The Genus *Hemischizocranium* Tuthill (Homoptera: Psyllidae), with Descriptions of Immature Stages[1]

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ABSTRACT. The genus *Hemischizocranium* Tuthill is reviewed and the nymphal stages of the two included species, *H. bessi* Tuthill and *H. aloha* (Caldwell) are described and figured. Keys to the adult and nymphal stages are provided.

Genus *Hemischizocranium* Tuthill

Hemischizocranium Tuthill 1956, Proc. Hawaii. Entomol. Soc. 16:158.

Diagnosis. Vertex quadrate, incompletely divided by medial sulcus; genal cones short, stout, blunt ended.

Tuthill (1956) proposed the genus *Hemischizocranium,* with *Hemischizocranium bessi* Tuthill as the type species, and transferred *Hevaheva aloha* Caldwell (1940) to this genus. Earlier, Zimmerman (1948) noted that *H. aloha* differed from other species of *Hevaheva* by its stout appearance, very long M_{1+2} and M_{3+4} veins, and distinctly shaped head capsule. This endemic Hawaiian genus is represented by two described species. Both species develop on the endemic tree *Zanthoxylum dipetalum* H. Mann (Rutaceae).

Adult diagnoses and descriptions of the immature stages of *H. bessi* and *H. aloha* are given below. The morphology of *H. bessi* is described in detail for the first instar nymph. Descriptions of later nymphal stages are limited to characters which differentiate them from earlier stages. Also, in the descriptions of the nymphal stages of *H. aloha,* character states in common with *H. bessi* usually are not referred to, unless the characters are illustrated in detail.

The term *sectaseta* was coined by Ferris (1924, p. 24). It refers to a seta which is constricted somewhere along its length, and the portion distal to the constriction has a noticeably reduced diameter compared to the proximal portion. These setae are associated with wax-production. The term *modified sectaseta* is used by us to refer to setae which are derived from sectasetae of the general type figured by Ferris (1924, p. 27), but which possess atypical shapes. Besides being variable in shape, a *modified sectaseta* can be recognized by its enlarged base. Apparently, such sectasetae are not associated with wax production.

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[2]Portion of a dissertation submitted to the Graduate Division, University of Hawaii by the senior author in partial fulfillment of requirements for the Ph.D. Degree in Entomology.
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KEY TO ADULTS OF THE HEMISCHIZOCRANIUM

1. M vein forks distal to wing midlength (Tuthill 1956, p. 159) ..... *bessi* Tuthill
- M vein forks proximal to wing midlength ..... *aloha* (Caldwell)

KEYS TO NYMPHAL STAGES OF THE GENUS HEMISCHIZOCRANIUM

First Instar

Length 0.49-0.54mm; width 0.31-0.33mm.

1. Basal abdominal segment with 2 submedial patches composed of many small, appressed spines on each side (Fig. 4, detail) ..... *aloha* (Caldwell)
- Not as above ..... *bessi* Tuthill

Second, Third and Fourth Instars

Second - length 0.73-0.82mm; width 0.51-0.55mm.
Third - length 1.16-1.25mm; width 0.82-0.88mm.
Fourth - length 1.79-2.05mm; width 1.27-1.49mm.

1. Dorsal modified sectasetae linear, flattened, apex divided, mixed with few setaceous modified sectasetae with enlarged bases; second instar (Figs. 1, C lower, three setae on left; 5); third instar (Figs. 1, E lower left; 6); fourth instar (Figs. 1, G lower left; 7) ..... *aloha* (Caldwell)
- Not as above: second instar (Fig. 1, D lower left); third instar (Fig. 1, F lower left); fourth instar (Fig. 1, H lower left) ..... *bessi* Tuthill

Fifth Instar

Length 2.87-3.21mm; width 2.18-2.46mm.

1. Dorsal modified sectasetae clavate, reduced in size, mixed with sectaceous modified sectasetae (with enlarged bases) (Fig. 1, I lower left) ..... *aloha* (Caldwell)
- Not as above (Fig. 1, J lower left) ..... *bessi* Tuthill

Hemischizocranium bessi Tuthill (Figs. 1, B, D, F, H, J; 2, A-J).

Hemischizocranium bessi Tuthill 1956, Proc. Hawaii. Entomol. Soc. 16:158-161.

Type locality: Bird Park (=Kipuka Puaulu), Kilauea, Hawaii Volcanoes National Park, Hawaii Island. Holotype female, allotype male deposited in U. S. National Museum Collection, Beltsville, Maryland. Type deposition

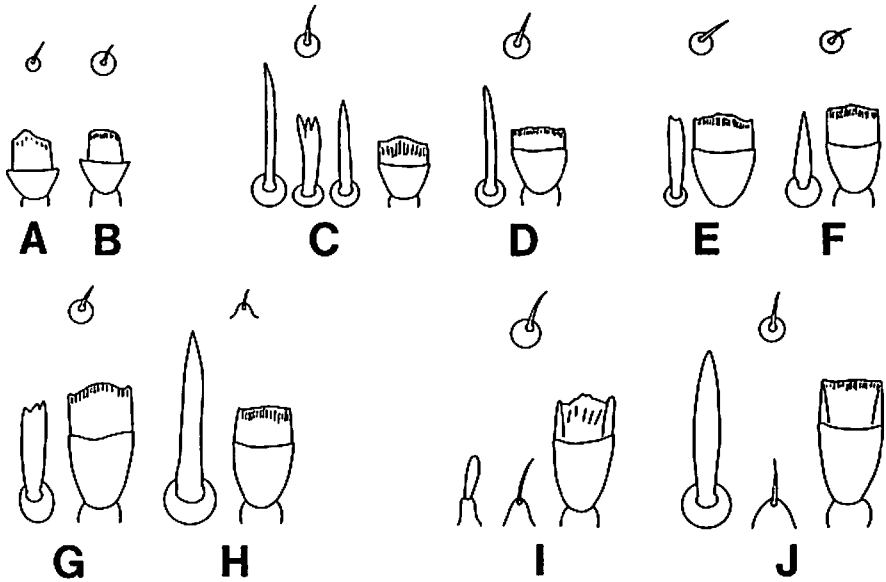

FIGURE 1. *Hemischizocranium* species; dorsal seta (upper), sectaseta (lower or lower right), and modified sectaseta (lower or lower left of sectaseta): A, C, E, G, I, *H. aloha;* B, D, F, H, J, *H. bessi.*

confirmed by M. Stoetzel, USDA/ARS Systematic Entomology Laboratory, on September 30, 1991.

Distribution: Hawaii Island.

Host: Nymphs free-living on leaves of *Zanthoxylum dipetalum* H. Mann.

Adult. Diagnosis. Differing from *H. aloha* by having proctiger somewhat tapered, anterior margin nearly linear, posterior margin arcuate, constricted apically; parameres stout, arched anteriorly (Tuthill 1956).

Immature Stages.

FIRST INSTAR (Figs. 1, B; 2, A, F).

Dimensions. Length 0.51-0.54mm; width 0.32-0.33mm.

Shape. Elliptical; meso- and metathorax laterally produced.

Margin. Specialized structure absent.

Dorsum. Sclerotization weak; head and thorax fused, longitudinally divided by a medial groove; cephaloprothorax, meso- and metathorax partially separated by submarginal suture on each side; wingpads absent; abdomen separated from thorax by distinct suture, abdominal segments nearly entirely fused, separated submarginally by short sutures. **Indumenta:** sectasetae (Figs. 1, B lower; 2, A) dorsoventrally compressed, submarginal, borne on short protuberances. Setae (Fig. 1, B upper) simple, few, small, subequal in length, borne on weakly developed protuberance. **Cuticular structures:** spinules in relatively short, narrow, transverse bands on meso-

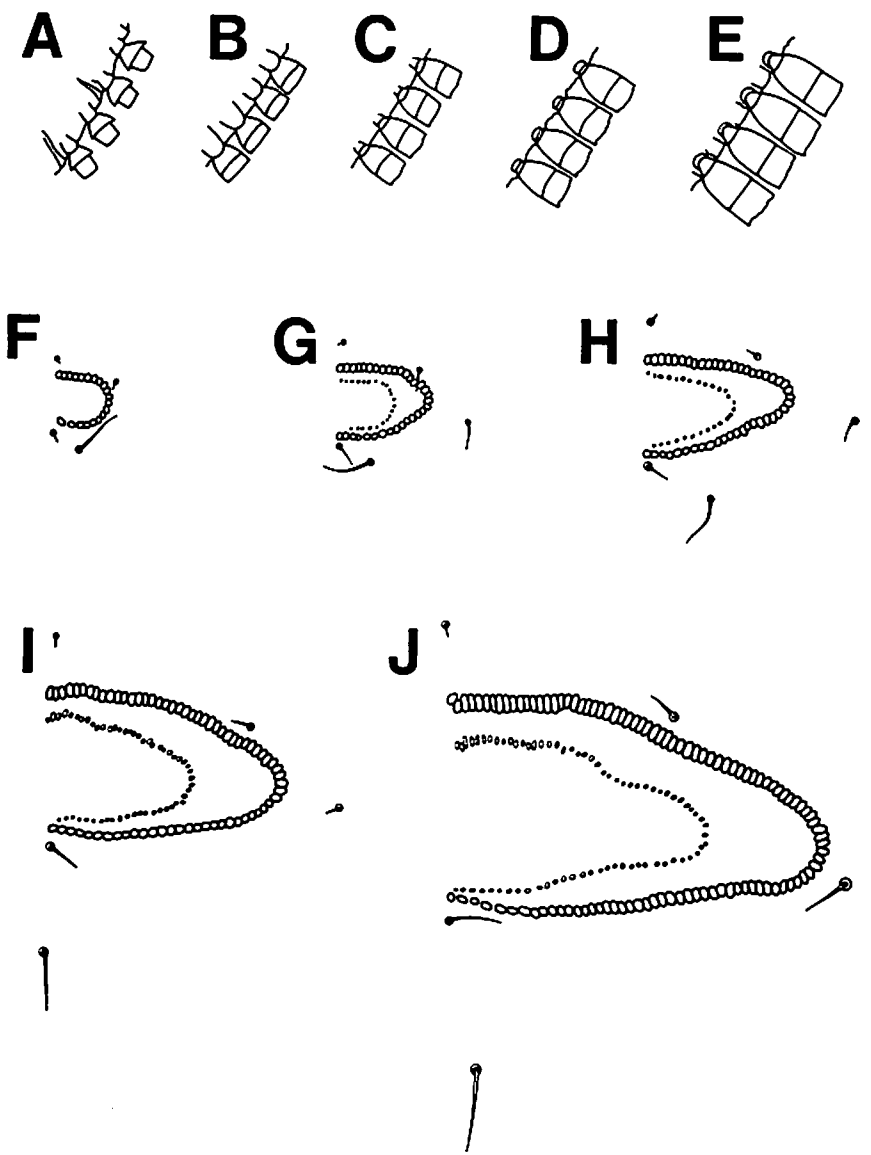

FIGURE 2. *Hemischizocranium bessi*, nymphal instars. Submarginal sectasetae: A, first instar; B, second instar; C, third instar; D, fourth instar; E, fifth instar. Circumanal pore rings: F, first instar; G, second instar; H, third instar; I, fourth instar; J, fifth instar.

and metathorax, 2 basal abdominal segments, extending almost to abdominal margin on other posterior segments. Minute points absent.

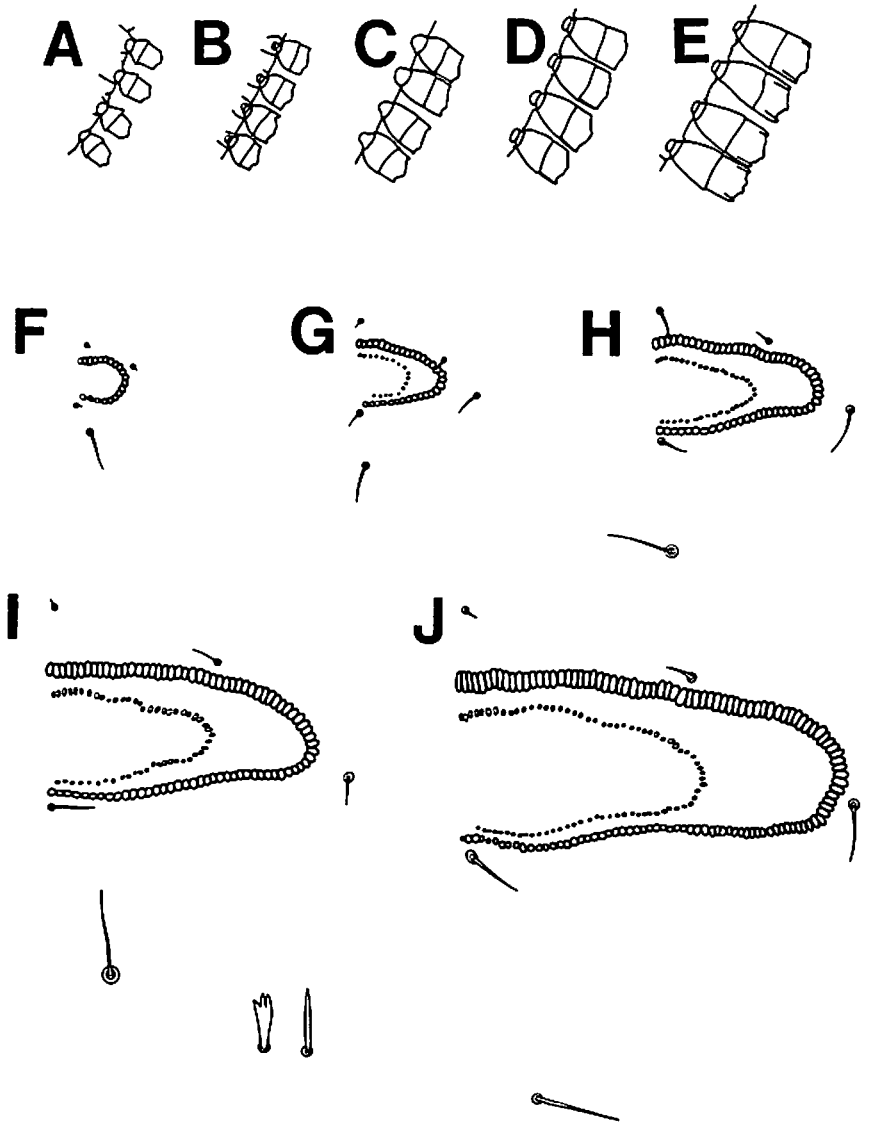

FIGURE 3. *Hemischizocranium aloha*, nymphal instars. Submarginal sectasetae: A, first instar; B, second instar; C, third instar; D, fourth instar; E, fifth instar. Circumanal pore rings: F, first instar; G, second instar; H, third instar; I, fourth instar; J, fifth instar.

Venter. Sclerotization absent except for cuticular structures, circumanal pore ring plate. **Indumenta:** setae simple, few, sparse, subequal in length; cephaloprothorax with 3 setae on each side, subequal in length; circumanal

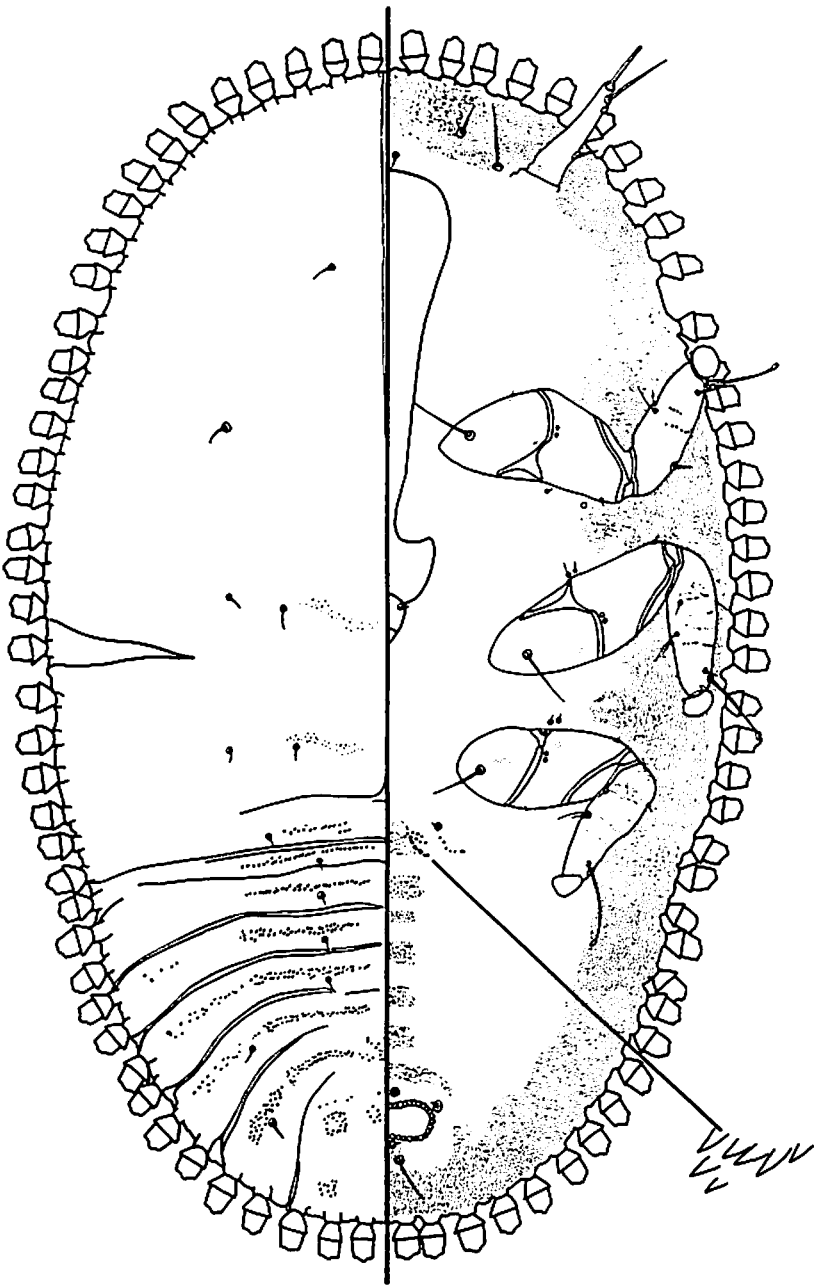

FIGURE 4. *Hemischizocranium aloha*, first instar nymph, dorsal and ventral aspects and detail.

pore ring surrounded by 4 setae on each side (1 anterior, 1 lateral and 2 posterior). **Cuticular structures:** spinules in short transverse band on each abdominal segment. Minute points dense in submarginal region of body. **Antennae:** elongate, 1 segmented; with 3 setae (1 elongate, blunt apical seta, 1 subapical, elongate seta and 1 specialized seta near base); with 4 sensoria (2 subapical, 1 nearer apex and 1 dorsal near base). **Labium:** basal segment with small seta on each side. **Legs:** relatively stout; trochanter undefined; femora not reaching margin of body; tibiotarsal articulations absent; claws present; pulvillus somewhat elliptical; tibiotarsi armed with few simple setae, with a subapical capitate seta with bent apex; spinules sparse; femora with 2 basal sensoria. **Circumanal pore ring** (Fig. 2, F).

SECOND INSTAR (Figs. 1, D; 2, B, G).

Dimensions. Length 0.77-0.82mm; width 0.53-0.55mm.

Shape. Cephaloprothorax anteriorly produced on each side.

Dorsum. Indumenta: sectasetae (Figs. 1, D lower right; 2, B). Modified sectasetae (Fig. 1, D lower left) mostly small, 1-3 on thorax enlarged, setaceous, each borne on protuberance, 0-1 on each wingpad base. Setae simple, mostly small, scattered, borne on short protuberance (Fig. 1, D upper); a few setae minute, sessile. **Cuticular structures:** spinules absent on thorax; arranged as interrupted band across abdominal segments, extending laterally to near margin on basal segments. Minute points absent. Abdomen with 4 short medial tubercles, forming longitudinal row.

Venter. Indumenta: setae on abdomen (1 submedial and 1 submarginal row on each side); 2 setae lateral of circumanal pore ring (1 enlarged and 1 reduced); circumanal pore ring surrounded by 5 setae on each side (2 anterior, 1 lateral and 2 posterior). **Cuticular structures:** minute points present, similar in pattern to first instar (not illustrated). Depressed spines in a group submedially on each side of 2 basal abdominal segments, apically broad, each bearing 2 or more small, flattened spine-like projections. **Antennae:** similar to first instar except for presence of 2 ventral setae (1 submedial and 1 basal). **Circumanal pore ring** (Fig. 2, G).

THIRD INSTAR (Figs. 1, F; 2, C, H).

Dimensions. Length 1.16-1.25mm; width 0.82-0.88mm.

Dorsum. Indumenta: sectasetae (Figs. 1, F lower right; 2, C), modified sectasetae (Fig. 1, F lower left) arranged in approximately longitudinal row on body. Setae (Fig. 1, F upper) more numerous than on previous instar, larger setae borne on prominent protuberances, concentrated on wing pads, in transverse row on each abdominal segment.

Venter. Indumenta: cephaloprothorax with 3-4 setae on each side. **Antennae:** two segmented; basal segment with 3 lateral setae (1 near base, 1 near apex and 1 specialized seta near apex); with 2 sensoria (1 lateral and 1 dorsal near base); apical segment with 2 setae (1 blunt apical seta and 1 subapical); with 3 sensoria (2 subapical and 1 near base). **Legs:** setae more numerous than on previous instar. **Circumanal pore ring** (Fig. 2, H).

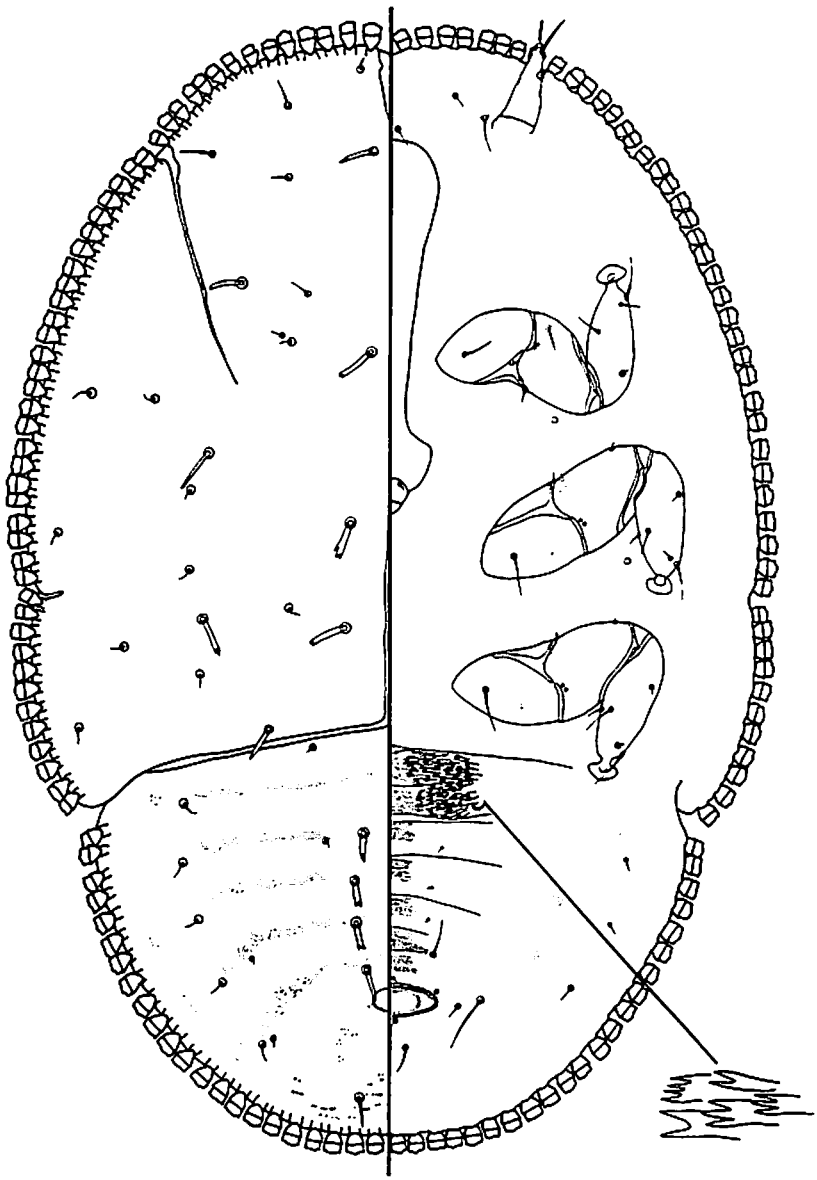

FIGURE 5. *Hemischizocranium aloha*, second instar nymph, dorsal and ventral aspects and detail.

FOURTH INSTAR (Figs. 1, H; 2, D, I).

Dimensions. Length 1.94-2.05mm; width 1.36-1.49mm.

Dorsum. Indumenta: sectasetae (Figs. 1, H lower right; 2, D); modified sectasetae (Fig. 1, H lower left) arranged in transverse row on each abdominal segment. Setae (Fig. 1, H upper) concentrated submarginally on body.

Venter. Indumenta: Modified sectasetae with enlarged base setaceous, in transverse row on each abdominal segment, extending to spiracles on each side. Cephaloprothorax with 5 setae, subequal in length. **Antennae:** four segmented; basal segment with 4 setae (2 ventral, 1 subapical and 1 submedial); with 2 dorsal (1 subapical and 1 medial), and 1 apical sensorium; second segment with 2 subapical setae (1 ventral and 1 dorsal) and 1 subapical sensorium; third segment with elongate subapical seta, 1 subapical specialized seta; apical segment with 1 blunt apical seta, and 2 subapical sensoria. **Legs:** profemora with 3, and meso- and metafemora with 4 sensoria near base. **Circumanal pore ring** (Fig. 2, I).

FIFTH INSTAR (Figs. 1, J; 2, E, J).

Dimensions. Length 3.07-3.21mm; width 2.18-2.30mm.

Dorsum. Indumenta: sectasetae (Figs. 1, J lower right; 2, E); modified sectasetae setaceous (Fig. 1, J lower left), more numerous than on previous instar, in row along bases of wing pads, in clusters arranged in longitudinal row on each side of midline, in transverse row across each abdominal segment. Setae (Fig. 1, J upper) more numerous than on previous instar.

Venter. Indumenta: setae more numerous on abdominal segments than on previous instar. **Antennae:** seven segmented, resembling antenna of fourth instar, except segments 2 and 3 of fourth instar divided in half, resulting in segments 2 and 4 without setae or sensoria; segments 5 and 6, each with 1 dorsal seta. **Circumanal pore ring** (Fig. 18, J).

Types. The holotype female and allotype male specimens were stated to be deposited in the collection of the Bernice P. Bishop Museum (Tuthill 1956), but they have been located in the collection of the U. S. National Museum.

Specimens Examined. Hawaii, Hawaii I., HVNP, Kipuka Puaulu, 23•VI•1989, ex *Zanthoxylum dipetalum*, G.K. Uchida, 4 males, 5 females, 25 nymphs (5 I, 5 II, 5 III, 5 IV, 5 V); Kipuka Puaulu, Haw., VIII•23•1958; *Xanthoxylum* (= *Zanthoxylum*); J.W. Beardsley Collector, 1 female.

Hemischizocranium aloha Caldwell (Figs. 1, A, C, E, G, I; 3, A-J; 4-8).

Hevaheva aloha Caldwell 1940, Proc. Hawaii. Entomol. Soc. 10:394.

Hemischizocranium aloha (Caldwell), Tuthill 1956, Proc. Hawaii. Entomol. Soc. 16:158.

Type locality: Mohihi, Kauai Island. Holotype male located in Bernice P. Bishop Museum, Honolulu.

Distribution: Kauai Island.

Host: Nymphs free-living mostly on venter of leaves of *Zanthoxylum dipetalum* H. Mann., usually feed on the sides of prominent veins.

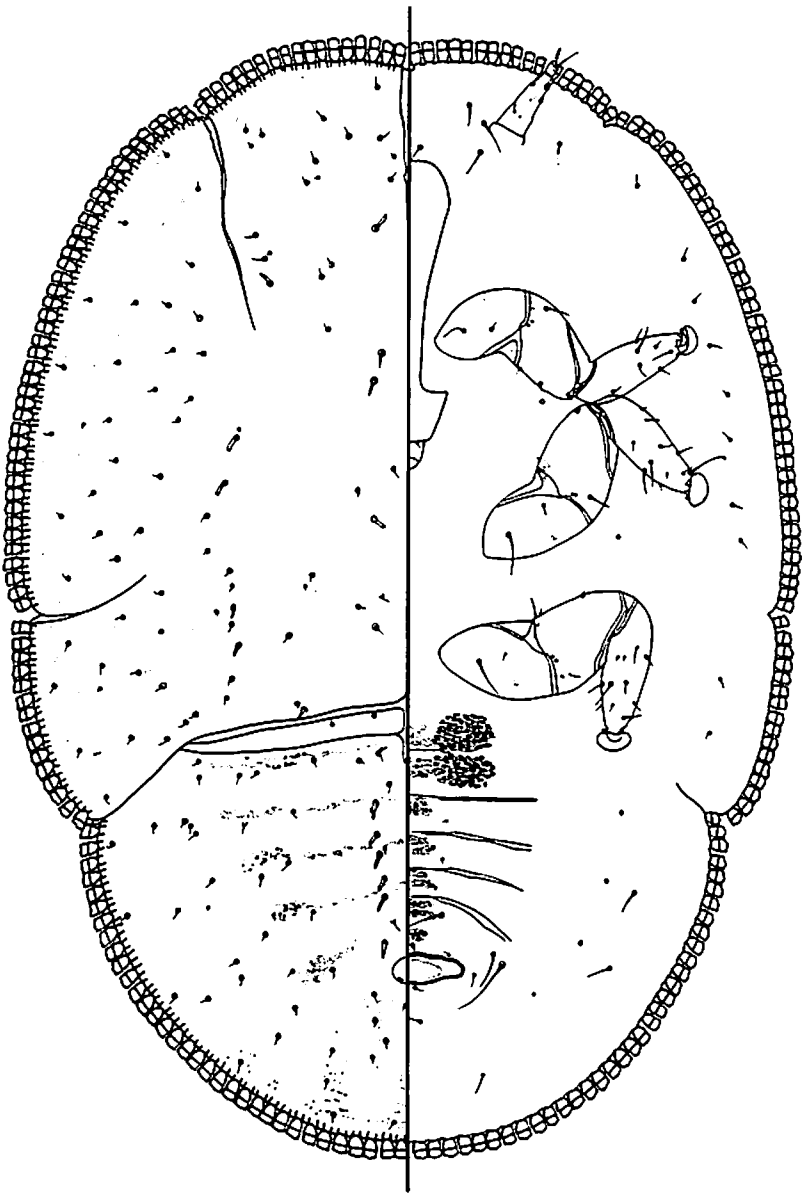

FIGURE 6. *Hemischizocranium aloha*, third instar nymph, dorsal and ventral aspects.

Adult. Diagnosis. Differing from *H. bessi* by having proctiger not tapered, anterior margin weakly arcuate, posterior margin bell-shaped; parameres with swollen base, arched posteriorly.

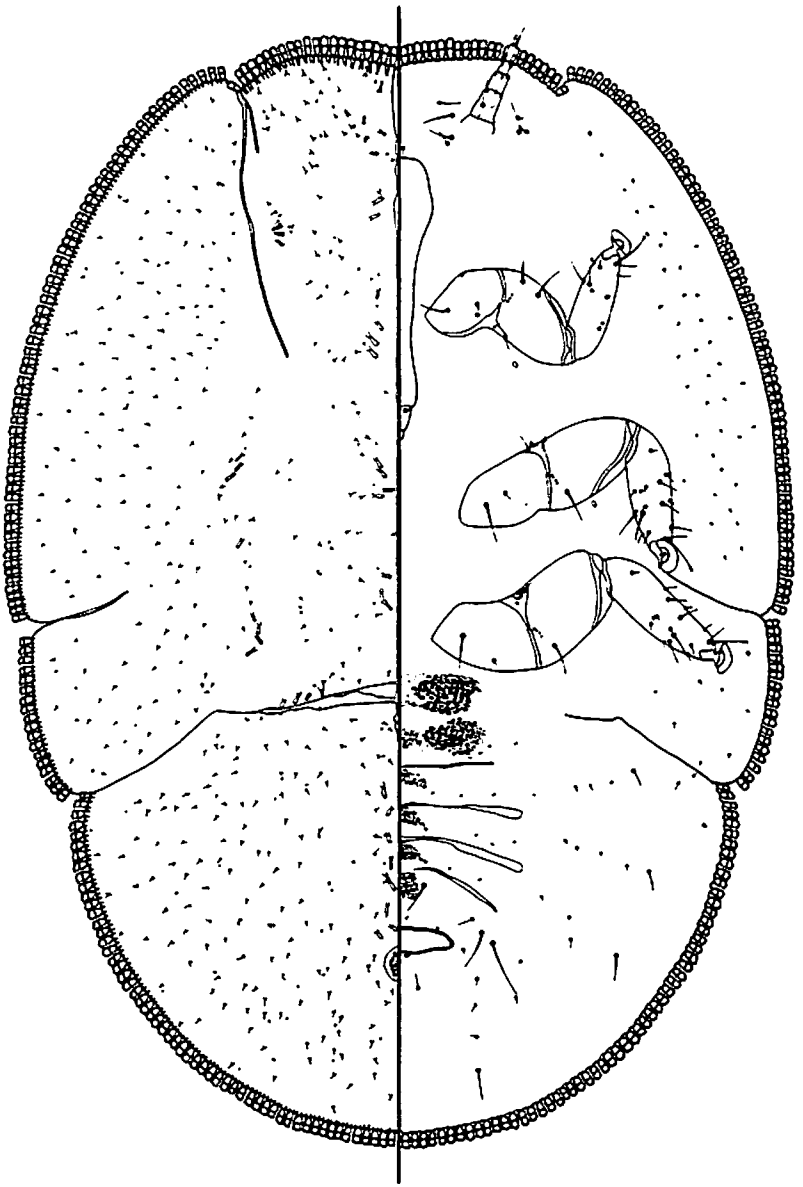

FIGURE 7. *Hemischizocranium aloha*, fourth instar nymph, dorsal and ventral aspects.

Immature Stages.

FIRST INSTAR (Figs. 1, A; 3, A, F; 4).

Dimensions. Length 0.49-0.53mm; width 0.31-0.32mm.

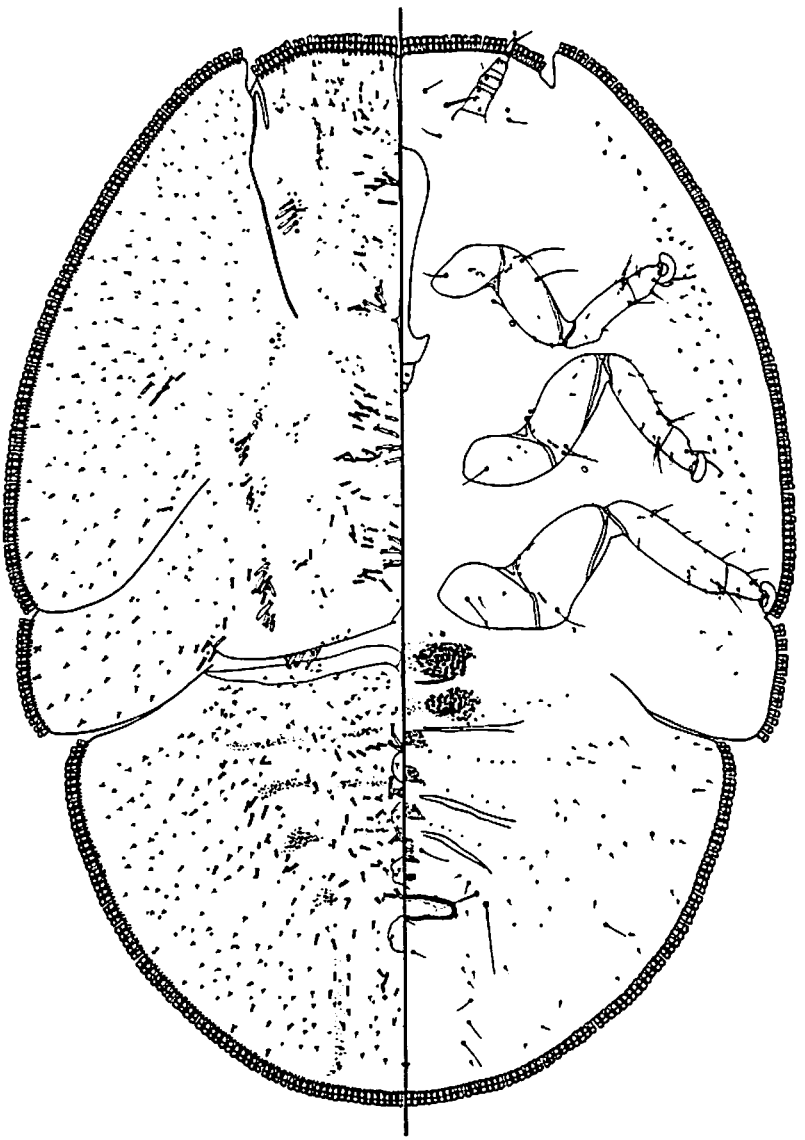

FIGURE 8. *Hemischizocranium aloha*, fifth instar nymph, dorsal and ventral aspects.

Dorsum. Indumenta: sectasetae (Figs. 1, A lower; 3, A). Setae (Fig. 1, A upper) simple, borne on weakly defined protuberance.

Venter. Indumenta: flattened, acute, depressed spines present in groups on each side of two basal abdominal segments (Fig. 4, detail). **Circumanal pore ring** (Fig. 3, F).

SECOND INSTAR (Figs. 1, C; 3, B, G; 5).

Dimensions. Length 0.73-0.76mm; width 0.51-0.52mm.

Dorsum. Indumenta: sectasetae (Figs. 1, C lower right; 3, B), modified sectasetae (Fig. 1, C lower, three setae to left of sectasetae) enlarged, flattened, in two longitudinal rows, with 1 submedial and 1 aligned along wing pad bases. Setae (Fig. 1, C upper). **Cuticular structures:** tubercle medial on apical third of abdomen.

Venter. Circumanal pore ring (Fig. 3, G).

THIRD INSTAR (Figs. 1, E; 3, C, H; 6).

Dimensions. Length 1.16-1.25mm; width 0.82-0.88mm.

Dorsum. Indumenta: sectasetae (Figs. 1, E lower right; 3, C); modified sectasetae (Fig. 1, E lower left) stout, lanceolate, forming two interrupted, sometimes somewhat depleted, longitudinal rows. Setae (Fig. 1, E upper).

Venter. Circumanal pore ring (Fig. 3, H).

FOURTH INSTAR (Figs. 1, G; 3, D, I; 7).

Dimensions. Length 1.79-2.01mm; width 1.27-1.43mm.

Dorsum. Indumenta: sectasetae (Figs. 1, G lower right; 3, D); modified sectasetae somewhat lanceolate with acute apex (Fig. 1, G lower left). Setae borne on prominent protuberances (Fig. 1, G upper).

Venter. Circumanal pore ring (Fig. 3, I).

FIFTH INSTAR (Figs. 1, I; 3, E, J; 8).

Dimensions. Length 2.87mm; width 2.46mm.

Dorsum. Indumenta: sectasetae (Figs. 1, I lower right; 3, E); modified sectasetae enlarged, flattened, capitate (Fig. 1, I lower left), numerous on cephaloprothorax, in clusters on each side of midline of meso- and metathorax; smaller, stout, flattened modified sectasetae (Fig. 1, I lower middle) scattered on outer one-third of dorsum, among setae which are borne on pronounced protuberances (Fig. 1, I upper).

Venter. Circumanal pore ring (Fig. 3, J).

Types. Holotype male (BISHOP 5533), Mohihi, (Kauai), 8-11-25; O.H. Swezey Collector; *Xanthoxylum* (= *Zanthoxylum*).

Other Specimens Examined. Hawaii, Kauai I., Kokee, Makaha, 24•II•1988, ex *Zanthoxylum dipetalum*, G.K. Uchida, 1 male, 2 females, 18 nymphs (5 I, 5 II, 3 III, 4 IV, 1 V).

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