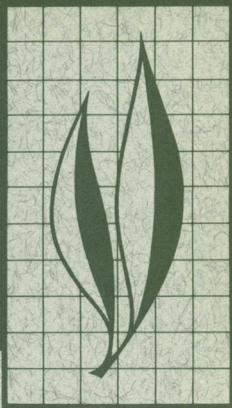


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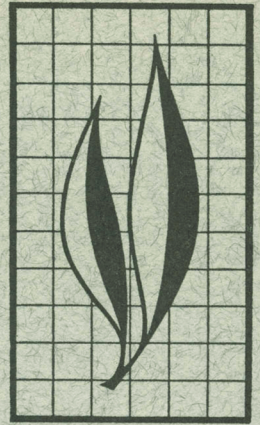
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Fourth Taxonomic Study of California Mealybugs, with Additional Species from North America, South America, and Japan (Homoptera: Coccoidea: Pseudococcidae)

Howard L. McKenzie

UNIVERSITY OF CALIFORNIA DIVISION OF AGRICULTURAL SCIENCES



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Fourth Taxonomic Study of California Mealybugs, with Additional Species from North America, South America, and Japan (Homoptera: Coccoidea: Pseudococcidae)^{1,2}

INTRODUCTION

AS MORE and more new species of pseudococcids (mealybugs) are discovered, not only in California but also in other areas of North and South America, it seems advisable to publish descriptions as promptly as possible. The material made available in this and the three earlier studies (McKenzie, 1960, 1961, 1962) will be used in organizing a definitive study on the systematics of California mealybugs. A number of species collected outside the state are considered, because they broaden our concepts of this important family of Coccoidea. Moreover, three species originally described from other states are here reported as occurring in California also. They are *Phenacoccus infernalis* McKenzie from Arizona, *Spilococcus parkeri* McKenzie from Nevada, and

Trionymus caricis McConnell from Maryland.

This paper describes two new genera of pseudococcids found in California and 22 new species: 13 of them—more than half—from California, four from Nevada, one from New Mexico, two from Mexico, one from Chile, and one from Japan. It presents revised keys to include the two new genera and the 20 new North American species, but no keys for the new species of *Rastrococcus* from Chile, or of *Balanococcus* from Japan.

The series of four studies contains descriptions of 58 valid new species of mealybugs now found in California, not counting *Chorizococcus microporus* McKenzie (1960), now considered a synonym of *C. lounsburyi* (Brain).

KEYS, DESCRIPTIONS, AND ADDITIONAL RECORDS

Each of the 12 genera in this main section includes one or more new species of mealybugs. In giving new information on morphology, systematic position, distribution, or economic importance of previously described species,

the arrangement is arbitrary: For species in any of these 12 genera, such data appear under the appropriate genus in the main part of the paper. A later section gives miscellaneous records on other species.

¹ Submitted for publication May 29, 1963.

² National Science Foundation Grant No. G-20871 provided funds for technical assistance and for a number of the illustrations.

Genus *Anisococcus* Ferris

The addition of one new species of *Anisococcus* necessitates a modification of Ferris' (1950) key. This is the first time the key has been altered. Six of the seven species now referred to this genus occur in California.

KEY TO SPECIES OF *ANISOCOCCUS* IN NORTH AMERICA: ADULT FEMALES

1. Anal ring "noncellular" or nearly so, dorsad from apex (tip) of abdomen. 2
 Anal ring definitely "cellular," placed at apex of abdomen..... 3
- 2(1). Anal ring as large as sclerotized area of anal-lobe cerarii, or nearly so;
 circulus absent *didymus* Ferris
 Anal ring much smaller than sclerotized area of anal-lobe cerarii; cir-
 culus present..... *ephedrae* (Coquillett)
- 3(1). Circulus absent 4
 Circulus present 5
- 4(3). With 17 pairs of cerarii clearly defined..... *crawii* (Coquillett)
 With scarcely more than 6 pairs of cerarii (those along sides of body
 obsolete) *adenostomae* (Ferris)
- 5(3). With tubular ducts of some type on dorsum 6
 Without tubular ducts of any type on dorsum..... *abnormalis* McKenzie
- 6(5). Dorsum bearing only short, slender setae..... *quercus* (Ehrhorn)
 Dorsum beset with short, stout, conical setae..... *oregonensis* Ferris

***Anisococcus abnormalis* McKenzie,
 new species
 (Figure 1)**

Suggested common name. Abnormal anisococcus mealybug.

Collection data. Adult females under a rock 2 miles west of Sierra City, Sierra County, California, collected October 2, 1962, by T. R. Haig (CSDA No. 62J5-53³). These are the only known specimens of this mealybug.

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Two female paratypes (on separate slides) in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Adult females, mounted, 2.50 to 3.00 mm long,

1.80 to 2.15 mm wide; body form sub-circular.

Dorsum with 15 or 16 pairs of cerarii; some reduction usual in thoracic area. Anal-lobe cerarius formed on a large, more or less circular, sclerotized area bearing 7 or 8 conical setae, 6 or 7 slender auxiliary setae of various lengths, and numerous trilocular pores. Anterior to this, auxiliary setae are usually absent, and each cerarius supports 4 or 5 conical setae (observed range from 1 to 5) about the same size as those of anal-lobe cerarius except in thoracic area, where one conical seta may be almost twice as long as any of the others.

Dorsum beset with trilocular pores throughout. Minute circular pores⁴ scattered. Tubular ducts absent. Body setae slender, evenly distributed. Anal ring at apex of abdomen; each of its 6 setae about twice as long as greatest diameter of ring.

³ California State Department of Agriculture accession number.

⁴ The minute circular pores might be called very small discoidal pores. However, the comparison is uncertain because there is no study on discoidal pores—their size, shape, structure, or probable limits of variation.

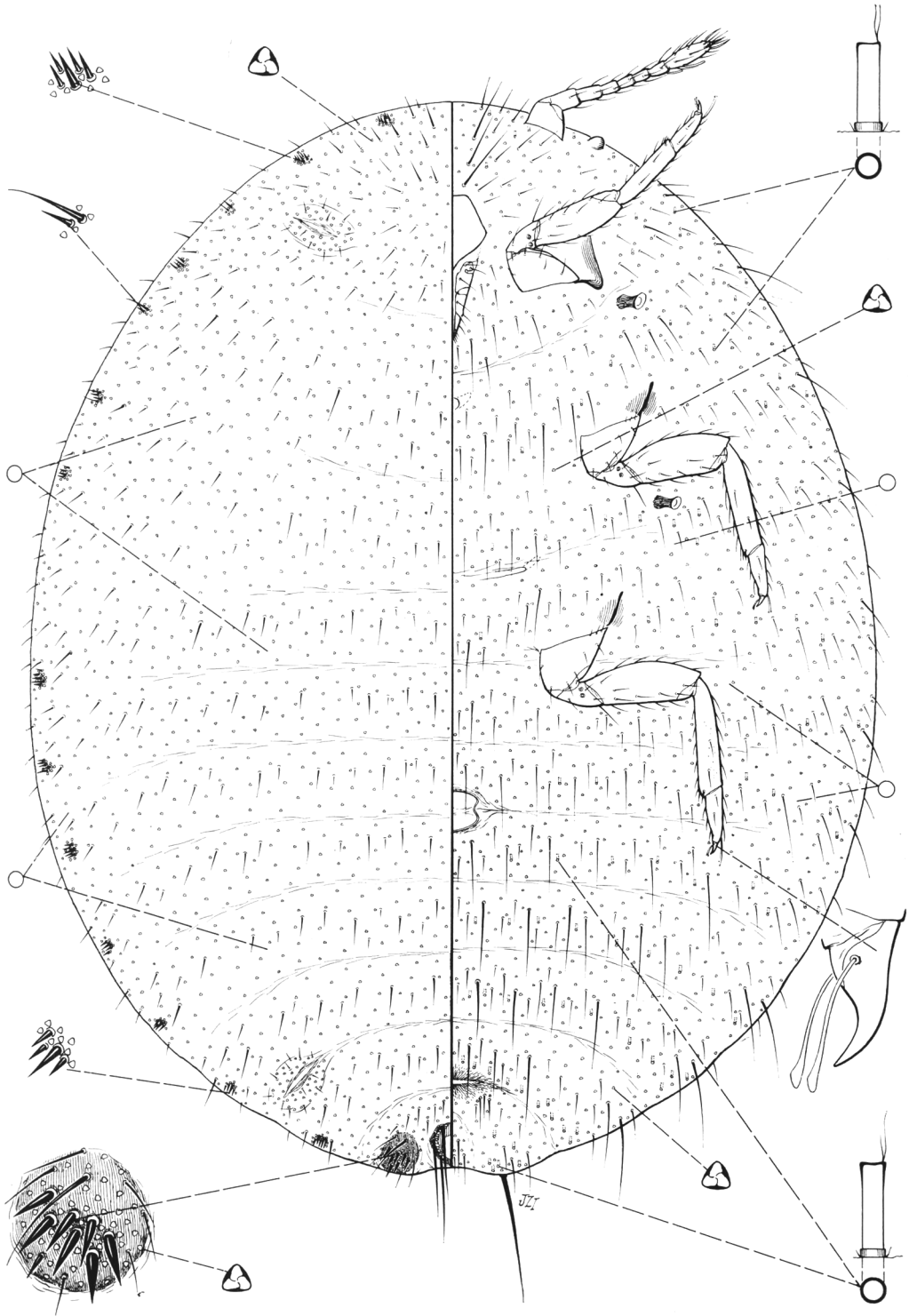


Fig. 1. *Anisococcus abnormalis* McKenzie, new species, collected under a rock 2 miles west of Sierra City, Sierra County, California.

Venter without multilocular disk pores, evenly beset with trilocular pores and with limited numbers of minute circular pores. Oral-collar ducts scattered across most of the abdominal segments, the thorax, and the head. Body setae mostly longer than those on dorsum.

Circulus quite large, broadly oval, capable of folding along intersegmental line. Legs relatively large and well formed, with 0 to 14 very small translucent pores⁵ along hind tibia; claws usually without denticles. Antennae 8-segmented, slender.

Notes. This species is somewhat atypical for *Anisococcus* in that it has no

tubular duct with an auxiliary "cell" or ring attached to its orifice. However, other morphological structures—enlarged, sclerotized anal lobes with numerous conical setae; 3 or more conical setae on all cerarii; and the complete absence of multilocular disk pores—suggest that the new species is a true member of this group. It appears to be closely related to *A. quercus* (Ehrhorn) but lacks the dorsal oral-collar ducts of that species.

I am in full accord with the late Harold Morrison's suggestion that the species be placed in *Anisococcus* even though it lacks one of the identifying characters of the genus.

Anthelococcus McKenzie, new genus

Genotype. This genus is established for the reception of the new species *Anthelococcus simondsi*.

Recognition characters. Pseudococcidae with moderately oval body form, as mounted. Two pairs of ostioles. Anal lobes never prominent. Cerarii reduced in number—basically 3 or 4 recognizable pairs on abdomen, on consecutive segments from apex. Fifth and sixth pairs of cerarii are uncertain because the conical setae are no larger than the smallest of the adjacent body setae and are obviously unpaired. Clusters or tufts of extremely long and stout auxiliary setae arranged segmentally along dorsal and ventral margins of the last 6 or 7 abdominal segments, obviously associated with the conical setae in segments where these are present. Dorsum without tubular ducts. Anal ring apical, of the usual "cellular" structure.

Venter with multilocular disk pores and quinquelocular pores. Circulus situated above line between fourth and fifth abdominal segments, not divided by this line. Legs well formed; claws without denticles. Antennae 6-segmented.

Notes. Specimens of this genus will key with some difficulty to *Trionymus* Berg (see McKenzie, 1962, p. 638). The main differences are that *Anthelococcus* has quinquelocular pores on venter; a broad, oval body form; a much larger circulus than that of *Trionymus*; and modified auxiliary setae, extremely long and stout, that occur in tufts along the dorsal and ventral margins of the last 6 or 7 abdominal segments. On the other hand, *Trionymus* has no quinquelocular pores on venter; it usually has an elongate body form; a small, compact circulus; and auxiliary setae usually slender, except on the anal-lobe cerarii, not nearly so conspicuous as in *Anthelococcus*, and usually on the dorsal surface only.

Name from Greek *anthēlē*: the downy plume of a reed (hence, a tuft) + *kokkos*: grain, seed, kermes scale.

Since *Anthelococcus* runs to the last few couplets of the generic key (McKenzie, 1962), the last portion of the key is recast to include the new genus. The modified portion of the key follows:

⁵ On some specimens the pores on legs appear merely as translucent dots, which cannot be identified clearly.

- 41(40). Quinquelocular pores on venter, especially in midregion of thorax
ANTHELOCOCCLUS McKenzie
 No quinquelocular pores on venter. 42
- 42(41). Body form of mature female normally elongate and slender;⁶ circulus,
 if present, always quite small, circular or oval, normally incapable
 of folding along intersegmental line⁷. *TRIONYMUS* Berg
 Body form of mature female broadly oval or rotund; circulus, if
 present, normally quite large, extending across the fold between
 fourth and fifth abdominal segments. 43
- 43(42). Cerarii confined to anal-lobe pair. *CHNAUROCOCCLUS* Ferris
 At least 4 or 5 pairs of cerarii on abdomen. 44
- 44(43). Multilocular disk pores present on both dorsal and ventral surfaces
 of abdomen *ORACELLA* Ferris
 Multilocular disk pores absent from abdomen
PARADOXOCOCCLUS McKenzie

Anthelococcus simondsi McKenzie,
 new species

(Figure 2)

Suggested common name. Simonds mealybug.

Collection data. Adult females on shagbark manzanita, *Arctostaphylos rudis* (Ericaceae), at Lompoc (Vandenberg Village), Santa Barbara County, California, collected February 27, 1963, by W. E. Simonds (CSDA No. 63C12-21). Additional paratype adult females on chamise, *Adenostoma fasciculatum* (Rosaceae), in the same locality, collected June 26, 1963, by H. L. McKenzie. The specimens were found only on crown and roots in the upper 4 to 6 inches of soil.

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Paratypes in museum, University of California, Davis, and in the United States National Collection of Coccoidea, Washington, D.C.

Gross external features. The mealybugs were covered with a fine, powdery,

white secretion. There was no evidence of lateral or caudal filaments.

Recognition characters. Adult females, mounted, 1.20 to 2.50 mm long, 0.90 to 2.00 mm wide; body form moderately oval.

Dorsum with cerarii on last 3 or 4 abdominal segments; fifth and sixth pairs uncertain because their conical setae are obviously unpaired and are no larger than the smallest of the adjacent body setae. Anal-lobe cerarius sclerotized, with 2 enlarged, somewhat lanceolate conical setae and a cluster of 4 to 7 extremely long and stout auxiliary setae surrounded by a concentration of trilocular pores and a few minute circular pores. Remaining cerarii with no evidence of sclerotization; with much shorter, paired conical setae; 7 to 10 of the extremely long and stout auxiliary setae in clusters or tufts along body margin; and fewer trilocular pores than on anal-lobe cerarius.

Dorsum evenly beset with trilocular pores. Minute circular pores, with diameter only half that of a trilocular pore, sparsely scattered submarginally. Tubular ducts absent. Body setae fairly

⁶ *Trionymus magnus*, with a broadly pyriform body form, is an exception. However, its circulus is very small and undivided, and all its other characters are typical of *Trionymus*.

⁷ In *Trionymus haancheni* McKenzie and *T. modocensis* (Ferris) the circulus is often divided by the intersegmental line. However, these two species are typical of *Trionymus* in all other characters.

numerous, in irregular transverse bands on abdominal segments, and covering thoracic segments and head; of several lengths, those of last segment and along margin of abdomen usually longest. Anal ring at apex of abdomen; its 6 setae nearly twice as long as diameter of ring.

Ventral sides of anal lobes with small, irregular, sclerotized areas. Noticeable clusters or tufts of elongate, stout setae conspicuous along margins of most abdominal segments. Venter with perhaps 40 to 50 multilocular disk pores: relatively few in region of vulva, several along posterior margin of seventh abdominal segment, possibly 1 or 2 on posterior margin of sixth segment. Quinquelocular pores numerous, in transverse bands along anterior margins of abdominal segments from seventh forward, on sternum, and in mid-region of head. Trilocular pores unevenly distributed, lacking in some

areas in sternal region and near mouthparts. A few minute circular pores scattered along submargin of body. Oral-collar ducts in clusters along lateral margins of abdominal segments, fewer in midregions of abdomen, thorax, and head.

Circulus moderately large, transversely oval, somewhat variable in position, apparently on fourth abdominal segment above fold between fourth and fifth segments, at times involved in this fold but apparently not divided by it. Legs moderately stout, with 16 to 28 translucent pores scattered along hind tibia and a few on distal end of hind femur; claws without denticles. Labium as long as clypeus or longer. Antennae 6-segmented, relatively short.

Note. This species is named for W. E. Simonds, who collected the original specimens and made them available for study, with appreciation for his contribution.

Genus *Balanococcus* Williams

On first examination, I thought a new pseudococcid received for determination from Japan might be assigned to the genus *Kiritshenkella* Borkhsenius. However, shortly after the appearance of Williams' (1962) splendid monograph, the resemblance of this mealybug to his new genus *Balanococcus* was quite obvious. Mounted specimens were subsequently forwarded to Dr. Williams, who confirmed my belief that they represented a new species and did belong in *Balanococcus*. Because the Takahashi lawn mealybug has not been collected in North America, it is unnecessary to revise Williams' key to receive it.

Balanococcus takahashii McKenzie, new species (Figure 3)

Suggested common name. Takahashi lawn mealybug.

Collection data. Adult females on mascarene grass (Korean velvetgrass),

Zoysia tenuifolia (Gramineae), at a golf course at Kawagoe, Saitama Prefecture (Honshu), Japan; collected August 28, 1961, by Nobuhiko Oho, of the Horticultural Research Station, Ministry of Agriculture and Forestry, Hiratsuka, Kanagawa, Japan. Additional paratypes on the same host at the research station in Hiratsuka—some 40 miles south of the first site—collected October 16, 1963, by Nobuhiko Oho. Mr. Oho implied that he had observed damage to the turf. He reported that the nymphs enter the leaf sheaths and leaves, where they mature and oviposit.

Type material. Holotype adult female (single specimen on slide) and paratypes in museum, University of California, Davis. Paratypes in United States National Collection of Coccoidea, Washington, D.C., in British Museum, London, and in collection of Ministry of Agriculture and Forestry, Japan.

Gross external features. No information.

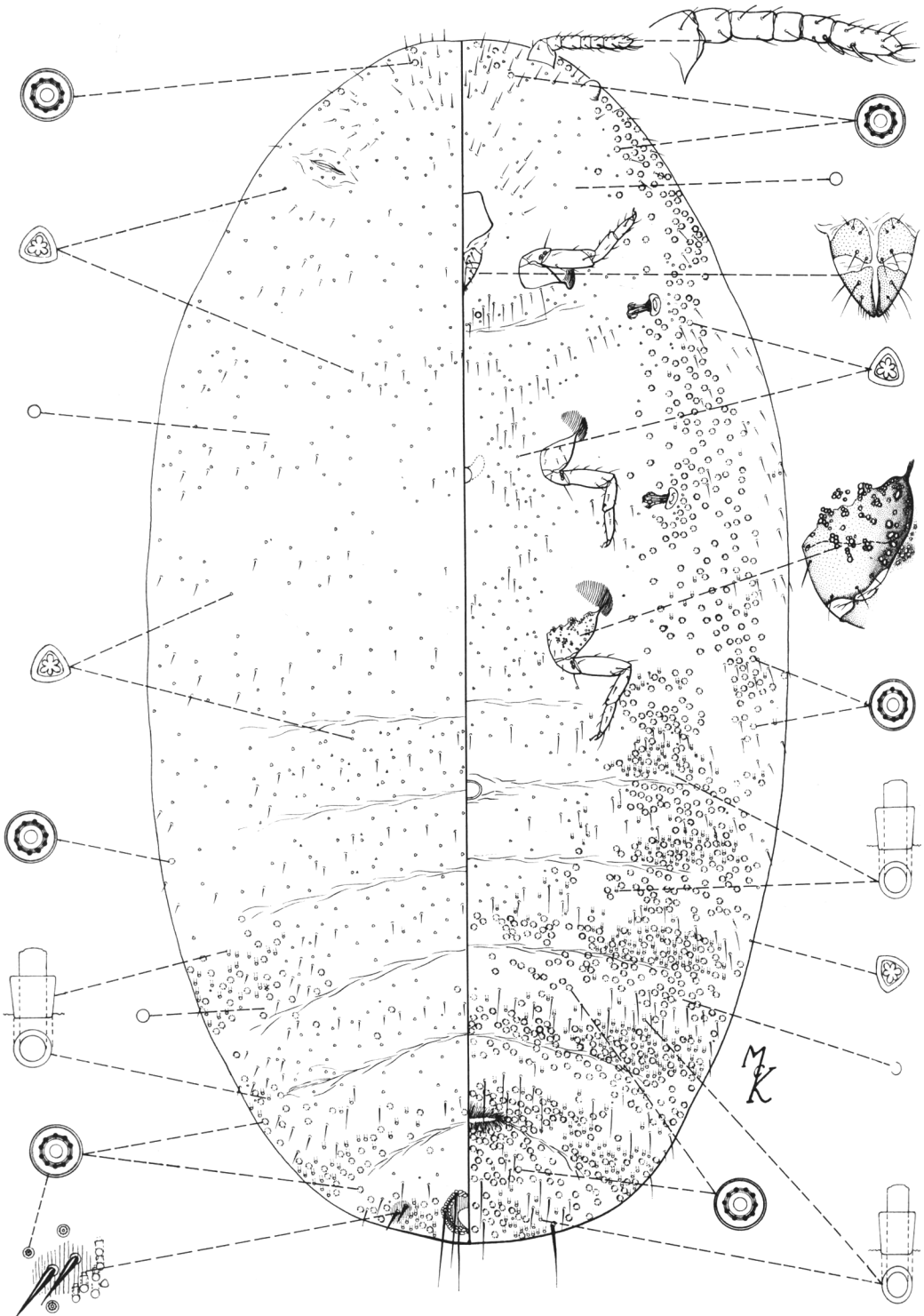


Fig. 3. *Balanococcus takahashii* McKenzie, new species, collected on mascarene grass, *Zoysia tenuifolia* (Gramineae), at Kawagoe, Saitama Prefecture (Honshu), Japan.

Recognition characters. Adult females, mounted, 2.10 to 3.10 mm long, 1.40 to 1.80 mm wide; body form oval, elongate.

Dorsum with both anterior and posterior ostioles. Cerarii only on anal lobes, represented by a slightly sclerotized area with a pair of elongate conical setae, no auxiliary setae, and no concentration of trilocular pores. Multilocular disk pores in considerable numbers on last 4 or 5 abdominal segments, especially along submargin of body; none on abdominal segments anterior to the fifth, none on thorax, a few along margins of head. Trilocular pores evenly distributed but rather sparse. Minute circular pores scattered. Tubular ducts of a special type, short and with a large oral collar, mostly clustered submarginally on last four abdominal segments, absent from remainder of dorsal body surface. Body setae sparse, all short and slender. Anal ring slightly dorsad from apex, with no unusual characters; with 2 rows of pores and with 6 setae, each about twice as long as diameter of ring.

Venter with multilocular disk pores extremely abundant, in transverse bands between apex and sixth abdominal segment and in a broad submarginal zone from fifth abdominal segment to head; often with 1 or 2 pores in sternal region. Trilocular pores comparatively sparse, apparently absent from last two abdominal segments. Minute circular pores scattered. Tubular ducts of modified oral-collar type, similar to those of dorsum, numerous on abdomen, less so on thorax, absent from head. Body setae

sparse, slender, and nearly all short.

Circulus transversely oval, not divided by intersegmental line. Legs rather short and slender; posterior coxae somewhat convex, with numerous conspicuous translucent pores; claws without denticles. Mouthparts short and broad. Antennae usually 6-segmented, comparatively short; apical segment bearing 2 or 3 sensory setae, fifth segment usually with only 1.

Notes. *Balanococcus takahashii* appears rather closely related to *B. boratynskii* Williams but lacks the dorsal marginal multilocular disk pores which that species has on abdominal segments anterior to the fifth and on thorax. At first sight this mealybug seems to resemble the genus *Kiritshenkella* Borkhsenius but, as Dr. Williams pointed out in his letter, it lacks the most striking character of *Kiritshenkella*—the concentration of trilocular pores on the midline on both dorsal and ventral surfaces.

Specimens of this mealybug were sent to me in January, 1962, by Nobuhiko Oho, a former student of the late Professor R. Takahashi. Mr. Oho had sent specimens to Professor Takahashi, who did not recognize the species and was quite sure it was unrecorded in Japan, and who suggested sending specimens to me for identification. I obtained Mr. Oho's permission to describe the species and to name it in honor of Professor Takahashi, for his outstanding contribution to the systematics of the Coccoidea of Japan and surrounding regions.

Genus *Chorizococcus* McKenzie

The genus *Chorizococcus* was described (McKenzie, 1960) to accommodate pseudococcid species with oral-rim ducts and reduced numbers of cerarii. McKenzie (1961) revised his original key to species to include three additional California species. A second revision,

which follows, includes two recently discovered species from California and one from Nevada and omits *C. microporus* McKenzie, here synonymized with *C. lounsburyi* (Brain). The genus now contains 18 North American species, 12 of which occur in California.

- 15(14). Venter with considerable numbers of multilocular disk pores on fourth abdominal segment and with 5 or more oral-rim ducts on head *polyporus* McKenzie
 Venter without multilocular disk pores on fourth abdominal segment and with only 1 or 2 oral-rim ducts on head. *californicus* McKenzie
- 16(14). With at least a few oral-rim ducts somewhere on venter. 17
 Without oral-rim ducts on venter. *shaferi* (Hollinger)
- 17(16). Venter with multilocular disk pores from apex to posterior margin of fifth abdominal segment; those on posterior margin across eighth segment rather numerous (observed range from 23 to 36, average 28.1); tiny denticle on claw *wilkeyi* McKenzie
 Venter with multilocular disk pores from apex to posterior margin of sixth abdominal segment (rarely 1 such pore on posterior margin of fifth segment); those on posterior margin across eighth segment comparatively few (observed range from 9 to 16, average 12.5); no denticle on claw *variabilis* McKenzie

Chorizococcus californicus

McKenzie, new species

(Figure 4)

Suggested common name. California chorizococcus mealybug.

Collection data. Adult females on branches and in axils of twigs of wild buckwheat, *Eriogonum* sp. (Polygonaceae), at Chico, Butte County, California, collected July 8, 1962, by T. R. Haig (CSDA No. 62G10-46). These are the only known specimens of the species.

Type material. Holotype adult female (single specimen on slide) and one female paratype in collection of California State Department of Agriculture, Sacramento. Paratypes in museum, University of California, Davis, and in United States National Collection of Coccoidea, Washington, D.C.

Gross external features. Adult female predominantly purplish, with no lateral or anal filaments; oviparous, with an elongate, whitish ovisac.

Recognition characters. Adult females, mounted, 2.10 to 3.00 mm long, 1.40 to 2.00 mm wide; body form broadly oval.

Dorsum normally with recognizable cerarii only on the last 4 abdominal segments. Anal-lobe cerarius with 2 small conical setae, 3 or 4 slender auxiliary setae, and a few somewhat crowded tri-

locular pores. Remaining cerarii with 2 conical setae each, more slender than those of the anal-lobe pair, and progressively shorter anteriorly; with no auxiliary setae, and with scarcely any concentration of trilocular pores.

Trilocular pores distributed rather evenly over entire dorsum. Oral-rim ducts in transverse bands of 15 to 26 on each abdominal segment except the last, also scattered over thorax and head. Body setae short and slender. Anal ring apical, with no unusual characters; each of its 6 setae about twice as long as diameter of ring.

Venter with multilocular disk pores from apex to posterior margin of fifth abdominal segment, in transverse bands across most segments to the body margin; none on thorax or head. Trilocular pores evenly beset over surface. Oral-collar ducts along posterior margins of abdominal segments, sparse on thorax, none on head. Oral-rim ducts along lateral margins of abdomen, in sternal area, and on head. Body setae slender and, for the most part, longer than those of dorsum.

Circulus absent. Legs comparatively long; hind coxa with cluster of translucent pores at base; claw without denticle. Mouthparts comparatively broad. Antennae normally 8-segmented, moderately long.

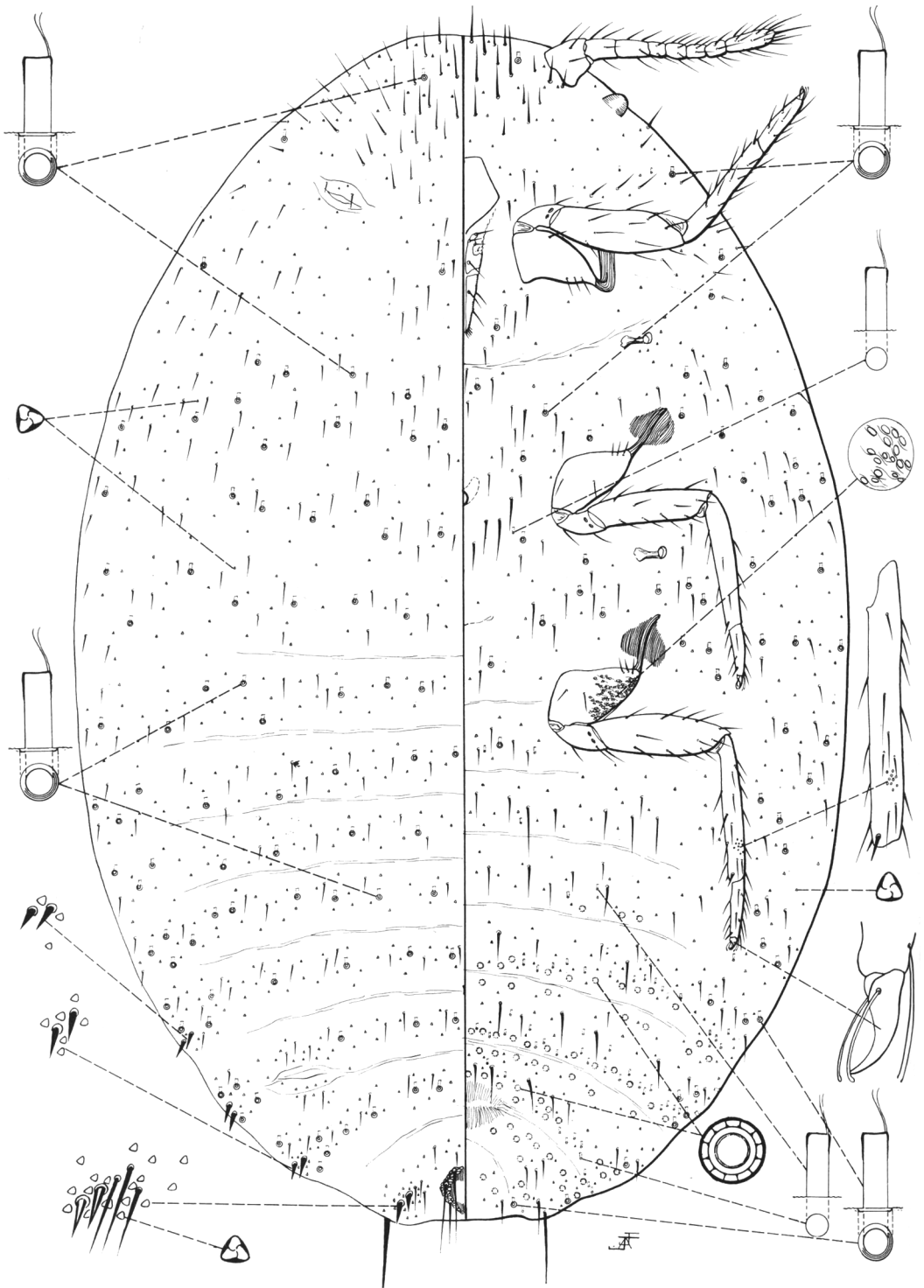


Fig. 4. *Chorzococcus californicus* McKenzie, new species, collected in axils of twigs of wild buckwheat, *Eriogonum* sp. (Polygonaceae), at Chico, Butte County, California.

Notes. This species appears to be quite closely related to *Chorizococcus polyporus* McKenzie. It differs in having fewer multilocular disk pores on venter of abdomen, none on third or fourth abdominal segments or near mouthparts; and fewer oral-rim ducts on dorsum of abdomen and head. *C. polyporus*, on the other hand, has numerous multiloculars on the venter of all abdominal segments and in area near mouthparts; and numerous oral-rim ducts on dorsum of all abdominal segments and of head.

***Chorizococcus interruptus*
McKenzie, new species**

(Figure 5)

Suggested common name. Interrupted mealybug.

Collection data. Adult females feeding on foliage of *Yucca* sp. (Agavaceae) in nursery at Perkins, Sacramento County, California; collected April 26, 1962, by M. Scribner and W. Irvine (CSDA No. 62D27-18).

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Paratypes in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Adult females, mounted, 2.00 to 3.00 mm long, 1.00 to 1.80 mm wide; body form normally elongate oval.

Dorsum with not more than 2 recognizable pairs of cerarii, these on the last 2 segments. Anal-lobe cerarius with 2 short, slender, conical setae, 4 or 5 slender auxiliary setae, and a few scattered trilocular pores; penultimate cerarius, when present, with 2 slender conical setae, no auxiliary setae, scarcely any concentration of trilocular pores.

Trilocular pores evenly distributed over entire dorsum. A few oral-collar ducts along margins of posterior abdom-

inal segments. Oral-rim ducts in single rows of 3 to 9 (average 5) across each abdominal segment except the last, sparsely scattered on thoracic segments and on head. Body setae all short and slender. Anal ring apical, with no unusual characters; each of its 6 setae about twice as long as greatest diameter of ring.

Venter with multilocular disk pores in considerable numbers, extending across abdominal segments from apex to posterior margin of fifth segment, occasionally with 1 or 2 near body margin of fourth segment. Trilocular pores generally distributed. Oral-collar ducts along posterior margins of abdominal segments from apex to fifth segment. A few oral-rim ducts, the same size as those on dorsum, scattered along body margin, absent from head. Body setae slender and generally longer than those on dorsum.

Circulus absent. Legs moderate in size; hind coxa with cluster of translucent pores at base; distal half of hind tibia with 1 or 2 irregular clusters of clear pores; some specimens with a very tiny denticle on claw, others without. Mouthparts moderately broad. Antennae 8-segmented, slender.

Notes. This species appears closely related to *Chorizococcus lounsburyi* but lacks the following characters, which are present in *C. lounsburyi*: clusters of oral-collar ducts, of two sizes, on venter along submargins of third to sixth abdominal segments; multilocular disk pores in sternal area anterior to hind coxae.

***Chorizococcus lounsburyi* (Brain)**

Pseudococcus lounsburyi Brain, 1912, pp. 179–82.⁸

Pseudococcus (*Trionymus*) *peregrinus* Green, 1925, pp. 40–41.

Trionymus lounsburyi (Brain). Ferris (in Zimmerman, 1948, pp. 260–61).

Trionymus lounsburyi (Brain). Ferris, 1950, pp. 271–72.

⁸ See "Literature Cited" for citations referred to in the text by author and date.

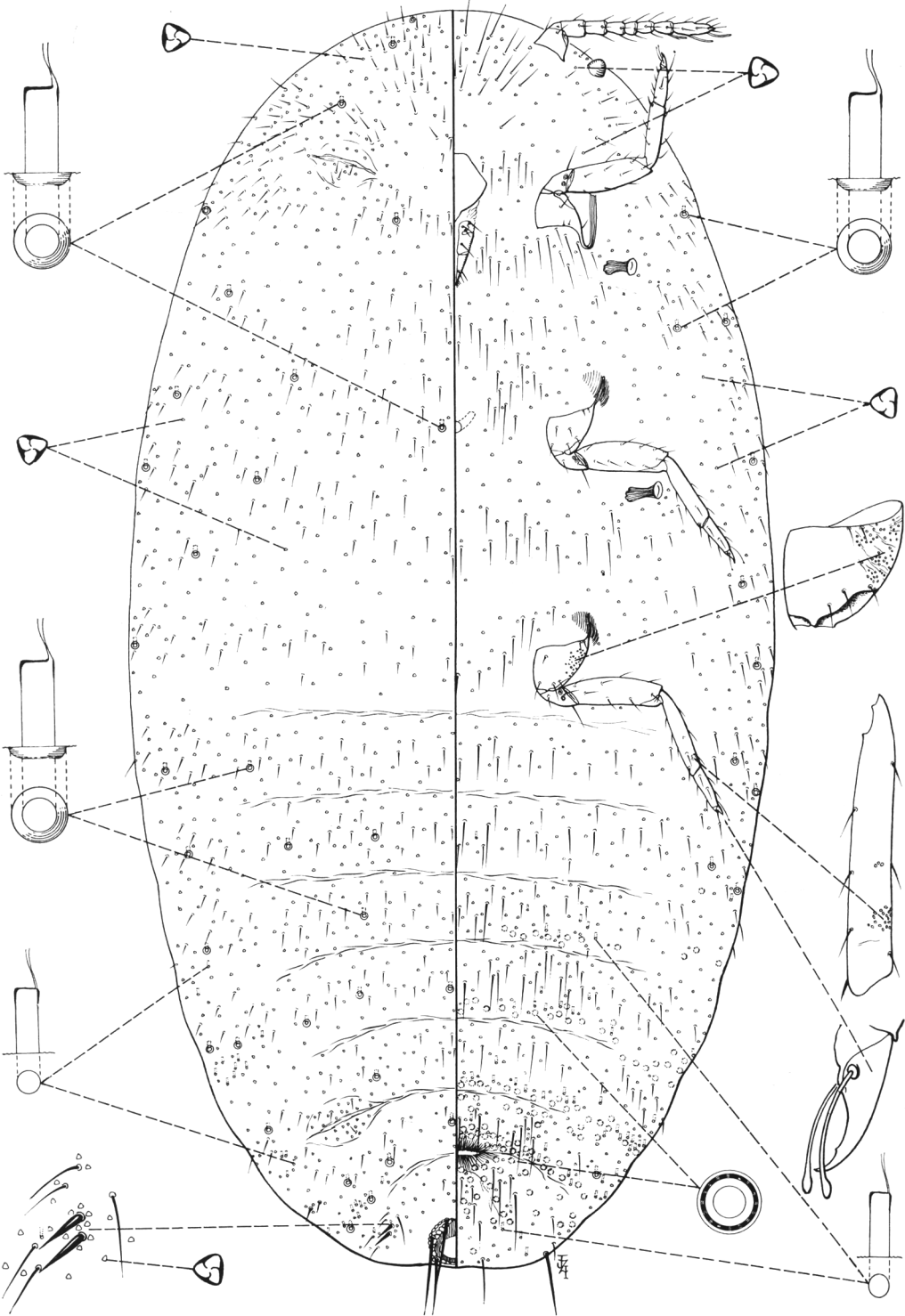


Fig. 5. *Chorizococcus interruptus* McKenzie, new species, collected on foliage of *Yucca* sp. (Agavaceae) at Perkins, Sacramento County, California.

Pseudococcus lounsburyi Brain. De Lotto, 1958, pp. 96–97.

Chorizococcus microporus McKenzie, 1960, pp. 699–701.

Chorizococcus peregrinus (Green). McKenzie, 1960, pp. 701, 703.

Chorizococcus lounsburyi (Brain). Williams, 1962, pp. 19, 21.

I am reviewing the synonymy and nomenclature of this mealybug because its taxonomic status has caused considerable concern during the last few years.

De Lotto (1958) had access to types of *C. lounsburyi* as well as to additional specimens, near type or equivalent—all from South Africa. He accepted Ferris' redescription (in Zimmerman, 1948) and considered the species valid.

McKenzie (1960) placed *Trionymus lounsburyi* as a synonym of *Chorizococcus peregrinus*, mainly on the basis of gross external features, color of eggs, and habitat preference. The morphological characters of these two forms, as mounted, are very similar.

Williams (1962) stated: "As *C. peregrinus* (Green) comes within the known range of variation, the name is sunk as a synonym of *C. lounsburyi*." He pointed out that the main problem seemed to lie in the variable numbers of ventral multilocular disk pores and of oral-rim ducts in the sternal area.

Chorizococcus microporus, described by McKenzie in 1960, is here considered a synonym of *C. lounsburyi*. Again the main differences are those that Williams pointed out (above).

Chorizococcus variabilis McKenzie, new species

(Figure 6)

Suggested common name. Variable chorizococcus mealybug.

Collection data. Adult females on Joshua tree, *Yucca brevifolia* (Agavaceae), at Las Vegas, Clark County, Nevada, collected May 24, 1961, by R. C. Bechtel. These are the only known speci-

mens of this mealybug. They were feeding on plant portions above the ground.

Type material. Holotype adult female (single specimen on slide) and paratypes in museum, University of California, Davis. Paratypes in collection of California State Department of Agriculture, Sacramento, and in United States National Collection of Coccoidea, Washington, D.C.

Gross external features. No information.

Recognition characters. Adult females, mounted, 1.75 to 2.75 mm long, 1.00 to 1.40 mm wide; body form broadly oval.

Dorsum with cerarii very weakly developed, occurring on the last 3 or more segments (possibly 6 or 7: average of the 15 specimens 4.6 pairs). Anal-lobe cerarius with 2 quite small conical setae, 2 or 3 slender auxiliary setae, and a very few scattered trilocular pores. Penultimate cerarius with 2 conical setae, slightly smaller than those of anal lobes, no auxiliary setae, a few trilocular pores. Anterior to this are 3 cerarii, or perhaps 4 or 5, with 2 very small setae, more slender than conical, no auxiliary setae, and 3 or 4 trilocular pores. Cerarii on third and fourth abdominal segments recognizable only with considerable difficulty.

Trilocular pores distributed rather sparsely over entire dorsum. Oral-rim ducts in bands of 3 to 7 on each abdominal segment except the last, also scattered on thorax and head. Body setae short and slender. Anal ring apical, with no unusual characters; each of its 6 setae about twice as long as diameter of ring.

Venter with multilocular disk pores in midregion of abdomen from apex to posterior margin of sixth abdominal segment. Trilocular pores distributed rather sparsely. Oral-rim ducts along submargin of abdomen and fairly numerous in certain lateral areas forward to head. Body setae slender and, for the most part, slightly longer than those of dorsum.

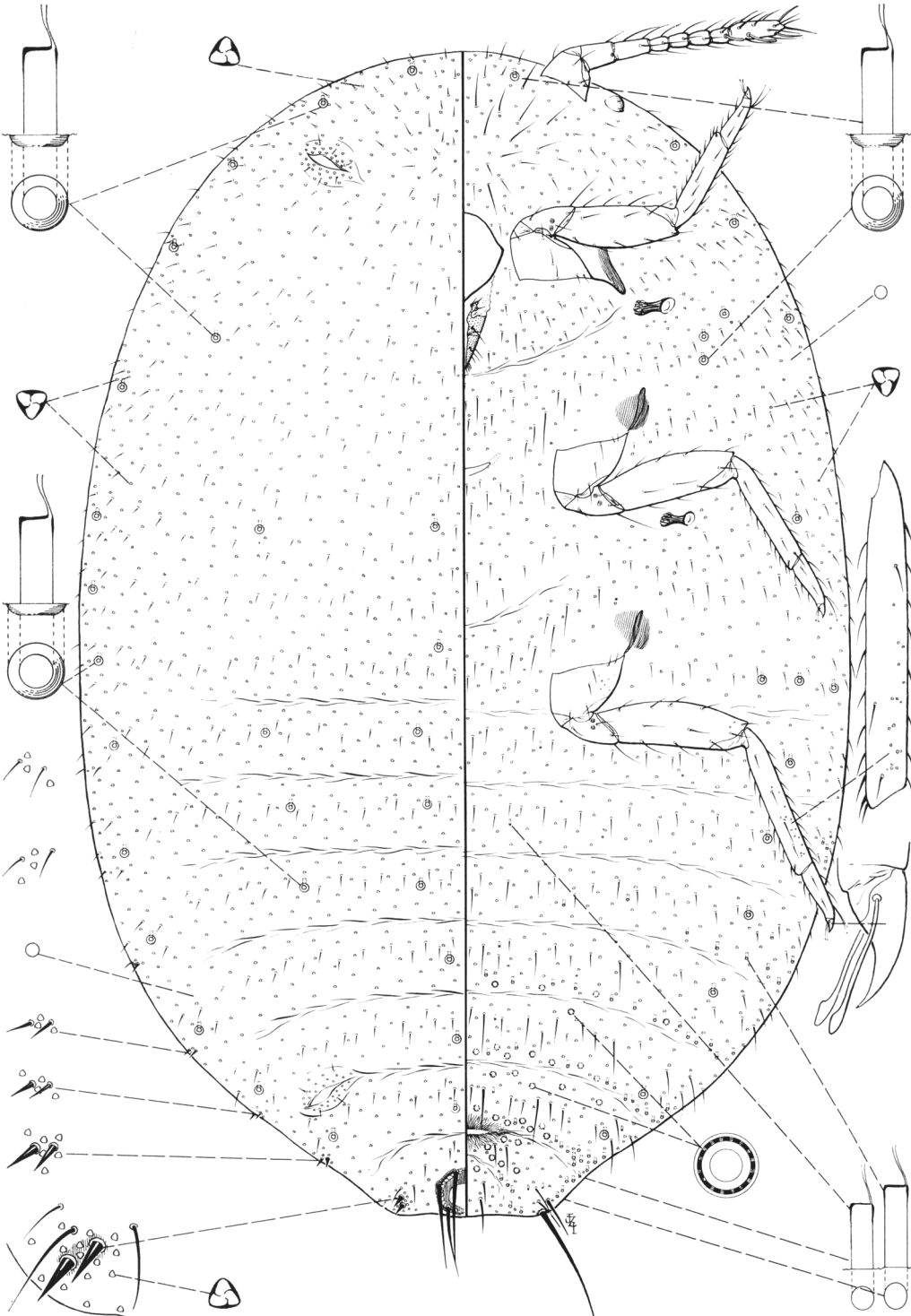


Fig. 6. *Chorizococcus variabilis* McKenzie, new species, collected on Joshua tree, *Yucca brevifolia* (Agavaceae), at Las Vegas, Clark County, Nevada.

Circulus absent. Legs comparatively large; 0 to 12 translucent pores on hind coxa and a few near end of hind femur; 6 to 14 translucent pores unevenly distributed on distal three-fourths of hind tibia; claw without denticle. Mouthparts comparatively broad. Antennae usually 8-segmented, moderately long.

Notes. The generic placement of this species is uncertain. Because of the variable numbers of abdominal cerarii the species seems to bridge the gap between *Chorizococcus* McKenzie, with 4 pairs or fewer, and *Spilococcus* Ferris, with 6

pairs or more. I am assigning the new species to *Chorizococcus* because it appears quite closely related to the genotype, *C. wilkeyi* McKenzie. The principal differences are that *C. wilkeyi* has multilocular disk pores in considerable numbers on venter from apex to fifth abdominal segment and the new species has fewer of these pores on posterior margin of eighth segment and usually none on posterior margin of fifth segment; also, *C. wilkeyi* has a tiny denticle on claw, but this is not found on *C. variabilis*.

Genus *Cryptoripersia* Cockerell

McKenzie (1960, pp. 706 and 764) transferred *Trionymus hypolithus* Shotwell to the genus *Cryptoripersia*, where it seems to have closer affinities, especially in the absence of recognizable cerarii. He pointed out that the species had been assigned to *Trionymus* primarily, it appeared, because of its elongate body form but that there was not enough evidence for using body form alone as a primary generic character. Another reason for placing less emphasis on body form as a primary characteristic of *Cryptoripersia* is that the single mealybug collected at Cedarville in 1962, otherwise identical with known specimens of *C. salina*, has an elongate form similar to that of *C. hypolithus*.

So far as we know, the various char-

acters employed for recognition of *Cryptoripersia* have only the basic value that coccidologists give them. The species discussed below have features hitherto unknown to this genus. Discoidal pores, appearing on the new specimens of *C. salina*, were found also on examination of two homotype specimens after they were soaked off the original slides and restained. The new species, *C. tubulata*, has numerous oral-rim ducts—not known in any other species of *Cryptoripersia*. In this instance, I would not use these structures for generic segregation, but this is still a matter of opinion.

The genus now includes four species for North America, two of which occur in California.

KEY TO SPECIES OF *CRYPTORIPERSIA* IN NORTH AMERICA: ADULT FEMALES

1. With oral-rim ducts somewhere on body *tubulata* McKenzie
Without oral-rim ducts 2
- 2(1). Multilocular disk pores present in considerable numbers on dorsal surface of abdomen; discoidal pores absent 3
Multilocular disk pores absent from dorsal surface of abdomen, although 1 or 2 pores may be found occasionally; discoidal pores present *salina* (Ehrhorn)
- 3(2). Multilocular disk pores quite numerous on ventral surface of fourth and fifth abdominal segments; body elongate, oval . . . *hypolithus* Shotwell
Multilocular disk pores absent from ventral surface of fourth and fifth abdominal segments; body quite strongly pyriform . . . *trichura* (Cockerell)

***Cryptoripersia salina* (Ehrhorn)**

Additional collection records. On California oatgrass, *Danthonia californica* (Gramineae), 2 miles south of Kneeland, Humboldt County, California, collected June 16, 1960, by T. R. Haig and K. Miller (CSDA No. 60F23-1). In ant nest under a rock at Cedarville, Modoc County, California, collected May 21, 1962, by T. R. Haig (CSDA No. 62E31-97).

Notes. All adult females from these two collections have numerous discoidal pores on dorsal and ventral body surfaces. They have many more short oral-collar ducts on the dorsum than are shown in Ferris's (1953) illustration of this species and many more multilocular disk pores on the venter. As all these characters appear also on the restrained homotype specimens, they should be added to the description of the species.

***Cryptoripersia tubulata* McKenzie,
new species**

(Figure 7)

Suggested common name. Tubulate mealybug.

Collection data. Adult females under a rock at Portola, Plumas County, California, in the nest of the ant *Formica subpolita camponoticeps*; collected November 20, 1962, by T. R. Haig (CSDA No. 62K23-13). One adult female paratype under a stone 1.5 miles north of Markleeville, Alpine County, California, collected November 1, 1962, by W. R. Bauer (CSDA No. 62K7-60).

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Paratypes in museum, University of California, Davis.

Gross external features. The mature mealybugs were enclosed in a white felted sac.

Recognition characters. Adult females, mounted, 2.50 to 3.10 mm long, 2.00 to 2.25 mm wide; body form rotund.

Dorsum with 2 pairs of ostioles. Cerarii absent except for anal-lobe pair, represented on each lobe by 2 elongate conical setae set rather close together, accompanied by several slightly shorter, more slender auxiliary setae and by obviously associated trilocular pores.

Dorsum beset with numerous trilocular and minute circular pores. Oral-collar ducts numerous, of average diameter, about three times as long as wide. Oral-rim ducts numerous, scattered over entire dorsal surface. Body setae slender and numerous. Anal ring set about its own diameter dorsad from apex of abdomen; with numerous pores in at least 2 rows; each of its 6 setae slightly longer than diameter of ring.

Venter with considerable numbers of multilocular disk pores, extending in rows across abdomen from apex to posterior margin of sixth abdominal segment, absent elsewhere. Trilocular pores evenly distributed. Minute circular pores scattered. Numerous oral-collar ducts, similar in size and shape to those on dorsum. Oral-rim ducts scattered from eighth abdominal segment to head. Body setae as numerous and practically the same size as those on dorsum.

Circulus absent. Legs relatively small, hind coxae with translucent pores, claw without denticle. Mouthparts short and moderately broad. Antennae 6-segmented. Eyes present.

Notes. This species is perhaps most closely related to *C. salina* but differs principally in having oral-rim tubular ducts, hitherto unknown in this genus, on both dorsal and ventral surfaces. Also, the new species has oral-collar ducts of average size, about three times as long as wide, whereas those of *C. salina* are of about the diameter of a trilocular pore and not more than twice as long as wide.

The late Harold Morrison kindly examined specimens of this species and made important comments regarding its generic assignment and its relationship to other species of *Cryptoripersia*.

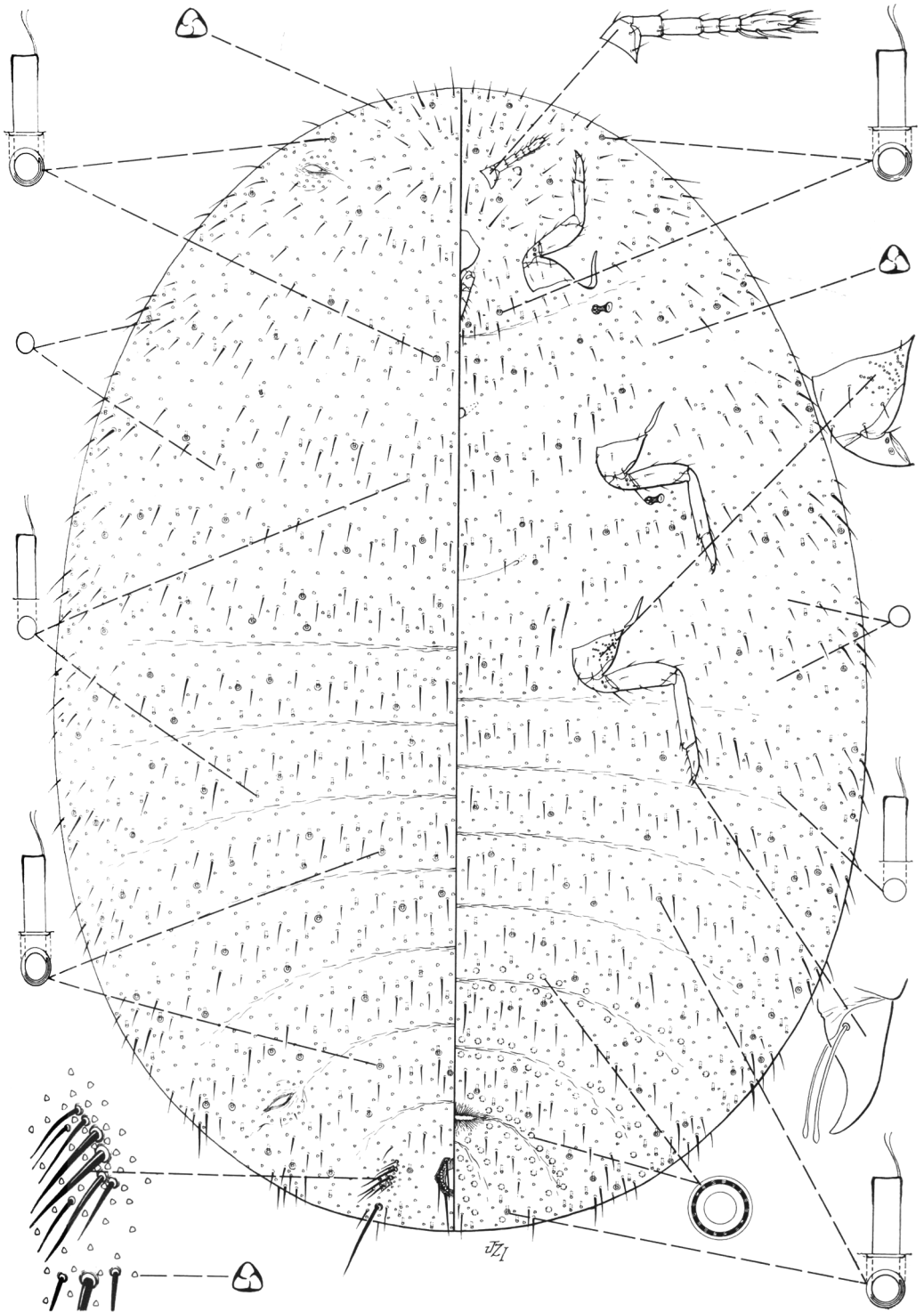


Fig. 7. *Cryptoripersia tubulata* McKenzie, new species, collected in an ant nest under a rock at Portola, Plumas County, California.

Genus *Dysmicoccus* Ferris

Now assigned to this genus are 23 adds one new species and corrects an species for North America, five of which error in the previous key (McKenzie, occur in California. The following key 1962).

KEY TO SPECIES OF *DYSMICOCCLUS* IN NORTH AMERICA: ADULT FEMALES

1. With multilocular disk pores on dorsum 2
Without multilocular disk pores on dorsum 3
- 2(1). With multilocular disk pores on dorsum of thorax and head; cerarii
on last 7 or 8 abdominal segments *desertorum* McKenzie
Without multilocular disk pores on dorsum of thorax or head; 17
pairs of cerarii *timberlakei* (Cockerell)
- 3(1). Circulus present 10
Circulus absent 4
- 4(3). All cerarii, except perhaps those of the head region, with 2 conical setae 5
Most of the cerarii with 3 or more conical setae, of various sizes
obesus (Lobdell)
- 5(4). Tubular ducts few—scarcely more than 10 on venter of abdomen;
anal-lobe cerarius surrounded by large and definite sclerotized area
aciculus Ferris
Tubular ducts more numerous—many more than 10 on venter of
abdomen; anal-lobe cerarius not surrounded by sclerotized area. . . . 6
- 6(5). Anal lobes sclerotized in area posterior to cerarius. . *diodium* (McConnell)
Anal lobes not sclerotized in area posterior to cerarius. 7
- 7(6). Large cluster of tubular ducts in lateroventral area of every segment
except head *mcdanieli* (Hollinger)
Cluster of 0 to 15 tubular ducts in lateroventral area, on abdominal
segments only 8
- 8(7). With cluster of 3 to 15 tubular ducts in lateroventral area on each of
the last 4 abdominal segments 9
With not more than 1 tubular duct in lateroventral area of any ab-
dominal segment, and often with none
fimbriatulus (Cockerell and King)
- 9(8). With 17 pairs of cerarii. *lasii* (Cockerell)
Cerarii recognizable only on abdominal segments. . . *junceus* (McConnell)
- 10(3). With 17 pairs of cerarii 14
With fewer than 17 pairs of cerarii 11
- 11(10). At least 10 recognizable pairs of cerarii 13
Not more than 7 recognizable pairs of cerarii including, at times, a
frontal pair 12
- 12(11). Circulus small, circular, not divided by intersegmental line
merrilli (Ferris)
Circulus large, oval, divided by intersegmental line. . *boninsis* (Kuwana)
- 13(11). Not more than 2 conical setae in any cerarius except in head region
ryani (Coquillett)
At least 3 conical setae in most of the cerarii. *difficilis* (Lobdell)
- 14(10). Tubular ducts absent from dorsum 15
At least a few tubular ducts on dorsum 21

- 15(14). Anal-lobe cerarius surrounded by a definite sclerotized area..... 16
 Anal-lobe cerarius with no surrounding sclerotized area..... 17
- 16(15). Penultimate cerarius with 2 conical setae and 2 or more auxiliary
 setae; 0 to 3 multilocular disk pores on venter, found only on last 2
 abdominal segments *pinicolus* McKenzie
 Penultimate cerarius with 4 or 5 conical setae and several auxiliary
 setae; 20 to 30 multilocular disk pores on venter, found on last 3
 abdominal segments *cuspidatae* (Rau)
- 17(15). With flat discoidal pores of various sizes on dorsum of abdomen an-
 terior to anal ring; some abdominal cerarii with 3 or more conical
 setae *brevipes* (Cockerell)
 Without flat discoidal pores in this position; no cerarii, other than
 those of the head region, with more than 2 conical setae..... 18
- 18(17). Few or no tubular ducts on venter of abdomen
roseotinctus (Cockerell and Cockerell)
 Numerous tubular ducts on venter of abdomen 19
- 19(18). Multilocular disk pores on venter from apex to posterior margin of
 fifth abdominal segment *hurdi* McKenzie
 Multilocular disk pores on venter from apex to posterior margin of
 seventh or eighth abdominal segment 20
- 20(19). Numerous tubular ducts in lateral areas of all abdominal segments
salmonaceus (Cockerell)
 Tubular ducts only in lateroventral areas of sixth to eighth abdominal
 segments *texensis* (Tinsley)
- 21(14). Definite sclerotized area surrounding anal-lobe cerarius..... 22
 No sclerotized area surrounding anal-lobe cerarius
morrisoni (Hollinger)
- 22(21). Tubular ducts scattered over entire dorsum..... *patulae* (Rau)
 Dorsum with tubular ducts only on abdomen..... *quercicolus* (Ferris)

***Dysmicoccus desertorum* McKenzie**

This is not the only species of *Dysmicoccus* that has multilocular disk pores on the dorsum, as was stated in the original description, under "Notes" (McKenzie, 1962, p. 646). *D. timberlakei* also has dorsal multiloculars. The revised key to species (above) incorporates this correction.

***Dysmicoccus pinicolus* McKenzie, new species**

(Figure 8)

Suggested common name. Pine dysmicoccus mealybug.

Collection data. Adult females on one-leaved pinyon pine, *Pinus monophylla* (Pinaceae), presumably above-ground on twigs, branches, and foliage, at Mountain Springs Summit, Clark

County, Nevada; collected July 1, 1961, by R. C. Bechtel. These are the only known representatives of the species.

Type material. Holotype adult female (single specimen on slide) and female paratypes in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Adult females, mounted, 3.00 to 4.00 mm long, 1.90 to 2.80 mm wide; body form broadly oval.

Dorsum, basically, with 17 pairs of cerarii. Anal-lobe cerarius with a definite sclerotized area, seen only on well-stained specimens; with 2 large conical setae, slender auxiliary setae, and numerous, somewhat crowded trilocular pores. Remaining abdominal cerarii with a slight degree of sclerotization,

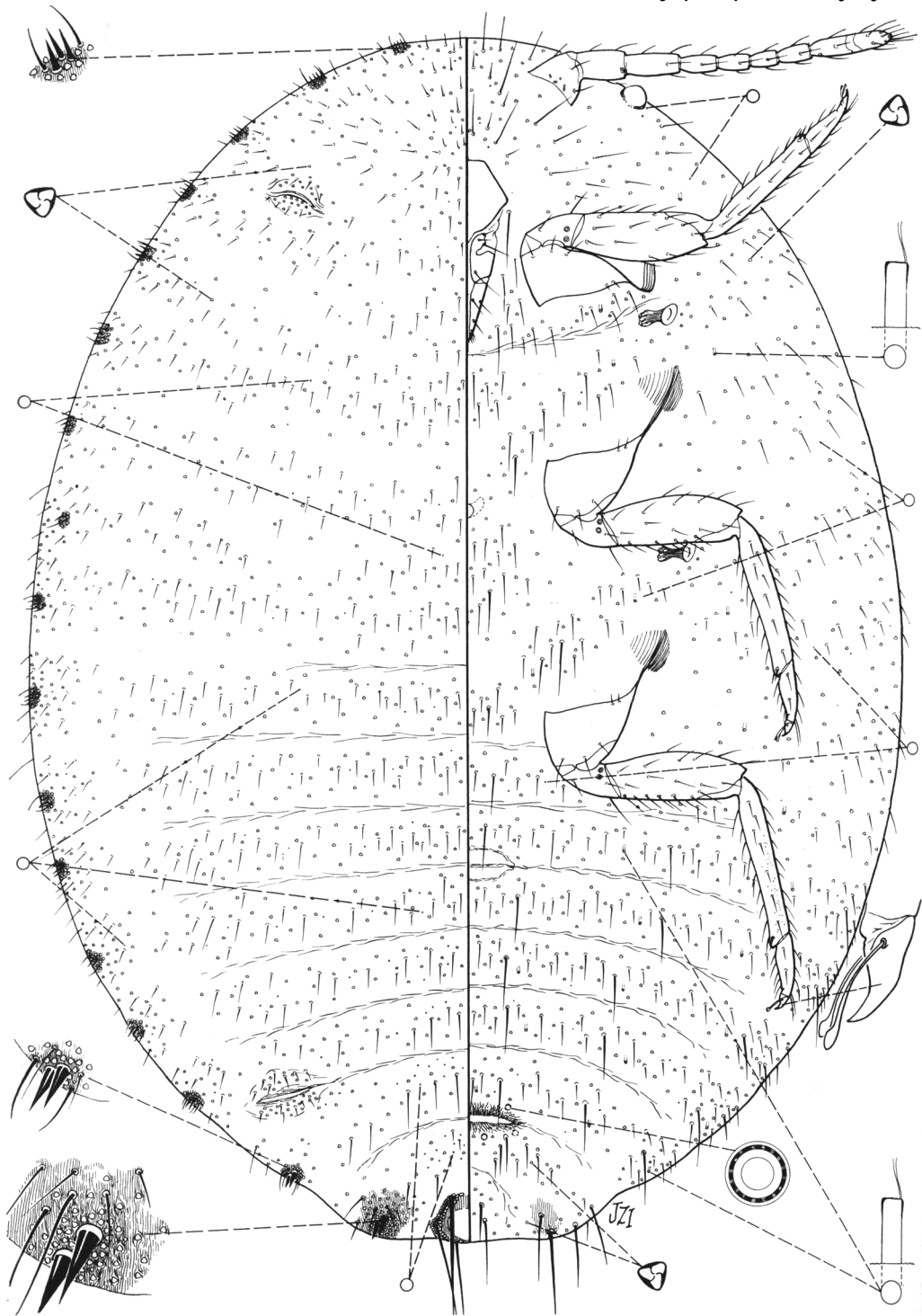


Fig. 8. *Dysmicoccus pinicolus* McKenzie, new species, collected on twigs and branches of one-leaved pinyon pine, *Pinus monophylla* (Pinaceae), at Mountain Springs Summit, Clark County, Nevada.

and each with 2 conical setae—progressively smaller with distance from anal lobes—2 or more slender auxiliary setae, and a few trilocular pores. Cerarii on thorax and head with 2 to 5 (usually 3) conical setae, otherwise similar to those on abdomen, including the slight sclerotization.

Dorsum beset with trilocular pores, fairly numerous minute circular pores, and short, slender, body setae. Anal ring apical, with no unusual characters; each of its 6 setae about twice as long as greatest diameter of ring.

Venter with 0 to 3 multilocular disk pores—if present, usually on last abdominal segment, posterior to vulva (one specimen had its single pore on eighth segment, anterior to vulva). Trilocular pores evenly beset over venter. Minute circular pores in moderate numbers. Oral-collar ducts sparsely scattered on body. Most of body setae slightly longer than those on dorsum.

Circulus quite large, usually appearing transversely oval, capable of folding along intersegmental line. Legs large, well formed; hind tibia with 12 to 26 (average 18) translucent pores distributed along most of segment; claw without denticle. Antennae 8-segmented, slender; apical segment frequently appearing divided by an irregular lighter band that suggests a ninth segment.

Notes. This species is rather closely related to *Dysmicoccus cuspidatae*, another mealybug that infests a member of the pine family, but there are marked morphological differences between the two species. *D. pinicolus* differs from *D. cuspidatae* in having only 2 conical setae instead of 4 or 5 on the penultimate cerarius, and in having multilocular disk pores either completely absent or reduced to 2 or 3 on venter of the last 2 abdominal segments instead of 20 to 30 on venter of the last 3 abdominal segments.

Genus *Heliococcus* Šulc

One new California species of *Heliococcus* occasions a revision of the earlier key (McKenzie, 1960) to include this and *H. malvastrus* McDaniel (1962), described in Texas. These two species,

with only 1 or 2 pairs of cerarii, differ from the other known species of *Heliococcus*, which have 18 pairs. The genus now includes six species for North America, three of them in California.

**KEY TO SPECIES OF *HELIOCOCCUS* IN NORTH AMERICA:
ADULT FEMALES**

- 1. With 17 or 18 recognizable pairs of cerarii 3
- With only 1 or 2 pairs of cerarii, either on anal lobes or on the last 2 abdominal segments 2
- 2(1). Cerarii on last 2 abdominal segments; denticle on claw; found on *Atriplex* sp. *atriplex* McKenzie
- Cerarii only on anal lobes; no denticle on claw; found on *Malvastrum* sp. *malvastrus* McDaniel
- 3(1). Dorsum with enlarged ducts few and inconspicuous, all of about the same size 4
- Dorsum with numerous enlarged ducts of various sizes 5
- 4(3). Venter with multilocular disk pores *insignis* (Lobdell)
- Venter without multilocular disk pores *adenostomae* McKenzie
- 5(3). Enlarged ducts of dorsum predominantly of the smaller size, with larger ducts few *osborni* (Sanders)
- Enlarged ducts of dorsum predominantly of the larger size, the smaller ducts few *stachyos* (Ehrhorn)

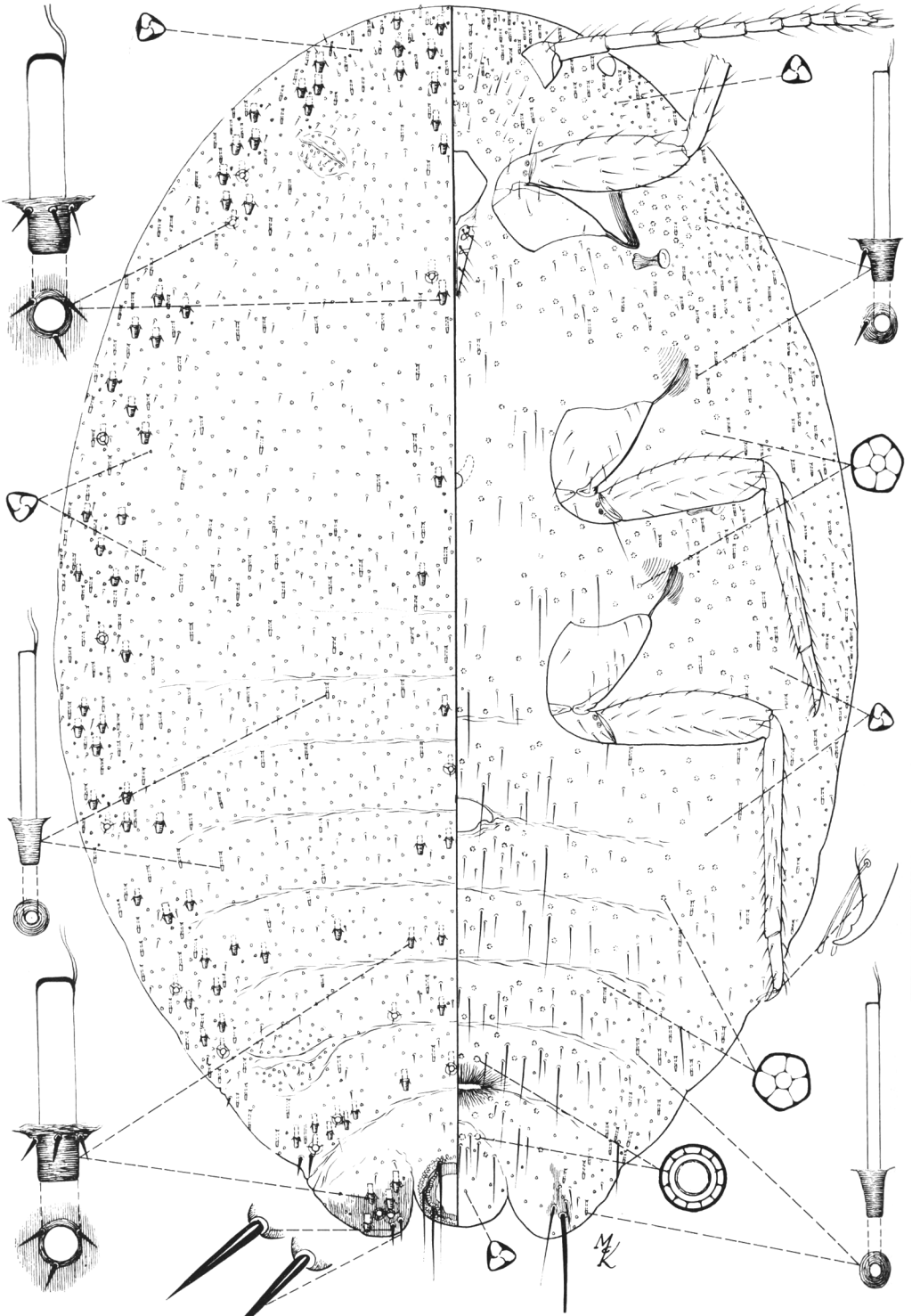


Fig. 9. *Heliococcus atriplicis* McKenzie, new species, collected on leaves of saltbush, *Atriplex lentiformis* (Chenopodiaceae), at Brawley, Imperial County, California.

***Heliococcus atriplicis* McKenzie,
new species**

(Figure 9)

Suggested common name. *Atriplex* heliococcus mealybug.

Collection data. Adult females on leaves of saltbush, *Atriplex lentiformis* (Chenopodiaceae), at Brawley, Imperial County, California; collected November 28, 1961, by V. D. Roth (CSDA No. 62D16-112). Apparently the infestation was very light.

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Two female paratypes (single specimen on each slide) in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Adult females, mounted, 2.80 to 3.60 mm long, 1.60 to 2.30 mm wide; body shape broadly oval.

Dorsum with only 2 pairs of cerarii. Anal-lobe cerarius somewhat sclerotized; with 2 small, slightly lanceolate, conical setae, a few small and inconspicuous auxiliary setae, and 4 or 5 enlarged tubular ducts, but without noticeable clustering of trilocular pores. Penultimate cerarius somewhat sclerotized; with 2 small, slightly lanceolate, conical setae, but without auxiliary setae, tubular ducts, or clustering of trilocular pores.

Trilocular pores generally scattered over dorsum. Characteristic enlarged tubular ducts of two markedly different sizes: The larger with duct prominence

short and broad, having 3 or 4 small setae arising from its base; the smaller ducts relatively more slender, occasionally with only one seta. Larger ducts numerous on dorsum, arranged in submarginal band from apex of abdomen to head and in an irregular series across certain abdominal segments, usually sixth and eighth; the smaller ones still more numerous, occurring in a definite submarginal band from eighth abdominal segment to tip of head and in irregular rows across abdominal segments, thorax, and head. Body setae all very small, distributed over entire body surface. Anal ring apical, with the distinctive structure of this genus, each of its 6 setae longer than diameter of ring.

Venter with a small, irregular sclerotization at base of anal-lobe seta. Not more than 5 multilocular disk pores, immediately around the vulva. Quinquelocular pores quite numerous from apex of abdomen to head. Trilocular pores relatively sparse, noticeable along body margin but lacking in some areas in mid-abdominal and sternal regions. Tubular ducts, similar to the smaller ones on dorsum, in some numbers along submarginal areas. Body setae slender, generally much longer than those on dorsum.

Circulus proportionately large, transversely oval, anterior margin often slightly produced laterally. Legs well formed, with a noticeable denticle on claw. Antennae 9-segmented.

Note. This species appears closely allied to *Heliococcus malvastrus*, but differs in having 2 pairs of cerarii as compared to only one—the anal-lobe pair—as in *H. malvastrus*.

Genus *Humococcus* Ferris

The new species of *Humococcus* described below, from Nevada, is unique for this genus because it has 5 or 6 pairs

of cerarii on abdomen, whereas species previously described from North America have only anal-lobe cerarii or none.

KEY TO SPECIES OF *HUMOCOCCUS* IN NORTH AMERICA: ADULT FEMALES

1. Abdomen with 5 or 6 pairs of cerarii. *ceraricus* McKenzie
Cerarii absent or with only the anal-lobe pair present. 2
- 2(1). Anal ring closely surrounded by numerous setae. *porterae* (Cockerell)
Anal ring not thus surrounded by setae 3
- 3(2). Oral-rim ducts on dorsum 4
No oral-rim ducts on dorsum 6
- 4(3). Multilocular disk pores on dorsum of abdomen. 5
No multilocular disk pores on dorsum of abdomen. *caritus* McKenzie
- 5(4). At least a few oral-rim and oral-collar ducts on venter of head and
thorax; anal ring dorsad from apex of abdomen by 3 or 4 times its own
diameter *atriplicis* Ferris
Oral-rim and oral-collar ducts absent ventrally from head and thorax;
anal ring dorsad from apex of abdomen by only slightly more than
twice its diameter *inornatus* McKenzie
- 6(3). Oral-collar ducts of the larger size rather numerous, forming a sub-
marginal band on venter from apex of abdomen to head
muhlenbergiae Ferris
Oral-collar ducts on venter few and confined to a submarginal row on
abdomen *hilariae* (Ferris)

Humococcus ceraricus McKenzie, new species (Figure 10)

Suggested common name. Black-greasewood mealybug.

Collection data. Adult females beaten off small twigs and branches of black greasewood, *Sarcobatus vermiculatus* (Chenopodiaceae), 1.3 miles southeast of Beatty, Nye County, Nevada; collected June 24, 1962, by T. C. Fuller (CSDA No. 62F29-4). An additional paratype specimen from same area and host was collected May 5, 1962, by D. M. Maddox (CSDA No. 62S15-12). Presumably the mealybug inhabits small cracks and crevices in the bark. No other collection of this species is known.

Type material. Holotype adult female (single specimen on slide) and female paratype in collection of California State Department of Agriculture, Sacramento. Paratypes in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Adult fe-

males, mounted, 1.00 to 1.80 mm long, 0.50 to 1.20 mm wide; body form oval, elongate.

Dorsum with recognizable cerarii on the last 5 or 6 abdominal segments. Anal-lobe cerarius represented merely by a pair of enlarged lanceolate setae, with no evidence of auxiliary setae or of associated trilocular pores. Anterior to this, cerarii similar but with setae progressively more slender.

A few multilocular disk pores on dorsum from fourth to eighth abdominal segments, sometimes 1 or 2 on thorax, none on head. Trilocular pores few and rather evenly distributed. A very few oral-collar ducts on certain abdominal segments. Oral-rim ducts in transverse rows on most abdominal segments, variable in number, with not more than 8 or 10 on each segment; a few also along margin and submargin of thorax, none on head. Last 4 or 5 abdominal segments beset with stout, elongate setae; segments anterior to these, including thorax and head, with setae short and slender. Anal ring dorsad from apex of abdomen by about one

fourth its diameter; consisting of a simple, sclerotized ring without pores; each of its 6 setae approximately three fourths as long as diameter of ring.

Venter with multilocular disk pores in considerable numbers from apex of abdomen to fifth abdominal segment, none elsewhere on venter. Trilocular pores quite sparsely distributed. A few oral-collar ducts along submargin of seventh and eighth abdominal segments. A few oral-rim ducts from fourth to eighth abdominal segments, absent elsewhere. Body setae similar to those on dorsum, although perhaps less numerous.

Circulus absent. Legs well formed, comparatively large; a few translucent pores on hind coxa; tiny denticle on claw. Mouthparts moderately long and relatively broad. Antennae 7-segmented, moderately long.

Notes. The presence of 5 or 6 pairs of cerarii would seem to set this species somewhat apart from the genus *Humococcus* as defined by Ferris (1953), who reported cerarii either entirely lacking

or present only on anal lobes. Aside from this difference the new species appears to be a genuine member of the genus.

Humococcus inornatus McKenzie

Additional collection record. Single adult female on desert-holly, *Atriplex hymenelytra* (Chenopodiaceae), from Death Valley, Inyo County, California; intercepted in quarantine at Kingman, Arizona, March, 1963, by N. O'Connell (CSDA No. 63C29-23); tentatively identified as *Humococcus inornatus*.

Notes. This specimen matches the description of *H. inornatus* in every detail except for the following minor differences: The dorsum has a few more oral-rim ducts on abdominal segments 7 to 9, especially on segment 9, and 1 or 2 on sternal region; and the claw apparently lacks a denticle.

This collection gives the second California record for the species and extends its known range by some 125 miles northeast of the type locality at Barstow.

Genus *Phenacoccus* Cockerell

Seven new species of *Phenacoccus*—four from California, one from New Mexico, and two from Mexico (in quarantine)—bring the total for the genus to 34 species in North America, 21 of

which occur in California. The following revision of the earlier key (McKenzie, 1961) includes these seven new species and one other described recently (McKenzie, 1962).

KEY TO SPECIES OF *PHENACOCCLUS* IN NORTH AMERICA:
ADULT FEMALES

- 1. With more than 1 circulus 2
- With 1 circulus or none 3
- 2(1). Abdominal cerarii with numerous conical setae, in clusters

dearnessi King

aceris Signoret
- 3(1). Multilocular disk pores absent 4
- Multilocular disk pores present, at least in region of vulva. 5
- 4(3). Anal-lobe cerarius with 6 to 10 enlarged setae of uniform size, borne on a sclerotized area; quinquelocular pores absent ventrally from abdomen *eriogoni* Ferris
- Anal-lobe cerarius with only 2 enlarged setae; quinquelocular pores present ventrally on abdomen *lycii* (Ferris)

- 5(3). Multilocular disk pores present on both dorsum and venter, at least on abdomen 6
- Multilocular disk pores confined to venter 17
- 6(5). Circulus absent *artemisiae* Ehrhorn
- Circulus present 7
- 7(6). Anal-lobe cerarius with 6 to 10 enlarged setae of uniform size, borne on a more or less sclerotized area *helianthi* (Cockerell)
- Anal-lobe cerarius with 2 enlarged setae of about the same size and sometimes with 1 or more smaller setae in addition, these not borne on a sclerotized area 8
- 8(7). At least one abdominal segment with a median dorsal cerarius consisting of 2 or 3 enlarged setae and a few pores 9
- Abdominal segments without such a cerarius 12
- 9(8). Median dorsal cerarius present only on ninth abdominal segment *nonarius* McKenzie
- Median dorsal cerarius absent from ninth abdominal segment, present on next anterior segment or segments 10
- 10(9). Dorsal and lateral areas with numerous multilocular disk pores as far forward as head; dorsum with numerous small tubular ducts *acericola* King
- Dorsal and lateral areas with multilocular disk pores only as far forward as mesothorax; tubular ducts of dorsum few and scattered. 11
- 11(10). Dorsal body setae throughout of the same shape and of approximately the same size as the cerarian setae; median dorsal cerarii on all abdominal segments except ninth *flaveolus* (Cockerell)
- Most of dorsal body setae distinctly shorter and more slender than the cerarian setae; median dorsal cerarii present only on abdominal segments 7 and 8 *franseriae* Ferris
- 12(8). Circulus narrowly and strongly produced laterally, resembling an ox yoke *gossypii* Townsend and Cockerell
- Circulus round or oval; only slightly produced laterally, if at all. . . . 13
- 13(12). Multilocular disk pores rather numerous on dorsum of thorax and head; occurring on Gramineae. *graminosus* McKenzie
- Multilocular disk pores absent from dorsum of thorax and head, except for 1 or 2 pores occasionally found on thorax. 14
- 14(13). Antennae normally 8-segmented 15
- Antennae normally 9-segmented 16
- 15(14). Venter with quinquelocular pores on thorax and with multilocular disk pores near posterior spiracle *hurdi* McKenzie
- Venter without quinquelocular pores on thorax and without multilocular disk pores near posterior spiracle *alleni* McKenzie
- 16(14). Multilocular disk pores in considerable numbers on dorsum of all abdominal segments except the last; venter with only a few quinquelocular pores on thorax near mouthparts, none on abdominal segments 3 to 6 *infernalis* McKenzie
- Multilocular disk pores of dorsum mostly along posterior borders of segments 6 and 7; quinquelocular pores in sternal region and on venter of abdominal segments 3 to 6 *eremicus* Ferris
- 17(5). Circulus present 18
- Circulus absent 29
- 18(17). Dorsum without tubular ducts except strictly marginal ones. 19

- Dorsum with a considerable number of tubular ducts scattered over surface 24
- 19(18). With 17 or 18 recognizable pairs of cerarii 21
- With 15 recognizable pairs of cerarii or fewer 20
- 20(19). With 15 pairs of cerarii; antennae 7- or 8-segmented; adult female usually less than 2.5 mm long *echeveriae* McKenzie
- With not more than 8 pairs of cerarii; antennae 9-segmented; adult female usually from 5 to 8 mm long *giganteus* McKenzie
- 21(19). With small but distinct sclerotized area surrounding base of each cerarius *rubivorus* Cockerell
- Cerarii without sclerotized area 22
- 22(21). Usually with only a few multilocular disk pores, these normally confined to posterior margin of eighth abdominal segment immediately anterior to vulva and ninth segment in area posterior to vulva; infrequently a single pore on seventh segment *defectus* Ferris
- Usually with considerable numbers of multilocular disk pores around vulva and forward at least to seventh abdominal segment 23
- 23(22). Antennae normally 8-segmented; circulus normally very small, oval; multilocular disk pores on venter, from apex of abdomen to segment posterior to circulus *solani* Ferris
- Antennae normally 9-segmented; circulus moderately large, flaccid, and subject to distortion, sometimes slightly produced laterally; multilocular disk pores usually confined to area immediately around vulva and to segment 7 *solenopsis* Tinsley
- 24(18). Abdominal segments 7 and 8 each with a median dorsal cerarius with setae nearly as large as those of lateral cerarii; tubular ducts especially abundant in dorsolateral areas of abdominal segments 6 to 9 *capensis* Ferris
- Abdominal segments without median dorsal cerarii; tubular ducts of dorsum not thus concentrated 25
- 25(24). Many of dorsal body setae as stout and as long as setae of lateral cerarii, sometimes longer *celtisifoliae* Hollinger
- Dorsal body setae noticeably shorter and more slender than setae of lateral cerarii 26
- 26(25). With 17 or 18 recognizable pairs of cerarii 27
- With not more than 15 recognizable pairs of cerarii 28
- 27(26). Hind tibiae straight-sided, relatively slender, with very few translucent pores or none; quinquelocular pores on venter in considerable numbers from sixth abdominal segment to and including sternal area; circulus relatively large and flaccid. *tibiae gracilis* McKenzie
- Hind tibiae definitely convex, with translucent pores fairly numerous but not densely clustered; quinquelocular pores few and inconspicuous, occurring principally on venter of head region; circulus small, oval *colemani* Ehrhorn
- 28(26). Quinquelocular pores on venter of head and thorax; antennae 9-segmented *minimus* Tinsley
- Quinquelocular pores absent from venter of head and thorax; antennae 8-segmented *dicoriae* McKenzie
- 29(17). With 18 recognizable pairs of cerarii on dorsum; venter with scarcely more than 10 multilocular disk pores, these immediately anterior to vulva *pauperatus* Ferris

- With 14 recognizable pairs of cerarii or fewer, these occurring on consecutive segments forward from apex of abdomen; multilocular disk pores on venter of ninth abdominal segment and forward at least to posterior margin of seventh 30
- 30(29). Antennae 7- or 8-segmented; no oral-collar ducts on dorsum of abdomen; found on *Lotus* *lotearum* McKenzie
Antennae 9-segmented; at least a few oral-collar ducts on dorsum of abdomen 31
- 31(30). With at least 6 or 7 pairs of abdominal cerarii 32
With cerarii on only the last 3 or 4 abdominal segments *eschsoltziae* McKenzie
- 32(31). With octolocular pores scattered over dorsal and ventral body surfaces *incomptus* McKenzie
Without octolocular pores 33
- 33(32). Multilocular disk pores on venter from ninth abdominal segment usually to fourth; denticle on claw very small, situated near the tip *advena* McKenzie
Multilocular disk pores of venter restricted to last three abdominal segments; denticle on claw well developed, not unusually near the tip *milleri* McKenzie

***Phenacoccus advena* McKenzie,
new species**

(Figure 11)

Suggested common name. Foreign mealybug.

Collection data. One adult female on a succulent, *Echeveria* sp. (Crassulaceae), from Cadereyta, State of Querétaro, Mexico; taken in quarantine at Laredo, Texas, January 6, 1947, by Jackson and Gillaspay (USDA No. 47-1278; Laredo No. 42082).

Type material. Holotype adult female (single specimen on slide) in United States National Collection of Coccoidea, Washington, D.C.

Gross external features. No information.

Recognition characters. Single adult female, mounted, 2.50 mm long, 1.60 mm wide; body form broadly oval.

Dorsum with cerarii on last 7 abdominal segments, plus 1 distinguishable pair of ocular cerarii. Anal-lobe cerarius with slight sclerotization. Each cerarius with 2 conical setae and without auxiliary setae; in addition to the 2 large conical setae, each of the anal-lobe pair and possibly also of the ocular

pair may have 1 or 2 slightly smaller conical setae. All cerarii with a very slight concentration of trilocular pores.

Single multilocular disk pore on dorsum of eighth abdominal segment, probably exceptional. Trilocular pores evenly beset over entire dorsum. Minute circular pores scattered. Oral-collar ducts sparsely scattered on abdomen and thorax, none on head. Body setae short and slender. Anal ring apical, small, with no unusual characters; each of its 6 setae approximately twice as long as greatest diameter of ring.

Venter with multilocular disk pores on all abdominal segments except second and third, none elsewhere. Trilocular pores and minute circular pores evenly beset. Oral-collar ducts in limited numbers. Body setae slender, slightly longer than those of dorsum.

Circulus absent. Legs comparatively stout and long; hind tibia of single specimen with 68 or 69 translucent pores; claw with tiny denticle quite near tip. Antennae moderately long, 9-segmented (i.e., distal segment appearing definitely divided).

Notes. This species is most closely related to another new species, *Phena-*

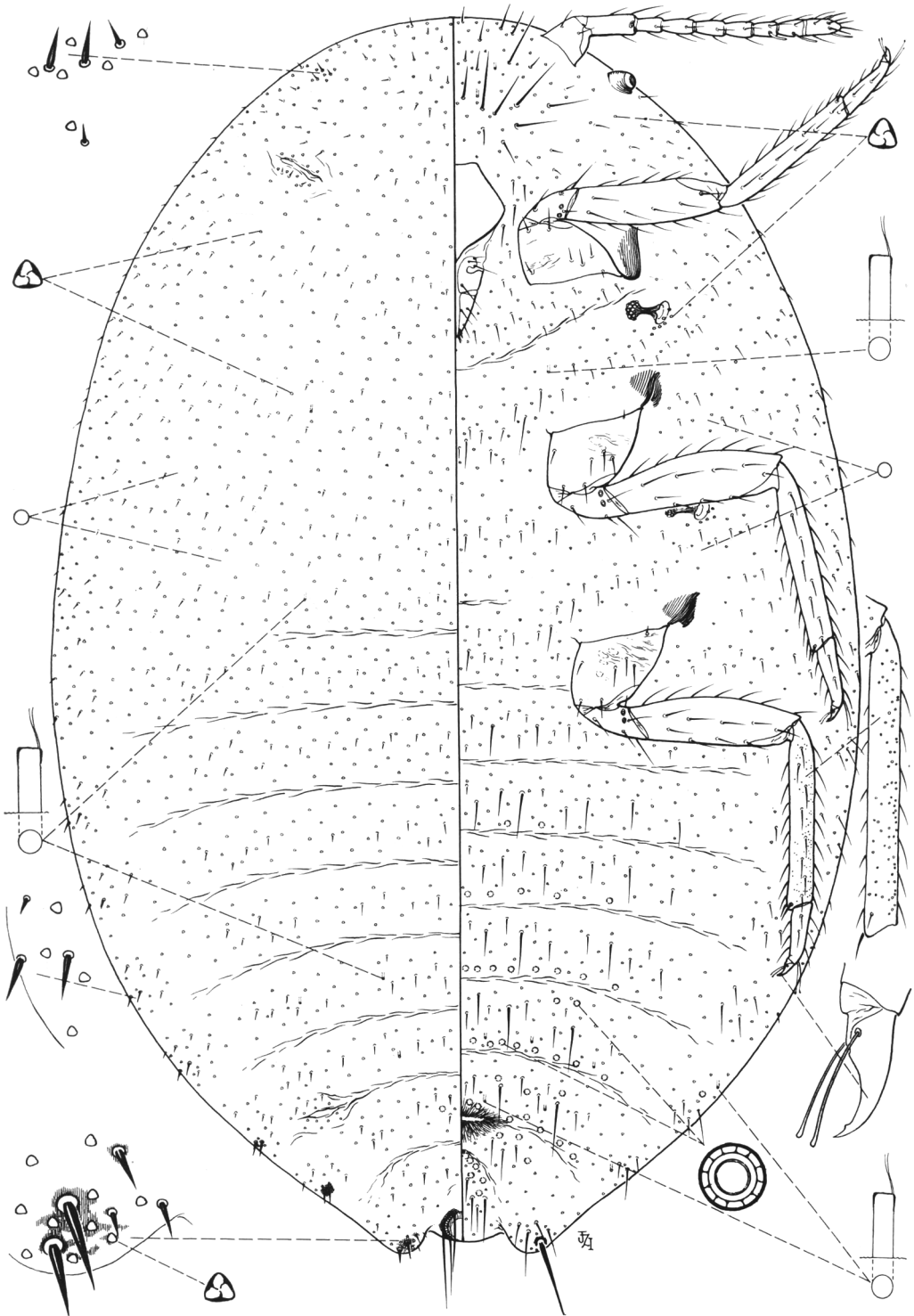


Fig. 11. *Phenacoccus advena* McKenzie, new species, collected on a succulent, *Echeveria* sp. (Cras-
sulaceae), in quarantine at Laredo, Texas, from Cadereyta, State of Querétaro, Mexico.

coccus milleri, but differs principally in having multilocular disk pores on venter of fourth to ninth abdominal segments rather than on only the last three segments, and in that the denticle is tiny and situated nearer to tip of claw than in *P. milleri*.

The monotypic adult female of this species was kindly loaned by the late Harold Morrison for preparation of the technical description given above.

***Phenacoccus allenii* McKenzie,
new species**
(Figure 12)

Suggested common name. Allen mealybug.

Collection data. Adult females on leaves and twigs of *Hymenoclea salsola* (Compositae), East Morongo Valley, San Bernardino County, California, collected April 11, 1962, by R. P. Allen (CSDA No. 62D18-41). This mealybug was found intermixed with another new species, *Phenacoccus nonarius*.

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Paratypes in museum, University of California, Davis, and in the United States National Collection of Coccoidea, Washington, D.C.

Gross external features. No information.

Recognition characters. Adult females, mounted, 2.85 to 4.00 mm long, 1.60 to 2.25 mm wide; body form broadly oval.

Dorsum normally with 18 pairs of cerarii, those on the last 4 abdominal segments with small amount of sclerotization. Each cerarius with 2 conical setae but no auxiliary setae, and with a slight concentration of trilocular pores. Anal-lobe cerarius and certain cerarii on head each may have 1 or 2 additional conical setae, slightly smaller than the 2 principal setae.

Considerable numbers of multilocular disk pores on dorsum of all abdom-

inal segments except, possibly, the last—those on segments 3 and 4 confined to submarginal areas; none on thorax and head. Trilocular pores evenly beset over entire dorsal surface, each pore appearing irregularly broken, with numerous fine lines. Considerable numbers of oral-collar ducts. Body setae fairly numerous, all short and slender. Anal ring apical, with no unusual characters; each of its 6 setae about twice as long as greatest diameter of ring.

Venter with considerable numbers of multilocular disk pores from apex of abdomen to and including second abdominal segment, none on thorax and head; pores extend across segments to body margins except on segment 3, where there may be only 1 or 2 pores, occurring submarginally. Quinquelocular pores absent. Trilocular pores distributed fairly evenly. Oral-collar ducts of two sizes in considerable numbers. Body setae slender and generally longer than those of dorsum.

Circulus quite large, normally appearing broadly oval, not divided by intersegmental furrow. Legs comparatively large; hind femur with 3 to 12 translucent pores at distal end; hind tibia with 25 to 51 translucent pores (average 40.6) scattered along most of segment, with some clustering on distal half; claw with prominent denticle. Antennae 8-segmented, moderately long.

Notes. This species is named for its collector, R. P. Allen. It is closely related to *Phenacoccus infernalis* but differs in having the following: antennae 8-segmented; no quinquelocular pores near mouthparts; oral-collar ducts on venter of thorax; circulus not divided by intersegmental line; 25 to 51 translucent pores on hind tibia. On the other hand, *P. infernalis* has 9-segmented antennae; has quinquelocular pores near mouthparts; lacks oral-collar ducts on venter of thorax; its circulus is divided transversely by intersegmental line; and it has only a few translucent pores on hind tibia. *P. allenii* is related also to *P. graminosus* but differs mainly in that

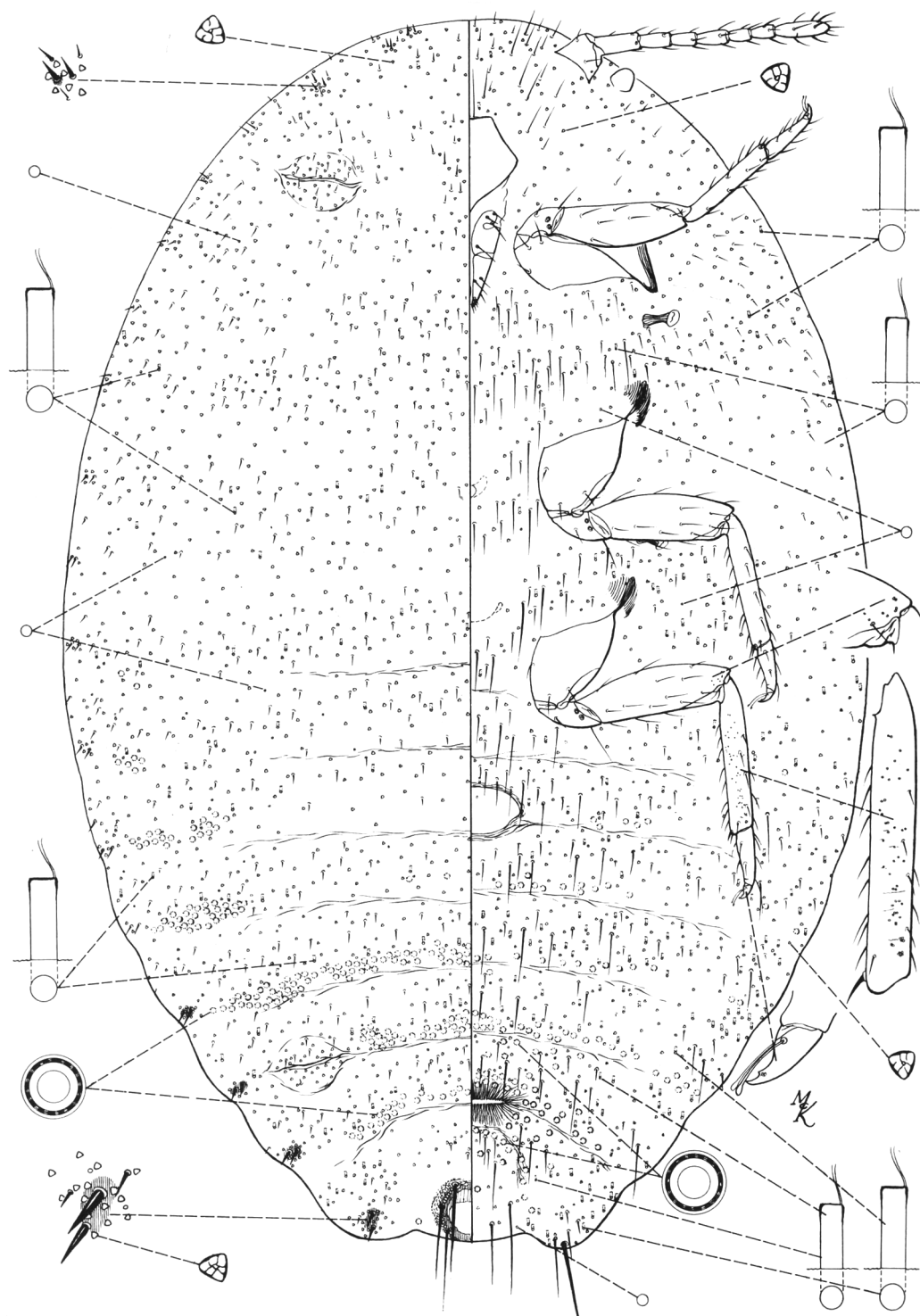


Fig. 12. *Phenacoccus alleni* McKenzie, new species, collected on leaves and twigs of *Hymenoclea salsola* (Compositae) at East Morongo Valley, San Bernardino County, California.

the multilocular disk pores of dorsum are confined to the abdominal segments, whereas in *P. graminosus* a few are found also on thorax and head.

***Phenacoccus giganteus* McKenzie,
new species**

(Figure 13)

Suggested common name. Giant phenacoccus mealybug.

Collection data. Adult females on burro-weed (bur-sage), *Franseria dumosa* (Compositae), found only on crowns or underground parts of the host; collected 12 miles south of Shoshone, Inyo County, California, April 13, 1963, by D. R. Miller.

Type material. Holotype adult female (single specimen on slide) and female paratypes in museum, University of California, Davis. Paratypes in collection of California State Department of Agriculture, Sacramento, and in the United States National Collection of Coccoidea, Washington, D.C.

Gross external features. In life, the pinkish body shows faintly through the very thin dusting of a whitish secretion. There are no noticeable caudal or lateral tassels. Before oviposition, the adult female becomes enclosed in a rather tough sac formed of fine waxy threads. Fully mature specimens were taken in April.

Recognition characters. Adult females, mounted, 5.0 to 8.0 mm long, 3.25 to 5.50 mm wide; body form broadly oval.

Dorsum with cerarii on the last 4 or 5 abdominal segments, occasionally 1 or 2 pairs distinguishable on prothorax and 1 or 2 ocular pairs on head. Anal-lobe cerarius with a small area of sclerotization. Each cerarius with 2 conical setae and without auxiliary setae; in addition to the 2 large conical setae, each of the anal-lobe cerarii and possibly the ocular cerarii may have 1 or 2 slightly smaller conical setae. All cerarii with a very slight concentration of trilocular pores.

Trilocular pores numerous and evenly beset over entire dorsum. Minute circular pores scattered. No tubular ducts of any kind. Body setae short and slender. Anal ring apical, with no unusual characters; each of its 6 setae slightly longer than greatest diameter of ring.

Venter with multilocular disk pores on all abdominal segments except second and third, especially numerous on the last 4 segments, lacking elsewhere. Trilocular pores evenly beset. Minute circular pores scattered. Oral-collar ducts fairly numerous on abdomen, especially along submargin, scattered elsewhere on venter. Body setae slender, slightly longer than those of dorsum.

Circulus comparatively large, usually shaped like a loaf of bread; situated on fourth abdominal segment, not capable of folding along the intersegmental line. Legs well formed, comparatively small; hind tibia with 62 to 172 translucent pores (average 98.6) distributed along entire segment; claw with prominent denticle. Mouthparts comparatively stout. Antennae 9-segmented, proportionately very small.

Notes. One of the outstanding features of this species is its enormous size, which is the obvious reason for naming it *giganteus*. Even the smaller of the adult females are usually 5 mm long—the size of the largest individuals in other known species.

This mealybug appears related to *Phenacoccus echeveriae* McKenzie but has only 6 to 8 pairs of cerarii and a 9-segmented antenna, as compared to the 15 pairs of cerarii normal for *P. echeveriae* and its 7- or 8-segmented antenna.

***Phenacoccus graminosus* McKenzie**

This species was collected on *Festuca*(?) (Gramineae) at Chico, Butte County, California, on September 24, 1962, by T. R. Haig (CSDA No. 62I27-45). This is the most northerly collection from the Central Valley; previous records are mostly coastal, from Ala-

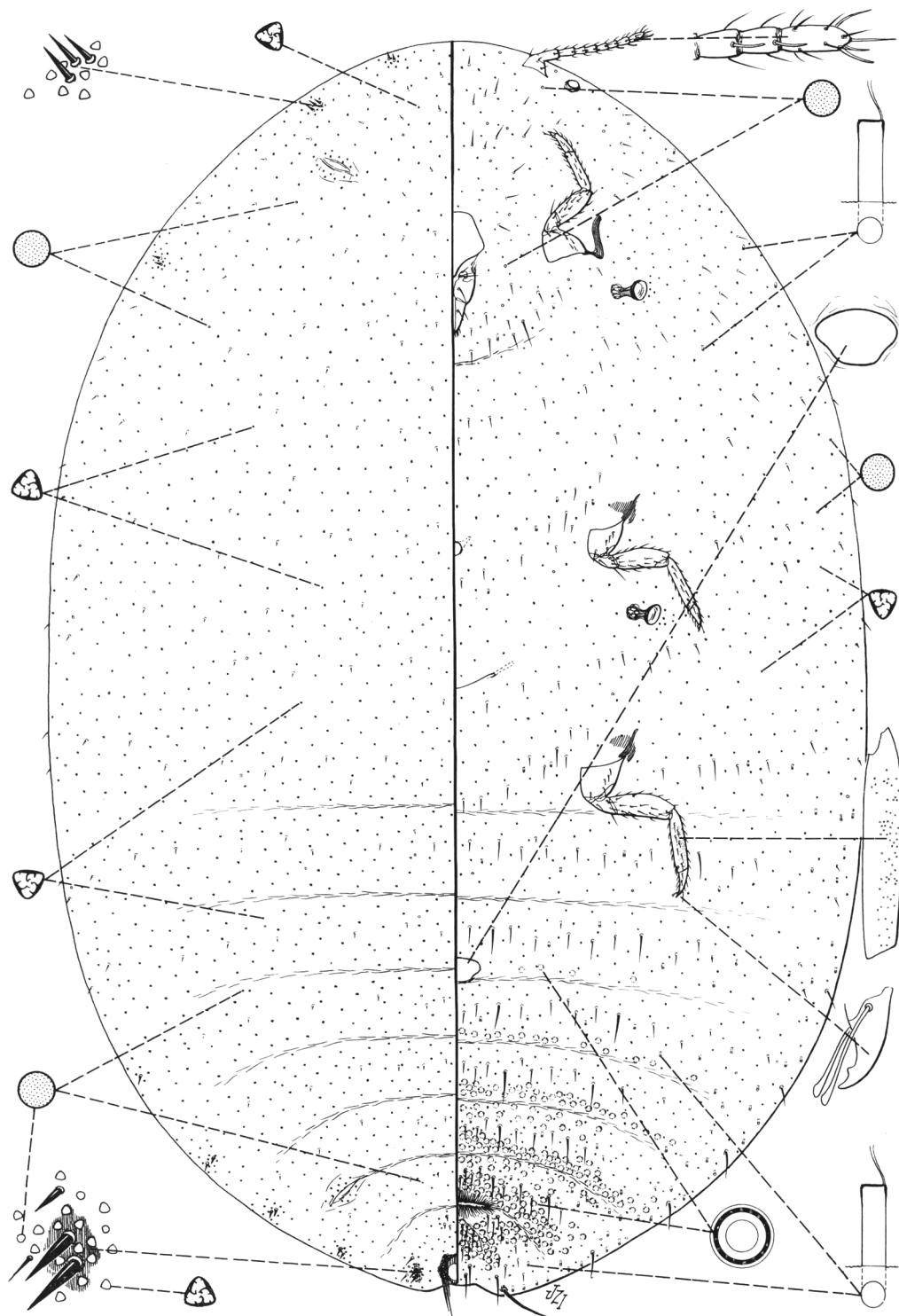


Fig. 13. *Phenacoccus giganteus* McKenzie, new species, collected on crowns and underground portions of burro-weed, *Franseria dumosa* (Compositae), 12 miles south of Shoshone, Inyo County, California.

meda, Contra Costa, Marin, Monterey, Santa Clara, and Solano counties.

***Phenacoccus hurdi* McKenzie,
new species**

(Figure 14)

Suggested common name. Hurd phenacoccus mealybug.

Collection data. Adult females on crown and underground parts of snake-weed, *Gutierrezia microcephala* [*G. lucida*] (Compositae), 6 miles west of Red Hill, Catron County, New Mexico; collected September 13, 1961, by P. D. Hurd (No. 174). This is the only known collection of this mealybug.

Type material. Holotype adult female (single specimen on slide) and female paratypes in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Adult females, mounted, 2.00 to 2.80 mm long, 1.25 to 1.80 mm wide; body form broadly oval.

Dorsum with 17 pairs of cerarii, as here interpreted. Anal-lobe cerarii with small amount of sclerotization. Each cerarius with 2 conical setae and without auxiliary setae; the anal-lobe cerarii and at times certain head cerarii each may have 1 or 2 additional conical setae. All cerarii with very slight concentration of trilocular pores.

Considerable numbers of multilocular disk pores on dorsum of all abdominal segments except the last; none on thorax and head, except that occasionally 1 pore occurs on thorax. Trilocular pores evenly beset over entire surface, each pore appearing irregularly broken, with numerous fine lines. Numerous oral-collar ducts of two distinct sizes. Body setae fairly numerous, all short and slender. Anal ring apical, without unusual characters; each of its 6 setae nearly twice as long as greatest diameter of ring.

Venter with considerable numbers of multilocular disk pores on all abdominal

segments, extending across segment to lateral margins, except on segment 3, where they occur essentially as a submarginal group; a few submarginal groups also on thorax. Quinquelocular pores considerably smaller than the multilocular pores, distributed abundantly in the median region of anterior abdominal segments, thorax, and head. Trilocular pores distributed rather evenly. Tubular ducts of two sizes, with slight oral rim, numerous on ventral surface but sparse on head. Body setae slender and generally longer than those of dorsum.

Circulus comparatively small, transversely oval, apparently not capable of folding along the intersegmental line. Legs comparatively stout; hind tibia with 33 to 55 (average 40) translucent pores along entire segment; claw with prominent denticle. Mouthparts comparatively elongate. Antennae 8-segmented, moderately long.

Notes. This species appears quite closely related to *Phenacoccus graminosus* but lacks the numerous multilocular disk pores so obvious in *P. graminosus* on dorsum of thorax and on venter near anterior spiracles. Moreover, *P. hurdi* was collected on a plant of the family Compositae, whereas *P. graminosus* is known only from representatives of the Gramineae.

Again I take considerable pleasure in naming a mealybug after Paul D. Hurd, who has collected and made available for study not only this species but also several other most interesting lots of pseudococcids. One of his Mexican collections supplied the species *Dysmicoccus hurdi* McKenzie (1962).

***Phenacoccus incomptus* McKenzie,
new species**

(Figure 15)

Suggested common name. Unadorned mealybug.

Collection data. Adult females on *Echeveria* sp. (Crassulaceae) from Mexico, taken in quarantine at San

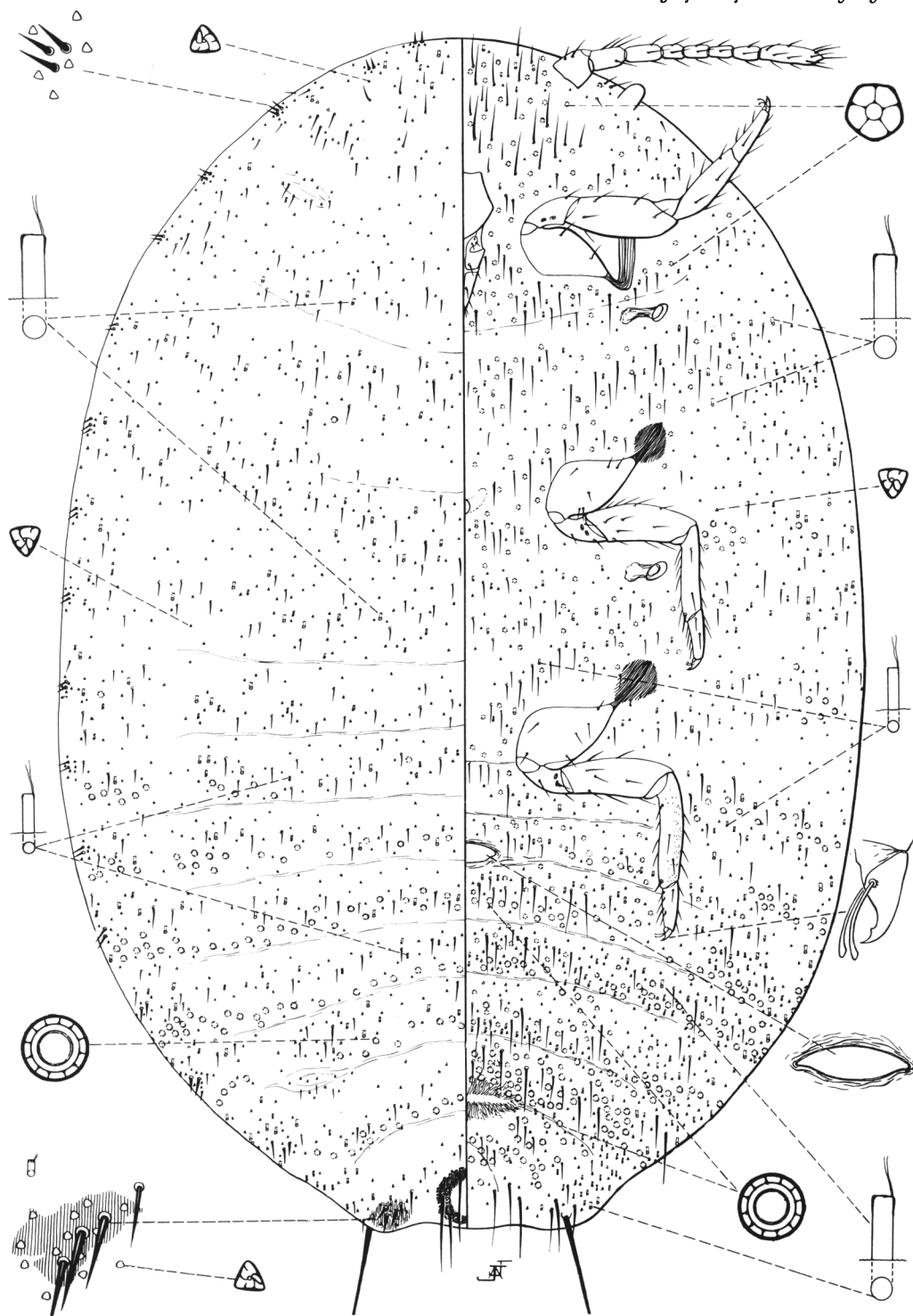


Fig. 14. *Phenacoccus hurdi* McKenzie, new species, collected on crowns and underground portions of snakeweed, *Gutierrezia microcephala* [*G. lucida*] (Compositae), 6 miles west of Red Hill, Catron County, New Mexico.

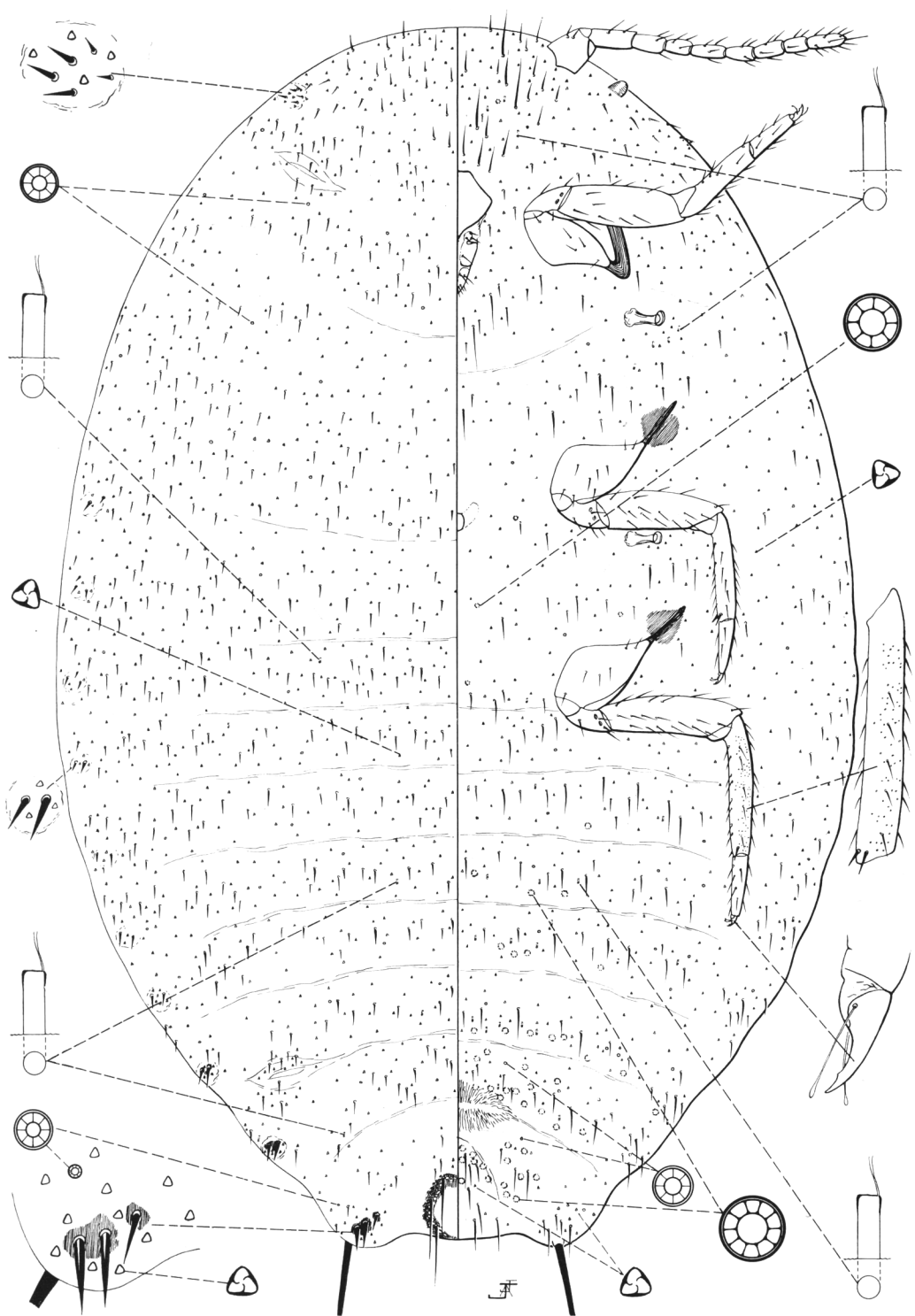


Fig. 15. *Phenacoccus incomptus* McKenzie, new species, collected on *Echeveria* sp. (Crassulaceae) in quarantine at San Francisco, California, from Mexico.

Francisco, California, on January 2, 1947, by C. E. Foust (USDA No. 47-1280; San Francisco No. 22504). This is the only known collection of the species.

Type material. Holotype adult female (single specimen on slide) in United States National Collection of Coccoidea, Washington, D. C. Single paratype female in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Largest available adult female, mounted, approximately 2.40 mm long, 1.25 mm wide; body form broadly oval.

Dorsum with cerarii on the last 8 abdominal segments, and 1 to 3 pairs distinguishable on thorax and head. Anal-lobe cerarius with small sclerotized area. Each cerarius with 2 conical setae and without auxiliary setae; in addition to the 2 large conical setae, each of the anal-lobe cerarii and possibly the head cerarii, when present, may have 1 or 2 slightly smaller conical setae. All cerarii with very slight concentration of trilobular pores.

Trilobular pores rather abundant, evenly beset over entire dorsum. Small circular, octolocular pores, apparently of one size, sparsely scattered. Tubular ducts, with a slight oral collar, distributed sparsely. Body setae numerous, all short and slender. Anal ring apical, with no unusual characters; each of its 6 setae about twice as long as greatest diameter of ring.

Venter with multilobular disk pores on all abdominal segments except second and third but lacking on thorax and head. Small numbers of octolocular pores of two sizes: the small pores on abdomen, the larger mostly on anterior abdominal segments, thorax, and head. Trilobular pores evenly distributed. Oral-collar ducts in limited numbers. Body setae slender, slightly longer than those on dorsum.

Circulus absent. Legs comparatively long; hind tibia with 51 to 86 (average 68) translucent pores; claw with tiny

denticle, quite near tip. Mouthparts comparatively short. Antennae usually 9-segmented, moderately long.

Notes. This species appears quite near to *Phenacoccus eschscholtziae* but is easily distinguished by its 8 pairs of abdominal cerarii and by its octolocular pores. *P. eschscholtziae*, on the other hand, has only 3 or 4 recognizable pairs of cerarii on abdomen and lacks octolocular pores. *P. incomptus* is related also to *P. advena*, but again is distinguished mainly by the presence of octolocular pores, these absent from *P. advena*.

The late Harold Morrison, of the United States Department of Agriculture, made specimens of this new species available for description.

Phenacoccus infernalis McKenzie

Specimens of this mealybug were found on ocotillo, *Fouquieria splendens* (Fouquieriaceae), in a nursery at Canoga Park, Los Angeles County, California, on April 18, 1963, by D. Williams (CSDA No. 63D24-24). The infested plants originated in Imperial County, California, according to the peddler who sold them to the nursery.

This species was previously collected from the same host at Tombstone, Arizona (McKenzie, 1962). Its occurrence in California supports the existing practice of describing new pseudococcids from other western states and from nearby countries.

Phenacoccus lotearum McKenzie

Specimens of this mealybug were collected on *Lotus* sp. (Leguminosae) at Escondido, San Diego County, California, on July 3, 1962, by R. O. Baker (CSDA No. 62G12-70). The new specimens have 35 to 51 translucent pores scattered along the entire hind tibia—a feature that was omitted from the original description (McKenzie, 1960). Reexamination of the type and paratype adult females of this species disclosed these hind tibial structures on the original material also.

***Phenacoccus milleri* McKenzie,
new species**

(Figure 16)

Suggested common name. Miller phenacoccus mealybug.

Collection data. Type and paratype adult females on sage, *Salvia columbariae* (Labiatae), 1 mile west of Joshua Tree, San Bernardino County, California; collected April 9, 1963, by D. R. Miller. Miller collected additional paratype adult females in the same locality on the same date from the following hosts: mountain dandelion, *Agoseris* (?) sp. (Compositae); fiddle-neck, *Amsinckia* sp. (Boraginaceae); *Coreopsis californica* (Compositae); filaree, *Erodium cicutarium* (Geraniaceae); *Layia glandulosa* (Compositae); desert-dandelion, *Malacothrix glabrata* (Compositae); and *Nama demissum* (Hydrophyllaceae). Other paratype adult females on desert-dandelion, *Malacothrix glabrata* (Compositae), on wild rhubarb, *Rumex hymenosepalus* (Polygonaceae), and on sage, *Salvia columbariae* (Labiatae), all 2 miles west of Yucca Valley, San Bernardino County, California, collected April 9, 1963, by D. R. Miller. The specimens were found only on the crowns or underground portions of the host plants.

Type material. Holotype adult female (single specimen on slide) and female paratypes in museum, University of California, Davis. Paratypes in collection of California State Department of Agriculture, Sacramento, and in the United States National Collection of Coccoidea, Washington, D.C.

Gross external features. In life this mealybug is of a somewhat lavender-gray color and is very thinly dusted with a waxy secretion. Apparently there are no lateral tassels; caudal tassels very small or lacking. No ovisac observed. Fully mature females were taken in April.

Recognition characters. Adult females, mounted, 2.10 to 3.90 mm long,

1.00 to 2.75 mm wide; body form broadly oval.

Dorsum with 7 to 14 recognizable pairs of cerarii: 4 to 8 pairs on most posterior segments of abdomen, 1 to 4 pairs on thorax, and 0 to 2 ocular pairs on head. Cerarii are reduced and often difficult to discern because the conical setae are unusually far apart. Anal-lobe cerarius with small amount of sclerotization. Each cerarius with 2 large conical setae and without auxiliary setae; in addition to the 2 large conical setae, the anal-lobe cerarius may have 3 or 4 smaller conical setae; an ocular cerarius may possibly have 1 or 2 of the smaller conical setae. All cerarii with a very slight concentration of trilocular pores.

Trilocular pores evenly beset over entire dorsum. Minute circular pores scattered. Oral-collar ducts, some with a very slight oral rim, on abdomen in median area and along submargin, a few scattered on thorax and head. Body setae very small, sparse. Anal ring apical, with no unusual characters; each of its 6 setae nearly twice as long as greatest diameter of ring.

Venter with multilocular disk pores on last 3 abdominal segments, absent elsewhere, except that one specimen had a single pore on venter of sixth abdominal segment. Trilocular pores evenly beset. Minute circular pores scattered. Oral-collar ducts, of the same type as those on dorsum, found mostly on abdomen, scattered on thorax and head. Body setae slender, more numerous and mostly longer than those on dorsum.

Circulus absent. Legs of moderate size; hind tibia slightly convex on inside margin and with 46 to 69 (average 54.7) very small translucent pores scattered over most of segment; claw with well-developed denticle. Antennae moderately long, 9-segmented: the distal segment definitely divided and of a characteristic shape—widest at the dividing line and tapering rather abruptly in both directions; other segments somewhat like those commonly found in the Margarodidae.

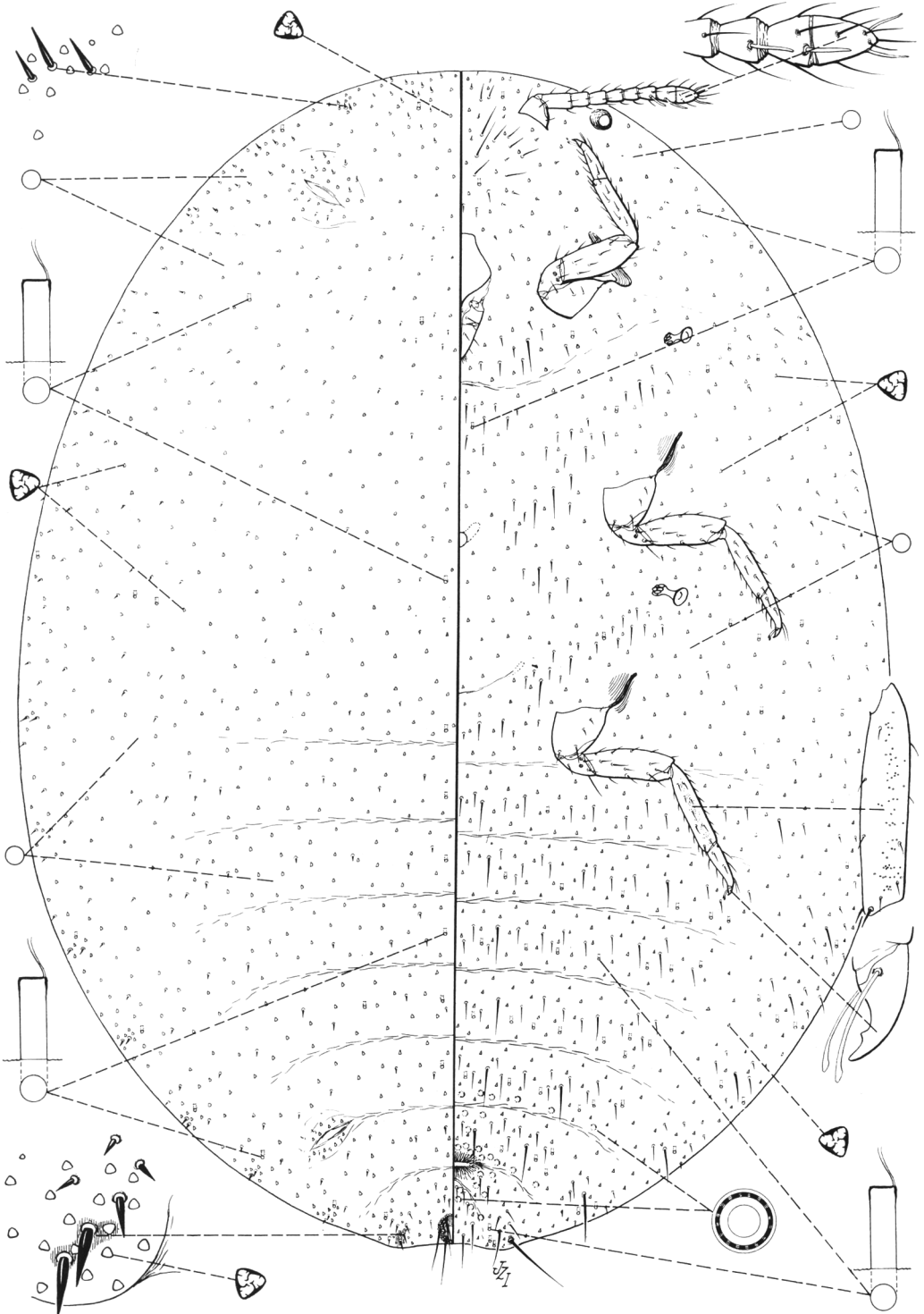


Fig. 16. *Phenacoccus milleri* McKenzie, new species, collected on crowns and underground portions of sage, *Salvia columbariae* (Labiatae), 1 mile west of Joshua Tree, San Bernardino County, California.

Notes. This species is perhaps most closely allied to the new species *Phenacoccus advena* but is distinguished by having multilocular disk pores of venter confined to the last 3 abdominal segments and by having the denticle of claw well developed and not noticeably close to the tip. *P. advena*, on the other hand, possesses ventral multiloculars on the last 6 abdominal segments, and the denticle on claw is very small and situated very close to tip.

This species is named for Douglass R. Miller, who has collected and made available for study not only this but also several other most interesting lots of pseudococoids.

***Phenacoccus nonarius* McKenzie,
new species**

(Figure 17)

Suggested common name. Nonarius mealybug.

Collection data. Adult females on leaves and twigs of *Hymenoclea salsola* (Compositae), East Morongo Valley, San Bernardino County, California; collected April 11, 1962, by R. P. Allen (CSDA No. 62D18-41). This mealybug was found intermixed with another new species, *Phenacoccus allenii*.

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Paratypes in museum, University of California, Davis.

Gross external features. No information.

Recognition characters. Adult females, mounted, 3.00 to 4.25 mm long, 1.65 to 2.25 mm wide; body form broadly oval.

Dorsum with 18 pairs of cerarii, each normally with 2 conical setae and with-

out auxiliary setae; in addition to the 2 large conical setae, each of the anal-lobe cerarii and certain of the head cerarii may have 2 or 3 slightly smaller conical setae. All cerarii with slight concentration of trilocular pores. Median dorsal cerarius on ninth segment, usually consisting of 2 conical setae the same size and shape as setae of the lateral cerarii.

Multilocular disk pores in considerable numbers on abdominal segments 6 to 8, none elsewhere on dorsum. Trilocular pores evenly beset over dorsum, each pore appearing irregularly broken with fine lines. Considerable numbers of rather large oral-collar ducts. Body setae sparse, very small. Anal ring apical, with no unusual characters; each of its 6 setae nearly twice as long as greatest diameter of ring.

Venter with considerable numbers of multilocular disk pores from apex to fifth abdominal segment, extending across segments to lateral area, none elsewhere. Quinelocular pores absent. Trilocular pores distributed rather evenly. Oral-collar ducts of two sizes: most of the smaller ones on abdomen, the larger predominating on thorax. Body setae slender, several times as long as those on dorsum.

Circulus quite large, transversely oval, usually appearing somewhat compressed, apparently capable of folding along intersegmental line. Legs fairly large; hind tibia with 8 to 17 small translucent pores; claw with prominent denticle. Antennae 9-segmented, moderately long.

Note. This mealybug is named *nonarius* because of the location of its median dorsal cerarius on the ninth abdominal segment, which distinguishes it from all previously known North American species of *Phenacoccus*.

Genus *Pseudococcus* Westwood

Four new species of *Pseudococcus* (McKenzie, 1962) were assigned to this genus only tentatively, until a compre-

hensive world-wide study of the genus might suggest a different relationship. These four species have fewer than the

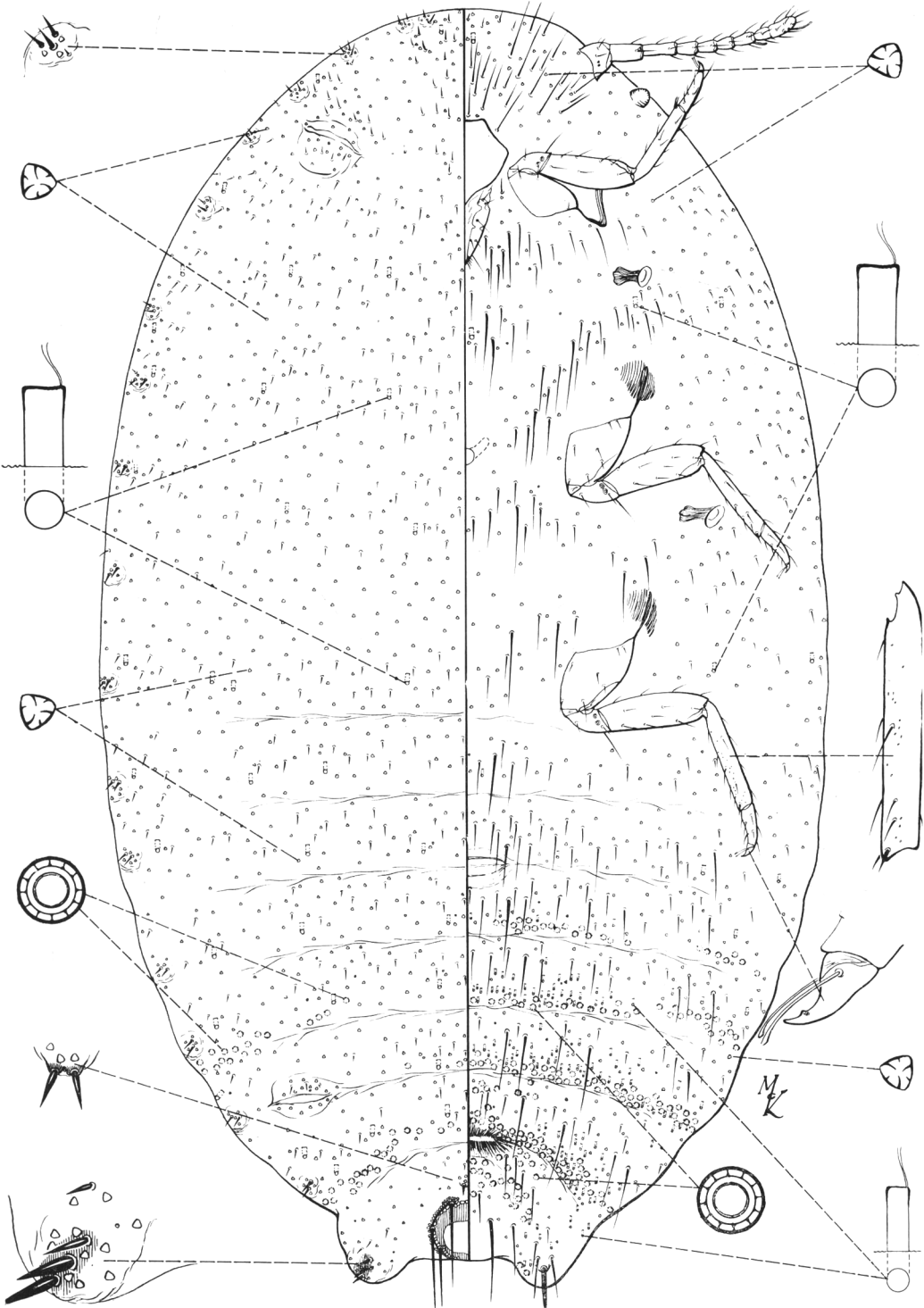


Fig. 17. *Phenacoccus nonarius* McKenzie, new species, collected on leaves and twigs of *Hymenoclea salsola* (Compositae) at East Morongo Valley, San Bernardino County, California.

usual 17 pairs of cerarii and lack auxiliary setae in some cerarii. The same situation appears in the two new California species described below; the new

species from Nevada is more typical of the genus. To the genus there are now assigned 18 species for North America, of which 11 occur in California.

KEY TO SPECIES OF *PSEUDOCOCCUS* IN NORTH AMERICA:
ADULT FEMALES

1. Circulus small, transversely oval, usually on fourth abdominal segment; never divided by intersegmental line, even if situated across it *microcirculus* McKenzie
Circulus normally quite large and, even if small, always divided by line between fourth and fifth abdominal segments 2
- 2(1). With at least 1 oral-rim duct on dorsum 3
Without oral-rim ducts on dorsum *diversus* McKenzie
- 3(2). With not more than 1 oral-rim duct near any cerarius 4
With 2 or 3, usually 3, oral-rim ducts near almost every cerarius *adonidum* (Linnaeus)
- 4(3). With one or more small, oval, discoidal pores along margin of eye.... 5
Without discoidal pores along margin of eye 6
- 5(4). Multilocular disk pores on venter of fourth abdominal segment; oral-collar ducts of two distinct sizes along ventral submargin of body: the larger ones with comparatively short tubes; recorded only from Orchidaceae *importatus* McKenzie
Multilocular disk pores usually lacking on venter of fourth abdominal segment, though a single pore may occur at times; oral-collar ducts, basically of one size, along ventral submargin of body; recorded from a long list of hosts *obscurus* Essig
- 6(4). With not more than 7 oral-rim ducts on dorsum of abdomen..... 7
With at least 10 oral-rim ducts on dorsum of abdomen, usually more.. 9
- 7(6). With 17 pairs of cerarii 8
With fewer than 16 pairs of cerarii *aberrans* McKenzie
- 8(7). Discoidal-type pores scattered on dorsal and ventral body surfaces; venter of sixth abdominal segment without multilocular disk pores, or sometimes with 1 such pore; at least 1 or 2 oral-rim ducts on dorsum of abdomen; body form subcircular, as mounted; found on *Prunus* sp. *prunicolus* McKenzie
Discoidal-type pores completely absent; venter of sixth abdominal segment with 3 to 5 multilocular disk pores along posterior margin; no oral-rim ducts on dorsum of abdomen; body form broadly oval, as mounted; found on *Agave* sp. *agavis* MacGregor
- 9(6). Dorsum with 1 oral-rim duct just posterior to each frontal cerarius... 10
Never with an oral-rim duct in this position..... *fragilis* Brain^o
- 10(9). Multilocular disk pores on venter of abdomen on only the last 3 or 4 segments 11
Multilocular disk pores on venter of last 5 or more abdominal segments 12
- 11(10). With 40 or more multilocular disk pores on venter, on anterior and posterior margins of eighth abdominal segment; no oral-rim ducts near anterior spiracles *dispar* McKenzie

^o *Pseudococcus gahani* Green is considered a synonym of *P. fragilis*, in agreement with Essig (1942), DeLotto (1958), and Williams (1962).

over entire dorsum. Oral-collar and oral-rim ducts apparently lacking. Body setae longer and thicker than in other species, some larger than those of venter, often with an enlarged basal sclerosis which may support also a smaller seta. Anal ring apical, with no unusual characters; each of its 6 setae nearly twice as long as greatest diameter of ring.

Venter with multilocular disk pores fairly numerous on the last 4 abdominal segments, with 1 or 2 on thorax, and none on head. Trilocular pores distributed fairly evenly. Oral-collar ducts mainly along submargin of abdomen, scattered on thorax and head. Oral-rim ducts in limited numbers, scattered on submargin of anterior abdominal segments, also laterad to the spiracles. Body setae approximately the same size as those of dorsum, often with a basal sclerosis which may support also a smaller seta.

Circulus proportionately small, normally appearing transversely oval, able to fold along intersegmental line. Legs relatively large, femora and tibiae appearing moderately enlarged; hind tibia with 42 to 90 (average 58) translucent pores; claw without denticle. Antennae 8-segmented, slender; eighth segment often appearing with lightened dividing band.

Notes. The reduced number of cerarii, some of which lack auxiliary setae, places *Pseudococcus diversus* with the atypical species still rather tentatively assigned to this genus. In character of its cerarian setae, this species resembles *P. macswaini* (McKenzie, 1962). The absence of oral-rim ducts on the dorsum precludes confusion with other North American species of this group.

The specimens collected on Meyer juniper at Fresno show the following slight divergences from the type series: They may have 7 to 9 pairs of cerarii on the abdomen—sometimes 7 or 8 cerarii on one side of the body and 9 on the other; certain cerarii on head and thorax often have extremely long and

thick auxiliary setae, sometimes associated with the short conical setae; one specimen shows a single oral-rim duct on dorsal submargin of third abdominal segment. In other details these specimens resemble *P. diversus*. An accurate appraisal of these morphological variations will require more material than is now available.

Pseudococcus importatus McKenzie

Reexamination of the two original specimens of *Pseudococcus importatus* makes it necessary to correct the description of the species (McKenzie, 1960). The type specimens have numerous minute circular pores on both body surfaces, incorrectly shown as oral-collar ducts on dorsal aspect of the original drawing; approximately 42 translucent pores on hind tibia, scattered along the entire length of the segment; and discoidal pores near the eyes.

Infestation by a mealybug here identified as *P. importatus* was found on several species of orchids—including *Dendrobium* sp., *Epidendrum* sp., and *Oncidium* sp.—in a nursery at Arcadia, Los Angeles County, California, April 25 and 30, 1963, by J. Hodge (CSDA No. 63E3-10). These adult females have either 16 or 17 pairs of cerarii and 28 to 33 oral-rim ducts on dorsum, thus varying slightly from the two type specimens, which have only 16 pairs of cerarii and only 7 or 8 oral-rim ducts on dorsum. The Arcadia specimens correspond to the type specimens in every other detail, including orchid host, two sizes of oral-collar ducts along ventral submargin of body, 35 to 43 translucent pores on hind tibia, and discoidal pores along margins of eyes.

Mealybugs collected in 1961 on baby orchid, *Odontoglossum grande* (Orchidaceae), at Compton, Los Angeles County, California, were tentatively identified (McKenzie, 1962) as *P. importatus*. Except that they have 30 or more oral-rim ducts on dorsum and only

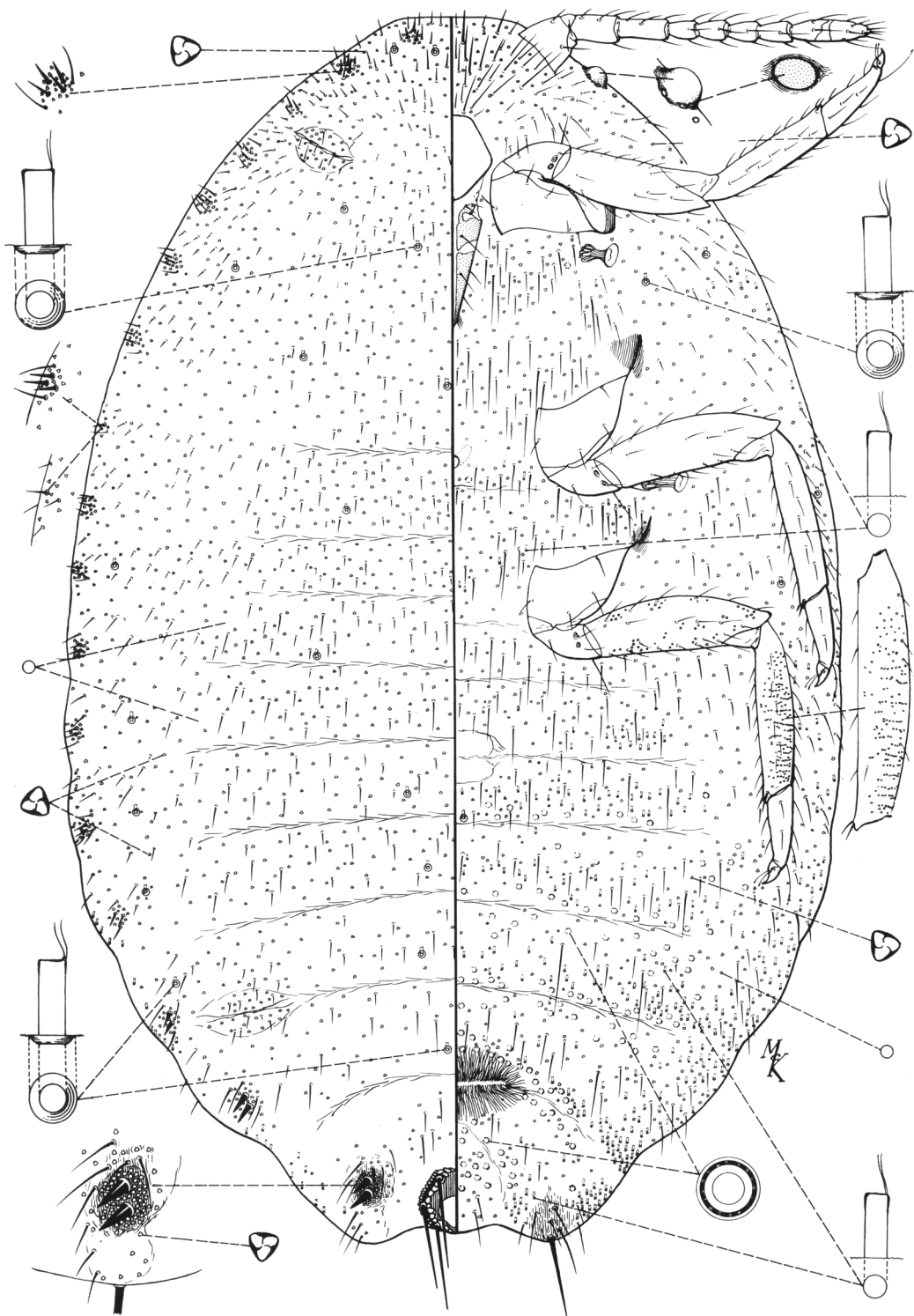


Fig. 19. *Pseudococcus obscurus* Essig, collected on *Opuntia* sp. (Cactaceae) at Los Angeles, Los Angeles County, California (type material).

about 33 translucent pores on hind tibia, these mealybugs correspond to the two type specimens.

The three collections provide the material needed for appraisal of variations in the morphology of the species.

***Pseudococcus microcirculus*
McKenzie**

Reexamination of the type series of the orchid mealybug, *Pseudococcus microcirculus*, adds the following characters to those in the original description and drawing (McKenzie, 1960): enlarged discoidal pores in the ventral sclerotization of anal lobe, 22 to 39 translucent pores on hind tibia, and smaller discoidal pores near eyes.

The following collection records add two counties to the known distribution of this mealybug in California; both collections are from *Cattleya* sp. (Orchidaceae) in nurseries: at Riverside, Riverside County, California, collected March 28, 1961, by N. W. Getz and Wrixon (CSDA No. 61C29-35); and at Santa Cruz, Santa Cruz County, California, collected June 13, 1961, by C. Lipska (CSDA No. 61F20-136).

According to D. J. Bingham, Nursery Service, California State Department of Agriculture, Sacramento, this mealybug infests roots primarily but crawls to upper parts of its hostplants when infestations become heavy. The program for eradication of this mealybug is continuing in certain California nurseries. However, certain quarantined nurseries considered free of this pest are having new outbreaks. Control is very difficult because of the root-infesting habits of the species.

***Pseudococcus obscurus* Essig
(Figure 19)**

Pseudococcus obscurus Essig (1909) has never been delineated adequately. Wilkey and McKenzie (1961) made a taxonomic appraisal of this and related species and showed enlarged details of

the hind legs. McKenzie (1962) discussed the species and some of its structural variations.

Now I present a drawing of *P. obscurus* in connection with the description of the very closely related new species *P. pseudobscurus*, described below. Some of the characters that make possible a positive identification of *P. obscurus* are the distribution and numbers of translucent pores on hind femora and tibiae and the discoidal pores near eyes.

***Pseudococcus prunicolus*
McKenzie, new species**

(Figure 20)

Suggested common name. Prune pseudococcus mealybug.

Collection data. Adult females on wild cherry, *Prunus* sp. (Rosaceae), at Cherry Creek, White Pine County, Nevada, collected September 14, 1962, by T. R. Haig (CSDA No. 62I20-71). The mealybugs were on the roots of the host, feeding about a foot underground. These are the only known specimens of the species.

Type material. Holotype adult female (single specimen on slide) in collection of California State Department of Agriculture, Sacramento. Female paratypes in museum, University of California, Davis.

Gross external features. The mealybug was light orange in color, covered with rather large, granular, and irregular white waxy plates, and surrounded by short and stout white waxy filaments.

Recognition characters. Adult females, mounted, 3.20 to 3.90 mm long, 2.60 to 3.00 mm wide; body form at full maturity subcircular, rotund.

Dorsum normally with 17 pairs of cerarii. Anal-lobe cerarius with a considerable degree of sclerotization, with a pair of stout conical setae and 12 to 18 slender auxiliary setae, and surrounded by a cluster of trilocular pores. Penultimate cerarius with slight sclerotization, 2 conical setae slightly smaller than

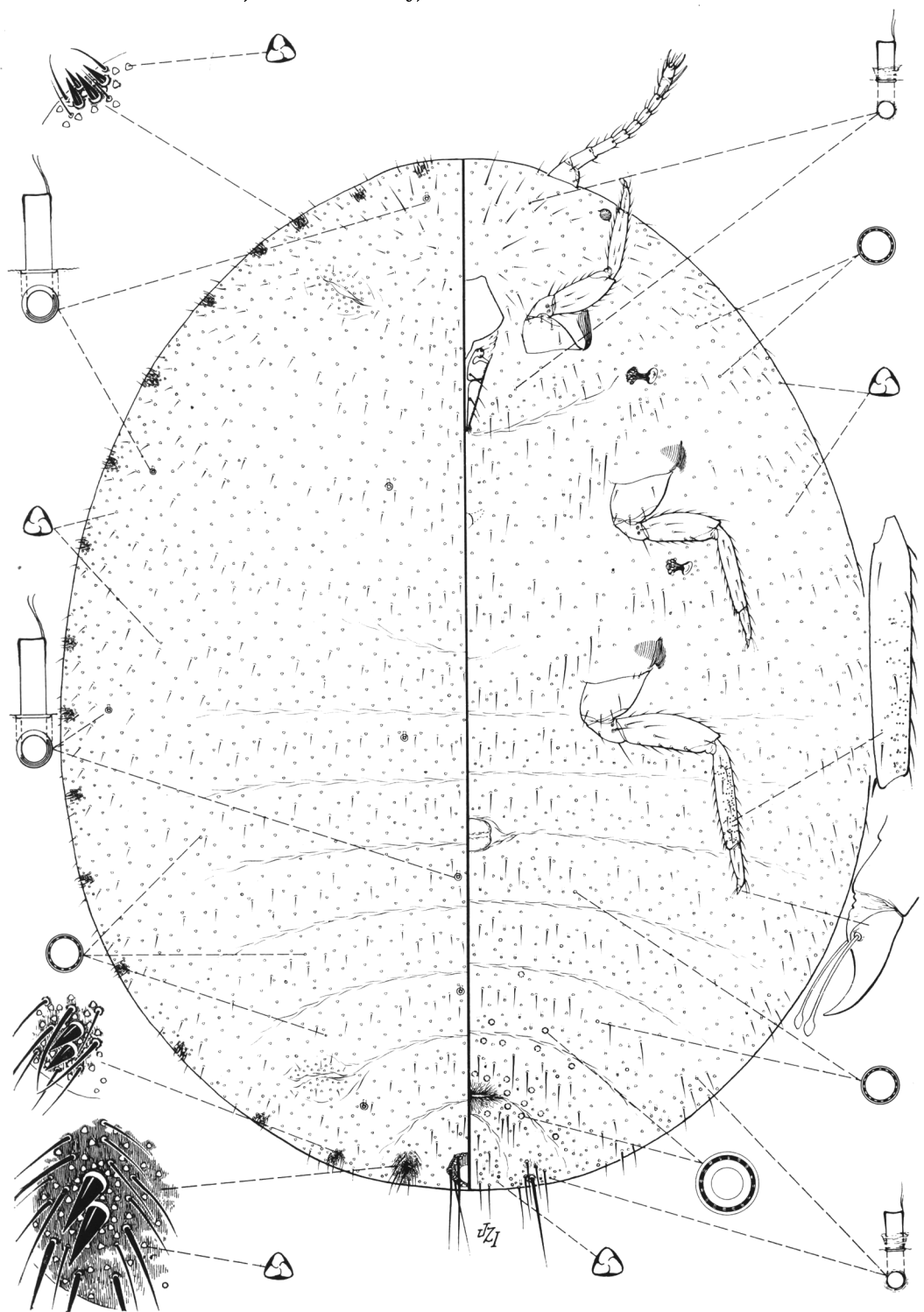


Fig. 20. *Pseudococcus prunicolus* McKenzie, new species, collected on roots of wild cherry, *Prunus* sp. (Rosaceae), at Cherry Creek, White Pine County, Nevada.

those of anal-lobe cerarius, 6 to 8 slender auxiliary setae, and a cluster of trilocular pores. Remaining cerarii similar to the penultimate, but certain cerarii on the anterior part of the thorax and on the head have little or no sclerotization, 3 or 4 conical setae, slender auxiliary setae, and trilocular pores.

Trilocular pores evenly distributed on dorsum. Small discoidal pores scattered, more abundant on dorsal submargin of abdomen, slightly smaller on thorax and head. Oral-collar ducts lacking. Oral-rim ducts in limited numbers: usually 1 to 6 or 7 on abdomen, with an obvious tendency toward the smaller number; 1 or 2 on thorax, and 1 posterior to the frontal cerarius. Body setae short and slender. Anal ring apical, with no unusual characters; each of its 6 setae at least twice as long as greatest diameter of ring.

Venter with sclerotization in area of anal-lobe setae either light and irregular or completely lacking. Multilocular disk pores relatively few, found only on the last 3 abdominal segments. Trilocular pores evenly beset. Small discoidal pores scattered, more abundant than on the dorsum, some appearing smaller than others. Small oral-collar ducts, as here interpreted, appear modified with an irregular, loose, expanded rim; all essentially of one size, fairly numerous, in transverse bands and along submargin of abdomen, scattered on thorax and head. Body setae slender, slightly longer than those on dorsum.

Circulus moderately large, normally appearing broadly oval, faintly divided by the intersegmental line. Legs only moderately well formed; with 54 to 78 translucent pores scattered along most of hind tibia; claw without denticle. Antennae 8-segmented.

Note. This species seems to have some resemblance to *Pseudococcus agavis* MacGregor but differs by having discoidal-type pores on both body surfaces and at least 1 or 2 oral-rim ducts on dorsum of abdomen—all lacking in *P. agavis*.

Pseudococcus pseudobscurus
McKenzie, new species

(Figure 21)

Suggested common name. False obscure mealybug.

Collection data. Adult females, in association with ants, infesting cones of Gowen cypress, *Cupressus goveniana* (Cupressaceae), 2 miles northwest of Cuesta Pass, Santa Lucia Range, San Luis Obispo County, California; collected May 20, 1962, by J. A. Powell. These are the only known examples of the species.

Type material. Holotype adult female (single specimen on slide) and female paratypes in museum, University of California, Davis.

Gross external features. The mealybug was covered with a whitish, waxy pubescence. There was no evidence of anal or lateral filaments.

Recognition characters. Adult females, mounted, 2.80 to 4.10 mm long, 1.90 to 3.00 mm wide; body form at maturity broadly oval.

Dorsum with 12 to 15 pairs of cerarii—fewer than for most species of *Pseudococcus*; cerarii often abortive or lacking on second abdominal segment and in thoracic region. Anal-lobe cerarius with a suggestion of sclerotization; with 2 stout conical setae, 4 or 5 slender auxiliary setae, and a cluster of trilocular pores. Penultimate cerarius with no sclerotization, with 2 smaller conical setae, 1 or 2 slender auxiliary setae, and a cluster of trilocular pores. Remaining abdominal cerarii similar to the penultimate, except that at times one of the conical setae may be shorter than its companion. Certain of the cerarii on anterior part of thorax and on head may have no sclerotization, 3 or 4 conical setae with or without auxiliary setae, and a few trilocular pores.

Trilocular pores evenly beset on dorsum. Minute circular pores scattered. Oral-collar ducts absent. Oral-rim ducts arranged in a single row of 4 to 8 across each abdominal segment except the last,

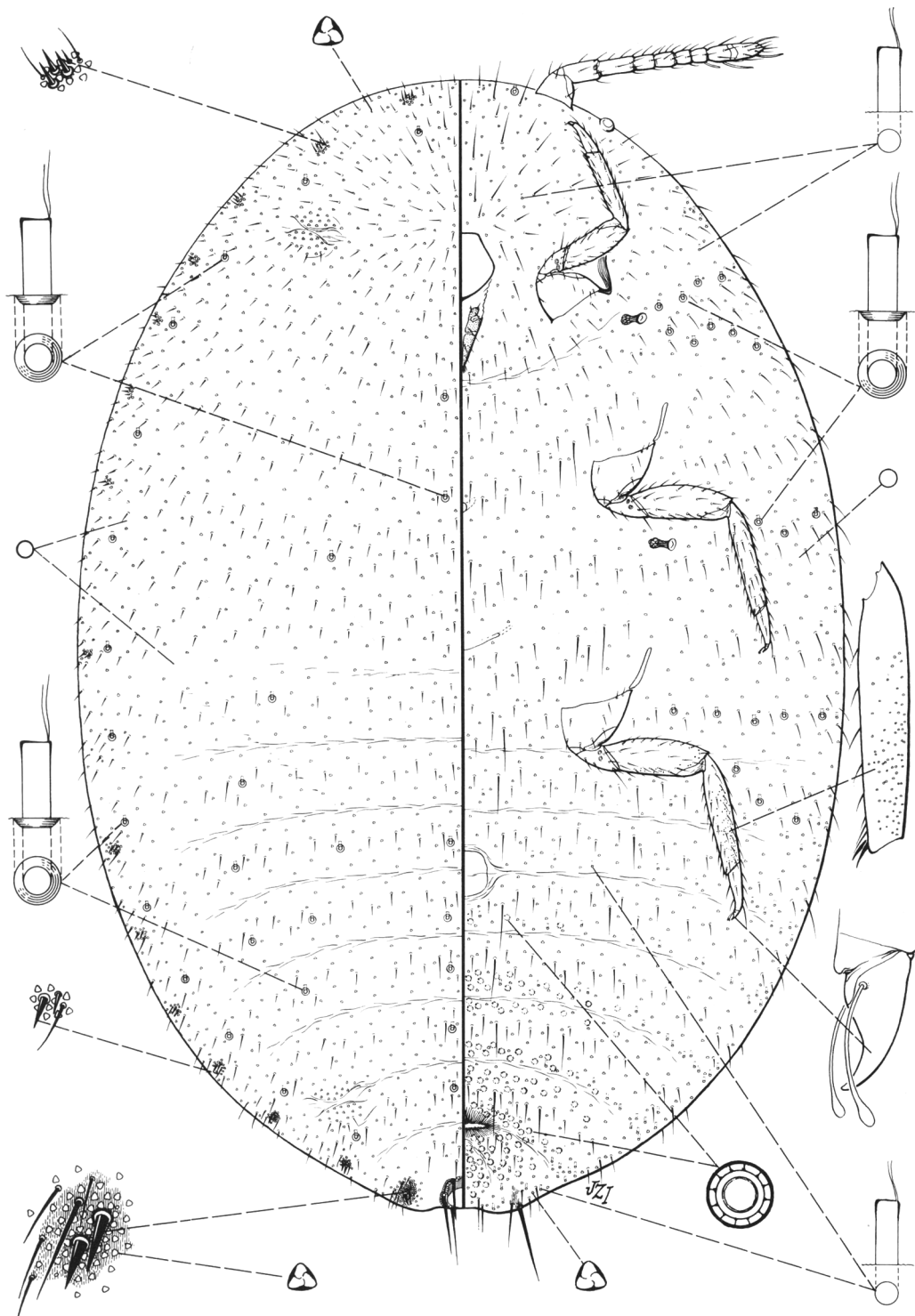


Fig. 21. *Pseudococcus pseudobscurus* McKenzie, new species, collected on cones of Gowen cypress, *Cupressus goveniana* (Cupressaceae), 2 miles northwest of Cuesta Pass, Santa Lucia Range, San Luis Obispo County, California.

and scattered over thoracic segments and head. Body setae short and slender. Anal ring at apex of abdomen, with no unusual characters; each of its 6 setae at least twice as long as greatest diameter of ring.

Venter with sclerotization in area of anal-lobe setae either light and irregular or completely absent. Multilocular disk pores fairly numerous, from apex of abdomen to fifth abdominal segment, absent elsewhere. Trilocular pores evenly beset. Minute circular pores in limited numbers. Oral-collar ducts on abdomen, perhaps more numerous along submargin, scattered on thorax and head. Oral-rim ducts submarginal, grouped laterad to both spiracles and to the hind legs, absent elsewhere on venter. Body setae slender, mostly longer than those on dorsum.

Circulus quite large, broadly oval, capable of folding along intersegmental line. Legs moderately well formed; 8 to 22 translucent pores on hind femur, distributed along posterior margin, 48 to 74 (average 61) on tibia, scattered along entire segment; claw without denticle. Antennae 8-segmented, slender, the apical segment often appearing with lightened dividing band.

Notes. *Pseudococcus pseudobscurus*

is practically a twin of *P. obscurus*. Differentiating characters of the new species are: absence of discoidal pores near eyes; reduction of cerarii on second abdominal segment, where they are either absent or abortive; number of oral-rim ducts—6 to 8 between body margin and anterior spiracle, also 6 to 8 between body margin and hind leg; and number and arrangement of translucent pores on hind leg—fewer than in *P. obscurus* and not in bands or clusters. On the other hand, *P. obscurus* has discoidal pores near eyes; cerarii on second abdominal segment usually present and normal; not more than 2 or 3 oral-rim ducts laterad from anterior spiracle, also 2 or 3 laterad from hind leg; and numerous translucent pores on hind leg, arranged in bands and clusters.

Pseudococcus sorghiellus (Forbes)

Specimens identified as *Pseudococcus sorghiellus* (Forbes) were collected on roots of a clover, *Trifolium* sp. (Leguminosae), 7 miles west of Hood River, Viento State Park, Hood River County, Oregon, on June 13, 1962, by R. F. Wilkey. As far as I can determine, this is the first record of this species in the western United States.

Genus *Rastrococcus* Ferris

Ferris (1954) indicated that his generic description of *Rastrococcus* applied only to the type species, formerly known as *Phenacoccus iceryoides* Green. He characterized the group as follows: "Pseudococcidae of the *Phenacoccus* group; that is, with 9-segmented antennae, with a tooth on the tarsal claw, and with 18 pairs of cerarii. Cerarii consisting of numerous truncate setae and trilocular pores, these arranged within the confines of a distinctly differentiated plate of some degree of sclerotization. Antennae 9-segmented. Circulus present."

Ferris placed three other species in *Rastrococcus*: *Phenacoccus mangiferae*

Green, *P. ornatus* Green, and *P. spinosus* Robinson. If a single genus is to include these four species, it would be difficult to define. In all species, the cerarii are developed on sclerotized areas and the antennae are 9-segmented. The type species and two others have apically truncate cerarian setae, the fourth has apically acute cerarian setae. Two of the four species definitely lack a denticle on the claw. The type species has 18 pairs of cerarii, but the other three species vary from 13 to 34 pairs of cerarii.

The late Harold Morrison suggested that *Rastrococcus* might receive the new pseudococcid from Chile, and suggested

Phenacoccus casuarinae Maskell and *Puto gisleni* Ossiannelsson as other likely candidates for inclusion in this genus. Both of these species have acute cerarian setae, similar to those of the Chilean species.

In spite of certain differences I am inclined to refer the Chilean species to *Rastrococcus*, recognizing that this position may become untenable with the discovery of more members of the group. Although several of the *Rastrococcus* species have some resemblance to the genus *Puto*, I would not refer them there because *Puto* is a very homogeneous group of some 30 species, which appear so naturally related that the addition of divergent species would only disturb the classification. Ultimately the discovery of additional species may justify the naming of one or two new genera for some of the *Rastrococcus* components.

***Rastrococcus chilensis* McKenzie,
new species**

(Figure 22)

Suggested common name. Chilean *rastrrococcus* mealybug.

Collection data. Adult females on monkey-puzzle, *Araucaria araucana* (Araucariaceae), presumably on foliage and branches, at Tolhuaca, Malleco Province, Chile, at 8,000 feet elevation; collected January 9, 1962, by R. L. Usinger. This is the only known collection of the species.

Type material. Holotype adult female (single specimen on slide) and paratypes in museum, University of California, Davis. Adult female paratype in United States National Collection of Coccoidea, Washington, D.C.

Gross external features. No information.

Recognition characters. Adult females, mounted, 1.85 to 3.00 mm long, 1.00 to 1.80 mm wide; body form broadly oval.

Dorsum with variable numbers of cerarii, from 22 to 30 pairs or perhaps more, their arrangement interrupted by division of individual cerarii or by intercalation of others. Each cerarius formed on a sclerotized plate, with 6 to 39 or more enlarged conical setae, acutely pointed; no auxiliary setae; trilocular pores numerous and crowded on cerarian plates; minute circular pores also found on the plates. Some cerarii appear to lack sclerotization, particularly those from the ocular to the frontal positions, inclusive.

Trilocular pores evenly beset over entire dorsum. Minute circular pores scattered on dorsal surface. No tubular ducts on dorsum. Body setae similar to cerarian setae in form but slightly smaller, quite numerous, arranged in transverse bands on abdominal segments, thorax, and head. Anal ring apical; with 6 thick, elongate setae, and with no unusual characters.

Venter without multilocular disk pores. Trilocular pores evenly distributed. A few oral-collar ducts on abdominal segments 6 to 8, also 1 or 2 such ducts along submargin of segment 4, lacking elsewhere. Body setae longer and more slender than those on dorsum.

Circulus proportionately large, transversely oval, slightly produced laterally, lying mostly on fourth abdominal segment and not divided by intersegmental line. Legs long and slender; hind coxa with a few translucent pores at base; hind tibia with 11 to 32 similar pores distributed along entire length; claw without denticle. Antennae 8-segmented, long and slender.

Notes. This mealybug seems to fall within the limits of *Rastrococcus*, as currently recognized, except for its 8-segmented antennae, its complete lack of multilocular disk pores anywhere on body, and the absence of a denticle on the claw. These characters distinguish *R. chilensis* from the other species of this genus.

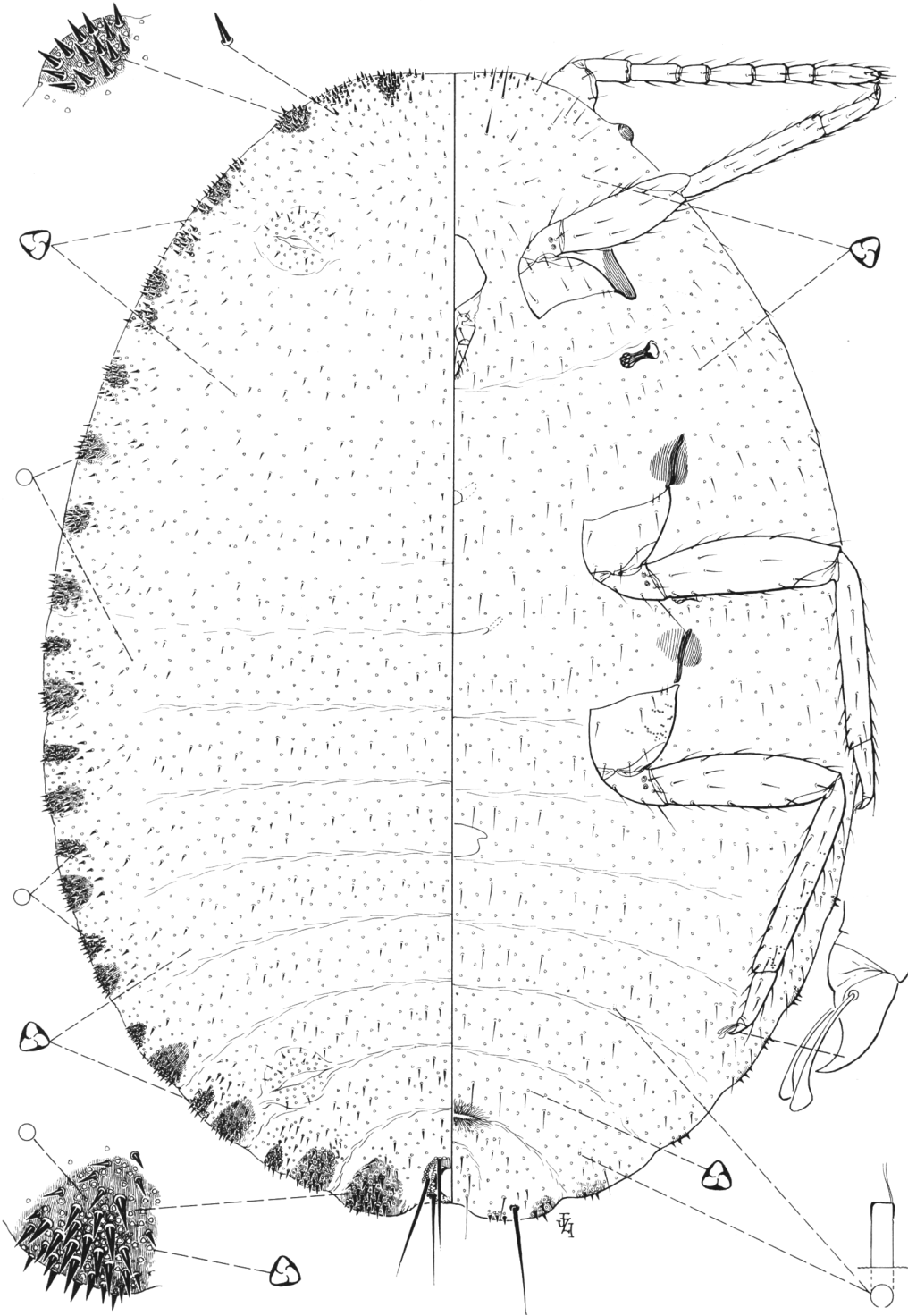


Fig. 22. *Rastrococcus chilensis* McKenzie, new species, collected on branches of monkey-puzzle, *Araucaria araucana* (Araucariaceae), at Tolhuaca, Malleco Province, Chile (8,000' elevation).

Scaptococcus McKenzie, new genus

Genotype. This genus is established for the reception of the new species *Scaptococcus californicus* McKenzie.

Recognition characters. Pseudococcidae with body form, as mounted, broadly oval or rotund. Two pairs of dorsal ostioles. Anal lobes lacking; cerarii lacking.

Dorsum without tubular ducts. Anal ring simplified, without "cellular" pores, consisting merely of a narrow sclerotized band bearing 6 setae, each scarcely half as long as the diameter of the ring.

Venter with multilocular disk pores confined to posterior portion of abdomen. Circulus absent in type species. Legs well formed, short and stout; anterior pair with femora and tibiae greatly thickened; each leg with denticle on claw. Antennae normally 8-segmented.

Notes. Specimens will run to *Amonostherium* Morrison and Morrison in the

revised key to genera (McKenzie, 1962, p. 639). The genus appears somewhat related to *Amonostherium* but differs in the character of the forelegs, which are conspicuously enlarged in comparison with the middle and hind pairs; in the absence of tubular ducts on dorsum; and in the absence of "cellular" pores in the anal ring. *Amonostherium*, on the other hand, has forelegs not too unlike the middle and hind pairs; tubular ducts on dorsum; and an anal ring with "cellular" appearance.

Name from Greek *skaptein*, to dig, because the forelegs may be adapted for digging, as they are greatly thickened and the tips of the claws show signs of wear.

To separate the new genus from *Amonostherium*, the portion of the generic key (McKenzie, 1962) which accepts *Scaptococcus* has been revised, as follows:

- 23(20). Cerarii completely absent or present only on anal lobes. A
Normally with 18 pairs of cerarii, sometimes reduced to 5 or 6 pairs
PHENACOCCLUS Cockerell
A(23). Tubular ducts present on dorsum; anal ring with a "cellular" appearance *AMONOSTHERIUM* Morrison and Morrison
Tubular ducts absent from dorsum; anal ring without "cellular" pores *SCAPTOCOCCLUS* McKenzie

Scaptococcus californicus McKenzie, new species

(Figure 23)

Suggested common name. Digger mealybug.

Collection data. Adult females on crown and roots of *Cryptantha* sp. (Boraginaceae) 3 miles northwest of Shoshone, Inyo County, California, collected April 13, 1963, by D. R. Miller.

Type material. Holotype adult female (single specimen on slide) and female paratypes in museum, University of California, Davis. Additional adult female paratypes in collection of California State Department of Agricul-

ture, Sacramento, and in the United States National Collection of Coccoidea, Washington, D.C.

Gross external features. Fully developed, brownish-pink females were enclosed in a cystlike, waxy ovisac, surrounded by loose particles of moist soil. Nymphs also were observed within the ovisac.

Recognition characters. Adult females, mounted, 2.90 to 3.40 mm long, 2.00 to 2.75 mm wide; body form broadly oval or rotund.

Dorsum without cerarii. Evenly beset with trilocular pores. Minute circular pores scattered, each less than half the diameter of a trilocular pore. Tubu-

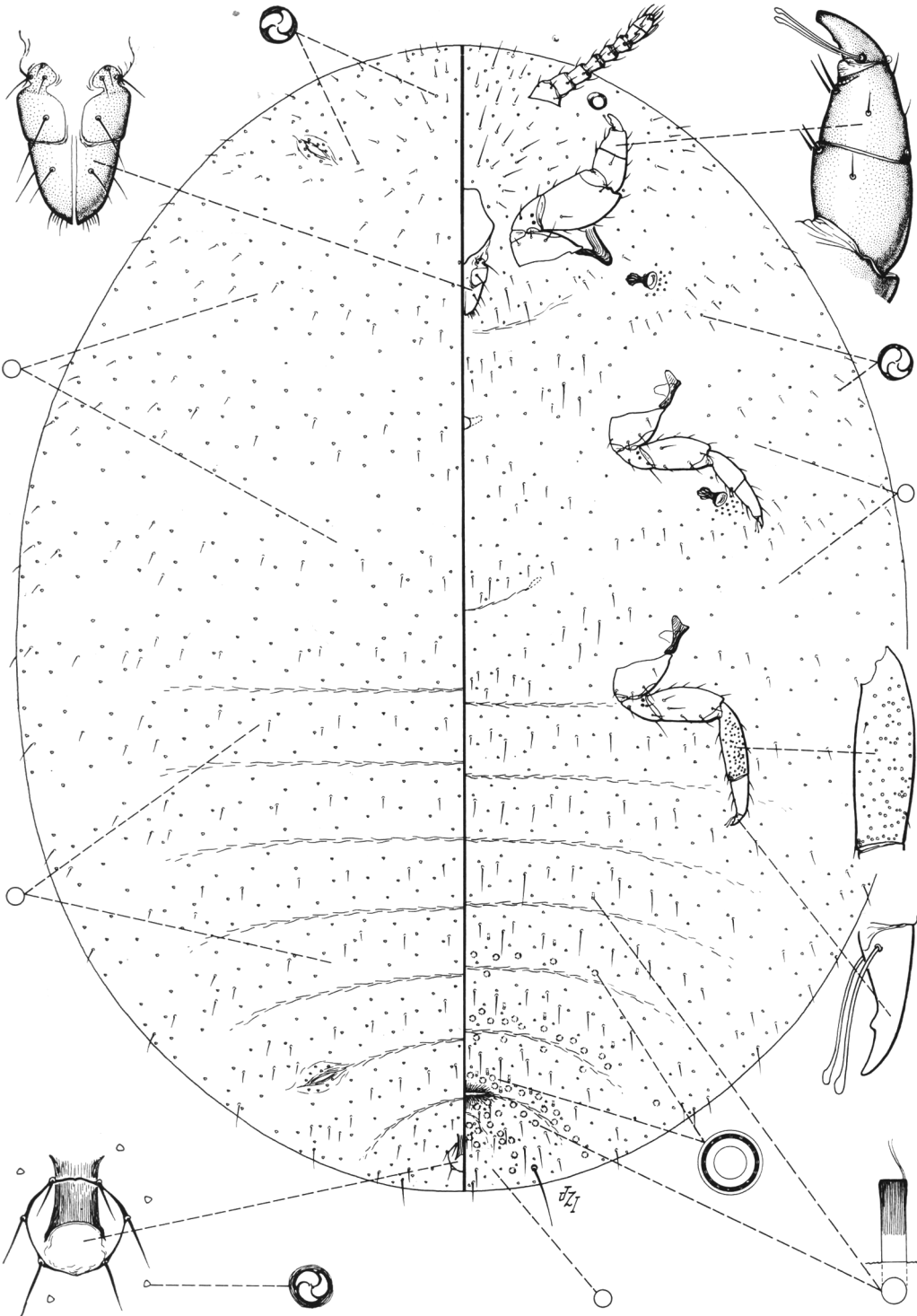


Fig. 23. *Scaptococcus californicus* McKenzie, new species, collected on crown and roots of *Cryptantha* sp. (Boraginaceae) 3 miles northwest of Shoshone, Inyo County, California.

lar ducts absent. Body setae comparatively small, occurring in somewhat irregular transverse bands on abdominal and thoracic segments, and scattered on head. Anal ring apical; simplified, without "cellular" pores, and consisting merely of a narrow sclerotized band bearing 6 short setae, each scarcely half as long as diameter of ring.

Venter with relatively few multilocular disk pores, which occur medially from apex of abdomen to posterior margin of sixth abdominal segment. Trilocular pores distributed rather evenly on abdomen, except for some clear areas, especially in thoracic region. Minute circular pores few and scattered. A very few oral-collar ducts in the same region as the multilocular disk pores, each about 3 times as long as the diameter of its orifice and strongly sclerotized on half of inner extremity. Body setae

somewhat longer than those on dorsum, rather sparse.

Circulus absent. Legs short and stout; anterior pair with femora and tibiae greatly thickened, as though adapted for digging; hind leg with 58 to 101 (average 80) translucent pores distributed rather evenly on tibia; with a noticeable denticle on claw. Mouthparts large, labium shorter than clypeus. Antennae normally 8-segmented (one specimen had 8 segments on one antenna, 7 on the other).

Notes. This mealybug appears distantly related to certain species of *Amonostherium* but differs principally in the absence of oral-collar ducts on dorsum and in the noncellular appearance of the anal ring. In *Amonostherium*, oral-collar ducts are present on dorsum, and the anal ring is definitely "cellular."

MISCELLANEOUS RECORDS

Recent collections have furnished new host or locality data for a few pseudococcids that do not belong in any of the 12 genera studied above. Two of these species—*Spilococcus parkeri*, from Nevada, and *Trionymus caricis*, from Maryland—are new to California. Notes of morphological interest are included for *Puto echinatus* and *Trionymus modocensis*.

Puto echinatus McKenzie

The illustration of *P. echinatus* that accompanies the original description (McKenzie, 1961) was made from a single poorly-stained, somewhat distorted holotype adult female. A reexamination of this slide mount revealed additional details: Dorsum with enlarged tubular ducts, similar to those in the cerarii of this species, in groups or short rows on thorax. Venter with 1 or 2 multilocular disk pores near middle coxae, a few around mouthparts, and 1 or 2 near antennal base.

Rhizoecus sonomae McKenzie

A single adult female specimen of this mealybug was collected from soil in Wooden Valley, Napa County, California, on April 29, 1962, by S. F. Bailey. This is the first record of the species in Napa County.

Spilococcus parkeri McKenzie

This mealybug was found on roots of California snakeweed, *Gutierrezia californica* (?) (Compositae), 3.4 miles northeast of Gilman Hot Springs, Riverside County, California; collected March 9, 1963, by D. R. Miller. This is the first record of the species in California.

The original collection (McKenzie, 1962) was from roots of *G. microcephala* at Pioche, Lincoln County, Nevada. The occurrence of this mealybug in California supports the existing practice of describing new pseudococcids from other western states and from nearby countries.

Trionymus caricis McConnell

This mealybug was collected on foliage of undetermined plants at Bradley Mountain near Dunsmuir, Siskiyou County, California, on September 20, 1961, by R. O. Schuster. This is the first California record of the species.

Trionymus modocensis (Ferris)

Mealybugs were collected on giant wildrye, *Elymus condensatus* (Gramineae), at Camarillo, Ventura County,

California, on July 31, 1962, by G. G. Beevor and D. Hare (CSDA No. 62H2-12). The specimens show slight structural divergences from the type for this species, such as 1 or 2 multilocular disk pores on dorsum of abdomen and more numerous multiloculars on venter of sixth abdominal segment. However, as these differences would probably fall well within the normal range of variation for the species, I am identifying the collection tentatively as *Trionymus modocensis* (Ferris).

SUMMARY

This paper describes two new pseudococcid genera, *Anthelococcus* and *Scaptococcus*, both collected in California, and 22 new species. Thirteen of the new species—more than half—were collected in California: *Anisococcus abnormalis*, *Anthelococcus simondsi*, *Chorizococcus californicus*, *C. interruptus*, *Cryptoripersia tubulata*, *Heliococcus atriplicis*, *Phenacoccus alleni*, *P. giganteus*, *P. milleri*, *P. nonarius*, *Pseudococcus diversus*, *P. pseudobscurus*, and *Scaptococcus californicus*. Four species were collected in Nevada: *Chorizococcus variabilis*, *Dysmicoccus pinicolus*, *Humococcus ceraricus*, and *Pseudococcus prunicolus*. *Phenacoccus hurdi* was collected in New Mexico. Two species, *Phenacoccus advena* and *P. incomptus*, came from Mexico and were taken in quarantine. *Rastrococcus chilensis* was collected in Chile. And *Balanococcus takahashii* was sent from Japan for identification.

Revised keys to North American species are given for the genera *Anisococcus*, *Chorizococcus*, *Cryptoripersia*, *Dysmicoccus*, *Heliococcus*, *Humococ-*

cus, *Phenacoccus*, and *Pseudococcus*. Parts of the key to North American genera are revised to include the two new genera.

Detailed drawings include *Pseudococcus obscurus* Essig in addition to the 22 new species. Additional descriptions or taxonomic notes are given for *Chorizococcus lounsburyi* (Brain), *Cryptoripersia salina* (Ehrhorn), *Dysmicoccus desertorum* McKenzie, *Humococcus inornatus* McKenzie, *Phenacoccus lotearum* McKenzie, *Pseudococcus importatus* McKenzie, *P. microcirculus* McKenzie, *Puto echinatus* McKenzie, and *Trionymus modocensis* (Ferris). New localities or host data are given for three of the preceding nine species and also for *Phenacoccus graminosus* McKenzie, *P. infernalis* McKenzie, *Pseudococcus sorghiellus* (Forbes), *Rhizoecus sonomae* McKenzie, *Spilococcus parkeri* McKenzie, and *Trionymus caricis* McConnell.

All but two of these 16 additional species occur in California and three of them—*P. infernalis*, *S. parkeri*, and *T. caricis*—are new to this state.

ACKNOWLEDGMENTS

The late Harold Morrison, Coccidologist in the Entomology Research Division, ARS, USDA, examined many of the new species described in this paper. As always, his observations and pertinent suggestions on systematics were extremely helpful. Through his courtesy, also, the United States National Collection of Coccoidea loaned specimens for the descriptions of two new species. Most gratefully I acknowledge Dr. Morrison's willing assistance, both in this and in my earlier work. Coccidologists and friends all over the world will feel his loss deeply.

D. J. Williams, Coccidologist in the British Museum, London, examined the Japanese mealybug and confirmed its assignment to his genus *Balanococcus*. The Bureau of Entomology, California State Department of Agriculture, Sac-

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THE AUTHOR:

Howard L. McKenzie is Entomologist in the Experiment Station, Davis.

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