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Systematic Analysis of *Acanthococcus* (Homoptera: Coccoidea: Eriococcidae) in the Western United States

Douglass R. Miller and Gary L. Miller
Systematic Entomology Laboratory, Agricultural Research Service
U.S. Department of Agriculture, Beltsville, MD, USA 20705

ABSTRACT

This paper is the first detailed treatment of the *Acanthococcus* species of the western United States. Keys, descriptions, and illustrations are given for 33 species including 7 that are new to science.

INTRODUCTION

The species of *Acanthococcus* Signoret of the western United States comprise 33 species including 7 that are new. Six species previously considered to be distinct are synonymized for the first time, and 2 others that were considered to occur in the U.S. were found to be restricted to Mexico. Seven of the 33 species that occur in the western U.S. were treated in detail (Miller 1991) and are not redescribed here. All species are included in the key to adult females and are illustrated. The species *"Eriococcus" gillettei* Tinsley is not included since it belongs in the family Kermesidae (Miller 1983).

The genus *Acanthococcus* recently has been treated as a separate and distinct genus from *Eriococcus* Targioni Tozzetti (Miller 1991) making it necessary to transfer all U.S. species previously placed in *Eriococcus* into *Acanthococcus*.

This paper is written to provide previously unpublished information on new species, new character systems, synonymy, and new records for a book that currently is in manuscript form by Mr. Raymond J. Gill, California Department of Food and Agriculture, Sacramento, on the eriococcids of California.

DEPOSITORIES

Depositories of specimens are as follows: The Natural History Museum, London (BM); California Department of Food and Agriculture, Sacramento (CDA); University of California, Davis (UCD); Museum of Natural History, Washington, D.C. (USNM); Virginia Polytechnic Institute and State University, Blacksburg (VPI); Zoological Institute, Academy of Sciences of St. Petersburg (ZAS).

METHODS

For the purposes of this study, western is defined as all localites west of the eastern borders of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. The terminology used is that of Miller and McKenzie (1967), Miller (1984), and Miller (1991). Measurements and numbers are taken from 10 specimens from as many localities as possible and are given as a range.

Detailed locality information is provided for species that include 50 or fewer geographic records. For those with more than 50 records, state and host information are summarized. The information under specimens examined is organized so as not to use unnecessary space. If a collection was made at the same locality, on the same date as a previously listed collection, the duplicate information is not repeated. For example, the documentation provided for some locality data of *A. dubius* is: "Riverside, XII-(?)-25, on *Haplopappus palmeri*, P.H. Timberlake (5 ad. fem. on 2 sl.) UCD; IX-24-33, on *Eriogonum* sp., collector (?) (5 ad. fem. on 5 sl.) UCD; on *Chrysothamnus* sp., J. D. Maple (2 ad. males) UCD. In this case the second collection was found in Riverside, even though "Riverside" is not repeated. In the third case, the collection was found in Riverside on September 24, 1933 even though this information is not repeated. Also note, that when there is only a single slide, such as in the third case, "1 sl." is not written but is assumed.

Chromosome numbers were determined using embryos extracted from adult females. Chromosome squashes and staining techniques are those described in McKenzie (1967).

Host records were compiled from information included on slides of the specimens studied and are given in a separate host list at the end of the publication..

RESULTS

Genus **ACANTHOCOCCUS** Signoret

Acanthococcus Signoret, 1875:35. Type species: *Acanthococcus aceris* Signoret, 1875:35, by monotypy.
Rhizococcus Signoret, 1875:36. Type species: *Rhizococcus gnidii* Signoret, 1875:37, by monotypy.
Greenisca Borchsenius, 1948:502. Type species: *Eriococcus inermis* Green, 1915:176, by original designation.
Anophococcus Balachowsky, 1954:61. Type species: *Eriococcus inermis* Green, 1915:176, by original designation.
Kaweckia Koteja and Zak-Ogaza, 1981:501. Type species: *Eriococcus glyceriae* Green, 1921:146, by original designation.

Diagnosis.— Adult female: dorsal surface covered with macrotubular ducts; ovisac covering all of body; anal lobes protruding from body, with enlarged setae; microtubular ducts present; multilocular pores present on venter and occasionally on dorsum; cruciform pores usually present; appendages well developed.

Notes.— In the United States, the genus *Acanthococcus* has been treated as a junior synonym of *Eriococcus*. However, the occurrence of distinctive enlarged tubular ducts on the type species of *Eriococcus* (*Coccus buxi* Fonscolombe) and the presence of these ducts on other species from Australia and Europe have caused us to agree with Borchsenius (1948) that *Acanthococcus* and *Eriococcus* are valid genera. Because of this change, all of the U. S. species previously treated as members of *Eriococcus*, should now be considered to be members of the genus *Acanthococcus*.

We agree with Williams (1985) that *Greenisca* Borchsenius should be treated as a junior synonym of *Acanthococcus*. It is intuitively clear that the occurrence of dorsal multilocular pores has arisen on numerous occasions within the *Acanthococcus* lineage. Species that possess dorsal multiloculars generally occur in wet habitats (e.g., *A. palustris*) or in situations where both the dorsal and ventral surfaces are in contact with the host substrate (e.g., *A. stellatus*). There are no obvious characters that would separate these species as a monophyletic unit other than dorsal multilocular pores which seem to be influenced by ecological rather than phylogenetic factors.

Gossyparia Signoret has been treated as a junior synonym of *Eriococcus* (=*Acanthococcus*) (Williams 1985) but is here considered to be distinct since it has a chromosome number of 28 (Schrader 1929; Nur 1967), has no macrotubular ducts on the medial area of the dorsum, and produces an ovisac that does not cover the entire dorsum.

KEY TO ADULT FEMALES OF *ACANTHOCOCCUS* IN THE WESTERN UNITED STATES

1. With 4 or fewer setae on each hind tibia 2
— With 5 or more setae on each hind tibia **17**

2(1). Dorsal multilocular pores absent 4
— Dorsal multilocular pores present **3**

3(2). Hind tibia about same length as tarsus or slightly shorter .... **palustris** (Dodds)
— Hind tibia conspicuously longer than tarsus ..... **stellatus** (McDaniel)

4(2). Anal lobes heavily sclerotized dorsally (figs. 2 and 5); microtubular ducts bifurcate **5**
— Anal lobes unsclerotized or slightly sclerotized dorsally (figs. 16 and 22); microtubular ducts simple **7**

5(4). Lateral enlarged setae equal in length to at least some dorsomedial setae; dorsomedial setae with acute or rounded apices **6**
— Lateral enlarged setae over 3 times longer than dorsomedial setae; dorsomedial setae with blunt apices ..... **araucariae** (Maskell)

6(5). With 4 or 5 setae on each tibia; hind coxae with pores absent; dorsal enlarged setae slender (fig. 5) ..... **azaleae** (Comstock)
With 2 setae on each tibia; hind coxae with many pores ventrally; dorsal enlarged setae with broad bases (fig. 30) ..... **pittospori** (Ferris)

7(4). Lateral enlarged setae approximately equal in length to largest dorsomedial setae **8**
— Lateral enlarged setae at least twice as long as largest dorsomedial setae **14**

8(7). Anal lobes each with 3 enlarged setae **9**
— Anal lobes each with 4 enlarged setae ..... **froebeae** Miller

9(8). Lateral enlarged setae straight or slightly curved; legs of normal size (figs. 25 and 27) **10**

— Lateral enlarged setae strongly curved; legs unusually large (figs. 22, 23, and 24) ..... **larreae** (Parrott & Cockerell) (in part)

10(9). Anal ring with 3 pairs of setae **11**

— Anal ring with 4 or more pairs of setae **12**

11(10). Enlarged setae truncate; abdominal segment IV with more than 30 enlarged setae ..... **mackenziei** Miller & Miller

— Enlarged setae rounded or acute; abdominal segment IV with less than 25 enlarged setae ..... **microtrichus** Miller & Miller

12(10). Largest lateral seta on each abdominal segment with rounded or blunt apex (figs. 1 and 37); large setae not in longitudinal pattern **13**

— Largest lateral seta on each abdominal segment with acute apex (fig. 11); large setae forming 3 pairs of longitudinal lines (lateral, sublateral, medial) ..... **dubius** (Cockerell) (in part)

13(12). Hind coxae with large, indistinct pores (fig. 1); cruciform pores normally absent ..... **adenostomae** (Ehrhorn)

— Hind coxae with small distinct pores (fig. 37); cruciform pores abundant ..... **tinsleyi** (Cockerell)

14(7). Abdominal quinquelocular pores more numerous than all other multilocular pores combined; front tibia with 4 setae **16**

— Abdominal quinquelocular pores less numerous than all other multilocular pores combined; front tibia with 5 setae **15**

15(14). Large sized enlarged setae forming forming discontinuous lateral line, large setae absent from anterior abdominal segments and and thorax ..... **kemptoni** (Parrott)

— Large sized enlarged setae forming forming continuous lateral line around body margin ..... **smithi** (Lobdell)

16(14). Dorsal surfaces of anal lobes each with 3 enlarged setae ..... **larreae** (Parrott and Cockerell) (in part)

— Dorsal surfaces of anal lobes each with 1 enlarged seta and 2 lanceolate setae ..... **nudulus** (Ferris)

17(1). Dorsal enlarged setae not fusiform **18**

— Dorsal enlarged setae fusiform ..... **salarius** (Ferris)

18(17). Microtubular ducts with apical sclerotized portion either rounded or blunt (fig. 36) **19**

— Microtubular ducts with apical sclerotized portion depressed medially (fig. 17) ..... **gerbergi** (McDaniel)

19(18). Abdominal quinquelocular pores less numerous than all other multilocular pores combined **20**
— Abdominal quinquelocular pores more numerous than all other multilocular pores combined **21**

20(19). Front tibiae each with 6 setae; not on grass ..... **texanus** (King)
— Front tibiae each with 5 setae; occurring on grass ... **insignis** (Newstead)

21(19). Tibia slightly longer or shorter than tarsus **22**
— Tibia at least one and one-half times longer than tarsus ..... **quercus** (Comstock)

22(21). Largest lateral seta on abdomen 3 times longer than medial or sublateral seta on dorsum; lateral abdominal setae forming conspicuous marginal band around shorter medial and sublateral setae **23**
— Largest lateral seta on abdomen less than 2 times longer than longest medial or sublateral seta; lateral abdominal enlarged setae not forming conspicuous marginal band as above **26**

23(22). With 2 or more large setae on margin of each abdominal segment **24**
— With 1 large seta on margin of each abdominal segment ..... **cryptus** (Cockerell)

24(23). Body oval; with 3 or more enlarged setae on margins of each abdominal segment; not on grass **25**
— Body elongate; with 2 large setae on margin of each abdominal segment; occurring on grass ..... **hoyi** Miller & Miller (in part)

25(24). Enlarged setae on medial and sublateral areas of abdomen truncate apically (fig. 7); on cactus ..... **coccineus** (Cockerell)
— Enlarged setae on medial and sublateral areas of abdomen rounded apically (fig. 14); not on cactus ..... **euphorbiae** (Ferris) (in part)

26(22). Anal lobes each with 4 enlarged setae **27**
— Anal lobes each with 3 enlarged setae **28**

27(26). Front tibiae each with 5 setae; occurring on grass ..... **washingtonensis** Miller & Miller
— Front tibiae each with 7 setae; occurring on *Arctostaphylos* ..... **macrobactrus** Miller & Miller

28(26). Large sized dorsal setae apically acute **29**
— Large sized dorsal setae apically rounded or truncate **32**

29(28). Anal ring with 4 pairs of setae; normally not on *Artemisia* **30**
— Anal ring with 3 pairs of setae; occurring on *Artemisia* ..... **epacrotrichus** Miller & Miller

30(29). Body oval; microtubular ducts moderate to long (5-14 μ long); not on grass **31**

— Body elongate (fig. 9); microtubular ducts short (4-5 μ long); occurring on grass ..... **diaboli** (Ferris)

31(30). Enlarged setae broad basally (fig. 39); microtubular ducts elongate (11-14 μ long); occurring on *Atriplex* ..... **whiteheadi** Miller

— Enlarged setae narrow basally (figs. 10 and 11); microtubular ducts moderate in length (5-8 μ long); not on *Atriplex* .. **dubius** (Cockerell) (in part)

32(28). Cruciform pores absent dorsally **33**

— Cruciform pores present dorsally ..... **stauroporus** Miller & Miller

33(32). Dorsal enlarged setae not as above; anal lobes acute **34**

— Dorsal enlarged setae characteristic (fig. 6); anal lobes rounded .... **barri** Miller

34(33). Large setae abundant over dorsum; body oval; not on grass **35**

— Large setae in reduced numbers on medial and lateral areas of dorsum (fig. 18); body elongate; occurring on grass .... **hoyi** Miller & Miller (in part)

35(34). With 3 pairs of longitudinal lines of large setae (medial, sublateral, lateral) present from abdominal segment VII through thorax **36**

— With 1 pair longitudinal lines of large setae (lateral), 3 pairs of lines rarely present on posterior 4 abdominal segments **38**

36(35). Largest lateral setae on abdominal segments VII and VI apically rounded **37**

— Largest lateral setae on abdominal segments VII and VI apically blunt or truncate ..... **arctostaphyli** (Ferris)

37(36). With more than 30 enlarged setae on abdominal segment V; frequently with 6 setae on front tibiae ..... **dubius** (Cockerell) (in part)

— With 30 or fewer enlarged setae on abdominal segment V; with 5 setae on front tibiae ..... **euphorbiae** (Ferris) (in part)

38(35). Microtubular ducts without sclerotized ring at dermal orifice; cruciform pores normally absent ..... **arenosus** (Cockerell)

— Microtubular ducts with sclerotized ring at demal orifice; cruciform pores present ..... **eriogoni** (Ehrhorn)

TREATMENT OF SPECIES

Acanthococcus adenostomae (Ehrhorn), n. comb.

Chamise eriococcin

Fig. 1

Eriococcus adenostomae Ehrhorn, 1898:244.
Nidularia adenostomatos (Ehrhorn), Lindinger, 1933:108.

Type Material.— From the syntypes of *E. adenostomae,* we have chosen and marked as lectotype an adult female labeled "*Eriococcus adenostomae* Ehrh — on *Adenostoma fasciculatum* Mt. View, Calif. Cotype. " (USNM). The slide contains 3 specimens; the center specimen is the lectotype. In addition, there are 13 paralectotypes.

Field Features.— Adult female purple, crushed body contents purple. Ovisac thick, white or yellowish-white. Present on branches and in fascicles of plant host.

Recognition Characters.— Adult female, mounted, 1.61-3.20 mm long, 1.03-1.91 mm wide. Anal lobes protruding, apically acute, with only small area of weak sclerotization; each lobe dorsally with 3 enlarged setae (same size and shape as those on rest of dorsum, variable in relative sizes), with 2-4 microtubular ducts; each lobe ventrally with 3 slender body setae and no sessile pores.

DORSUM with enlarged setae of 1 size; 2 or 3 setae on margin of each abdominal segment slightly larger than remaining setae. Largest lateral seta 24-30 μ long, largest medial seta 19-22μ; on abdominal segments VII through II longest lateral seta 1.2-1.6 times longer than longest medial seta. Enlarged setae slightly curved, with apices rounded or blunt; setal rings thin. Enlarged setae in small numbers — e.g., abdominal segment IV with from 18-23 (1 specimen with 38) — showing no particular longitudinal pattern. Macrotubular ducts of large size only, present over dorsum. Microtubular ducts moderate in length (range 6-7 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion about 1/3 size of remaining portion; total sclerotized area slightly longer than unsclerotized area; dermal orifice inconspicuous. Microtubular ducts numerous over dorsum.

Anal ring apical, usually ventral, with 4 pairs of setae.

VENTER with lanceolate body setae moderate (longest seta on abdominal segment VII from 19-25 μ long, on segment II from 50-75 μ), medial setae capitate. Enlarged setae same as on dorsum except somewhat smaller and apices more acute; present along body margin from abdominal segments VIII or VII through head. Macrotubular ducts of 2 kinds: larger size same as on dorsum in small numbers along body margin; smaller size present in medial or sublateral areas of abdominal segment VII through head. Microtubular ducts restricted to lateral areas. Multilocular pores of 2 kinds quinqueloculars most numerous, present over entire venter; triloculars rare, present on anterior abdominal segments and on thorax and head. Cruciform pores absent.

Legs robust; hind coxae with characteristically shaped pores (fig. 1) on both dorsal and ventral surfaces, most numerous on dorsal surface; hind femora with a few such pores on dorsal surface; tibiae with 4 setae; inner, apical, tibial setae elongate, not enlarged; tarsi longer than tibiae (hind tibia/tarsus ratio from 0.75-

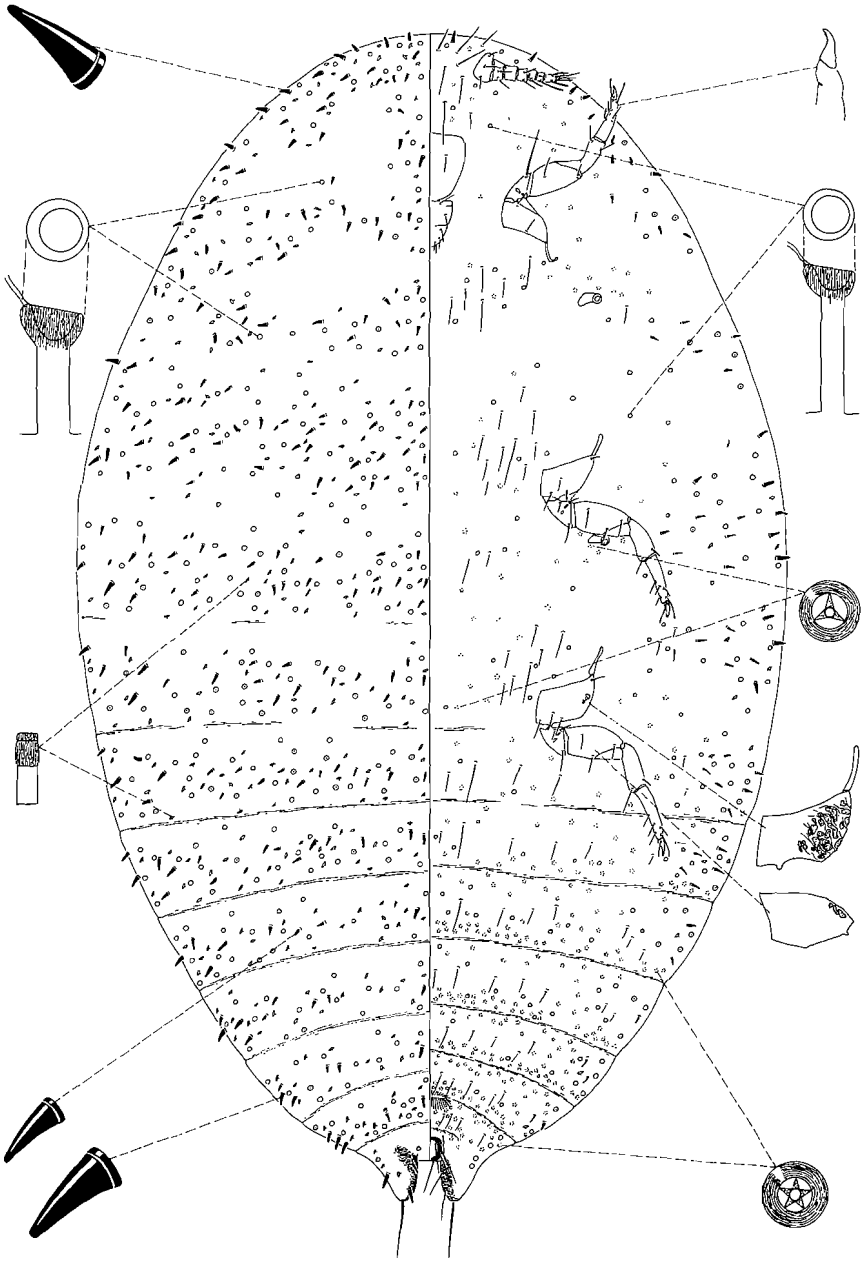


FIGURE 1. *Acanthococcus adenostomae* (Ehrhorn). South rim W. of research station Santa Cruz Island, California, VI-20-67, on *Adenostoma fasciculatum*.

0.91); claw with denticle near tip. Antennae normally 7-segmented rarely with 6, third segment usually longest. Apical segment with 3 sensory setae; second segment from apex with 1 slightly longer and more slender than single sensory seta on third segment from apex.

Notes.— *Acanthococcus adenostomae* is quite different from all other North American species of *Acanthococcus*. It is similar in appearance to *A. tinsleyi*, but has enlarged setae with blunt apices, from 18-23 enlarged setae on abdominal segment V, characteristic large pores on hind coxae and femora, no cruciform pores, and occurs on *Adenostoma*; *A. tinsleyi* has enlarged setae with rounded apices, from 44-56 enlarged setae on abdominal segment V, small pores on hind coxae and femora, numerous cruciform pores, and occurs on *Atriplex*.

Specimens Examined.—CALIFORNIA, CALAVERAS Co.: Valley Springs, V-5-14, on *Adenostoma fasciculatum*, E. O. Essig (6 ad. fem. on 2 sl.) UCD. LAKE Co.: 5 mi. N. Lower Lake, V-25-59, on *A. fasciculatum*, T. R. Haig (3 ad. fem.) CDA. MENDOCINO Co.: 11 mi. E. Capella, V-28-59, on *A. fasciculatum*, T. R. Haig (10 ad. fem. on 2 sl.) CDA. NAPA Co.: Oakville, V-5-60, on *A. fasciculatum*, T. R. Haig (2 ad. fem.) CDA; 13 mi. E. Rutherford, III-10-68, on *A. fasciculatum*, T. Kono (4 ad. fem. on 4 sl.) CDA; 14 mi. W. Winters, II-5-68, on *A. fasciculatum*, R. F. Wilkey (5 ad. fem., 3 first instars, 1 ad. male on 6 sl.) CDA. SACRAMENTO Co.: Sacramento, V-5-31, on *Adenostoma* sp., Backman (6 ad. fem.) CDA. SAN BENITO Co.: Pinnacles, IV-29-19, on *Adenostoma* sp., G. F. Ferris (4 ad. fem. on 2 sl.) UCD. SAN BERNARDINO Co.: Cajon Pass, summit, V-24-25, on *A. fasciculatum*, J. D. Maple (5 ad. fem.) UCD. SAN DIEGO Co.: 2 mi. S. Valley Center, III-27-64, on *A. fasciculatum*, D. R. Miller and J. A. Froebe (2 ad. fem. on 2 sl.) UCD. SANTA CLARA Co.: Black Mountain, III-24-19OO, on *A. fasciculatum*, S. I. Kuwana (3 ad. fem. on 2 sl.) UCD; Stevens Creek, Mt. View, IV-20-98, on chamise bush, collector (?) (3 paralectotype ad. fem.) USNM; near Mountain View, in mountains, date (?), on *A. fasciculatum*, E. M. Ehrhorn (1 lectotype, 10 paralectotypes ad. fem. on 3 sl.) USNM; Stanford University, IV-(?)-14, on *A. fasciculatum*, G. F. Ferris (17 ad. fem. on 5 sl.) UCD, USNM. SHASTA Co.: 8 mi. W. Shasta, IV-2-63, on *A. fasciculatum*, T. R. Haig (6 ad. fem. on 2 sl.) CDA. SOLANO Co.: Monticello Dam, Vaca Mountains, V-3-63, on *A. fasciculatum*, J. S. Buckett (4 ad. fem. on 2 sl.) UCD. YOLO Co.: Davis, III-5-64, on *Adenostoma* sp., D. R. Miller and J. A. Froebe (5 ad. fem. on 5 sl.) UCD; 1 mi. N. Rumsey, V-3-64, on *Adenostoma* sp., D. R. Miller and J. A. Froebe (3 ad. fem. on 3 sl.) UCD.

Host and Distribution.— Occurring only on *Adenostoma* in the chaparral areas of California.

Acanthococcus araucariae (Maskell), n. comb.

Norfolk Island pine eriococcin

Fig. 2

Eriococcus araucariae Maskell, 1879:218.
Uhleria araucariae (Maskell), Cooke, 1881:41.
Rhizococcus araucariae (Maskell), Comstock, 1881:339-340.
Criococcus araucariae (Maskell), Rutherford, 1915:110-111 (lapsus).
Nidularia araucariae (Maskell), Lindinger, 1933:108.

Type Material.—We have studied 2 slides from Maskell's type series of *E.*

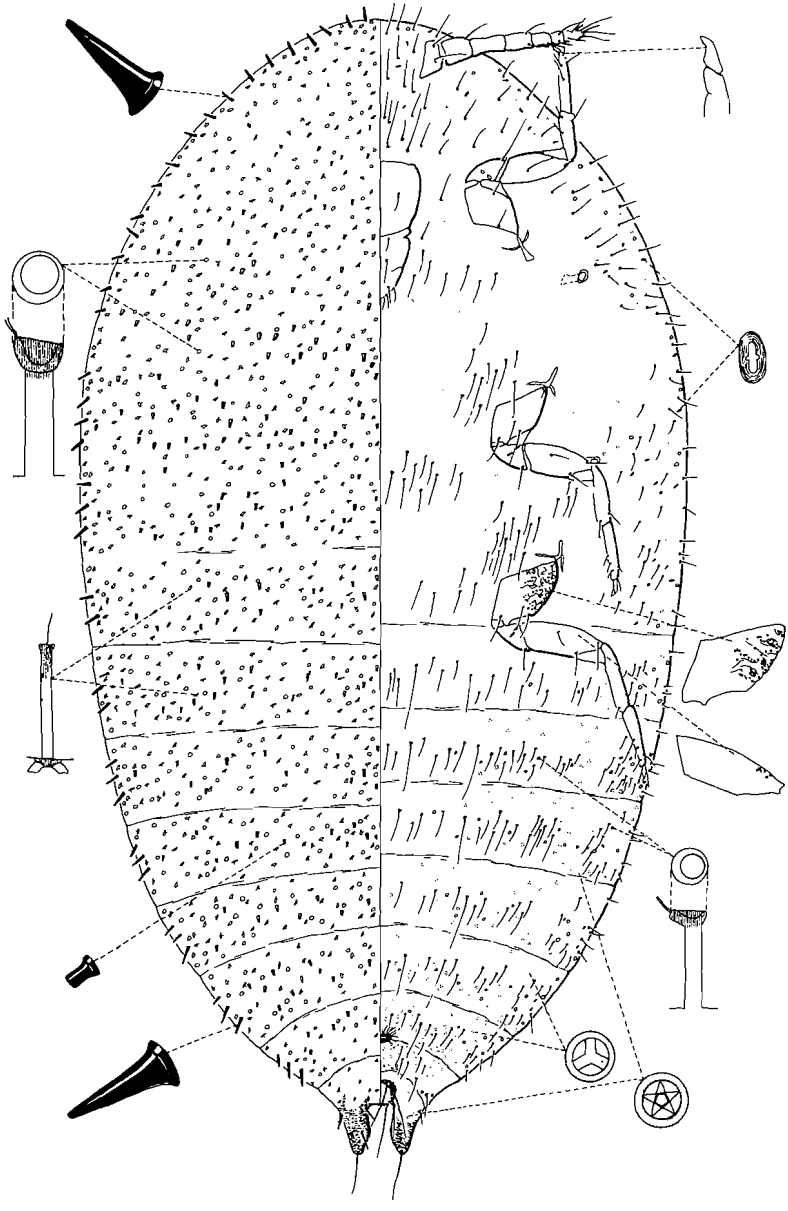


FIGURE 2. *Acanthococcus araucariae* (Maskell). San Fancisco Golden Gate Park, California, IX-26-67, on *Araucaria excelsa*.

araucariae. For details, see Deitz and Tocker (1980).

Field Features.— Newly mature adult female brownish-yellow with 1 pair of purple stripes on sublateral area of dorsum; old females purple. Crystalline rods noticeable along lateral margin only. Ovisac felted, white; enclosing adult female and up to 207 yellow eggs.

Occurring on foliage of host.

Recognition Characters.— Adult female, mounted, 1.86-2.61 mm long, 0.80-1.40 mm wide. Anal lobes large, protruding, with entire lobe area heavily sclerotized; each lobe dorsally with 3 enlarged setae (all nearly equal in size), with 6-10 microtubular ducts; each lobe ventrally with 4 slender body setae and 0-9 sessile pores.

DORSUM with enlarged setae of 2 sizes: larger size present along entire body margin, with two or three present on margin of each abdominal segment; smaller size restricted to medial and sublateral areas. Largest lateral seta 28-32 μ long, largest small seta 6-7 μ; on abdominal segments VII through II longest lateral seta 4.3-4.8 times longer than longest medial and sublateral seta. Lateral setae straight, slender, with blunt apices; medial setae small, squat, with blunt apices; setal rings thin. Enlarged setae in moderate numbers — e.g., abdominal segment IV with from 23-37 — with no longitudinal pattern. Macrotubular ducts present over entire dorsum. Microtubular ducts long (8-10 μ long), with area farthest from dermal orifice lightly sclerotized and weakly divided into 2 parts, apical portion blunt or rounded, from 1/4-1/2 of remaining sclerotized portion; total sclerotized area approximately equal to unsclerotized area; dermal orifice large, heavily sclerotized, with 2 protruding tubes. Microtubular ducts numerous over dorsum.

Anal ring usually ventral, with 4 pairs of setae.

VENTER with lanceolate body setae abnormally elongate (longest seta on abdominal segment VII from 59-84 μ long, on segment II from 94-147 μ), medial setae apically acute. Enlarged setae absent. Macrotubular ducts of 2 kinds: larger size same as on dorsum, restricted to body margin; smaller size with flattened "cup", present in medial or sublateral areas of abdominal segments VII through III, most numerous on posterior abdominal segments. Microtubular ducts absent. Multilocular sessile pores of 2 kinds: quinqueloculars present on abdomen, absent in medial areas of segments IV through III, present on thorax, rare or absent on head; triloculars abnormally abundant, almost completely replacing quinqueloculars on anterior abdominal segments, thorax, and head. Cruciform pores small, difficult to distinguish, if present, scattered along body margin.

Legs with hind coxae dorsally with 48-84 pores, ventral surface with 92-117; hind femora dorsally with 0-8 pores, absent ventrally; hind 2 pairs of tibiae with 4 setae, front tibiae with 5; inner, apical, tibial setae unenlarged; tarsi and tibiae nearly equal (hind tibia/tarsus ratio 0.95-1.00); claw with very small denticle near tip. Antennae normally 7-segmented rarely with 6, segment 3 longest. Apical segment with 3 sensory setae; second segment from apex with 1 of same size and shape as single sensory seta on third segment from apex.

Notes.— Brown (1967) has indicated that the chromosome number of this species is 2n=18 in New Guinea and Australia, whereas Nur (1967) has shown that this species in San Francisco possesses 2n=16. (We have confirmed Nur's results.) Although we have not seen the specimens that Brown studied, we have been unable to separate morphologically any entities within this species. We have examined specimens sent by Miss Helen Brookes from Australia, but these specimens

unlike the material from Australia seen by Brown had 2n=16. Until more material can be examined, this problem must remain unresolved.

Acanthococcus araucariae is quite different from all other species of *Acanthococcus* known from the United States. It is distinguished by the presence of an unusual setal pattern, microtubular ducts, and heavily sclerotized anal lobes.

United States Distribution.— California, Connecticut, District of Columbia, Florida, Hawaii, Massachusetts, Missouri, New York, Pennsylvania, Texas.

This species has been carried all over the world, but is probably native to Australia (Hoy 1962). In the United States, it occurs out-of-doors only in the warmer parts of the country.

Hosts.— Recorded from *Araucaria* and *Juniperus,* but juniper is probably an accidental host.

Acanthococcus arctostaphyli (Ferris), n. comb.

Manzanita eriococcin

Fig. 3

Eriococcus arctostaphyli Ferris, 1955:102.

Type Material.—Since Ferris did not designate 1 of the 5 specimens on the "type slide" as a holotype, we have selected 1 of the adult females from this slide and designated it as the lectotype. The selected specimen is in the upper left-hand corner of the cover slip and is marked with a ring. This slide has 2 labels, the right label reads "*Eriococcus arctostaphyli* n. sp. Type Slide" the left label reads "Host. Manzanita Cajon-Cal VII-29-1946 P. De Bach Coll" (UCD). In addition, there are 9 paralectotypes.

Field Features.— No available information. It probably occurs on the foliage of its host.

Recognition Characters.— Adult female, mounted, 2.18-3.26 mm long, 1.48-2.09 mm wide. Anal lobes narrow, protruding, with little or no sclerotization. Each lobe dorsally with 3 slender enlarged setae (approximately same size), with 1-3 microtubular ducts; each lobe ventrally with 4 slender body setae and 0-5 sessile pores.

DORSUM with enlarged setae of 2 sizes: 1 or 2 setae along margin of each abdominal segment large, additional large setae along body margin of thorax and head, and in sublateral and medial longitudinal lines on abdomen and thorax; remaining setae small. Largest large seta 56-62 μ long; largest small seta 30-36 μ; on abdominal segments VII through II longest large seta 1.6-1.9 times longer than longest small seta. Larger setae straight, with truncate or blunt spices; smaller size curved, with rounded apices; all with thin, setal rings. Enlarged setae abundant — e.g., abdominal segment IV with 38-81 — with large type setae forming 3 pairs of longitudinal lines (medial, sublateral, lateral). Macrotubular ducts present over entire dorsum. Microtubular ducts moderate in length (6-8 μ long), with area farthest from orifice sclerotized and divided into 2 parts, apical portion rounded or truncate, from 1/2 to equal length of remaining sclerotized portion; total sclerotized portion approximately equal to unsclerotized area; dermal orifice with unsclerotized

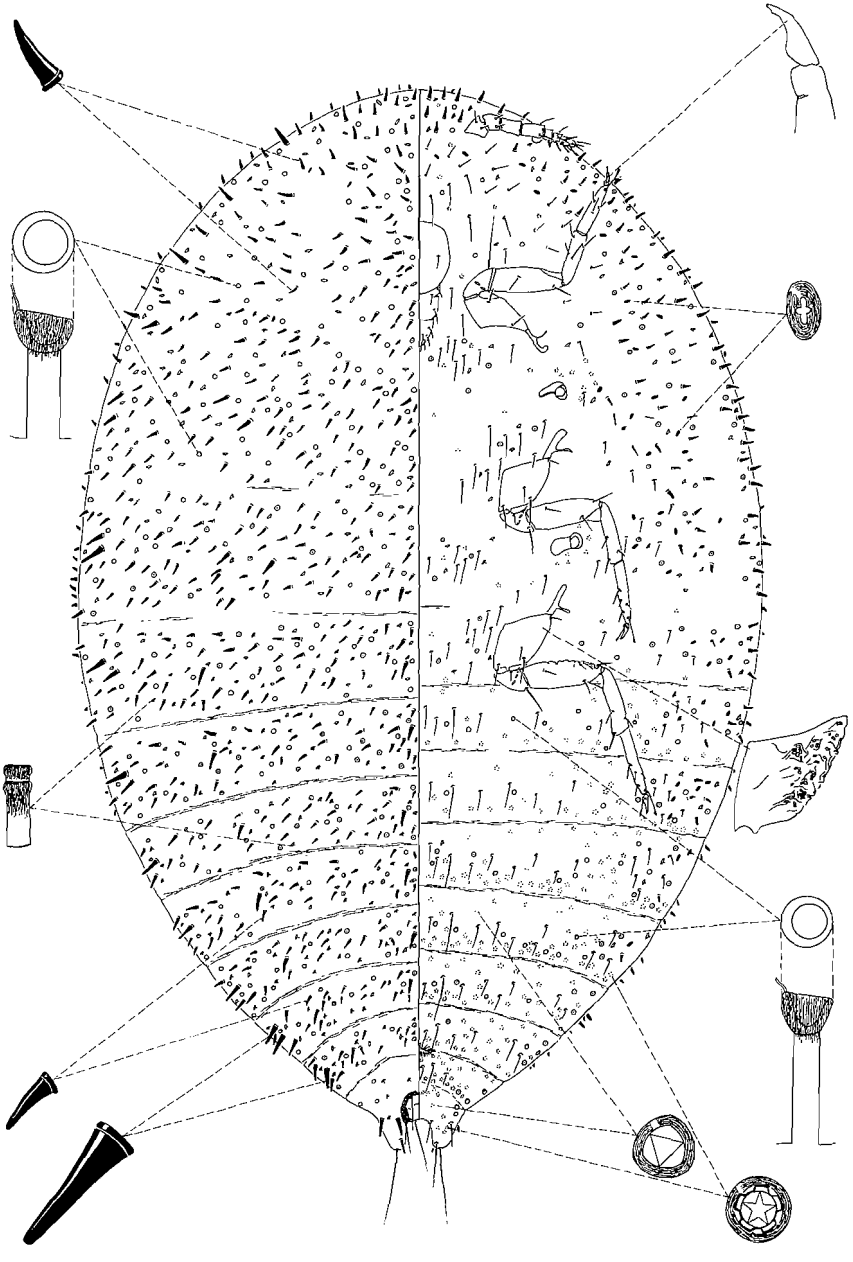


FIGURE 3. *Acanthococcus arctostaphyli* (Ferris). Cajon, California, VII-29-46, on *Arctostaphylos* sp.

ring. Microtubular ducts numerous over surface.

Anal ring dorsal or ventral, with 3 or 4 pairs of setae.

VENTER with lanceolate body setae (longest seta on abdominal segment VII from 44-53 μ long, on segment II from 66-112 μ), medial setae weakly capitate. Enlarged setae of same type as smaller dorsal setae, present along lateral margins from abdominal segments V or VI through head, most numerous on thorax. Macrotubular ducts of 2 kinds: larger size same as those on dorsum, present primarily along lateral margins of abdomen and on thorax and head, rarely present in medial areas of abdomen; smaller size present in medial or sublateral areas of abdominal segment VII or VI through head, most numerous on anterior abdominal segments. Microtubular ducts same as on dorsum, most numerous along body margin, rare in medial areas. Multilocular pores of 3 kinds: septeloculars rarely present; quinqueloculars and triloculars present over entire surface, most numerous on abdomen, weakly clustered around spiracles. Cruciform pores present laterally from abdominal segment V forward to head.

Legs with hind coxae dorsally with 16-96 pores, ventral surface with 0-24; hind femora dorsally with 0-9 pores, absent ventrally; hind 2 pairs of tibiae each with 5 setae, front pair with 6; inner, apical, tibial setae more robust than other leg setae; tibiae usually slightly longer than tarsi (hind tibia/tarsus ratio 0.97-1.10); claws with denticle near tip. Antennae 7-segmented, third or fourth segment longest. Segment 7 with 2 or 3 slender sensory setae; segment 6 with 1 longer and more slender than single sensory seta on segment 5.

Notes.— *Acanthococcus arctostaphyli* is quite similar in appearance to *A. dubius*, but differs from it in the shape of the dorsal enlarged setae.

Specimens Examined.— CALIFORNIA, SAN BERNARDINO Co.: Cajon, VIII-29-46, on *Arctostaphylos* sp., P. DeBach (1 ad. fem. lectotype, 4 ad. fem. paralectotypes) UCD. SHASTA Co.: Redding, date (?), on *A. patula* (?), R. W. Doane (5 ad. fem. paralectotypes) USNM.

Host and Distribution.— Known only from *Arctostaphylos*. Although this species has been recorded only from California, it is probably present in Oregon and Washington also.

Acanthococcus arenosus (Cockerell)

Sand eriococcin

Fig. 4

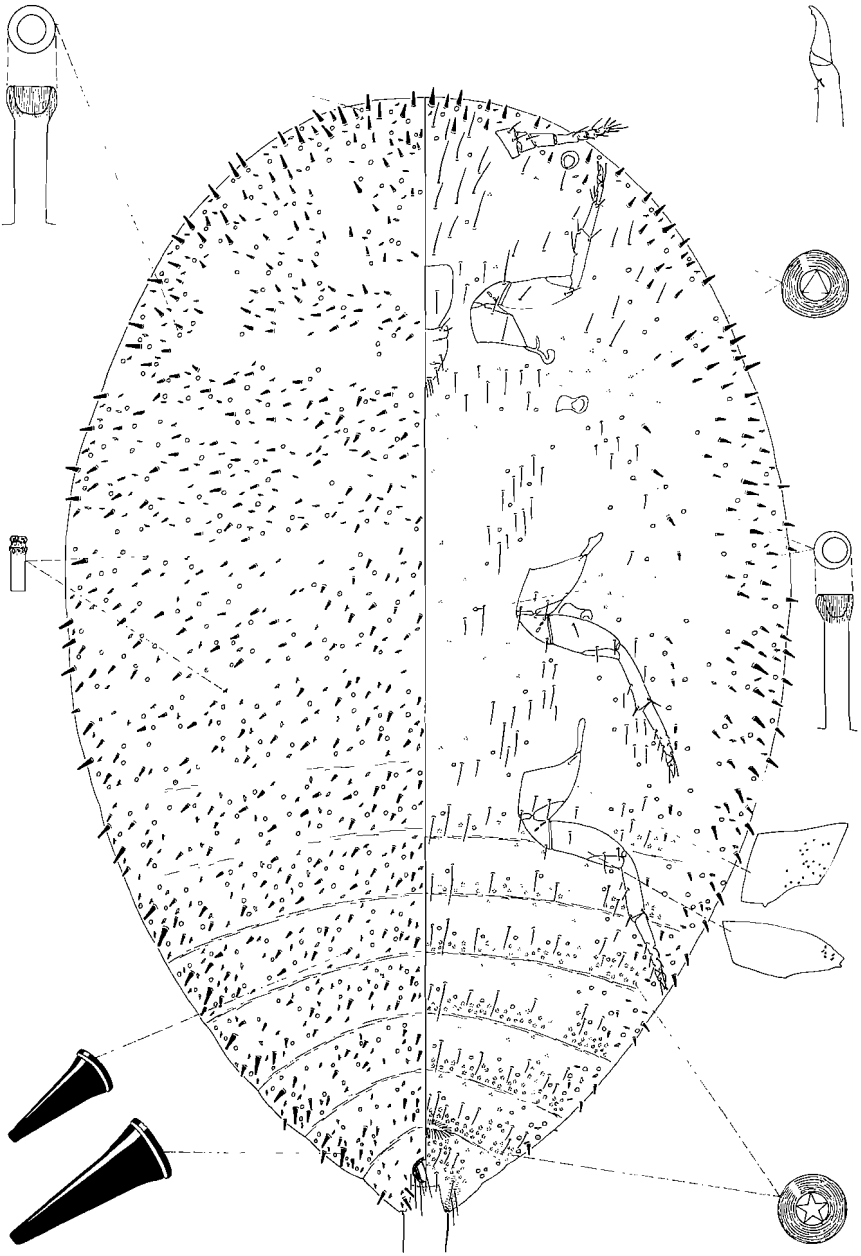
This species was described in a recent paper on the *Acanthococcus* species that occur in the United States on *Atriplex* and will not be redescribed here (see Miller 1991).

Acanthococcus azaleae (Comstock)

Azalea bark scale

Fig. 5

Eriococcus azaleae Comstock, 1881:338.
Eriococcus borealis Cockerell, 1899:369-370 (new synonomy).
Nidularia azaleae (Comstock), Lindinger, 1933:117.



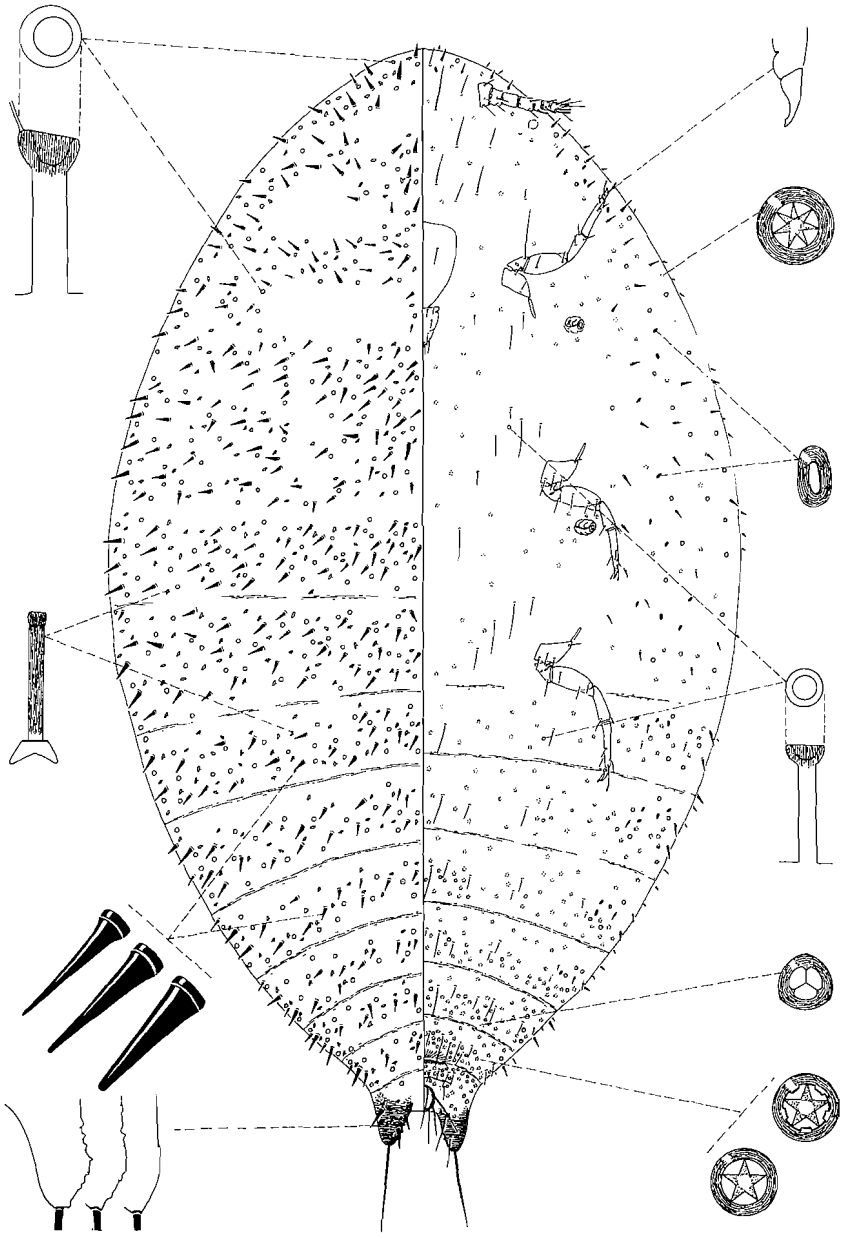


FIGURE 5. *Acanthococcus azaleae* (Comstock). Ithaca, New York, VI-19-35, on *Rhododendron carolinianum*.

Nidularia borealis (Cockerell), Lindinger, 1933:108.
Acanthococcus azaleae (Comstock), Borchsenius, 1949:350-351.

Type Material.— From the syntypes of *E. azaleae,* we have chosen and marked as lectotype an adult female labeled "On *Azalea* Agr. Greenhouse, D. C. Pergande Jan. 6, 1881." and "No. 822 *Eriococcus azaleae* Comstock." (USNM). There are 4 specimens on the slide; the second specimen from the right is here designated as the lectotype, and is so indicated on the slide. These specimens in addition to 6 others, were all remounted in November 1933. In addition, there are 51 paralectotypes.

Field Features.— Adult female oval, apex of abdomen pointed; body dark red or purple. Dorsal surface covered with many long, slender, yellow spines (Comstock 1881). On the dorsum several long, coarse, crystalline rods produced that cause species to blend well with pubescent areas of host (Davis 1896). Ovisac tough, white; may contain 50-250 reddish-purple eggs (Comstock 1881; Davis 1896).

This species has been recorded as overwintering as an egg or first instar nymph in the ovisac (Davis 1896), as nymphs (English and Turnipseed 1950), and as nymphs and adults (Stimmel 1982). There is 1 generation per year in the north and 2 generations in the south. Crawlers emerge from April to late May in Alabama (English and Turnipseed 1950) and from late June to mid-July in Pennsylvania (Stimmel 1982). By June, male sacs can be found; they emerge as adults in August (Davis 1896). In Alabama, crawlers from a second generation emerge in September and subsequently overwinter (English and Turnipseed 1950). Crawlers settle in branch or leaf axils. Summer life cycle is complete in approximately 130 days and winter life cycle is complete in 250 days in the south (English and Turnipseed 1950).

Recognition Characters.— Adult female, mounted, 1.09-3.15 mm long, 0.61-2.06 mm wide, anal lobes strongly protruding, apically acute, heavily sclerotized, with 0 to numerous teeth on mesal margin (fig. 5); each lobe dorsally with 3 enlarged setae (normally lateral seta largest or equal to posterior seta, anteromedial seta smallest), with 3-7, usually 4, microtubular ducts; each lobe ventrally with 3 slender body setae and rarely with a few sessile pores.

DORSUM with enlarged setae normally of 2 sizes: 2 or 3 larger setae along margin of each abdominal segment and on margin of thorax and head, additional large setae often present in medial and sublateral lines, although sometimes absent; remaining setae small. Largest large seta 47-62 μ long, largest small seta 31-41 μ; on abdominal segments VII through II longest large seta 1.2-1.8 times longer than longest small seta. Enlarged setae straight, with acute or rounded apices; all with thin setal rings. These setae in moderate numbers over dorsum — e.g., abdominal segment IV with from 22-35—large setae arranged in 3 pairs of longitudinal lines (medial, sublateral, lateral). Macrotubular ducts present over dorsum. Microtubular ducts large (range 10-12 μ long), with area farthest from dermal orifice sclerotized and weakly divided into 2 parts, apical portion rounded, about one fourth length of remaining sclerotized portion; total sclerotized portion much longer than unsclerotized area; dermal orifice heavily sclerotized, with 2 protruding tubes. Microtubular ducts numerous over dorsum.

Anal ring usually ventral, with 4, rarely 3, pairs of setae.

VENTER with lanceolate body setae elongate (longest seta on abdominal segment VII from 56-72 μ long, on segment II from 47-67 μ), medial setae apically acute. Enlarged setae of small size only, present along body margin from abdominal

segments V or IV through head. Macrotubular ducts of 2 kinds: larger size in small numbers along body margin; smaller size in reduced numbers in medial or sublateral areas of abdominal segment VII through III, extremely rare on thorax, absent on head. Microtubular ducts absent. Multilocular sessile pores of 3 kinds: septeloculars are or absent; quinqueloculars variable in form (fig. 5), most numerous sessile pore, present over entire venter; triloculars rare, more numerous than septeloculars, scattered over entire surface. Cruciform pores present along lateral margin from abdominal segment V through head.

Legs small; hind coxae and femora with no pores; posterior 2 pairs of tibiae with 4 setae, anterior pair with 5; inner, apical, tibial setae elongate, not enlarged; tarsi always longer than tibiae (hind tibia/tarsus ratio 0.61-0.77); claws with conspicuous denticle near tip. Antennae normally 7-segmented rarely with 8, third rarely fourth segment longest. Apical segment with 4 sensory setae; second segment from apex with only 1 equal in size to single sensory seta on third segment from apex.

Notes.— *Acanthococcus azaleae* is quite variable morphologically and for this reason has been considered 2 separate species (*A. azaleae* and *E. borealis*). The shape and relative sizes of the enlarged setae are quite variable. All of the specimens examined that were collected on *Rhododendron* spp. were of the typical *A. azaleae* type (possessing enlarged setae with rounded apices); all of those from central Texas and east and from southern Oregon and north (excluding Canada and Alaska) fit within this category. All of the specimens examined that were not found on *Rhododendron* and were from California east to Utah, were of the *borealis* type (possessing enlarged setae with acute apices). Because specimens from the overlapping area in the extreme northern part of California were intermediate in form, we conclude that there is only a single variable species.

Acanthococcus azaleae is distinct from all other North American species of *Acanthococcus* by the following combination of characters: slender enlarged setae (fig. 5), bifurcate microtubular ducts, heavily sclerotized anal lobes, no leg pores, 5 setae on front pair of tibiae and 4 on hind 2 pairs of tibiae. While *A. azaleae* is similar in appearance to *A. ericae*, it has large-sized enlarged setae no more than 1.8 times longer than small-sized setae; *A. ericae* has large-sized setae that are at least 3 times longer than small-sized setae.

United States Distribution.— Alabama, Arkansas, California, Colorado, Connecticut, District of Columbia, Florida, Georgia, Idaho, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Montana, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, West Virginia.

Known from 33 of the United States and probably occurring in most areas of North America.

Hosts.— Found on *Acer, Celtis, Fremontia, Gaylussacia, Pieris, Populus, Rhododendron, Ribes, Salix, Thuja,* and *Vaccinium.* Preferred hosts seem to belong to Ericaceae and Salicaceae.

Acanthococcus barri Miller

Barr eriococcin

Fig. 6

This species was described in a recent paper on the *Acanthococcus* species that occur in the United States on *Atriplex* and will not be redescribed here (see Miller 1991).

Acanthococcus coccineus (Cockerell), n. comb.

Cactus eriococcin

Fig. 7

Eriococcus coccineus Cockerell, 1894a:204.
Eriococcus coccineus var. *lutescens* Cockerell, 1894a:204.
Nidularia coccinea (Cockerell), Lindinger, 1933:108.

Type Material.— From the syntypes of *E. coccineus*, we have chosen and marked as lectotype an adult female labeled "On cactus in greenhouse, Lincoln, Nebraska Prof. Bruner May 23, 1894 6259" (USNM). There are 2 specimens on the slide; the specimen on the lower right side of the cover slip, away from the label is the lectotype. In addition, there are 9 paralectotypes.

The "variety" named *lutescens* is only a color form and should not be considered as a valid subspecific or specific name.

Field Features.— Adult female elongate oval. Body usually violet purple with central yellow band, occasionally crimson red, or dull yellow; color changes due to period of development and perhaps amount or lack of feeding. Ovisac loose, white.

Early instars remain attached to fleshy parts of cactus; adult female often migrates to spines of cactus just before oviposition. Male sacs also normally produced on cactus spines.

Recognition Characters.— Adult female, mounted, 1.42-3.17 mm long, 0.81-2.03 mm wide. Anal lobes protruding, with acute apex, moderately sclerotized; each lobe dorsally with 3 enlarged setae (posteromedial seta largest, anteromedial seta smallest, lateral seta intermediate), with 4-7 microtubular ducts; each lobe ventrally with 4 slender body setae and 5 or 6 sessile pores.

DORSUM with enlarged setae of 2 primary sizes: setae along body margin and in medial area of thorax large; enlarged setae on remaining areas noticeably small and inconspicuous, being no larger in diameter than that of most ventral body setae. Normally, with 3 large setae along body margin of each abdominal segment, becoming more numerous on thorax and head. Largest large seta 53-62 μ long, largest small seta 7-10 μ; on abdominal segments VIII through II longest lateral seta 5.7-8.5 times longer than longest sublateral or medial seta. Large setae straight, with truncate apices, although this character may be somewhat variable, smaller large setae with rounded apices; small setae straight, with blunt apices; setal rings thin. Enlarged setae few — e.g., abdominal segment IV with 10-23 — these setae showing no particular longitudinal pattern. Large setae in medial area of thorax variable in number; within same population there may be 0-15 present. Macrotubular ducts conspicuously large in diameter, present over entire surface. Microtubular ducts moderate in length (4-6 μ long), with area farthest from dermal orifice

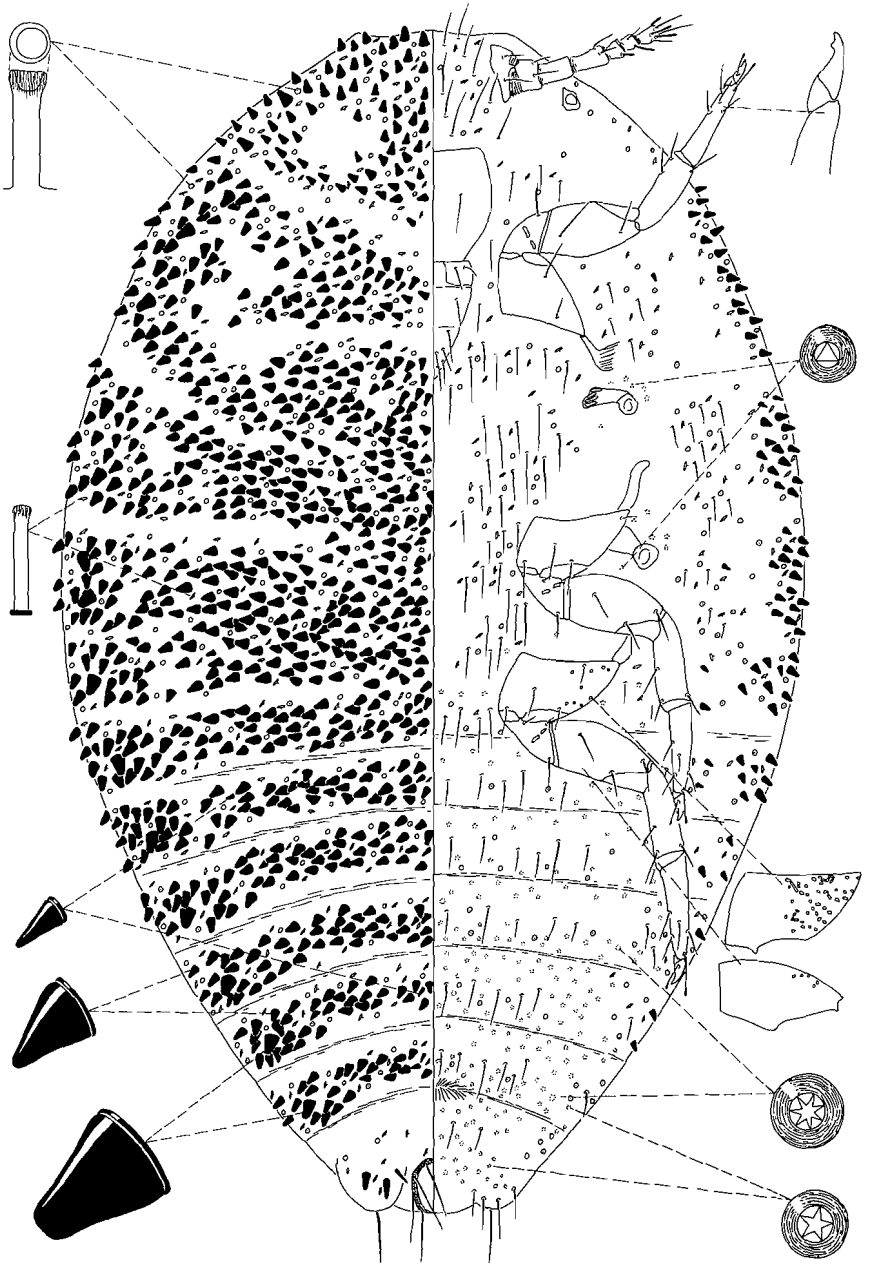


FIGURE 6. *Acanthococcus barri* Miller. 2 miles E. Tonopah, VII-7-68, on *Atriplex* organ pipe

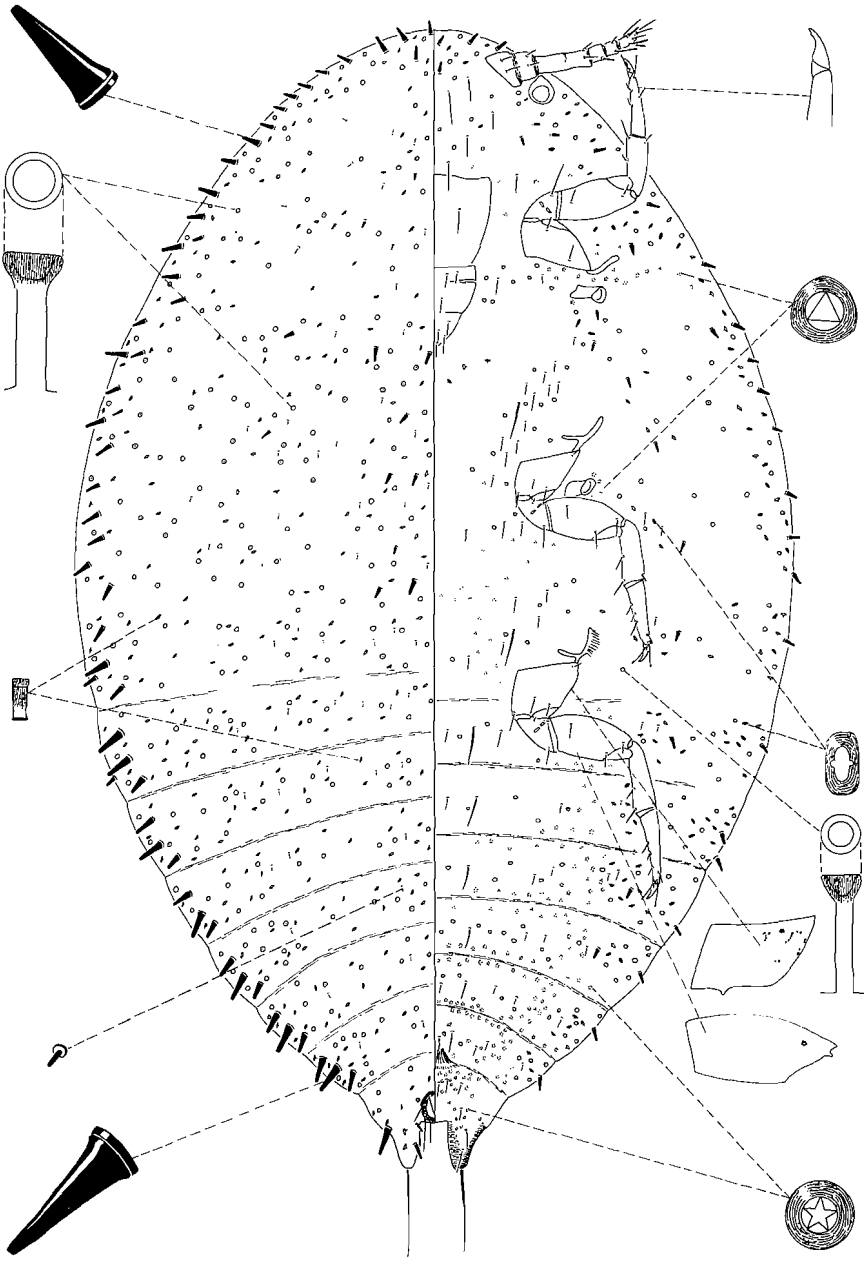


FIGURE 7. *Acanthococcus coccineus* (Cockerell) Tucson, Arizona, II-19-30, on organ pipe cactus.

sclerotized and divided into 2 parts, apical portion rounded, from 1/2 to equal length of remaining sclerotized portion; total sclerotized area much longer than unsclerotized area; dermal orifice normally with lightly sclerotized ring. Microtubular ducts numerous over dorsum.

Anal ring dorsal or ventral, with 4 or 5 pairs of setae, usually 4.

VENTER with lanceolate body setae moderate in length (longest seta on abdominal segment VII from 23-34 μ long, on segment II from 47-66 μ), medial setae capitate. Enlarged setae present in 2 areas: from abdominal segment VII through head in lateral row; also in sublateral row from abdominal segment VI or V through prothorax just below anterior spiracles, this row present or absent. Setae on both areas of 2 kinds: most with blunt apices; a few, generally smaller and with rounded apices. Macrotubular ducts of 2 kinds: larger size same as on dorsum, restricted to lateral areas; smaller size present on medial areas of venter. Microtubular ducts rare, present only near lateral margins. Multilocular sessile pores of 2 kinds: quinqueloculars most abundant kind of sessile pore, most numerous on posterior abdomen, rare on thorax; triloculars unusually abundant for genus, present mainly on anterior abdomen and on thorax and head. Cruciform pores present on lateral margins from abdominal segments VI or V through head, rarely present in medial areas.

Legs with hind coxae dorsally with 12-29 pores, ventral surface with these pores absent; hind femora dorsally with 2-6 pores, absent ventrally; tibiae with 5 setae; inner, apical, tibial setae robust; tibiae and tarsi nearly equal in length (hind tibia/tarsus ratio from 0.84-0.96); claws with inconspicuous denticle near tip. Antennae 6- or 7-segmented, when 6-segmented third segment longest, when 7-segmented third and fourth segments subequal. Apical segment with 3 sensory setae; second segment from apex with or without single sensory seta; third segment from apex with single short sensory seta.

Notes.— *Acanthococcus coccineus* is distinguished from other North American species of *Acanthococcus* by the longest lateral setae on abdomen at least 5 times longer than longest medial setae, truncate enlarged setae, and a medial cluster of large-sized setae on thorax and head.

United States Distribution.— Arizona, California, District of Columbia, Florida, Maryland, Minnesota, Missouri, Nebraska, New York, Texas, Virginia, Washington, West Virginia.

This species appears to be a native of Mexico and the southern-most part of Texas, New Mexico, Arizona, and California. Since cactus plants have been transplanted all over the world, it has become nearly cosmopolitan in nurseries and greenhouses.

Hosts.— Almost completely restricted to the Cactaceae. Although it has been recorded on other plant hosts, these probably are incidental records reflecting the adult female's habit of wandering some distance before forming an ovisac. Cactus genera known to be inhabited are: *Cereus, Echinocactus, Echinocereus, Echinopsis, Hylocereus, Mammillaria, Opuntia, Pelecyphora, Rebutia, Rhipsalis, Selenicereus,* and *Wilcoxia.*

Acanthococcus cryptus (Cockerell), n. comb.

Cryptic eriococcin

Fig. 8

Eriococcus tinsleyi cryptus Cockerell, 1901:210.
Eriococcus cryptus Cockerell, 1902:469.
Nidularia crypta (Cockerell), Lindinger, 1933:108.

Specimens examined that correspond to records given in various literature sources as *E. cryptus* but are here considered as misidentifications, are as follows: MEXICO, NORTHERN BAJA CALIFORNIA: Jaraguay, date (?), on *Atriplex* sp.; collector (?). SOUTHERN BAJA CALIFORNIA: La Paz, VI-(?)-19, on *Atriplex* sp., G. F. Ferris; Mulege, Concepcion Bay, III-(?)-34, on *Atriplex* sp., G. F. Ferris.

Type Material.— Originally collected at Las Vegas, New Mexico, April 19, 1901 by W. P. Cockerell (not found at USNM). Authentic type material has not been examined; however, 2 slides labeled "*Eriococcus cryptus*, Las Vegas N.M. Jan., 1902 W. P. Cockerell (on roots of *Gutierrezia* sp.)" were seen. The 14 specimens on these slides agree well with the original description. Since they are topotypical, we believe these specimens to be similar enough to the type to give an adequate concept of the species.

Field Features.— Adult female oval. Newly formed adult females dark gray; fully gravid females deep red; legs and antennae dark yellow to brown. Crystalline rods produced along lateral margins only; these rods moderate in length and curved posteriorly. Ovisac with eggs red to pink. Clear, anal secretion readily produced.

Crematogaster ants frequently associated with this species. In one instance, 42 dried eriococcins of all stages, except third to adult males, were found stored in a tunnel in the root of a *Gutierrezia* plant. It appeared that they were placed there by the associated ants.

Present on roots and subterranean crowns of host.

Recognition Characters.— Adult female, mounted, 1.73-3.12 mm long, 1.30-2.67 mm wide. Anal lobes rounded, moderately sclerotized; each lobe dorsally with 3 enlarged setae (anteromedial seta normally longer than posteromedial seta, rarely equal, lateral seta shortest), with 1-3, usually 2, microtubular ducts; each lobe ventrally with 4, rarely 5, slender body setae and 2-10 sessile pores.

DORSUM with enlarged setae of 2 sizes: setae along body margin large, with 1 on margin of each abdominal segment; remaining setae small and inconspicuous. Largest large seta 40-49 μ long, largest small seta 18-29 μ; on abdominal segments VII through III, longest lateral seta 3.0-4.5 times longer than longest dorsomedial seta. Large setae curved, with rounded apices and thin setal rings; small setae straight, with relatively acute apices and thick setal rings. Enlarged setae few — e.g., abdominal segment IV with 18-25 — these setae arranged in no particular longitudinal pattern. Macrotubular ducts scattered over entire surface. Microtubular ducts moderate in length (7-8 μ long), with area farthest from dermal orifice sclerotized and weakly divided into 2 parts, apical portion rectangular, from 1/4-1/2 length of remaining sclerotized portion; total sclerotized area much longer than unsclerotized area; dermal orifice with heavily sclerotized ring. Microtubular

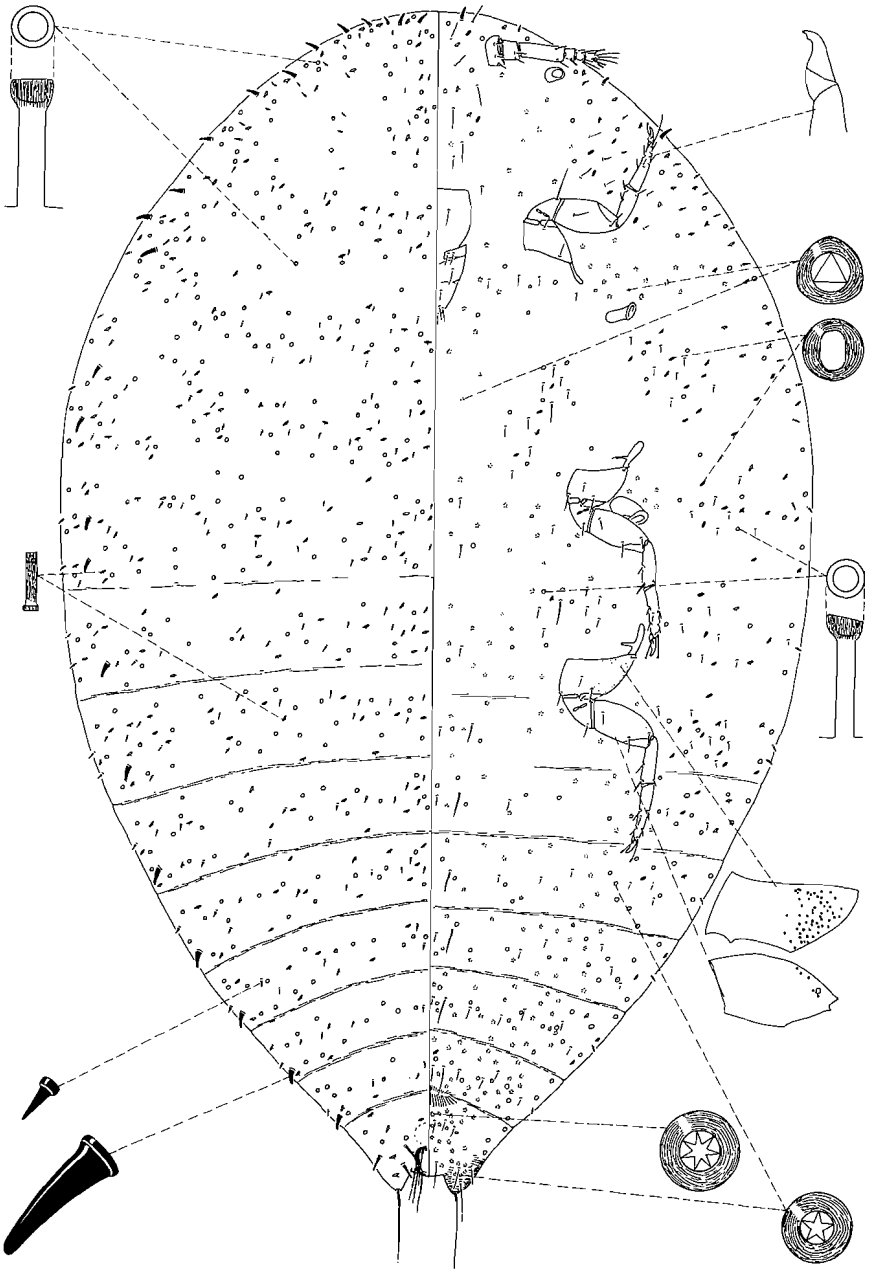


FIGURE 8. *Acanthococcus cryptus* (Cockerell). Rimmy Jim, Arizona, VIII-8-66, on *Gutierrezia* sp.

ducts numerous over surface.

Anal ring dorsal or rarely ventral, with 4 or 5 pairs of setae.

VENTER with lanceolate body setae moderate in length (longest on abdominal segment VII from 31-47 μ long, on segment II from 31-37 μ), medial setae capitate. Enlarged setae of same 2 kinds as on dorsum: larger size uncommon, present along margin of thorax and head; smaller size present along lateral margin from abdominal segment VII or VI through head. Macrotubular ducts of 2 kinds: larger size present on lateral and sublateral areas, with one such duct near each of 2 longest medial body setae on abdominal segments VII through III; smaller size present in medial areas. Microtubular ducts near body margin. Multilocular sessile pores of 3 kinds: septeloculars least common, if present, on abdominal segment VIII or VII and near spiracles; quinqueloculars most abundant, present over entire surface; triloculars rare, present on thorax and head. Cruciform pores present along lateral margin of anterior abdominal segments and on sublateral areas of thorax and head.

Legs with hind coxae dorsally with 26-43 pores, ventral surface with 12-41; hind femora dorsally with 3-7 pores, ventral surface with 0-3; tibiae with 5 setae; inner, apical, tibial setae may or may not be robust; tarsi rarely same length as tibiae, usually slightly longer (hind tibia/tarsus ratio 0.77-1.00); claws with denticle near tip. Antennae usually 6-segmented, rarely 7-segmented, third segment longest. Apical segments with 3 sensory setae; second segment from apex normally without sensory setae; third segment from apex with single sensory seta.

Notes.— *Acanthococcus cryptus* is similar in appearance to *A. larreae*, but is distinguished by 5 setae on each tibia, differently shaped large-sized setae (fig. 9), and different host; *A. larreae* has 4 setae on each tibia.

Specimens Examined.— ARIZONA, COCONINO Co.: Hay Lake, X-23-32, on *Gutierrezia sarothrae*, A. A. Nichol (12 ad. fem. on 6 sl.) UCD; 5 mi. E. Rimmy Jim, VIII-8-66, on *Gutierrezia* sp., D. R. Miller (5 ad. fem. on 3 sl.) CDA, UCD. MOHAVE Co.: Kingman, IX-1-68, on *Gutierrezia* sp., D. R. Miller and J. E. Lauck (2 ad. fem.) UCD. YAVAPAI Co.: 5 mi. N. Rimrock, IX-2-68, on *Gutierrezia* sp., D. R. Miller and J. E. Lauck (1 ad. fem.)

CALIFORNIA, INYO Co.: Deep Springs, (?)-(?)-37, on *Gutierrezia* sp., G. F. Ferris (1 ad. fem.) UCD.

KANSAS, MEAD Co.: XI Ranch, IX-17-44, on *G. dracuncubides* (?) (*Amphiachyris*), W. Norr (10 spm. on 3 sl.) USNM. NEW MEXICO, CATRON Co.: 5 mi. s. Glenwood, IX-6-68, on *Gutierrezia* sp., D. R. Miller and J. E. Lauck (4 ad. fem. on 2 sl.) UCD. HIDALGO Co.: 7 mi. NE. Lordsburg, IX-5-68, on *Gutierrezia* sp., D. R. Miller and J. E. Lauck (2 ad. fem.) UCD. QUAY Co.: Tucumcari, VI-4-76, on *Gutierrezia* sp., D. Foster (3 ad. fem. on 2 sl.) USNM. SAN MIGUEL Co.: 4 mi. S Apache Springs, VII-2-70, on *Gutierrezia* sp., D. R. Miller (6 ad. fem. on 3 sl.) USNM.

TEXAS, BRISCOE Co.: escarpment nr. Quitaque, (?)-(?)-21, on *Grindelia* sp., G. F. Ferris (1 ad. fem.) UCD. BREWSTER Co.: 29 mi. S.E. Marathon Hiway 90, V-12-76, on *Gutierrezia* sp., R. D. Gordon and D. R. Miller (6 ad. fem. on 3 sl.) USNM; Marathon, VI-30-76, on *Gutierrezia* sp., D. Foster (2 ad. fem. on 2 sl.) USNM. ECTOR Co.: nr. Odessa, IX-16-45, on *Gutierrezia sarothrae*, P. F. Allen (3 spm.) USNM. GARZA Co.: Post, Montgomery Estate, IX-15-62, on *G. microcephala*, E. Huddleston (3 ad. fem., 1 second instar male on 3 sl.) CDA. GAINES Co,: Seminole, VI-20-76, on *Gutierrezia* sp., D. Foster (8 ad. fem. on 5 sl.) USNM. HARDEMAN Co.: nr. Quanah, Red River, (?)(?)-21, on *Gutierrezia* sp., G. F. Ferris (2 ad. fem. on 2 sl.) UCD.

HOWARD Co.: 20 mi. N. Big Spring, on guava, V-4-76, R. D. Gordon and D. R. Miller (7 ad. fem. on 4 sl.) USNM. JONES Co.: Yecker Ranch, on *Gutierrezia* sp., IV-8-76, D. Foster, (7 ad. fem. on 7 sl.) USNM. LYNN Co.: 4 mi. S. New Home, V-3-76, on *Gutierrezia* sp., R. D. Gordon and D. R. Miller (6 ad. fem. on 3 sl.) USNM. MARTIN Co.: Patricia, VI-23-76, on *Gutierrezia* sp., D. Foster (1 ad. fem.) USNM. MOORE Co.: Dumas, VII-1-70, on *Gutierrezia* sp., D. R. Miller (2 ad. fem. on 2 sl.) USNM. PECOS Co.: nr. Sheffield, Pecos River, (?)-(?)-21, on *Gutierrezia* sp., G. F. Ferris (6 ad. fem. on 3 sl.) UCD; Pyote, VI-23-76, on *Gutierrezia* sp., D. Foster (4 ad. fem. on 3 sl.) USNM. PRESIDIO Co.: Presidio, X-25-46 and VIII-15-47, on *Viguiera stenoloba*, J. H. Russell (12 spm. on 2 sl.) USNM. Terrel Co.: 5 mi. W. Sanderson, V-12-76, on *Machaeranthera* sp., R. D. Gordon and D. R. Miller (2 ad. fem. on 2 sl.) USNM; Dryden, VI-9-76, on *Gutierrezia* sp., D. Foster (3 ad. fem. on 3 sl.) USNM. WARD Co.: Pyote, V-5-76, on Compositae, R. D. Gordon and D. R. Miller (4 ad. fem. on 2 sl.) USNM.

Hosts and Distribution.— Restricted primarily to the Compositae. Confirmed plant genera are as follows: *Grindelia, Gutierrezia, Machaeranthera, Psidium,* and *Viguiera. Gutierrezia* seems to be the preferred host.

Distributed throughout the warm areas of the southwestern United States.

Acanthococcus diaboli (Ferris), n. comb.

Mount Diablo eriococcin

Fig. 9

Eriococcus diaboli Ferris, 1955:122.

Specimens examined that correspond to records given by Ferris (1955) as *A. diaboli*, but considered as misidentifications are as follows: NEW YORK, SARATOGA Co., Saratoga Springs, VIII-(?)-38, on "grass", G. Rau.

Type Material.— In the original description Ferris discussed 2 separate collections as belonging to this species. He did not, however, indicate in this description or on the slides that the specimens from Saratoga Springs were to be considered as paratypes. Because of this, only the single specimen from Mt. Diablo can be considered as type material. This slide is labeled "*Eriococcus diaboli* n. sp. In nest of *Pogonomyrmex* Rock city camp, Mt. Diablo, Calif. 4/23/39 Ting" (UCD). Since Ferris referred to this specimen as "type" and since it is the only specimen from the type locality, it is considered as the holotype.

Field Features.— Body light gray; body contents slightly darker. Venter with smooth, white bloom. Ovisac tough, felted; encloses female and many orange eggs.

Originally found in *Pogonomyrmex* ant nest. This species occurs on the grass blades of the host.

Recognition Characters.— Adult females, mounted, 2.31-3.99 mm long, 1.50-1.75 mm wide. Anal lobes acute, weakly sclerotized along mesal margins; each lobe dorsally with 3 enlarged setae (anteromedial seta slender, longest; posteromedial seta slender, shortest; lateral seta robust), with 2 or 3 microtubular ducts; each lobe ventrally with 4 or 5 slender body setae and no sessile pores.

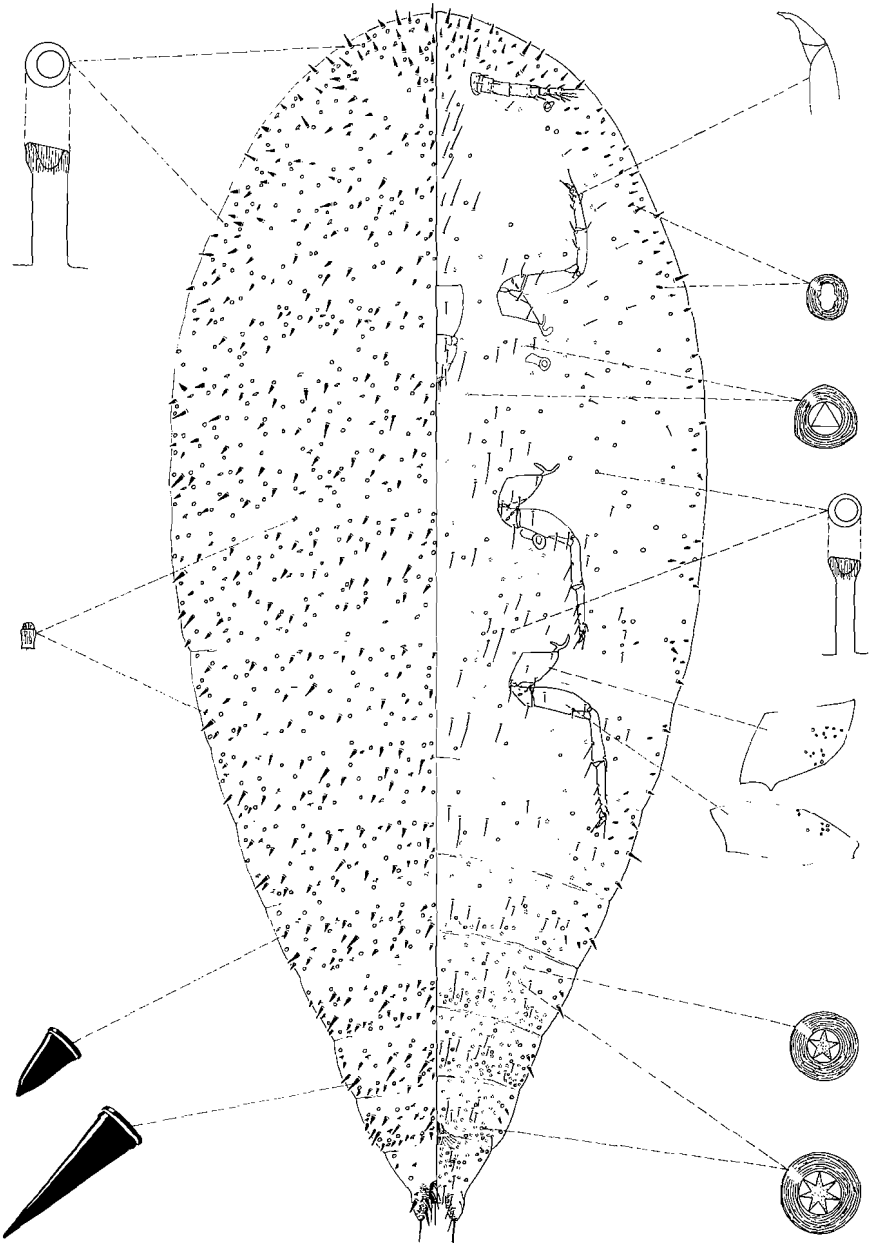


FIGURE 9. *Acanthococcus diaboli* (Ferris). Mt. Diablo, California, IV-23-39, in nest of *Pogonomyrmex* sp.

DORSUM with enlarged setae of 2 primary kinds: larger size in transverse row in middle of each abdominal segment and along margins of thorax and head; remaining setae small, scattered over surface. Normally 1 large seta and 2 or 3 small setae along margin of each abdominal segment. Largest large seta 39-53 μ long, largest small seta 19-30 μ; on abdominal segments VII through II longest large seta 1.3-1.9 times longer than longest small seta. Largest setae straight, with acute, rarely rounded, apices; smallest type straight, often short and squat, with rounded apices; setal rings thin. Enlarged setae abundant — e.g., abdominal segment IV with 31-53 — largest setae arranged in 3 pairs of longitudinal lines (medial, sublateral, lateral). Macrotubular ducts conspicuously large in diameter, numerous. Microtubular ducts small (4-5 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, from 1/2 to nearly equal length of remaining sclerotized portion; total sclerotized area much longer than unsclerotized area; dermal orifice with only slight indication of sclerotized ring. Microtubular ducts scattered over surface.

Anal ring dorsal or ventral, with 4 or 5 pairs of setae.

VENTER with lanceolate body setae moderately long (longest seta on abdominal segment VII from 34-47 μ long, segment II from 50-69 μ) medial setae apically acute. Enlarged setae primarily of one kind, larger size rare, present only on thorax and head; smaller size present from abdominal segment VII through head. Macrotubular ducts of 2 sizes: although intermediate sizes occur, larger size restricted to lateral areas; smaller size present on medial and sublateral areas of surface. Microtubular ducts uncommon, present only near lateral margins. Multilocular sessile pores of 3 kinds: septeloculars least common, when present, restricted to abdomen; quinqueloculars most common, present over entire surface, most abundant on posterior abdominal segments; triloculars present on anterior abdominal segments, thorax, and head. Cruciform pores unusually small, present in reduced numbers from abdominal segment IV or III through head.

Legs normal for genus; hind coxae dorsally with 8-18 pores, ventral surface with 0-6; hind femora dorsally with 3-9 pores, ventral surface with 0-2; tibiae with 5 setae; inner, apical, tibial setae only slightly or not enlarged; tibiae shorter than tarsi (hind tibia/tarsus ratio 0.83-0.96); claws unusually slender, with small denticle. Antennae 7-segmented, fourth segment longest. Segment 7 with 3 sensory setae; segment 6 with none or only 1 slightly longer than the single sensory seta on segment 5.

Notes.—*Acanthococcus diaboli* is similar in appearance to *A. washingtonensis*, but is distinguished by having more than 30 enlarged setae on abdominal segment V, large lateral setae with acute apices, and 3 enlarged setae on each anal lobe; *A. washingtonensis* has less than 20 enlarged setae on abdominal segment V, large lateral setae with rounded apices, and 4 enlarged setae on each anal lobe.

Specimens Examined.— CALIFORNIA, CONTRA COSTA Co.: Mt. Diablo, Rock City Camp, IV-23-39, in nest of *Pogonomyrmex* sp., P. C. Ting (1 holotype ad. fem.) UCD. SAN BENITO Co.: 2 mi. N. Paicines, VI-23-66, on *Stipa* sp., D. R. Miller (6 ad. fem. on 6 sl.) CDA, UCD. LOS ANGELES Co.: Lancaster, Neenach, IV-12-61, on *Hordeum leporinum*, G. G. Beevor (9 ad. fem. on 3 sl.) CDA; Gorman, III-28-60, on *Sitanion* sp., G. G. Beevor (2 ad. fem. on 2 sl.) CDA. SANTA BARBARA Co.: Cuyama, V-16-55, on "native grass", G. G. Beevor (8 ad. fem. on 4 sl.) CDA; Cuyama Valley, IV-28-55, on *Oryzopsis hymenoides*, G. G. Beevor (2 ad. fem.) CDA; Goode

Canyon, IV-25-55, on "native grass, G. G. Beevor (4 ad. fem. on 4 sl.) CDA; V-18-55, on *Triticum aestivum*, G. G. Beevor (2 ad. fem.) CDA. OREGON, KLAMATH Co.: 2 mi. NE. Olene, VIII-l-68, on grass, D. R. Miller and R. F. Denno (4 ad. fem. on 2 sl.) UCD.

Host and Distribution.— Known from the western parts of northern California and southern Oregon on many grass genera; *Hordeum, Oryzopsis, Sitanion, Stipa, Triticum.*

Acanthococcus dubius (Cockerell), n. comb.

Uncertain eriococcin

Figs. 10 and 11

Eriococcus dubius Cockerell, 1896:18.
Eriococcus quercus toumeyi Cockerell, 1900:594 (new synonymy).
Eriococcus cockerelli Essig, 1913:179-181.
Eriococcus paenulatus Ferris, 1920:18-19 (new synonymy).
Eriococcus stanfordianus Ferris, 1920:21-22 (new synonymy).
Eriococcus villosus Ferris, 1920:22-23 (new synonymy).
Eriococcus toumeyi (Cockerell), Ferris, 1921:77.
Nidularia cockerelli (Essig), Lindinger, 1933:108.
Nidularia dubia (Cockerell), Lindinger, 1933:108.
Nidularia paenulata (Ferris), Lindinger, 1933:116.
Nidularia stanfordiana (Ferris), Lindinger, 1933:116.
Nidularia villosa (Ferris), Lindinger, 1933:117.
Nidularia villosula Lindinger, 1943:223 (new synonymy).
Eriococcus villosulus (Lindinger), Hoy, 1963:124.

Type Material.— From the 3 syntype slides, we have chosen and marked as lectotype an adult female labeled "*Eriococcus dubius* Ckll. On Unknown shrub. Valles, Mex. Oct. 13, 1894 Type -" (USNM). This slide contains 5 specimens; the specimen in the bottom row, on the left, nearest the old label is the lectotype. In addition, there are 9 paralectotypes. After examining the route taken by Townsend through Mexico in 1894, it is apparent that "Valles" is actually Ciudad de Valles.

We have also been able to examine the holotype or syntypes of the following synonymous species: *E. cockerelli* Essig, *E. paenulatus* Ferris, *E. stanfordianus* Ferris, and *E. villosulus* (Lindinger) (=*E. villosus* Ferris). We have not seen type material of *E. toumeyi* Cockerell, but we have examined material from *Prosopis* near the type locality and a homotype designated by Ferris.

Field Features.— Adult female narrowly oval; body purple to green. Ovisac felted; encloses 55-150 eggs.

Present on roots, crown, or underside of foliage.

Recognition Characters.— Adult female, mounted, 1.72-3.50 mm long, 1.21-2.47 mm wide. Anal lobes narrow and pointed, normally lightly sclerotized; each lobe dorsally with 3 enlarged setae (lateral seta normally equal to posteromedial seta, sometimes lateral seta longest, anteromedial seta shortest), with 2 or 3 microtubular ducts; each lobe ventrally with 3 body setae and 3-13 sessile pores.

DORSUM with enlarged setae of 2 sizes: 1 seta along margin of each abdominal

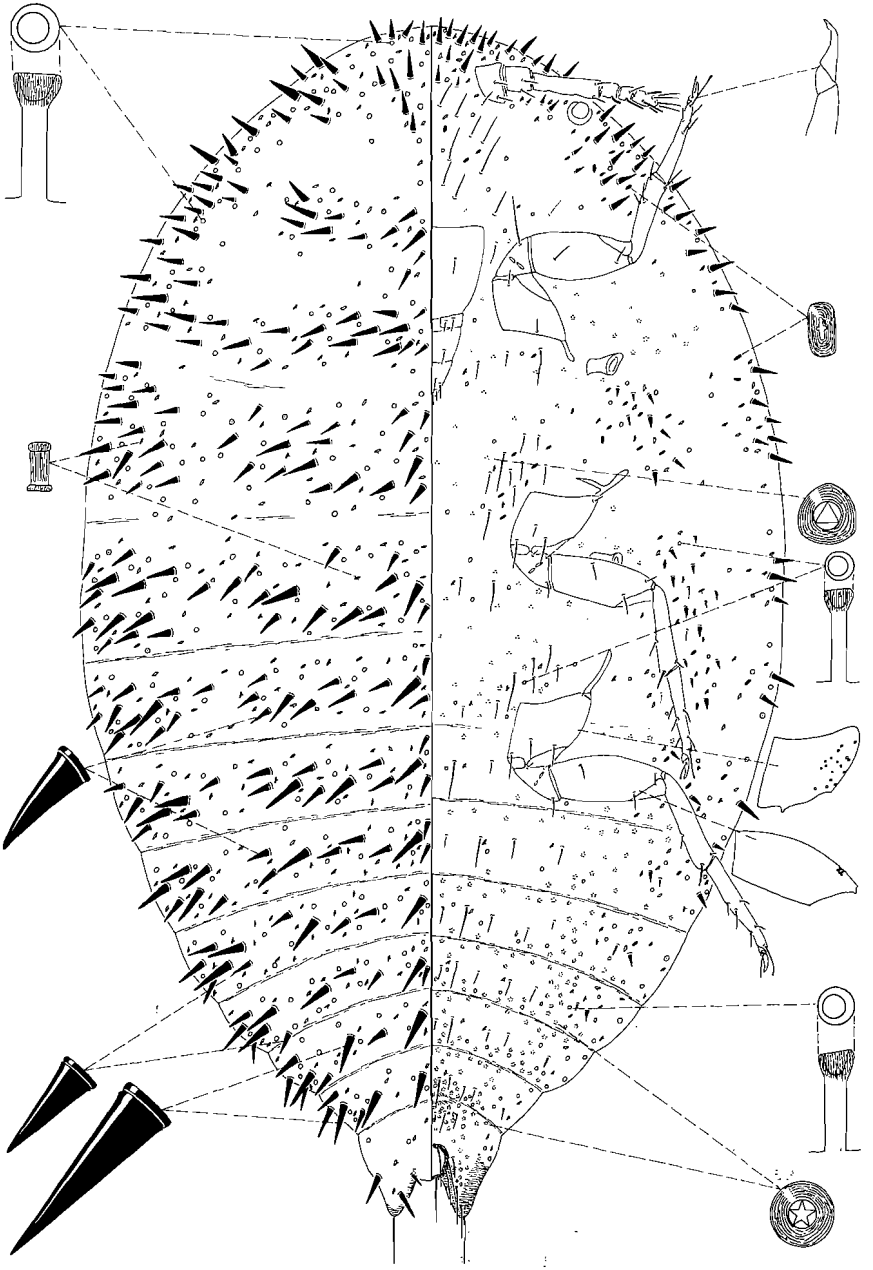


FIGURE 10. *Acanthococcus dubius* (Cockerell). El Centro, California, VII-27-64, on *Hibiscus* sp.

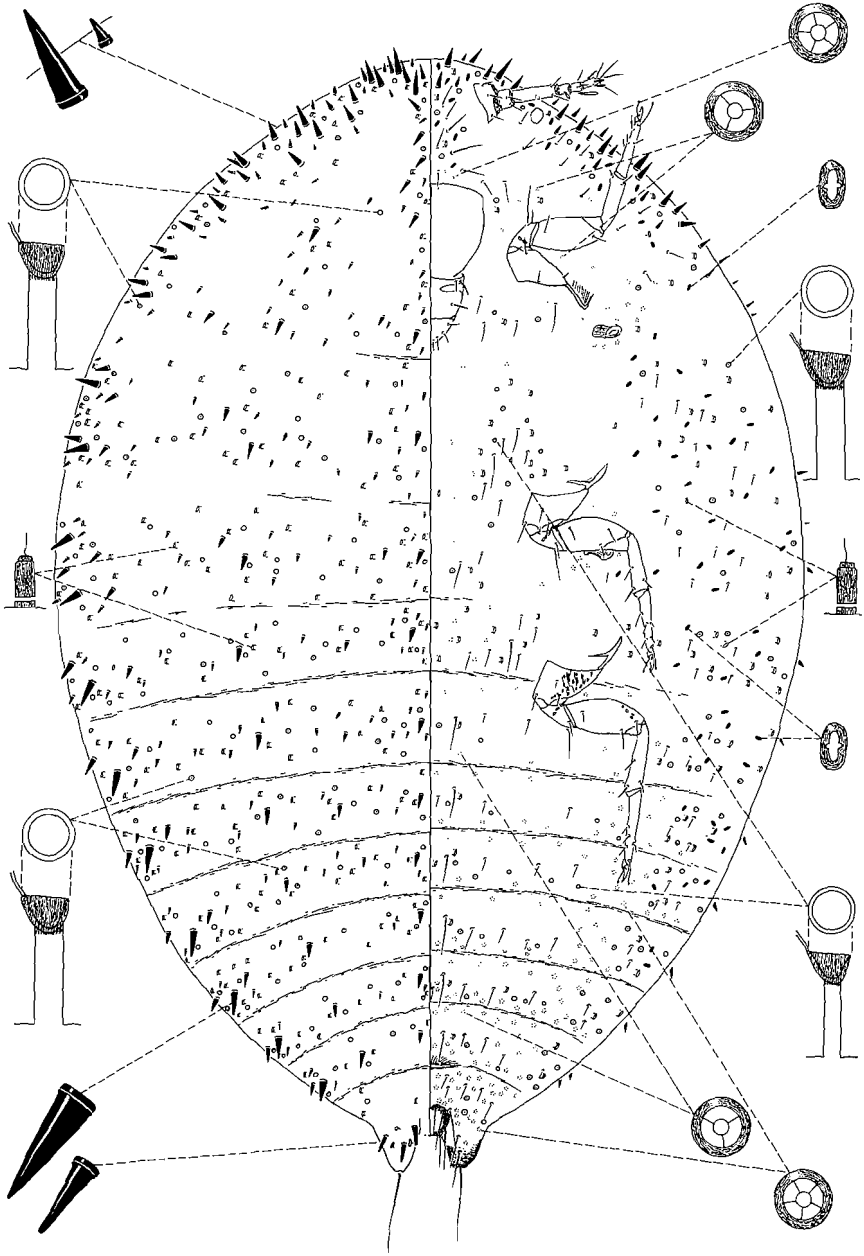


FIGURE 11. *Acanthococcus dubius* (Cockerell). 4 mi. E. El Toro, California, III-25-64, on Compositae.

segment large, additional pairs of large setae on medial and sublateral areas of abdominal segments VIII through thorax; remaining setae small. Largest large seta 47-78 μ long, largest small seta 31-47 μ; on abdominal segments VIII through III longest large seta 1.2-1.9 times longer than longest small seta. Lateral setae, including large type, straight, with apices acute; medial setae either straight or slightly curved, normally with acute apices; all with thin setal rings. Enlarged setae in moderate to large numbers — e. g., abdominal segment V with 23-56 — large setae arranged in 3 pairs of longitudinal lines (medial, sublateral, lateral). Macrotubular ducts lightly scattered over dorsum. Microtubular ducts moderate in length (5-7 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, from 1/4-1/2 length of remaining sclerotized portion; total sclerotized portion varying from equal to 3 times longer than unsclerotized area; dermal orifice normally with heavily sclerotized ring. Microtubular ducts scattered over surface.

Anal ring either dorsal or ventral, with 4 pairs of setae.

VENTER with lanceolate body setae elongate (longest seta on abdominal segment VIII from 33-53 μ long, on segment II from 62-81 μ), medial setae rarely capitate. Enlarged setae of small size only, present along margins of abdominal segments VIII or VII through head. Macrotubular ducts of 2 or 3 kinds: larger size same as on dorsum, present on lateral areas; intermediate size present on sublateral areas of abdomen; smaller size present on medial areas of abdomen, thorax, and head. Microtubular ducts present over entire surface, most abundant on lateral areas. Multilocular sessile pores of 3 kinds: septeloculars normally absent, if present, restricted to anterior abdominal segments; quinqueloculars abundant on abdomen, common or uncommon on thorax and head; triloculars rare on abdomen, most abundant on thorax. Cruciform pores present along lateral margin of anterior abdominal segments, and on thorax, and head, also present anterior to each pair of legs.

Legs normal for genus; hind coxae dorsally with 13-38 pores, ventral surface with 0-24; hind femora dorsally 0-6 pores, ventral surface with 0-4; hind 2 pairs of tibia with 5, rarely 4, setae, front tibiae with 6 rarely with 5; inner, apical, tibial setae may or may not be robust; tibiae and tarsi nearly equal (hind tibia/tarsus ratio 0.85-1.12); claws with small denticle near tip. Antennae usually 6-segmented, rarely 7-segmented, third segment longest. Apical segment with 2 or 3 sensory setae; second segment from apex with sensory setae either absent or weakly developed; third segment from apex with only 1 sensory seta which is short and robust.

Notes.— *Acanthococcus dubius* is extremely variable and may even be a complex of species. We have examined approximately 150 slides containing specimens which fall within the range of this species as here understood. Although there are several geographically different entities which can be separated morphologically, they seem to intergrade structurally in intermediate areas. With a better understanding of the biology of these entities it may be possible to designate subspecies.

Acanthococcus dubius is similar in appearance to *A. eriogoni*, but is distinguished by enlarged setae with acute apices, straight or slightly curved medial and sublateral setae, medial and sublateral setae of 2 sizes with large size forming 3 pairs of longitudinal lines from abdominal segment VIII through posterior thorax, front tibiae normally with 6 setae, and microtubular ducts normally with short area of sclerotization; *A. eriogoni* has enlarged setae with rounded apices, strongly curved medial and sublateral setae, medial and sublateral setae all of approximately

the same size, particularly on abdominal segment V forward through head, front tibiae with 5 setae, and microtubular ducts with long area sclerotization. For description of *A. eriogoni* see Miller (1991). See *A. arctostaphyli* and *A. euphorbiae* for additional comparisons.

United States Distribution.— Alabama, Arizona, California, Colorado, Maryland, Nevada, Oregon, and Texas.

Distributed primarily throughout warm areas of the southwestern United States and in Mexico.

Hosts.— Found on many plant genera: *Acacia, Agoseris, Ambrosia, Artemisia, Asclepias, Baccharis, Calliandra, Eriogonum, Euphorbia, Franseria, Gossypium, Haplopappus, Helianthemum, Hibiscus, Lantana, Lupinus, Mammillaria, Mimosa, Nerisyrenia, Prosopis, Quercus, Sphaeralcea, Stephanomeria.* There seems to be no particular host preference.

Acanthococcus epacrotrichus Miller and Miller, n. sp.

Pointed hair eriococcin

Fig. 12

Type Material.— Adult female holotype (left specimen of 2 specimens on slide) with right label "*Eriococcus* 12 mi. NE. Olene, Klamath Co., OREGON 2-VIII-68 ex *Artemisia* sp. D. R. Miller & R. F. Denno 1306"; left label "*Eriococcus epacrotrichus* Miller and Miller TYPE, Holotype, Paratype" (UCD). In addition, there are 59 paratypes.

Field Features.— Body dark purple; legs dark yellow. Adult female covered with many short crystalline rods of approximate same size. Ovisac noticeably tough, difficult to break open, and frequently produced under the bark of host; may contain 90-157 orange-yellow eggs.

This species occurs on the foliage and bark of its host.

Recognition Characters.— Adult female holotype, mounted, 1.81 mm long, 1.13 mm wide (paratypes 2.05-3.15 mm long, 1.21-2.31 mm wide). Anal lobes slightly protruding, rounded, lightly sclerotized; each lobe dorsally with 3 enlarged setae (all approximately equal), with microtubular ducts absent; each lobe ventrally with 3 body setae and no sessile pores.

DORSUM with enlarged setae of 2 indistinct sizes: 1 or 2 larger setae on margin of each abdominal segment, absent elsewhere; remaining setae of smaller size. Largest large seta 37 μ long (paratypes 31-46 μ), largest small seta 26 μ long (paratypes 25-34 μ); longest large seta 1.4 times longer than longest small seta (paratypes 1.2-1.6 times). Enlarged setae slender, straight, with acute apices; setal rings thin. Enlarged setae abundant — e.g., abdominal segment IV with 74 (paratypes with 61-93) — large setae forming no longitudinal pattern. Macrotubular ducts short (5 μ long) (paratypes 4-6 μ), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, approximately 1/3 length of remaining sclerotized portion; total sclerotized area over twice length of unsclerotized area; dermal orifice sclerotized. Microtubular ducts abundant over surface.

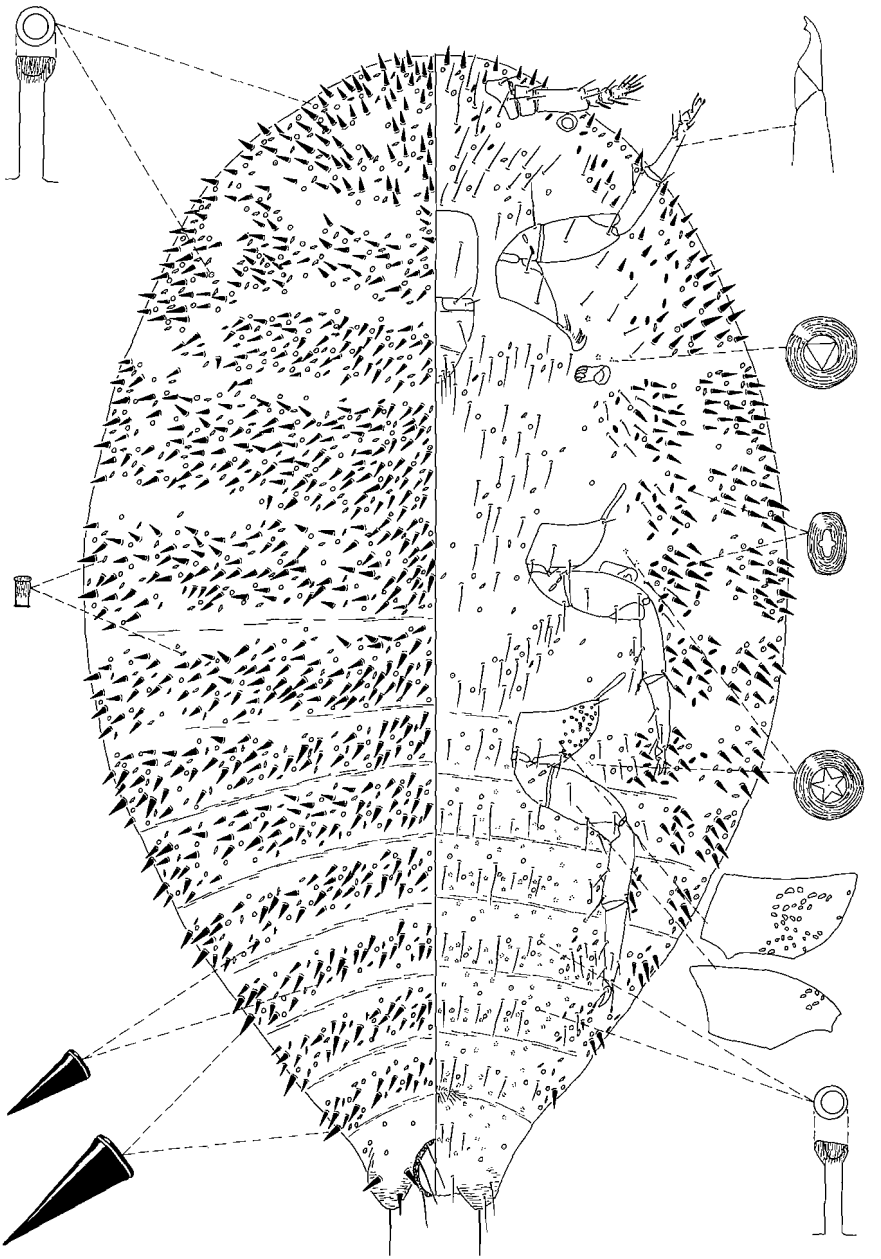


FIGURE 12. *Acanthococcus epacrotrichus* Miller and Miller, n. sp. 12 mi. NE. Olene, Oregon, VIII-2-68, on *Artemisia* sp.

Anal ring dorsal, with 3 pairs of setae.

VENTER with lanceolate body setae elongate (longest seta on abdominal segment VII 41 μ long (paratypes 34-47 μ), on segment II 59 μ (paratypes 62-87 μ), medial setae slightly capitate apically. Enlarged setae in unusually large numbers along margin from abdominal segment VII through head. Macrotubular ducts of 2 sizes: larger size present over entire surface; smaller size restricted to sublateral areas of abdomen. Microtubular ducts most abundant on lateral margins, present over entire surface except on medial areas of abdomen. Multilocular sessile pores in unusually small numbers on thorax, absent on head, and of 2 kinds: quinqueloculars most abundant sessile pore, present on abdomen and near spiracles; triloculars rare, present on anterior abdominal segments and near spiracles. Cruciform pores present from anterior abdominal segments through head.

Legs with hind coxae dorsally with 34 and 39 pores (paratypes with 20-75), ventrally with 25 and 13 (paratypes with 3-39); hind femora dorsally with 7 and 6 pores (paratypes with 2-8), ventrally with 0 and 1 (paratypes with 0-4); tibiae each with 5 setae; inner, apical, tibial setae robust; tarsi approximately equal to tibae (hind tibia/tarsus ratio 0.98) (paratypes 0.90-1.06); claws with large denticle. Antennae 6-segmented, third segment longest. Segment 6 with 3 sensory setae; segment 5 with one longer and more slender than single sensory seta on segment 4.

Variation.— Some paratypes vary from holotype by having the following characteristics: anal lobes apically acute and heavily sclerotized; anal lobes each with 3 or 4 microtubular ducts; microtubular ducts rarely with orifice unsclerotized; antennae normally 7-segmented.

Notes.— *Acanthococcus epacrotrichus* is similar in appearance to *A. diaboli*, but is distinguished by having oval body form, more than 60 enlarged setae on abdominal segment V, no ventral multilocular sessile pores on thorax except near spiracles, and is found on non-grass hosts; *A. diaboli* has elongate body form (fig. 12), less than 60 enlarged setae on abdominal segment V, ventral multilocular sessile pores scattered over thorax, and is found on grass.

Specific Epithet.— The name *epacrotrichus*, from the Greek epakros, meaning "pointed at the end" and trichos, meaning "hair", refers to the acute apices of the dorsal enlarged setae.

Specimens Examined.— CALIFORNIA, ALPINE Co.: Monitor Pass, VIII-2-64, on (?) (Compositae), D. R. Miller and J. A. Froebe (2 ad. fem. paratypes on 2 sl.) UCD. INYO Co.: Deep Springs Valley, X-(?)-28, on *Artemisia* sp., G. F. Ferris (5 ad. fem. paratypes on 2 sl.) UCD. LASSEN Co.: 8 mi. W. Susanville, VII-8-64, on *Artemisia* sp., D. R. Miller (1 ad. fem. paratype, 1 second instar fem. paratype on 2 sl.) UCD. NEVADA Co.: Sagehen Creek Research Station, VII-15-66, on *A. tridentata*, D. R. Miller (1 ad. fem. paratype, 1 second instar male paratype on 2 sl.) UCD. ORANGE Co.: Modjeska Canyon, VI-12-64, on *Artemisia* sp., D. R. Miller and J. A. Froebe (3 ad. fem. paratypes on 3 sl.) BM, UCD, USNM. RIVERSIDE Co.: Tenaja nr. Wildomar, V-26-71, *A. californica*, D.R. Miller, J. L. Miller, and E. R. Miller (3 ad. fem. on 2 sl.) USNM. SIERRA Co.: 2 mi. N. Sagehen Creek, VII-6-64, on *Artemisia* sp., D. R. Miller (1 ad. fem. paratype, 1 second instar fem. paratype on 2 sl.) UCD.

IDAHO, TWIN FALLS Co.: 10 mi. SE. Rogerson, IV-ll-63, on *Artemisia* sp., W.

F. Barr (3 ad. fem. paratypes on 2 sl.) UCD.

NEVADA, ELKO Co.: 2 mi. S. Elko, VIII-1-67, on *A. arbuscula*, D. R. Miller and D. S. Horning (2 ad. fem. paratypes) UCD. WASHOE Co.: 2 mi. E. Steamboat, VI-22-67, on *A. tridentata*, R. C. Bechtel and H. L. McKenzie (1 ad. fem.) UCD.

OREGON, KLAMATH Co.: 12 mi. NE. Olene, VIII-2-68, on *Artemisia* sp., D. R. Miller and R. F. Denno (1 ad. fem. holotype, 19 ad. fem. paratypes) CDA, UCD, VPI, ZAS. LAKE Co.: 1 mi. N. Valley Falls, VIII-9-68, on *A. tridentata*, D. R. MIller and R. F. Denno (8 ad. fem. pratypes, 2 ad. male paratypes, 5 fourth instar male paratypes, 1 third instar male paratype, 1 second instar male paratype on 5 sl.) UCD.

WASHINGTON, WHITMAN Co.: 3 mi. E. Wawawai, VIII-7-70, on *Artemisia* sp., D.R. Miller and L. S. Hawkins (3 ad. fem. on 2 sl.) USNM.

MEXICO, NORTHERN BAJA CAI1IFORNIA. SE. Ensenada, II-1-34, on *A. californica*, G. F. Ferris (2 ad. fem. paratypes) UCD.

Host and Distribution.— Occurring on various species of *Artemisia*. Probably found throughout the western United States in the sagebrush areas.

Acanthococcus eriogoni (Ehrhorn)

Eriogonum eriococcin

Figs. 13

This species was described in a recent paper on the *Acanthococcus* species that occur in the United States on *Atriplex* and will not be redescribed here (see Miller 1991).

Acanthococcus euphorbiae (Ferris), n. comb.

Euphorbia eriococcin

Figs. 14 and 15

Eriococcus euphorbiae Ferris, 1955:128.
Eriococcus plucheae Ferris, 1955:154 (new synonymy).

Type Material.—From the syntypes of *E. euphorbiae* we have chosen and marked as lectotype an adult fem. labeled "*Eriococcus euphorbiae* n. sp, *Euphorbia polycarpa*, 13 mi. N.W. Indio P.H. Timberlake" (UCD). There is 1 adult female on the slide. In addition, there are 6 paralectotypes. It has also been possible to see the types of *E. plucheae*.

Field Features.— Body oval. Newly formed adult female grayish-purple to green; gravid and overwintering females deep red. Ovisac white, felted.

This species is found on the crown and roots of its host.

Recognition Characters.— Adult female, mounted, 1.30-3.12 mm long, 0.64-2.23 mm wide. Anal lobes protruding, apically acute, lightly sclerotized; each lobe dorsally with 3 enlarged setae (normally lateral seta equal to posteromedial seta, anteromedial seta shortest), with 2-4 microtubular ducts; each lobe ventrally with 3 body setae and 1-5 sessile pores.

DORSUM with enlarged setae of 2 primary sizes: larger setae present along lateral margins, with 1-3 on margin of each abdominal segment; 1 pair of setae on sublateral area of each abdominal segment may be large or small; 1 pair of setae on medial area of each abdominal segment rarely large; remaining setae small. Largest

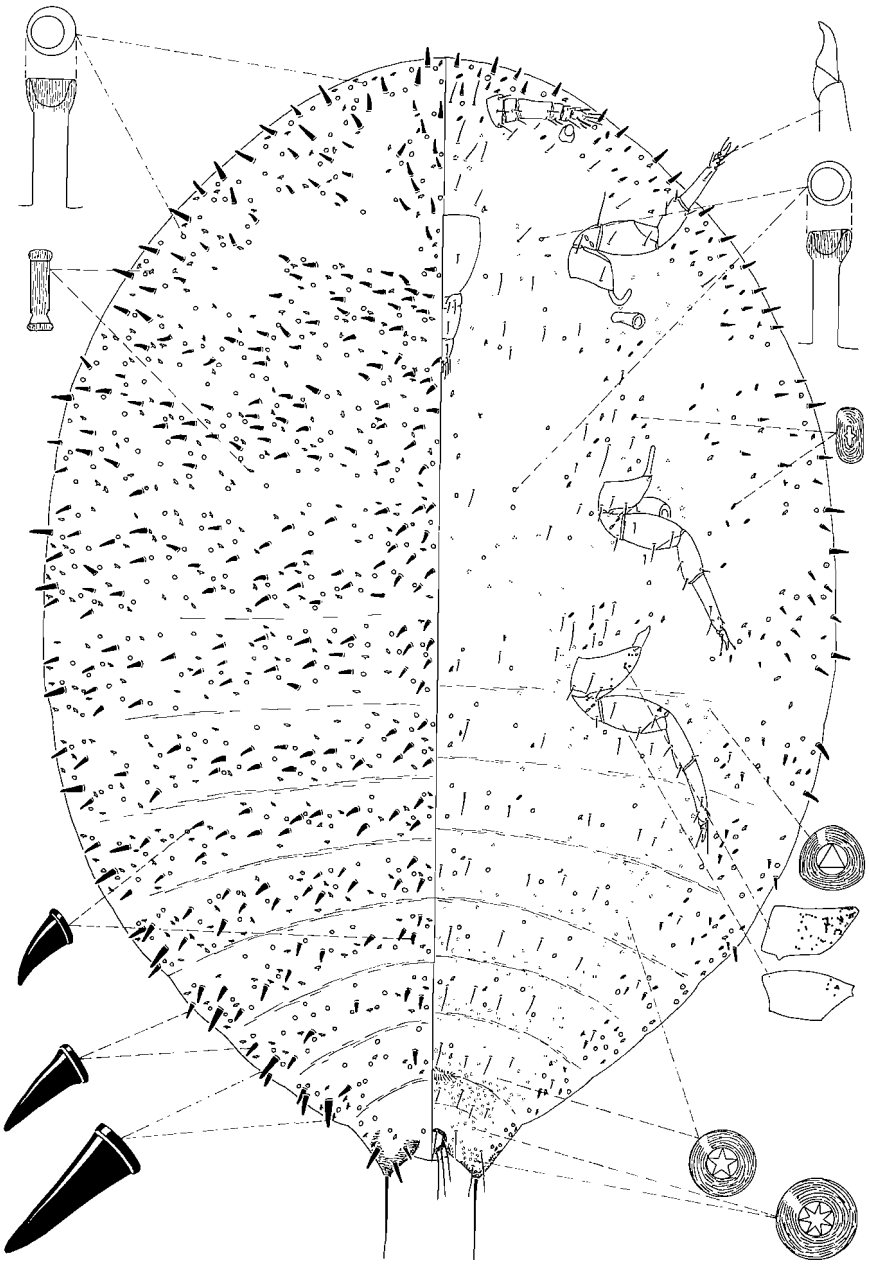


FIGURE 13. *Acanthococcus eriogoni* (Ehrhorn). Flagstaff, Arizona, date and host unknown.

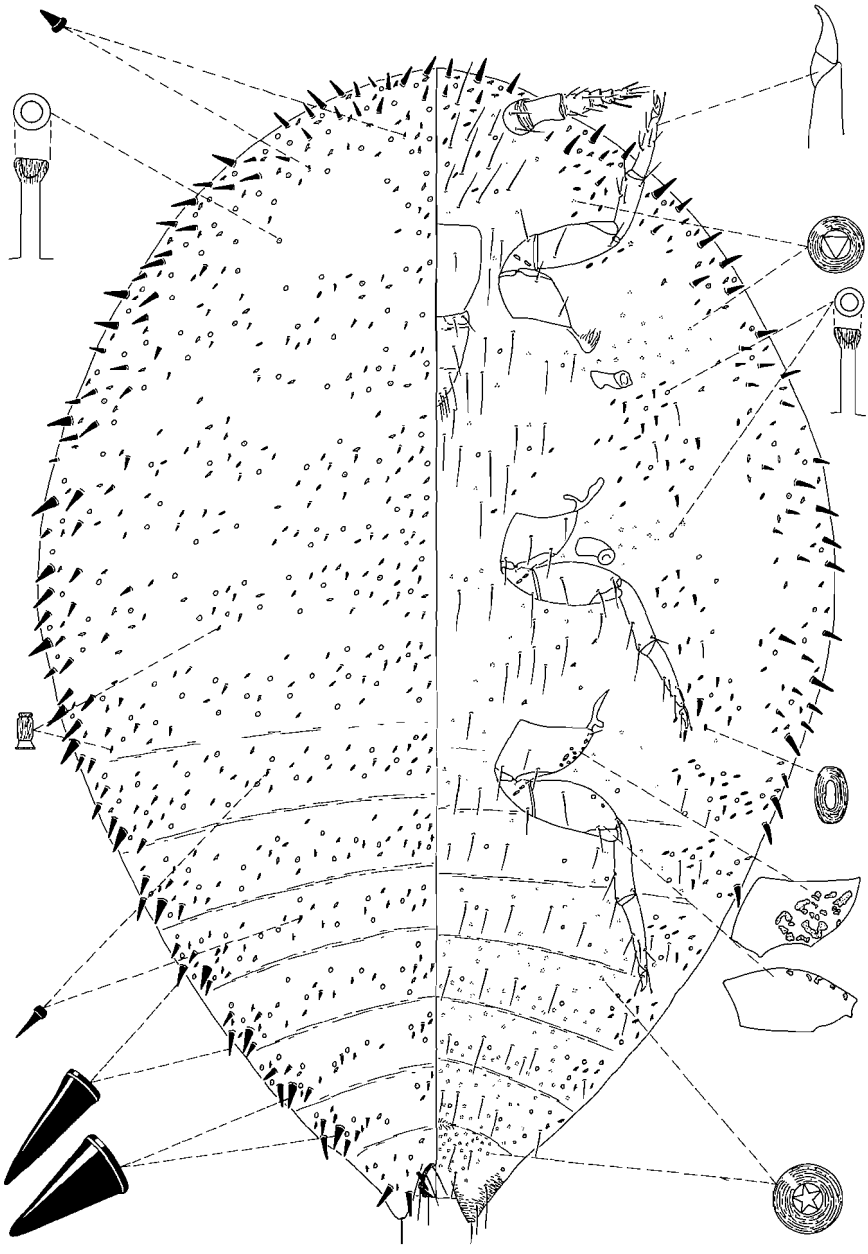


FIGURE 14. *Acanthococcus euphorbiae* (Ferris), dorsomedial setae reduced. 2 mi. NW. Independence, California, I-30-65, on *Eriogonum fasciculatum*.

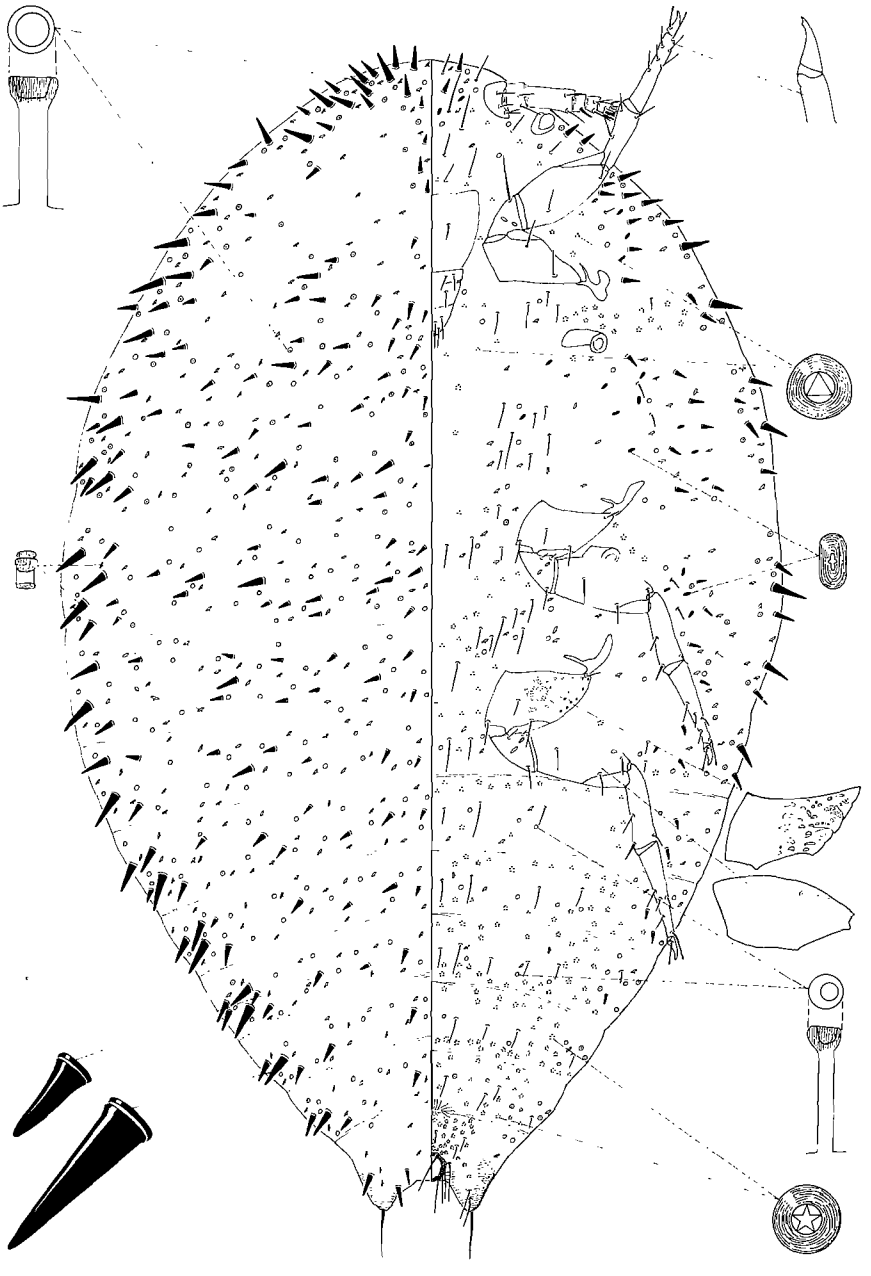


FIGURE 15. *Acanthococcus euphorbiae* (Ferris), dorsomedial setae enlarged. Glamis, California, II-2-66, on *Euphorbia* sp.

large seta 44-63 μ long, largest small seta 19-33 μ; on abdominal segments VII through II longest large seta 1.5-2.9 times longer than longest small seta. Large setae straight or slightly curved, with rounded almost acute apices; small setae slightly curved, with rounded apices; all with thin setae rings. Enlarged setae few — e.g., abdominal segment IV with 18-23 — often arranged in 3 pairs of longitudinal lines (medial, sublateral, lateral). Macrotubular ducts large, lightly scattered over surface. Microtubular ducts small to moderate (4-7 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, from 1/4-1/2 length of remaining sclerotized portion; total sclerotized area 4 times longer than unsclerotized area; dermal orifice with weakly to heavily sclerotized ring. Microtubular ducts lightly scattered over surface.

Anal ring dorsal or ventral, with 4 pairs of setae.

VENTER with lanceolate body setae elongate (longest seta on abdominal segment VII from 28-48 μ long, on segment II from 47-81 μ) medial setae apically acute. Enlarged setae same sizes as on dorsum, present near body margin from abdominal segment VII or VI through head. Macrotubular ducts of 2 or 3 kinds: larger size present on lateral areas; medium size, if present, on sublateral areas of abdomen, on medial areas of thorax and head; smaller size present on medial areas of abdomen near transverse rows of body setae. Microtubular ducts either restricted to lateral areas or present on lateral areas, on medial areas near large body setae, on thorax and head near medial clusters of body setae. Multilocular sessile pores of 2 or 3 kinds: septeloculars rarely present on abdomen; quinqueloculars abundant on abdomen, rare on thorax and head; triloculars uncommon on abdomen, most abundant on thorax and head. Cruciform pores present on lateral and sublateral areas from abdominal segment VII or V through head, sometimes on medial areas of abdominal segment II and anterior to hind 2 pairs of legs.

Legs with hind coxae dorsally with 15-56 pores, ventral surface with 0-30; hind femora dorsally with 2-8 pores, ventral surface with these pores absent; tibiae with 5 setae; inner, apical, tibial setae only slightly more robust than other leg setae; tarsi longer than tibiae (hind tibia/tarsus ratio O.85-0.90); claws with denticle near tip. Antennae 6- or 7-segmented, third or fourth segment longest. Apical segment with 3 sensory setae; second segment from apex with sensory setae absent, rarely with 1 longer and more slender than single sensory seta on third segment from apex.

Notes.— The general appearance of *A. euphorbiae* is quite variable because of differences in the sizes of the enlarged setae. The medial and sublateral setae are quite variable. Within a single population, specimens may be found with the longest medial and sublateral setae nearly equal or one-third the size of the largest lateral setae. The use of the relative sizes of the lateral setae to the dorsomedial setae in the past has caused this species to be split into several entities.

Acanthococcus euphorbiae is similar in appearance to *A. dubius*, but is distinguished by having enlarged setae with rounded apices, and lateral enlarged setae much longer than remaining medial and sublateral enlarged setae; *A. dubius* has enlarged setae with acute apices, and lateral setae much the same length as the sublateral and/or medial enlarged setae.

United States Distribution.— Arizona, California, Idaho, Nevada, and Texas. Distributed throughout the warm areas of the United States.

Hosts.—Occurring on many host genera: *Artemisia, Chrysothamnus, Eriogonum, Euphorbia, Gossypium, Gutierrezia, Talinum.*

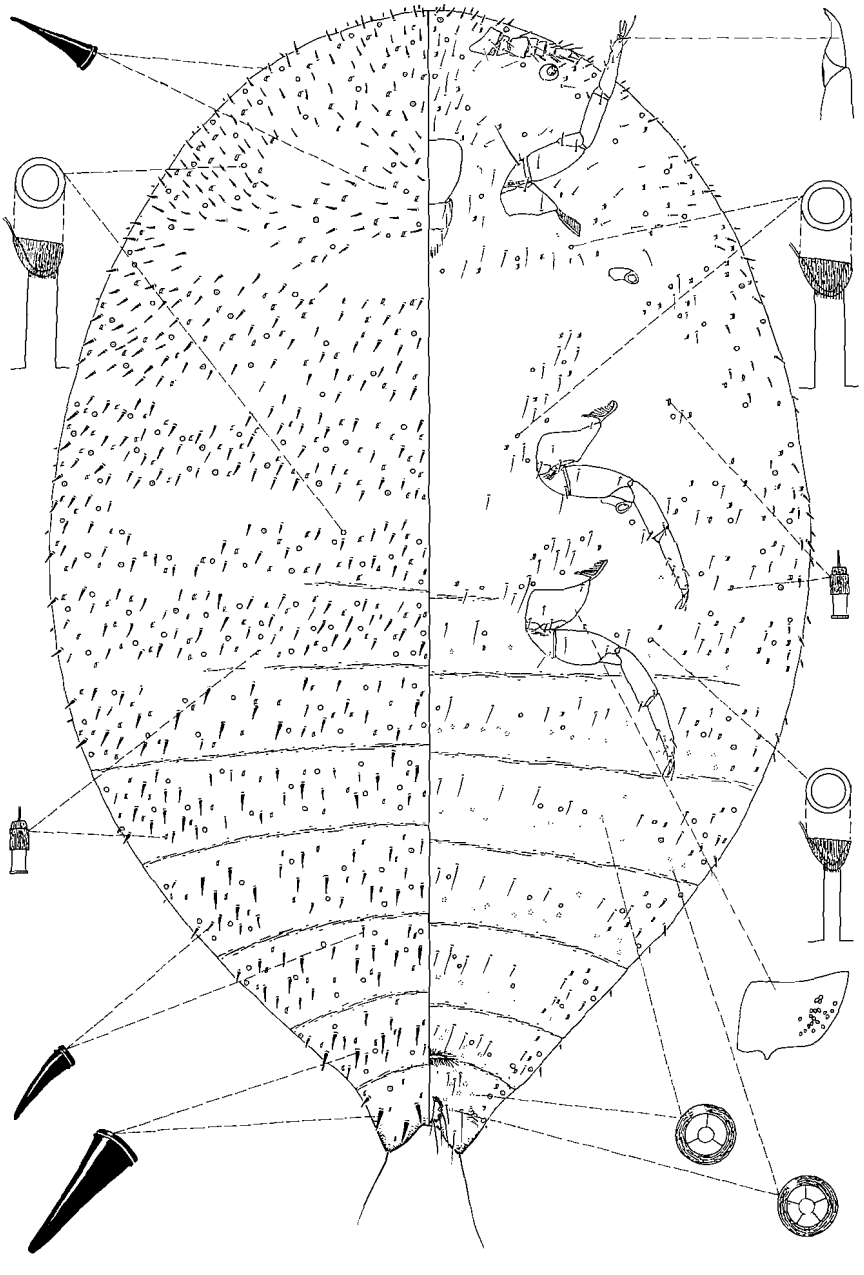


FIGURE 16. *Acanthococcus froebeae* Miller. 5 mi. N. Baker, California, 4-13-65, on *Franseria* sp.

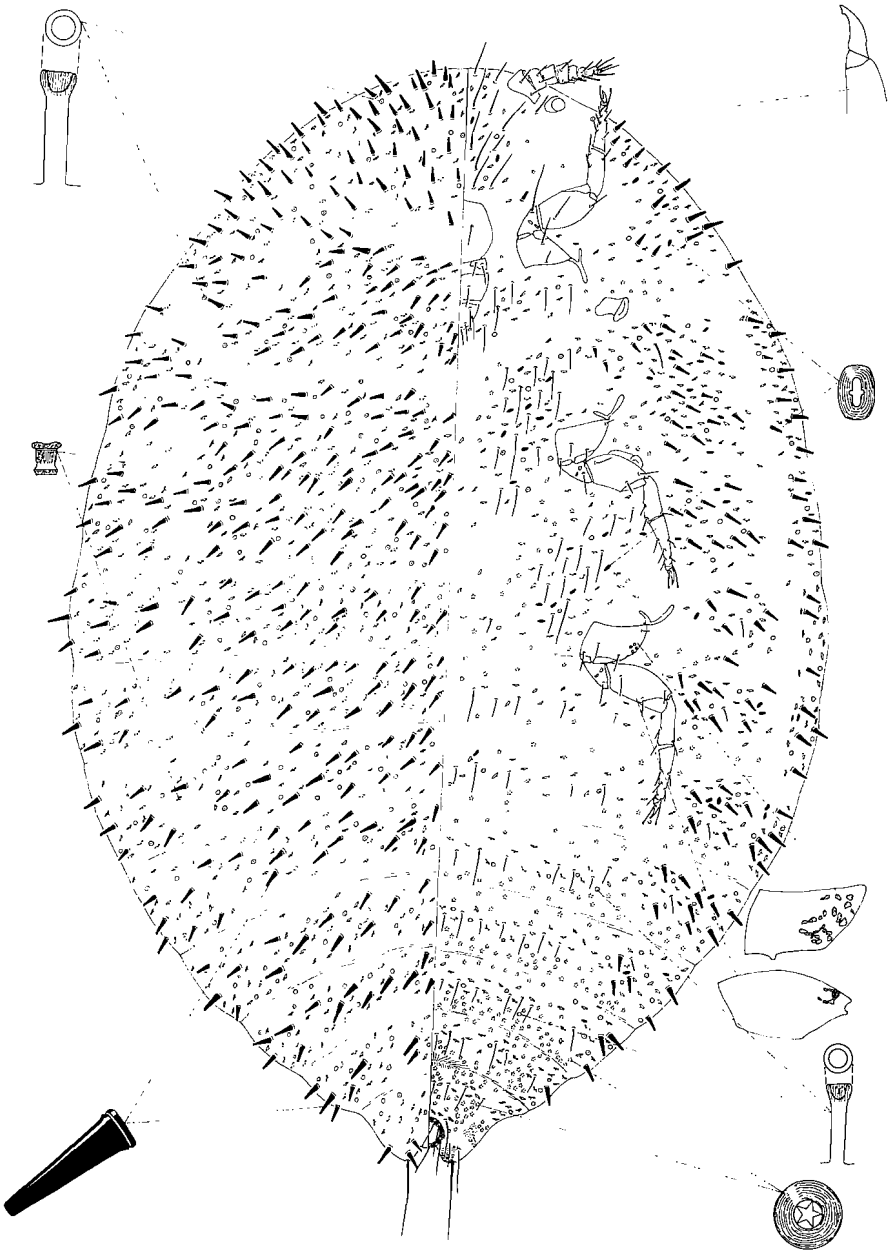


FIGURE 17. *Acanthococcus gerbergi* (McDaniel). Wahweap, Arizona, IX-3-64, on Malvaceae.

Acanthococcus froebeae Miller

Froebe eriococcin

Fig. 16

This species was described in a recent paper on the *Acanthococcus* species that occur in the United States on *Atriplex* and will not be redescribed here (see Miller 1991).

Acanthococcus gerbergi (McDaniel), n. comb.

Gerberg eriococcin

Fig. 17

Eriococcus gerbergi McDaniel, 1959:137-138.

Type Material.— From the syntypes of E. *gerbergi*, we have chosen and marked as lectotype an adult female; the left label reads "*Eriococcus gerbergi* McDaniel ms., On *Fraxinus* sp. Distrito Fed. Mex 27-IV-58 T. Macias, Coll. Type 58 1816"; the right label reads "*Eriococcus gerbergi* McDaniel, Distrito Federal Mex. 27-14-58, Host: *Fraxinus* sp. col. T. Macias Det. B. McDaniel" (USNM). The specimen on the left hand side of the slide nearest the largest label, is the lectotype. In addition, 1 adult female paralectotype is also present on the same slide.

Field Features.— Adult female rotund. Fully gravid females dark purple; body contents bright red. Ovisac filamentous, covering all of female. Before ovisac is produced, anal secretion is mixed with sand pebbles forming large sticky mass posterior to abdomen. Anal secretion clear, often utilized by ants.

This species occurs on the roots, crown, and branches (?) of its host.

Recognition Characters.— Adult female, mounted, 1.78-3.84 mm long, 1.11-2.94 mm wide. Anal lobes small and rounded, lightly sclerotized; each lobe dorsally with 3 enlarged setae (all approximately equal in size, although any 1 may be larger than other 2), with 3-6 microtubular ducts; each lobe ventrally with 3, rarely 2, slender body setae and 2-6 sessile pores.

DORSUM with enlarged setae essentially of 1 size, some of posterolateral setae slightly larger than rest. Largest seta 37-47 μ long, smallest seta 19-31 μ. Setae straight, with blunt apices; setal rings thin. Enlarged setae abundant — e.g., abdominal segment IV with 41-56 — these setae showing no longitudinal pattern. Macrotubular ducts in small numbers over surface. Microtubular ducts of characteristic shape (fig. 17), moderate in length (6-8 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion with 2 "humps", equal to 1/2 length of remaining sclerotized portion; total sclerotized area varying from equal to 6 times length of unsclerotized area; dermal orifice heavily sclerotized. Microtubular ducts extremely abundant.

Anal ring either ventral or apical, with 3 or 4 pairs of setae.

VENTER with lanceolate body setae moderate in length (largest seta on abdominal segment VII from 37-41 μ long, on segment II from 37-59 μ), medial setae slender, apices often capitate. Enlarged setae same as on dorsum, present near body margin from abdominal segment VII through head. Macrotubular ducts of 2 kinds: larger size present over entire surface; smaller size rare, present only on

abdomen. Microtubular ducts abnormally abundant over entire surface. Multilocular pores of 4 kinds: septeloculars and hexaloculars rarely present; quinqueloculars abundant, present over entire surface; triloculars normally absent, rarely present. Cruciform pores present along lateral margins of abdominal segments VII or VI through head, and near posterior 2 pairs of legs.

Legs with hind coxae dorsally with 24-52 large pores, ventral surface with 0-4; femora dorsally with 3-18 pores, absent on ventral surface; tibiae with 5 setae; inner, apical, tibial setae only slightly larger than remaining leg setae; tarsi longer than tibiae (hind tibia/tarsus ratio 0.83-0.97); claws with denticle near tip, sometimes absent. Antennae 7-segmented, third segment, rarely fourth, longest. Segment 7 with 3 sensory setae; segment 6 with 1 slightly longer and more slender than single sensory seta on segment 5.

Notes.— *Acanthococcus gerbergi* is distinguished from all known species of *Acanthococcus* by the presence of distinctly shaped microtubular ducts which are abundant not only on the dorsum but also over the entire venter.

Specimens Examined.—ARIZONA, COCONINO Co.: Wahweap, IX-3-64, on (?) (Malvaceae), D. R. Miller and F. D. Parker (3 ad. fem. on 3 sl.) UCD.

IDAHO, CANYON Co.: 15 mi. S. Nampa, VIII-4-55, VI-16-57, on *Eurotia lanata*, W. F. Barr (5 ad. fem. on 5 sl.) UCD.

NEVADA, NYE Co.: 12 mi. E. Tonopah, VII-7-68, on *E. lanata*, D. R. Miller and R. F. Denno (10 ad. fem. on 5 sl.) UCD, USNM; 35 mi. W. Warm Springs, VII-5-70, D. R. Miller (1 ad. fem.) USNM

UTAH, SAN JUAN Co.: Aneth, VII-4-70, host (?), D. R. Miller (6 ad. fem. on 3 sl.) USNM.

MEXICO, DISTRITO FEDERAL: Locality (?), IV-27-58, on *Fraxinus* sp., T. Macias (1 lectotype ad. fem., 1 paralectotype ad. fem.)

Hosts and Distribution.— Found on 3 different plant hosts.

With records published by McDaniel (1964) from San Patricio County, Texas, this species is known to occur in warm areas of Arizona, Idaho, Nevada, Texas, and Mexico.

Acanthococcus hoyi Miller and Miller, n. sp.

Hoy eriococcin
Figs. 18 and 19

Type Material.— Adult female holotype (1 specimen on slide). Right label "*Eriococcus kemptoni* Parr, T274, On ? *Bouteloua* sp., Ft. Davis Fig., Ferris, 1921, Coccidae of Texas, G.F.F."; left label "*Acanthoccus hoyi* Miller and Miller, holotype" (UCD). In addition, there are 23 paratypes.

Field Features.— No information is available on this species. We assume, that as an immature, it infests grass blade sheaths and as an adult it produces an ovisac exposed on the leaf blades.

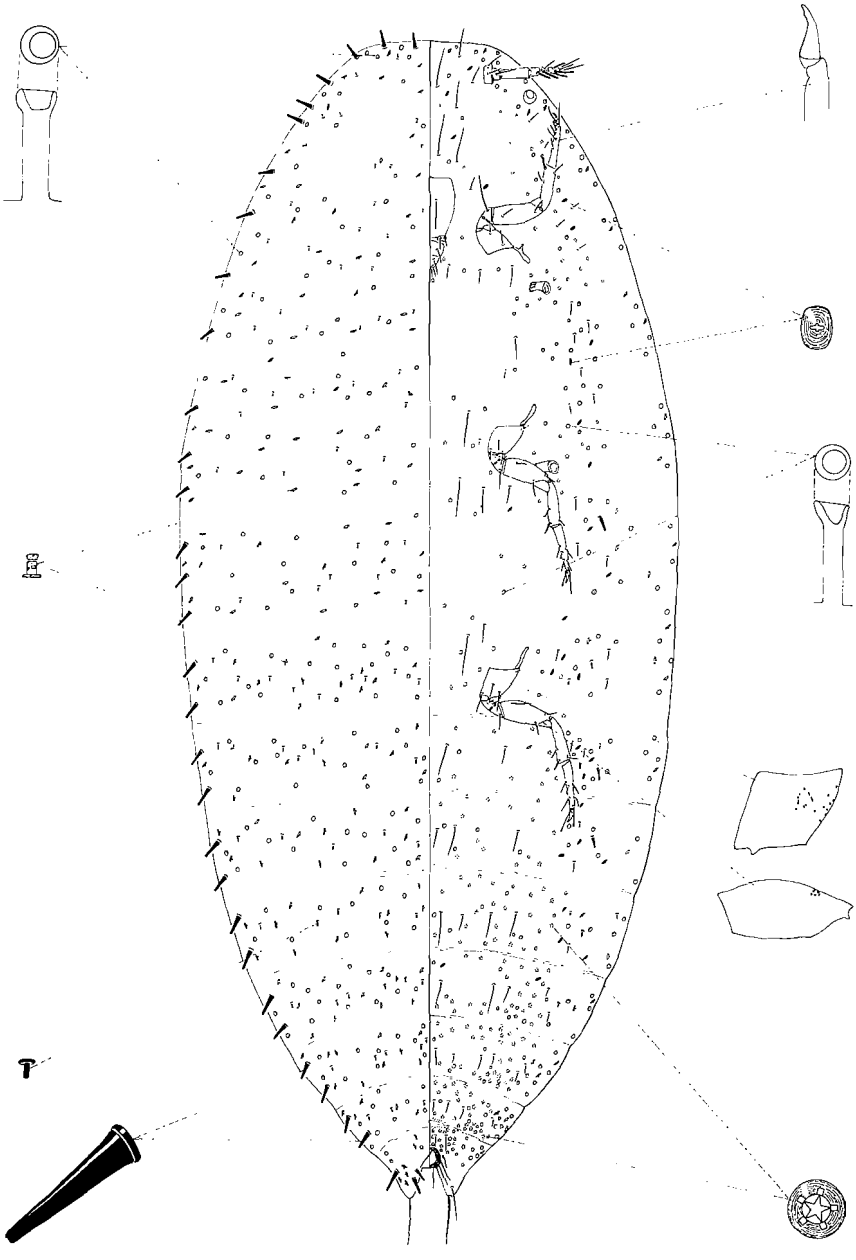


FIGURE 18. *Acanthococcus hoyi* Miller and Miller, n. sp., enlarged dorsomedial setae absent. Fort Davis, Texas, 1921, on *Bouteloua* sp.

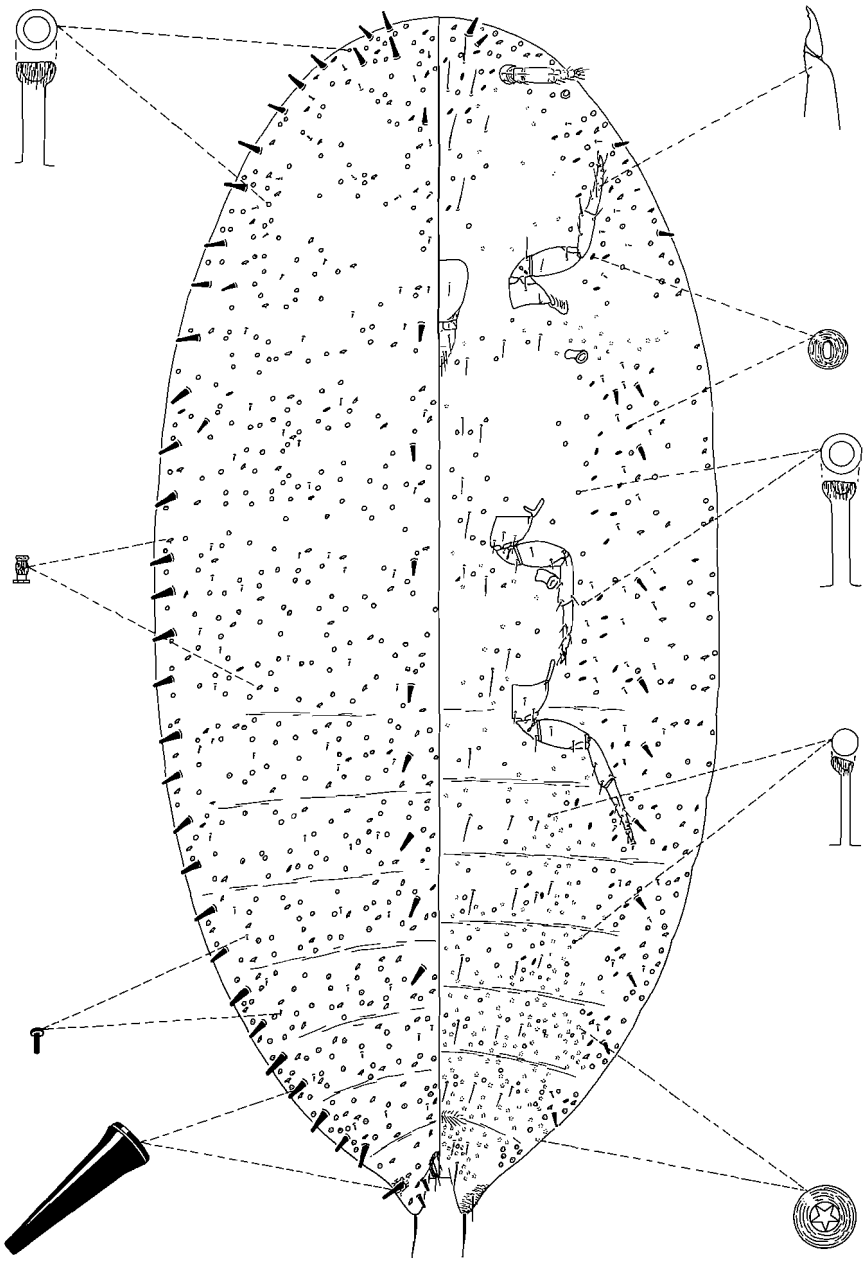


FIGURE 19. *Acanthococcus hoyi* Miller and Miller, n. sp., enlarged dorsomedial setae present. 2 mi. W. Rodeo, New Mexico, VIII-2-66, host unknown.

Recognition Characters.— Adult female holotype, mounted, 2.23 mm, 1.13 mm wide (paratype adult females 1.47-2.88 mm long, 0.80-1.42 mm wide). Anal lobes strongly protruding, narrow, unsclerotized; each lobe dorsally with 3 enlarged setae (lateral seta longest, anteromedial seta shortest), with 3 or 4 microtubular ducts; each lobe ventrally with 2 slender body setae and no sessile pores.

DORSUM with setae of 2 sizes: larger size present along entire body margin, with 2 present on margin of each abdominal segment; smaller size restricted to medial and sublateral areas. Largest lateral seta 40 μ long (paratypes 31-61 μ), largest medial seta 8 μ long (paratypes 7-11 μ); longest lateral seta 5.2 times longer than longest medial seta (paratypes 3.1-6.5 times). Lateral setae straight, long, slender, with blunt apices, setal rings thin; medial setae straight, short, slender, with blunt apices, setal rings large. Enlarged setae few – e.g., abdominal segment IV with 13 (paratypes 13-16) – with no longitudinal pattern. Macrotubular ducts large, scattered over surface. Microtubular ducts short (3 μ long) (paratypes 3-4 μ), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, approximately equal in length to remaining sclerotized portion; total sclerotized area slightly longer than unsclerotized area; dermal orifice abnormally large, heavily sclerotized. Microtubular ducts scattered over surface.

Anal ring ventral, with 4 pairs of setae.

VENTER with lanceolate body setae moderate in length (longest seta on abdominal segment VII 19 μ long (paratypes 16-31 μ)), on segment II 46 μ (paratypes 39-52 μ), medial setae slender, apices acute. Enlarged setae uncommon, both sizes present in small numbers. Macrotubular ducts of 2 kinds: larger size same as on dorsum, present along lateral margins; smaller size relatively abundant, distributed throughout sublateral and medial areas of entire surface. Microtubular ducts present on lateral areas. Multilocular pores of 2 kinds: quinqueloculars present over entire surface, most abundant on posterior abdominal segments; triloculars very rare. Cruciform pores present on sublateral areas of abdominal segment V through head.

Legs long, slender, hind coxae dorsally with 19 and 15 very small pores (paratypes with 12-29), absent on ventral surface; hind femora dorsally with 6 and 0 small pores (paratypes with 0-7 pores); tibiae with 5 setae; inner, apical, tibial setae slightly more robust than other leg setae; tarsi slightly longer than tibiae (hind tibia/tarsus ratio 0.95) (paratypes from 0.80-0.96); claws with small denticle near tip. Antennae 6-segmented, third segment longest. Segment 6 with 3 sensory setae; segment 5 with 1 equal in size to single sensory seta on segment 4.

Variation.— This species seems to be very constant in its external morphology.

Notes.— This species was originally included by Ferris (1955) under the name of *E. kemptoni*. See *A. kemptoni* for detailed discussion.

Acanthococcus hoyi is distinguished from other grass infesting species of *Acanthococcus* in the western United States by having small sized dorsomedial enlarged setae on each anal lobe and more quinquelocular than septelocular pores.

Specific Epithet.— We take great pleasure in naming this species, *A. hoyi*, after the late James M. Hoy, an important worker of the New Zealand eriococcids.

Specimens Examined.— ARIZONA, COCHISE Co.: Portal, VIII-23-68, on *Bouteloua curtipendula*, D. M. Tuttle (1 ad. fem., 1 second instar male and fem.) CDA.

CALIFORNIA, LOS ANGELES Co.: 3 mi. S. Lancaster, VII-12-18, on "grass", G. F. Ferris (1 ad. fem. paratype) UCD.

COLORADA, WELD Co.: Nunn, Pawnee Grassland Pasture, IV-29-71, R. Kumar (1 ad. fem. paratype) USNM

NEW MEXICO, COLFAX Co.: Koehler, VIII-17-09, on *Bouteloua* sp, C. N. Ainslie (4 ad fem.) USNM. HIDALGO Co.: 2 mi. W. Rodeo, VIII-2-66. on (?) (Gramineae), D. R. Miller (2 ad. fem. on 2 sl.) UCD. SANTA FE Co.: Lamy, date (?), on *Bouteloua* sp., C. N. Ainslie (1 ad. fem.) USNM.

TEXAS, BAILEY Co.: Muleshoe, (?)-(?)-21, on "grass", G. F. Ferris (4 ad. fem. paratypes on 3 sl.) UCD. BREWSTER Co.: Iron Mt. Ranch 8 mi. N. Marthon, V-11-76, on grass, R. D. Gordon and D. R. Miller (1 ad. fem. paratype) USNM. BRISCOE Co.: near Quintaque, edge staked plains, date (?), on *Bouteloua* sp., M. E. Hollinger (2 ad. fem. paratypes) UCD. DALLAM Co.: Dalhart, X-(?)-12, on *Bouteloua* sp., C. N. Anislie (2 ad fem. paratypes, 4 ad. fem. , 35 first instar nymphs on 5 sl) USNM. EL PASO Co.: Fort Bliss, VI-(?)-21, on "grass", G. F. Ferris (6 ad. fem. paratypes on 3 sl) BM, UCD. Moore Co.: Dumas, VI-30-70, on Gramineae, D. R. Miller (1 ad. fem. paratype) ZAS. JEFF DAVIS Co.: Fort Davis (?)-(?)-21, on *Bouteloua* sp., G. F. Ferris (1 ad. fem. holotype, 4 ad fem. paratypes on 5 sl.) CDA, USNM, UCD, VPI. PRESIDO Co.: 5 mi. W. Marfa, V-10-76, on grass, R. D. Gordon and D.R. Miller (1 ad. fem. paratype) CDA.

Host and Distribtution.— Know only from *Bouteloua* spp. This species occurs in the warm areas of the southwestern United States.

Acanthococcus insignis (Newstead), n. comb.

Remarkable eriococcin

Fig. 20

Eriococcus insignis Newstead, 1891:164-165.
Eriococcus saratogensis Rau, 1938:157-159 (new synonyny).

Type Material.— Although we have not examined type material of this species, we have seen a single specimen from England identified by E. E. Green.

We have studied topotypes of *E. saratogenesis,* but have been unable to locate type material.

Field Features.— Adult females dark red. Ovisac tough, yellowish-white; produced on leaves of host.

Recognition Characters.— Adult female, mounted, 1.97-3.02 mm long, 0.80-1.20 mm wide. Anal lobes narrow, with acute apices, lightly sclerotized, each lobe dorsally with 3 setae (relative lengths variable, anteromedial seta more slender than other anal lobe setae), with 3-5 microtubular ducts; each lobe ventrally with 3 slender body setae and 4-8 sessile pores.

DORSUM with enlarged setae of 2 sizes: larger size distributed along body margin, with 3-5, normally 4, present on margin of each abdominal segment, 2 of which are larger than rest; smaller size present on dorsomedial and sublateral areas. Largest lateral seta 51-62 μ long; largest medial seta 16-22 μ; longest lateral seta 2.9 to 3.5 times longer than longest medial or sublateral seta. Large lateral setae

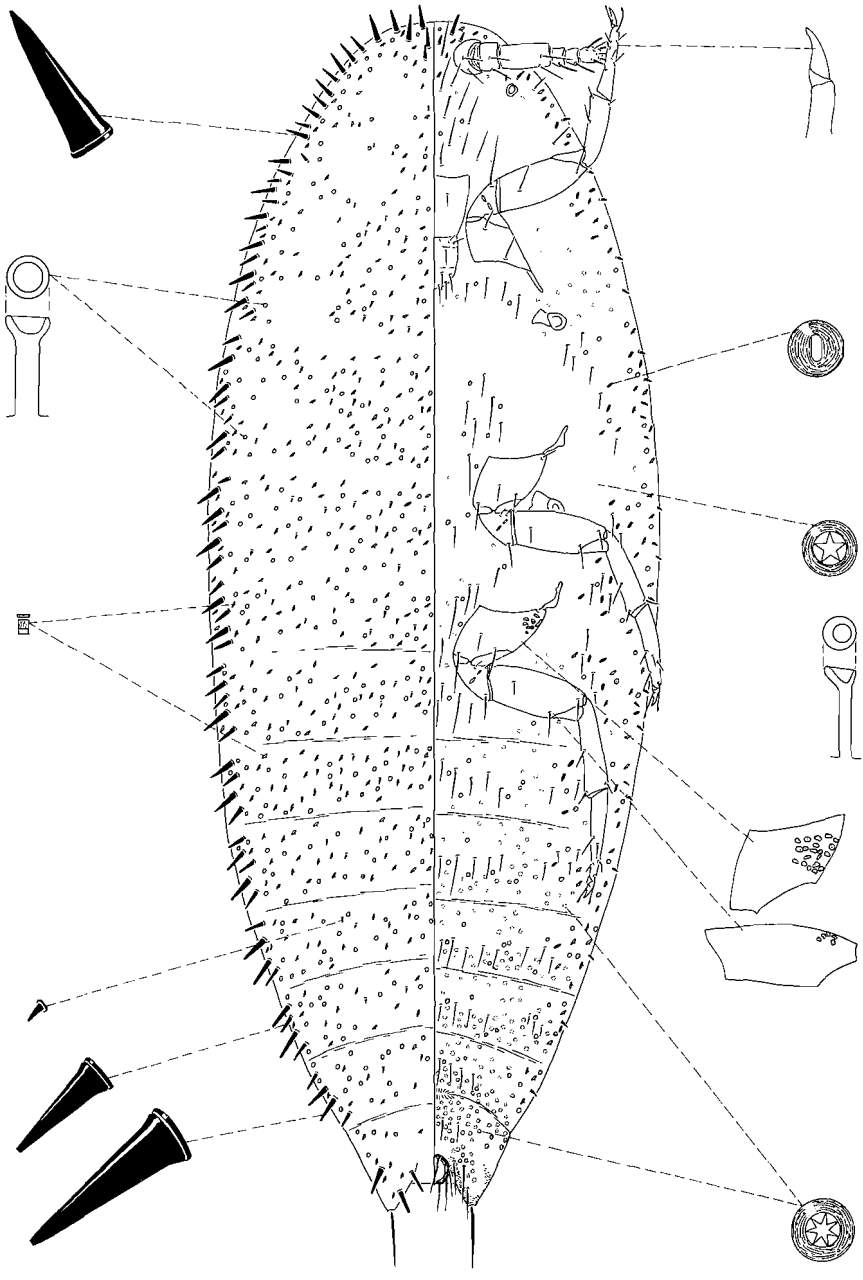


FIGURE 20. *Acanthococcus insignis* (Newstead). Discovery Bay, Washington, VIII-20-66, on "grass".

straight, those on last 5-6 abdominal segments apically truncate, those remaining with acute apices; small setae straight, with rounded apices; all with thin setal rings. Dorsal setae in moderate numbers e.g., abdominal segment IV with 21-27 — with no longitudinal pattern. Macrotubular ducts scattered over surface. Microtubular ducts small (about 4 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion narrow to rectangular, approximately 1/2-1/3 length of remaining portion; total sclerotized area longer than unsclerotized area; dermal orifice lightly sclerotized, rarely unsclerotized. Microtubular ducts scattered over surface.

Anal ring ventral or apical, with 3 pairs of setae.

VENTER with lanceolate body setae elongate (largest seta on segment VII from 37-50 μ long, segment II from 81-100 μ), medial setae apically acute. Enlarged setae of small type present on lateral margin from abdominal segment VII or VI through head; large size present on anterior apex of head. Macrotubular ducts of 2 kinds: larger size same as on dorsum, present along lateral margins; smaller size distributed throughout medial and sublateral areas. Microtubular ducts present along lateral margins of body. Multilocular pores of 2 kinds: septeloculars most abundant sessile pores, present over entire surface; quinqueloculars present in small numbers over venter. Cruciform pores present on lateral margins from abdominal segment VI or V forward through head.

Legs with hind coxae dorsally with 19-34 pores, ventral surface with 2-28; hind femora dorsally with 2-7 pores, absent ventrally; tibiae with 5 setae; inner, apical, tibial setae slightly larger than other leg setae; tarsi and tibiae approximately equal (hind tibia/tarsus ratio 0.88-1.16); claws with denticle small or absent. Antennae 6-segmented, third segment longest. Segment 6 with 3 sensory setae; segment 5 with 1 only slightly resembling a sensory seta that is longer and more slender than single sensory seta on segment 4.

Notes.— *Acanthococcus insignis* is similar in appearance to *A. smithi*, but is distinguished by having some lateral setae with rounded or acute apices, dorsomedial and sublateral setae with rounded apices, and 5 setae on each tibia; *A. smithi* has all enlarged setae with blunt or truncate apices, and 4 setae on the hind 2 pairs of tibiae.

Specimens Examined.— CALIFORNIA, SAN DIEGO Co.: Del Mar, VIII-28-67, on *Phleum* sp., E. Gray (5 ad. fem. on 5 sl.) CDA.

IDAHO, COUNTY (?): location (?), VII-15-83, on *Elymus* sp. leaf, B. Youtie (1 ad. fem.) USNM CANYON Co.: Parma, III-12-24, on *Malus sylvestris*, C. Wakeland (3 ad. fem.) USNM.

MINNESOTA, RAMSEY Co.: St. Paul, X-15-75, on grass, Cook (2 ad. fem. on 2 s.) USNM; VIII-12-76, on *Agropyron repans*, ? collector (12 ad. fem. on 12 sl.) USNM.

NEW YORK, SARATOGA Co.: Saratoga Springs, (?)-(?)-36, on "grass", G. Rau (2 ad. fem.) UCD.

WASHINGTON, JEFFERSON Co.: Discovery Bay, VIII-20-66, on "grass", S. Nakahara (3 ad. fem. on 3 sl.) UCD. KING Co.: Seattle, IV-8-44, on *Spiraea douglasii*, Wilbur (2 ad. fem.) USNM. KITTITAS Co.: Ellensburg, VIII-16-73, on *Phleum pratense*, E. C. Klostermeyer (23 ad. fem., 2nd fem., and 1st on 13 sl.) USNM. OKANOGAN Co.: Pateras, IV-30-75, on *Malus sylvestris*, F. A. Rushmore (4 ad. fem.) USNM.

Hosts and Distribution.— Known from both Rosaceae and Gramineae, although we believe the records from Rosaceae are incidental.

Found in California, Idaho, Minnesota, New York, and Washington in North America. Known also throughout much of the Palearctic region.

Acanthococcus kemptoni (Parrott), n. comb.

Kempton eriococcin

Fig. 21

Eriococcus kemptoni Parrott, 1900:144.
Nidularia kemptoni (Parrott) Lindinger, 1933:116.
Eriococcus kemptoni Parrott; Ferris, 1955:134 (misidentification, actually *A. hoyi* Miller and Miller).
Eriococcus mancus Ferris, 1955:138 (junior homonym of *Rhizococcus casuarinae* var. *mancus* Maskell, 1897).
Eriococcus mutilus Hoy, 1963:103 (replacement of *E. mancus* Ferris) (new synonymy).
Eriococcus kemptoni Parrott; McDaniel, 1964:102 (misidentification, actually *A. hoyi* Miller and Miller).

Ferris (1955) treated *E. kemptoni* and *E. mancus* as 2 separate species. After examining the types of both species, it is apparent that the specimens Ferris named and illustrated as *E. mancus* are actually *E. kemptoni*. The specimens that he determined and illustrated as *E. kemptoni* are actually an undescribed species. In order to rectify these errors, it has been necessary to place *E. mancus* as a synonym of *E. kemptoni*, and describe as new, the specimens designated by Ferris as *E. kemptoni*.

Hoy (1963) discovered that the name *Eriococcus mancus* Ferris, 1955, was preoccupied by *Eriococcus mancus* (Maskell), 1897. Thus, he replaced mancus, as understood by Ferris, with a new name *Eriococcus mutilus* Hoy, 1963. Since *E. mancus* is a synonym of *E. kemptoni*, so also is *E. mutilus*.

Type Material.— From the syntypes of E. *kemptoni* we have chosen and marked as lectotype an adult female, the left label reads "*Eriococcus kemptoni* Parrott. on *Andropogon scoparius* Dundee, KS. Type" (USNM). There is only 1 specimen on the slide. In addition, there is 1 paralectotype.

Field Features.— Body elongate, dark yellow to almost orange. Body margin adorned with several lateral rods that are curved posteriorly on the abdomen, anteriorly on the head. Ovisac felted, unusually thick, white when first produced, turning yellow within several days of deposition; enclosing 10-65 pinkish eggs. Overwinters in egg stage.

Occurs on crown of plant. Males present in late August and early September in northen Virginia.

Recognition Characters.— Mounted, 1.40 to 1.90 mm long, 0.80 to 1.60 mm wide. Anal lobes protruding, apically acute, moderately sclerotized ventrally; each lobe dorsally with 3 enlarged setae (either anteromedial seta shortest and posteromedial and lateral setae equal, or all 3 setae equal), with 0 to 2 microtubular ducts; each lobe ventrally with 3 slender body setae and 2 to 4 sessile pores.

DORSUM with enlarged setae of 2 sizes: with from 6 to 11 larger sized setae present along body margin from abdominal segment VII through V, IV, III, or II, with 2 or 3 such setae on each margin of abdominal segment VIII, with 2 setae on each margin of abdominal segments VII and VI, with 1 or 2 setae on margins of

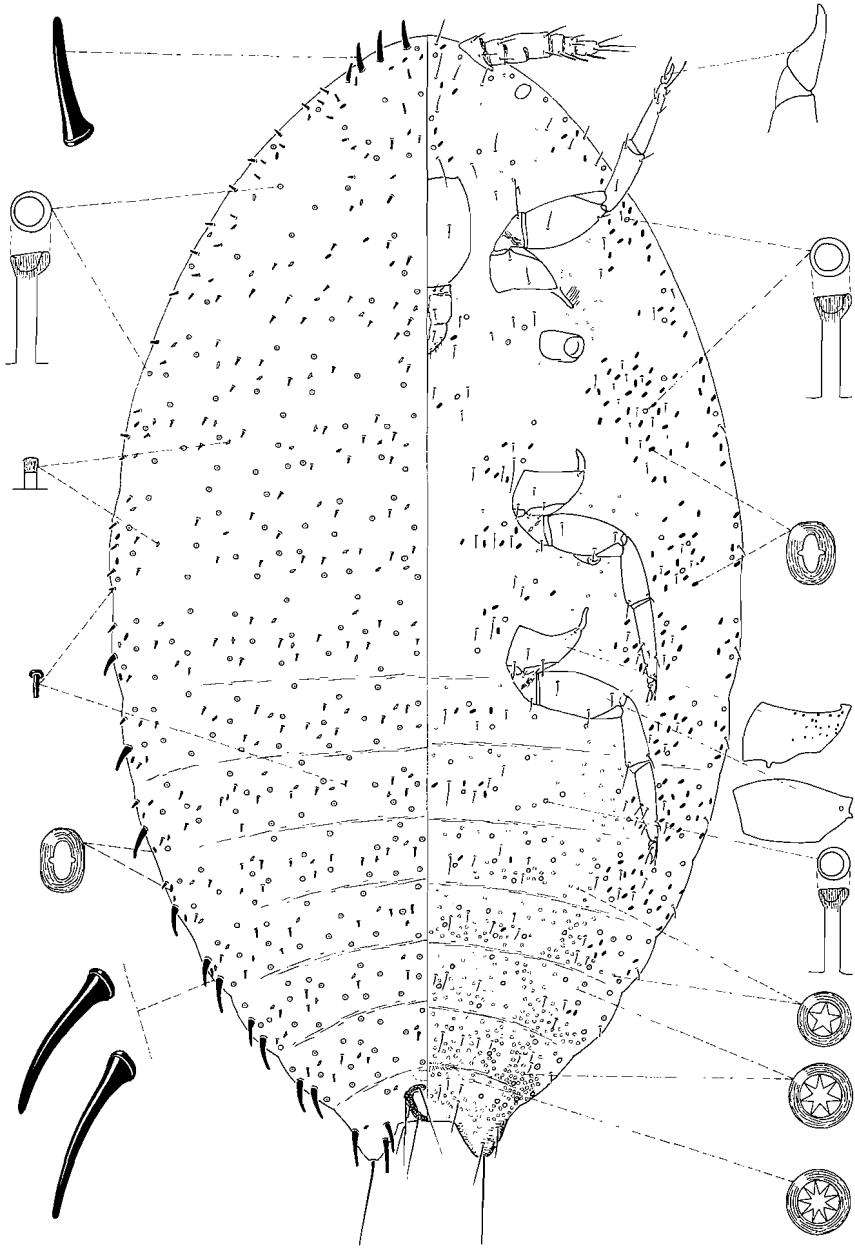


FIGURE 21. *Acanthococcus kemptoni* (Parrott). Stillwater, California, XII-13-53 on "bunch grass".

segment V, and with 0 or 1 setae on margin of segments III through II, 3 or 4 large setae also present along each margin of head; small sized setae scattered over dorsum. Largest large sized seta 35 to 50 μ long; largest small sized seta 10 to 13 μ, longest lateral seta 3.1 to 4.0 times longer than longest dorsomedial seta. Large sized setae long, slender, curved, with rounded apices; small sized setae short, straight, with apices blunt; with thin setal rings. Dorsal setae in moderate numbers — e.g., abdominal segment IV with 23 to 28 — with no longitudinal pattern except for marginal line formed by large sized setae. Macrotubular ducts large, abundant over surface. Microtubular ducts short (approximately 5 μ long), often impossible to find, with area farthest from dermal orifice sclerotized but not divided; total sclerotized area approximately equal to unsclerotized area; dermal orifice unsclerotized. Microtobular ducts apparently scattered over surface. Cruciform pores present along body margin.

Anal ring dorsal, with 4 pairs of setae. With raised area just anterior to anal ring.

VENTER with lanceolate body setae short (longest seta on abdominal segment VII 25-32 μ long, on segment II 25-42 μ), medial seta apically acute. Enlarged setae absent. Macrotubular ducts of 2 kinds: larger size same as on dorsum, present along lateral margins; smaller size distributed throughout medial and sublateral areas. Microtubular ducts apparently absent. Multilocular sessile pores unusually abundant in sublateral area of abdominal segments VII and VI, of 3 kinds: noneloculars and quinqueloculars relatively uncommon; septeloculars most abundant. Cruciform pores most numerous along body margins, present in variable numbers in medial regions, normally absent on posterior 2 or 3 abdominal segments.

Legs with hind coxae dorsally with 9-18 pores, ventral surface with 2-10; hind femora normally with pores absent rarely with 1 pore on dorsal surface; hind 2 pairs of tibiae with 4 setae, front pair of tibiae with 5 rarely 4; inner, apical, tibial setae unenlarged; tarsus longer than tibia (hind tibia/tarsus ratio 0.69-0.85); claws with unusually small denticle; leg setae abnormally elongate for eriococcins. Antennae normally with 7 segments, rarely 6-segmented, when 7-segmented, third and fourth segments longest. Apical segment with 3 or 4 sensory setae; second segment from apex with 1 seta same size and shape as single sensory seta on third segment from apex.

Notes.— *Acanthococcus kemptoni* is different from all other species of *Acanthococcus* by the following combination of characters: lateral line of large sized setae discontinuous, absent on anterior abdominal segments and thorax; medial and sublateral enlarged setae on dorsum of small size only; septelocular pores most numerous type of sessile pore; antennal sensory setae on second and third segments for apex approximately equal in size and shape; hind 2 pairs of tibiae each with 4 setae, front pair with 5; small denticle on claw.

Specimens Examined.— ALABAMA, RANDOLPH Co.: Locality (?), VII-25-77, on Andropogon sp., C. H. Ray, Jr., I. Daniels, and K. Manuel (1 ad. fem.) USNM.

GEORGIA, FULTON Co.: Fort McPherson, VI-4-43, on *Andropogon virginicus*, H. S. McConnell (4 ad. fem., 2 embryo first instar nymphs) USNM.

KANSAS, COUNTY (?): Dundee, VIII-(?)-1899, on *A. scoparius*, R. H. Kempton (1 lectotype ad. fem., 1 paralectotype ad. fem., 2 ad. fem., on 3 sl.) USNM. BUTLER Co.: Douglass, VI-28-70, on Gramineae, D. R. Miller (6 ad. fem. on 3 sl.) USNM.

KIOWA Co.: 9 mi. E. Greensburg, VI-29-70, on Gramineae, D. R. Miller (2 ad. fem.) USNM. SUMNER Co.: Wellington, XI-(?)-10, on *A. scoparius* E. O. G. Kelly (3 ad. fem.) USNM.

MISSOURI, OREGON Co.: 20 mi. N. Alton, VII-15-70, on Gramineae, D. R. Miller and F. D. Parker (3 ad. fem.) USNM.

MISSISSIPPI, LOWNDES Co.: College, Agricultural and Mechanical College, XI-28-27, on "broom sedge" *Andropogon* sp. M. R. Smith (2 ad. fem.) USNM.

OKLAHOMA, PAYNE Co.: Stillwater, XI-12-53, on "bunch grass" F. A. Fenton (5 ad. fem.) USNM.

VIRGINIA, COUNTY (?): Locality (?), XII-28-05, on *A. virginicus*, collector (?) (6 ad. fem. on 2 sl.) USNM; nr. Fredericksburg, VII-17-71, on *Andropogon* sp., D. R. Miller (6 ad. fem. on 3 sl.) USNM. INDEPENDENT CITY: Charlottesville, VI-16-46 and VIII-20-46, on "broom sedge" *Andropogon* sp., D. W. Clancy (5 ad. fem. on 2 sl.) USNM. KING GEORGE Co.: Locality (?), VIII-30-70, on *Andropogon* sp., S. Nakahara ((3 ad. fem. on 2 sl.) USNM.

Host and Distribution.— Known only from *Andropogon* spp. Probably occurring throughout most of the areas east of the Rocky Mountains that have relatively mild winters and summer rains.

Acanthococcus larreae (Parrott and Cockerell), n. comb.

Creosote eriococcin

Figs. 22, 23, and 24

Eriococcus larreae Parrott and Cockerell (in Cockerell and Parrott), 1899:231.
Nidularia larreae (Parrott and Cockerell), Lindinger, 1933:116.
Eriococcus calvus Ferris, 1955:114 (new synonymy).

Type Material.— From the syntypes of *E. larreae*, we have chosen and marked as lectotype an adult female labeled "*Eriococcus larreae* Parr. & Ckll. on roots of Larrea Mesilla Park, N. Mex. Jan 21-1899- #22" (USNM). There are 2 adult females on the slide, the specimen on the lower right is here designated as the lectotype. In addition, there is 1 other slide that contains approximately 6 badly mutilated paralectotypes. Although the published description lists the collection date as January 23, there is no doubt that this material is part of the type series. We have also examined the type series of *E. calvus*.

Discussion.— *Acanthococcus larreae* is extremely variable, not only morphologically, but also in its behavior. Because of this, we have included 3 illustrations showing the range of variability. Because of this variation, the description will treat the 2 extremes separately where they differ. Since the lectotype specimen of *A. larreae* is more similar to the intermediate form (fig. 23), this form also will be mentioned separately. In order to avoid further taxonomic confusion, the extreme illustrated in the figure 24 will be referred to as "microseta extreme", the other extreme (fig. 22) will be referred to as "macroseta extreme".

Field Features.— Adult female rotund. Body reddish-purple externally; when crushed, body contents bright red. Dorsum naked, with no bloom or crystalline rods. Lateral areas in "macroseta extreme" with a few elongate, curved rods, each with single, yellow, enlarged seta at base. Rods absent in "microseta extreme".

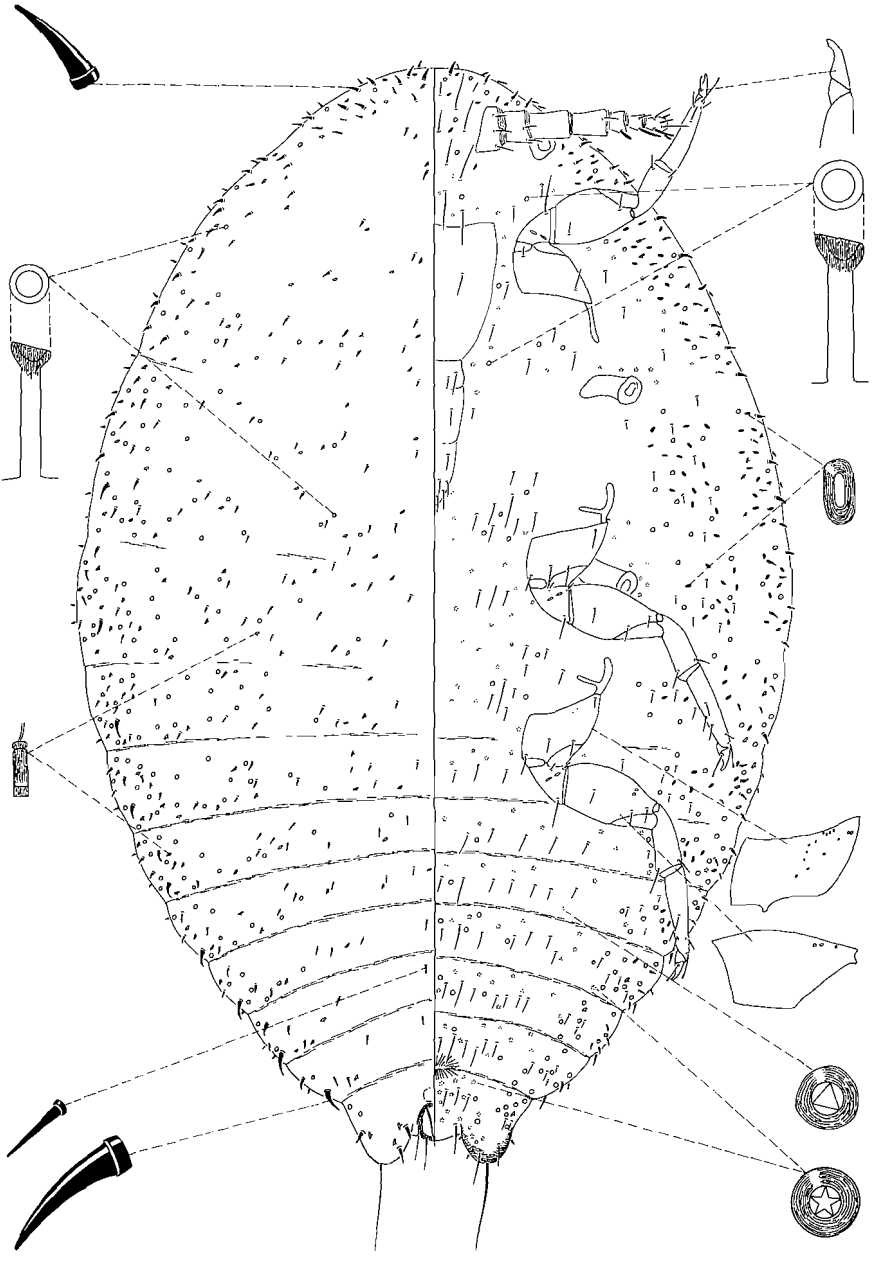


FIGURE 22. *Acanthococcus larreae* (Parrott and Cockerell), intermediate form. El Paso, Texas, VI-?-21, host unknown.

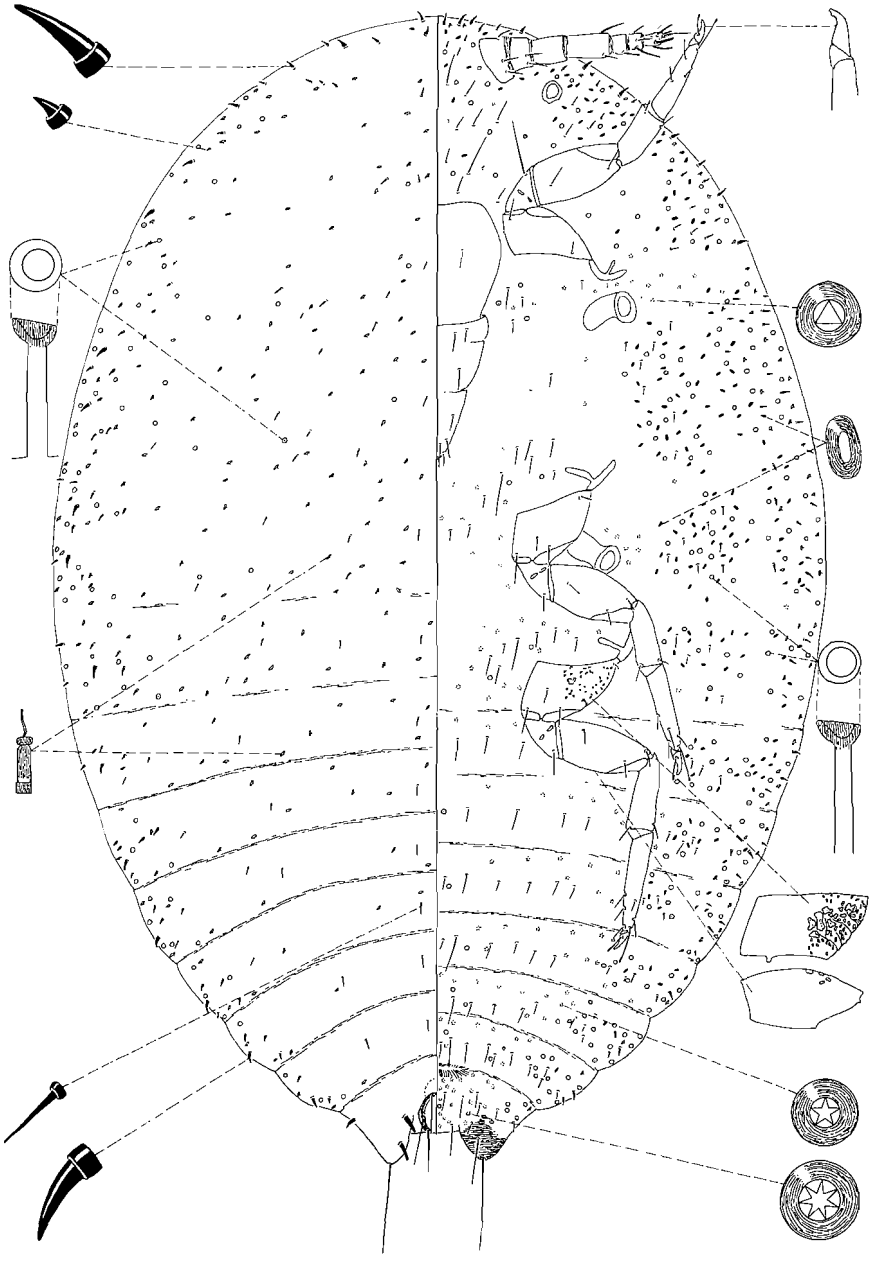


FIGURE 23. *Acanthococcus larreae* (Parrott and Cockerell), microsetae extreme form. Bahia de Los Angeles, Mexico, II-23-68, on *Larrea divaricata*.

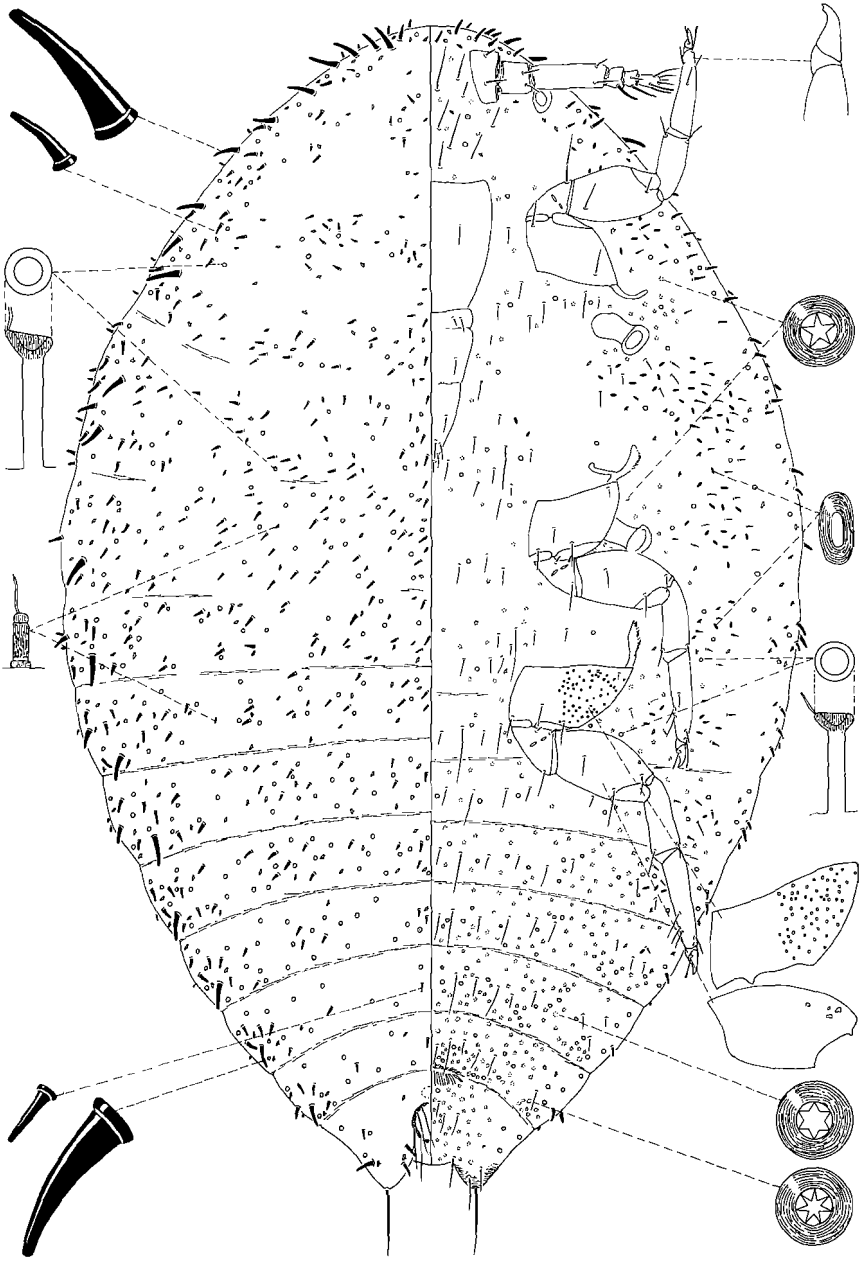


FIGURE 24. *Acanthococcus larreae* (Parrott and Cockerell), macrosetae extreme form. 3 mi. S. Oscuro, New Mexico, VIII-5-66, on *Larrea divaricata*.

Venter with light sprinkling of smooth, white bloom. Ovisac loose, filamentous; in "macroseta extreme" encloses all of female; dorsal ovisac absent in "microseta extreme" however, a heavy wax pad is produced beneath each female that may support many first instar nymphs. Clear anal secretion produced. Often attended by ants— *Crematogaster* sp. Found on subterranean crown and roots of host.

Recognition Characters.— Adult female, mounted, 1.79-3.51 mm long, 1.22-2.80 mm wide. Anal lobes rounded, weakly sclerotized; each lobe dorsally with 3 enlarged setae, on "macroseta extreme" (lateral seta robust, approximately equal in length to 2 medial setae), on "microseta extreme" (lateral seta shorter and slightly less robust than remaining 2 equally sized medial setae), on "intermediate" (all 3 setae approximately same size), with 0-2 microtubular ducts; each lobe ventrally with 3-5 slender body setae and a few sessile pores.

DORSUM with enlarged setae of various sizes, largest lateral seta on "macroseta extreme" 49-59 μ long, largest medial seta 12-13 μ; on "microseta extreme" largest lateral seta 16-23 μ long, largest medial seta 9-11 μ; on "intermediate" largest lateral seta approximately 41 μ long, largest medial seta approximately 11 μ; on abdominal segments VII through II longest lateral seta on "macroseta extreme" 3.3-3.7 times longer than longest dorsal medial seta; on "microseta extreme" 1.l-1.3 times; on "intermediate" approximately 2.2 times. Large lateral setae curved, with blunt apices on "macroseta extreme"; with acute apices on "microseta extreme" and " intermediate"; remaining lateral setae of same form, but smaller. Medial abdominal setae on "macroseta extreme" straight, robust, with rounded apices; on "microseta extreme" straight, thin, with acute apices; on "intermediate" these setae more slender than on macroseta extreme, but more robust than on "microseta extreme"; all with thin setal rings. Enlarged setae in moderate or small numbers — e.g., abdominal segment IV on "macroseta extreme" with 23-35, "microseta extreme" with 18-21, "intermediate" with approximately 26 — these setae showing no particular longitudinal pattern. Macrotubular ducts 1 size only, on "macroseta extreme" present over entire surface, on "microseta extreme" and "intermediate" restricted primarily to body margin, there being more medially on "intermediate" than on "microseta extreme". Microtubular ducts moderate in length (6-8 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, from 1/2-2/3 length of remaining sclerotized portion; total sclerotized area much longer than unsclerotized area; dermal orifice heavily sclerotized. Microtubular ducts numerous over dorsum except on "microseta extreme" and "intermediate" where these ducts are rare on abdomen.

Anal ring dorsal, with 3-5 pairs of setae, (usually 4 on "macroseta extreme", usually 3 on "microseta extreme" and "intermediate").

VENTER with lanceolate body setae variable (longest seta on abdominal segment VII on "macroseta extreme" from 62-84 μ long, on "microseta extreme" from 22-44 μ, on "intermediate" approximately 47 μ; on abdominal segment II on "macroseta extreme" from 81-106 μ long, on "microseta extreme" from 22-34 μ, on "intermediate" approximately 44 μ), medial setae with acute apices. Enlarged setae same as on dorsum except smaller; present along body margin from abdominal segment II through head; largest on head. Macrotubular ducts on "macroseta extreme" of 2 kinds: smaller size rare, restricted to abdomen, present on sublateral areas; larger size same as on dorsum, present over entire surface, mainly on lateral areas. Macrotubular ducts on "microseta extreme" and "intermediate", of 1 size: slightly larger than on dorsum, less numerous than on "macroseta extreme",

especially in medial areas of abdomen. Microtubular ducts uncommon, present mainly on lateral areas. Multilocular sessile pores of 4 kinds on "macroseta extreme': septeloculars and hexaloculars in reduced numbers, present on abdominal segments VIII through VI; quinqueloculars most abundant sessile pore, present over entire surface; triloculars present or absent. Multilocular sessile pores of 3 kinds on "microseta extreme": septeloculars present in small numbers on abdominal segments VIII and VII rarely on segments II and I; quinqueloculars same as on "macroseta extreme"; triloculars although rare, never absent, more numerous than on "macroseta extreme". Multilocular sessile pores of 2 kinds on "intermediate": quinqueloculars same as on "macroseta extreme"; triloculars same as on "microseta extreme". Cruciform pores numerous, present on "macroseta extreme" and "intermediate" from abdominal segment V or IV through head, most abundant near anterior spiracle. Cruciform pores on "microseta extreme" more numerous than on "macroseta extreme", present from abdominal segment VII through head.

Legs noticeably large; hind coxae on "macroseta extreme" dorsally with 58-65 pores, on "microseta extreme" with 26-43, on "intermediate" with 10-32, ventral surface on "macroseta extreme" with 61-67 pores, on "microseta extreme" with 19-37, on "intermediate" with 14-36; hind femora dorsally with 0-10, ventral surface with 0-7; tibiae with 4 setae; inner, apical, tibial setae slender; tarsi always longer than tibiae, (hind tibia/tarsus ratio from 0.64-0.90); claws on "macroseta extreme" and "microseta extreme" with conspicuous denticle near tip, on "intermediate" denticle less obvious. Mouthparts noticeably large. Antennae on "macroseta extreme" 6-segmented, on "microseta extreme" 7-segmented, on "intermediate" normally 7-segmented rarely 6-segmented; when 6-segmented, third segment longest, when 7-segmented, fourth segment longest. Apical segment with 4 sensory setae; second segment from apex with 1 slender seta which only slightly resembles a sensory seta; third segment from apex with 1 such seta definitely of sensory type.

Notes.— *Acanthococcus larreae* is most similar in appearance to *A. cryptus*, but is distinguished by having differently shaped enlarged setae, and 4 setae on each tibia; *A. cryptus* has 5 setae on each tibia.

Specimens Examined.— ("Macroseta extreme") NEW MEXICO, LINCOLN Co.: 3 mi. S. Oscuro, VIII-5-66, on *Larrea divaricata*, D. R. Miller (2 ad. fem., 1 second instar fem., 1 second instar male on 4 sl.) UCD. OTERO Co.: Canyon above Alamogordo, VIII-4-66, on *L. divaricata*, D. R. Miller (2 ad. fem. on 2 sl.) UCD.

TEXAS, BREWSTER Co.: Lajitas, III-20-68, on, *L. divaricata*, D. R. Miller and R. W. Rust (8 ad. fem. on 5 sl.) CDA, UCD, USNM; Terlingua, on *Larrea* sp., D. R. Miller and R. W. Rust (4 ad. fem., 1 second instar fem. on 4 sl.) CDA, UCD, USNM. EL PASO Co.: El Paso, VI-(?)-21, on *L. divaricata* (=*Covillea glutinosa*), G. F. Ferris (6 ad. fem., 2 second instar fem. on 5 sl.) UCD. PRESIDIO Co.: Presidio, II-3-45 and I-1-46, on *L. divaricata*, Russell (6 spm. on 2 sl.) USNM; III-20-68, on *L. divaricata*, D. R. Miller and R. W. Rust (4 ad. fem. on 2 sl.) UCD. VAL VERDE Co.: Langtry, V-13-76, Host (?), R. D. Gordon and D. R. Miller (5 ad. fem. on 3 sl.) USNM.

("Microseta extreme")

MEXICO, NORTHERN BAJA CALIFORNIA: Bahia de Los Angeles, II-23-68, on *L. divaricata*, D. R. Miller (3 ad. fem. on 3 sl.) UCD.

CALIFORNIA, EL DORADO Co.: Myers Inspection Station, VI-22-56, on *Larrea* sp., collector (?) (3 ad. fem. on 2 sl.) CDA. KERN Co.: near Mojave, Salt Dale, IV-27-36, on *L. divaricata*, G. F. Ferris (3 ad. fem. on 2 sl.) UCD. SAN BERNARDINO

Co.: near Barstow, Garlic Springs, V-24-35, on *L. divaricata*, J. D. Maple (5 ad. fem. on 4 sl.) UCD; VI-l-35, on *L. divaricata* (=*Larrea tridentata*), J. D. Maple (13 ad. fem. on 5 sl.) UCD.

NEVADA, LINCOLN Co.: 20 mi. S. Alamo, VIII-3l-68, on *Larrea* sp., D. R. Miller and J. E. Lauck (1 ad. fem.) UCD.

("Intermediate")

NEW MEXICO, DONA ANA Co.: Mesilla Park, I-21-1899, on *Larrea* sp., J. P. Parrott (8 spm. on 2 sl.) USNM.

TEXAS, EL PASO Co.: El Paso, Mount Franklin, VI-(?)-2l, on *L. divaricata*, G. F. Ferris (2 ad. fem. on 2 sl.) UCD.

Host and Distribution.— Known only from *Larrea*. After more collecting, we believe that the various extremes will show distinct geographic patterns. At the present, the "microseta extreme" is found only in the west, the "macroseta extreme" is in Texas and central New Mexico, and the "intermediate" is in western New Mexico and western Texas.

Acanthococcus mackenziei Miller and Miller, n. sp.

McKenzie eriococcin

Fig. 25

Type Material.— Adult female holotype (1 specimen on slide) with right label "Valentine Cave, Lava Beds Nat. Monument, Siskiyou Co., California 29-VI-1963 ex *Eriogonum latifolium* var. *saxicola* roots & crown Coll. D.R Miller #85"; left label "*Eriococcus mackenziei* Miller and Miller Holotype TYPE" (UCD). In addition, there are 5 paratypes.

Field Features.— This species occurs on the crown and roots of its host.

Recognition Characters.— Adult female holotype, mounted, 1.22 mm long, 0.69 mm wide (paratypes 1.19-1.85 mm long, 0.74-1.25 mm wide). Anal lobes slightly protruding, rounded, weakly sclerotized ventrally; each lobe dorsally with 3 enlarged setae (all approximately same size), with 3 microtubular ducts; each lobe ventrally with 3 body setae and 4 sessile pores.

DORSUM with enlarged setae of 1 size. Largest setae 23 μ long (paratypes 25-29 μ), smallest seta 12 μ long (paratypes 12-17 μ); longest seta 1.9 times longer than smallest seta (paratypes 1.7-2.1 times). All setae straight, with truncate apices; setal rings thin. Enlarged setae abundant—e.g., abdominal segment IV with 53 (paratypes with 40-68) — showing no longitudinal pattern. Macrotubular ducts unusually small, scattered over surface. Microtubular ducts moderate in length (6 μ long) (paratypes 5-6 μ), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, approximately 1/2 length of remaining sclerotized portion; total sclerotized area longer than unsclerotized portion; dermal orifice unsclerotized. Microtubular ducts scattered over surface.

Anal ring apical, bent around abdomen apex, with 3 pairs of setae.

VENTER with lanceolate body setae short (longest seta on abdominal segment VII 34 μ long (paratypes 34-41 μ) on segment II 34 μ long (paratypes 31-41 μ), medial setae slightly capitate apically. Enlarged setae present along lateral margins from abdominal segments VII or VI through head. Macrotubular ducts of same size as

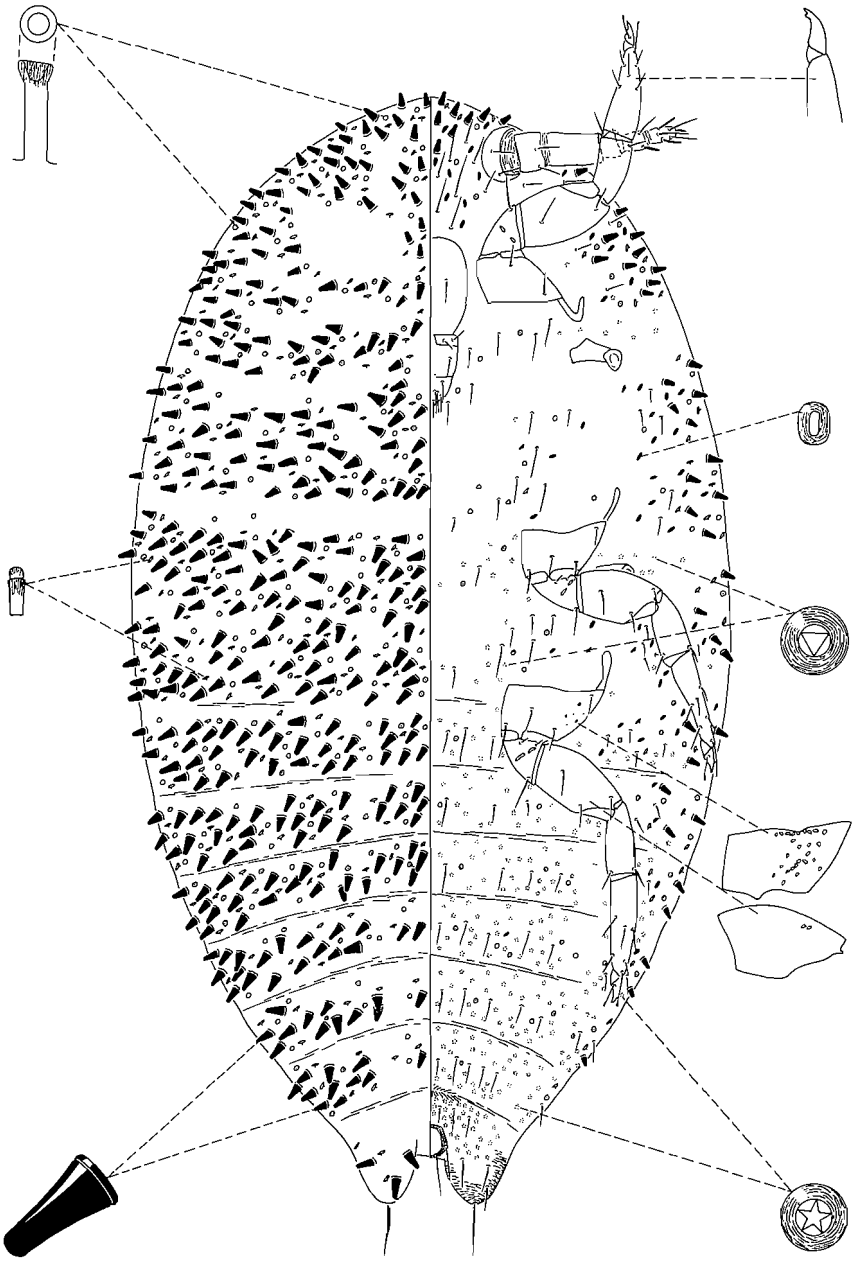


FIGURE 25. *Acanthococcus mackenziei* Miller and Miller, n. sp. Valentine Cave, California, VI-29-63, on *Eriogonum latifolium* var. *saxicola*.

those on dorsum, scattered over surface, most abundant along lateral margins. Microtubular ducts scattered along body margins. Multilocular sessile pores of 2 kinds: quinqueloculars scattered over surface, most abundant on abdomen; triloculars rare, most abundant near spiracles. Cruciform pores present along body margin from anterior abdominal segments through head.

Legs with hind coxae dorsally with 26 and 53 pores (paratypes with 25 and 44), ventrally with 5 and 18 pores (paratypes with 9-21); hind femora dorsally with 2 and 3 (paratypes with 2-7), absent ventrally; tibiae with 4 setae; inner, apical, tibial setae slightly larger than other leg setae; tarsi much longer than tibiae (hind tibia/tarsus ratio 0.68) (paratypes 0.68-0.80); claws with denticle near tip. Antennae 6-segmented, third segment longest. Segment 6 with 3 sensory setae; segment 5 with 1 equal in size to single sensory seta on segment 4.

Variation.— The paratypes differ from the holotype as follows: anal lobes on 1 specimen each possess 4 enlarged setae; microtubular ducts normally with sclerotized ring at dermal orifice; antennae rarely 7-segmented.

Notes.— *Acanthococcus mackenziei* is similar in appearance to *A. stauroporus*, but is distinguished by the absence of dorsal cruciform pores, and having 4 setae on each tibia; *A. stauroporus* has many dorsal cruciform pores, and 5 setae on each tibia.

Specific Epithet.— We take great pleasure in naming this species, *A. mackenziei*, after the late Howard L. McKenzie, whose advice was critical in starting this research more than 25 years ago.

Specimens Examined.— CALIFORNIA, SISKIYOU Co.: Lava Beds National Monument, Valentine Cave, VI-29-63, on *Eriogonum latifolium* var. *saxicola* and *E. umbellatum* var. *polyanthum*, D. R. Miller (1 ad. fem. holotype and 5 ad. fem. paratypes on 6 sl.) BM, CDA, UCD, USNM.

Host and Distribution.— Known only from type locality on *Eriogonum*.

Acanthococcus macrobactrus Miller and Miller, n. sp.

Long rod eriococcin

Fig. 26

Type Material.— Adult female holotype (1 specimen on slide) with right label "Mt. Tamalpais Marin Co., Calif. VI-23-68. D. R. Miller on *Arctostaphylos canescens*"; left label "*Eriococcus macrobactrus* Miller and Miller TYPE Holotype" (UCD). In addition, there are 18 paratypes.

Field Features.— Body yellow in newly formed adult females, turning white as they become older; legs yellowish brown. Adult female produces many elongate crystalline rods of 2 sizes; the longer rods are produced from the longest setae and are approximately 3/4 the length of the female; the smaller rods are approximately 1/2-3/4 the length of the longer sized rods. Pubescent effect of rods causes adult females to blend with very hairy host. Ovisac not observed.

This species occurs on the new growth of the aerial portions of its host.

Recognition Characters.— Adult female holotype, mounted, 1.99 mm long, 0.94

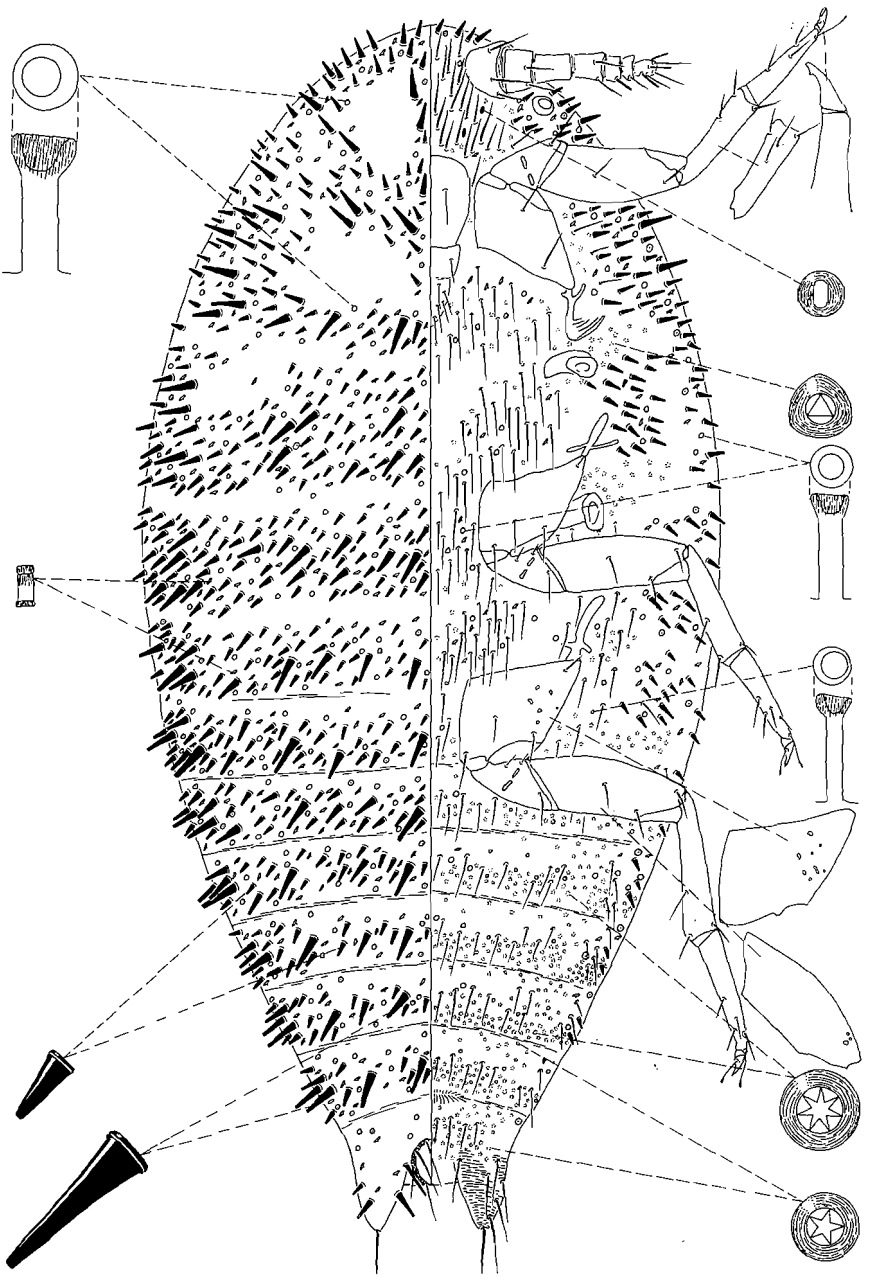


FIGURE 26. *Acanthococcus macrobactrus* Miller and Miller, n. sp. Mt. Tamalpais, California, VI-23-68, on *Arctostaphylos canescens*.

mm wide (paratypes 1.90-2.25 mm long, 0.92-1.34 mm wide). Anal lobes strongly protruding, acute, sclerotized ventrally; each lobe dorsally with 4 enlarged setae (anteromedial seta longest and most slender, posteromedial seta equal to posterolateral seta, anterolateral seta shortest), with 3 microtubular ducts; each lobe ventrally with 6 body setae and 3 sessile pores.

DORSUM with enlarged setae of 2 sizes: larger setae present medially, sublaterally, and laterally from abdominal segment VII through thorax, with 3 such setae on margin of each abdominal segment; remaining setae of small size. Largest large seta 68 μ long (paratypes 62-70 μ), largest small seta 26 μ long (paratypes 25-28 μ); longest large seta 2.7 times longer than longest small seta (paratypes 2.4-2.7 times). All setae straight, slender with truncate apices; setal rings thin. Enlarged setae abundant — e.g., abdominal segment IV with 59 (paratypes with 60-74) — large setae forming 6 or 8 longitudinal lines (2 lines medially, 4 lines sublaterally, and 2 lines laterally). Macrotubular ducts unusually large, scattered over surface. Microtubular ducts moderate in length (7 μ long) (paratypes 5-7 μ), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, smaller than remaining sclerotized portion; total sclerotized area approximately equal in length to unsclerotized portion; dermal orifice weakly sclerotized. Microtubular ducts abundant over surface.

Anal ring dorsal, with 4 pairs of setae.

VENTER with lanceolate body setae elongate (longest seta on abdominal segment VII 69 μ long (paratypes 68-94 μ), on segment II 97 μ (paratypes 81-103 μ)), medial setae apically acute. Enlarged setae present along lateral margins from abdominal segment VII or VI through head. Macrotubular ducts of 3 kinds: larger size same as on dorsum, restricted to lateral margins; intermediate size present medially near longest body setae and along body margins; smaller size restricted to medial areas. Microtubular ducts present along lateral margins of abdomen, scattered over entire thorax and head. Multilocular sessile pores of 3 kinds: septelocular pores uncommon, most abundant on abdomen; quinqueloculars present in large numbers over entire surface; triloculars rare. Cruciform pores uncommon, present near anterior thorax and on head.

Legs unusually large; hind coxae dorsally with 23 and 8 pores (paratypes with 26-71), ventrally with 3 and 6 (paratypes with 0-25); hind femora dorsally with 3 and 2 pores (paratypes with 0-5), absent ventrally; hind 2 pairs of tibiae each with 6 setae, front pairs with 7; inner, apical, tibial setae slightly more robust than remaining leg setae; tibiae slightly longer than tarsi (hind tibia/tarsus ratio 1.09) (paratypes 1.02-1.09); claws with small denticle near tip. Antennae 7-segmented, third and fourth segments longest. Segment 7 with 3 sensory setae; segment 6 with these setae absent; segment 5 with 1, more robust and shorter than sensory setae on segment 7.

Variation.— The paratypes differ from the holotype as follows: relative sizes of anal lobe setae is highly variable, although the anteromedial seta is always the longest; anal lobes each rarely with 5 enlarged setae, 5 ventral body setae, 3-6 microtubular ducts, and up to 8 sessile pores; microtubular ducts sometimes without orifice sclerotization; cruciform pores sometimes absent; antennae rarely 6-segmented.

Notes.— *Acanthococcus macrobactrus* is distinguished from all other North American species of *Acanthococcus* by 6 setae on each hind 2 pairs of tibiae, 7 setae

on each front tibia, 5 or 6 ventral body setae on each anal lobe, and an unusually large number of ventral body setae. It is unusual in having 4 or 5 enlarged setae on each anal lobe, and tibia/tarsus ratio of consistently more than 1.00.

Specific Epithet.— The name *macrobactrus*, from the Greek makros, meaning "long", and baktron, meaning "stick or rod", refers to the numerous elongate crystalline rods produced on the cuticular surface.

Specimens Examined.— CALIFORNIA, MARIN Co.: Mount Tamalpais, VI-17-68, on *Arctostaphylos canescens*, H. L. McKenzie and J. W. Beardsley (3 ad. fem. paratypes on 2 sl.) UCD, USNM; VI-23-68, on *A. canescens*, D. R. Miller (1 ad. fem. holotype, 4 ad. fem. paratypes, 10 second instar fem. paratypes on 5 sl.) BM, CDA, UCD; VII-25-68, on *A. canescens*, D. R. Miller (1 ad. fem. paratype) UCD.

Host and Distribution.— Known only from the type locality.

Acanthococcus microtrichus Miller and Miller, n.sp.

Small seta eriococcin

Fig. 27

Type Material.— Adult female holotype (1 specimen on slide) with right label "*Eriococcus paucispinus* Ferris Tl18-2. On Compositae. Mt. Franklin, El Paso. June 1921. Ferris Coccidae of Texas"; left label "*Acanthococcus microtrichus* Miller and Miller Holotype TYPE" (UCD). In addition, there are 2 paratypes.

Field Features.— No available information.

Recognition Characters.— Adult female holotype, mounted, 1.54 mm long, 1.00 mm wide (paratypes 1.55-1.65 mm long, 0.90-0.94 mm wide). Anal lobes protruding, acute, lightly sclerotized ventrally; each lobe dorsally with 3 enlarged setae (anteromedial longest and most slender, remaining setae equal), with 2 microtubular ducts; each lobe ventrally with 3 body setae and 2 sessile pores.

DORSUM with enlarged setae of 1 size. Largest seta 12 μ long (paratypes 13-16 μ), smallest seta 7 μ long (paratypes 7-8 μ); longest seta 1.8 times longer than smallest seta (paratypes 1.8-1.9 times). All setae straight or slightly curved with rounded or acute apices; setal rings thick. Enlarged setae few — e.g., abdominal segment IV with 20 (paratypes with 17-19) — showing no longitudinal pattern. Macrotubular ducts scattered over surface. Microtubular ducts moderate in length (8 μ long) (paratypes 7-8 μ), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, approximately 1/3 length of remaining portion, total sclerotized area at least 5 times longer than unsclerotized portion, dermal orifice weakly sclerotized. Microtubular ducts scattered over surface.

Anal ring dorsal, with 3 pairs of setae.

VENTER with lanceolate body setae moderate in length (longest seta on abdominal segment VII 41 μ long (paratypes 40-47 μ), segment II 56 μ long (paratypes 56-59 μ), medial setae apically acute. Enlarged setae present along lateral margins from abdominal segment VII through head. Macrotubular ducts of 2 sizes: larger size restricted to lateral margins near enlarged setae; smaller size present on medial and sublateral areas of surface. Microtubular ducts present

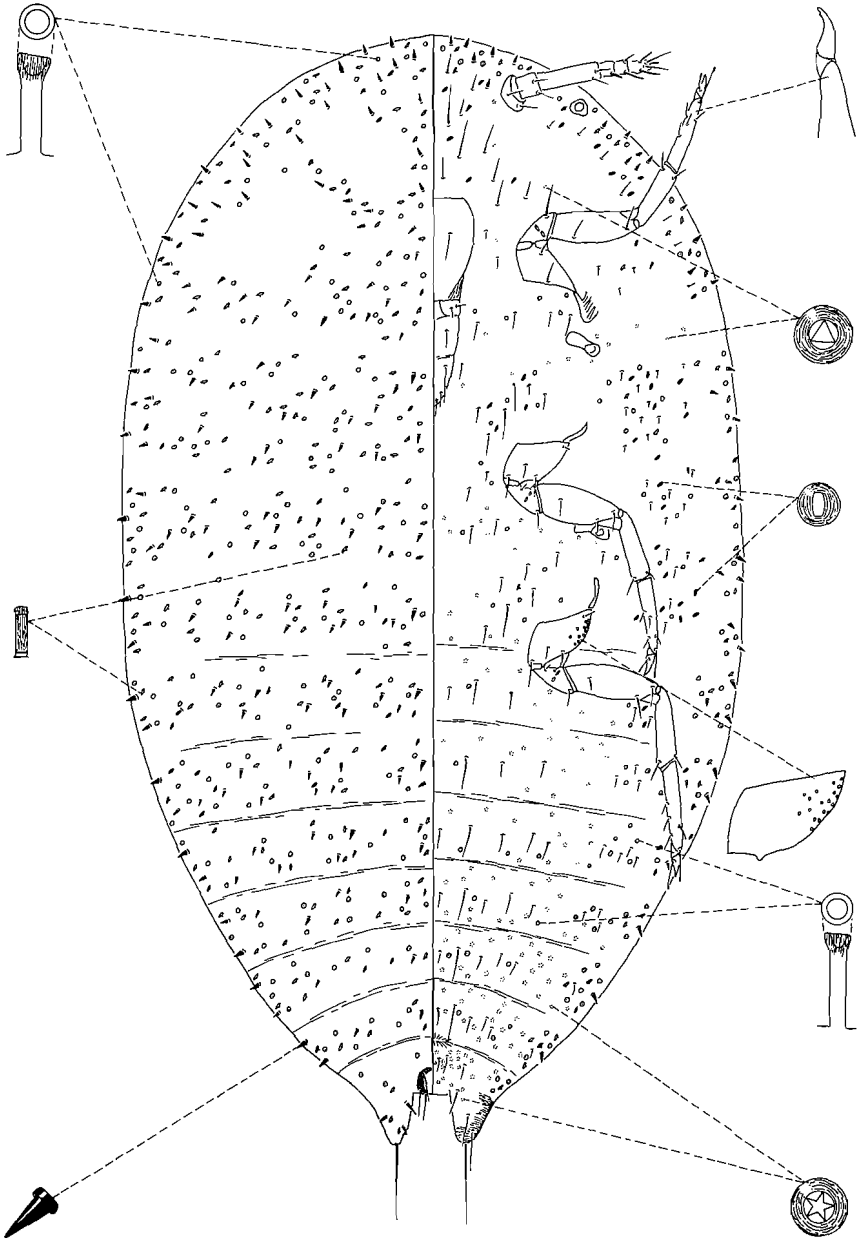


FIGURE 27. *Acanthococcus microtrichus* Miller and Miller, n. sp. El Paso, Texas, VI-?-21, on (?) (Compositae).

along lateral margins. Multilocular sessile pores of 2 kinds: quinquelocular pores abundant over surface, most numerous on abdomen; triloculars present on anterior abdominal segments and near spiracles. Cruciform pores present along lateral margins of anterior abdominal segments and on thorax and head.

Legs with hind coxae dorsally with 16 and 18 pores (paratypes with 10-14), ventrally with 9 and 12 pores (paratypes with 8-10); hind femora with pores absent; tibiae each with 4 setae; inner, apical, tibial setae unenlarged; tarsi longer than tibiae (hind tibia/tarsus ratio 0.83) (paratypes 0.82); claws with small denticle. Antennae 6-segmented, third segment longest. Segment 6 with 3 sensory setae; segment 5 with one longer than single sensory seta on segment 4.

Variation.— The paratypes differ from the holotype by having dorsal anal lobe setae in which the anteromedial seta is longest, posteromedial seta is slightly shorter, and the lateral seta is the shortest; antennae that may be 7-segmented.

Notes.— *Acanthococcus microtrichus* is similar in appearance to *A. paucispinus* (Ferris), but is distinguished by 4 setae on each tibia, sclerotization on ventral surface of anal lobes only, and 3 enlarged setae on each lobe; *A. paucispinus* has 5 setae on each tibia, sclerotization on both anal lobe surfaces, and no enlarged setae on anal lobes.

Specific Epithet.— The name *microtrichus*, from the Greek mikros, meaning "small or little", and trichos, meaning "hair", refers to the reduced size of the enlarged setae.

Specimens Examined.— TEXAS, EL PASO Co.: Mount Franklin, El Paso, VI-(?)-21, on (?) (Compositae), G. F. Ferris (1 ad. fem. holotype, 2 ad. fem. paratypes on 3 sl.) UCD, USNM.

Host and Distribution.— Known only from the type locality.

Acanthococcus nudulus (Ferris), n. comb.

Bare eriococcin

Fig. 28

Onceropyga nudula Ferris, 1955:211.
Oregmopyga nudula (Ferris), Hoy, 1963:179.
Eriococcus nudulus (Ferris), Miller and McKenzie, 1967:483.

Type Material.— We have examined the lectotype which has 2 labels. The right label reads "*Eriococcus nudulus* n. sp. T288, on *Bouteloua* sp., Between Vernon and Quanah., Ferris, 1921, Type, Coccidae of Texas, G. F. F."; the left label reads "*Eriococcus nudulus* (Ferris). Lectotype, desig. D. R. Miller, 1967" (UCD). In addition, there are 2 paralectotypes.

Field Features.— No information is available on this species.

Recognition Characters.— Adult female, mounted, 2.33-2.50 mm long, 1.14-1.43 mm wide. Anal lobes broad, with rounded apices, unsclerotized; each lobe dorsally with 3 setae (anteromedial seta of enlarged type, shorter than remaining 2 setae,

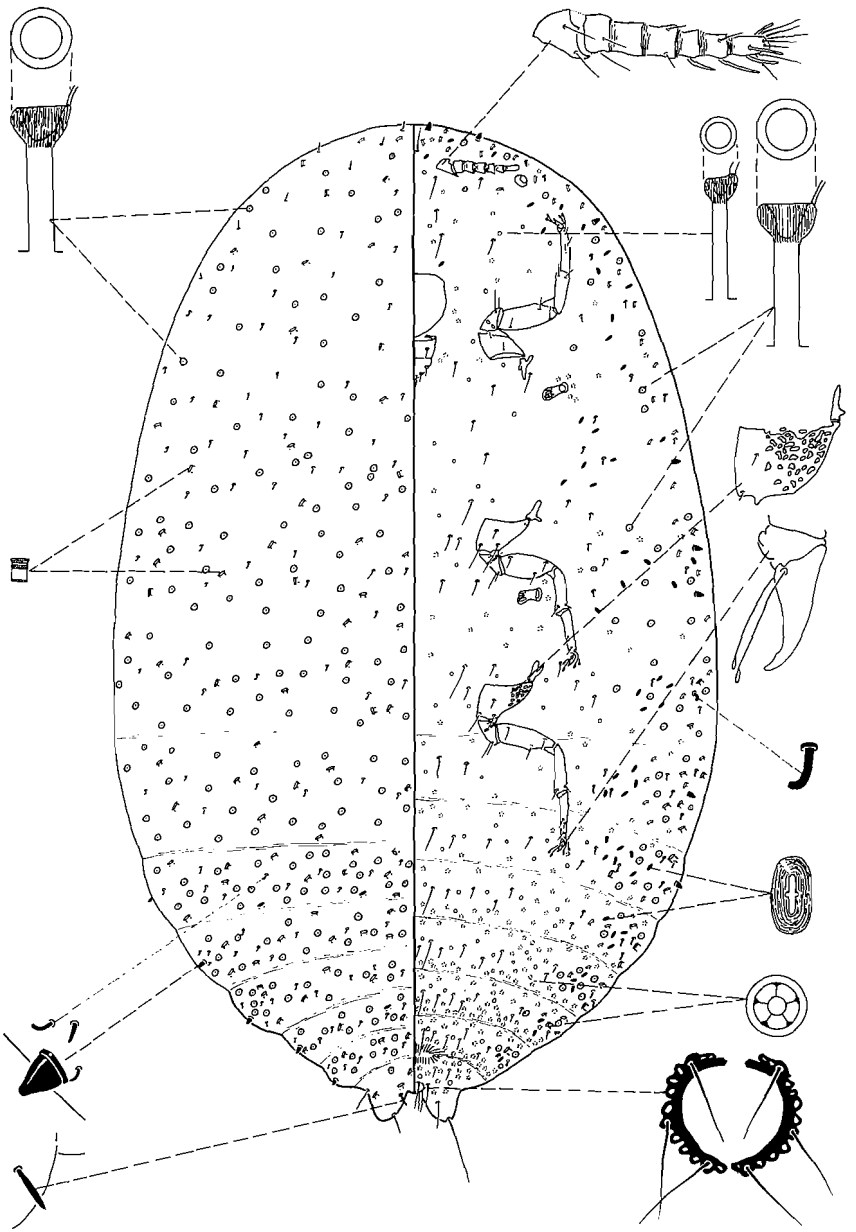


FIGURE 28. *Acanthococcus nudulus* (Ferris). Between Vernon & Quanah, Texas, 1921, on *Bouteloua* sp.

posteromedial and lateral setae of lanceolate type, equal in length), with 2 microtubular ducts; each lobe ventrally with 2 slender body setae and 1-3 sessile pores.

DORSUM with enlarged setae of 2 or 3 sizes: larger size distributed along body margin, often with 1 present on margin of each abdominal segment; medium sized setae at times replacing larger size; smaller size present over entire surface. Largest lateral seta 11-13 μ long; largest medium sized seta 10-11 μ; largest small seta 9-11 μ; longest lateral seta 1.2 times longer than largest small seta. Larger lateral setae "acorn-shaped" with blunt apices and relatively thin setal rings; medium setae thin and strongly curved, with blunt apices and thin setal rings; small setae same shape as medium setae except not as robust, with apices often more acute, and setal rings relatively large. Dorsal setae uncommon — e.g., abdominal segment IV with 18-22 — with no longitudinal pattern. Macrotubular ducts moderate in size, scattered over entire surface. Microtubular ducts small (4 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rectangular, approximately equal length of remaining sclerotized portion; total sclerotized area slightly longer than unsclerotized area; dermal orifice lightly sclerotized, rarely with no sclerotization. Microtubular ducts scattered in small numbers over surface.

Anal ring ventral, with 3 pairs of setae.

VENTER with lanceolate body setae moderate in length (largest seta on abdominal segment VII from 18-26 μ long, segment II from 44-53 μ), medial setae slender, apices acute. Enlarged setae of small type present on lateral and sublateral areas from posterior abdominal segments forward through head; large and medium sized setae rarely present on lateral margins. Macrotubular ducts of 2 kinds: larger size same as on dorsum, present along lateral margins; smaller size relatively abundant, distributed throughout medial and sublateral areas. Microtubular ducts present along lateral margin of body. Multilocular pores of 2 kinds: septeloculars rarely present on posterior abdominal segments; quinqueloculars present over entire surface, most abundant on anterior abdominal segments. Cruciform pores present along lateral margins of abdominal segment VII through head.

Legs with hind coxae dorsally with 39-70 pores, ventral surface with 22-35; hind femora with these pores absent; tibiae with 4 setae; inner, apical, tibial setae unenlarged; tarsi slightly longer than tibiae (hind tibia/tarsus ratio 0.87-0.93), claws with denticle very small or absent. Antennae 7-segmented, third and fourth segments longest. Segment 7 with 3 sensory setae; segment 6 with 1 only slightly resembling a sensory seta and much longer but more slender than single sensory seta on segment 5.

Notes.— *Acanthococcus nudulus* is quite distinctive, but is most similar in appearance to *A. paucispinus*. Both species have the unusual character of dorsal body setae on the anal lobes and the absence of prominent enlarged setae on the mediodorsal portion of the body. *Acanthococcus nudulus* is distinguished by 2 dorsal body setae on each anal lobe, 2 ventral body setae on each lobe, 4 setae on each front tibia, 7-segmented antennae, differentiated lateral line of enlarged setae, and many curved mediodorsal setae; *A. paucispinus* has 3 dorsal body setae on each anal lobe, 3 ventral body setae on each lobe, 6 setae on each front tibia, 6-segmented antennae, no differentiated lateral setae of enlarged type, and no curved dorsal medial setae.

This species is similar to species of *Ovaticoccus* and *Oregmopyga* but differs by possessing prominent, lightly sclerotized anal lobes, 3 dorsal and 3 ventral setae on each lobe, and at least 1 lobe seta enlarged.

Specimens Examined.— TEXAS, BEMAN Co.: between Vernon and Quanah, (?)-(?)-21, on *Bouteloua* sp., G. F. Ferris (1 ad. fem. lectotype, 2 ad. fem. paralectotypes on 3 sl.) UCD.

Host and Distribution.— Known only from Gramineae in Texas.

Acanthococcus palmeri (Cockerell), n. comb.

Palmer eriococcin

After examining type material of *A. palmeri* and the specimens recorded by Hoy (1963) as *A. palmeri* from La Jolla, California, it is apparent that the La Jolla material is not this species. Although it is poorly mounted, it probably belongs in *A. dubius* (Cockerell). *Acanthococcus palmeri* is not treated in this publication since it is known from Mexico only.

Acanthococcus palustris (Dodds), n. comb.

Marsh eriococcin

Fig. 29

Eriococcus palustris Dodds, 1923:57.
Nidularia palustris (Dodds), Lindinger, 1933:116.

Type Material.—The holotype has been examined, the left label reads "Almonte, Marin Co. California. November, 11, 1921. Host plant *Spartina filiosa* Trin."; right label "*Eriococcus palustris* Dodds C.T. Dodds type" (California Academy of Sciences). In addition, we have examined 4 paratypes.

Field Features.—Dodds (1923) presented the following field data. Adult females violet gray; eggs, first and second instars cadmium yellow. Adult females on upper surface of host leaves. Ovisac felted, white when first produced, grayish after wetting by salt water; contains average of 60-70 eggs with as many as 92 eggs. First instars apparently overwinter in ovisac. In laboratory, first molt occurs 17 days after hatching, second molt occurs approximately a week later. Ovisac produced 1 day after second molt.

This species occurs in a very unusual habitat for an eriococcid. It is known only from the high tide level of San Francisco Bay where it may be subject to short periods of submergence.

The chalcid, *Aphycus clauseni* (Timberlake) (Encyrtidae), has been recorded as a parasite of this species. Dodds (1923) states that a large percentage of the *A. palustris* infestation examined was parasitized.

Recognition Characters.— Mounted, 2.2-3.8 mm long, 0.9-1.4 mm wide. Anal lobes protruding, apically acute or rounded, lightly sclerotized; each lobe dorsally with 3 enlarged setae (anteromedial and posteromedial setae approximately equal, lateral seta shortest), with 0-1 microtubular duct; each lobe ventrally with 3 or 4 slender body setae and 3-13 sessile pores.

DORSUM with enlarged setae of 2 types: larger type present on anal lobes, abdominal segment IX, and on head; smaller size divided into 2 groups: on each abdominal segment 1 pair of medial setae, 1 pair of mediolateral setae, and 1, 2, or 3, normally 2, pairs of lateral setae are conspicuously larger than the remaining small sized setae. Largest seta on anal lobes varying from 22-35 μ long, largest seta

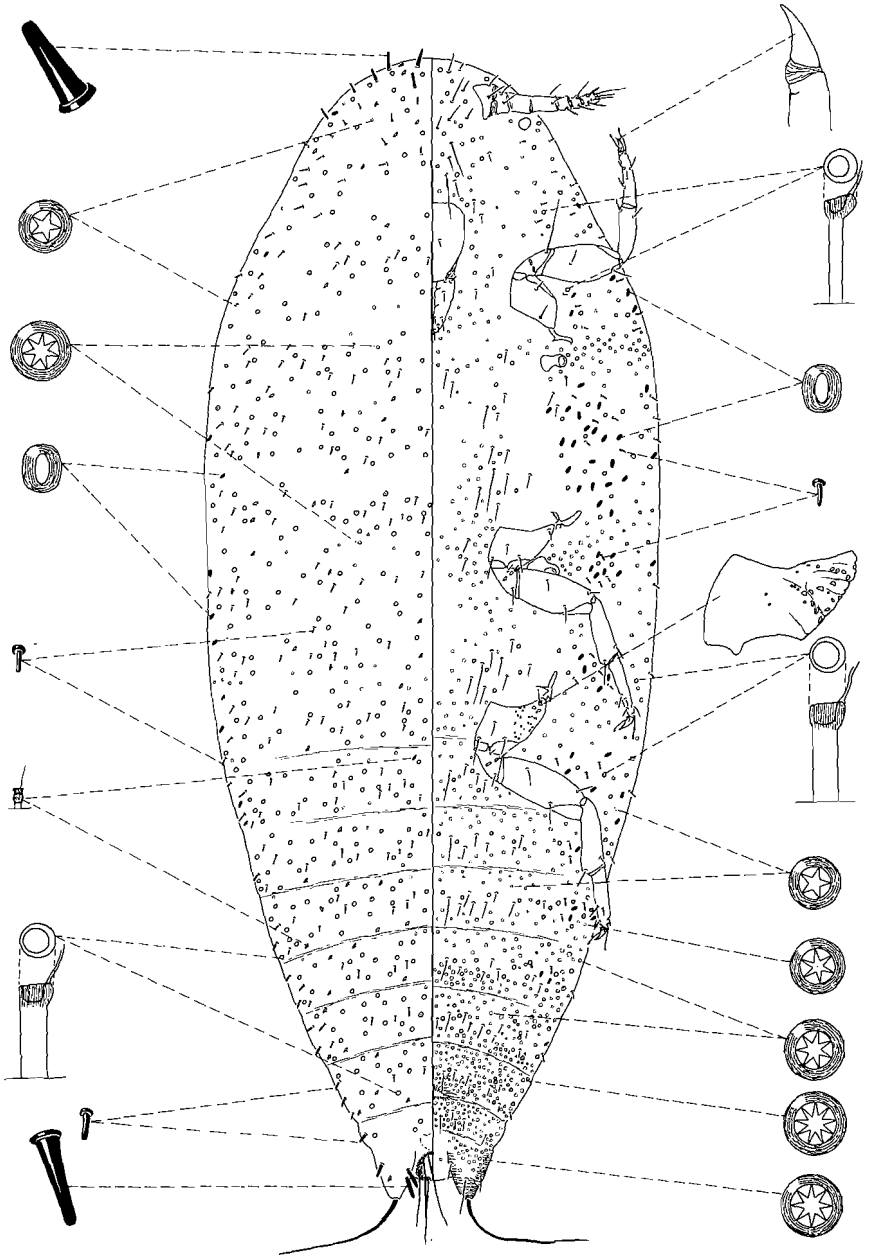


FIGURE 29. *Acanthococcus palustris* (Dodds). Almonte, California, 11-11-21, on Spartina sp.

on head 25-38 μ long; largest small sized seta varying from 7-17 μ long. Anal lobe setae straight, with truncate apices; large sized setae on head straight, with acute or truncate apices; small sized setae either straight or slightly curved, with truncate or rounded apices; setal rings thin. Enlarged setae moderate in number — e.g., abdominal segment IV with 17-23 — larger sized small type setae forming 3 pairs of longitudinal lines (medial, mediolateral, lateral). Macrotubular ducts abundant over surface. Microtubular ducts moderate in length (3-5 μ long), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion truncate, approximately 1/2 length of remaining sclerotized portion; total sclerotized area slightly longer than unsclerotized area; dermal orifice unsclerotized. Microtubular ducts in small numbers over surface. Multilocular sessile pores lightly scattered over surface, most abundant on medial areas of anterior abdominal segments and on posterior thorax, sometimes absent on head and posterior 2 or 3 abdominal segments, on abdomen present only near anterior or posterior margins of each segment, of 3 or 4 kinds: nonelocular rare or absent; septeloculars most abundant; quinqueloculars nearly as numerous as septeloculars. Cruciform pores restricted to body margin.

Anal ring apical, with 3 or 4 pairs of setae.

VENTER with lanceolate body setae moderate in length (longest seta on abdominal segment VII 30-38 μ long, on segment II 50-62 μ); medial setae slender, apices acute. Enlarged setae of small size present along body margin. Macrotubular ducts of 2 indistinct kinds: larger size same as on dorsum, present only near body margin; smaller size present on medial and sublateral areas, associated with body setae. Microtubular ducts normally absent. Multilocular sessile pores abundant, most numerous on posterior abdominal segments, of 5 kinds: noneloculars more abundant than octoloculars and hexaloculars, less abundant than quinqueloculars; octoloculars and hexaloculars least abundant; septeloculars most abundant; quinqueloculars less abundant than septeloculars more abundant than noneloculars. Cruciform pores present sublaterally and/or laterally from abdominal segment VII, VI, or IV through head, pores present on head in small numbers normally restricted to posterior margin of head with 1 or 2 pores near antennae, most abundant in cluster posterior to each anterior spiracle.

Legs with hind coxae dorsally with 14-41 pores, ventrally with 3-38; tibiae each with 4 setae; inner, apical, tibial setae unenlarged, unusually elongate; tibae and tarsi approximately equal (hind tibia/tarsus ratio 0.90-1.04); claws without denticle. Antennae 6- or 7-segmented, when 6-segmented, third segment longest. When 6-segmented, segment 6 with 3 or 4 sensory setae; segment 5 with 1 slightly longer and more slender than single sensory seta on segment 4. Body margin with characteristic indentation demarking separation of thorax and head.

Notes.— *Acanthococcus palustris* is unique among the western species of *Acanthococcus* in having dorsal multilocular pores and large sized enlarged setae restricted to the anal lobes and head.

Specimens Examined.— CALIFORNIA, MARIN CO.: Almonte, X-29-21 and XI-11-21, on *Spartina foliosa*, C. T. Dodds (1 ad. fem. holotype, 4 ad fem. paratypes, 14 ad. fem., 24 first instar nymphs on 15 sl.) Calif. Acad. Sci., UCD, USNM.

Host and Distribution.— Probably occuring on *Spartina* in areas near the high tide level along the Pacific Coast from Baja California to Oregon and Washington.

Acanthococcus pittospori (Ferris), n. comb.

Pittosporum eriococcin

Fig. 30

Eriococcus pittospori Ferris, 1955:152.

Type Material.— We have examined the holotype adult female; it is labeled "No. 54186 Cal. Dept. Agr., Loc. San Francisco, California, August 24 - 1954, ex *Pittosporum tenuifolium*, R. P. Allen coll., *Eriococcus pittospori* n. sp. Type" (UCD). In addition, 25 paratypes have been examined.

Field Features.— Adult female abnormally small. Body varies from brown to red. Ovisac frequently with yellow tinge.

This species is found primarily on the bark of the trunk and branches of its host, but it may occasionally be on the underside of leaves.

Recognition Characters.— Adult female, mounted, 0.77-1.53 mm long, 0.50-1.03 mm wide. Anal lobes broad, protruding, heavily sclerotized; with several mesal teeth; each lobe dorsally with 3 enlarged setae (lateral seta equal to posteromedial seta, anteromedial seta shortest), with from 2-4 microtubular ducts; each lobe ventrally with 2, rarely 3, body setae and 1-5 sessile pores.

DORSUM with enlarged setae of 2 primary sizes: with 1 on lateral, sublateral, and medial areas of each abdominal segment, also scattered over thorax and head; remaining setae small. Largest large seta 28-36 μ long, largest small seta 17-27 μ; on abdominal segments VII through II longest large seta 1.3-1.6 times longer than longest small seta. All enlarged setae slightly curved, with long slender apices and broad bases; setal rings normally fused with apical portion of seta. Enlarged setae in moderate numbers, e.g., abdominal segment IV with 26-30 — large setae arranged in 3 pairs of longitudinal lines (medial, sublateral, lateral). Macrotubular ducts small, with elongate tube, present over entire surface. Microtubular ducts extremely elongate (12-14 μ long) with area farthest from dermal orifice sclerotized and undivided; total sclerotized portion less than 1/10 length of unsclerotized portion; dermal orifice bifurcate, unsclerotized. Microtubular ducts in small numbers over surface.

Anal ring normally bent around abdomen apex, with 3 pairs of setae.

VENTER with lanceolate body setae short (longest seta on segment VII from 26-36 μ long, segment II from 22-42 μ), medial setae noticeably capitate. Enlarged setae of small type only, present along lateral margin from abdominal segment VII through head. Macrotubular ducts of 2 kinds: larger size present along lateral margins of abdomen, and over thorax and head; smaller size restricted to medial area of abdomen. Microtubular ducts restricted to lateral margins only. Multilocular sessile pores of 2 kinds: quinqueloculars scattered over entire surface; triloculars, if present, rare. Cruciform pores absent.

Legs with hind coxae dorsally with 55-67 pores, ventral surface with 0-1; these pores absent on hind femora; tibiae with 2 setae; inner, apical, tibial setae unenlarged; hind tarsi slightly longer than tibiae (hind tibia/tarsus ratio 0.93-1.00); claws with denticle near tip; both pair digitules abnormally swollen apically. Antennae 6-segmented, rarely with segment 3 partially divided, third segment longest, segment 6 with 3 sensory setae; segment 5 with 1 equal in size and shape to single sensory seta on segment 4.

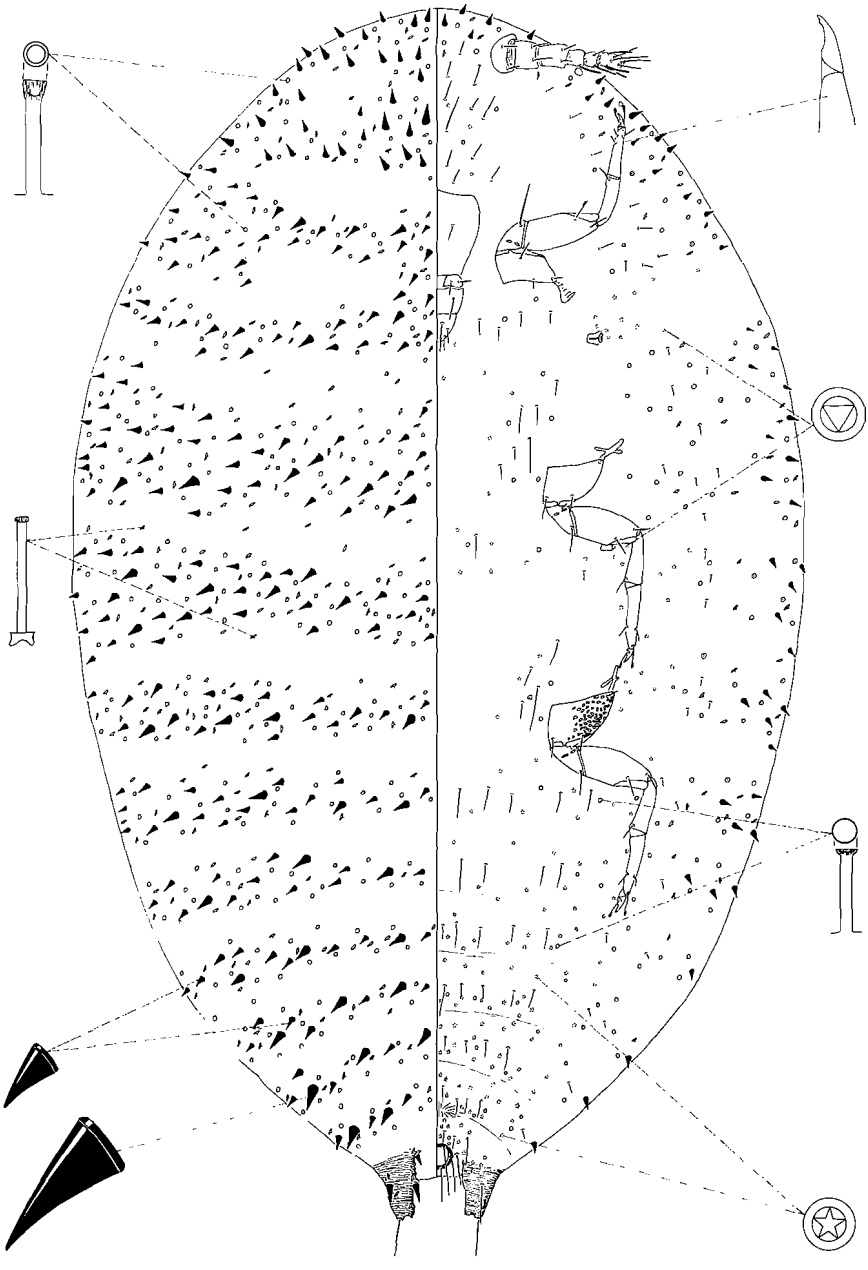


FIGURE 30. *Acanthococcus pittospori* (Ferris). Golden Gate Park, California, IX-26-67, on *Pittosporum* sp.

Notes.— *Acanthococcus pittospori* is different from any other North American species of *Acanthococcus*; it has only 2 setae on the hind tibiae, the shape of the enlarged setae is distinct, and the microtubular ducts are extreemly enlongate. *Acanthococcus pittospori* apparently is introduced, since it is known only from the San Francisco area and since it closely resembles species from Australia and New Zealand. *Acanthococcus pittospori* is very similar in appearance to *Eriococcus albatus* Hoy, *Eriococcus minus* Hoy, and *Eriococcus sophorae* Green. Although these species resemble *A. pittospori*, none have the bifurcate opening of the microtubular ducts. This type of tubular duct is characteristic of Australian species (Hoy 1962).

Specimens Examined.— CALIFORNIA, SAN FRANCISCO Co.: San Francisco, VIII-24-54, on *Pittosporum tenuifolium*, R. P. Allen (1 ad. female holotype, 25 ad. fem. paratypes, 4 ad. fem. on 7 sl.) CDA, UCD, USNM; V-7-58, on *P. tenuifolium*, R. P. Allen (3 ad. fem., 1 second instar male, 1 first instar nymph on 1 sl.) CDA; San Francisco, Golden Gate Park, IX-29-63, on *Pittosporum* sp., D. R. Miller and J. A. Froebe (5 ad. fem. on 4 sl.) UCD; XII-13-63, on *P. tenuifolium*, R. P. Allen (13 ad. fem., 21 second instar fem., 5 ad. male on 6 sl.) UCD; XI-l-64, on *Pittosporum* sp., D. R. Miller (4 ad. fem. on 2 sl.) UCD; San Francisco, III-26-65, on *Coprosma* sp., E. Tsugita and R. P. Allen (7 ad. fem., 1 ad. male on 5 sl.) CDA, USNM; San Francisco, Golden Gate Park, IX-26-67, on *Pittosporum* sp., D. R. Miller and J. A. Beardsley (6 ad. fem. on 3 sl.) UCD.

Hosts and Distribution.— Found on *Coprosma* and *Pittosporum*. Introduced into the United States, probably from Australia.

Acanthococcus quercus (Comstock), n. comb.

Oak eriococcin

Fig. 31

Rhizococcus quercus Comstock, 1881:340.
Eriococcus quercus (Comstock), Cockerell, 1894:31
Eriococcus howardi Ehrhorn, 1906:331.
Eriococcus quercus var. *gilensis* Cockerell, 1909:167.
Nidularia quercus (Comstock), Lindinger, 1933:116

Type Material.— We have studied 3 very poor specimens apparently from the type material labeled "*Dactylopius*? on scrub oak, Rock Ledge, Fla 408" and 2 mutilated specimens labeled "*Eriococcus quercus* Comst Ft. George Fla Dr. Turner April 27-1880 Type" (USNM). In addition, we have examined other material from the Comstock collection labeled "*Eriococcus quercus* Comst On *Quercus*" and "On Scrub Oak, Florida March 17, 1880". We also examined type material of *E. quercus* var. *gilensis* labeled "*Eriococcus quercus gilensis* Ckll, on *Quercus toumeyi*, Belleuve, Gila Co., Ariz D. G. Craig, July 17, 1908 Type" (USNM) and of *E. howardi* Ehrhorn labeled "*Eriococcus howardi* Ehrh., on Oak Santa Clara Calif July 1901 Type (USNM).

Field Features.— Adult female dark reddish-purple with faint yellow stripe on dorsomedial area. Covered dorsally with many short crystalline rods that curve back to the derm; lateral rods longer than those on medial areas and curve only slightly. Ovisac heavy, white; encloses female and 91-146 dark red eggs.

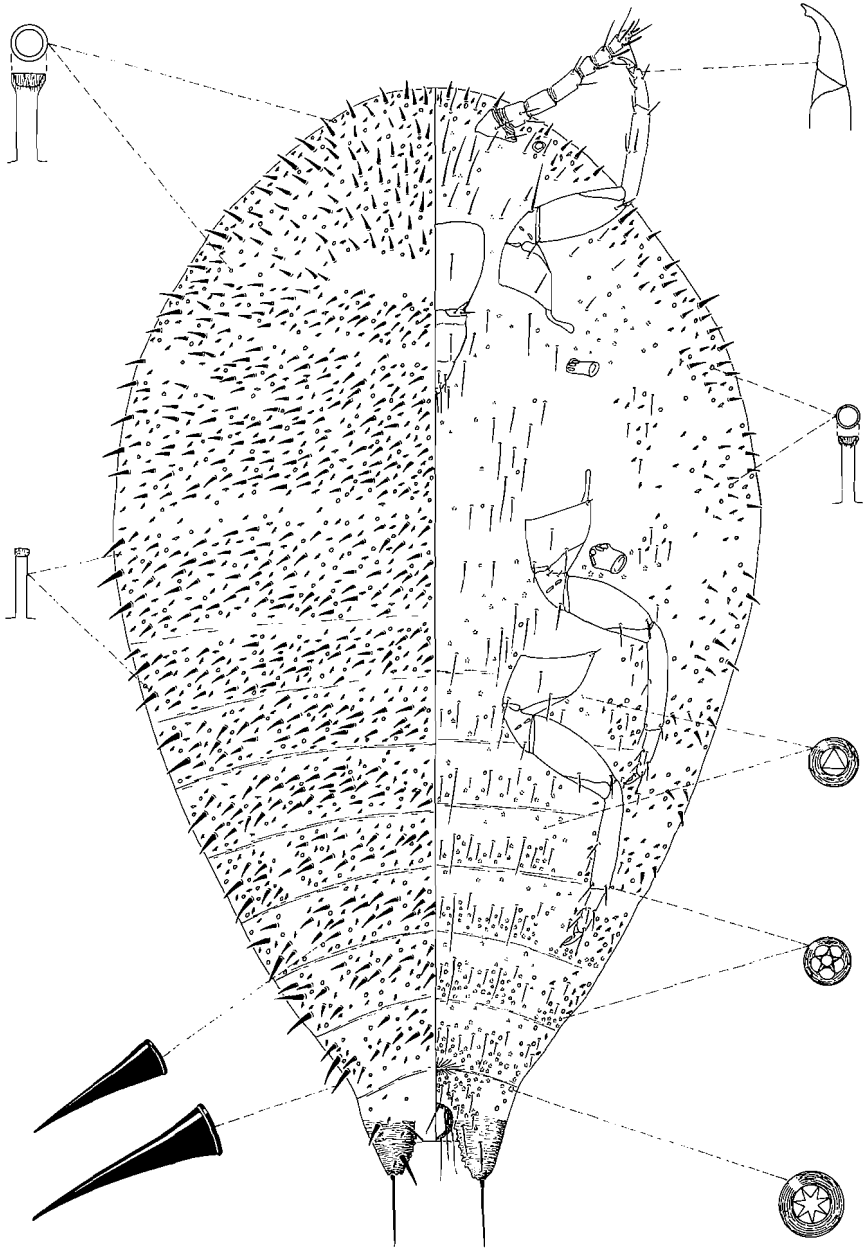


FIGURE 31. *Acanthococcus quercus* (Comstock). Putah Canyon, California, VII-25-68, on *Quercus* sp.

This species is bivoltine in the central valley of California and is found on the newly formed branches and leaf axils of its host. It seems to prefer the new growth and only rarely feeds on leaves.

Recognition Characters.— Adult females, mounted, 1.46-3.00 mm long, 0.79-2.29 mm wide. Anal lobes narrow, protruding, heavily sclerotized, each with 2 or 3 rows of medial teeth; each lobe dorsally with 3 enlarged setae (relative sizes variable), with from 3-9 microtubular ducts; each lobe ventrally with 3 body setae and 0-6 sessile pores.

DORSUM with enlarged setae of 2 primary sizes: 2 or 3 large setae on marginal area of each abdominal segment, also present along margin of thorax and head; remaining setae small. Relative sizes of large versus small setae variable; specimens collected in mountains or along east coast of the United States have small setae about 1/2 length of large setae; specimens collected in low areas of the southwestern United States have small setae about 3/4 length of large setae. There also seem to be fewer setae on specimens collected in the eastern United States. Largest large seta 47-70 μ long, largest small seta 22-47 μ) on abdominal segments VII through II largest large seta 1.1-2.4 times longer than longest small seta. All enlarged setae curved, apices acute except on small setae of eastern form; setal rings thin. Enlarged setae variable in number — e.g., abdominal segment IV on western specimens with 44-54, eastern specimens with 26-37 — large setae normally showing no longitudinal pattern, rarely arranged in 3 pairs of longitudinal lines (medial, sublateral, lateral). Macrotubular ducts moderate in size, with abnormally shallow "cup", scattered over surface. Microtubular ducts moderate to elongate (7-10 μ long), with area farthest from dermal orifice sclerotized, but not divided, apical portion rounded; total sclerotized portion approximately 1/5 length of unsclerotized portion; dermal orifice unsclerotized, microtubular ducts extremely numerous over surface.

Anal ring normally ventral, with from 3-6, normally 4, pairs of setae.

VENTER with lanceolate body setae elongate (longest seta on abdominal segment VII from 34-53 μ long, on segment II from 78-140 μ), medial setae apically acute. Enlarged setae same as on dorsum, present along margins of abdominal segment VI or V through head. Macrotubular ducts of 2 kinds: larger size present on lateral and sublateral areas only; smaller size on medial and sublateral areas. Microtubular ducts unusually numerous on lateral and sublateral areas, absent elsewhere. Multilocular pores of 3 kinds: septeloculars present in small numbers on abdomen; quinqueloculars abundant on abdomen; in reduced numbers on thorax and head; triloculars most numerous on thorax and head, rare on abdomen. Cruciform pores absent.

Legs with pores absent; hind 2 pairs of tibiae with 5 setae, front pair with 6; inner, apical, tibial setae enlarged; tibiae nearly twice as long as tarsi (hind tibia/tarsus ratio 1.69-2.69); claws with large denticle near tip. Antennae normally 7-segmented, rarely 6- or 8-segmented, fourth segment normally longest. Apical segment with 3 sensory setae; second segment from apex with 1 equal in size to single sensory seta on third segment from apex.

Notes.— *Acanthococcus quercus* is distinguished from all other species of *Acanthococcus* in the United States by having microtubular ducts with undivided sclerotized apices and the hind tibiae 1.5-3.0 times longer than the hind tarsi.

United States Distribution.— Alabama, Arizona, California, District of Co-

lumbia, Florida, Georgia, Louisiana, Maryland, Mississippi, New Jersey, Texas, Virginia.
The eastern form occurs from eastern Texas to Florida and along the east coast to New Jersey. The western form occurs from western Texas to central California.

Hosts.— Occurring on *Quercus*. The 2 grass records are probably of females that have left the oak host for oviposition only.

Acanthococcus salarius (Ferris)

Salt eriococcin
Fig. 32

This species was described in a recent paper on the *Acanthococcus* species that occur in the United States on *Atriplex*, and will not be redescribed here (see Miller 1991).

Acanthococcus smithi (Lobdell), n. comb.

Smith eriococcin
Fig. 33

Eriococcus smithi Lobdell, 1929:764-765.

Type Material.— We have examined 3 paratypes mounted on a single slide labeled "*Eriococcus smithi* Lodell, On broom straw grass *Andropogon virginicus*, Meridian, Miss. Coll Dr M. R. Smith, Nov 14, 1927, att argentine ants" (USNM).

Field Features.— Ovisac tough, closely felted, light brown, dorsally flattened; produced along dorsal midrib surface of grass leaves (Lobdell 1937).
It is likely that the immatures occur in the leaf blade sheaths.

Recognition Characters.— Adult females, mounted, 1.67-3.75 mm long, 0.80-1.77 mm wide. Anal lobes strongly protruding, narrow, apically acute, strongly sclerotized; each lobe dorsally with 3 enlarged setae (lateral seta longest, posteromedial and anteromedial setae equal), with from 1-5 microtubular ducts; each lobe ventrally with 3 body setae and 2-5 sessile pores.
DORSUM with setae of 2 sizes: larger size present along entire body margin, with 3 or 4 present on margin of each abdominal segment; smaller size restricted to medial and sublateral areas. Largest lateral seta 41-56 μ long, longest medial or sublateral seta 9-11 μ; longest lateral seta 4-6 times longer than longest medial seta. Lateral setae straight, slender, with blunt or truncate apices; medial setae same except much smaller; setal rings thin. Dorsal setae few — e.g., abdominal segment IV with 18-24 — with no longitudinal pattern. Macrotubular ducts abnormally elongate, scattered over surface. Microtubular ducts too small to measure, with area farthest from dermal orifice sclerotized and apparently undivided, apically rounded; dermal orifice abnormally large, heavily sclerotized. Microtubular ducts could be seen only on anal lobes, but preparations studied were very poor and it is possible that they occur over entire surface.
Anal ring apical, bent around abdominal apex, with 4 pairs of setae.
VENTER with lanceolate body setae moderate in length (largest seta on

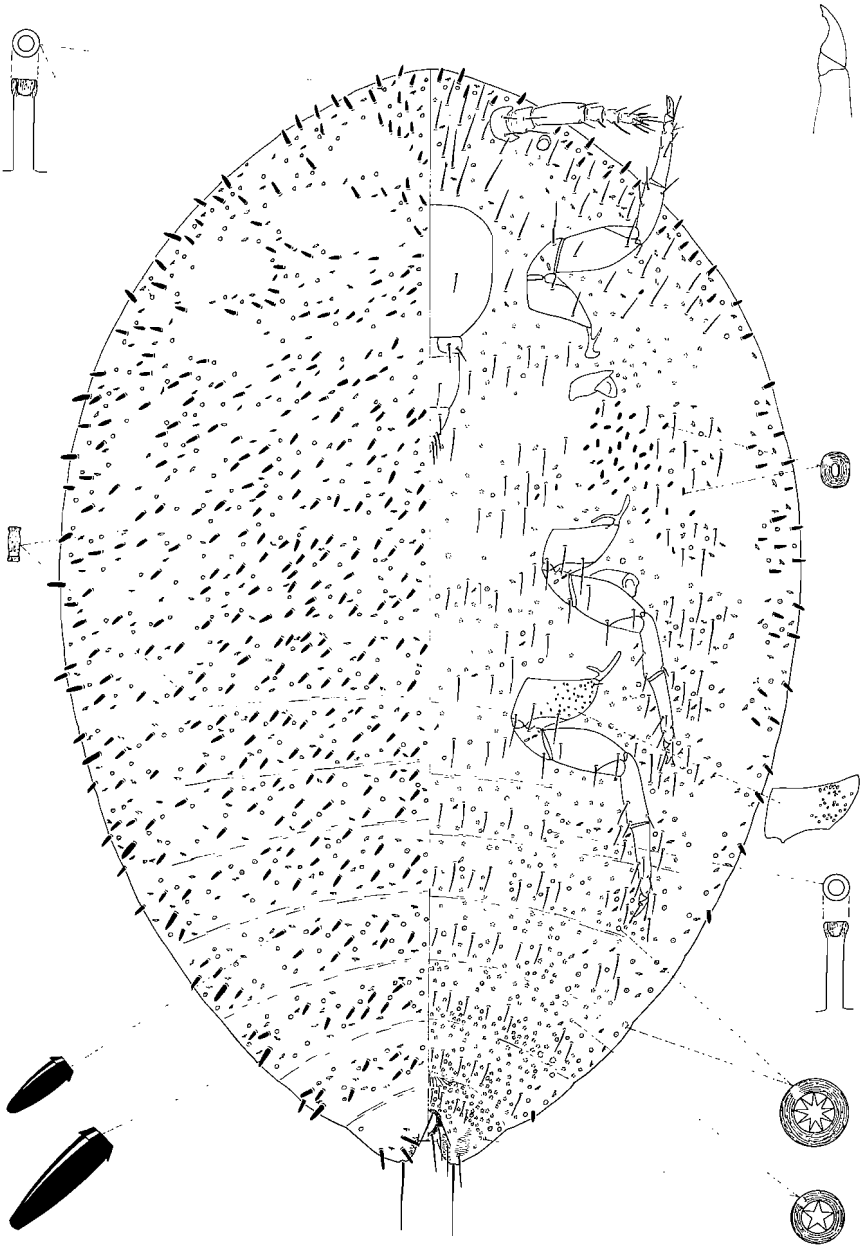


FIGURE 32. *Acanthococcus salarius* (Ferris). 15 miles N. Kramer Junction, California, XII-27-64, on *Atriplex* sp.

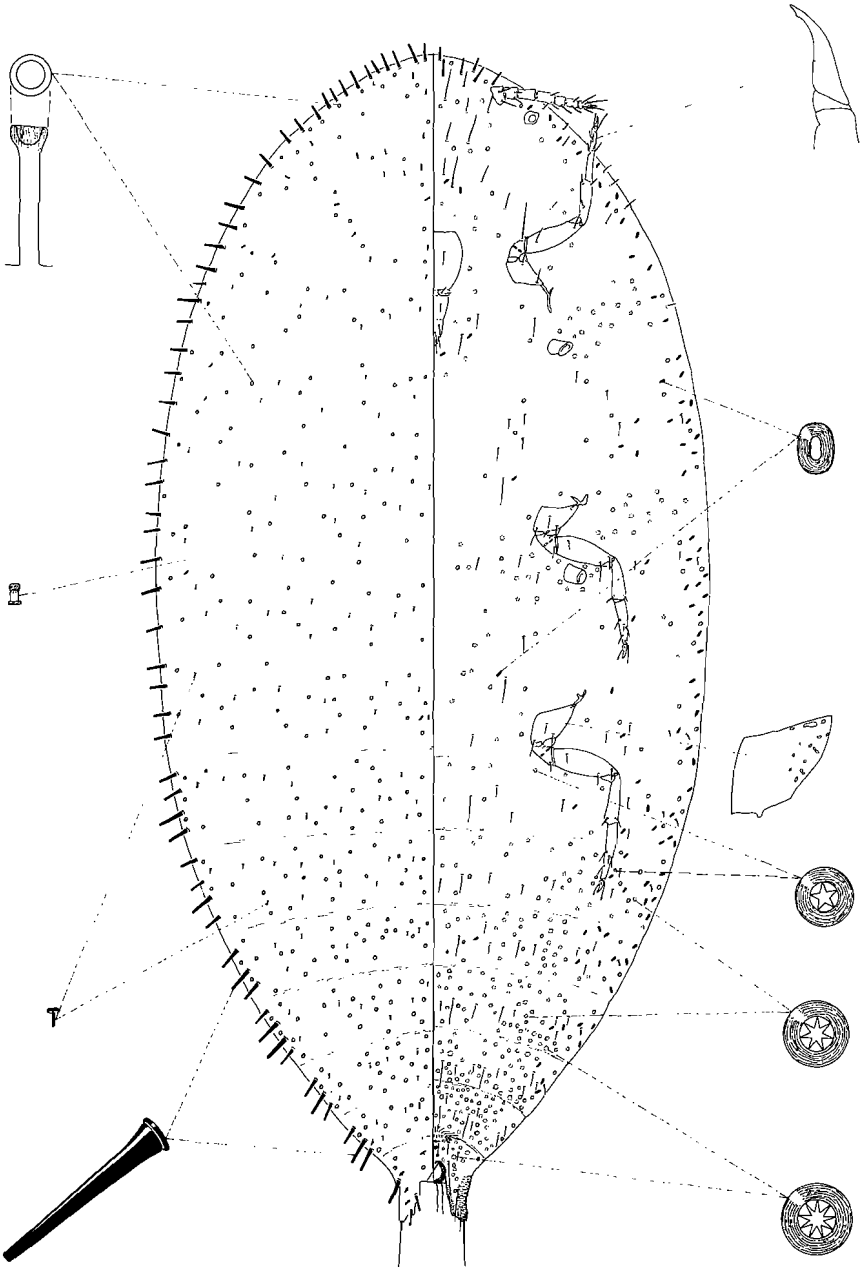


FIGURE 33. *Acanthococcus smithi* (Lobdell). Baton Rouge, Louisiana, V-3-21, on *Andropogon* sp.

abdominal segment VII from 25-38 μ long, on segment II from 28-53 μ), medial setae slender, apices acute. Enlarged setae absent except on apex of head. Macrotubular ducts of 1 kind: same as on dorsum scattered over surface. Microtubular ducts absent (?). Multilocular pores of 4 kinds: noneloculars present in small numbers, most numerous on sublateral areas of abdomen; septeloculars most numerous type multilocular pores, present over surface; quinqueloculars scattered over surface; triloculars rare or absent. Cruciform pores most abundant on lateral areas from abdominal segment VII or VI through head, also present medially in small numbers on anterior abdominal segments, thorax, and head.

Legs slender; hind coxae dorsally with 6-23 pores, absent on ventral surface; these pores absent on femora; hind 2 pairs of tibiae with 4 setae, front pair with 5; inner, apical, tibial setae slightly more robust than other leg setae; tarsi longer than tibiae (hind tibia/tarsus ratio from 0.74-0.84); claws with very small denticle near tip. Antennae 7-segmented, third or fourth segment longest. Segment 7 with 2 or 3 sensory setae; segment 6 with 1 slightly longer than single sensory seta on segment 5.

Notes.—Since all material examined was in poor condition, there may be a few inaccuracies in this discription.

Acanthococcus smithi closely resembles *A. hoyi*, but is distinguished in having many more septelocular pores than quinquelocular pores, only 4 setae on each of posterior legs, 3 or 4 setae on margin of each abdominal segment, and 7-segmented antennae; *A. hoyi* has many more quinquelocular pores than septelocular pores, 5 setae on each of posterior legs, 2 setae on each margin of each abdominal segment, and 6-segmented antennae.

Acanthococcus smithi also resembles *A. insignis*, but is distinguished in having relatively long lateral setae all with blunt apices, and 4 setae on each of hind tibiae; *A. insignis* has relatively short lateral setae some of which have rounded or acute apices and 5 setae on each tibia.

Specimens Examined.— FLORIDA, COUNTY (?): Indrio, IX-11-53, on "indetermined grass", G. B. Merrill (6 ad. fem. on 2 sl.) UCD; Everglades Park, IV-17-73, on *Distichlis* sp., R. Beshear (1 ad. fem.) USNM; Naples, IV-30-75, on "grass", S. Kitto (1 ad. fem.) USNM; Bluefield, X-6-80, on *Andropogon virginicus*, Cambell (7 ad. fem. on 4 sl.) USNM. ST. LEON Co.: Locality (?), X-19-73, J. E. Nickerson (2 ad. fem. on 2 sl.) USNM; Tall Timbers Res. St., V-12-1975, on *Andropogon virginicus*, R. F. Denno, D. R. Miller, and J. A. Davidson (18 ad. fem. on 8 sl.) USNM.

GEORGIA, CHATHAM Co.: Savannah, XII-9-44, on *Ammophilia* sp., Mallia (1 spm.) USNM.

LOUISIANA, EAST BATON ROUGE Co.: Baton Rouge, V-3-21, on *Andropogon* sp., W. Bradley (2 ad. fem.) UCD.

MISSISSIPPI, CHOCTAW Co.: Weir, IX-14-29, on "broom sedge" *Andropogon* sp., M. R. Smith (2 ad. fem. on 2 sl.) UCD. LAUDERDALE Co.: Meridian, XI-14-27, on *A. virginicus*, M. R. Smith (3 ad. fem. paratypes) USNM. NEWTON Co.: Decatur, VII-5-29, on *Andropogon* sp., M. R. Smith (1 ad. fem.) UCD.

PENNSYLVANIA, ERIE Co.: Presque Isle, VII-20-22, on *Ammophilia brevigulata*, F. M. Trimble (3 spm. on 2 sl.) USNM.

RHODE ISLAND, NEWPORT Co.: Newport, VIII-20-42, on *Andropogon virginicus*, H. S. McConnell (1 spm.) USNM.

SOUTH CAROLINA, COUNTY (?): Spartanburg, Date (?), on *Avena sativa*, G.

G. Ainslie (1 ad. fem.) USNM.

TEXAS, HARDEMAN Co.: near Quanah, Red River, date (?), on "grass", M. E. Hollinger (2 ad. fem.) UCD.

Host and Distribution.— Know only from Gramineae. Probably widespread throughout the east, occurring as far west as Texas.

Acanthococcus stauroporus Miller and Miller, n. sp.

Cruciform pore eriococcin

Fig. 34

Type Material.— Adult female holotype (smallest specimen on slide), with left label "*Acanthococcus stauroporus*, Miller and Miller Holotype TYPE paratype"; right label "7 mi. E. Lakeview, Lake Co., OREGON 3-VIII-1968 ex *Artemisia* sp. D. R. Miller and R. F. Denno" (UCD). The type slide contains 2 specimens. In addition to the holotype, there are 7 paratypes.

Field Features.— Body white; ovisac not observed.

Found under bark on the branches of plant host.

Recognition Characters.— Adult female holotype, mounted, 1.74 mm long (paratypes 1.32-2.03 mm long), 1.07 mm wide (paratypes 0.76-1.10 mm wide), lobes small, rounded, weakly sclerotized ventrally; each lobe dorsally with 3 enlarged setae (all approximately same size), with 3 microtubular ducts; each lobe ventrally with 3 body setae and 4 or 5 sessile pores.

DORSUM with enlarged setae of 1 size, although posterior setae are somewhat larger than those on other areas. Largest seta 28 μ long (paratypes 16-29 μ), smallest seta 12 μ long (paratypes 10-14 μ); longest seta 2.4 times longer than smallest seta (paratypes 1.5-2.1 times). All setae straight, with truncate apices; setal rings thin. Enlarged setae abundant — e.g., abdominal segment IV with 54 (paratypes with 70-126) — no longitudinal pattern present. Macrotubular ducts unusually small, scattered in small numbers over surface. Microtubular ducts moderate in length (8 μ long) (paratypes 7-9 μ), with area farthest from dermal orifices sclerotized and divided into 2 parts, apical portion rounded, smaller than remaining sclerotized portion; total sclerotized area slightly longer than unsclerotized portion; dermal orifice weakly sclerotized. Microtubular ducts abundant over surface. Cruciform pores present from anterior abdominal segments forward through head.

Anal ring ventral, with 3 pairs of setae.

VENTER with lanceolate body setae moderate in length (longest seta on abdominal segment VII 44 μ long (paratypes 37-44 μ), on segment II 44 μ long (paratypes 41-47 μ), medial setae apically acute. Enlarged setae present along lateral margins from abdominal segment VII or VI through head. Macrotubular ducts of same size as those on dorsum, scattered over surface. Microtubular ducts present along lateral margins. Multilocular sessile pores of 2 kinds: quinqueloculars scattered over abdomen, restricted to spiracular areas on thorax, absent on head; triloculars rare. Cruciform pores abundant, present along lateral margins of abdomen, numerous over entire ventral surfaces of thorax and head.

Legs small; hind coxae dorsally with 67 and 54 pores (paratypes with 21-64), ventrally with 36 and 24 (paratypes with 6-24); hind femora dorsally with 10 pores (paratypes with 3-7) ventrally with 1 and 2 pores (paratypes with 0-1); tibiae with

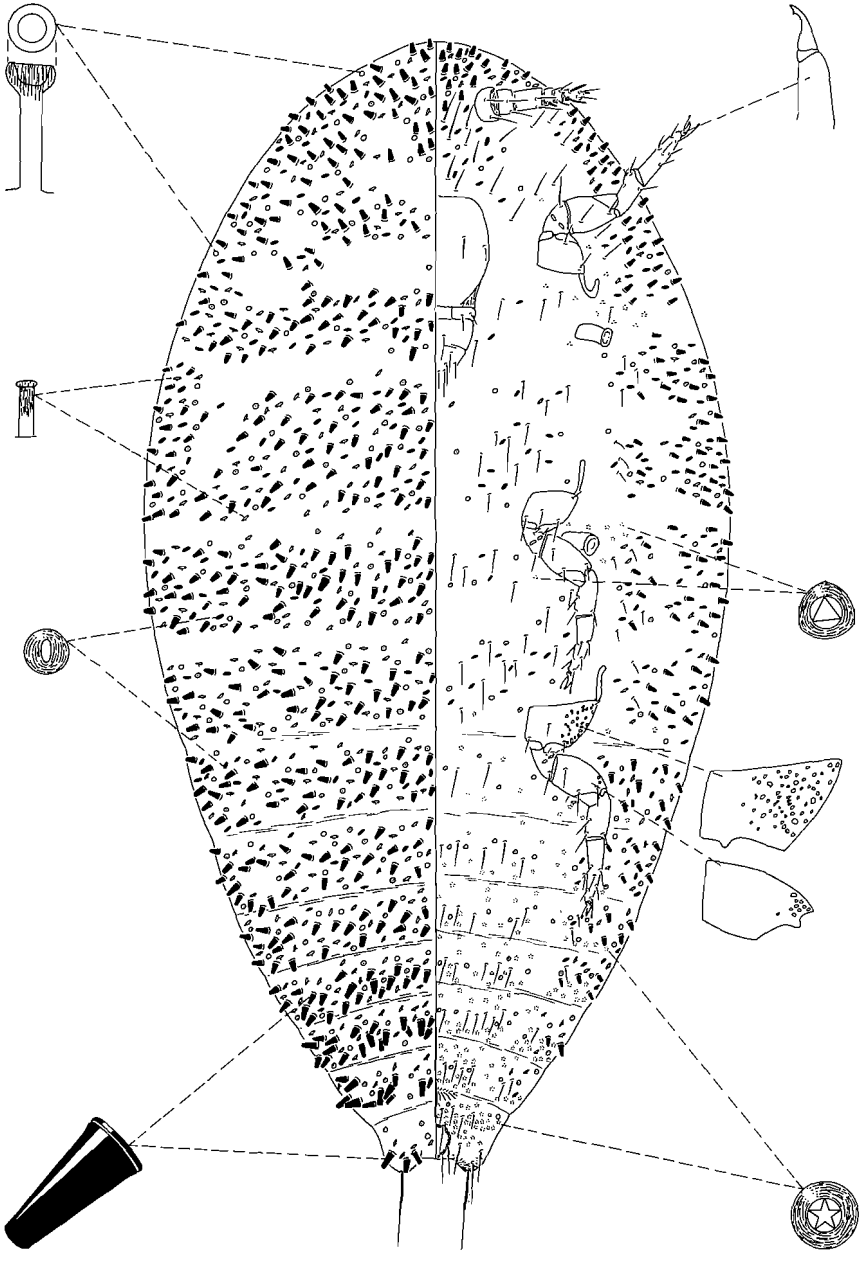


FIGURE 34. *Acanthococcus stauroporus* Miller and Miller, n. sp. 7 mi. E. Lakeview, Oregon, 3-VIII-68, ex *Artemisia* sp.

5 setae; inner, apical, tibial setae enlarged; tarsi longer than tibiae (hind tibia/tarsus ratio 0.81) (paratypes 0.82-1.00); claws with denticle near tip. Antennae 6-segmented, third segment longest. Segment 6 with 3 sensory setae, segment 5 with 1 longer and more slender than single sensory seta on segment 4.

Variation.— Within the type series there is a large amount of variation in the numbers of dorsal and ventral enlarged setae and in the lengths of these setae.

Notes.— *Acanthococcus stauroporus* is similar in appearance to members of *Oregmopyga* Hoy, but is considered an *Acanthococcus* species since it has no dorsal multilocular pores, enlarged setae that are much longer than wide, and 3 enlarged setae on each anal lobe. It is distinguished from all other western United States species of *Acanthococcus* by the presence of numerous dorsal cruciform pores.

Specific Epithet.— The name *stauroporus*, from the Greek stauros, meaning "cross", and poros, meaning "hole or passage", refers to the abundant cruciform pores present on the dorsum.

Specimens Examined.— ARIZONA, COCONINO Co.: South Rim of Grand Canyon, IX-24-67, on *Artemisia tridentata*, H. L. McKenzie (5 ad. fem. paratypes on 5 sl.) BM, CDA, UCD, USNM.

OREGON, LAKE Co.: 7 mi. E. Lakeview, VIII-3-68. on *Artemisia* sp., D. R. Miller and R. F. Denno (1 ad. fem. holotype, 2 ad. fem. paratypes on 2 sl.) UCD, VPI.

WASHINGTON, WHITMAN Co.: 3 mi. E. Wawawai, VIII-7-70, on *Artemisia* sp., D. R. Miller and L. S. Hawkins (2 ad. fem. on 2 sl.) USNM.

Host and Distribution.— Known only from the perimeter of the Great Basin on *Artemisia*.

Acanthococcus stellatus (McDaniel), n. comb.

Star eriococcin

Fig. 35

Eriococcus stellatus McDaniel, 1963:111.

Type Material.— The holotype adult female is labeled as follows: right label "*Eriococcus stellatus* Lubbock Co. Tex. April 27-1962 Ex. *Quercus stellata* B. McDaniel S. McDaniel coll." left label "*Eriococcus stellatus* McDaniel Holotype female" (UCD). In addition, there are 5 paratypes (1 not seen).

Field Features.— According to original description this species was found on the rough bark beneath the scale covers of *Melanaspis obscura* (Comstock). *Acanthococcus stellatus* "was enclosed within a complete sac of felted waxen threads. This sac was oval in shape, giving the appearance of a small round ball, with the entire ventral portion of the insect exposed when removed from its host." (McDaniel 1963).

The Virginia infestation was found on exposed oak roots.

Recognition Characters.— Mounted, 1.20-2.90 mm long, 0.70-2.10 mm wide.

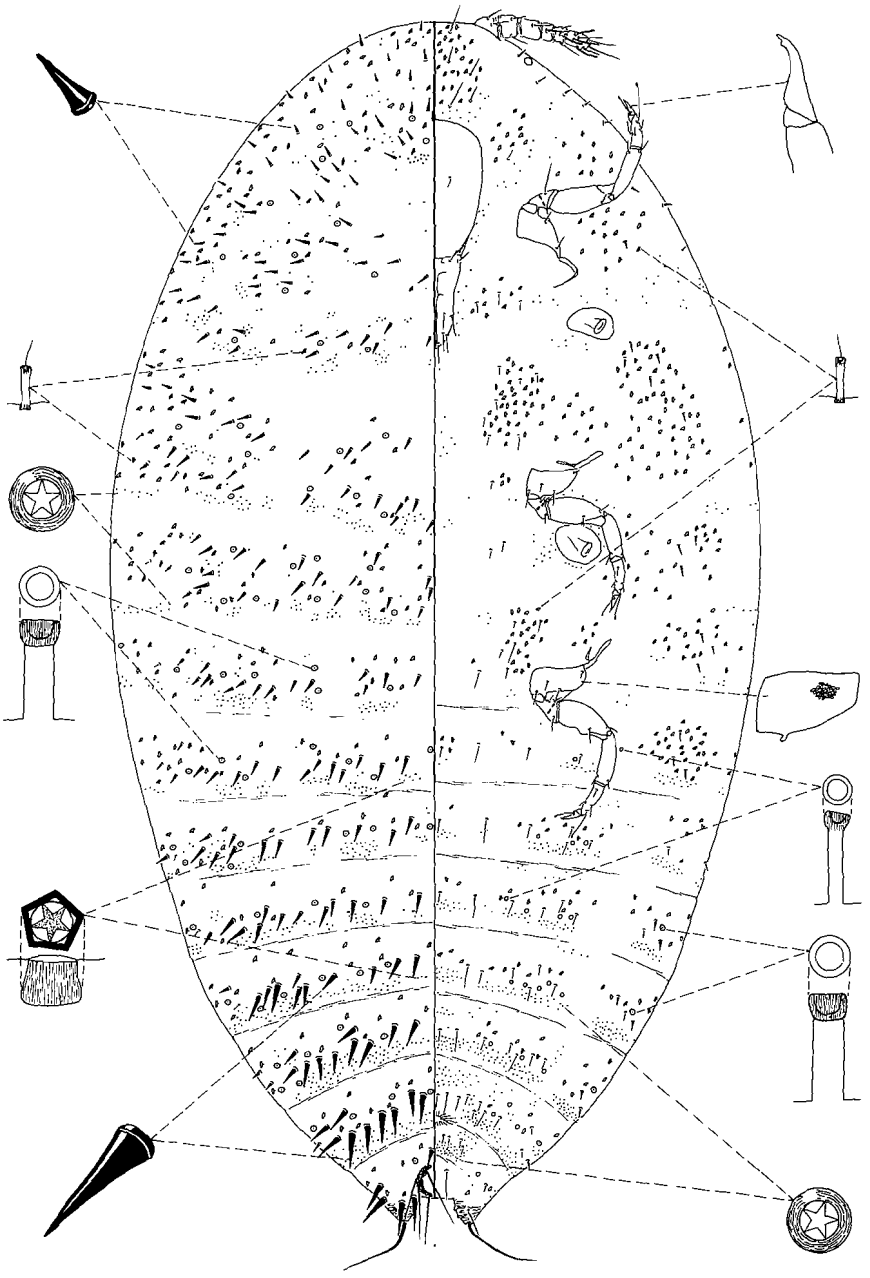


FIGURE 35. *Acanthococcus stellatus* (McDaniel). Charlottesville, Virginia, X-17-46, on exposed oak roots.

Anal lobes small, slightly protruding, with weakly indicated teeth on mesal margin, normally heavily sclerotized, some specimens with sclerotization limited to marginal areas of lobes; each lobe dorsally with 4 enlarged setae (normally anterolateral seta smallest, others equal, rarely all 4 setae equal) with 2-4 microtubular ducts; each lobe ventrally with 2 body setae and no sessile pores. Body either oval or rotund.

DORSUM with enlarged setae present from abdominal segments VIII or VII through head, of 1 variable size becoming smaller anteriorly. Largest seta 40-53 μ long, smallest seta 12-18 μ. Setae straight or slightly curved with acute apices; setal rings thin. Enlarged setae in moderate numbers — e.g., abdominal segment IV with 25-35 — showing no longitudinal pattern. Macrotubular ducts of 1 kind, unusually large, scattered over entire surface. Microtubular ducts moderate in length (6-9 μ long), with area farthest from dermal orifice sclerotized and undivided; total sclerotized area 1/2-1/4 as long as unsclerotized area; dermal orifice often bifurcate and lightly sclerotized. Microtubular ducts scattered over surface, most abundant on lateral areas of anterior thorax and head. Multilocular sessile pores restricted to lateral areas, of quinquelocular type only. Multilocular "tubular" pores approximately 5 μ long, abundant, present in large clusters over surface, most abundant on posterior abdominal segments, normally of quinquelocular type only, rarely with 2 or 3 triloculars. Cruciform pores absent.

Anal ring apical, with 3 or 4 pairs of setae.

VENTER with lanceolate body setae moderate in length (longest seta on abdominal segment VII varying from 24-33 μ long, on segment I from 20-35 μ); medial setae apically acute. Small sized enlarged setae present along body margin. Macrotubular ducts restricted to abdomen, of 2 sizes: larger size same size and shape as on dorsum, normally with 1 duct present near each lateral margin of abdominal segments VIII through V, IV, or III; smaller size present on medial and sublateral areas, most abundant, scattered over abdomen, present in large clusters on thorax and head. Multilocular sessile pores of 1, 2, or 3 kinds: hexaloculars and triloculars normally absent; quinqueloculars abundant over surface, most abundant on posterior abdominal segments, normally present in large clusters. Cruciform pores absent.

Legs with hind coxae dorsally with characteristic tight cluster of translucent pores composed of 11-29 pores, pores sometimes fused, absent ventrally; hind femora on 1 out of 10 specimens possess 5 small pores on dorsal surface, absent ventrally; tibiae normally with 2 or 3 pores near proximal end on dorsal surface; tibia normally with 4 setae, rarely hind tibiae with 5; inner, apical, tibial setae unenlarged; tarsi shorter than tibiae (hind tibiae/tarsus ratio 1.26-1.57); claws with denticle near tip. Antennae 6-segmented, third segment longest and sometimes showing sign of division. Apical segment with 3, 4, or 5 sensory setae; segment 5 with 1 slightly longer than single sensory seta on segment 4.

Notes.— The specimen referred to by McDaniel (1963) as a "nymphal stage" has been examined and is a newly molted adult female.

Acanthococcus stellatus is distinct from all other species of *Acanthococcus* in having tubular dorsal quinquelocular pores, tarsi conspicuously shorter than tibiae, and no cruciform pores.

Specimens Examined.— TEXAS, LUBBOCK Co.: Along Highway 82, IV-27-62, on *Quercus stellata*, B. and S. McDaniel (1 ad .fem. holotype, 4 ad. fem. paratypes on

3 sl.) UCD, USNM.

VIRGINIA, INDEPENDENT CITY: Charlottesville, X-17-47, or "oak", D. W. Clancy (8 ad. fem.) USNM.

Host and Distribution.— Probably occurring only on *Quercus* in warm areas east of the Rocky Mountains.

Acanthococcus texanus (King), n. comb.

Texas eriococcin

Fig. 36

Eriococcus texanus King, 1902:286.
Eriococcus bahiae Ehrhorn, 1906:330 (new synonymy).
Nidularia texana (King), Lindinger, 1933:117.
Nidularia bahiae (Ehrhorn), Lindinger, 1933:108.
Rhizococcus texanus (King), Hoy, 1963:119.

The following specimens have been examined and, although recorded as E. bahiae or E. texanus in the literature, they are not *A. texanus*: MEXICO, SOUTHERN BAJA CALIFORNIA: La Paz, VI-(?)-19, on *Dalea emoryi*, G. F. Ferris; Punta Palmilla, San Jose del Cabo, VII-(?)-19, on *Porophyllum gracile*, G. F. Ferris; San Antonio, VII-14-19, on "mimosaceous shrub", G. F. Ferris; San Pedro, VII-(?)-19, on *Chamaesyce* sp. G. F. Ferris; Todos Santos, VIII-(?)-19, on *Dalea emoryi*, G. F. Ferris.

ARIZONA, GRAHAM Co.: near Safford, Graham Mountains, V-25-34, on *Thurberia thespesioides* (=*Gossypium thurberi*), S. D. Smith.

CALIFORNIA, INYO Co.: Big Pine, Owens Valley, VII-(?)-18, on *Eriogonum* sp., G. F. Ferris. SANTA CLARA Co.: near Stanford University, I-3-17, on "grass", G. F. Ferris.

NEW MEXICO. DONA ANA Co.: Mesa W. Las Cruces, VI-29-18 on *Gutierrezia* sp., G. F. Ferris.

TEXAS, BREWSTER Co.: Chisos Mountains, 1921, on *Gymnoloma tenuifolia* collector (?).

FRANCE: Ile de Poraque, 1913, on *Crithmum maritimum*, collector (?).

Type Material.— Through the courtesy of Ms. Marion E. Smith, University of Massachusetts, we have been able to examine a slide labeled "*Eriococcus texanus* King Type 1902" (University of Massachusetts). From the 3 adult female syntypes on the slide we have chosen and marked as lectotype the specimen on the left, farthest from the old label. The remaining 2 specimens are paralectotypes.

Recognition Characters.— Adult female, mounted, 1.89-4.47 mm long, 1.11-3.22 mm wide. Anal lobes protruding, weakly sclerotized on dorsum only; each lobe dorsally with 3 enlarged setae (relative lengths highly variable) with 1-3 microtubular ducts; each lobe ventrally with 3 or 4 slender body setae and 1-11 sessile pores.

DORSUM with enlarged setae of 2 sizes: larger setae present along body margin; small setae on medial and sublateral areas. Largest lateral seta 34-68 μ long, largest small seta on abdomen 12-29 μ; on abdominal segments VII through II longest lateral seta 1.8-3.2 times longer than longest sublateral or medial seta. Lateral setae variable, normally straight, with rounded apice but slightly curved; small setae curved, with rounded apices, becoming, increasingly longer on anterior

UCD; X-14-16, on *E. confertiflorum*, R. E. and G. F. Ferris (2 ad. fem. on 2 sl.) USNM; Mount Hamilton, Lick Observatory, VI-22-65, on *E. confertiflorum*, D. R. Miller (2 ad. fem. on 2 sl.) UCD; Palo Alto, Corte Madera Creek, X-3O-16, on *Fragaria* sp., R. W. Doane (2 ad. fem. on 2 sl.) USNM; Sweeney Ridge, 1 mi. S. County Jail, VII-4-64, on "chaparral", D. J. Price (2 ad. fem. on 2 sl.) UCD. SIERRA Co.: 5 mi. S. Sierraville, IX-22-65, on *Ceanothus prostratus*, A. A. Millecan (5 ad. fem. on 5 sl.) CDA. SISKIYOU Co.: 2 mi. N. Mount Shasta, XI-9-65, on *C. prostratus*, T. R. Haig (2 ad. fem. on 2 sl.) CDA.

IDAHO, BEAR LAKE Co.: 7 mi. NW. Liberty, VIII-3-67, on *Symphoricarpos* sp., D. R. Miller and D. S. Horning (4 ad. fem. on 2 sl.) UCD. BINGHAM Co.: 20 mi. SW. Idaho Falls, VIII-14-66, on *Pteryxia* sp., D. R. Miller (6 ad. fem. on 4 sl.) UCD. BUTTE Co.: Craters of the Moon, near headquarters, VIII-8-67, on *P. terebinthina*, D. R. Miller and D. S. Horning (5 ad. fem. on 3 sl.) CDA, UCD.

MONTANA, MADISON Co.: 7 mi. S. Ennis, VIII-22-64, on *Chrysothamnus* sp., D. R. and J. F. Miller (2 ad. fem. on 2 sl.) UCD. MISSOULA Co.: Missoula, Greenough Park, date (?), on (?), R. A. Cooley (3 ad. fem.) USNM.

NEVADA, LANDER Co.: Kingston Recreation Area, VII-9-68, on *Symphoricarpos* sp., D. R. Miller and R. F. Denno (3 ad. fem. on 2 sl.) UCD.

OREGON, JOSEPHINE Co.: Cave Junction, VIII-8-41, on (?), J. Shuh (15 ad. fem. on 5 sl.) CDA, UCD, USNM. WALLOWA Co.: 15 mi. N. Enterprise, VIII-6-70, on Cruciferae, D. R. Miller (6 ad. fem. on 3 sl.) USNM; on *Vacccinium* sp., D. R. Miller (6 ad. fem. on 3 sl.) USNM.

TEXAS, TOM GREEN Co.: San Angelo, III-(?)-O2, in "nests of *Crematogaster punctulata* on young roots or shoots", W. M. Wheeler (1 ad. fem. lectotype, 2 ad. fem. paralectotypes on 1 sl.) Univ. of Mass.

WASHINGTON, CHELAN Co.: Blewett, VII-3-66, on *Symphoricarpos* sp., S. Nakahara (14 ad. fem. on 6 sl.) UCD.

Hosts and Distribution.—Known from a diverse range of plant genera: *Ceanothus, Chrysothamnus, Eriogonum, Eriophyllum, Fragaria, Lygodesmia, Pinus, Pteryxia, Quercus, Symphoricarpos.*

This species primarily infests the cool winter areas of the northwestern United States, although the type is from Texas.

Acanthococcus tinsleyi (Cockerell)

Tinsley eriococcin
Fig. 37

This species was described in a recent paper on the *Acanthococcus* species that occur in the United States on *Atriplex*, and will not be redescribed here (see Miller 1991).

Acanthococcus washingtonensis Miller and Miller, n. sp.

Washington eriococcin
Fig. 38

Type Material.— Adult female holotype (specimen on left of cover slip nearest old label) with left label "*Eriococcus* On *Agropyron spicatum* Chattaroy, Washington June 28, 1954 Dr. Telford colr. 54 1134"; right label "*Acanthococcus washingtonensis* Miller and Miller Holotype TYPE Paratypes PARATYPE" (USNM). There are 5

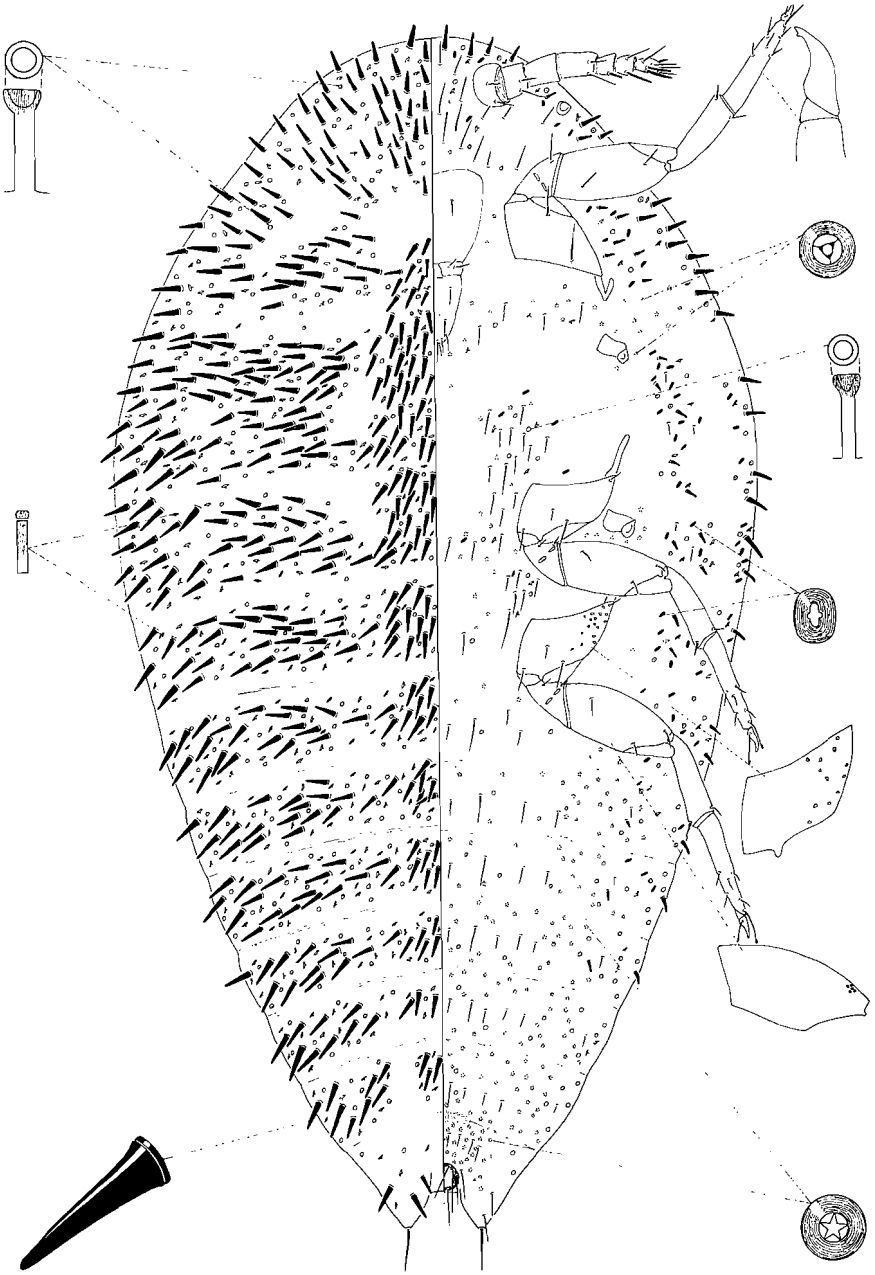


FIGURE 37. *Acanthococcus* tinsleyi (Cockerell). New Mexico, quarantined at Blythe, California, X-25-60, on *Atriplex* sp.

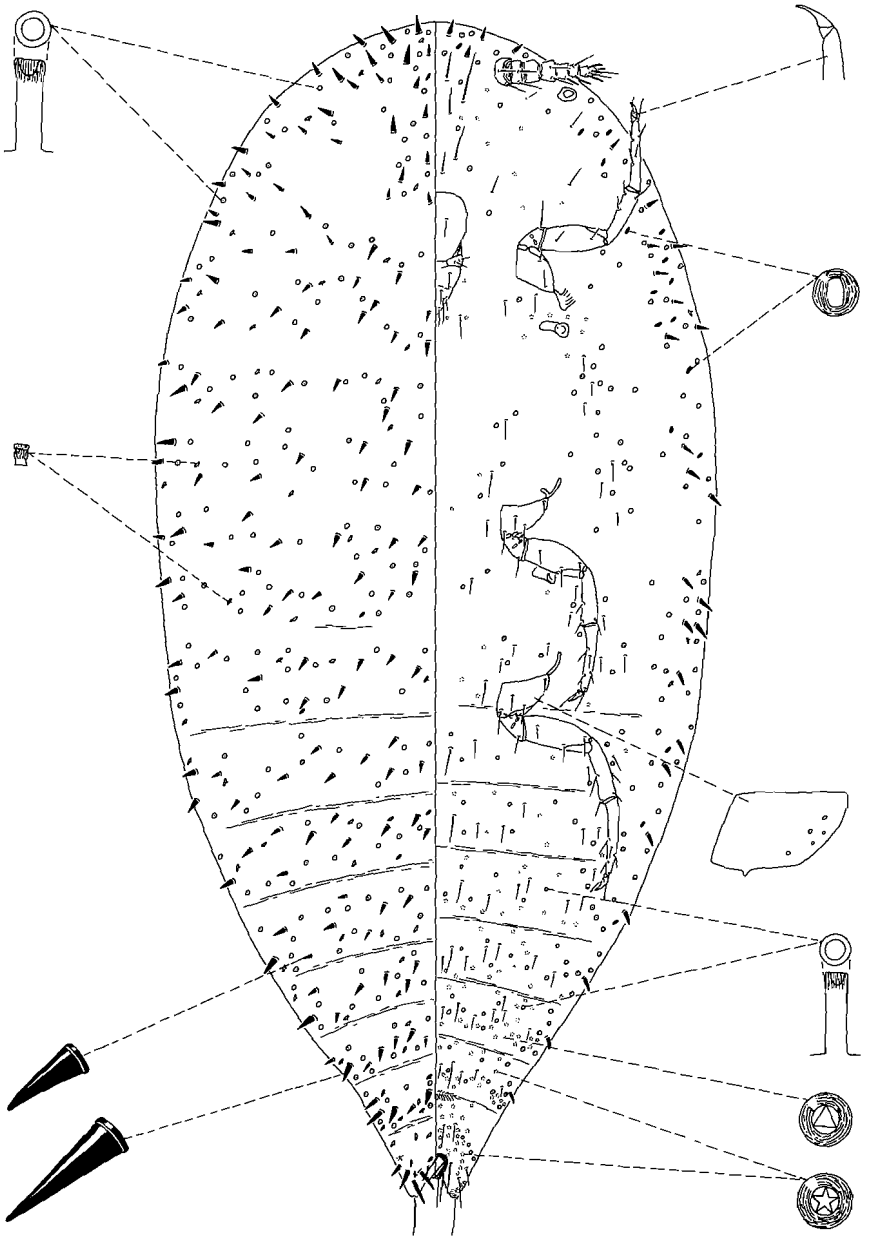


Fig. 38. *Acanthococcus washingtonensis* Miller and Miller, n. sp. Chattaroy, Washington, VI-28-54, on *Agropyron spicatum*.

specimens on the type slide. In addition to the holotype, there are 7 paratypes.

Field Features.— No available information.

Recognition Characters.— Adult female holotype, mounted, 2.21 mm long, 0.97 mm wide (paratypes 1.64-2.36 mm long, 0.70-0.99 mm wide). Anal lobes protruding, acute, weakly sclerotized ventrally, each lobe dorsally with 4 slender enlarged setae (anteromedial and posteromedial setae longest and approximately equal, anterolateral seta shortest, posterolateral seta intermediate in length, but most robust), with 2 microtubular ducts; each lobe ventrally with 3 body setae and 2 sessile pores.

DORSUM with enlarged setae of 1 size: although there are 2 indistinct types, they intergrade. Largest seta 41 μ long (paratypes 31-37 μ), smallest seta 18 μ long (paratypes 17-19 μ); longest seta 2.2 times longer than smallest seta (paratypes 1.9-2.4 times). Most setae slightly curved with rounded apices, largest setae sometimes straight; setal rings thin. Enlarged setae in small numbers — e.g., abdominal segment IV with 17 (paratypes with 14-16) — larger setae with weak indication of 6 longitudinal lines (medial, sublateral, lateral). Macrotubular ducts in small numbers over surface. Microtubular ducts short (5 μ long) (paratypes 4-5 μ), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, approximately 1/2 length of remaining sclerotized portion; total sclerotized area longer than unsclerotized portion; dermal orifice unsclerotized. Microtubular ducts unusually uncommon.

Anal ring ventral, with 4 pairs of setae.

VENTER with lanceolate body setae elongate (longest seta on abdominal segment VII 31 μ long (paratypes 28-34 μ), on segment II 32 μ (paratypes 32-37 μ)), medial setae apically acute. Enlarged setae present along lateral margins from abdominal segment VII through head. Macrotubular ducts of 2 kinds: larger size present along lateral margins on abdomen, and thorax and head; smaller size present on medial areas of abdomen and posterior portions of thorax. Microtubular ducts unusually rare, restricted to lateral margins of thorax. Multilocular sessile pores of 2 kinds: quinqueloculars abundant, scattered over surface; triloculars rare, present on abdomen. Cruciform pores present from anterior abdominal segments through head.

Legs with hind coxae dorsally with 5 and 4 pores (paratypes with 3-12), absent ventrally; hind femora dorsally with 1 and 0 pores (paratypes with 0-1), absent ventrally; tibiae each with 5 setae; inner, apical, tibial setae unenlarged; tarsi longer than tibiae (hind tibia/tarsus ratio 0.76) (paratypes 0.75-0.89); claws with denticle absent. Antennae 7-segmented, third and fourth segments longest. Segment 7 with 3 sensory setae; segment 6 with 1 longer than single sensory seta on segment 5.

Variation.— The paratypes differ from the holotype by sometimes having the anal ring on dorsum; 6-segmented antennae.

Notes.— *Acanthococcus washingtonensis* is similar in appearance to *Acanthococcus carolinae* (Williams) but is distinguished by 4 setae on each anal lobe; *A. carolinae* has 3 setae on each anal lobe.

For an additional comparison see "Notes" under *A. diaboli*.

Specific Epithet.— The name *washingtonensis* refers to the state of Washington where this species was first collected.

Specimens Examined.— IDAHO, IDAHO Co.: Middle Fork Salmon River, X-8-70, on Stipa comata, J. L. Hougaard (10 ad. fem. on 3 sl.) USNM.

WASHINGTON, SPOKANE Co.: Chattaroy, VI-28-54, on *Agropyron spicatum*, Telford (1 ad. fem. holotype, 4 ad. paratypes) USNM. WHITMAN Co.: Pullman, VI-3O-49, on *A. inermis* (=*spicatum* ?), D. Brannon (3 ad. fem. paratypes) USNM.

Hosts and Distribution.— Known from Idaho and Washington on *Agropyron* and *Stipa*.

Acanthococcus whiteheadi Miller

Whitehead eriococcin

Fig. 39

This species was described in a recent paper on the *Acanthococcus* species that occur in the United States on *Atriplex*, and will not be redescribed here (see Miller 1991).

CHROMOSOME NUMBERS

Chromosome numbers were determined for 8 species of *Acanthococcus* in the western U.S. They are as follows:

1. *Acanthococcus araucariae* — San Francisco, Golden Gate Park, San Francisco Co., Calif., IX-21-68, on *Araucaria excelsa*. 2n=16 (see also notes for *A. araucariae*).
2. *Acanthococcus cryptus* — 5 mi. S. Glenwood, Catron Co., New Mexico, IX-6-68, on *Gutierrezia* sp. 2n=16.
3. *Acanthococcus dubius*— 5 mi. E. El Toro, Orange Co., Calif., VIII-24-68, on *Stephanomeria* sp. 2n=16.
4. *Acanthococcus epacrotrichus* — 12 mi. NE. Olene, Klamath Co., Oregon, VIII-2-68, on *Artemisia* sp. 2n=16; 1 mi. N. Valley Falls, Lake Co., Oregon, VIII-4-68, on *A. tridentata* 2n=16.
5. *Acanthococcus eriogoni* — 5 mi. S. Wabuska, Lyon Co., Nevada, VII-5-68, on *Eurotia lanata* 2n=16.
6. *Acanthococcus larreae* — 20 mi. S. Alamo, Lincoln Co., Nevada, VIII-31-68, on *Larrea* sp. 2n=16.
7. *Acanthococcus quercus* — Putah Canyon, Yolo Co., Calif., several collections made during spring, summer, and fall 1968, On *Quercus* sp. 2n=18.
8. *Acanthococcus texanus* — Kingston Recreation Area, Lander Co., Nevada, VII-9-68, on *Symphoricarpos* sp. 2n=16.

CONCLUSIONS

One complex of species is not resolved to our satisfaction. The group includes *A. dubius*, *A. eriogoni*, and *A. euphorbiae*. It appears that these species and their possible siblings are in the process of speciation in the western U.S. In several instances differences in external appearance of body color, ovisac shape, and ovisac color have been noticed, but consistent morphological characters have not been discovered. Unfortunately, this group includes the most abundant species in the

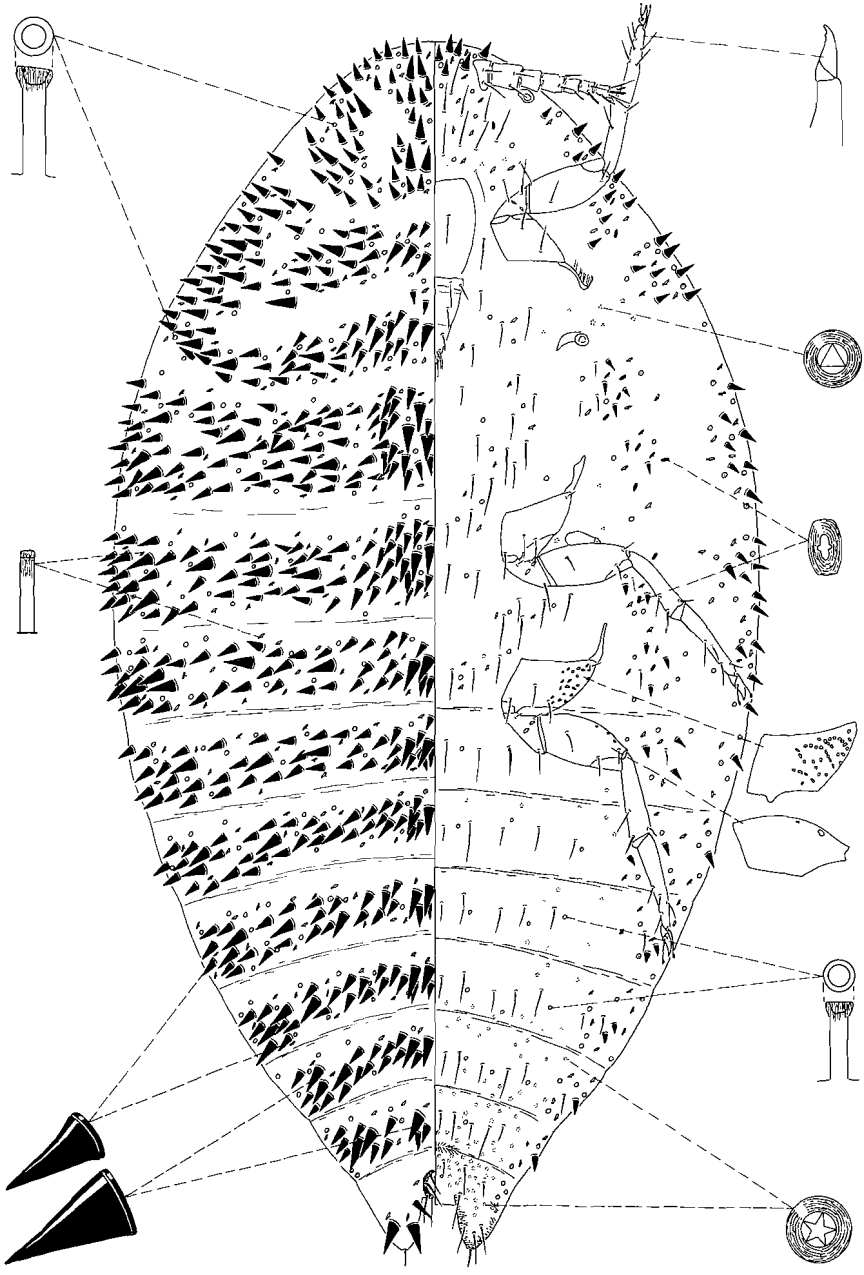


FIGURE 39. *Acanthococcus whiteheadi* Miller. 8 miles E. Hawthorne, Nevada, VII-68, on *Atriplex* sp.

western U.S. and therefore leaves a major component of the *Acanthococcus* fauna unresolved. The key to adult females deals with as much variation as possible, but does so by allowing these species to be diagnosed in several areas of the key. Clearly, this complex of species is a likely candidate for analysis using molecular character systems.

The chromosome numbers presented in this paper are consistent with those presented by Brown (1967) and Nur (1967) for other species. Of the 15 species of *Acanthococcus* recorded by Brown from areas other than North America, only 3 had a chromosome number of 2n=16; of the remaining 12 species, 2 had 2n=14, and 10 had 2n=18. In the western U.S., all of the species examined had 2n=16 except *A. quercus* which possesses 2n=18.

HOST PLANTS OF *ACANTHOCOCCUS* IN THE WESTERN UNITED STATES

ACACIA GREGGII A. Gray
Acanthococcus dubius (Cockerell)
ACACIA CONSTRICTA PAUCISPINA Woot. & Standl.
Acanthococcus dubius (Cockerell)
ACER SP.
Acanthococcus azaleae (Comstock)
ADENOSTOMA SP.
Acanthococcus adenostomae (Ehrhorn)
ADENENOSTOMA FASCICULATUM Hook. & Arn.
Acanthococcus adenostomae (Ehrhorn)
AGOSERIS GRANDIFLORA (Nutt.) Greene
Acanthococcus dubius (Cockerell)
AGROPYRON INERME (Scribn. & J. G. Sm.) Rydb.
Acanthococcus washingtonensis Miller & Miller
AGROPYRON REPENS Beauv.
Acanthococcus insignus (Newstead)
AGROPYRON SPICATUM (Pursh) Scribn. & J. G. Sm.
Acanthococcus washingtonensis Miller & Miller
AMBROSIA SP.
Acanthococcus dubius (Cockerell)
AMBROSIA ARTEMISIIFOLIA L.
Acanthococcus dubius (Cockerell)
AMMOPHILIA SP.
Acanthococcus smithi (Lobdell)
AMMOPHILIA BREVILIGULATA Fern.
Acanthococcus smithi (Lobdell)
AMPHIACHYRIS DRACUNCULOIDES (DC) Nutt.
Acanthococcus cryptus (Cockerell)
ANANAS SP.
Acanthococcus coccineus (Cockerell)
ANDROPOGON SP.
Acanthococcus kemptoni (Parrott)
Acanthococcus smithi (Lobdell)
ANDROPOGON SCOPARIUS Michx.
Acanthococcus kemptoni (Parrott)

ANDROPOGON VIRGINICUS L.
Acanthococcus kemptoni (Parrott)
Acanthococcus smithi (Lobdell)
ARAUCARIA SP.
Acanthococcus araucariae (Maskell)
ARAUCARIA BIDWILLI Hook.
Acanthococcus araucariae (Maskell)
ARAUCARIA COLUMNARIS (G. Forst.) Hook.
Acanthococcus araucariae (Maskell)
ARCTOSTAPHYLOS SP.
Acanthococcus arctostaphyli (Ferris)
Acanthococcus dubius (Cockerell)
ARCTOSTAPHYLOS CANESCENS Eastw.
Acanthococcus macrobactrus Miller & Miller
ARTEMISIA SP.
Acanthococcus epacrotrichus Miller & Miller
Acanthococcus stauroporus Miller & Miller
ARTEMISIA ARBUSCULA Nutt.
Acanthococcus epacrotrichus Miller & Miller
ARTEMISIA CALIFORNICA Less.
Acanthococcus dubius (Cockerell)
Acanthococcus epacrotrichus Miller & Miller
ARTEMISIA TRIDENTATA Nutt.
Acanthococcus epacrotrichus Miller & Miller
Acanthococcus stauroporus Miller & Miller
ARTEMISIA PYCNOCEPHALA DC
Acanthococcus euphorbiae (Ferris)
ASCLEPIAS CURASSAVICA L.
Acanthococcus dubius (Cockerell)
ATRIPLEX SP.
Acanthococcus arenosus (Cockerell)
Acanthococcus barri Miller
Acanthococcus cryptus (Cockerell)
Acanthococcus eriogoni (Ehrhorn)
Acanthococcus froebeae Miller
Acanthococcus salarius (Ferris)
Acanthococcus tinsleyi (Cockerell)
Acanthococcus whiteheadi Miller
ATRIPLEX CANESCENS (Pursh) Nutt.
Acanthococcus arenosus (Cockerell)
Acanthococcus barri Miller
Acanthococcus euphorbiae (Ferris)
Acanthococcus tinsleyi (Cockerell)
ATRIPLEX CONFERTIFOLIA Torr. & Frem.
Acanthococcus barri Miller
AVENA SATIVA L.
Acanthococcus smithi (Lobdell)
BACCHARIS SP.
Acanthococcus dubius (Cockerell)

BASSIA HYSSOPIFOLIA (Pall.) Kuntze
Acanthococcus arenosus (Cockerell)
BETULA SP.
Acanthococcus dubius (Cockerell)
BOUTELOUA SP.
Acanthococcus hoyi Miller & Miller
Acanthococcus nudulus (Ferris)
Acanthococcus quercus (Comstock)
BOUTELOUA CURTIPENDULA (Michx.) Torr.
Acanthococcus hoyi Miller & Miller
CALLIANDRA SP.
Acanthococcus dubius (Cockerell)
CELTIS SP.
Acanthococcus azaleae (Comstock)
CEANOTHUS PROSTRATUS Benth.
Acanthococcus texanus (King)
CERATOIDES LANTANA (Pursh) J. T. Howell
Acanthococcus eriogoni (Ehrhorn)
CEREUS SP.
Acanthococcus coccineus (Cockerell)
CEREUS PERUVIANUS (L.) Mill.
Acanthococcus coccineus (Cockerell)
CITRUS SP.
Acanthococcus dubius (Cockerell)
CROTALARIA PUMILA Ortega
Acanthococcus dubius (Cockerell)
CROTON SP.
Acanthococcus eriogoni (Ehrhorn)
CHRYSOTHAMNUS SP.
Acanthococcus euphorbiae (Ferris)
Acanthococcus texanus (King)
Acanthococcus tinsleyi (Cockerell)
CHRYSOTHAMNUS VISCIDIFLORUS (Hook.) Nutt.
Acanthococcus euphorbiae (Ferris)
COPROSMA SP.
Acanthococcus pittospori (Ferris)
DIPLACUS SP.
Acanthococcus dubius (Cockerell)
DISTICHLIS SP.
Acanthococcus smithi (Lobdell)
DUDLEYA SP.
Acanthococcus coccineus (Cockerell)
ECHINOCACTUS SP.
Acanthococcus coccineus (Cockerell)
ECHINOCACTUS ORCUTTII Engelm.
Acanthococcus coccineus (Cockerell)
ECHINOCACTUS UNCINATUS Gal.
Acanthococcus coccineus (Cockerell)
ECHINOCACTUS SETISPINUS Engelm.
Acanthococcus coccineus (Cockerell)

ECHINOCERUS SP.
Acanthococcus coccineus (Cockerell)
ECHINOPSIS SP.
Acanthococcus coccineus (Cockerell)
Acanthococcus eriogoni (Ehrhorn)
EPHEDRA CALIFORNICA Wats.
Acanthococcus eriogoni (Ehrhorn)
ERIOGONUM SP.
Acanthococcus dubius (Cockerell)
Acanthococcus eriogoni (Ehrhorn)
Acanthococcus euphorbiae (Ferris)
Acanthococcus texanus (King)
ERIOGONUM DEFLEXUM Torr.
Acanthococcus eriogoni (Ehrhorn)
ERIOGONUM FASCICULATUM Benth.
Acanthococcus dubius (Cockerell)
ERIOGONUM HERACLEOIDES Nutt.
Acanthococcus euphorbiae (Ferris)
ERIOGONUM INFLATUM Torr. & Frem.
Acanthococcus eriogoni (Ehrhorn)
ERIOGNUM LATIFOLIUM Sm.
Acanthococcus dubius (Cockerell)
ERIOGONUM LATIFOLIUM Sm ssp. SAXICOLA (Heller) S. Stokes
Acanthococcus mackenziei Miller & Miller
ERIOGONUM UMBELLATUM Torr. ssp. POLYANTHUM (Benth.) S. Stokes
Acanthococcus mackenziei Miller & Miller
ERIOGONUM WRIGHTII Torr.
Acanthococcus dubius (Cockerell)
Acanthococcus eriogoni (Ehrhorn)
ERIOPHYLLUM AMBIGUUM (A. Gray) A. Gray
Acanthococcus dubius (Cockerell)
ERIOPHYLLUM CONFERTIFLORUM DC
Acanthococcus dubius (Cockerell)
Acanthococcus texanus (King)
EUPHORBIA SP.
Acanthococcus coccineus (Cockerell)
Acanthococcus dubius (Cockerell)
Acanthococcus eriogoni (Ehrhorn)
Acanthococcus euphorbiae (Ferris)
EUPHORBIA ALBOMARGINATA Torr. & A. Gray
Acanthococcus euphorbiae (Ferris)
EUPHORBIA POLYCARPA Benth.
Acanthococcus euphorbiae (Ferris)
EUROTIA LANATA (Pursch) Moq.
Acanthococcus eriogoni (Ehrhorn)
Acanthococcus gerbergi (McDaniel)
FRAGARIA SP.
Acanthococcus texanus (King)
FRANSERIA SP.
Acanthococcus dubius (Cockerell)

Acanthococcus froebeae Miller
FRAXINUS SP.
Acanthococcus gerbergi (McDaniel)
FREMONTIA SP.
Acanthococcus azaleae (Comstock)
GAYLUSSACIA SP.
Acanthococcus azaleae (Comstock)
GRAYIA SPINOSA (Hook.) Moq.
Acanthococcus arenosus (Cockerell)
GRINDELIA SP.
Acanthococcus cryptus (Cockerell)
GOSSYPIUM SP.
Acanthococcus dubius (Cockerell)
GOSSYPIUM THURBERI Tod.
Acanthococcus euphorbiae (Ferris)
GUTIERREZIA SP.
Acanthococcus arenosus (Cockerell)
Acanthococcus cryptus (Cockerell)
Acanthococcus eriogoni (Ehrhorn)
Acanthococcus euphorbiae (Ferris)
GUTIERREZIA CALIFORNICA (DC) Torr. & A. Gray
Acanthococcus euphorbiae (Ferris)
GUTIERREZIA MICROCEPHALA (DC) A. Gray
Acanthococcus cryptus (Cockerell)
GUTIERREZIA SAROTHRAE (Pursh) Britt. & Rusby
Acanthococcus cryptus (Cockerell)
HAPLOPAPPUS PALMERI A. Gray
Acanthococcus dubius (Cockerell)
HAPLOPAPPUS VENETUS (Humb.) Blake
Acanthococcus eriogoni (Ehrhorn)
HARRISIA SP.
Acanthococcus coccineus (Cockerell)
HAWORTHIA SP.
Acanthococcus coccineus (Cockerell)
HELIANTHEMUM SCOPARIUM Nutt.
Acanthococcus dubius (Cockerell)
HORDEUM LEPORINUM Link
Acanthococcus diaboli (Ferris)
HYBISCUS SP.
Acanthococcus dubius (Cockerell)
HYLOCEREUS SP.
Acanthococcus coccineus (Cockerell)
JUNIPERUS SP.
Acanthococcus araucariae (Maskell)
LANTANA SP.
Acanthococcus dubius (Cockerell)
LARREA SP.
Acanthococcus larreae (Parrott & Cockerell)
LARREA DIVARICATA Cav.
Acanthococcus cryptus (Cockerell)

Acanthococcus larreae (Parrott & Cockerell)
LUPINUS SP.
Acanthococcus dubius (Cockerell)
LYGODESMIA SPINOSA Nutt.
Acanthococcus texanus (King)
MACHAERANTHERA SP.
Acanthococcus cryptus (Cockerell)
MALUS SYLVESTRIS Mill.
Acanthococcus insignis (Newstead)
MAMMILLARIA SP.
Acanthococcus coccineus (Cockerell)
Acanthococcus dubius (Cockerell)
MAMMILLARIA DECIPIENS Scheidw.
Acanthococcus coccineus (Cockerell)
MAMMILLARIA DIFFICILIS Quehl.
Acanthococcus coccineus (Cockerell)
MAMMILLARIA ERECTA Lem.
Acanthococcus coccineus (Cockerell)
MAMMILLARIA HEYDERI Muhlenpf.
Acanthococcus coccineus (Cockerell)
MAMMILLARIA KUNZEANA Bod. & Quehl
Acanthococcus coccineus (Cockerell)
MAMMILLARIA LONGIMAMMA DC
Acanthococcus coccineus (Cockerell)
MAMMILLARIA MAGNIMAMMA Haw.
Acanthococcus coccineus (Cockerell)
MAMMILLARIA MAZATLANENSIS Schum.
Acanthococcus coccineus (Cockerell)
MAMMILLARIA POSELGERI Hildmann
Acanthococcus coccineus (Cockerell)
MAMMILLARIA RHODANTHA Link & Otto
Acanthococcus coccineus (Cockerell)
MAMMILLARIA STANDLEYI (Britt. & Rose) Orcutt
Acanthococcus coccineus (Cockerell)
MERIOLIX SERRULATA Raf.
Acanthococcus eriogoni (Ehrhorn)
MIMOSA DYSOCARPA Benth.
Acanthococcus dubius (Cockerell)
NERISYRENIA CAMPORUM (A. Gray) Greene
Acanthococcus dubius (Cockerell)
OPUNTIA SP.
Acanthococcus coccineus (Cockerell)
ORYZOPSIS HYMENOIDES (Roemer & Schult.) Ricker.
Acanthococcus diaboli (Ferris)
PALAFOXIA LINEARIS (Cav.) Lag.
Acanthococcus eriogoni (Ehrhorn)
PARKINSONIA SP.
Acanthococcus dubius (Cockerell)
PARONYCHIA JAMESII Torr. & A. Gray
Acanthococcus eriogoni (Ehrhorn)

Acanthococcus tinsleyi (Cockerell)
PELECYPHORA ASSELIFORMIS Ehrb.
Acanthococcus coccineus (Cockerell)
PHLEUM SP.
Acanthococcus insignis (Newstead)
PHLEUM PRATENSE L.
Acanthococcus insignis (Newstead)
PHLOX SUBULATA L.
Acanthococcus eriogoni (Ehrhorn)
PIERIS SP.
Acanthococcus azaleae (Comstock)
PIERIS SP.
Acanthococcus azaleae (Comstock)
PIERIS JAPONICA (Thunb.) D. Don ex G. Don
Acanthococcus azaleae (Comstock)
PINUS SP.
Acanthococcus coccineus (Cockerell)
Acanthococcus texanus (King)
PITTOSPORUM SP.
Acanthococcus pittospori (Ferris)
PITTOSPORUM TENUIFOLIUM Banks & Soland. ex Gaertn.
Acanthococcus pittospori (Ferris)
PLUCHEA SP.
Acanthococcus euphorbiae (Ferris)
PLUCHEA SERICEA (Nutt.) Cov.
Acanthococcus euphorbiae (Ferris)
POPULUS TRICHOCARPA Torr. & A. Gray
Acanthococcus azaleae (Comstock)
PROSOPIS JULIFLORA (Swartz) DC
Acanthococcus dubius (Cockerell)
PSIDIUM SP.
Acanthococcus cryptus (Cockerell)
PSORALEA MICRANTHA A. Gray
Acanthococcus arenosus (Cockerell)
PTERYXIA SP.
Acanthococcus texanus (King)
PTERYXIA TEREBINTHINA (Hook.) Coult. & Rose
Acanthococcus texanus (King)
QUERCUS SP.
Acanthococcus dubius (Cockerell)
Acanthococcus quercus (Comstock)
Acanthococcus texanus (King)
QUERCUS AGRIFOLIA Nee
Acanthococcus quercus (Comstock)
QUERCUS CHRYSOLEPIS Liebm.
Acanthococcus quercus (Comstock)
QUERCUS DURATA Jeps.
Acanthococcus quercus (Comstock)
QUERCUS EMORYI Torr.
Acanthococcus quercus (Comstock)

QUERCUS KELLOGGII Newb.
Acanthococcus quercus (Comstock)
QUERCUS RUBRA L.
Acanthococcus quercus (Comstock)
QUERCUS STELLATA Wang.
Acanthococcus quercus (Comstock)
Acanthococcus stellatus (McDaniel)
QUERCUS TURBINELLA Greene
Acanthococcus euphorbiae (Ferris)
REBUTIA SP.
Acanthococcus coccineus (Cockerell)
RHIPSALIS PILOCARPA Lufgren.
Acanthococcus coccineus (Cockerell)
RHODODENDRON SP.
Acanthococcus azaleae (Comstock)
RHODODENDRON CAROLINIANUM Rehd.
Acanthococcus azaleae (Comstock)
RHODODENDRON CATAWBIENSE Michx.
Acanthococcus azaleae (Comstock)
RHODODENDRON INDICUM (L.) Sweet
Acanthococcus azaleae (Comstock)
RHODODENDRON MAXIMUM L.
Acanthococcus azaleae (Comstock)
RHODODENDRON MUCRONULATUM Turcz.
Acanthococcus azaleae (Comstock)
RIBES SP.
Acanthococcus azaleae (Comstock)
SALIX SP.
Acanthococcus azaleae (Comstock)
SARCOBATUS VERMICULATUS (Hook.) Torr.
Acanthococcus arenosus (Cockerell)
SELENICERUS SP.
Acanthococcus coccineus (Cockerell)
SIDA SP.
Acanthococcus dubius (Cockerell)
SIDA HEDERACEA (Dougl.) Torr.
Acanthococcus eriogoni (Ehrhorn)
SITANION SP.
Acanthococcus diaboli (Ferris)
SPARTINA FOLIOSA Trin.
Acanthococcus palustris (Dodds)
SPHAERALCEA AMBIGUA A. Gray
Acanthococcus dubius (Cockerll)
SPHAERALCEA ORCUTTII Rose
Acanthococcus dubius (Cockerell)
SPIRAEA SP.
Acanthococcus azaleae (Comstock)
SPIRAEA DOUGLASII Hook.
Acanthococcus insignis (Newstead)

STEPHANOMERIA SP.
Acanthococcus dubius (Cockerell)
STIPA SP.
Acanthococcus diaboli (Ferris)
STIPA COMATA Trin. & Rupr.
Acanthococcus washingtonensis Miller & Miller
SUAEDA SP.
Acanthococcus dubius (Cockerell)
SYMPHORICARPOS SP.
Acanthococcus texanus (King)
TALINUM AURANTIACUM Engelm.
Acanthococcus euphorbiae (Ferris)
THUJA SP.
Acanthococcus azaleae (Comstock)
TRITICUM AESTIVUM L.
Acanthococcus diaboli (Ferris)
VACCINIUM SP.
Acanthococcus azaleae (Comstock)
Acanthococcus texanus (King)
VIGUIERA SP.
Acanthococcus cryptus (Cockerell)
WILCOXIA SP.
Acanthococcus coccineus (Cockerell)

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