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5221

New genera and species of felt scales (Hemiptera: Coccoomorpha: Eriococcidae), with descriptions of new species and immature instars of described species

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New genera and species of felt scales (Hemiptera: Coccoomorpha: Eriococcidae), with descriptions of new species and immature instars of described species

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MARY FOLEY BENSON

COLOR PLATE 1. *Acanthococcus araucariae* (Maskell 1879), note adult female before ovisac formation; adult female in broken ovisac with eggs; immature instars; adult male; adult male in male sac with filaments protruding. USA: California: San Francisco Co: San Francisco, Golden Gate Park, IX-26-1967, on *Araucaria excelsa*, D.R. Miller.

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Abstract

In this work, emphasis is placed on the Eriococcidae (Hemiptera: Coccoomorpha) of the Nearctic Region including the immature instars of many species not previously described, two new genera (*Carphococcus* Miller and Stocks and *Ypofloiococcus* Miller and Stocks), and 11 new species (*Acanthococcus pennya* Miller and Stocks, *Carph. apodus* Miller and Stocks, *Carpochloroides eugeniae* Miller and Stocks, *Ovaticoccus betsyae* Miller and Stocks, *Ov. gordonii* Miller and Stocks, *Ov. haigi* Miller and Stocks, *Ov. maryfoleybensonae* Miller and Stocks, *Ov. telotrichus* Miller and Stocks, *Ov. tuttlei* Miller and Stocks, *Ov. villanuevorum* Miller and Stocks and *Y. libeauae* Miller and Stocks). In addition to the new taxa, descriptions and illustrations are provided for adult females, adult males and/or immature instars of *Ac. arenosus* (Cockerell), *Ac. coccineus* (Cockerell), *Ac. dennoi* Miller and Miller, *Ac. gallicolus* (Cockerell & Rohwer), *Ac. hoyi* Miller and Miller, *Ac. kemptoni* (Parrott), *Apezococcus idiaestes* Ferris, *Carmo. mexicanus* Ferris, *Cryptococcus fagisuga* Lindinger, *Cr. williamsi* Kosztarab and Hale, *Hypericicoccus hyperici* (Ferris), *Ov. agavacearum* Pellizzari and Kozár, *Ov. agavium* (Douglas), *Ov. cornutus* (Ferris), *Ov. densus* (Miller), *Ov. eriogoni* (Miller), *Ov. exoticus* Pellizzari and Kozár, *Ov. neglectus* (Cockerell), *Ov. peruvianus* (Granara de Willink & Díaz), *Ov. salviae* Miller, *Ov. sanguineus* (Miller), *Ov. tippinsi* Miller and Miller, *Ov. variabilis* Miller, *Spiroporococcus braggi* (Cockerell & Robinson), *S. yuccae* (Ferris) and *Xerococcus foquieriae* Ferris. Lectotype designations are made for *Ap. idiaestes*, *Carmo. mexicanus* and *H. hyperici*. New collection data are provided for *Ov. californicus* McKenzie, *Ov. johnsoni* (Miller), *Ov. mackenziei* Miller, *Ov. parvispina* (Chaffin) and *Ov. viscosa* (Kondo). Dichotomous keys are given for: determination of most eriococcid instars of both sexes; Nearctic genera of the Eriococcidae based on adult females; adult females, second-instar females, second-instar males, and first-instar nymphs of *Ovaticoccus* Kloet 1944; and the seven species of *Acanthococcus* Signoret 1875 treated here, based on first-instar nymphs. *Oregmopyga* Hoy 1963 and *Cornoculus* Ferris 1955 are treated as junior subjective synonyms of *Ovaticoccus*. *Atriplicia* Cockerell and Rohwer 1909 has been placed previously as a junior synonym of *Eriococcus* but here is regarded as a junior subjective synonym of *Acanthococcus*. We treat 44 species; new descriptions are provided for 101 treated instars, and detailed line drawings are given for all but three of them. The following species, listed in ScaleNet as occurring in the Nearctic Region, are transferred to *Acanthococcus* from *Eriococcus* Targioni Tozzetti 1868: *Acanthococcus actius* Miller and Miller 1993 **rev. comb.**; *Ac. arenariae* Miller and Miller 1993 **rev. comb.**; *Ac. barri* Miller 1991 **rev. comb.**; *Ac. beshearae* Miller and Miller 1993 **rev. comb.**; *Ac. dennoi* Miller and Miller 1993 **rev. comb.**; *Ac. droserae* Miller, Liu and Howell 1992 **rev. comb.**; *Ac. epacrotrichus* Miller and Miller 1992 **rev. comb.**; *Ac. froebeae* Miller 1991 **rev. comb.**; *Ac. gallicolus* (Cockerell & Rohwer 1909) **comb. n.**; *Ac. hoyi* Miller and Miller 1992 **rev. comb.**; *Ac. mackenziei* Miller and Miller 1992 **rev. comb.**; *Ac. macrobactrus* Miller and Miller 1992 **rev. comb.**; *Ac. megaporus* Miller and Miller 1993 **rev. comb.**; *A. mesotrichus* Miller and Miller 1993 **rev. comb.**; *Ac. microtrichus* Miller and Miller 1992 **rev. comb.**; *Ac. monotrichus* Miller and Miller 1993 **rev. comb.**; *Ac. ophius* Miller and Miller 1993 **rev. comb.**; *Ac. stauroporus* Miller and Miller 1992 **rev. comb.**; *Ac. washingtonensis* Miller and Miller 1992 **rev. comb.**; and *Ac. whiteheadi* Miller 1991 **rev. comb.** In addition, two species are transferred to *Acanthococcus* from *Rhizococcus* Signoret: *Ac. coccineus* (Cockerell 1894a) **rev. comb.** and *Ac. kemptoni* (Parrott 1900) **rev. comb.** Three images of water color paintings by Mary Foley Benson are included.

Key words: Sternorrhyncha, scale insects, North America, *Acanthococcus*, *Apezococcus*, *Carpochloroides*, *Cryptococcus*, *Hypericicoccus*, *Spiroporococcus*, *Xerococcus*

Introduction

The Eriococcidae is the fourth largest family of scale insects (Hemiptera: Coccoomorpha), including 663 species in 106 genera worldwide, as recorded in ScaleNet (see García Morales *et al.* 2016). There is considerable morphological

and molecular evidence demonstrating that what previously was thought to be a single family, *i.e.*, the Eriococcidae, comprises several separate lineages (Cook *et al.* 2002; Cook & Gullan 2004, Gullan & Cook 2007, Cox & Williams 1987; Hodgson 2002, Hodgson 2020; Hodgson & Hardy 2013). Although there is agreement that there are several components within the broad concept of the Eriococcidae, there are several different interpretations of the taxonomy of these groups. There seems to be general acceptance that there are at least three separate clades of the Eriococcidae: the A or acanthococcid clade, the BSE or beelsoniid-stictococcid-eriococcid clade, and the G or Gondwanan clade (Cook & Gullan 2004, Hardy *et al.* 2008). Hodgson (2020) presents a review of this information, with a suggestion concerning a slightly modified classification. For the purposes of this paper, we will treat the Eriococcidae in the traditional sense, recognizing that some of the taxa described here may fall within at least two different groups within the “family.”

In the Nearctic Region, ScaleNet records 88 eriococcid species in 15 genera, but 20 of those species placed currently in *Eriococcus* Targioni Tozzetti 1868 are here transferred to *Acanthococcus* Signoret 1875. The rationale is that the type species of *Eriococcus* (*E. buxi* Boyer de Fonscolombe 1868) is part of the so-called BSE lineage, which is different from the acanthococcid lineage containing the Nearctic species (Cook *et al.* 2002). Unfortunately, there is a paucity of molecular data for species that occur in the Nearctic. The one species in Cook *et al.* (2002) is *E. coccineus* (Cockerell 1894a), which is part of the acanthococcid lineage including the type species of *Acanthococcus* (*Ac. aceris* Signoret 1875). Kozár *et al.* (2013) transferred the appropriate Palearctic species of *Eriococcus* to *Acanthococcus*, but the Nearctic species also need to be transferred, as follows: *Acanthococcus actius* Miller and Miller 1993 **rev. comb.**; *Ac. arenariae* Miller and Miller 1993 **rev. comb.**; *Ac. barri* Miller 1991 **rev. comb.**; *Ac. beshearae* Miller and Miller 1993 **rev. comb.**; *Ac. dennoi* Miller and Miller 1993 **rev. comb.**; *Ac. droserae* Miller, Liu and Howell 1992 **rev. comb.**; *Ac. epacrotrichus* Miller and Miller 1992 **rev. comb.**; *Ac. froebeae* Miller 1991 **rev. comb.**; *Ac. gallicolus* (Cockerell & Rohwer 1909) **rev. comb.**; *Ac. hoyi* Miller and Miller 1992 **rev. comb.**; *Ac. mackenziei* Miller and Miller 1992 **rev. comb.**; *Ac. macrobactrus* Miller and Miller 1992 **rev. comb.**; *Ac. megaporus* Miller and Miller 1993 **rev. comb.**; *Ac. mesotrichus* Miller and Miller 1993 **rev. comb.**; *Ac. microtrichus* Miller and Miller 1992 **rev. comb.**; *Ac. monotrichus* Miller and Miller 1993 **rev. comb.**; *Ac. ophius* Miller and Miller 1993 **rev. comb.**; *Ac. stauroporus* Miller and Miller 1992 **rev. comb.**; *Ac. washingtonensis* Miller and Miller 1992 **rev. comb.**; and *Ac. whiteheadi* Miller 1991 **rev. comb.**

In the Neotropical Region, ScaleNet lists 95 eriococcid species in 34 genera, but one of these species is placed in *Eriococcus* and should be transferred to a different genus. Five species occur in both the Nearctic and Neotropical regions: *Ac. dubius* (Cockerell 1896), *Capulinia sallei* Signoret 1875, *Rhizococcus coccineus* (Cockerell 1894a), *R. kemptoni* (Parrott 1900), and *Uhleria araucariae* (Maskell 1879); and seven genera are represented in both regions: *Acanthococcus*, *Capulinia* Signoret 1875, *Carpochloroides* Cockerell 1899, *Oregmopyga* Hoy 1963, *Ovaticoccus* Kloet 1944, *Rhizococcus* Signoret 1875, and *Uhleria* Cooke 1881. In the New World, 177 eriococcid species are recorded in 41 genera. Details of how some of these genera are treated differently in this paper are given in the discussion preceding the key to Nearctic genera below.

The first author began working on the Eriococcidae in 1963 and published his first paper on the family in 1967 (Miller & McKenzie 1967). Since that time, he has published several papers on the family, but because most eriococcids are not of agricultural importance, they were of secondary importance to an employee of the US Department of Agriculture. However, from 1970 to the present (more than 50 years), eriococcid material was collected and slide mounted to await study after retirement. This paper presents the results of this accumulated research. Initially it was not intended to be monographic in nature but simply a publication that would bring together all of 50 years-worth of descriptions and illustrations. During the review process, and through the urging of the referees and collaborators, it has become more nearly monographic than originally intended. The second author has helped to bring diverse aspects of this diffuse information into a publishable form and as a specialist in scale-insect taxonomy, has verified and enhanced the conclusions.

Materials and methods

Over the past 50 plus years, slide-mounted specimens have been prepared using many different protocols. Perhaps the best preparations were made by the late Richard (Dick) F. Wilkey (California Department of Food and Agriculture, Sacramento, California, USA) following the procedures described in Wilkey (1990). The illustrations

and descriptions were made using several different microscopes, most recently with a Leica DMRB compound light microscope with 10x, 20x, 40x, and 100x objectives. Measurements were made using a calibrated eyepiece micrometer. Illustrations were made using a camera lucida, which can cause some distortion at the perimeter of the field of vision.

Plant names were verified or corrected based on WFO (2022) (www.worldfloraonline.org accessed on December 24, 2021). Original host names are presented as they appear on the slide label, with the correct names given in brackets (Appendix 2).

Line drawings of slide-mounted specimens were made using the following procedure. Each illustration was first roughed-in with the camera lucida; legs, antennae and mouthparts were positioned on the rough illustration and oriented to be consistent with the normal pattern, with the front legs directed forward and the hind two pairs directed posteriorly. Not all structural details were visible with the camera lucida, but those that were evident were placed on the rough illustration. The latter were then used as landmarks, and all illustrated features were placed on the illustration usually by viewing the specimen with the high-power dry objective (40x) or the oil immersion objective (100x). Enlargements were made as they appeared through the microscope and were not copied from one illustration to the next; they are not given to scale. Once an illustration was inked, it was digitized and enhanced using Adobe Photoshop. As is the case for most scale-insect illustrations, the left side of the body illustrates the dorsum, and the right side shows structures on the venter.

Measurements were taken from five to 10 specimens originating from as many different localities and hosts as possible; they are given as a range, but because they were taken from so few specimens, an average (mean) was not calculated. Descriptions of new species are written using data taken from the holotype and then the range from five to 10 of the paratypes is given, when available. Descriptions of previously described species include the range of measurements only. The specimen-label data given in the “Specimens examined” section includes only information not previously published. Exact label data are given only for primary type specimens, with information on each line of the label separated by “/”. Detailed synonymies are provided for most species consistent with the information given in ScaleNet (García Morales *et al.* 2016). Abdominal segments are labeled with Roman numerals, e.g., abdominal segment 8 is “segment VIII” without a modifier of “abdominal.” Character states such as the presence of a claw denticle or a 3-segmented labium are not repeated in each description because they are common in most species, but if the species has a character state different than the norm it is included.

Conventions and depositories

Specimen depositories

ANIC—Australian National Insect Collection, CSIRO, Canberra, Australia

CDFA—California Department of Food and Agriculture, Sacramento, California, USA

FSCA—Florida State Collection of Arthropods, Gainesville, Florida, USA

MNHN—Muséum national d’Histoire naturelle, Paris, France

NHM—Natural History Museum, London, UK

UCD—University of California, Davis, California, USA

UNAM—Universidad Nacional Autónoma de México, Mexico City, Mexico

USNM—United States National Museum, Beltsville, Maryland, USA

Abbreviations of adult male structures

aed—aeedeagus, al—alar lobes, alsc—alar sclerites, ao—anal opening, br—basal rod, ca—cranial apophysis, cd—claw digitule, cl—clypeus, cla—claw, cs—capitate setae, de—denticle, dmcr—dorsal arm of midcranial ridge, dmep—dorsomedial sclerite, dse—dorsal eye, fls—flagellate setae, fs—fleshy setae, fr—furca, g—gena, lb—labium, lmcr—lateral arm of midcranial ridge, lo—lateral ocellus, lpl—lateroplurite, ma—mesothoracic apophysis, mtp—median tergal plate, mp—multilocular pore, mses—mesepisternum, mtes—metepisternum, mr—marginal ridge of metasternum, mt—mouth tubercle, ocs—ocular sclerite, pa—prothoracic apophyses, pcr2—mesothoracic precoxal ridge, pcr3—metathoracic precoxal ridge, pnr—metapostnotal ridge, por—postoccipital ridge, pr—pleural ridges, prn—pronotal sclerites, prnr—pronotal ridges, procr—ventral postocular ridge, pror—preoral ridge, prsc—prescutum, ps—penial sheath, pscs—prescutal suture, px—pharynx, sclr—scutellar ridge, set—scutum, st—style,

stn1—prosternum, stn2—mesosternum, td—tarsal digitule, tfpc—tail-forming pore clusters, ve—ventral eye, vmcr—midcranial ridge, wv—wing veins, x—X-type pore.

Abbreviations on illustrations and caption letters, excluding adult males

A—enlarged seta, B—slightly enlarged seta, C—7-locular pore, D—5-locular pore, E—3-locular pore, F—microtubular duct, G—macrotubular duct, H—cruciform pore, I—anal ring, J—antenna, K—dorsal surface of coxa of adult female, L—claw, M—preantennal pore, N—flagellate seta, O—femur, P—front tibia, Q—dorsal surface of coxa of second-instar female, R—cauda, S—6-locular pore, T—more than 7-locular pore, U—4-locular pore, V—leg remnant, W—hind leg, X—anal lobe, Y—spiracle, Z—body margin, AA—microtrichia, BB—labium, CC—weakly indicated pore.

Morphology

Illustrations of the various structures and exemplars of their diversity are provided in Figs 1 and 2. The capital letters given above in “Abbreviations on illustrations” identify the structures and the associated small letters show some of the diversity that is found in the text. For example, in Fig. 1, Ia–If are anal rings and Ie is the unusual anal ring of *Carp. eugeniae*. In Fig. 2, Za–Zc show the diversity of the dermal pattern along the body margin, and Za is the body margin of *Ov. gordonii*. Figs 1 and 2 do not include enlargements of all of the structures used in the taxonomic descriptions. We here provide figure numbers for finding enlarged illustrations of structures not found in Figs 1 and 2: for “slightly enlarged setae” see “B” in Fig. 33; for “dorsal surface of coxa of adult female” see “K” in Fig. 103; for “preantennal pore” see “M” in Fig. 63; for “front tibia” see “P” in Fig. 12; for “coxa of second-instar female” see “Q” in Fig. 84; for “cauda” see “R” in Fig. 13; for “leg remnant” see “V” in Fig. 19; for “anal lobe” see “X” in Fig. 89; for “spiracle” see “Y” in Fig. 97; for “microtrichia” see “AA” in Fig. 103; for “labium” see “BB” in Fig. 106; and for “weakly indicated pore” see “CC” in Fig. 6.

The morphological terminology used in this work is an aggregation of terms and definitions given by Hoy (1962), Miller and McKenzie (1967) and Kozár *et al.* (2013). If the illustrations listed above are insufficient for understanding a structure, clarification can be obtained by examining these publications.

Notes

Due to variation caused by the quality of different microscopes, and different planes of view and illustrators, we have not used the structural details of the multilocular pores or the cruciform pores as diagnostic character states. However, the number of loculi in the multilocular pores is a useful character.

There is no clear-cut differentiation among the three types of setae, i.e., enlarged setae, slightly enlarged setae and enlarged setae. For those of intermediate condition, we have based our decision on their type based on the location of the setae and their relative size.

We have introduced a new term for the cuticular cover that sometimes is present over the anal opening; it is termed the “anal flap” (see Figs 1 Ia and 56).

Sometimes it is difficult to determine the exact location of the lateral-most longitudinal line of enlarged setae. In some cases we have discussed them as dorsal and in others they are listed as ventral; essentially, they are marginal. Many descriptions mention the presence of longitudinal lines of setae. After examining the digital images of species that are described as having longitudinal lines of enlarged setae on the dorsum, 2 reviewers indicated that they could not see the lines on the head and thorax but could see them on the abdomen. The lines are normally represented by a single seta (or a single larger seta) on each side of the abdomen at each of the medial, mediolateral and lateral positions. However, on the head and thorax the lines sometimes are represented by a cluster of setae (or larger setae) but are clustered in the medial, mediolateral and lateral positions with bare spaces in between. We consider these clusters to form longitudinal lines contiguous with the more obvious lines on the abdomen.

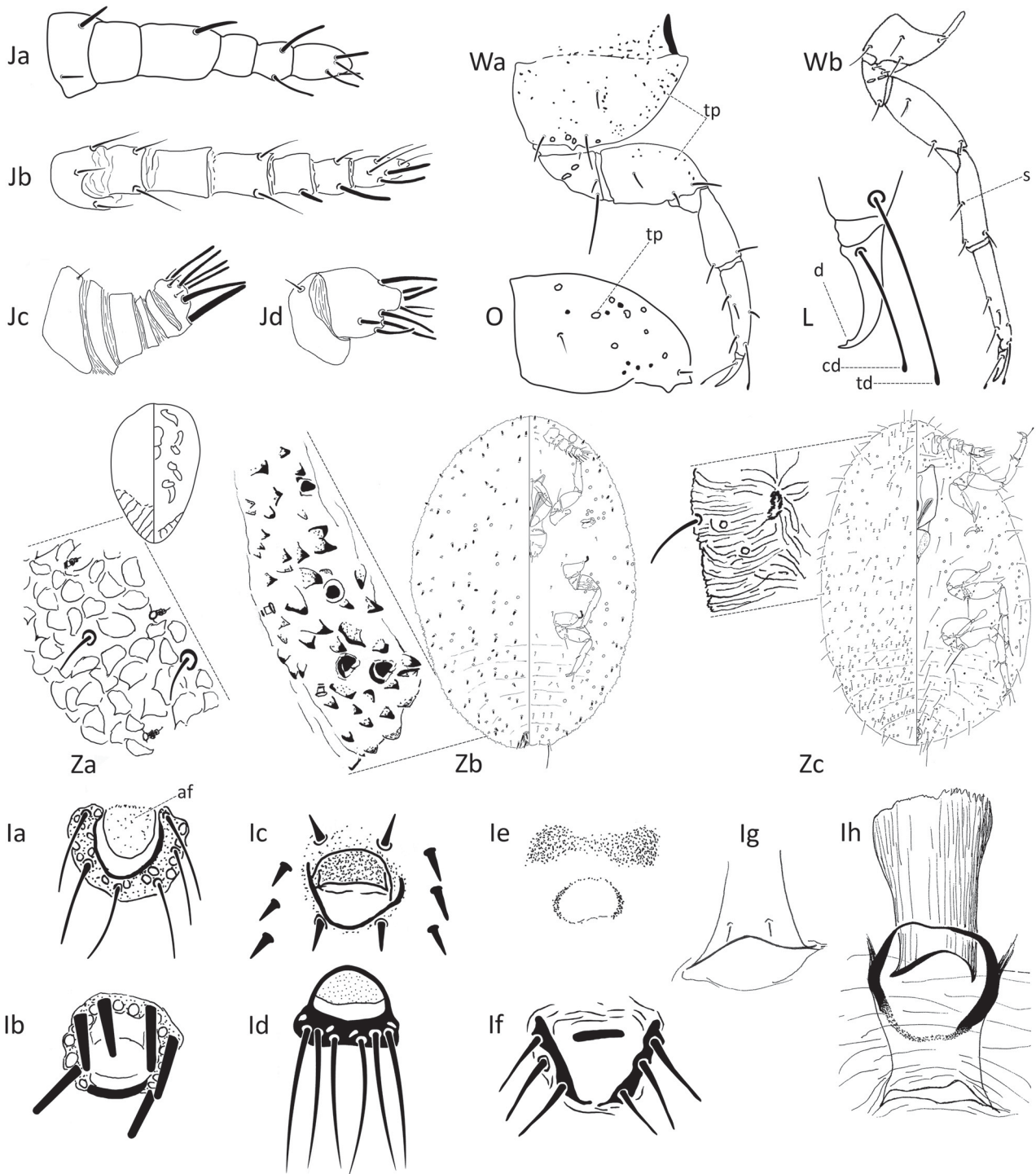


FIGURE 1. General morphology. I=Anal ring: Ia—*Ov. maryfoleybensoniae* first-instar nymph; Ib—*H. hyperici* second-instar ♀; Ic—*Cryptococcus fagisuga* second-instar ♀; Id—*Carphococcus apodus* second-instar ♀; Ie—*Carpochloroides eugeniae* adult ♀; If—*Ov. agavium* second-instar ♂; Ig—*Carmo. eugeniae* third-instar ♂; Ih—*Ov. villanuevorum* adult ♀. J=Antennae: Ja—*Acanthococcus arenosus* first-instar nymph; Jb—*Ac. gallicolus* adult ♀; Jc—*Carmo. eugeniae* adult ♀; Jd—*Apezococcus idiaestes* second-instar ♀. L=Claw: *Ovaticoccus salviae* first-instar nymph with claw digitules (cd), tarsal digitules (td) and denticle (d). O=Femur: *Ac. pennyae* adult ♀ with translucent pores (tp). W=Legs: Wa—*Ac. pennyae* adult ♀; Wb—*Ac. hoyi* second-instar ♂ with middle seta (s). Z=Body margins: Za—*Ov. gordonii* adult ♀; Zb—*Hypericicoccus hyperici* second-instar ♀; Zc—*Ypofloiococcus libeauae* adult ♀.

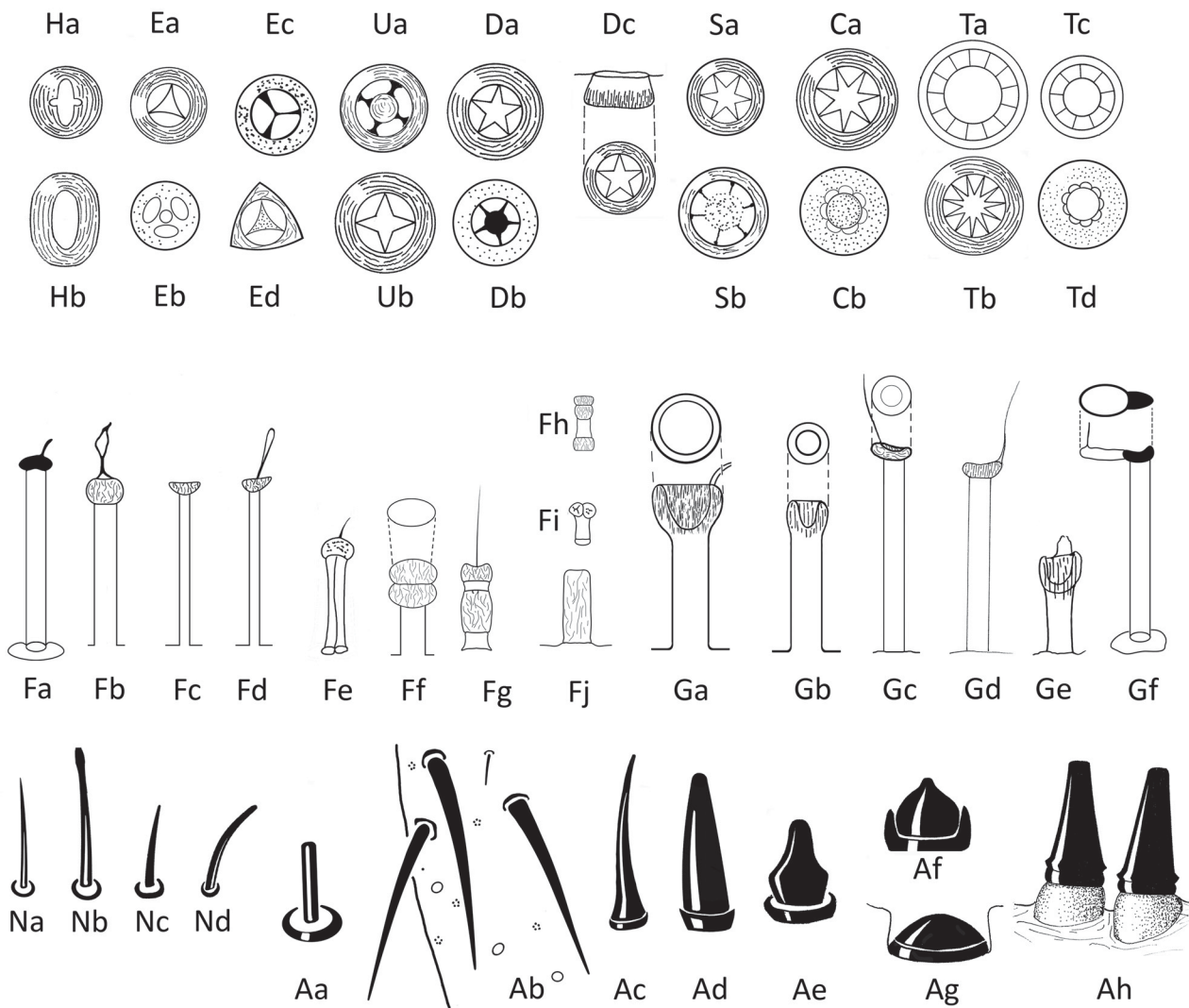


FIGURE 2. General morphology. A=Enlarged setae: Aa—*Acanthococcus hoyi* second-instar ♂; Ab—*Carpochloroides eugeniae* adult ♀; Ac—*Ac. kemptoni* first-instar nymph; Ad—*Xerococcus fouquieriae* first-instar ♀; Ae—*Hypericicoccus hyperici* first-instar nymph; Af—*Apezococcus idiaestes* adult ♀; Ag—*Ovaticoccus densus* second-instar ♀; Ah—*Carphococcus apodus* adult ♀; C=7-locular pores: Ca—*Ac. gallicolus* adult ♀; Cb—*Hy. hyperici* first-instar nymph; D=5-locular pores: Da—*Ac. gallicolus* adult ♀; Db—*Ov. salviae* first-instar nymph; Dc—*Cryptococcus fagisuga* first-instar nymph; E=3-locular pores: Ea—*Ac. gallicolus* second-instar ♀; Eb—*Ov. eriogoni* second-instar ♀; Ec—*X. fouquieriae* first-instar ♂; Ed—*Ac. gallicolus* adult ♀; Fa—*Ypofloiococcus libeanae* second-instar ♂; F=Microtubular ducts: Fb—*Cr. fagisuga* second-instar ♀; Fc—*Carpo. eugeniae* first-instar nymph; Fd—*Carpo. eugeniae* first-instar nymph; Fe—*Y. libeanae* second-instar ♀; Ff—*Hy. hyperici* first-instar nymph; Fg—*Carpho. apodus* second-instar ♀; Fh—*Ov. telotrichus* adult ♀; Fi—*Y. libeanae* second-instar ♀; Fj—*Ov. agavium* second-instar ♀; G=Macrotubular ducts: Ga—*Ov. exoticus* second-instar ♂; Gb—*Cr. fagisuga* second-instar ♀; Gc—*Carpo. mexicanus* adult ♀; Gd—*Carpo. mexicanus* adult ♀; Ge—*Ac. pennyae* adult ♀; Gf—*Y. libeanae* adult ♀; H=Cruciform pores: Ha—*Ac. hoyi* second-instar ♀; Hb—*Ac. kemptoni* first-instar nymph; N=Flagellate setae: Na—*Ov. adoxus* second-instar ♀; Nb—*Ov. agavium* second-instar ♂; Nc—*Ov. adoxus* second-instar ♀; Nd—*H. hyperici* fourth-instar ♂; S=6-locular pores: Sa—*Ov. telotrichus* first-instar nymph; Sb—*Ov. telotrichus* third-instar ♂; T=pores with >7 loculi: Ta—*Ov. agavium* fourth-instar ♂; Tb—*Carpho. apodus* adult ♀; Tc—*Ov. agavium* fourth-instar ♂; Td—*Hy. hyperici* first-instar nymph; U=4-locular pores: Ua—*Ov. eriogoni* first-instar nymph; Ub—*Ap. idiaestes* adult ♀.

Taxonomy

Key to immature instars and adult females and males of most species of Eriococcidae in North America

1(0)	Macrotubular ducts absent	3
–	Macrotubular ducts present	2
2(1)	Without vulva; without translucent pores on hind coxa; antennae usually each 7-segmented	second-instar male
–	With vulva; usually with translucent pores on hind coxa; antennae, if well developed, usually each 6- or 7-segmented	adult female
3(1)	Antennae with obvious setae	5
–	Antennae without obvious setae	4
4(3)	Posterior apex of last abdominal segment broadly rounded, not obviously developing into penial sheath	third-instar male (prepupa)
–	Posterior apex of last abdominal segment acutely rounded, obviously developing into penial sheath	fourth-instar male (pupa)
5(3)	Labium well developed, with setae; penial sheath and aedeagus absent	6
–	Labium absent or poorly developed, without setae; penial sheath and aedeagus present	fifth-instar male (adult male)
6(5)	Flagellate setae usually absent from dorsum; posterior spiracles each usually with 1 associated multilocular pore; hind coxae each without weakly developed translucent pores	first-instar nymph
–	Flagellate setae present on dorsum; posterior spiracles each usually with 2 or more associated multilocular pores; hind coxae each with weakly developed translucent pores	second-instar female

Key to Nearctic genera of Eriococcidae, based on adult females

Notes: The generic key is intended to facilitate identification of eriococcid species occurring in the Nearctic region; it may not agree with all current generic concepts and may not work with congeneric species found in other geographic regions. Some of the genera given in ScaleNet as occurring in the Nearctic are subsumed within other genera, pending a more definitive analysis of the morphological and molecular character systems. Here we consider *Anophococcus* Balachowsky 1954, *Gossyparia* Signoret 1875, *Rhizococcus*, and *Uhleria* as part of *Acanthococcus*; however, formally they are not considered synonyms. We formally synonymize *Cornoculus* **syn. n.** and *Oregmopyga* **syn. n.** as junior subjective synonyms of *Ovaticoccus*. We also describe two new genera, i.e., *Carphococcus* **gen. n.** and *Ypofloiococcus* **gen. n.** *Cryptococcus* Douglas 1890 is treated as part of the Eriococcidae, rather than as a separate family in agreement with the analysis of Gwiazdowski *et al.* (2006) and Nan *et al.* (2013). *Eriococcus* is now restricted to two species (Kozár *et al.* 2013) that do not occur in the Nearctic.

1(0)	Legs absent, or represented by unsegmented remnants	2
–	Legs present, with distinct segments	8
2(1)	Microtubular ducts elongate, more than 4 times longer than wide, with single internal sclerosis	3
–	Microtubular ducts short, or absent, less than 4 times longer than wide, with double internal sclerosis	6
3(2)	Leg remnants present, represented by pore plate or unsegmented swellings	4
–	Leg remnants absent	<i>Carpochloroides</i> Cockerell (in part)
4(3)	Leg remnants present near anal ring; hind leg remnants represented by unsclerotized projection	5
–	Leg remnants present near posterior spiracle; hind leg remnants represented by sclerotized plate	<i>Cryptococcus</i> Lindinger
5(4)	Multilocular pores present on venter and dorsum, not restricted to spiracular area	<i>Carpochloroides</i> Cockerell (in part)
–	Multilocular pores restricted to area near spiracles on venter	<i>Capulinia</i> Signoret
6(2)	Microtubular ducts and cruciform pores present	7
–	Microtubular ducts and cruciform pores absent	<i>Xerococcus</i> Ferris
7(6)	Pore plate absent; enlarged setae restricted to abdomen; cruciform pores restricted to venter	<i>Carphococcus</i> Miller and Stocks gen. n.
–	Pore plate present posterior to hind spiracle; enlarged setae scattered over dorsum; cruciform pores present on dorsum and venter	<i>Apezococcus</i> Ferris
8(1)	Anal ring bearing 3 pairs of setae; anal lobes not projecting or projecting slightly, each usually without enlarged setae	9
–	Anal ring bearing 4 pairs of setae; anal lobes projecting, each usually with 2–4 enlarged setae	<i>Acanthococcus</i> Signoret
9(8)	Anal-ring setae flagellate, apically acute; body margin without apically acute projections, occasionally with dome-shaped projections or reticulate pattern	10
–	Anal-ring setae enlarged, apically truncate; body margin with numerous apically acute projections	<i>Hypericicoccus</i> Williams
10(9)	Spiracles without concentrated cluster of multilocular pores in atrium or false atrium	11
–	Spiracles with concentrated cluster of multilocular pores in atrium or false atrium	<i>Spiroporococcus</i> Miller
11(10)	Macrotubular ducts, when present, without enlarged flap attached to vestibule; antennae each with apical 3 segments with sensory setae; labium usually 3-segmented	<i>Ovaticoccus</i> Kloet
–	Macrotubular ducts with enlarged flap attached to vestibule; antennae each with apical 2 segments with sensory setae; labium 2-segmented	<i>Ypofloiococcus</i> Miller and Stocks gen. n.

Acanthococcus Signoret 1875

Acanthococcus Signoret 1875: 16. Type species: *Acanthococcus aceris* Signoret 1875 by monotypy.

Atriplicia Cockerell and Rohwer 1909: 169 **syn. n.** Type species: *Atriplicia gallicola* Cockerell and Rohwer 1909 by monotypy.

Generic diagnosis of adult female: Enlarged setae usually abundant on dorsum, but some species with setae restricted to all or part of body margin; anal lobes generally large and protruding, each with 1 or more enlarged setae, usually 3; macrotubular ducts present on adult female and second-instar male; microtubular ducts present, usually associated with enlarged setae; multilocular pores present at least on venter, usually each with 5 loculi; cruciform pores usually present; translucent pores present on hind legs of adult female and second-instar female, usually on femur and coxa; anal ring usually with 4 pairs of setae and 1 or 2 rows of pores; each femur usually with 5 setae; each tibia usually with 4–6 setae; claw with denticle; digitules on tarsus and claw usually capitate; antennae 6- or 7-segmented, with sensory setae on distal 3 segments; labium 3-segmented, basal segment small, with 2 setae.

Notes: For an explanation and a list of the 20 Nearctic species transferred from *Eriococcus* to *Acanthococcus* in this work, please see the Introduction above.

In North America, adult females of the species in *Acanthococcus* are most similar to adult females of species of *Ovaticoccus* but differ as follows (character states of *Acanthococcus* are in brackets): anal ring normally with three or fewer pairs of setae (with four pairs of setae); anal lobes not protruding or protruding slightly, inconspicuous (protruding strongly, conspicuous); without frontal lobes (with or without frontal lobes); translucent pores usually on hind coxa only (on hind femur and coxa). Species of *Acanthococcus* also are similar to the Australasian and Neotropical genus *Madarococcus* Hoy 1962 (Hardy *et al.* 2008) but differ as follows (character states of *Acanthococcus* in brackets): suranal seta expanded (suranal seta flagellate); anal lobes large and almost plate like, heavily sclerotized (anal lobes not plate like, usually slightly sclerotized).

Etymology: The generic epithet “*Acanthococcus*” is a combination of the Greek word “*akantha*” meaning spine or thorn, and “*kokkos*” meaning “seed” or “scale insect” and is a masculine noun. The generic epithet is formed to point out the enlarged setae on the dorsum of many species of the genus.

Field features: Body usually pear-shaped, with various arrangements and shapes of crystalline wax rods formed on the enlarged setae; forming white felted ovisac that covers body, with small posterior exit hole. Occurring on most parts of host including roots, crown, branches, and leaves, rarely inducing galls.

Key to *Acanthococcus* species treated here, based on first-instar nymphs

- 1(0) Each hind tibia with 5 setae, including middle seta 4
- Each hind tibia with 4 setae, without middle seta 2
- 2(1) Each front tibia with 4 setae, without middle seta; medial enlarged setae on dorsum of abdomen as large as largest lateral setae 3
- Each front tibia with 5 setae, with middle seta; medial enlarged setae on dorsum of abdomen smaller than largest lateral setae *kemptoni* (Parrott)
- 3(2) Multilocular pores near spiracles each often with 7 or 9 loculi; multilocular pores on abdomen predominantly each with 5 loculi; cruciform pores present on ventral margin of thorax *dennoi* Miller and Miller
- Multilocular pores near spiracles each with 5 loculi; multilocular pores on abdomen predominantly each with 3 loculi; cruciform pores absent from ventral margin of thorax *pennyae* Miller and Stocks **sp. n.**
- 4(1) Hind femora each with 5 setae 5
- Hind femora each with 4 setae *coccineus* (Cockerell)
- 5(4) Margin of each abdominal segment with 1 enlarged seta 6
- Margin of each abdominal segment with 2 enlarged setae *hoyi* Miller and Miller
- 6(5) Medial and mediolateral enlarged setae on dorsum of abdomen about same size as lateral setae; cruciform pores absent *gallicolus* (Cockerell & Rohwer)
- Medial and mediolateral enlarged setae on dorsum of abdomen smaller than lateral setae; cruciform pores usually present near ventral margin of thorax *arenosus* (Cockerell)

Acanthococcus arenosus (Cockerell) comb. n.

Eriococcus arenosus Cockerell 1897: 514.

Acanthococcus arenosus (Cockerell); Miller 1991: 334 (change of combination).

Specimens examined: UNITED STATES: New Mexico: Rio Arriba Co.: Embudo, IX-26-1897?, host unknown, T.D.A. Cockerell? (35 first-instar nymphs on 1 slide) USNM.

Etymology: The species epithet “*arenosus*” is formed from the Latin word “*arena*” meaning “sandy place” and probably refers to the sandy habitat where this species often occurs.

First-instar nymph (Fig. 3)

Description: Slide-mounted specimens 0.4–0.6 mm long, 0.2–0.3 mm wide. Body slightly pear-shaped, with protruding anal lobes. Anal lobes broad, apically acute, lightly sclerotized; each lobe dorsally with 3 enlarged setae (anteromedial seta normally shortest, posteromedial and lateral setae equal, sometimes all setae about equal), 1 microtubular duct, each lobe ventrally with 3 flagellate setae including suranal seta and anal-lobe seta.

Dorsum without flagellate setae; enlarged setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral) in transverse rows from head to segment VII; enlarged setae of 2 sizes; larger size along body margin, with 1 on each margin of each abdominal segment, more numerous on head and thorax; smaller size in medial and mediolateral areas, largest large-sized setae 13–15 µm long, largest small-sized setae 7–9 µm, longest lateral seta about 2 times longer than longest medial seta; lateral setae slightly curved, conical, with slightly rounded apices; medial setae straight, conical, with blunt or rounded apices, increasing in size anteriorly; setal rings thin; segment IV with 5 or 6 setae. Macrotubular ducts absent. Microtubular ducts each with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded and about ½ length of remaining sclerotized portion; total sclerotized area same length as or longer than unsclerotized area; dermal orifice unsclerotized. Microtubular ducts on abdomen associated with mediolateral pairs of enlarged setae, forming 1 pair of longitudinal lines; on thorax and head, microtubular ducts associated with medial or mediolateral and lateral pairs of enlarged setae, forming 2 pairs of longitudinal lines. Multilocular and cruciform pores absent. Microtrichia present on segments II to VII.

Anal ring apical, with 3 setae on each side of ring, suranal setae flagellate, slightly enlarged. Anal tube without sclerotization, with anal flap.

Venter with longest flagellate seta on segment II 10–15 µm long, on segment VII 24–32 µm long; longest anal-lobe seta 170–220 µm long. Enlarged setae on lateral margins from head, thorax, or anterior segments to segment VII, conical. Macrotubular ducts absent. Microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores usually present on head and near spiracles; 3-locular pores most numerous, present elsewhere; with 1 pore on each side of head, 1 near medial areas of hind and middle coxae, 1 near each spiracle, and in irregular mediolateral longitudinal line on each side of abdomen. Cruciform pores sometimes present adjacent to mid- and hind coxae. Legs with each femur with 5 setae including 2 proximal setae; each tibia with 5 setae, 1 seta in middle; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 128–145 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia present in medial areas of metathorax to VIII, absent from coxae.

Notes: The description is based on 38 specimens from the type locality. The first-instar nymph of *Ac. arenosus* is most similar to the first-instar nymph of *Ac. coccineus* in having the dorsal medial and mediolateral enlarged setae noticeably smaller than the lateral enlarged setae, the predominant multilocular pores with three loculi, and the ventral lateral enlarged setae increase in size anteriorly. The species differ as follows (character states in brackets are of *A. arenosus*): dorsomedial and mediolateral enlarged setae cylindrical (predominantly conical); each femur with five setae (each femur with four setae).

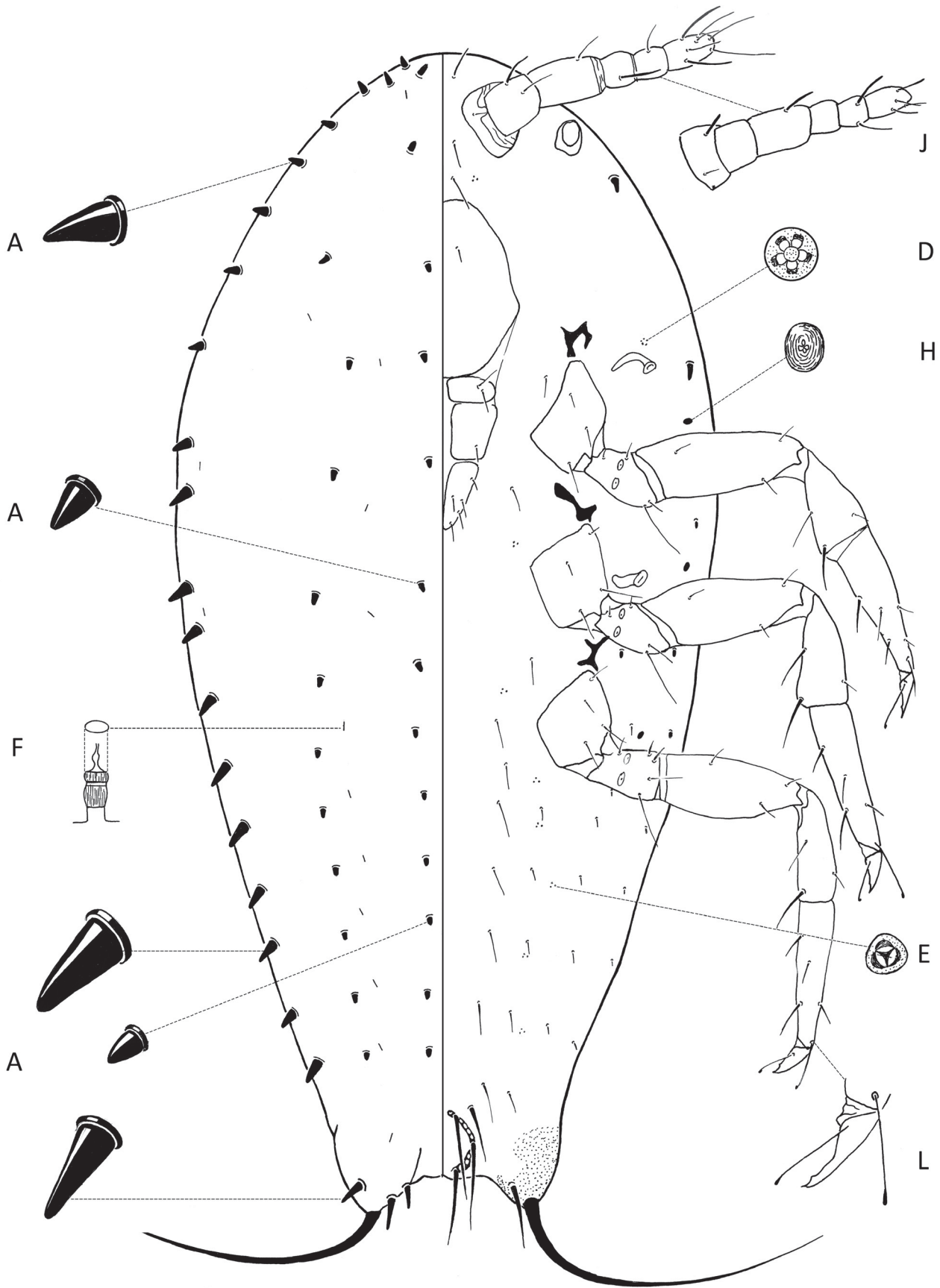


FIGURE 3. *Acanthococcus arenosus* (Cockerell 1897), first-instar nymph, Embudo, Rio Arriba Co., New Mexico, USA, September 26, 1897?, host unknown, T.D.A. Cockerell. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; J=antenna; L=claw.

Acanthococcus coccineus (Cockerell) rev. comb.

Eriococcus coccineus Cockerell 1894a: 204.

Eriococcus coccineus lutescens Cockerell 1894a: 204 (junior synonym discovered by Ferris 1955: 116).

Eriococcus saboteneus Kuwana and Tanaka 1922: 215–221 (junior synonym discovered by Kozár *et al.* 2013: 432).

Nidularia coccinea (Cockerell); Lindinger 1933a: 108 (change of combination requiring emendation of specific epithet for agreement in gender).

Acanthococcus coccineus (Cockerell); Miller and Miller 1992: 19–22 (change of combination).

Rhizococcus coccineus (Cockerell); Kozár 2009: 106 (change of combination).

Acanthococcus coccineus (Cockerell); Hodgson and Miller 2010: 99–100 (revived combination; previously published).

Rhizococcus coccineus (Cockerell); Kozár, Kaydan, Konczné Benedicty and Szita 2013: 432 (revived combination; previously published).

Specimens examined: UNITED STATES: Maryland: Prince Georges Co.: Beltsville, in greenhouse, VI-3-1977, on *Mammillaria* sp., J. Tassone (6 first-instar nymphs on 2 slides) USNM. New York: Bronx County, The Bronx, VIII-31-1944, on *Mammillaria* sp. and *Harrisia* sp., G. Rau (42 first-instar nymphs on 1 slide) USNM. Texas: El Paso Co.: El Paso, IV-29-1925, on cactus, T.A. Arnold (42 first-instar nymphs on 1 slide) USNM; El Paso, X-12-1926, on *Neomammillaria* sp., T.A. Arnold (27 first-instar nymphs on 1 slide) USNM.

Etymology: The species epithet “*coccineus*” is formed from the Latin word “*coccineus*” meaning “scarlet” or “red like a berry” and probably refers to the red color of this species under certain circumstances.

Notes: Based on the synonymy given above, it is clear that generic assignments of species within the Eriococcidae are sometimes confused. Kozár *et al.* (2013) distinguished adult females of *Acanthococcus* species from adult females of *Rhizococcus* species as follows (character states of *Acanthococcus* are in brackets): hind tibiae each with five setae (four) and microtubular ducts short (long). Koteja (1974) also indicated that *Acanthococcus* (=Acanthococcini) differs from *Rhizococcus* (=Rhizococcus group), with the former having eight pairs of setae on the labium while the latter has nine. Examination of these character states in the publication by Kozár *et al.* (2013) shows considerable incongruence. For example (the generic character state is given in brackets), *R. brevenniae* (Goux 1993) has eight pairs of labial setae (nine), *Ac. altaicus* Matesova 1967 (= *Ac. spiraeae* Borchsenius 1949) has nine pairs (eight), *Ac. isacanthus* Danzig 1975 has nine pairs (eight), *R. heteroacanthus* (Balachowsky 1927) has four tibial setae (five), *Ac. latialis* (Leonardi 1907) has five tibial setae (four), and there is some overlap in the microtubular duct lengths. We here consider these character states to be useful in species-level diagnoses, but, until more detailed analyses can be undertaken on the classification of eriococcid genera, we are reinstating the assignment of this species to the widespread genus *Acanthococcus*.

First-instar nymph (Fig. 4)

Description: Slide-mounted specimens about 0.5 mm long, 0.2–0.3 mm wide. Body slightly pear-shaped, with protruding anal lobes. Anal lobes narrow, apically acute, lightly sclerotized; each lobe dorsally with 3 enlarged setae (anteromedial seta normally shortest, posteromedial and lateral setae equal, sometime all setae about equal), 1 microtubular duct, each lobe ventrally with 3 flagellate setae including suranal seta and anal-lobe seta.

Dorsum without flagellate setae; enlarged setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral) in transverse rows from head to segment VII; enlarged setae of 2 sizes: larger size present along body margin, with 1 on margin of each abdominal segment, more numerous on head and thorax; smaller size in medial and mediolateral areas; largest enlarged setae 15–18 µm long; largest small-sized setae 5–6 µm; longest lateral seta 3–4 times longer than longest medial seta; lateral setae straight or slightly curved, conical, with acute to slightly rounded apices; medial setae straight, cylindrical, with blunt or rounded apices, cylindrical setae increasing in size anteriorly; setal rings thin; segment IV with 6 setae. Macrotubular ducts absent. Microtubular ducts with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded and about ½ length of remaining sclerotized portion; total sclerotized area longer than unsclerotized area; dermal orifice unsclerotized. Microtubular ducts on abdomen associated with mediolateral pairs of enlarged setae, forming 1 pair of longitudinal lines; on thorax and head, microtubular ducts associated with medial or mediolateral and lateral pairs of enlarged setae, forming 2 pairs of longitudinal lines. Multilocular and cruciform pores absent. Microtrichia present on segments II to VII. With numerous nodules on medial areas of thorax and head.

Anal ring apical, with 3 setae on each side of ring, suranal setae flagellate, slightly enlarged. Anal tube without sclerotization, with anal flap.

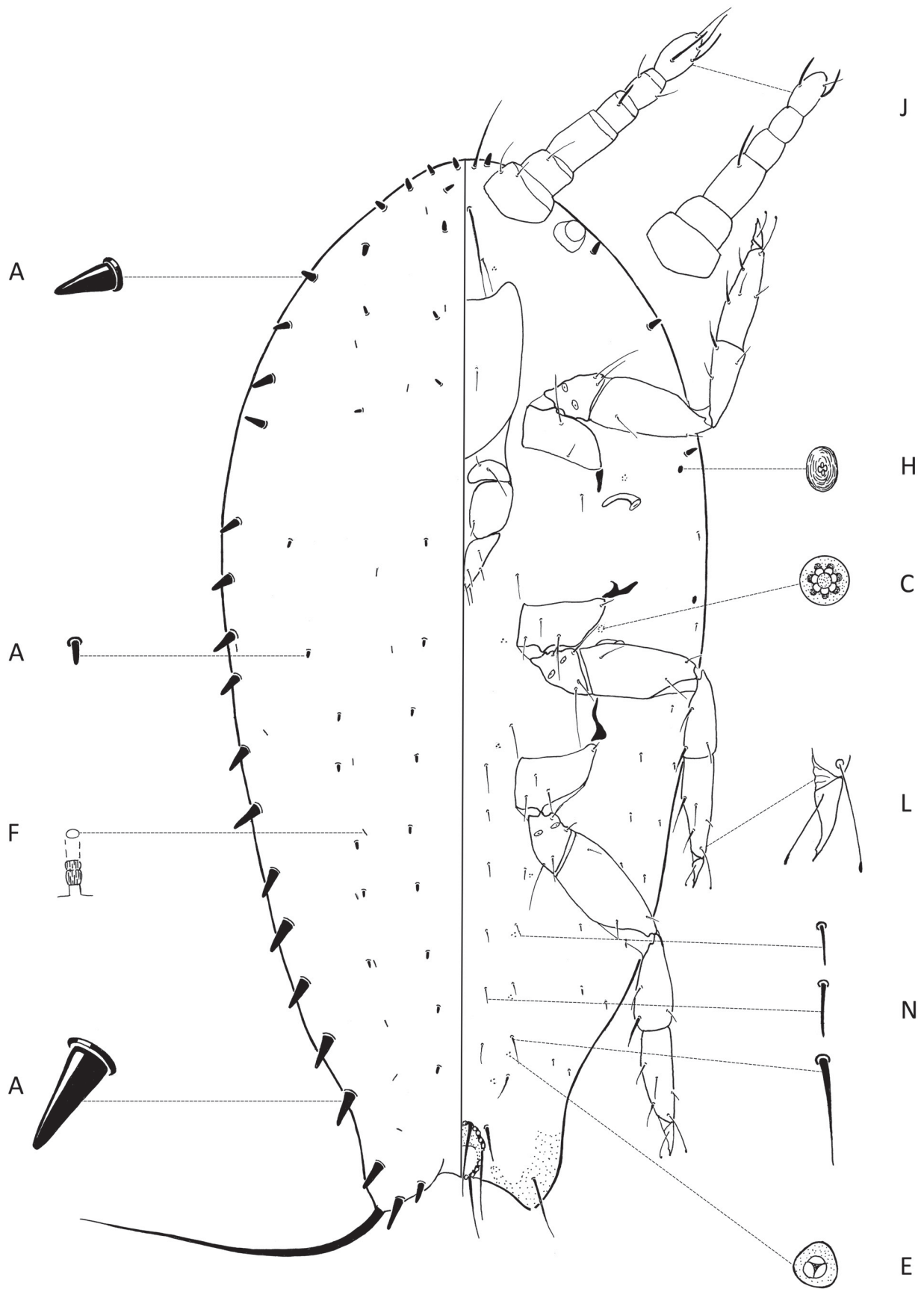


FIGURE 4. *Acanthococcus coccineus* (Cockerell 1894), first-instar nymph, The Bronx, Bronx County, New York, USA, August 31, 1944, on *Mammillaria* sp. and *Harrisia* sp., G. Rau. A=enlarged seta; C=7-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; J=antenna; L=claw; N=flagellate seta.

Venter with longest flagellate seta on segment II 7–9 µm long, on segment VII 22–30 µm; longest anal-lobe seta 144–160 µm long. Enlarged setae on lateral margins from head to segment VII, ranging from conical anteriorly to cylindrical posteriorly. Macrotubular ducts absent. Microtubular ducts absent. Multilocular pores of 3 or 4 kinds: 5-locular pores and 4-locular pores normally present near spiracles; 7-locular pores usually absent, sometimes on thorax; 3-locular pores most numerous, present elsewhere; with 1 pore on each side of head, 1 near medial areas of mid- and hind coxae, and 1 pore on each side of any or all of segments II to VII, forming 1 pair of mediolateral longitudinal lines. Cruciform pores absent. Legs with each tibia with 5 setae, 1 seta in middle; each femur with 4 setae including 1 proximal seta; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 128–135 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia in medial areas of metathorax to segment VIII, absent from coxae.

Notes: The description is based on 131 specimens from four localities. The first-instar nymph of *Ac. coccineus* is most similar to the first-instar nymph of *Ac. arenosus* by the dorsal medial and mediolateral enlarged setae noticeably smaller than the lateral enlarged setae, the predominant multilocular pores with 3 loculi, and the ventrolateral enlarged setae increasing in size anteriorly. The species differ as follows (character states in brackets are of *Ac. coccineus*): dorsomedial and mediolateral enlarged setae conical (predominantly cylindrical); each femur with five setae (each femur with four setae).

***Acanthococcus dennoi* Miller and Miller rev. comb.**

Acanthococcus dennoi Miller and Miller 1993: 27.

Eriococcus dennoi (Miller & Miller); Miller and Gimpel 1999: 213 (change of combination).

Specimens examined: material not reported previously: UNITED STATES: Georgia: Bryan Co.: no specific locality, IX-17-1974, on *Spartina patens*, R.J. Beshear (2 first-instar nymphs on 2 slides) USNM. South Carolina: Charleston Co.: Isle of Palms, IX-15-1963, on *Spartina* sp. grass, J.T. Rogers (37 first-instar nymphs on 1 slides) USNM.

Etymology: The species epithet “*dennoi*” was named in honor of the late Robert F. Denno, Department of Entomology, University of Maryland, USA, who collected this and many other interesting scale insects.

First-instar nymph (Fig. 5)

Description: Slide-mounted specimens 0.5–0.7 mm long, 0.2–0.3 mm wide. Body pear-shaped, with protruding anal lobes. Anal lobes apically rounded; each lobe dorsally with 3 apically acute enlarged setae, posteromedial seta largest, lateral seta smallest, microtubular ducts absent; each lobe ventrally with 3 flagellate setae including suranal seta and anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and sublateral), in transverse rows from head to segment VII; of 2 sizes: larger setae on head and anal lobes with acute apices; smaller size over remainder of surface with acute apices; largest enlarged setae 16–19 µm long, largest seta on head 14–18 µm long; largest small-sized setae 7–8 µm long; with 8 setae on segment IV. Microtubular ducts each about 3 µm long, forming 1 pair of irregular longitudinal lines on mediolateral area of head, thorax and abdomen. Macrotubular ducts, cruciform pores, and multilocular pores absent. Microtrichia present on abdomen.

Anal ring ventral or apical, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization, with anal flap.

Venter with setae flagellate, longest seta on segment II approximately 13 µm long, on segment VII about 11 µm; longest anal-lobe seta 130 µm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores of 3 kinds: 9-locular pores, if present, located near spiracles; 7-locular pores most abundant on thorax; 5-locular pores most abundant on abdomen. Cruciform pores restricted to thorax, with 2 or 3 pores along each thoracic body margin. Legs without pores; each femur with 5 setae, 3 distal and 2 proximal; each tibia with 4 setae; hind tibia/tarsus 0.7–0.8. Claw without denticle near tip. Antennae each 6-segmented, about 95 µm long. Without frontal lobe. Preantennal pore present. Microtrichia present on abdomen, absent from coxae.

Notes: The description is based on 29 specimens from two localities. Of the seven *Acanthococcus* species treated in this publication, the first-instar nymph of *Ac. dennoi* is most similar to the first-instar nymph of *Ac. pennyae* in having four setae on each hind tibia, five setae on each hind femur, and dorsomedial enlarged setae usually about same size as lateral setae. They differ as follows (character states in brackets are of *Ac. dennoi*): the predominant multilocular pore on the ventral abdomen with 3 loculi (5 loculi); cruciform pores absent (present).

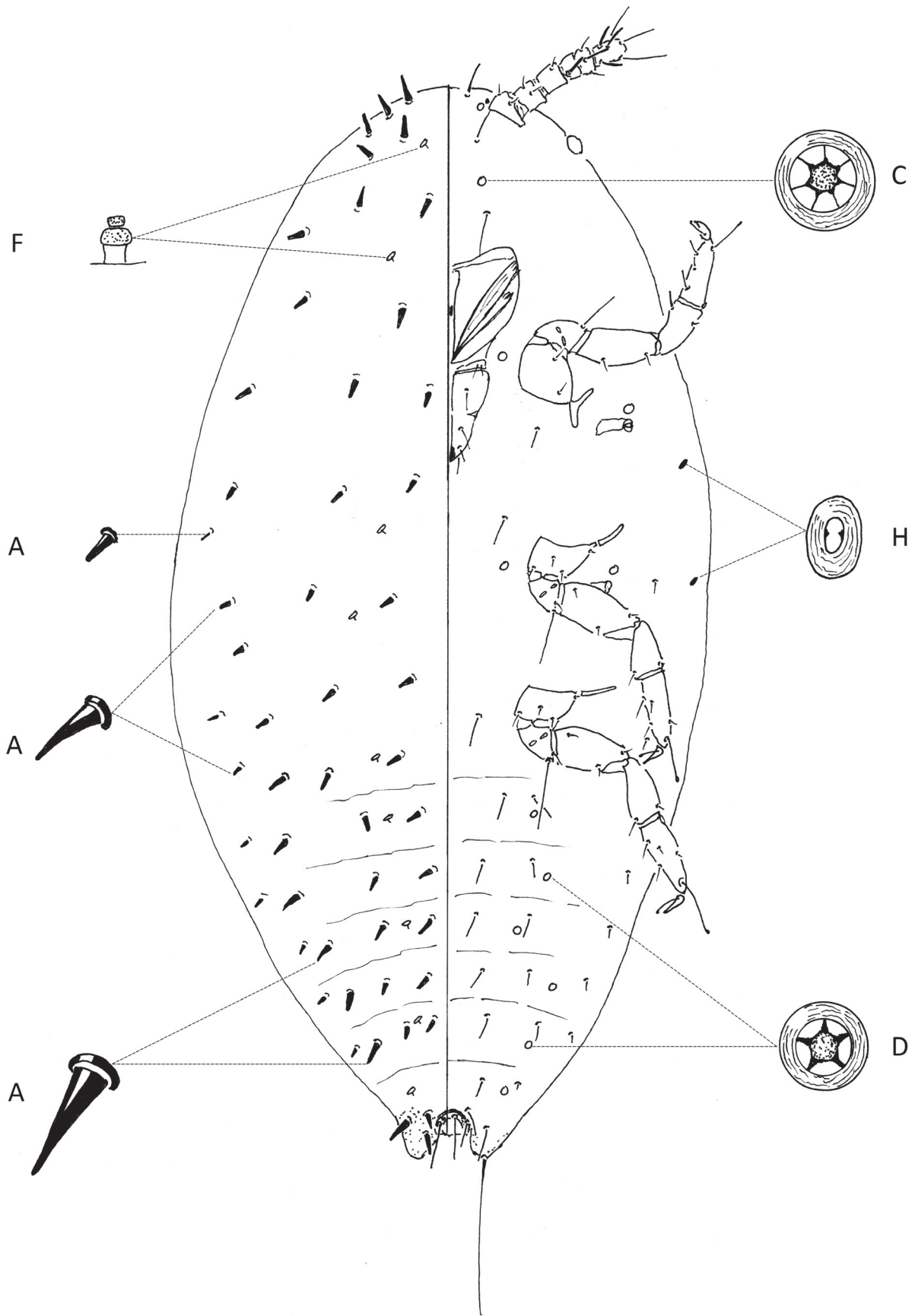


FIGURE 5. *Acanthococcus dennoi* Miller and Miller 1993, first-instar nymph, Richmond Hill State Park, Bryan Co., Georgia, USA, September 17, 1974, on *Spartina patens*. R.J. Beshear. A=enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore.

Acanthococcus gallicolus (Cockerell & Rohwer) comb. n.

Atriplicia gallicola Cockerell and Rohwer 1909: 169.

Eriococcus gallicola (Cockerell & Rohwer); Lindinger 1914: 116 (change of combination and misspelling of species epithet).

Nidularia gallicola (Cockerell & Rohwer); Lindinger 1933a: 113 (change of combination).

Eriococcus gallicolus Ferris 1957: 85 (revived combination requiring emendation of specific epithet for agreement in gender).

Type material: We have examined two series of specimens (received at USNM October 30, 1908 and November 9, 1908 from L.C. Bragg) with identical information as the type series except they were sent to the USNM rather than to Cockerell and Rohwer. There is no doubt that these specimens are identical to the type series but were not used for the original description. We also have seen specimens collected by Townsend in 1896 that were mentioned by Cockerell and Rohwer (1909) in the original description of the species but were excluded from the type series.

Specimens examined: Locality ?: received at USNM V-?-1927, on *Atriplex* sp., T.D.A Cockerell (2 ad. ♀♀ on 1 slide) USNM. UNITED STATES: California: Inyo Co.: Deep Springs, IX-27-1925, on *Atriplex* sp., G.F. Ferris (2 ad. ♀♀ on 1 slide) UCD. Colorado: Las Animas Co.: Trinidad, received at USNM XI-9-1908, on *A. canescens*, L.C. Bragg (9 ad. ♀♀, 8 second-instar ♀♀ exuviae on 5 slides) USNM; Trinidad, received at USNM X-30-1908, on *A. canescens*, L.C. Bragg (13 ad. ♀♀, 2 second-instar ♀♀, 2 first-instar nymphs on 9 slides) USNM. New Mexico: Dona Ana Co.: Las Cruces, X-9-1896, on *A. canescens*, C.H.T. Townsend (5 ad. ♀♀, 1 second-instar ♀ exuviae, 7 first-instar nymphs on 3 slides) USNM; Mesilla Park, V-5-1909, on *A. canescens*, C.N. Ainslie (6 ad. ♀♀, 26 first-instar nymphs on 4 slides) USNM.

Etymology: The species epithet “*gallicolus*” is formed from the Latin word “*galla*” meaning “gall” or “oak apple” and apparently refers to the gall induced by this species.

Field features: *Acanthococcus gallicolus* induces the leaf of the host to fold, forming a gall. According to Cockerell and Rohwer (1909: 170), “The gall, about 4.5 mm long, consists of the subglobular swollen base of the *Atriplex* leaf, the sides being folded upwards, leaving an open slit above, the margins of which are curled outward. The end of leaf makes a pointed process at the end of each gall.” According to Felt (1918), the galls are alternate on the host plant. Dried galls contain the exuviae of the second-instar female and the withered adult female, and are lined with a thin layer of wax similar to the secretion produced on the venter of many eriococcids.

Adult female (Fig. 6)

Description: Slide-mounted specimens, 0.9–2.4 mm long, 0.8–2.1 mm wide. Body rotund, with anal lobes protruding. Anal lobes each slender, apically acute, either lightly sclerotized or without sclerotization. Each lobe dorsally with 3 slender setae and no microtubular ducts; each lobe ventrally with 3 or 4 flagellate setae including suranal seta and anal-lobe seta and 0 or 1 multilocular pores.

Dorsum with all setae flagellate, without longitudinal lines, arranged in transverse rows on head to segment VII; of 1 variable size: largest seta about 7 µm long; segment IV with 10–13 setae. Macrotubular ducts in small numbers over surface. Microtubular ducts absent. Multilocular pores scattered over surface, of 3 kinds: 7-locular pores and 3-locular pores uncommon; 5-locular pores abundant. Cruciform pores absent. Microtrichia present from segment III or IV to VIII.

Anal ring normally bent around posterior apex of abdomen, usually with 4 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization or weakly sclerotized.

Venter with flagellate setae noticeably longer than those on dorsum, setae on segment II 85–122 µm long, on segment VII 61–82 µm; anal-lobe seta 162–270 µm long; setae apically acute. Enlarged setae absent. Macrotubular ducts smaller than those on dorsum, on abdomen only. Microtubular ducts absent. Multilocular pores with 5-loculi only, scattered over entire surface, most abundant near vulva. Cruciform pores absent. Large numbers of weakly indicated pores on metathorax and anterior abdominal segments, surrounding hind pair of legs. Legs with hind coxae dorsally each with 0–6 pores, absent ventrally; each femur with 5 setae; each tibia with 5 setae, 1 in middle of tibia; tibia/tarsus 0.7–1.0; claws each with denticle near tip; tarsal and claw digitules apically capitate. Antennae each 7-segmented, rarely with 6, 189–208 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia present on all coxae; in medial areas of segment II to VIII, sometimes absent.

Notes: The description is based on 33 specimens from six localities. The adult female of *A. gallicolus* is unique in lacking dorsal enlarged setae, dorsal microtubular ducts, and in having dorsal multilocular pores and numerous pores on the derm next to the hind coxae.

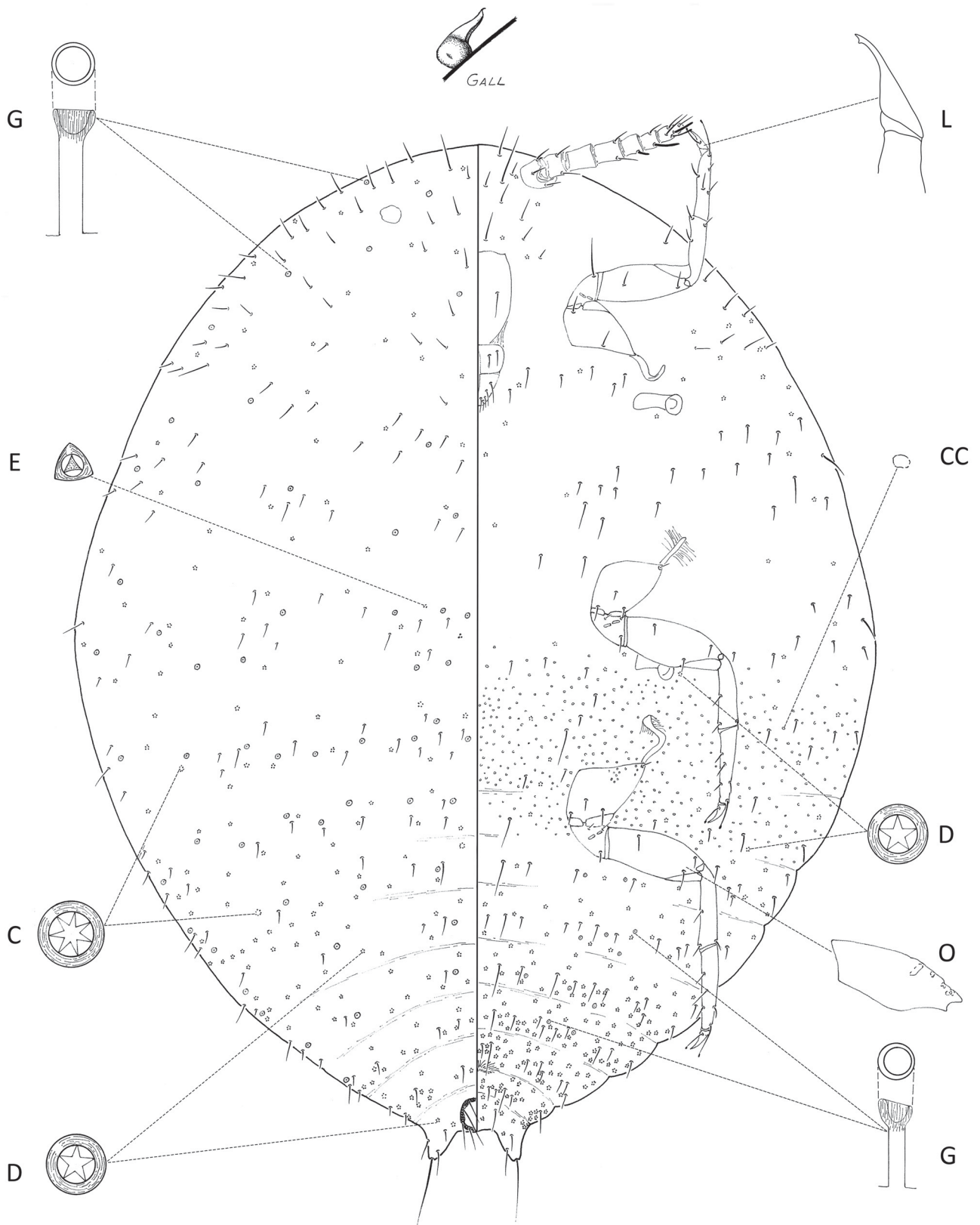


FIGURE 6. *Acanthococcus gallicolus* (Cockerell and Rohwer 1909), adult female, Trinidad, Las Animas Co., Colorado, USA: received at USNM September 9, 1908, on *Atriplex canescens*, L.C. Bragg. C=7-locular pore; D=5-locular pore; E=3-locular pore; G=macro tubular duct; L=claw; O=femur; CC=weakly indicated pore.

As is the case for many gall-inducing species of eriococcids, the morphology of *Ac. gallicolus* appears to have evolved to accommodate living in a different microhabitat. The main character state separating this species from other *Acanthococcus* species is the absence of enlarged setae. The enlarged setae of species of *Acanthococcus* serve as the base of crystalline wax rods that may function in camouflaging the species or in protecting it from natural enemies. In the case of *Ac. gallicolus*, the enlarged setae apparently have been lost because their utility would seem to be unnecessary within the confines of a gall. Since the first-instar nymph of *Ac. gallicolus* is nearly identical to the first-instar nymphs of many other North American species of *Acanthococcus* we agree with Lindinger (1914) and Ferris (1957) and consider *Atriplicia* to be a junior subjective synonym, in this case of *Acanthococcus*, not *Eriococcus*.

Second-instar female (Fig. 7)

Description: Slide-mounted specimens each 0.9 mm long, 0.6 mm wide. Body pear-shaped, with protruding anal lobes. Anal lobes narrow and pointed, lightly sclerotized on both surfaces, each lobe dorsally with 3 flagellate setae, each lobe ventrally with 3 or 4 flagellate setae including suranal seta and elongate anal-lobe seta.

Dorsum with all setae flagellate, scattered over head and anterior thorax, arranged in 3 pairs of longitudinal lines (medial, sublateral and lateral), from posterior thorax to segment VII; of 2 sizes, largest 10–12 µm long on abdomen, smallest on head and thorax about 5 µm long; segment IV with 7 or 8 setae. Microtubular ducts each about 3 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded and about ½ length of remaining sclerotized portion; when present restricted to segment VIII. Multilocular pores of 5-locular kind only, scattered over entire surface. Cruciform pores absent. Microtrichia present on segments II to VIII.

Anal ring apical, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with longest flagellate seta on segment II about 43 µm long, on segment VII about 36 µm; anal-lobe seta 102–196 µm long; setae apically acute. Enlarged setae absent. Microtubular ducts absent. Multilocular pores scattered over entire surface, of 2 kinds: 5-locular pores most abundant; 3-locular pores rare. Legs with each femur with 5 setae; each tibia with 5 setae, with 1 in middle; tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 108–147 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia present on coxae, absent elsewhere.

Notes: The description is based on 11 specimens from two localities. The illustration and description are based on exuviae and may have some discrepancies. The second-instar female of *Ac. gallicolus* is unique in lacking dorsal enlarged setae, and in having dorsal multilocular pores.

First-instar nymph (Fig. 8)

Description: Slide-mounted specimens 0.4–0.5 mm long, 0.2–0.3 mm wide. Body slightly pear-shaped, with protruding anal lobes. Anal lobes broad, apically acute, lightly sclerotized; each lobe dorsally with 3 enlarged setae (anteromedial seta normally shortest, posteromedial and lateral setae equal, rarely all setae equal), microtubular ducts usually absent from lobes, each lobe ventrally with 3 or 4 slender setae including suranal seta and anal-lobe seta.

Dorsum without flagellate setae; enlarged setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), on thorax and abdomen, with no additional setae between lines except on head; setae of 1 variable size, becoming smaller anteriorly, present in transverse rows from head to segment VII; setae straight or slightly curved, with slightly rounded apices; segment IV with 6 setae. Macroducts absent. Microtubular ducts with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded and about ½ length of remaining sclerotized portion; total sclerotized area longer than unsclerotized area; dermal orifice unsclerotized. Microtubular ducts on abdomen associated with mediolateral pairs of enlarged setae forming 1 pair of longitudinal lines; on thorax and head microtubular ducts associated with medial or mediolateral and lateral pairs of enlarged setae forming 2 pairs of longitudinal lines. Multilocular and cruciform pores absent. Microtrichia present on segments IV to VIII.

Anal ring apical, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with body setae flagellate, longest seta on segment II approximately 11 µm long, on segment VII about 19 µm; longest anal-lobe seta 100–171 µm long. Enlarged setae on lateral margins of segments VI and VII and near spiracles. Macroducts absent. Microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores most numerous; 3-locular pores uncommon but present on all specimens examined; distribution of these pores relatively constant, rarely with pore near anterior margin of metathoracic pairs of legs, otherwise same as in illustration. Cruciform pores absent. Legs with each femur with 5 setae; each tibia with 5 setae, 1 seta in middle; tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 104–161 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia absent from coxae, present in medial areas of segments IV to VIII.

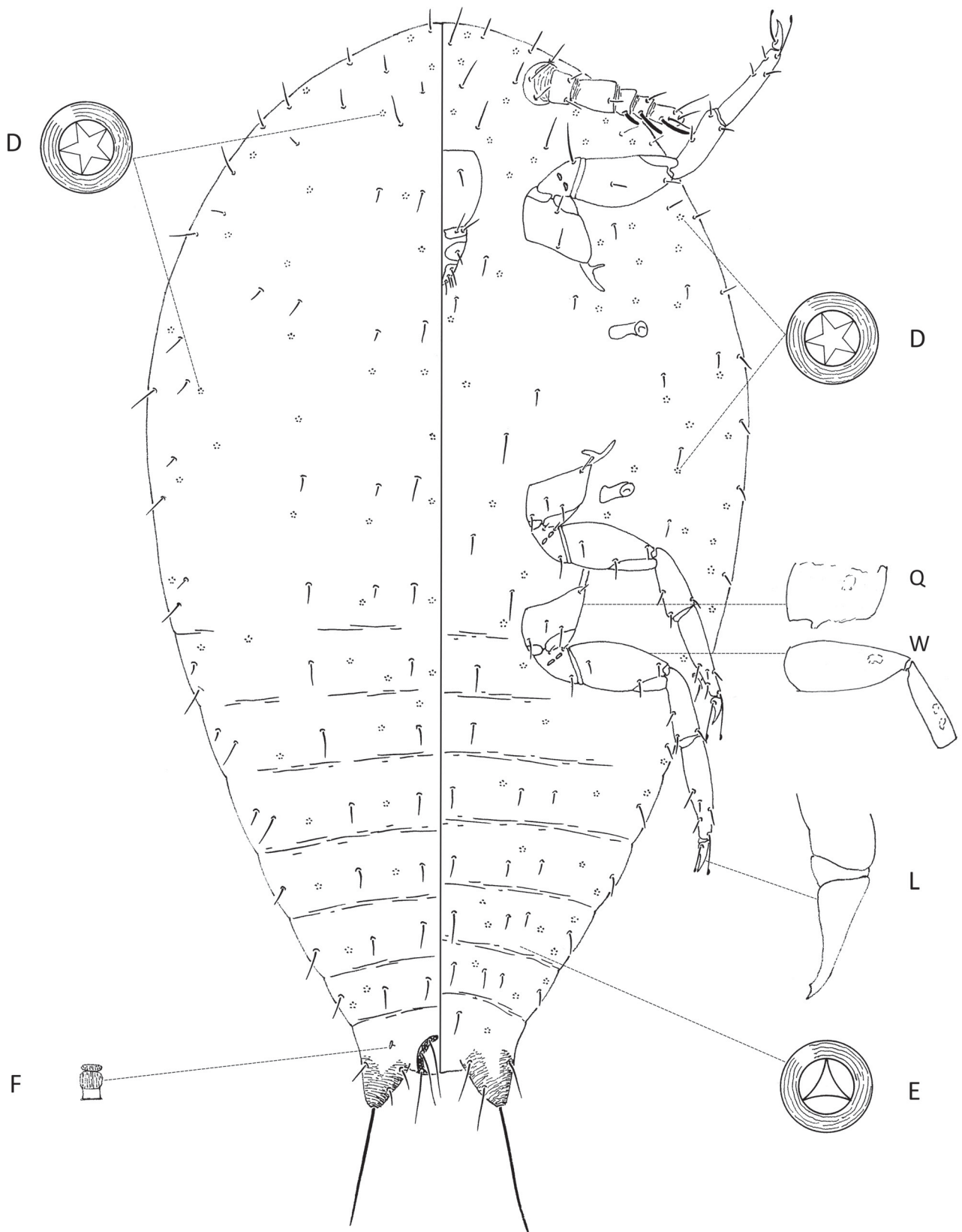


FIGURE 7. *Acanthococcus gallicolus* (Cockerell and Rohwer 1909), second-instar female, Trinidad, Las Animas Co., Colorado, USA: received at USNM September 9, 1908, on *Atriplex canescens*, L.C. Bragg. D=5-locular pore; E=3-locular pore; F=microtubular duct; L=claw; Q=dorsal surface of coxa; W=hind leg.

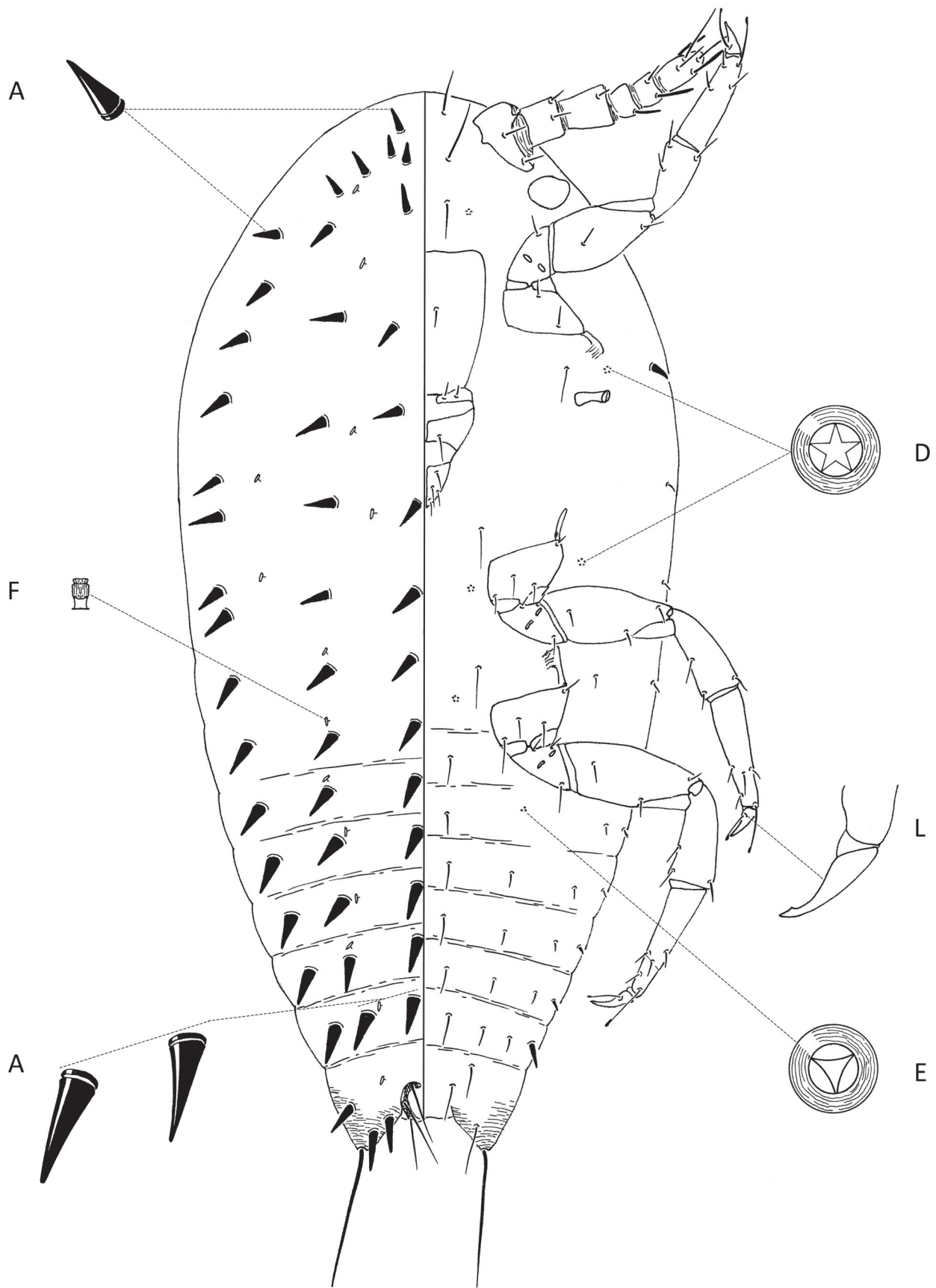


FIGURE 8. *Acanthococcus gallicolus* (Cockerell and Rohwer 1909), first-instar nymph, Mesilla Park, Dona Ana Co., New Mexico, May 5, 1909, on *Atriplex canescens*, C.N. Ainslie. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; L=claw.

Notes: The description is based on 37 specimens from three localities. The first-instar nymph of *Ac. gallicolus* is most similar to the first-instar nymph of *Ac. arenosus* in having five setae on each hind tibia and five setae on each hind femur. They differ as follows (character states of *Ac. gallicolus* are given in brackets): medial and mediolateral enlarged setae smaller than the lateral enlarged setae (about the same size as the lateral setae); cruciform pores usually present (absent).

Acanthococcus hoyi Miller and Miller rev. comb.

Eriococcus kemptoni Parrott 1900; Ferris 1955: 134-135 (misidentification discovered by Miller and Miller 1992: 47).

Acanthococcus hoyi Miller and Miller 1992: 44-48.

Eriococcus hoyi (Miller & Miller); Miller and Gimpel 1999: 214 (change of combination).

Specimens examined: material not reported previously: UNITED STATES: Arizona: Cochise Co.: Portal, VIII-23-1968, on *Bouteloua curtipendula*, D.M. Tuttle (1 second-instar ♀ and 1 second-instar ♂ on 2 slides) CDFA. Texas: Dallam Co.: Dalhart, X-(?)-1912, on *Bouteloua* sp., C.N. Ainslie (35 first-instar nymphs on 1 slide) USNM.

Etymology: The species epithet “*hoyi*” is named in honor of the late Jim M. Hoy, Department of Scientific and Industrial Research, New Zealand who published several important works on the Eriococcidae of New Zealand including two books.

Field features: Probably occurring in leaf blade sheaths.

Second-instar female (Fig. 9)

Description: Slide-mounted specimen 1.1 mm long, 0.4 mm wide. Body elongate, with protruding anal lobes. Anal lobes apically acute, lightly sclerotized; each lobe dorsally with 3 apically truncate enlarged setae, lateral seta longest, anteromedial seta shortest, with 1 microtubular duct; each lobe ventrally with 3 flagellate setae, including suranal seta and elongate anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae forming 4 pairs of longitudinal lines, (medial, mediolateral, sublateral and lateral) on abdomen, lines less obvious on head and thorax; enlarged setae of 2 sizes: larger size present along body margin, with 2 present on each margin of each abdominal segment; smaller size present in medial, mediolateral, and sublateral areas; largest lateral enlarged setae each about 41 µm long; largest small-sized setae each about 9 µm; longest lateral seta 4-5 times longer than longest medial seta; lateral setae straight or slightly curved, slender, with blunt apices; medial setae straight, short, with blunt apices; setal rings thin; segment IV with 10 setae. Microtubular ducts each about 4 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded; sclerotized area slightly longer than unsclerotized area; dermal orifice weakly sclerotized; microtubular ducts scattered over entire surface. Multilocular and cruciform pores absent. Microtrichia present on posterior segments.

Anal ring apical, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with longest seta on segment II about 25 µm long; longest on segment VII about 29 µm; anal-lobe seta about 180 µm long. Enlarged setae absent, although sublateral setae more robust than medial setae. Microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores most abundant on head and thorax, present mediolaterally on abdomen; 3-locular pores, when present, located near inner margin of middle pair of coxae. Cruciform pores in sublateral line along body margin. Legs with each femur with 5 setae; each tibia with 5 setae, with 1 seta in middle; hind tibia/tarsus 0.8. Antennae each 6-segmented, about 160 µm long. Frontal lobes absent; preantennal pore present. Microtrichia present on abdomen, absent from coxae.

Notes: The description is based on one specimen from one locality. The second-instar female of *Ac. hoyi* is most similar to the second-instar female of *Ac. kemptoni* by having the lateral enlarged setae noticeably larger than the dorsal medial and mediolateral setae. They differ as follows (character states in brackets are of *Ac. hoyi*): large-sized lateral setae restricted to abdomen and head (present around entire body margin); each hind tibia without middle seta (with middle seta).

Second-instar male (Fig. 10)

Description: Slide-mounted specimen 0.8 mm long, 0.3 mm wide. Body elongate, with protruding anal lobes. Anal lobes apically acute; each lobe dorsally with 3 apically truncate enlarged setae, anterolateral seta longest, anteromedial seta shortest, with 1 microtubular duct; each lobe ventrally with 3 flagellate setae including suranal seta and elongate anal-lobe seta.

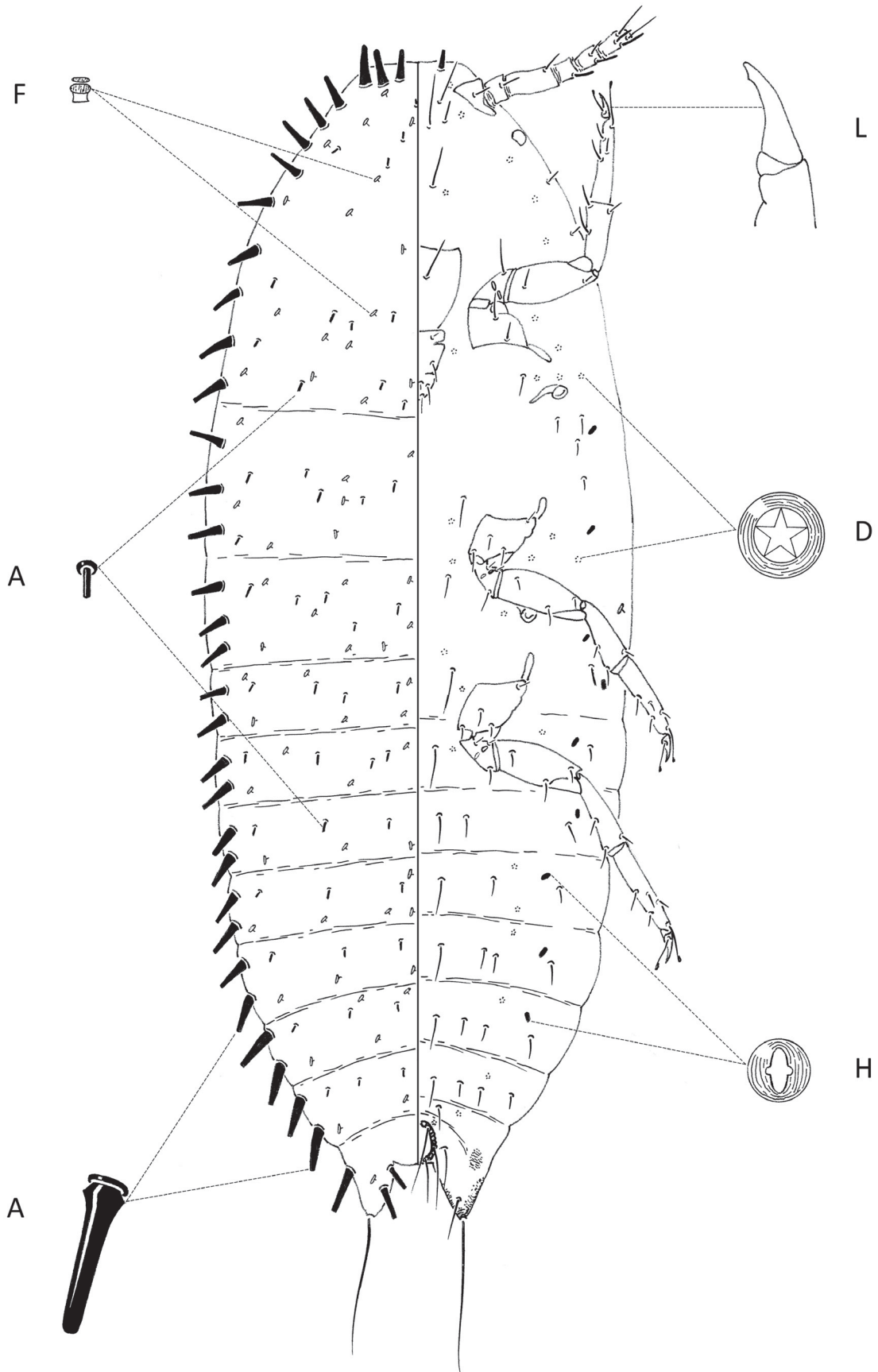


FIGURE 9. *Acanthococcus hoyi* Miller and Miller 1992, second-instar female, Portal, Cochise Co., Arizona, USA, August 23, 1968, on *Bouteloua curtipendula*, D.M. Tuttle. A=enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; L=claw.

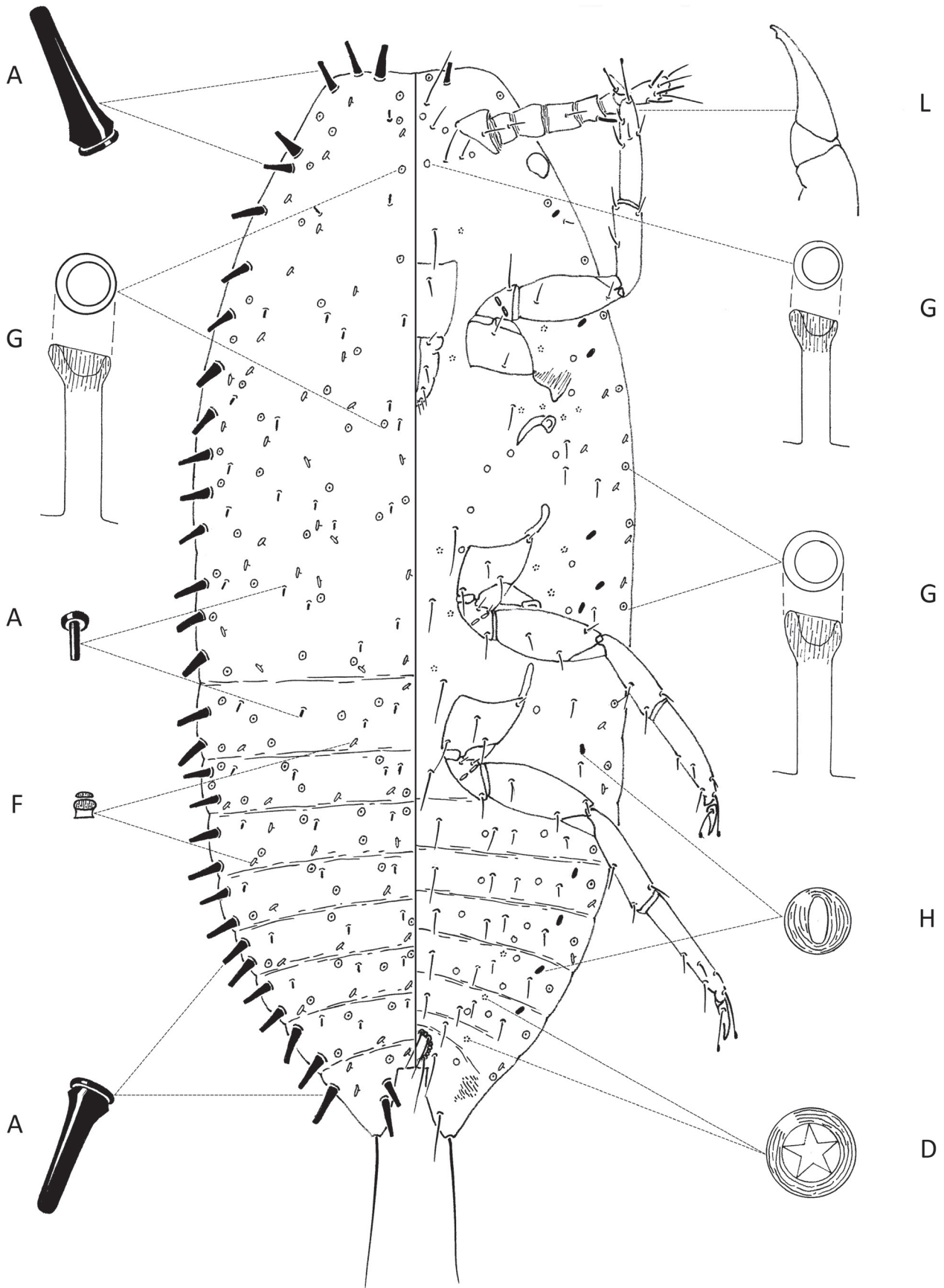


FIGURE 10. *Acanthococcus hoyi* Miller and Miller 1992, second-instar male, Portal, Cochise Co., Arizona, USA, August 23, 1968, on *Bouteloua curtipendula*, D.M. Tuttle. A=enlarged seta; D=5-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; L=claw.

Dorsum without flagellate setae. Enlarged setae forming 4 pairs of longitudinal lines, (medial, mediolateral, sublateral and lateral) on abdomen; arranged in transverse rows from head to segment VII; enlarged setae of 2 sizes: larger size along body margin, with 2 setae on margin of each abdominal segment; smaller size in medial, mediolateral, and sublateral areas; largest lateral enlarged setae each about 32 μm long; largest small-sized setae each about 9 μm ; longest lateral seta about 4 times longer than longest medial seta; lateral setae straight or slightly curved, slender, with truncate apices; medial setae straight, with truncate apices; setal rings thin; segment IV with 10 setae. Macrotubular ducts of 1 size, abundant over entire surface. Microtubular ducts each about 4 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded; sclerotized area slightly longer than unsclerotized area; dermal orifice weakly sclerotized; microtubular ducts scattered over entire surface. Multilocular and cruciform pores absent. Microtrichia on segments VII and VIII.

Anal ring dorsal, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with longest seta on segment II about 28 μm long; longest on segment VII about 22 μm long; anal-lobe seta 178–202 μm long. Enlarged setae absent. Macrotubular ducts of 2 kinds: larger size (same size as on dorsum) most numerous near body margin; smaller size in medial areas of head, thorax and abdomen. Multilocular pores all 5-locular pores, present near mouthparts, spiracles, and mediolaterally on abdomen. Microtubular ducts present along body margin on thorax and abdomen. Cruciform pores present along body margin. Legs without pores; each femur with 5 setae; each tibia with 5 setae, 1 seta in middle; hind tibia/tarsus 0.8. Antennae each 7-segmented, about 170 μm long. Frontal lobes absent; preantennal pore present. Microtrichia on mesothorax to VIII, and on hind 2 pairs of coxae.

Notes: The description is based on one specimen from one locality. The only other *Acanthococcus* second-instar male described here is of *Ac. pennyae* and it differs as follows (character states in brackets are of *Ac. hoyi*): dorsal enlarged setae all about same size (dorsal medial and mediolateral enlarged setae conspicuously shorter than the lateral setae); enlarged setae apically acute (enlarged setae apically truncate); tibiae each with four setae (tibiae each with five setae); dorsal multilocular pores present (dorsal multilocular pores absent); ventral cruciform pores absent (cruciform pores present).

First-instar nymph (Fig. 11)

Description: Slide-mounted specimen 0.5 mm long, 0.2 mm wide. Body elongate, with protruding anal lobes. Anal lobes broad, apically acute, weakly sclerotized; each lobe dorsally with 3 apically rounded enlarged setae, anteromedial seta shortest, remaining setae equal in length, with 0 or 1 microtubular ducts; each lobe ventrally with 3 flagellate setae including suranal seta and elongate anal-lobe seta.

Dorsum without flagellate setae; enlarged setae forming 3 pairs of longitudinal lines, (medial, mediolateral and lateral), in transverse rows from head to segment VII; of 2 sizes: larger size present along body margin, with 2 setae present on each margin of each abdominal segment, on anterior abdominal segments anterior seta slightly smaller than posterior seta; smaller size present in medial and submedial areas; largest enlarged setae 20–24 μm long; largest small-sized setae 6–7 μm long; longest lateral seta 3–4 times longer than longest medial seta; lateral setae straight or slightly curved, slender, with rounded apices; medial setae straight, with blunt or rounded apices; setal rings thin; segment IV with 8 setae. Microtubular ducts about 3 μm long, with area farthest from dermal orifice sclerotized, undivided; dermal orifice weakly sclerotized; forming 1 pair of longitudinal lines on abdomen (mediolateral) and 2 pairs of lines on thorax (medial and lateral). Macrotubular ducts, cruciform pores, and multilocular pores absent. Microtrichia on segments I to VIII.

Anal ring either apical or ventral, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with setae flagellate, longest seta on segment II about 13 μm long, on segment VII about 15 μm long; longest anal-lobe seta 172–190 μm long. Enlarged setae, macrotubular ducts, and microtubular ducts absent. Multilocular pores fairly consistent on head and thorax, with about the same numbers of 3-locular pores and 5-locular pores; head pore present; pore near anterior spiracles usually present; pore near posterior spiracle present or absent; pore present near metathoracic legs; pores present or absent on segments II to VII, with total of 4–10 pores on each side of body. Cruciform pores present along lateral margin of thorax, with 3 rarely 4 such pores on each body margin. Legs without pores; each femur with 5 setae; each tibia with 5 setae, 1 in middle of tibia; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, about 130 μm long. Frontal lobes absent; preantennal pore present. Microtrichia on segments II to VIII; absent from coxae.

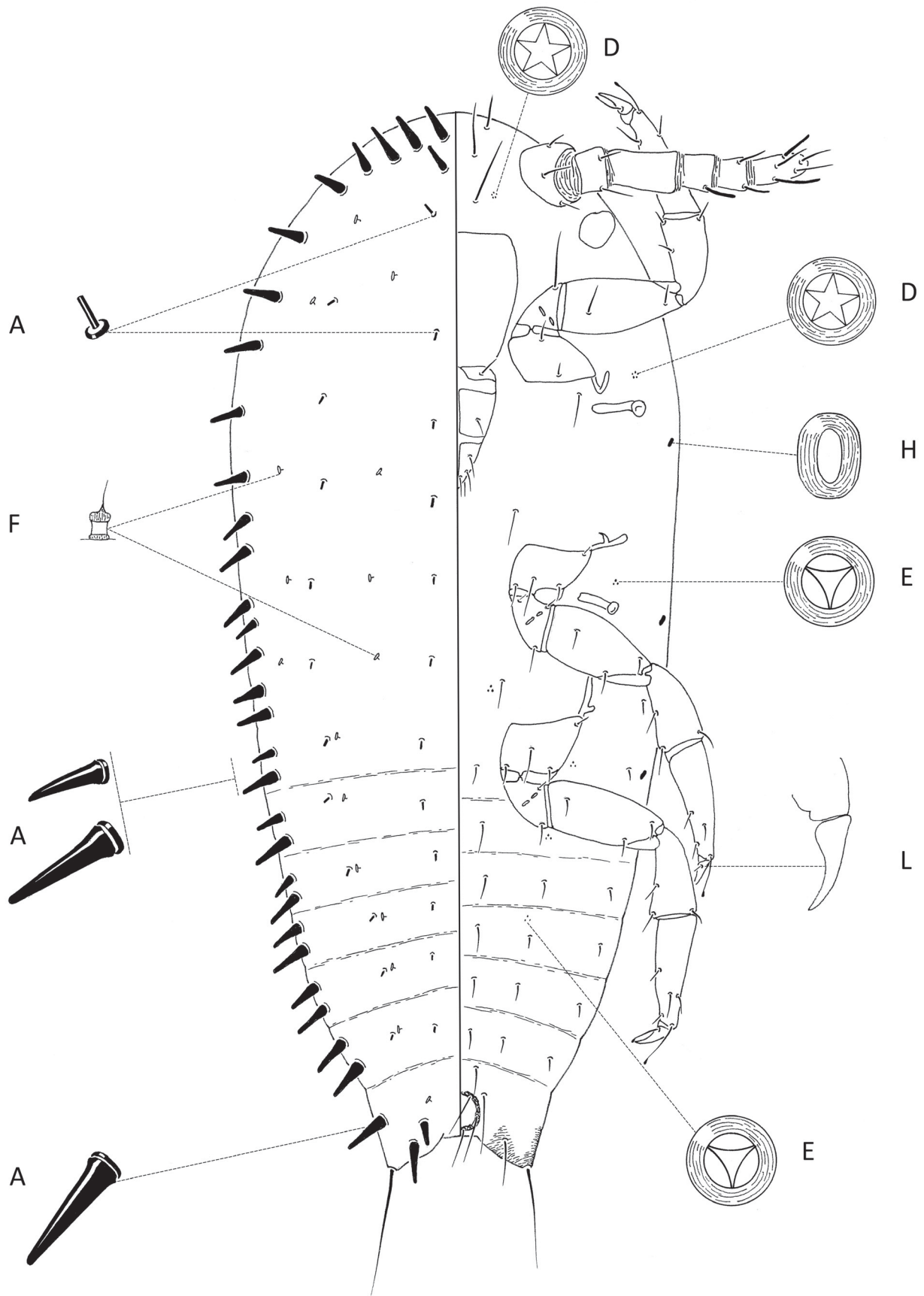


FIGURE 11. *Acanthococcus hoyi* Miller and Miller 1992, first-instar nymph, Dahart, Hartley Co., Texas, USA, October ?, 1912, on *Bouteloua* sp., C.N. Ainslie. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; L=claw.

Notes: The description is based on 35 specimens from one locality. Among the first-instar nymphs described here, *Ac. hoyi* is most similar to the first-instar nymph of *Ac. kemptoni* in having the medial and mediolateral setae conspicuously shorter than the marginal setae. They differ as follows (character states in brackets are of *Ac. hoyi*): large-sized marginal setae restricted to abdomen and head (present around entire margin); each tibia without middle seta (with middle seta); with 1 large-sized setae on each lateral margin of each abdominal segment (with 2).

***Acanthococcus kemptoni* (Parrott) rev. comb.**

Eriococcus kemptoni Parrott 1900: 144.

Nidularia kemptoni (Parrott); Lindinger 1933a: 116 (change of combination).

Eriococcus mancus Ferris 1955: 138. (junior synonym discovered by Miller & Miller 1992: 51-54). Notes: The type material of *Eriococcus mancus* Ferris is misidentified specimens of *Eriococcus kemptoni*.

Acanthococcus kemptoni (Parrott); Miller and Miller 1992: 51-54 (change of combination).

Rhizococcus kemptoni (Parrott); Kozár 2009: 109. (change of combination).

Specimens examined: material not reported previously: UNITED STATES: Georgia: Fulton Co.: Ft. Mc Pherson, VI-4-1943, on *Andropogon virginicus*, H.S. McConnell (4 ad. ♀♀, 2 embryonic first-instar nymphs and 40 first-instar nymphs on 2 slides) USNM. Kansas: Barber Co.: 10 mi. N. Medicine Lodge, VI-28-1970, on grass, tended by Formicidae, *Crematogaster punctulata*, D.R. Miller (5 second-instar ♀♀, 3 first-instar nymphs on 1 slide) USNM; Butler Co.: Douglass, VI-28-1970, on grass, D.R. Miller (10 first-instar nymphs on 1 slide) USNM. Virginia: independent city in Commonwealth of Virginia, 7 mi. E. Fredericksburg, III-15-1971, V-7-1971 and VII-17-1971, on *A. virginicus*, S. Nakahara and D.R. Miller (41 first-instar nymphs on 4 slides) USNM.

Etymology: The species epithet “*kemptoni*” is named in honor of one of the original collectors (R.H. Kempton) from Kansas.

Field features: Occurring on grass leaf blades.

Second-instar female (Fig. 12)

Description: Slide-mounted specimens 1.1–1.2 mm long, 0.5–0.6 mm wide. Body elongate, with protruding anal lobes. Anal lobes apically acute, lightly sclerotized; each lobe dorsally with 3 elongate, apically rounded enlarged setae, all about same length; each lobe ventrally with 3 flagellate setae including anal-lobe seta and 2 or 3 multilocular pores.

Dorsum without flagellate setae. Enlarged setae forming 3 or 4 pairs of longitudinal lines (medial, mediolateral, sublateral and lateral); enlarged setae of 2 sizes: larger size along body margin on segments IV to VIII and on head, with 2 on each margin of each abdominal segment; smaller size in medial, mediolateral and sublateral areas; largest lateral enlarged setae each about 38 µm long; largest small-sized setae each about 8 µm; longest lateral seta 4–5 times longer than longest medial seta; lateral setae straight or slightly curved, slender, with rounded apices; medial setae straight, short, with blunt apices; setal rings thin; segment IV with 9–11 setae. Microtubular ducts absent. Multilocular and cruciform pores absent. Microtrichia present on segments II to VIII.

Anal ring apical, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with longest seta on segment II about 18 µm long; longest on segment VII about 20 µm; anal-lobe seta about 310–330 µm long. Enlarged setae of small size only, present in lateral and sublateral areas of head, thorax and anterior abdominal segments. Microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores scattered over head and thorax, present mediolaterally on abdomen; 7-locular pores common, 5-locular pores most abundant. Cruciform pores variable, present laterally and sublaterally on head, thorax, and anterior abdominal segments, sometimes scattered in medial areas of thorax and abdomen. Legs with hind coxae with 2 or 3 indefinite pores on dorsal surface; hind 2 pairs of tibiae each with 4 setae, without seta in middle of tibia, front tibiae each with 5 setae, with 1 seta in middle of tibia; hind tibia/tarsus 0.7–0.9. Antennae each 6-segmented, about 190 µm long. Frontal lobes absent; preantennal pore present. Microtrichia present on mesothorax to segment VIII.

Notes: The description is based on five specimens from one locality. The presence of two large-sized enlarged setae on each lateral margin of segments IV to VIII and also on the head, but not on the remaining part of the lateral head, thorax, and anterior abdomen, is unique for the second-instar female of *Ac. kemptoni*. It also is distinctive in having five setae on each front tibia but only four on each hind tibia. For a comparison of this species with *Ac. hoyi* see the “Notes” section of the second-instar female of that species.

First-instar nymph (Figs 13 and 14)

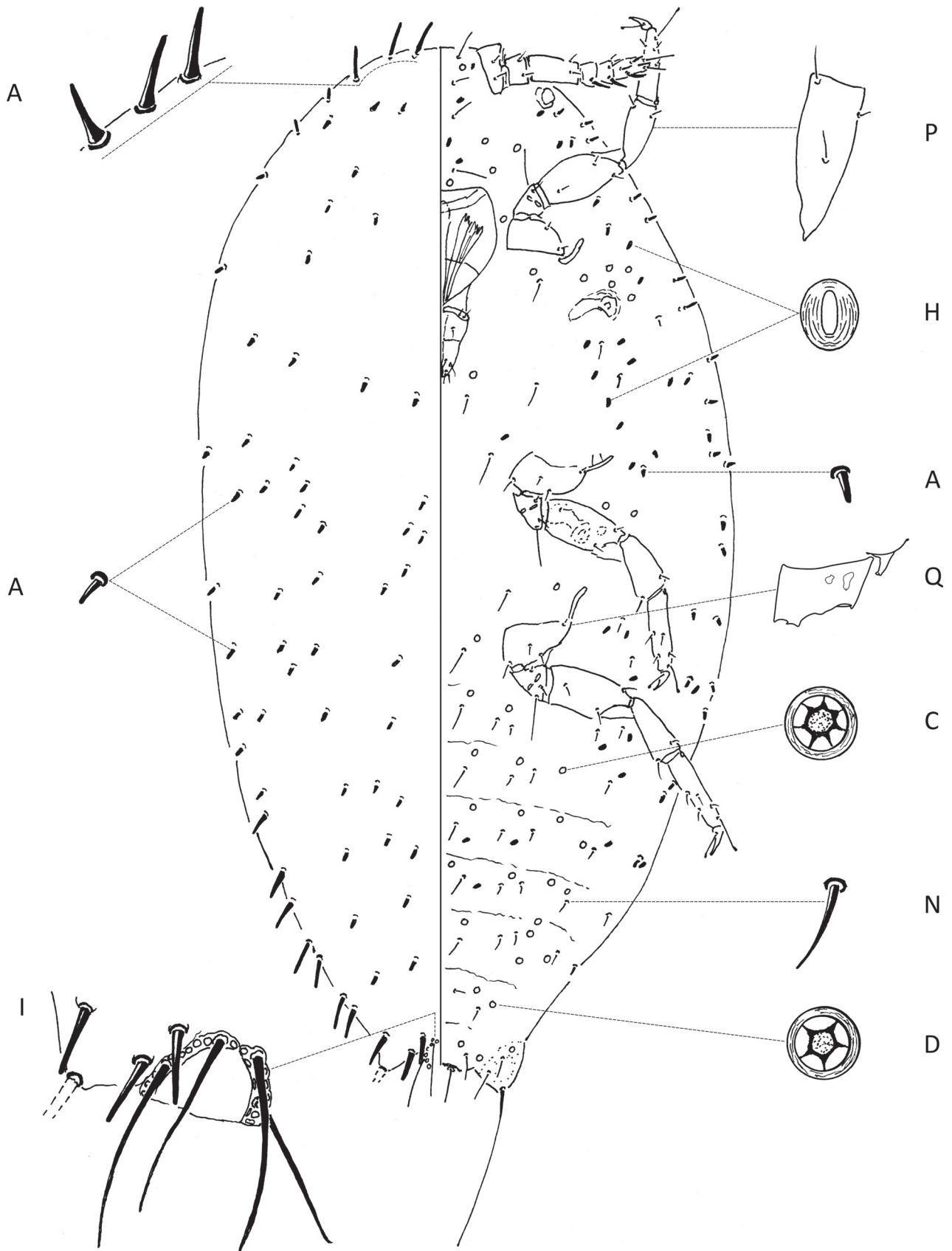


FIGURE 12. *Acanthococcus kemptoni* (Parrott 1900), second-instar female, Barber Co., Kansas, USA: 10 miles N. Medicine Lodge, June 28, 1970, on grass, tended by *Crematogaster punctulata*, D.R. Miller. A=enlarged seta; C=7-locular pore; D=5-locular pore; H=cruciform pore; I=anal ring; N=flagellate seta; P=front tibia; Q=dorsal surface of coxa.

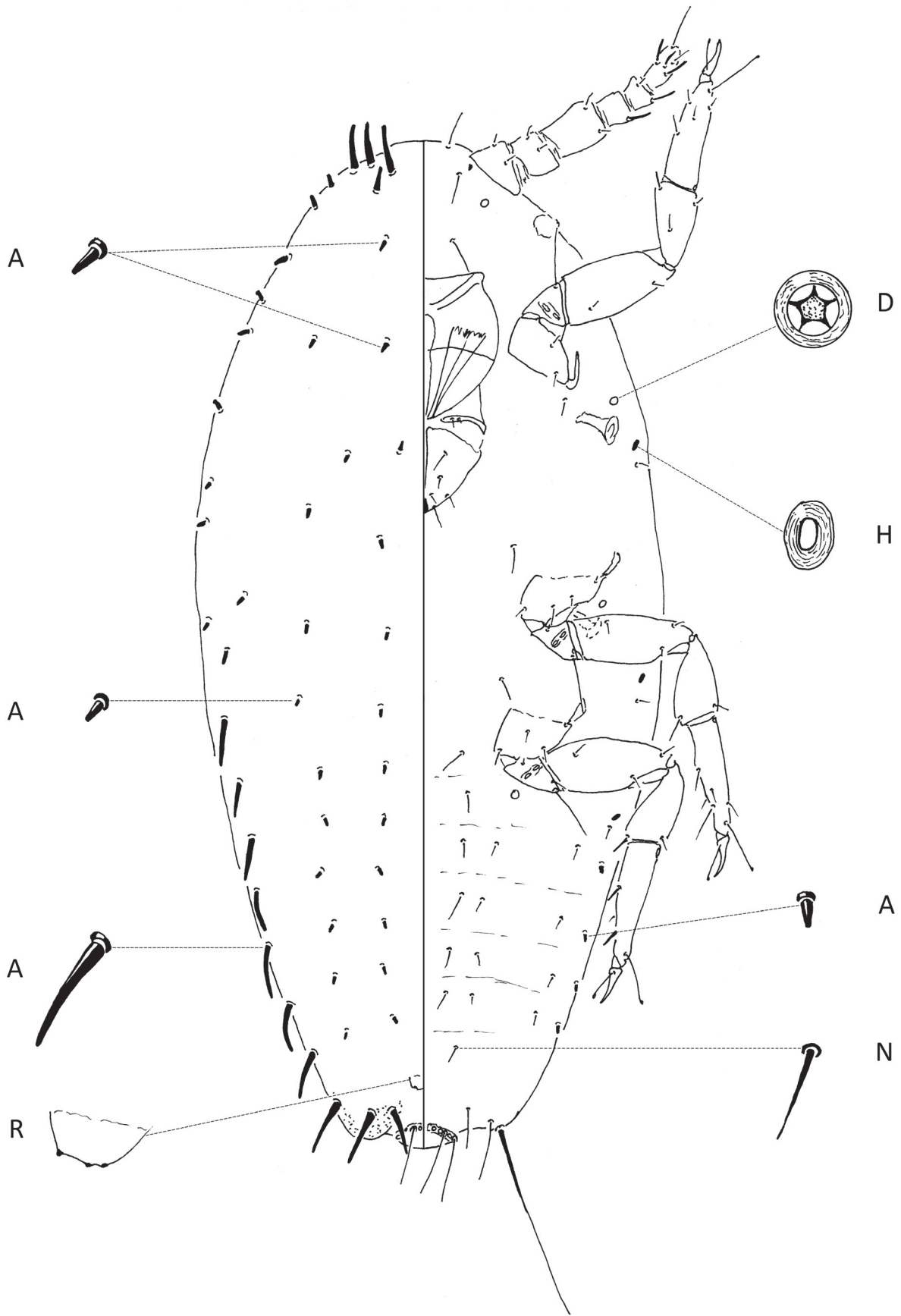


FIGURE 13. *Acanthococcus kemptoni* (Parrott 1900), first-instar nymph #1, 7 miles E. Fredericksburg, independent city in Commonwealth of Virginia, USA, March 15, 1971, on *Andropogon virginicus*, S. Nakahara and D.R. Miller. A=enlarged seta; D=5-ocular pore; H=cruciform pore; N=flagellate seta; R=cauda.

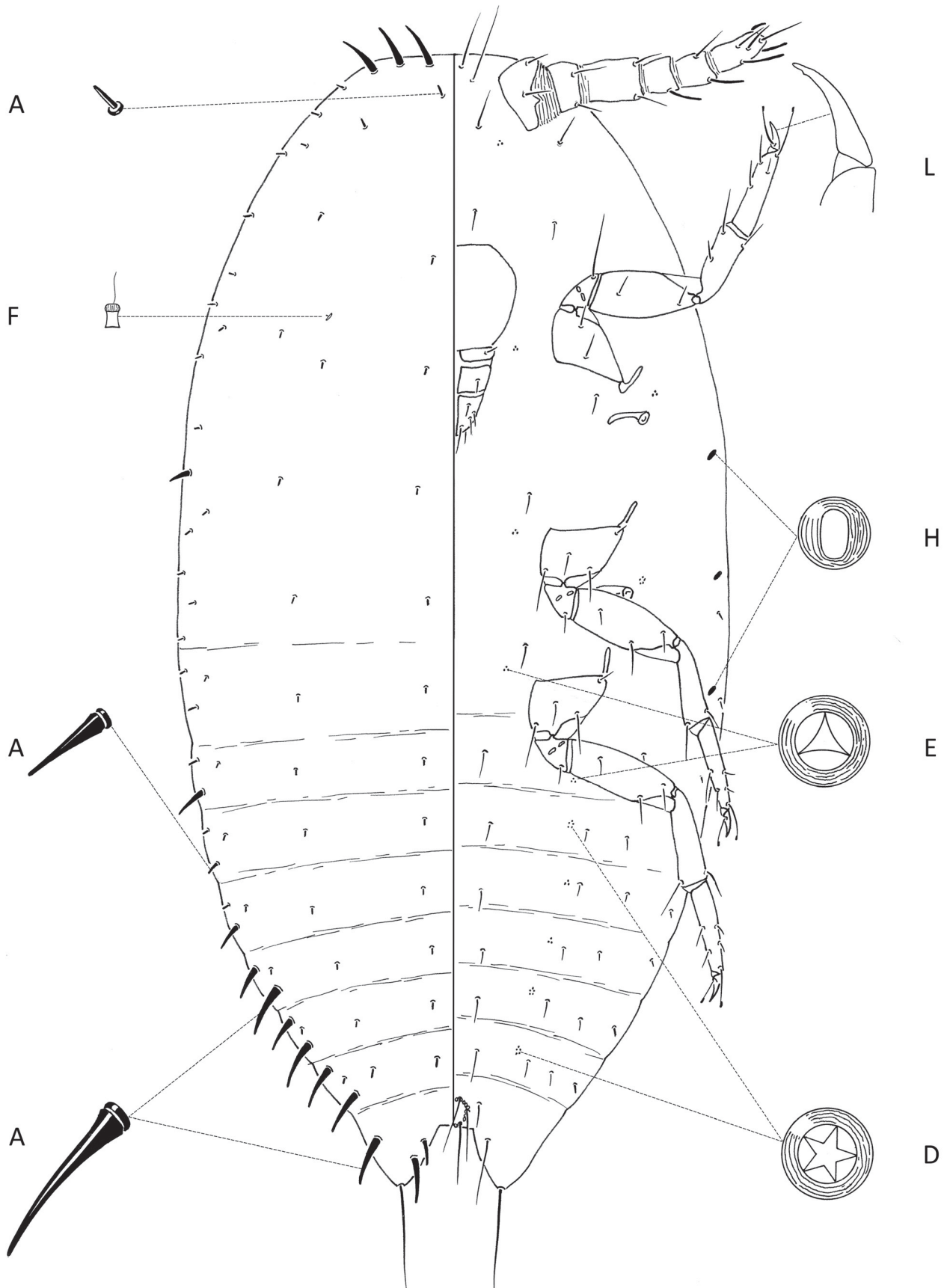


FIGURE 14. *Acanthococcus kemptoni* (Parrott 1900), first-instar nymph #2, 7 miles E. Fredericksburg, independent city in Commonwealth of Virginia, Virginia, USA, May 7, 1971, on *Andropogon virginicus*, S. Nakahara and D.R. Miller. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; L=claw.

Description: Slide-mounted specimens 0.6–1.0 mm long, 0.3–0.5 mm wide. Body elongate oval, with protruding anal lobes. Anal lobes broad, apically rounded, slightly sclerotized; each lobe dorsally with 3 apically enlarged setae with apices narrowly rounded, all setae about same length, without microtubular ducts; each lobe ventrally with 3 flagellate setae including suranal seta and elongate anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae forming 3 pairs of longitudinal lines on abdomen (medial, mediolateral and lateral), less obvious on thorax and head; enlarged setae of 2 sizes: larger size along body margin on segments II, III, or IV to VIII and on head, with 1 present on each margin of each abdominal segment; smaller size in medial and mediolateral areas; largest lateral enlarged setae 33–35 µm long; largest small-sized setae each about 8 µm; longest lateral seta 4–5 times longer than longest medial seta; lateral setae straight or slightly curved, slender, with rounded or pointed apices; medial setae straight, short, with blunt apices; setal rings thin; segment IV with 6 setae. Microtubular ducts rare or absent. Multilocular and cruciform pores absent. Microtrichia present on segments II to VIII. Cauda present.

Anal ring apical, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with setae flagellate, longest seta on segment II 13–19 µm long, longest seta on VII 10–18 µm long; longest anal-lobe seta about 250 µm long. Small-sized enlarged setae present laterally on most anterior abdominal segments; macrotubular ducts and microtubular ducts absent. Multilocular pores all 5-locular, present near base of antenna, near each spiracle, and mediolaterally on 1 or more abdominal segments, sometimes present near mouth parts. Cruciform pores present along lateral margin of thorax and anterior abdomen, with 3 such pores on each body margin. Legs without pores; each femur with 5 setae; hind tibiae each with 4 setae, without seta in middle of hind tibia; front tibiae each with 5 setae, with seta in middle of tibia; hind tibia/tarsus 0.7. Antennae each 6-segmented, 140–150 µm long. Frontal lobe absent; preantennal pore present. Microtrichia present on mesothorax to segment VIII.

Notes: For an explanation of the transfer of *Rhizococcus kemptoni* from *Rhizococcus* to *Acanthococcus*, please see the Introduction and “Notes” on *Ac. coccineus* above; we are reinstating the assignment of this species to the widespread genus *Acanthococcus*.

The description is based on 131 first-instar nymphs and two embryos from three localities. For a comparison of the first-instar nymph of *Ac. kemptoni* with the first-instar nymph of *Ac. hoyi*, see the “Notes” section of that species.

Acanthococcus pennyae Miller and Stocks sp. n.

Eriococcus sp. “CA1” Cook and Gullan 2004: 445, 447 (informal designation).

Specimens examined: **Adult female holotype** (single specimen on slide) with right label “*Acanthococcus / pennyae* / Miller & Stocks / Holotype;” left label “Glamis, Imperial / Co., CALIFORNIA / 18-V-1969 / ex. *Olneya tesota* / Coll. D. Dyer / OR69E22-45;” label on back of slide “*Acanthococcus / pennyae* Miller & Stocks / CDFA / HOLOTYPE / Glamis 69.” Holotype is in CDFA. **Paratypes:** UNITED STATES: Arizona: Maricopa Co.: Mesa, II-28-1925, on *Olneya tesota*, P.T. Vorhies (4 first-instar nymph paratypes on 1 slide) UCD (1 slide). California: Imperial Co.: Glamis, V-18-1969, on *O. tesota*, D. Dyer (1 ad. ♀ holotype, 13 ad. ♀♀, 8 first-instar nymphs and 1 second-instar ♂ on 23 slides) ANIC (1 slide), NHM (3 slides), CDFA (9 slides), FSCA (2 slides), MNHN (1 slide), UCD (2 slides), UNAM (1 slide), USNM (4 slides); Glamis, IV-16-1970, on *O. tesota*, R.A. Flock and R.F. Wilkey (4 ad. ♀♀, 2 second-instar ♂♂ and 22 first-instar nymphs on 4 slides) CDFA (3 slides), UCD (1 slide); Winterhaven, VI-29-1972, on *O. tesota*, Davis and Paddock (4 ad. ♀♀ on 4 slides): CDFA (2 slides), UCD (1 slide), USNM (1 slide).

Etymology: This species is named in honor of Penny Gullan (ANIC) who has made many amazing contributions to the field of coccidology and entomology. The species was chosen because Penny and the first author (DRM) independently became aware of its unusual habit of inducing galls on its host. There is only one other species of *Acanthococcus* in the USA that induces galls, namely *Ac. gallicolus*. We had planned to describe the species together, but Penny returned to her homeland in Australia and DRM was slow in making it a priority.

Field features: Occurring in leaf roll galls on the host, which is commonly called desert ironwood or palo fierro, and is the only species in the genus *Olneya* (Fabaceae).

Adult female (Fig. 15)

Description: Holotype, slide-mounted specimen 1.8 mm long, 0.9 mm wide (paratypes 1.6–2.6 mm long, 0.9–1.7 mm wide). Body pear-shaped, with strongly protruding anal lobes. Anal lobes each dorsally with 3 weakly capitate enlarged setae, anteromedial seta shortest, remaining setae about equal, with 1 microtubular duct; each lobe ventrally with 3 flagellate setae including anal-lobe seta and 2 5-locular pores.

Dorsum without flagellate setae. Enlarged setae not arranged in longitudinal lines; in transverse rows from head to segment VII; enlarged setae of 1 variable size: largest seta 45 µm long (paratypes 40–50 µm); smallest seta 18 µm long (paratypes 15–19 µm); present in medial and mediolateral areas, becoming increasingly smaller anteriorly; enlarged setae straight, posterior setae each with slightly capitate apex, remaining setae each with acute apex; setal rings thin; segment IV with 37 enlarged setae (paratypes with 37–44). Macrotubular ducts of 2 kinds: larger size in areas with enlarged setae; smaller size restricted to lateral regions of anterior abdominal segments. Microtubular ducts approximately 6 µm long (paratypes 5–6 µm), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or bilobed, about ½ length of remaining sclerotized portion; total sclerotized area either same length as, or longer than, unsclerotized area; dermal orifice unsclerotized or slightly sclerotized. Multilocular pores of 2 kinds: 5-locular pores most abundant, scattered over entire surface; 3-locular pores most common along anterior margins of anterior abdominal segments and on head and thorax. Cruciform pores uncommon along body margin of head and thorax. Microtrichia on segments IV to VIII.

Anal ring apical, with 4 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with longest seta on segment II 55 µm long (paratypes 52–68), on segment VII 52 µm long (paratypes 42–58 µm); longest anal-lobe seta 105 µm long (paratypes 87–117 µm). Enlarged setae absent. Macrotubular ducts scattered over entire surface except on head. Microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores most abundant, present over entire surface except on medial areas of thorax; 3-locular pores in small numbers over surface, most abundant on thorax and head. Cruciform pores along body margin from head to anterior abdominal segments. Small pores on derm anterior to hind coxae. Legs with hind coxae unusually large, dorsally with 40 pores (paratypes with 45–67), ventrally with 33 (paratypes with 26–50); each femur with 5 setae, each hind femur with 11 pores dorsally (paratypes with 3–12), 6 pores ventrally (paratypes with 2–9), each tibia with 4 setae, without seta in middle of tibia, without pores; hind tibia/tarsus 0.8 (paratypes 0.6–0.8). Antennae each 6- or 7-segmented, 175 µm long (paratypes 170–200 µm). Frontal lobe absent. Preantennal pore present. Microtrichia on mesothorax to segment VIII; also present on all coxae.

Notes: The description is based on 22 specimens from three localities. The adult female of *Ac. pennyae* is distinct when compared with other members of the genus by having: unusually large hind coxae; a few small pores on the derm anterior of the hind coxa; multilocular pores on the dorsum; enlarged setae restricted to the dorsum; and microtubular ducts absent from the venter.

This species was sequenced by Lyn Cook based on specimens from *Olneya* in California, and was included in the phylogenetic analysis presented in Cook and Gullan (2004). It was labeled informally as *Eriococcus* sp. “CA1” in Table 1 and Fig. 1 of that publication and has GenBank accession numbers for 18S (AY795537) and for COII (AY791958).

Second-instar male (Fig. 16)

Description: Slide-mounted specimen 0.9 mm long, 0.5 mm wide. Body pear-shaped, with protruding anal lobes. Anal lobes apically acute; each lobe dorsally with 3 apically acute enlarged setae, approximately equal in size, with 1 or 2 microtubular ducts; each lobe ventrally with 3 or 4 flagellate setae including suranal seta and anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae with weak indication of 3 pairs of longitudinal lines of slightly larger setae (medial, mediolateral and sublateral), enlarged setae present over entire surface, of 1 variable size: largest seta about 30 µm long; enlarged setae elongate, straight or slightly curved, with acute apices; with 10 enlarged setae on segment IV. Macrotubular ducts of 1 size, abundant over entire surface. Multilocular pores abundant over entire surface, of 2 kinds: 5-locular pores most numerous anteriorly and posteriorly, 3-locular pores most abundant on thorax and anterior abdominal segments. Microtubular ducts each about 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded; sclerotized area slightly longer than unsclerotized area; dermal orifice weakly sclerotized; microtubular ducts scattered over entire surface. Cruciform pores absent. Microtrichia present on abdomen.

Anal ring dorsal, with 3 setae on each side of ring, suranal setae flagellate. Anal tube unsclerotized.

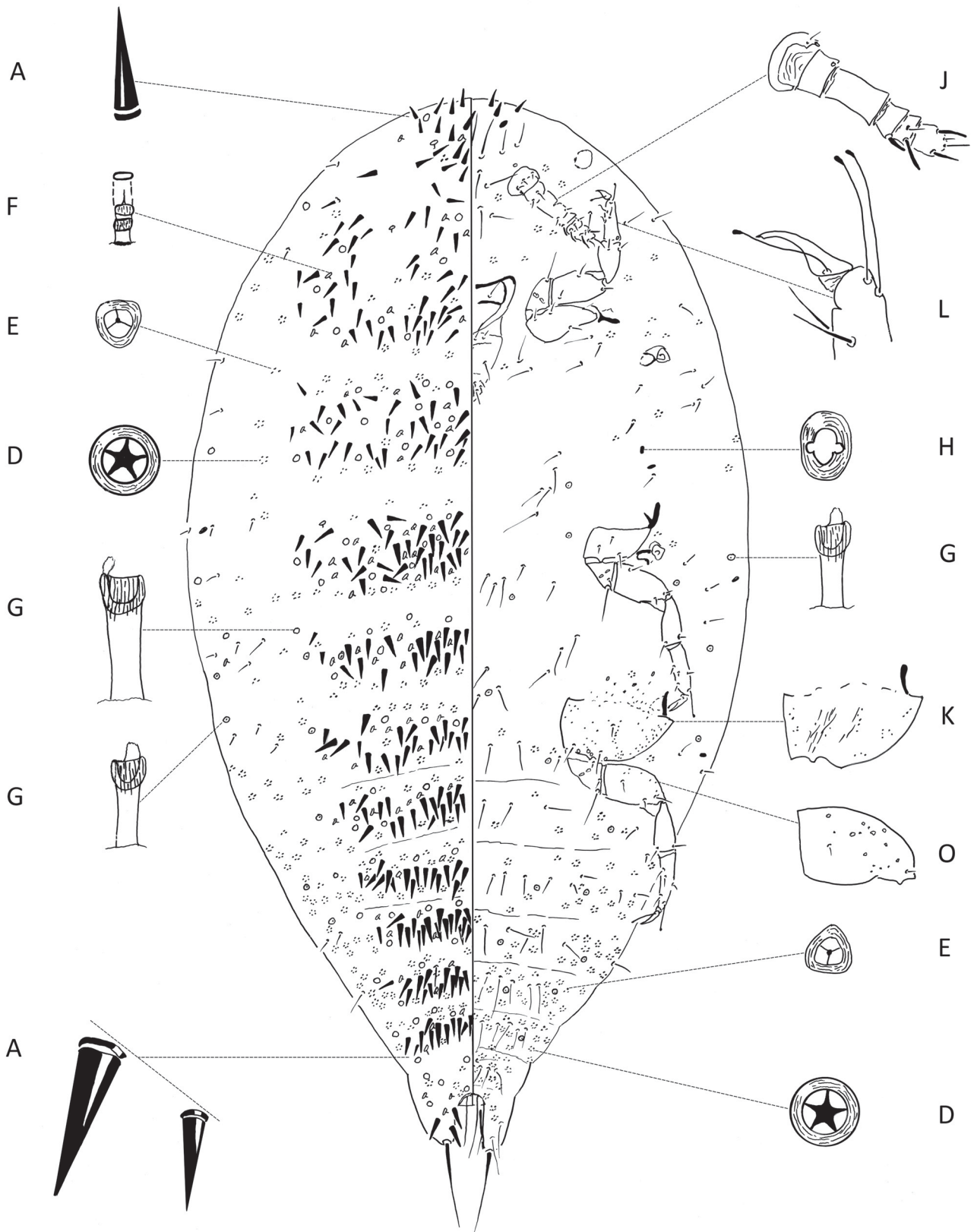


FIGURE 15. *Acanthococcus pennyae* sp. n., adult female, Glamis, Imperial Co., California, USA, April 16, 1970, on *Olneya tesota*, R.A. Flock and R.F. Wilkey. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; J=antenna; K=dorsal surface of coxa; L=claw; O=femur.

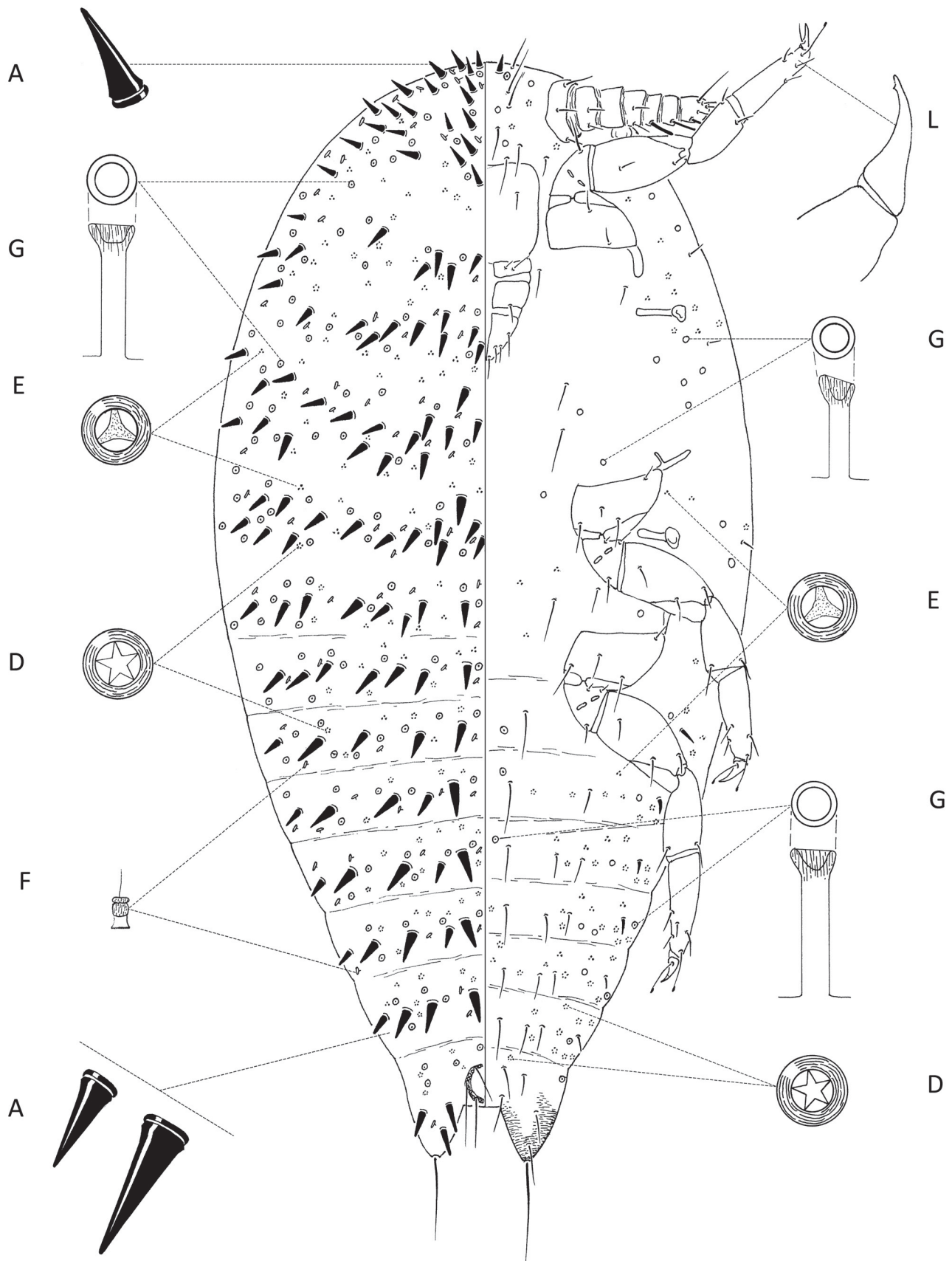


FIGURE 16. *Acanthococcus pennyae* sp. n., second-instar male, Glamis, Imperial Co., California, USA, April 16, 1970, on *Olneya tesota*, R.A. Flock and R.F. Wilkey. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macrotubular duct; L=claw.

Venter with longest seta on segment II about 42 µm long; longest on segment VII about 42 µm; longest anal-lobe seta 155–188 µm long. Slightly enlarged flagellate setae on sublateral areas of anterior abdominal segments. Macrotubular ducts of 2 kinds: larger size same size as on dorsum, most numerous on abdomen; smaller size on thorax and head. Multilocular pores of 2 kinds: 5-locular pores and 3-locular pores in approximately equal numbers. Microtubular ducts and cruciform pores absent. Legs without pores; each femur with 5 setae; each tibia with 4 setae, without seta in middle of tibia; hind tibia/tarsus 0.8. Antennae each 7-segmented, about 142 µm long. Frontal lobe absent. Preantennal pore present. Microtrichia present on prothorax to segment VIII; also present on all coxae.

Notes: This description is based on three specimens from one locality. The second-instar males of *Ac. pennyae* are unique in having dorsal multilocular pores and five setae on each femur. For a comparison of the second-instar males of *Ac. pennyae* and *Ac. hoyi* see the “Notes” section of the latter.

First-instar nymph (Fig. 17)

Description: Slide-mounted specimens 0.5–0.6 mm long, 0.3–0.4 mm wide. Body pear-shaped, with protruding anal lobes. Anal lobes apically acute; each lobe dorsally with 3 apically acute enlarged setae, either all setae equal in size or posteromedial longest and anteromedial shortest; microtubular ducts absent; each lobe ventrally with 3 flagellate setae including suranal seta and anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae present over entire surface, fewer present along margins of anterior abdominal segments and on thorax, forming transverse rows from head to segment VII; enlarged setae of 2 sizes: larger setae variable, on segments II or III to VII forming 3 pairs of longitudinal lines (medial, mediolateral and lateral), enlarged setae on head, thorax, and segments I and II more abundant and without conspicuous longitudinal pattern; smaller-sized setae in single longitudinal line along body margin, decreasing in size posteriorly: largest enlarged setae each about 28 µm long; largest small-sized setae each about 10 µm long; large setae each elongate, straight or slightly curved, with acute apices, small setae each short, conical, straight with acute apices; segment IV with 6 setae. Microtubular ducts each about 4 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded; sclerotized area slightly longer than unsclerotized area; dermal orifice weakly sclerotized; microtubular ducts scattered over entire surface, forming 1 pair of longitudinal lines on abdomen (mediolateral) and 2 pairs of lines on thorax (mediolateral and lateral). Macrotubular ducts, cruciform pores, and multilocular pores absent. Microtubular ducts on segments I to VIII.

Anal ring apical, dorsal, or ventral, with 3 setae on each side of ring, suranal setae flagellate. Anal tube without sclerotization.

Venter with setae flagellate, longest seta on segment II approximately 12 µm long, on segment VII about 18 µm; longest anal-lobe seta 132–162 µm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores fairly consistent, of 2 kinds: 3-locular pores most abundant, rarely with 5-locular pores near spiracles; head pore present; pore near anterior spiracles usually present; pore near posterior spiracle present or absent; pore present near metathoracic legs; pores present or absent on segments III to VII, with total of 5–7 pores on each side of body. Cruciform pores absent. Legs without pores; each femur with 5 setae; each tibia with 4 setae, without seta in middle of tibia; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 88–98 µm long. Frontal lobe absent. Preantennal pores present. Microtrichia present from mesothorax to segment VIII.

Notes: The description is based on 22 specimens from three localities. The first-instar nymphs of *Ac. pennyae* are similar to the first-instar nymphs of *Ac. dubius* (not illustrated or described here). They are similar by the arrangement of the dorsal enlarged setae, which are all about the same size and shape and are organized in three pairs of longitudinal lines on the abdomen. They can be separated as follows (character states in brackets are of *Ac. pennyae*): with five or six setae on each hind tibia including one or two in the middle (with 4 setae on each hind tibia, without seta in the middle).

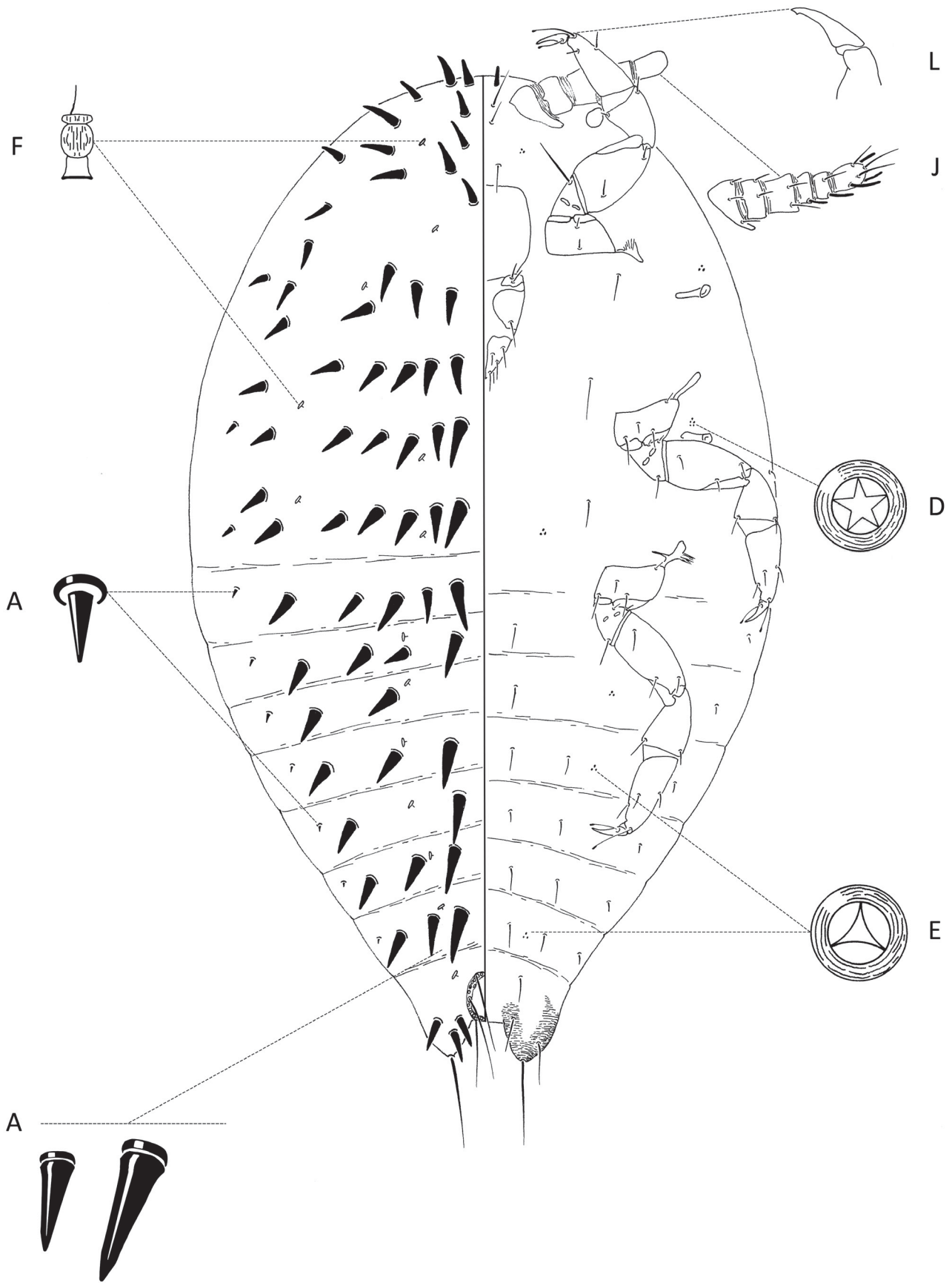


FIGURE 17. *Acanthococcus pennyae* sp. n., first-instar nymph, Glamis, Imperial Co., California, USA, April 16, 1970, on *Olneya tesota*, R.A. Flock and R.F. Wilkey. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; J=antenna; L=claw.

Apezococcus Ferris 1955

Apezococcus Ferris 1955: 79. Type species: *Apezococcus idiastes* Ferris 1955, by original designation and monotypy.

Diagnosis of adult female: Anal lobes absent; enlarged setae on dorsum and venter, with broad bases, setal ring thick; dorsal flagellate setae restricted to abdomen; microtubular ducts on both body surfaces; macrotubular ducts absent; multilocular pores restricted to venter; cruciform pores on both body surfaces; anal ring without setae; legs absent except for remnant of hind legs represented by large plate; antennae reduced; spiracles abnormally large.

Diagnosis of second-instar female: Same as adult female except legs represented by small rudiments.

Diagnosis of first-instar nymph: Same as adult female except enlarged setae restricted to dorsum; dorsal flagellate setae scattered over entire surface; microtubular ducts absent; cruciform pores on venter only; anal ring with 3 pairs of setae; legs well-developed, without claw denticle; antennae each 6-segmented; spiracles not unusually large.

Etymology: The genus epithet *Apezococcus* is formed from the Greek prefix “a” meaning “without,” the Greek “pezos” meaning “on foot” and the Greek “kokkos” meaning “round structure” or “scale insect”, and refers to the lack of legs on this scale insect. The generic name is a masculine noun.

Field features: Adult female nearly bare of waxy secretions, not forming an ovisac. Occurring in grass sheaths.

Apezococcus idiastes Ferris

Apezococcus idiastes Ferris 1955: 79.

Type material: From the syntypes we have selected and marked as lectotype an adult female. The left label reads “T280 / *Apezococcus idiastes* n. sp. / On *Aristida* / TYPE / Pecos R., near Sheffield, / Ferris, 1921 G.F.F.” UCD. There are 2 specimens on the slide, the specimen on the left when viewed with the naked eye is the lectotype.

Specimens examined: UNITED STATES: Arizona: northeast Arizona, ?-?-1940, on undetermined grass, G.F. Ferris (8 ad. ♀♀ and possibly 1 first-instar nymph on 4 slides) UCD; Coconino Co.: near House Rock, VII-25-1940, on *Sporobolus* sp., G.F. Ferris (2 ad. ♀♀ paralectotypes on 1 slide) UCD; House Rock Valley, IX-?-1945, on undetermined grass, Stafanovich (2 ad. ♀♀ on 1 slide) UCD; near Flagstaff, near Sunset Crater, ?-?-1940, on *Bouteloua* sp., G.F. Ferris (3 ad. ♀♀ on 2 slides) UCD. Colorado: Weld Co.: Nunn Pawnee Grassland, VII-22-1970, host unknown, R. Kumar (3 adult ♀♀ and 5 first-instar nymphs on 2 slides) USNM. South Dakota: Custer County: Custer State Park, V-08-1967, on *B. hirsuta* (= *Chondrosum hirsutum*), M. Koszarab (1 ad. ♀ on 1 slide) USNM; Pennington Co.: Wasta, VII-12-1970, on grass, D.R. Miller (1 adult ♀ and 1 first-instar nymph on 2 slides) USNM. Texas: El Paso Co.: Mt. Franklin, VI-?-1921, on grass, G.F. Ferris (9 ad. ♀♀ paralectotypes, 5 first-instar nymphs paralectotypes on 11 slides) UCD; Maverick Co.: 35 mi. W. Eagle Pass, ?-?-1921, on grass, G.F. Ferris (2 ad. ♀♀ paralectotypes on 2 slides) UCD; Pecos Co.: Pecos River, near Sheffield, VI-?-1921, on *Aristida* sp., G.F. Ferris (1 ad. ♀ lectotype and 4 ad. ♀♀ paralectotypes on 5 slides) UCD; Pecos River, near Sheffield, ?-?-1921, on *Stipa* sp., G.F. Ferris (5 ad. ♀♀, 1 second-instar ♀ on 4 slides) CDFA, UCD.

Etymology: We are uncertain of the derivation of the species epithet “*idiastes*.” We suspect that it is from the Greek word “*idios*” meaning “distinct” and refers to the distinct characteristics of this unusual species.

Field features: According to Ferris (1955: 79) “Occurring at the base of the culms under leaf sheaths, almost bare of secretion.”

Adult female (Fig. 18)

Description: Slide-mounted specimens, 0.9–2.5 mm long, 0.7–2.4 mm wide. Body oval to rotund, without protruding anal lobes. Anal-lobe areas each dorsally with 0 or 1 enlarged seta and 1 short flagellate seta; each ventrally with 2 or 3 flagellate setae and 0 or 1 cruciform pores.

Dorsum with flagellate setae restricted to posterior 2 or 3 abdominal segments, each about 10 µm long. Enlarged setae not arranged in longitudinal pattern, scattered over surface on head to segment VII; of 1 variable size, largest seta about 7 µm long; enlarged setae dome-shaped or nipple-shaped, normally with short apical projection, sometimes without projection; setal base robust, sometimes as large as seta itself; newly molted adult females with enlarged setae each partially recessed in dermal pocket, with truncate apices, and moderately thick setal rings;

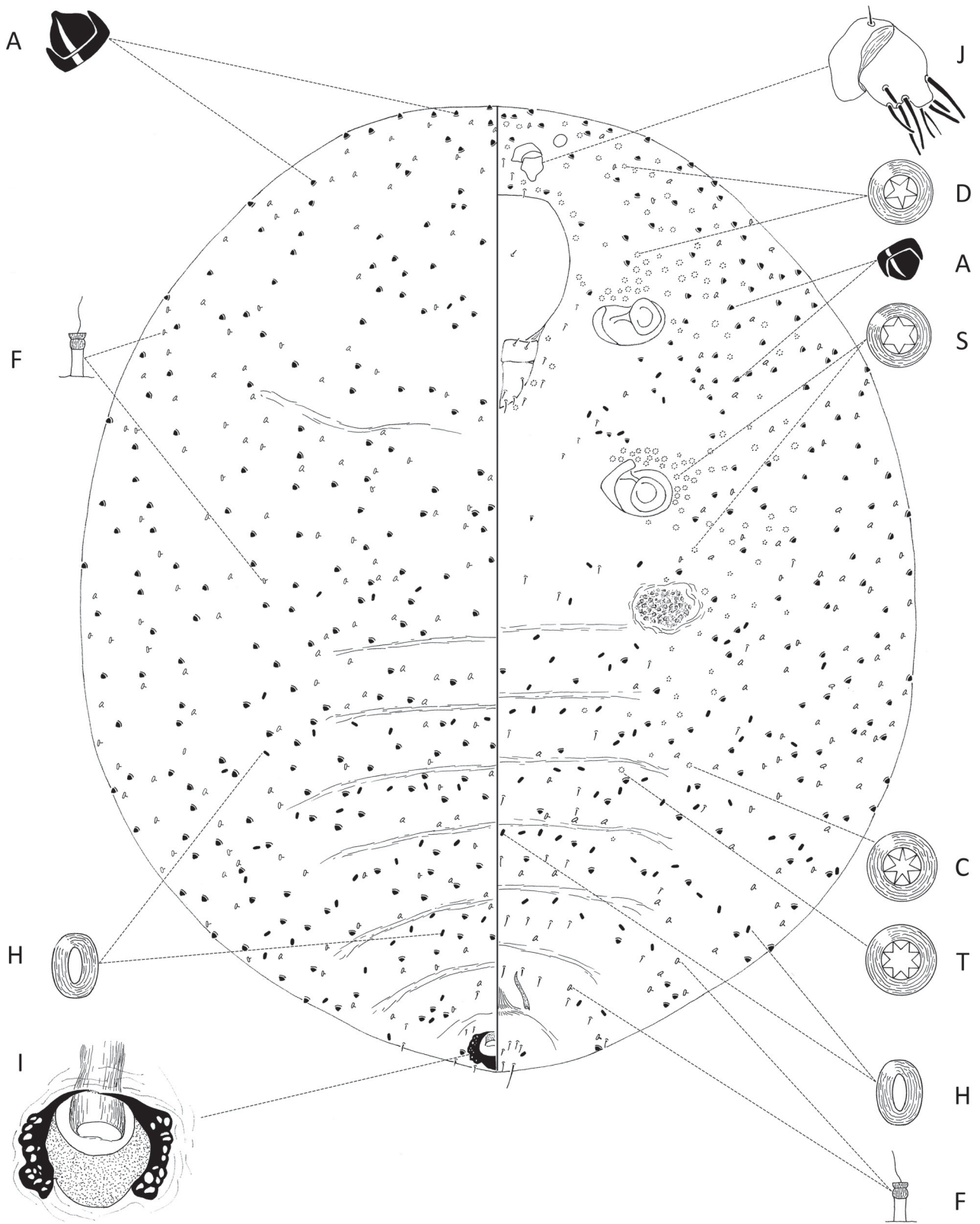


FIGURE 18. *Appezococcus idiastes* Ferris 1955, adult female, Pecos River, near Sheffield, Texas, USA., month ?, day ?, 1921, on *Stipa* sp., G.F. Ferris. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; S=6-locular pore; T=pore with >7 loculi.

segment IV with 18–25 setae. Macrotubular ducts absent. Microtubular ducts about 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion truncate, slightly smaller than remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice normally unsclerotized, rarely with weak sclerotization, without projection. Microtubular ducts abundant over entire surface. Multilocular pores absent. Cruciform pores on posterior thorax and abdomen, rarely with 1 or 2 on head and anterior thorax. Microtrichia absent.

Anal ring ventral or dorsal, circular, incomplete, with a few cells and no setae, without anal flap. Anal tube sclerotized.

Venter with flagellate setae slightly more robust than on normal eriococcid, setae on segment II 10–15 µm long, on segment VII 12–21 µm; anal-lobe seta 30–50 µm long; medial setae apically slightly swollen or acute. Enlarged setae about same size as smaller dorsal enlarged setae; lateral setae from head to segment VI or VII; medial setae variable, normally on head and most abdominal segments, absent from thorax; often difficult to distinguish from multilocular pores. Macrotubular ducts absent. Microtubular ducts in same areas as enlarged setae. Multilocular pores most abundant near spiracles, also in submedial line from head to segments III, IV, or V, with few pores near mouthparts; multilocular pores of 4–7 types: 7-locular pores and 5-locular pores most abundant, 6-locular pores and 8-locular pores slightly less abundant, 9-locular pores, 4-locular pores, and 3-locular pores rare or absent. Cruciform pores absent from head, restricted to areas near metathoracic pore plates and spiracles, scattered over abdomen. Sclerotized bars on each side of vulva unusually conspicuous. Legs absent except for large pore plate on metathorax. Antennae abortive, each 2- or 3-segmented, 37–48 µm long. Thin sensory setae present on 1 or 2 segments. Frontal lobes and preantennal pore absent. Microtrichia present in medial areas of head to segment VIII.

Notes: The description is based on 37 specimens from nine localities. The adult female of *Ap. idiastes* is unique in having a pore plate posterior to the hind spiracle; enlarged setae scattered over dorsum and not arranged in longitudinal lines; and cruciform pores present on the dorsum and venter.

Second-instar female (Fig. 19)

Description: Slide-mounted specimens 0.8–0.9 mm long, 0.4–0.6 mm wide. Body oval to rotund, without protruding anal lobes. Anal-lobe areas each dorsally with 0 or 1 enlarged seta and 1 short flagellate seta; ventrally with 2–5 flagellate setae including anal-lobe seta.

Dorsum with flagellate seta about 7 µm long, restricted to posterior 1 or 2 abdominal segments. Enlarged setae in transverse rows on head to segment VII of 1 variable size: largest seta about 7 µm long. Enlarged setae of 2 sizes: larger size approximately 8 µm long, present in 2 pairs of longitudinal lines (mediolateral and lateral) on posterior thorax to segment VII, also near eye; smaller size about 6 µm long, scattered from head to segment VII, most abundant on thorax. Enlarged setae basically same shape as on adult female except setal bases smaller; segment IV with 8 setae. Microtubular ducts associated with enlarged setae. Cruciform pores rare, present on posterior thorax and anterior areas of abdomen. Microtrichia absent.

Anal ring dorsal, circular, incomplete, with few cells and no setae, without anal flap. Anal tube sclerotized.

Venter with longest flagellate seta on segment II 11 µm long, on segment VII 13 µm; anal-lobe seta 38 µm long; medial setae apically acute. Enlarged setae of smaller size only, restricted to lateral margins. Microtubular ducts in lateral and sublateral areas. Multilocular pores present from head to anterior abdominal segments, most abundant near spiracles; multilocular pores of 4 or 5 types: 5-locular pores most abundant, 6-locular pores, 4-locular pores and 3-locular pores rare or absent. Cruciform pores scattered over thorax and abdomen. Sclerotized bars absent. Legs rudimentary, normally with 3 pairs. Antennae each 2-segmented, about 20 µm long. Frontal lobes and preantennal pore absent. Microtrichia present in medial areas of head to segment VIII.

Notes: The description is based on one specimen from at, or near, the type locality. The second-instar female of *Ap. idiastes* is unique in having: legs represented by sclerotized plates or unsclerotized projections; anal ring with setae absent; dome-shaped setae present on dorsum; cruciform pores on dorsum and venter.

First-instar nymph (Fig. 20)

Description: Slide-mounted specimen about 0.6 mm long, 0.3 mm wide. Body elongate, without protruding anal lobes. Anal-lobe area dorsally each with 1 flagellate seta and 1 enlarged seta; ventrally each with 2–4 flagellate setae including anal-lobe seta.

Dorsum with flagellate setae in single longitudinal line in medial area on each side of body, sometimes line incomplete or nearly absent. Enlarged setae of 1 size present in 2 pairs of longitudinal lines (mediolateral and lateral) on each side of body, in transverse rows from head to segment VII; largest seta about 7 µm long; enlarged setae

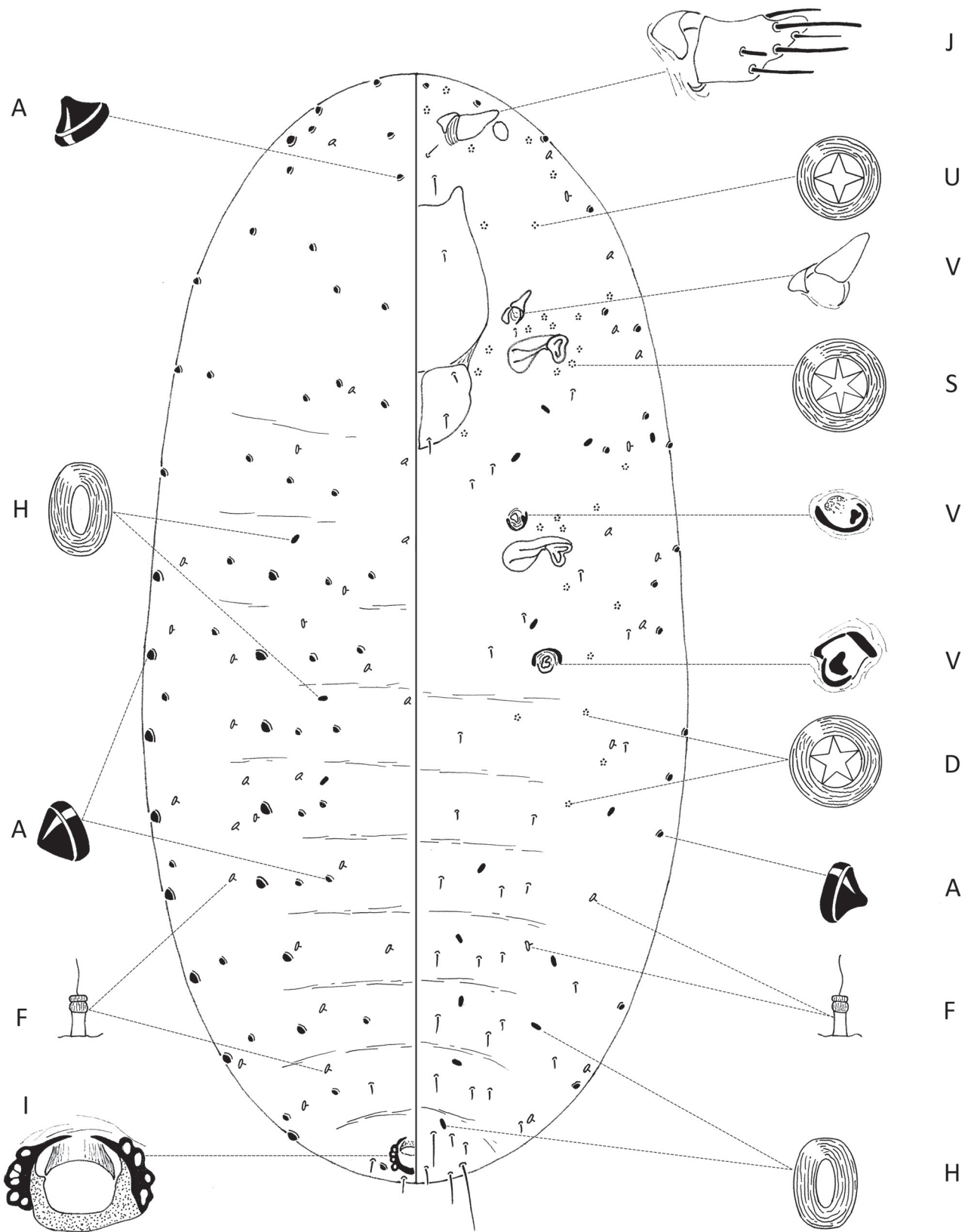


FIGURE 19. *Apezococcus idiaestes* Ferris 1955, second-instar female, Pecos River, near Sheffield, Texas, USA, month ?, day ?, 1921, on *Stipa* sp., G.F. Ferris. A=enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; S=6-locular pore; U=4-locular pore; V=leg remnant.

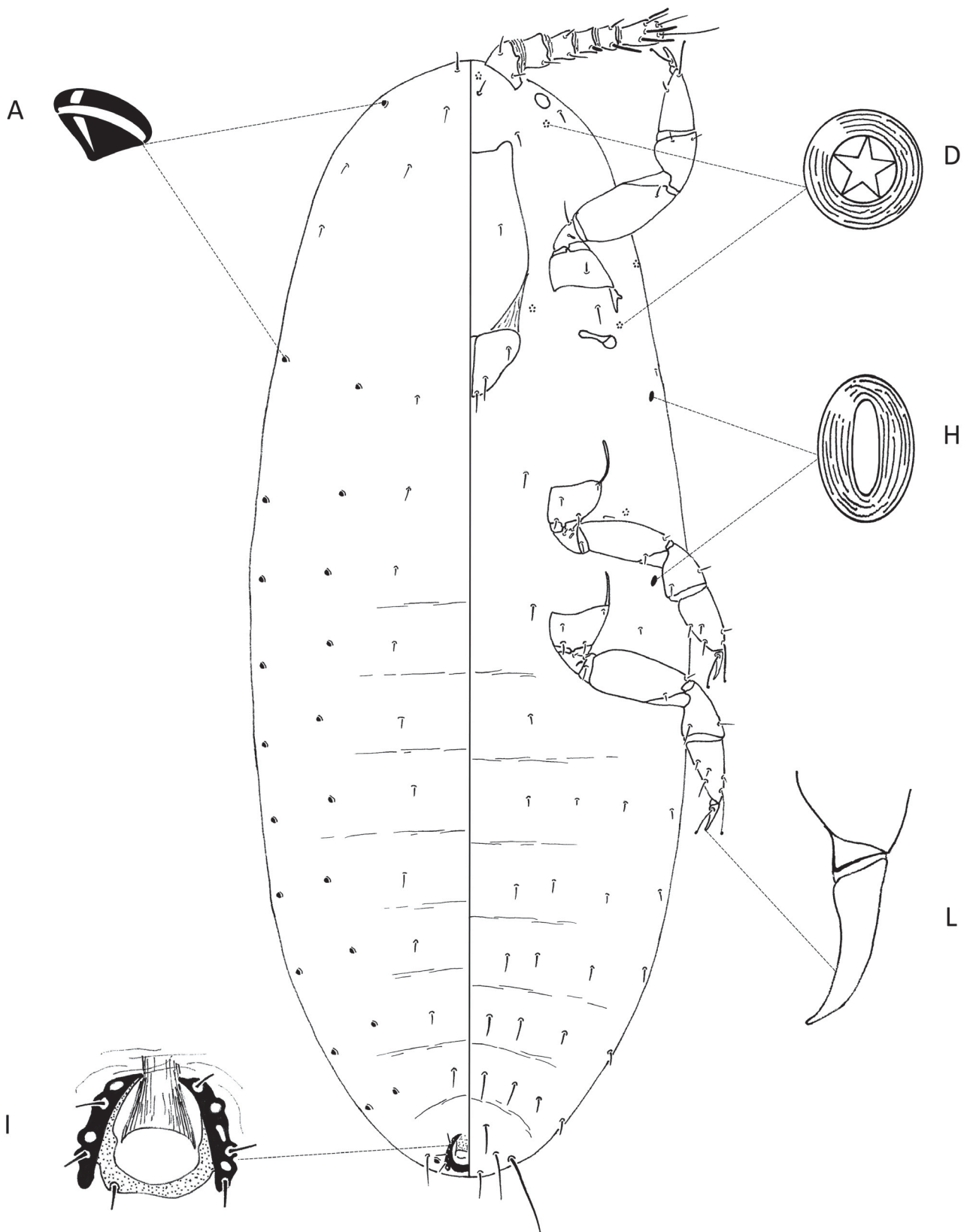


FIGURE 20. *Apezococcus idiaestes* Ferris 1955, first-instar nymph, Mt. Franklin, El Paso Co., Texas, USA, June ?, 1921, on grass, G.F. Ferris. A=enlarged seta; D=5-locular pore; H=cruciform pore; I=anal ring; L=claw.

dome-shaped with rounded apex; setal base medium; segment IV with 6 setae including 4 enlarged setae and 1 or 2 flagellate setae; segment IV with combined total of 4 enlarged setae on dorsum and venter. Macrotubular ducts, microtubular ducts, multilocular pores, and cruciform pores absent. Microtrichia absent.

Anal ring dorsal, semicircular, incomplete, divided anteriorly and posteriorly, with 2 or 3 inconspicuous setae on each side of ring, each shorter than diameter of ring, with 1 or 2 cells on each side of ring; additional pair of setae absent; anal tube sclerotized; anal orifice unsclerotized.

Venter with flagellate setae, longest seta on segment II broken, on segment VII about 17 μm ; longest anal-lobe seta approximately 70 μm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores with 2 on each side of head, and 1 near each spiracle, usually 5-locular pores. Cruciform pores present in sublateral areas of thorax. Legs without pores; each femur with 3 setae, without proximal seta; each tibia with 4 setae; hind tibia/tarsus 0.7. Antenna 6-segmented, about 120 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia apparently absent.

Notes: The description is based on six specimens from two localities. The first-instar nymph of *Ap. idiaestes* is most similar to the first-instar nymph of several species of *Ovaticoccus* in having dome-shaped enlarged setae, a reduced anal ring, and longitudinal lines of dorsal enlarged setae. *Apezococcus idiaestes* is unique in having the following combination of character states: multilocular pores with five loculi; dome-shaped setae restricted to mediolateral and lateral lines; and each femur with three setae.

***Carphococcus* Miller and Stocks gen. n.**

Type species: *Carphococcus apodus* Miller and Stocks **sp. n.**, by current designation and monotypy.

Diagnosis of adult female: Legs absent. Antennae reduced. Enlarged setae restricted to posterior abdominal segments, each situated on a dermal protrusion, and with blunt apices. Anal ring reduced, with few pores. Body margin crenulate, similar to species of *Aclerda* Signoret (Acleridae). Multilocular pores present on anterior abdominal segments, thorax, and head. Macrotubular and microtubular ducts present on dorsum and venter. Cruciform pores present. Small microducts present on abdomen only. Anal lobes not protuberant. Small sclerotized nodules present along body margin on both surfaces.

Diagnosis of second-instar female: Legs absent. Antennae reduced. Enlarged setae restricted to lateral margins, each situated on a small dermal protrusion. Anal ring reduced, with few pores. Multilocular pores present on body margins of anterior abdominal segments, thorax, and head of both surfaces. Microtubular ducts present on dorsum and venter. Cruciform pores present. Without protuberant anal lobes.

Etymology: The genus epithet “*Carphococcus*” is formed from the Greek word “*karphos*” meaning wrinkled and the Greek “*kokkos*” meaning “round structure” or “scale insect” and refers to the wrinkled or crenulate body margin of this scale insect. The generic name is a masculine noun.

Field features: Probably occurring inside grass leaf sheaths.

***Carphococcus apodus* Miller and Stocks sp. n.**

Specimens examined: Adult female holotype (single specimen on slide) with right label “*Carphococcus* / *apodus* / Miller & Stocks / Holotype / adult ♀;” left label “*Gymnococcus* / 30 km. E. Rosario / on *Arthrostylidium* / *longifolium* / Mt. La Dispensa, Sinaloa Mex. / 1500 ft. Aug. 6, 1943 / FA McClure, colr. / Mc Clure 21204 / 44-666;” label on back of slide “*Carphococcus* / *apodus* Miller & / Stocks / HOLOTYPE / USNM.” Holotype is in USNM. **Paratypes:** MEXICO: Sinaloa: Mt. La Dispensa, 30 km E. Rosario, 1,500 ft. elevation, VIII-6-1943, on *A. longifolium* (= *Guadua longifolia*), F.A. Mc Clure (1 ad. ♀ holotype, 1 ad. ♀ paratype, 2 second-instar ♀♀ exuviae paratypes, on 4 slides) UNAM (1 slide), USNM (3 slides).

Etymology: The species epithet “*apodus*” is derived from the Greek word “*a-*” meaning “absence”, and the Greek word “*podos*” meaning “foot” and refers to the absence of legs in this species.

Field features: Probably occurring in leaf sheaths of the bamboo host.

Adult female (Fig. 21)

Description: Holotype, slide mounted, 2.0 mm long, 1.0 mm wide (paratype 4.1 mm long, 1.1 mm wide). Body

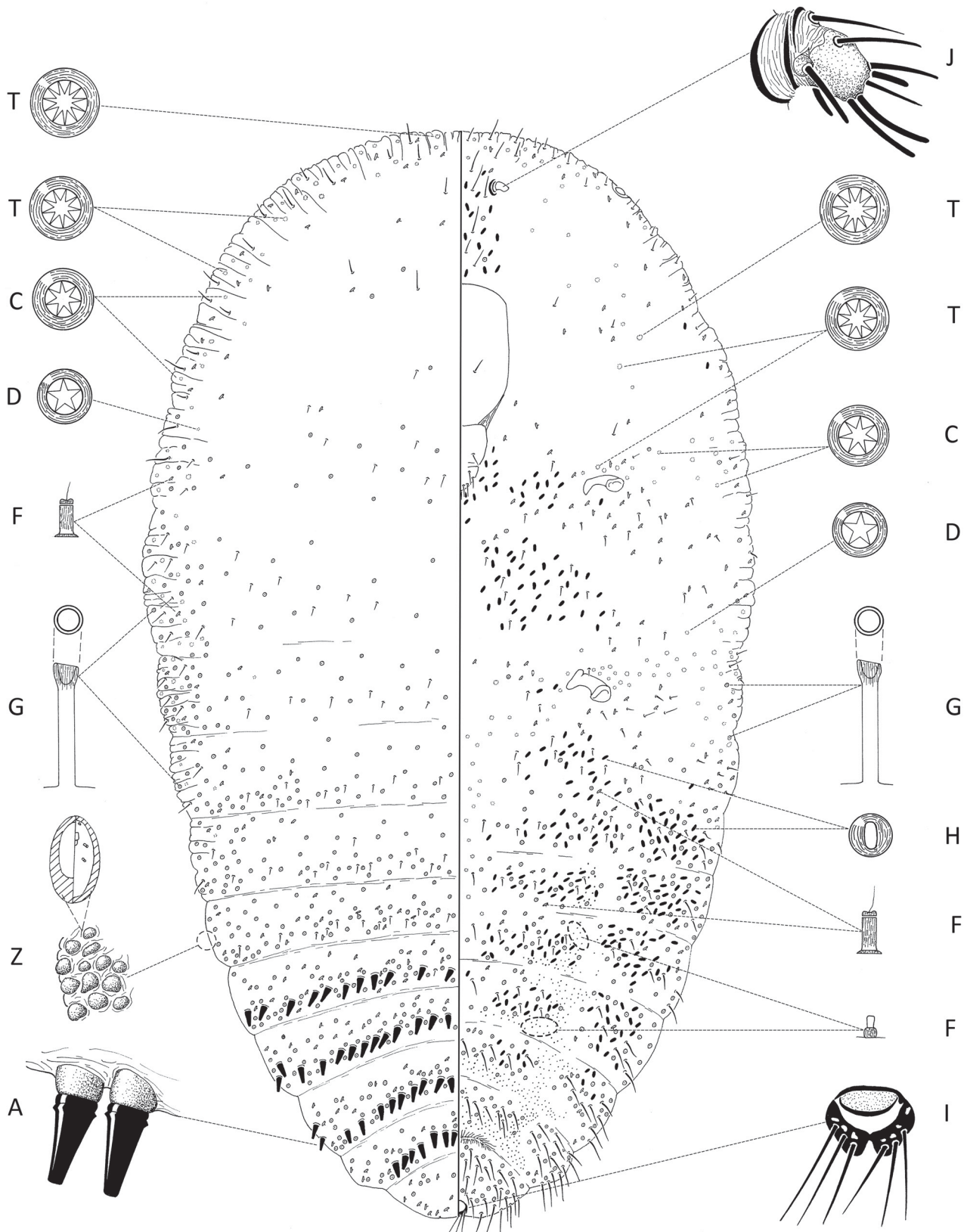


FIGURE 21. *Carphococcus apodus* sp. n., adult female. 30 km. E. Rosario, Mt. La Dispensa (elevation 1,500 ft.), Sinaloa, Mexico, August 6, 1943, on *Arthrostylidium longifolium* (= *Guadua longifolia*), F.A. McClure. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; G=macroduct; H=cruciform pore; I=anal ring; J=antenna; T=pore with >7 loculi; Z=body margin (hatched areas on the body of the inset with crenulations).

elongate, without protruding anal lobes. Anal-lobe area dorsally each without enlarged or flagellate setae, with several microtubular ducts; ventrally each with 5 or more flagellate setae, including elongate anal-lobe seta, and with several micro- and macro-tubular ducts.

Dorsum with flagellate setae from head to segments III or IV, largest setae along body margin each 24 μm long, (paratype 22). Enlarged setae in transverse rows on abdominal segment IV to VII, with no longitudinal pattern; of 1 size: largest seta approximately 30 μm long, smallest approximately 22 μm ; enlarged setae straight, with truncate apices, and thick setal bases that appear fused to main part of seta; each seta on dermal projection; segment IV with 22 enlarged setae (paratypes with 29). Macro-tubular ducts scattered over entire surface, decreasing in abundance anteriorly, each about 25 μm long (paratype 25–30). Microtubular ducts each about 6 μm long (paratypes 5–7 μm), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or bilobular, $\frac{1}{4}$ or $\frac{1}{2}$ length of remaining sclerotized portion; total sclerotized area same length as or longer than unsclerotized area; dermal orifice heavily sclerotized, without projecting tube. Microtubular ducts lightly scattered over entire surface, least numerous in medial areas of head, thorax, and anterior abdominal segments. Multilocular pores present along body margin from head to segment II, of 4 kinds: 11-locular pores and 5-locular pores uncommon, in approximately equal numbers; 9-locular pores less numerous than 7-locular pores; 7-locular pores most abundant. Cruciform pores absent. Sclerotized nodules present over surface of head to segment III. Microtrichia absent. Body margin crenulate from head to segment III.

Anal ring ventral, circular, complete, with few small cells and 3 setae on each side of ring, each longer than diameter of ring. Anal tube and anal opening unsclerotized, with anal flap.

Venter with flagellate setae noticeably elongate on posterior abdominal segments, becoming shorter anteriorly, longest seta on segment II 18 μm (paratype 15) long, on segment VII 46 μm (paratype 43); anal-lobe seta 132 μm long (paratype broken); setae apically acute. Enlarged setae absent. Macro-tubular ducts of same size as on dorsum, abundant on abdomen, uncommon on head and thorax. Microtubular ducts sparsely scattered over surface. Small microtubular ducts in mediolateral lines from segment III to VIII. Multilocular pores of same 4 kinds and relative abundance as on dorsum, present along body margin from head to segment II, near spiracles, and in medial areas of mesothorax to segment IV. Cruciform pores present in medial areas from head through segment VI, in sublateral clusters from segment II to VI. Legs absent. Antennae each either unsegmented or 3-segmented, about 37 μm long (paratype 68); when unsegmented, apical segment with 5 sensory setae; when 3-segmented, proximal 2 segments with thin, broken, sclerotized rings, with 3 or 4 sensory setae. Eyes ventral, present in small dermal pocket. Frontal lobes and preantennal pore absent. Microtrichia present from prothorax to segment VII.

Notes: The description is based on two specimens from one locality. The adult female of *Carpho. apodus* is similar to the adult female *Ap. idiastes* in lacking legs and in having reduced antennae. It differs as follows (character states of *Carpho. apodus* are in brackets): body margin without crenulations or wrinkles (with wrinkles); body margin without nodules (with nodules); enlarged setae abundant over dorsum (restricted to abdomen on dorsum); with 1 size of microtubular duct (with 2 sizes, smaller ducts concentrated on venter of abdomen).

Second-instar female (Fig. 22)

Description: Slide-mounted specimens, 1.7–1.8 mm long, 0.8–1.0 mm wide. Body elongate, without protruding anal lobes. Anal-lobe area dorsally without setae or ducts; laterally each lobe area with 3 marginal enlarged setae; ventrally each with 2 or 3 flagellate setae including elongate anal-lobe seta.

Dorsum with flagellate setae from head to segment VIII, arranged in 4 pairs of longitudinal lines, longest seta about 23 μm long. Enlarged setae present along body margin from pro- or mesothorax to posterior apex of abdomen, with 2 setae present on each lateral margin of each abdominal segment except VIII with 3 pairs, seta on anterior margin of each segment largest, arranged in single marginal longitudinal line; of 1 variable size: largest seta about 40 μm long, smallest about 22 μm . Enlarged setae straight, with acute apices and thick setal bases that appear fused to main part of seta, set on dermal projection; with 4 setae on segment IV. Macro-tubular ducts absent. Microtubular ducts 5–7 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or bilobular, $\frac{1}{4}$ or $\frac{1}{2}$ length of remaining sclerotized portion; total sclerotized area same length as or longer than unsclerotized area; dermal orifice either lightly or heavily sclerotized, without projecting tube. Microtubular ducts lightly scattered over surface, least numerous in medial areas of head, thorax, and anterior abdominal segments. Multilocular pores along body margin from head to segment V, of 3 kinds: 11-locular pores, 7-locular pores, and 5-locular pores; 7-locular pores most abundant. Cruciform pores absent. Sclerotized nodules and crenulations absent, with a few small projections near posterior body margin. Microtrichia absent.

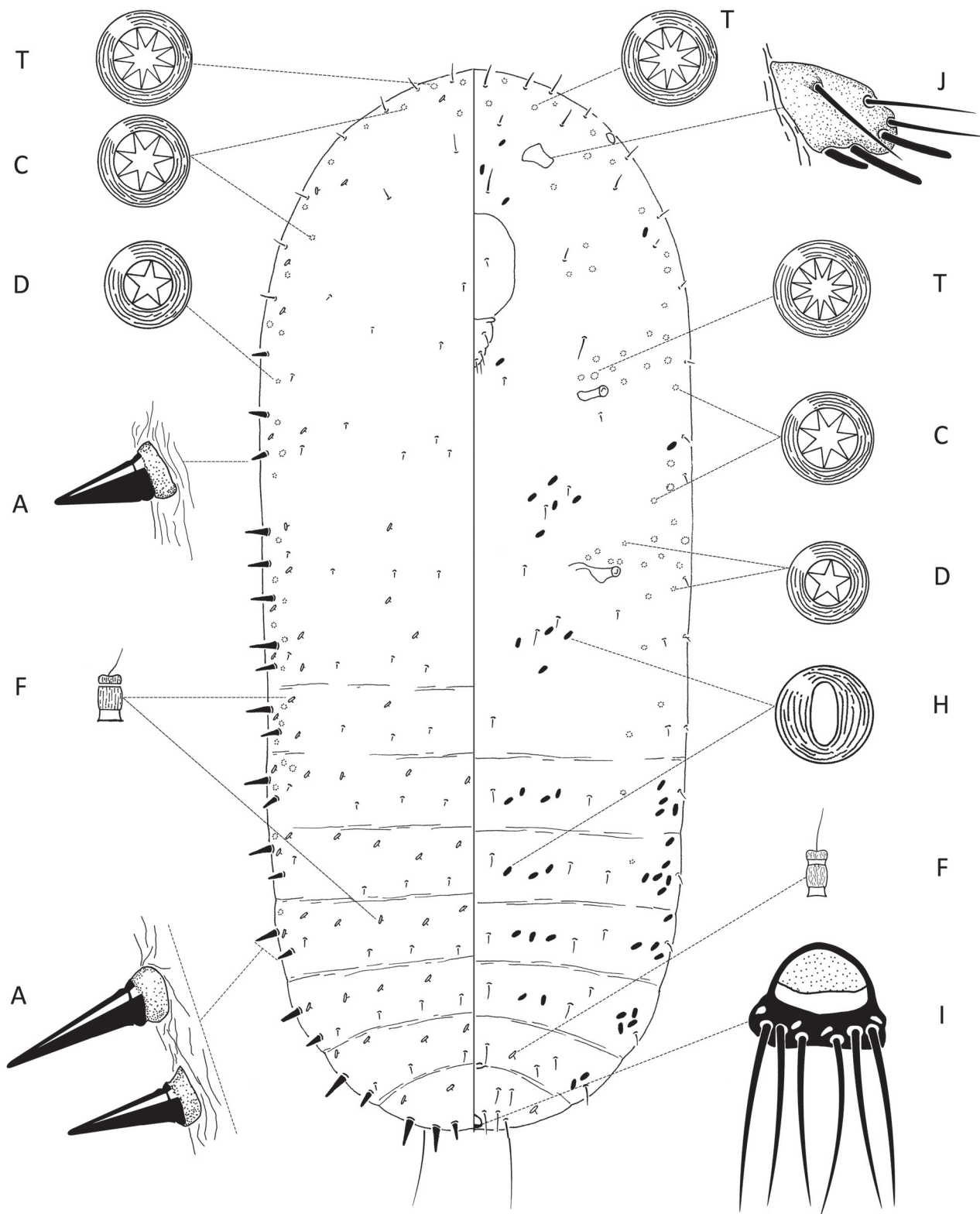


FIGURE 22. *Carphococcus apodus* sp. n., second-instar female (shed skin). 30 km. E. Rosario, Mt. La Dispensa (elevation 1,500 ft.), Sinaloa, Mexico, August 6, 1943, on *Arthrostylidium longifolium* (= *Guadua longifolia*), F.A. McClure. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; T=pore with >7 loculi.

Anal ring ventral, circular, complete, with few small cells and with 3 setae on each side of ring, each longer than diameter of ring. Anal tube and anal opening weakly sclerotized, with anal flap.

Venter with flagellate setae present over entire surface, longest seta on segment II 12 µm long, on segment VII 28 µm long; anal-lobe seta 98 µm long. Enlarged setae absent. Macrotubular ducts absent. Microtubular ducts restricted to posterior 2 abdominal segments. Multilocular pores of same 3 kinds and relative abundance as on dorsum, present along body margin from head to segment IV, near spiracles, and in medial areas of mesothorax to segment IV. Cruciform pores in medial areas from head through segment VI, in sublateral clusters on segments II to VII. Legs absent. Antennae unsegmented, each about 52 µm long, with 3 sensory setae. Eyes ventral, each set in small dermal pocket. Without small microtubular ducts. Frontal lobes and preantennal pore absent. Microtrichia present on segments VI to VIII.

Notes: The description is based on two mutilated exuviae from one locality. The second-instar female of *Carpophodius* is unique in lacking legs, and in having unsegmented antennae, a distinctively shaped anal ring, and many multilocular pores predominantly with more than 5 loculi.

***Carpochloroides* Cockerell 1899**

Carpochloroides Cockerell 1899: 12. Type species: *Carpochloroides viridis* Cockerell, 1899: 12–13, by monotypy.

Generic diagnosis of adult female: legs absent or greatly reduced; microtubular ducts with single internal sclerotization, not divided, similar in form to macrotubular ducts but smaller; macrotubular ducts, when present, with shallow internal cup; multilocular pores usually of 5-locular type; antennae unsegmented; labium 1- or 2-segmented; anal ring greatly reduced, usually without pores and setae; clypeus often with large anterior apodemes; frontal lobes, preantennal tubercles and cruciform pores absent.

Notes: Ferris (1957) described a second species (*Carpophodius mexicanus*), which induces galls even though the type species (*Carpophodius viridis*) from Brazil was not found in a gall. Based on morphology, there is reasonable evidence to place both species in the same genus. Since the mounted specimens were in such poor condition, the first author decided to look at dry material that Ferris retained and found a very interesting dilemma while examining the insides of the galls: there were two morphologically distinct adult females present. We have treated the two different types of adult female as specimens of two different species, i.e., *Carpophodius mexicanus* and *Carpophodius eugeniae* Miller and Stocks **sp. n.** It is unclear if there were mixed infestations in more than one gall. However, the fact that immature instars of *Carpophodius eugeniae* were the only ones found in the galls suggests the possibility that *Carpophodius mexicanus* specimens invaded the galls induced by *Carpophodius eugeniae*. This hypothesis was first suggested by Penny Gullan (ANU, Australian National University, and ANIC, Australian National Insect Collection, Canberra) when reviewing the manuscript. Another hypothesis is that the two kinds of adult females are morphotypes of the same species. We have decided to proceed with describing *Carpophodius eugeniae* as a new species to direct attention to its unusual life history and morphology. A third hypothesis is that one of the kinds of adult females is an inquiline within the confines of the gall induced by the second kind of adult female, but this seems unlikely. It also is of interest that *Carpophodius eugeniae* has second-instar males with legs and second-instar females that are legless. This is unusual within the Coccothraupinae.

Etymology: The generic epithet *Carpochloroides* was composed by Cockerell (1899) and apparently refers to the body of the adult female, which resembles the green fruit of the *Eugenia* host. It is derived from the Greek words “*karpos*” meaning “fruit”, “*chloros*” meaning “green”, and “*oeidos*” meaning “likeness of form”. It is a masculine noun (Williams 2011).

Carpochloroides eugeniae* Miller and Stocks **sp. n.*

Type material: **Adult female holotype** mounted singly on slide, with right label “*Carpochloroides / eugeniae* Miller / & Stocks / HOLOTYPE / UCD;” left label “*eugeniae / ad ♀ / On Eugenia / acapulcensis / Chivela, Oaxaca / Mexico / Ferris, 1926 / in eriococcid gall.*” Holotype is in UCD. **Paratypes:** MEXICO: Oaxaca: Chivela, II-(?)-1925, on *Eugenia acapulcensis*, G.F. Ferris (1 ad. ♀ holotype, 45 ad. ♀♀ paratypes, 65 second-instar ♀♀ paratypes,

9 ad. ♂♂ paratypes, 2 second-instar ♂♂ paratypes, 1 second-instar ♂ molting to third-instar prepupa paratype, 50 first-instar nymph paratypes, 47 first-instar nymph shed-skin paratypes, 1 first-instar nymph molting to second-instar ♂ paratype on 18 slides) UCD (8 slides), USNM (10 slides). This list does not include the slides that have been misplaced. See the “Notes” section of the “First-instar nymph” description for details.

Etymology: The species epithet “*eugeniae*” is based on the scientific name of the host plant of this species.

Field features: The following information is based on observations of the dry galls taken from the original Ferris collection. The galls are formed in small branches at the points where the leaf petioles are attached. Galls vary from 1 to 2 cm in diameter and are nearly spherical in shape. The inner cavity is also spherical and varies from 5–9 mm in diameter. Two species occur in these galls and although *Carp. eugeniae* is the most abundant, adult females of *Carp. mexicanus* have been found in the same galls. Each gall contains many specimens, and most specimens within a single gall are synchronized so that the same gall contains individuals primarily in the same life stage. Different galls, though synchronized internally, can be in quite different life stages compared to other galls. The inner cavity of the gall is lined with a white waxy secretion and the cavity is often filled with small balls of felted wax. Under a dissection microscope the insects can be observed scattered over the wall of the cavity with their stylets inserted. Attempts to locate an exit hole from the gall were unsuccessful. The only holes observed are apparently emergence holes formed by parasitoids. If *Carp. eugeniae* and *Carp. mexicanus* are different species, it is likely that *Carp. eugeniae* is the species that induces the gall, not *Carp. mexicanus* as suggested by Ferris (1957).

Adult female (Fig. 23)

Description: Holotype, slide mounted, 0.8 mm long, 0.6 mm wide (paratypes 0.6–1.2 mm long, 0.4–0.8 mm wide). Body pyriform, without protruding anal lobes. Anal-lobe area dorsally with 2 setae, 1 long and robust, 1 short and thin, and 1 5-locular pore; ventrally with 2 or 3 flagellate setae including elongate anal-lobe seta, and 1 or 2 5-locular pores.

Dorsum with flagellate setae scattered over entire surface, conspicuously shorter than enlarged setae, longest about 13 µm long. Enlarged setae unusually elongate, of 1 size, in transverse rows over surface, forming 3 pairs of longitudinal lines (medial, mediolateral and lateral), mediolateral lines restricted to thorax and anterior abdomen, each line with 1 seta per segment except on thorax and head, where lateral lines each with 2 or 3 setae per segment. Segment IV with 4 enlarged setae (paratypes with 2–4). Largest seta 98 µm long (paratypes 80–120). Enlarged setae straight or slightly curved, with acute or slightly capitate apices, and thin setal base; some setae bifurcate. Macrotubular ducts with internal sclerosis nearly flat, without conspicuous concavity, abundant over surface, except uncommon on posterior 2 or 3 abdominal segments. Microtubular ducts with narrow cup-shaped internal sclerotization similar to sclerotization of macrotubular ducts, about 6 µm long, total sclerotized area approximately 1/8th length of unsclerotized area; dermal orifice unsclerotized. Microtubular ducts in small numbers over surface, most abundant along body margin. Multilocular pores scattered over entire surface, of 2 kinds: 7-locular pores; 5-locular pores most abundant. Cruciform pores absent. Microtrichia absent.

Anal ring dorsal, situated near body apex, or apical; ring itself represented only by small, lightly sclerotized plate anterior to anal opening, without setae or pores. Anal tube lightly sclerotized at dermal orifice. Anal flap absent.

Venter with flagellate setae noticeably short, longest seta on segment II about 11 µm long, on segment VII 12 µm long; anal-lobe seta 85 µm long (paratypes 55–88 µm), often apically capitate; setae apically acute. Enlarged setae absent. Macrotubular ducts of same size as on dorsum, scattered over entire surface, least abundant on head. Microtubular ducts restricted to lateral areas, most numerous on thorax, lightly scattered over surface. Multilocular pores of 2 kinds: 7-locular pores rare, absent from some paratypes; 5-locular pores abundant over entire surface, least numerous on head, clustered around spiracles. Legs absent. Antennae each 6-segmented (paratypes 5- or 6-segmented), 65 µm long (paratypes 45–62 µm); apical segment with 6 sensory setae (paratypes with 4–6 sensory setae); segment 1 with or without 1 small flagellate seta, remainder of antenna without setae. Mouthparts unusually large, labium undivided. Eyes, frontal lobes, preantennal pores and microtrichia absent.

Notes: The description is based on 45 specimens from one locality. The adult female of *Carp. eugeniae* is most similar to the adult female of *Carp. mexicanus* but differs as follows (character states in brackets are those of the female of *Carp. eugeniae*): with short dorsal flagellate setae only (with enlarged setae and short flagellate setae); with small macrotubular ducts but without microtubular ducts (with microtubular and macrotubular ducts); with unsegmented antennae (with 5- or 6-segmented antennae); with large apodemes attached to the clypeus (without large apodemes); and without a plate anterior to the anal opening (with a plate).

Second-instar female (Fig. 24)

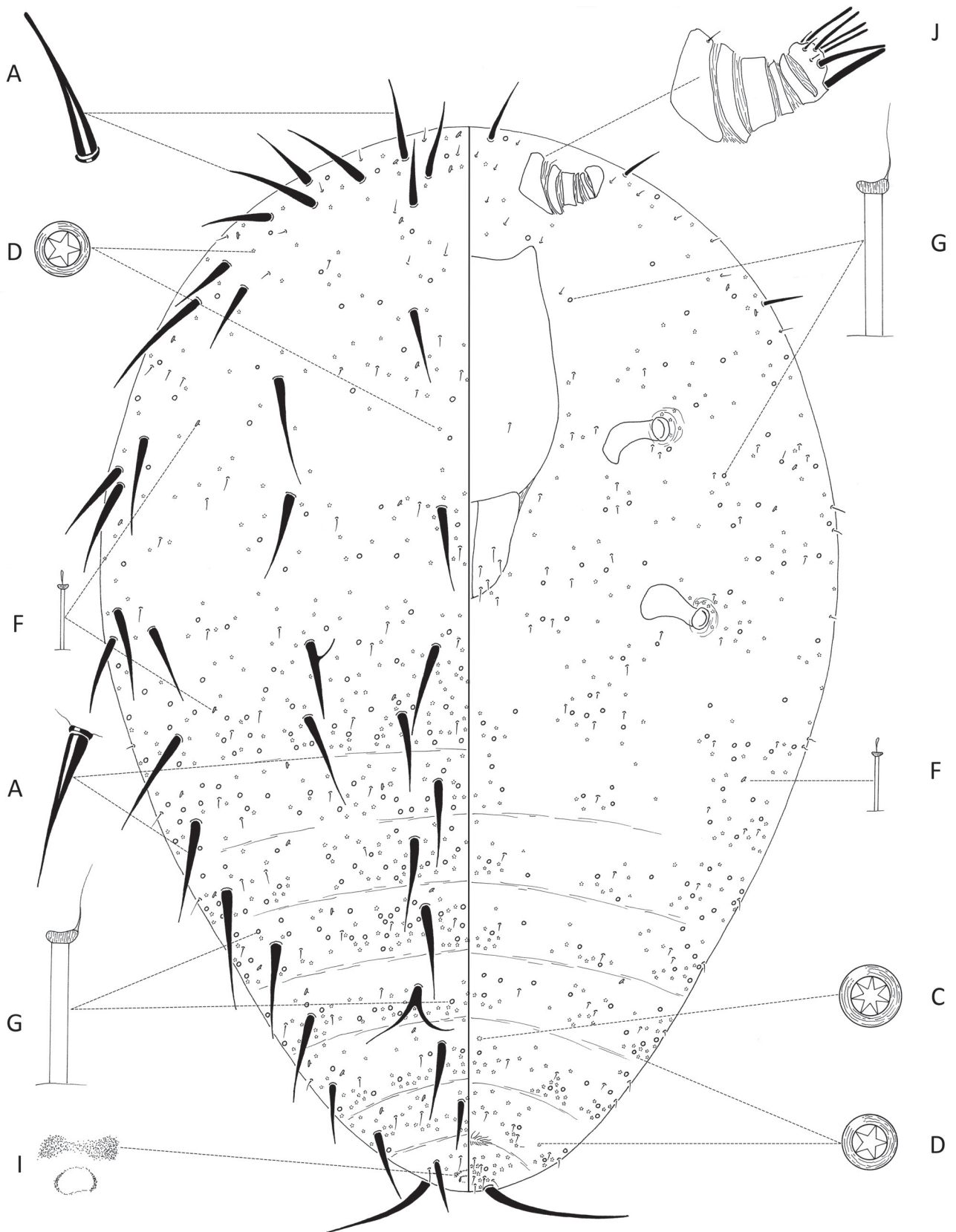


FIGURE 23. *Carpochloroides eugeniae* sp. n., adult female, Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; G=macroduct; I=anal ring; J=antenna.

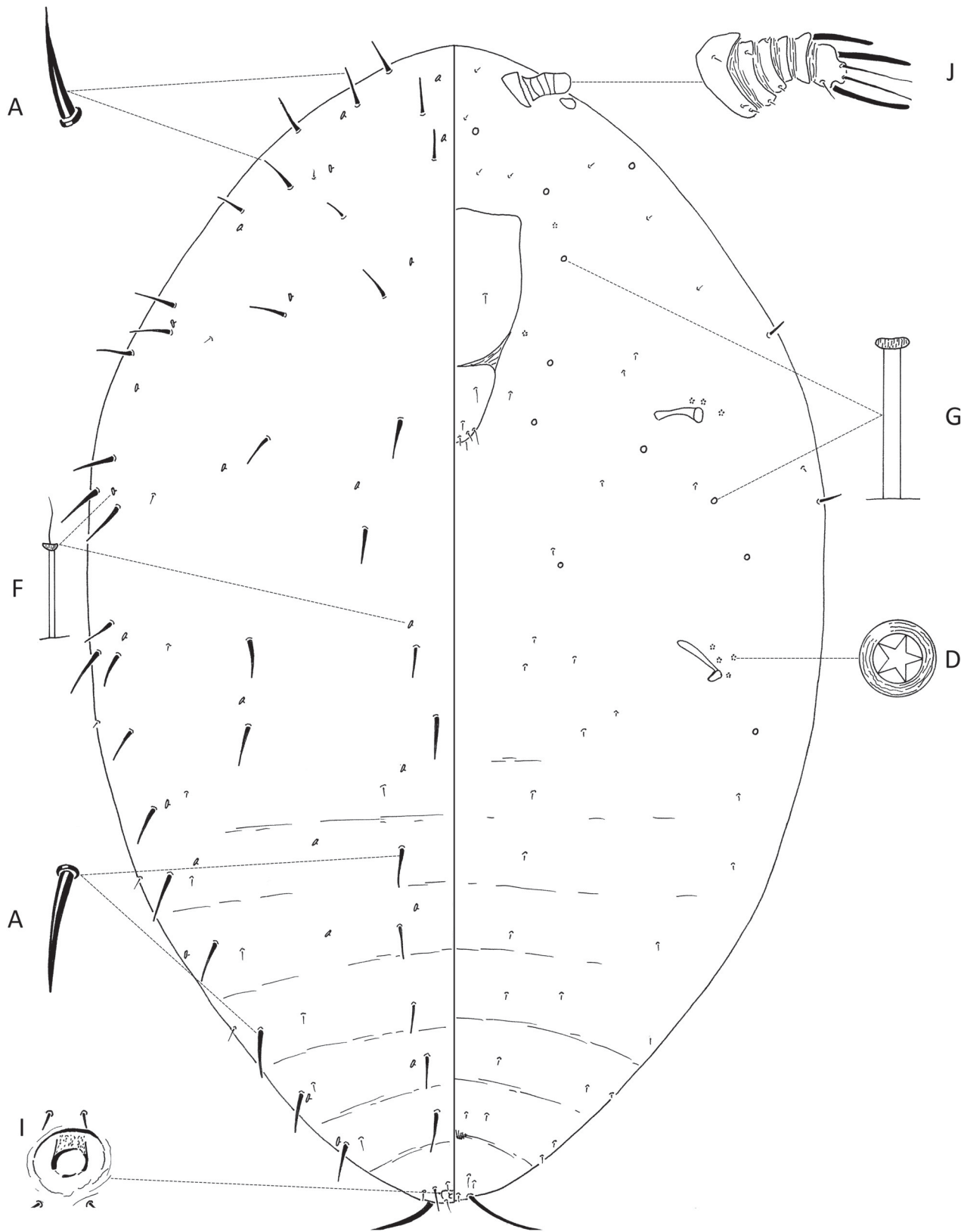


FIGURE 24. *Carpochloroides eugeniae* sp. n., second-instar female, Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. A=enlarged seta; D=5-locular pore; F=microtubular duct; G=macrotubular duct; I=anal ring; J=antenna.

Description: Slide-mounted specimens, 0.4–0.7 mm long, 0.2–0.5 mm wide. Body oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 setae, 1 longer and slightly more robust, 1 shorter and thin; each ventrally with 2 or 3 flagellate setae including elongate anal-lobe seta.

Dorsum with flagellate setae most abundant near body margin, noticeably smaller than enlarged setae. Enlarged setae arranged in same pattern as on adult female, not as conspicuously long and robust; largest seta 25–38 μm long. Macrotubular ducts absent. Microtubular ducts difficult to discern, apparently in small numbers over surface, similar to those on adult female except smaller. Multilocular pores usually absent, rarely with 4-locular or 5-locular pores on segments II or III. Cruciform pores absent. Without microtrichia.

Anal ring apical, ring variable, sometimes represented only by small sclerotized area, other times forming complete ring, often with 1 pair of short setae on each side of ring associated with, but not on, anal ring sclerotization. Anal tube orifice sclerotized.

Venter with flagellate setae about same length throughout entire surface, longest seta on segment II 6 μm long, on segment VII 5 μm long; anal-lobe seta 40–60 μm long. Enlarged setae absent. Macrotubular ducts small, present in small numbers on head, thorax, and anterior abdominal segments. Microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores in small numbers on head, thorax, and anterior abdominal segments, most numerous near spiracles; 4-locular pores rare or absent. Cruciform pores absent. Legs absent, sometimes with wrinkled area where metathoracic legs would be. Antennae each normally 6-segmented, sometimes with 4 or 5 segments; 25–38 μm long. Eyes ventral. Labium with 2 indistinct segments, basal segment not observed. Frontal lobes absent. Preantennal pore absent. Microtrichia absent.

Notes: The description is based on 65 specimens from one locality. The second-instar female of *Carp. eugeniae* is unique in having narrow, elongate enlarged setae, legs absent, anal ring reduced, microtubular ducts similar in appearance to small macrotubular ducts, macrotubular ducts present in small numbers on the venter only.

Adult male (Fig. 25)

Description: Slide-mounted specimens, 0.8–1.0 mm long, 0.4–0.5 mm wide. Body slightly pear-shaped, without protruding anal lobes.

Dorsum without lateral tail-forming clusters, multilocular pores, or X-type derm pores. Flagellate setae short, apically acute, about same length as ventral setae, increasing in size posteriorly, some setae with small amount of sclerotization around setal socket, scattered over entire surface, setae on segments VIII and IX unusually abundant. Penial sheath (ps) sclerotized, other abdominal sclerotization variable, normally restricted to lateral areas of segment VIII, sometimes also on segment VII. Thoracic sclerotization absent. Head sclerotization variable, normally with part of ocular sclerite (ocs) visible and with small amount of sclerotization in dorsomedial area. Dorsal eye usually absent, sometimes indicated by small, raised area on ocular sclerite. Rarely dorsal arm of midcranial ridge (dmcr) weakly indicated, dorsal eye (dse) relatively well-developed, ocular sclerite absent.

Penial sheath (ps) 130–180 μm long, width/length 0.8–1.0, style (st) in lateral view slightly curved, apically with several small papillae. Sheath heavily sclerotized on both surfaces, with weak indication of division and with unusually large number of flagellate setae. Basal rod absent.

Venter with flagellate setae present medially on head, thorax, and segments II to VII, also present submedially and laterally on abdomen; 1 or 2 setae on each metepisternum (mtes), rarely with 1 on each mesepisternum (mses). Abdominal sclerotization present on lateral areas of segments VII and VIII. Thoracic sclerotization limited to small areas associated with pro- (pa) and mesothoracic (ma) apophyses and to sclerotization associated with pleural ridges (pr) of each leg. Head sclerotization restricted to ventromedial area near anterior apex of head and to ventral portion of ocular sclerite (ocs). Mouth structure variable, unusually complex for adult male; normally rudiments of clypeus (cl) and labium (lb) present, often possessing setae apically, pharynx (px) present. Cranial apophysis (ca) bifurcate. Ventral and lateral ocelli normally absent, rarely indicated by small, raised areas on ocular sclerite. Pro- and mesothoracic legs approximately same size, metathoracic legs longest. Fleshy setae absent from legs except slightly enlarged on inner margin of tibia. Tarsal digitules absent, claw digitules not reaching tip of claw, apically acute. Antennae each 5- or 6-segmented, third segment longest, apical segment rounded; fleshy setae present on apical 2 segments, capitate setae absent.

Notes: The description is based on 9 specimens from one locality. The adult male of *Carp. eugeniae* is quite variable, particularly in regard to abdominal sclerotization, ocular sclerite development, eye development, mouth structure, setal patterns, and antennal segmentation. It is similar to the adult males of *Pseudochermes fraxini* (Kaltenbach) and *Ovaticoccus adoxus* (Ferris) in having little or no head and thoracic sclerotization, unusual antennae, no

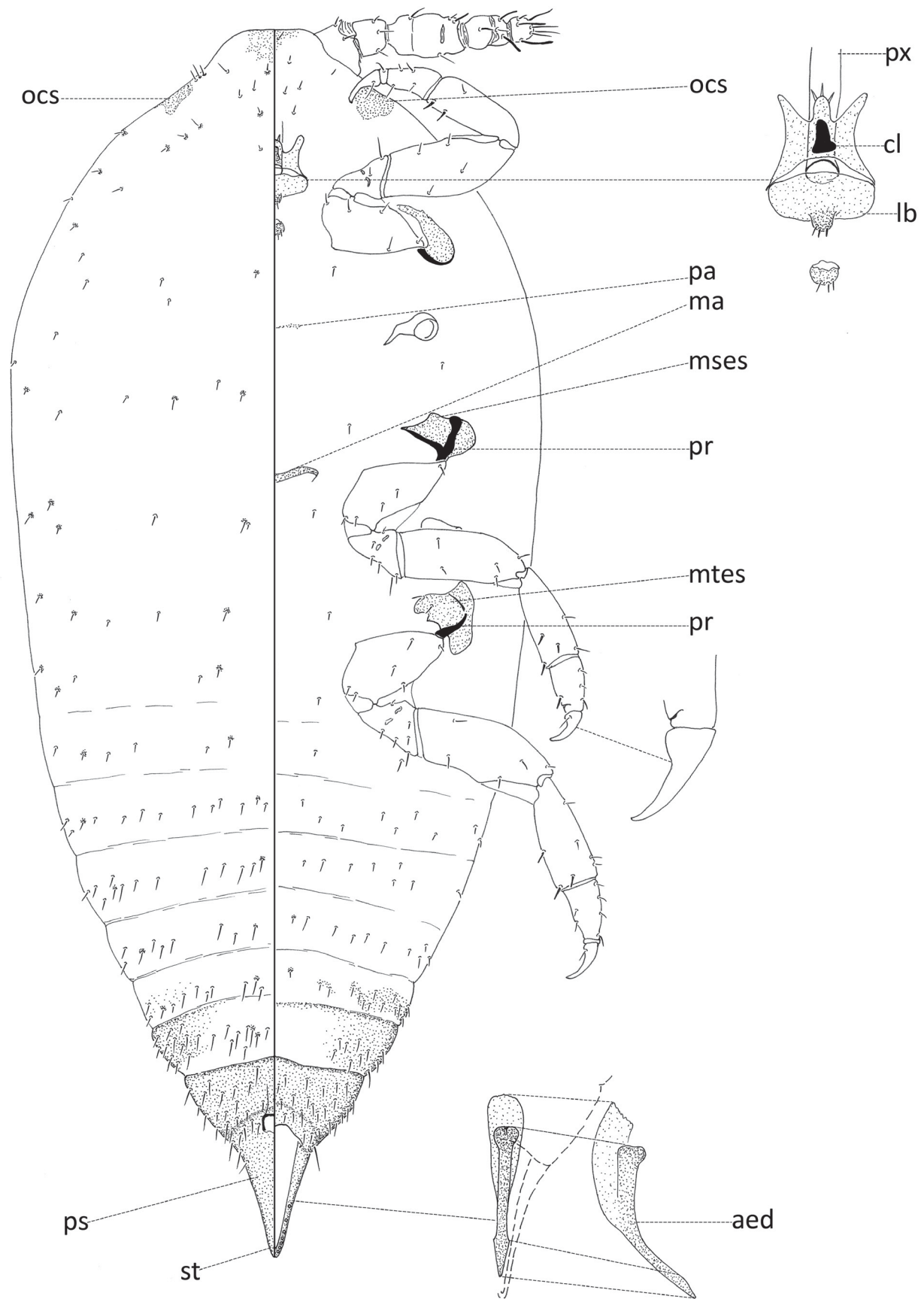


FIGURE 25. *Carpochloroides eugeniae* sp. n., adult male (apterous), Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. See Materials and methods for abbreviations.

wings or hamulohalteres, and no tail-forming pore clusters. *Pseudochermes fraxini* differs as follows (character states of *Carpo. eugeniae* are in brackets): antennae each 8-segmented (5- or 6-segmented); claw digitules reaching tip of claw (not reaching tip); penial sheath same length as, or shorter than, other abdominal segments (longer). *Ovaticoccus adoxus* differs from *C. eugeniae* as follows: antennae each 9-segmented (5- or 6-segmented); multilocular pores present (absent); fleshy setae on distal 6 segments of antenna (on distal 2 segments); fleshy setae on tibiae (absent from tibiae).

Fourth-instar male (pupa) (Fig. 26)

Description: Slide-mounted specimen 0.8 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes.

Dorsum with flagellate setae of 2 kinds: slightly enlarged setae restricted to lateral margins of segment VIII; thin flagellate setae scattered over surface, basically of same pattern as on second-instar male, increasing in length posteriorly. Without tubular ducts, multilocular pores, or sclerotization.

Penial sheath unsclerotized, without lobular development. Setae present on dorsum only. Anal opening dorsal, with anal-tube orifice weakly sclerotized. Genital opening slightly developed ventrally near sheath apex.

Venter with multilocular pores and tubular ducts absent. Body setae of same distribution as on adult male, noticeably shorter than on dorsum, anal-lobe seta 23 μ m long. Mouth opening and cranial apophysis present. Legs and antennae without indication of setae. Antennae each 4- or 5-segmented.

Notes: The description is based on one specimen from one locality. The pupa of *Carpo. eugeniae* is unique among the few eriococcid pupae that have been described, in lacking multilocular pores.

Third-instar male (prepupa) (Fig. 27)

Description: Slide-mounted specimen 0.6 mm long, 0.4 mm wide. Body elongate oval, without projecting anal lobes.

Dorsum with flagellate setae of 2 kinds: slightly enlarged setae restricted to lateral margins of segment VIII; thin flagellate setae scattered over surface, basically in same pattern as on second-instar male, increasing in length posteriorly. Without tubular ducts, multilocular pores, or sclerotization.

Penial sheath unsclerotized, without lobular development. Setae present on venter only. Anal opening dorsal, with anal tube orifice weakly sclerotized, located near posterior apex. Genital opening slightly developed ventrally near sheath apex.

Venter with multilocular pores and tubular ducts absent. Body setae of same distribution as on adult male, noticeably shorter than on dorsum, anal-lobe seta 20 μ m long. Mouth opening, pharynx, and cranial apophysis present. Legs and antennae without indication of setae. Antennae each 4- or 5-segmented.

Notes: The description is based on one specimen from one locality. The prepupa of *Carpo. eugeniae* is unique among the few eriococcid prepupae that have been described in lacking multilocular pores.

Second-instar male (Fig. 28)

Description: Slide-mounted specimens, 0.4–0.5 mm long, 0.2–0.3 mm wide. Body oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 setae, 1 longer; each ventrally with 3 flagellate setae including elongate anal-lobe seta.

Dorsum with flagellate setae most abundant near body margin, noticeably smaller than enlarged setae. Enlarged setae arranged in same pattern as on adult female, not as conspicuously long and robust; largest seta 20–34 μ m long, setae rarely capitate. Macrotubular ducts absent. Microtubular ducts difficult to discern, apparently in small numbers over surface, similar to those on adult female except smaller. Multilocular pores usually absent, rarely with 2 or 3 5-locular pores on thorax. Cruciform pores absent. Without microtrichia.

Anal ring dorsal or apical, ring abortive, normally partially developed around anal tube opening, often with 1 or 2 short setae on each side of ring associated with, but not on, anal ring. Anal tube heavily sclerotized near dorsal surface.

Venter with flagellate setae about same length throughout surface, longest seta on segment II 5 μ m long, on segment VII 6 μ m long; anal-lobe seta 35–63 μ m long. Enlarged setae absent. Macrotubular ducts small, difficult to see, present in small numbers on head, thorax, and anterior abdominal segments. Microtubular ducts absent, or present on posterior part of head and thorax. Multilocular pores of 2 kinds: 5-locular pores in small numbers, always present near spiracles, sometimes present near legs, on lateral margins of 1 or 2 abdominal segments, and near mouthparts; 3-locular pores rare or absent. Cruciform pores absent. Legs present, each femur with 3 setae, all distal; tibiae each with 4 setae; hind tibia/tarsus 0.7–0.9; tarsal and claw digitules apically acute; claws with small denticle near tip.

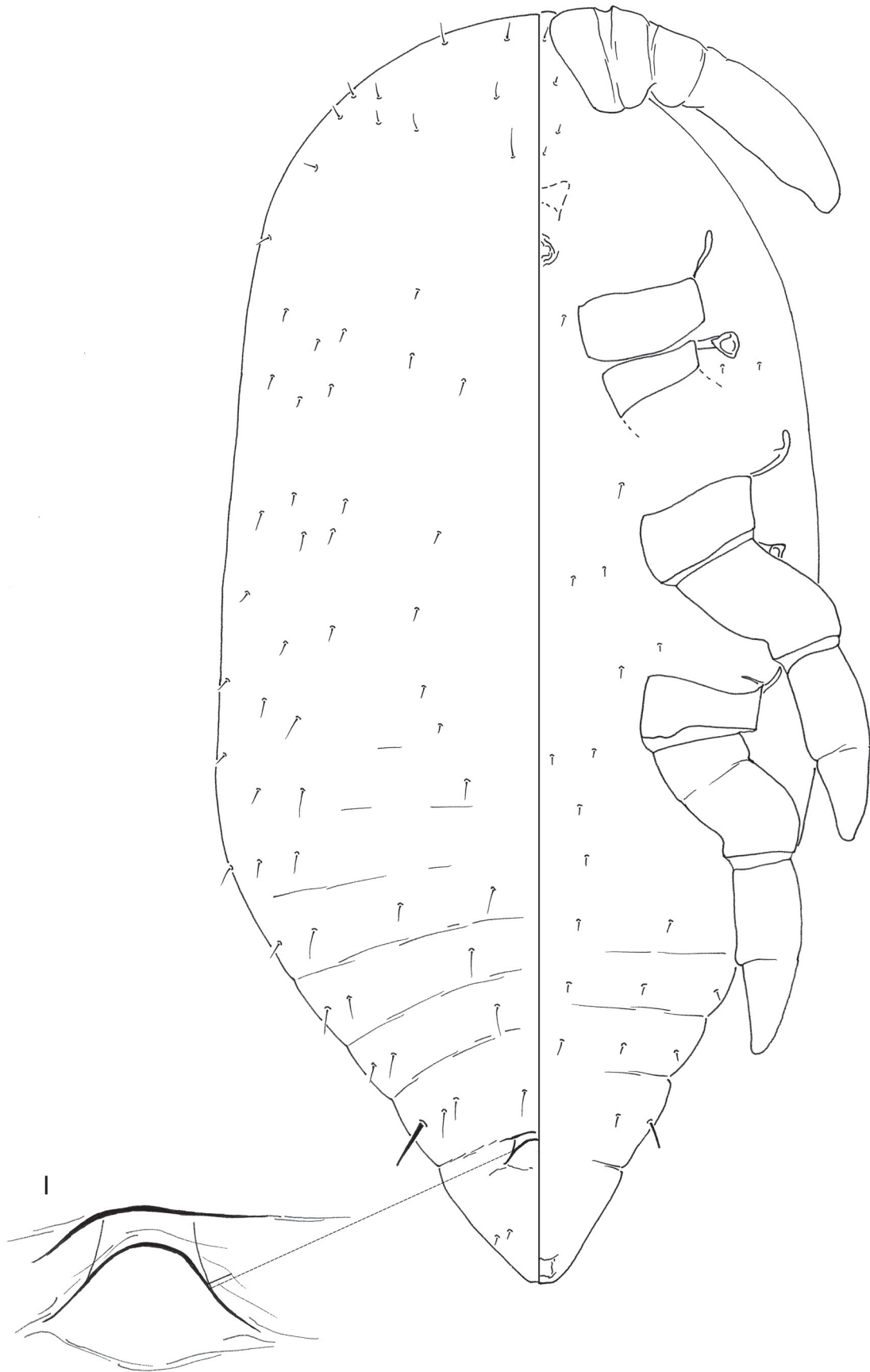


FIGURE 26. *Carpochloroides eugeniae* sp. n., fourth-instar male (pupa), Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. I=anal ring.

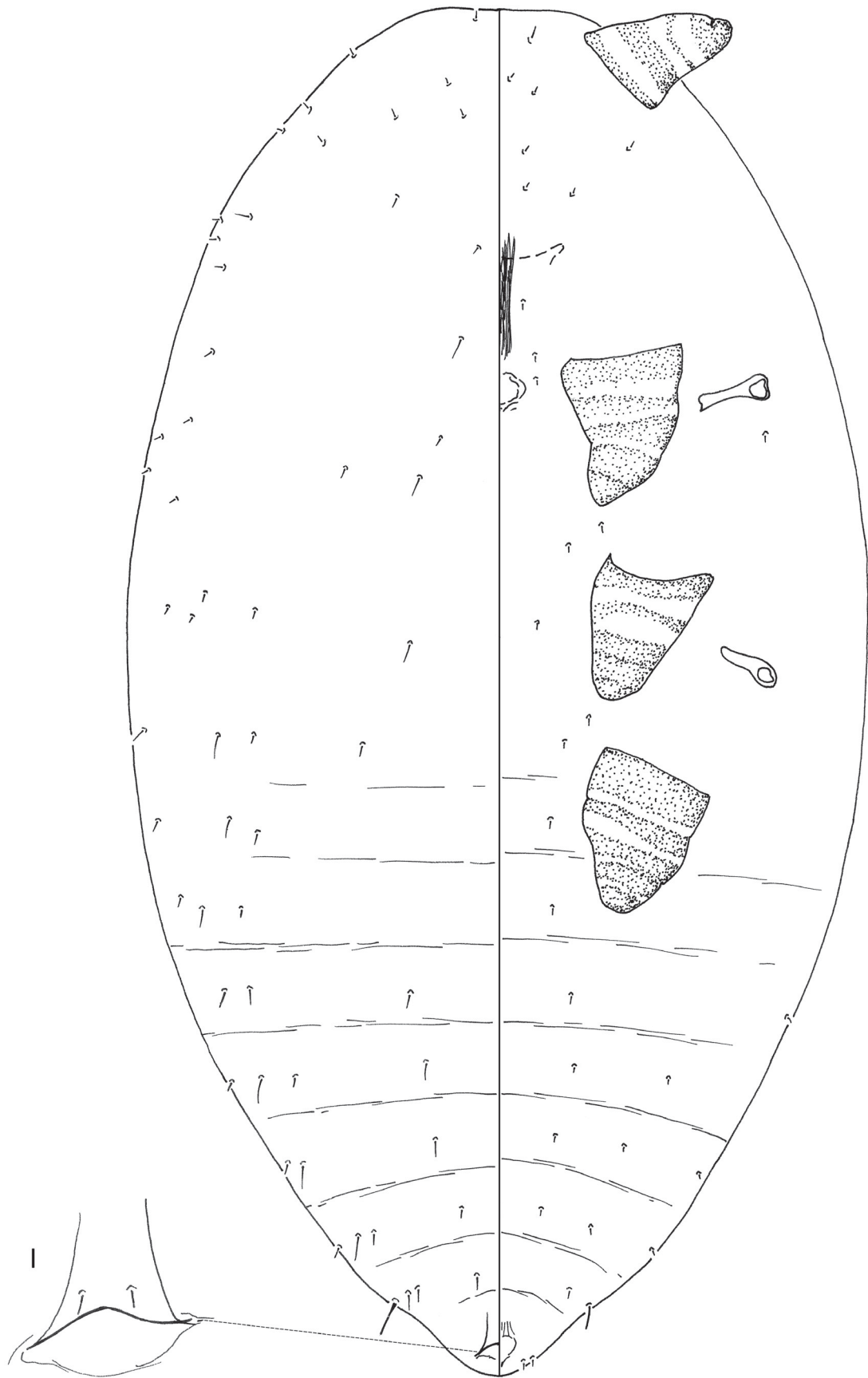


FIGURE 27. *Carpochloroides eugeniae* sp. n., third-instar male (prepupa), Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. I=anal ring.

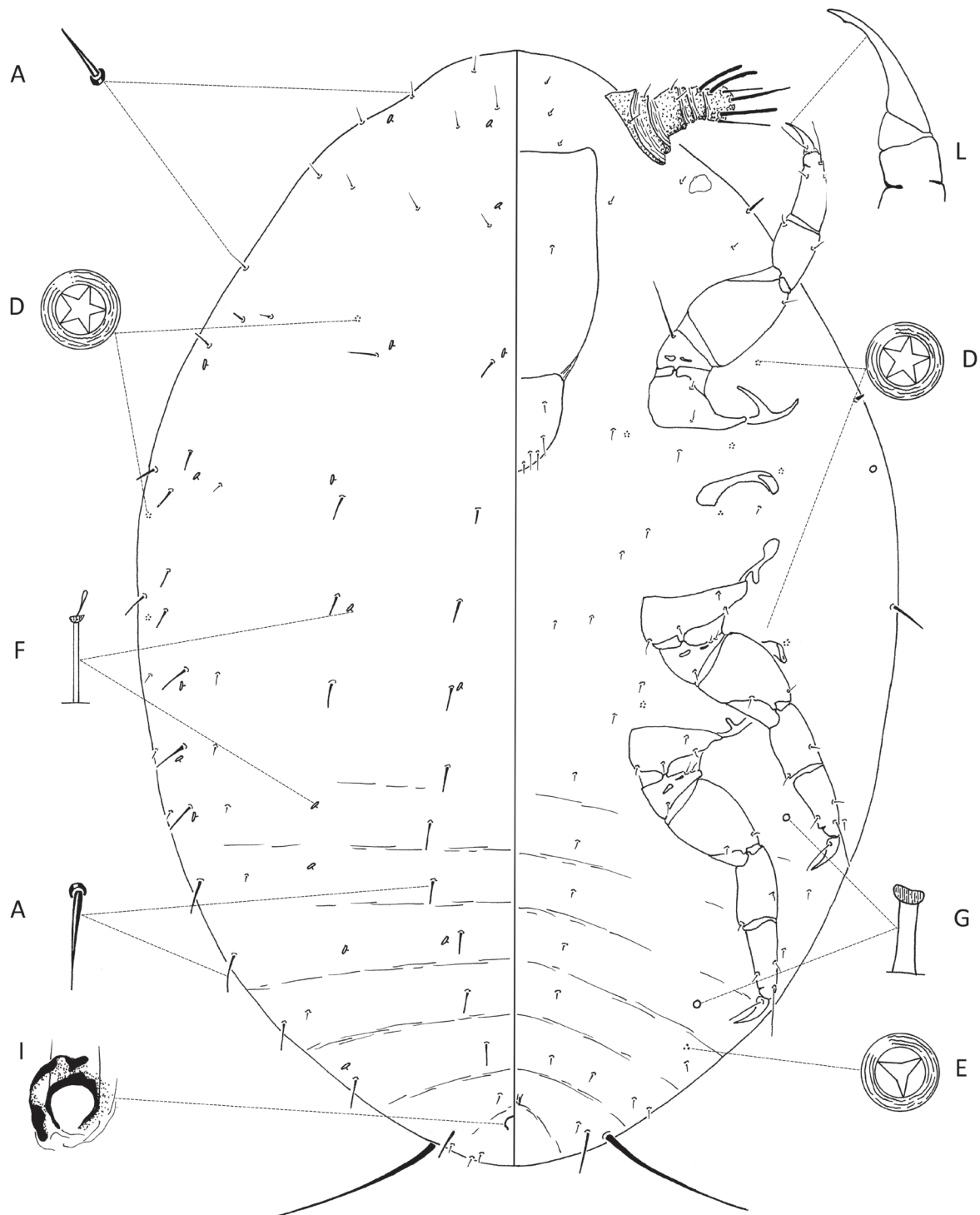


FIGURE 28. *Carpochloroides eugeniae* sp. n., second-instar male, Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. A=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macro tubular duct; I=anal ring; L=claw.

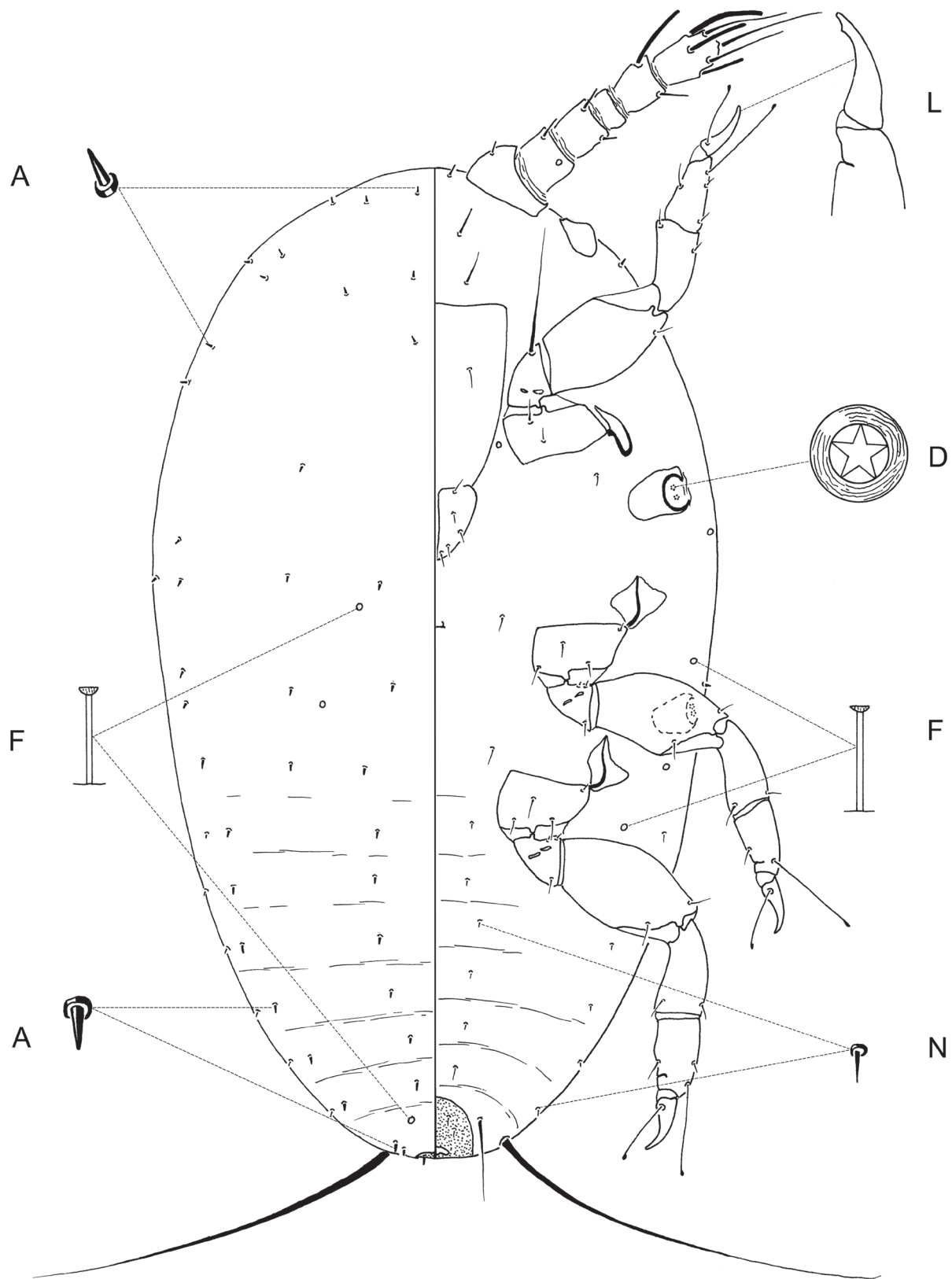


FIGURE 29. *Carpochloroides eugeniae* sp. n., first-instar nymph, Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. A=enlarged seta; D=5-locular pore; F=microtubular duct; L=claw; N=flagellate seta.

Antennae each usually 6-segmented, 1 specimen with 5 segments; each about 38 μm long; apical segment with 4 sensory setae and 1 or 2 flagellate setae; segment 5 with 1 sensory seta and 1 flagellate seta; segment 4 without setae; segments 2 and 1 each with 1 seta.

Notes: The description is based on six specimens from one locality. The second-instar male of *Carmo. eugeniae* is unique in having: narrow, elongate enlarged setae; anal ring reduced; microtubular ducts similar in appearance to small macrotubular ducts; macrotubular ducts in small numbers on the venter only.

It is interesting that the second-instar male retains its legs, whereas the second-instar female lacks them; we have discovered a similar situation in the second-instar males of *Xerococcus fouquieriae*. We have been unable to find any other species of scale insect that shows this kind of sexual dimorphism in the second-instar nymphs.

First-instar nymph (Fig. 29)

Description: Slide-mounted specimens 0.2–0.3 mm long, 0.1–0.2 mm wide. Body oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 short conical setae and 1 longer seta; ventrally each with 2 or 3 elongate setae including anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae not conspicuously enlarged, forming 3 pairs of longitudinal lines on head and thorax (medial, mediolateral and lateral), without mediolateral line on abdomen; enlarged setae short and slender, straight sides, thin setal bases, longest setae about 6 μm long. Tubular ducts intermediate between macro- and microtubular ducts, difficult to discern, normally in small numbers, sometimes absent. Multilocular and cruciform pores absent.

Anal ring bent over abdominal apex, dorsal portion composed of large, sclerotized plate with 2 short setae on each side of ring but not associated with anal opening and small opening for anal tube; ventral portion extension of dorsal plate with 1 pair of conical setae.

Venter with setae flagellate, longest seta on segments II and VII about 7 μm long; anal-lobe seta unusually long, 190–250 μm long. Enlarged setae absent. Tubular ducts of same kind as on dorsum, present on thorax, rarely on head. Multilocular pores with 5 loculi only, with 1 or 2 in atria of each spiracle. Cruciform pores absent. Legs with each femur with 2 or 3 setae, distal only; each tibia with 4 setae; tibia/tarsus 0.9–1.1. Antennae each 6-segmented, about 68 μm long. Frontal lobes, preantennal pores and microtrichia absent.

Notes: The description is based on numerous specimens from one locality. The first-instar nymph of *Carmo. eugeniae* is similar to the first-instar nymph of *C. viridis* in having multilocular pores in the atria of the spiracles. The two species differ by the following (character states in brackets are of *C. eugeniae*): with unusually elongate and enlarged dorsal setae, longer than width of each abdominal segment (enlarged setae nearly flagellate, not enlarged, shorter than width of each abdominal segment); without a sclerotized plate associated with anal ring (with large, sclerotized plate associated with anal ring).

The above specimens were sent by Gordon Ferris Stanford University, to Harold Morrison, US Department of Agriculture, in 1950 for the latter's opinion; they were determined as "Eriococcinae" and "Eriococcidae genus uncertain." The shipment must have included galls from which specimens were mounted by Morrison, but the slide labels do not look like USDA labels or Stanford University labels. We mounted more specimens from the dry collection and it included 247 specimens of various instars on 51 slides. Unfortunately, most of these specimens have been misplaced (six of the slides have been rediscovered and are in the USNM), but they served as the basis of the extensive descriptions and illustrations presented above. Unfortunately, the prepupa and pupa specimens have not been recovered, but specimens of all other instars are included in the "Type material" section. We decided to include all of the information gleaned from the missing and found specimens because it documents an interesting and unique life history. Hopefully additional collections will be made in the future and the misplaced specimens will be found. When they are found, they are to be considered paratypes since they were used for the original description and are from the same collection as the type specimens listed above.

***Carpochloroides mexicanus* Ferris**

Carpochloroides mexicanus Ferris 1957: 84.

Type material: From the syntypes, we have chosen and marked as lectotype an adult female; the right label reads "*Carpochloroides / mexicanus / Type / Eugenia / acapulcensis / Chivela, Mexico / G.F. Ferris 1926 / STANFORD*"

UNIVERSITY / NATURAL HISTORY MUSEUM”; left label “*Carpochloroides / mexicanus* / (Ferris) / 1 ad. ♀ / 1 parasite larva” and gives a map of their position (UCD); label on back of slide “*Carpochloroides / mexicanus* Ferris / LECTOTYPE / Parasite larva / UCD.” In addition, there are 9 paralectotypes, some of which were used by Ferris for the line drawing; others were used for the original description of the gall and were mounted after the original description.

Specimens examined: MEXICO: Oaxaca: Chivela, III-?-1926, on *Eugenia acapulcensis*, G.F. Ferris (1 ad. ♀ lectotype, 4 ad. ♀♀ paralectotypes mounted by Ferris on 3 slides, 5 ad. ♀♀ paralectotypes mounted at USDA on 4 slides) UCD (5 slides), USNM (3 slides).

Etymology: The species epithet “*mexicanus*” is named in honor of the country where the species was collected.

Field features: *Carpochloroides mexicanus* was found in galls that contained not only this species but also numerous specimens of *Carpo. eugeniae*. For a detailed description of the gall, see “Field notes” of the latter species, above. In the original description of *Carpo. mexicanus*, Ferris (1957: 84) described it in the field as follows: “Forming gall on the small twigs of the host, these galls involving the petioles of several leaves, almost globular and attaining a length of as much as two cm. There must be some opening to this gall but this is extremely obscure.” It seems likely that *Carpo. mexicanus* is not the species that induces the galls.

Adult female (Fig. 30)

Description: Slide-mounted specimens, 1.1–1.6 mm long, 0.9–1.4 mm wide. Body rotund, without protruding anal lobes. Anal-lobe areas each dorsally with 2 or 3 short flagellate setae, 0–3 macrotubular ducts; ventrally each with 2 or 3 flagellate setae, including elongate anal-lobe seta, 0–2 macrotubular ducts.

Dorsum with flagellate setae slightly longer than ventral setae, each about 7 µm long, not arranged in pattern. Enlarged setae absent. Macrotubular ducts unusually elongate, apical sclerotized cup unusually flat, abundant over entire surface. Microtubular ducts absent. Multilocular pores all 5-locular, lightly scattered over surface except absent from posterior abdominal segments. Cruciform pores absent. Microtrichia absent.

Anal ring reduced, circular, weakly sclerotized, without pores or setae; anal tube without sclerotization, dermal orifice sclerotized. Without anal flap.

Venter with flagellate setae noticeably short, about 5 µm long; anal-lobe setae 25–38 µm long, setae apically acute. Enlarged setae absent. Macrotubular ducts of same size and shape as on dorsum, scattered over entire surface. Microtubular ducts absent. Multilocular pores of same kind and distribution as on dorsum except with small cluster near each spiracle. Cruciform pores absent. Legs absent. Antennae each unsegmented, about 18 µm long, with 4 or 5 sensory setae and 0–2 short flagellate setae. Labium 2- or 3-segmented. Clypeolabral shield with large anterior lobes. Frontal lobes, preantennal pores and microtrichia absent.

Notes: The description is based on ten specimens from one locality. The adult female of *Carpo. mexicanus* keys to *Carpochloroides* in the generic key presented by Hodgson *et al.* (2004) but differs as indicated in the “Notes” section of the genus given above. Specimens of this species are in poor condition, making description and illustration difficult at best. Details of the labium were difficult to discern; the proximal segment may not be as distinct as illustrated.

***Cryptococcus* Douglas 1890**

Cryptococcus Douglas 1890: 155. Type species: *Cryptococcus fagisuga* Lindinger 1936 (= *Coccus fagi* Bärensprung 1849) by monotypy.

Note: *Cryptococcus* and *Pseudochermes* were placed in the family Cryptococcidae by Kozár *et al.* (2013), based primarily on the plate that surrounds the anal opening and on the presence of only 1 seta on each side of the basal segment of the labium. However, molecular evidence based on 18S sequence data suggests the placement of *Cryptococcus* in the Eriococcidae *sensu lato*, i.e., in the Gondwanan clade (see Cook & Gullan 2004, Gwiazdowski *et al.* 2006 and Nan *et al.* 2013). Therefore, we are treating the two species of *Cryptococcus* that occur in the U.S. as part of the family Eriococcidae.

Etymology: The generic epithet “*Cryptococcus*” is formed from the Greek word “*kryptos*” meaning “secret” or “hidden” and the Greek word “*kokkos*” meaning “round structure” or “scale insect”, and refers to the highly cryptic nature of species in the genus.

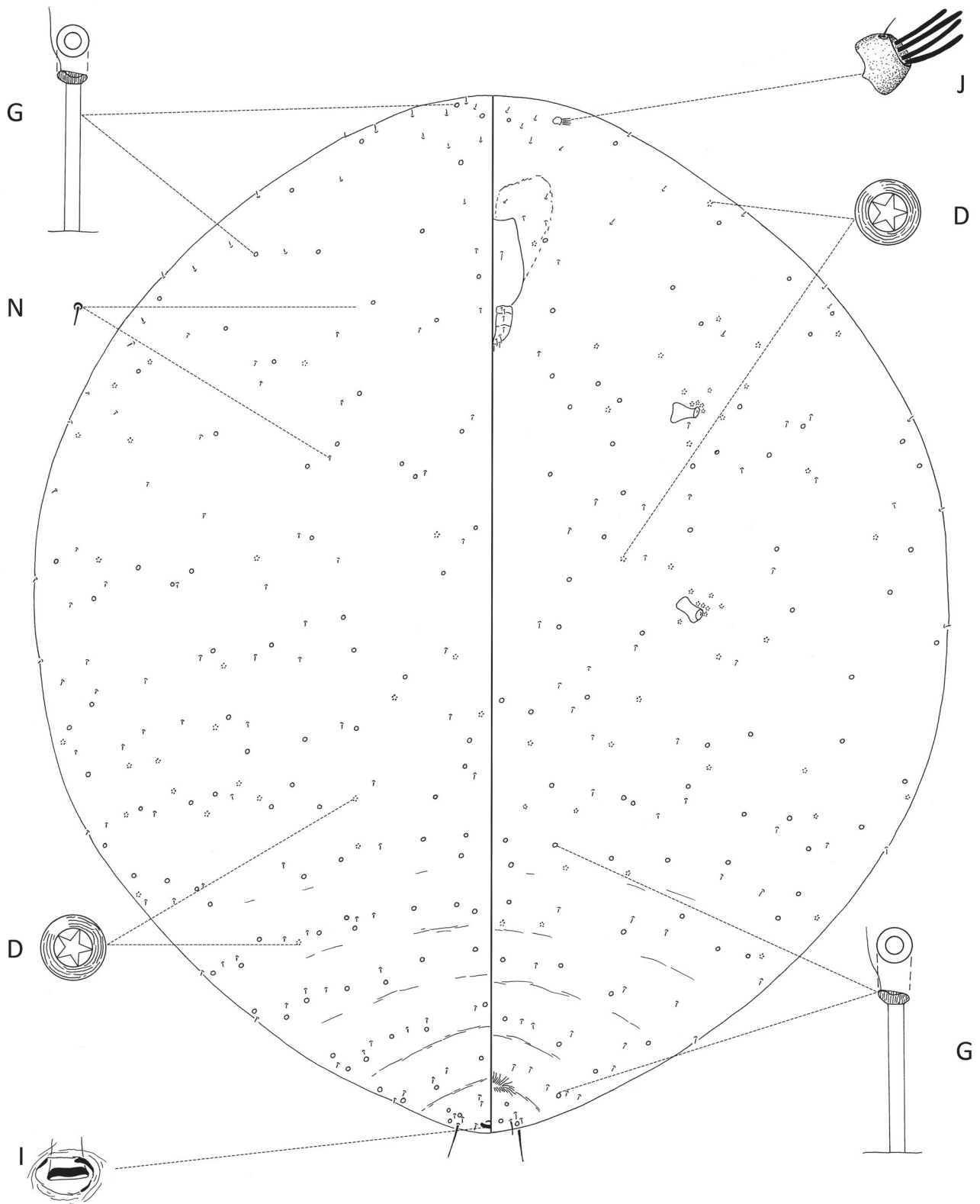


FIGURE 30. *Carpochloroides mexicanus* Ferris 1957, adult female, Chivela, Oaxaca, Mexico, February ?, 1925, on *Eugenia acapulcensis*, G.F. Ferris. D=5-locular pore; G=macrotubular duct; I=anal ring; J=antenna; N=flagellate seta.

Cryptococcus fagisuga Lindinger

Cryptococcus fagisuga Lindinger 1936: 444.

Specimens examined: UNITED STATES: Massachusetts: Berkshire Co.: Jamaica Plain, Arnold Arboretum, XII-20-1929, on *Fagus grandifolia*, J. Ehrlich (4 ad. ♀♀, 15 first-instar nymphs on 2 slides) USNM. New Hampshire: Grafton Co.: Franconia Notch State Park, VI-25-1967, on *F. grandifolia*, M. Kosztarab (10 ad. ♀♀ on 6 slides) CDFA. New Jersey: Bergen Co.: Fort Lee, Coytesville, IX-3-1944, on *F. grandifolia*, G. Rau (7 ad. ♀♀, 11 first-instar nymphs on 3 slides) USNM. New York: Nassau Co.: Long Island, Locust Valley, XII-15-1934, on “beech” (= *F. grandifolia*?) G. Van Yahres (7 ad. ♀♀, 15 first-instar nymphs on 3 slides) USNM; Westchester Co.: Scarsdale, IX-27-1934, on “beech,” E.P. Felt (5 ad. ♀♀, 22 first-instar nymphs on 1 slide) USNM. EUROPE, locality (?), Maskell collection #163 (13 ad. ♀♀, 11 first-instar nymphs on 4 slides) USNM. FRANCE: near Trianon Palace, Versailles, VIII-12-1966, trunk of *F. sylvatica*, E. and M. Kosztarab (1 ad. ♀ on 1 slide) CDFA. GERMANY: Hamburg, VIII(?)–1898, on *Fagus* sp., L. Reh (11 ad. ♀♀, 11 first-instar nymphs on 3 slides) USNM. UNITED KINGDOM: Isle of Man: Laxey, VII-11-1998, on *F. sylvatica*, F.D. Bennett (1 ad. ♀ on 1 slide) CDFA. POLAND: Szczecin, Stettin, VII-28-1898, on “beech,” T. Pergande (68 ad. ♀♀, 26 second-instar ♀♀ on 9 slides) USNM.

Etymology: The species epithet “*fagisuga*” is based on the scientific Latin name of its host “*Fagus*” and the Latin suffix “*sug*” meaning “under” or “within”, possibly referring to living in confined areas on the “*Fagus*” host.

The adult female of this species was described in detail by Miller and Miller (1993) and information in that paper is not repeated here.

Second-instar female (Fig. 31)

Description: Slide-mounted specimens 0.3–0.4 mm long, 0.2–0.3 mm wide. Body rotund, without protruding anal lobes. Anal-lobe area dorsally with 1 or 2 enlarged setae; ventrally each with 3 enlarged setae associated with anal opening, without elongate anal-lobe seta.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), each seta about 5 µm long. Without enlarged setae. Macrotubular ducts distributed in same pattern as flagellate setae. Microtubular ducts, when present, restricted to 1 or 2 along body margin of head and/or abdomen. Multilocular and cruciform pores and microtrichia absent.

Anal ring apical, with sclerotized plate around opening, with 2 enlarged setae on each side of ring immediately adjacent to ring and 3 enlarged setae on each side of ring laterad to opening, without pores. Anal tube and anal opening weakly sclerotized, without anal flap.

Venter with flagellate setae about same length throughout surface, longest seta on segment II 5 µm long, on segment VII 6 µm long; distinct anal-lobe seta absent. Enlarged setae restricted to anal-lobe area. Macrotubular ducts of 2 sizes: small size normally absent, when present restricted to areas of abdomen; larger size present along body margin. Microtubular ducts absent or present in small numbers on head. Multilocular pores all 5-locular, restricted to spiracular openings. Legs absent except for small pocket in position of metathoracic legs. Antennae normally unsegmented, sometimes with indication of 2 or 3 segments, each about 15 µm long. Labium with 2 indistinct segments, basal segment not observed. Frontal lobes and preantennal pores absent. Microtrichia present on segments VI to VIII.

Notes: The description is based on 26 specimens from one locality. Second-instar females of *Cr. williamsi* have not been available for comparison.

First-instar nymph (Fig. 32)

Description: Slide-mounted specimens 0.3–0.4 mm long, 0.1–0.3 mm wide. Body oval or rotund, with slightly protruding anal lobes. Anal-lobe areas each dorsally with 1 pair of enlarged setae; ventrally with 1 flagellate seta and anal-lobe seta.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), longest seta on segment II about 3 µm long, on segment VII about 9 µm. Enlarged setae present in cerarian arrangement on lateral areas of segments V or VI to VIII. Macrotubular and microtubular ducts absent. Multilocular pores tubular, of 5-locular type, arranged in 2 pairs of longitudinal lines on abdomen (mediolateral and lateral), also present on head. Microtrichia absent.

Anal ring apical, normally poorly developed, without enlarged plate anteriorly and without pores. With 1 or 2 enlarged setae associated with ring and 1 or 2 flagellate setae but not on it. Anal tube and anal opening without sclerotization; without anal flap.

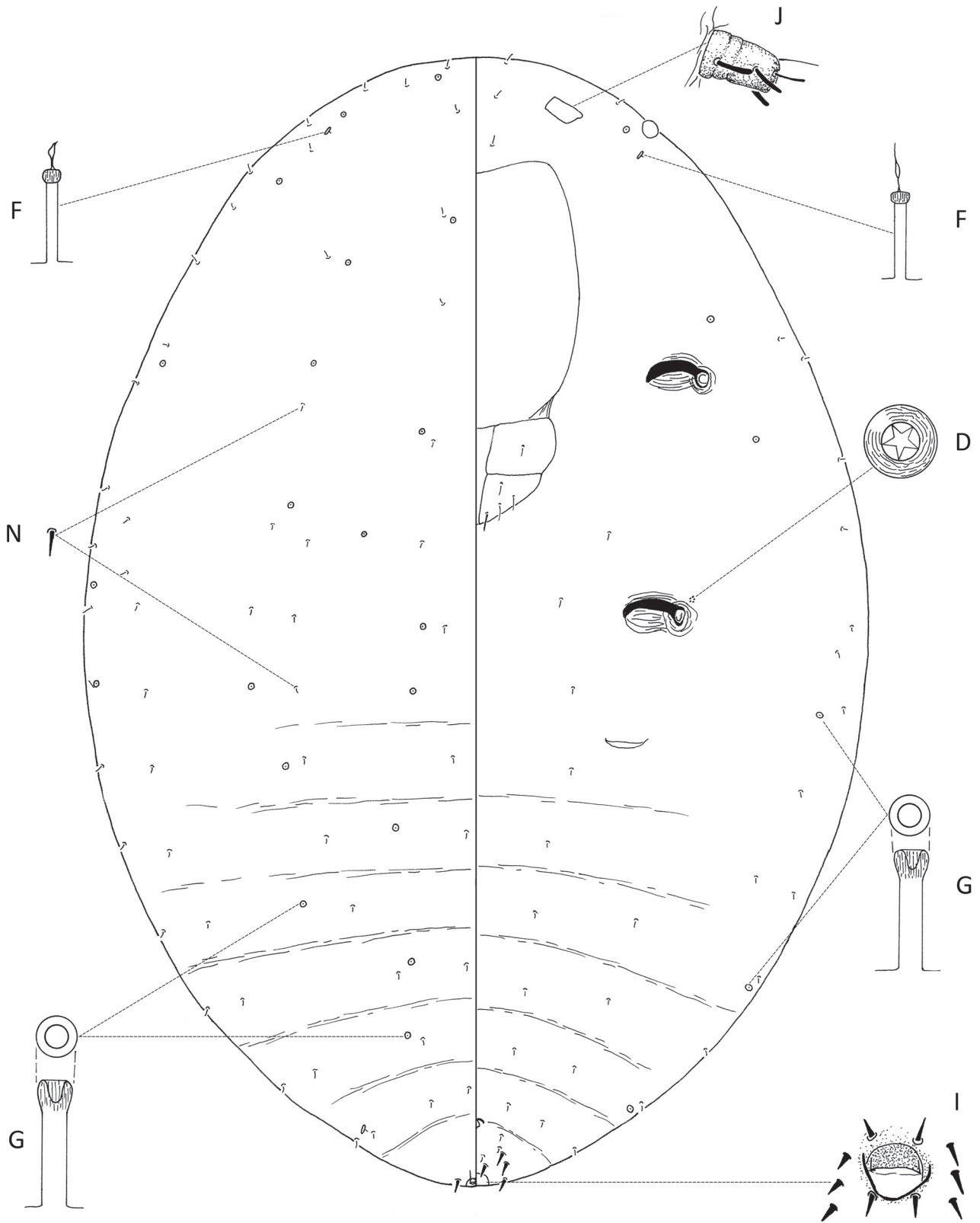


FIGURE 31. *Cryptococcus fagisuga* Lindinger 1936, second-instar female, Stettin, Szczecin, Poland, July 28, 1898, on “beech” (= *Fagus* sp.?). T. Pergande. D=5-locular pore; F=microtubular duct; G=macrotubular duct; I=anal ring; J=antenna; N=flagellate seta.

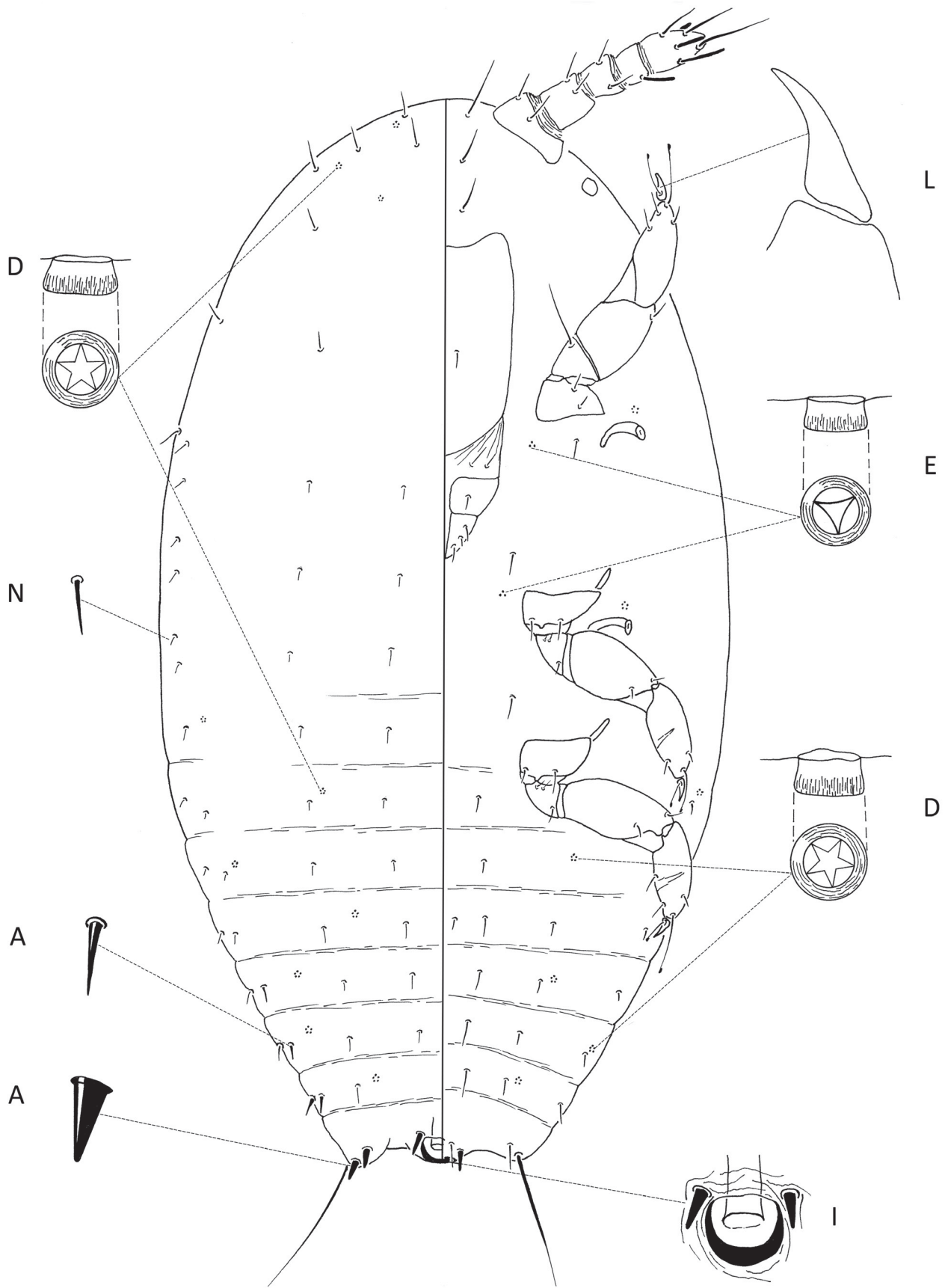


FIGURE 32. *Cryptococcus fagisuga* Lindinger 1936, first-instar nymph, Jamaica Plain, Arnold Arboretum, Berkshire Co., Massachusetts, USA, December 20, 1929, on *Fagus grandifolia*, J. Ehrlich. A=enlarged seta; D=5-locular pore; E=3-locular pore; I=anal ring; L=claw; N=flagellate seta.

Venter with flagellate setae present over entire surface, longest seta on segments II about 3 µm long, on segment VII about 7 µm long; anal-lobe seta about 42 µm long. An enlarged seta on segment VIII on each side of anal ring near posterior apex of body. Macrotubular ducts and microtubular ducts absent. Multilocular pores tubular, of 2 kinds: 3-locular pores normally present near base of posterior pair of legs; 5-locular pores present in 2 pairs of longitudinal lines on thorax and abdomen, absent from head. Legs present; each femur with 3 setae; each tibia with 1 seta; tibia and tarsus partially or completely separated; claw and tarsal digitules unusually long, apically capitate; claw without a denticle. Antennae each 5-segmented, about 55 µm long. Frontal lobes, preantennal pores and microtrichia absent.

Notes: The description is based on 85 specimens from six localities. The first-instar nymphs of *Cr. fagisuga* and *Cr. williamsi* are similar in having 5-segmented antennae, a similar anal ring structure, and no tubular ducts. *Cryptococcus williamsi* can be separated as follows (character states of *Cr. fagisuga* are given in brackets): each femur with one seta (three setae); ventral multilocular pores primarily with three loculi (five loculi).

***Cryptococcus williamsi* Kosztarab and Hale**

Cryptococcus williamsi Kosztarab and Hale 1968: 7.

Specimens examined: UNITED STATES: Iowa: Story Co.: Ames, VI-14-1932, on soft maple (= *Acer* sp.), H.E. Guthrie (25 ad. ♀♀, 1 first-instar nymph on 1 slide) USNM. Vermont: Caledonia Co.: XI-1-1966, on *Acer* sp., R.L. Murray (20 ad. ♀♀ on 15 slides) CDFA. CANADA: Ontario: Sault Ste. Marie, date (?), on (?), O.H. Lindquist (4 ad. ♀♀, 11 first-instar nymphs on 10 slides) USNM.

Etymology: The species epithet “*williamsi*” is named in honor of the famous coccidologist, Douglas J. Williams, of the Natural History Museum, London, UK (Miller & Watson 1995).

The adult female of this species was described in detail by Miller and Miller (1993) and information from that paper is not repeated here.

First-instar nymph (Fig. 33)

Description: Slide-mounted specimen 0.3 mm long, 0.2 mm wide. Body elongate oval, with slightly protruding anal lobe. Anal-lobe areas each dorsally with 1 pair of enlarged setae; each ventrally with 1 flagellate seta and anal-lobe seta.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), longest seta on segment II 5–6 µm, on segment VII 8–10 µm. Enlarged setae present in cerarian arrangement on lateral areas of segments VI or VII to VIII. Macrotubular and microtubular ducts absent. Multilocular pores tubular, of 3 kinds: 3-locular pores most abundant, 4- and 5-locular pores rare or absent; pores arranged in 2 pairs of longitudinal lines on abdomen (mediolateral and lateral), also present on head. Microtrichia present on posterior abdominal segments.

Anal ring apical, normally poorly developed, without enlarged plate anteriorly and without pores. With 1 or 2 enlarged setae and 1 or 2 flagellate seta associated with ring but not situated on it. Anal tube weakly sclerotized, anal opening unsclerotized. Anal flap absent.

Venter with flagellate setae present over entire surface, longest seta on segment II 1–6 µm long and VII 5–8 µm long; anal-lobe seta 60–68 µm long. Enlarged seta on segment VIII near posterior apex of body. Macrotubular ducts and microtubular ducts absent. Multilocular pores tubular, of 3 kinds: 3-locular pores normally near base of posterior pairs of legs; 5-locular pores in 2 pairs of longitudinal lines on thorax and 1 pair on abdomen, 4-locular pores rare or absent, absent from head. Legs present; each femur with 1 seta; each tibia with 1 seta; tibia and tarsus either separate or fused; claw and tarsal digitules unusually long, apically capitate; claw without a denticle. Antennae each 5-segmented, about 60 µm long. Frontal lobes and preantennal pores absent. Microtrichia present on abdomen.

Notes: The description is based on five specimens from two localities. The first-instar nymphs of *Cr. williamsi* and *Cr. fagisuga* are similar; for a comparison of these species see the “Notes” section of *Cr. fagisuga* above.

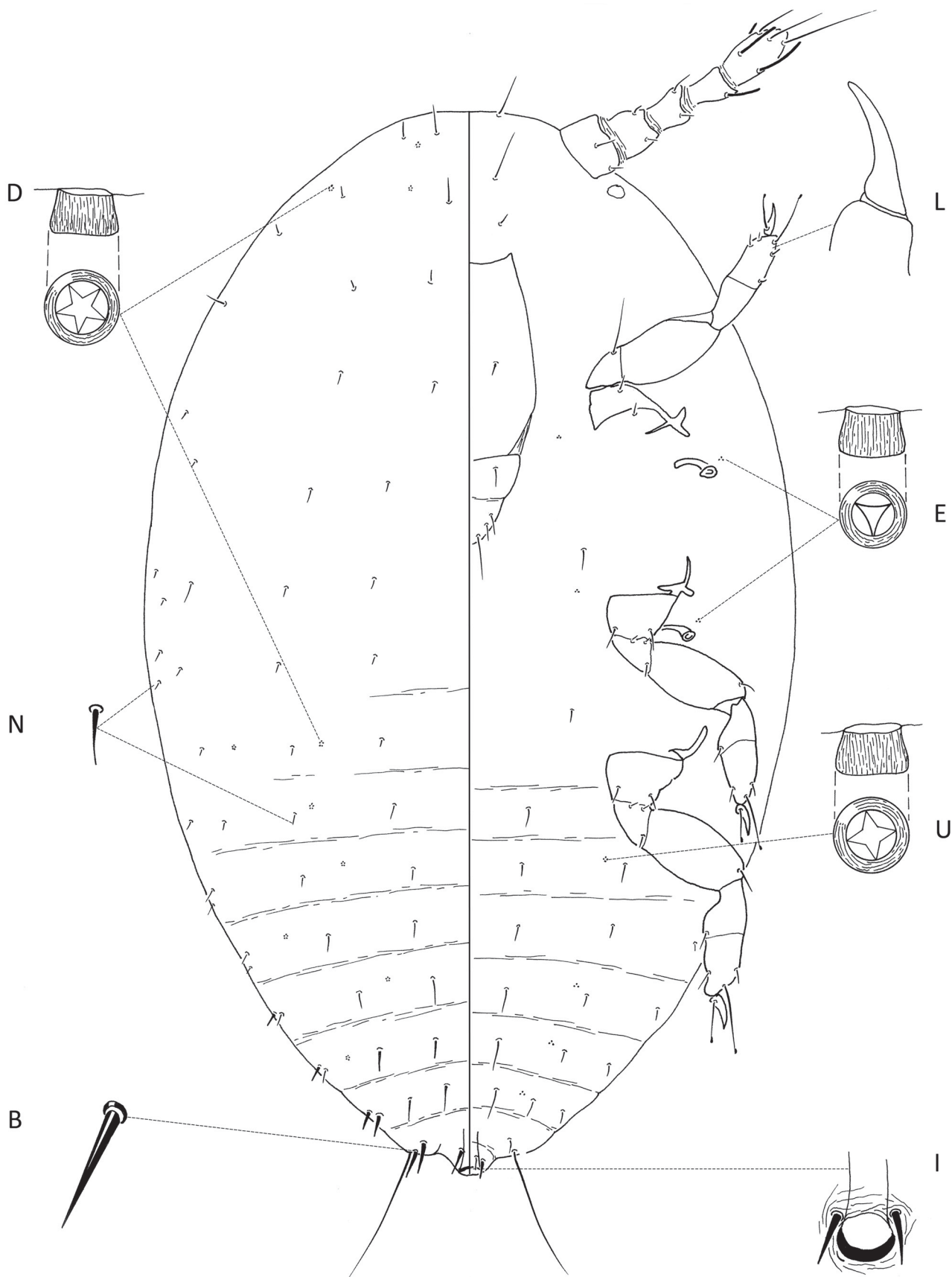


FIGURE 33. *Cryptococcus williamsi* Kosztarab and Hale 1968, first-instar nymph, Sault Ste. Marie, Ontario, Canada, date (?), on (?), O.H. Lindquist. B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; I=anal ring; L=claw; N=flagellate seta; U=4-locular pore.

Hypericococcus Williams 1963

Trachycoccus Ferris 1955: 215. Type species: *Trachycoccus hyperici* Ferris by monotypy and original designation (junior homonym discovered by Williams 1961: 93). Notes: Homonym of *Trachycoccus* Borchsenius 1950: 781.

Hypericococcus Williams 1963: 93. Type species: *Trachycoccus hyperici* Ferris 1955: 215 (replacement name for *Trachycoccus* Ferris 1955).

Diagnosis of adult female: Derm along body margin with numerous small projections; anal lobes not projecting; enlarged setae with broad bases similar to most species of *Ovaticoccus*; ventral setae enlarged near anal ring; microtubular ducts on both surfaces; macrotubular ducts absent; multilocular pores on both surfaces; cruciform pores present; anal ring with unusually robust setae; legs and antennae reduced.

Hypericococcus hyperici (Ferris)

Trachycoccus hyperici Ferris 1955: 215.

Hypericococcus hyperici (Ferris); Williams 1961: 93 (change of combination based on homonymy of generic name; see above).

Type material: Ferris (1955) did not designate a holotype, so we here designate a lectotype from the syntype series labeled as follows: right label “UCD 1638 / Host. *Hypericum* / in Quar. fr. Bloomington / Ill. / Coll. Daniels & Heuer / Date 12-14-53 / LACo #Q2653.” Left label “*Trachycoccus* (= *Hypericococcus*) / *hyperici* / Lectotype / with map of position of lectotype and paralectotype specimens / Paralectotype / Desig. Miller & Stocks.” Deposited in UCD.

Specimens examined: UNITED STATES: Georgia: Emanuel Co.: unknown locality, I-4-1971, on *Hypericum* sp., H.H. Tippins (2 ad. ♀♀ on 2 slides) CDFA, USNM. Illinois: McLean Co.: Bloomington, XII-3-1953, on *Hypericum* sp., C.W. Bridges (7 ad. ♀♀ on 7 slides) CDFA; Bloomington, XII-14-1953, on *Hypericum* sp., Daniels and Heuer (4 ad. ♀♀, 17 first-instar nymphs on 3 slides) CDFA, USNM (these are not syntype specimens) (data for syntype specimens used by Ferris for original description are given in type material above and are in UCD). Indiana: Tippecanoe Co.: unknown locality, X-5-1954, on *Hypericum* sp., D.L. Schuder (4 ad. ♀♀, 4 second-instar ♀♀, 4 ad. ♂♂ apterous, 2 ad. ♂♂ brachypterous, 1 fourth-instar pupa apterous, 6 second-instar ♂♂, 5 first-instar nymphs on 5 slides) UCD, USNM; Lafayette, Clegg Memorial, VII-8-1974, on *Hypericum* sp., D.L. Schuder (4 ad. ♀♀, 4 second-instar ♀♀, 5 ad. ♂♂ macropterous, 3 ad. ♂♂ apterous, 2 ad. ♂♂ brachypterous, 2 fourth-instar ♂♂ pupae apterous, 3 fourth-instar ♂♂ pupae macropterous, 2 third-instar ♂♂ prepupae with wing buds, 3 third-instar ♂♂ prepupae without wing buds, 12 second-instar ♂♂, 25 first-instar nymphs on 12 slides) USNM. Tennessee: DeKalb Co.: taken in quarantine at Saticoy, California from McMinnville, V-25-1951, on *Deutzia* ? sp., H.E. Bronson (1 second-instar ♀, 2 second-instar ♂♂ on 1 slide) CDFA; taken in quarantine at Los Angeles, California from Smithville, IV-11-1951, on *Cistus* sp., “rock rose” (= *Cistus* sp.?), L.D. McCorkindale (8 ad. ♀♀ on 4 slides) UCD; taken in quarantine at Palmdale, California from Smithville, IV-11-1951, on *Cistus* sp., F. Phelan and L.D. McCorkindale (2 ad. ♀♀ on 2 slides) UCD; taken in quarantine at Vallejo, California from Smithville, IV-12-1951, on “rock rose” (= *Cistus* sp.?), L.S. Garrett (3 ad. ♀♀ on 3 slides) CDFA, UCD. Texas: Ellis Co.: taken in quarantine at Oxnard, California from Waxabachie, III-?-1953, on *Spiraea* sp., W. Dunning (2 ad. ♀♀ on 2 slides) CDFA, UCD.

Etymology: The generic and species epithets “*Hypericococcus*” and “*hyperici*” are based on the Latin scientific name of the host-plant of this scale insect, *Hypericum*.

Field features: Occurring under bark of *Hypericum*; body brightly colored.

The adult female of this species was described in detail by Ferris (1955) and Miller and Miller (1993) and information from those papers is not repeated here.

Second-instar female (Figs 34 and 35)

Description: Slide-mounted specimens 0.6–0.7 mm long, 0.4–0.5 mm wide. Body elongate oval, without protruding anal lobes. Each lobe dorsally with 0 or 1 enlarged seta and 2 or 3 flagellate setae; each lobe ventrally with 1 medium-sized seta and 1 longer anal-lobe seta; multilocular pore sometimes present.

Dorsum with flagellate setae uncommon, in submarginal areas from head to posterior abdominal segments, and in mediolateral and submedial areas of head and thorax. Enlarged setae all of 1 size arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), with 1–3 setae in each line; largest seta 8–10 µm long; with rounded to

truncate apices and narrow setal base; segment IV with 7–9 setae (including flagellate setae). Macrotubular ducts absent. Microtubular ducts 4–6 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or indented, about same size as remaining sclerotized portion; sclerotized area 2 times longer than unsclerotized area; dermal orifice sclerotized, with simple protruding tube. Microtubular ducts scattered over entire surface. Multilocular pores of 3 or 4 kinds: 5-locular pores, 7-locular pores, 9-locular pores, and 11-locular pores in incomplete line in mediolateral areas of abdomen and thorax. Cruciform pores variable in number, from 1–13 scattered on thorax and abdomen. Acute dermal nodules present along body margin and submargin. Microtrichia present in medial areas of thorax and abdomen.

Anal ring apical, ventral or dorsal, circular, complete, cellular, with 3 slightly enlarged setae on each side of ring, each seta slightly shorter than greatest diameter of ring; additional seta often associated with, but not attached to, ring. Orifice of anal tube unsclerotized or weakly sclerotized; with anal flap.

Venter with flagellate setae, longest seta on segment II 7–10 μm long, on segment VII 10–16 μm long; anal-lobe seta 83–90 μm long. With 1 or 2 enlarged setae on lateral margin of each side of each body segment from head to abdominal segment VII. Macrotubular ducts absent. Microtubular ducts uncommon near body margin. Multilocular pores of 4 kinds: with 5–11 loculi, 7-locular pores most numerous, in mediolateral areas from head to posterior abdominal segments, most abundant near spiracles. Cruciform pores absent or uncommon on thorax and abdomen. Legs with 2–4 translucent pores on dorsal surface of each hind coxa; each femur with 2 or 3 setae, without proximal setae; each tibia with variable number of setae from 1–4, without middle seta; hind tibia/tarsus 0.9, tibia and tarsus sometimes fused. Antennae each 6-segmented, 90–95 μm long. Frontal lobes and preantennal pores absent. Acute dermal nodules on submarginal and marginal areas. Microtrichia present over entire surface, often present on coxae.

Notes: The description is based on eight specimens from two localities. The second-instar female of *Hy. hyperici* shares several character states with the same instar of *Ovaticoccus cornutus* (Ferris), *Ov. telotrichus* Miller and Stocks and *Ov. tippinsi* (Miller & Miller) in having: dorsal cruciform pores, pores in the anal ring, and multilocular pores predominantly with more than 5 loculi. *Hypericococcus hyperici* differs by having the anal ring setae enlarged, a character state not found in the similar species of *Ovaticoccus*. There are two specimens of *Hy. hyperici* that differ from the above description in having: acute dermal nodules abundant over most of dorsal surface; dorsal flagellate setae rare; and dorsal and ventral multilocular pores more abundant (Fig. 35).

Adult male (macropterous) (Fig. 36)

Description: Slide-mounted specimens each about 0.9 mm long, 0.3 mm wide. Body elongate, segment VIII produced laterally.

Dorsum with 1 pair of tail-forming pore clusters (tfpc); each cluster with 1 or 2 setae, each apically capitate, when 2, some specimens with setae approximately same size: longest setae 48–100 μm long; shortest setae 42–75 μm long, other specimens with short setae approximately 25 μm long, not apically rounded or capitate. Multilocular pores in tail-forming pore clusters, each cluster with 16–18 tightly clustered pores in cavity surrounding setae, each multilocular pore with 4, 5, or 6 loculi, 4- or 5-locular pores most common; multilocular pores also sometimes present near anterior and posterior spiracles, with 5–7 loculi. X-type pores (x) present near dorsal arm of midcranial ridge (dmcr). Flagellate setae slender, apically acute, curved, approximately same length as those on venter or slightly shorter, with 1 or 2 near margin, 1 or 2 mediolaterally, and 1 submedially on each side of most segments II to VII, with 1 pair of elongate setae in medial area of segment VIII; setae on pro-, meta- and mesothorax; head setae anterior to postoccipital ridge (por) and along dorsal arm of midcranial ridge. Abdominal sclerotization weakly indicated or absent, when present, in mediolateral and lateral areas, on median tergal plate of VIII. Metapostnotal sclerites and ridge absent. Scutellar ridge (sclr) strongly developed. Scutum (sct) sclerotized throughout, except for 2 circular areas adjacent to scutellum. Prescutum (prsc) elongate oval or rectangular. Prescutal suture (pscs) weakly developed. Pronotal ridges (prnr) strongly developed; pronotal sclerites (prn) sometimes present. Hamulohalteres absent. Wings 700–900 μm long, each with alar lobe (al), alar sclerites (alsc) and veins (wv), without setae and sensoria. Postoccipital ridge (por) weakly sclerotized, lateral ends simple. Dorsal arm of midcranial ridge (dmcr) thin, touching postoccipital ridge posteriorly; connected to lateral (lmcr) arms anteriorly. Dorsomedial sclerite (dmep) lightly sclerotized. Dorsal eye (dse) approximately 26–28 μm in diameter. Lateral ocellus (lo) present where dorsal and ventral postocular ridge (pocr) reaches margin of head. Ocular sclerite (ocs) weakly sclerotized dorsally. Microtrichia on posterior abdominal segments.



FIGURE 34. *Hypericicoccus hyperici* (Ferris 1955), second-instar female #1 (dermal nodules less abundant; multilocular pores uncommon) Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA, July 8, 1974, on *Hypericum* sp., D.L. Schuder. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct (shown in two views); H=cruciform pore; I=anal ring; J=antenna; L=claw; Q=dorsal surface of coxa; T=pore with >7 loculi; Z=body margin.

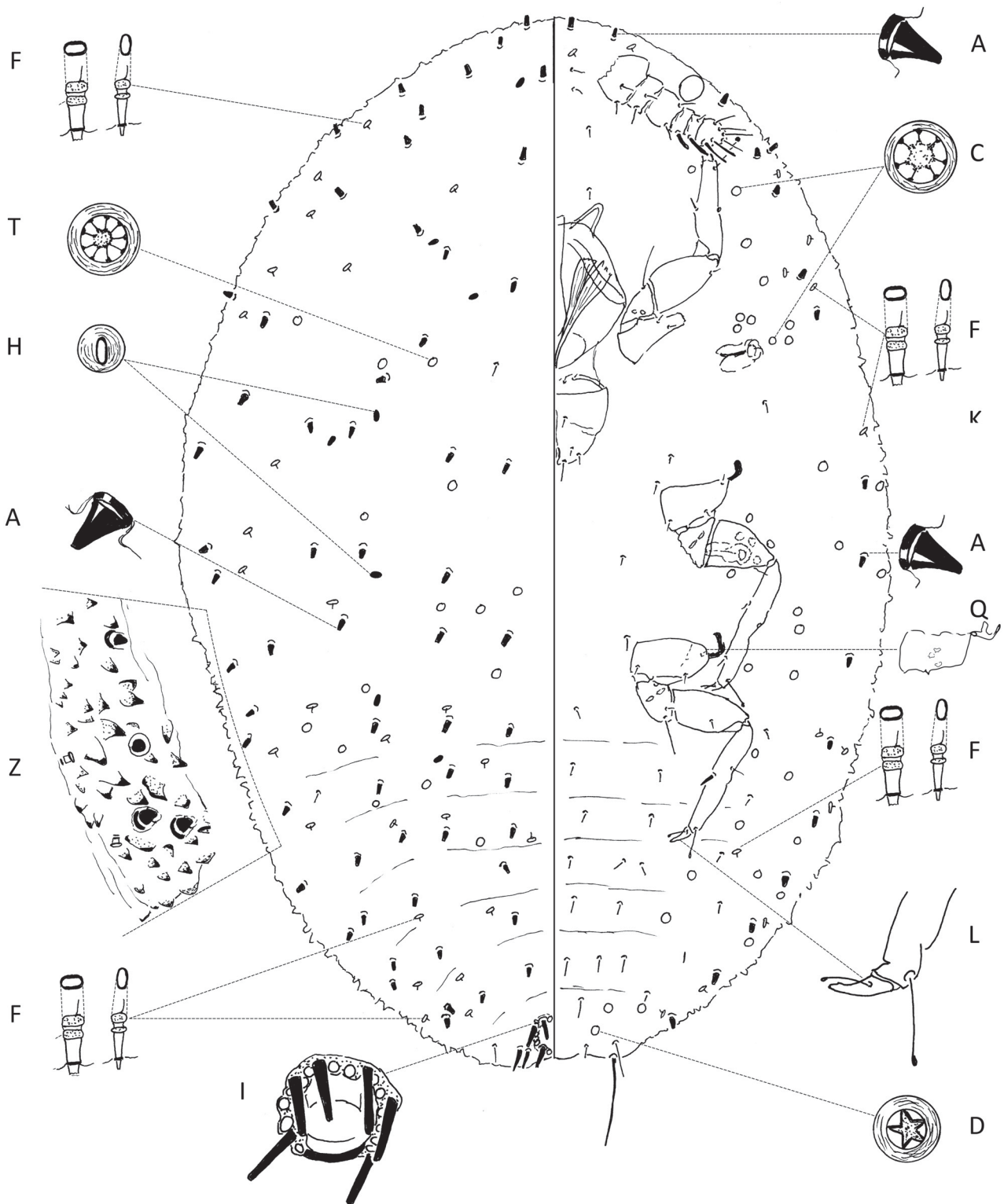


FIGURE 35. *Hypericicoccus hyperici* (Ferris 1955), second-instar female #2 (dermal nodules abundant; multilocular pores common), Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA, July 8, 1974, on *Hypericum* sp., D.L. Schuder. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct (shown in two views); H=cruciform pore; I=anal ring; L=claw; Q = dorsal surface of coxa; T=pore with >7 loculi; Z=body margin.

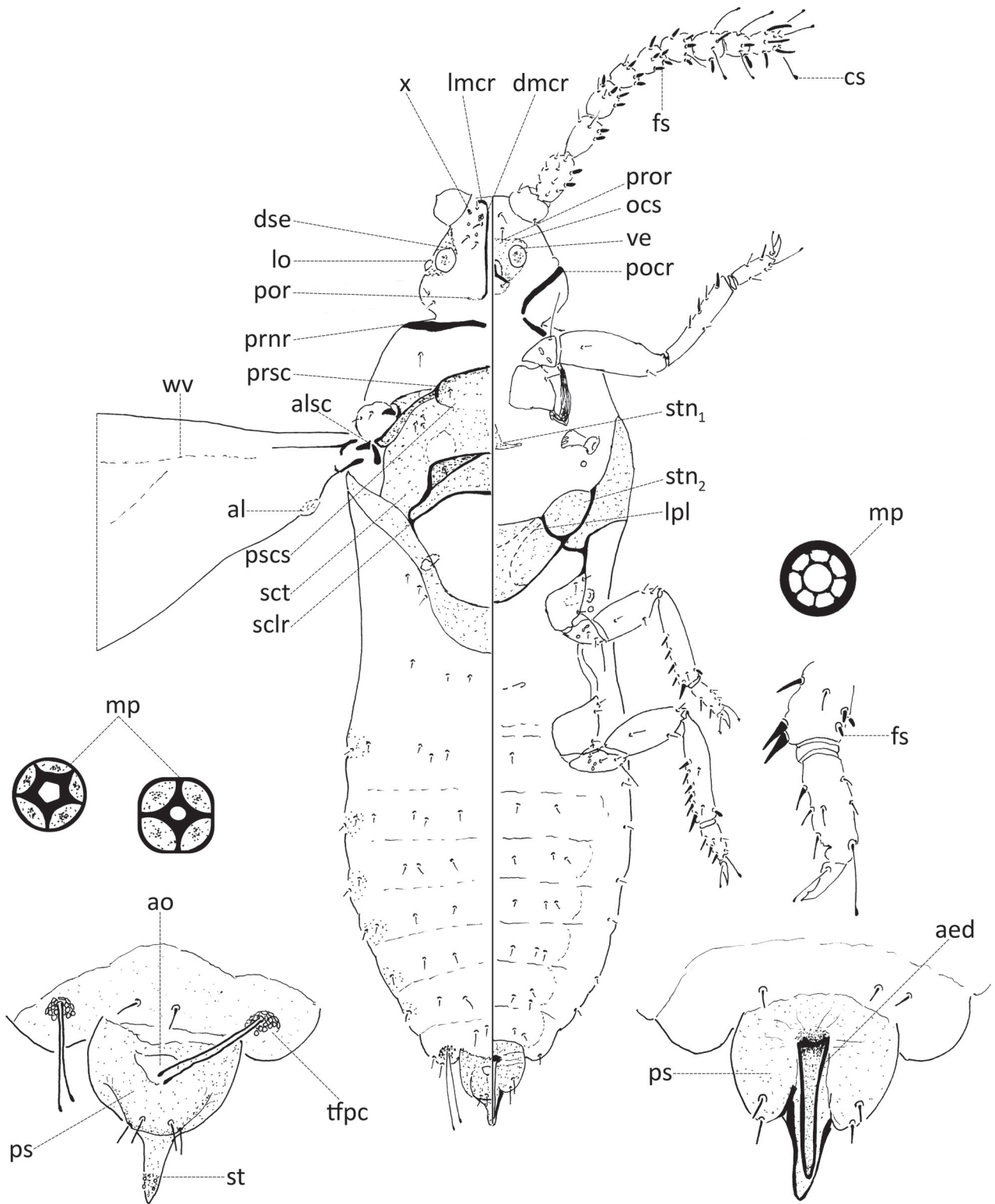


FIGURE 36. *Hypericococcus hyperici* (Ferris 1955), adult male (macropterous), Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA, July 8, 1974, on *Hypericum* sp., D.L. Schuder. See methods section for explanation of abbreviations.

Penial sheath (ps) 90–95 µm long; elongate, width 66–77 µm; width/length 0.7–0.8 style (st) in lateral view slightly curved, apically with several small papillae. Sheath with indication of longitudinal division ventrally. Dorsal surface weakly sclerotized anteriorly, with 2 or 3 setae on each side; ventral surface with small swellings laterally, each containing 2 setae. Basal rod (br) small, not reaching anterior margin of penial sheath. Anal opening near anterior edge of penial sheath.

Venter usually with flagellate setae laterally, mediolaterally, and medially, less abundant anteriorly; with or without single pair of setae near front legs, usually with single pair anterior to hind legs; head setae present near midline of head between antennal base and ventral eye (ve). Abdominal sclerotization absent or weakly developed on medial and mediolateral areas of segments II to VIII; without sclerotization elsewhere. Metathoracic precoxal ridge absent. Mesosternum (stn2) well-developed, with large furca; lateropleurites (lpl) on mesothorax triangular. Prosternum (stn1) present or absent, triangular. Mouth tubercle (mt) present. Preoral ridge (pror) weakly or strongly sclerotized, not touching postocular ridge. Ventral midcranial ridge (vmcr) absent, or weakly developed anteriorly. Cranial apophysis (ca) rounded apically. Ocular sclerite (ocs) unsclerotized except immediately surrounding ventral eye or sclerotized between eyes. Ventral eye (ve) 24–27 µm in diameter. Prothoracic legs or mesothoracic legs longest. Fleshy setae (fs) on outer distal portion of tibia, sometimes on outer proximal portion of tarsus. Inner setae on apical margin of tibia and tarsus enlarged. Claw with small denticle; digitules on tarsus and claw weakly capitate. Antennae 10-segmented, approximately 368 µm long, second segment longest, about 1.5 times longer than apical segment, last segment apically rounded or slightly pointed. Fleshy setae present on segments 2–10; capitate setae (cs) present on last 3 segments.

Notes: The description is based on five specimens from one locality. The illustration utilized all five specimens because the specimens are in poor condition. There are only two heads (one detached), three wings (two detached), and the thorax and abdomen of most specimens are missing legs or are oriented in a manner making it difficult to observe all of the structures.

The macropterous adult male of *Hy. hyperici* is similar to the adult male of *Ov. agavium* in lacking hamulohalteres, and in having small alar lobes, fleshy setae on the legs, and capitate and fleshy setae on the antennae. The species differ from *Hypericicoccus hyperici* having capitate setae restricted to the last three antennal segments, whereas *Ov. agavium* has them on the last six antennal segments.

Adult male (brachypterous) (Fig. 37)

Description: Slide-mounted specimens each 0.8–1.0 mm long, 0.3 mm wide. Body elongate, with segment VIII slightly produced laterally.

Dorsum with 1 pair of tail-forming pore clusters (tfpc); each cluster with 1 or 2 setae, apically capitate or apically acute, when 2 present, of 2 distinct sizes: longest seta 65 µm long; shortest setae 20–22 µm long. Multilocular pores (mp) in tail-forming pore clusters, each with 4, 5 or 6 loculi, 4-locular pores most common; multilocular pores also present near posterior spiracle, with 6 or 7 loculi. X-type pores (x) near dorsal arm of midcranial ridge (dmcr). Flagellate setae slender, apically acute, curved, approximately same length as those on venter or slightly shorter, with 2 or 3 near margin and 2 submedially on each side of most of segments II to VII, sometimes with mediolateral seta on each side of anterior abdominal segments; with 1 pair of elongate setae in medial area of segment VIII; setae present on prothorax, mesothorax and metathorax; head setae present anterior to postoccipital ridge (por) and along dorsal arm of midcranial ridge (dmcr). Abdominal sclerotization weakly indicated or absent, when present, in mediolateral and lateral areas, present on median tergal plate (mtp) of VIII. Metapostnotal sclerites (pn3) present in some specimens, metapostnotal ridge absent. Scutellar ridge (sclr) strongly developed. Scutum (sct) sclerotized throughout, except for 2 circular areas adjacent to scutellum. Prescutum (prsc) elongate oval or rectangular. Prescutal suture (pscs) weakly developed. Pronotal ridges (prnr) strongly developed; pronotal sclerites absent. Hamulohalteres absent. Wings short, 300–330 µm long, without alar lobes, setae, sensoria, or veins. Postoccipital ridge (por) weakly or strongly sclerotized, lateral ends normally bifurcate. Dorsal arm of midcranial ridge (dmcr) thin, touching postoccipital ridge posteriorly; connected to lateral (lmcr) arms anteriorly. Dorsomedial sclerite (dmep) lightly sclerotized. Dorsal eye (dse) approximately 21–24 µm in diameter. Lateral ocellus (lo) present where dorsal and ventral postocular ridge (pocr) reaches margin of head. Ocular sclerite (ocs) weakly sclerotized dorsally. Microtrichia in medial areas of posterior abdominal segments.

Penial sheath (ps) 85–95 µm long; elongate, width 64–95 µm; width/length 0.8–1.0, style (st) in lateral view slightly curved, apically with several small papillae. Sheath with indication of longitudinal division ventrally. Dorsal surface weakly sclerotized anteriorly, with 2 setae on each side; ventral surface with small swellings laterally,

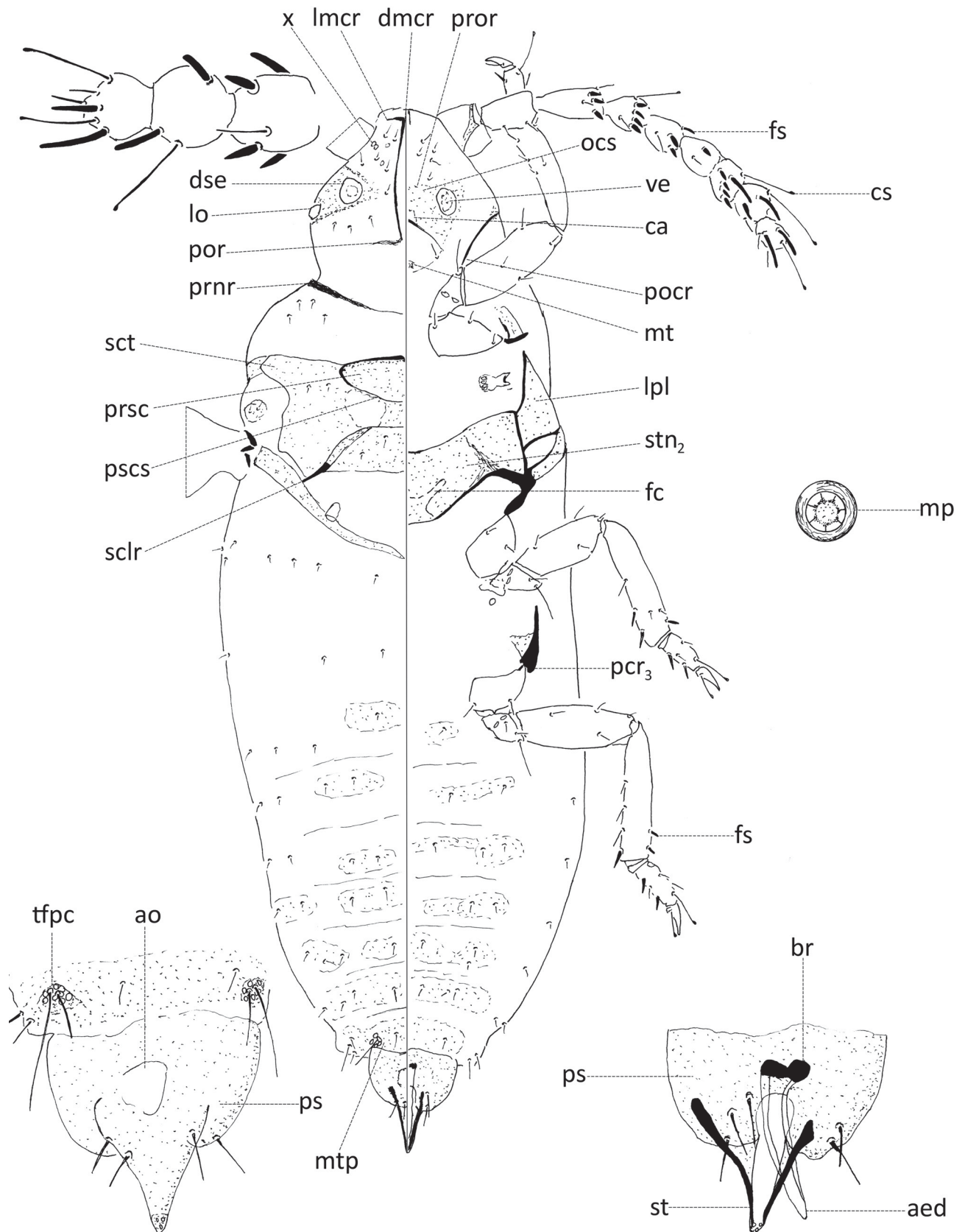


FIGURE 37. *Hypericicoccus hyperici* (Ferris 1955), adult male (brachypterous), unknown locality, Tippecanoe Co., Indiana, USA, October 5, 1954, on *Hypericum* sp., D.L. Schuder. See methods section for explanation of abbreviations.

each containing 1–3 setae. Basal rod (br) small, not reaching anterior margin of penial sheath. Anal opening (ao) near anterior edge of penial sheath.

Venter usually with flagellate setae laterally, mediolaterally, and medially, less abundant anteriorly; thoracic setae with or without single pair near anterior legs, usually with single pair anterior to hind legs; head setae present near midline of head between antennal base and ventral eye. Abdominal sclerotization weakly developed on medial and mediolateral areas of segments II to VIII; without sclerotization elsewhere. Metathoracic precoxal ridge (pcr3) weakly developed. Mesosternum (stn2) well-developed, with furca (fc); lateropleurites (lpl) on mesothorax triangular. Prosternum (stn1) absent. Mouth tubercle (mt) present. Preoral ridge (pror) weakly or strongly sclerotized, not touching postocular ridge. Ventral midcranial ridge (vmcr) absent, or weakly developed anteriorly. Cranial apophysis (ca) rounded apically. Ocular sclerite (ocs) unsclerotized except immediately surrounding ventral eye or sclerotized between eyes. Ventral eye (ve) 20–21 μm in diameter. Prothoracic or metathoracic legs longest. Fleshy setae present on outer distal portion of tibia. Inner setae on apical margin of tibia and tarsus enlarged. Claw with small denticle; digitules on tarsus and claw weakly capitate. Antennae each 8- or 9-segmented, 307–365 μm long, second or third segments longest, 1.9–2.0 times longer than apical segment, last segment apically rounded or slightly pointed. Fleshy setae present on segments 3–9; capitate setae (cs) present on last 3 or 4 segments. With frontal tubercle near base of antennae.

Notes: The description is based on four specimens from two localities. The brachypterous adult male of *Hy. hyperici* is similar to the brachypterous adult male of *Acanthococcus salicicola* (Borchsenius) and *A. spuria* (Modeer) as described by Afifi (1968) in having short wings. They differ as follows (character states in brackets are those of *Hy. hyperici*): hamulohalteres present (absent); without multilocular pores near posterior spiracle (present); fleshy setae on antennae about same length as flagellate setae (shorter than flagellate setae).

There is a single specimen that looks like the apterous form, but it has a small wing bud on one side that is about 52 μm long and has alar sclerites at the base of the wing.

Adult male (apterous) (Fig. 38)

Description: Slide-mounted specimens 0.7–0.9 mm long, 0.2–0.4 mm wide. Body elongate, segment VIII not produced laterally. Wings and hamulohalteres absent.

Dorsum with 1 pair of tail-forming pore clusters (tfpc); each cluster with 1 or 2 elongate, apically blunt, but not capitate setae, of 2 distinct sizes: longest setae 30–50 μm long; shortest setae about 15 μm long; with 5–8 multilocular pores; some specimens with pore cluster absent or highly reduced. Multilocular pores restricted to tail-forming pore clusters, rarely with 1 associated with each posterior spiracle, each multilocular pore with 3, 4, 5, or 6 loculi, 5-locular pores most common. X-type pores (x) present near dorsal arm of midcranial ridge (dmcr). Body setae slender, apically acute, curved, approximately same length as those on venter or slightly shorter, with 2 or 3 near margin and 2 mediolaterally on each side of segments II to VII, with 1 pair of elongate setae in medial area of segment VII and VIII; setae on prothorax, mesothorax and metathorax; head setae anterior to postocular ridge (por), on genae (g), and along dorsal arm of midcranial ridge (dmcr). Abdominal sclerotization on median tergal plate VII and VIII weakly developed and on lateral pleurites of segments II to VIII. Microtrichia present medially and mediolaterally on posterior abdominal segments. Thorax without sclerotization, except lateral areas of scutum (sct) weakly sclerotized and pronotal ridge present (prnr). Postoccipital ridge (por) weakly sclerotized. Dorsal arm of midcranial ridge (dmcr) thin, touching postoccipital ridge (por) posteriorly; connected to lateral (lmcr) and ventral arms (vmcr) anteriorly. Dorsomedial sclerite (dmep) lightly sclerotized. Dorsal eye (dse) 16–21 μm in diameter. Lateral ocellus (lo) well-developed, touching dorsal and ventral postocular ridge (pocr). Ocular sclerite (ocs) weakly sclerotized. Microtrichia on posterior abdominal segments.

Penial sheath (ps) 72–100 μm long; broad, width 78–80 μm ; width/length 0.8–1.1, style (st) in lateral view straight or slightly curved, apically with several small papillae. Sheath with indication of longitudinal division ventrally. Dorsal surface weakly sclerotized anteriorly, with 2 setae on each side; ventral surface with small swellings laterally, each containing 1–3 setae. Basal rod (br) small, not reaching anterior margin of penial sheath. Anal opening (ao) near anterior edge of penial sheath.

Venter usually with flagellate setae laterally, mediolaterally, and submedially on abdomen, less abundant anteriorly; thoracic setae with or without single pair near anterior legs, usually with single pair anterior to hind legs; head setae only near anterior portion of ventral arm of midcranial ridge (vmcr) and on mouth tubercle (mt). Abdominal sclerotization restricted to segment VIII, with inconspicuous plate in submedial area; without sclerotization elsewhere. Mesothoracic precoxal ridge (pcr2) well-developed. Marginal ridge (mr) of mesosternum present; furca (fr) well-developed. Prosternum absent. Mouth tubercle (mt) present. Preoral ridge (pror) weakly sclerotized, not

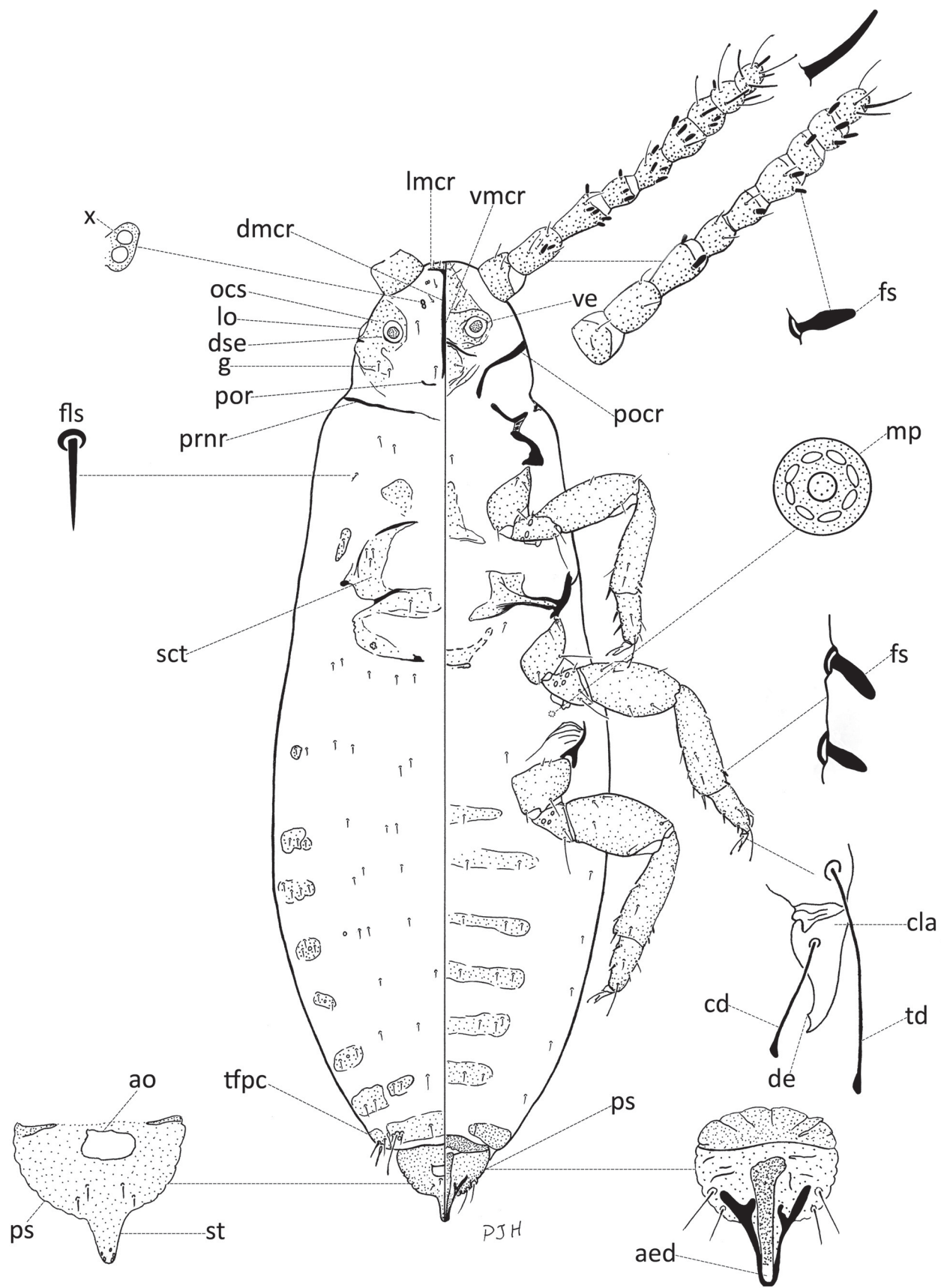


FIGURE 38. *Hypericicoccus hyperici* (Ferris 1955), adult male (apterous), Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA, July 8, 1974, on *Hypericum* sp., D.L. Schuder. See methods section for explanation of abbreviations.

touching postocular ridge. Cranial apophysis (ca) rounded apically. Ocular sclerite (ocs) unsclerotized except immediately surrounding ventral eye. Ventral eye 12–20 µm in diameter. Legs about same size. Fleshy setae on outer distal portion of tibia of all legs. Inner setae on apical margin of tibia and inner setae on tarsus enlarged. Claw with small denticle; digitules on tarsus and claw weakly capitate. Antennae each 9-segmented, rarely with 8, 210–230 µm long, third segment longest, 1.7–1.8 times longer than apical segment, apical segment apically rounded. Fleshy setae present on segments 3–9; capitate setae present on segments 6–8.

Notes: The description is based on seven specimens from two localities. The apterous adult male of *Hy. hyperici* is most similar to the apterous adult male of *Ov. adoxus*, based on the illustration and description of Hodgson (2020). They differ in many ways including the following (character states of *Hy. hyperici* are given in brackets): without tail-forming pore clusters (with pore clusters); with one pair of eyes (with three pairs); without capitate setae on antennae (with capitate setae); with multilocular pores near spiracles (without pores).

Fourth-instar male (pupa with wing buds) (Fig. 39)

Description: Slide-mounted specimens 0.7–1.2 mm long, 0.2–0.4 mm wide. Body elongate, small lobes present on segment VII.

Dorsum with flagellate setae with rounded or slightly capitate apex, in longitudinal lines on abdomen (medial, mediolateral and lateral), uncommon on thorax, more abundant on head. Multilocular pores absent, or with 1 or 2 near body margin on posterior abdominal segments. Discoidal pores absent. Lobe on lateral margin of segment VII sclerotized. Hamulohalteres absent. Front wing buds 260–430 µm long, partially sclerotized. Ocular sclerite lightly sclerotized. Microtrichia on posterior abdominal segments.

Penial sheath weakly sclerotized, dorsally without lobes, with 2 setae on each side. Anal opening not observed, genital opening represented by small wrinkles ventrally.

Venter with multilocular pores with 5–12 loculi, present along lateral margins of segments IV to VI or VII, absent from anterior 2 or 3 abdominal segments, also near both pairs of spiracles, and mesad of prothoracic and mesothoracic legs. Discoidal pores absent. Flagellate setae apically acute, in 3 pairs of longitudinal lines (medial, mediolateral and lateral), slightly longer than dorsal setae; longest lateral seta on segment VII 55–65 µm long. Mouth tubercle absent. Legs partly developed, setae indicated only by clear dots. Antennae each 10-segmented, 280–385 µm long. Microtrichia on mesothorax to segment VIII, and on venter of mid- and hind coxae. Eye absent.

Notes: The description is based on three specimens from one locality. Two specimens are molting to the adult and it is difficult to determine which structures are on the pupa and which are on the adult. The third specimen is a partially collapsed shed skin. The pupa of *Hy. hyperici* is very similar to the pupa of *Ov. agavium* but differs by lacking multilocular pores on the anterior abdominal segments, whereas *Ov. agavium* has these structures.

Fourth-instar male (pupa without wing buds) (Fig. 40)

Description: Slide-mounted specimen 0.7 mm long, 0.3mm wide. Body elongate, small lobes present on segments VII.

Dorsum with flagellate setae with rounded apex, in longitudinal lines on abdomen (medial, mediolateral and lateral), uncommon on thorax, more abundant on head. Multilocular and discoidal pores absent. Lobe on lateral margin of segment VII sclerotized. Hamulohalteres absent. Front wing buds absent. Ocular sclerite lightly sclerotized. Microtrichia on posterior abdominal segments.

Penial sheath weakly sclerotized, dorsally without lobes, with 2 setae on each side. Anal opening not observed; genital opening represented by small wrinkles at apex of sheath.

Venter with multilocular pores with 5–13 loculi, locular structure sometimes irregular, present along lateral margins of segments II to VI, absent from segment I; also, near both pairs of spiracles, and mesad to mesothoracic legs. Discoidal pores absent. Flagellate setae apically acute, in 3 pairs of longitudinal lines (medial, mediolateral and lateral), slightly longer than dorsal setae; longest lateral seta on segment VII 55 µm long. Mouth tubercle present. Legs partly developed, setae indicated only by clear dots. Antennae each 9-segmented, 240 µm long. Microtrichia present on mesothorax to segment VIII, and on venter of mid- and hind coxae. Eye absent.

Notes: The description is based on three specimens from two localities. One specimen is mounted on its side and is twisted at the abdomen. Two specimens are molting to the adult and it is difficult to determine which structures are on the pupa and which are on the adult. The pupa of this species is very similar to the pupa of *Ov. agavium*, even possessing multilocular pores on the anterior abdominal segments.

Third-instar male (prepupa with wing buds) (Fig. 41)

Description: Slide-mounted specimens 0.9–1.0 mm long, 0.5–0.6 mm wide. Body elongate, without lobes on segment VII, or lobes slightly protruding.

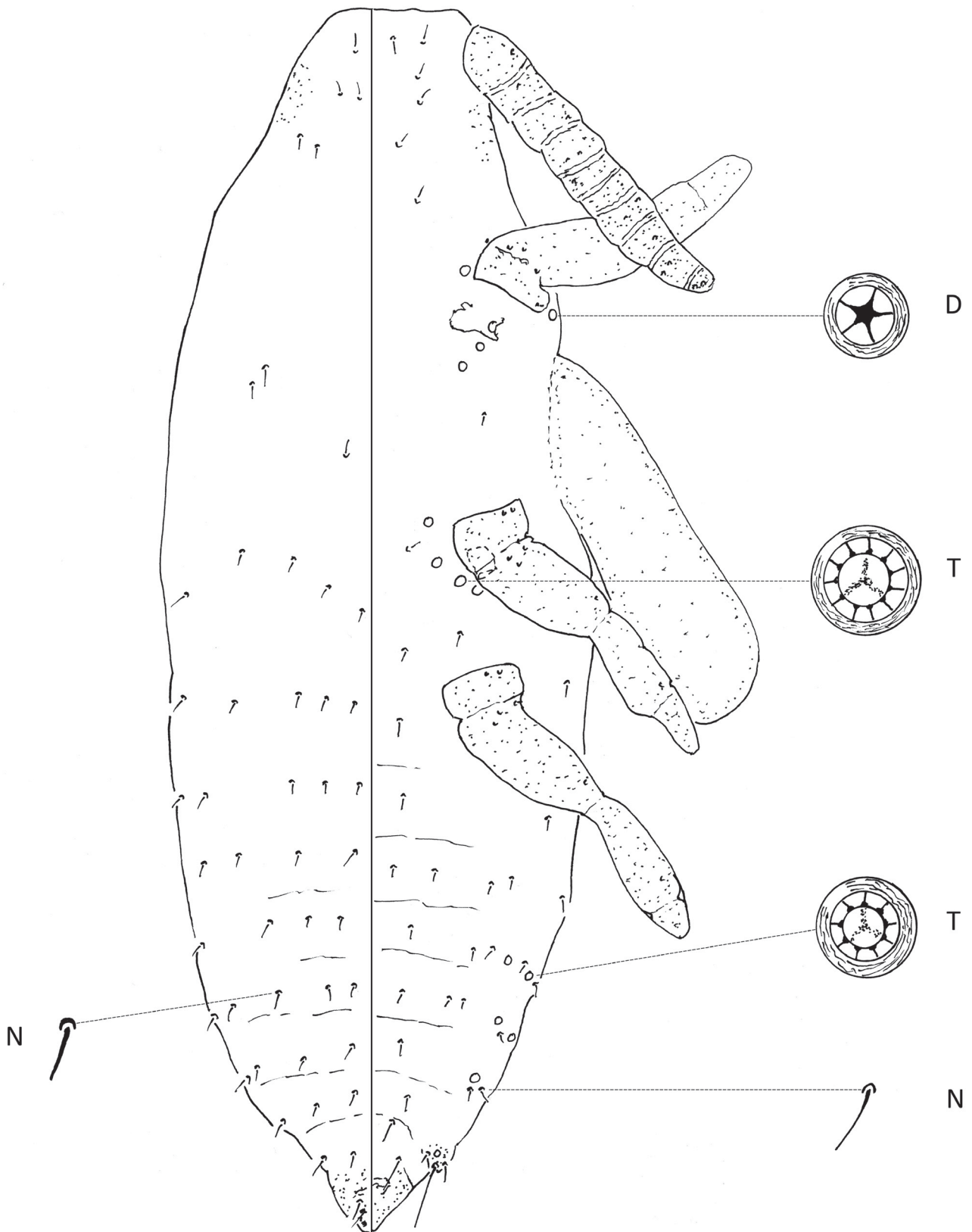


FIGURE 39. *Hypericicoccus hyperici* (Ferris 1955), fourth-instar male (macropterous pupa), Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA, July 8, 1974, on *Hypericum* sp., D.L. Schuder. D=5-locular pore; N=flagellate seta; T=pore with >7 loculi.

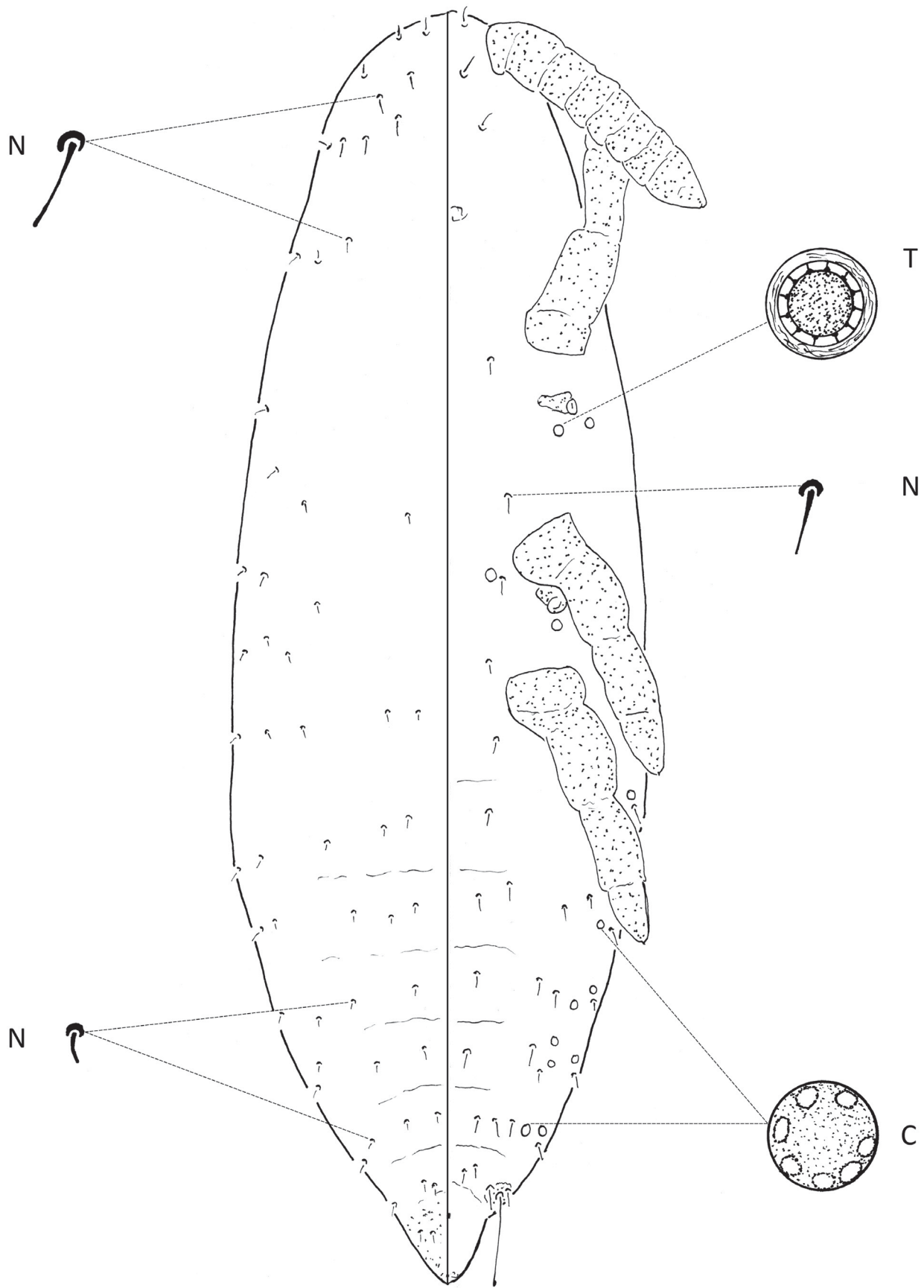


FIGURE 40. *Hypericicoccus hyperici* (Ferris 1955), fourth-instar male (apterous pupa), unknown locality, Tippecanoe Co., Indiana, USA, October 5, 1954, on *Hypericum* sp., D.L. Schuder. C=7-locular pore; N=flagellate seta; T=pore with >7 loculi.

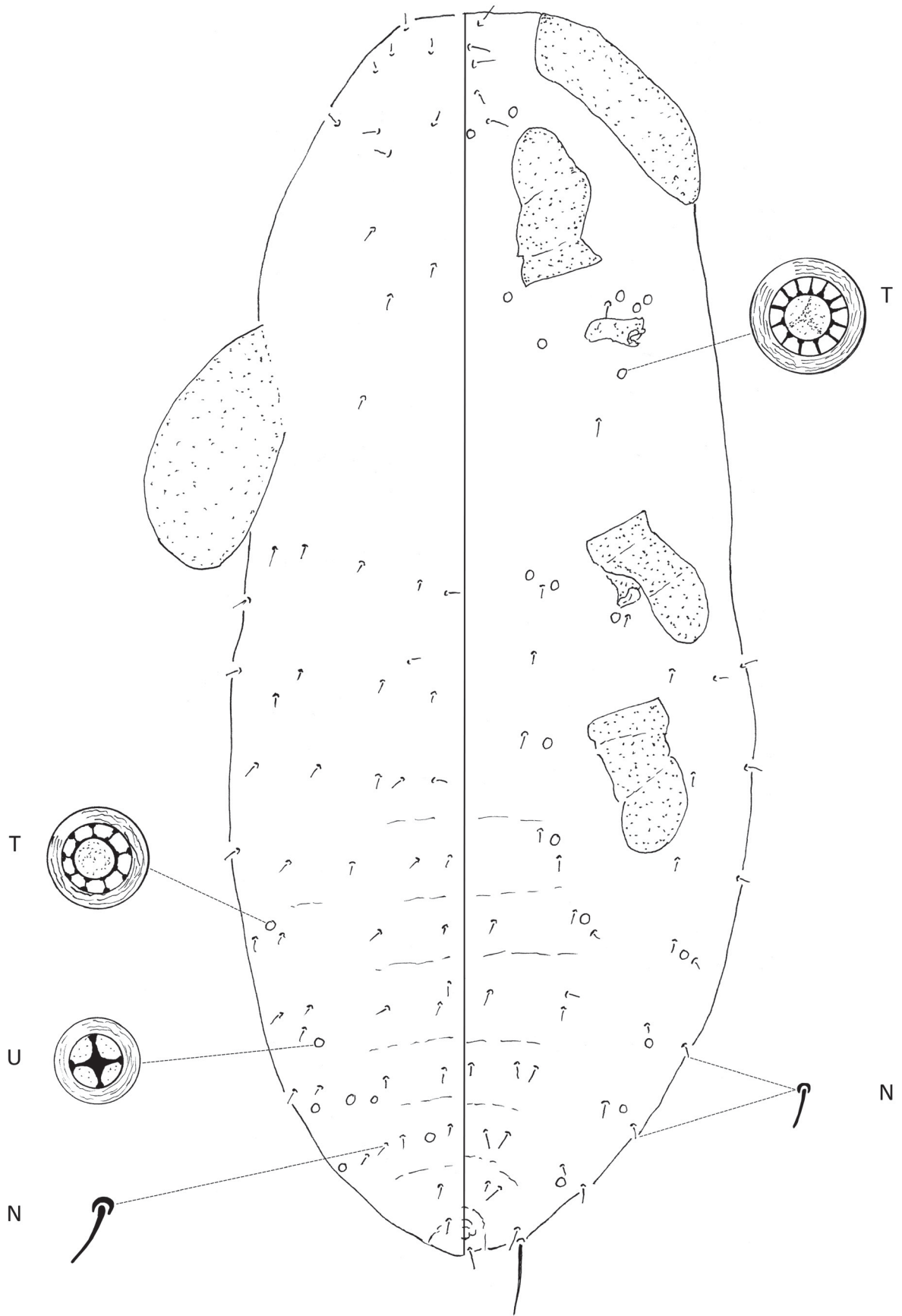


FIGURE 41. *Hypericococcus hyperici* (Ferris 1955), third-instar male (macropterous prepupa), Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA., July 8, 1974, on *Hypericum* sp., D.L. Schuder. N=flagellate seta; T=pore with >7 loculi; U=4-locular pore.

Dorsum with flagellate setae with rounded or slightly capitate apex, in longitudinal lines on abdomen (medial, mediolateral and lateral), uncommon on thorax, more abundant on head. Multilocular pores on medial and/or marginal areas of segments III to VI, with 4–13 loculi. Discoidal pores absent. Without dorsal sclerotization except wing buds. Hamulohalteres absent. Front wing buds 110–205 µm long, partially sclerotized. Microtrichia on posterior abdominal segments.

Penial sheath absent. Anal opening not observed, genital opening represented by small wrinkles ventrally.

Venter with multilocular pores with 7–12 loculi, in 2 pairs of longitudinal lines on mediolateral and/or lateral areas of segments I to VI, also near both pairs of spiracles, mesad to prothoracic, mesothoracic and metathoracic legs, and medially on head. Discoidal pores absent. Flagellate setae apically acute, in 3 pairs of longitudinal lines (medial, mediolateral and lateral), slightly longer than dorsal setae; longest lateral seta on segment VII about 60 µm long. Mouth tubercle absent or represented by small, wrinkled area. Legs partially developed, setae absent. Antennae unsegmented, each 175–198 µm long. Microtrichia on mesothorax to segment VIII, absent from legs. Eye absent.

Notes: The description is based on two specimens from one locality, that are molting to the fourth-instar pupa. The prepupa of *Hy. hyperici* is very similar to the prepupa of *Ov. agavium* but differs by having dorsal multilocular pores on the posterior abdominal segments, whereas *Ov. agavium* lacks these structures.

Third-instar male (prepupa without wing buds) (Fig. 42)

Description: Slide-mounted specimens 0.6–0.7 mm long, 0.3–0.4 mm wide. Body elongate, with small lobes on segment VII.

Dorsum with flagellate setae with slightly rounded apex, sometimes slightly capitate, in longitudinal lines on abdomen (medial, mediolateral and lateral), uncommon on thorax, more abundant on head. Multilocular pores on medial and/or marginal areas of segments III to VI, with 6–12 loculi. Discoidal pores absent. Without dorsal sclerotization. Hamulohalteres and anterior wing buds absent. Microtrichia on segments III or IV to VII.

Penial sheath absent. Anal opening not observed, genital opening represented by small wrinkles ventrally.

Venter with multilocular pores with 7–12 loculi, in 2 pairs of longitudinal lines on mediolateral and/or lateral areas of segments I to VI, also near both pairs of spiracles, mesad to prothoracic, mesothoracic and metathoracic legs, and medially on head, sometimes absent from mesad to metathoracic legs. Discoidal pores absent. Flagellate setae apically acute, in 3 pairs of longitudinal lines (medial, mediolateral and lateral), setae slightly longer than dorsal setae; longest lateral seta on segment VII 45–52 µm long. Mouth tubercle represented by small, wrinkled area. Legs partially developed, represented by 3-segmented stubs, setae absent. Antennae unsegmented, each 110–125 µm long. Microtrichia on mesothorax to segment VIII, absent from legs. Eye absent.

Notes: The description is based on three specimens from one locality. The prepupa of *Hy. hyperici* is very similar to the prepupa of *Ov. agavium* but differs by having dorsal multilocular pores on the posterior abdominal segments, whereas *Ov. agavium* lacks these structures.

Second-instar male (Fig. 43)

Description: Slide-mounted specimens 0.7–0.8 mm long, 0.4–0.5 mm wide. Body elongate oval, with slightly protruding anal lobes. Each lobe dorsally with 1 5-locular pore and 2 or 3 flagellate setae; each lobe ventrally with 1 medium-sized seta and 1 longer anal-lobe seta; multilocular pore sometimes present ventrally, with 1 or 2 microtubular ducts and 1 or 2 macrotubular ducts.

Dorsum with flagellate setae over surface, in longitudinal lines (medial, mediolateral and lateral) on each side of body from head to posterior abdominal segments, some specimens with flagellate setae replaced by enlarged setae in lateral and mediolateral lines, with 1–3 setae in each line. Enlarged setae absent or restricted to few slightly enlarged flagellate setae, or with some lateral and mediolateral setae enlarged and pear-shaped; segment IV with 7–9 setae (including flagellate setae). Macrotubular ducts scattered over entire surface. Microtubular ducts 4–5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or indented, longer or same length as length of remaining sclerotized portion; sclerotized area same size or longer than unsclerotized area; dermal orifice weakly sclerotized, with simple protruding tube. Microtubular ducts uncommon over surface, more abundant near enlarged setae when present. Multilocular pores of 3 kinds: 5-locular pores, 7-locular pores and 9-locular pores, present over entire surface, in 2 pairs of longitudinal lines (lateral and mediolateral), or restricted to few in mediolateral area. Cruciform pores uncommon on abdomen and/or thorax. Acute dermal nodules along body margin and submargin of abdomen. Microtrichia present in medial areas of thorax and abdomen.

Anal ring ventral, dorsal, or marginal, circular, complete, cellular, with 3 slightly enlarged setae on each side

of ring (less enlarged than second-instar females and with more acute apices), each slightly shorter than greatest diameter of ring; additional pair of setae often associated with, but not attached to, ring. Orifice of anal tube unsclerotized or weakly sclerotized.

Venter with setae flagellate, longest seta on segment II 19–25 µm long, on segment VII 16–30 µm; anal-lobe seta 85 µm long. With 1 or 2 slightly enlarged flagellate setae on lateral margin of each side of each body segment from head to segment VII, or with these setae enlarged and pear-shaped. Macrotubular ducts absent. Microtubular ducts uncommon near body margin, more abundant on specimens with enlarged setae. Multilocular pores of 3 or 4 kinds: with from 5–11 loculi, 7-locular pores most numerous, scattered over surface or arranged in 3 pairs of longitudinal lines (lateral, mediolateral and medial). Cruciform pores absent or present near body margin from head to posterior abdomen. Legs without translucent pores on hind coxa; each femur with 3 setae, without proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 7-segmented, 112–131 µm long. Frontal lobes absent. Preantennal pore present. Acute dermal nodules on submarginal and marginal areas of abdomen. Microtrichia over entire surface, present on hind 2 pairs of coxae.

Notes: The description is based on 18 specimens from two localities. The second-instar male of *Hy. hyperici* is most similar to *Ov. davesmithi* Miller and Stocks, in having the anal ring with pores and the dorsum with multilocular pores. They differ as follows (character states in brackets are of *Hy. hyperici*): the most prevalent type of multilocular with five loculi (seven loculi), and the anal ring setae not enlarged (enlarged).

First-instar nymph (Fig. 44)

Description: Slide-mounted specimens 0.4–0.6 mm long, 0.2–0.4 mm wide. Body elongate or broadly oval, anal lobes small, slightly protruding. Each lobe dorsally with 0 or 1 enlarged seta and 2 or 3 flagellate setae; each lobe ventrally with 1 medium-sized seta and 1 longer anal-lobe seta.

Dorsum with flagellate setae arranged in 1 pair of longitudinal lines (submedial), decreasing in length anteriorly, slightly enlarged posteriorly, slightly shorter than those on venter, some specimens with 1 or 2 enlarged setae replacing flagellate setae on abdomen. Enlarged setae present in 2 pairs of longitudinal lines (marginal and mediolateral), with 2 setae on each side of each body segment from head to segment VII or VIII, some specimens with mediolateral enlarged setae on thorax and head replaced by flagellate setae. Enlarged setae pear-shaped, approximately same size, largest seta 7–8 µm long, with truncate apices and narrow setal base; segment IV with 6 setae (including flagellate setae). Macrotubular ducts absent. Microtubular ducts 4–6 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, about same size as remaining sclerotized portion; sclerotized area 2 times longer than unsclerotized area; dermal orifice unsclerotized or weakly sclerotized, with simple protruding tube. Microtubular ducts present in marginal and submarginal areas from thorax to segment VIII. Multilocular pores absent. Normally with 1 cruciform pore on each side of body submarginally on mesothorax. Dermal nodules present along body margin and submargin. Microtrichia in medial areas of thorax and abdomen.

Anal ring apical or rarely dorsal; circular, complete, cellular, with 3 slightly enlarged setae on each side of ring, each slightly shorter than greatest diameter of ring; additional pair of setae often associated with, but not attached to, ring. Orifice of anal tube unsclerotized or weakly sclerotized.

Venter with flagellate setae on segment II 5–8 µm long, on segment VII 12–18 µm long; elongate anal-lobe seta 101–165 µm long. With 1 enlarged seta on lateral margin of each side of each body segment from head, prothorax or mesothorax to segment VII. Microtubular ducts marginal. Multilocular pores normally with 1 posterior to each eye, 2 associated with each anterior spiracle, 1 associated with each posterior spiracle, 1 or 2 on each side of segments VI and/or VII; multilocular pores of 3 kinds: 11-locular pores rare, present near spiracles; 7-locular pores more numerous, associated with spiracles; 5-locular pores sometimes in marginal area near eye, in mediolateral areas of segment VI and/or VII. Cruciform pores absent. Legs well-developed, without pores; each femur with 2 or 3 setae, without proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.9–1.1. Antennae each 6-segmented, 98–111 µm long. Without preantennal pore or frontal tubercle. Microtrichia in medial and mediolateral areas of thorax and abdomen. Dermal nodules marginal and submarginal.

Notes: The description is based on 47 specimens from three localities. The first-instar nymph of *Hy. hyperici* is most similar to the first-instar nymph *Ov. braggi* (Cockerell & Robinson), in having dorsomedial setae, pores in the anal ring and a complete anal ring. They differ as follows (character states in brackets are of *Hy. hyperici*): multilocular pores near the anterior spiracle with five loculi (seven loculi), and the anal ring setae are not enlarged (enlarged).

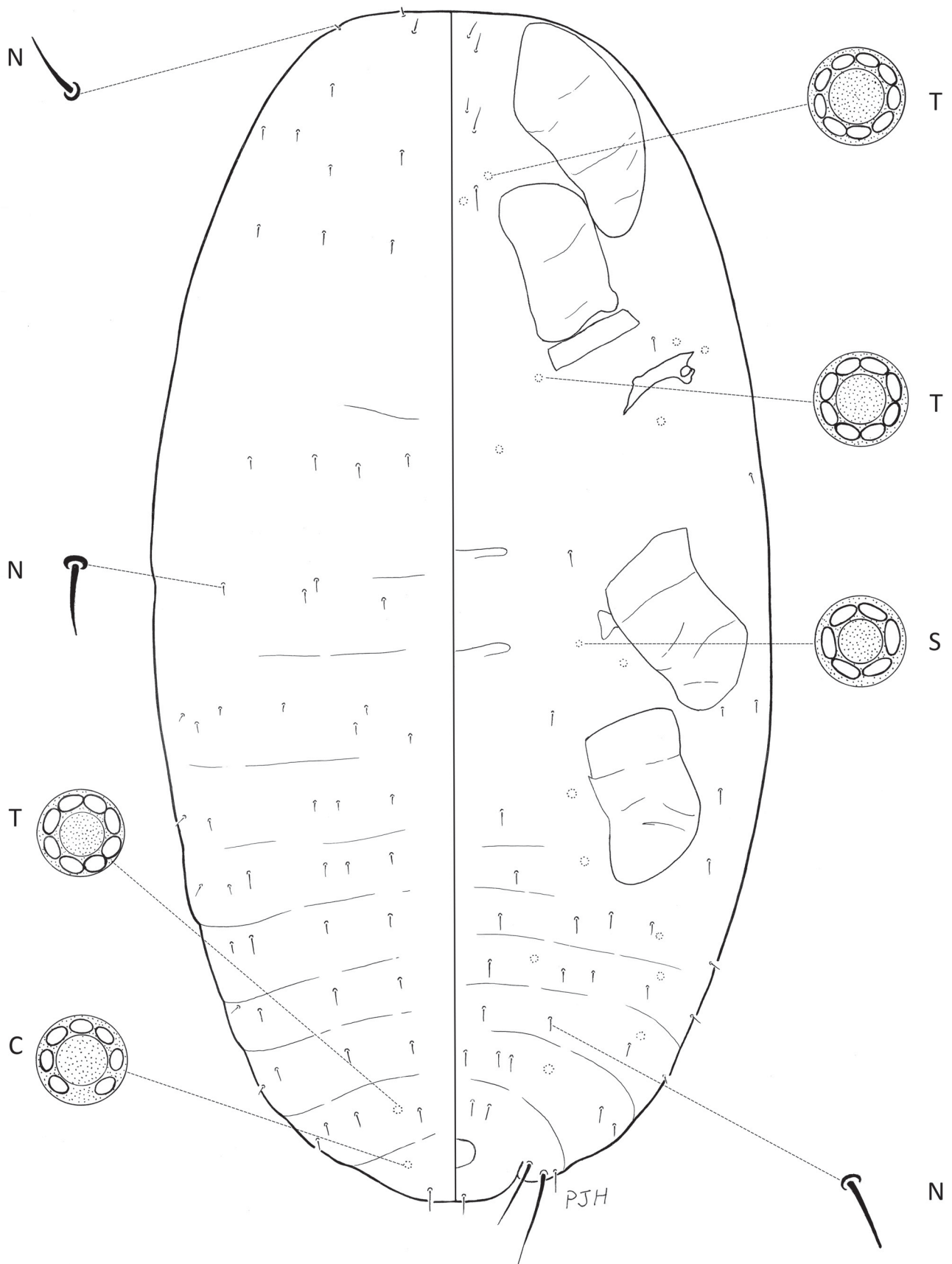


FIGURE 42. *Hypericicoccus hyperici* (Ferris 1955), third-instar male (apterous prepupa), Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA., July 8, 1974, on *Hypericum* sp., D.L. Schuder. C=7-locular pore; N=flagellate seta; S=6-locular pore; T=pore with >7 loculi.

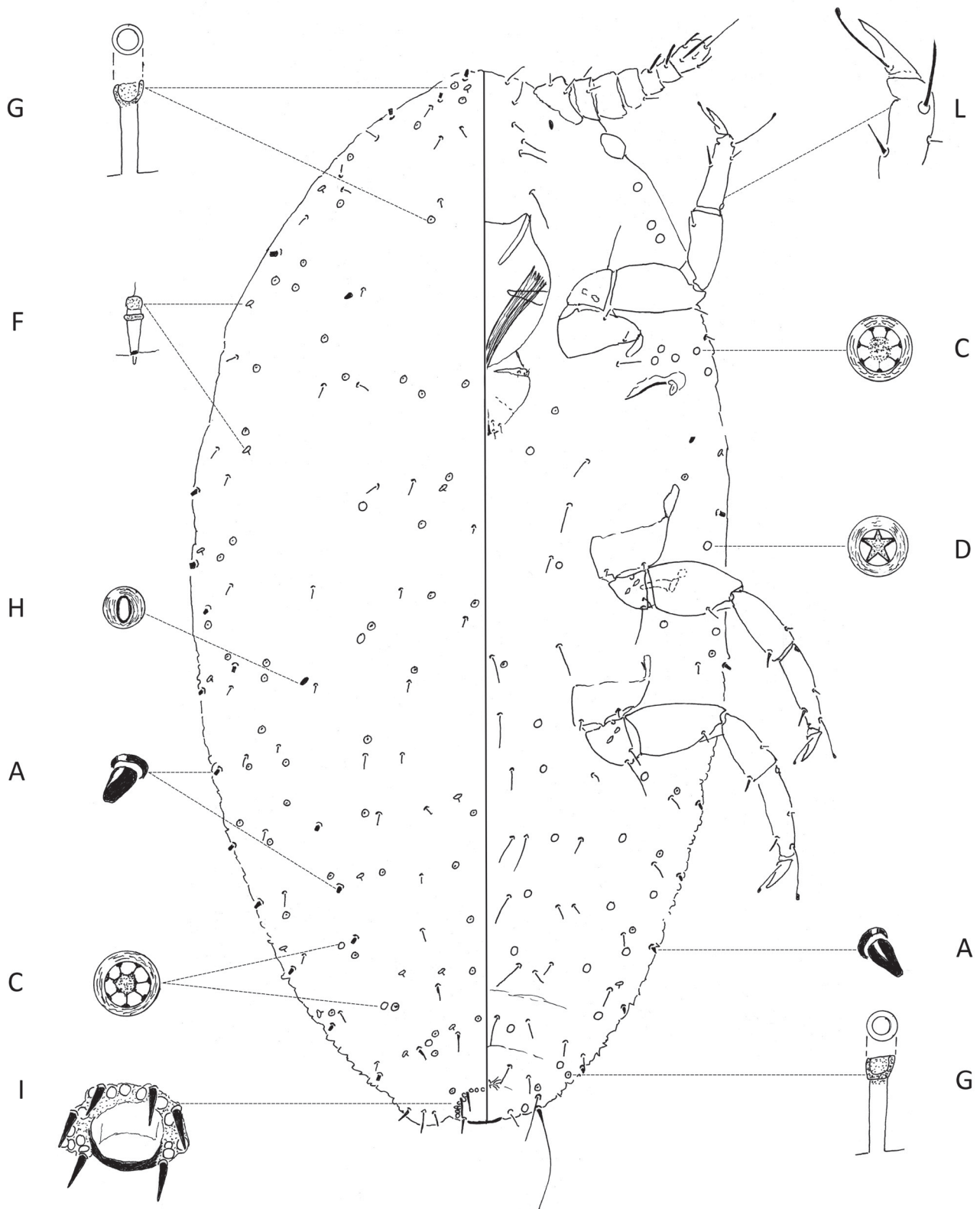


FIGURE 43. *Hypericicoccus hyperici* (Ferris 1955), second-instar male, Lafayette, Clegg Memorial, Tippecanoe Co., Indiana, USA, July 8, 1974, on *Hypericum* sp., D.L. Schuder. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring; L=claw.

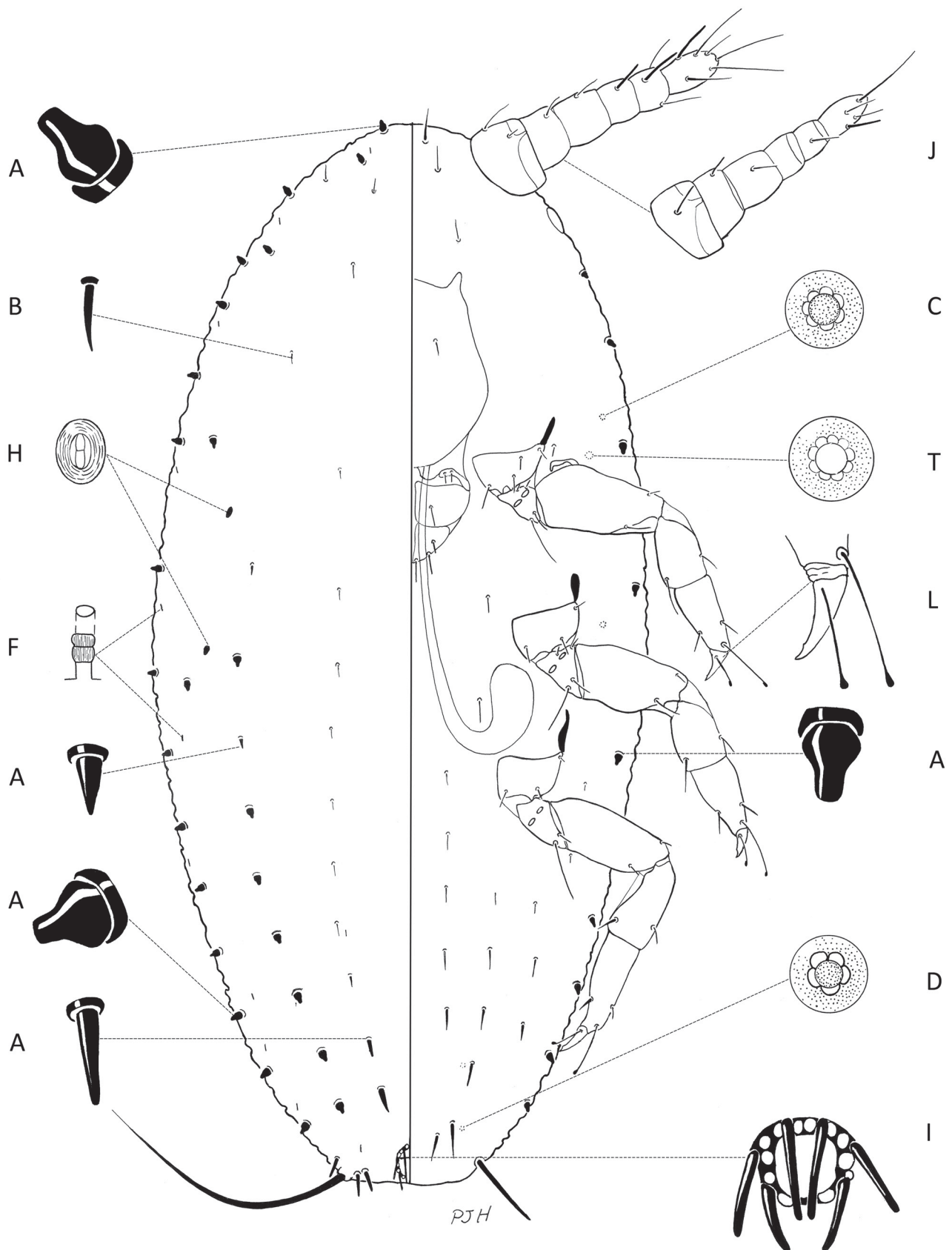


FIGURE 44. *Hypericicoccus hyperici* (Ferris 1955), first-instar nymph, Bloomington, McLean Co., Illinois, USA, December 14, 1953, on *Hypericum* sp., Daniels and Heuer. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; T=pore with >7 loculi.

***Ovaticoccus* Kloet 1944**

Gymnococcus Cockerell 1894b: 1053. Type species: *Coccus agavium* Douglas 1888 by monotypy (junior homonym discovered by Kloet 1944: 86). Notes: junior homonym of a genus of Mycetozoa (*Gymnococcus* Zopf 1887)

Ovaticoccus Kloet 1944: 86 (replacement name for the junior homonym *Gymnococcus* Cockerell 1894b). Type species: *Coccus agavium* Douglas 1888 by monotypy.

Cornoculus Ferris 1955: 81 **syn. n.** Type species: *Cornoculus cornutus* Ferris 1955, by monotypy.

Onceropyga Ferris 1955: 208 **syn. n.** Type species: *Eriococcus neglectus* Cockerell 1895, by original designation (junior homonym discovered by Hoy 1963: 179). Notes: junior homonym of a genus of Lepidoptera: Zygaenidae, *Onceropyga* Turner 1906.

Oregmopyga Hoy 1963: 179 **syn. n.** Type species: *Eriococcus neglectus* Cockerell 1895, by original designation (replacement name for the junior homonym *Onceropyga* Ferris 1955)

Generic diagnosis of adult female: Body oval or rotund. Anal lobes either not protruding, or protruding slightly. Flagellate setae on dorsum and venter, longest setae usually medially on ventral abdomen. Often with enlarged setae of species-specific shape. Usually with microtubular ducts and macrotubular ducts (only in adult females and second-instar males). Multilocular pores present with from 3–12 or 14 loculi. Cruciform pores present or absent. Anal ring variable, configuration usually diagnostic, normally with 2 lateral plates, sometimes with plates joined by sclerotization anteriorly and/or posteriorly forming complete or partial ring; with or without pores, usually with 3 setae on each side of ring, anal tube and/or anal opening sometimes sclerotized, sometimes with anal flap covering anal opening. Legs well-developed; hind coxae each with translucent pores in adult and second-instar females; each femur with 3–5 setae, without translucent pores; each tibia with 3–5 setae, rarely with 1 in middle of tibia; each tarsus with campaniform sensillum near junction of tibia and with 2 capitate digitules; claws each with denticle and 2 capitate digitules. Antennae each 6- or 7-segmented, apical 3 segments each with 1 or more fleshy setae. Without frontal lobes. With preantennal pore. Microtrichia usually present dorsally at least on posterior abdominal segments, present ventrally from head or thorax to posterior abdominal segments, often present on coxae.

Notes: Including *Oregmopyga* and *Cornoculus* as junior subjective synonyms of *Ovaticoccus* gives a broader definition of the genus. No single character is diagnostic for all *Ovaticoccus* species, but the genus can be recognized by the following combination of characters: anal lobes not protruding or slightly protruding; anal-lobe areas each without enlarged setae or rarely with one or two; anal ring often reduced and with zero to three setae on each side of ring; enlarged setae often characteristically shaped; claw digitules same length as, or longer than claw, and capitate. *Ovaticoccus* is similar to *Acanthococcus* in having: enlarged setae; microtubular ducts each with two internal scleroses; claw digitules longer than claw and capitate. Species of *Acanthococcus* differ by (character states of *Ovaticoccus* species are given in brackets): anal lobes protruding, each lobe usually with three or four enlarged setae (anal lobes not protruding or slightly protruding, each lobe with two or fewer enlarged setae); anal ring with four setae on each side of ring and with at least one ring of cells (anal ring with zero to three setae on each side of ring and often with reduced number of cells); enlarged setae often conical, not pear- or nipple-shaped (enlarged setae sometimes conical, often pear- or nipple-shaped). Species of *Ovaticoccus* are similar also to species of the Old-World genus *Hispaniococcus* Kozár in having: three setae on each side of anal ring; enlarged setae nipple-shaped in one species of *Hispaniococcus*; and microtubular ducts with two internal sclerotized areas. Species of *Hispaniococcus* differ from species of *Ovaticoccus* by (character states in brackets are of *Ovaticoccus*): claw digitules shorter than length of claw and apically acute (claw digitules same length as, or longer than, length of claw and apically capitate); anal lobes protruding; and each lobe with three or more enlarged setae (anal lobes not protruding or slightly protruding, and each lobe with two or fewer enlarged setae).

Ferris (1955) and Miller and McKenzie (1967) characterized *Oregmopyga* as having: slightly protruding anal lobes; and often possessing characteristically shaped enlarged setae, e.g., nipple-shaped. Species in the genus usually possess an anal ring with two rows of pores and three pairs of elongate setae, and 7-segmented antennae. The only character that consistently characterizes species of *Oregmopyga* is the presence of slightly protruding anal lobes, but even these vary from clearly protruding to barely perceptible. However, *Oregmopyga* species with protruding anal lobes present a mosaic of other character states that include an anal ring without pores, e.g., *Or. neglecta* (the type species); an anal ring with reduced setae, e.g., *Or. neglecta*; and antennae that are 6-segmented, e.g., *Or. eriogoni* Miller. There are species of *Ovaticoccus* that possess similarly shaped enlarged setae to *Oregmopyga* species, e.g., *Ov. exoticus* Pellizzari and Kozár, and have 7-segmented antennae, e.g., *Ov. agavium* (Douglas). Based on this variation, we place *Oregmopyga* as a junior subjective synonym of *Ovaticoccus*.

Ferris (1955) characterized the single species of *Cornoculus* (*C. cornutus*) as having: unusually large horn-like eyes; characteristically shaped setae, e.g., nipple-shaped; antennae 7-segmented; multilocular pores on dorsum and venter; and anal ring reduced. Miller and McKenzie (1967) added a second species to *Cornoculus* (*C. densus* Miller), based primarily on the large number of macrotubular ducts on the lateral areas of the venter but not having unusual eyes. With the exception of the unusual eyes, the species of *Cornoculus* possess all of the characteristics of species of *Ovaticoccus* and are here considered to be part of the latter genus. The unusual large eyes are believed to be an autapomorphy.

Enlarged setae are common, obvious and distinctive characters in *Ovaticoccus* species and often have been used as diagnostic of many species. However, we have found their presence or absence to be unreliable for species recognition except in the first-instar nymphs, and even in this instar there can be variation. Adult females and second-instar nymphs tend to show a great deal of variation; surprisingly, transformation of flagellate setae from enlarged setae appears to occur with ease in the process of molting. We have found specimens of the same instar, from the same locality, both with and without enlarged setae, e.g., second-instar males of *Ov. agavium* and adult females of *Ov. betsyae* Miller and Stocks **sp. n.** We also have observed specimens with the presence of enlarged setae on one side of the body, and not on the other. Because of this variation we have avoided using the presence or absence of enlarged setae as primary diagnostic characters of species whenever possible. However, the shape of enlarged setae is reliable in characterizing many *Ovaticoccus* species, e.g., *Ov. davesmithi* Miller and Stocks versus *Ov. johnsoni* Miller.

The arrangement of the dorsal setae (either enlarged or flagellate or both) is segmental, usually with a single row of setae across each abdominal segment and a less obvious segmental arrangement on the head and thorax. In most species there also is a longitudinal arrangement of these setae, often characterized as lateral, mediolateral and medial. This longitudinal pattern is most obvious in the first-instar nymph, but can be seen in the adult female and even some of the male instars in some species. This arrangement can be useful in distinguishing among different species. Although the descriptions often describe this pattern as occurring on the entire dorsum, it may not be as obvious on the head and thorax as it is on the abdomen.

The seta that is normally located near the anal ring and often is mentioned as “additional pair of closely associated setae not attached to anal ring” in the descriptions of the anal ring, is most likely the same as the suranal seta. It often is difficult to determine the anterior limits of the so-called anal-lobe area, which may cause inconsistencies in the data presented in the text. The suranal seta is usually included in these data for the ventral anal lobe.

Other structures useful in species recognition in *Ovaticoccus* that merit special mention are multilocular pores, the anal ring, and the setae on the femur. The predominant number of loculi in multilocular pores is a reliable diagnostic character. Many species have the predominant kind of multilocular pores with five loculi, e.g., *Ov. sanguineus* Miller, but several species have pores predominantly with seven loculi, e.g., *Ov. cornutus*, or even nine loculi, e.g., *Ov. tippinsi*. The same loculus-number predominance often occurs throughout the life history of the species in first-instar nymphs, second-instar males and females, and adult females.

The structure of the anal ring also is surprisingly consistent throughout the life history of a species. For example, the anal ring of *Ov. neglectus* is horseshoe shaped, lacks pores, the setae are minute or absent, the anal tube and anal opening are weakly sclerotized, and there is no anal flap. This is true for all instars except the male prepupa, pupa, and adult. In contrast to *Ov. neglectus*, the consistent structure of the anal ring in the first-instar nymph, second-instar male and female, and adult female of *Ov. agavium* is composed of two lateral plates, each with three setae on each side of the ring that are each about as long as the greatest diameter of the ring, which lacks pores; furthermore, these instars of *Ov. agavium* have the anal tube unsclerotized, the anal opening is sclerotized, and lacks an anal flap.

The number and distribution of the setae on the femur follow the same pattern, i.e., they remain the same throughout the life history of each species. There are several diagnostic patterns including: a total of four setae (one proximal seta, three distal setae), e.g., *Ov. haigi* Miller and Stocks **sp. n.**; five setae (two proximal setae, three distal setae), e.g., *Ov. sanguineus*; and three setae (zero proximal setae, three distal setae), e.g., *Ov. neglectus*.

Unlike most species of *Acanthococcus*, species of *Ovaticoccus* rarely have a middle seta on the tibia. Miller and McKenzie (1967), Gill (1993), and Kozár *et al.* (2013) used this as a diagnostic character state for species recognition within the Eriococcidae, but surprisingly the setae on the femur are much more diagnostic for species in *Ovaticoccus*.

Intraspecific variation occurs in certain species of *Ovaticoccus* causing the use of “in part” designations in dichotomous keys. Examples include: the number of segments in the antennae of the adult female of *Ov.*

maryfoleybensonae and of *Ov. davesmithi* (6- or 7-segmented); the sclerotization of the anal ring on the adult female of *Ov. mackenziei* (complete or divided anteriorly); and cruciform pores on the second-instar females of *Ov. salviae* (present or absent).

Etymology: The genus epithet “*Ovaticoccus*” is formed from the Latin word “*ovatus*” meaning “egg-shaped” and the Greek “*kokkos*” meaning “round structure” or “scale insect” and apparently refers to the oval body shape of this scale insect. The generic name is a masculine noun.

Field features: Found in a diversity of microhabitats including within the leaf-blade sheaths of grasses, the tightly adhering bases of leaves of yucca and agave, under the bark of shrubs such as *Salvia* and *Hypericum*, and in cyst-like encasements in the soil. Generally, they are found in tight, protected areas of the host.

Key to *Ovaticoccus* and *Hypericicoccus* species based on adult females

1(0)	Dorsal cruciform pores present	2
–	Dorsal cruciform pores absent	21
2(1)	Pores present in anal ring	3
–	Pores absent from anal ring	11
3(2)	Dorsum without dorsal dermal projections; with macrotubular ducts; legs well formed	5
–	Dorsum with numerous dorsal dermal projections; without macrotubular ducts; legs poorly formed	4
4(3)	Hind coxae without pores; without enlarged setae or with fewer than 15	<i>gordoni</i> Miller and Stocks sp. n.
–	Hind coxae with pores; with more than 20 enlarged setae	<i>hyperici</i> (Ferris)
5(3)	Antennae 7-segmented	6
–	Antennae 6-segmented	17
6(5)	Multilocular pores predominantly with 5 loculi	10
–	Multilocular pores predominantly with more than 5 loculi, or with equal numbers of 5-locular pores and 7-locular pores	7
7(6)	Eyes not enlarged; without large clusters of macrotubular ducts in ventrolateral areas of abdominal segments	8
–	Eyes enlarged; with large clusters of macrotubular ducts in ventrolateral areas of abdominal segments	<i>cornutus</i> (Ferris)
8(7)	Enlarged setae present near body margin; anal ring complete	9
–	Enlarged setae absent; anal ring divided posteriorly	<i>maryfoleybensonae</i> Miller and Stocks sp. n. (in part)
9(8)	Without pores on hind coxae; with conical setae on margin of abdominal segment VIII	<i>telotrichus</i> Miller and Stocks sp. n. (in part)
–	With pores on hind coxae; with dome-shaped setae on margin of abdominal segment VIII	<i>davesmithi</i> (Miller & Stocks) (in part)
10(6)	Dorsal enlarged setae uncommon or absent, if present, then most abundant dorsally on margin; cruciform pores absent or uncommon in ventromedial areas between legs (<10), often restricted to marginal areas	39
–	Dorsal enlarged setae common, present over entire dorsal surface; cruciform pores abundant over entire ventral surface including between legs (>10)	<i>parvispinus</i> (Chaffin)
11(2)	Without cluster of dorsal cruciform pores on segment VIII	13
–	With cluster of dorsal cruciform pores on segment VIII	12
12(11)	Without distinct pores on hind coxae; on grass	<i>adoxus</i> (Ferris)
–	With distinct pores on hind coxae; on cactus	<i>villanuevorum</i> Miller and Stocks sp. n.
13(11)	Macrotubular ducts present on dorsum; on several hosts	14
–	Macrotubular ducts absent from dorsum; on <i>Hymenoclea</i>	<i>viscosa</i> (Kondo) (in part)
14(13)	Multilocular pores predominantly with 5 loculi	15
–	Multilocular pores predominantly with more than 5 loculi	<i>tuttlei</i> Miller and Stocks sp. n.
15(14)	Anal ring with setae; enlarged setae conical or pear-shaped, with base narrower than length of seta	16
–	Anal ring without setae; enlarged setae dome-shaped, basal width same as or wider than length of seta	<i>densus</i> (Miller)
16(15)	Antennae 7-segmented; without small pores on derm anterior to hind coxae; on <i>Artemisia</i> and <i>Eriogonum</i>	<i>variabilis</i> Miller
–	Antennae 6-segmented; with small pores on derm anterior to hind coxae; on grass	<i>haigi</i> Miller and Stocks
17(5)	Anal ring incomplete, divided either dorsally or ventrally or both	18
–	Anal ring complete, not divided	20
18(17)	Translucent pores present on hind coxae; enlarged setae conical or absent	19
–	Translucent pores absent from hind coxae; enlarged setae dome-shaped	<i>tippinsi</i> (Miller & Miller)
19(18)	Enlarged setae absent	<i>maryfoleybensonae</i> Miller and Stocks sp. n. (in part)
–	Enlarged setae present	<i>strongyla</i> (Miller & Miller)
20(17)	Without pores on hind coxae; with conical setae on margin of abdominal segment VIII	<i>telotrichus</i> Miller and Stocks sp. n. (in part)
–	With pores on hind coxae; with dome-shaped setae on margin of abdominal segment VIII	<i>davesmithi</i> (Miller & Stocks) (in part)
21(1)	Anal ring complete, not divided	22

–	Anal ring divided anteriorly or posteriorly, or both	29
22(21)	With dorsal multilocular pores	23
–	Without dorsal multilocular pores	27
23(22)	Anal ring pores absent	24
–	Anal ring pores present	26
24(23)	Antennae each 6-segmented	25
–	Antennae each 7-segmented	<i>viscosa</i> (Kondo) (in part)
25(24)	Small pores present on derm anterior to hind coxa	<i>salviae</i> Miller
–	Small pores absent from derm anterior to hind coxa	<i>mackenziei</i> Miller (in part)
26(23)	Enlarged setae longer than wide; antennae each 7-segmented	<i>peninsularis</i> (Ferris) (in part)
–	Enlarged setae about as wide as long; antennae each 6-segmented	<i>erigoni</i> (Miller)
27(22)	Without small pores anterior to hind coxae	28
–	With small pores anterior to hind coxae	<i>senarius</i> McKenzie
28(27)	Anal ring without setae or with 1 inconspicuous seta on each side of ring	<i>parkerorum</i> Miller
–	Anal ring with 3 setae on each side of ring	<i>variabilis</i> Miller (in part)
29(21)	Protruding anal lobes absent	32
–	Protruding anal lobes present, sometimes small	30
30(29)	Pores absent from derm anterior to hind coxa	31
–	Pores present on derm anterior to hind coxa	<i>neglectus</i> (Cockerell)
31(30)	Anal ring with pores; with enlarged setae; alcohol with preserved specimens clear	38
–	Anal ring without pores; without enlarged setae; alcohol-preserved specimens turn liquid crimson	<i>sanguineus</i> (Miller)
32(29)	Cruciform pores absent from ventromedial areas of abdomen	36
–	Cruciform pores present in ventromedial areas of abdomen	33
33(32)	Macrotubular ducts present at least on posterior abdominal segments	34
–	Macrotubular ducts absent	<i>exoticus</i> Pellizzari and Kozár
34(33)	Macrotubular ducts present on head and/or thorax	35
–	Macrotubular ducts restricted to abdomen	<i>agavium</i> (Douglas)
35(34)	Dorsal multilocular pores scattered over entire surface, with more than 10	<i>agavacearum</i> Pellizzari and Kozár
–	Dorsal multilocular pores restricted to head and thorax, with fewer than 10	<i>variabilis</i> Miller (in part)
36(32)	Microtubular ducts absent	37
–	Microtubular ducts present	<i>mackenziei</i> Miller (in part)
37(36)	Multilocular pores with about equal numbers of 5-locular and 7-locular pores; cruciform pores common lateroventrally, forming clusters of 9–18 pores on each of abdominal segments II or III to VII; occurring on <i>Agave</i> sp.	<i>californicus</i> McKenzie
–	Multilocular pores primarily 5-locular, with 3-locular pores uncommon; cruciform pores in small numbers lateroventrally, forming clusters of 1 or 2 pores on each of abdominal segments II, III, or IV to VIII; occurring on <i>Yucca</i> sp.	<i>betsyae</i> Miller and Stocks sp. n.
38(31)	Hind coxae with translucent pores restricted to ventral surface	<i>peninsularis</i> (Ferris) (in part)
–	Hind coxae with translucent pores present on both surfaces	<i>johnsoni</i> (Miller)
39(10)	Hind coxae greatly enlarged, with numerous translucent pores on both surfaces	<i>amplicoxae</i> Williams and Martin
–	Hind coxae not enlarged, with few translucent pores on ventral surface	<i>peruvianus</i> (Granara de Willink & Díaz)

Key to *Ovaticoccus* and *Hypericicoccus* species based on second-instar females

1(0)	Dorsal cruciform pores present	2
–	Dorsal cruciform pores absent	11
2(1)	With pores in anal ring	3
–	Without pores in anal ring	8
3(2)	Most abundant multilocular pores with more than 5 loculi	4
–	Most abundant multilocular pores with 5 loculi	6
4(3)	Anal ring setae thin, flagellate, apices acute	5
–	Anal ring setae thick, apices blunt	<i>hyperici</i> (Ferris)
5(4)	Dorsal multilocular pores present	<i>tippinsi</i> (Miller & Miller)
–	Dorsal multilocular pores absent except on head	<i>cornutus</i> (Ferris)
6(3)	Enlarged setae approximately as long as wide, dome-shaped	7
–	Enlarged setae longer than wide, conical or pear-shaped	<i>peruvianus</i> (Granara de Willink)
7(6)	Hind tibiae each with seta medially (total of 5 setae)	<i>densus</i> (Miller) (in part)
–	Hind tibiae each without seta medially (total of 4 setae)	<i>davesmithi</i> (Miller & Stocks)
8(2)	Enlarged setae conical or pear-shaped, length greater than width	9
–	Enlarged setae dome-shaped, length shorter or same as width	<i>densus</i> (Miller) (in part)
9(8)	Dorsal cruciform pores not restricted to area anterior to anal ring	10
–	Dorsal cruciform pores restricted to medial area anterior to anal ring on segment VIII sometimes with 1 or 2 medial pores on segment VII	<i>adoxus</i> Ferris

10(9)	Cruciform pores present ventrally; not occurring on <i>Salvia</i>	19
–	Cruciform pores absent ventrally; occurring under bark of <i>Salvia</i>	<i>salviae</i> Miller (in part)
11(1)	Ventral cruciform pores absent	12
–	Ventral cruciform pores present	16
12(11)	Dorsal multilocular pores present	13
–	Dorsal multilocular pores absent	21
13(12)	Anal ring setae absent or shorter than half of diameter of ring	14
–	Longest anal ring seta longer than half of diameter of ring	15
14(13)	Each femur with 3 setae, without proximal seta; enlarged setae present ventrolaterally	<i>neglectus</i> (Cockerell) (in part)
–	Each femur with 4 setae, with proximal seta; enlarged setae absent ventrolaterally	<i>betsyae</i> Miller and Stocks sp. n.
15(13)	Cruciform pores usually absent ventromedially	<i>salviae</i> Miller (in part)
–	Cruciform pores usually present ventromedially	<i>agavium</i> (Douglas) (in part)
16(11)	Dorsal multilocular pores present	18
–	Dorsal multilocular pores absent	17
17(16)	Enlarged setae present on venter; usually without proximal seta on each femur	<i>eriononi</i> (Miller)
–	Enlarged setae absent from venter; usually with proximal seta on each femur	<i>viscosa</i> (Kondo)
18(16)	Each femur with 3 or 4 setae, 1 proximal seta present or absent	20
–	Each femur with 5 setae, 2 proximal setae present	<i>sanguineus</i> (Miller) (in part)
19(10)	Each femur with 4 setae, 3 distally, 1 proximally	<i>haigi</i> Miller and Stocks sp. n.
–	Each femur with 5 setae, 3 distally, 2 proximally	<i>sanguineus</i> (Miller) (in part)
20(18)	Each femur with 3 setae, without proximal seta	<i>agavium</i> (Douglas) (in part)
–	Each femur with 4 setae, with 1 proximal seta	<i>exoticus</i> Pellizzari and Kozár
21(12)	Abdominal segment IV with combined total of 8 enlarged setae on dorsum and venter; without microtubular ducts in mediolateral areas of dorsum of abdomen	<i>variabilis</i> Miller
–	Abdominal segment IV with combined total of 9–11 enlarged setae on dorsum and venter; with microtubular ducts in mediolateral areas of dorsum of abdomen	<i>neglectus</i> (Miller) (in part)

Key to *Ovaticoccus* and *Hypericicoccus* species based on second-instar males

1(0)	Anal ring without pores	2
–	Anal ring with pores	5
2(1)	Ventral cruciform pores present	3
–	Ventral cruciform pores absent	4
3(2)	Anal ring incomplete with 2 lateral plates, divided anteriorly and posteriorly	8
–	Anal ring complete or divided anteriorly	<i>viscosa</i> (Kondo)
4(2)	Each femur with 3 setae including 3 distal setae, without proximal seta	9
–	Each femur with 4 setae including 1 proximal seta and 3 distal setae	<i>betsyae</i> Miller and Stocks sp. n.
5(1)	5-locular pores most abundant kind of multilocular pore	6
–	7-locular pores most abundant kind of multilocular pore	<i>hyperici</i> (Ferris)
6(5)	Dorsal enlarged setae present; dorsal microtubular ducts present	7
–	Dorsal enlarged setae absent; dorsal microtubular ducts absent	<i>peruvianus</i> (Granara de Willink)
7(6)	Enlarged setae dome-shaped, about as wide as long; anal ring with fewer than 10 pores	<i>davesmithi</i> (Miller & Stocks)
–	Enlarged setae conical or dome-shaped, longer than wide; anal ring with more than 10 pores	<i>parvispinus</i> (Chaffin)
8(3)	Each femur with 4 setae, 1 proximally and 3 distally	<i>exoticus</i> Pellizzari and Kozár
–	Each femur with 3 setae, all 3 distally	<i>agavium</i> (Douglas)
9(4)	Ventral abdominal segments each with more than 5 multilocular pores; 7-locular pores abundant, nearly as common as 5-locular pores; microtubular ducts common on dorsum, with more than 5	<i>neglectus</i> (Cockerell)
–	Ventral abdominal segments each with fewer than 5 multilocular pores; 7-locular pores rare or absent, most multilocular pores with 5 loculi; microtubular ducts rare on dorsum, with fewer than 5	<i>salviae</i> Miller

Key to *Ovaticoccus* and *Hypericicoccus* species based on first-instar nymphs

1(0)	Dorsomedial longitudinal line of enlarged setae present on abdomen, sometimes restricted to 1 or 2 setae on posterior segments	2
–	Dorsomedial longitudinal line of enlarged setae absent from abdomen	9
2(1)	Pores absent from anal ring	3
–	Pores present in anal ring	6
3(2)	Most multilocular pores with 5 or more loculi, or with equal numbers of 3- and 5-locular pores	4
–	Most multilocular pores with 3 loculi	<i>variabilis</i> Miller
4(3)	Anal ring divided posteriorly and anteriorly	14
–	Anal ring not divided or divided anteriorly only	5

5(4)	Each femur with 3 setae; each tibia without middle seta	<i>erioni</i> (Miller)
–	Each femur with 5 setae; each tibia with middle seta	<i>densus</i> (Miller)
6(2)	Anal ring complete	7
–	Anal ring incomplete	8
7(6)	Multilocular pore associated with anterior spiracle with 7 loculi; anal ring setae enlarged, with rounded apices	<i>hyperici</i> (Ferris)
–	Multilocular pore associated with anterior spiracle with 5 loculi; anal ring setae slender, with acute apices	<i>braggi</i> (Cockerell & Robinson)
8(6)	Multilocular pores absent dorsally; without ventral enlarged setae	15
–	Multilocular pores present dorsally on abdominal segment VIII; lateral longitudinal line of enlarged setae present ventrally	<i>parvispinus</i> (Chaffin)
9(1)	Each femur with 3 or 4 setae	10
–	Each femur with 5 setae	12
10(9)	Each femur with 4 setae	11
–	Each femur with 3 setae	<i>neglectus</i> (Cockerell)
11(10)	Multilocular pores predominantly with 5 or more loculi, 3-locular pores absent or rare; enlarged setae restricted to lateral areas	<i>adoxus</i> Ferris
–	Multilocular pores predominantly with 3 loculi, pores with 5 loculi absent or rare; enlarged setae forming 2 pairs of longitudinal lines (mediolateral and lateral)	<i>haigi</i> Miller and Stocks sp. n.
12(9)	Anal lobes with conical enlarged setae; with a few cruciform pores on thorax	13
–	Anal lobes without conical enlarged setae; without cruciform pores	<i>davesmithi</i> (Miller & Stocks)
13(12)	Enlarged setae present in mediolateral line on dorsal abdomen	<i>telotrichus</i> Miller and Stocks sp. n.
–	Enlarged setae absent mediolaterally on dorsal abdomen	<i>tippinsi</i> (Miller & Miller)
14(4)	Each femur with 4 setae, including proximal seta	<i>agavacearum</i> Pellizzari and Kozár, also <i>exoticus</i> Pellizzari and Kozár
–	Each femur with 3 setae, without proximal seta	<i>agavium</i> (Douglas)
15(8)	Two multilocular pores associated with each spiracle; multilocular pores predominantly with more than 5 loculi	<i>maryfoleybensoanae</i> Miller and Stocks sp. n.
–	One multilocular pore associated with each spiracle; multilocular pores predominantly with 5 loculi	<i>peruvianus</i> (Granara de Willink)

***Ovaticoccus adoxus* (Ferris)**

(Color plate 2)

Gymnococcus adoxus Ferris 1955: 180.

Ovaticoccus adoxus (Ferris); Boratynski 1958: 173–175 (change of combination).

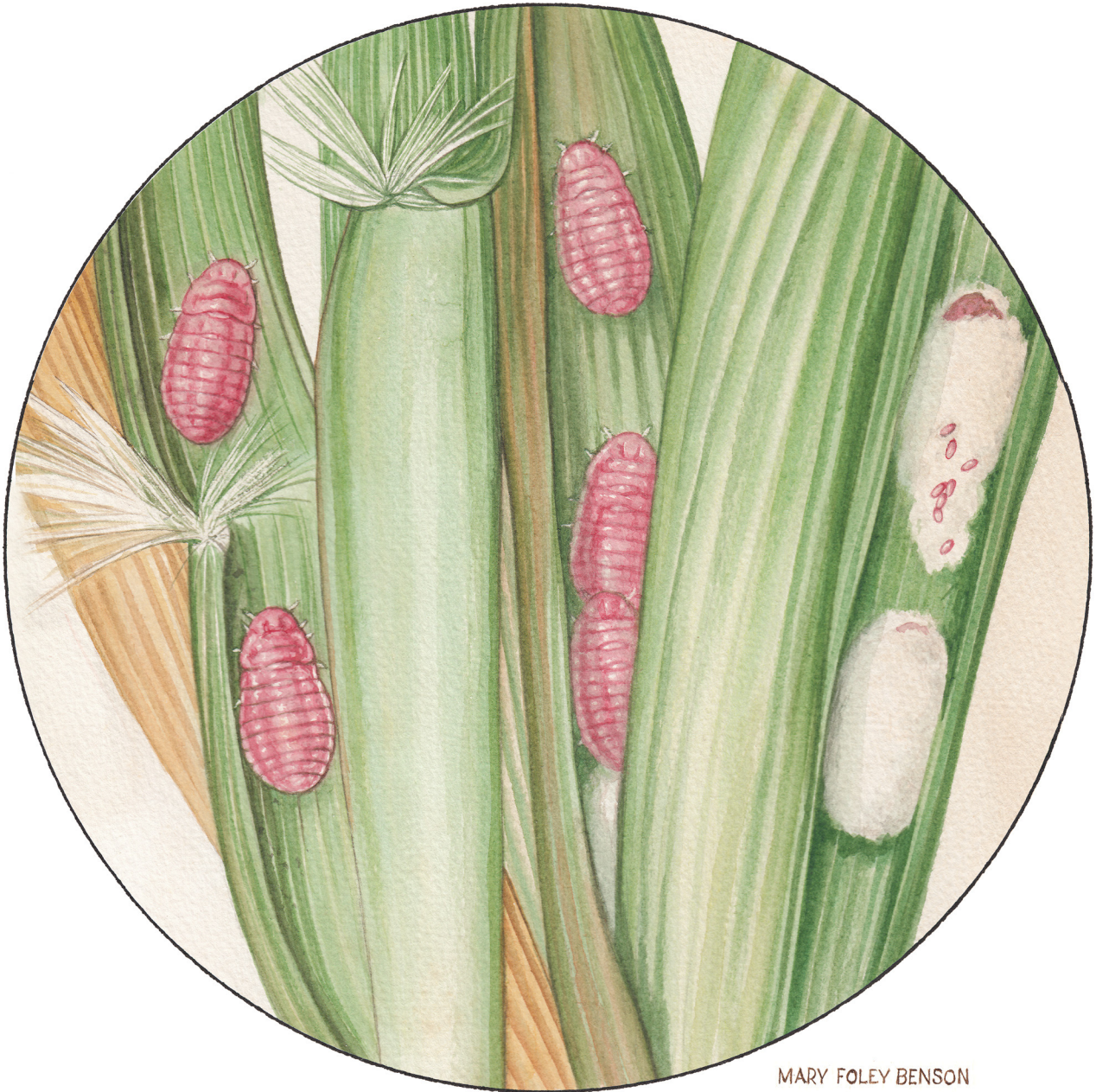
Specimens examined: UNITED STATES: Arizona: Cochino Co.: Winoa, VIII-8-1966, on grass, D.R. Miller (2 ad. ♀♀ on 2 slides) UCD, USNM; Cochise Co., Willcox, IX-4-1981, on grass, J.E. Lauck and D.R. Miller (1 ad. ♀) UCD. Colorado: Mesa Co.: 24 mi. E. Grand Junction, IX-19-1967, on *Sporobolus cryptantha*, H.L. McKenzie (4 ad. ♀♀ on 2 slides) UCD; Powers Co.: 20 mi. S. Lamar, VI-30-1970, on grass, D.R. Miller (1 ad. ♀ on 1 slide) UCD. New Mexico: Bernalillo Co.: 3 mi. W. Albuquerque, VIII-7-1966, on grass, D.R. Miller (2 ad. ♀♀ on 1 slide) UCD; Luna Co.: 20 mi. W. Las Cruces, VIII-4-1966, on grass, D.R. Miller (1 ad. ♀, 1 second-instar ♀ on 1 slide) UCD; Quay Co.: 5 mi. W. Tucumcari, VII-2-1970, on grass, D.R. Miller (3 ad. ♀♀ on 1 slide) UCD; San Juan Co.: 8 mi. N. Chaco Canyon National Monument, VIII-13-1981, on *Sporobolus* sp.?, J.F. Miller and D.R. Miller (1 second-instar ♀, 4 first-instar nymphs on 3 slides) UCD. Texas: El Paso Co.: mesa at El Paso, ?-?-1921, on undetermined grass, G.F. Ferris (4 ad. ♀♀ on 2 slides) UCD; El Paso, VII-?-1921, on grass, G.F. Ferris (1 ad. ♀, 1 second-instar ♀ on 1 slide, paralectotype) UCD; Moore Co.: Dumas, VII-1-1970, on grass, D.R. Miller (4 ad. ♀♀ on 2 slides) UCD; Oldham Co.: 5 mi. W. Vega, VII-5-1970, on grass, D.R. Miller (3 ad. ♀♀ on 2 slides) UCD.

The adult female of this species was described by Ferris (1955) and Miller and McKenzie (1967), and the adult male was described in detail by Hodgson (2020). Information from those papers is not repeated here. The only mention of immature instars was by Ferris (1955), indicating that they have enlarged setae.

Etymology: The species epithet “*adoxus*” is formed from the Greek word “*adoxos*” meaning “obscure” or “insignificant” and probably refers to the obscure habitat of this species.

Second-instar female (Figs 45 and 46)

Description: Slide-mounted specimens 1.0–1.3 mm long, 0.7–0.8 mm wide. Body elongate, without protruding anal lobes. Anal-lobe areas each dorsally with 0–1 enlarged seta, 1 or 2 short flagellate setae, 1 or 2 cruciform pores; ventrally with 2 or 3 flagellate setae including suranal seta and anal-lobe seta, 0 or 1 5-locular pores.



MARY FOLEY BENSON

COLOR PLATE 2. *Ovatococcus adoxus* (Ferris 1955), with grass-blade sheath pulled open to expose insects, note red adult females without ovisac and adult females with ovisac and eggs. USA: New Mexico: Bernalillo Co.: 3 mi. W. Albuquerque, VIII-7-1966, on grass, D.R. Miller.

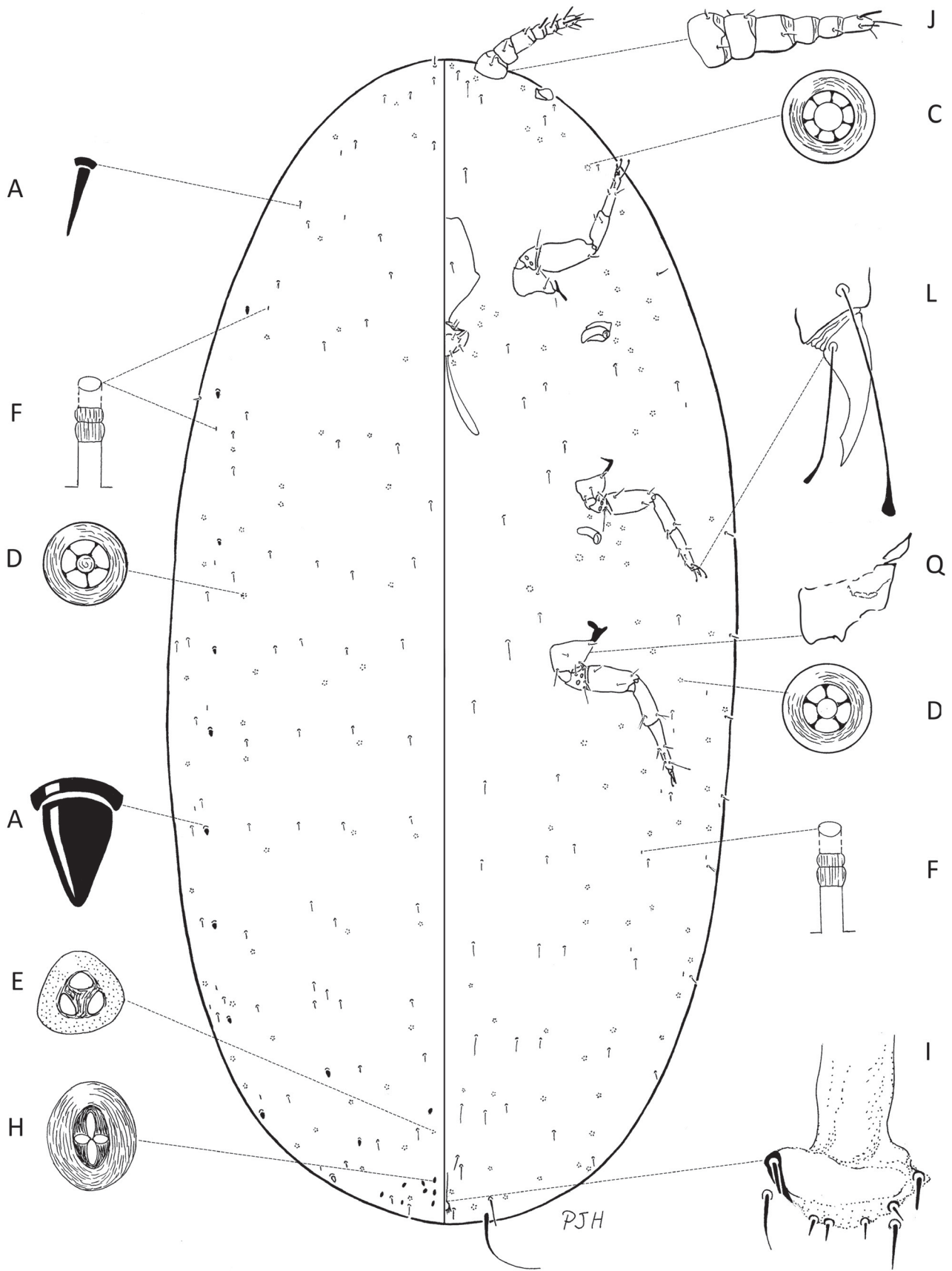


FIGURE 45. *Ovaticoccus adoxus* (Ferris 1955), second-instar female. #1 (few enlarged setae), 20 miles W. Las Cruces, Luna Co., New Mexico, USA, August 4, 1966, on grass, D.R. Miller. A=enlarged seta; C=7-locular pore; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; Q=dorsal surface of coxa.

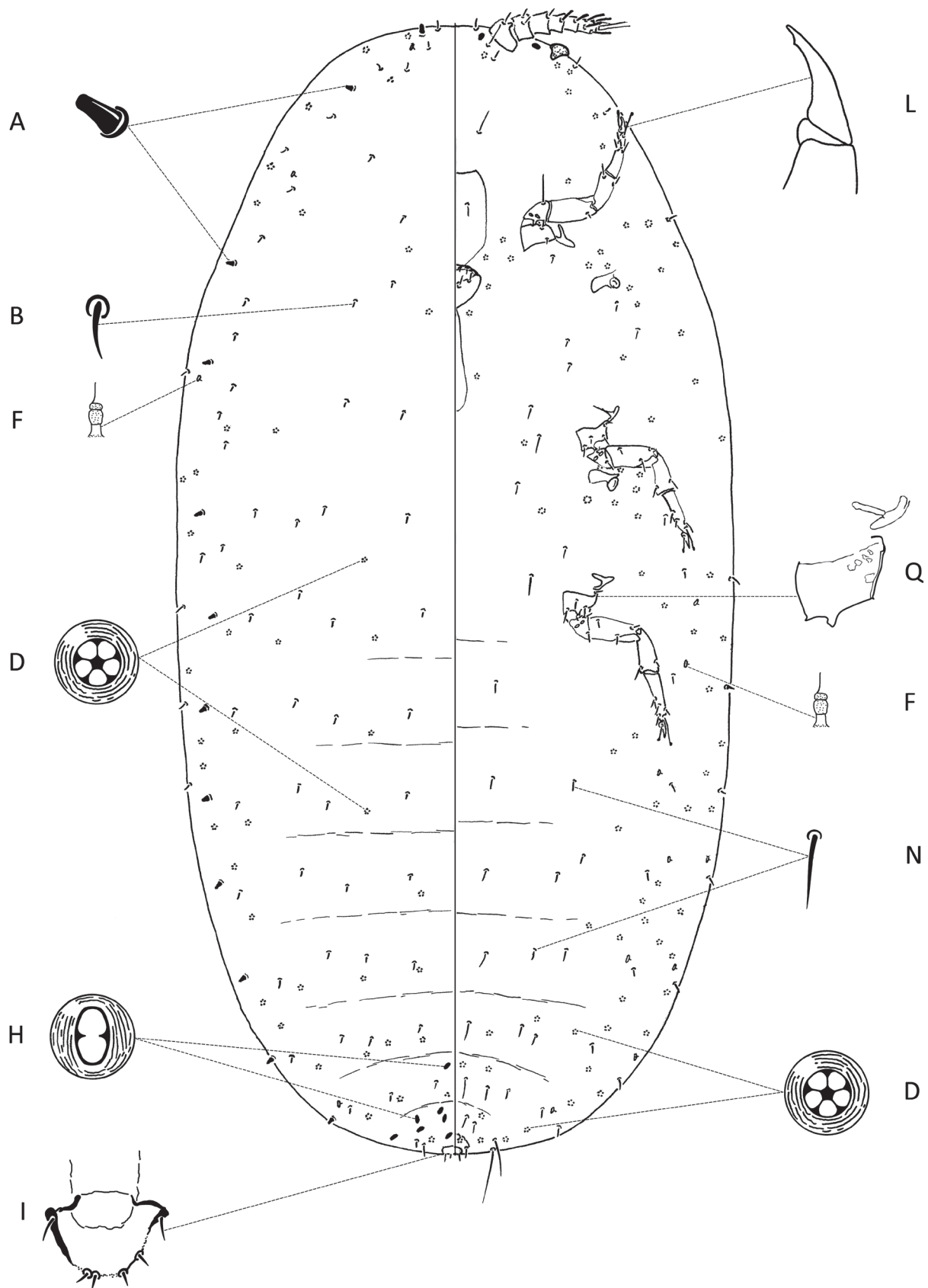


FIGURE 46. *Ovaticoccus adoxus* (Ferris 1955), second-instar female. #2 (complete lateral longitudinal line of enlarged setae), 8 miles N. Chaco Canyon National Monument, New Mexico, USA., August 13, 1981, on *Sporobolus* sp.?, J.F. Miller and D.R. Miller. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; L=claw; N=flagellate seta; Q=dorsal surface of coxa.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral); each medial line with 1 seta on each side of segment, each mediolateral and lateral line with 1 or 2 setae on each side of segment, dorsal setae shorter than those on venter. Enlarged setae variable in number and distribution, of 1 size: normally present in single irregular longitudinal line along body margin, rarely with 1 or 2 setae in mediolateral areas; largest seta 7–8 µm long; enlarged setae conical, laterally with nearly straight sides, with blunt apex; setal base thin; not in dermal pockets; segment IV with 10–12 setae, including 2 or 3 enlarged setae and 8–10 flagellate setae; segment IV with combined total of 2 or 3 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 6 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or bilobular, ¼ or ½ length of remaining sclerotized portion; total sclerotized area same length as, or longer than, unsclerotized area; dermal orifice weakly sclerotized, without protruding tube. Microtubular ducts in small numbers along body margin. Multilocular pores of 1–3 kinds: 5-locular pores most numerous, scattered over entire surface; 3-locular pores and 6-locular pores rare. Cruciform pores restricted to cluster on segment VIII and occasionally VII. Microtrichia absent.

Anal ring apical, circular, with 2 small weakly sclerotized lateral plates, without cells and with little or no sclerotization, with 3 short setae on each side of ring, each shorter than diameter of ring; anal tube without sclerotization, anal orifice weakly sclerotized; with anal flap.

Venter with longest flagellate seta on segment II about 15 µm long, on segment VII 18–20 µm long; anal-lobe seta 70–80 µm long. Enlarged setae absent. Macrotubular ducts absent. Microtubular ducts present or absent on head and thorax, present along margin and submargin of abdomen. Multilocular pores of 2–4 kinds: 5-locular pores most abundant, present along body margin; 6- and 7-locular pores in reduced numbers, most abundant near spiracles; 3-locular pores present or absent. Cruciform pores usually absent, rarely present on head. Legs with hind coxae each with 2 or 3 indistinct pores; each femur with 4 setae, including 1 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.9. Antennae each 6-segmented, about 140 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from thorax to segment VIII, absent from coxae.

Notes: The description is based on three specimens from three localities. The second-instar female of *Ov. adoxus* is similar to the second-instar of *Ov. haigi* in having a very reduced anal ring, conical enlarged setae each with straight margins and a blunt apex, four setae on each femur, and occurring on grasses. They differ in having (character states in brackets are those of *Ov. adoxus*): cruciform pores present along body margin (restricted to cluster on segment VIII, rarely also on VII).

First-instar nymph (Fig. 47)

Description: Slide-mounted specimens 0.6–1.0 mm long, 0.2–0.5 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 1 or 2 short flagellate setae; ventrally with 2 or 3 flagellate setae including suranal seta and anal-lobe seta, 0 or 1 5-locular pore.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (medial and mediolateral). Enlarged setae in lateral longitudinal line from head to segment VII, 1 specimen with 1 mediolateral seta on segment VII, some setae replaced by flagellate setae on thoracic segments; largest setae 5–6 µm long; enlarged setae conical, laterally with nearly straight sides, with blunt apex; setal base thin; not in dermal pockets; segment IV with 6 setae including 2 enlarged setae and 4 flagellate setae; segment IV with combined total of 2 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 2 µm long, with area farthest from dermal orifice sclerotized and undivided; dermal orifice sclerotized; rare, present mediolaterally on segment VIII, sometimes with 1 adjacent to middle and hind legs near enlarged setae. Multilocular pores absent. Cruciform pore usually present near 2 enlarged setae on mesothorax. Microtrichia absent.

Anal ring apical, circular, essentially unsclerotized, incomplete, divided posteriorly and anteriorly, with 1 cell at base of most setae; with 3 setae on each side of ring, each longer or same length as greatest diameter of ring; anal tube and anal orifice unsclerotized; without anal flap.

Venter with longest flagellate seta on segment II 9–15 µm long, on segment VII 15–17 µm long; anal-lobe seta 89–105 µm long. Enlarged setae, macrotubular ducts and microtubular ducts absent. Multilocular pores present near base of antenna, laterad to labium, adjacent to each spiracle, and in mediolateral longitudinal line on each side of segments II to VII, of 2 or 3 kinds: 5-locular pores abundant on head and abdomen; 7- and 8-locular pores present near spiracles; 5-locular pores most abundant. Cruciform pores absent. Legs without pores; each femur with 4 setae, 1 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 6-segmented, 130–131 µm long. Frontal lobes absent. Preantennal pore inconspicuous. Microtrichia present in medial area of metathorax and abdomen, absent from coxae.

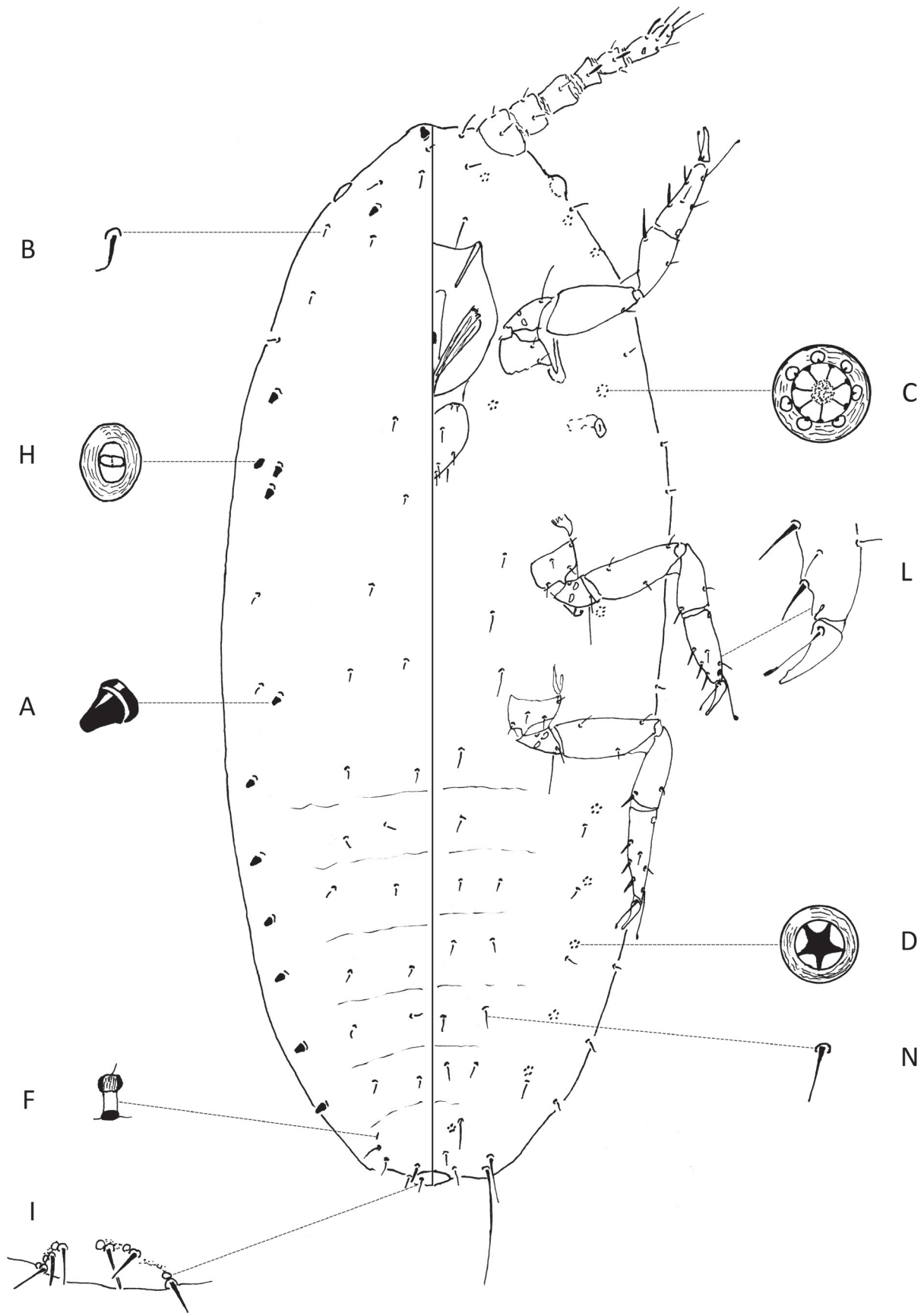


FIGURE 47. *Ovatococcus adoxus* (Ferris 1955), first-instar nymph. 8 miles N. Chaco Canyon National Monument, New Mexico, USA., August 13, 1981, on *Sporobolus* sp.?, J.F. Miller and D.R. Miller. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; L=claw; N=flagellate seta.

Notes: The description is based on four specimens from one locality. The first-instar nymph of *Ov. adoxus* is unique in having a nearly complete lateral longitudinal line of enlarged setae from the head to segment VII, and lacking enlarged setae elsewhere except for one or two sometimes present posteromedially on segment VII.

***Ovaticoccus agavacearum* Pellizzari and Kozár**

Ovaticoccus agavacearum Pellizzari and Kozár 2011: 63–65.

Type specimens: We have been unable to locate material of this species from North America; it was originally described from Italy on potted *Yucca* by Pellizzari and Kozár (2011) including detailed illustrations and descriptions of the adult female and first-instar nymph, and that information will not be repeated here.

Etymology: “The species name [*agavacearum*] means ‘of the Agavaceae’ after the family of the host plant on which this species was collected.” (Pellizzari & Kozár 2011: 63).

Notes: *Ovaticoccus agavacearum* is similar to *Ov. agavium* but differs as follows, as given by Pellizzari and Kozár (2011: 64): adult female with “macrotubular ducts on head and thorax (only on the abdomen in *O. agavium*) and few cruciform pores, these restricted to the abdominal segments (numerous, and also on thorax in *O. agavium*). Moreover, the dome-shaped spines are very few and of one size (numerous, and of different size on *O. agavium*). The first-instar nymph of *O. agavacearum* is similar to that of *O. agavium* but the latter sometimes has two cruciform pores on each side of the last abdominal segments, the anal ring has only two sclerotized lateral plates and the setae are hair-like.” Based on the illustrations of *Ov. agavacearum* it also is similar to *Ov. exoticus* in having four setae on each femur, including one proximal seta, but differs by having macrotubular ducts on the dorsum (absent in *Ov. exoticus*) and few dorsal enlarged setae (many in *Ov. exoticus*).

***Ovaticoccus agavium* (Douglas)**

Coccus agavium Douglas 1888: 150.

Gymnococcus agavium (Douglas); Cockerell 1894b: 1053 (change of combination).

Ripersia agavium (Douglas); Newstead 1897: 12-13. (change of combination).

Pseudantonina agaves Chiaromonte 1929: 61-62 (junior synonym).

Ovaticoccus agavium (Douglas); Kloet 1944: 86 (change of combination).

Specimens examined: UNITED STATES: California: Los Angeles Co.: Los Angeles, V-28-1940, on *Aloe* sp., F.R. Platt (10 ad. ♀♀ on 3 slides) UCD; Pasadena, V-12-1938, on *Yucca* sp., Marsh (8 ad. ♀♀ on 4 slides) UCD. Orange Co.: Stanton, VI-7-1966, on *Yucca* sp., R. Wyatt (5 ad. ♀♀ on 5 slides) CDA. San Bernardino Co.: Yucca Valley, XI-16-1967, on *Agave* sp., Cambin (2 ad. ♀♀, 1 ad. ♂ on 3 slides) UCD; San Diego Co.: Torrey Pines, IV-6-1965, on *Agave* sp., J.R. Carlin (1 ad. ♀) UCD. Massachusetts: Suffolk Co.: Cambridge, Harvard Botanical Gardens, VII-15-1921, on *Agave* sp., and *A. scolymus* (= *A. potatorum*), H. and E. Morrison (6 ad. ♀♀, 3 second-instar ♀♀, 8 first-instar nymphs on 5 slides) USNM. Missouri: Independent city: Saint Louis, Missouri Botanical Garden, VII-25-1923, on *Agave* sp., H.L. Sanford (7 ad. ♀♀, 3 second-instar ♀♀, 3 first-instar nymphs, 6 ad. ♂♂, 1 third-instar ♂, 5 second-instar ♂♂ on 8 slides) USNM. New York: Bronx Co.: Bronx, VIII-31-1944, on *Agave* sp., G. Rau (4 ad. ♀♀ on 1 slide) USNM; New York Co.: New York, New York Botanical Gardens, VII-1-1921, on *A. neglecta* and *A. antillarum* (?), H.L. Sanford and L.C. Griffith (17 ad. ♀♀, 5 second-instar ♀♀, 6 first-instar nymphs, 1 ad. ♂, 2 fourth-instar ♂♂ on 10 slides) USNM; New York Botanical Garden, III-29-1937, on *Agave* sp., G. Rau (2 ad. ♀♀ on 2 slides) UCD, USNM. MEXICO: State (?): XI-1-1952, on *Agave* sp., W.B. Wood (1 second-instar ♀, 3 second-instar ♂♂ on 1 slide) USNM; V-4-1960, on cactus plants, J. Hidalgo Jr., (1 ad. ♀ on 1 slide) USNM; XII-22-1967, on *Agave* sp., C.H. Spitzer (2 ad. ♀♀ on 1 slide) USNM. Puebla: Zacatepec, VII-16-1967, on *Agave* sp., D.R. Miller and J. Villanueva B. (3 ad. ♀♀ on 3 slides) UCD. Vera Cruz: intercepted at New York, VII-21-1927, on *A. atrovirens*, H.Y. Gouldman (3 ad. ♀♀ on 1 slide) USNM. SPAIN: Intercepted at New York, X-21-1959, on *Agave* sp., J. Hidalgo Jr., (1 ad. ♀ on 1 slide) USNM. UNITED KINGDOM: England: Kew Gardens, VI-22-1956, VI-27-1957, and V-26-1964, on *Agave* sp., *A. decipens*, and *A. franzosini*, S.A. Afifi and K. Boratyński (29 ad. ♀♀, 29 second-instar ♀♀, 40 first-instar nymphs, 8 ad. ♂♂, 4 fourth-instar ♂♂, 5 third-instar ♂♂, 21 second-instar ♂♂ on 16 slides) NHM.

The adult female of this species was described in detail by Boratyński (1958), Miller and McKenzie (1967) and Miller and Miller (1993), and information from those papers is not repeated here. Boratyński also briefly discussed the morphological character states of the first-instar nymph, second-instar female and adult male; he included a drawing and description of a second-instar male (labeled as a third-instar male). Miller and McKenzie (1967) included descriptions of the first-instar nymph, second-instar female (labeled as a second- or third-instar female) and second-instar male (labeled as a third- or fourth-instar male), but did not include illustrations. Afifi (1968) and Hodgson (2020) described and illustrated the adult male but our illustration and description shows slightly different character states, particularly the sensory setae on the tibiae.

Etymology: The species epithet “*agavium*” is based on the scientific name of the host of this species.

Second-instar female (Fig. 48)

Description: Slide-mounted specimens 0.7–1.0 mm long, 0.3–0.5 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae and 0 or 1 5-locular pore; each ventrally with 3 or 4 flagellate setae including suranal seta and elongate anal-lobe seta, and 0 or 1 5-locular pore.

Dorsum with single longitudinal line of flagellate setae along lateral margin, rarely with 1 or 2 such setae on sublateral areas of posterior abdominal segments. Enlarged setae of 2 sizes: larger size present in 3 pairs of longitudinal lines (medial, mediolateral and lateral); smaller size present in 2 pairs of longitudinal lines, sometimes some or all of small-sized setae replaced by flagellate setae; largest seta 9–12 µm long; enlarged setae variable in shape from thin and conical with straight lateral margins to broad and pear-shaped with curved lateral margins; setal base thin; segment IV with 7–10 setae including 6–10 enlarged setae and 0–4 flagellate setae; segment IV with combined total of 6–10 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts normally absent, rarely with 1 or 2 on abdomen. Multilocular pores of 1 or 2 kinds: 5-locular pores most numerous, scattered over entire surface, rarely with more pores on head; 3-locular pores rarely present. Cruciform pores absent. Microtrichia absent.

Anal ring ventral, semicircular, incomplete, non-cellular, with 3 setae on each side of ring, each normally shorter than diameter of ring; additional pair of setae often associated with, but not attached to, ring; anal tube weakly sclerotized, dermal orifice sclerotized; without anal flap.

Venter with setae flagellate, longest seta on segment II 15–25 µm long, on segment VII 12–30 µm long; anal-lobe seta approximately 85 µm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores most abundant, present over entire surface, least abundant on head; 3-locular pores rare, normally on thorax and head. Cruciform pores variable, in clusters of 1–4 pores, on lateral margins of segments V or VI to VII or VIII, also in medial areas from segment II or III to VII, rarely with 1 or 2 pores on head and thorax. Legs with small number of translucent pores on hind coxa; each femur with 3 setae, without proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 140–150 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia present on prothorax to segment VIII and on ventral surface of hind 2 pairs of coxae.

Notes: The description is based on 41 specimens from five localities. The second-instar female of *Ov. agavium* is most similar to the second-instar female of *Ov. exoticus* in lacking dorsal cruciform pores and in having dorsal multilocular pores and similarly shaped anal rings. They differ as follows (character states in brackets are those of *Ov. agavium*): each femur with four setae including a proximal seta (with three setae, without a proximal seta); without ventromedial cruciform pores (normally with ventromedial cruciform pores).

Adult male (macropterous) (Fig. 49)

Description: Slide-mounted specimens 1.0–1.2 mm long, 0.3–0.4 mm wide. Body elongate, segment VIII somewhat produced laterally, giving lobular appearance.

Dorsum with 1 pair of tail-forming pore clusters (tfpc); each cluster with 2 elongate, capitate setae of 2 distinct sizes: longest seta 120–145 µm long; shortest setae 85–115 µm long; with 35–50 multilocular pores. Multilocular pores restricted to tail-forming pore clusters, each with 3, 5, or 7 loculi, 5-locular pores most common. X-type pores (x) normally present near dorsal arm of midcranial ridge (dmcr), rarely absent. Flagellate setae slender, apically acute, approximately same length as those on venter, in clusters of 2 or 3 near each margin of segments II to VIII, also in transverse rows on segments II to VII, with 1 pair of elongate setae in medial area of segment VIII; setae present on metathorax and mesothorax, absent from prothorax; head setae present posterior to postoccipital ridge (por) and along dorsal arm of midcranial ridge. Abdominal sclerotization variable, median tergal plate VIII (mtp) clearly indicated, sometimes present on segments II, V, VI and VII, nearly always present around marginal clusters

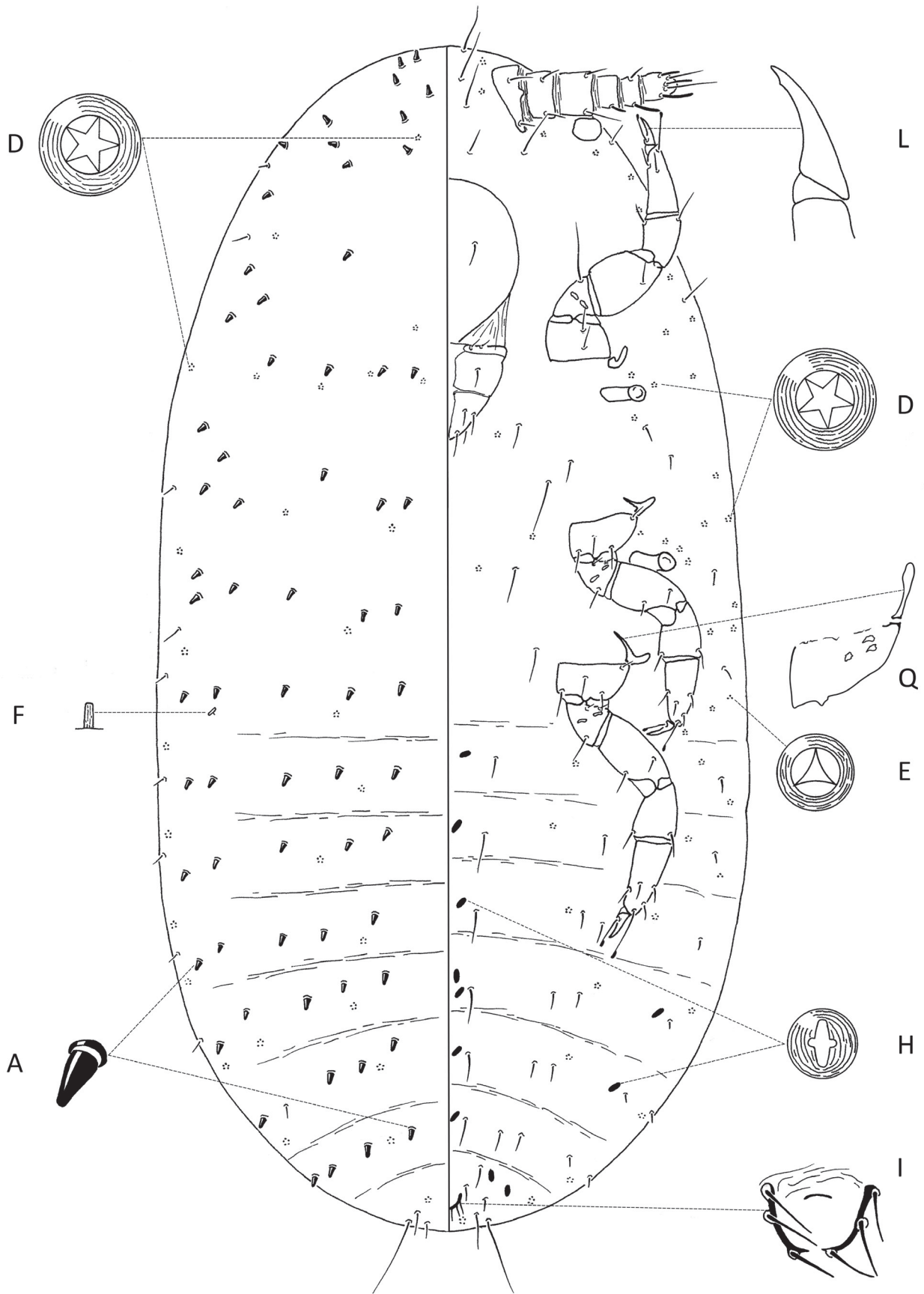


FIGURE 48. *Ovaticoccus agavium* (Douglas 1888), second-instar female. Mexico, State (?): November 21, 1952, on *Agave* sp., W.B. Wood. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; L=claw; Q=dorsal surface of coxa.

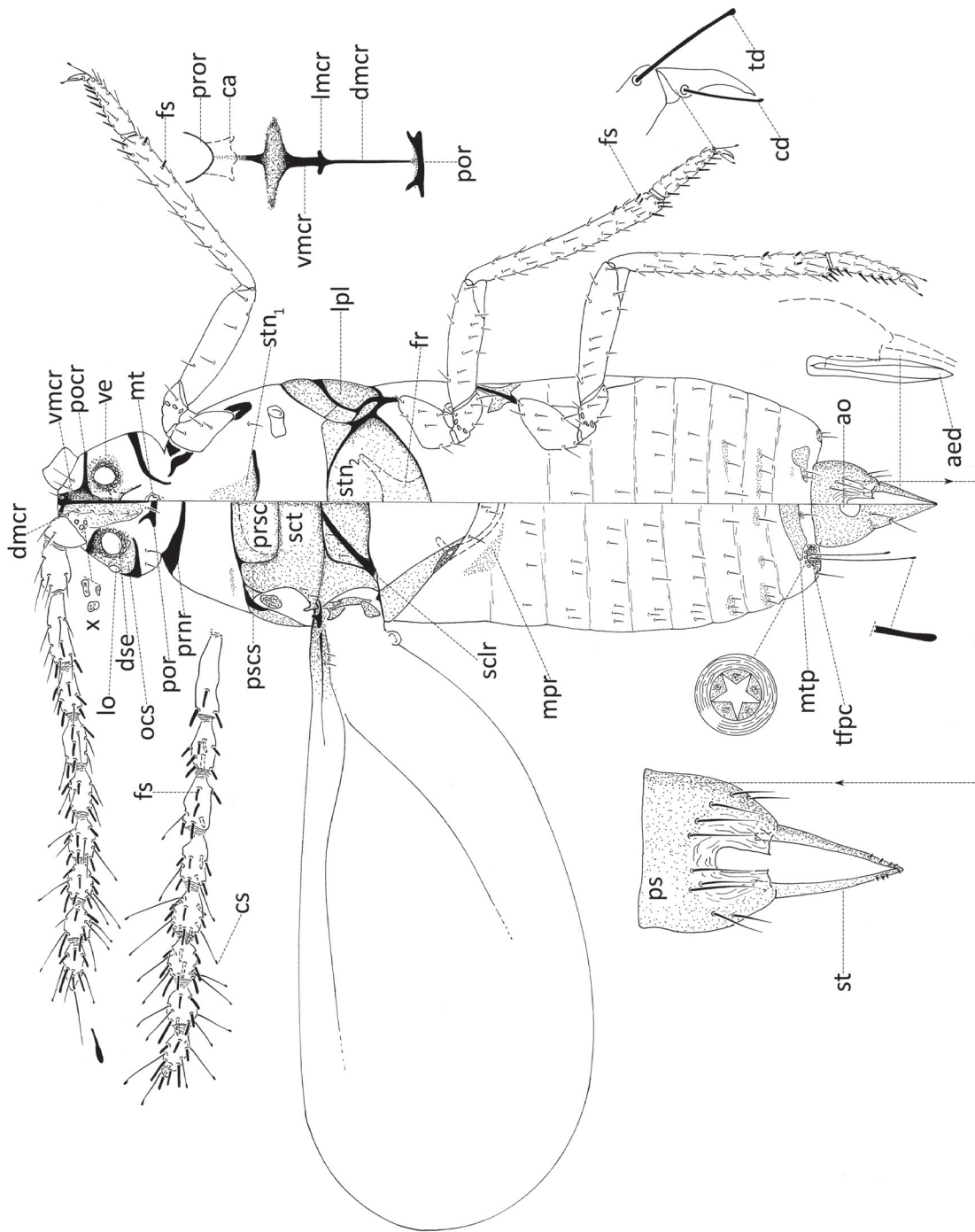


FIGURE 49. *Ovatococcus agavium* (Douglas 1888), adult male, Kew Gardens, England, United Kingdom, June 22, 1956, on *Agave decipens*, S.A. Affi and K. Boratyński. See methods section for explanation of abbreviations.

of setae on segments VI and VII. Metapostnotal ridge (mpr) normally present. Scutellar ridge (sclr) strongly developed. Scutum (sct) sclerotized throughout. Prescutum (prsc) rectangular. Prescutal suture (pscs) weakly developed. Pronotal ridges (pnrr) normally strongly developed; pronotal sclerites not observed. Hamulohalteres absent. Mesothoracic wings each with 2 setae near wing base. Postoccipital ridge (por) large, lateral ends normally bifurcate. Dorsal arm of midcranial ridge thin, usually nearly touching postoccipital ridge posteriorly, rarely ending far from postoccipital ridge; connected to lateral and ventral arms anteriorly. Dorsomedial sclerite (dmep) lightly sclerotized. Dorsal eye (dse) approximately 28 µm in diameter. Lateral ocellus (lo) approximately 15 µm in diameter, attached to postocular ridge by small arm. Ocular sclerite (ocs) strongly sclerotized dorsally.

Penial sheath (ps) 130–158 µm long, elongate, width/length 0.63–0.67, style (st) in lateral view straight, apically with several small papillae. Sheath with weak indication of longitudinal division ventrally. Dorsal surface heavily sclerotized; ventral surface with large membranous area as well as ventral slit in medial areas, sclerotized anteriorly and laterally. Basal rod absent.

Venter with flagellate setae present medially, mediolaterally, and laterally on segments II or IV to VIII, with 1 or 2 setae on segment II; thoracic setae, when present, restricted to single pair near anterior legs; head setae present only near anterior portion of ventral arm of midcranial ridge (vmcr). Abdominal sclerotization restricted to posterior 3 or 4 pregenital segments; segment VIII with conspicuous plate in submedial area and with 1 pair of small lateral plates; segments V to VII with light sclerotization in medial or submedial areas. Metathoracic precoxal ridge (pcr₃) weakly developed or absent. Lateropleurites (lpl) on mesothorax continuous. Mesosternum (stn₂) well-developed with large furca (fr). Prosternum (stm₁) varying from short to thin and triangular to rectangular. Mouth tubercle (mt) present. Preoral ridge (pror) heavily sclerotized, not touching postocular ridge. Cranial apophysis (ca) bifurcate. Ocular sclerite (ocs) unsclerotized except immediately surrounding ventral eye (ve). Ventral eye approximately same size as dorsal eye. Prothoracic and mesothoracic legs approximately equal in size, metathoracic legs longest. Trochanters each with 3 campaniform sensilla on each surface. Fleshy setae (fs) on distal portion of tibia, absent from tarsus. Inner setae on apical margin of tibia and inner margin of second tarsal segment enlarged; claw (cla) with small denticle (de). Antennae each 10-segmented, third segment longest, 1.8–2.1 times longer than apical segment, tenth segment apically pointed. Fleshy setae present on segments 3–10; capitate setae (cs) on segments 5 or 6–10.

Notes: The description is based on 16 specimens from four localities. Adult males are known for three species of *Ovaticoccus*: *Ov. adoxus*, *Ov. agavium*, and *Ov. salviae*. The adult male of *Ov. adoxus* is apterous and quite different from the other two; in fact, Hodgson (2020) suggested that the campaniform sensilla on the trochanter show more similarity to eriococcids in the Gondwanan lineage than those from North America. The adult males of *Ov. agavium* and *Ov. salviae* are similar to the adult male of *Ov. agavium* in lacking hamulohalteres, and in having 10-segmented antennae with fleshy setae and capitate setae, and similar genital capsules. They differ as follows (character states in brackets are of *Ov. agavium*): with two small unsclerotized circular areas on scutum next to the scutellum (scutum without unsclerotized areas); wing without hamulohaltere pocket (with pocket); lateral ocellus reduced or absent (present and obvious).

Fourth-instar male (pupa) (Fig. 50)

Description: Slide-mounted specimens 1.1–1.2 mm long, 0.4 mm wide. Body elongate, small lobes present on segment VIII.

Dorsum with flagellate setae of approximately same pattern as adult male; often with 1 lateral seta on each of posterior 4 or 5 abdominal segments, enlarged apically. Multilocular pores restricted to lateral margins of abdomen, with 3–13 loculi. Discoidal pores absent. Lobe on lateral margin of segment VIII sclerotized. Hamulohalteres absent. Front wing buds approximately 410 µm long, partially sclerotized. Ocular sclerite lightly sclerotized on dorsal and lateral areas only.

Penial sheath sclerotized, dorsally with 1 small lobe on each side of body, each with 2 elongate setae. Anal opening dorsal, without sclerotized rim.

Venter with multilocular pores of same kinds as on dorsum, present along lateral margins of segments I or II to VII or VIII, in small numbers on medial and mediolateral areas of anterior 4 or 5 segments, also near both pairs of spiracles. Discoidal pores absent. Flagellate setae of same distribution as adult male, slightly longer than dorsal setae, usually acute; longest lateral seta on segment VIII 88–98 µm long. Mouth tubercle present. Legs partially developed, setae indicated only by clear dots. Antennae each 10-segmented, about 200 µm long. Microtrichia on prothorax to segment VIII, and on venter of mid- and hind coxae. Eye represented by sclerotized band.

Notes: The description is based on 6 specimens from two localities. The macropterous pupa of *Hy. hyperici*

described in this work is similar to the macropterous pupa of *Ov. agavium* in having reduced appendages, reduced or no mouthparts, and the presence of multilocular pores and flagellate setae. They differ as follows (character states in brackets are of *Ov. agavium*): in lacking dorsal multilocular pores (pores present on margin).

Third-instar male (prepupa) (Fig. 51)

Description: Slide-mounted specimen about 1.0 mm long, 0.3 mm wide, not including wing buds. Small lateral lobes present on segment VIII.

Dorsum with flagellate setae of same pattern as adult male, of 2 types: some setae on medial, mediolateral and lateral areas of abdomen more robust than remaining setae, with apex slightly swollen, other setae apically acute. Multilocular pores either entirely absent or restricted to lateral margins of abdomen, rarely with 1 pore on thorax. Entire dorsum unsclerotized. Front wing buds approximately 19 µm long. Ocular sclerite absent.

Abdominal segment IX small, normally not protruding, unsclerotized except abortive ring near anal opening. Anal opening ventral. Small lobes sometimes visible.

Venter with multilocular pores with 9–13 loculi, scattered over surface except in medial areas of posterior abdominal segments. Flagellate setae apically acute, slightly longer than those on dorsum; longest lateral setae on segment VIII 75–89 µm long. Legs and antennae small and poorly defined, partially sclerotized. Eye absent.

Notes: The description is based on six specimens from two localities. No other prepupae of *Ovaticoccus* species have been described for comparison except those treated in this paper. The macropterous prepupa of *Hy. hyperici* is similar to the macropterous prepupa of *Ov. agavium* in having reduced appendages, reduced or no mouthparts, and in the presence of multilocular pores and flagellate setae. They differ as follows (character states in brackets are of *Ov. agavium*): dorsal multilocular pores present on posterior abdomen (absent); without a lobe on margin of segment VIII (present).

Second-instar male (Fig. 52)

Description: Slide-mounted specimens 0.8–1.0 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae and 0 or 1 5-locular pore; each ventrally with 2 or 3 flagellate setae including suranal seta and elongate anal-lobe seta, 0 or 1 tubular duct and 0 or 1 multilocular pore.

Dorsum with flagellate setae of 2 kinds: largest setae with slightly expanded apices, arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), rarely absent; smaller setae present over entire surface, apically acute. Enlarged setae normally absent, rarely with 1 or 2 on abdomen; segment IV with 11 or 12 flagellate setae, without enlarged setae. Macrotubular ducts present over entire surface. Microtubular ducts normally absent, rarely with 1 or 2 on abdomen. Multilocular pores normally restricted to last 3 or 4 abdominal segments near body margin, rarely with few pores in medial areas of anterior abdominal segments and thorax, of 4 kinds: 7-locular pores, 4-locular pores, and 3-locular pores in equal numbers; 5-loculars most abundant. Cruciform pores and microtrichia absent.

Anal ring ventral, semicircular, incomplete, non-cellular, with 3 setae on each side of ring, each normally shorter than diameter of ring; additional pair of setae often associated with, but not attached to, ring; anal tube weakly sclerotized, with dermal orifice sclerotized or unsclerotized; without anal flap.

Venter with flagellate setae on segment II 35–42 µm long, on segment VII 38–43 µm long; anal-lobe seta 95–115 µm long. Enlarged setae absent. Macrotubular ducts on mediolateral and lateral areas of thorax and abdomen, uncommon on head. Microtubular ducts absent. Multilocular pores scattered over entire surface. Cruciform pores variable, normally restricted to lateral margins of segments V to VII, each segment margin with 1 pore; rarely pores more abundant. Legs with hind coxae without pores; each femur with 3 setae, without proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 7-segmented, 175–183 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia present on ventral surface of hind 2 pairs of coxae.

Notes: The description is based on 29 specimens from three localities. The second-instar male of *Ov. agavium* is most similar to the second-instar male of *Ov. exoticus* in having few or no enlarged setae, lacking dorsal cruciform pores and in having similarly shaped anal rings. They differ as follows (character states in brackets are those of *Ov. agavium*): each femur with four setae including a proximal seta (with three setae, without a proximal seta); without ventromedial cruciform pores (normally with ventromedial cruciform pores).

First-instar nymph (Fig. 53)

Description: Slide-mounted specimens 0.5–0.6 mm long, 0.2–0.3 mm wide. Body elongate, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae; each ventrally with 2 flagellate setae including suranal and anal-lobe seta.

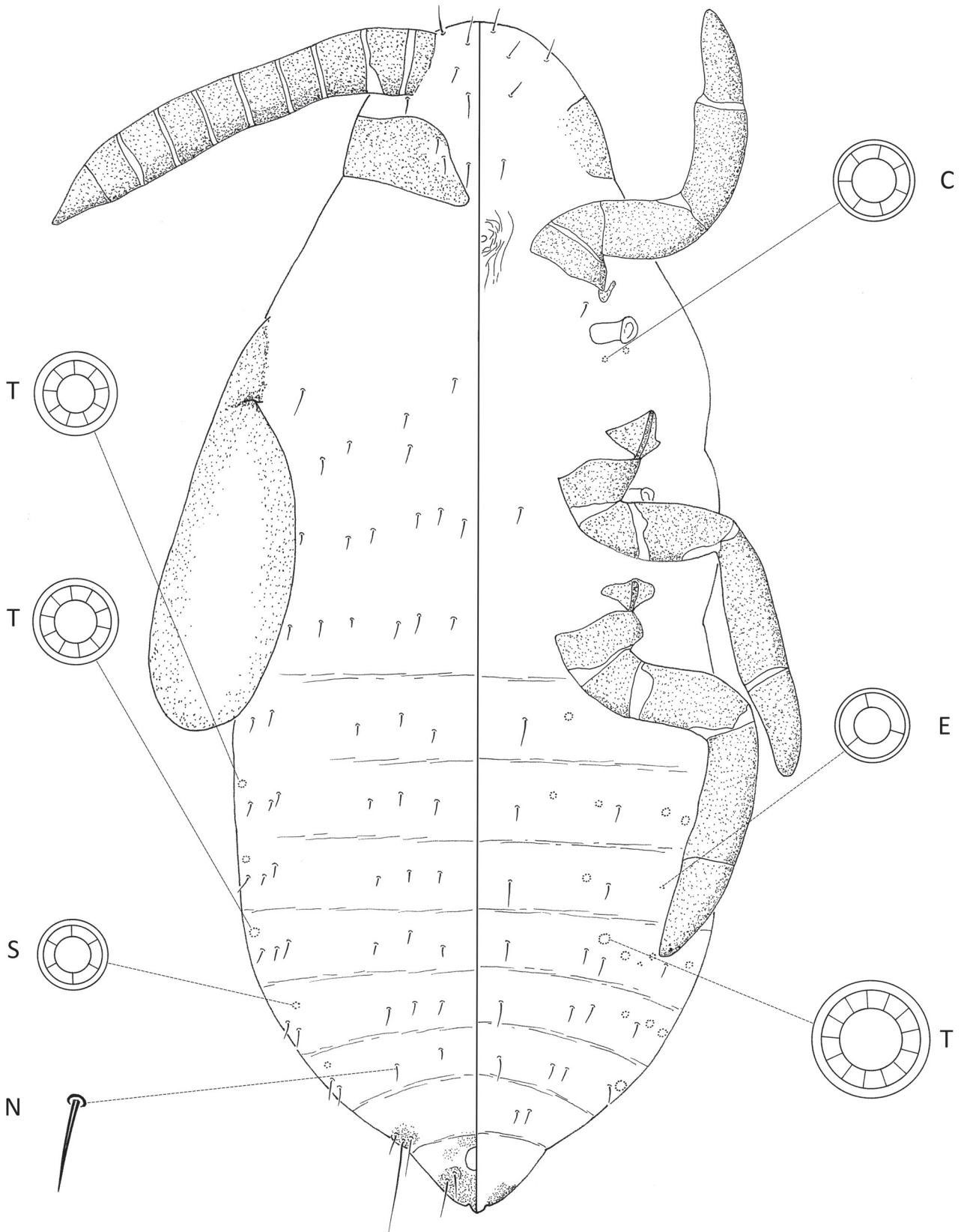


FIGURE 50. *Ovaticoccus agavium* (Douglas 1888), fourth-instar male (pupa). New York Botanical Garden, New York City, New York Co., New York, USA, July 1, 1921, on *Agave neglecta*, H.L. Stanford and L.C. Griffith. C=7-locular pore; E=3-locular pore; N=flagellate seta; S=6-locular pore; T=pore with >7 loculi.

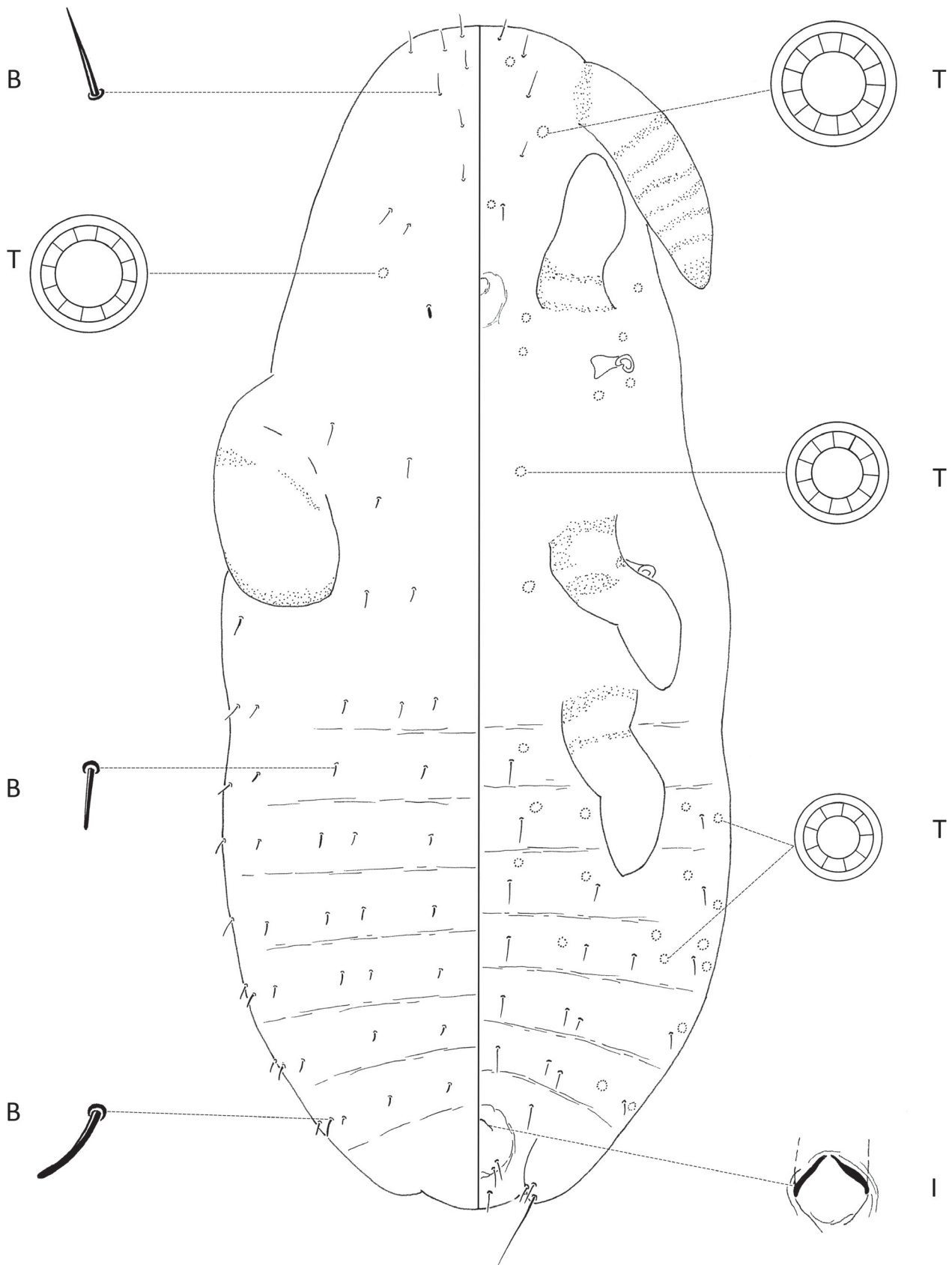


FIGURE 51. *Ovatococcus agavium* (Douglas 1888), third-instar male (prepupa). Cactus House, Missouri Botanical Garden, St. Louis, Independent City, Missouri, USA, July 25, 1923, on *Agave* sp., H.L. Stanford. B=slightly enlarged seta; I=anal ring; T=pore with >7 loculi.

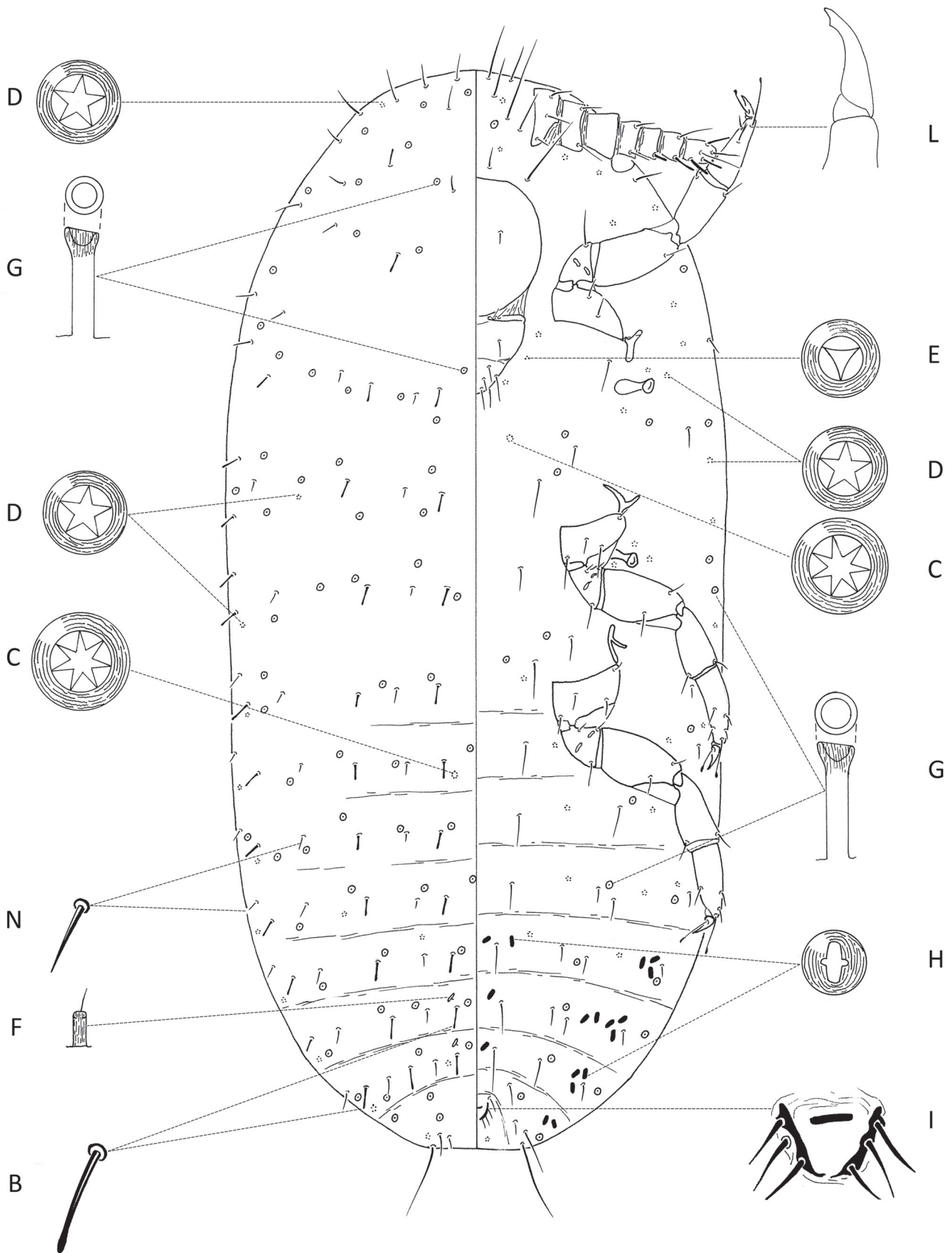


FIGURE 52. *Ovatococcus agavium* (Douglas 1888), second-instar male. Cactus House, Missouri Botanical Garden, St. Louis, Independent City, Missouri, USA, July 25, 1923, on *Agave* sp., H.L. Stanford. B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring; L=claw; N=flagellate seta.

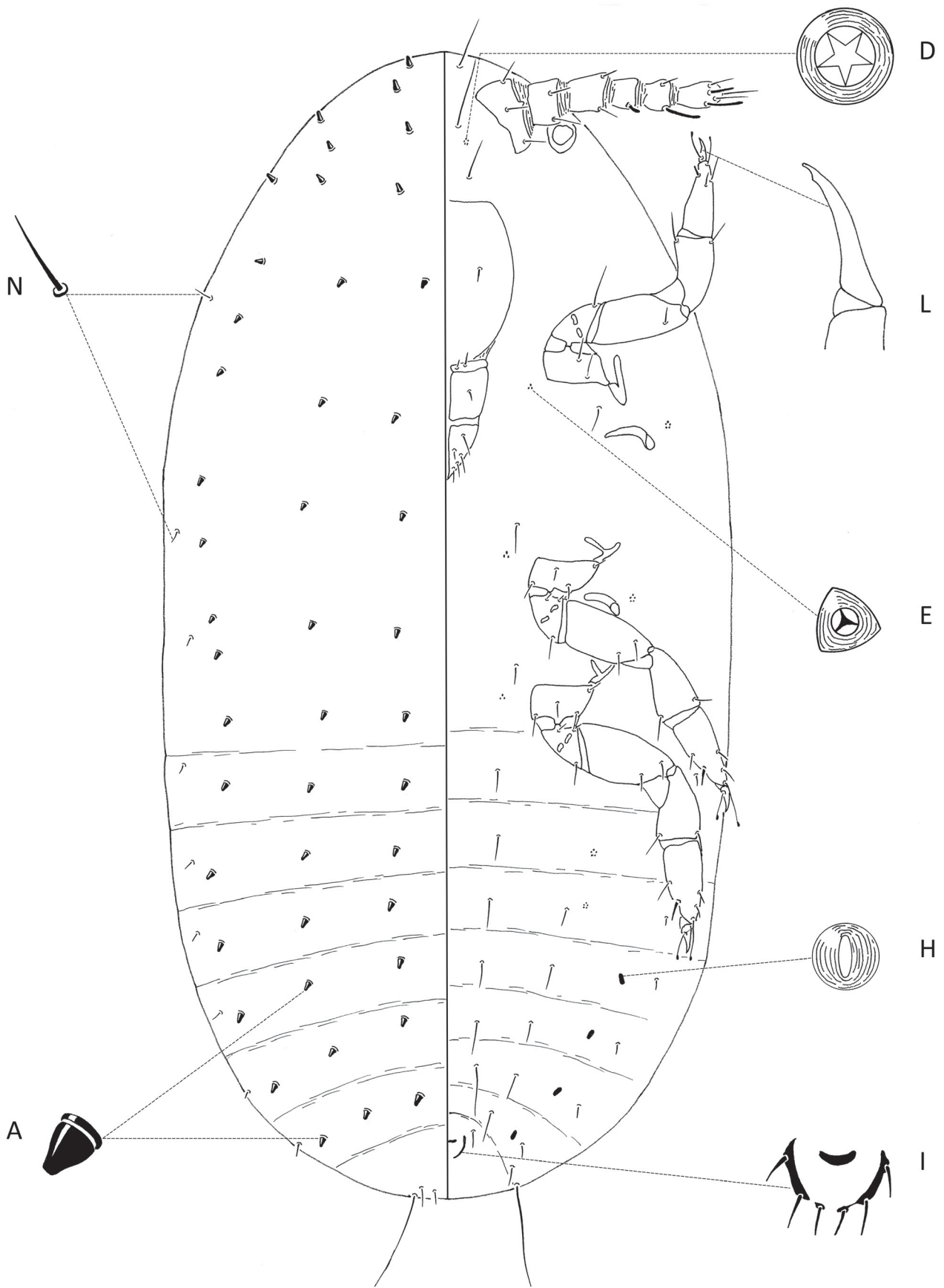


FIGURE 53. *Ovatococcus agavium* (Douglas 1888), first-instar nymph. New York Botanical Garden, New York City, New York Co., New York, USA, July 1, 1921, on *Agave neglecta*, H.L. Stanford and L.C. Griffith. A=enlarged seta; D=5-locular pore; E=3-locular pore; H=cruciform pore; I=anal ring; L=claw; N=flagellate seta.

Dorsum with flagellate setae in single longitudinal line along body margin. Enlarged setae of 1 size in 3 pairs of longitudinal lines (medial, mediolateral and lateral), in transverse rows from head to segment VII; largest seta 6–9 μm long; enlarged setae pear-shaped with truncate apex; setal base thin; segment IV with 6–8 setae including 6 enlarged setae and 2 flagellate setae; segment IV with combined total of 6–8 enlarged setae on dorsum and venter. Macrotubular ducts, microtubular ducts, multilocular pores, and cruciform pores absent. Microtrichia absent.

Anal ring ventral, semicircular, incomplete, divided anteriorly and posteriorly, non-cellular, with 3 setae on each side of ring, each normally shorter than diameter of ring; additional pair of setae often associated with, but not attached to, ring; anal tube with dermal orifice sclerotized or unsclerotized; anal orifice unsclerotized; without anal flap.

Venter with flagellate setae, longest seta on segment II approximately 16 μm long, on segment VII 20–27 μm long; longest anal-lobe seta approximately 85 μm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores fairly consistent; head normally with 5-locular pores, rarely 3-locular pores; spiracles each with 5-locular pores; mesothoracic and metathoracic legs each with 3-locular pores; segments IV and V each with 5-locular pores. Cruciform pores present in sublateral areas of segments V to VIII. Legs without pores; each femur with 3 setae, without proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7–0.9. Antenna 6-segmented, 105–115 μm long, Frontal lobes absent. Preantennal pore present. Microtrichia on metathorax to segment VIII, not visible on legs.

Notes: The description is based on 57 specimens from four localities. The first-instar nymph of *Ov. agavium* is most similar to the first-instar nymph of *Ov. exoticus* in having the dorsomedial longitudinal line of enlarged setae present at least on the abdomen, with similarly shaped anal rings, and usually with ventrolateral cruciform pores on the abdomen. They differ as follows (characters in brackets are those of *Ov. agavium*): each femur with four setae including a proximal seta (with three setae, without a proximal seta).

***Ovaticoccus betsyae* Miller and Stocks sp. n.**

Type material: Adult female holotype middle specimen of 3, with right label “*Ovaticoccus / betsyae* / Miller & Stocks / HOLOTYPE / [with a drawing of the position of the 3 specimens on the slide and arrows pointing to the 2 paratypes and holotype] / paratypes USNM.” Left label “*Ovaticoccus / betsyae* / Pinyon Hills / San Bernardino / Co., CA on *Yucca / brevifolia*, D.R. / Miller XII-7-81.” Label on back “*Ovaticoccus / betsyae* Miller & / Stocks / HOLOTYPE & / PARATYPES / USNM / Pinyon Hills.” Holotype is in USNM. **Paratypes:** UNITED STATES: California: Los Angeles Co.: Lancaster (taken in quarantine at Borrego Springs), XI-9-1956, on *Yucca brevifolia*, J.P. Dion (2 second-instar ♀♀ paratypes, 1 second-instar ♂ paratype on 3 slides) CDFA; Lancaster (taken in quarantine at San Diego), XII-13-1956, on *Yucca brevifolia*, J.P. Dion (2 ad. ♀♀ paratypes and 1 second-instar ♀ paratype on 1 slide) CDFA; Lancaster, IV-2-1963, on *Yucca brevifolia*, A. Cravens (2 ad. ♀♀ paratypes on 2 slides) CDFA; Lancaster (northern part), XII-27-1964, on *Yucca brevifolia*, D.R. Miller and J.F. Miller (2 ad. ♀♀ paratypes on 1 slide) UCD; San Fernando, I-15-1962, on *Yucca* sp., H. Whitmore (13 ad. ♀♀ paratypes on 11 slides) CDFA (9 slides), UCD (1 slide), USNM (1 slide); San Bernardino Co.: 3 mi. S. Kramer Junction, XII-28-1964, on *Yucca brevifolia*, D.R. Miller and J.F. Miller (2 ad. ♀♀ paratypes on 1 slide) UCD; 5 mi. S. Kramer Junction, I-24-1965, on *Yucca brevifolia*, D.R. Miller (2 ad. ♀♀ paratypes on 1 slide) UCD; Pinyon Hills, XII-7-1981, on *Yucca brevifolia*, D.R. Miller and E.R. Miller (1 ad. ♀ holotype, 2 ad. ♀♀ paratypes on 1 slide) USNM. Utah: Washington Co.: 2 mi. E. Welcome Spring, XI-18-2004, on *Yucca brevifolia*, M.E. Gruwell, R. Gwiazdowski, B.B. Normark (2 ad. ♀♀ on 1 slide, not a paratype) USNM.

The type specimens of this species from *Yucca* sp. were originally included by Miller and McKenzie (1967) in *Ovaticoccus californicus* primarily because both lack microtubular ducts; it now is apparent that they are a different species, here described as *Ov. betsyae*.

Etymology: *Ovaticoccus betsyae* is named in honor of Elizabeth (Betsy) Ross Miller who is the mother of the first author and who passed away at the age of 102 in 2020. She assisted in collecting the holotype of this species and often helped with collecting material in various parts of Southern California. She was present when the first author discovered that *Ov. salviae* occurs under the bark of its host. She and her husband James L. Miller (the first author’s father) spent many hours collecting *Ov. salviae* at a location on a regular basis and sent the samples to Maryland to help understand the life history of the species (see Appendix 1).

Field features: Occurring at base of leaves closely appressed to main body of plant.

Adult female (Fig. 54)

Description: Holotype, slide mounted, about 2.4 mm long, 1.4 mm wide (paratypes 1.9–2.4 mm long, 1.1–1.5 mm wide). Holotype with part of ventral surface of segment VIII located on dorsal surface, some paratypes similar, others with ventral segment of VIII entirely on venter. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally and ventrally with 5 flagellate setae (paratypes with 6 or 7 setae) including suranal seta and elongate anal-lobe seta, 6 5-locular pores (paratypes with 5–7).

Dorsum with flagellate setae scattered over entire surface, shorter than those on venter, straight. Enlarged setae on head, thorax, and abdomen, forming 2 sporadic longitudinal lines on mediolateral and lateral areas, with 11 setae (paratypes with 0–4 setae, not in longitudinal lines, present on head and posterior abdominal segments); largest seta 8 μm long (paratypes 8–10 μm); conical, sometimes with slight concavity near apex, central projection thin, with slightly rounded apex; setal base thin, not located in dermal pocket; segment IV with 13 setae including 1 enlarged seta and 12 flagellate setae (paratypes with 13–15 setae including 0 or 1 enlarged seta and 12–14 flagellate setae); segment IV with combined total of 0 or 1 enlarged seta dorsally and ventrally. Macrotubular ducts uncommon, in marginal and submarginal areas of segments VI–VIII, with 7 ducts (paratypes with 4–9) on segments V, VI or VII to VIII, each about 12 μm long (paratypes 10–18 μm). Microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores scattered over entire surface, less abundant anteriorly; 3-locular pores rare. Cruciform pores and microtrichia absent.

Anal ring ventral, circular, divided anteriorly (divided posteriorly and anteriorly in some paratypes), without cells, with 3 setae on each side of ring (paratypes sometimes with 1 missing on 1 side), each noticeably shorter than diameter of ring; anal tube unsclerotized; anal opening sclerotized; without anal flap.

Venter with longest seta on segment II 30 μm long (paratypes 18–30 μm), on segment VII 40 μm long (paratypes 38–42 μm); longest anal-lobe seta 127 μm long (paratypes 112–127 μm). Enlarged setae on 1 side of head (absent from paratypes) of same type as on dorsum. Macrotubular ducts absent (paratypes with 2 or 3 ducts on posterior abdominal segments). Microtubular ducts absent. Multilocular pores over entire surface, most abundant posteriorly, of 2 kinds: 5-locular pores most abundant; 3-locular pores rare or absent. Cruciform pores near body margin on segments IV–VI (paratypes with pores on any or all of segment III–VIII), with 6 pores on each side of body (paratypes with 1–8 pores). Legs with hind coxae with 4 and 5 dorsal pores and 1 faint ventral pore (paratypes with 3–6 dorsal pores, 1–8 ventral pores); each femur with 4 setae including 1 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7 (paratypes 0.6–0.8). Antennae each 7-segmented, 187 μm long (paratypes 168–210 μm). Frontal lobes absent. Preantennal pore present. Microtrichia absent from body, present on ventral surface of hind 2 pairs of coxae.

Notes: The description is based on six specimens from two localities. The adult female of *Ov. betsyae* is most similar to the adult female of *Ov. californicus* in lacking microtubular ducts and dorsal cruciform pores, having an incomplete anal ring and a proximal seta on the femur. They differ as follows (character states in brackets are of *Ov. betsyae*): multilocular pores with about equal numbers of 5-locular pores and 7-locular pores (predominantly 5-locular pores); cruciform pores common ventrolaterally, forming clusters of 9–18 pores on abdominal segments (ventrolateral clusters with one or two pores); occurring on *Agave* sp. (on *Yucca* sp.).

Second-instar female (Fig. 55)

Description: Slide-mounted specimen 0.8 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe area dorsally each with 2 flagellate setae and 2 5-locular pores; ventrally each with 3 flagellate setae including suranal seta and elongate anal-lobe seta, and 1 5-locular pore.

Dorsum with flagellate setae scattered over entire surface in segmental rows, often curved. Enlarged setae of 1 size, present erratically along body margin, occasionally in medial and mediolateral areas of thorax and abdomen; largest seta 10 μm long; enlarged setae each narrowly conical with thin apex; setal base thin, about same thickness as flagellate setal base; segment IV with 10 flagellate setae; without enlarged setae. Macrotubular ducts absent. Microtubular ducts absent. Multilocular pores all 5-locular pores present over entire dorsum, arranged in rows, less abundant on head. Cruciform pores absent. Microtrichia present on segments VII and VIII.

Anal ring ventral, semicircular, incomplete, non-cellular, with 3 poorly developed setae on each side of ring, each shorter than diameter of ring; additional pair of setae associated with, but not attached to, ring; anal tube weakly sclerotized, dermal orifice sclerotized.

Venter with flagellate setae, longest seta on segment II 12 μm long, on segment VII 25 μm long; anal-lobe seta 80 μm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores of

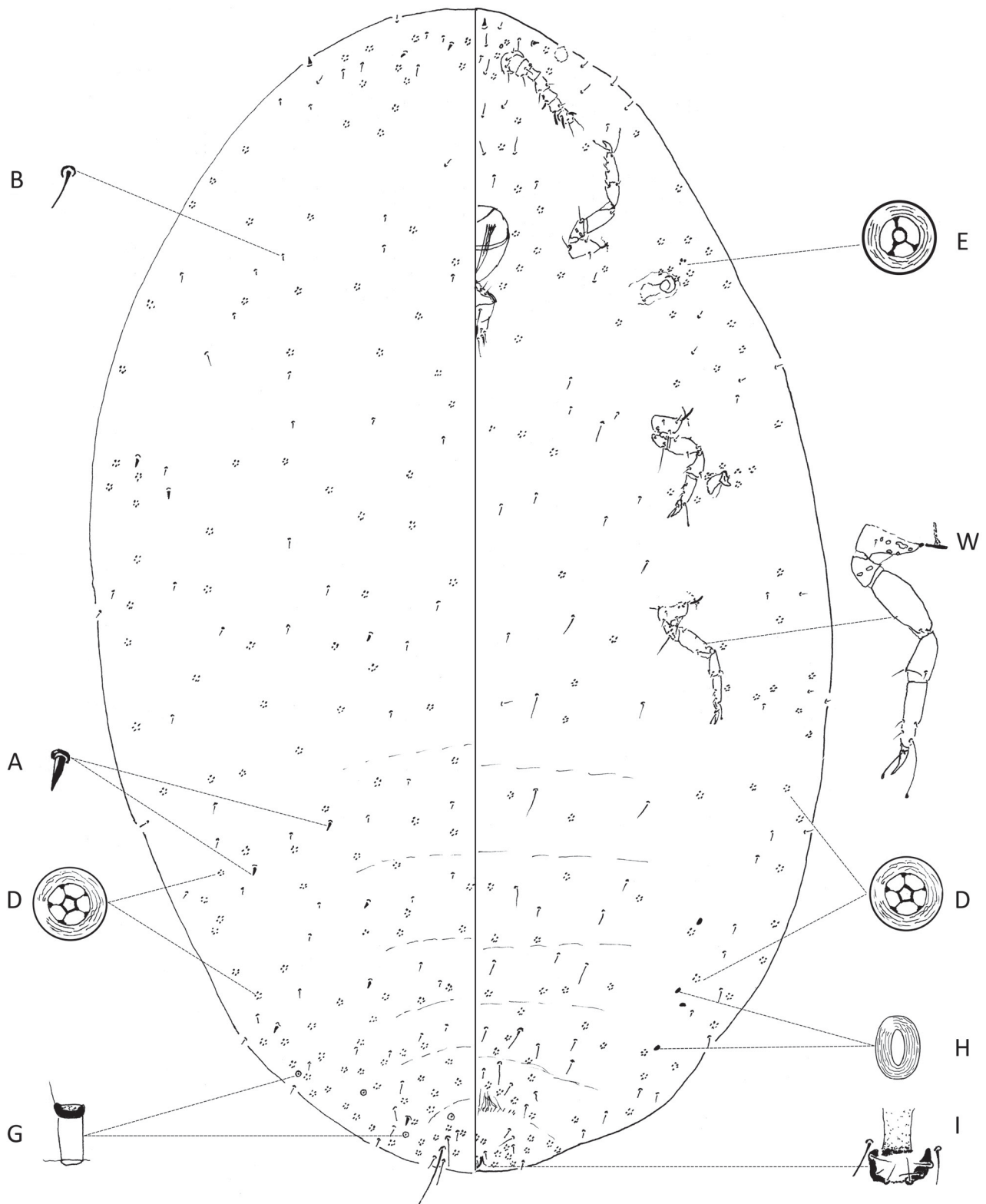


FIGURE 54. *Ovatococcus betsyae* sp. n., adult female, Lancaster (northern part), Los Angeles Co., California, USA., December 27, 1964, on *Yucca brevifolia*, D.R. Miller and J.F. Miller. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; G=macrotubular duct; H=cruciform pore; I=anal ring; W=hind leg.

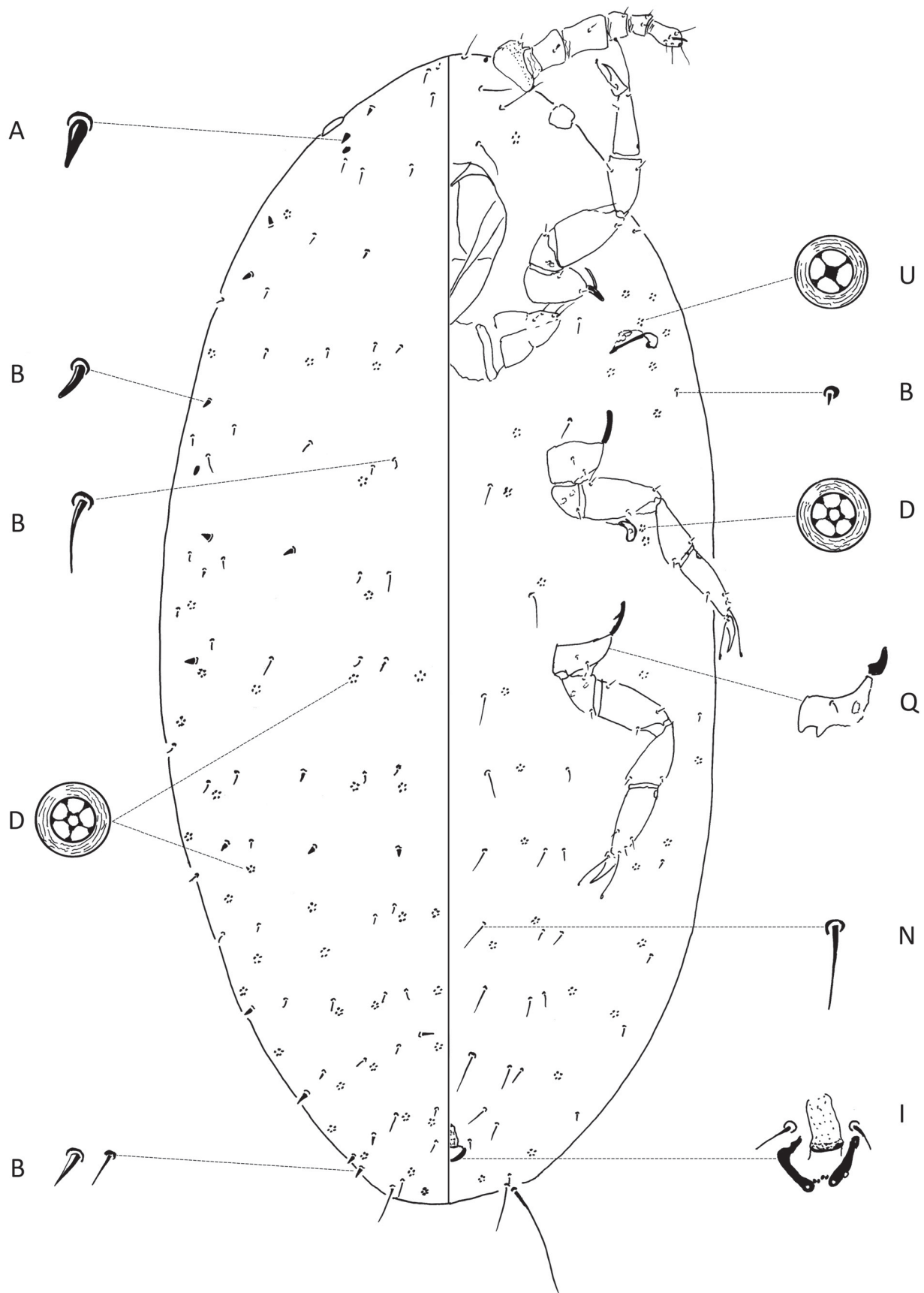


FIGURE 55. *Ovatococcus betsyae* **sp. n.**, second-instar female, Lancaster (taken in quarantine at San Diego), Los Angeles Co., California, USA, December 13, 1956, on *Yucca brevifolia*, J.P. Dion. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; I=anal ring; N=flagellate seta; Q=dorsal surface of coxa; U=4-locular pore.

2 kinds: 5-locular pores most abundant, scattered over entire surface; 4-locular pores near anterior spiracles. Cruciform pores rare, 1 near body margin on segment V. Legs with 0 or 1 translucent pores on hind coxa; each femur with 4 setae including 1 proximally and 3 distally; each tibia with 3 setae, without middle setae; hind tibia/tarsus 0.8. Antennae each 6-segmented, about 138 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia on head to segment VIII and on ventral surface of hind 2 pairs of coxae.

Notes: The description is based on three specimens from two localities. The second-instar female of *Ov. betsyae* is most similar to the second-instar female of *Ov. neglectus* in lacking cruciform pores and in having an incomplete anal ring with setae absent or much shorter than diameter of ring. They differ as follows (character states in brackets are of *Ov. betsyae*): each femur with three setae, without proximal seta (four setae, with one proximal seta); microtubular ducts present (absent); enlarged setae broad, with lateral margins curved (enlarged setae narrow, with lateral margins nearly straight); enlarged setae in three definite pairs of longitudinal lines from mesothorax to segment VII (enlarged setae with three indefinite pairs of longitudinal lines, setae in medial and mediolateral lines often replaced by flagellate or transitional setae).

Second-instar male

A single specimen of *Ovaticoccus betsyae* is available, but it is in such poor condition that an illustration has not been attempted. Character states that can be discerned are presented below, others are left out.

Description: Slide-mounted specimen 0.7 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally and ventrally with flagellate setae and tubular ducts.

Dorsum with flagellate setae scattered over entire surface in segmental rows, often curved. Enlarged setae absent; segment IV with 8 flagellate setae. Macrotubular ducts scattered over entire surface. Microtubular ducts absent. Multilocular pores all 5-locular pores arranged in rows, less abundant on head. Cruciform pores absent. Microtrichia on segments VI to VIII.

Anal ring semicircular, incomplete, non-cellular, with 3 poorly developed setae on each side of ring, each shorter than diameter of ring; additional pair of setae associated with, but not attached to, ring; anal tube weakly sclerotized, anal opening sclerotized.

Venter with body setae flagellate, longest seta on segment II 30 μm long, on segment VII 30 μm long; anal-lobe seta broken. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores all 5-locular, scattered over entire surface. Cruciform pores absent. Legs without translucent pores on hind coxa; each femur with 4 setae, including 1 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.5. Antennae each 7-segmented, about 92 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia on abdomen and on ventral surface of hind 2 pairs of coxae.

Notes: The description is based on one specimen that is not in good enough condition to illustrate. The second-instar male of *Ov. betsyae* is most similar to the second-instar male of *Ov. neglectus* and *Ov. salviae* in lacking pores in the anal ring and ventral cruciform pores. They differ as follows (characters in brackets are of *Ov. betsyae*): each femur with three setae, without proximal seta (four setae with one proximal seta).

Ovaticoccus cornutus (Ferris) comb. n.

Cornoculus cornutus Ferris 1955: 81.

Specimens examined: UNITED STATES: Texas: Brewster Co.: Chisos Mountains, ?-?-1921, on undetermined grass, G.F. Ferris (4 second-instar ♀♀) UCD.

The adult female and second-instar female (as “late instar”) were described in detail in Miller and McKenzie (1967) and Ferris (1955) and the information in those publications is not repeated here. The justification for treating *Cornoculus* as a junior synonym of *Ovaticoccus*, leading to this new species combination, is provided in the “Notes” section that follows the generic description above.

Etymology: The species epithet “*cornutus*” is formed from the Latin word “*cornutus*” meaning “horned” and refers to the horn-like eyes of this species.

Second-instar female (Fig. 56)

Description: Slide-mounted specimen 1.4 mm long, 0.6 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae, 1 enlarged seta, 2 or 3 microtubular ducts; each ventrally with 2 or 3 flagellate setae including suranal seta and anal-lobe seta, 1 enlarged seta.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (medial and lateral), usually short and curved. Enlarged seta arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral); nipple-shaped, laterally with curved margins, setal ring thick, often set in pocket in derm, with 36 setae on each side of body, with 1 conical seta on head; largest seta about 15 µm long; segment IV with 10 setae including 6 enlarged and 4 flagellate setae; segment IV with combined total of 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 7 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, ¼ or ½ length of remaining sclerotized portion; total sclerotized area same length as, or longer than, unsclerotized area; dermal orifice weakly sclerotized, with protruding tube. Multilocular pores restricted to head; pores of 2 kinds: 7-locular pores and 5-locular pores. Cruciform pores in transverse rows from thorax to anterior abdominal segments. Microtrichia on posterior 3 abdominal segments.

Anal ring ventral, oval, tongue-like structure fusing anterior end of ring forming complete structure, cellular, with 2 setae on each side of ring, each shorter than diameter of ring; anal tube without sclerotization, anal orifice unsclerotized, with anal flap.

Venter with longest flagellate seta on segment II 28 µm long, on segment VII 28 µm long; anal-lobe setae broken. Enlarged setae along body margin from head to segment VIII, in 2 pairs of longitudinal lines on lateral and sublateral areas, sublateral setae slightly smaller. Macrotubular ducts absent. Microtubular ducts along body margin, associated with enlarged setae. Multilocular pores scattered in medial and mediolateral areas of head, thorax, and anterior abdominal segments, also laterally on head and anterior thorax, of 3 kinds: 7-locular pores most abundant, 6-locular pores and 5-locular pores also present. Cruciform pores rare near body margin on thorax and abdomen. Legs with 1 or 2 indefinite pores on dorsal surface of hind coxa; each femur with 5 setae including 2 proximal setae and 3 distal setae; each tibia with 4 setae, without middle setae; hind tibia/tarsus 0.8. Antennae each 6-segmented, 135 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from prothorax to segment VII, also on each coxa.

Notes: This description is based on one specimen from the type locality. Second-instar females of *Ov. cornutus* are most similar to second-instar females of *Ov. tippinsi* in having dorsal cruciform pores, the most predominant multilocular pore with more than five loculi, a cellular anal ring, each femur with five setae, and two pairs of ventrolateral longitudinal lines of enlarged setae. They differ as follows (character states in brackets are of *Ov. cornutus*): anal ring divided anteriorly and posteriorly (not divided or divided anteriorly); predominant multilocular pore with more than seven loculi (seven loculi); dorsal enlarged setae restricted to posterior abdomen (over entire dorsum); dorsal multilocular pores scattered over dorsal surface (restricted to head). *Ovaticoccus cornutus* also is similar to *Ov. telotrichus*; for a comparison, see the “Notes” section of that species below.

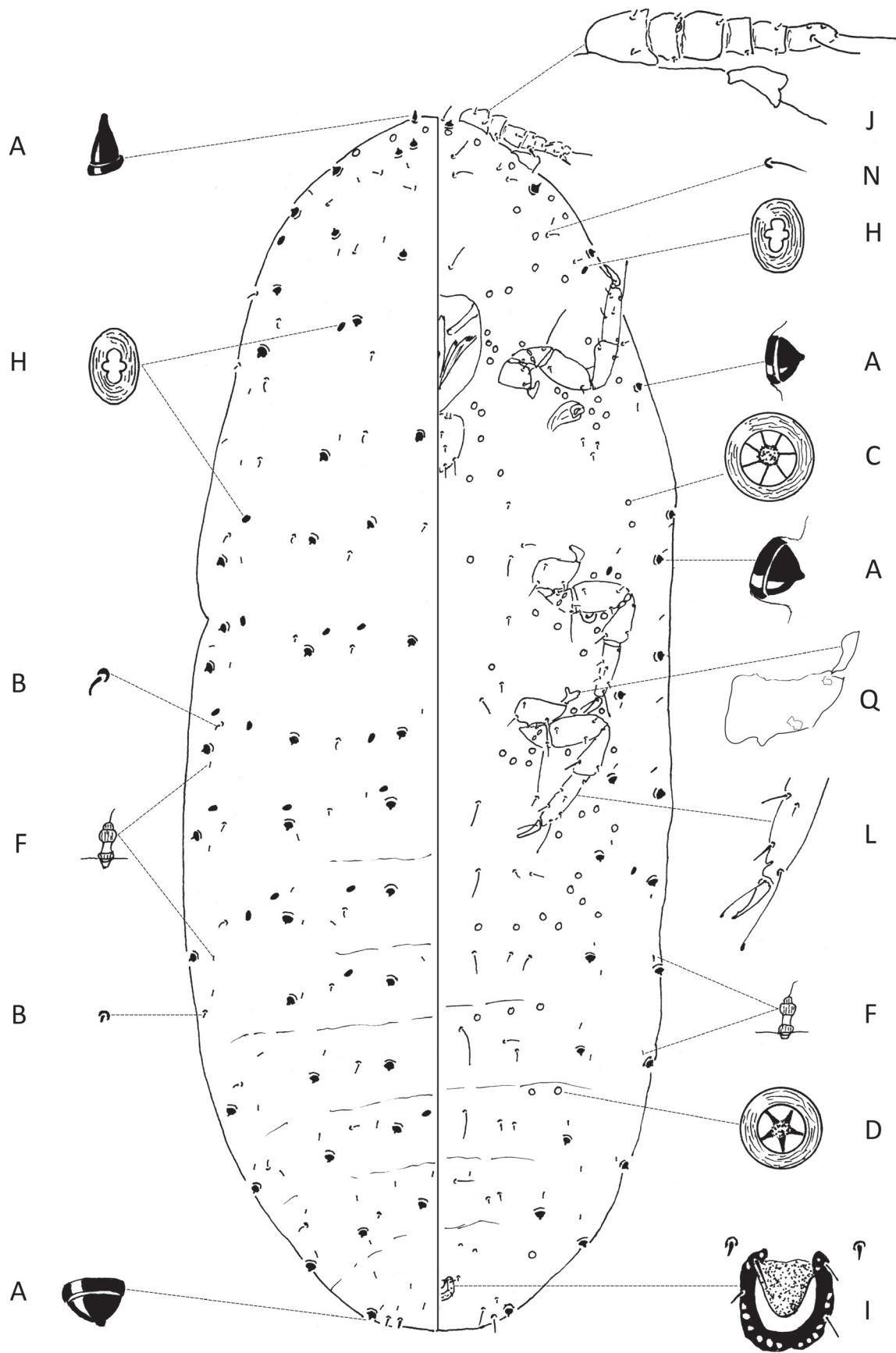


FIGURE 56. *Ovatococcus cornutus* (Ferris 1955), second-instar female, Chisos Mountains, Brewster Co., Texas, USA., ?-?-1921, on undetermined grass, G.F. Ferris. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; N=flagellate seta; Q=dorsal surface of coxa.

***Ovaticoccus californicus* McKenzie**

Ovaticoccus californicus McKenzie 1964: 22.

The adult female of this species was described in detail by McKenzie (1964) and was redescribed by Miller and McKenzie (1967); information from these papers is not repeated here.

Notes: In McKenzie (1964) there is mention of immature specimens of *Ov. californicus*, but it is clear that these specimens are of an entirely different species (Miller & McKenzie, 1967). One slide contains two adult female paratypes that definitely are *Ov. californicus*, but the two second-instar females are not conspecific. One specimen has an adult that has emerged far enough to see characteristics useful for conclusions about its identity. It has the following character states: numerous translucent pores on the hind coxa, some of which are on the derm anterior to the coxa (a diagnostic characteristic of *Ov. neglectus*); microtubular ducts present on both surfaces; broad enlarged setae; each femur with four setae including one that is proximal; anal ring circular, perhaps divided anteriorly; anal-ring setae longer than diameter of ring. We conclude that although these specimens are similar to *Ov. neglectus*, they differ in the number of setae on each femur and the length of the anal ring setae; they appear to be specimens of an unknown species.

Adult-female specimens of *Ov. californicus* collected on *Yucca* sp. were misidentified by Miller and McKenzie (1967) and are now considered to be *Ov. betsyae*.

***Ovaticoccus davesmithi* (Miller & Stocks) comb. n.**

Oregmopyga davesmithi Miller and Stocks 2017: 807–822.

The justification for treating *Oregmopyga* as a junior synonym of *Ovaticoccus*, leading to this new species combination, is provided in the “Notes” section that follows the generic description above.

Etymology: The species epithet “*davesmithi*” was named in honor of Dave Smith, Systematic Entomology Laboratory, United States Department of Agriculture, Washington, D.C., USA, in recognition of his numerous scientific achievements.

***Ovaticoccus densus* (Miller) comb. n.**

Cornoculus densus Miller in Miller and McKenzie 1967: 487–489.

The justification for treating *Cornoculus* as a junior synonym of *Ovaticoccus*, leading to this new species combination, is provided in the “Notes” section that follows the generic description above. The adult female and second-instar female (as “second or third-instar”) of this species were described by Miller and McKenzie (1967). We do not provide a redescription of the adult female, but provide more information about the second-instar female.

Etymology: The species epithet “*densus*” is formed from the Latin word “*densus*” meaning “dense” or “compact” and refers to the unusual concentration of macro tubular ducts on the lateral areas of the abdomen.

Second-instar female (Figs 57 and 58)

Description: Slide-mounted specimens 1.9–2.4 mm long, 0.8–1.2 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae, 1 or 2 enlarged seta, 1 or 2 microtubular ducts; each ventrally with 2–4 flagellate setae including suranal seta, anal-lobe seta and 0–1 enlarged seta, with 0–1 cruciform pore.

Dorsum with flagellate setae scattered over entire surface in medial and mediolateral areas, also marginally on head and anterior thorax, usually short and curved. Enlarged setae restricted to lateral areas from head to segment VII or VIII; setae dome-shaped, often set in pocket in derm, with 40–54 setae on each side of body; largest seta about 12–15 µm long; segment IV with 16 or 17 setae including 5–8 enlarged setae and 9–11 flagellate setae; segment IV with combined total of 8 enlarged setae dorsally and ventrally. Macro tubular ducts absent. Microtubular ducts 7–8 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, ¼ or ½ length of remaining sclerotized portion; total sclerotized area much longer than unsclerotized area; dermal orifice large,

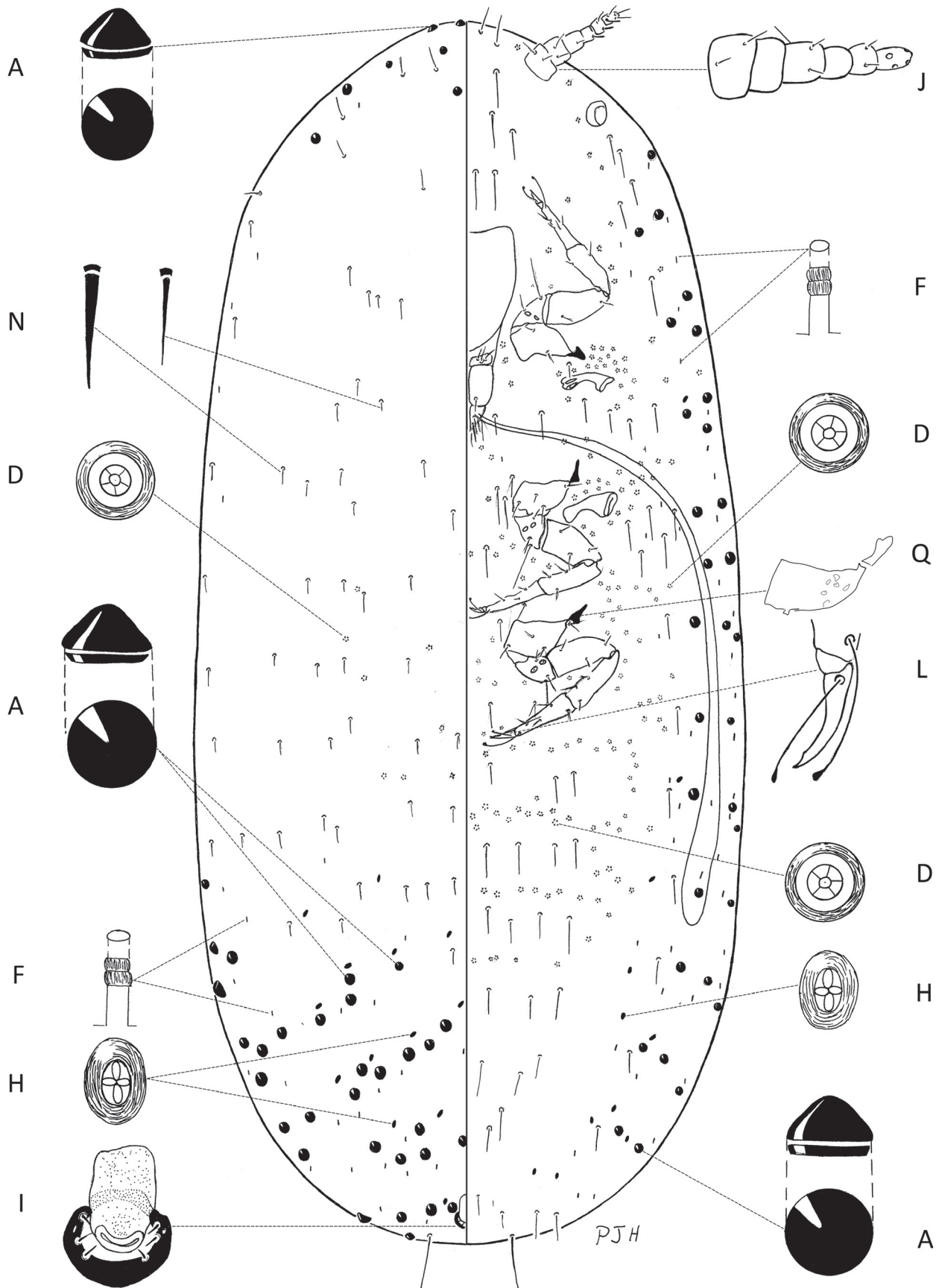


FIGURE 57. *Ovatococcus densus* (Miller 1967), second-instar female, #1 (more dorsal enlarged setae). Seeley, Imperial Co., California, USA, March 25, 1965, on *Hilaria rigida*, R.A. Flock and L. Pineda. A=enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; N=flagellate seta; Q=dorsal surface of coxa.

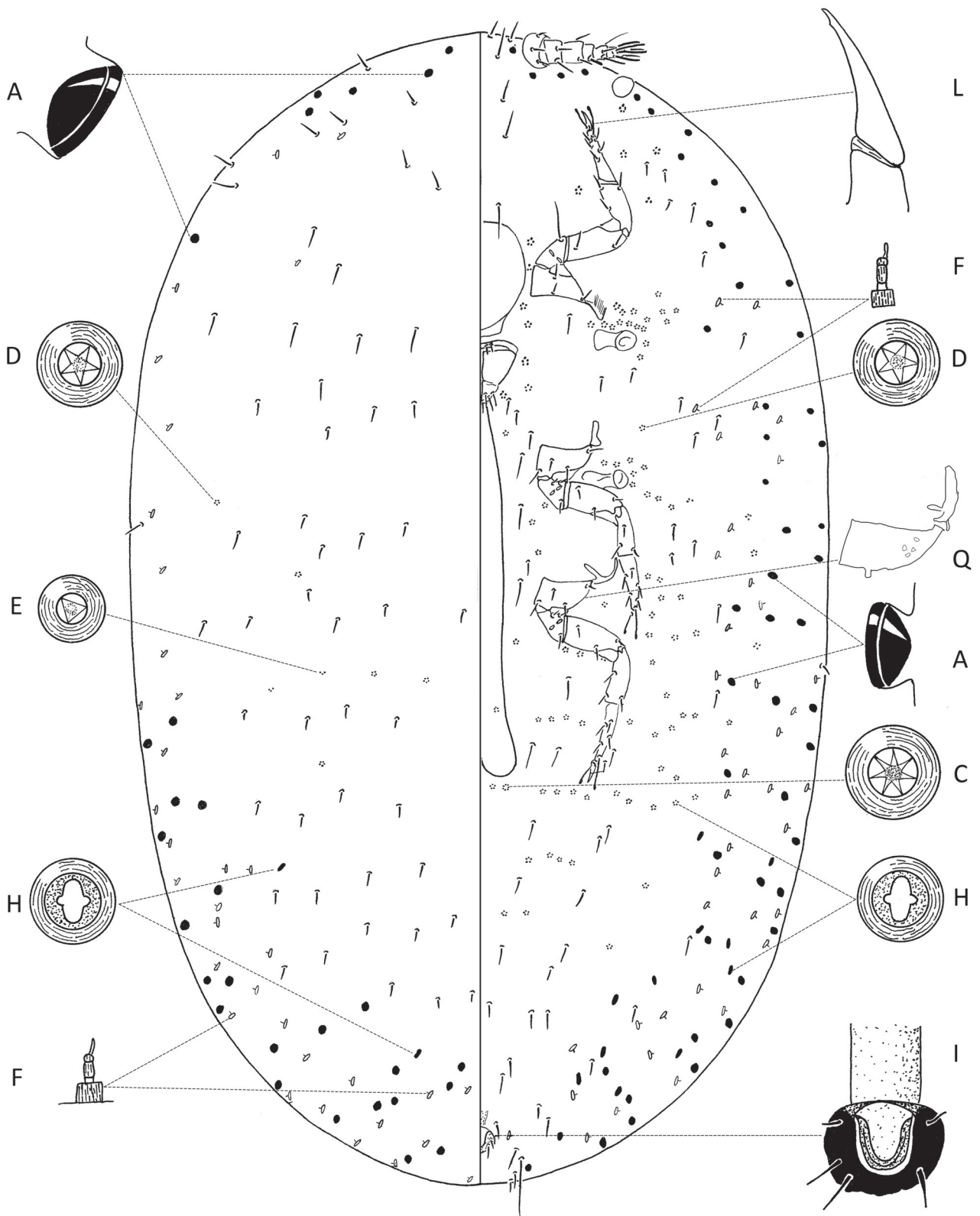


FIGURE 58. *Ovaticoccus densus* (Miller 1967), second-instar female, #2 (fewer dorsal enlarged setae). 2 miles E. Yuma, Yuma Co., Arizona, USA, July 29, 1966, on *Distichlis* sp., D.R. Miller. A=enlarged seta; C=7-locular pore; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; L=claw; Q=dorsal surface of coxa.

heavily sclerotized, without protruding tube. Microtubular ducts scattered laterally from prothorax or mesothorax to segment VIII. Multilocular pores absent on 1 specimen, or present on metathorax to segment II; pores of 3 kinds: 3-locular pores and 4-locular pores uncommon, 5-locular pores most abundant. Cruciform pores variable, restricted to mediolateral areas of posterior segments in some specimens, present medially and mediolaterally on others. Without microtrichia.

Anal ring ventral, oval, tongue-like structure fusing anterior end of ring forming complete structure, non-cellular or with weakly indicated pores near bases of setae, with 2 or 3 indefinite setae on each side of ring, each shorter than diameter of ring; extra seta anterior to ring sometimes attached to ring with noticeable sclerotization. Anal tube sclerotized, anal opening sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 38–47 μm long, on segment VII 30–38 μm long; anal-lobe setae 120–132 μm long. Enlarged setae along body margin from head to segment VIII, sometimes absent from head and anterior thorax, in 2 pairs of longitudinal lines on lateral and sublateral areas, sublateral setae slightly smaller. Macrotubular ducts absent. Microtubular ducts present along body margin, associated with enlarged setae. Multilocular pores scattered in medial, mediolateral, and lateral areas of head, thorax, and segments II to V, of 3 kinds: 5-locular pores most abundant, 4-locular pores and 7-locular pores rare. Cruciform pores near body margin on segments IV to VIII. Legs with 1–5 indefinite pores on dorsal surface of hind coxa; each femur with 5 setae including 2 proximal setae and 3 distal setae; each tibia with 5 setae, with 1 seta in middle; hind tibia/tarsus 0.8–0.9. Antennae each 6-segmented, 187–188 μm long. Frontal lobes absent. Preantennal pores present. Microtrichia from mesothorax to segment VIII, also on mesothoracic and metathoracic coxae.

Notes: This description is based on three specimens from two localities. Second-instar females of *Ov. densus* are most similar to the second-instar female of *Ov. davesmithi* in having dome-shaped enlarged setae restricted to the body margin, multilocular pores predominantly with five loculi, and each femur with five setae. They differ as follows (character states in brackets are of *Ov. densus*): each tibia with four setae, without a seta in the middle (with five setae, with a seta in the middle); with one or two multilocular pores on each side of the anterior abdominal segments (in rows of more than 10 multilocular pores on each side of the anterior abdominal segments).

First-instar nymph (Fig. 59)

Description: Slide-mounted specimen 1.2 mm long, 0.7 mm wide. Body elongate or broadly oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 or 3 flagellate setae; each lobe ventrally with 1 enlarged seta and 3 flagellate setae including suranal seta and elongate anal-lobe seta.

Dorsum with flagellate setae arranged in 3 pairs of loose longitudinal lines on head and thorax (medial, mediolateral and lateral), in 2 pairs of lines on abdomen (medial and mediolateral) all about same size, shorter than those on venter. Enlarged setae in 1 pair of longitudinal lines on abdomen (lateral), with 1 seta on each side of each body segment from segment III to VII, with 1 enlarged seta medially on segment VII. Enlarged setae dome-shaped, with width about same size or wider than length, of 1 size; largest seta 7 μm long, without definite apex, and narrow setal base; segment IV with 6 setae, including 4 flagellate setae and 2 enlarged setae; segment IV with combined total of 4 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each about 6 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or rectangular, about half size of remaining sclerotized portion; sclerotized area at least 2 times longer than unsclerotized area; dermal orifice heavily sclerotized, sometimes with inconspicuous protruding tube. Microtubular ducts from mesothorax to segment VII. Multilocular pores absent. With 1 cruciform pore on each side of body marginally on segment VI. Microtrichia in medial areas from metathorax to abdominal segment VIII.

Anal ring ventral, circular, complete, with few or no cells, with 3 setae on each side of ring, each about same length as greatest diameter of ring; additional pair of setae associated with, but not attached to, ring. Orifice of anal tube heavily sclerotized, with anal flap.

Venter with flagellate setae on segment II about 15 μm long, on segment VII 26 μm long; elongate anal-lobe seta 110 μm long. With 1 enlarged seta on lateral margin of each side of each body segment from head to segment VII, extra seta on mesothorax. Microtubular ducts absent. Multilocular pores with 1 mesad to each leg, and 1 associated with each spiracle, absent elsewhere, multilocular pores of 2 kinds: 7-locular pores associated with spiracles; 5-locular pores associated with each leg, 5-locular pores most numerous. Cruciform pores absent. Legs without pores; each femur with 5 setae, including 2 proximal and 3 distal; each tibia with 5 setae including 1 in middle; hind tibia/tarsus 0.8. Antennae each 6-segmented, about 138 μm long. Frontal lobes absent. With preantennal pore. Microtrichia in medial and mediolateral areas of abdomen.

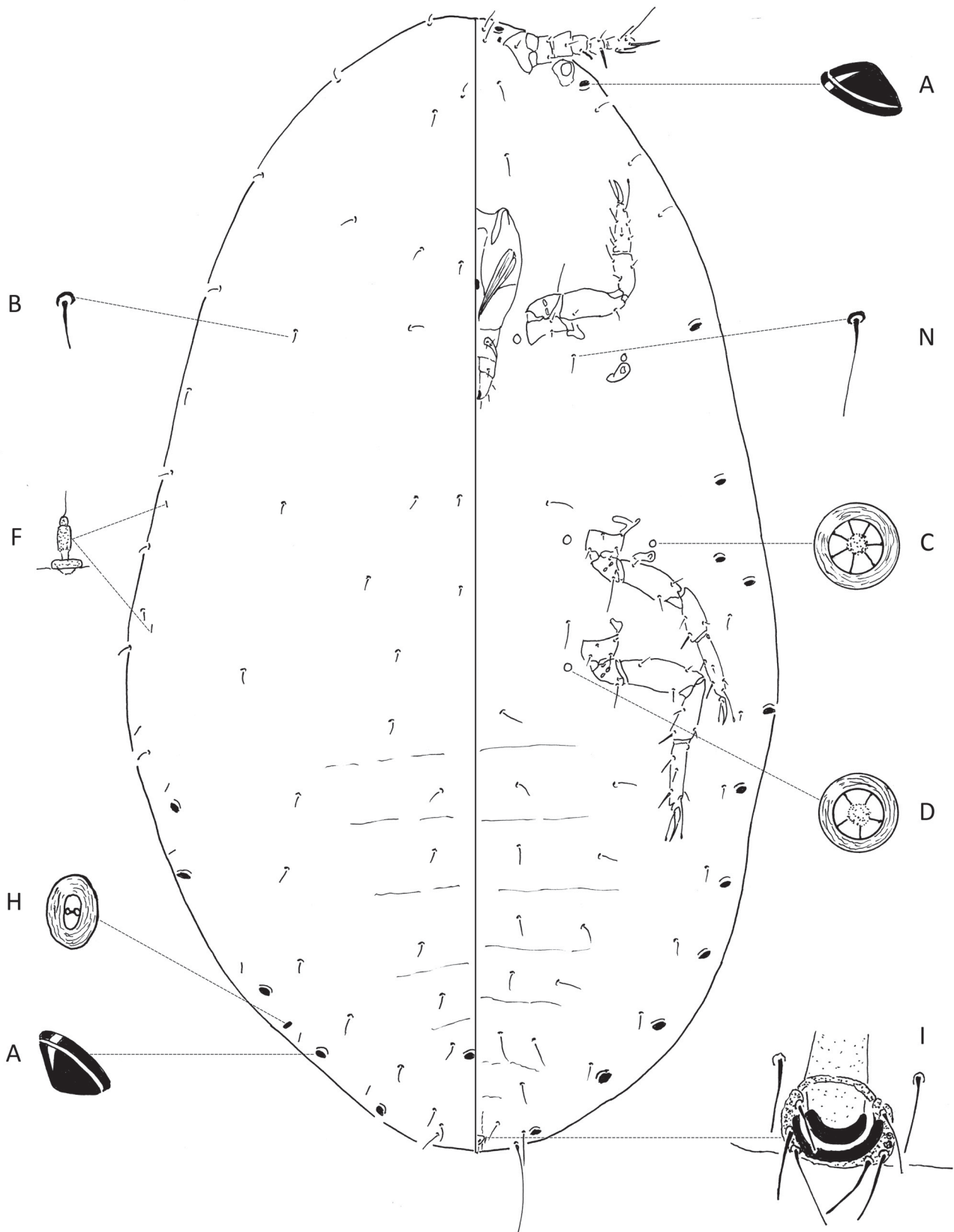


FIGURE 59. *Ovaticoccus densus* (Miller 1967), first-instar nymph, 2 miles E. Yuma, Yuma Co., Arizona, USA, July 29, 1966, on *Distichlis* sp., D.R. Miller. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; N=flagellate seta.

Notes: The description is based on one specimen from one locality. The first-instar nymph of *Ov. densus* is most similar to the first-instar nymph of *Ov. davesmithi* in having dome-shaped enlarged setae restricted to the body margin, and each femur with five setae. They differ as follows (character states in brackets are of *Ov. densus*): each tibia with four setae, without a seta in the middle (with five setae, with a seta in the middle); with a few multilocular pores on venter of abdomen (absent from abdomen).

***Ovaticoccus eriogoni* (Miller) comb. n.**

Oregmomyga eriogoni Miller in Miller and McKenzie 1967: 491.

Specimens examined: UNITED STATES: California: Los Angeles Co.: 4 mi. N. Castaic, VI-19-1964, on *Eriogonum* sp., D.R. Miller (1 ad. ♀, 1 second-instar ♀ on 2 slides) UCD; Riverside Co.: Poppet, 2 mi. N. Poppet Flats, Highway 243, IV-20-1999, on *Eriogonum* sp., I. Foldi and R.J. Gill (10 ad. ♀♀ on 3 slides) CDF; Whitewater Cny., 4 mi. N. Highway 10, near Whitewater, III-25-1971, on *Eriogonum* sp., R.J. Gill and E. Paddock (3 ad. ♀♀, 1 second-instar ♂ on 4 slides) CDF; San Diego Co.: 1 mi. E. Mt. Laguna, III-6-1983, on *Eriogonum* sp., R.J. Gill (5 ad. ♀♀ on 2 slides) CDF; 5 mi. S.E. Fallbrook, V-8-1964, on *Eriogonum* sp., D.R. Miller (1 second-instar ♀, 3 first-instar nymphs on 1 slide) UCD; Santa Barbara Co.: Santa Rosa Island, middle of Water Canyon, VI-10-1978, on *Eriogonum* sp., D.R. Miller (6 ad. ♀♀, 5 first-instar nymphs on 8 slides) USNM; Ventura Co.: S.E. Oxnard, IV-25-1969, on *Eriogonum* sp., D.R. Miller and A.A. Grigarick (2 ad. ♀♀ on 1 slide) UCD.

The justification for treating *Oregmomyga* as a junior synonym of *Ovaticoccus*, leading to this new species combination, is provided in the “Notes” section that follows the generic description above. The adult female and second-instar female (as “second or third-instar”) of this species were described by Miller and McKenzie (1967). We do not provide a redescription of the adult female, but do provide more information about the second-instar female.

Etymology: The species epithet “*erion*” is based on the scientific name of the host of this species.

Second-instar female (Fig. 60)

Description: Slide-mounted specimens 0.8–1.1 mm long, 0.4–0.6 mm wide. Body elongate oval, with slightly protruding anal lobes. Anal-lobe areas dorsally each with 2 or 3 flagellate setae; ventrally each with 2–4 flagellate setae including suranal seta and anal-lobe seta.

Dorsum with flagellate setae forming 2 pairs of longitudinal lines on abdomen, more widely scattered on thorax and head. Enlarged setae from head to segment VII, in 3 pairs of longitudinal lines (medial, mediolateral and lateral) on abdomen, more abundant and scattered on head and thorax; largest seta 8–9 µm long; enlarged setae nipple-shaped, laterally with curved margins, rounded apex, and moderately-sized setal rings; set in dermal pockets; segment IV with 10 setae including 4 flagellate setae and 6 enlarged setae; segment IV with combined total of 9 or 10 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts 5–9 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, shorter or about same size as remaining sclerotized portion; total sclerotized area same length as, or slightly shorter than, unsclerotized area; dermal orifice unsclerotized or weakly sclerotized; without protruding tube. Microtubular ducts scattered over entire surface, associated with enlarged setae from head to segment VII. Multilocular and cruciform pores absent. Microtrichia on segments VII and VIII.

Anal ring round, dorsal, incomplete, anterior and posterior sections usually unsclerotized, without pores or with 1 or 2, additional pair of closely associated setae not attached to anal ring, with 2 or 3 setae on each side of ring, each shorter than diameter of ring; anal tube and anal opening unsclerotized, without anal flap.

Venter with longest flagellate seta on segment II 17–26 µm long, on segment VII 20–28 µm long; anal-lobe seta 93–105 µm long. Enlarged setae along body margin and submargin, with 1 or 2 on each side of each body segment. Microtubular ducts associated with enlarged setae. Multilocular pores of 2 or 3 kinds: 5-locular pores most abundant, in medial and mediolateral areas of head to segments VI or VII; 3- and 4-locular pores slightly less common than 5-locular pores. Cruciform pores laterally on head and/or thorax. Legs with 3–5 indistinct pores on hind coxa; each femur with 3, rarely 4, setae, usually without proximal seta; hind tibia with 3 or 4 setae, without middle seta; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 103–108 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from mesothorax to segment VIII, also on mesothoracic and metathoracic coxae.

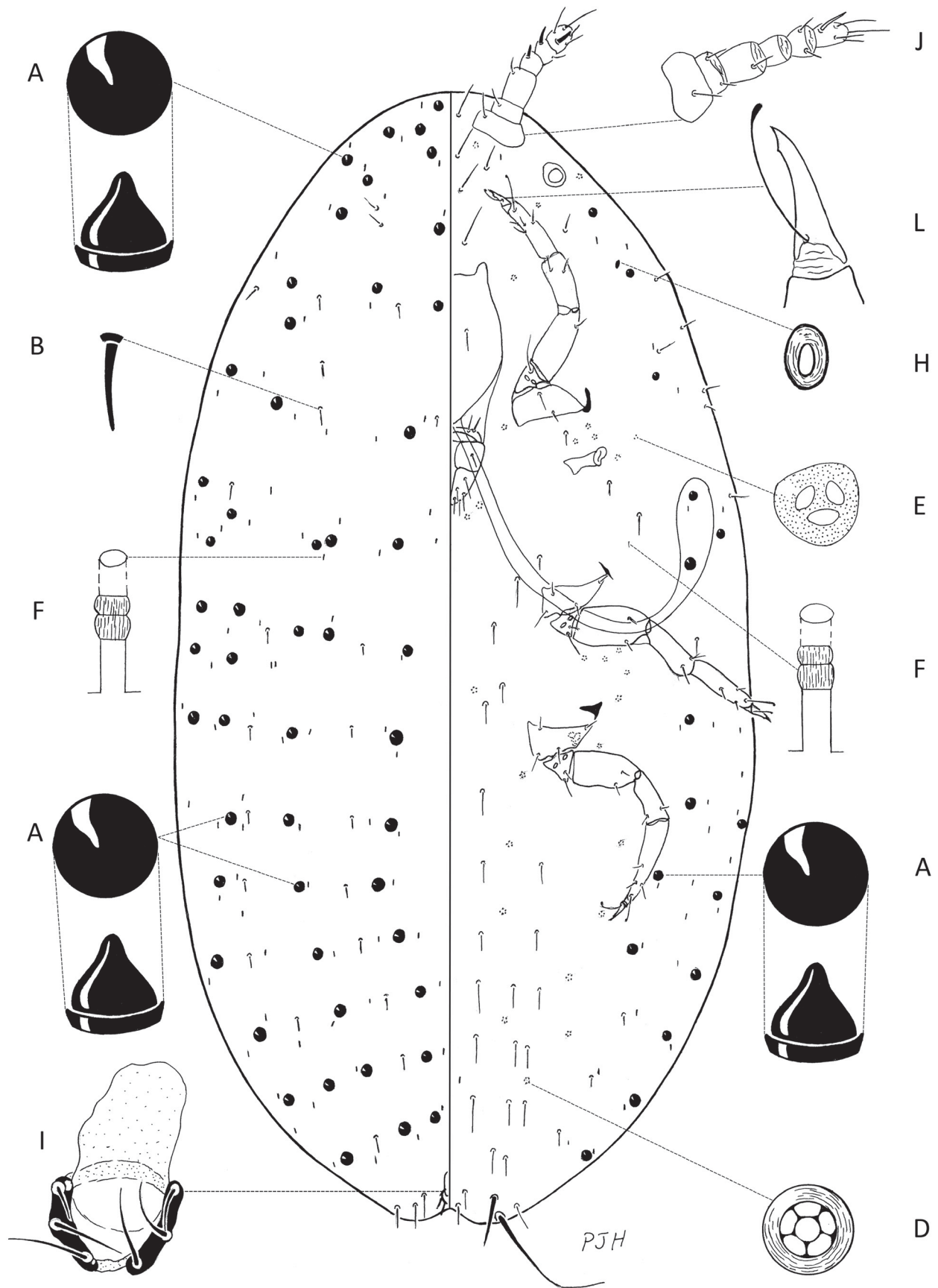


FIGURE 60. *Ovaticoccus eriogoni* (Miller 1967), second-instar female, 5 miles SE Fallbrook, San Diego Co., California, USA, May 8, 1964, on *Eriogonum* sp., D.R. Miller. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H = cruciform pore; I=anal ring; J=antenna; L=claw.

Notes: The description is based on four specimens from three localities. The second-instar female of *Ov. eriogoni* is most similar to the second-instar female of *Ov. viscosa* in lacking dorsal multilocular and cruciform pores and having a circular anal ring usually without pores. They differ as follows (character states in brackets are of *Ov. eriogoni*): each femur with a proximal seta (usually without a proximal seta); without ventral enlarged setae (with ventral enlarged setae).

First-instar nymph (Fig. 61)

Description: Slide-mounted specimens each 0.6 mm long, 0.3–0.4 mm wide. Body oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae and 1 or 2 microtubular ducts; ventrally each with 2–4 flagellate setae including suranal seta and anal-lobe seta.

Dorsum with flagellate setae in small numbers on head and thorax; sometimes with 1 on abdomen in place of enlarged seta. Enlarged setae from head to segment VII, in 3 pairs of longitudinal lines (medial, mediolateral and lateral); largest seta 5–7 µm long; enlarged setae pear-shaped, laterally with curved margins, rounded apex, and moderately-sized setal rings; not set in dermal pockets; segment IV with 6 setae, usually all enlarged; segment IV with combined total of 5 or 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts 5–6 µm long, area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, usually about same length as remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice unsclerotized or weakly sclerotized; with protruding filament. Microtubular ducts scattered over entire surface, least abundant anteriorly, weakly associated with lines of enlarged setae. Multilocular and cruciform pores absent. Microtrichia on segments VII and VIII.

Anal ring dorsal or apical, circular, usually incomplete anteriorly, 1 specimen complete anteriorly, complete posteriorly, without cells, anterior margin unsclerotized, with 2 or 3 setae on each side of ring, additional seta closely associated with ring but not attached to anal ring, anal ring setae each about same length as greatest diameter of ring, anal tube and anal opening weakly sclerotized or unsclerotized, without anal flap.

Venter with longest flagellate seta on segment II 11–12 µm long, on segment VII 20–34 µm long; anal-lobe seta 83–103 µm long. Enlarged setae and microtubular ducts absent. Multilocular pores of 3 types: 5-locular pores, 4-locular pores, and 3-locular pores; 4-locular pores uncommon, 5- and 3-locular pores in about equal numbers; normally on head, thorax and abdomen, 1 specimen without pores on abdomen. Cruciform pores absent. Legs without pores; each femur with 3 setae, without proximal setae; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.9–1.0. Antennae each 6-segmented, 104–116 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from metathorax to segment VIII, also on mesothoracic and metathoracic coxae.

Notes: The description is based on eight specimens from two localities. The first-instar nymph of *Ov. eriogoni* is most similar to the first-instar nymph of *Ov. agavium* by lacking dorsal multilocular and cruciform pores, having three longitudinal lines of enlarged setae and having three setae on each femur, without a proximal seta. They differ as follows (character states in brackets are of *Ov. eriogoni*): medial longitudinal line of enlarged setae complete, including on head (incomplete, replaced by flagellate setae on head); with ventral cruciform pores (absent); anal ring divided anteriorly and posteriorly (divided anteriorly or sometimes complete anteriorly, complete posteriorly).

***Ovaticoccus exoticus* Pellizzari and Kozár**

Ovaticoccus exoticus Pellizzari and Kozár 2011: 61–63.

Type material: We have not examined type material of this species but have a long series of specimens that agree well with the original description.

Specimens examined: UNITED STATES: Arizona: Maricopa Co.: Mesa, II-27-1975, on *Yucca* sp., D. Munson (2 ad. ♀♀ on 1 slide); Phoenix, Desert Botanical Garden, *Agave* greenhouse, X-24-2007, on *A. americana*, W. Iselin (13 ad. ♀♀ on 4 slides) CDFA; Mohave Co., Peach Springs, ?-?-1921, on *Agave* sp., G.F. Ferris (1 ad. ♀ on 1 slide) UCD. California: Contra Costa Co.: Walnut Creek, III-6-2012, on *A. americana*, Somers (2 ad. ♀♀ on 1 slide) CDFA; Los Angeles Co.: Pacoima, VI-27-1941, on *Agave* sp. and *A. utahensis*, L.E. Meyers (12 ad. ♀♀ on 4 slides) UCD; Orange Co.: Anaheim, IX-27-1930, on “century plant” (= *A. americana*?) collector ? (2 ad. ♀♀ on 1 slide) UCD; Orange Co.: Newport Beach, V-24-2012, on *Agave* sp., J. Rivas (8 ad. ♀♀ on 3 slides) CDFA; Riverside Co., Corona, XII-3-1956, on *Yucca* sp., H.L. McKenzie (3 ad. ♀♀ on 1 slide) UCD; San Bernardino Co., Calico,

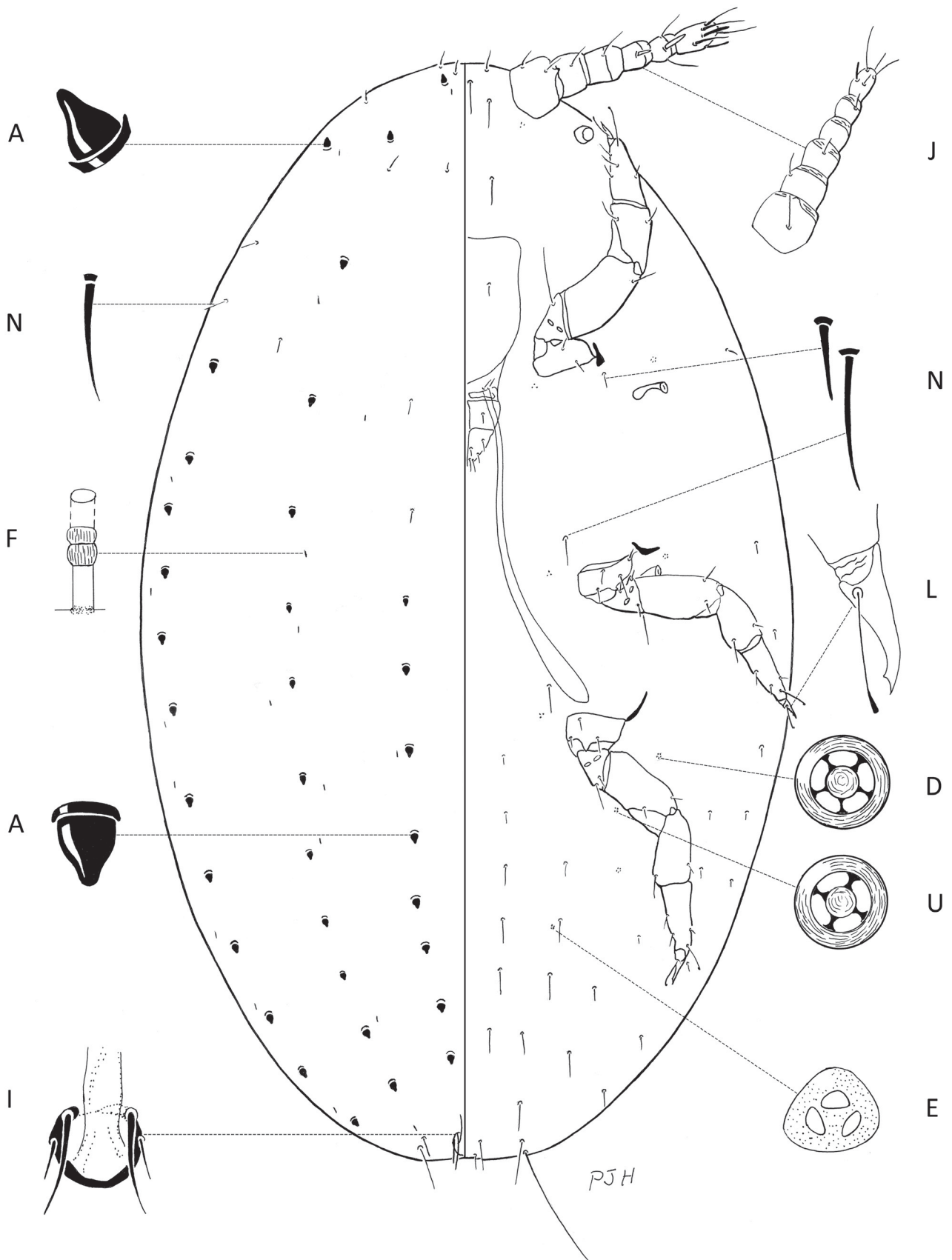


FIGURE 61. *Ovatococcus eriogoni* (Miller 1967), first-instar nymph, 5 miles SE Fallbrook, San Diego Co., California, USA, May 8, 1964, on *Eriogonum* sp., D.R. Miller. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; I=anal ring; J=antenna; L=claw; N=flagellate seta; U=4-locular pore.

on *Agave utahensis* var. *nevadensis*, R. Camblin (4 ad. ♀♀ on 2 slides) UCD; Ivanpah Mountains, from herbarium specimen, ?-?-1942, on *Agave nevadensis*, collector ? (3 ad. ♀♀, 1 second-instar ♀, 2 first-instar nymphs on 2 slides) UCD; San Bernardino Co.: Joshua Tree, XI-8-1961, on *Yucca* sp., L. Dolch and R. Scheider (2 ad. ♀♀ on 1 slide) CDFA; San Diego Co., El Cajon, IX-10-1957, on *Agave* sp., F. Yaruss (1 ad. ♀ on 1 slide) UCD; Santa Barbara Co., Santa Barbara, III-11-1931, on “cactus?” F.C. Greer (1 ad. ♀ on 1 slide). Texas: El Paso Co.: El Paso, Mt. Franklin, VII-?-1921, on *A. lechuguilla*, (8 ad. ♀♀ on 6 slides) UCD. Utah, Washington Co., St. George, ?-?-1924, on *Yucca* sp., V.M. Tanner (3 ad. ♀♀ on 2 slides) UCD. MEXICO: State ?: Intercepted at Douglas, Arizona, I-2-1958, on *A. schottii*, R.H. Russell (4 ad. ♀♀ on 1 slide) USNM; Intercepted at San Francisco, California, V-31-1939, on *Agave* sp., C.H. Oatridge (10 ad. ♀♀, 1 second-instar ♀, on 4 slides) USNM; Intercepted at San Ysidro, California, XII-2-1960, on *A. shawii*, E.D. Algert (6 ad. ♀♀, 5 second-instar ♀♀ on 2 slides) USNM; Intercepted at Brownsville, Texas, III-25-1957, on *Agave* sp., Allen (4 ad. ♀♀ on 1 slide) USNM; Intercepted at Brownsville, Texas, V-20-1990, on *A. americana*, D. Riley (1 ad. ♀, 2 second-instar ♀♀, 2 first-instar nymphs on 1 slide) USNM; Intercepted at El Paso, Texas, VII-14-1989, on *A. americana*, J. Alaniz (3 ad. ♀♀, 1 second-instar ♂, 1 ad. ♂ on 4 slides) USNM; Intercepted at Laredo, Texas, III-12-1952, on “cactus”, Averill (3 ad. ♀♀ on 1 slide) USNM; Intercepted at Laredo, Texas, III-16-1952, on “cactus”, Johnston (5 ad. ♀♀ on 2 slides) USNM. State of Baja del Sur, Magdalena, intercepted at Nogales, Arizona, IV-28-1948, on *Yucca* sp., Johnson and Callahan (5 ad. ♀♀ on 1 slide) USNM; State of Jalisco, Cuatitlan, V-11-1958, on “maguey tequilero”, (= *A. tequilana*?) R. MacGregor (2 ad. ♀♀ on 1 slide) USNM; Tequila, IV-7-1953, on “maguey tequilero”, (= *A. tequilana*?) G. Halfter (2 ad. ♀♀ on 1 slide) USNM. State of Mexico: San Juan Teotihuaca, IV-28-1954, on *Agave* sp., I.B. de Barrera (1 ad. ♀ on 1 slide) USNM. State of Puebla: road between Apizaco and Zacatepec, V-24-1954, on *Yucca* sp., R. MacGregor (2 ad. ♀♀ on 1 slide) USNM; Zacatepec, V-24-1954, on *Yucca* sp., R. MacGregor (1 ad. ♀ on 1 slide) USNM. State of Tamaulipas: Ciudad Victoria, intercepted at Washington, D.C., II-25-1922, on *A. funkiana*, W.T. Owrey (1 ad. ♀ on 1 slide) USNM. State of Zacatecas: Zacatecas, VII-18-1976, on *Agave* sp., L. Holguia, J. Vigil (1 ad. ♀ on 1 slide) USNM.

Etymology: “The species name [*exoticus*] is based on the Latin adjective *exoticus* meaning ‘foreign, alien’, because this species, even though collected in Sicily (Italy), surely does not belong to [the] European fauna”. (Pellizzari & Kozár 2011: 61).

Field features: Occurring at base of host leaves.

Adult female (Fig. 62)

Description: Slide-mounted specimens 1.0–3.8 mm long, 0.5–2.4 mm wide. Body elongate oval to nearly rotund, without protruding anal lobes. Anal-lobe areas dorsally each with 2 or 3 flagellate setae, 0 or 1 microtubular ducts, and 3–5 5-locular pores; ventrally each with 3–5 flagellate setae including suranal seta and anal-lobe seta, and 4–8 5-locular pores.

Dorsum with flagellate setae scattered over entire surface, noticeably shorter than those on venter, becoming progressively shorter anteriorly, straight. Enlarged setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), from head to segment VII or VIII, least numerous in medial areas of thorax, decreasing in size anteriorly, of 1 size; largest seta 10–12 µm long. Enlarged setae conical, with straight sides, with truncate apices, moderately thick setal rings; not recessed in dermal pockets; segment IV with 18–23 setae (including 4–6 enlarged setae and 12–17 flagellate setae); segment IV with combined total of 5 or 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts 4–6 µm long, area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, ½ length of remaining sclerotized portion; total sclerotized area same length as, or larger than, unsclerotized area; dermal orifice slightly sclerotized, with single protruding duct. Microtubular ducts scattered over entire surface, least abundant on head. Multilocular pores of 2 kinds: 5-locular pores most abundant, 3-locular pores in small numbers; pores scattered over entire surface, most abundant along body margin. Cruciform pores and microtrichia absent.

Anal ring ventral, circular, divided posteriorly and anteriorly or weakly connected posteriorly, without cells, with 3 setae on each side of ring, each same length as, or shorter than, greatest diameter of ring; in addition, with 1 pair of setae associated with, but not on, ring; anal tube weakly sclerotized, opening of anal tube sclerotized, without anal flap.

Venter with longest seta on segment II 25–38 µm long, on segment VII 30–45 µm long, anal-lobe seta 118–145 µm long. Enlarged setae absent. Macrotubular ducts absent. Microtubular ducts in reduced numbers near lateral clusters of cruciform pores. Multilocular pores along body margin, in medial areas on posterior 4 or 5 abdominal segments and near mouthparts, of 2 or 3 kinds: 7-locular pores sometimes absent, 3-locular pores rare, 5-locular pores abundant. Cruciform pores in lateral clusters along each margin of segments III–VII, also in small numbers in

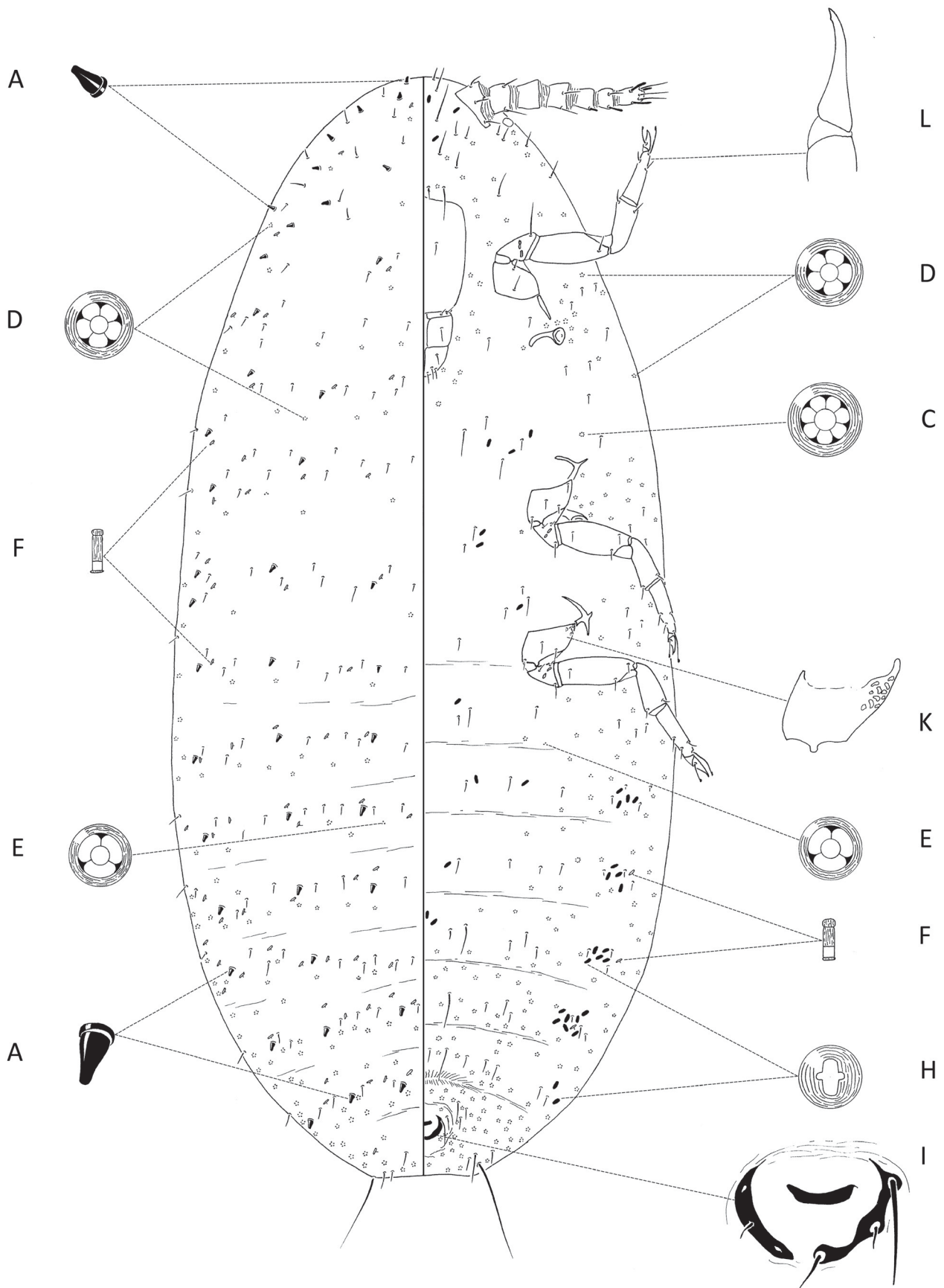


FIGURE 62. *Ovatococcus exoticus* Pellizzari and Kozár 2011, adult female, taken in quarantine at San Ysidro, California, USA from Mexico, December 2, 1960, on *Agave shawii*, E.D. Algert. A=enlarged seta; C=7-locular pore; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; K=dorsal surface of coxa; L=claw.

medial areas of head, thorax, and anterior abdominal segments. Legs with hind coxae each dorsally with 3–21 pores, ventrally with 4–11 pores; each femur with 4 setae, 1 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 7-segmented, 200–220 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia absent except on hind 2 pairs of coxae.

Notes: The description is based on 47 specimens from 10 localities. The adult female of *Ovaticoccus exoticus* is most similar to the adult female *Ov. agavium* (for a comparison, see the “Notes” section of that species above). This species was treated as part of *Ov. agavium* by Miller and McKenzie (1967) and Ferris (1955) but the work of Pellizzari and Kozár (2011) makes it clear that it is a distinct species.

Second-instar female (Figs 63 and 64)

Description: Slide-mounted specimens each 0.9–1.0 mm long, 0.4–0.5 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe area dorsally each with 2 flagellate setae and 0 or 1 5-locular pores; ventrally each with 3–4 flagellate setae including suranal seta and elongate anal-lobe seta and 0 or 1 5-locular pores.

Dorsum with 2 longitudinal lines of flagellate setae on abdomen (mediolateral and sublateral), more abundant on thorax and head. Enlarged setae of 1 size: in 3 pairs of longitudinal lines (medial, mediolateral and lateral); largest seta about 5 µm long; enlarged setae pear-shaped or conical, with straight or slightly curved lateral margins, apically rounded or truncate; setal base thin; segment IV with 10–12 setae including 6 enlarged setae and 4–6 flagellate setae; segment IV with combined total of 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts variable, often on posterior abdominal segments mediolaterally and/or laterally. Multilocular pores variable in number and distribution (Figs 63 and 64), of 1 or 2 kinds: 5-locular pores most numerous, scattered over entire surface, rarely with more pores on head; 3-locular pores less common. Cruciform pores absent. Microtrichia from segment IV to VIII.

Anal ring ventral, semicircular, incomplete, non-cellular, with 3 setae on each side of ring, each normally shorter than diameter of ring; additional pair of setae often associated with, but not attached to, ring; anal tube unsclerotized, dermal orifice sclerotized; without anal flap.

Venter with setae flagellate, longest seta on segment II about 15 µm long, on segment VII about 21 µm long; anal-lobe seta approximately 80 µm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores of 2 kinds: 5-locular pores most abundant, present over entire surface, least abundant on head; 3-locular pores rare, normally on thorax and head. Cruciform pores in clusters of 1–4 pores on lateral margins of segments IV to VII or VIII, also in medial areas from segment III to VII. Legs with 1 or 2 indefinite translucent pores on hind coxa; each femur with 4 setae, with 1 proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8. Antennae each 6-segmented, about 140 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia on prothorax to segment VIII and on ventral surface of hind 2 pairs of coxae.

Notes: The description is based on nine specimens from four localities. The second-instar female of *Ov. exoticus* is most similar to the second-instar of *Ov. agavium* (for a comparison, see the “Notes” section of that species above).

Second-instar male (Fig. 65)

Description: Slide-mounted specimen 1.4 mm long, 0.6 mm wide. Body elongate, without protruding anal lobes. Anal-lobe area dorsally each with 2 flagellate setae, 1 multilocular pore, 1 or 2 macrotubular ducts; ventrally each with 3–4 flagellate setae including suranal seta and elongate anal-lobe seta, 1 multilocular pore, 1–3 cruciform pores, 1 or 2 macrotubular ducts.

Dorsum with flagellate setae on 1 specimen arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), medial lines on each segment comprise 1 seta on each side of body, mediolateral lines comprise 2 setae on each side of body, and lateral lines comprise 1 or 2 setae on each side of body. Enlarged setae absent. Second specimen with posterior flagellate setae often replaced by enlarged setae or transitional setae; some abdominal segments with medial, mediolateral and lateral flagellate setae as above, other segments with enlarged setae in broken longitudinal lines in medial, mediolateral, and lateral areas, some setae partially enlarged appearing as transitional between flagellate setae and enlarged setae; enlarged setae most abundant on posterior abdomen. Largest enlarged seta about 7 µm long; enlarged setae conical, with straight lateral margin, with rounded apex; setal base thin; not in dermal pockets; with 10 setae on segment IV, all flagellate; segment IV with combined total of 0–6 enlarged setae dorsally and ventrally. Macrotubular ducts over entire surface, about 11–15 µm long. Microtubular ducts 7–8 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion slightly smaller than remaining sclerotized portion; dermal orifice unsclerotized; rare or absent. Multilocular and cruciform pores absent. Without microtrichia.

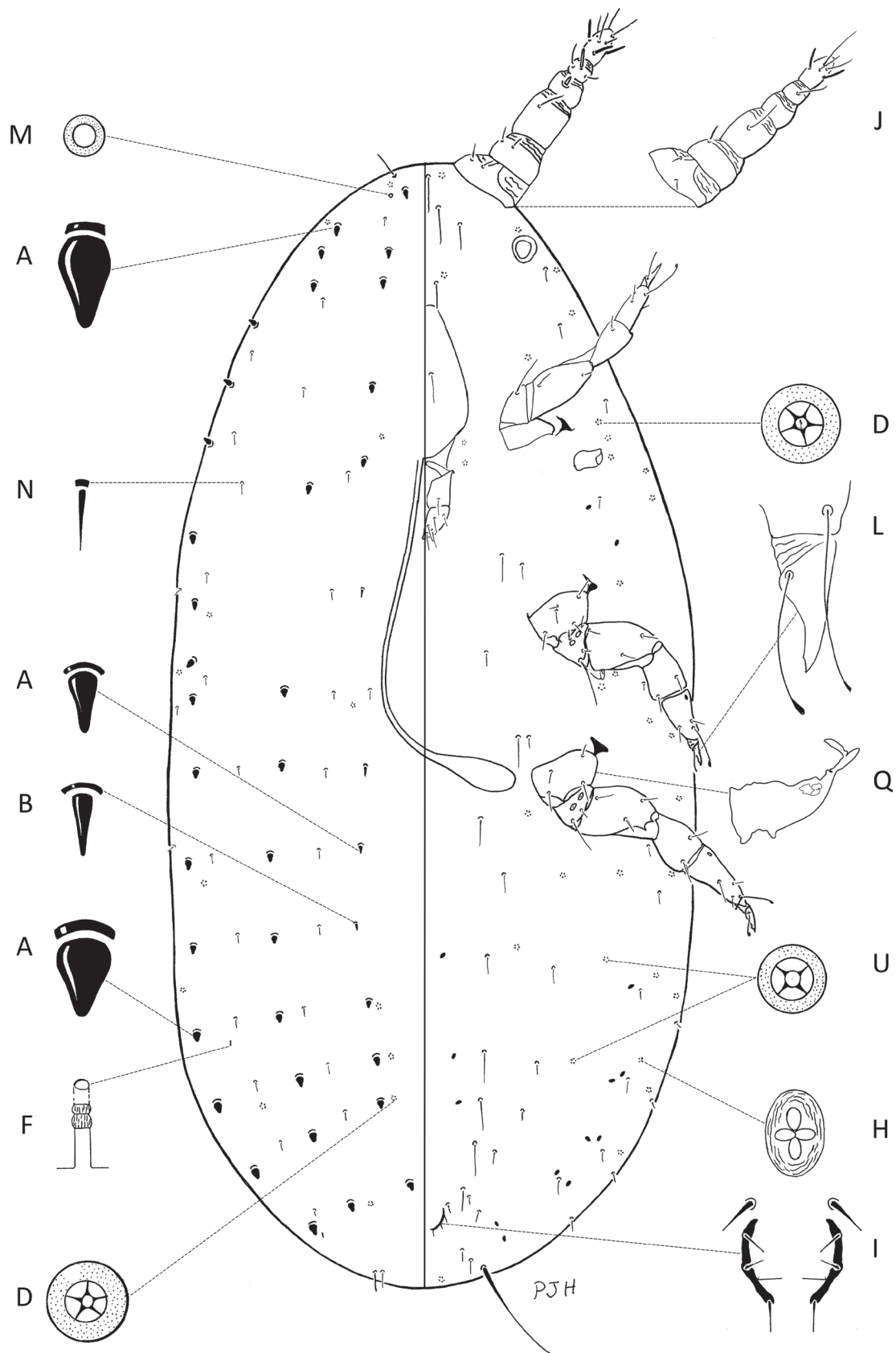


FIGURE 63. *Ovaticoccus exoticus* Pellizzari and Kozár 2011, second-instar female #1 (few dorsal multilocular pores, few dorsal enlarged setae), taken in quarantine at San Ysidro, California, USA from Mexico, December 2, 1960, on *Agave shawii*, E.D. Algert. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; M=preantennal pore; N=flagellate seta; Q=dorsal surface of coxa; U=4-locular pore.

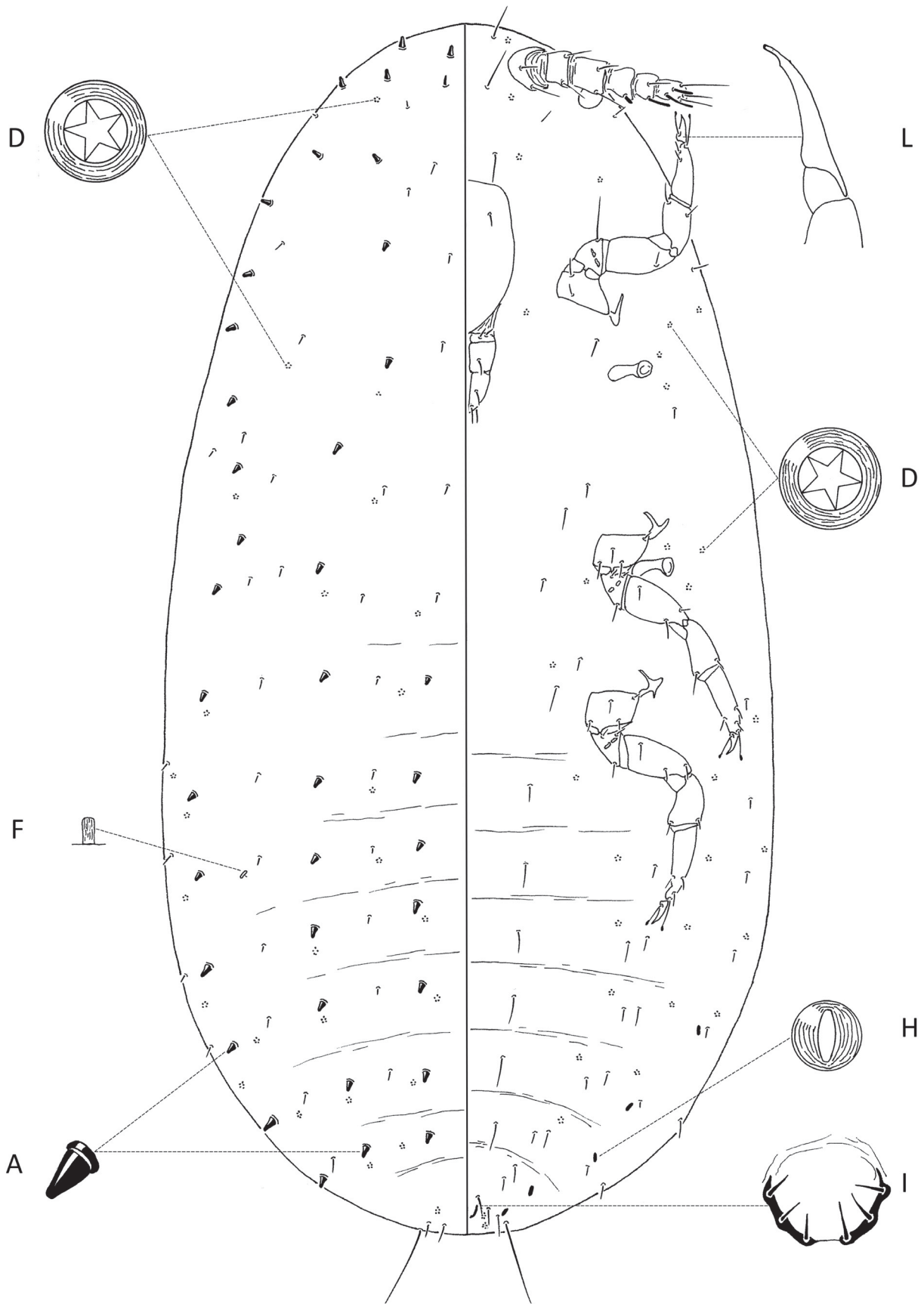


FIGURE 64. *Ovatococcus exoticus* Pellizzari and Kozár, 2011, second-instar female #2 (many dorsal multilocular pores, many dorsal enlarged setae), intercepted at Brownsville, Texas, USA, V-20-1990, on *Agave americana*, D. Riley. A=enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; L=claw.

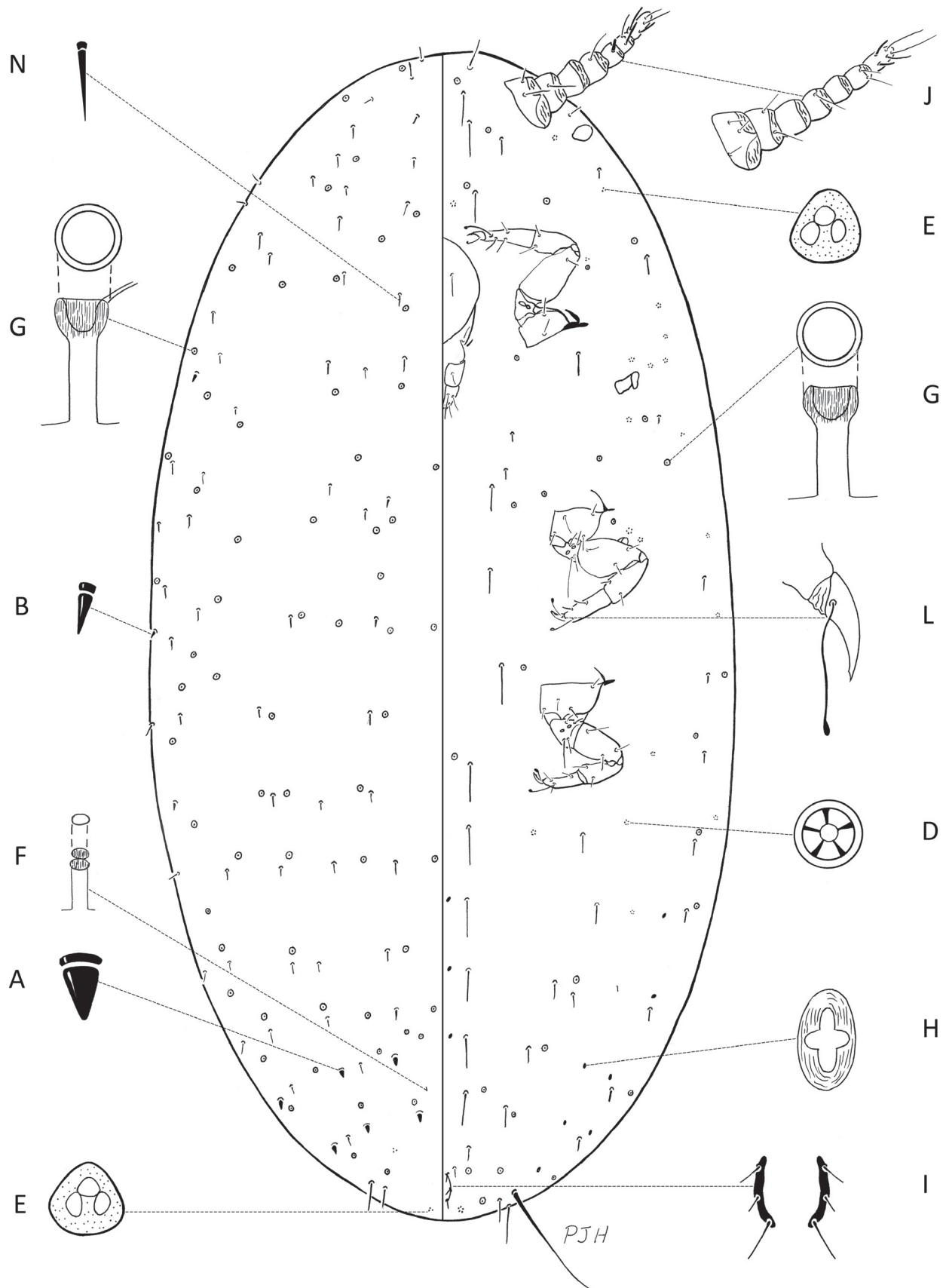


FIGURE 65. *Ovatococcus exoticus* Pellizzari and Kozár 2011, second-instar male, taken in quarantine at El Paso, Texas, USA, from Mexico, July 14, 1989, on *Agave americana*, J. Alaniz. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; N=flagellate seta.

Anal ring ventral, circular, incomplete posteriorly and anteriorly, with 2 lateral sclerotized plates, non-cellular, with 3 setae on each side of ring, each same length as, or shorter than, greatest diameter of ring; with additional pair of setae associated with ring; anal tube unsclerotized, anal opening weakly sclerotized, without anal flap.

Venter with longest flagellate seta on segment II 27 μm long, on segment VII 27 μm long; longest anal-lobe seta 70 μm long. Enlarged setae absent. Macrotubular ducts about same size as those on dorsum, scattered over head and thorax, in medial, mediolateral and lateral longitudinal lines on abdomen. Microtubular ducts rare or absent. Multilocular pores scattered over entire surface, least abundant posteriorly, of 3 or 4 kinds: 7-locular pores and 3-locular pores uncommon; 5-locular pores most abundant. Cruciform pores in clusters medially and laterally on abdomen. Legs without pores; each femur with 4 setae, including 1 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8. Antennae each 7-segmented, about 180 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia from mesothorax to segment VIII, also on hind 2 pairs of coxae.

Notes: The description is based on two specimens from one locality. The second-instar male of *Ov. exoticus* is most similar to the second-instar male of *Ov. agavium* (for a comparison, see the “Notes” section of that species above).

First-instar nymph (Fig. 66)

Description: Slide-mounted specimens 0.5–0.6 mm long, 0.2–0.4 mm wide. Body elongate, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae; each ventrally with 3–4 flagellate setae including suranal seta and anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae of 1 size in 3 pairs of longitudinal lines (medial, mediolateral and lateral), in transverse rows from head to segment VII; largest seta 7–9 μm long; enlarged setae pear-shaped with truncate apex; setal base thin; segment IV with 6 enlarged setae, without flagellate setae; segment IV with combined total of 6–8 enlarged setae on dorsum and venter. Macrotubular ducts, microtubular ducts, multilocular pores, and cruciform pores absent. Microtrichia absent.

Anal ring ventral, semicircular, incomplete, divided anteriorly and posteriorly, non-cellular, with 3 setae on each side of ring, each normally shorter than diameter of ring; additional pair of setae often associated with, but not attached to, ring; anal tube with dermal orifice sclerotized; anal orifice unsclerotized; without anal flap.

Venter with flagellate setae, longest seta on segment II approximately 12–18 μm long, on segment VII 15–17 μm long; longest anal-lobe seta approximately 75–90 μm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores fairly consistent; head normally with 5-locular pores, rarely 3-locular pores; spiracles each with 7-locular pores; mesothoracic and metathoracic legs each with 3-, 4- or 5-locular pores; any or all of segments III, IV and V each with 3-locular or 5-locular pores. Cruciform pores in sublateral areas of segments V to VIII. Legs without pores; each femur with 4 setae, with 1 proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7–0.8. Antenna 6-segmented, 118–128 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia on metathorax to segment VIII, not visible on legs.

Notes: The description is based on four specimens from two localities including one embryo and one nearly useless specimen. The first-instar nymph of *Ov. exoticus* is most similar to the first-instar nymph of *Ov. agavium* in having the dorsomedial longitudinal line of enlarged setae present at least on the abdomen, with similarly shaped anal rings, and usually with ventrolateral cruciform pores on the abdomen. They differ as follows (characters in brackets are those of *Ov. exoticus*): each femur with three setae, without a proximal seta (with four setae, including a proximal seta).

***Ovaticoccus gordonii* Miller and Stocks sp. n.**

Type material: Adult female holotype mounted singly on a slide with right label “*Ovaticoccus / gordonii / Miller & Stocks / R.D. Gordon / D.R. Miller #3086 / HOLOTYPE.*” Left label “on *Viguiera / stenoloba / 2.3 mi. N. of Main Rd. / on Point Gap Rd. / Big Bend Nat’l Pk. / Brewster Co. Texas / V-6-1976.*” Label on back of slide “*Ovaticoccus / gordonii* Miller / & Stocks / USNM / HOLOTYPE.” Holotype is in USNM. **Paratypes:** UNITED STATES: Texas: Brewster Co.: Big Bend National Park, 2.3 mi. N. of Main Rd., on Point Gap Rd., V-26-1976, on *Viguiera stenoloba*, D.R. Miller and R.D. Gordon (1 ad. ♀ holotype, 26 ad. ♀♀ paratypes on 14 slides) NHM (1 slide), Cdfa (1 slide), FSCA (1 slide), MNHN (1 slide), UCD (1 slide), UNAM (1 slide), USNM (9 slides).

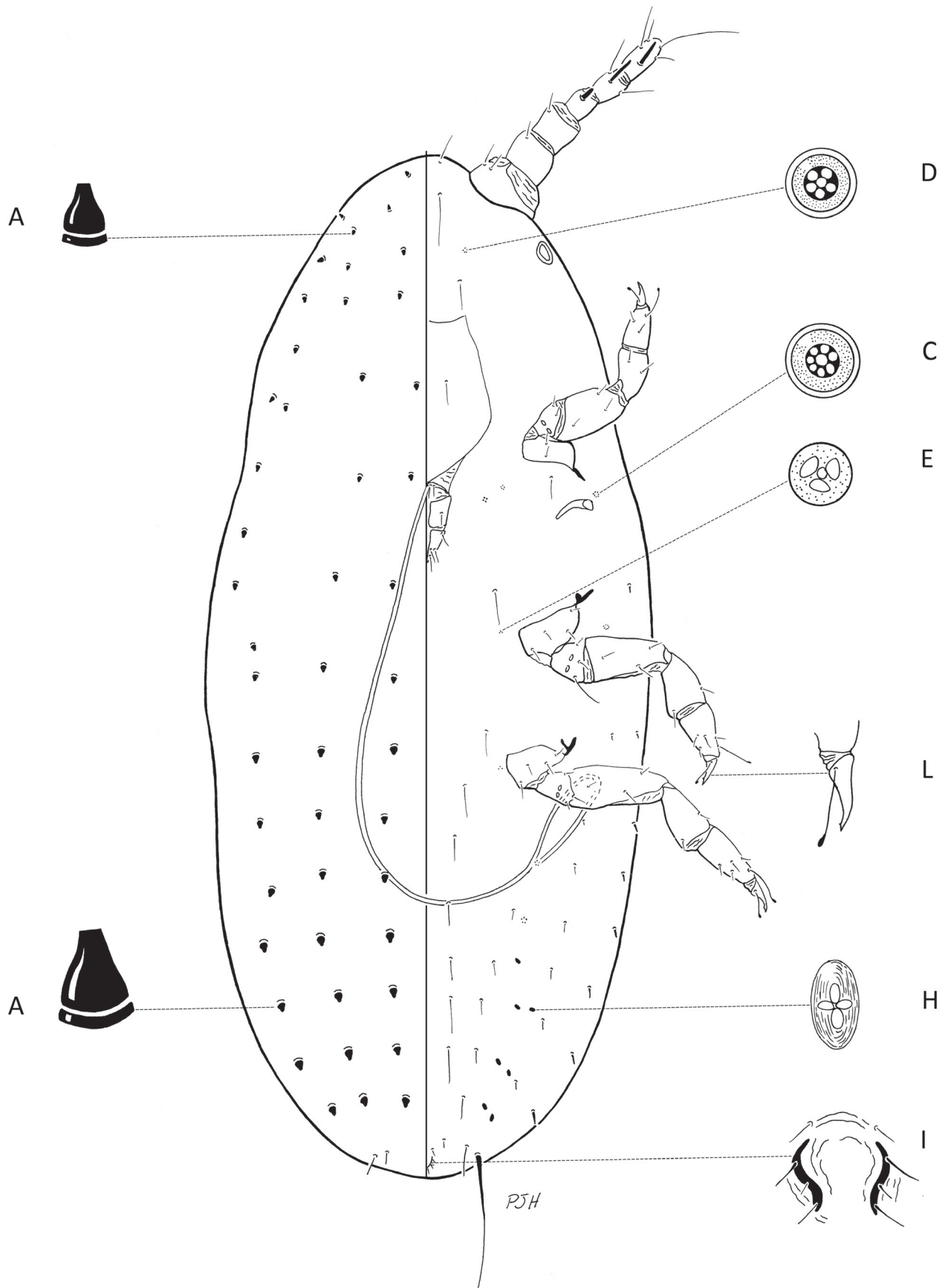


FIGURE 66. *Ovatococcus exoticus* Pellizzari and Kozár 2011, first-instar nymph, taken in quarantine at Brownsville, Texas, USA from Mexico, May 20, 1990, on *Agave americana*, D. Riley. A=enlarged seta; C=7-locular pore; D=5-locular pore; E=3-locular pore; H=cruciform pore; I=anal ring; L=claw.

Etymology: This species is named for Robert D. Gordon who has spent many hours in the field with the first author and who has been a good friend for more than 50 years. A memorable event in the field was when the first author was helping Bob collect scarab beetles in the burrows of prairie dogs during this same trip in 1976. The burrows contained not only prairie dog dung, scarabs, and various other biota, but also fleas. When Bob developed a high fever, the local physician eventually diagnosed his pathogen as the plague. How many people do you know these days who have actually contracted the black death? He has survived!

Field features: Occurring under the bark of the host.

Adult female (Fig. 67)

Description: Holotype, slide mounted 1.3 mm long, 1.1 mm wide (paratypes 1.3–1.6 mm long, 0.9–1.2 mm wide). Large specimens with dorsal surface of segments VII and VIII bent so that they are located on venter. Body oval (paratypes oval, rotund, or pear-shaped), without protruding anal lobes, with inconspicuous cauda. Anal-lobe area dorsally each with 2 or 3 flagellate setae, 2 or 3 microtubular ducts, and several 5-locular pores; ventrally each with 3 or 4 flagellate setae including suranal seta and anal-lobe seta and several 5-locular pores.

Dorsum with flagellate or slightly enlarged setae scattered over entire surface, shorter than on venter, slightly curved. Enlarged setae usually absent (absent from holotype but with enlargement of seta to show shape when present (A on Fig. 67) (paratypes with 0–16 on each side, most with 0–3), when present, restricted to margin, most often on head and anterior thorax, rarely on abdomen; largest seta on paratypes 10–15 μm long; enlarged setae conical with concavity near apex, central projection with slightly rounded apex, setal base thin; segment IV with 24 flagellate setae (paratypes with 20–24), without enlarged setae. Macrotubular ducts absent. Microtubular ducts each 8 μm long (paratypes 6–7 μm), with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion shorter than remaining sclerotized portion, sclerotized portion same length as, or longer than, unsclerotized portion; dermal orifice sclerotized, with single protruding duct. Microtubular ducts scattered over entire surface. Multilocular pores of 2 or 3 kinds: 7-locular pores rare; 5-locular pores on head and segments IV to VIII; paratypes rarely with 3-locular pores. Multilocular pores sometimes absent from head, rarely with 1 or 2 on prothorax, always on segments VII and VIII, often on segments IV, V and VI. Cruciform pores on head to segment V (paratypes on head or prothorax to IV, V or VI). Microtrichia absent.

Anal ring ventral, circular, divided posteriorly (oval and complete on some paratypes), with 3 cells on 1 side and 4 on other (paratypes with 5 or 6 cells on each side), with 3 setae on each side of ring, each slightly shorter than diameter of ring; anal tube unsclerotized, anal opening sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 12 μm long (paratypes 14–18 μm), on segment VII 25 μm long (paratypes 29–40 μm); longest anal-lobe seta 72 μm long (paratypes 70–95 μm). Enlarged setae absent (paratypes sometimes with 1 or 2 near body margin of head and anterior thorax), of same type as on dorsum. Macrotubular ducts absent. Microtubular ducts uncommon along body margin. Multilocular pores in medial areas of segments VI to VIII, laterally along body margin, particularly abundant near spiracles, rarely in medial areas of thorax, of 2 kinds: 5-locular pores most abundant, 7-locular pores uncommon. Cruciform pores near body margin on prothorax to segment III (paratypes normally with pores on margin of head to segment V or VI, occasionally with 1 or 2 pores medially on thorax). Legs of some paratypes malformed, with tibia and tarsus fused; hind coxae without pores, each femur with 4 setae including 1 proximal seta (paratypes with 1–4), each tibia with 4 setae, without middle seta (paratypes with number of setae on each hind tibia 4, setae on each front and middle tibia varies from 1–4); hind tibia/tarsus 0.7 (paratypes 0.6–0.8) when separate. Antennae each 5-, 6- or 7-segmented (of 47 antennae on paratypes, 2 are 5-segmented, 31 are 6-segmented, and 14 are 7-segmented), each antenna 132 and 128 μm long (paratypes 120–147 μm). Frontal lobes absent. Preantennal pore present. Microtrichia on head to segment VIII (paratypes with microtrichia from head or prothorax to segment VIII), and on ventral surface of each coxa. Surface of dorsum from segment III–VIII covered with nodules (paratypes with nodules on dorsum from head, prothorax, or abdominal segment I–VIII); on posterior segments on venter.

Notes: The description is based on 27 specimens from one locality. Adult females of *Ov. gordonii* share some similarities with adult female of *Hy. hyperici* (Ferris) in having: numerous dermal projections on the body; at least some specimens with poorly formed legs; and no macrotubular ducts. *Hypericococcus hyperici* differs by having (character states in brackets are of *Ov. gordonii*): more than 20 enlarged setae (enlarged setae absent or fewer than 15); enlarged setae broad, with width of seta about as wide as length of seta (narrow, with width of seta much narrower than length of seta); hind coxae with translucent pores (translucent pores absent); dorsal multilocular pores abundant on medial areas of thorax (rare or absent). The adult female of *Ov. gordonii* is unique among the species of *Ovaticoccus* in lacking anal lobes, translucent pores on the hind legs, and macrotubular ducts.

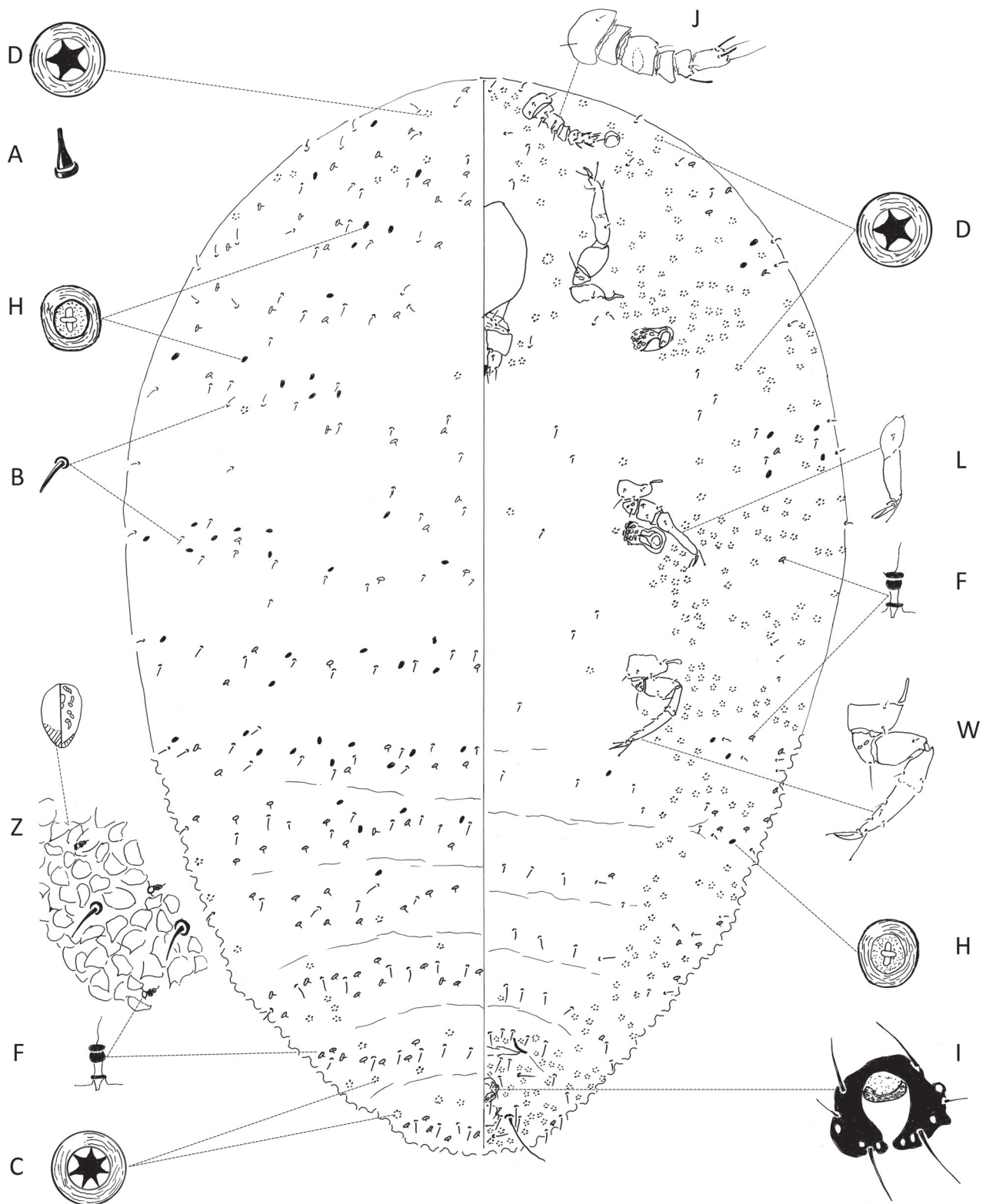


FIGURE 67. *Ovatococcus gordoni* sp. n., adult female, Big Bend National Park, 2.3 miles N. of Main Rd., on Point Gap Rd., Brewster Co., Texas, USA, May 26, 1976, on *Viguiera stenoloba*, D.R. Miller and R.D. Gordon. A=enlarged seta (not present on this specimen); B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; W=leg; Z=body margin (hatched areas on the body of the inset with dermal projections).

Ovaticoccus haigi Miller and Stocks sp. n.

Type material: Adult female holotype with right label “No. 68C13-24 Cal. Dept. Agr. / Loc. Hwy. 99, 3 mi. S. of / Merced, California / March 12, 1968 / ex. *Distichlis* / *spicata*, T.R. Haig coll.” Left label “*Ovaticoccus* / *haigi* Miller / HOLOTYPE / Det. by / CDFA / III-68 EAS B.” Label on the back of the slide “*Ovaticoccus haigi* / Miller & Stocks / HOLOTYPE / CDFA / Merced.” The holotype is deposited in CDFA. **Paratypes:** UNITED STATES: California: Alameda Co.: SE of Livermore, X-10-1968, on *D. spicata*, T. Kono and T.C. Fuller (2 ad. ♀♀ paratypes, on 2 slides) CDFA (1 slide), UCD (1 slide); Fresno Co.: 4.5 mi. N. El Nido, VIII-20-1968, on *D. spicata*, T.R. Haig (3 ad. ♀♀ paratypes, 2 second-instar ♀♀ paratypes on 3 slides) CDFA (1 slide), UCD (1 slide), USNM (1 slide); Merced Co.: 4 mi. NW Los Banos, on Henry Miller Road, III-20-1968, on *D. spicata*, T.R. Haig (4 ad. ♀♀ paratypes on 4 slides) CDFA (1 slide), FSCA (1 slide), UNAM (1 slide), USNM (1 slide); 3 mi. S. Merced on Highway 99, III-12-1968, on *D. spicata*, T.R. Haig (1 ad. ♀ holotype, 19 ad. ♀♀ paratypes on 20 slides) NHM (1 slide), CDFA (8 slides), FSCA (1 slide), NMNH (1 slide), UCD (4 slides), USNM (5 slides); Mono Co., Chalfant, VII-6-1970, *D. spicata*, D.R. Miller (2 ad. ♀♀, 2 first-instar nymph paratypes on 2 slides) UCD (1 slide), USNM (1 slide).

Etymology: This species is named in honor of the late Tom R. Haig, formerly of the California Department of Food and Agriculture, Sacramento, California, USA, who collected many interesting species of scale insects.

Adult female (Fig. 68)

Description: Holotype, slide mounted, 3.2 mm long, 1.8 mm wide (paratypes 2.1–3.4 mm long, 1.3–1.9 mm wide). Body elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 4 and 5 flagellate setae (paratypes 3 or 4), 0 and 1 microtubular duct (paratypes 0 or 1), 1 cruciform pore (paratypes 0 or 1) and 3 or 4 5-locular pores (paratypes 0–4); body apex bent so that anal-lobe structures normally found on venter now located on dorsum.

Dorsum with flagellate setae scattered over entire surface, shorter than those on venter, straight or slightly curved. Enlarged setae on lateral margin of head, with 2 on 1 side and 3 on other (paratypes with 0–3 on each side); largest seta 10 µm long (paratypes 10–13 µm); enlarged setae conical, laterally with nearly straight sides, with truncate apices; setal base broad; not in dermal pocket; segment IV with 18 setae, all flagellate (paratypes with 17–20 flagellate setae). Macrotubular ducts scattered over entire surface, least abundant on anterior thorax and head, each about 24 µm long (paratypes 23–28 µm). Microtubular ducts each approximately 5 µm long (paratypes 5–6 µm), area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, about equal in size to remaining sclerotized portion, dermal orifice slightly sclerotized, without protruding duct. Microtubular ducts scattered over entire surface, most abundant on posterior part of abdomen. Multilocular pores scattered over entire surface, of 3 or 4 kinds: 7-locular pores, 6-locular pores, and 3-locular pores rare; 5-locular pores abundant. Cruciform pores in lateral clusters from head to segment VII, least abundant on thorax. Microtrichia on segments VII and VIII.

Anal ring dorsal (bent around abdominal apex on some paratypes, rarely ventral), semicircular, incomplete, divided posteriorly, non-cellular, with 3 setae on each side of ring (paratypes sometimes with 2), each shorter than greatest diameter of ring; anal tube unsclerotized; anal opening sclerotized; without anal flap.

Venter with longest flagellate seta on segment II 30 µm long (paratypes 28–40 µm), on segment VII 38 µm long (paratypes 35–43 µm); longest anal-lobe seta 105 µm long (paratypes 83–115 µm). Enlarged setae of same type as on dorsum near lateral margin of thorax. Macrotubular ducts scattered over entire surface, least abundant anteriorly. Microtubular ducts near body margin, absent from head. Multilocular pores of same types and relative numbers as on dorsum, scattered over entire surface, most abundant posteriorly, unusually numerous near body margin. Cruciform pores on marginal and submarginal areas of head to segment VI (paratypes head to segment V or VI). Legs with hind coxae each dorsally with 46 and 61 pores (paratypes 20–72 pores), ventrally with 22 and 29 pores (paratypes with 19–35 pores); ventral pores on derm anterior to coxa; each femur with 4 setae, including 1 proximal seta and 3 distal setae; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7 (paratypes 0.7–0.8). Antennae each 6-segmented (of 44 antennae examined, all but 1 is 6-segmented although many have segment 3 partially divided), 168 and 170 µm long (paratypes 163–190 µm). Frontal lobes absent. Preantennal pore present. Microtrichia on mesothorax to segment VIII (paratypes with microtrichia from prothorax to segment VIII), and on ventral surface of each coxa.

Notes: The description is based on 32 specimens from five localities. The adult female of *Ov. haigi* is similar to the adult female of *Ov. adoxus* in having similar anal ring structure, few small conical enlarged setae, dorsal and

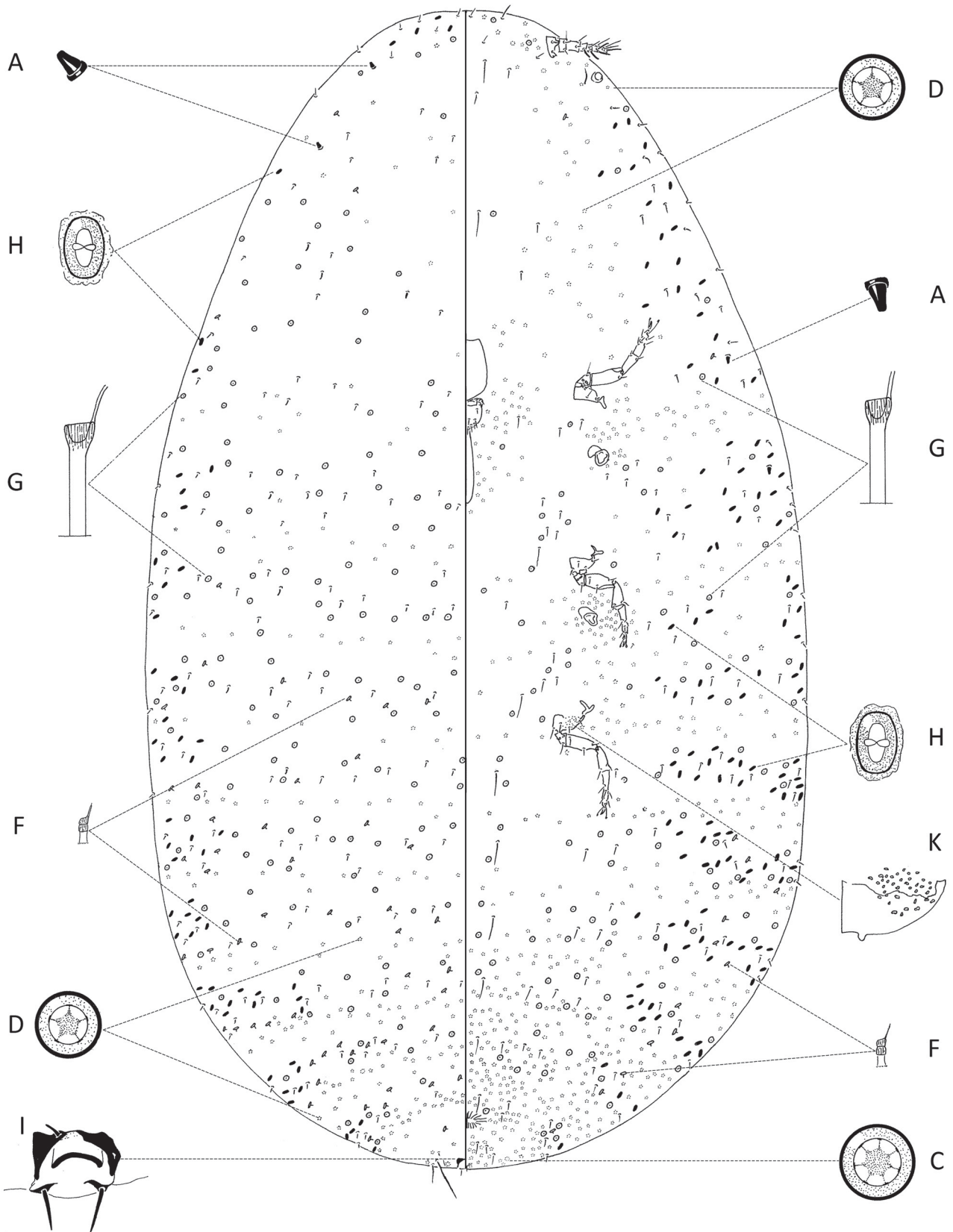


FIGURE 68. *Ovatococcus haigi* Miller and Stocks **sp. n.**, adult female, 3 miles S. of Merced, Highway. 99, Merced Co., California, USA, March 12, 1968, on *Distichlis spicata*, T.R. Haig. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring; K=dorsal surface of coxa.

ventral cruciform pores and multilocular pores, and four setae on each femur. They differ as follows (character states in brackets are those of *Ov. haigi*): with numerous cruciform pores on dorsum of segment VIII (absent or few); pores absent from anterior to hind coxa (present).

Second-instar female (Fig. 69)

Description: Slide-mounted specimen 1.2 mm long, 0.7 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 or 3 flagellate setae; ventrally each with 2 or 3 flagellate setae including anal-lobe seta, and 1 or 2 5-locular pores.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), medial lines on each segment with 1 or rarely 2 setae on each side, mediolateral lines with 2 setae on each side, and lateral lines with 1 or 2 setae on each side. Enlarged setae in longitudinal line along body margin, 1 specimen without mediolateral enlarged setae, second specimen with 4 mediolateral setae on each side of body on mesothorax posteriorly to segment II; largest setae 9–10 µm long; enlarged setae conical, laterally with nearly straight sides, with truncate apices; setal base broad; not in dermal pocket; with 10 or 12 setae on segment IV including 2 enlarged setae and 8 or 10 flagellate setae; segment IV with combined total of 1 or 2 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion about same size as remaining sclerotized portion; dermal orifice unsclerotized; uncommon, most abundant along body margin. Multilocular pores scattered over entire surface, all of 5-locular kind only. Cruciform pores near body margin and on submargin of abdomen. Microtrichia on segments VII and VIII.

Anal ring dorsal, semicircular, incomplete, divided posteriorly, non-cellular, with 0–3 setae on each side of ring, each shorter than greatest diameter of ring; anal tube sclerotized; anal opening sclerotized; with anal flap.

Venter with longest flagellate seta on segment II 22–25 µm long, on segment VII 21–22 µm long; anal-lobe seta 82–88 µm long. Enlarged setae absent. Macrotubular ducts absent. Microtubular ducts near body margin of thorax and abdomen. Multilocular pores scattered over entire surface, of 5-locular type only. Cruciform pores near body margin. Legs with hind coxae each with 2 or 3 pores on ventral surface and 0 or 1 on dorsal surface; each femur with 4 setae, 1 proximal seta and 3 distal setae; each tibia with 4 setae, without middle seta. Antennae each 6-segmented, 128–138 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia on prothorax to segment VIII, and on ventral surface of mid- and hind- pairs of coxae.

Notes: This description is based on two specimens from one locality. The second-instar female of *Ov. haigi* is most similar to the second-instar female of *Ov. adoxus* in having similar anal ring structure, few small conical enlarged setae, dorsal and ventral cruciform pores and multilocular pores, and four setae on each femur. They differ as follows (characters in brackets are those of *Ov. haigi*): with cruciform pores restricted to dorsum of abdominal segment VIII and rarely VII (scattered over body).

First-instar nymph (Fig. 70)

Description: Slide-mounted specimen 0.8 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae, 0 or 1 microtubular ducts; ventrally each with 3 or 4 flagellate setae including suranal seta and anal-lobe seta.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (medial and mediolateral). Enlarged setae in lateral longitudinal line from head to segment VII, replaced by flagellate setae on some thoracic segments, also in mediolateral areas of posterior thoracic and anterior abdominal segments, 1 specimen without mediolateral line of setae on 1 side of body; with 15–17 enlarged setae on each side of body; largest setae each about 10 µm long; enlarged setae conical, laterally with nearly straight sides, with truncate apices; setal base broad; not in dermal pocket; with 6 setae on segment IV, including 2–4 enlarged setae and 2–4 flagellate setae; segment IV with combined total of 2–4 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 3 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, slightly smaller than remaining sclerotized portion; dermal orifice unsclerotized; present in mediolateral areas, absent from head. Multilocular and cruciform pores absent. Microtrichia on segments VII and VIII.

Anal ring dorsal, semicircular, incomplete, divided posteriorly, non-cellular, with 1 or 3 setae on each side of ring, each shorter than greatest diameter of ring; anal tube and anal opening unsclerotized.

Venter with longest flagellate seta on segment II 16 µm long, on segment VII 17 µm long; anal-lobe seta 87 and 100 µm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores in small numbers over surface, of 2 kinds: 5-locular pores restricted to area laterad to spiracles and in medial area of head;



FIGURE 69. *Ovatococcus haigi* Miller and Stocks **sp. n.**, second-instar female, 4.5 miles N. El Nido, Fresno Co., California, USA, August 20, 1968, on *Distichlis spicata*, T.R. Haig. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; L=claw; Q=dorsal surface of coxa.

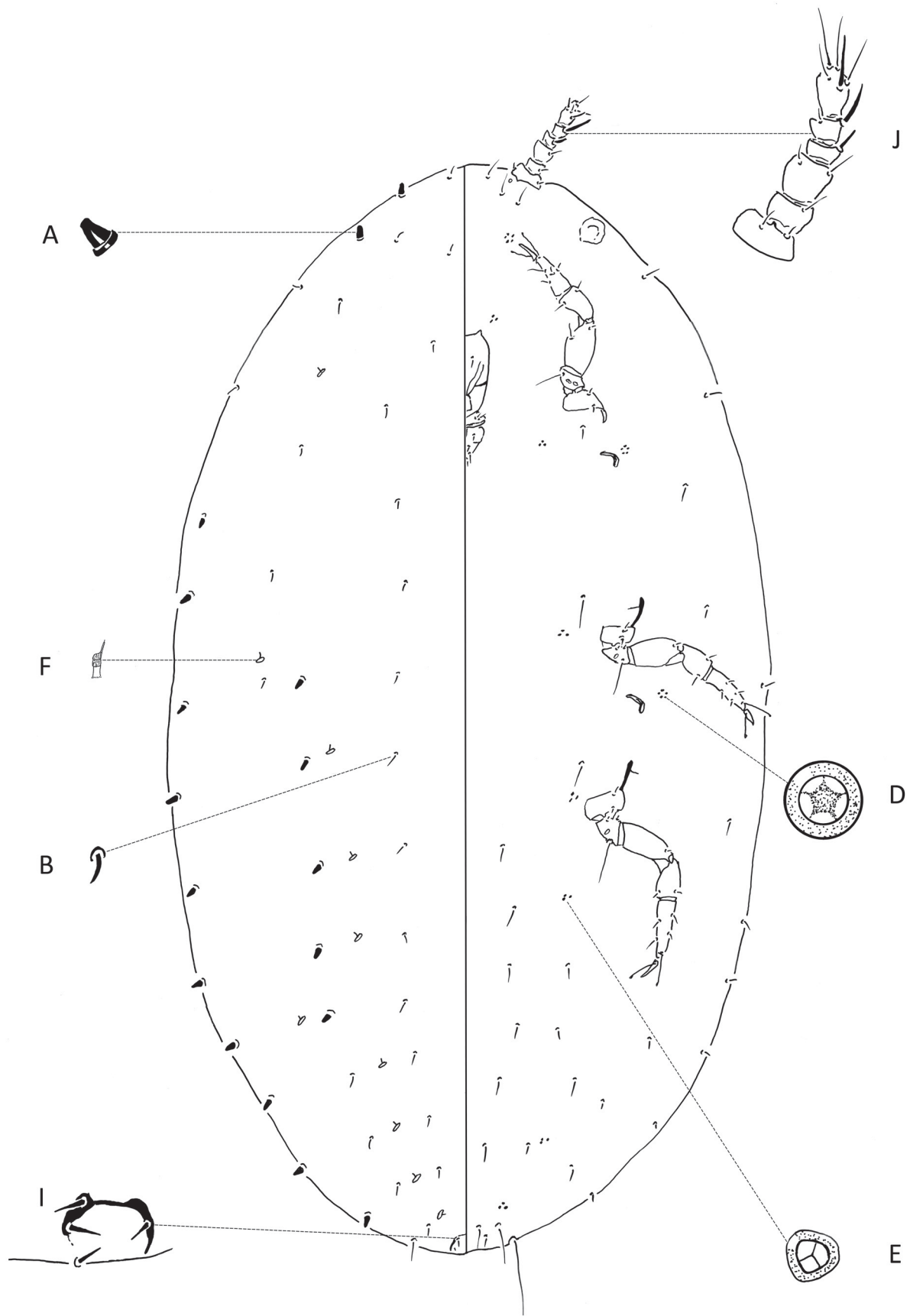


FIGURE 70. *Ovatococcus haigi* Miller and Stocks **sp. n.**, first-instar nymph, Chalfant, Mono Co., California, USA, July 6, 1970, *Distichlis spicata*, D.R. Miller. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; I=anal ring; J=antenna.

3-locular pores on head near mouthparts, on thorax near base of each pair of legs, and on abdomen with 2 near mediolateral setae on segments II, VII and VIII. Cruciform pores absent. Legs without pores; each femur with 4 setae, including 1 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7. Antennae each 6-segmented, 101–103 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia in medial area of metathorax and abdomen.

Notes: This description is based on two specimens from one locality. The first-instar nymph of *Ov. haigi* is most similar to the first-instar nymph of *Ov. neglectus* in lacking a dorsomedial line of enlarged setae, and having enlarged setae conical, anal ring without pores and reduced, and with a mediolateral longitudinal line of enlarged setae. They differ by having (character states in brackets are those of *Ov. haigi*): each femur with three setae, without a proximal seta (four setae including a proximal seta); mediolateral longitudinal line of enlarged setae complete (mediolateral longitudinal line of enlarged setae absent from head and anterior of thorax).

***Ovaticoccus johnsoni* (Miller) comb. n.**

Oregmomyga johnsoni Miller in Miller and McKenzie 1967: 493.

Material examined: not reported in the original description: UNITED STATES: Arizona: Apache Co.: Concho, VII-19-1930?, host ?, L.P. Wehrle #354 (1 ad. ♀ on 1 slide) UCD; 4 mi. E. Concho, VII-19-1940, host ?, L.P. Wehrle #354 (1 second-instar ♀, 5 second-instar ♂♂, 3 first-instar nymphs) UCD. California: Kern Co.: 4 mi. E. Monolith, IX-17-1966, on *Gutierrezia sarothrae*, T.R. Haig (9 ad. ♀♀ on 7 slides) Cdfa. San Joaquin Co.: 7 mi. W. Tracy, I-23-1968, on *G. "bractaeta"* [sic], T.R. Haig (7 ad. ♀♀ on 4 slides) Cdfa. Colorado: Mesa Co.: 24 mi. E. Grand Junction, IX-18-1967, on *G. sarothrae*, H.L. McKenzie (1 ad. ♀ on 1 slide) UCD. New Mexico: Grant Co.: 27 mi. SW Silver City, IX-5-1968, on *Hymenoxys richardsonii*, D.R. Miller and J.E. Lauck (1 ad. ♀ on 1 slide) UCD.

The justification for treating *Oregmomyga* as a junior synonym of *Ovaticoccus*, leading to this new combination, is provided in the "Notes" section that follows the generic description above. The adult female was described in detail by Miller and McKenzie (1967) and information from that paper is not repeated here. The "nymph" described in that paper is not conspecific with *O. johnsoni* because it has a non-cellular anal ring. In other species the structure of the anal ring remains relatively constant in the adult and immature female instars and the second-instar male. Here we describe the second-instar female and male and the first-instar nymph, but have not illustrated them.

Etymology: This species was named in honor of the late John W. Johnson, a talented high school biology teacher and naturalist.

Second-instar female

Description: Slide-mounted specimen 1.3 mm long, 0.6 mm wide. Body oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 or 3 flagellate setae, 0 or 1 enlarged setae, 2 microtubular ducts; ventrally each with 2 or 3 flagellate setae including suranal seta and anal-lobe seta, and 0 or 1 3-locular or 5-locular pores.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (mediolateral and lateral). Enlarged setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), medial line absent or reduced on head and anterior thorax; largest setae each about 10 μm long; enlarged setae conical, laterally with nearly straight sides, with truncate apices; setal base broad; not in dermal pocket; with 10 setae on segment IV, including 6 enlarged setae and 4 flagellate setae; segment IV with combined total of 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 7 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion about half size of remaining sclerotized portion; dermal orifice unsclerotized or weakly sclerotized; scattered over entire surface. Multilocular and cruciform pores absent. Microtrichia on segments VII and VIII.

Anal ring ventral, semicircular, incomplete, divided posteriorly, cellular, with 3 setae on each side of ring, each shorter than greatest diameter of ring; anal tube unsclerotized; anal opening sclerotized; with anal flap.

Venter with longest flagellate seta on segment II about 12 μm long, on segment VII 18 μm long; anal-lobe seta about 67 μm long. Enlarged setae absent. Macrotubular ducts absent. Microtubular ducts near body margin of thorax and abdomen. Multilocular pores scattered over entire surface, of 5-locular type only. Cruciform pores near body margin. Legs with hind coxae with 1 or 2 pores on ventral surface and 0 or 1 on dorsal surface; each femur with 5 setae including, 2 proximal setae and 3 distal setae; each tibia with 5 setae, with 1 in middle. Antennae each

6-segmented, about 150 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia on mesothorax to segment VIII, and on ventral surface of mid- and hind- pairs of coxae.

Notes: This description is based on one specimen from one locality. The second-instar female of *Ov. johnsoni* is most similar to the second-instar female of *Ov. viscosa* in lacking dorsal multilocular and cruciform pores and in having ventral cruciform pores on the thorax. They differ as follows (character states in brackets are those of *Ov. johnsoni*): without pores in the anal ring (with pores); without middle seta on tibiae (with middle seta).

Second-instar male

Description: Slide-mounted specimen 0.8 mm long, 0.5 mm wide. Body oval, with slightly protruding anal lobes. Anal-lobe area dorsally each with 2 flagellate setae, 2 or 3 multilocular pores, 1 or 2 microtubular ducts and 1 or 2 macrotubular ducts; ventrally each with 3 flagellate setae including suranal seta and elongate anal-lobe seta, 1 multilocular pore, 1 or 2 macrotubular ducts and 1 microtubular duct.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral), medial lines on each segment comprise 1 seta on each side of body, mediolateral lines comprise 2 setae on each side, and lateral lines comprise 1 or 2 setae on each side; enlarged setae absent; with 10 setae on segment IV all flagellate. Macrotubular ducts over entire surface, about 12 μm long. Microtubular ducts 7–8 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion slightly smaller than remaining sclerotized portion; dermal orifice unsclerotized; scattered over entire surface. Multilocular and cruciform pores absent. With microtrichia on segment VIII.

Anal ring ventral, circular, incomplete anteriorly, cellular, with 3 setae on each side of ring, each shorter than greatest diameter of ring; without additional pair of setae associated with ring; anal tube sclerotized, anal opening weakly sclerotized, anal flap present.

Venter with longest flagellate seta on segment II 26 μm long, on segment VII 27 μm long; longest anal-lobe seta 50 μm long. Enlarged setae absent. Macrotubular ducts about same size as those on dorsum, scattered over head and thorax, in medial, mediolateral, and lateral longitudinal lines on abdomen. Microtubular ducts rare or absent. Multilocular pores scattered over entire surface, least abundant on head, of 3 or 4 kinds: 7-locular pores and 3-locular pores uncommon; 5-locular pores most abundant. Cruciform pores in small numbers on lateral areas of thorax. Legs without pores; each femur with 5 setae, including 2 proximally and 3 distally; each tibia with 5 setae, with seta in middle; hind tibia/tarsus 0.8. Antennae each 7-segmented, about 150 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia from mesothorax to segment VIII, also on hind 2 pairs of coxae.

Notes: The description is based on six specimens from one locality. *Ovaticoccus johnsoni* is most similar to *Ov. peruvianus* in lacking dorsal enlarged setae and dorsal multilocular pores and in having pores in the anal ring. They differ as follows (character states of *Ov. johnsoni* in brackets): without dorsal microtubular ducts (with dorsal microtubular ducts).

First-instar nymph

Description: Slide-mounted specimen 0.8 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae, 1 enlarged seta, 0 or 1 microtubular ducts; ventrally each with 2 or 3 flagellate setae, suranal seta and including anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral) from head to segment VII or VIII; largest setae about 8 μm long; enlarged setae conical, laterally with nearly straight sides with truncate apices; setal base broad; not in dermal pockets; with 6 setae on segment IV all enlarged. Macrotubular ducts absent. Microtubular ducts each approximately 7 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, slightly smaller than remaining sclerotized portion; dermal orifice unsclerotized; scattered over entire surface. Multilocular and cruciform pores absent. Microtrichia on segments VII and VIII.

Anal ring dorsal, semicircular, incomplete, divided anteriorly, cellular, with 3 setae on each side of ring, each shorter than greatest diameter of ring; anal tube and anal opening unsclerotized, anal flap present.

Venter with longest seta on segment II 10 μm long, on segment VII 17 μm long; anal-lobe seta 6 μm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores in small numbers over surface, of 2 kinds: 5-locular pores restricted to area laterad of spiracles and in medial area of head; 3-locular pores on head near mouthparts, on thorax near base of each pair of legs, and on abdomen with 2 near mediolateral setae on segments II, VII and VIII; 3-locular pores most abundant. Cruciform pores in lateral areas of thorax. Legs without pores; each femur with 5 setae including 2 proximally and 3 distally; each tibia with 5 setae, 1 in middle;

hind tibia/tarsus 0.7. Antennae broken, probably each 6-segmented. Frontal lobes absent. Preantennal pore present. Microtrichia in medial area of mesothorax and abdomen.

Notes: This description is based on one specimen and two exuviae from one locality. The first-instar nymph of *Ov. johnsoni* is most similar to the first-instar nymph of *Ov. peruvianus* in having 3 pairs of longitudinal lines of enlarged setae on the dorsum and pores in the anal ring. They differ by having (character states in brackets are those of *Ov. johnsoni*): most multilocular pores with five loculi (with three loculi); each tibia with four setae (usually with five setae, with one in middle).

***Ovaticoccus mackenziei* Miller**

Ovaticoccus mackenziei Miller in Miller and McKenzie 1967: 515–517.

Material examined: not previously reported: California: Imperial Co.: Holtville, II-11-1972, on *Ephedra* sp., R.A. Flock (1 ad. ♀ on 1 slide) CDFA. San Bernardino Co.: Morongo Valley, V-11-1971, on *Ephedra* sp., Dixon and Hunter (4 ad. ♀♀ on 4 slides) CDFA.

Etymology: This species was named in honor of the late Howard L. McKenzie, the first author's major professor and well-known coxistologist.

The adult female and second-instar female (as "first or second instar") were described by Miller and McKenzie (1967) and information from that paper is not repeated here.

***Ovaticoccus maryfoleybensoniae* Miller and Stocks sp. n.**

Type material: Adult female holotype (specimen on right side of slide of 3 specimens) with right label "Ovaticoccus / maryfoleybensoniae / Miller & / Stocks / Holotype / Paratypes; with a map of the position of the holotype and the two paratypes." Left label "Dactylopiinae / on Muhlenbergia / Elk Point, S. Dakota / C.N. Ainslie, Coll. / 2-25.18 / Rec'd 1932 in / G.N. Ainslie Collection / Webster #11824;" label on back of slide "Ovaticoccus / maryfoleybensoniae / Miller & Stocks / HOLOTYPE / USNM / South Dakota." The holotype is in USNM. **Paratypes:** UNITED STATES: South Dakota: Union Co.: Elk Point, IX-2-1925, on *Muhlenbergia* sp., C.N. Ainslie (1 ad. ♀ holotype, 6 ad. ♀♀ paratypes, 37 first-instar nymph paratypes on 5 slides), UCD (1 slide), USNM (4 slides).

Etymology: This species is named in honor of the late Mary Foley Benson who was a talented artist and scientific illustrator. In the study of scale insects, she is best known for her watercolor paintings of mealybugs in the field and her line drawings of slide-mounted specimens in McKenzie (1967). The jacket on this publication is a bright, colorful collage of the ornate images of the mealybugs of California. Early in her career she illustrated many scale insects for the publications of Louise Russell and Harold Morrison and contributed several images for the 1952 Agriculture Yearbook. Her artwork depicting plants, insects, and insect life histories has been displayed in several art galleries in the western USA. The watercolor pictures of *Acanthococcus araucariae*, *Ovaticoccus adoxus* and *O. salviae* included in this publication were presented to the first author in 1966. She also is known for being one of the first women to fly in the Army Air Corps during World War II.

Field features: Probably occurring in leaf blade sheaths.

Adult female (Fig. 71)

Description: Holotype, slide mounted, 4.8 mm long, 1.4 mm wide (paratypes 3.8–4.4 mm long, 1.4–1.5 mm wide). Body elongate, without protruding anal lobes. Anal-lobe areas each dorsally with 3 setae and cluster of more than 10 multilocular pores; ventrally each with 3 setae including suranal seta and anal-lobe seta and cluster of more than 10 multilocular pores.

Dorsum with flagellate setae apically acute, shorter than those on venter, becoming progressively shorter anteriorly, not arranged in longitudinal lines, flagellate. Enlarged setae absent; segment IV with 20 setae (paratypes with 18–22). Macrotubular ducts scattered over entire surface, less numerous than on venter, in small numbers on segments V–VII. Microtubular ducts approximately 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, slightly shorter than remaining sclerotized portion; dermal orifice inconspicuous and lightly sclerotized, without protruding tube. Microtubular ducts in small numbers on posterior 3

abdominal segments and on head. Multilocular pores over entire surface, of 4 kinds: 9-locular pores more numerous than 6-locular pores and 5-locular pores, less abundant than 7-locular pores; 6-locular pores and 5-locular pores rare. Cruciform pores abundant, most numerous on lateral margins excluding segment VIII. Microtrichia absent.

Anal ring ventral, incomplete, divided posteriorly, cellular, with 3 setae on each side of ring, each approximately ½ length of greatest diameter of ring; with additional pair of setae associated with ring but not attached; anal tube sclerotized; anal opening sclerotized; without anal flap.

Venter with longest flagellate seta on segment II 30 µm long (paratype 22–28 µm), on segment VII 32 µm long (paratypes 30–35 µm); anal-lobe seta 182 µm long (paratypes 155–185 µm). Enlarged setae absent. Macrotubular ducts same size as on dorsum, present over entire surface. Microtubular ducts near lateral margins of thorax and abdomen. Multilocular pores most abundant posteriorly, of same kinds as on dorsum. Cruciform pores from head to segment VI; most abundant near lateral margins of anterior abdominal segments. Legs with hind coxae with 13 and 18 pores dorsally, ventrally with 0 and 1 (paratypes dorsally with 12–22, ventrally without pores); each femur with 5 setae including 2 proximal setae and 3 distal; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8 (paratypes 0.7–0.9). Antennae each 7-segmented (paratypes 6- or 7-segmented), 205 and 200 µm long (paratypes 185–200 µm). Frontal lobes absent. Preantennal pore absent. Microtrichia absent from derm, present on all coxae.

Notes: This description is based on seven specimens from one locality. The adult female of *Ov. maryfoleybensoanae* is most similar to the adult female of *Ov. davesmithi* in having dorsal and ventral multilocular pores and cruciform pores, the multilocular pores predominantly with more than five loculi, and by having five setae on each femur including two proximal setae. They differ by having (character states in brackets are those of *Ov. maryfoleybensoanae*): enlarged setae present near body margin (absent); anal ring complete (incomplete).

First-instar nymph (Fig. 72)

Description: Slide-mounted specimens 0.5–0.6 mm long, 0.2–0.3 mm wide. Body elongate oval, with protruding anal lobes. Anal-lobe areas dorsally each with 3 flagellate setae, 0 or 1 microtubular ducts; ventrally each with 3 flagellate setae including suranal seta and anal-lobe seta.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral); longitudinal lines replaced by enlarged setae on posterior segments, usually medial line ends on segment VI, mediolateral line ends on segment V, lateral line ends on segment III, some specimens with 1 or 2 more or less. Enlarged setae in 3 pairs of longitudinal lines on abdomen (medial, mediolateral and lateral) replacing flagellate lines posteriorly; largest setae about 8 µm long; enlarged setae nipple shaped, laterally with curved sides, with rounded apices; setal base thin; not in dermal pocket; with 6 setae on segment IV, including 2 enlarged setae and 4 flagellate setae; segment IV with combined total of 2 enlarged setae on dorsum and venter. Macrotubular ducts absent. Microtubular ducts approximately 4 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or truncate depending on angle, about same length as remaining sclerotized portion; dermal orifice sclerotized; in lateral areas of abdomen, uncommon on head and thorax. Multilocular pores absent. Cruciform pores in lateral areas of thorax. Microtrichia from mesothorax to segment VIII.

Anal ring ventral or marginal, semicircular, incomplete, divided anteriorly, cellular, with 3 setae on each side of ring, each same length as or longer than greatest diameter of ring; with additional pair of setae associated with anal ring; anal tube weakly sclerotized, anal opening sclerotized, without anal flap.

Venter with longest flagellate seta on segment II 10–17 µm long, on segment VII 18–27 µm long; anal-lobe seta 120–172 µm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores abundant, in submarginal row from head to segment VIII, with 2 associated with each spiracle, of at least 5 kinds: 5-locular pores uncommon, 7-locular pores most abundant, 9-locular pores, 10-locular pores, and 11-locular pores often present. Cruciform pores absent. Legs without pores; each femur with 5 setae including 2 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 6-segmented, 128–138 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia in medial area of mesothorax to segment VIII, absent from coxae.

Notes: This description is based on 37 specimens from one locality. The first-instar nymph of *Ov. maryfoleybensoanae* is most similar to the first-instar nymph of *Ov. peruvianus* in lacking dorsal multilocular pores, having a few dorsal cruciform pores on the thorax, and having dorsal microtubular ducts. They differ by having (character states in brackets are those of *Ov. maryfoleybensoanae*): multilocular pores predominantly with five loculi (more than five); with one multilocular pore associated with each spiracle (two); mediolateral and lateral lines of enlarged setae present from head to segment VII (present on abdomen only).

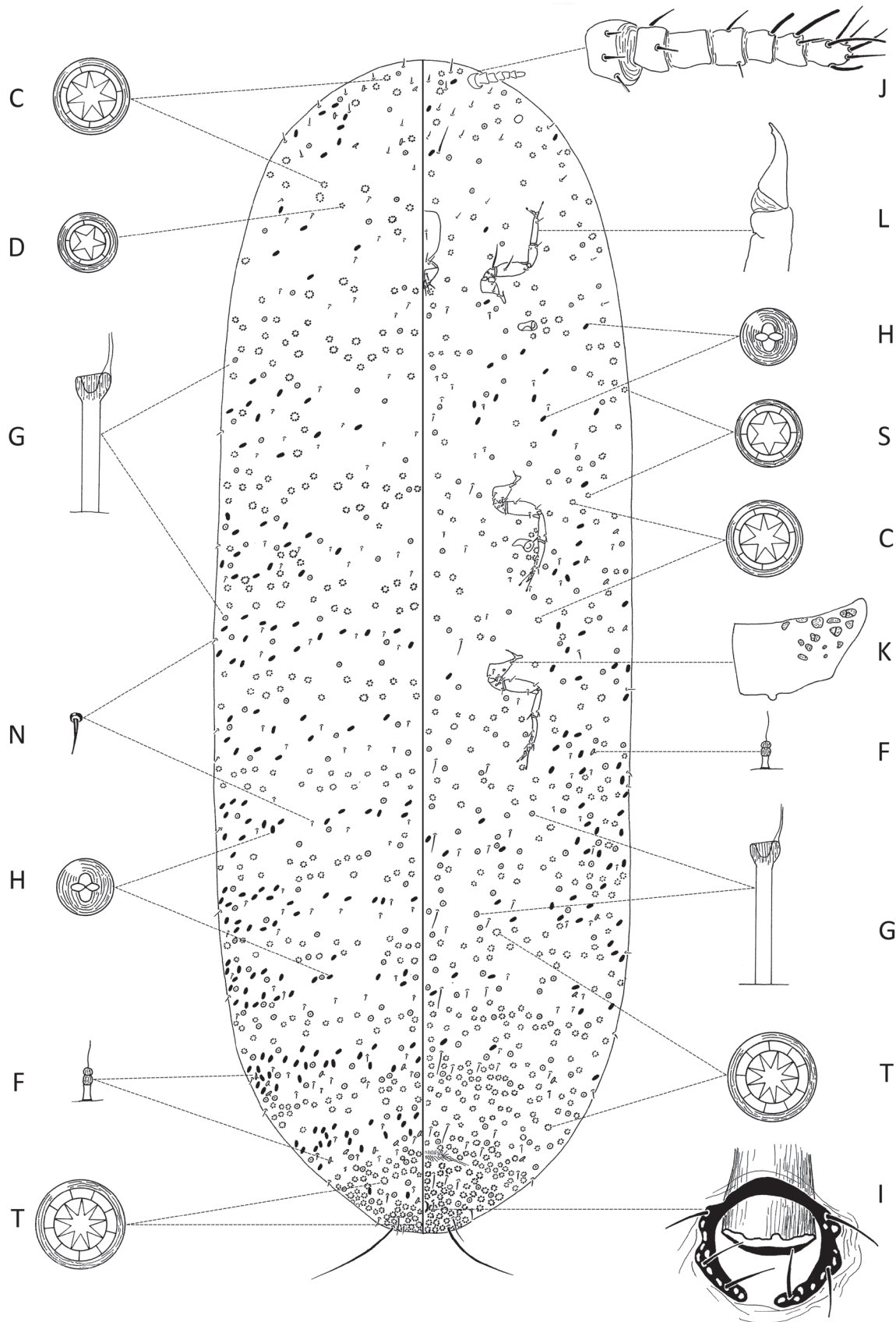


FIGURE 71. *Ovatococcus maryfoleybensonae* sp. n., adult female, Elk Point, Union Co., South Dakota, USA, September 2, 1925, on *Muhlenbergia* sp., C.N. Ainslie. C=7-locular pore; D=5-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring; J=antenna; K=dorsal surface of coxa; L=claw; N=flagellate seta; S=6-locular pore; T=pore with >7 loculi.

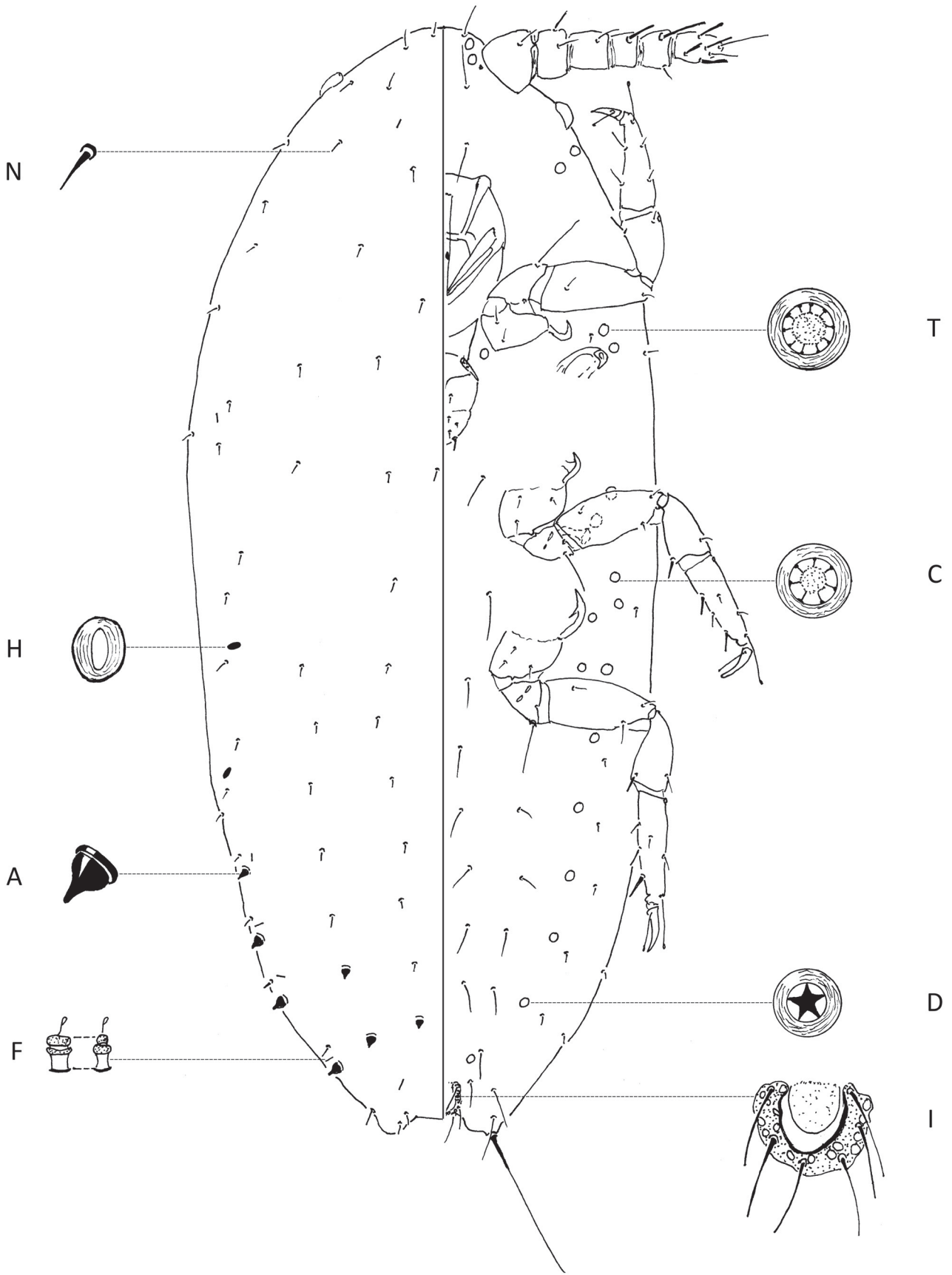


FIGURE 72. *Ovatococcus maryfoleybensoniae* sp. n., first-instar nymph, Elk Point, Union Co., South Dakota, USA, September 2, 1925, on *Muhlenbergia* sp., C.N. Ainslie. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct (shown in two views); H=cruciform pore; I=anal ring; N=flagellate seta; T=pore with >7 loculi.

Ovaticoccus neglectus (Cockerell) comb. n.

Eriococcus neglectus Cockerell 1895: 8.

Nidularia neglecta (Cockerell); Lindinger 1933a: 116 (change of combination).

Onceroptyga neglecta (Cockerell); Ferris 1955: 209 (change of combination).

Oregmomyga neglecta (Cockerell); Hoy 1963: 179 (change of combination).

Material examined: not previously reported are as follows: UNITED STATES: Arizona: Apache Co.: 20 mi. N. St. Johns, IX-6-1968, on *Atriplex* sp. D.R. Miller and J.E. Lauck (1 ad. ♀ on 1 slide) UCD; Cochise Co.: 10 mi W. Tombstone, III-17-1968, on *Atriplex* sp., D.R. Miller and R.W. Rust (4 ad. ♀♀ on 2 slides) UCD. California: Kern Co.: 9 mi. E. Cuyama, VI-28-1966, on *Atriplex* sp., D.R. Miller (4 ad. ♀♀ on 3 slides) UCD; Piru, IX-25-1934, on *Artemisia*?, E.T. Gammon (7 ad. ♀♀ on 2 slides) CDFA; Quatal Canyon, V-25-1977, on *Atriplex* sp., R. Hobza and R.J. Gill (7 ad. ♀♀, 3 second-instar ♀♀ on 5 slides) CDFA. New Mexico: San Juan Co.: 8 mi. N. Shiprock, IX-6-1968, on *Atriplex* sp., D.R. Miller and J.E. Lauck (1 ad. ♀ on 1 slide) UCD. Oregon: Lake Co.: 24 mi. E. Christmas Valley, VIII-8-1968, on *Atriplex canescens*, D.R. Miller and R.F. Denno (4 ad. ♀♀ on 3 slides) UCD.

Etymology: The species epithet “*neglectus*” is formed from the Latin word “*neglectus*” meaning “neglected” or “not chosen.” Cockerell (1895: 8) stated “Las Cruces, N. M., on stems of *Atriplex canescens*, looking very like the *Phoradendron* seeds so commonly seen on trees in this vicinity. The plants are thickly infested by them, but I had entirely overlooked them until recently, notwithstanding that I pass within a few feet of them on my way to and from College.”

The adult female was described in detail by Miller and McKenzie (1967); information concerning that instar is not repeated here. That paper also includes descriptions of the second-instar female (as “late instar”), first-instar nymph (as “early instar”), and second-instar male (as “probably third-instar”); we provide more detailed descriptions below.

Second-instar female (Fig. 73)

Description: Slide-mounted specimens 0.7–0.8 mm long, 0.4 mm wide. Body oval, with slightly protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae, 0 or 1 microtubular duct; ventrally each with 3 or 4 flagellate setae including suranal seta and anal-lobe seta.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (mediolateral and lateral), each line with 1 seta on each side of segment, sometimes flagellate setae replace medial enlarged setae. Enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral), 1 or 2 replaced by flagellate setae or transitional setae; largest setae 8–10 µm long; enlarged setae nipple shaped, laterally with curved sides, with rounded apices; setal base moderate; in dermal pocket; with 10 setae on segment IV including 6 enlarged setae and 4 flagellate setae; segment IV with combined total of 9–11 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Multilocular pores absent or uncommon on thorax and head, 5-locular pores only. Cruciform pores absent or present on thorax. Microtrichia absent, or weakly developed on segments VII and VIII.

Anal ring dorsal, circular, incomplete, divided posteriorly, non-cellular, with 0–3 small setae on each side of ring, each shorter than greatest diameter of ring; anal tube unsclerotized or weakly sclerotized; anal opening unsclerotized; without anal flap.

Venter with longest flagellate seta on segment II 20–25 µm long, on segment VII 21–23 µm long; anal-lobe seta 103–126 µm long. Enlarged setae in 1 pair of longitudinal lines (lateral), often slightly smaller than dorsal enlarged setae. Macrotubular ducts absent. Microtubular ducts uncommon laterally, usually near enlarged setae, each approximately 8 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion smaller than remaining sclerotized portion; dermal orifice unsclerotized; without protruding tube; scattered over entire surface, associated with enlarged setae. Multilocular pores scattered over entire surface, arranged in rows of 5 or more on each abdominal segment, of 4 kinds: 5-locular pores most abundant, 6- and 7-locular pores less abundant, and 9-locular pores uncommon or absent. Cruciform pores absent. Legs with hind coxae each with 2–4 pores on dorsal surface; each femur with 3 setae, without proximal setae; each tibia with 4 setae, without middle seta. Antennae each 6-segmented, 98–100 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia on head to segment VIII, and on ventral surface of mid- and hind- pairs of coxae.

Notes: This description is based on nine specimens from two localities. The second-instar female of *Ov. neglectus* is most similar to the second-instar female of *Ov. variabilis* in lacking dorsal and ventral cruciform pores, and in having ventral enlarged setae, and by having predominantly 5-locular pores. They differ as follows (character states

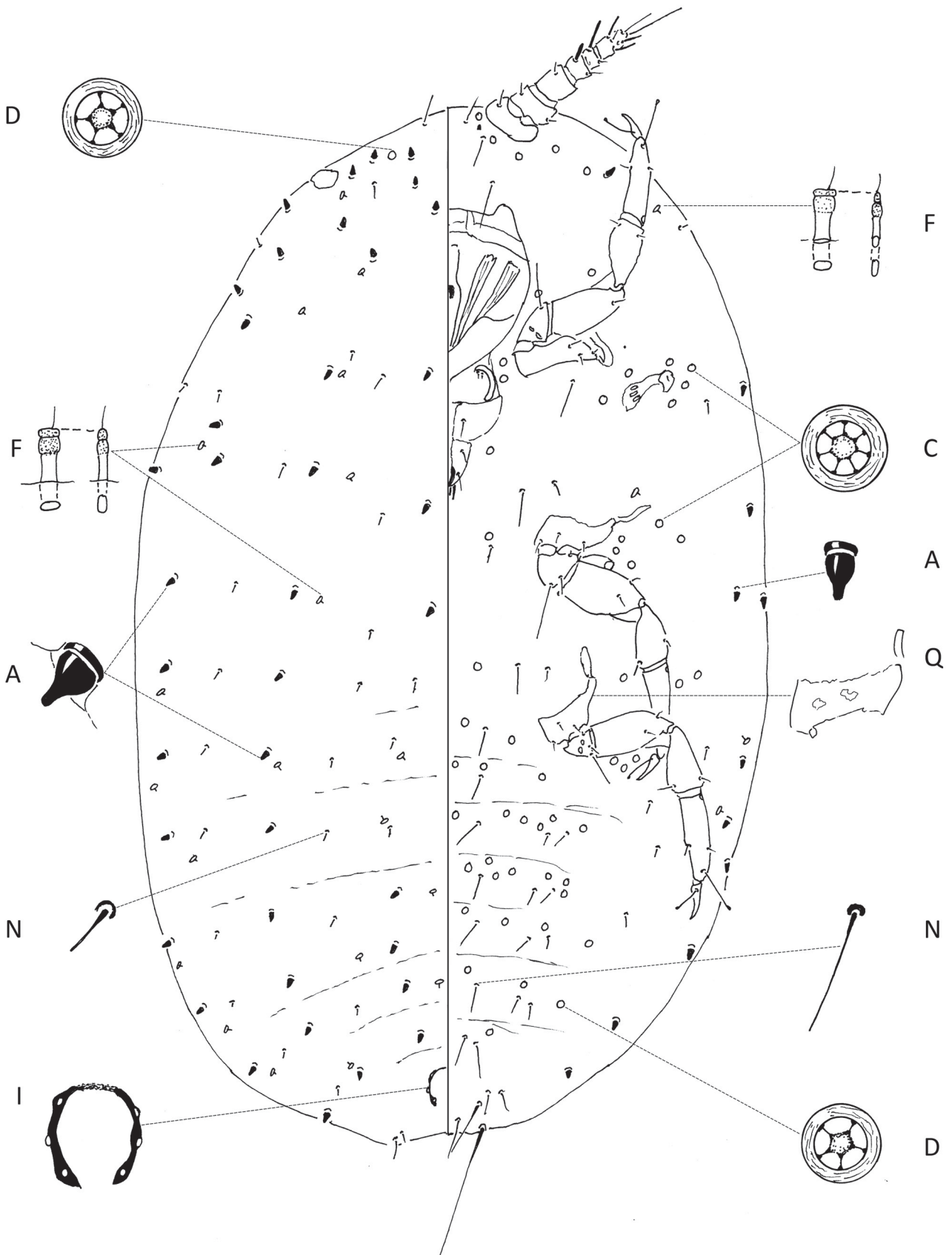


FIGURE 73. *Ovatococcus neglectus* (Cockerell 1895), second-instar female, Rough Rock, Apache Co., Arizona, USA, ?, 1940, on *Atriplex* sp., G.F. Ferris. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct (shown in two views); I=anal ring; N=flagellate seta; Q=dorsal surface of coxa.

in brackets are those of *Ov. neglectus*): with ventral abdominal multilocular pores uncommon, arranged in mediolateral longitudinal lines, usually with one or two on each side of each abdominal segment (pores common, in rows of more than five on each segment); without microtubular ducts in dorsomedial areas of abdomen (with microtubular ducts scattered over dorsum).

Second-instar male (Fig. 74)

Description: Slide-mounted specimens 0.7–0.8 mm long, 0.4 mm wide. Body oval, with slightly protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae; ventrally each with 2 or 3 flagellate setae including suranal seta and anal-lobe seta, and 0 or 1 multilocular pore.

Dorsum with flagellate setae in segmental rows, arranged in 3 or 4 pairs of longitudinal lines (medial, mediolateral, sublateral and lateral), often with more than 1 seta in each line particularly on anterior segments; dorsal setae shorter than those on venter. Enlarged setae variable, 1 specimen without enlarged setae, others with nearly as many as on second-instar female; when present, enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral), medial and mediolateral setae on posterior abdominal segments often replaced by flagellate setae or transitional setae; largest setae 8–10 µm long; enlarged setae nipple shaped, laterally with curved sides, with rounded apices; setal base moderate; not in dermal pocket; segment IV with 8–10 flagellate setae and 0–3 enlarged setae; segment IV with combined total of 0–6 enlarged setae dorsally and ventrally. Microtubular ducts each approximately 6 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion smaller than remaining sclerotized portion; dermal orifice unsclerotized; without protruding tube; scattered over entire surface, most abundant medially and laterally. Macrotubular ducts present over entire surface. Multilocular pores uncommon laterally on head and thorax, of 1 or 2 kinds: 7-locular pores uncommon, 5-locular pores most abundant. Cruciform pores absent. Microtrichia on segment VIII.

Anal ring ventral, semicircular, incomplete, non-cellular, with 2 or 3 setae, or setal bases, on each side of ring, each normally shorter than diameter of ring; without additional pair of setae with anal ring; anal tube unsclerotized, with dermal orifice sclerotized or weakly sclerotized, without anal flap.

Venter with flagellate setae on segment II 21–30 µm long, on segment VII 27–30 µm long; anal-lobe seta 90–110 µm long. Enlarged setae, when present, along body margin of abdomen, with 1 or 2 on thorax, often slightly smaller than dorsal enlarged setae. Macrotubular ducts on mediolateral and lateral areas of thorax and abdomen. Microtubular ducts present laterally. Multilocular pores scattered over entire surface, common, with more than 2 pores on each side of each segment, of 3–6 kinds: 5-locular pores most abundant; 7-locular pores common; 4-locular pores, 6-locular pores and 9-locular pores rare or absent. Cruciform pores absent. Legs with hind coxae without pores; each femur with 3 setae, without proximal seta; tibia each with 3 or 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 7-segmented, 120–130 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from head to segment VIII, also on ventral surface of coxae.

Notes: The description is based on six specimens from one locality. The second-instar male of *Ovaticoccus neglectus* is most similar to the second-instar male of *Ov. salviae* in lacking dorsal cruciform pores, each femur with three setae, and by having a similarly shaped anal ring. They differ as follows (character states in brackets are those of *Ov. neglectus*): 7-locular pores rare or absent (7-locular pores abundant, nearly as common as 5-locular pores); ventral multilocular pores uncommon on abdomen, most segments each with less than five pores (in rows of 10 or more pores on each segment); microtubular ducts rare or absent (microtubular ducts common on dorsum and lateral venter).

First-instar nymph (Fig. 75)

Description: Slide-mounted specimens 0.4–0.6 mm long, 0.2–0.3 mm wide. Body elongate oval, with slightly protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae, 0 or 1 microtubular ducts; ventrally each with 3 flagellate setae including anal-lobe seta.

Dorsum with flagellate setae arranged in 1 pair of longitudinal lines (medial), occasionally with 1 or 2 replaced by enlarged seta. Enlarged setae in 2 pairs of longitudinal lines on abdomen (mediolateral and lateral); largest setae about 6 µm long; enlarged setae nipple shaped, laterally with curved sides, with rounded apices; setal base thin; not in dermal pocket; with 6 setae on segment IV, including 4 enlarged setae and 2 flagellate setae; segment IV with combined total of 4 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or truncate depending on visual angle, smaller than remaining sclerotized portion; dermal orifice unsclerotized; in lateral and mediolateral areas of abdomen, less common on head and thorax. Multilocular pores absent. Cruciform pores absent. Microtrichia from mesothorax or segment II to segment VIII.

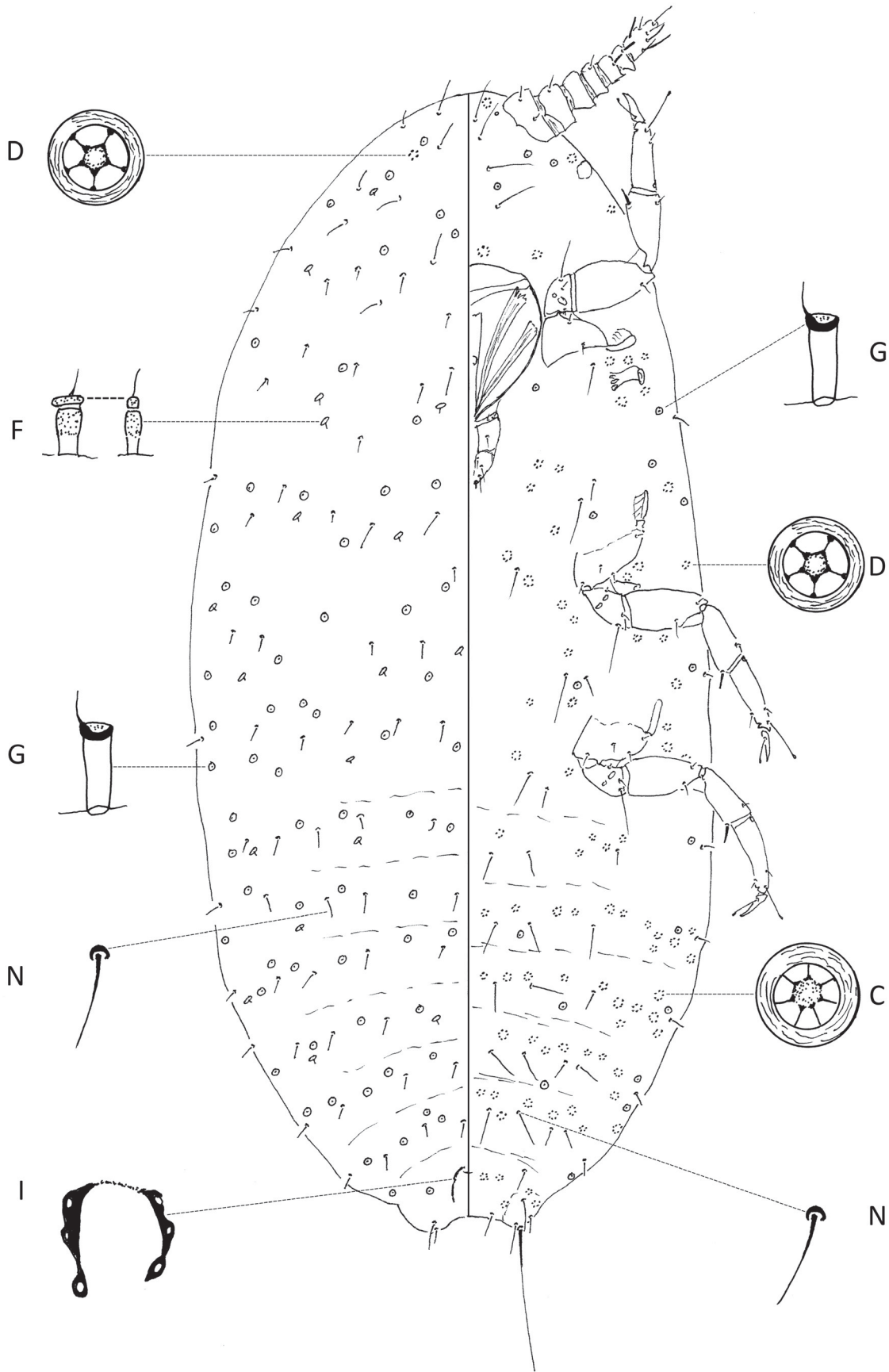


FIGURE 74. *Ovatococcus neglectus* (Cockerell 1895), second-instar male, Rough Rock, Apache Co., Arizona, USA, ?, 1940, on *Atriplex* sp., G.F. Ferris. C=7-locular pore; D=5-locular pore; F=microtubular duct (shown in two views); G=macroduct; I=anal ring; N=flagellate seta.

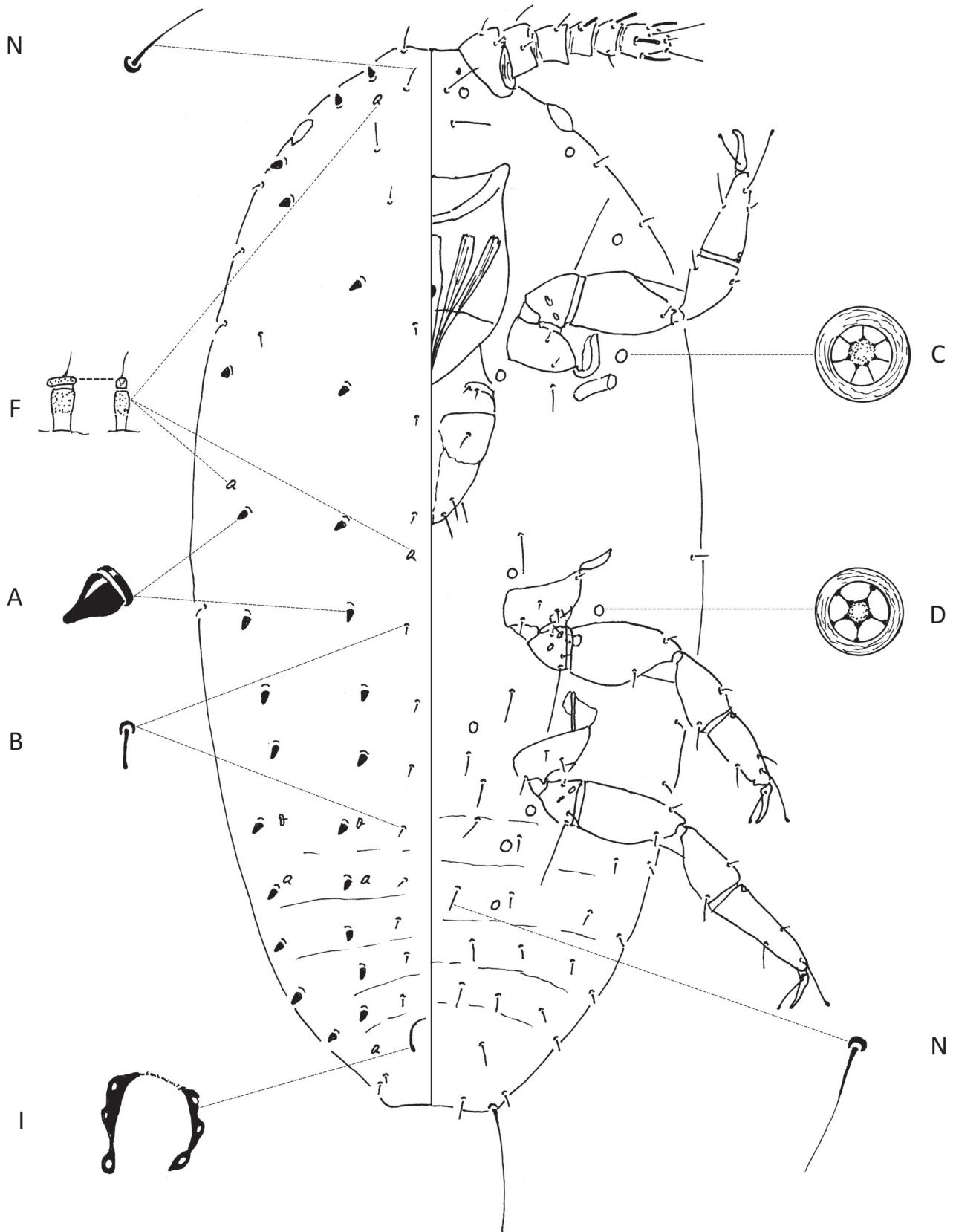


FIGURE 75. *Ovatococcus neglectus* (Cockerell 1895), first-instar nymph, Rough Rock, Apache Co., Arizona, USA, ?, 1940, on *Atriplex* sp., G.F. Ferris A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct (shown in two views); I=anal ring; N=flagellate seta.

Anal ring dorsal, semicircular, horseshoe shaped, divided posteriorly, non-cellular, with 3 setae on each side of ring, each shorter than half of diameter of ring; without additional pairs of setae associated with anal ring; anal tube unsclerotized, anal opening sclerotized, without anal flap.

Venter with longest flagellate seta on segment II 9–13 µm long, on segment VII 12–13 µm long; anal-lobe seta 75–85 µm long. Enlarged setae absent. Macrotubular ducts and microtubular ducts absent. Multilocular pores present at base of antennae, near eye, between front leg and mouthparts, laterad of front legs, 1 associated with each spiracle, 1 mesad of each mid- and hind coxa, 1–4 forming mediolateral longitudinal line on anterior abdominal segments; of 3 kinds: 5-locular pores most abundant, 7-locular pores and 3-locular pores uncommon or absent. Cruciform pores absent. Legs without pores; each femur with 3 setae, without proximal setae; each tibia with 3 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 6-segmented, 93–100 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia in medial area of mesothorax or metathorax to segment VIII, absent from coxae.

Notes: This description is based on five specimens from one locality. The first-instar nymph of *Ov. neglectus* is most similar to the first-instar nymph of *Ov. salviae* in having three setae on each femur, by lacking cruciform pores, and by having a similar distribution pattern of multilocular pores. They differ as follows (character states in brackets are of *Ov. neglectus*): without enlarged setae (with two longitudinal lines of setae); anal ring setae more than half as long as the greatest diameter of the ring (less than half, sometimes represented by socket only).

***Ovaticoccus parvispinus* (Chaffin) comb. n.**

Eriococcus parvispinus Chaffin 1923: 169.

Onceropyga parvispina (Chaffin); Ferris 1955: 213–214 (change of combination).

Oregmopyga parvispina (Chaffin); Hoy 1963: 180 (change of combination).

Type material: The lectotype of this species was designated by Miller and Miller (1993) and is deposited in the USNM; there is one additional paralectotype in the USNM. In addition, there are two paralectotype slides; one contains two adult females and the other contains a single adult female (in FSCA).

The justification for treating *Oregmopyga* as a junior synonym of *Ovaticoccus*, leading to this new species combination, is provided in the “Notes” section that follows the generic description above. The adult female of this species was described by Chaffin (1923), Ferris (1955), Miller and McKenzie (1967), and Miller and Miller (1993) and information from those papers is not repeated here.

Etymology: The species epithet “*parvispinus*” is formed from the Latin word “*parvus*” meaning “little” or “small” and the Latin word “*spina*” meaning “spine” and probably refers to the small enlarged setae (spines) that occur on this species.

Notes: There is some question about the identity of the adult male mentioned by Chaffin (1923). The presence of two pairs of lateral caudal filaments is characteristic of males of mealybugs in the Phenacoccini and is not known to occur in eriococcid males. However, the body of the male is described as “bright carmine”, which would be more typical of an eriococcid.

Several collections of specimens either the same as, or similar to, this species are available for study. In addition to the collections from Florida and Texas which are typical of the material described in Chaffin (1923), we have seen also series of specimens from the Bahamas on orchid, Grand Turk on *Epidendrum*, Mexico on *Beaucarnea* and an unknown shrub, Oklahoma on grass, and Peru on *Capparis avicennifolia*. The latter four collections are here included in *Ov. peruvianus* based on the reduced number of enlarged setae, but variation in other characters, and the diversity of hosts and wide geographic range are surprising for a single species. Morphological diversity includes differences in the abundance of enlarged setae, the distribution of cruciform pores and multilocular pores, and the arrangement of microtubular ducts. Unfortunately, we were unable to find sufficient morphological uniformity to convince us that there are more than two easily recognizable species within this possible complex of species. One species in the complex, other than *Ov. parvispinus*, was described by Granara de Willink and Díaz (2007) as *Oregmopyga peruviana* and was distinguished by the lack of, or highly reduced number of, enlarged setae. It is treated here as a distinct species, i.e., *Ov. peruvianus* (see below).

***Ovaticoccus peninsularis* (Ferris) rev. comb.**

Fonscolombia peninsularis Ferris 1921: 66, 78.

Pseudohermes peninsularis (Ferris); Lindinger 1933b: 31-32, 50 (change of combination).

Gymnococcus peninsularis (Ferris); Ferris 1955: 188 (change of combination).

Ovaticoccus peninsularis (Ferris); Boratynski 1958: 174 (change of combination).

Oregmopyga peninsularis (Ferris); Miller and McKenzie 1967: 501-503 (change of combination).

Etymology: The species epithet “*peninsularis*” is named for the Baja California Peninsula, Mexico, where it was first collected.

The justification for treating *Oregmopyga* as a junior synonym of *Ovaticoccus*, leading to this revised combination, is provided in the “Notes” section that follows the generic description above. The adult female was described in detail by Ferris (1921) and Miller and McKenzie (1967) and is not repeated here. No additional specimens have been collected of this species since the original description of Ferris (1921).

***Ovaticoccus peruvianus* (Granara de Willink & Díaz) comb. n.**

Oregmopyga peruviana Granara de Willink and Díaz 2007: 5–10.

Type specimens: We have not seen type material of *Ov. peruvianus*, but have seen a series of specimens from Peru that closely resembles the original description. Some of the collections mentioned as part of the *Ov. parvispinus* complex of species are tentatively placed in *Ov. peruvianus* awaiting further study.

Material examined: MEXICO: San Luis Potosi: Tomazunchale (in quarantine at San Diego, California), VII-19-1962, on *Beaucarnea* sp., A.D. Atnip (2 ad. ♀♀, on 2 slides) CDEFA, UCD; Tamaulipas, 10 mi. E. Ciudad Monte, II-25-1972, on leafless shrub, D.R. Miller and F.D. Parker (3 ad. ♀♀, on 3 slides) USNM. PERU: Piura: Chato, near Catacon, IX-4-1910, on “bichayo” native shrub (= *Beautempsia avicennifolia*?), C.H.T. Townsend (3 ad. ♀♀, on 1 slide) USNM. UNITED STATES: Oklahoma: Caddo Co: specific locality unknown, on grass, R. Beshear (1 ad. ♀, on 1 slide) USNM.

Etymology: The species epithet “*peruviana*” is named for the country where it was first collected.

The justification for treating *Oregmopyga* as a junior synonym of *Ovaticoccus*, leading to this new combination, is provided in the “Notes” section that follows the generic description above. The adult female, second-instar male and female, and first-instar nymph of this species were described in detail by Granara de Willink and Díaz (2007) and information from that paper is not repeated here. We include a new description of the adult female from localities and hosts other than in the original description and include the species in keys to the various instars.

Adult female (Fig. 76)

Description: Slide-mounted specimens 1.9–2.3 mm long, 1.2–1.4 mm wide. Body broadly oval, with slightly protruding anal lobes. Anal-lobe areas dorsally each with 2 or 3 flagellate setae, 0–2 microtubular ducts, and 3–10 5-locular pores; ventrally each with 3 or 4 flagellate setae including suranal seta and anal-lobe seta, 4–7 5-locular pores, and 0 or 1 macro tubular duct.

Dorsum with flagellate setae often curved, with rounded apex, scattered over entire surface, noticeably shorter than those on venter. Enlarged setae uncommon or absent, with 0–4 on body margin of 1 size; largest seta 11–12 µm long. Enlarged setae straight or curved, conical, lateral margins slightly curved, apex narrowly rounded, with moderately thick setal ring; not in dermal pockets; segment IV with 11–20 setae including 0–2 enlarged setae and 11–18 flagellate setae; segment IV with combined total of 0–2 enlarged setae dorsally and ventrally. Macro tubular ducts abundant over entire surface, usually absent from segment VIII. Micro tubular ducts 5–8 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, about ¼ length of remaining sclerotized portion, total sclerotized area same length as, or 1 or 2 times longer than, unsclerotized area; dermal orifice sclerotized, with simple protruding tube. Micro tubular ducts scattered over entire surface, least abundant on head. Multilocular pores of 3 kinds: 3- and 4-locular pores rare; 5-locular pores abundant, scattered over entire surface, least abundant on head. Cruciform pores over surface from mesothorax to segment V, VI or VII. Microtrichia on segments VII and VIII.

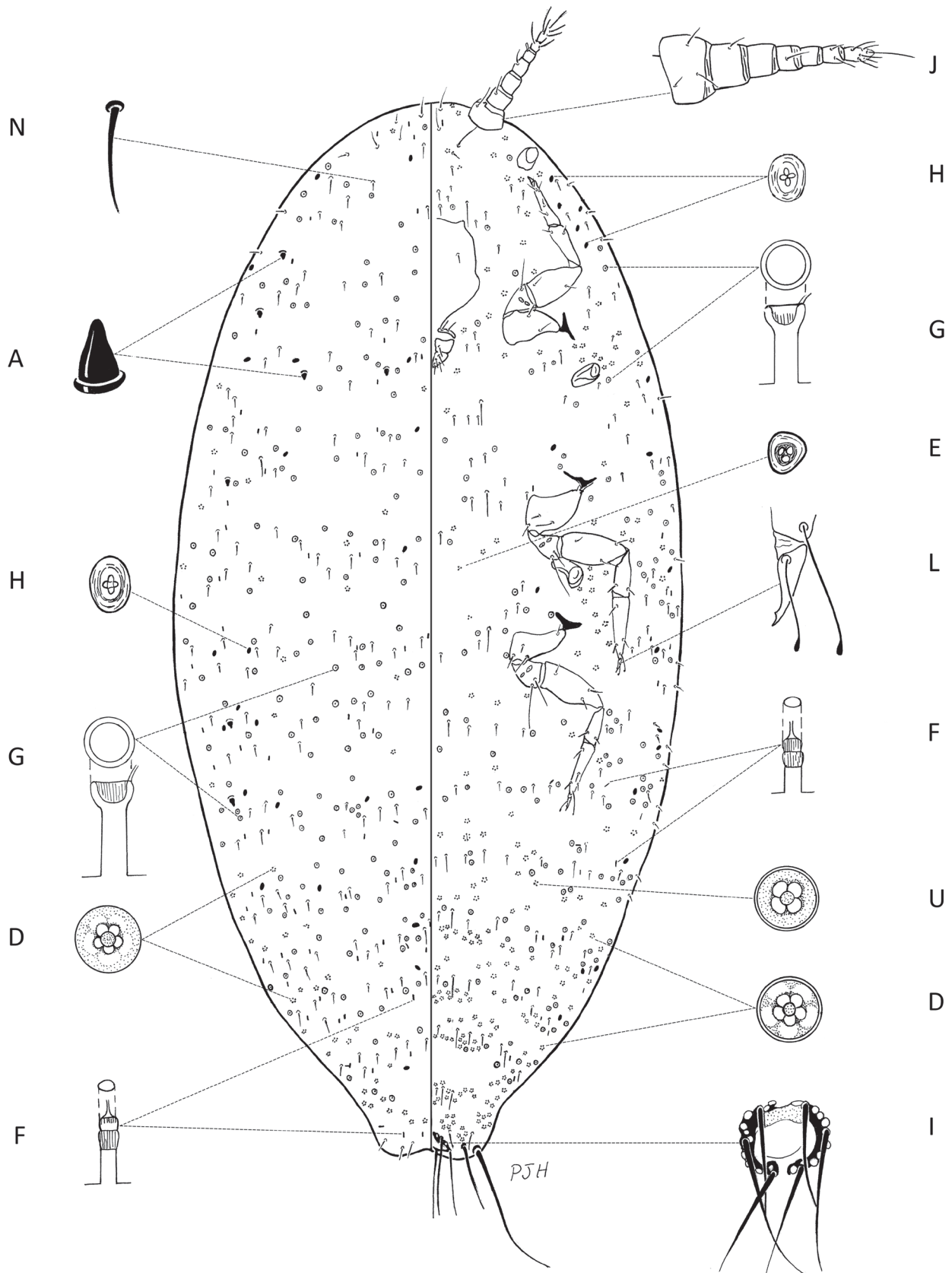


FIGURE 76. *Ovaticoccus peruvianus* (Granara de Willink and Diaz 2007), adult female, 10 miles E. Ciudad Monte, Tamaulipas, Mexico, February 25, 1972, on leafless shrub, D.R. Miller and F.D. Parker. A=enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; N=flagellate seta; U=4-locular pore.

Anal ring ventral, apical, or dorsal, semicircular, incomplete anteriorly and posteriorly, sometimes connected anteriorly or posteriorly with slightly sclerotized bar, cellular, with single ring of pores in sclerotized areas, with 3 setae on each side of ring, each longer than diameter of ring, with or without additional pair of setae near ring, anal tube unsclerotized, anal orifice sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 23–30 µm long, on segment VII 28–33 µm long; anal-lobe seta 160–188 µm long; medial setae apically rounded. Enlarged setae absent. Macrotubular ducts scattered over surface except absent from segment VIII. Microtubular ducts scattered over entire surface, least abundant in medial areas. Multilocular pores of 3 kinds: 3-locular pores and 7-locular pores uncommon, 5-locular pores abundant over entire surface. Cruciform pores uncommon or absent medially, with fewer than 10 between legs, in lateral areas of thorax and abdominal segments, abundance variable among specimens. Legs with hind coxae dorsally with 4–35 pores, ventrally with 0–2 pores: each femur with 4 or 5 setae, including 1 or 2 proximal setae and 3 distal setae; each tibia with 4 setae, without middle seta; tibia/tarsus 0.8. Antennae each 7-segmented, 182–188 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from pro- or mesothorax to segment VIII, on hind 2 pairs of coxae.

Notes: The description is based on six specimens from three localities. The adult female of *Ov. peruvianus* is most similar to the adult female of *Ov. parvispinus* in having: proximal setae on the femur; slightly protruding anal lobes; numerous dorsal and ventral multilocular pores; and cruciform pores on both surfaces. They differ as follows (character states in brackets are those of *Ov. peruvianus*): cruciform pores absent or uncommon in ventromedial areas between legs <10, often restricted to marginal areas (cruciform pores common between legs >10, present over surface); dorsal enlarged setae uncommon or absent, when present, found on body margin (dorsal enlarged setae abundant over entire surface).

***Ovaticoccus salviae* Miller**

(Color plate 3)

Ovaticoccus salviae Miller in Miller and McKenzie 1967: 521.

Material examined: not included in previous publications: California: Riverside Co.: Corona, XII-29-1970, on *Salvia apiana*, E.R. and J.L. Miller (5 first-instar nymphs on 1 slide) USNM; Corona, V-3-1971, on *S. apiana*, E.R. and J.L. Miller (3 first-instar nymphs on 1 slide) USNM; Corona, V-18-1971, on *S. apiana*, E.R. and J.L. Miller (5 second-instar ♀♀, 1 first-instar nymph on 1 slide) USNM; Corona, VIII-26-1971, on *S. apiana*, E.R. and J.L. Miller (3 ad. ♂♂ on 1 slide) USNM; Corona, IX-17-1971, on *S. apiana*, E.R. and J.L. Miller (4 ad. ♂♂ on 1 slide) USNM; Corona, X-25-1971, on *S. apiana*, E.R. and J.L. Miller (1 first-instar nymph on 1 slide) USNM; Corona, III-22-1972, on *S. apiana*, E.R. and J.L. Miller (10 first-instar nymphs on 1 slide) USNM; Corona, III-29-1972, on *S. apiana*, E.R. and J.L. Miller (17 first-instar nymphs on 2 slides) USNM; Corona, IV-6-1972, on *S. apiana*, E.R. and J.L. Miller (12 first-instar nymphs on 1 slide) USNM; Corona, IV-18-1972, on *S. apiana*, E.R. and J.L. Miller (6 first-instar nymphs on 1 slide) USNM; Corona, IV-20-1972, on *S. apiana*, E.R. and J.L. Miller (8 first-instar nymphs on 1 slide) USNM; Corona, V-9-1972, on *S. apiana*, E.R. and J.L. Miller (4 first-instar nymphs on 1 slide) USNM; Corona, V-11-1972, on *S. apiana*, E.R. and J.L. Miller (1 ad. ♀, 7 first-instar nymphs on 2 slides) USNM; Corona, V-18-1972, on *S. apiana*, E.R. and J.L. Miller (2 second ♀♀, 6 first-instar nymphs on 3 slides) USNM; Corona, V-25-1972, on *S. apiana*, E.R. and J.L. Miller (3 second-instar ♀♀, 2 first-instar nymphs on 1 slide) USNM; Corona, VI-15-1972, on *S. apiana*, E.R. and J.L. Miller (2 ad. ♀♀, 4 second-instar ♀♀ on 2 slides) USNM; Corona, VI-14-1973, on *S. apiana*, E.R. and J.L. Miller (1 second-instar ♀ on 1 slide) USNM; Corona, VI-29-1973, on *S. apiana*, E.R. and J.L. Miller (3 second-instar ♀♀ on 1 slide) USNM; Corona, VII-6-1973, on *S. apiana*, E.R. and J.L. Miller (2 ad. ♀♀, 1 second-instar ♀ on 1 slide) USNM; Corona, VII-13-1973, on *S. apiana*, E.R. and J.L. Miller (2 ad. ♀♀, 1 second-instar ♀ on 1 slide) USNM.

Etymology: The species epithet “*salviae*” is formed for the host of this species.

The adult female of this species was described in detail by Miller and McKenzie (1967) and information from that paper is not repeated here.

Life history: From December 1970 to November 1973, branches of infested *Salvia apiana* containing *Ovaticoccus salviae* were collected at a site in Corona, California, and were examined using a dissecting microscope. Bark was removed from the branches and the specimens encountered were preserved, mounted, and recorded (Ap



COLOR PLATE 3. *Ovatococcus salviae* Miller 1967, with bark removed, note pink adult females of *Ov. salviae*; brown and pink adult female of *Ov. salviae* (apparently fed on by a chloropid larva); adult fly and puparium of chloropid predator. USA: California: San Bernardino Co.: 1 mi. West of Cajon, I-24-1965, on *Salvia apiana*, D.R. Miller.

pendix 1). Based on this information, it appears that this species has a single generation each year with crawlers appearing as early as October, but more commonly in March and present until the end of May. Second-instar females were present from early May to mid-July and adult females were encountered in most samples except in March and April. Only a single second-instar male was collected, most likely because this instar forms its cocoon on parts of the plant that were not sampled. Adult males also were rarely collected, but those that were found were taken in July, August, and September.

Second-instar female (Figs 77 and 78)

Description: Slide-mounted specimens 0.7–0.8 mm long, 0.4–0.5 mm wide. Body broadly or elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae; ventrally each with 2 or 3 flagellate setae sometimes including suranal seta and including anal-lobe seta.

Dorsum with flagellate setae forming 2 or 3 pairs of longitudinal lines on abdomen, more widely scattered on thorax and head; flagellate setae sometimes replace enlarged setae. Enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral) on abdomen, lines less distinct on thorax and head often replaced by flagellate setae anteriorly in medial and mediolateral lines and in transverse rows on posterior thorax and abdomen to segment VII; of 1 size: largest seta 6–7 μm long; enlarged setae conical, laterally with nearly straight sides, with broadly rounded apices; moderately thick setal rings; not in dermal pockets; segment IV with 6–8 setae including 5 or 6 enlarged setae and 2 or 3 flagellate setae; segment IV with combined total of 6–8 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each about 6 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, about same size as remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice unsclerotized; without protruding tube. Microtubular duct distribution variable, restricted to submarginal areas from head to segment VIII, restricted to abdomen, restricted to head and thorax, or absent. Multilocular pores of 5-locular pore type only; on margin of head, sometimes on margin of abdomen. Cruciform pores variable, sometimes restricted to marginal areas of abdomen, sometimes restricted to margin of head and thorax, sometimes present along entire body margin, sometimes absent. Microtrichia absent.

Anal ring round, normally dorsal, occasionally bent around posterior apex, without cells and with weak sclerotization, anterior section unsclerotized, with 2 setae on each side of ring, posterior pair adjacent to ring, longest seta less than greatest diameter of anal ring; anal tube and anal ring unsclerotized, without anal flap.

Venter with longest flagellate seta on segment II 10–15 μm long, on segment VII 18–28 μm long; anal-lobe seta 77–88 μm long. Enlarged setae variable, marginal on any or all of head, thorax, or abdomen. Macrotubular ducts and microtubular ducts absent. Multilocular pores of 2–4 kinds: 5-locular pores most abundant over surface except absent from segments VI and VII; 3-, 4- and 7-locular pores in reduced numbers, most abundant near spiracles, 4-locular pores present or absent. Cruciform pores absent. Legs with each hind coxa with 1–4 indefinite pores; each femur with 2 or 3 setae, without proximal setae; hind tibia with 1–3 setae, without middle seta; hind tibia/tarsus 0.7–0.9. Antennae each 6-segmented, 75–82 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia from prothorax or mesothorax to segment VIII, on hind 2 pairs of coxae.

Notes: The description is based on five specimens from one locality. All specimens appear to be teneral; this may explain the distorted shape of the legs. The second-instar female of *Ov. salviae* is most similar to the second-instar female of *Ov. neglectus* in having each femur with three setae, and a similarly shaped anal ring. They differ as follows (character states in brackets are those of *Ov. salviae*): with ventral abdominal multilocular pores common, in rows of more than five on each abdominal segment (pores uncommon, arranged in mediolateral lines, usually with one or two on each side of each segment).

Adult male (Fig. 79)

Description: Slide-mounted specimens 1.0–1.2 mm long, 0.3–0.4 mm wide. Body elongate, segment VIII not produced laterally.

Dorsum with 1 pair of tail-forming pore clusters (tfpc); each cluster with 2 elongate, apically blunt, but not capitate setae, of 2 distinct sizes: longest seta 62–72 μm long; shortest setae 42–48 μm long; with 8–10 multilocular pores (normally cluster oriented so that pores cannot be counted). Multilocular pores restricted to tail-forming pore clusters, each with 3-, 4- or 5-loculi, 4-locular pores most common. X-type pores (x) present near dorsal arm of midcranial ridge (dmcr), rarely absent. Flagellate setae slender, apically acute, curved, approximately same length as those on venter or slightly shorter, with 2 or 3 near margin, 2 mediolaterally, and 1 medially on each side of most of segments II to VII, with 1 pair of elongate setae in medial area of segment VIII; setae on

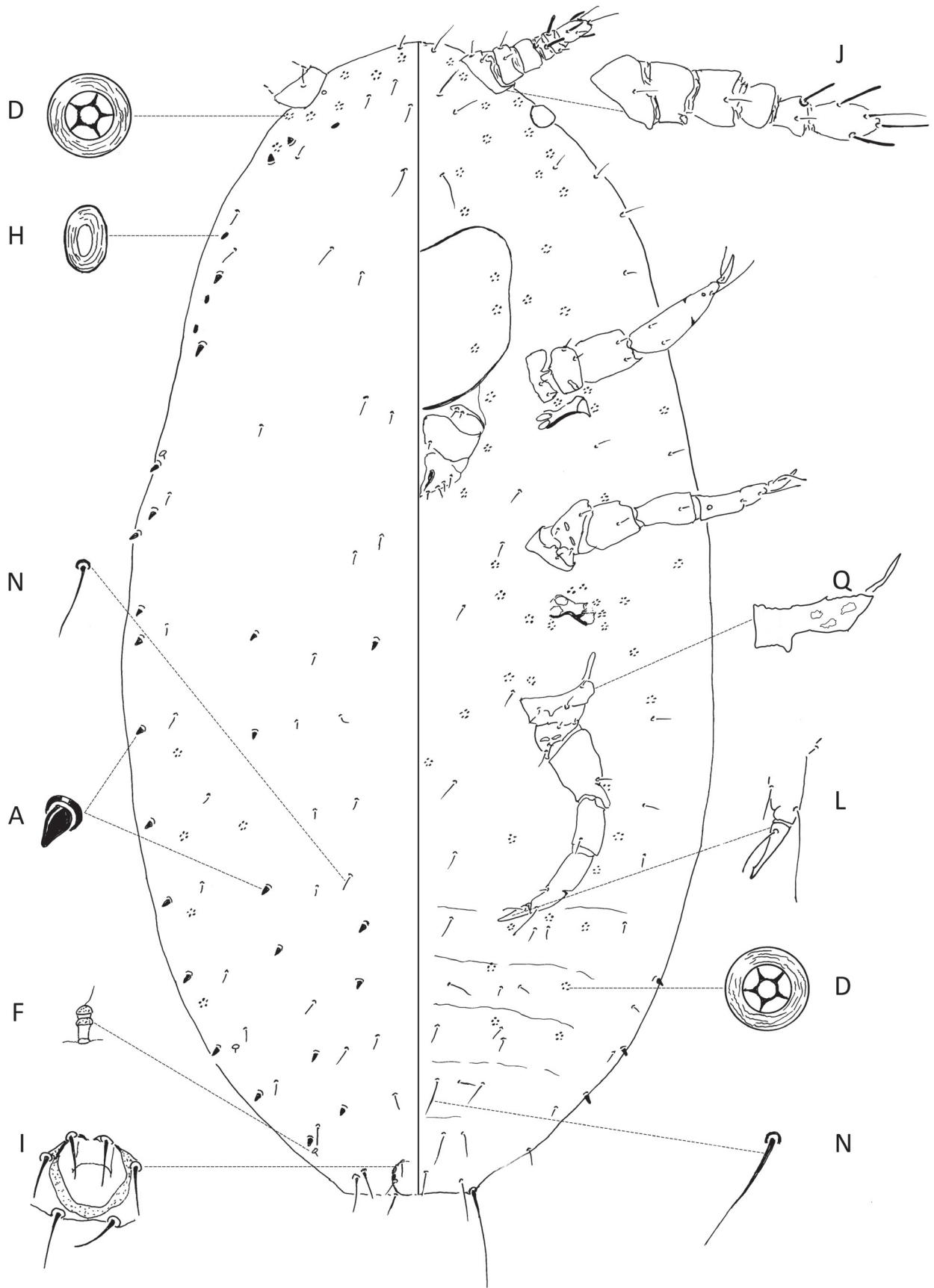


FIGURE 77. *Ovatococcus salviae* Miller 1967, second-instar female #1 (with cruciform pores), Corona, Riverside Co., California, USA, June 29, 1973, on *Salvia apiana*, E.R. and J.L. Miller. A=enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; N=flagellate seta; Q=dorsal surface of coxa.

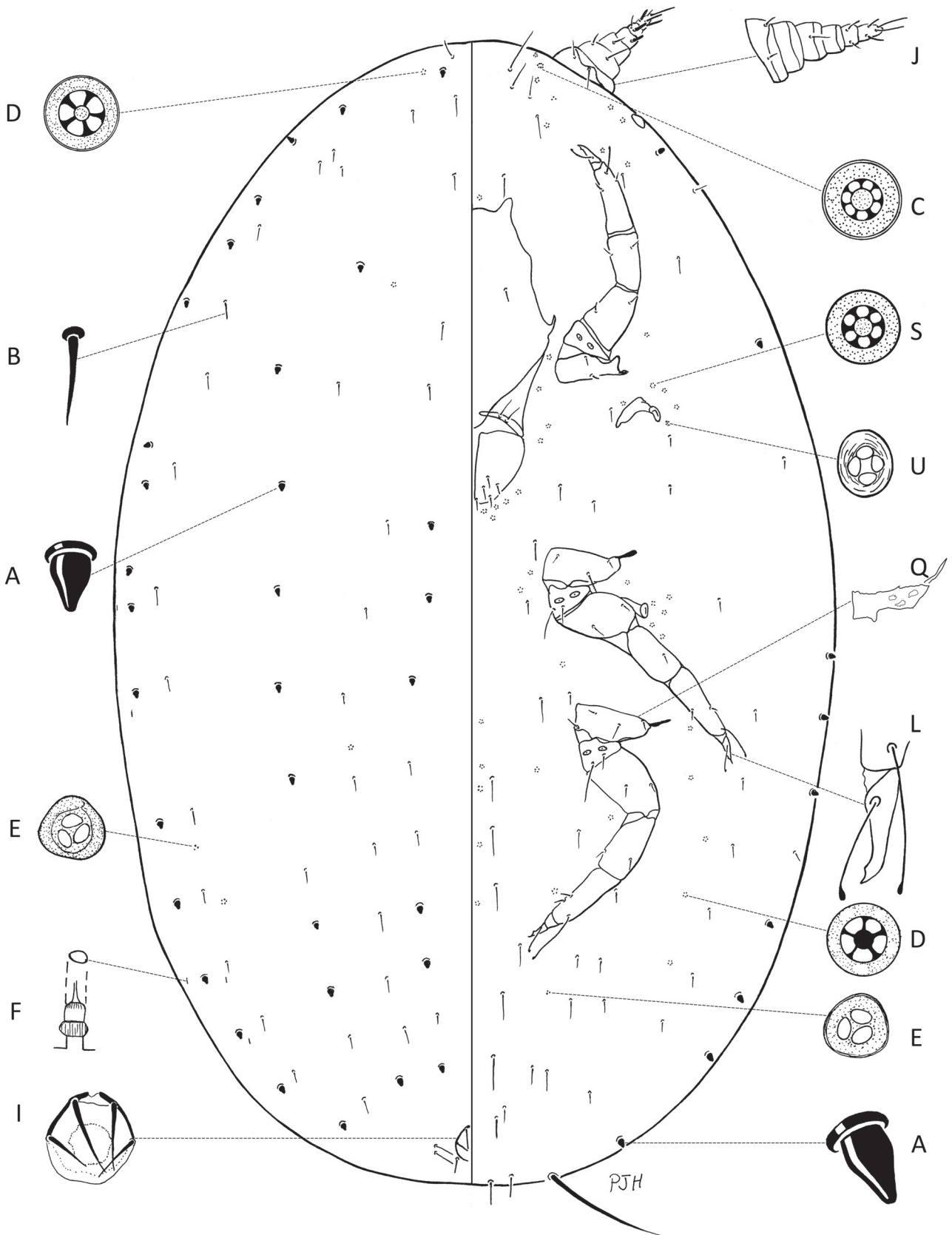


FIGURE 78. *Ovatococcus salviae* Miller 1967, second-instar female #2 (without cruciform pores), Corona, Riverside Co., California, USA, May 25, 1972, on *Salvia apiana*, E.R. and J.L. Miller. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; E=3-locular pore; F=microtubular duct; I=anal ring; J=antenna; L=claw; Q=dorsal surface of coxa; S=6-locular pore; U=4-locular pore.

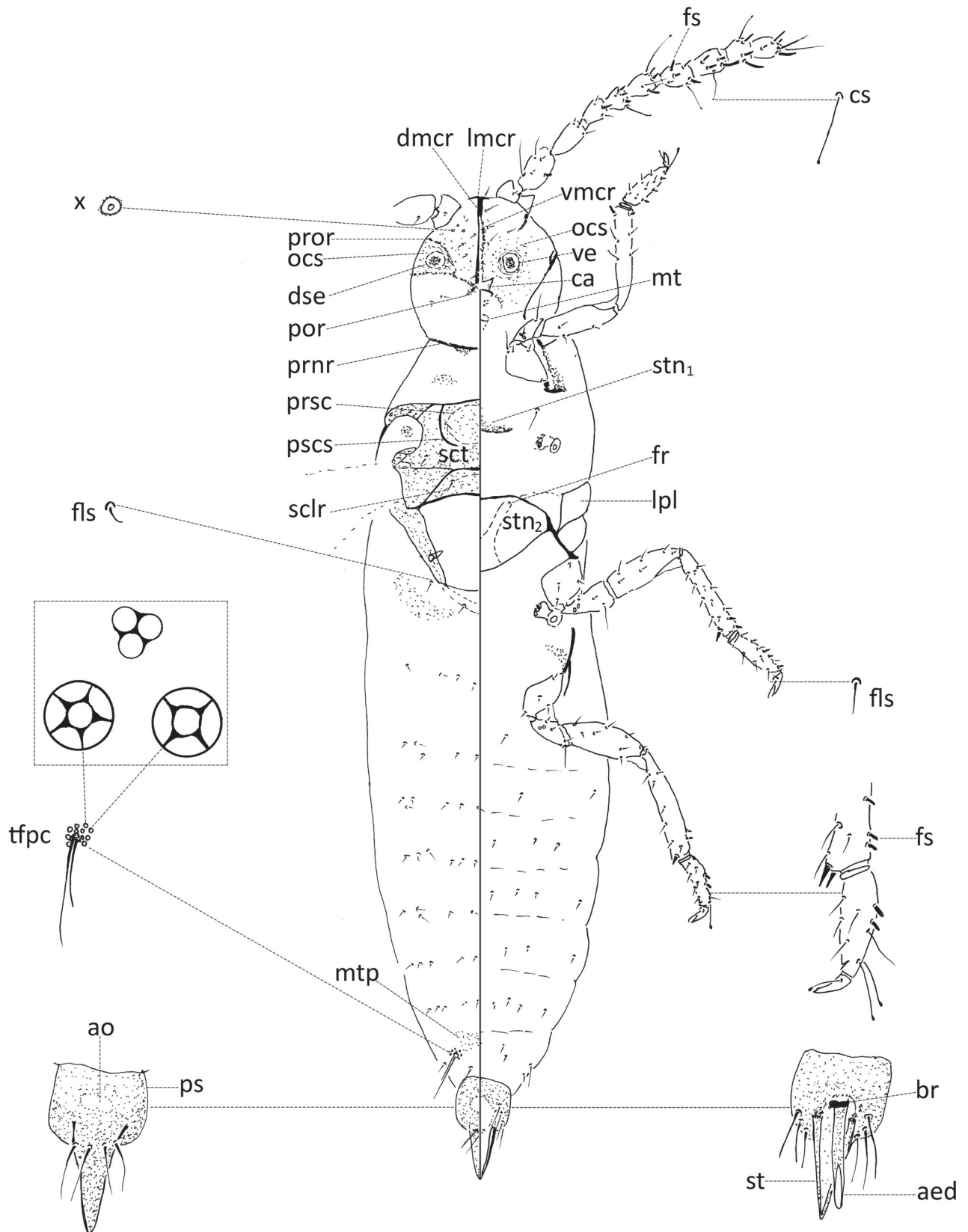


FIGURE 79. *Ovaticoccus salviae* Miller 1967, adult male, Corona, Riverside Co., California, USA, August 26, 1971, on *Salvia apiana*, E.R. and J.L. Miller. For explanation of abbreviations see the methods section.

metathorax and mesothorax, absent from prothorax; head setae posterior to postocular ridge (por) and along dorsal arm of midcranial ridge. Abdominal sclerotization absent except median tergal plate (mtp) VIII weakly sclerotized. Metapostnotal sclerites (pn3) present, metapostnotal ridge absent. Scutellar ridge (sclr) strongly developed. Scutum (sct) sclerotized throughout, except 2 circular areas adjacent to scutellum. Prescutum (prsc) rectangular, 1 specimen with circular clear area in medial area. Prescutal suture (pscs) weakly developed. Pronotal ridges (prnr) normally strongly developed; pronotal sclerites not observed. Hamulohalteres absent. Mesothoracic wings each without setae and alar lobe. Postoccipital ridge (por) weakly or strongly sclerotized, lateral ends normally bifurcate. Dorsal arm of midcranial ridge (dmcr) thin, touching postoccipital ridge posteriorly; connected to lateral (lmcr) and ventral arms (vmcr) of midcranial ridge anteriorly. Dorsomedial sclerite (dmep) lightly sclerotized. Dorsal eye (dse) approximately 28 μm in diameter. Lateral ocellus absent or weakly indicated where dorsal and ventral postocular ridges (procr) reach margin of head. Ocular sclerite (ocs) weakly sclerotized dorsally.

Penial sheath (ps) 100–122 μm long; elongate, width 58–65 μm ; width/length 0.5–0.6, style (st) in lateral view straight, apically with several small papillae. Sheath with indication of division ventrally. Dorsal surface weakly sclerotized anteriorly, with 2 setae on each side; ventral surface with large membranous area as well as ventral longitudinal slit in medial areas, sclerotized anteriorly and laterally, with 3 setae on each side. Basal rod (br) small, not reaching anterior margin of penial sheath.

Venter usually with flagellate setae laterally and submedially, less abundant anteriorly; thoracic setae with or without single pair near anterior legs, usually with single pair anterior to hind legs; head setae present only near anterior portion of ventral arm of midcranial ridge (vamr). Abdominal sclerotization restricted to segment VIII, with inconspicuous plate in submedial area; without sclerotization elsewhere. Metathoracic precoxal ridge (pcr3) weakly developed or absent. Mesosternum (stn2) well-developed, with furca (fr); lateropleurites on mesothorax (lpl) triangular. Prosternum (stn1) varying from short or thin and triangular to rectangular. Mouth tubercle (mt) present. Preoral ridge (pror) weakly sclerotized, not touching postocular ridge (pocr). Cranial apophysis (ca) bifurcate. Ocular sclerite (ocs) unsclerotized except immediately surrounding ventral eye. Ventral eye (ve) 20–22 μm in diameter. Prothoracic or metathoracic legs longest. Trochanters each with 2 or 3 campaniform sensilla on each surface. Fleshy setae (fs) on outer distal portion of tibia and tarsus. Inner setae on apical margin of tibia enlarged, inner setae on tarsus not enlarged. Claw with small denticle; digitules on tarsus and claw weakly capitate. Antennae each 10-segmented, 385–390 μm long, third segment longest, 2.3 times longer than apical segment, tenth segment apically rounded. Fleshy setae on segments 3–10; capitate setae (cs) on segments 5 or 7–10 (many specimens without antennae, those with antennae often with setae broken).

Notes: The description is based on seven specimens from one locality. The adult male of *Ov. salviae* is most similar to the adult male of *Ov. agavium*. For a comparison, see the “Notes” section of that species.

Second-instar male (Fig. 80)

Description: Slide-mounted specimens 0.8 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae; ventrally each with 2 or 3 flagellate setae including anal-lobe seta.

Dorsum with flagellate setae scattered over entire surface, not forming obvious longitudinal lines. Enlarged setae absent. Macrotubular ducts scattered over entire surface. Microtubular ducts represented by single duct on segment VI, about 6 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, about same size as remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice unsclerotized; without protruding tube. Multilocular and cruciform pores absent. Microtrichia absent.

Anal ring round, apical, without cells and with weak sclerotization, with 3 setae on each side of ring, longest seta shorter than greatest diameter of ring; anal tube and anal ring unsclerotized, without anal flap.

Venter with longest flagellate seta on segment II 25 μm long, on segment VII 25 μm long; anal-lobe seta 92 μm long. Enlarged setae absent. Macrotubular ducts scattered over entire surface. Microtubular ducts absent. Multilocular pores uncommon, when present on abdominal segments, with fewer than 2 on each side of each segment, all 5-locular, in medial areas of head, thorax, and anterior abdominal segments, also clustered near openings of spiracles. Cruciform pores absent. Legs without pores; each femur with 3 setae, without proximal setae; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7. Antennae each 7-segmented, about 90 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia from mesothorax to segment VIII, on hind 2 pairs of coxae.

Notes: The description is based on one specimen from one locality. The second-instar male of *Ov. salviae* is

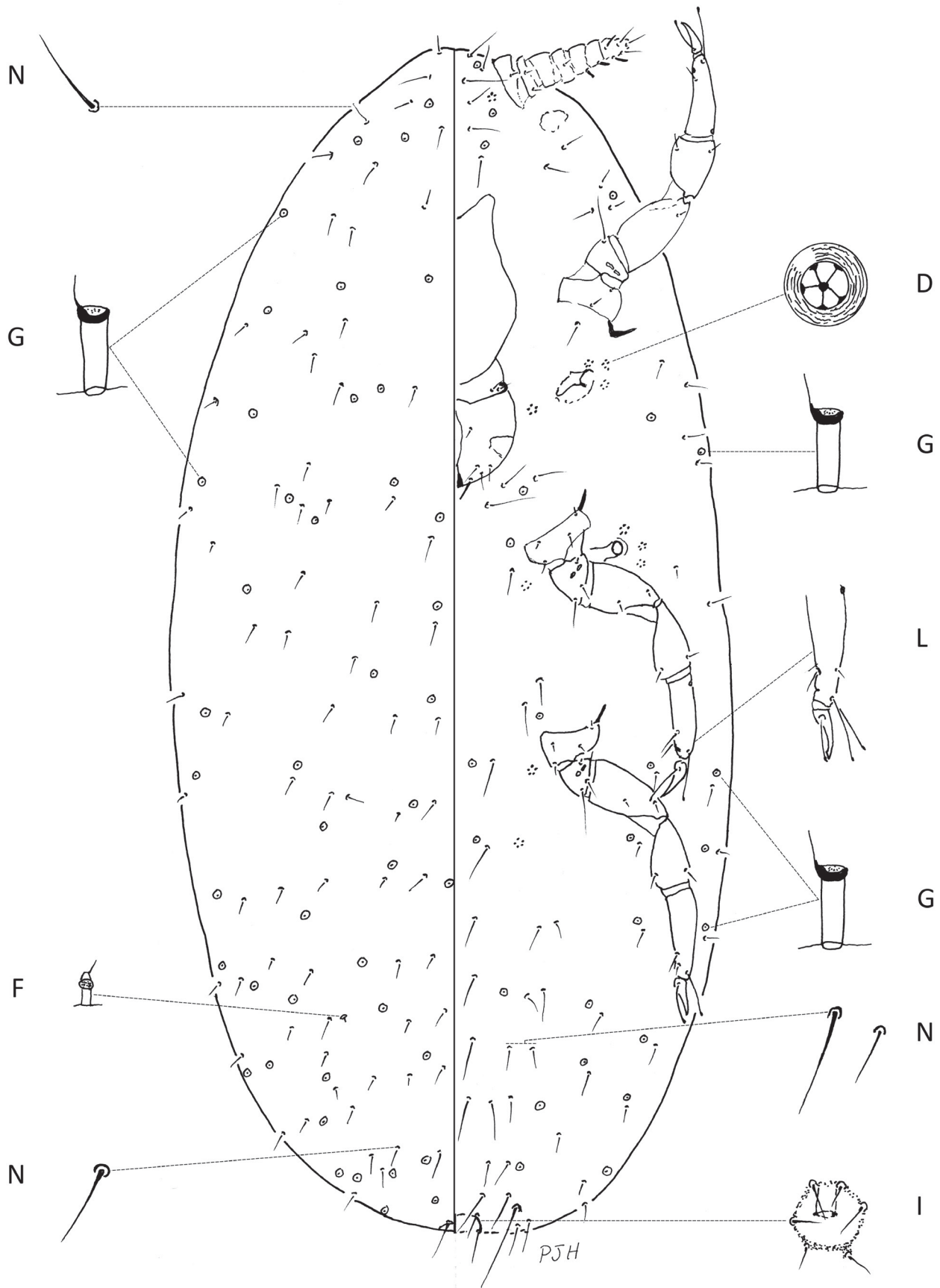


FIGURE 80. *Ovatococcus salviae* Miller 1967, second-instar male, Corona, Riverside Co., California, USA, June 15, 1972, on *Salvia apiana*, E.R. and J.L. Miller. D=5-locular pore; F=microtubular duct; G=macro tubular duct; I=anal ring; L=claw; N=flagellate seta.

most similar to the second-instar male of *Ov. neglectus* in lacking dorsal cruciform pores, having each femur with three setae and having a simple non-cellular anal ring. They differ as follows (character states in brackets are those of *Ov. salviae*): with ventral abdominal multilocular pores common, in rows of more than five on each abdominal segment (pores are uncommon, arranged in mediolateral lines, usually with one or two on each side of some segments, often absent on several segments).

First-instar nymph (Fig. 81)

Description: Slide-mounted specimens 0.5–0.7 mm long, 0.2–0.4 mm wide. Body elongate oval to broadly oval, without protruding anal lobes. Anal-lobe areas dorsally each with 2 flagellate setae, with 0 or 1 microtubular duct; ventrally each with 2 or 3 flagellate setae including anal-lobe seta.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral) with 2 setae in each lateral line on mesothorax to segment VII, randomly scattered on head and prothorax. Enlarged setae absent. Microtubular ducts about 5–6 µm long, area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, usually shorter than length of remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice unsclerotized. Microtubular ducts in mediolateral line on any or all of mesothorax, metathorax, segments I, II, V and VIII, also present laterally on segment I. Multilocular and cruciform pores absent. Microtrichia on segments II to VIII.

Anal ring on dorsum near abdomen apex or rarely bent around apex, weakly sclerotized, circular, posterior margin unsclerotized, non-cellular, with 2 or 3 setae on each side of ring, posteriormost pair of setae sometimes not attached to anal ring, each anal-ring seta slightly shorter than greatest diameter of ring, anal tube and anal ring unsclerotized, without anal flap.

Venter with longest flagellate seta on segment II 12–14 µm long, on segment VII 17–25 µm long; anal-lobe seta 80–137 µm long. Enlarged setae and microtubular ducts absent. Multilocular pores present at base of antennae, near eye, between front leg and mouthparts, laterad to front legs, 1 associated with each spiracle, 1 mesad to each mid and hind coxa, 3 or 4 forming mediolateral longitudinal line on each side of abdominal segments; of 3 kinds: 5-locular pores, 4-locular pores, and 3-locular pores; 4-locular pores uncommon, 5- and 3-locular pores in about equal numbers. Cruciform pores absent. Legs with hind tibia/tarsus 0.9–1.0; each femur with 3 setae, all distal, without proximal setae; each tibia with 4 setae, without middle seta. Antennae each 6-segmented, 92–115 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from metathorax to segment VIII, absent from coxae.

Notes: This description is based on 34 specimens from one locality. The first-instar nymph of *Ov. salviae* is most similar to the first-instar nymph of *Ov. neglectus* in having a poorly developed anal ring, lacking dorsal multilocular pores and by lacking dorsal cruciform pores. They differ as follows (character states of *Ov. salviae* are in brackets): dorsal enlarged setae present (absent).

***Ovaticoccus sanguineus* (Miller) comb. n.**

Oregmopyga sanguinea Miller in Miller and McKenzie 1967: 503–505.

Etymology: The species epithet “*sanguinea*” is based on the Latin word “*sanguis*” meaning “blood” and refers to the blood red color of the alcohol preservative in which specimens are stored.

The justification for treating *Oregmopyga* as a junior synonym of *Ovaticoccus*, leading to this new combination, is provided in the “Notes” section that follows the generic description above. The adult female of this species was described in detail by Miller and McKenzie (1967) and information from that paper is not repeated here.

Second-instar female (Fig. 82)

Description: Slide-mounted specimens 1.3–1.4 mm long, 0.7–0.8 mm wide. Body elongate oval, with slightly protruding anal lobes. Anal-lobe areas dorsally each with 3 flagellate setae, 2 multilocular pores, 1 microtubular duct; ventrally each with 3 or 4 flagellate setae including suranal seta and elongate anal-lobe seta, with 0 or 1 multilocular pore.

Dorsum with flagellate setae arranged in 2 or 3 pairs of longitudinal lines (medial, mediolateral and lateral), some flagellate setae replaced by enlarged setae or transitional setae making lines of enlarged and flagellate setae indefinite. Enlarged setae erratically forming 3 pairs of longitudinal lines (medial, mediolateral and lateral), of 1 size; largest seta 10–11 µm long; enlarged setae pear-shaped or conical, laterally with slightly curved margins, lon

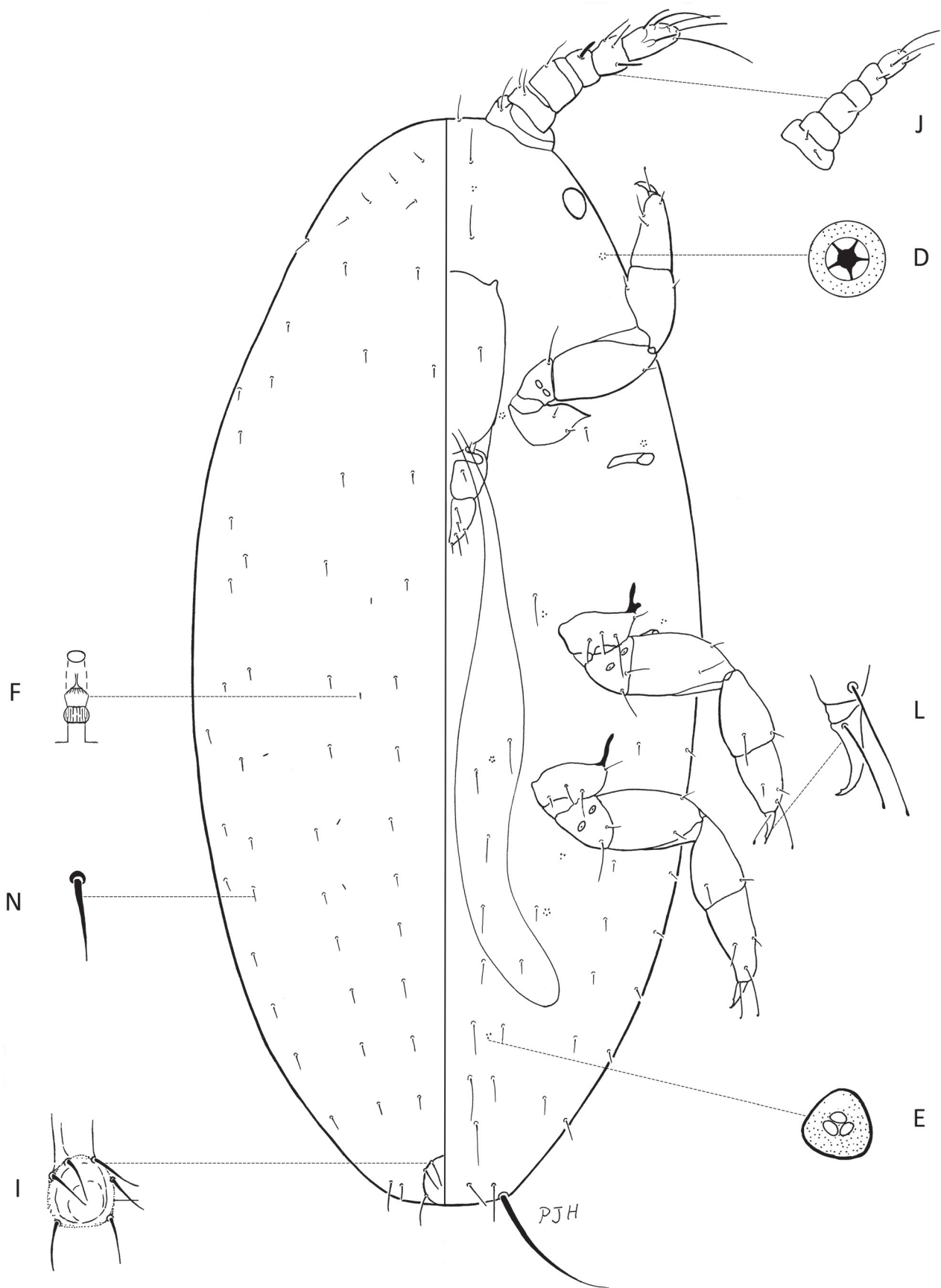


FIGURE 81. *Ovatococcus salviae* Miller 1967, first-instar nymph, Corona, Riverside Co., California, USA, April 6, 1972, on *Salvia apiana*, E.R. and J.L. Miller. D=5-locular pore; E=3-locular pore; F=microtubular duct; I=anal ring; J=antenna; L=claw; N=flagellate seta.

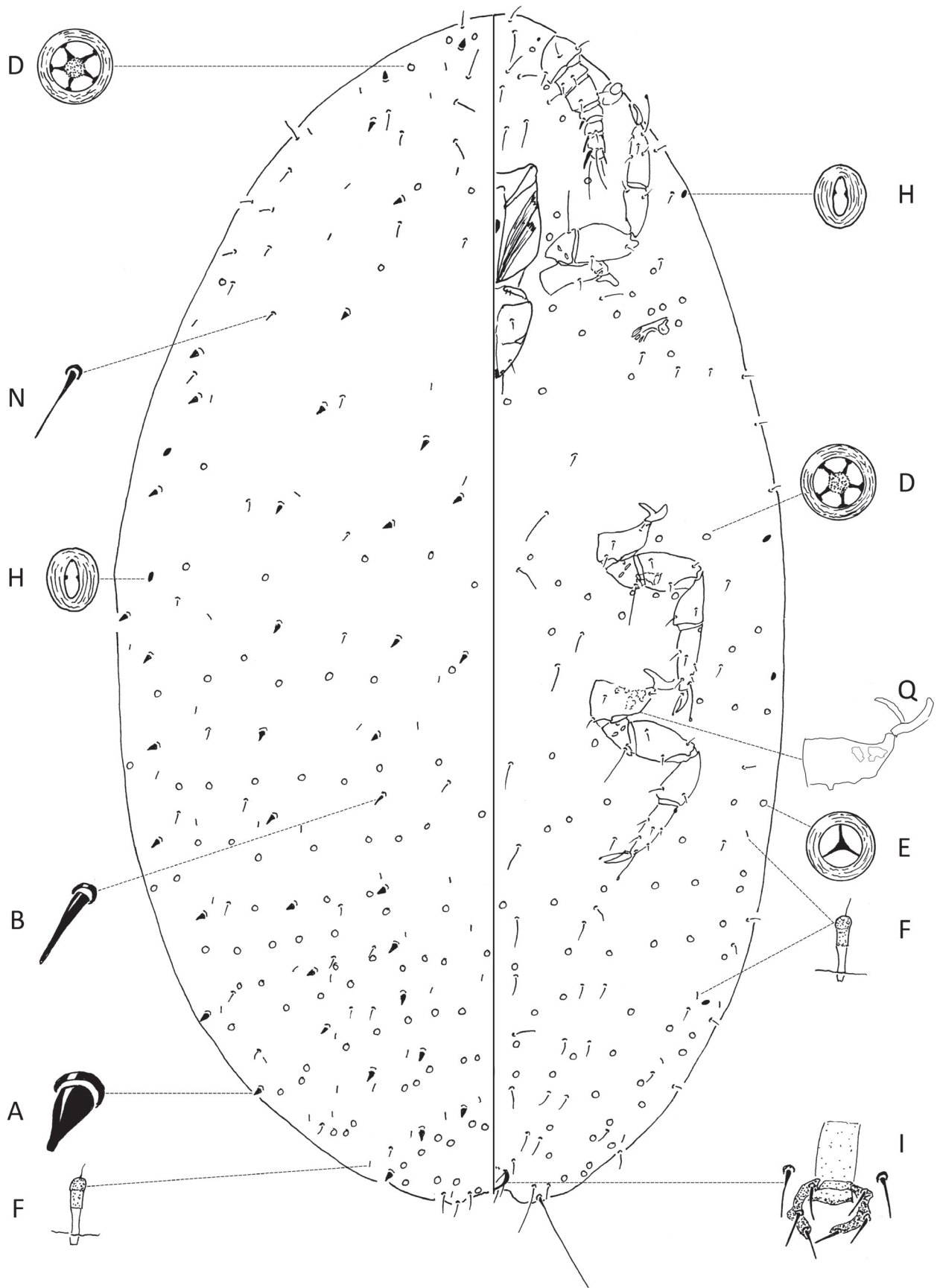


FIGURE 82. *Ovatococcus sanguineus* (Miller 1967), second-instar female, Thousand Palms Canyon, Riverside Co., California, USA, April 16, 1965, on *Haplopappus acradenius*, D.R. Miller. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; N=flagellate seta; Q=dorsal surface of coxa.

ger than wide, with thin, rounded apex; setal base thin; usually in dermal pockets; segment IV with 11 or 12 setae, including 5 or 6 enlarged setae and 6 or 7 flagellate setae; segment IV with combined total of 5 or 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts 7–8 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or bilobular depending on visual angle, about same length as remaining sclerotized portion; total sclerotized area same length as, or longer than, unsclerotized area; dermal orifice weakly sclerotized, with protruding flattened tube. Microtubular ducts over entire surface, associated with enlarged setae. Multilocular pores all of 5-locular kind, in segmental rows from head to segment VIII. Cruciform pores absent or uncommon in lateral areas of thorax. Microtrichia absent.

Anal ring ventral, divided into 2 lateral plates bridged by weak sclerotization anteriorly, incomplete posteriorly, non-cellular, with 3 setae on each side of ring, each about same length as greatest diameter of ring; with additional pair of setae associated with ring but not touching it; anal tube and anal orifice sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 21–30 µm long, on segment VII 19–21 µm long; anal-lobe seta 155–167 µm long. Enlarged setae absent. Macrotubular ducts absent. Microtubular ducts present laterally. Multilocular pores of 2 kinds: 5-locular pores most abundant, 3-locular pores rare, in segmental rows over surface. Cruciform pores uncommon in lateral areas on thorax and abdomen. Legs with hind coxae with 2–5 indistinct pores; each femur with 5 setae including 2 proximal setae and 3 distal setae; each tibia with 4 distal setae, without middle seta; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 137–145 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from head to segment VIII, also on hind 2 pairs of coxae.

Notes: The description is based on two specimens from one locality. The second-instar female of *Ov. sanguineus* is most similar to the second-instar female of *Ov. neglectus* in having dorsal multilocular pores, a non-cellular anal ring, and 3 pairs of longitudinal lines of enlarged setae on the abdomen. They differ as follows (character states in brackets are of *Ov. sanguineus*): each femur with three setae, all distal (five setae including two proximal and three distal); without ventral cruciform pores (with ventral cruciform pores near body margin).

***Ovaticoccus telotrichus* Miller and Stocks sp. n.**

Type material: Adult female holotype (only specimen on slide) with left label “*Ovaticoccus / telotrichus / ad ♀ / on grass / Iron Mt. Ranch / 8 mi. N. Marathon / Brewster Co. Texas / V-11-1976 R.D. Gordon / D.R. Miller #3172;*” right label “*Ovaticoccus / telotrichus / Miller & Stocks / HOLOTYPE / USNM;*” label on back “*Ovaticoccus / telotrichus* Miller / & Stocks / HOLOTYPE / USNM / Iron.” The holotype is deposited in the USNM. **Paratypes:** MEXICO: Jalisco: 23 mi. S. Guadalajara, on unknown grass, D.R. Miller and F.D. Parker (8 second-instar ♀♀, 3 second-instar ♂♂, 13 first-instar nymphs on 8 slides) USNM (7 slides), UNAM (1 slide); Tlaxcala: 26 km. N. Apizaco, VII-12-1967, on unknown grass, J. Villanueva B. and D.R. Miller (1 ad. ♀, 6 first-instar embryos on 2 slides) UCD (1 slide), UNAM (1 slide). UNITED STATES: Texas: Brewster Co.: Iron Mountain Ranch, on unknown grass, R.D. Gordon and D.R. Miller (3 ad. ♀♀, 2 second-instar ♀♀, 1 second-instar ♂, 1 third-instar ♂ on 4 slides) USNM.

Etymology: The name “*telotrichus*” is formed from the Greek words “*telos*” meaning “end”, and “*trichos*” meaning “hair”, and refers to the diagnostic enlarged setae on the posterior end of the abdomen.

Field features: Occurring in leaf blade sheaths.

Adult female (Fig. 83)

Description: Holotype, slide mounted, 3.6 mm long, 1.4 mm wide (paratypes 2.7–4.8 mm long, 1.0–2.2 mm wide). Body elongate oval; without protruding anal lobes. Anal-lobe area on each side dorsally with 1 flagellate seta (paratypes with 1 or 2), 2 or 3 conical enlarged setae, 2 or 3 microtubular ducts (paratypes sometimes with 1), with or without multilocular pores; ventrally each with 2 flagellate setae including anal-lobe seta, 4 or 5 multilocular pores (paratypes with 5–12), 1 microtubular duct, 1 or 2 macrotubular ducts.

Dorsum with flagellate setae slightly shorter than those on venter on posterior segments, conspicuously shorter anteriorly, scattered over entire surface. Enlarged setae of 2 sizes and shapes; conical setae restricted to 2 on 1 side and 3 on other (paratypes with 3 on each side) on posterior apex of abdomen; largest seta about 25 µm long; enlarged setae conical, with straight sides and rounded apex; setal base large, not recessed in dermal pockets; other setae nipple-shaped, forming longitudinal line laterally, holotype with 1 seta on each side of several abdominal segments and on thorax, some paratypes with 3 on each side of each abdominal segment; with curved sides, apex rounded; setal base medium; recessed in dermal pockets; segment IV with 12 setae (paratypes with 12–16), all flagellate;

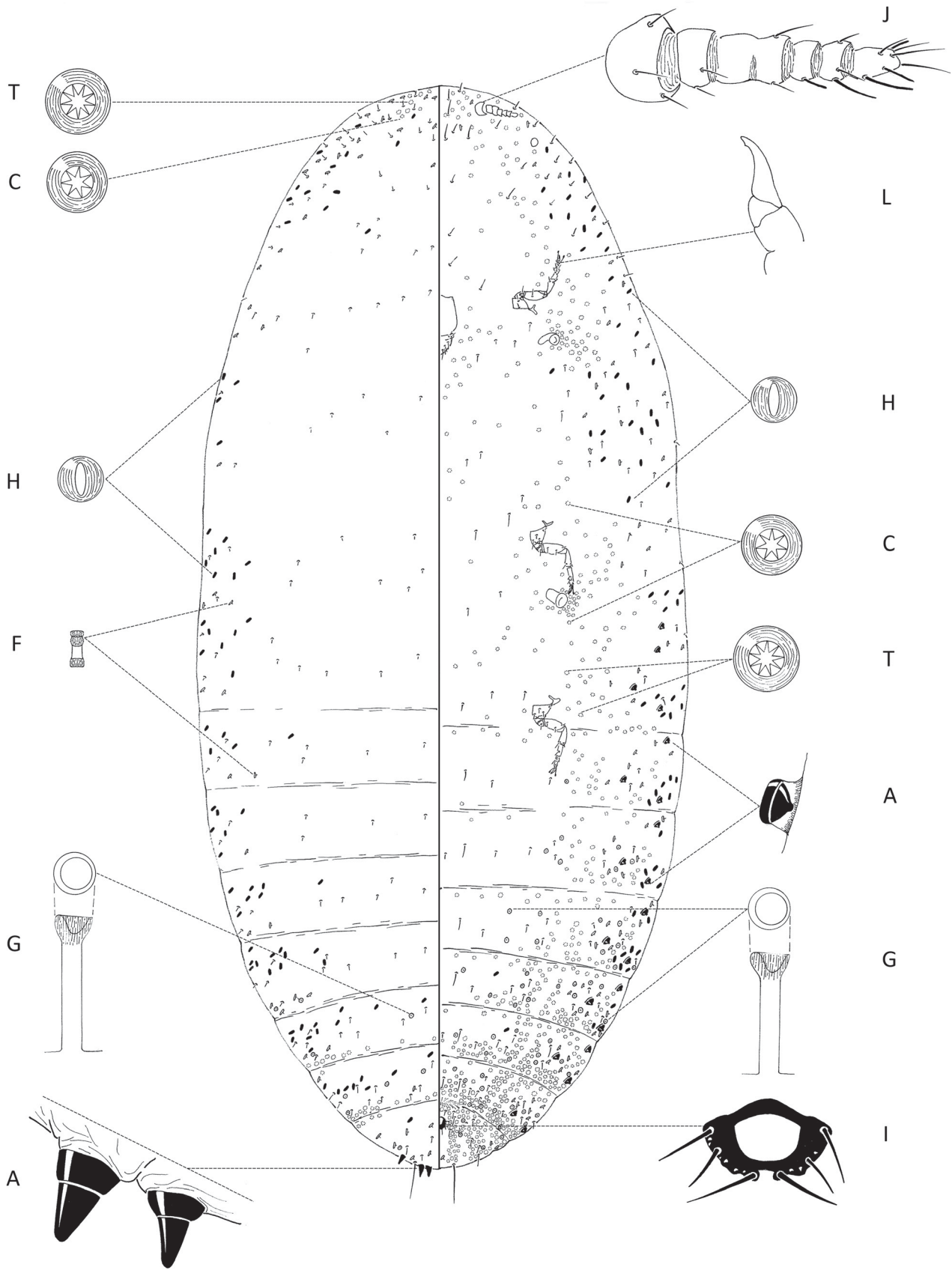


FIGURE 83. *Ovaticoccus telotrichus* sp. n., adult female, 26 km. N. Apizaco, Tlaxcala, Mexico, July 12, 1967, on unknown grass, J. Villanueva B. and D.R. Miller. A=enlarged seta; C=7-locular pore; F=microtubular duct; G=macroduct; H=cruciform pore; I=anal ring; J=antenna; L=claw; T=pore with >7 loculi.

segment IV with combined total of 2–6 enlarged setae dorsally and ventrally. Macrotubular ducts absent (paratypes with small numbers on segments V to VII). Microtubular ducts each approximately 6 µm long (paratypes 6–8 µm), area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, slightly shorter than remaining sclerotized portion; dermal orifice large and heavily sclerotized; with tube protruding from orifice. Microtubular ducts in small numbers along body margin, nearly absent on thorax. Multilocular pores on posterior margins of segments III to VII, on anterior margin of segment VIII (some paratypes on posterior margins of VII and VIII only), and on anterior margin of head (some paratypes, on lateral margins of thorax); of 3 kinds: 9-locular pores less abundant than 7-locular pores; 5-locular pores rare. Cruciform pores along body margin and in medial areas of segments VI to VIII. Microtrichia on segment VIII.

Anal ring ventral, complete, with few small cells, with 3 setae on each side of ring, each approximately same length as, or slightly shorter than, greatest diameter of ring, without additional pair of setae associated with ring, anal tube unsclerotized, anal orifice sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 29 µm long (paratypes 28–29 µm) segment VII 40 µm long (paratypes 23–35 µm); anal-lobe seta broken (paratypes 150–165 µm long). Enlarged setae variable, of 1 size; in 1 pair of longitudinal lines (sublateral) with 4 setae on 1 side and 2 on other, with 1 seta per segment when present (some paratypes with 2 pairs of longitudinal lines [lateral and sublateral] from mesothorax to segment VII; normally with 3 pairs per segment); largest seta about 13 µm long, nipple-shaped, with central projection, lateral margins curved; setal base thick; recessed in dermal pocket. Macrotubular ducts on segments II to VIII. Microtubular ducts along body margin. Multilocular pores over entire surface, noticeably abundant along body margin, in medial areas on posterior 4 or 5 abdominal segments; of 3 or 4 kinds: 9-locular pores less numerous than 7-locular pores; 5-locular pores and 6-locular pores rare or absent. Cruciform pores along body margin from head to segment V, also in small numbers in medial areas of segments V and VI. Legs without pores; each femur with 5 setae including 2 proximal setae and 3 distal setae; each tibia with 4 setae, without middle seta; with hind tibia/tarsus 0.9 (paratypes 1.0). Antennae each 7-segmented (paratypes sometimes 6-segmented with third segment partially divided), 150 µm long (paratypes 160–170). Frontal lobes absent. Preantennal pore present. Microtrichia from prothorax to segment V, also on all coxae.

Notes: This description is based on five specimens from two localities. The adult female of *Ov. telotrichus* is similar to the adult female of *Ov. davesmithi* and *Ov. tippinsi* in having five setae on each femur, nipple-shaped enlarged setae, and enlarged setae arranged in lateral longitudinal lines on venter. They differ as follows (character states in brackets are of *Ov. telotrichus*): without enlarged setae on segment VIII or without conical setae on segment VIII (with three pairs of conical setae on segment VIII).

Second-instar female (Fig. 84)

Description: Slide-mounted specimens 1.3–1.4 mm long, 0.5 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 3 enlarged setae, 0 or 1 flagellate setae, 2 or 3 microtubular ducts; ventrally each with 3 flagellate setae, suranal seta and including anal-lobe seta, with 1 microtubular duct, 1 or 2 multilocular pores.

Dorsum with flagellate setae forming 3 pairs of longitudinal lines on abdomen (medial, mediolateral and lateral), more widely scattered on thorax and head. Enlarged setae of 2 sizes and shapes; conical setae restricted to 3 pairs on posterior apex of abdomen; largest seta 25–27 µm long; enlarged setae conical, with straight sides and narrow, rounded apex; setal base large; not recessed in dermal pockets; other enlarged setae nipple-shaped, forming 2 pairs of longitudinal lines (mediolateral and lateral), with 1–4 setae on each side of each abdominal segment, from head to segment VII, with curved sides, apex rounded or truncate; largest seta 6–8 µm long; setal base medium; recessed in dermal pockets; segment IV with 9–11 setae including 3 or 4 enlarged setae and 6 or 7 flagellate setae; segment IV with combined total of 5 or 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts 4–5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion truncate, about same size as remaining sclerotized portion; total sclerotized area longer or same length as unsclerotized area; dermal orifice unusually large, sclerotized; with or without protruding tube. Microtubular ducts associated with enlarged setae in mediolateral and lateral areas from head to segment VIII. Multilocular pores restricted to head, sometimes with only 1 or 2. Cruciform pores in mediolateral and lateral areas of head or prothorax to segment VII. Microtrichia from segment III or IV to VIII, absent on 1 specimen.

Anal ring oval, ventral, cellular, heavily sclerotized, anterior section bridged by anal opening and flap, with 3 setae on each side of ring, with additional pair of setae associated with ring, longest seta longer than greatest diameter of anal ring; anal tube unsclerotized, anal opening sclerotized, with anal flap.

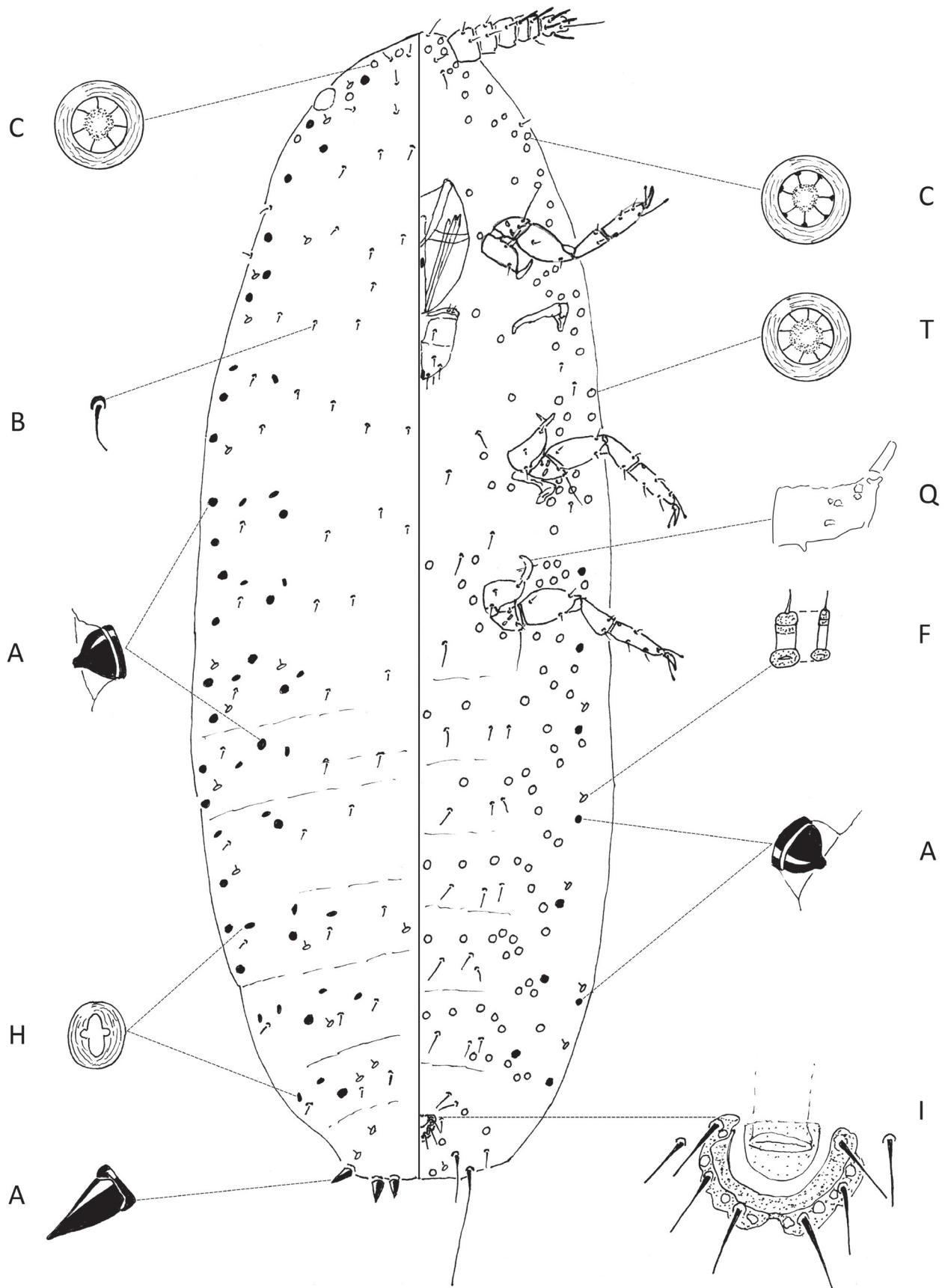


FIGURE 84. *Ovaticoccus telotrichus* sp. n., second-instar female, 23 miles S. Guadalajara, Jalisco, Mexico, July 3, 1972, on unknown grass, D.R. Miller and F.D. Parker. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; F=microtubular duct (shown in two views); H=cruciform pore; I=anal ring; Q=dorsal surface of coxa; T=pore with >7 loculi.

Venter with longest flagellate seta on segment II 16–25 μm long, on segment VII 20–28 μm long; anal-lobe seta 122–127 μm long. Enlarged setae nipple-shaped, in 1 longitudinal line (sublateral) from thorax to segment VII, sometimes with 1 or 2 mediolaterally on posterior abdominal segments. Macrotubular ducts absent. Microtubular ducts limited to lateral areas of abdomen. Multilocular pores scattered over entire surface, of 3 kinds: 7-locular pores most abundant; 9-locular pores less common, most abundant on thorax and head; 5-locular pores less common, most abundant on abdomen. Cruciform pores absent. Legs with each coxa with 0–4 indefinite pores; each femur with 5 setae including 2 proximal setae and 3 distal setae; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 6-segmented, 122–142 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia from prothorax to segment VI or VII, on hind 2 pairs of coxae.

Notes: The description is based on 10 specimens from two localities. The second-instar female of *Ov. telotrichus* is most similar to the second-instar of *Ov. cornutus* in having dorsal cruciform pores, each femur with five setae, nipple-shaped enlarged setae, multilocular pores predominantly with more than five loculi, and dorsal multilocular pores restricted to head. They differ as follows (character states in brackets are those of *Ov. telotrichus*): enlarged setae nipple-shaped on posterior abdominal segment (conical); eye spur-shaped (dome-shaped); with medial longitudinal line of enlarged setae (without medial line); 9-locular pores absent or rare (abundant).

Third-instar male (prepupa) (Fig. 85)

Description: Slide-mounted specimen 1.0 mm long, 0.4 mm wide, not including wing buds. Small lateral lobes on segment VIII.

Dorsum with flagellate setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral) on each abdominal segment except segment VIII, mediolateral line with 2 or 3 setae on each side, medial and lateral lines each with 1 seta, setal apices acute. Multilocular pores in medial longitudinal line on abdomen also with 1 or 2 pores mediolaterally, with 1 or 2 pores on head and thorax. Front wing buds each approximately 12 μm long. Ocular sclerite absent. Microtrichia on segments VII and VIII.

Abdominal segment IX small, protruding slightly, unsclerotized; anal opening dorsal; small lobes present.

Venter with flagellate setae apically acute, slightly longer than those on dorsum; longest lateral setae on segment IX about 80 μm long. Multilocular pores with 5–13 loculi, scattered over surface of head and thorax, in medial and lateral areas on abdomen, most abundant laterally. Legs and antennae small and poorly defined, partially sclerotized. Eye absent. Microtrichia from head to segment IX.

Notes: The description is based on one specimen from one locality. The third-instar male of *Ov. telotrichus* is most similar to the macropterous prepupa of *Hy. hyperici* in having reduced appendages, reduced or no mouthparts, and the presence of multilocular pores and flagellate setae. They differ as follows (character states in brackets are of *Ov. telotrichus*): dorsal multilocular pores absent medially (present medially on abdomen); without multilocular pores on head and thorax (present, uncommon).

Second-instar male (Fig. 86)

Description: Slide-mounted specimens, 1.0–1.1 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas dorsally each with 3 enlarged setae, 1 microtubular ducts, 2 or 3 multilocular pores; ventrally each with 3 flagellate setae including suranal seta and anal-lobe seta, 1–4 multilocular pores.

Dorsum with flagellate setae scattered over entire surfaces, not forming definite longitudinal lines. Enlarged setae of 1 size restricted to 3 pairs on posterior apex of abdomen; largest seta about 10 μm long; enlarged setae conical, with straight sides and narrow, rounded apex; setal base large; not recessed in dermal pocket; segment IV with 10–12 setae, all flagellate. Macrotubular ducts scattered over entire surface. Microtubular ducts 4–5 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion truncate, about same size as remaining sclerotized portion; total sclerotized area longer, or same length as, unsclerotized area; dermal orifice unusually large, sclerotized; with or without protruding tube. Microtubular ducts rare, restricted to posterior abdominal segments, sometimes absent; specimens from Texas with more dorsal microtubular ducts in mediolateral areas. Multilocular pores variable, same relative abundance as on venter, usually on head, mesothorax, and posterior margin of abdominal segments. Cruciform pores most abundant laterally on thorax and anterior abdominal segments, occasionally in mediolateral areas of abdomen. Microtrichia obvious on segment VIII, inconspicuous on segments VI and VII.

Anal ring oval, ventral, cellular, heavily sclerotized, anterior section bridged by anal opening and flap, with 3 setae on each side of ring, with additional pair of setae associated with ring, longest seta longer than greatest diameter of anal ring; anal tube unsclerotized, anal opening sclerotized, with anal flap.

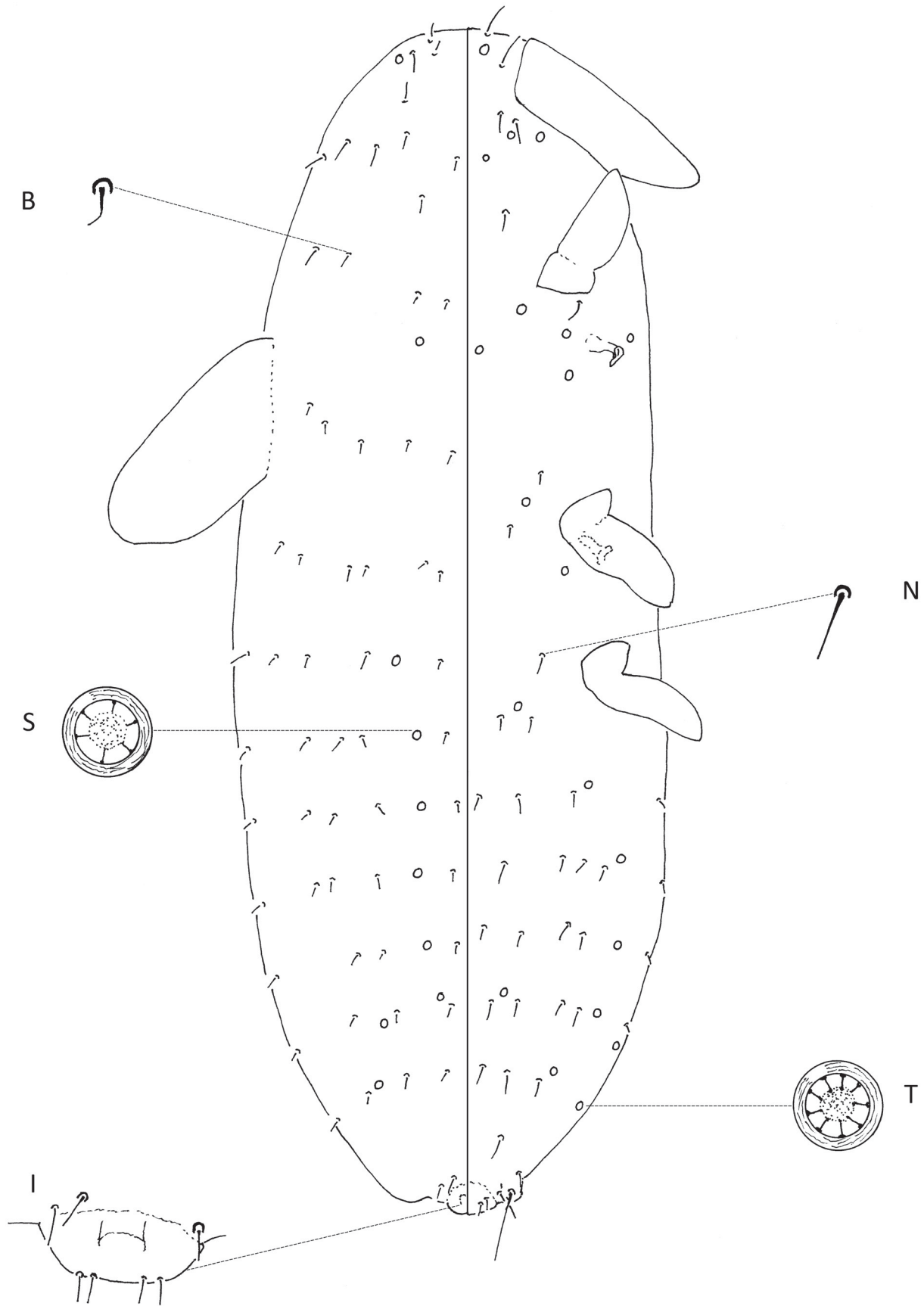


FIGURE 85. *Ovatococcus telotrichus* sp. n., third-instar male (prepupa), 23 miles S. Guadalajara, Jalisco, Mexico, July 3, 1972, on unknown grass, D.R. Miller and F.D. Parker. B=slightly enlarged seta; I=anal ring; N=flagellate seta; S=6-locular pore; T=pore with >7 loculi.

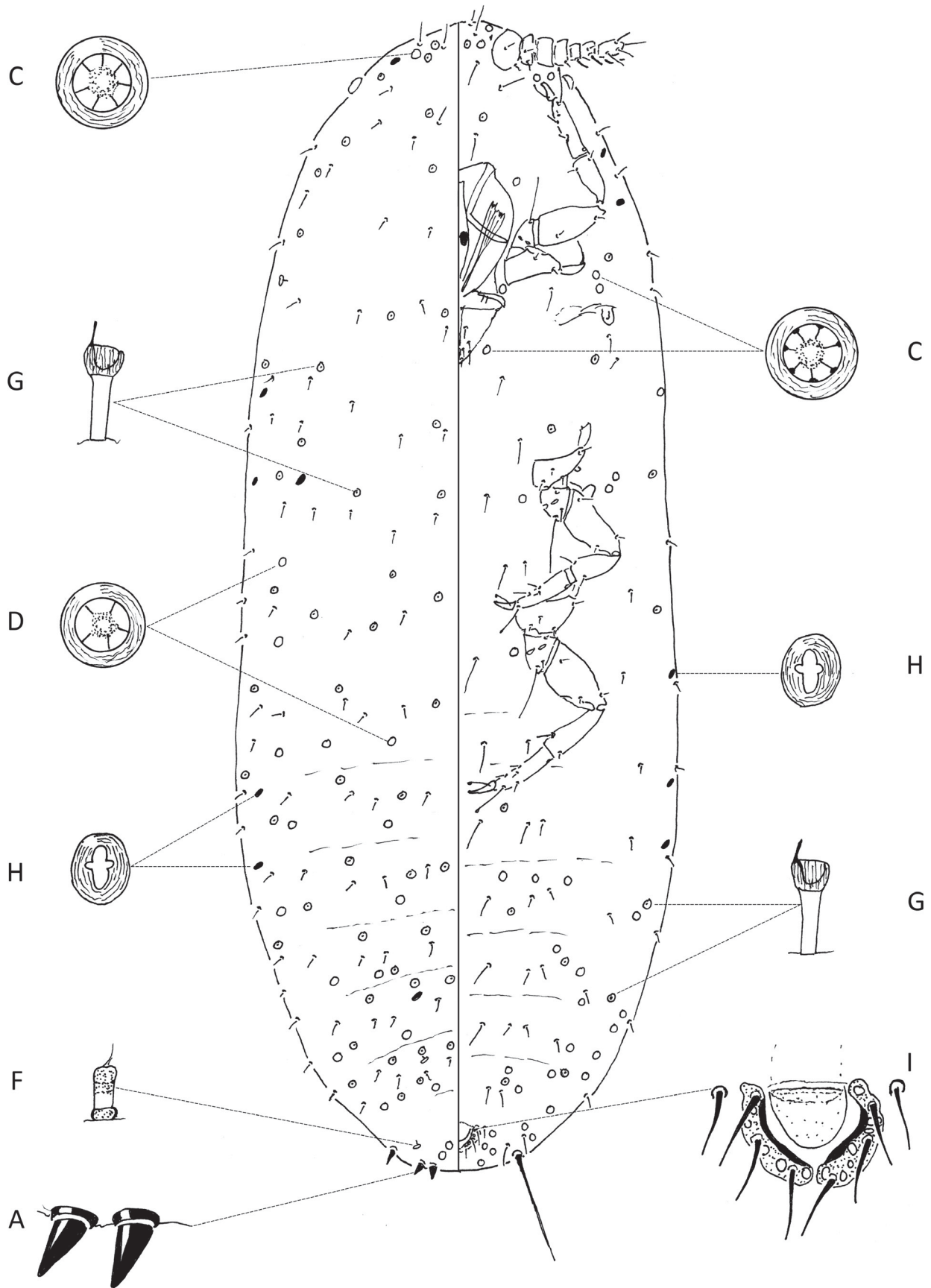


FIGURE 86. *Ovaticoccus telotrichus* sp. n., second-instar male, 23 miles S. Guadalajara, Jalisco, Mexico, July 3, 1972, on unknown grass, D.R. Miller and F.D. Parker. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring.

Venter with longest flagellate seta on segment II 20–25 µm long, on segment VII 22–28 µm long; anal-lobe seta 88–96 µm long. Enlarged setae absent. Macrotubular ducts in small numbers over surface, absent medially on thorax, most abundant laterally. Microtubular ducts absent. Multilocular pores scattered over entire surface, of 2 kinds: 7-locular pores most abundant, 5-locular pores most abundant on abdomen; Texas specimens with more 5-locular pores, less common than 7-locular pores. Cruciform pores scattered laterally. Legs without pores; each hind femur with 5 setae including 2 proximal setae and 3 distal setae; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 7-segmented, 125–127 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from prothorax to segment VIII, on hind 2 pairs of coxae.

Notes: The description is based on four specimens from two localities. The second-instar male of *Ov. telotrichus* is most similar to the second-instar male of *Ov. davesmithi* in having the anal ring with pores and an anal flap, each femur with five setae, and with dorsal multilocular pores. They differ as follows (character states in brackets are those of *Ov. telotrichus*): apex of abdomen without conical enlarged setae (with three pairs of conical enlarged setae); nipple-shaped enlarged setae present (nipple-shaped setae absent); and multilocular pores predominantly with five loculi (seven loculi).

First-instar nymph (Fig. 87)

Description: Slide-mounted specimens 0.4–0.7 mm long, 0.2–0.3 mm wide. Body broadly oval, without protruding anal lobes. Anal-lobe area on each side dorsally without flagellate seta, with 3 conical enlarged setae, with 1 microtubular duct; ventrally each with 1 or 2 flagellate setae including anal-lobe seta.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (medial and lateral) on mesothorax to segment IV or V, randomly scattered on head and prothorax. Enlarged setae of 2 kinds: conical setae in anal-lobe area, 3 on each side of segment VIII, also with 1 pair on sublateral and lateral areas of segments IV or V to VII; nipple-shaped setae in 2 pairs of longitudinal lines (sublateral and lateral, lateral line partially ventral) from prothorax or mesothorax to segment VII, each line composed of 1 seta per segment, with 2 pairs of setae on anterior margin of head. Largest conical seta about 18 µm long, much more elongate than on adult female, with more acute apex and smaller setal base; largest nipple-shaped seta about 8 µm long; segment IV with 7 or 8 setae including 6 flagellate setae and 1 or 2 slightly enlarged setae; segment IV with combined total of 4 or 5 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts about 4 µm long, with area farthest from dermal orifice sclerotized and undivided. Microtubular ducts in lateral line from segment II to VII. Multilocular pores absent. Cruciform pores, when present, near body margin at juncture of thorax and abdomen. Without microtrichia.

Anal ring apical or ventral, circular, divided anteriorly and posteriorly, cellular, with 3 somewhat enlarged setae on each side of ring, each longer than greatest diameter of ring, anal tube unsclerotized, anal opening slightly sclerotized, apparently with anal flap.

Venter with longest flagellate seta on segment II 14–15 µm long, on segment VII 20–22 µm long; anal-lobe seta 110–112 µm long. Enlarged setae in longitudinal line along body margin, conical posteriorly, nipple-shaped anteriorly, from prothorax to segment VIII. Microtubular ducts absent. Multilocular pores present at base of antennae, near eye, between front leg and mouthparts, laterad to front legs, 1 associated with each spiracle, 1 mesad to each mid- and hind coxa, 1 between mid- and hind pair of legs mediolaterally, 5 or 6 forming mediolateral longitudinal line on each side of abdominal segments, sometimes with 1 or 2 in sublateral line on anterior abdominal segments; of 4 kinds: 7-locular pores and 5-locular pores approximately equal in numbers, 6-locular pores, and 9-locular pores uncommon. Cruciform pores near body margin of thorax. Legs without pores; each femur with 5 setae including 2 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.7–0.9. Antennae each 6-segmented, about 115 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from metathorax to segment VII, absent from coxae.

Notes: This description is based on six poorly stained embryos retained within the bodies of the adult females and 13 separately mounted specimens from two localities. The first-instar nymph of *Ov. telotrichus* is most similar to the first-instar nymphs of *Ov. davesmithi* and *Ov. tippinsi* in having five setae on each femur and nipple-shaped setae in lateral longitudinal lines. They differ as follows (character states in brackets are of *Ov. telotrichus*): without enlarged setae on abdominal segment VIII or without conical setae on abdominal segment VIII (with three pairs of conical setae on segment VIII).

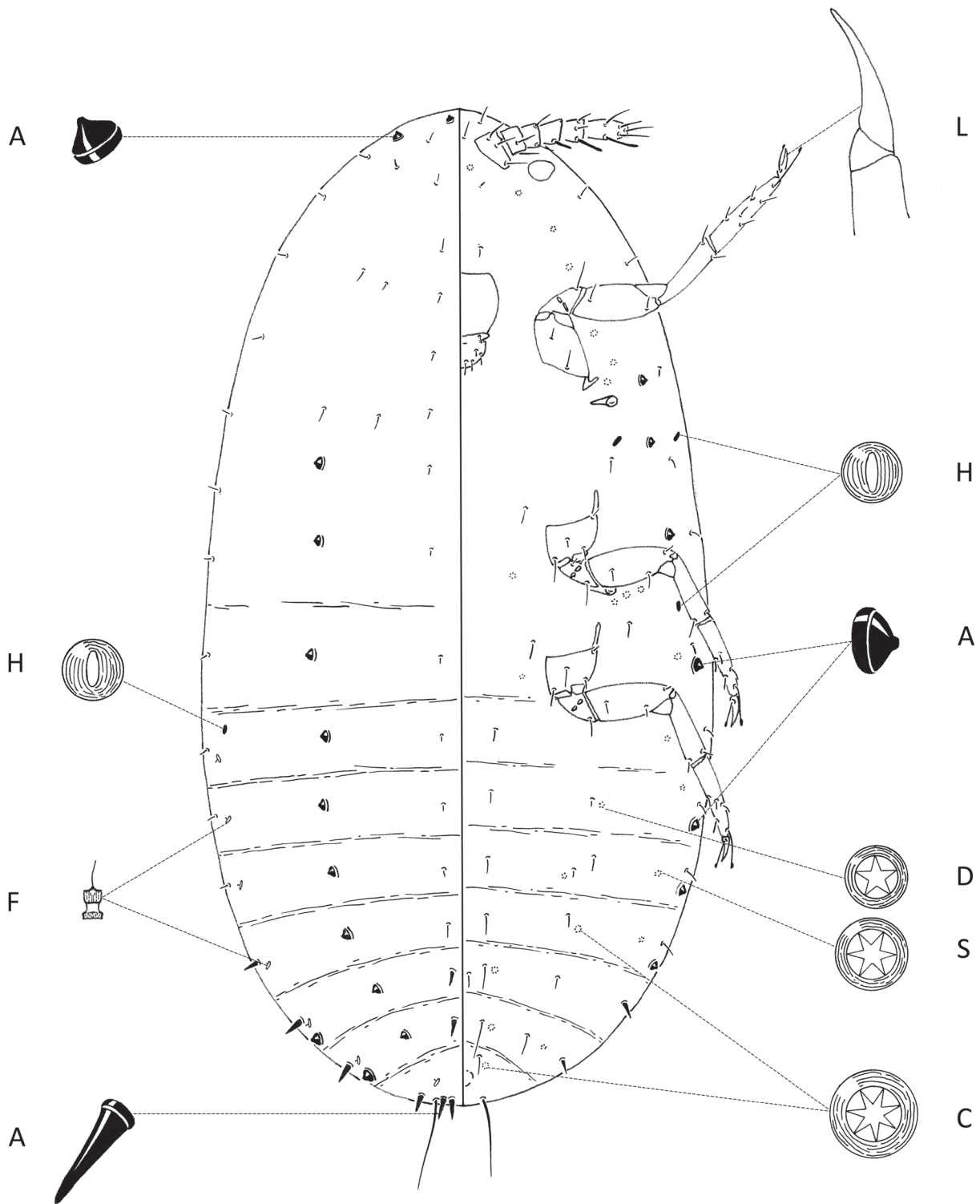


FIGURE 87. *Ovaticoccus telotrichus* sp. n., first-instar nymph (embryo), Iron Mt. Ranch, 8 miles N. Marathon, Brewster Co., Texas, USA, May 11, 1976, on unknown grass, R.D. Gordon and D.R. Miller. A=enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; H=cruciform pore; L=claw; S=6-locular pore.

Ovaticoccus tippinsi (Miller & Miller) comb. n.

Oregmomyga tippinsi Miller and Miller 1993: 81.

Etymology: The species epithet “*tippinsi*” was described in honor of the late Hamlin H. Tippins, University of Georgia, Experiment, Georgia, USA who spent much of his career studying the scale insects of Georgia.

The justification for treating *Oregmomyga* as a junior synonym of *Ovaticoccus*, leading to this new combination, is provided in the “Notes” section that follows the generic description above. The adult female of this species was described in detail by Miller and Miller (1993) and information from that paper is not repeated here.

Second-instar female (Fig. 88)

Description: Slide-mounted specimens 1.1–1.4 mm long, 0.4–0.5 mm wide. Body elongate oval, with protruding anal lobes. Anal-lobe areas each dorsally with 3 flagellate setae; ventrally each with 1–4 flagellate setae including suranal seta and elongate anal-lobe seta, with 0 or 1 microtubular ducts.

Dorsum with flagellate setae arranged in 2 or 3 pairs of longitudinal lines (medial, mediolateral and lateral), some flagellate setae replaced by enlarged setae or transitional setae making lines of enlarged and flagellate setae indefinite. Enlarged setae restricted to lateral and sublateral areas of segments IV, V, or VI and VII, of 2 sizes; largest seta 13–14 μm long; enlarged setae pear-shaped to conical, laterally with curved or straight margins, with rounded apex; setal base thin; usually in dermal pockets; segment IV with 10–12 setae, some specimens with all flagellate setae, others with up to 4 enlarged setae; segment IV with combined total of 4–8 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts 3–4 μm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded or bilobular, about same length as remaining sclerotized portion; total sclerotized area same length as, or longer than, unsclerotized area; dermal orifice weakly sclerotized, with protruding rounded tube. Microtubular ducts most abundant laterally, less abundant medially from head to segment VIII. Multilocular pores with 6–13 loculi: 7-locular pores and 9-locular pores most abundant; in segmental rows from head to segment VIII. Cruciform pores scattered over surface of head and thorax, uncommon on abdomen. Microtrichia on segments VI to VIII.

Anal ring ventral or apical, divided anteriorly and posteriorly, cellular, with 3 setae on each side of ring, each longer than greatest diameter of ring, with additional pair of setae associated with anal ring but not attached, anal tube unsclerotized, anal opening slightly sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 12–22 μm long, on segment VII 20–22 μm long; anal-lobe seta 135–150 μm long. Enlarged setae laterally from prothorax, mesothorax or metathorax to segment VII, with 2 or 3 setae on each side of each segment in each lateral longitudinal line. Macrotubular ducts absent. Microtubular ducts present laterally. Multilocular pores of same kinds as on dorsum, most abundant laterally, uncommon in medial areas of head and abdomen. Cruciform pores absent. Legs with hind coxae with 2–5 indistinct pores; each femur with 5 setae including 2 proximal setae and 3 distal setae; each tibia with 4 distal setae, without middle seta; hind tibia/tarsus 0.9–1.0. Antennae each 6-segmented, 117–120 μm long. Frontal lobes absent. Preantennal pore present. Microtrichia from prothorax to segment VIII, also on hind 2 pairs of coxae.

Notes: The description is based on seven specimens from four localities. The second-instar female of *Ov. tippinsi* is most similar to the second-instar female of *Ov. telotrichus* in having ventral enlarged setae, dorsal cruciform pores, and a cellular anal ring. They differ as follows (character states in brackets are of *Ov. tippinsi*): apex of abdomen with three pairs of conical enlarged setae (without enlarged setae at abdominal apex); without dorsal multilocular pores (with dorsal multilocular pores).

First-instar nymph (Fig. 89)

Description: Slide-mounted specimen 0.9 mm long, 0.4 mm wide. Body elongate oval, with slightly protruding anal lobes. Anal-lobe area on each side dorsally with 3 conical, enlarged setae, with 1 multilocular pore and 1 microtubular duct; ventrally each with 2 flagellate setae including anal-lobe seta, with 1 or 2 multilocular pores and 1 enlarged seta.

Dorsum with flagellate setae arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral) on head to segment VII, lateral line replaced by slightly enlarged conical setae on segments II to IV and nipple-shaped enlarged setae on segments V to VII. Enlarged setae of 2 kinds: conical setae in anal-lobe area and anterior abdominal segments, 3 on each side of segment VIII; nipple-shaped setae in lateral line on each side of segments V to VII; largest conical seta about 22 μm long; largest nipple-shaped seta about 9 μm long, not in dermal pocket; segment IV with 2 slightly enlarged setae and 2 or 3 pairs of flagellate setae; segment IV with combined total of 5 or 6 slightly

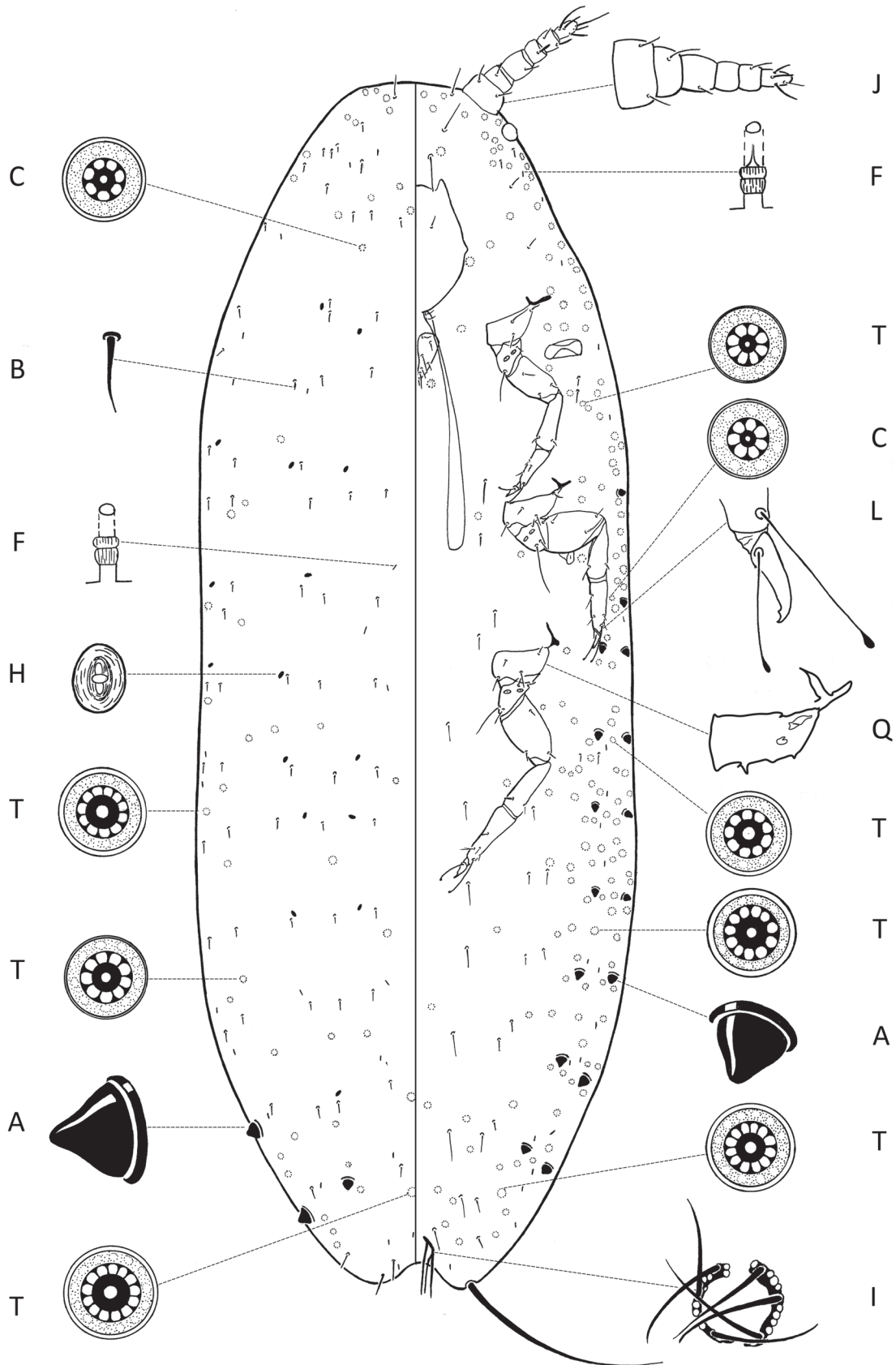


FIGURE 88. *Ovatococcus tippinsi* (Miller & Miller 1993), second-instar female, Junction of 92 and 41, Collier Seminole State Park, Collier Co., Florida, April 11, 1974, on grass, R.F. Denno and D.R. Miller. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; Q=dorsal surface of coxa; T=pore with >7 loculi.

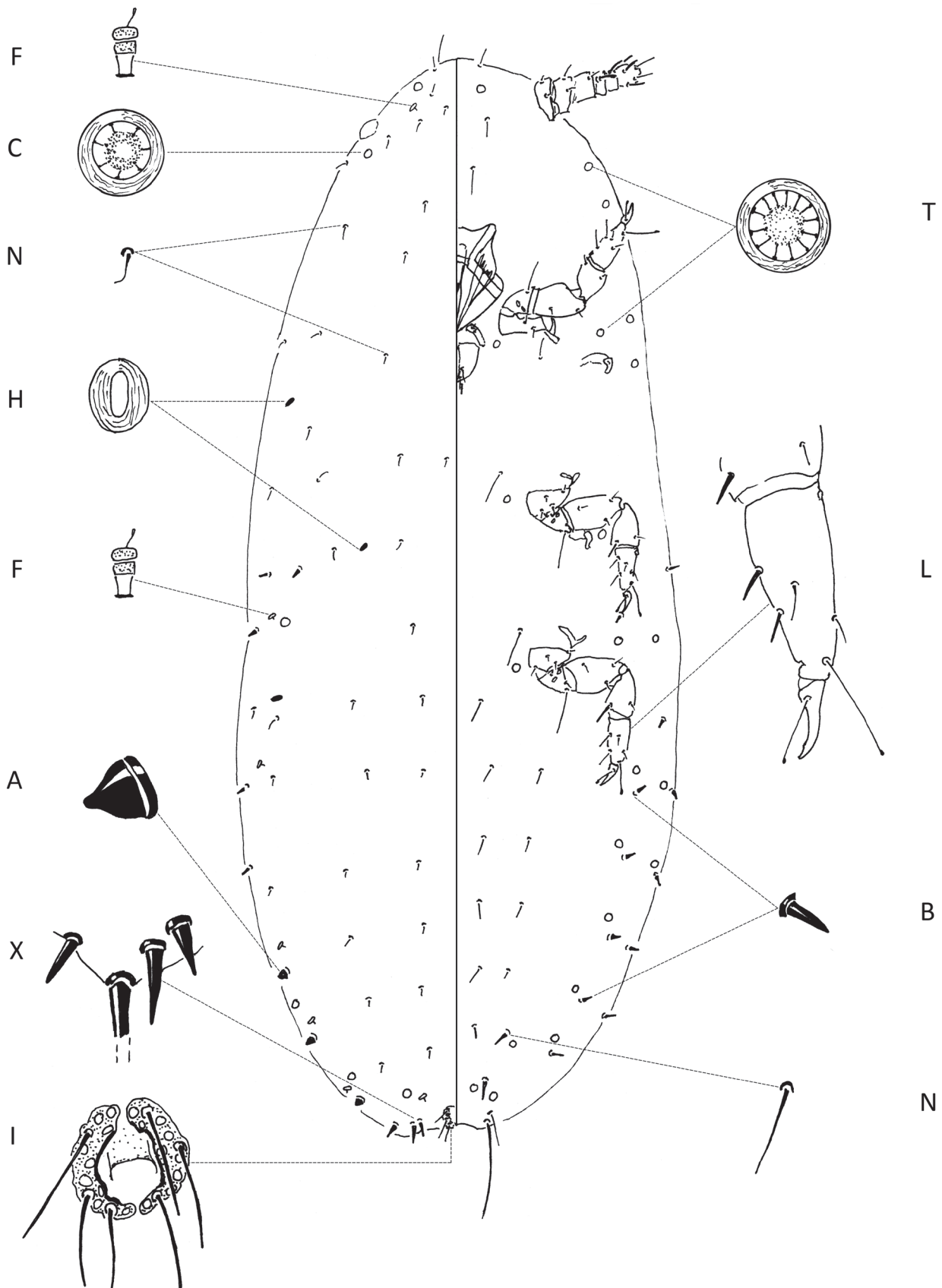


FIGURE 89. *Ovatococcus tippinsi* (Miller & Miller 1993), first-instar nymph, Lake north of Mahogany Hammock, Dade Co., Florida, USA, April 9, 1974, on *Muhlenbergia* sp., R.F. Denno and D.R. Miller. A=enlarged seta; B=slightly enlarged seta; C=7-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; L=claw; N=flagellate seta; T=pore with >7 loculi; X=anal lobe.

enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each about 4 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion broadly rounded, about same length as remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice weakly sclerotized, without protruding tube. Microtubular ducts in lateral line from head to segment VIII. Multilocular pores laterally on head, metathorax, and segments V to VII. Cruciform pores uncommon laterally on thorax and anterior abdomen. Microtrichia on segments VII and VIII.

Anal ring apical or ventral, circular, divided anteriorly and posteriorly, cellular, with 3 setae on each side of ring, each longer than greatest diameter of ring, anal tube unsclerotized, anal opening slightly sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 10 µm long, on segment VII 11 µm long; anal-lobe seta 145 µm long. Slightly enlarged conical setae in longitudinal line along body margin from segment II–VII. Microtubular ducts absent. Multilocular pores present between antennae, along body margin posterior to eye, between front leg and mouthparts, laterad to front legs, 1–3 associated with each spiracle, 1 mesad to each mid- and hind coxa, 2 laterad to each hind leg, 9 or 10 forming lateral longitudinal line on each side of abdominal segments, sometimes with 1 or 2 in sublateral lines on anterior abdominal segments; of 6 kinds: 7-locular pores and 9-locular pores approximately equal in numbers, 5-locular pores less frequent but more numerous than 11- and 13-locular pores. Cruciform pores absent. Legs without pores; each femur with 5 setae including 2 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.9. Antennae each 6-segmented, each about 107 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from metathorax to segment VII, absent from coxae.

Notes: This description is based on one specimen from one locality. The first-instar nymph of *Ov. tippinsi* is most similar to the first-instar nymph of *Ov. telotrichus* in having five setae on each femur, three enlarged setae associated with each anal-lobe area, and several multilocular pores associated with each spiracle. They differ as follows (character states in brackets are of *Ov. tippinsi*): with mediolateral line of enlarged setae on abdomen (without); nipple-shaped setae present on head (absent); multilocular pores absent from dorsum (present).

***Ovaticoccus tuttlei* Miller and Stocks sp. n.**

Type material: Adult female holotype mounted singly on slide, with right label “*Ovaticoccus / tuttlei / Portal, Cochise Co., / Arizona -2-IX-1967 / ex Hilaria mutica / DMTuttle / ENTOMOLOGY / U.C., Davis, Calif.*” Left label “*Ovaticoccus / tuttlei* Miller / and Stocks / Holotype.” The holotype is deposited in UCD. **Paratypes:** Arizona: Cochise Co.: Portal, IX-2-1967, on *H. mutica*, D.M. Tuttle (1 ad. ♀ holotype on 1 slide) UCD; Portal, IX-2-1967, on *Muhlenbergia porteri*, D.M. Tuttle (2 ad. ♀♀ paratypes on 2 slides) UCD (1 slide), USNM (1 slide); Portal, VIII-23-1968, on *Aristida adscensionis*, D.M. Tuttle (2 ad. ♀♀ paratypes on 2 slides) BM (1 slide), CDFA (1 slide).

Etymology: This species is named in honor of the late Donald M. Tuttle, who was a professor in the Entomology Department at the University of Arizona, USA. He was stationed at the experiment station in Yuma, Arizona, and was a well-known acarologist. He often collected interesting scale insects, particularly mealybugs and eriococcids, while studying spider mites.

Adult female (Fig. 90)

Description: Holotype, slide-mounted, 1.6 mm long, 0.5 mm wide (paratypes 1.4–1.6 mm long, 0.5–0.6 mm wide). Body elongate oval, with slightly protruding anal lobes. Anal-lobe areas dorsally each with 2 slightly enlarged flagellate setae (paratypes 2 or 3), 0 and 1 microtubular duct (paratypes 0 or 1), and 7 7-locular pores or 9-locular pores (paratypes 5–9 5-locular pores, 7-locular pores, or 9-locular pores); ventrally each with 2 flagellate setae including anal-lobe seta, and 7 or 8 5-locular pores, 7-locular pores, or 9-locular pores (paratypes 6 or 7 7-locular pores or 9-locular pores), without macrotubular ducts (paratypes 0 or 1).

Dorsum with flagellate setae scattered over entire surface, noticeably shorter than those on venter, slightly curved. Enlarged setae absent (paratypes with 0–3 slightly enlarged setae on body margin, same shape as other dorsal setae). Macrotubular ducts scattered over entire surface, least abundant on anterior thorax and head, about 20 µm long (paratypes 21–29 µm). Microtubular ducts each 5 µm long (paratypes 4–5 µm), area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, slightly smaller than remaining sclerotized portion, dermal orifice sclerotized, often with protruding duct. Microtubular ducts most abundant near body margin, absent medially. Multilocular pores scattered over entire surface, of 3 or 4 kinds: 9-locular pores, 7-locular pores,

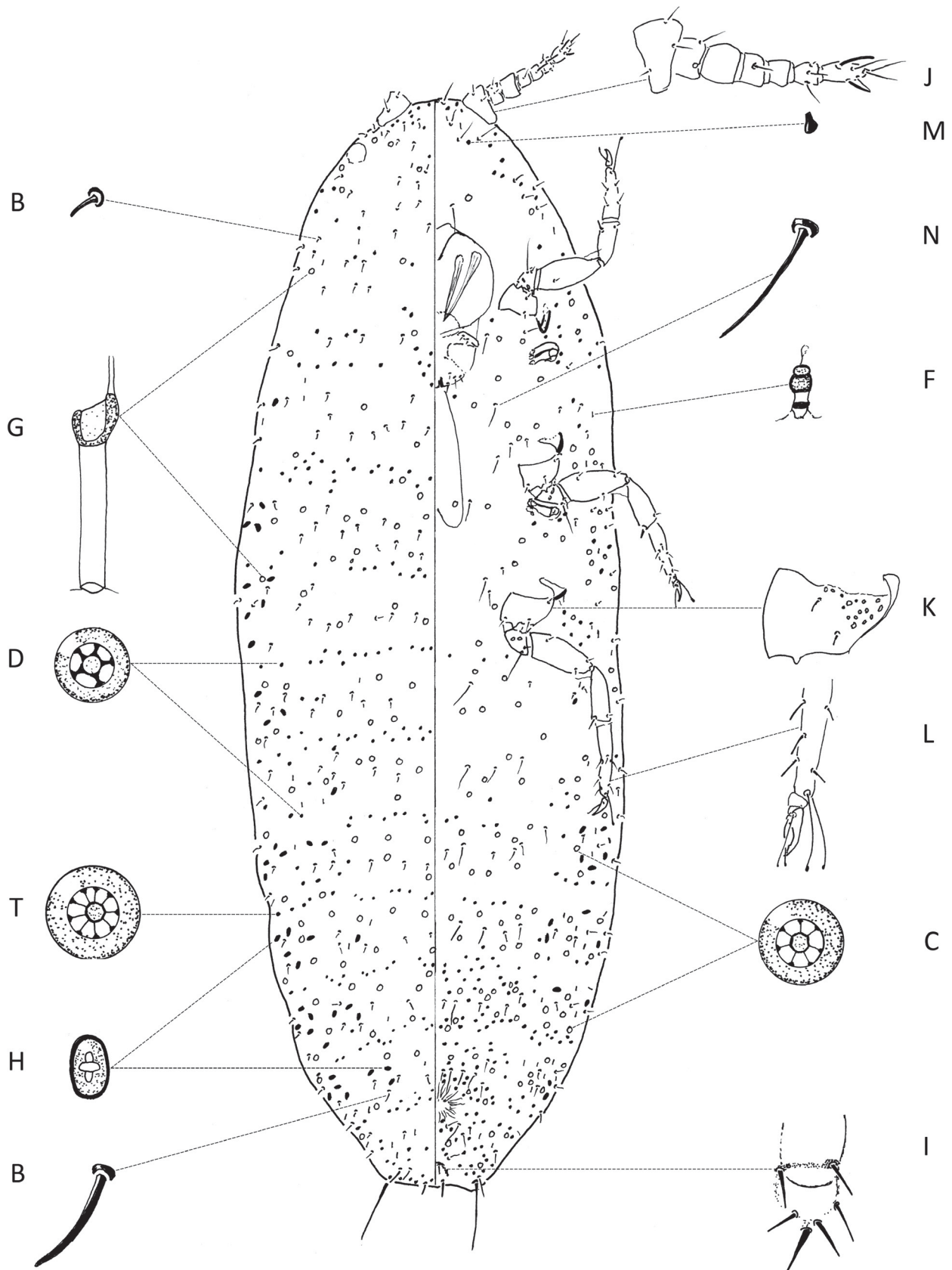


FIGURE 90. *Ovatococcus tuttlei* sp. n., adult female, Portal, Cochise Co., Arizona, USA, September 2, 1967, on *Hilaria mutica*, D.M. Tuttle. B=slightly enlarged seta; C=7-locular pore; D=5-locular pore; F=microtubular duct; G=macrotubular duct; H=cruciform pore; I=anal ring; J=antenna; K=dorsal surface of coxa; L=claw; M=preantennal pore; N=flagellate seta; T=pore with >7 loculi.

6-locular pores, and 5-locular pores; 7-locular pores most abundant. Cruciform pores in lateral clusters from mesothorax to segment VII, least abundant on thorax (paratypes sometimes with pores in mediolateral areas and medially on segments VI and VII). Microtrichia on segment VII.

Anal ring ventral, nearly absent, anterior portion weakly sclerotized near anterior pair of setae, semicircular, incomplete, usually unsclerotized posteriorly, sometimes with small area of sclerotization near 1 posterior seta, essentially non-cellular, with 1 pore near anterior seta (paratypes without cells) with 3 setae on each side of ring (paratypes sometimes with 2 setae on each side), posterior setae slightly enlarged, setae each shorter than greatest diameter of ring; anal tube weakly sclerotized, anal opening tube weakly sclerotized, without anal flap.

Venter with longest flagellate seta on segment II 30 μm long (paratypes 25–32 μm), on segment VII 32 μm long (paratypes 28–32 μm); longest anal-lobe seta 90 μm long (paratypes 82–95 μm). Enlarged setae absent. Macrotubular ducts scattered over entire surface, least abundant anteriorly, some macrotubular ducts in middle areas of segments slightly smaller. Microtubular ducts near body margin, absent medially. Multilocular pores of same kinds and relative numbers as on dorsum, most abundant near body margin, rare or absent medially on head and anterior thorax, forming distinct rows on abdomen. Cruciform pores on marginal areas of segments II to VII (paratypes on mesothorax, metathorax, or segment II to VI or VII). Legs with hind coxae dorsally with 14 and 17 pores (paratypes 9–18 pores), ventrally without pores (paratypes with 0–2 pores); each femur with 5 setae including 2 proximally and 3 distally; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.8 (paratypes 0.7–0.8). Antennae each 7-segmented, each 182 and 175 μm long (paratypes 162–187 μm). Frontal lobes absent. Preantennal pore present. Microtrichia on prothorax to segment VIII (paratypes with microtrichia from mesothorax or metathorax to segment VIII), and on ventral surface of each coxa.

Notes: The description is based on five specimens from one locality. The adult female of *Ov. tuttlei* is most similar to the adult female of *Ov. haigi* in having a very reduced anal ring, dorsal and ventral cruciform pores, and dorsal multilocular pores. These species differ as follows (character states in brackets are those of *Ov. tuttlei*): with 6-segmented antennae (7-segmented); with translucent pores present on derm anterior to hind coxae (absent); each femur with four setae including one proximal seta (five setae including two proximal setae); multilocular pores predominantly with five loculi (seven loculi).

Ovaticoccus variabilis Miller

Ovaticoccus variabilis Miller in Miller and McKenzie 1967: 525.

Material examined: not previously reported: UNITED STATES: California: Nevada Co.: Sagehen Creek, nr. Hobart, VII-15-1964, on host unknown, J.S. Gleen (5 ad. ♀♀ on 2 slides) UCD; Sagehen Creek Research Station, VII-15-1966, on *Artemisia tridentata*, D.R. Miller (3 ad. ♀♀, 3 second-instar ♀♀, 6 second-instar ♂♂, 3 first-instar nymphs on 5 slides) UCD, USNM; Sierra Co., 15 mi. SE Sierraville, VIII-2-1970, on *Artemisia* sp., D.R. Miller (2 second-instar ♀♀, 1 first-instar nymph on 2 slides) USNM. Idaho, Fremont Co., St. Anthony Sand Dunes, VII-5-1967, on *A. tridentata*, D.R. Miller (1 second-instar ♀, on 1 slide) USNM. Oregon, Harney Co., Burns, VIII-3-1970, on *A. tridentata*, D.R. Miller (1 ad. ♀, 1 second-instar ♀, on 1 slide) USNM; Klamath Co., 2 mi. NE Olene, VIII-1-1968, on *Artemisia* sp., D.R. Miller and R.F. Denno (1 ad. ♀, on 1 slide) UCD; Lake Co., 5 mi. N. North Fork Crooked Creek, Warner Mountains, VIII-3-1968, on *Artemisia* sp., D.R. Miller and R.F. Denno (2 second-instar ♀♀, 1 second-instar ♂, on 1 slide) UCD.

The adult female and first-instar nymph of this species were described in Miller and McKenzie (1967) and information on the adult female is not repeated here. A more detailed description of the first-instar nymph and the first descriptions of the second-instar female, second-instar male and the pupa are included below.

Etymology: The species epithet “*variabilis*” is from the Latin word “*variabilis*” meaning “variable” and refers to the highly diverse morphology of specimens from different habitats.

Second-instar female (Fig. 91)

Description: Slide-mounted specimens 0.7–0.9 mm long, 0.3–0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 or 3 flagellate setae; ventrally each with 3 flagellate setae including suranal seta and elongate anal-lobe seta.

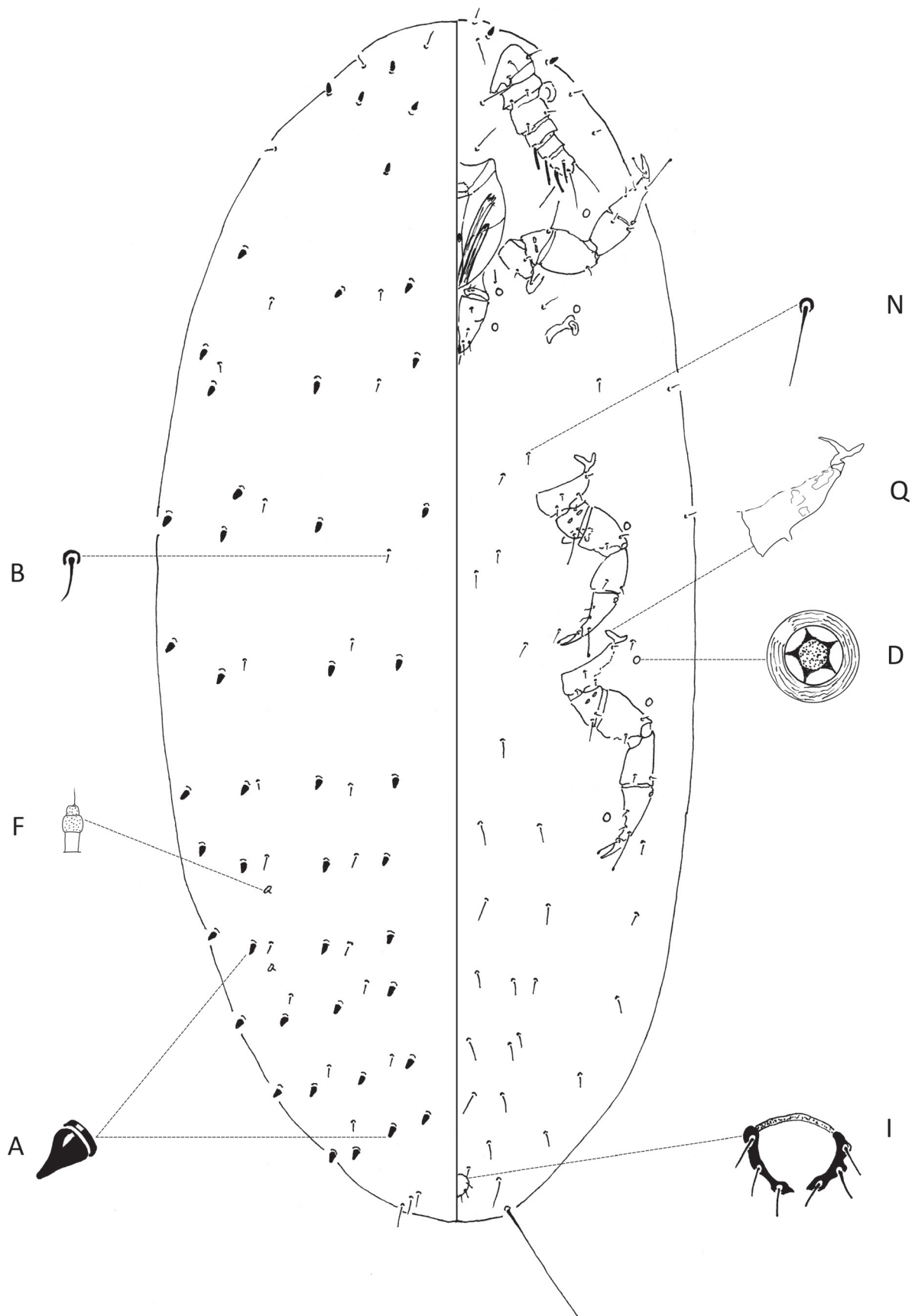


FIGURE 91. *Ovatococcus variabilis* Miller 1967, second-instar female, St. Anthony Sand Dunes, Fremont County, Idaho, USA, August 5, 1964, on *Artemisia tridentata*, D.R. Miller. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; F=microtubular duct; I=anal ring; N=flagellate seta; Q=dorsal surface of coxa.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (submedial and sublateral). Enlarged setae in 4 pairs of longitudinal lines (medial, mediolateral, sublateral and lateral) from head to segment VII, some enlarged setae replaced by flagellate setae on head and prothorax. Largest setae about 7 µm long; enlarged setae pear-shaped, laterally with curved sides, with narrow rounded apex; setal base thin; not in dermal pockets; segment IV with 10–12 setae including 8 enlarged setae and 4 or 5 flagellate setae; segment IV with combined total of 8 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, normally smaller than remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice unsclerotized, without tube projecting from orifice; microtubular ducts rare laterally on posterior abdominal segments. Multilocular and cruciform pores, and microtrichia absent.

Anal ring ventral, incomplete, divided posteriorly, with narrow bridge between lateral plates, some specimens without bridge, non-cellular; with 3 setae on each side of ring, each shorter or approximately equal in length to greatest diameter of ring; extra seta on each side of ring, not in sclerotization; anal tube and anal opening unsclerotized, anal flap absent.

Venter with longest flagellate seta on segment II 12–14 µm long, on segment VII 15–16 µm long; anal-lobe seta 80–89 µm long. Enlarged setae present or absent laterally. Multilocular pores present near base of antenna, laterad to labium, adjacent to each spiracle, and in mediolateral longitudinal line on each side of any or all of segments II–V, of 2 kinds: 5-locular pores on head and abdomen; 3-locular pores sometimes near spiracles; 5-locular pores most abundant. Cruciform pores absent. Legs with hind coxae with several indefinite pores; each femur with 3 setae, all distal; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.9. Antennae each 6-segmented, 103–117 µm long. Frontal lobes absent. Preantennal pore inconspicuous or absent. Microtrichia from laterad to mouthparts to segment VIII, also on mesothoracic and metathoracic coxae.

Notes: The description is based on nine specimens from five localities. The second-instar female of *Ov. variabilis* is similar to the second-instar female of *Ov. neglectus* in lacking cruciform pores and in lacking dorsal multilocular pores. These species differ as follows (character states in brackets are those of *Ov. variabilis*): spiracles each with many associated multilocular pores (with one or two); abdominal segments with multilocular pores arranged in rows of several pores (with no more than two pores on each abdominal segment, often without multilocular pores).

Fourth-instar male (pupa) (Fig. 92)

Description: Slide-mounted specimen 1.5 mm long, 0.6 mm wide. Body elongate, small marginal lobes present on segment VIII.

Dorsum with flagellate setae in segmental rows, clusters of longer setae on margins of segments II to VIII, apices of setae slightly enlarged, slightly shorter than ventral setae. Multilocular pores restricted to lateral margins of prothorax and anterior abdominal segments, with 5–13 loculi. Discoidal pores absent. Lobe on lateral margin of segment VIII sclerotized. Hamulohalteres absent. Front wing buds approximately 440 µm long, partially sclerotized. Ocular sclerite lightly sclerotized on dorsal and lateral areas only.

Penial sheath sclerotized, dorsally without conspicuous lobes, each side with 1 pair of elongate setae. Anal opening not evident.

Venter with flagellate setae slightly longer than dorsal setae, usually apically acute; longest lateral seta on segment VIII 99 µm long. Multilocular pores of same kinds as on dorsum, present mesad to front and middle legs, clustered near anterior spiracles, in small numbers near posterior spiracle, abundant over surface of segments II to VI or VII. Discoidal pores absent. Mouth tubercle present. Legs partly developed, setae not indicated. Antennae each 10-segmented, about 500 µm long. Microtrichia on prothorax to segment VIII, absent from coxae. Eye on body margin.

Notes: The description is based on one specimen from one locality. The fourth-instar male of *Ov. variabilis* is most similar to the fourth-instar male of *Ov. agavium* in having reduced appendages, reduced or no mouthparts, and the presence of multilocular pores and flagellate setae. They differ as follows (character states in brackets are of *Ov. variabilis*): dorsal multilocular pores absent from area anterior to wing buds (pores present).

Second-instar male (Fig. 93)

Description: Slide-mounted specimens 0.9–1.0 mm long, 0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae and 1 or 2 macrotubular ducts; ventrally each with 2 or 3 flagellate setae including suranal seta and elongate anal-lobe seta, with 0 or 1 macrotubular duct.

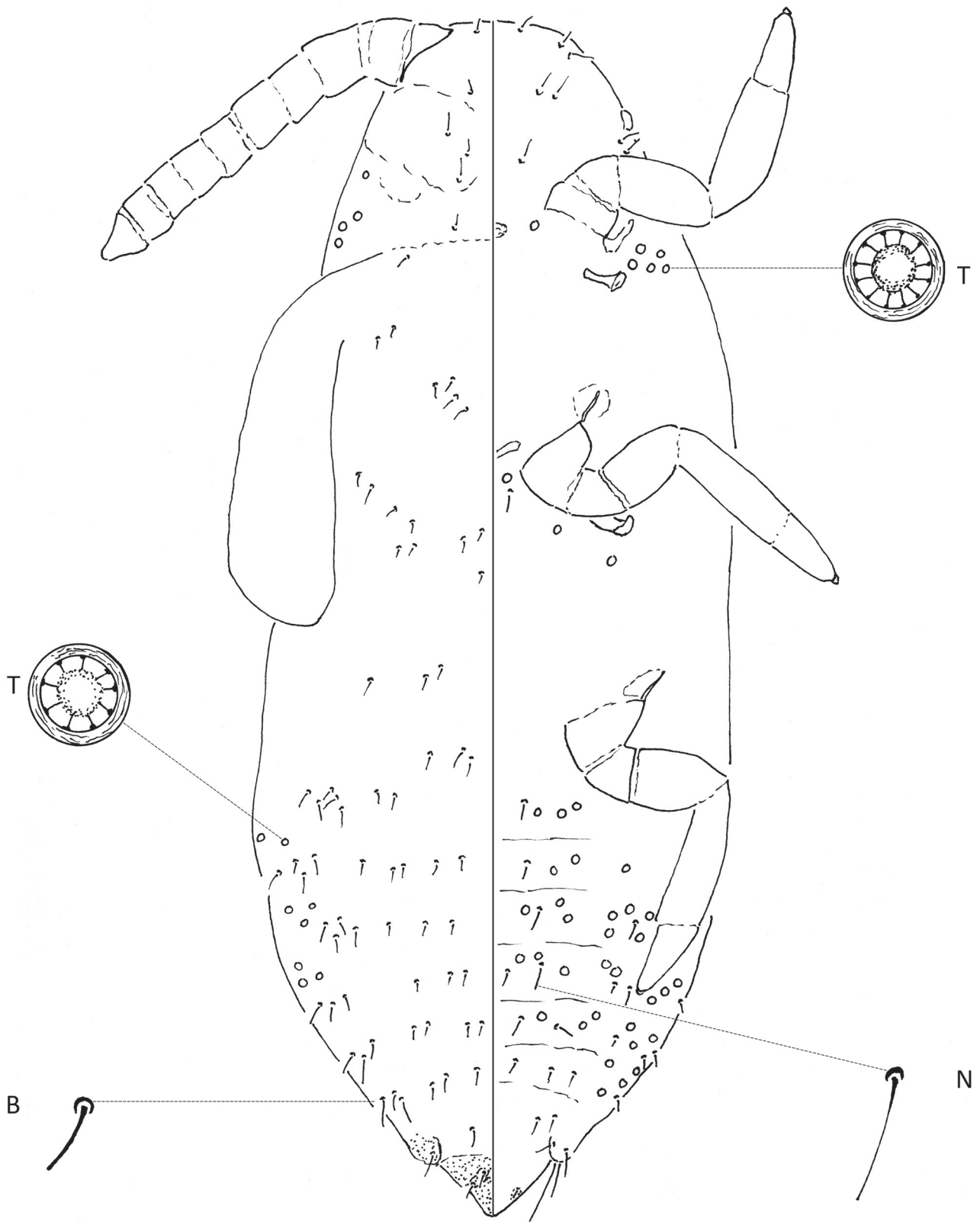


FIGURE 92. *Ovatococcus variabilis* Miller 1967, fourth-instar male (pupa), Sagehen Creek Research Station, elevation 5,800 ft., Nevada Co., California, July 15, 1966, on *Artemisia tridentata*, D.R. Miller. B=slightly enlarged seta; N=flagellate seta; T=pore with >7 loculi.

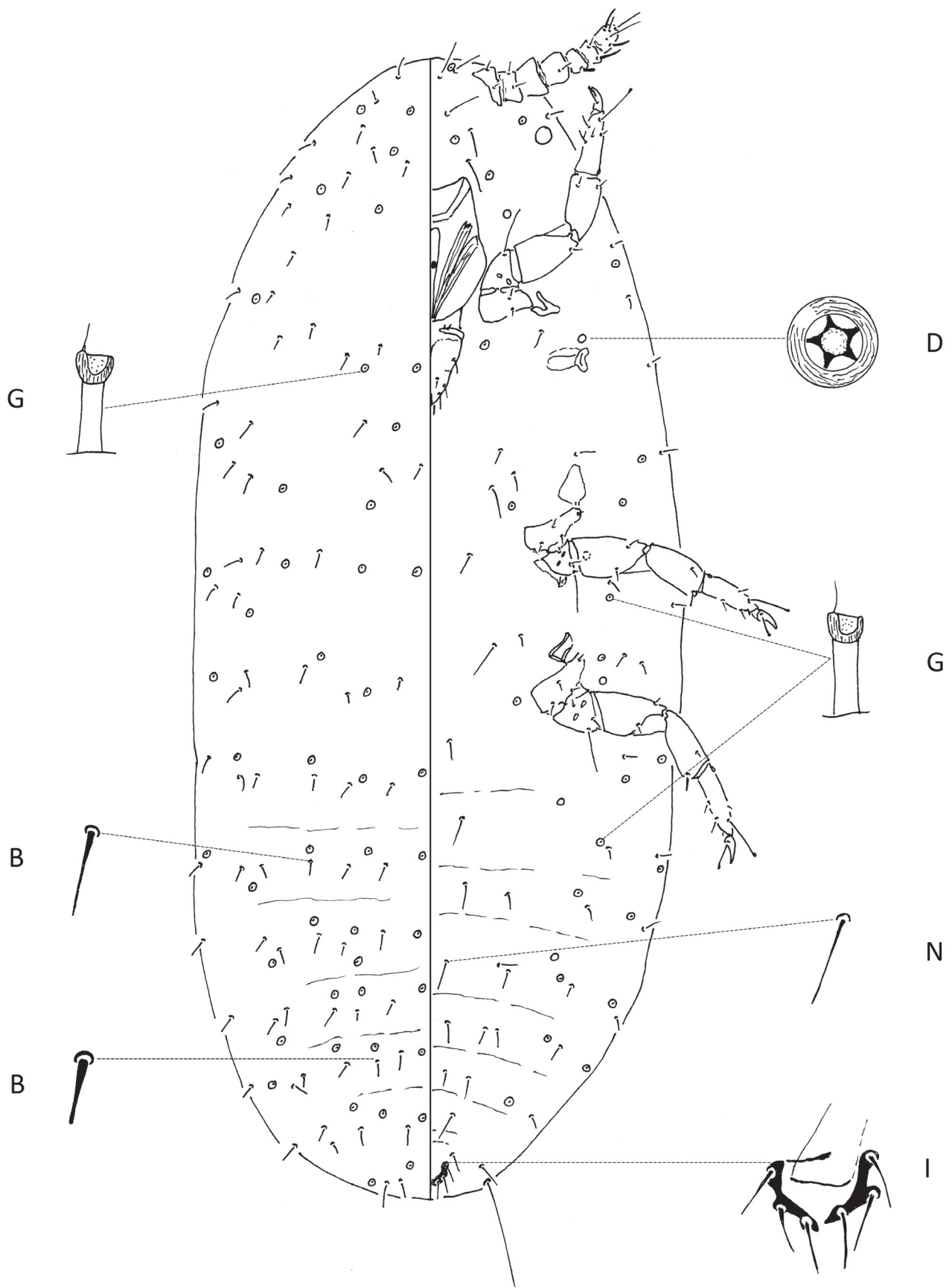


FIGURE 93. *Ovatococcus variabilis* Miller 1967, second-instar male, Sagehen Creek Research Station, elevation 5,800 ft., Nevada Co., California, USA, July 15, 1966, on *Artemisia tridentata*, D.R. Miller. B=slightly enlarged seta; D=5-locular pore; G=macrotubular duct; I=anal ring; N=flagellate seta.

Dorsum with 2 kinds of flagellate setae: some setae with slightly expanded apices, arranged in 3 pairs of longitudinal lines (medial, mediolateral and lateral); apically acute setae in 2 longitudinal lines between expanded-apices setae (mediolateral and lateral). Enlarged setae absent; segment IV with 11 or 12 setae. Macrotubular ducts over entire surface. Microtubular ducts and multilocular pores absent. Microtrichia on segments VI or VII to VIII.

Anal ring ventral, semicircular, incomplete, anterior connection between lateral plates sometimes absent or weakly sclerotized, non-cellular, with 3 setae on each side of ring, each normally shorter or same length as diameter of ring; additional pair of setae associated with, but not attached to, ring; anal tube weakly sclerotized or unsclerotized, with anal opening weakly sclerotized or unsclerotized, without anal flap.

Venter with flagellate setae on segment II 29–31 µm long, on segment VII 25–30 µm long; anal-lobe seta 78–82 µm long. Enlarged setae absent. Macrotubular ducts in mediolateral and lateral areas. Microtubular ducts absent. Multilocular pores uncommon, of 2 kinds: 3-locular pores rare or absent, 5-locular pores most abundant; with 1 present laterad to mouthparts, 1 laterad to each front coxa, 1 near each spiracle, 1 laterad to each hind coxa, in mediolateral line on each side of segments III and V, some specimens without multilocular pores on abdomen. Cruciform pores absent. Legs with hind coxae without pores; each femur with 3 setae, without proximal seta; each tibia with 4 setae, without middle seta; hind tibia/tarsus 0.9–1.0. Antennae each 7-segmented, 130–134 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from prothorax to segment VIII, also on coxae.

Notes: The description is based on seven specimens from two localities. The second-instar male of *Ov. variabilis* is most similar to the second-instar male of *Ov. salviae* in lacking enlarged setae, lacking cruciform pores, and in having few multilocular pores. They differ as follows (character states in brackets are those of *Ov. variabilis*): two or three multilocular pores associated with each spiracle (one multilocular pore associated with each spiracle); anal ring without definite lateral plates (two heavily sclerotized lateral plates present).

First-instar nymph (Fig. 94)

Description: Slide-mounted specimens 0.7–0.8 mm long, 0.3–0.4 mm wide. Body elongate oval, without protruding anal lobes. Anal-lobe areas each dorsally with 2 flagellate setae; ventrally each with 3 or 4 flagellate setae including suranal seta and elongate anal-lobe seta, with 0 or 1 microtubular duct.

Dorsum with flagellate setae on head and prothorax. Enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral) from head to segment VII; enlarged setae pear-shaped, with curved sides; largest setae about 5 µm long; not in dermal pocket; abdominal segment IV with 6 setae, all enlarged; segment IV with combined total of 8 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, normally smaller than remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice unsclerotized, without tube projecting from orifice; distribution of microtubular ducts variable, sometimes laterally from head to segment VII, sometimes with only 1 or 2 on abdomen. Multilocular and cruciform pores absent. Microtrichia from segment VI to VIII.

Anal ring ventral or apical, incomplete, divided posteriorly, in some cases with anterior bridge between lateral plates absent or weakly sclerotized, in others present and sclerotized, non-cellular; with 3 setae on each side of ring, each approximately equal in length to greatest diameter of ring; extra seta on each side of ring, not in sclerotization; anal tube and anal opening unsclerotized, without anal flap.

Venter with longest flagellate seta on segment II 10–18 µm long, on segment VII 15–18 µm long; anal-lobe seta 92 µm long. Enlarged setae, similar to those on dorsum, in longitudinal line laterally. Macrotubular ducts absent. Microtubular ducts rarely on anal lobe. Multilocular pores rare near each spiracle, laterad to mouthparts, in mediolateral area on each side of segment III or IV, all 3-locular pores. Cruciform pores absent. Legs without pores; each femur with 3 setae, all distal; each tibia with 4, without middle seta; hind tibia/tarsus 0.9. Antennae each 6-segmented, 128–130 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia on posterior abdominal segments.

Notes: The description is based on three specimens from one locality. The first-instar nymph of *Ov. variabilis* is similar to the first-instar nymph of *Ov. eriogoni* in having the anal ring without pores, no cruciform pores, and dorsal flagellate setae restricted to head and thorax. They differ as follows (character states in brackets are those of *Ov. variabilis*): multilocular pores predominantly with five or more loculi (with three loculi); with three pairs of longitudinal lines of enlarged setae (with four pairs).

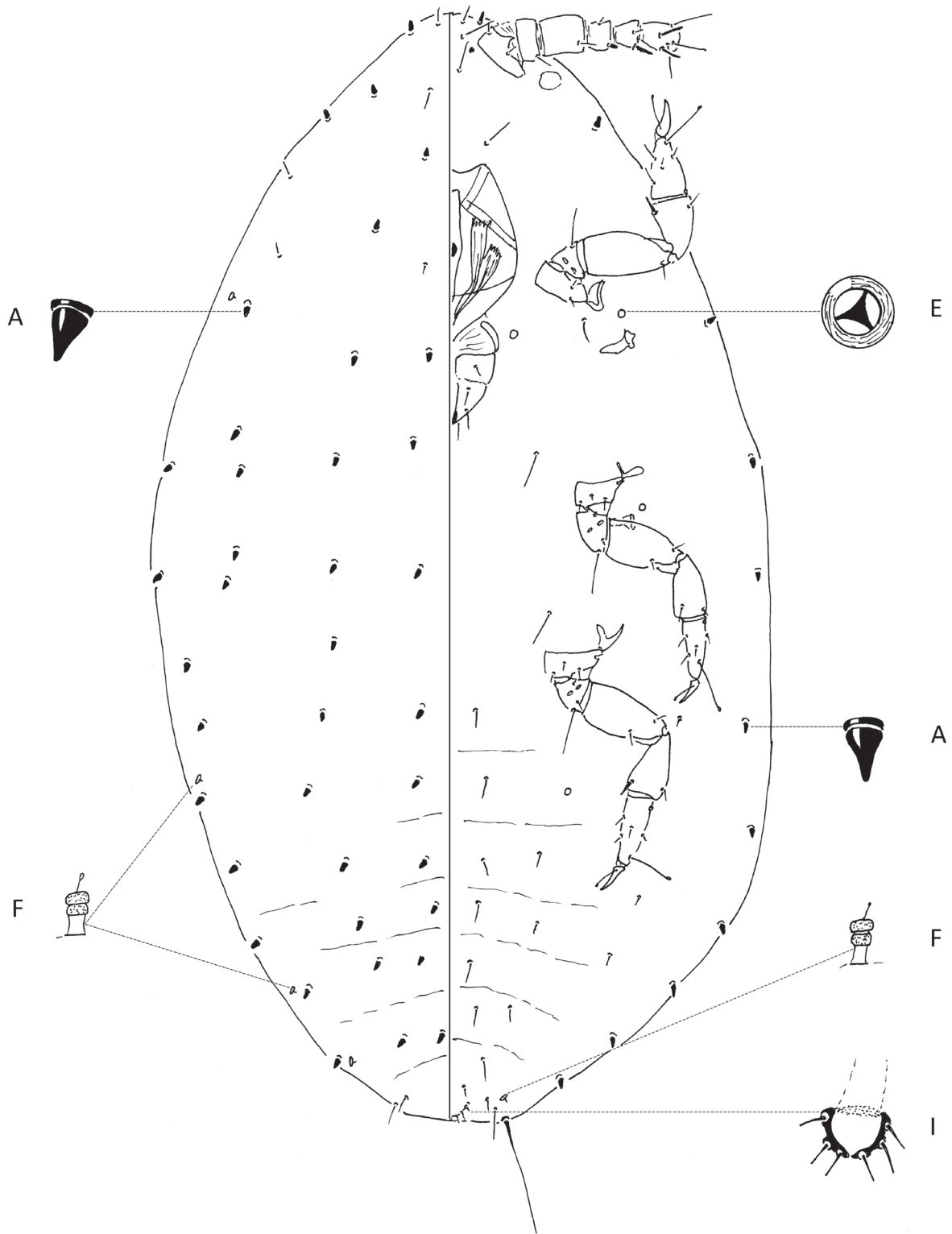


FIGURE 94. *Ovatococcus variabilis* Miller 1967 first-instar nymph, Sagehen Creek Research Station, elevation 5,800 ft., Nevada Co., California, USA, July 15, 1966, on *Artemisia tridentata*., D.R. Miller. A=enlarged seta; E=3-locular pore; F=microtubular duct; I=anal ring.

Ovaticoccus villanuevorum Miller and Stocks sp. n.

Type material: Adult female holotype (single specimen on slide) with right label “*Ovaticoccus* / n. sp. / 10 mi. S. Texcoco, Mexico, / -12-VII-1967 / ex *Opuntia* sp. / DRMiller & J. Villanueva / UNAM / ENTOMOLOGY / U. C. DAVIS CALIF. / 819;” left label “*Ovaticoccus* / *villanuevorum* / Miller / & / Stocks / Holotype;” label on back “*Ovaticoccus* / *villanuevorum* / Miller & Stocks / HOLOTYPE / UNAM / Texcoco.” Deposited in UNAM. **Paratypes:** MEXICO: Taken in quarantine at El Paso, II-19-1966, on “cacti leaf,” from Berlese funnel, G. Dunn and L.D. Weast (1 ad. ♀ paratype on 1 slide) USNM; State of Queretaro:, taken in quarantine at Laredo, Texas from Cadereyta, VI-2-1949, on “cactus,” T.P. Chapman (1 ad. ♀ paratype on 1 slide) USNM; State of Mexico, 10 mi. S. Texcoco, VII-12-1967, on *Opuntia* sp., J. Villanueva B. and D.R. Miller (1 ad. ♀ holotype, 3 ad. ♀♀ paratypes, on 4 slides) NHM (1 slide), UCD (1 slide), UNAM (1 slide), USNM (1 slide); State of Puebla: 7 mi. NE Zapotitlan, III-1-1972, on *Opuntia* sp., D.R. Miller and F.D. Parker (7 ad. ♀♀ paratypes, on 3 slides) Cdfa (1 slide), FSCA (1 slide), USNM (1 slide).

Etymology: This species is named in honor of Juan Villanueva Barredos and his son Juan Antonio Villanueva who both provided enormous support and encouragement while the first author was collecting in their country (Mexico) over more than 3 decades. Special thanks to them!

Adult female (Fig. 95)

Description: Holotype, slide mounted 3.9 mm long, 2.0 mm wide (paratypes 2.5–3.5 mm long, 1.7–1.8 mm wide). Body elongate oval; without protruding anal lobes. Anal-lobe area dorsally each with 2–4 flagellate setae, numerous cruciform pores and macrotubular ducts; ventrally each with 2–4 flagellate setae including elongate anal-lobe seta, numerous cruciform pores, macrotubular ducts, microtubular ducts, and multilocular pores.

Dorsum with flagellate setae noticeably shorter than those on venter; each abdominal segment with 2 or 3 setae medially, mediolaterally, and laterally, slightly longer and more robust than remaining setae; setae on head longer than other setae; longer setae normally bent, sometimes apically capitate. Enlarged setae absent; segment IV with 23 flagellate setae (paratypes with 23–27 flagellate setae). Macrotubular ducts abundant over entire surface, varying in size from large and elongate, to small and short. Microtubular ducts approximately 6 µm long, area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, ½ length of remaining sclerotized portion, total sclerotized area same length as unsclerotized area, dermal orifice unsclerotized, without protruding tube. Microtubular ducts in small numbers along body margin, nearly absent on thorax. Multilocular pores on posterior and anterior margins of each abdominal segment, least abundant on posterior abdominal segments and on head, of 2 kinds: 5-locular pores most abundant, 3-locular pores rare. Cruciform pores unusually abundant on medial portion of each abdominal segment, most abundant on posterior abdominal segments. Microtrichia absent.

Anal ring unusual for eriococcid, recessed in dermal pocket, ring partially sclerotized, circular, non-cellular, without setae. Anal tube sclerotized, anal opening sclerotized, without anal flap.

Venter with longest flagellate seta on segment II 73 µm long, (paratypes 57–75 µm), on segment VII 53 µm long (paratypes 43–50 µm); anal-lobe seta 112 µm long (paratypes 95–112 µm); setae apically acute. Enlarged setae absent. Macrotubular ducts abundant over entire surface, most numerous on abdomen, of same variable sizes as on dorsum. Microtubular ducts uncommon, most abundant on lateral areas of posterior abdominal segments, rare on lateral areas of head, thorax, and posterior abdominal segments, of same type as on dorsum. Multilocular pores over entire surface, most abundant on posterior abdominal segments, least abundant on head, of 4 kinds: 7-locular pores, 6-locular pores, and 3-locular pores rare; 5-loculars abundant. Cruciform pores in small clusters between antennae, with 1 or 2 pores on thorax, and lateral clusters on segments III to VIII. Legs with hind coxae dorsally with 105 and 130 pores, ventrally with 40 and 50 pores (paratypes dorsally with 44–158, ventrally with 13–62 pores); each femur with 3 setae, all distal; each tibia with 4 setae, without middle seta; hind tibia longer than tarsus, tibia/tarsus 1.3 and 1.4 (paratypes 1.2–1.4). Antennae each 7-segmented, about 360 µm long (paratypes 260–640 µm). Frontal lobes and preantennal pores absent. Microtrichia from mesothorax to segment VII, also on coxae of middle legs.

Notes: This description is based on 13 specimens from three localities. *Ovaticoccus villanuevorum* is unique in having the tibia longer than the tarsus, and the anal opening in a recessed pocket.

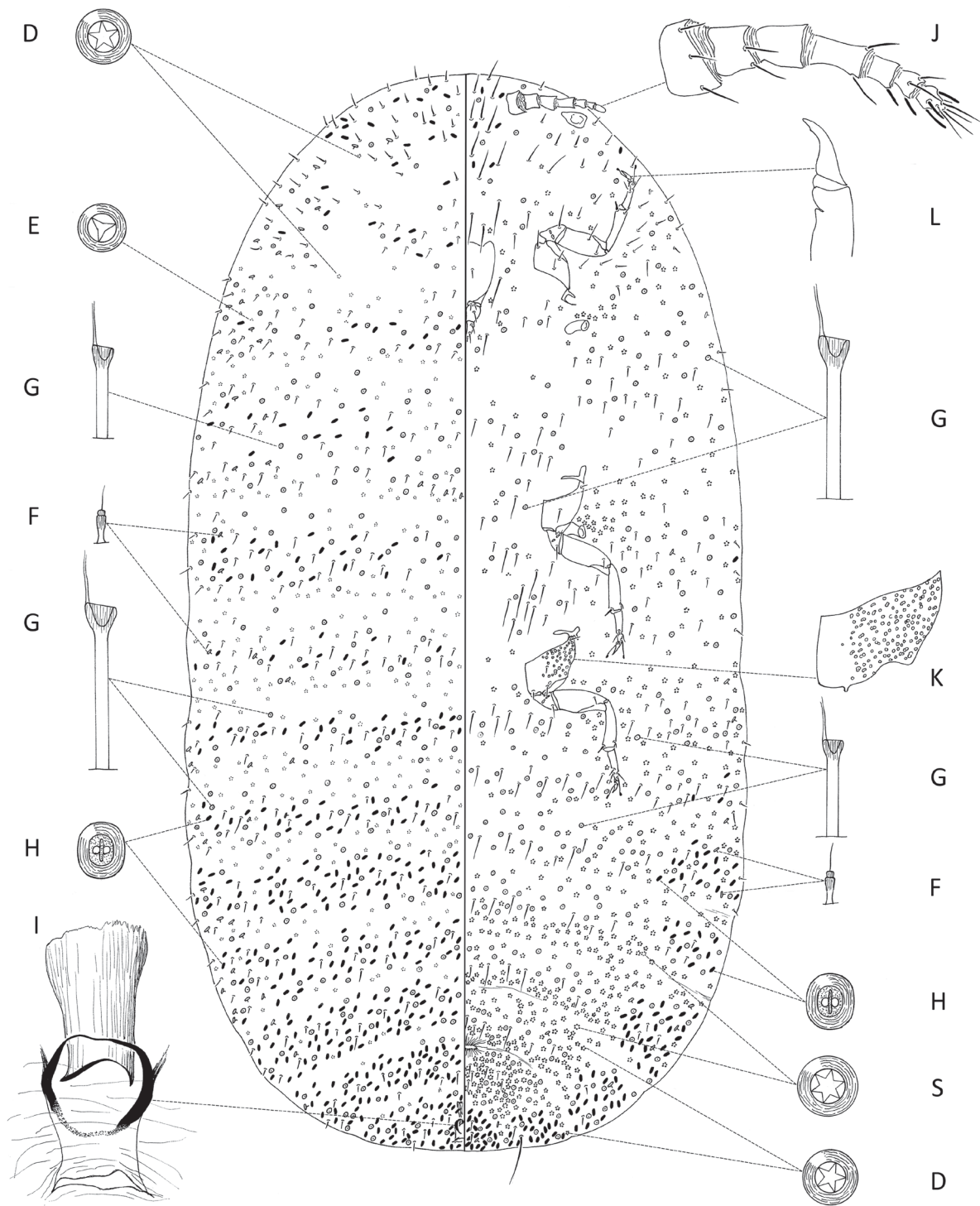


FIGURE 95. *Ovatococcus villanuevorum* Miller and Stocks **sp. n.**, adult female, 10 miles S. Texcoco, State of Mexico, Mexico, July 12, 1967, on *Opuntia* sp., J. Villanueva B. and D.R. Miller. D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macroduct; H=cruciform pore; I=anal ring; J=antenna; K=dorsal surface of coxa; L=claw; S=6-locular pore.

Ovaticoccus viscosa (Kondo) comb. n.

Oregmopyga viscosa Kondo in Kondo *et al.* 2004: 4–11.

Material examined: not previously reported: UNITED STATES: California: San Bernardino Co.: near Hesperia, VIII-16-2002, on *Hymenoclea* sp. crown and roots, E.R. Miller and D.R. Miller (2 ad. ♀♀, 1 second-instar ♂, on 1 slide) USNM; Pinyon Hills, XII-7-1981, on *Hymenoclea* sp., D.R. Miller (4 second instar ♂♂, on 2 slides) USNM. Nevada: Lyon Co.: 8 mi. E. Hawthorne, VII-1-1980, on *Hymenoclea* sp., D.R. Miller (3 ad. ♀♀, on 2 slides) USNM.

The justification for treating *Oregmopyga* as a junior synonym of *Ovaticoccus*, leading to this new combination, is provided in the “Notes” section that follows the generic description above. The adult female, second-instar female, and second-instar male of this species were described in detail by Kondo *et al.* (2004) and that information is not repeated here.

Etymology: The species epithet “*viscosa*” is from the Latin word “*viscosus*” meaning “sticky” and refers to the sticky translucent secretion that forms the encasement that surrounds the body of the adult female.

Spiroporococcus Miller 1967

Spiroporococcus Miller in Miller and McKenzie 1967: 528. Type species *Fonscolombia yuccae* Ferris 1919, by original designation.

Generic diagnosis: The known immature instars of *Spiroporococcus* are similar to the same instars of *Ovaticoccus* in having reduced anal lobes and uniquely shaped enlarged setae. They differ by (character states in brackets are of *Spiroporococcus*): lacking a concentration of multilocular pores in area surrounding atrium of spiracles (having a concentration of multilocular pores in false atrium of spiracles); usually having four setae on each tibia, without middle seta (with five setae on each tibia, including one in the middle).

More information on this genus is provided by Miller and McKenzie (1967). The three known species, *S. braggi* (Cockerell & Robinson), *S. ruber* (Parrott & Cockerell) and *S. yuccae* (Ferris), all occur in the southwestern USA. Further information is provided here for *S. braggi* and *S. yuccae*.

Etymology: The generic epithet “*Spiroporococcus*” is based on the Greek words “*Spir*” meaning “to breathe” or “spiracle,” “*poros*” meaning “pore” and “*kokkos*” meaning “round” or “scale insect” and refers to the cluster of pores in the atrium of the spiracle.

Key to *Spiroporococcus* species based on adult females

(modified from Miller & McKenzie 1967)

- 1(0) Enlarged setae absent 2
- Enlarged setae present *braggi* (Cockerell & Robinson)
- 2(1) Cruciform pores in clusters anterior to mid- and hind legs; microtubular ducts present over entire dorsum *yuccae* (Ferris)
- Cruciform pores not in clusters; microtubular ducts present only on last few abdominal segments of dorsum
- *ruber* (Parrott & Cockerell)

Spiroporococcus braggi (Cockerell & Robinson)

Fonscolombia braggi Cockerell and Robinson 1915: 106.

Pseudochermes braggi (Cockerell & Robinson); Lindinger 1933b: 32 (change of combination).

Ripersia braggi (Cockerell & Robinson); Lindinger 1937: 195 (change of combination).

Tychea braggi (Cockerell & Robinson); Lindinger 1943: 151 (change of combination).

Gymnococcus braggi (Cockerell & Robinson); Ferris 1955: 184 (change of combination).

Ovaticoccus braggi (Cockerell & Robinson); Boratynski 1958: 174 (change of combination).

Spiroporococcus braggi (Cockerell & Robinson); Miller and McKenzie 1967: 529-531 (change of combination).

Material examined: UNITED STATES: Colorado: Boulder Co.: Boulder, V-31-1911, on *Berberis repens*, L.C. Bragg (2 second-instar ♀♀ molting to ad. ♀♀, 1 second-instar ♀, 6 second-instar ♂♂ on 5 slides) UCD.

Since this species was described in *Fonscolombia* in 1915, it has been moved to six other genera, but has been in *Spiroporococcus* since the work of Miller and McKenzie (1967). Cockerell and Robinson (1915) provided a very short description of the adult female with a few sketches of cuticular structures, but there is no modern description of the adult female of this species. The second-instar female and second-instar male of this species were erroneously described by Miller and McKenzie (1967) as (“second [?] instar”) and (“third-instar”) respectively. The description of the second-instar male is not repeated here, but for the second-instar female we add a new description and illustration.

Etymology: The species epithet “*braggi*” was formed to honor Luther C. Bragg, who was the curator of the Colorado Agricultural College museum in Boulder, Colorado, USA from 1905 to 1911 and who collected this species.

Adult female

Description: One of the second-instar females is molting to the adult female. Unfortunately, it is not possible to discern all of the diagnostic character states of the adult female, but the following can be seen: enlarged setae on dorsum in 3 pairs of longitudinal lines; enlarged setae conical, lateral margins slightly curved, with blunt apex; with combined total of 8 enlarged setae on segment IV on dorsum and venter; microtubular ducts on dorsum and lateral areas of venter; anal ring with pores, complete; anal ring setae shorter than diameter of ring, slightly enlarged; each femur with 5 setae, 2 proximal and 3 distal; each tibia with 5 setae, 1 in middle.

Notes: The description is based on one molting adult female from one locality. *Spiroporococcus braggi* differs from other species of *Spiroporococcus* by having dorsal enlarged setae.

Second-instar female (Fig. 96)

Description: Slide-mounted specimens 0.7–1.0 mm long, 0.4–0.5 mm wide. Body broadly oval, with slightly protruding anal lobes. Anal-lobe areas each dorsally with 1 or 2 flagellate setae, 1 or 2 enlarged setae, 1 microtubular duct, 1 or 2 multilocular pores; ventrally each with 3 flagellate setae including suranal seta and elongate anal-lobe seta.

Dorsum with flagellate setae arranged in 2 pairs of irregular longitudinal lines (medial and mediolateral), setae often curved. Enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral) from head to segment VII, with 1 or 2 pairs of enlarged setae on segment VIII, some enlarged setae replaced by flagellate setae on head and prothorax. Largest setae 8–11 µm long; enlarged setae conical, laterally with nearly straight sides, with blunt apex; setal base thin; not in dermal pockets; segment IV with 9 or 10 setae including 6 enlarged setae and 4 flagellate setae: segment IV with combined total of 10 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts 4–6 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, normally smaller than remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice sclerotized, with tube projecting from orifice; microtubular ducts scattered over entire surface, abundant on abdomen, associated with enlarged setae. Multilocular pores rare, usually with 1 or 2 on segment VIII. Cruciform pores absent. Microtrichia on segments V to VIII.

Anal ring ventral, complete, with narrow bridge between lateral plates, with few inconspicuous pores; with 3 setae on each side of ring, each shorter than greatest diameter of ring, slightly enlarged; with extra seta on each side of ring; anal tube and anal opening sclerotized; with anal flap.

Venter with longest flagellate seta on segment II 12–17 µm long, on segment VII 12–27 µm long; anal-lobe seta about 140 µm long. Enlarged setae from head to segment VII, with 2 longitudinal lines in lateral areas. Multilocular pores abundant over entire surface, concentrated in false atrium of each spiracle; of 3 kinds: 5-locular pores most abundant; 3-locular pores and 7-locular pores rare, 7-locular pores sometimes absent. Cruciform pores laterally on thorax. Legs with hind coxae with inconspicuous pores, sometimes absent; each femur with 5 setae, 2 proximal and 3 distal; each tibia with 5 setae, with 1 in middle; hind tibia/tarsus 0.8. Antennae each 6-segmented, 120–125 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from head or mesothorax to segment VIII, also on mesothoracic and metathoracic coxae.

Notes: The description is based on three specimens from one locality. For a comparison of *Spiroporococcus braggi* with *S. yuccae*, see the “Notes” section of that species below.

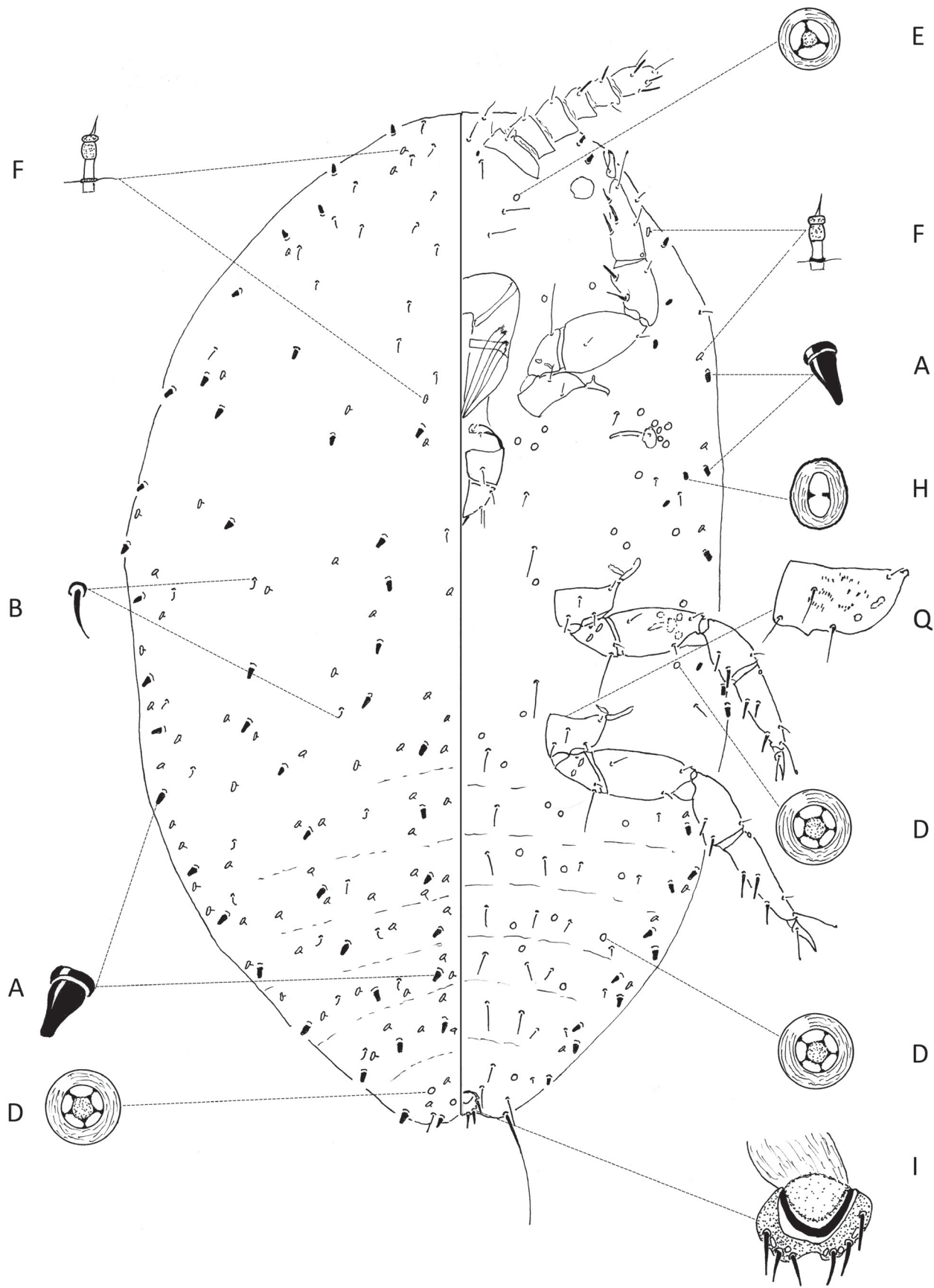


FIGURE 96. *Spioporococcus braggi* (Cockerell & Robinson 1915), second-instar female, Boulder, Boulder Co., Colorado, May, 31, 1911, on *Berberis repens*, L.C. Bragg. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; Q=dorsal surface of coxa.

Spiroporococcus yuccae (Ferris)

Fonscolombia yuccae Ferris 1919: 18.

Pseudohermes yuccae (Ferris); Lindinger 1933b: 32 (change of combination).

Gymnococcus yuccae (Ferris); Ferris 1955: 190 (change of combination).

Ovaticoccus yuccae (Ferris); Boratynski 1958: 174 (change of combination).

Spiroporococcus yuccae (Ferris); Miller and McKenzie 1967: 533-535 (change of combination).

Material examined: not previously published: Arizona: Pima Co.: Santa Rita Range, 30 mi. S. Tucson, XII-?-1978, on *Digitaria californica*, E. Hoffman (1 ad. ♀ on 1 slide) CDFA.

Since this species was described in *Fonscolombia* in 1919, it has been moved to four other genera, but has been in *Spiroporococcus* since the work of Miller and McKenzie (1967). The adult female of this species was described by Ferris (1919, 1955) and by Miller and McKenzie (1967). Information from these papers is not repeated here. A “nymphal female” (= second-instar female) was described by Miller and McKenzie (1967) but is redescribed and illustrated in more detail here.

Etymology: The species epithet “*yuccae*” is based on the scientific name of the host plant of this species.

Second-instar female (Fig. 97)

Description: Slide-mounted specimens 1.1–1.2 mm long, 0.6 mm wide. Body broadly oval, with protruding anal lobes. Anal-lobe areas each dorsally with 2 or 3 flagellate setae, with 1 or 2 enlarged setae, 0 or 1 microtubular ducts; ventrally each with 3 flagellate setae including elongate anal-lobe seta.

Dorsum with flagellate setae arranged in 2 pairs of longitudinal lines (medial and mediolateral). Enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral) from head to segment VII, with 1 pair of enlarged setae lateral on segment VIII, some enlarged setae replaced by flagellate setae on head and prothorax. Largest setae about 12 µm long; enlarged setae conical, laterally with nearly straight sides, with rounded apex; setal base thin; not in dermal pockets; segment IV with 9 or 10 setae including 5 or 6 enlarged setae and 4 flagellate setae; segment IV with combined total of 6 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts each approximately 5 µm long, with area farthest from dermal orifice sclerotized and divided into 2 parts, apical portion rounded, normally smaller than remaining sclerotized portion; total sclerotized area same length as unsclerotized area; dermal orifice unsclerotized, with inconspicuous tube projecting from orifice; microtubular ducts scattered over entire surface, associated with enlarged setae. Multilocular pores rare, usually with 1 or 2 on segment VIII. Cruciform pores and microtrichia absent.

Anal ring dorsal or marginal, complete, with narrow bridge between lateral plates, with few inconspicuous pores; with 3 setae on each side of ring, each shorter than greatest diameter of ring; without extra seta on each side of ring; anal tube and anal opening unsclerotized; with anal flap.

Venter with longest flagellate seta on segment II 12–15 µm long, on segment VII 12–20 µm long; anal-lobe seta about 102 µm long. Enlarged setae absent. Multilocular pores abundant over entire surface, concentrated in false atrium of each spiracle; of 2 kinds: 5-locular pores most abundant; 9-locular pores rare near spiracles, sometimes absent. Cruciform pores laterally from head or thorax to segments V or VI, sometimes less abundant. Legs with hind coxae with inconspicuous pores; each femur with 5 setae, 2 proximal and 3 distal; each tibia with 5 setae, with 1 in middle; hind tibia/tarsus 0.7–0.8. Antennae each 6-segmented, 150–157 µm long. Frontal lobes absent. Preantennal pore present. Microtrichia from mesothorax to segment VIII, also on mesothoracic and metathoracic coxae.

Notes: The description is based on six specimens from two localities. The second-instar female of *S. yuccae* is similar to the only other known second-instar female of a species of *Spiroporococcus*, i.e., *S. braggi*, in having a concentration of multilocular pores in the false atrium of the thoracic spiracles. *Spiroporococcus braggi* differs as follows (character states of *S. yuccae* are given in brackets): with a combined total of 10 enlarged setae on segment IV on dorsum and venter (with combined total of six).

We also have examined two second-instar females and two wingless adult males from Fabens, Texas on *Atriplex* sp., July 1921 collected by G.F. Ferris, that are tentatively determined as this species, but they are in such poor condition that it is difficult to be certain about their identity.

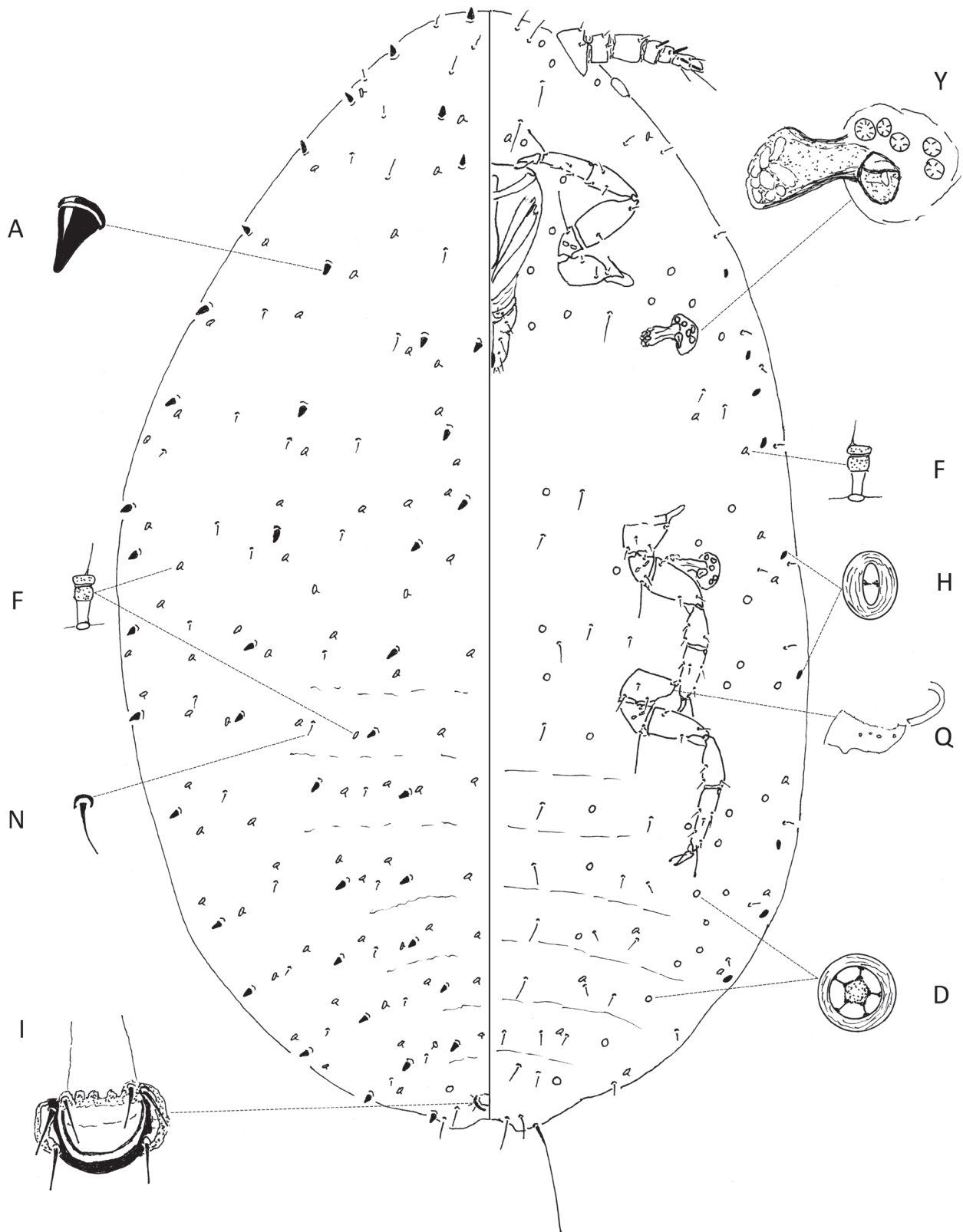


FIGURE 97. *Spiroporococcus yuccae* (Ferris 1919), second-instar female, El Paso, El Paso Co., Texas, USA, July ?, 1921, on *Agave lophantha* var. *poselgeri* (=lecheguilla), G.F. Ferris. A=enlarged seta; D=5-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; N=flagellate seta; Q=dorsal surface of coxa; Y=spiracle.

Xerococcus Ferris 1921

Xerococcus Ferris 1921: 80. Type species: *Xerococcus fouquieriae* Ferris 1921, by original designation and monotypy.

Ferris (1921, 1955, 1957) prepared the only detailed description and illustration of this monotypic genus.

Etymology: The generic epithet “*Xerococcus*” is a combination of the Greek words “*xeros*” meaning “dry,” and “*kokkos*” meaning “seed” or “scale insect” and is a masculine noun. The generic epithet is formed because this scale insect occurs in the very xeric desert habitat of Baja California, Mexico.

Field features: According to Ferris (1921: 80) “Occurring beneath the bark scales of the host, imbedded in a considerable amount of amorphous secretion; insects of a bright red color in life.”

Generic diagnosis of adult female: Anal lobes large, strongly protruding; legs represented by small, sclerotized areas; antennae reduced; enlarged setae slightly enlarged; derm with small sclerotized nodules; anal ring complete, without pores, slightly invaginated; multilocular pores restricted to venter, primarily 3-locular pores; macrotubular ducts on both surfaces; microtubular ducts and cruciform pores absent.

Generic diagnosis of second-instar female: Same as adult female except with fewer macrotubular ducts, smaller anal lobes, and fewer multilocular pores, predominantly with 3-locular pores.

Generic diagnosis of first-instar female: Anal lobes small, rounded; legs fully developed, claw with small denticle; antennae each 6-segmented; enlarged setae present along body margin, becoming increasingly shorter and more dome-shaped anteriorly; derm nodules present; multilocular pores near spiracles only, 3-locular; tubular ducts and cruciform pores absent.

Generic diagnosis of second-instar male: anal lobes weakly developed; legs fully developed; dorsal setae in 3 pairs of longitudinal lines; dorsal setae flagellate, weakly capitate; single seta on each tibia; anal ring broad, heavily sclerotized, without separate lateral plates; multilocular pores 3-locular; with dermal nodules; antennae each 7-segmented.

Generic diagnosis of first-instar male: anal lobes weakly developed; dorsal setae in 3 pairs of longitudinal lines; dorsal setae enlarged; single seta on each tibia; anal ring thin, invaginated; multilocular pores normally 3-locular; with dermal nodules.

Notes: *Xerococcus* is distinctive among eriococcid genera in having: sexually dimorphic first-instar nymphs; and second-instar males with legs and second-instar females with legs reduced.

Xerococcus fouquieriae Ferris

Xerococcus fouquieriae Ferris 1921: 80.

Type material: The adult female holotype is mounted on a slide by itself and is labelled as follows: right label “*Xerococcus* Type / *fouquieriae* new species / On *Fouquieria* / *penninsularis* / La Paz, Baja Calif., / Mex. / June 1919 G.F. Ferris / Entomological Laboratory / Stanford University G.F. F.” left label is red with “TYPE.” (UCD).

Paratypes: MEXICO: State (?), intercepted at San Ysidro, VIII-29-1953, on *Fouquieria* sp., E.D. Algert (2 ad. ♀♀, 2 second-instar ♀♀ on 1 slide) USNM. Lower Baja California: La Paz, VI-(?)-1919, on *F. penninsularis* (= *diguetii*), G.F. Ferris (1 ad. ♀ holotype, 6 ad. ♀♀ paratypes, 4 second-instar ♀♀ paratypes, 2 first-instar ♀♀ paratypes, 1 first-instar ♂ paratype on 6 slides) and (20 ad. ♀♀, 30 second-instar ♀♀, 40 first-instar ♀♀, 2 first-instar ♂♂ on 9 slides) UCD, USNM; Upper Baja California: Punta Prieta, III-(?)-1934, *F. diguetii*, G.F. Ferris (5 ad. ♀♀, 3 second-instar ♀♀, 2 second-instar ♂♂, 10 first-instar ♀♀, 6 first-instar ♂♂, on 9 slides) UCD.

Etymology: The species epithet “*fouquieriae*” is based on the scientific name of the host of this species.

Adult female (Fig. 98)

Description: Slide-mounted specimens 1.4–2.4 mm long, 0.8–1.7 mm wide. Body pear-shaped, often heavily sclerotized on head and thorax, with large, heavily sclerotized anal lobes. Each lobe dorsally and ventrally with variable number of slightly enlarged setae.

Dorsum with setae slightly enlarged, increasingly more robust posteriorly, dorsal setae noticeably shorter than those on venter. Macrotubular ducts characteristically sclerotized for nearly 2/3 length of tube; present over entire surface. Microtubular ducts, multilocular pores, and cruciform pores absent. Derm with numerous small nodules along body margin. Microtrichia absent.

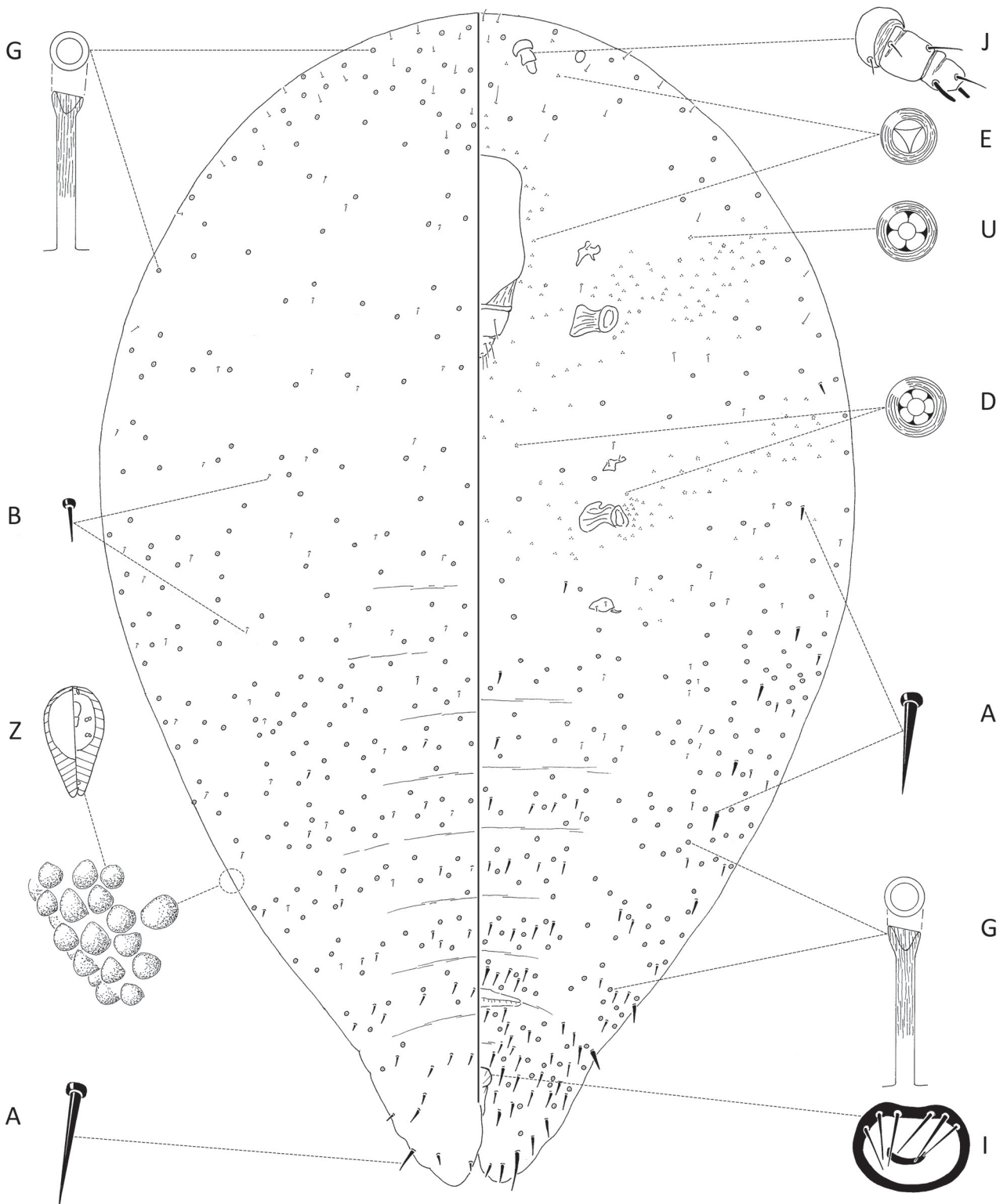


FIGURE 98. *Xerococcus fouquieriae* Ferris 1921, adult female, La Paz, Lower Baja California, Mexico, part of Stickney collection received in 1937, on *Fouquieria penninsularis* (= *diguetii*), G.F. Ferris. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; G=macrotubular duct; I=anal ring; J=antenna; U=4-locular pore; Z=body margin (hatched areas on the body of the inset with nodules).

Anal ring ventral or dorsal (normally oriented vertically and characters not visible), circular, complete, without cells, with 3 setae on each side of ring, each slightly shorter than greatest diameter of ring. Anal tube unsclerotized, orifice of anal tube sclerotized, without anal flap.

Venter with 1 robust seta near margin of each of mesothoracic and metathoracic segments and each abdominal segment; remaining setae robust on posterior abdominal segments, becoming increasingly smaller anteriorly; setae on segment II 12–30 µm long, on segment VII 18–25 µm long; elongate anal-lobe seta absent. Macrotubular ducts of same type as on dorsum on sublateral areas of head and thorax, over entire abdominal surface. Microtubular ducts absent. Multilocular pores most abundant near spiracles and mouthparts, scattered in small numbers over rest of thorax and head, rarely in reduced numbers on anterior 1 or 2 abdominal segments; of 3 kinds: 5-locular pores and 4-locular pores rare, 3-locular pores most abundant. Derm with nodules along body margin. Vulva difficult to discern. Cruciform pores absent. Legs represented by small, sclerotized areas, probably remnants of coxae. Antennae poorly developed, 2-, 3- or 4-segmented, each about 65 µm long. Frontal lobes absent and preantennal pore absent. Microtrichia absent.

Notes: The description is based on 25 specimens from three localities. Adult females of *X. fouquieriae* are unique among eriococcids; see under the genus above.

Second-instar female (Fig. 99)

Description: Slide-mounted specimens, 0.7–0.9 mm long, 0.5–0.6 mm wide. Body elongate oval, with large, sclerotized anal lobes, not as large as adult female. Each lobe dorsally with 1 or 2 setae, seta on lateral margin of lobe noticeably enlarged; ventrally each lobe with 3 or 4 flagellate setae including suranal seta, without elongate anal-lobe seta.

Dorsum with setae flagellate except single robust seta on each margin of segments VII and VIII. Macrotubular ducts similar to those of adult female, scattered over surface, sometimes absent from segments VI and VII. Microtubular ducts, multilocular pores, and cruciform pores absent. Derm with numerous small nodules along body margin. Microtrichia absent.

Anal ring ventral, circular, complete, without cells, with 3 setae on each side of ring, each about same length as greatest diameter of ring. Orifice of anal tube and anal tube unsclerotized, without anal flap.

Venter with 1 robust seta near margin of prothoracic, mesothoracic and metathoracic segments and each abdominal segment; remaining setae slender; setae on segment II about 10 µm long, on segment VII about 16 µm long; elongate anal-lobe seta absent. Macrotubular ducts of same type as on dorsum along body margin of thorax and abdomen, absent from head, with a few ducts on medial areas of thorax and anterior abdominal segments. Microtubular ducts absent. Multilocular pores most abundant near spiracles, sometimes with 1 or 2 pores near mouthparts and antennae, normally of 3-locular type only, rarely with 1 or 2 5-locular or 4-locular pores. Derm with nodules along body margin. Cruciform pores absent. Legs represented by small, sclerotized areas, probably remnants of coxae. Antennae poorly developed, 3- or 4-segmented, about 60 µm long. Frontal lobes, preantennal pore absent and microtrichia absent.

Notes: The description is based on 44 specimens from two localities. The second-instar female of *X. fouquieriae* is unique in having: legs represented by small sclerotizations; antennae reduced; macrotubular ducts sclerotized for about 2/3 of length; derm with numerous nodules; 3-locular pores most numerous.

First-instar female (Fig. 100)

Description: Slide-mounted specimens 0.6–0.7 mm long, 0.3–0.5 mm wide. Body elongate oval, anal lobes small, slightly protruding. Each lobe protruding, not as large as adult female; each lobe dorsally with 3 enlarged setae, 1 medial, 2 lateral, all approximately equal in length and several nodules; each lobe ventrally with 3 flagellate setae including suranal seta and anal-lobe seta.

Dorsum with flagellate setae in 2 pairs of longitudinal lines (submedial and mediolateral,), slightly shorter than those on venter. Enlarged setae on body margin from posterior portion of head to anal lobes (on venter in illustration), with 1 seta on each body segment from head to segment V, with 2 setae on each body margin of segments VI and VII, and 3 setae on each anal lobe. Enlarged setae increasing in size posteriorly, becoming increasingly more elongate posteriorly, largest seta about 22 µm long, enlarged setae with rounded apices and broad setal base. Macrotubular ducts absent. Dermal nodules along margin of posterior abdominal segments and between antennae. Microtrichia absent.

Anal ring difficult to discern, invaginated; apparently with 3 setae on each side of ring, each about same length as diameter of ring, without pores, invaginated between lobes. Orifice of anal tube unsclerotized.

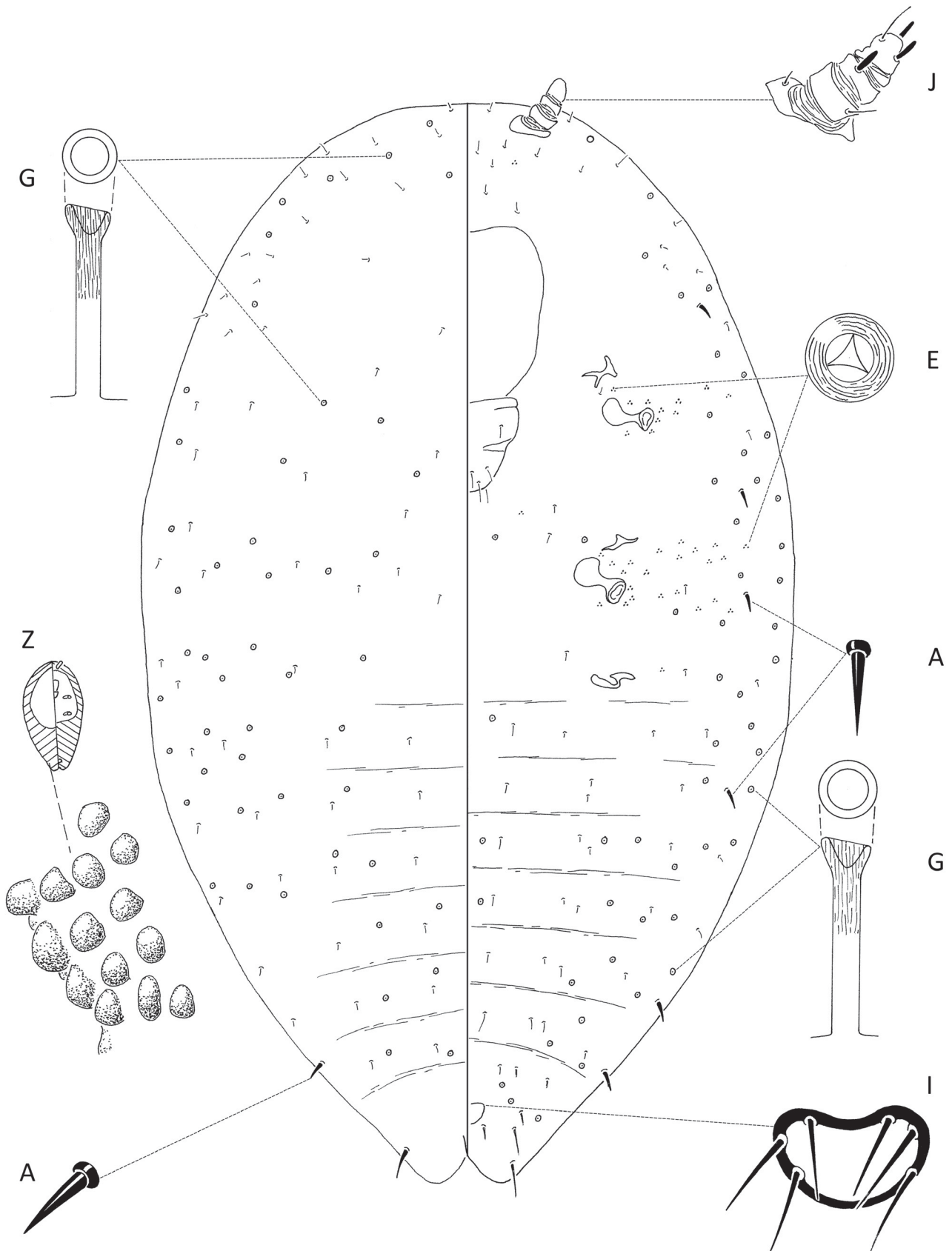


FIGURE 99. *Xerococcus fouquieriae* Ferris 1921, second-instar female, intercepted at San Ysidro, State ?, Mexico, August 29, 1953, on *Fouquieria* sp., E.D. Algert. A=enlarged seta; E=3-locular pore; G=macrotubular duct; I=anal ring; J=antenna; Z=body margin (hatched areas on the body of the inset with nodules).

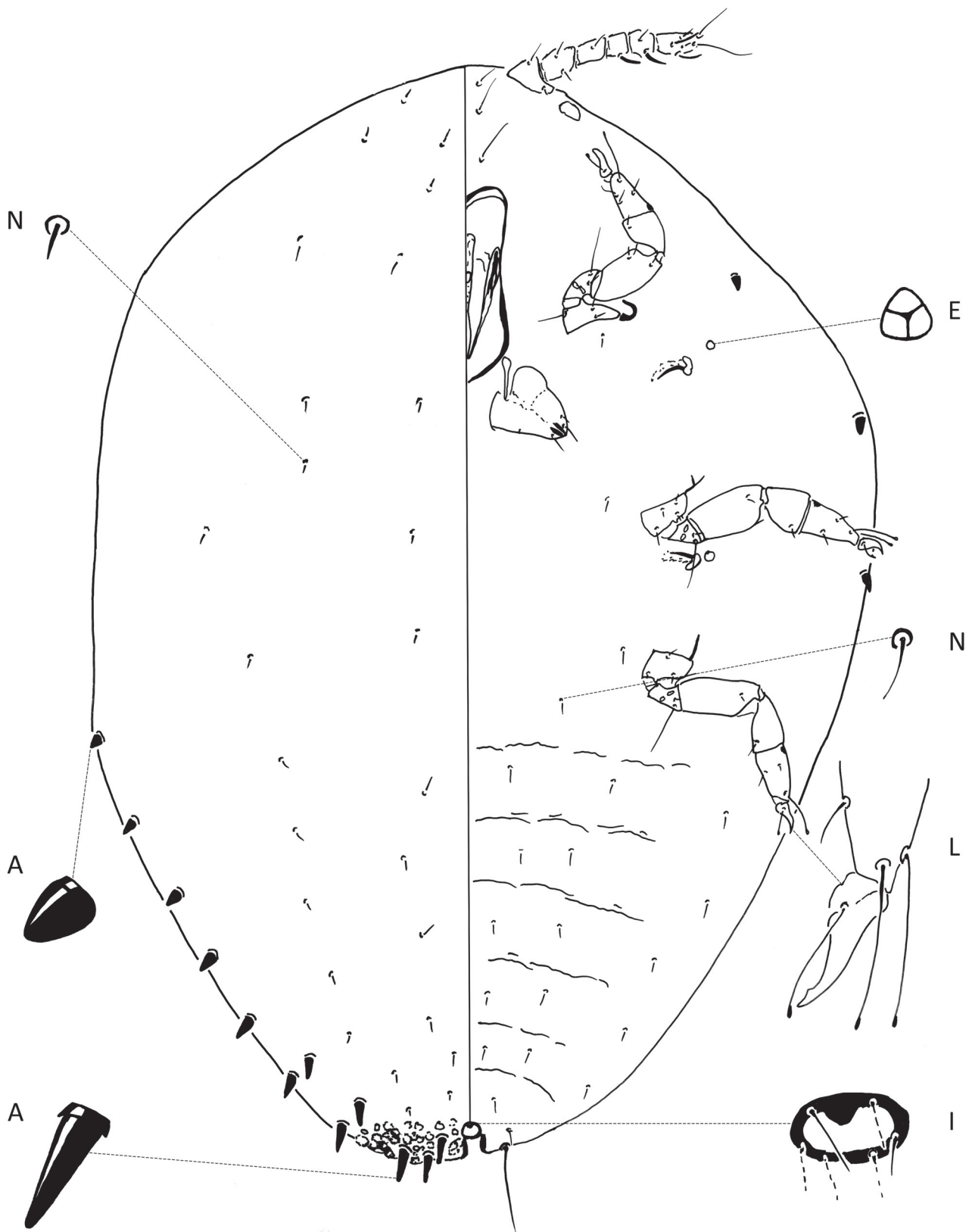


FIGURE 100. *Xerococcus fouqueriae* Ferris 1921, first-instar female, La Paz, Lower Baja California, Mexico, June ?, 1919, on *Fouquieria penninsularis* (= *diguetii*), G.F. Ferris. A=enlarged seta; E=3-locular pore; I=anal ring; L=claw; N=flagellate seta.

Venter with flagellate setae on segment II about 10 µm long, on segment VII about 14 µm long; elongate anal-lobe seta about 58 µm long. Enlarged setae of same type as on dorsum along body margin of thorax. Macrotubular ducts and microtubular ducts absent. Multilocular pores of 3-locular type only, with 1 pore near atrium of each spiracle. Derm nodules same as on dorsum. Cruciform pores absent. Legs well-developed, without pores; each femur with 3 setae, proximal setae absent; each tibia with 1 seta, without middle setae; hind tibia/tarsus 0.9; claws with small denticle near tip. Antennae each 6-segmented, 115–125 µm long. Frontal lobes, preantennal pores, and microtrichia absent.

Notes: The description is based on 56 specimens from one locality. The first-instar female of *X. fouquieriae* is unique in having: enlarged setae restricted to body margin; each tibia with 1 seta; anal ring invaginated; and derm marginally with numerous nodules. For a comparison of the first-instar male with the first-instar female of *X. fouquieriae* see the “Notes” section of the former.

Second-instar male (Fig. 101)

Description: Slide-mounted specimens 0.6–1.0 mm long, 0.3–0.5 mm wide. Body oval, without protruding anal lobes or with lobes slightly protruding. Anal-lobe areas each dorsally with 2 or 3 flagellate setae with slightly swollen apices; ventrally each with 2 or 3 flagellate setae including suranal seta and anal-lobe seta.

Dorsum with flagellate setae with slightly expanded apices, arranged in 3 or 4 pairs of longitudinal lines (medial, mediolateral and lateral) of setae. Enlarged setae absent; segment IV with 6 or 8 filamentous setae. Macrotubular ducts over entire surface, sclerotization restricted to cup area. Microtubular ducts absent. Multilocular absent. Microtrichia weakly indicated on segments VII and VIII. Derm nodules laterally and sublaterally on segments II to VIII.

Anal ring ventral, circular, complete, broad, without distinct lateral plates, cellular, with 3 setae on each side of ring, each about same length as diameter of ring; additional pair of setae associated with, but not attached to, ring; anal tube and anal opening unsclerotized, with anal flap.

Venter with flagellate setae on segment II 21–30 µm long, on segment VII 32–37 µm long; anal-lobe seta about 38 µm long. Enlarged setae absent, but 1 or 2 setae on lateral area of each abdominal segment slightly enlarged with slightly expanded apex. Macrotubular ducts in mediolateral and lateral areas, also near base of each coxa. Microtubular ducts absent. Multilocular pores uncommon, of 3-locular kind only, restricted to spiracular area, with 0–3 near each spiracle. Cruciform pores absent. Legs with hind coxae without pores; each femur with 3 setae, without proximal seta; each tibia with 1 distal seta; hind tibia/tarsus 0.8–0.9. Antennae each 7-segmented, 140–170 µm long. Frontal lobes and preantennal pores absent. Microtrichia from mesothorax to segment VIII, also on hind 2 pairs of coxae.

Notes: The description is based on three specimens from one locality. One of the specimens is molting from the first-instar male to the second-instar male and character states are difficult to discern. The second-instar male of *X. fouquieriae* is unique in having a single seta on each tibia, and in having a broad, heavily sclerotized anal ring without separate lateral plates and with a few small pores. Within the Eriococcidae it is unusual for second-instar males to have legs when the second-instar females of the same species are legless, which is the case for *X. fouquieriae*. The same kind of dimorphism also is true of *Carp. eugeniae*.

First-instar male (Fig. 102)

Description: Slide-mounted specimens, 0.6–0.7 mm long, 0.3–0.4 mm wide. Body elongate oval, with slightly protruding anal lobes. Anal-lobe areas each dorsally with 3 enlarged setae; ventrally each with 2 flagellate setae including suranal seta and slightly elongate anal-lobe seta.

Dorsum without flagellate setae. Enlarged setae in 3 pairs of longitudinal lines (medial, mediolateral and lateral) from head to segment VIII; conical, with slightly curved sides; largest setae about 15–19 µm long; not in dermal pocket; abdominal segment IV with 6 setae, all enlarged; segment IV with combined total of 8 enlarged setae dorsally and ventrally. Macrotubular ducts absent. Microtubular ducts absent. Multilocular and cruciform pores absent. Microtrichia normally absent, rarely on posterior 2 or 3 abdominal segments. Derm nodules along body margin.

Anal ring ventral, in pocket at posterior apex of abdomen; sides of ring vertical with setae pointed inward; complete, lateral plates absent; non-cellular; with 3 setae on each side of ring, each approximately equal in length to greatest diameter of ring; extra seta on each side of ring, not in sclerotization; anal tube and anal opening unsclerotized; without anal flap.

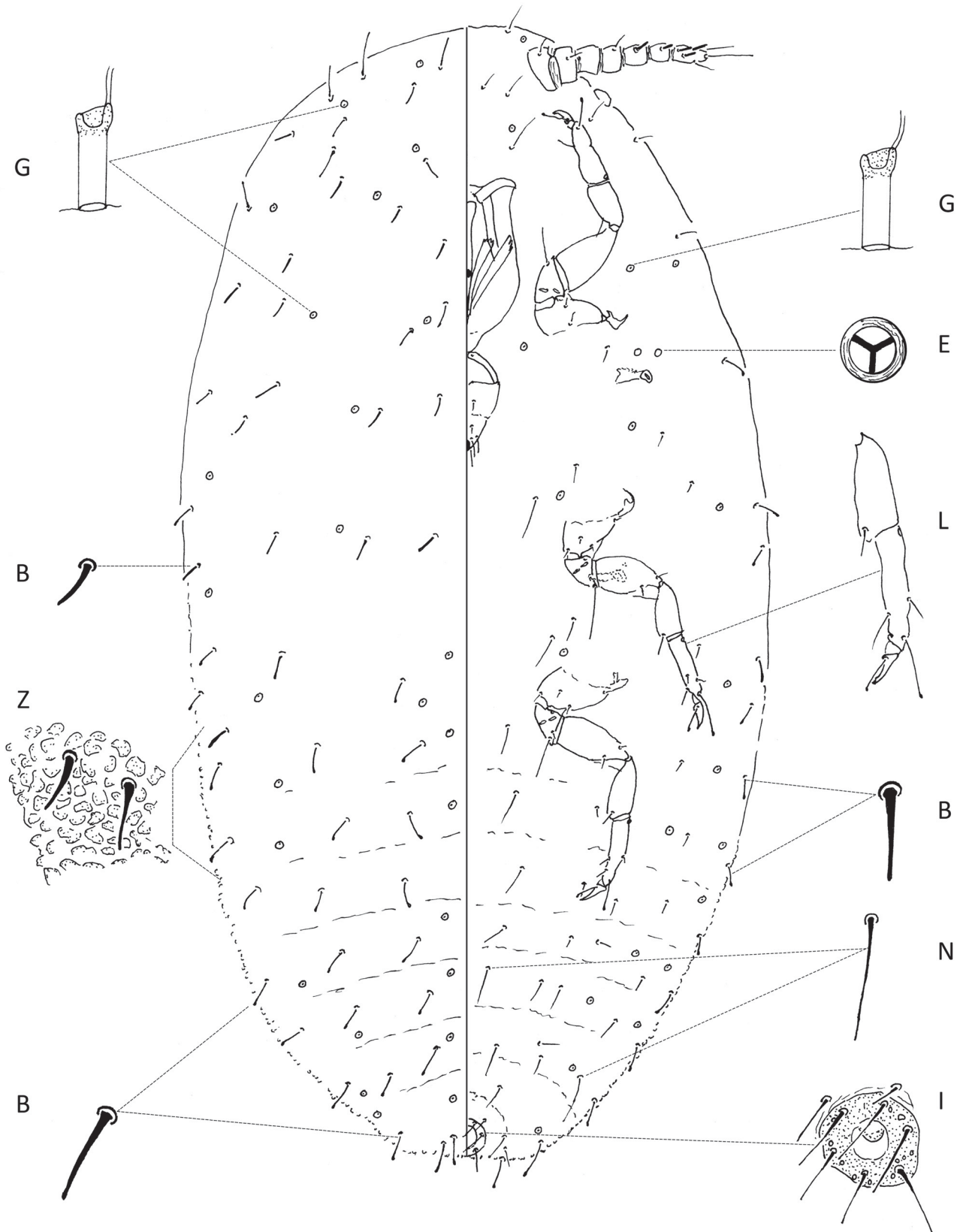


FIGURE 101. *Xerococcus fouquieriae* Ferris 1921, second-instar male, Punta Prieta, La Paz, Lower Baja California, Mexico, March ?, 1934, on *Fouquieria penninsularis* (= *diguetii*), G.F. Ferris. B=slightly enlarged seta; E=3-locular pore; G=macrotubular duct; I=anal ring; L=claw; N=flagellate seta; Z=body margin.

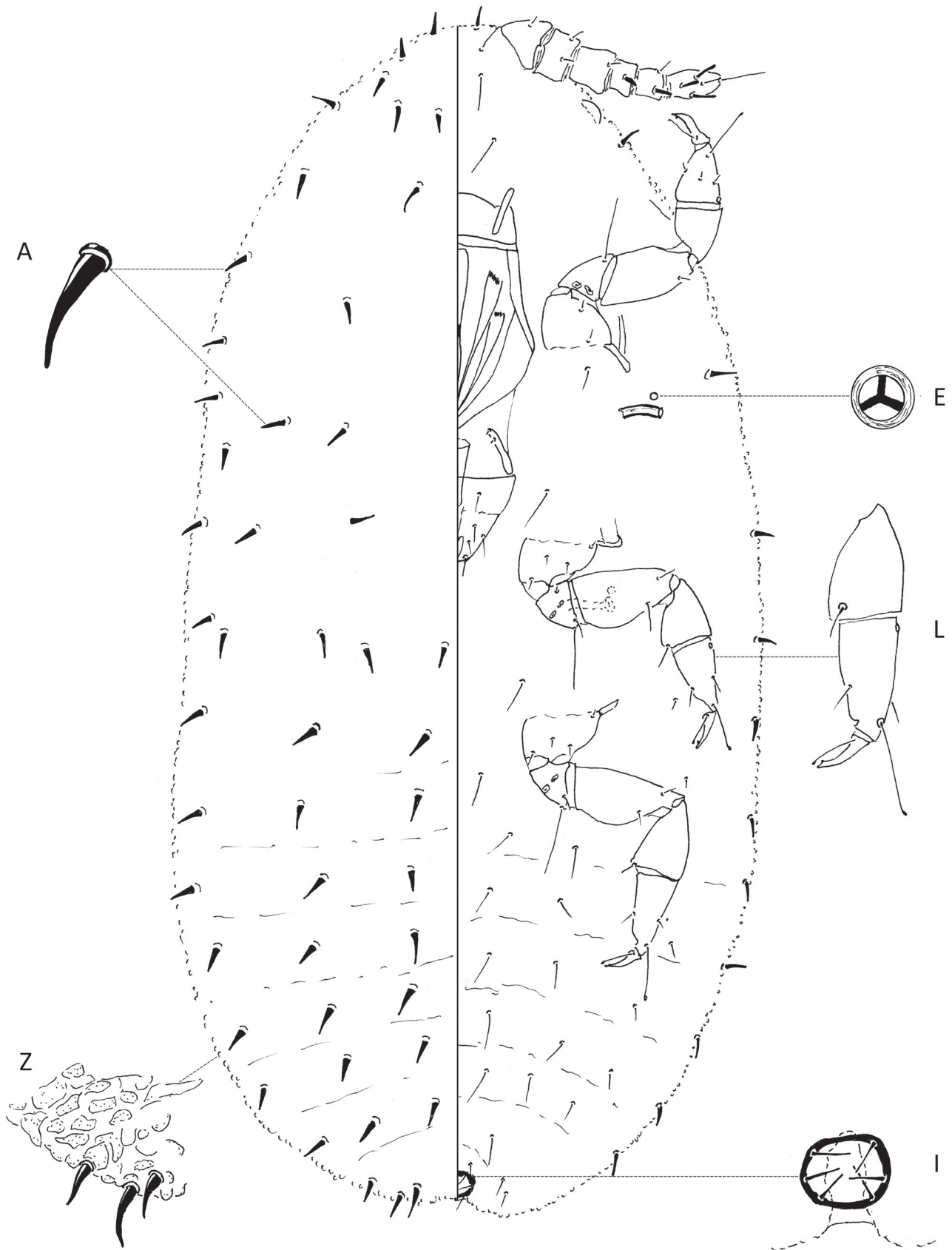


FIGURE 102. *Xerococcus fouqueriae* Ferris 1921, first-instar male, Punta Prieta, La Paz, Lower Baja California, Mexico, March ?, 1934, on *Fouquieria penninsularis* (= *diguetii*), G.F. Ferris. A=enlarged seta; E=3-locular pore; I=anal ring; L=claw; Z=body margin.

Venter with longest flagellate seta on segment II 13–15 µm long, on segment VII 25–28 µm long; anal-lobe seta about 55 µm long. Enlarged setae in longitudinal line laterally. Macrotubular ducts absent. Microtubular ducts absent. Multilocular pores rare, restricted to 1 near each spiracle; of 1 or 2 kinds: 3-locular pores most abundant, 4-locular pores rare, normally absent. Cruciform pores absent. Legs without pores; each femur with 3 setae, without proximal setae; each tibia with 1 seta, without middle seta; hind tibia/tarsus 0.8–0.9. Antennae each 6-segmented, 110–120 µm long. Frontal lobes absent. Preantennal pore usually absent, present in 1 specimen. Microtrichia on segments II or III to VIII, absent from coxae.

Notes: The description is based on nine specimens from two localities. It is difficult to determine the exact location of the lateral-most longitudinal line of enlarged setae. The first-instar male of *X. fouquieriae* differs from the first-instar female by having (character states of the first-instar female are in brackets): one size of enlarged seta over the entire dorsum (enlarged setae are restricted to the body margin). The first-instar male of *X. fouquieriae* is unique among first-instar eriococcid nymphs in having a single seta on each tibia and the anal ring situated in a dermal pocket. There are not many sexually dimorphic first-instar nymphs known for eriococcids. Hodgson and Miller (2010) indicated that *Apiococcus singularis* Hempel has two first-instar nymph forms and surmised that one of them is the male. We suggest that there are morphologically different first-instar male and female nymphs of *Carpoc. eugeniae*. Cook *et al.* (2000) and Gullan *et al.* (2005: 216) state that “sexual dimorphism occurs among crawlers of taxa in which first-instar females disperse but males develop in, or on, the maternal gall. Examples include the first-instar nymphs of *Cystococcus* Fuller, some *Apiomorpha* species, and species of Beesoniidae.” In the case of *X. fouquieriae*, it appears that both male and female instars disperse, but perhaps to different parts of the host.

***Ypofloiococcus* Miller and Stocks gen. n.**

Type species: *Ypofloiococcus libeauae* Miller and Stocks sp. n. by current designation and monotypy.

Generic diagnosis of adult female: Macrotubular ducts each with large flap attached to vestibule; microtubular ducts of 3 sizes, with single sclerotized area distally; multilocular pores in large clusters on posterior abdominal segments ventrally; cruciform pores absent; anal ring usually complete, with few or no pores; hind coxae with unusually large numbers pores; hind tibia longer than tarsus; antennae each with sensory setae restricted to apical 2 segments; labium 2-segmented, apical segments fused, basal segment narrow, with 1 seta on each side; anal lobes not projecting; enlarged setae absent.

Notes: The species in *Ypofloiococcus* is most similar to *Ovaticoccus* species but differs as follows (characters of *Ypofloiococcus* in brackets): macrotubular ducts without loop attached to vestibule (with loop attached to vestibule); microtubular ducts of one size (two or three sizes); microtubular ducts, when present, with double distal sclerotization (when present, with single distal sclerotization); antennae each with sensory setae on apical three segments (apical two segments); labium three-segmented (two-segmented).

Etymology: *Ypofloiococcus* is a combination of the Greek words “*ypo*” meaning “under,” “*floios*” meaning “bark,” and “*kokkos*” meaning “seed” or “scale insect” and is a masculine noun. The generic epithet is formed because of the habit of the type species, *Ypofloiococcus libeauae*, to reside under the bark of its host.

Field features: Occurring under bark on the trunk of the host.

***Ypofloiococcus libeauae* Miller and Stocks sp. n.**

Type material: Adult female holotype right specimen of 2 on slide, with right label “C 663 MHR / Cedros Island, / Costa Rica / III-17-1978 / Coll. M. Kosztarab / Det. D.R.M.” Left label “*Ypofloiococcus / libeauae / Miller / & Stocks / Holotype*” and a map is given of the position of the holotype; label on back of slide “*Ypofloiococcus / libeauae* Miller & / Stocks / HOLOTYPE & / PARATYPE / USNM / Costa Rica.” The holotype is deposited in the USNM. **Paratypes:** COSTA RICA: Cedros Island, III-17-1978, on ?, M. Kosztarab (1 ad. ♀ holotype, 7 ad. ♀♀ on 4 slides) USNM. MEXICO: Quintana Roo: Tulum, VI-30-1999, on “chinchona”, (*Cinchona* sp.?), D.R. Miller and E.A. Sanderson (26 ad. ♀♀, 28 second-instar ♀♀, 10 second-instar ♂♂, 1 first-instar nymph on 13 slides) NHM (1 slide), CDFA (1 slide), FSCA (1 slide), UCD (1 slide), UNAM (1 slide), USNM (8 slides).

Etymology: This species is named in honor of Elizabeth (Libby Libeau) Apfel Sanderson who assisted the first author in collecting part of the type series of this species in Mexico. She tolerated the questioning stares of bystanders while DRM collected specimens under the bark of the host.

Field characters: Specimens collected in Mexico were found under the bark of a tree that the local people called chinchona. We suspect that it may be a species of *Cinchona* which is the source of quinine used as a treatment for malaria. Bodies of the larger specimens were bright red and the body margin had a coating of white wax.

Adult female (Fig. 103)

Description: Holotype, slide mounted 1.6 mm long, 0.9 mm wide (paratypes 1.3–2.5 mm long, 1.1–1.3 mm wide). Body oval (nearly rotund in some paratypes), anal lobes not protruding. Anal-lobe area difficult to discern, dorsally each with 3 flagellate setae including elongate anal-lobe seta (paratypes 2–4), 1 microtubular duct (paratypes 2–4); ventrally each with 2 or 3 flagellate setae including suranal seta and elongate anal-lobe seta (paratypes 3 or 4), 0 microtubular ducts (paratypes 0–4), and 13 and 19 5-locular pores (paratypes 25–30 5-locular pores).

Dorsum with flagellate setae scattered over entire surface, noticeably shorter than those on venter, slightly curved, longest about 12 μm long. Enlarged setae absent. Macrotubular ducts unusual, with large loop attached to vestibule, scattered over entire surface, least abundant on anterior thorax and head, most abundant near body margin, each about 23 μm long (paratypes 20–31 μm). Microtubular ducts of 2 sizes; largest most abundant near body margin, common near anterior and posterior margins of abdominal segments, each about 7 μm long (paratypes 5–9 μm), area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube divided longitudinally; smallest abundant over surface, each about 3 μm long (paratypes 3–5 μm), area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube divided longitudinally. Multilocular and cruciform pores absent. Microtrichia absent. Derm conspicuously sculptured over entire surface.

Anal ring ventral. Costa Rican population with anal ring semicircular, thick around circumference except anterior portion thin, without cells, or 1 or 2 near base of setae, with 3 setae on each half of ring, longest 37 μm long (paratypes from Costa Rica 37–53 μm , from Mexico 28–34 μm), each seta longer than greatest diameter of ring; anal tube and anal opening sclerotized; with anal flap. Mexican population differs with anal ring complete, thick around circumference, with more small pores, with anal flap.

Venter with longest flagellate seta on segment II 62 μm long (paratypes 62–80 μm), on segment VII 33 μm long (paratypes 39–59 μm); longest anal-lobe seta 52 μm long (paratypes 48–68 μm). Enlarged setae absent. Macrotubular ducts same as on dorsum, with noticeable loop attached to vestibule, near body margin. Microtubular ducts of 3 sizes: largest uncommon, in mediolateral areas of segments IV to VII (paratypes III or IV to VIII), same shape as smaller microtubular ducts, length about 19 μm (paratypes 19–23 μm), tube undivided longitudinally; medium-sized ducts same as longest on dorsum, most abundant marginally, often near anterior and posterior margins of abdominal segments, rare or absent medially on thorax; smallest same as smallest on dorsum, most abundant marginally, often in medial areas of abdominal segments, rare or absent medially on thorax. Multilocular pores in conspicuous clusters in submarginal areas of segments V to VIII, small cluster on IV; also in medial and submedial rows on segments V to VIII, with 1 or 2 pores on segment IV (paratypes without pores on IV or with 1–5 pores); multilocular pores also near antennae, mouthparts, and spiracles and in submarginal areas of thorax to segment II (1 paratype with pores restricted to spiracular areas); multilocular pores of 1 kind: all 5-locular. Cruciform pores absent. Legs with hind coxae dorsally with 115 and 137 large pores (paratypes 119–137 pores), ventrally with 20 pores (paratypes with 0–19 pores); each femur with 4 setae, with 1 seta proximally; each tibia with 4 setae, setae on lateral margin inconspicuous, without middle seta; hind tibia/tarsus 1.3 (paratypes 1.3–1.6); hind tibia-tarsus length 142 μm long (paratypes 150–183 μm). Antennae each 6-segmented, 147 and 161 μm long (paratypes 200–228 μm); sensory setae on each antenna restricted to distal 2 segments. Frontal lobes and preantennal pores absent. Labium 98 μm long (paratypes 77–107 μm), 1- or 2-segmented; basal segment thin, sclerotized bar; apical 2 segments fused, basal segment with 1 pair of setae. Microtrichia on metathorax to segment V (paratypes with microtrichia from mesothorax or metathorax to segment IV or V), absent from ventral surfaces of coxae.

Notes: The description is based on 32 specimens from two localities. The adult females of *Y. libeauae* are unique within the Eriococcidae of the New World in having the following combination of character states: hind tibia longer than hind tarsus; macrotubular ducts with conspicuous loop attached to vestibule; hind coxae each covered in translucent pores dorsally; sensory setae restricted to distal two segments of each antenna; three sizes of microtubular ducts; multilocular pores forming large clusters on abdomen.

Second-instar female (Fig. 104)

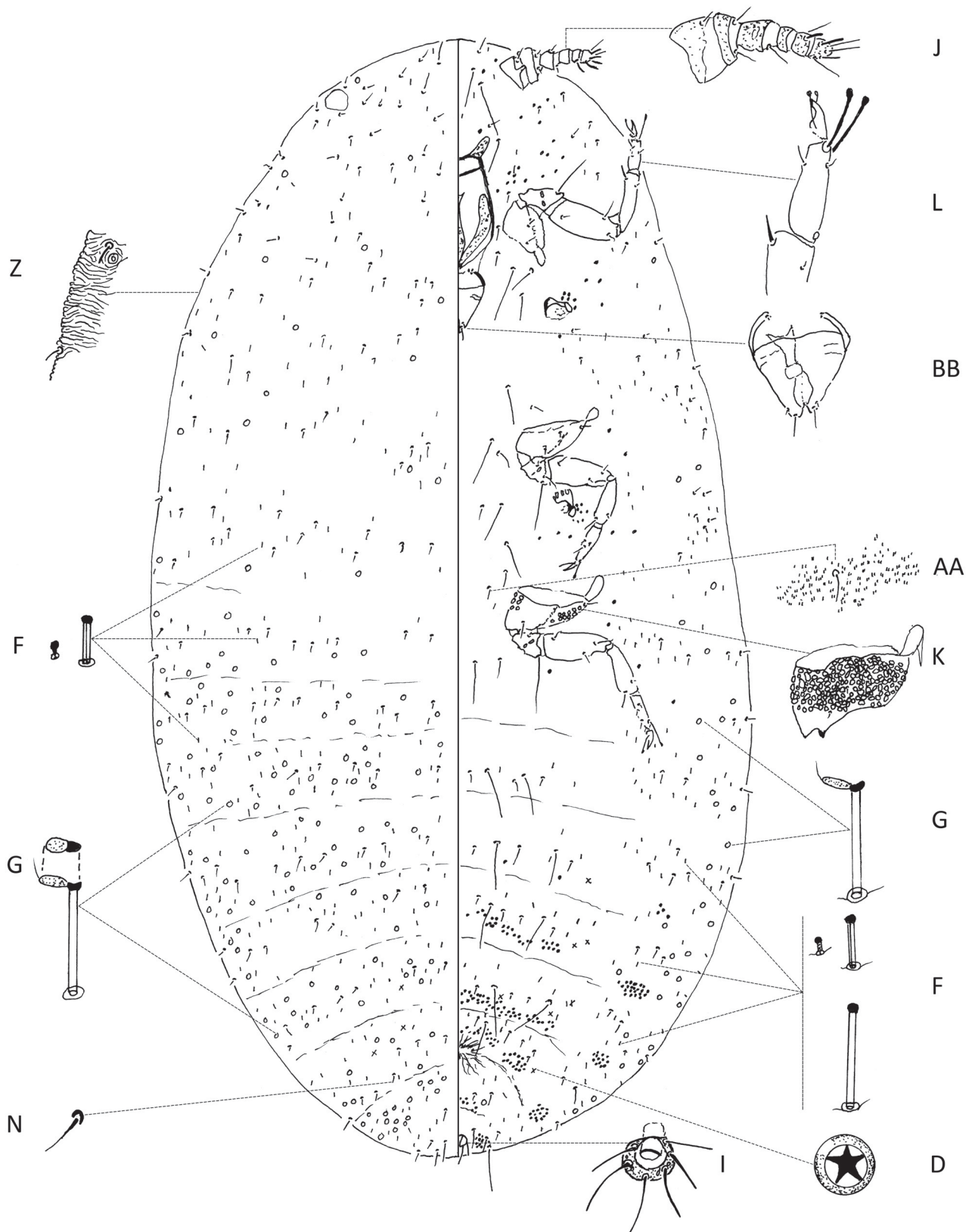


FIGURE 103. *Ypofloiococcus libeauae* sp. n., adult female, Costa Rica: Cedros Island, March 17, 1978, on ?, M. Kosztarab. D=5-locular pore; F=microtubular duct; G=macro-tubular duct; I=anal ring; J=antenna; K=dorsal surface of coxa; L=claw; N=flagellate seta; Z=body margin; AA=microtrichia; BB=labium.

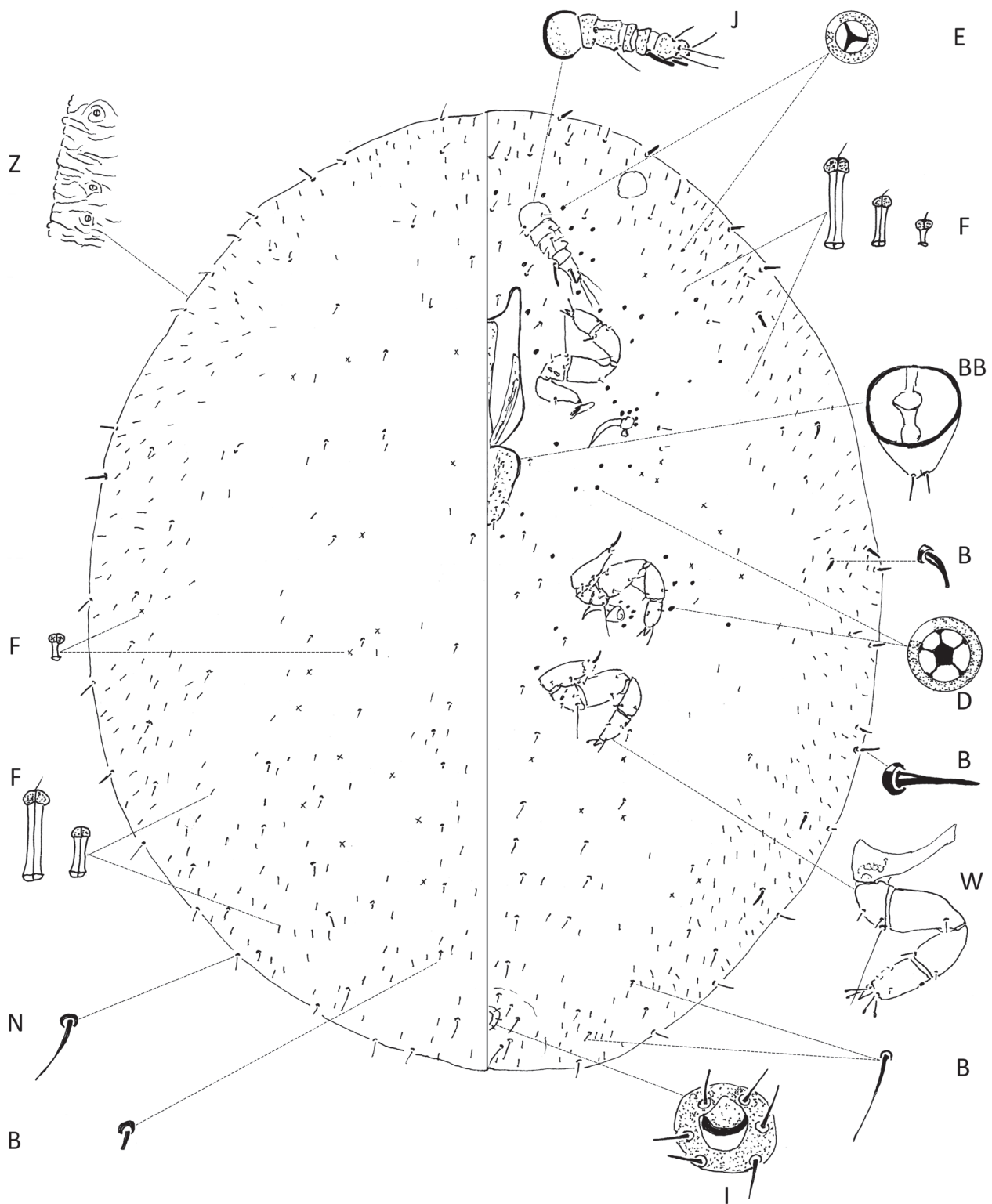


FIGURE 104. *Ypofloiococcus libeauae* sp. n., second-instar female, Tulum, Quintana Roo, Mexico, June 30, 1999, on "chinchona," (*Cinchona* sp.?), D.R. Miller and E.A. Sanderson. B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; I=anal ring; J=antenna; N=flagellate seta; W=hind leg; Z=body margin; BB=labium.

Description: Slide-mounted specimens 0.6–0.9 mm long, 0.4–0.7 mm wide. Body oval or nearly round, anal lobes not protruding. Anal-lobe areas difficult to delineate, dorsally each with 1 or 2 flagellate setae, 2–7 microtubular ducts; ventrally each with 1–3 flagellate setae including suranal seta, without anal-lobe seta, 0–3 microtubular ducts.

Dorsum with flagellate setae scattered in small numbers over surface, with 1 large seta on body margin of each abdominal segment, posterior marginal and submarginal setae about same length as medial ventral setae, medial setae noticeably shorter than those on venter, slightly curved, largest seta 16–19 μm long. Enlarged setae usually absent, some specimens with posterolateral and sublateral setae slightly enlarged similar to those on venter. Macrotubular ducts absent. Microtubular ducts of 3 sizes; largest type most abundant near body margin, 8–11 μm long, area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube divided longitudinally; medium size scattered over surface, most abundant in medial areas, each about 5 μm long, area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube divided longitudinally; smallest type uncommon, restricted to medial areas, each about 3 μm long, area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube undivided longitudinally. Multilocular and cruciform pores, and microtrichia, absent. Derm sculptured over entire surface, not as pronounced as on adult female.

Anal ring ventral, semicircular, thick around circumference, without cells or with 1 or 2 near setal base, with 3 setae on each half of ring, longest 3–9 μm long, each seta shorter than greatest diameter of ring; anal tube unsclerotized, opening of anal tube sclerotized, with anal flap.

Venter with longest seta on segment II 4–9 μm long, on segment VII 8–11 μm long; without elongate anal-lobe seta. Enlarged setae slightly more robust than flagellate setae, on body margin from head, thorax, or anterior abdominal segments to segment VIII, with 1 seta on margin of each body segment from head to segment VIII; sublateral setae sometimes enlarged, smaller than lateral setae. Enlarged setae either increasing in size posteriorly or anteriorly, largest seta about 16–19 μm long, enlarged setae with slightly rounded apices. Macrotubular ducts absent. Microtubular ducts of same 3 sizes as on dorsum: largest and medium size nearly restricted to lateral areas; smallest type uncommon in medial areas. Multilocular pores near antennae, mouthparts, spiracles, and in medial areas of thorax, of 2 types: 5-locular pores most abundant, 3-locular pores uncommon or absent. Cruciform pores absent. Legs with hind coxae dorsally with 1–5 pores, ventrally without pores; each femur with 3 or 4 setae, usually with 1 proximal seta; each tibia with 4 setae, setae on lateral margin inconspicuous, without middle seta; hind tibia/tarsus 1.2–1.3. Antennae each 6-segmented, 74–79 μm long. Frontal lobes and preantennal pores absent. Labium 1- or 2-segmented; basal segment thin, sclerotized bar; apical 2 segments fused, basal segment without setae or with 1 on each side. Microtrichia on head to segment V or VI, absent from ventral surface of coxae. With cavity slightly deeper than sublateral and lateral areas of body, encompassing antennae, legs, spiracles, and medial and mediolateral areas of abdomen.

Notes: The description is based on 28 specimens from one locality. The second-instar females of *Y. libeauae* are unique within the Eriococcidae of the New World in having the following combination of character states: hind tibia longer than hind tarsus; sensory setae restricted to distal two segments of each antenna; three sizes of microtubular ducts; labium 1- or 2-segmented; dorsal derm sculptured.

Second-instar male (Fig. 105)

Description: Slide-mounted specimens 0.7–1.1 mm long, 0.5–0.6 mm wide. Body oval or nearly round, anal lobes not protruding. Anal-lobe area difficult to delineate, dorsally each with 1 or 2 flagellate setae, 0–3 microtubular ducts; ventrally each with 4 flagellate setae including suranal seta and elongate anal-lobe seta, 0 or 1 microtubular ducts.

Dorsum with flagellate setae long, scattered in small numbers over surface, with 1 large seta on body margin of each abdominal segment, increasing in length from medial to lateral and usually from posterior to anterior, medial setae noticeably shorter than those on venter, straight or slightly curved, largest seta 25–28 μm long. Enlarged setae absent. Macrotubular ducts unusual, with large loop attached to vestibule, scattered over surface near anterior margin of abdominal segments and near body margin, 11–14 μm long. Microtubular ducts of 2 sizes: largest type abundant over surface near posterior margin of abdominal segments, 12–16 μm long, area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube undivided longitudinally; smaller size variable, scattered over surface, most abundant in lateral and mediolateral areas, 3–5 μm long, area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube divided longitudinally. Multilocular and cruciform pores absent. Without microtrichia. Derm sculptured over entire surface, not as pronounced as on adult female.

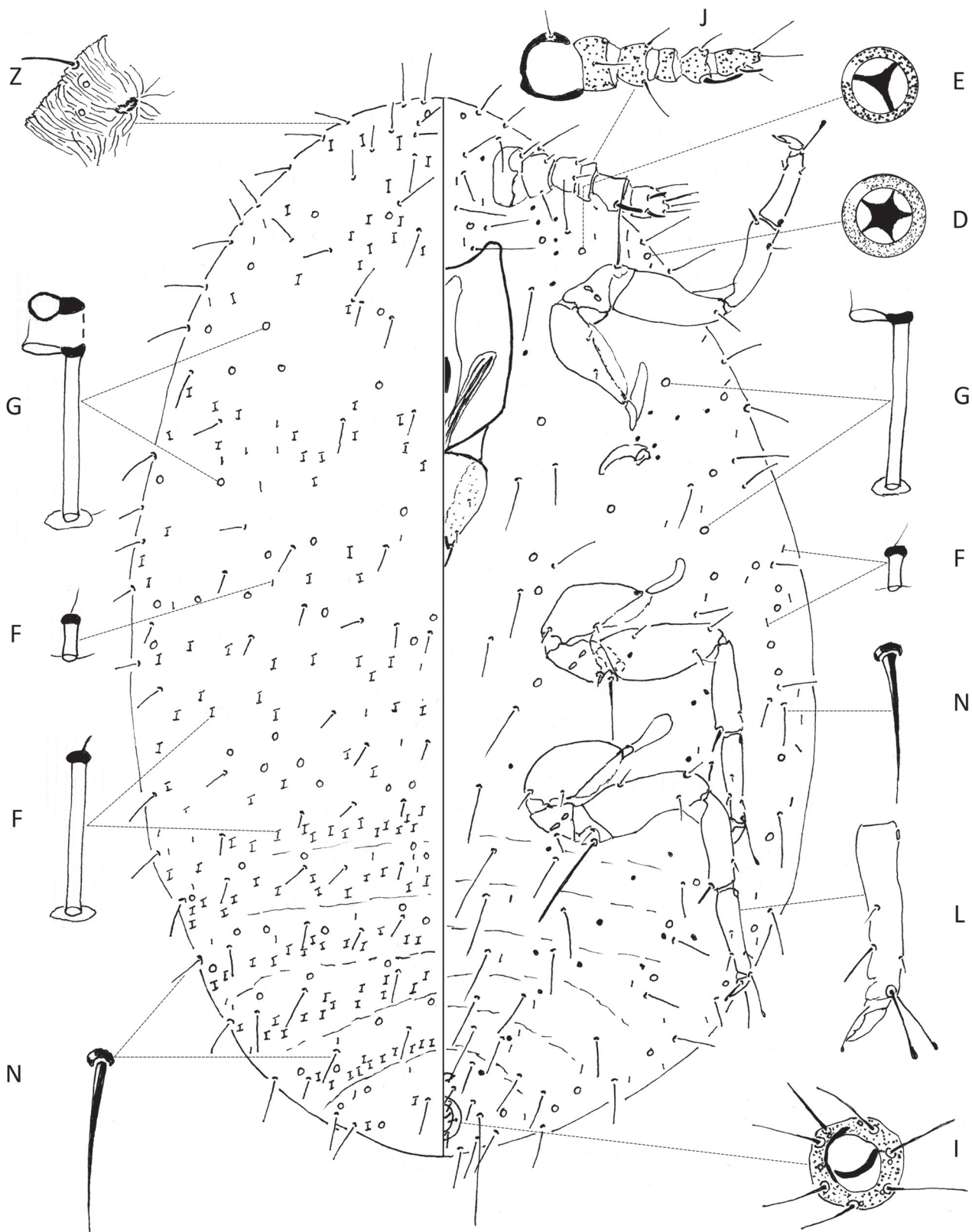


FIGURE 105. *Ypofloiococcus libeauae* sp. n., second-instar male, Tulum, Quintana Roo, Mexico, June 30, 1999, on “chinchona,” (*Cinchona* sp.), D.R. Miller and E.A. Sanderson. D=5-locular pore; E=3-locular pore; F=microtubular duct; G=macrotubular duct; I=anal ring; J=antenna; L=claw; N=flagellate seta; Z=body margin.

Anal ring ventral or marginal, semicircular, thick around circumference, with 2–5 cells, with 3 setae on each half of ring, (rarely with 1 extra seta), longest 17–28 μm long, each seta about same length as width of anal ring; anal tube unsclerotized, opening of anal tube sclerotized, with anal flap.

Venter with longest flagellate seta on segment II 43–51 μm long, on segment VII 50–51 μm long; anal-lobe seta 57–76 μm long. Enlarged setae absent. Macrotubular ducts scattered over surface, absent or rare in lateral and mediolateral areas of abdomen. Microtubular ducts of smaller size, most abundant laterally, with several in medial areas of abdomen. Multilocular pores near antennae, mouthparts, spiracles, and in medial areas of thorax, forming mediolateral longitudinal line on abdomen, sometimes absent from posterior 2 or 3 abdominal segments; of 2 kinds: 5-locular pores most abundant, 3-locular pores rare or absent. Cruciform pores absent. Legs with hind coxae without pores, ventral surface of coxa partially sclerotized; each femur with 3 or 4 setae, usually with 1 proximal seta; each tibia with 3 or 4 setae, setae on lateral margin inconspicuous, without middle seta; hind tibia/tarsus 1.0–1.1. Antennae each 6-segmented, each 101–139 μm long. Antennae with sensory seta restricted to distal 2 segments. Frontal lobes absent. Preantennal pore seen on 1 specimen. Labium 1- or 2-segmented; basal segment thin, sclerotized bar; 2 distal segments fused, basal segment without setae. Microtrichia on head, prothorax, mesothorax, or metathorax to segment VII, sometimes on ventral surface of hind 2 pairs of coxae.

Notes: The description is based on 10 specimens from one locality. The second-instar males of *Y. libeanae* are unique within the Eriococcidae of the New World in having the following combination of character states: antennae each 6-segmented; macrotubular ducts with large loop attached to vestibule; without enlarged setae; sensory setae restricted to distal two segments of antennae; two sizes of microtubular ducts; labium 1- or 2-segmented; dorsal derm sculptured.

First-instar nymph (Fig. 106)

Description: Slide-mounted specimen 0.4 mm long, 0.3 mm wide. Body nearly round, anal lobes not protruding. Anal-lobe areas difficult to delineate, dorsally without flagellate setae; ventrally each lobe area with 4 or 5 flagellate setae including suranal seta and elongate anal-lobe seta.

Dorsum with flagellate setae scattered in small numbers over surface, medial setae shorter than those on venter, straight or slightly curved, largest seta 5 μm long. Enlarged setae nipple-shaped, arranged in lateral longitudinal line on abdomen, with 1 seta on each side of each abdominal segment, with 1 enlarged seta on thorax; longest enlarged seta about 6 μm long, with 2 such setae on segment IV. Macrotubular ducts absent. Microtubular ducts near body margin, often associated with enlarged setae, each about 6 μm long, area farthest from dermal orifice sclerotized and undivided, dermal orifice unsclerotized, without protruding duct, tube divided longitudinally. Multilocular and cruciform pores absent. Microtrichia absent. Derm not sculptured.

Anal ring ventral, semicircular, weakly sclerotized, without cells, all but 1 seta broken, peg shaped, with 3 setae on each half of ring, setal bases conspicuous, longest seta 2 μm long, each seta shorter than width of anal ring; anal tube unsclerotized, opening of anal tube sclerotized, without anal flap.

Venter with longest flagellate seta on segment II about 5 μm long, on segment VII about 11 μm long; anal-lobe seta about 61 μm long. Enlarged setae around body margin, nipple-shaped, similar to dorsum. Macrotubular ducts absent. Microtubular ducts near body margin of posterior abdominal segments. Multilocular pores near mouthparts, spiracles, and in medial areas of thorax, forming mediolateral longitudinal line on abdomen, of 2 kinds: 3-locular pores most abundant, 5-locular pores rare. Cruciform pores in small numbers in mediolateral areas of posterior thorax. Legs with hind coxae without pores, ventral surface of each hind coxa partially sclerotized; each femur with 4 setae, with 1 proximal seta; each tibia with 3 or 4 setae, setae on lateral margin inconspicuous, without middle seta; hind tibia/tarsus 1.0. Antennae each 6-segmented, about 66 μm long; sensory setae restricted to distal 2 segments. Frontal lobes absent. Preantennal pore present. Labium 1- or 2-segmented; basal segment thin, sclerotized bar; apical 2 segments fused, basal segment without setae. Microtrichia absent. Possibly with ventral cavity.

Notes: The description is based on one specimen from one locality. The first-instar nymph of *Y. libeanae* is unique within the Eriococcidae of the New World in having the following combination of character states: sensory setae restricted to distal two segments of antennae; microtubular ducts divided longitudinally, with a single internal sclerotization; labium 1- or 2-segmented.

Because the single specimen is in poor condition, it was necessary to extrapolate the position of such structures as the enlarged setae and various flagellate setae. It is likely that there are more setae on each surface, but neither setal bases nor the setae themselves were visible using even the highest magnifications. It is not certain that the structures considered to be cruciform pores are really this kind of pore; they might be small microtubular ducts. For

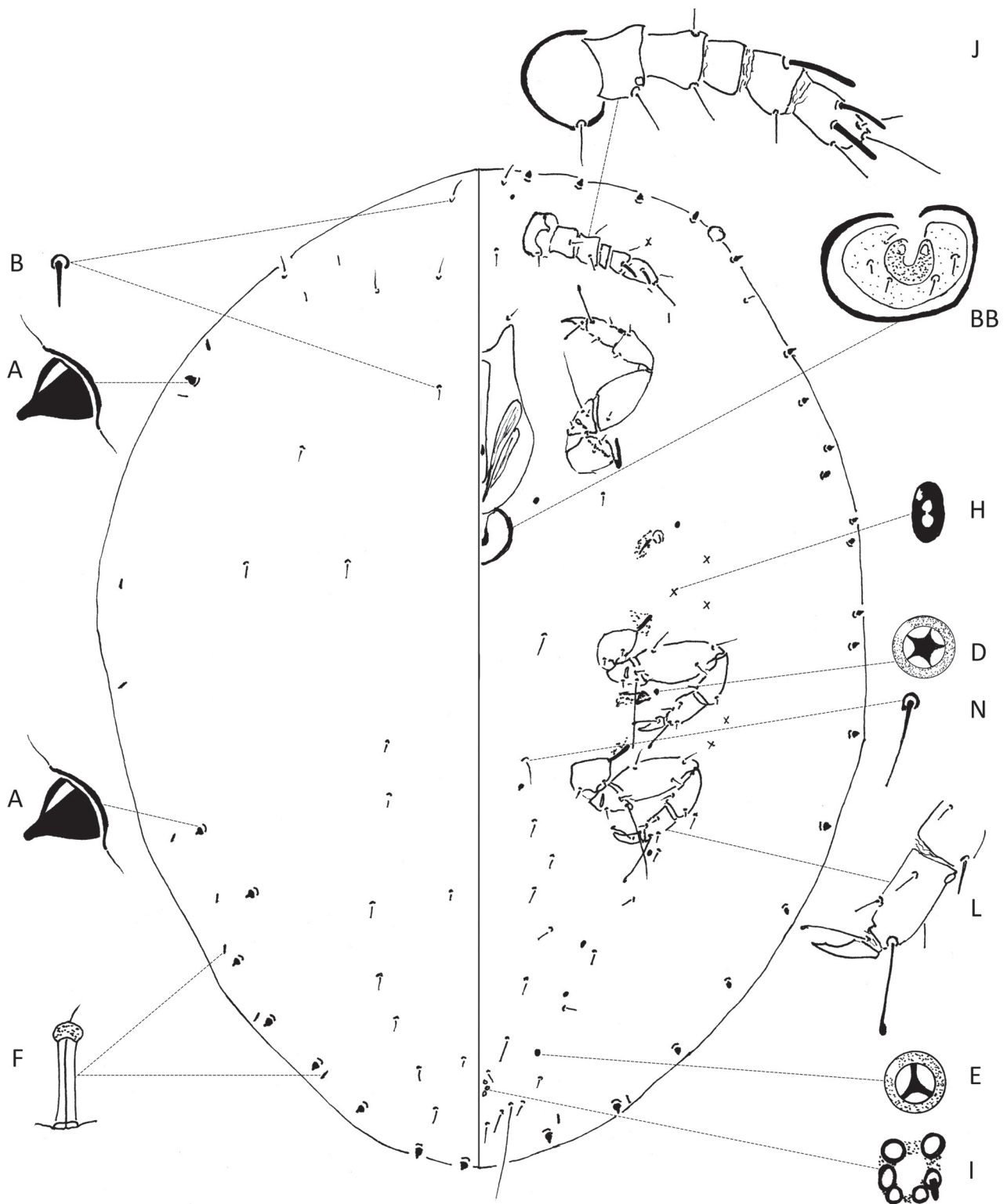


FIGURE 106. *Ypofloiococcus libeauae* sp. n., first-instar nymph, Tulum, Quintana Roo, Mexico, June 30, 1999, on “chinchona,” (*Cinchona* sp. ?), D.R. Miller and E.A. Sanderson. A=enlarged seta; B=slightly enlarged seta; D=5-locular pore; E=3-locular pore; F=microtubular duct; H=cruciform pore; I=anal ring; J=antenna; L=claw; N=flagellate seta; BB=labium.

some reason the Canada balsam mounting medium of the Mexican collection is cloudy, making it difficult to see some structures. The most likely explanation may be because of inadequate dehydration of the specimens before mounting them on the slide (P.J. Gullan, personal communication, June 2022).

Discussion

Emphasis in this paper is on all instars of the species studied, not just the adult female. With few exceptions, it has been possible to discover characters useful in diagnosing species in all of the instars, and keys based on immatures demonstrate the reliability of the less-known instars for identification. Characters often considered to be useful in previous research, such as the presence or absence of enlarged setae, have been demonstrated to be not as reliable as other less-obvious features such as the shape of the enlarged setae, the setal arrangement on the tibia and femur, and the number of loculi in the multilocular pores. We have shown also that the arrangement of the setae on the femur and the shape and structure of the anal ring are consistent throughout the life history of the species and seem to be little changed between the first-instar nymphs, second-instar males and females, and the adult females.

The discovery of two forms of adult females in the galls induced by either *Carpo. eugeniae* or *Carpo. mexicanus* is of special interest. There are three possible explanations: i) the crawlers of the non-gall inducing species accidentally invaded the gall while it was being formed; ii) there are two adult female morphotypes of the same species; iii) one of the species is an inquiline. We have chosen to accept the first hypothesis, even though the second hypothesis is more parsimonious. We describe *Carpo. eugeniae* as a new species consistent with the first hypothesis to draw attention to this unusual life history. It is interesting also that the second-instar males of *Carpo. eugeniae* have fully developed legs but the second-instar females are essentially legless. A similar situation was found in *X. fouquieriae*. These examples may be the first of this kind of sexual dimorphism within the Coccoomorpha.

Several of the species described in this paper including *Hy. hyperici*, *Ov. mackenziei*, *Ov. salviae*, *Ov. variabilis*, *X. fouquieriae*, and *Y. libeanae* were found under the bark of their host. This is a habitat rarely explored by collectors, however, it was a favorite collecting strategy of the late Jack W. Beardsley (Department of Entomology, University of Hawaii), especially in Australia under the bark of eucalypt hosts (P.J. Gullan, personal communication, August 2022).

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APPENDIX 1. *Ovaticoccus salviae* collection data, UNITED STATES: Riverside Co.: Corona, on *Salvia apiana*, collectors E.R. Miller and J.L. Miller.

Collection date	First-instar nymph	Second-instar ♀	Adult ♀	Second-instar ♂	Adult ♂
I-18-72			x		
II-9-74			x		
III-16-83	x				
III-22-72	x				
III-29-72	x				
IV-6-72	x				
IV-18-72	x				
IV-20-72	x				
V-3-71	x				
V-9-72	x	x	x	x	
V-11-72	x	x			
V-18-71	x		x		
V-18-72	x	x			
V-25-72	x	x			
VI-7-71			x		
VI-14-73		x			
VI-15-72		x	x		
VI-28-71			x		
VI-29-73		x	x		
VII-13-71			x		
VII-27-71			x		x
VII-6-73		x	x		
VII-13-73		x	x		
VIII-26-71			x		x
IX-17-71			x		x
X-8-73			x		
X-25-71	x		x		
XI-7-73			x		
XI-28-71			x		
XII-29-70	x		x		

APPENDIX 2. Host names.

Common names

Beech (= *Fagus grandifolia* Ehrh.?) (Fagaceae)
 bichayo native shrub (= *Beautempsia avicennifolia* (Kunth) Gaudich.?) (Capparaceae)
 cacti leaf (Cactaceae)
 century plant (= *Agave americana* L.) (Asparagaceae)
 chinchona (= *Cinchona* sp.) (Rubiaceae)
 maguey tequilero (= *Agave tequilana* F.A.C.Weber?) (Asparagaceae)
 cactus (Cactaceae)
 grass (Poaceae)
 rock rose, rockrose (= *Cistus* sp.?) (Cistaceae)
 soft maple (= *Acer* sp.?) (Sapindaceae)
 undetermined grass (Poaceae)

Scientific names

Acer sp. (Sapindaceae)
Agave americana L. (Asparagaceae)
Agave antillarum Descourt (Asparagaceae)
Agave atrovirens Karw. ex Salm-Dyck (Asparagaceae)
Agave decipens Baker (Asparagaceae)
Agave franzosini Baker (Asparagaceae)
Agave funkiana K.Koch and C.D.Bouché (Asparagaceae)
Agave lechuguilla Torr. (Asparagaceae)
Agave neglecta Small (Asparagaceae)
Agave schottii Engelm. (Asparagaceae)
Agave scolymus (= *Agave potatorum*, Zucc.) (Asparagaceae)
Agave sp. (Asparagaceae)
Agave utahensis Engelm. (Asparagaceae)
Agave utahensis var *nevadensis* Engelm. ex Greenm. and Roush (Asparagaceae)
Aloe sp. (Xanthorrhoeaceae)
Andropogon virginicus L. (Poaceae)
Aristida adscensionis L. (Poaceae)
Aristida sp. (Poaceae)
Artemisia sp. (Asteraceae)
Artemisia tridentata Nutt. (Asteraceae)
Arthrostylidium longifolium (= *Guadua longifolia* (E. Fourn.) R.W.Pohl) (Poaceae)
Atriplex canescens (Pursh) Nutt. (Amaranthaceae)
Atriplex sp. (Amaranthaceae)
Beaucarnea sp. Lem. (Asparagaceae)
Berberis repens Lindl. (Berberidaceae)
Bouteloua curtipendula (Michx.) Torr. (Poaceae)
Bouteloua hirsuta (= *Chondrosum hirsutum* (Lag.) Sweet) (Poaceae)
Bouteloua sp. (Poaceae)
Cistus sp. (Cistaceae)
Deutzia sp. (Hydrangeaceae)
Digitaria californica (Benth.) Henrard (Poaceae)
Distichlis spicata (L.) Greene (Poaceae)
Distichlis sp. (Poaceae)
Eriogonum sp. (Polygonaceae)
Eugenia acapulcensis Steud. (Myrtaceae)
Fagus grandifolia Ehrh. (Fagaceae)
Fagus sp. (Fagaceae)
Fagus sylvatica (Fagaceae)
Fouquieria diguetii (Tiegh.) I.M.Johnst. (Fouquieriaceae)
Fouquieria penninsularis (= *Fouquieria diguetii*) (Fouquieriaceae)
Fouquieria sp. (Fouquieriaceae)
Harrisia sp. (Cactaceae)
Hilaria mutica Britton (Poaceae)
Hypericum sp. (Hypericaceae)
Mammillaria sp. (Cactaceae)
Muhlenbergia porteri Scribn. ex Beal (Poaceae)
Muhlenbergia sp. (Poaceae)
Neomammillaria sp. (Cactaceae)
Olneya tesota A.Gray (Fabaceae)
Opuntia sp. (Cactaceae)
Salvia apiana Jeps (Lamiaceae)

Spartina patens (Aiton,) Muhl. (Poaceae)
Spiraea sp. (Rosaceae)
Sporobolus cryptantha (Torr.) A.Gray (Poaceae)
Sporobolus sp. (Poaceae)
Stipa sp. (Poaceae)
Viguiera stenoloba S.F.Blake (Asteraceae)
Yucca brevifolia Engelm. (Asparagaceae)
Yucca sp. (Asparagaceae)