar; and 6- or 7-segmented antennae; *D. obesus*, however, has many multilocular disk pores; 2 anal-lobe cerarian setae; completely sclerotized anal-lobe cerarii; a patch of elongate body setae on dorsum of segments 9 and 8; no ventral anal-lobe sclerotization; and 8-segmented antennae.

Inclusion of this species in the "genus" *Dysmicoccus* adds more weight to Beardsley's (1966) belief that this group is polyphyletic and should be re-examined and defined in a stricter sense.

Genus *Hypogeococcus* Rau

The pseudococcid genus *Hypogeococcus* was described by Rau in 1938. The type of the genus was designated *H. barbarae* Rau, by the rule of monotypy. Ferris (1953) described a second species, *H. spinosus*. A third species, found in Costa Rica, Guatemala, Mexico, Nicaragua, and Venezuela, and herein described as new, is added to this genus.

Both Ferris (1953) and McKenzie (1967) pointed out the possibility that *Hypogeococcus barbarae* and *H. spinosus* might not be congeneric. The differences in the dorsal enlarged setae and the presence or absence of trilocular pores supported this thought, but both authors decided to leave the species in *Hypogeococcus*. The addition of a third species seems to bridge the gap

between *H. barbarae* and *H. spinosus*. Both the new species and *H. barbarae* lack dorsal enlarged setae of the same size as those in the cerarii, and the new species and *H. spinosus* both lack trilocular pores. It is now apparent that all three species have many characters in common.

Notes. This genus shows some relationship to *Pedronia* Green. Both genera have very large cerarian setae and restricted numbers of sessile pores. *Hypogeococcus* has a single circulus and many tubular ducts, whereas *Pedronia* has neither.

Hypogeococcus is also quite close to *Pandanicola* Beardsley in most respects, but differs in possessing no oral-rim tubular ducts.

KEY TO SPECIES OF *HYPOGEOCOCCUS*: ADULT FEMALES

1. Trilocular pores present somewhere on body *barbarae* Rau
- Trilocular pores absent 2
- 2(1). Body setae on dorsum of abdomen not enlarged
othnius Miller and McKenzie
Body setae on dorsum of abdomen enlarged, of same size as those in
cerarian areas *spinosus* Ferris

Hypogeococcus othnius Miller and McKenzie, new species

(Figure 6)

Suggested common name. Strange mealybug.

Collection data. Type and paratype adult females, and immature paratype on *Cattleya* sp. (Orchidaceae), collected at Washington, D.C., from Venezuela, August 3, 1938, by L. L. Spesard.

Additional paratypes were collected as follows: Adult female on *Schomburgkia undulata* (Orchidaceae), collected at San Francisco, California, from Costa Rica, January 28, 1946, by Douglas. Adult female, one immature, on "orchid," collected at San Pedro, California, from Costa Rica, May 4,

1964, by L. R. Gillogly. Adult females on "orchid," collected at Washington, D.C., from Guatemala, September 9, 1932, by D. P. Limber. Adult female on "orchid," collected at Honolulu, Hawaii, from Guatemala, May 14, 1934, by L. A. Whitney. Adult female on "orchid," collected at Hoboken, New Jersey, from Mexico, July 5, 1941, by Price. Adult female on *Laelia* sp. (Orchidaceae), collected at Laredo, Texas, from Mexico, January 1, 1944, by E. P. Reagan. Adult female, one immature, on *Epidendrum* sp. (Orchidaceae), collected at San Francisco, California, from Mexico, August 16, 1944, by R. D. Clemens. Adult female, one immature, on "orchid," collected at Laredo, Texas, from Mexico, September 22, 1947, by unknown collector. Adult females on

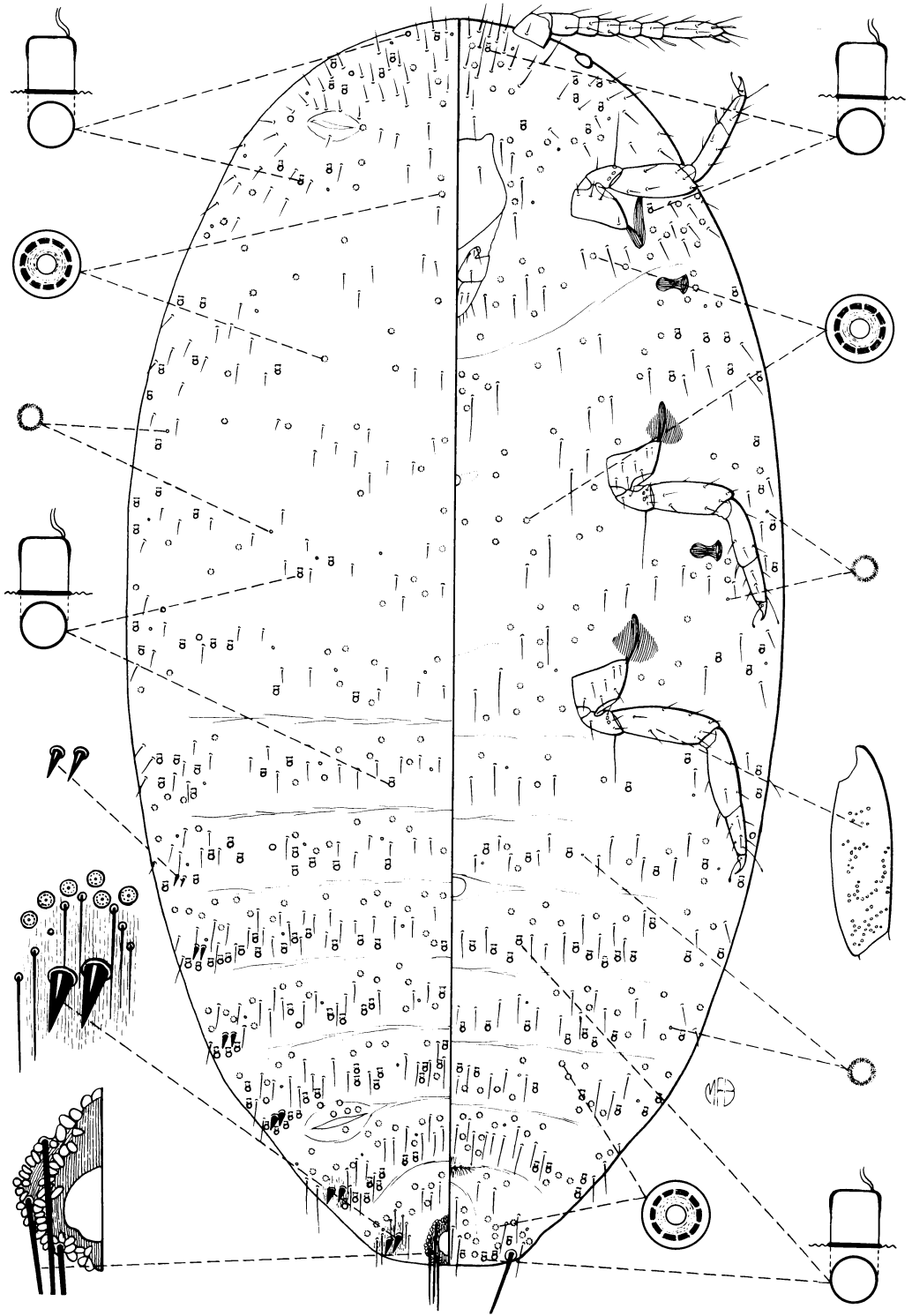


Fig. 6. *Hypogeococcus othnius* Miller and McKenzie, new species, collected in quarantine at Washington, D. C., from Venezuela, August 3, 1938, on *Cattleya* sp. (Orchidaceae).

Epidendrum sp., collected at Laredo, Texas, from Arriago, Chiapas, Mexico, July 13, 1950, by Cary. Adult female, one immature, on "orchid," collected at San Pedro, California, from Oaxaca, Mexico, December 6, 1965, by L. R. Gillogly. Adult females on "orchid," collected at San Francisco, California, from Nicaragua, July 5, 1938, by R. D. Clemens.

Type material. Holotype adult female (on slide with three paratypes; second specimen from left is holotype), deposited at USNM. Twenty-one adult female paratypes and four immature paratypes (excluding three paratypes on slide with holotype) on 15 slides (excluding holotype slide) (BM, CDA, INIA, UCD, UCS, USNM, VPI).

Gross external features. No information.

Recognition characters. Adult female holotype, mounted, 1.51 mm long, 0.94 mm wide (paratypes, from 1.24 to 2.39 mm long, 0.57 to 1.47 mm wide); body elongate to elongate oval.

Dorsum with 6 pairs of cerarii, sixth pair on one side reduced to 1 seta. Anal-lobe cerarii each with 2 large conical setae, 6 or 7 auxiliary setae, 1 or 2 multilocular disk pores, 1 small discoidal pore, weak basal sclerotization. Remaining cerarian setae becoming progressively smaller, setae of sixth pair approximately one-half length of setae of anal-lobe pair; each cerarius with 2 large, conical setae, several auxiliary setae, small discoidal pores, no basal sclerotization. Trilocular pores absent. Small discoidal pores scattered over surface. Multilocular disk pores present over entire surface, most abun-

dant on abdomen. Oral-collar tubular ducts noticeably short, with large orifices, present over entire abdomen and metathorax, restricted to marginal areas of anterior thoracic segments and head. Body setae slender, approximately same length as those on venter.

Anal ring dorsal, touching apex of abdomen; noticeably broad, although with only 2 rows of pores; each of its 6 setae over twice the length of greatest diameter of ring.

Venter with multilocular disk pores scattered over entire surface. Trilocular pores absent. Small discoidal pores present in small numbers. Oral-collar tubular ducts of same type as on dorsum, present over abdomen, restricted to body margin of thorax and head. Body setae moderate in length.

Single, undivided circulus resting on fourth-fifth intersegmental line. Legs robust; tibiae dorsally with 61 and 59 translucent pores (paratypes, 17 to 79); tarsal and claw digitules capitate, extending beyond tip of claw; claws with denticle absent. Antennae 7-segmented.

Variation. Although most of the paratypes agree with the above description, some variation has been noted. There may be 5 or 7 pairs of cerarii, and more oral-collar tubular ducts; the femur often has a few translucent pores; the circulus may be more longitudinally elongate and divided; and the antennae may be 6-segmented.

Notes. This species is distinct from the other members of this genus in that it has no enlarged dorsal body setae on the abdomen, and has very short, wide, oral-collar tubular ducts.

Genus *Mammicoccus* Balachowsky

The pseudococcid genus *Mammicoccus* was described by Balachowsky in 1959. The type of the genus was designated as *Mammicoccus murilloi* Bala-

chowsky, a Colombian species. A second species, found in Peru, and herein described as new, is added to this remarkable mealybug genus.

KEY TO SPECIES OF *MAMMICOCCLUS*: ADULT FEMALES

1. With 1 circulus, located on abdominal segment 4; oral-collar tubular ducts absent on thorax and head *murilloi* Balachowsky
- With 3 circuli, these located on abdominal segments 3, 4, and 5; oral-collar tubular ducts present on lateral areas, both dorsally and ventrally, of thorax and head *balachowskyi* Miller and McKenzie

***Mammicoccus balachowskyi* Miller and McKenzie, new species**

(Figure 7)

Suggested common name. Balachowsky mealybug.

Collection data. Adult female on flower of unidentified plant, collected 2 mi. S. Caraz Ancash, Peru (7,000 ft), February (?), 1964, by O. F. Clark.

Type material. Holotype adult female (single specimen on slide), deposited at UCD.

Gross external features. No information.

Recognition characters. Adult female holotype, mounted, 2.19 mm long, 1.06 mm wide; body elongate oval.

Dorsum with 16 and 17 cerarii; tendency for those along thoracic margin to disappear. Anal-lobe cerarii each with 2 conical setae, 1 auxiliary seta, several associated trilocular pores, no basal sclerotization. Remaining cerarii each with 2 conical setae, no auxiliary setae, slight concentration of trilocular pores; all cerarii on raised protuberances. Trilocular pores scattered over surface. Small discoidal pores in small numbers over surface. Two multilocular disk pores present on fifth abdominal segment, absent elsewhere. Oral-collar tubular ducts most abundant along body margin, with a few such pores present on medial and sublateral areas of abdomen and thorax. Body setae noticeably short, conspicuously shorter than those on venter.

Anal ring, although illustrated as dorsal, bent around abdominal apex, with 2 rows of pores; each of its 6 setae twice as long as greatest diameter of ring.

Venter with multilocular disk pores on medial region of abdomen, present on posterior and anterior margins of abdominal segments 9 through 7, restricted to posterior margins of segments 6 and 5. Quinquelocular pores present on midregion of abdominal segment 6 forward through prothorax, absent on posterior abdomen and head. Triloculars scattered as on dorsum. Small discoidal pores distributed in small numbers over surface. Oral-collar tubular ducts present along entire body margin, on medial areas of abdominal segments 7 through 2, and in small numbers near legs; variable in size but not distinctive enough to separate. Body setae moderate in length.

Three circuli; middle circulus on abdominal segment 4 quite distinctive, with 11 protuberances; circuli on segments 5 and 3 normal, each with single protuberance. Legs relatively large and slender; tibiae dorsally with 46 and 57 translucent pores, scattered along entire segment; tarsal digitules acute, not reaching tip of claw; claw digitules all broken, probably capitate; claws with noticeable denticle on plantar surface near tip. Antennae slender, 9-segmented.

Notes. This species is closely related to *Mammicoccus murilloi* Balachowsky, but differs in that it has 3 circuli; oral-collar tubular ducts on anterior abdominal segments, thorax, and head; ventral multilocular disk pores on abdominal segment 5; no quinquelocular pores on head; and many tibial translucent pores. *M. murilloi*, on the other hand, has 1 circulus; no oral-collar tubular ducts anterior to abdominal segment 5; quinquelocular pores on head; and no tibial translucent pores.

We take great pleasure in dedicating this species to our friend and colleague, Dr. A. Balachowsky, who not only named the remarkable genus to which this mealybug is assigned, but also kindly sent us the type slide of *Mammicoccus murilloi* so that we might compare it with the new species. Dr. Balachowsky has contributed much to our

knowledge of the Coccoidea through his excellent publications on this subject.

Dr. William H. Ewart, Entomologist, University of California, Riverside, kindly made available the slide mount of this new pseudococcid species. To him we extend our sincere appreciation.

Prorhizococcus Miller and McKenzie, new genus

Type of genus. Only known species so far is *Prorhizococcus atopoporus* Miller and McKenzie, herein described as new.

Recognition characters. Body form oval, somewhat more acute posteriorly. Two pairs of ostioles present.

Dorsum with single pair of conical setae on each anal lobe. Surface covered with unusual type of modified oral-rim tubular ducts. Trilocular pores present; discoidal and minute circular pores absent.

Anal ring with 2 rows of pores and 6 setae.

Venter with multilocular disk pores on abdomen. Trilocular pores scattered over surface. Oral-collar tubular ducts same type as on dorsum, present over entire surface.

Circulus absent. Legs abnormally small, as in *Rhizococcus*. Hind coxae with a few translucent pores; such pores absent on other leg segments; claws without denticle on plantar surface. Antennae 4-segmented, segment 2 showing trace of two divisions (thus may vary from 4 to 6 segments); antennae abnormally broad and short, as in *Rhizococcus*.

Notes. This genus seems somewhat related to *Rhizococcus* Kunekel d'Heroulais, with its small legs and characteristic antennae; however, the presence of cerarii, oral-rim tubular ducts rather than bi- or tritubular pores, and coxal translucent pores sets it apart from *Rhizococcus*.

Prorhizococcus is also similar to *Pygmaeococcus* McKenzie in that it has

small legs and antennae; no tri- or bitubular pores; similar type oral-collar tubular ducts scattered over both surfaces. It differs in that it has cerarii; oral-rim tubular ducts; multilocular disk pores; and no circulus. *Pygmaeococcus*, on the other hand, has no cerarii; tubular ducts without rims; no multilocular disk pores; and a circulus.

Prorhizococcus atopoporus Miller and McKenzie, new species

(Figure 8)

Suggested common name. Strange-pored mealybug.

Collection data. Adult females on unidentified grass (Gramineae), collected 10 km. S. E. El Seco, Puebla, Mexico, July 14, 1967, by D. R. Miller and J. Villanueva B.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. One adult female paratype (USNM).

Gross external features. Body, in nature, is slightly pyriform, yellow, heavily covered with a white, waxy secretion. No caudal filaments observed. A smooth ovisac covers the entire female and is approximately equal to the length of a fully developed adult female.

This mealybug inhabits the roots of its host.

Recognition characters. Adult female holotype, mounted, 1.39 mm long, 0.91 mm wide (paratype, 1.23 mm long, 0.80 mm wide); body oval, somewhat more acute posteriorly.

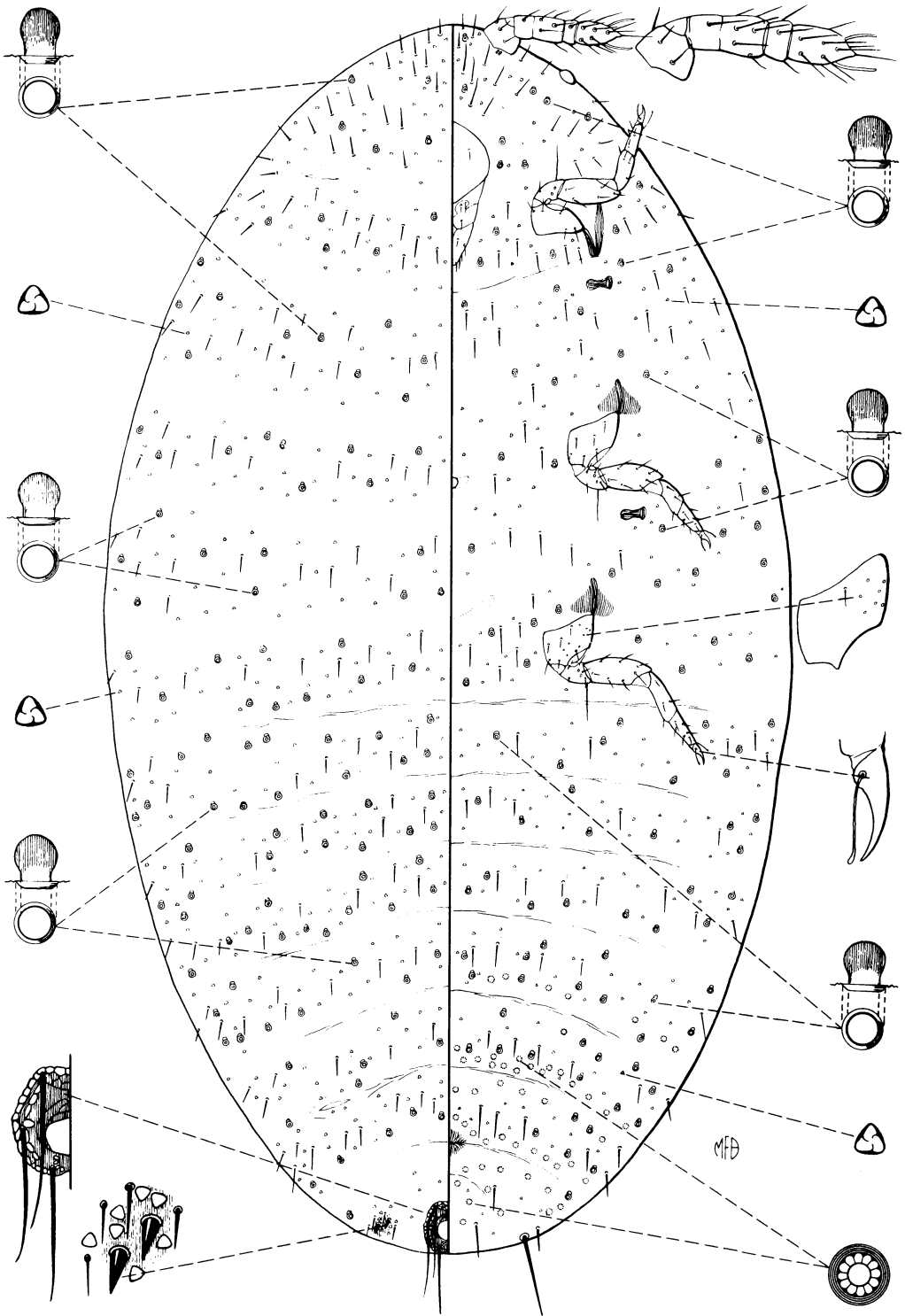


Fig. 8. *Prorhizoecus atopoporus* Miller and McKenzie, new species, collected 10 kilometers southeast of El Seco, Puebla, Mexico, July 14, 1967, on unidentified grass (Gramineae).

Dorsum with single pair of cerarii (anal lobe), each with 2 conical setae, 3 or 4 auxiliary setae, cluster of 7 or 9 trilocular pores, and sclerotized basal area. Trilocular pores in reduced numbers over surface. Discoidal pores absent. Oral-rim tubular ducts distinctive; area farthest from derm bulbous, heavily sclerotized, with rim surrounding dermal orifice; distributed over entire surface, least numerous on head. Dorsal body setae elongate, either nearly as long as or equal to those on venter.

Anal ring dorsal, touching posterior apex of abdomen, with 2 rows of pores; each of its 6 setae approximately one and one-half times as long as greatest diameter of ring.

Venter with multilocular disk pores present on posterior and anterior margins of abdominal segments 9 and 8, present on posterior margin of segments 7 and 6, one such pore on anterior margin of segment 7. Trilocular pores sparsely scattered over surface. Discoidal pores absent except on or

near antennae. Oral-rim tubular ducts same as on dorsum, present over entire surface. Body setae short, equal to dorsal body setae on all areas except abdominal segments 9 and 8, where ventral setae are slightly longer.

Circulus absent. Legs small; hind coxae dorsally with 7 and 6 translucent pores, ventrally with 7 and 8 pores (paratype, 8 and 9 dorsally, 9 and 13 ventrally); tarsal digitules capitate, not reaching tip of claw; claw digitules capitate, slightly longer than claw; claws slender, denticle absent. Antennae 4-segmented, but segment 2 showing indication of two divisions. Eyes small.

Variation. The paratype agrees in detail with the holotype. The only noticeable difference is that the anterior margin of abdominal segment 7 has 3 multilocular disk pores rather than 1.

Notes. This species is most closely related to *Pygmaeococcus morrisoni* McKenzie. For comparison, see "Notes" under *Prorhizococcus*.

Genus *Pseudococcus* Westwood

This genus, with the single species herein described as new, contains 21 species for North America. To accom-

modate the new species the key presented by McKenzie (1967) is revised as follows:

- A. Circulus absent *beardsleyi* Miller and McKenzie
 Circulus present 1
 1(A). "With at least a few translucent pores present on trochanter of hind leg *sorghiellus* (Forbes)"

Pseudococcus beardsleyi Miller and McKenzie, new species

(Figure 9)

Suggested common name. Beardsley mealybug.

Collection data. Type and paratype adult females on *Arctostaphylos subcordata* (Ericaceae), collected on South Ridge, west of University of California Research Station, Santa Cruz Island, Santa Barbara Co., California, June 18, 1967, by D. R. Miller, M. R. Benedict, and A. S. Menke.

Additional paratypes were collected as follows: Adult females on *Arctostaphylos* sp., on trail to Mt. Wilson, Los Angeles Co., California, June 27, 1968, by J. W. Beardsley. Adult females on *A. canescens*, collected at Inverness, Marin Co., California, June 23, 1968, by D. R. Miller and R. F. Denno. Adult females on *A. canescens*, collected at Mt. Tamalpais, Marin Co., California, June 12, 1968, by J. W. Beardsley.

Type material. Holotype adult female (single specimen on slide), depos-

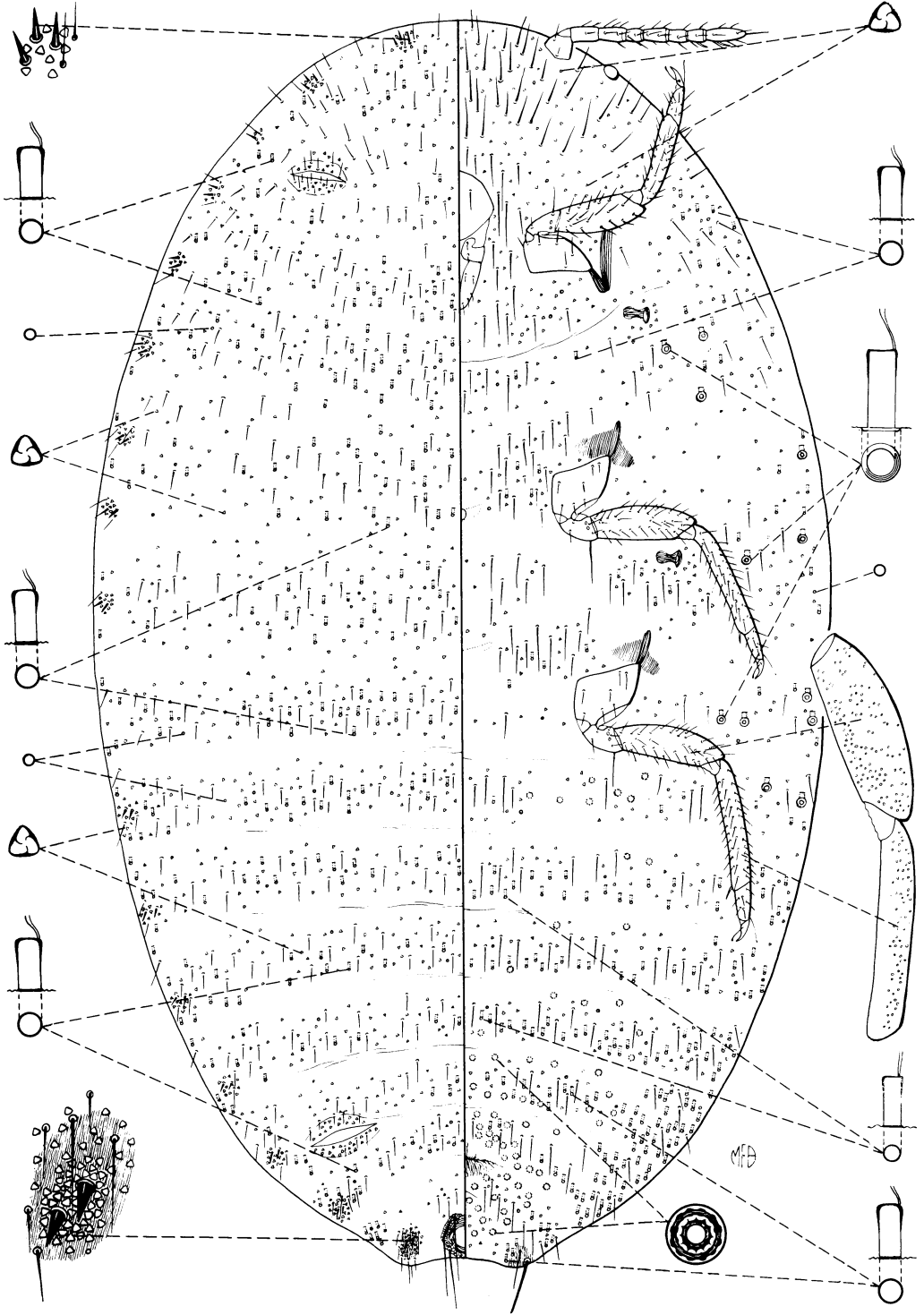


Fig. 9. *Pseudococcus beadsleyi* Miller and McKenzie, new species, collected at Santa Cruz Island, South Ridge, west of University of California Research Station, Santa Barbara County, California, June 18, 1967, on *Arctostaphylos subcordata* (Ericaceae).

ited at UCD. Thirty-two adult female paratypes on 24 slides (BM, CDA, INIA, UCS, UCD, UH, USNM, VPI, ZAS).

Gross external features. The body form of the adult female is oval. This mealybug is lightly dusted with a fluffy, white secretion which only partly covers the red body of the adult female. Fifteen or 16 pairs of lateral filaments surround the body; the caudal pair is elongate, varying from one-half to three-quarters the length of the body; the remaining filaments are all approximately equal except for the penultimate pair, which is slightly longer. A filamentous ovisac is produced which completely encloses the adult female and many orangish-yellow eggs. The body contents are red when the female is crushed. The ostiole secretion is yellow.

This mealybug is found on the leaves and branches of several glandular species of *Arctostaphylos*.

Recognition characters. Adult female holotype, mounted, 3.06 mm long, 1.90 mm wide (paratypes, 2.18 to 3.48 mm long, 1.14 to 2.29 mm wide); body oval.

Dorsum with 15 or 16 cerarii. Anal-lobe cerarii large, each with 2 robust, conical setae, 3 or 4 auxiliary setae, conspicuous cluster of approximately 45 trilocular pores, 1 or 2 minute circular pores, large area of heavy sclerotization. Penultimate cerarii each with 2 conical setae noticeably smaller than those on anal lobes, but larger than those on remaining cerarii, 4 or 5 auxiliary setae, cluster of approximately 20 trilocular pores, one small discoidal pore, small area of sclerotization; remaining abdominal and thoracic cerarii each with 2 elongate, conical setae, 2 or 3 auxiliary setae, 9 or 10 trilocular pores, from zero to 2 small discoidal pores, no basal sclerotization; cerarii on abdominal segment 2 absent; ninth cerarius counting forward from anal-lobe pair reduced, with 2 slightly robust body setae, 1 or 2 auxiliary body setae, 4 or 5 asso-

ciated trilocular pores, no basal sclerotization; with 3 pairs of cerarii on head, the two most anterior pairs each with 3 or 4 conical setae, 2 or 3 auxiliary setae, 7 or 8 associated trilocular pores, no basal sclerotization; remaining pair on head reduced, same as reduced thoracic cerarii. Trilocular and small discoidal pores in small numbers over surface. Multilocular disk pores absent. Oral-rim tubular ducts absent. Oral-collar tubular ducts present over surface, most abundant on medial and lateral areas with bare area between. Body setae noticeably shorter than those on venter.

Anal ring dorsal, touching posterior apex of abdomen, with 2 rows of pores, outer row only slightly sclerotized; each of its 6 setae about one and one-half times as long as greatest diameter of ring.

Venter with multilocular disk pores on medial region of abdomen. These pores present on posterior and anterior margins of abdominal segments 9 through 6, on anterior margins of segments 5 and 4 with perhaps 1 or 2 such pores on posterior margins, also scattered over segment 3. Trilocular and small discoidal pores same as on dorsum. Large discoidal pores absent. Oral-rim tubular ducts present on lateral areas of anterior abdominal segments and on thorax near spiracles and lateral margins. Oral-collar tubular ducts of two sizes: larger size same as on dorsum, primarily restricted to lateral areas; smaller size present in medial and mediolateral areas of abdomen and thorax, least abundant on medial portion of thorax, absent on head. Body setae normal for genus.

Circulus absent. Legs slender; hind coxae with translucent pores absent; femora dorsally with 170 and 139 pores (paratypes, 90 to 182), absent ventrally; tibiae dorsally with 82 and 89 pores (paratypes, 47 to 108), absent ventrally; tarsal and claw digitules capitate, extending beyond tip of claw;

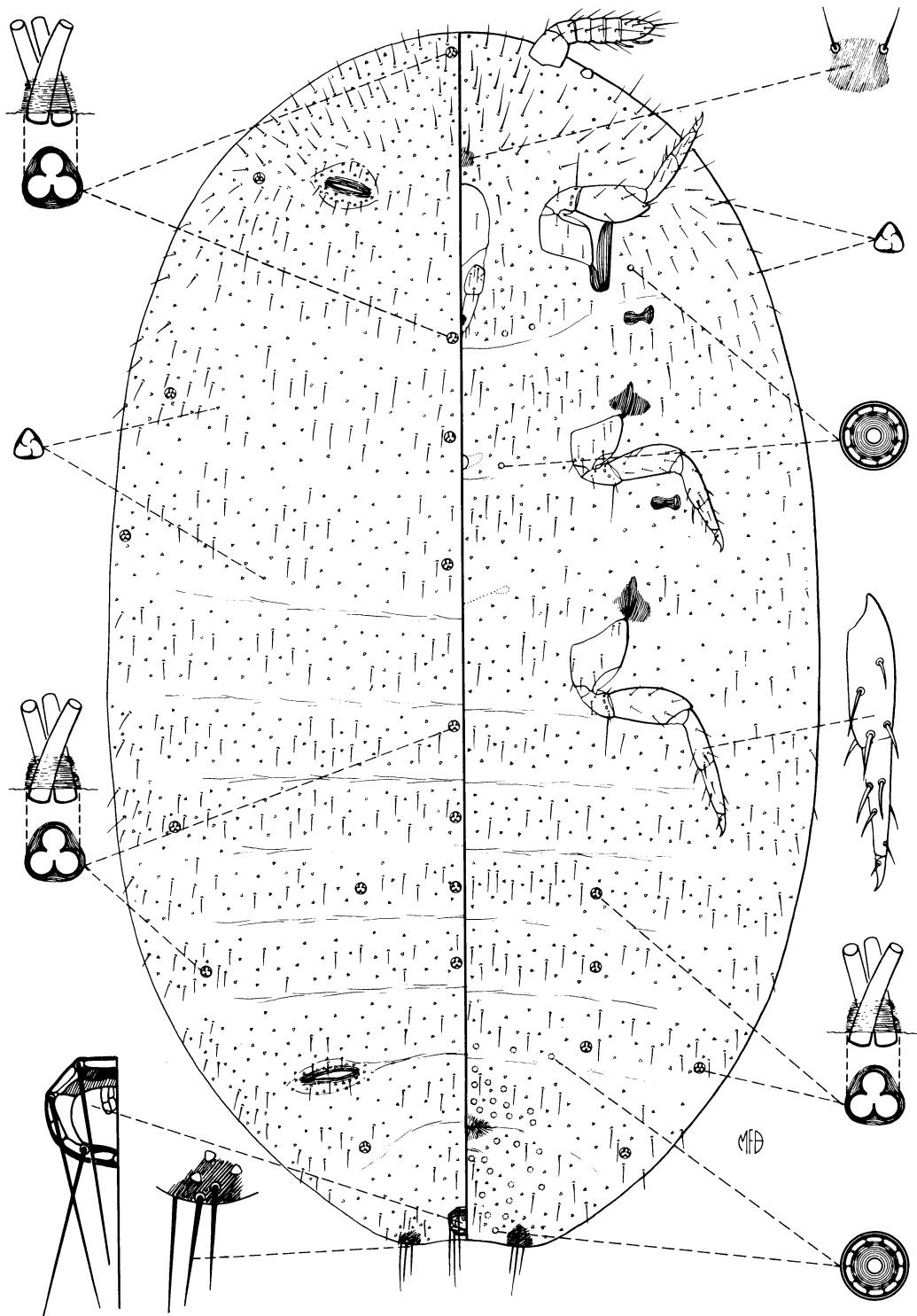


Fig. 10. *Rhizococcus neostangei* Miller and McKenzie, new species, collected at Jalapa (Rio Cedeño), Vera Cruz, Mexico, July 16, 1967, on *Rhus* (?) sp. (Anacardiaceae).

each with small area of sclerotization bearing 3 elongate body setae and 3 or 4 trilocular pores. Multilocular disk pores absent. Trilocular pores scattered over surface. Tritubular pores forming 5 broken longitudinal lines (1 medially, 2 mediolaterally, 2 laterally), from ninth abdominal segment forward through head. Oral-collar tubular ducts absent. Body setae slender, slightly shorter than ventral setae.

Anal ring dorsal, with inner row of pores clouded; each of its 6 setae approximately twice as long as greatest diameter of ring.

Venter with multilocular disk pores in transverse rows across abdominal segments 9, 8, and 7, restricted to posterior margin on segment 7; also present near anterior two pairs of legs. Tri-

locular pores scattered over entire surface. Tritubular pores restricted to abdomen, forming 4 longitudinal lines (2 mediolaterally, 2 laterally). Oral-collar tubular ducts absent. Body setae relatively short, slender.

Circulus absent. Legs well developed; tibiae and tarsi armed with a few stout spines; tarsal digitules absent; claws with short, setose digitules, no denticle. Antennae 6-segmented; sixth segment with 4 sensory setae, same size as single sensory seta on segment 5.

Notes. This species is most closely related to *Rhizococcus stangei* McKenzie, but differs in that it has no dorsal multilocular disk pores. *R. stangei*, on the other hand, has several dorsal multilocular disk pores scattered over abdominal segments 8 through 6.

Genus *Spilococcus* Ferris

This genus, with the two species herein described as new, contains 24 species for North America. To accommodate the

new species, the key presented by McKenzie (1967) should be revised as follows:

- A(3). Noticeable cluster of oral-collar tubular ducts on venter between anterior spiracle and body margin*villanuevai* Miller and McKenzie
- Ventral oral-collar tubular ducts absent between anterior spiracle and body margin 4
- 4(A). "Frontal cerarius definitely developed, with 2 to 3 conical setae set close together*larreae* Ferris"
- and
- 19(18). Noticeable cluster of oral-collar tubular ducts on venter between anterior spiracle and body margin B
- Ventral oral-collar tubular ducts absent between anterior spiracle and body margin 21
- B(19). Many dorsal setae noticeably more robust than remaining body setae*nototrichus* Miller and McKenzie
- Dorsal enlarged setae absent 20
- 20(B). "6 or 7 noticeable pairs of cerarii on abdomen counting forward from anal lobes, absent on thorax and head; oral-collar tubular ducts very lightly scattered over dorsal surface, except for segment 9*keiferi* McKenzie"

Spilococcus nototrichus Miller and McKenzie, new species
(Figure 11)

Suggested common name. Dorsal-spine mealybug.

Collection data. Adult females, one immature, on *Eriogonum* sp. (Polygonaceae), collected at Newport Beach (Back Bay), Orange Co., California, December 21, 1964, by D. R. and J. F. Miller.

Type material. Holotype adult female (on right side of slide; one paratype on left), deposited at UCD.

Gross external features. This mealybug is cream-colored. The derm is lightly dusted with a smooth, white, waxy secretion. The filaments were observable only on the caudal areas.

It is found on the main roots of its host.

Recognition characters. Adult female holotype, mounted, 1.98 mm long, 1.10 mm wide; body elongate oval.

Dorsum with 16 or 17 cerarii. Anal-lobe cerarii each with 2 elongate conical setae, 5 or 6 slender auxiliary setae, cluster trilocular pores, weak area basal sclerotization. Remaining abdominal cerarii each with 2 or 3 elongate, conical setae, and small cluster of trilocular pores. Thoracic and head cerarii each with 1 or 2 slender conical setae and no associated trilocular pores. Multilocular disk pores absent. Dorsum evenly beset with trilocular pores. Large discoidal pores present in small numbers over dorsum. Oral-rim tubular ducts in moderate numbers over entire surface. Oral-collar tubular ducts of two sizes: larger size forming conspicuous clusters on lateral margins of abdominal segments 9 through 2; smaller size rare, present near cerarii on abdominal segments 9 through 3. Body setae noticeably enlarged; although longer than cerarian setae, approximately of same basal diameter, shorter than ventral body setae.

Anal ring dorsal, touching abdominal apex, with 2 rows of pores, outer row weakly sclerotized; each of its 6 setae about one and one-half times as long as greatest diameter of ring.

Venter with multilocular disk pores present on posterior margins of abdominal segments 9 through 7, rows restricted to posterior margins on segments 6 and 5, with a few such pores on segments 4 and 3, one posterior to front pair of legs. Trilocular pores scattered over surface. Large discoidal pores rare,

lightly distributed over surface. Oral-rim tubular ducts in small numbers along body margin, 1 or 2 on abdomen, 3 or 4 on thorax, 1 on head. Oral-collar tubular ducts same size as on dorsum: larger size present in transverse rows along posterior margin of abdominal segments 9 through 4, present in lateral cluster on abdominal segment 3, in characteristic cluster between anterior spiracles and body margins; smaller size in small numbers, closely associated with transverse rows of body setae on abdomen, a few present on thorax. Body setae noticeably elongate.

Circulus absent. Legs normal for genus; dorsal surface of hind coxae with 30 and 50 translucent pores, ventral surface with 0 and 22; dorsal surface of hind femora with 9 and 19 translucent pores, ventral surface with 0 and 6; dorsal surface of hind tibiae with 23 and 26 translucent pores, these pores absent on ventral surface; tarsal and claw digitules capitate, reaching tip of claw; claws with denticle absent. Antennae 8-segmented.

Notes. Although this species falls well within the limits of the genus *Spilococcus*, it most closely resembles a member of *Pseudococcus*. *P. megasetosus* McKenzie and the species herein described as new both have enlarged dorsal body setae, two sizes of oral-collar tubular ducts showing approximately the same distribution patterns, full complement of cerarii, same type of discoidal pores, and multilocular disk pores of approximately the same type and placement. They differ, however, not only in generic characters, but also in the circulus, coxal and femoral translucent pores, oral-rim tubular ducts, and antennae.

Within *Spilococcus*, the new species remotely resembles *S. keiferi* McKenzie. It differs in that it has dorsal enlarged body setae; 16 or 17 pairs of cerarii; femoral pores; and no dorsomedial oral-collar tubular ducts. *S. keiferi*, on the other hand, has no dorsal enlarged body

setae; 6 or 7 pairs of cerarii; no femoral pores; and a few medial oral-collar tubular ducts.

***Spilococcus villanuevai* Miller and
McKenzie, new species**

(Figure 12)

Suggested common name. Villanueva mealybug.

Collection data. Adult females, one immature, on *Rhus* (?) sp. (Anacardiaceae), collected at Jalapa (Rio Ce-deño), Vera Cruz, Mexico, July 16, 1967, by D. R. Miller and J. Villanueva B.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. One immature paratype (UCD).

Gross external features. This mealybug is lightly covered with a smooth, white, waxy secretion. A full complement of 17 pairs of filaments surrounds the body margins. The body is light gray.

It was found on the underside of a leaf of the host plant.

Recognition characters. Adult female holotype, mounted, 2.40 mm long, 1.30 mm wide; body narrowly oval.

Dorsum with 17 pairs of cerarii. Anal lobe cerarii each with 2 slender, conical setae, 2 auxiliary setae, associated cluster of trilocular pores, and basal area of moderate sclerotization. Remaining cerarii each containing 2 slender, conical setae, reduced cluster of trilocular pores, and small area of light sclerotization. Dorsum evenly beset with sparsely scattered trilocular pores. Small discoidal pores inconspicuous, few in number. Oral-rim tubular ducts forming 3 longitudinal lines, 1 medially, and 1 along each body margin near cerarii, these present from abdominal segment 8 forward through head. Oral-collar tubular ducts strictly marginal, restricted to abdomen. Body setae short and slender.

Anal ring apical, with 2 distinct rows of pores; each of its 6 setae about twice as long as greatest diameter of ring.

Venter with multilocular disk pores present in transverse rows from abdominal segments 9 through 5; anterior margin of segments 6 and 5 with no such pores. Trilocular pores evenly beset over venter. Small discoidal pores of same size and shape as those on dorsum, sparsely distributed. Oral-rim tubular ducts variable; one side with a few pores scattered near the lateral margins from abdominal segment 6 through head, other side with these ducts absent. Oral-collar tubular ducts numerous, of two sizes; smaller size infrequent, associated with transverse row of elongate body setae on segments 8 through 4, a few present in medial area of thorax near legs; larger size numerous, forming large lateral clusters and transverse rows on posterior margins of segments 9 through 3; also present in characteristic clusters between anterior spiracles and body margin. Body setae elongate.

Circulus moderate in size, divided by intersegmental line. Legs well developed; dorsal surface of hind coxae with 27 and 42 translucent pores, ventral surface with 7 and 14; hind tibiae with these structures absent; tarsal and claw digitules capitate, reaching tip of claw; claws with denticle absent. Antennae 8-segmented, although segment 3 appears somewhat divided.

Notes. This species is most closely related to *Spilococcus corticosus* McKenzie in that it has many cerarii and a cluster of oral-collar tubular ducts between anterior spiracle and body margin. It differs from *S. corticosus* in having no dorsal oral-collar tubular ducts, a full complement of 17 pairs of cerarii, and a large, divided circulus. *S. corticosus*, on the other hand, has: many dorsal oral-collar tubular ducts; 5 to 14 pairs of cerarii; and no circulus or, if present, small and undivided.

We take great pleasure in naming

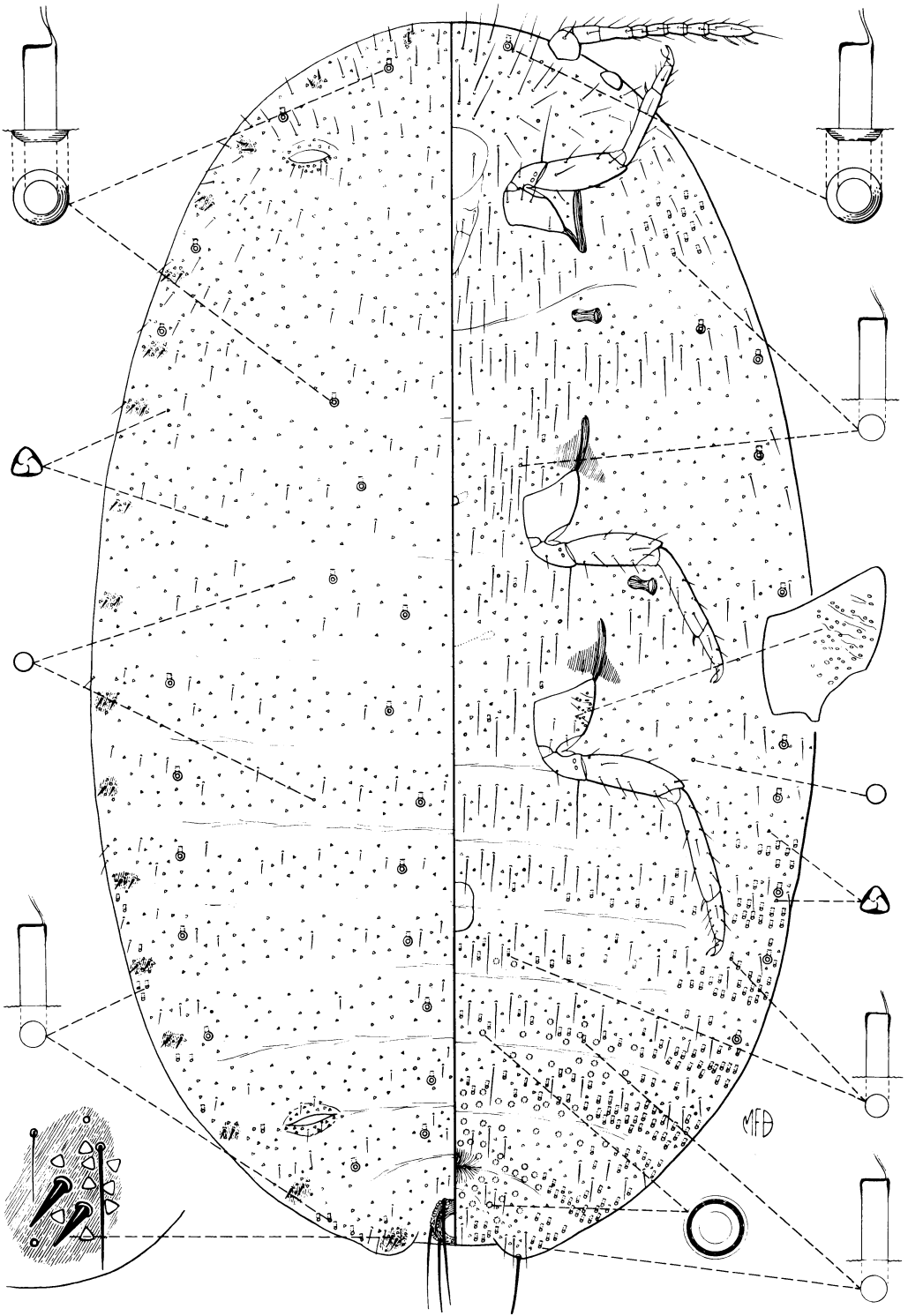


Fig. 12. *Spilococcus villanuevai* Miller and McKenzie, new species, collected at Jalapa (Rio Cedeño), Vera Cruz, Mexico, July 16, 1967, on *Rhus* (?) sp. (Anacardiaceae).

this mealybug after Dr. Juan Villanueva B. who has been very helpful in making available pseudococcid specimens from Mexico.

Genus *Trionymus* Berg

This genus, with the three species herein described as new, contains 23 species for North America. To accommodate the new species, the key presented by McKenzie (1967) should be revised as follows:

- A(3). Oral-collar tubular ducts absent on dorsal surface; ventral multilocular disk pores absent on abdominal segment 6
coronus Miller and McKenzie
 Oral-collar tubular ducts present on dorsum of last 3 or 4 abdominal segments; ventral multilocular disk pores present on abdominal segment 6 4
- 4(A). "Discoidal pores with poriferous centers numerous on both body surfaces; hind coxae not perceptibly larger than coxae of other legs
nanus Cockerell"
 and
- B(6). Discoidal pores present C
 Discoidal pores absent 7
- C(B). With two distinct sizes of oral-collar tubular ducts; multilocular disk pores concentrated around spiracles ... *strongylus* Miller and McKenzie
 With only one size oral-collar tubular duct; multilocular disk pores not concentrated around spiracles D
- D(C). Circulus small and oval; antennae 7-segmented
magnus (Cockerell and Cockerell)
 Circulus large and quadrate; antennae 6-segmented
idahoensis Miller and McKenzie
- 7(B). Dorsal multilocular disk pores present on mesothorax through head; antennae normally 7-segmented 8
 Dorsal multilocular disk pores absent on mesothorax through head, except for an occasional pore; antennae normally 8-segmented, rarely with 7 *utahensis* (Cockerell)
- 8(7). Ventral multilocular disk pores on abdomen unusually numerous, those of segments 7 to 5 medially arranged in broad bands of 4 pores deep *clandestinus* McConnell
 Ventral multilocular disk pores on abdomen medially in bands nowhere more than 2 pores deep *caricis* McConnell
 and
 delete couplet number 9(8) in McKenzie (1967).

Trionymus coronus Miller and McKenzie, new species

(Figure 13)

Suggested common name. Crown mealybug.

Collection data. Adult females on unidentified grass (Gramineae), col-

lected 10 km. S. W. Jalapa, Vera Cruz, Mexico, July 13, 1967, by D. R. Miller and J. Villanueva B.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. Four adult female paratypes on three slides (UCD, USNM, INIA).

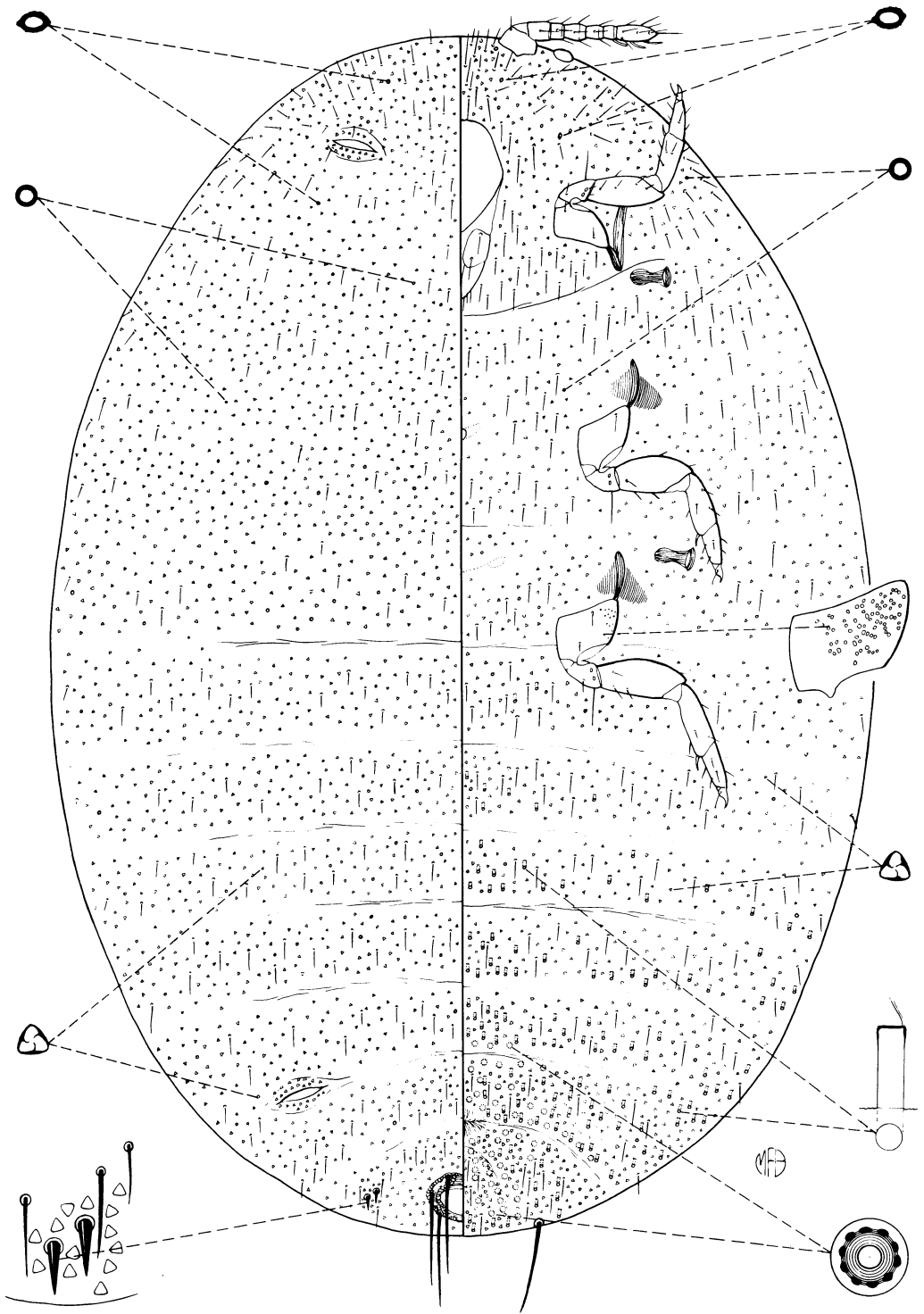


Fig. 13. *Trionymus coronus* Miller and McKenzie, new species, collected 10 kilometers southwest of Jalapa, Vera Cruz, Mexico, July 13, 1967, on unidentified grass (Gramineae).

Gross external features. This mealybug is lightly dusted with a smooth white bloom which does not cover the yellow body color. A single pair of short caudal filaments is apparent. A filamentous ovisac is produced beneath and behind the adult female and is from one-half to three-fourths as long as the total length of a completely mature female.

This mealybug is found on the crown and roots of the host plant.

Recognition characters. Adult female holotype, mounted, 2.16 mm long, 1.52 mm wide (paratypes, 2.16 to 2.76 mm long, 1.52 to 2.42 mm wide); body broadly oval.

Dorsum with single pair of cerarii (anal lobe), each with 2 conical setae, 2 or 3 slender auxiliary setae, small cluster trilocular pores, no basal sclerotization. Trilocular pores numerous, evenly beset over dorsum. Multilocular disk pores absent. Discoidal pores slightly smaller than trilocular pores, becoming increasingly larger anteriorly; present in small numbers over entire dorsum. Oral-collar tubular ducts absent. Body setae slender, only slightly shorter than those on venter.

Anal ring dorsal, removed anteriorly from apex of abdomen by approximately one-half of ring diameter, with 2 rows of conspicuous pores; each of its 6 setae about twice as long as greatest diameter of ring.

Venter with multilocular disk pores restricted to segments 9 through 7, those on segment 7 present only on posterior margin. Trilocular pores abundant, evenly beset over venter. Discoidal pores of same sizes as on dorsum, present in small numbers over entire venter, most abundant along lateral margins. Oral-collar tubular ducts variable in size, present from abdominal segments 9 through 3, most abundant in medial areas. Body setae noticeably short.

Circulus absent. Legs small, robust; dorsal surface of hind coxae with 69 and 83 conspicuous translucent pores

(paratypes, 42 to 97), ventral surface with 0 and 5 (paratypes, 0 to 9); hind tibiae with these pores absent; tarsal and claw digitules capitate, extending beyond tip of claw; claws with denticle absent. Antennae, 8-segmented on one side, 7 on the other.

Variation. Paratype adult females with as few as 2 multilocular disk pores on venter of abdominal segment 7; rarely with 1 oral-collar tubular duct on dorsum of abdominal segment 9; antennae rarely 8-segmented, usually 7.

Notes. This species is most closely related to *Trionymus nanus* Cockerell, but differs in that it has no ventral multilocular disk pores on abdominal segment 6; hind coxae noticeably larger than anterior coxae; no dorsal oral-collar tubular ducts; and anal ring removed from apex of abdomen by at least one-half of diameter of anal ring. *T. nanus* has at least a few ventral multilocular disk pores on segment 6; hind coxae of same size as anterior coxae; several dorsal oral-collar tubular ducts; and anal ring apical.

This species is also closely related to *Trionymus smithii* (Essig), but differs in that it has no ventral multilocular disk pores on abdominal segment 6; and no dorsal multilocular disk pores nor oral-collar tubular ducts. *T. smithii* has many multilocular disk pores on venter of abdominal segment 6; and at least a few dorsal multilocular disk pores and oral-collar tubular ducts.

There is also a remarkable similarity between this species and *Chnaurococcus trifolii* (Forbes), but it has many more trilocular pores (i.e., dorsum of abdominal segment 8 with approximately 200 such pores), no ventral multilocular disk pores on abdominal segment 6, and is found on grass host. *C. trifolii*, on the other hand, has only a light scattering of trilocular pores (i.e., dorsum of abdominal segment 8 with approximately 100 such pores), a few ventral multilocular disk pores on abdominal segment 6, and is never found on grass.

***Trionymus idahoensis* Miller and
McKenzie, new species**

(Figure 14)

Suggested common name. Idaho mealybug.

Collection data. Type and paratype adult females on *Elymus* sp. (Gramineae), collected at St. Anthony Sand Dunes, Fremont Co., Idaho, August 5, 1967, by D. R. Miller and D. S. Horning. One adult female paratype and one adult female on *Elymus* sp., collected 2 mi. S. Driggs, Teton Co., Idaho, August 4, 1967, by D. R. Miller and D. S. Horning.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. Seven adult female paratypes on five slides (BM, CDA, UCD, USNM, VPI).

Gross external features. This mealybug is lightly dusted with a smooth white bloom through which the pink or red body is readily visible. A single pair of minute caudal filaments is normally apparent. A smooth, loosely felted ovisac is produced which encloses the entire female and many bright red eggs.

This species has been found on the crown and main roots of its grass host.

Recognition characters. Adult female holotype, mounted, 2.83 mm long, 1.84 mm wide (paratypes, 1.68 to 3.59 mm long, 1.08 to 2.03 mm wide); body broadly oval.

Dorsum with single definite pair of cerarii (anal lobe), each with 2 slender, conical setae, 1 auxiliary seta, cluster trilocular pores, several associated discoidal pores, and weak area of basal sclerotization. Multilocular disk pores present from posterior abdominal segment through prothorax, most numerous on abdominal segments 8 and 7. Dorsum evenly beset with many trilocular pores. Two sizes discoidal pores present over surface, most numerous near anal-lobe cerarii. Oral-collar tubular ducts small, present from apex of abdomen forward through prothorax.

Body setae short, slender, approximately same size as those on venter.

Anal ring dorsal, slightly removed from apex of abdomen, with 2 rows of pores, outer row weakly sclerotized; each of its 6 setae approximately equal in length to greatest diameter of ring.

Venter with multilocular disk pores present in transverse rows from abdominal segment 9 through head. Trilocular pores numerous over entire surface. Discoidal pores of two sizes, in small numbers over venter. Oral-collar tubular ducts same as on dorsum, present from abdominal segment 9 forward through head. Body setae short.

Circulus large, square, divided by intersegmental line. Legs well developed; dorsal surface of hind coxae with 22 and 42 small translucent pores (paratypes, 27 to 46), ventral surface with 9 and 12 (paratypes, 10 to 21); tarsal and claw digitules capitate, reaching tip of claw; claws with denticle absent. Antennae 6-segmented.

Variation. Paratypes all conform closely with type, although several minor variations exist: rarely with no ventral multilocular disk pores on head or, if present, with no more than 2; anal ring rarely apical.

Single specimen not included in type series differs in having no dorsal multilocular disk pores, ventral multiloculars restricted to posterior margins of apical five abdominal segments, discoidal pores much more numerous on both surfaces, perhaps replacing the multiloculars.

Notes. This species is close to several other species, but it does not fit any one of them. It is most closely related to *Trionymus caricis* McConnell, but differs in possessing discoidal pores all over the body, whereas *T. caricis* completely lacks these structures.

It is close to *Trionymus magnus* (Cockerell and Cockerell), but differs in having two sizes of discoidal pores, a large circulus, and 6-segmented antennae, whereas *T. magnus* has only one size of discoidal pore, a very small circulus, and 7-segmented antennae.

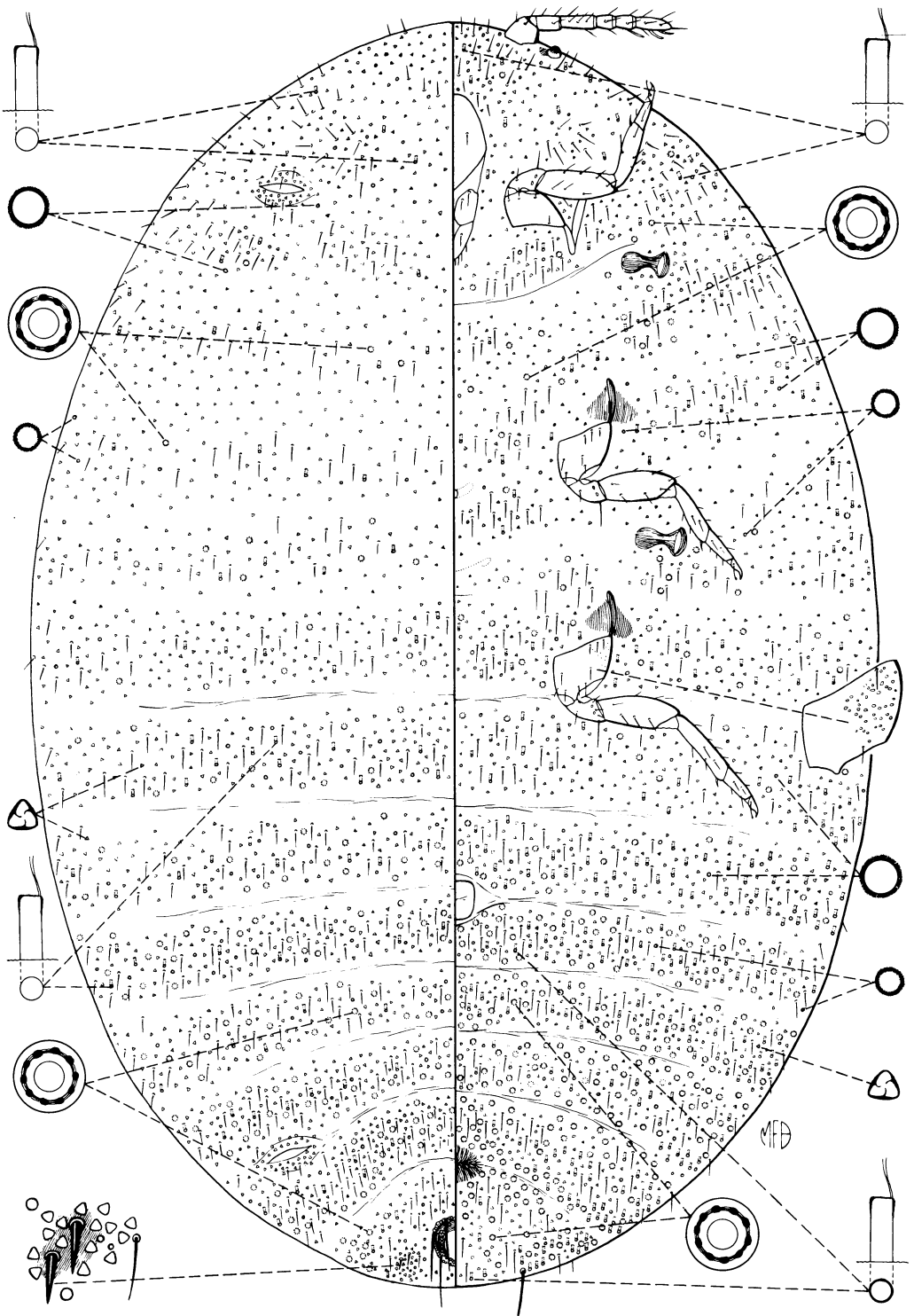


Fig. 14. *Trionymus idahoensis* Miller and McKenzie, new species, collected at Saint Anthony Sand Dunes, Fremont County, Idaho, August 5, 1967, on *Elymus* sp. (Gramineae).

***Trionymus strongylus* Miller and
McKenzie, new species**

(Figure 15)

Suggested common name. Rotund mealybug.

Collection data. Adult females on *Trichachne* sp. (Gramineae), collected at Madera Canyon, Santa Cruz Co., Arizona, July 31, 1966, by D. R. Miller.

Type material. Holotype adult female (single specimen on slide), deposited at UCD. Six adult female paratypes on three slides (BM, UCD, USNM).

Gross external features. The adult female is pyriform. This mealybug is lightly dusted with a smooth, white bloom which does not conceal the light-purple body color. A heavy, felted sac completely encloses the adult female as in *Cryptoripersia salina* (Ehrhorn). This sac varies from one to one and one-half times the length of a fully formed adult female. First-instar nymphs within the sac are light yellow.

This mealybug is found on the "bulbs" and roots of its host.

Recognition characters. Adult female holotype, mounted, 2.45 mm long, 1.93 mm wide (paratypes, 3.48 to 4.20 mm long, 2.11 to 3.31 mm wide); body rotund.

Dorsum with single pair of cerarii (anal lobe), each with 2 conical setae, 2 slender auxiliary setae, small cluster trilocular pores, 1 or 2 oral-collar tubular ducts, and small, weakly sclerotized basal area. Trilocular pores in moderate numbers over surface. Multilocular disk pores present on posterior and anterior margins of each abdominal segment, also present on thorax, absent on head. Small discoidal pores smaller than trilocular pores, scattered over entire surface. Oral-collar tubular ducts of two sizes: larger size in very small numbers, present only on lateral areas of anterior abdominal segments, thorax, and head; smaller size abundant over entire surface, least common on head.

Body setae only slightly shorter than those on venter.

Anal ring dorsal, removed anteriorly from apex of abdomen by approximately one-fourth of ring diameter; this structure unusually broad, with 3 or 4 rows conspicuous pores; each of its 6 setae approximately one and one-half times as long as greatest diameter of ring.

Venter with multilocular disk pores on posterior and anterior margins of abdominal segments 9 through 3, these rows restricted to posterior margin on segment 2; also restricted to lateral and sublateral areas of thorax, with large clusters concentrated around spiracles; nearly absent on head. Trilocular and small discoidal pores scattered over surface. Oral-collar tubular ducts of same two sizes as on dorsum: larger size present in small numbers along posterior margin of thorax; smaller size abundant over entire surface. Body setae short.

Circulus unusually small, surrounded by intersegmental line, not divided. Legs small; hind coxae unusually broad, dorsal surface with 23 and 29 translucent pores (paratypes, 20 to 28), ventral surface with 29 and 33 (paratypes, 27 to 46), with 3 or 4 pores separate from each coxa on derm anterior to each hind leg; hind tibiae with translucent pores absent; tarsal and claw digitules capitate, extending beyond tip of claw; claws without denticle. Antennae 6-segmented.

Variation. The paratypes differ from the holotype in the following manner: body form on slide rarely pyriform; multilocular disk pores rarely less abundant, but of same distribution patterns, sometimes with a few such pores on dorsum of head; larger sized oral-collar tubular ducts may be more or less abundant (one specimen has as few as 4 such ducts); there are frequently 2 circuli; antennae either 6- or 7-segmented.

Notes. Generic placement of this species is difficult because of the rotund body form, but since it is most closely

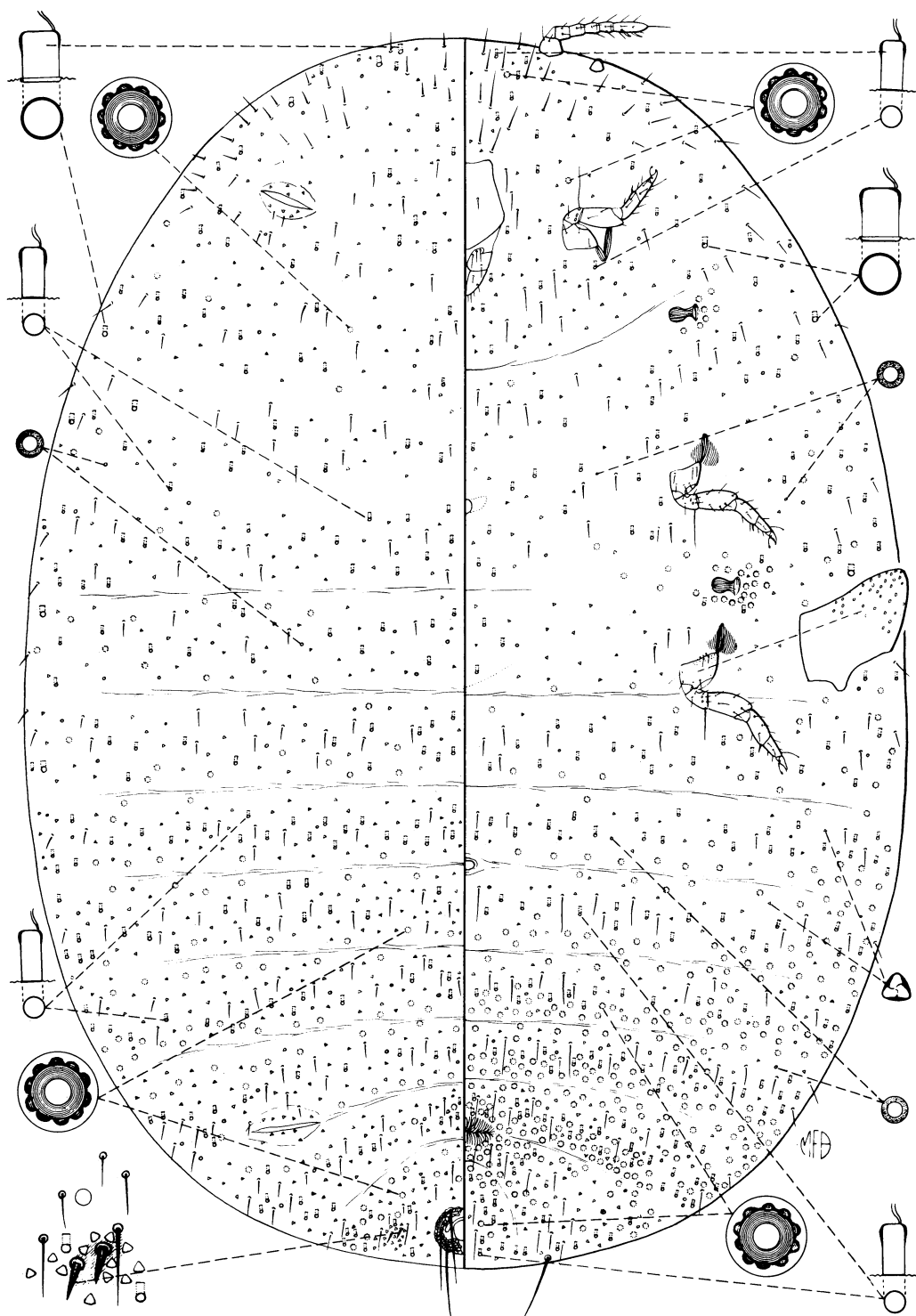


Fig. 15. *Trionymus strongylus* Miller and McKenzie, new species, collected at Madera Canyon, Santa Cruz County, Arizona, July 31, 1966, on *Trichachne* sp. (Gramineae).

related to *Trionymus magnus* (Cockerell and Cockerell), another questionable *Trionymus* species, we have decided to leave both species in this genus pending further study.

This species differs from *Trionymus magnus* in that it has lateral series of large-sized, oral-collar tubular ducts; broad, porous anal ring; and multilocular disk pores clustered around each spiracle. *T. magnus*, on the other hand, has no large-sized, oral-collar tubular

ducts; relatively thin anal ring with few pores; and no multilocular disk pores clustered around spiracles.

This species is also similar to *Chorizococcus coniculus*, herein described as new, but differs in that it has no oral-rim tubular ducts; clusters of multilocular disk pores around each spiracle; and 1 or 2 circuli. *C. coniculus* has oral-rim tubular ducts; no multilocular spiracular clusters; and no circuli.

ACKNOWLEDGMENTS

We wish to give special thanks to Mr. Richard F. Wilkey of the Bureau of Entomology, California State Department of Agriculture, Sacramento, for his assistance in preparing slide mounts and in giving advice in certain critical areas.

Miss Louise M. Russell of the Systematic Entomology Laboratory, Agricultural Research Service, U. S. Department of Agriculture, was extremely helpful in making available certain critical type specimens necessary for comparison with the included new spe-

cies. Without her help this paper would not have been possible.

Mrs. Mary Foley Benson prepared the illustrations identified by her initials. We appreciate the help and concern she has expressed for this work. Mrs. Helen Court made the remaining drawings.

We wish to give special thanks to the staff and students of the Entomology Department, University of California, Davis, for their assistance and criticisms of this manuscript.

LITERATURE CITED

- BALACHOWSKY, A.
1959. Otras cochinillas nuevas Colombia. *Revista Acad. Colombia Ciencias Exactas Fisicas Nat.* 10:362-66.
- BEARDSLEY, J. W.
1965. Notes on the pineapple mealybug complex, with descriptions of two new species. *Proc. Hawaii. Ent. Soc.* 19:55-68.
1966. Insects of Micronesia, Homoptera: Coccoidea. *Insects of Micronesia* 6:377-562.
- FERRIS, G. F.
1953. Atlas of the scale insects of North America. Volume VI. The Pseudococcidae (Part II). Stanford, California: Stanford University Press. Pp. 279-506.
1955. On some genera of the Pseudococcidae. *Microent.* 20:1-19.
- MCKENZIE, H. L.
1967. Mealybugs of California with taxonomy, biology and control of North American species. Berkeley: University of California Press. 525 pp.
- RAU, G. J.
1938. Four more new species of mealybugs from New York State. *Canad. Ent.* 70:157-65.
- WILLIAMS, D. J.
1969. A new species of *Cataenococcus* on banana in Costa Rica. *Bul. Ent. Res.* 59:101-04.

Genus <i>Hypogeococcus</i> Rau	578
<i>Hypogeococcus othnius</i> Miller and McKenzie, new species	578
Genus <i>Mammicoccus</i> Balachowsky	580
<i>Mammicoccus balachowskyi</i> Miller and McKenzie, new species	581
Genus <i>Prorhizoecus</i> Miller and McKenzie, new genus . . .	583
<i>Prorhizoecus atopoporus</i> Miller and McKenzie, new species	583
Genus <i>Pseudococcus</i> Westwood	585
<i>Pseudococcus beardsleyi</i> Miller and McKenzie, new species	585
Genus <i>Rhizoecus</i> Kunckel d'Herculais	588
<i>Rhizoecus neostangei</i> Miller and McKenzie, new species .	588
Genus <i>Spilococcus</i> Ferris	590
<i>Spilococcus nototrichus</i> Miller and McKenzie, new species	590
<i>Spilococcus villanuevai</i> Miller and McKenzie, new species	593
Genus <i>Trionymus</i> Berg	595
<i>Trionymus coronus</i> Miller and McKenzie, new species . .	595
<i>Trionymus idaboensis</i> Miller and McKenzie, new species .	598
<i>Trionymus strongylus</i> Miller and McKenzie, new species .	600
ACKNOWLEDGMENTS	602
LITERATURE CITED	602

The journal HILGARDIA is published at irregular intervals, in volumes of about 650 to 700 pages. The number of issues per volume varies.

Single copies of any issue may be obtained free, as long as the supply lasts; please request by volume and issue number from:

**Agricultural Publications
University of California
Berkeley, California 94720**

The limit to nonresidents of California is 10 separate titles. The limit to California residents is 20 separate titles.

The journal will be sent regularly to libraries, schools, or institutions in one of the following ways:

- 1. In exchange for similar published material on research.**
- 2. As a gift to qualified repository libraries only.**
- 3. On a subscription basis—\$7.50 a year paid in advance.**
All subscriptions will be started with the first number issued during a calendar year. Subscribers starting during any given year will be sent back numbers to the first of that year and will be billed for the ensuing year the following January. Make checks or money orders payable to The Regents of The University of California; send payment with order to Agricultural Publications at above address.