

## New Species and New Records of Endemic Hawaiian Mealybugs (Homoptera: Pseudococcidae)

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The mealybug species considered in this paper are all apparently endemic to the Hawaiian Islands. Each has been found only on a single species or a few closely related species of native plants. Other undescribed species from the islands of Oahu and Hawaii are at hand, and additional specialized collecting for these unobtrusive insects may be expected to bring to light many more new forms. The native mealybug fauna of the island of Kauai, for example, is virtually unknown, the single endemic species so far described from that island having been removed from a museum herbarium specimen (Beardsley, 1957).

The proper generic assignment of many of our Hawaiian mealybugs presents a difficult problem. Since the Zimmerman-Ferris treatment of the Hawaiian species in 1948, the generic classification of North American mealybugs has been extensively revised (Ferris, 1950, 1953). If one accepts the Ferris definition of such genera as *Pseudococcus* and *Trionymus* it is obvious that several of our endemic species cannot remain in the genera to which they were originally assigned (e.g.: *Pseudococcus straussiae* Ehrhorn, *Trionymus refertus* Ferris). As a temporary expedient I have placed the new species described below within long established genera. When the mealybug faunas of Hawaii and other Pacific areas are adequately known, more clearly defined relationships than are now evident may become apparent.

Genera are here considered in the same order as they are treated in Volume 5 of *INSECTS OF HAWAII* (Zimmerman, 1948).

Field work on the island of Hawaii, the results of which are reported here in part, was made possible through a grant of funds from the McInerny Foundation of Honolulu. I wish to express my appreciation to the McInerny Foundation for its support of this work.

Holotypes of the new species described below are deposited in the Bernice P. Bishop Museum, Honolulu. Paratypes have been placed in the Bishop Museum; the collection of the Experiment Station, HSPA, Honolulu; and in the National Coccid Collection in the U. S. Department of Agriculture, Washington, D.C.

**Pedronia acanthocauda** Beardsley

*Pedronia acanthocauda* Beardsley, 1957, PROC. HAW. ENT. SOC. 16 (2) : 230-231, fig. 5.

This mealybug was described from material removed from herbarium specimens of the host housed in the Bernice P. Bishop Museum, Honolulu. On January 1, 1959, I collected living material of the species from a clump of the type host, *Dicranopteris owhyhensis* Hooker, which was found along the Koolau Summit Trail, Oahu, about one-half mile southeast of its juncture with Poamoho Trail. The mealybugs were found within aborted, rolled-over pinnule tips of the host fronds, like those from which the type material was removed. A number of parasitized females were found and several adults of a black endemic species of *Anagyrus* were reared. Male cocoons were also present and a few winged adult males were secured.

**Pedronia cibotii** Beardsley

*Pedronia cibotii* Beardsley, 1957, PROC. HAW. ENT. SOC. 16 (2) :222-224, fig. 2.

Previously known only from Mt. Tantalus, Oahu, this species recently has been collected at an additional locality on Oahu (near the summit of the Poamoho Trail), and in the Kilauea Volcano area on the island of Hawaii. Both collections were from the type host, *Cibotium chamissoi* Kaulfuss. Specimens of both these lots show variations in the development of the cerarii not found in the type series. Instead of possessing four conical setae of nearly equal size on each abdominal cerarius anterior to the anal pair, as in the type, many of these specimens have two of the conical setae much reduced in size, and in some cases one or two of the spines are entirely absent from some cerarii. These differences are considered too slight to warrant the erection of a new name, however.

**Pedronia hawaiiensis** Ferris

*Pedronia hawaiiensis* Ferris, 1948, INS. HAWAII 5:168, fig. 97

A specimen of this species was removed from a herbarium specimen of *Dicranopteris owhyhensis* Hooker in the Bishop Museum which was collected on Mt. Konahuanui, Oahu, July 3, 1872, by Hillebrand and Lydgate. In addition, I have recently collected specimens on *D. emarginata* (Brack.) W. Robins found growing along the Kipapa and Poamoho Trails in the Koolau Mountains of Oahu. These are new host records for the species which previously has been collected only on *D. linearis* (Burmeister) Underwood. On *D. emarginata* the mealybugs were found associated with the same sort of rosette deformation of the host pinnules which is characteristic of infestations on *D. linearis* (see Beardsley, 1957).

**Claviccoccus tribulus** Ferris

*Claviccoccus tribulus* Ferris, 1948, INS. HAWAII 5:174, fig. 99.

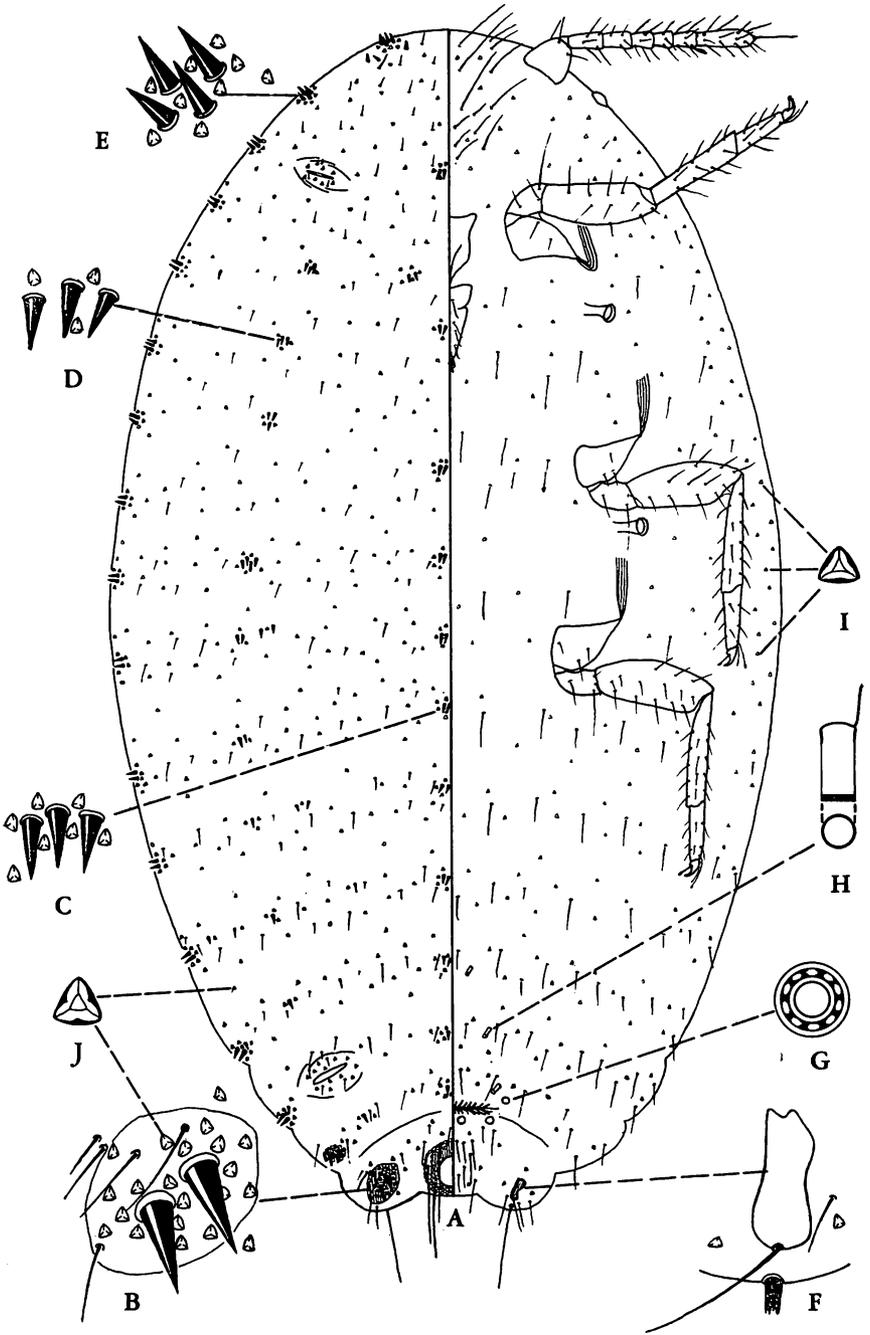
This unusual mealybug, previously known only from the type material, has been collected several times during the past two years from the lower surfaces of leaves of *Hibiscus arnottianus* Gray along the Manoa Cliff Trail, Mt. Tantalus, Oahu. The host is common along that trail, and, although the leaves of many of these plants were searched, I found the mealybug present only in one small area. It seems worthy of note that the undersurfaces of the leaves of those plants which harbored mealybugs were slightly tomentose, whereas on all other plants examined the undersides of the leaves were quite glabrous.

**Pseudococcus dorsispinosus**, new species (fig. 1.)

Female. With 17 pairs of marginal cerarii, the anal pair each with 2 conical setae about  $22\ \mu$  long plus 3 or 4 slender accessory setae  $24$  to  $45\ \mu$  long, surrounded by a concentration of about 18 to 24 trilocular pores, and borne on an area of weak to moderate sclerotization (fig. 1, B). Penultimate cerarii each with 2 conical setae about  $16\ \mu$  long, 1 or 2 slender accessory setae about  $24$  to  $32\ \mu$  long, and a small concentration of about 8 to 12 trilocular pores borne on a small area of weak sclerotization (fig. 1, C). Anterior marginal cerarii unsclerotized except for a narrow area around the bases of the conical setae in some; most with 2 conical setae about  $12\ \mu$  long, some of those on head and thorax and occasionally the anterior abdominal segments with 3 or 4 such conical setae; slender accessory setae frequently lacking, a single seta occasionally present; each with a few trilocular pores (4 to 9 in type) around the bases of the conical setae (fig. 1, E). A medio-dorsal cerarius present on each discernible abdominal segment anterior to the ninth, 2 or 3 such cerarii on the thorax, and one on the head between the anterior dorsal ostioles, there being 10 or 11 such cerarii in the series. Each medio-dorsal cerarius (fig. 1, C) consisting of from 2 to 4 conical setae about  $12\ \mu$  long and a small concentration of about 3 to 6 trilocular pores; without slender accessory setae. A less complete series of cerarii present sublaterally on each side of the dorsum, one cerarius of the series on each of most of the segments between the anterior and posterior pairs of dorsal ostioles. These cerarii consisting of from 1 to 4 conical setae about  $12\ \mu$  long plus a few trilocular pores (fig. 1, D). A few scattered small or slender conical setae present between the medio-dorsal and sublateral series, particularly on the posterior portion of the dorsum

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FIG. 1. *Pseudococcus dorsispinosus*, n. sp. A, dorsal and ventral aspects of mature female; B, anal cerarius; C, medio-dorsal cerarius, D, sublateral cerarius; E, anterior marginal cerarius; F, ventral sclerotized area of anal lobe; G, multilocular disc pore; H, ventral tubular duct; I, ventral trilocular pore; J, dorsal trilocular pore.



and near the interantennal cerarii. Dorsal trilocular pores evenly, fairly sparsely scattered; a trifle larger than those of the venter (dorsal triloculars about  $4.5 \mu$  maximum width, ventral triloculars about  $3.5 \mu$  maximum width) (fig. 1, J). Dorsal tubular ducts absent. Dorsal body setae sparse, short (about 9 to  $18 \mu$  long). Two pairs of dorsal ostioles present.

Venter of each anal lobe with a small elongate area of weak sclerotization (fig. 1, F); probably discernible only in well-stained specimens. A very few (usually about 6) small ventral tubular ducts present, usually one pair submedially on abdominal segments 6, 7 and 8. These about  $3 \mu$  in diameter, about  $6 \mu$  long, and with a weak oral collar (fig. 1, H). Multilocular disc pores (fig. 1, G) very few, usually about 6 or 8 located about the vulvar opening. Trilocular pores (fig. 1, I) evenly, rather sparsely distributed over venter. Ventral body setae fairly sparse, mostly 30 to  $80 \mu$  long; longer ventral setae of head up to about  $120 \mu$  long. Anal lobe setae about 110 to  $130 \mu$  long; anal ring setae about 110 to  $140 \mu$  long.

Circulus absent. Antennae 7-segmented in type and several paratypes, 8-segmented or 7-8-segmented combinations in others; 290 to  $360 \mu$  long. Beak 2-segmented, about  $130 \mu$  long by  $75 \mu$  maximum width. Legs moderately short and stout; hind femora of type  $175 \mu$  long by  $63 \mu$  maximum width. A few very tiny, poorly defined, translucent dots on upper surfaces of hind femora and tibiae.

Body form oval; type 1.8 mm. long by 0.93 mm. maximum width.

Described from 17 slide-mounted specimens. Type and 2 paratypes on 3 slides: ex leaves of *Pipturus*, Waikane Trail, Kooīau Mts., Oahu, July 22, 1956, J. W. Beardsley collector. Fourteen paratypes on 9 slides: on *Pipturus* leaves, valley below Puu Kanehoa, Waianae Mts., Oahu, Sept. 14 and Oct. 27, 1958, J. W. Beardsley collector.

This mealybug may be separated easily from all other Hawaiian species of *Pseudococcus* by the presence of distinct dorsal cerarii. Eventually, a new genus almost certainly must be erected to receive this species as it cannot remain in *Pseudococcus* as defined by Ferris.

In addition to the type material, a series of specimens is at hand which I collected from *Pipturus* leaves on Mt. Tantalus, Oahu, during 1957 and 1958, and which I have tentatively assigned to this species. These are similar to the type material except that there is marked reduction in the number of dorsal cerarii present. The sublateral series is absent in all these specimens, and the medio-dorsal series is reduced to form 4 to 10 discernible cerarii. It is felt that the number of dorsal cerarii present may be a somewhat variable character, and that with additional collecting specimens intermediate between the typical and the Mt. Tantalus forms may be found.

The living mealybugs were found mostly on the undersurfaces of the host leaves, particularly along the midribs and other large veins. When collected they were very pale yellow to almost white in color, and each

possessed a complete set of 17 pairs of short peripheral wax filaments. Each filament of the caudal pair was equal in length to about one-third the maximum width of the dorsum, while the anterior filaments were equal to only about one-eighth of the width of the dorsum. Very short humps of wax were present on the dorsum at the sites of the medio-dorsal and sublateral cerarii. Male cocoons were common in the Mt. Tantalus material, and a number of small winged males were reared. A few parasitized individuals were found and a small black species of *Anagyrus*, presumably endemic, emerged from one of these.

### ***Pseudococcus floriger* Ferris**

*Pseudococcus floriger* Ferris, 1948, INS. HAWAII 5:212-213, fig. 120.

Specimens of this species are at hand from the following localities: above Kawela, Molokai, 1,500 ft., Dec. 13, 1956, J. W. Beardsley collector; Wailupe Valley, Oahu, 1,000 ft., Dec. 26, 1956, J. W. Beardsley collector; hills behind Wahiawa, Oahu, July 11, 1957, E. J. Ford collector. These collections were all from the type host, *Dracaena aurea* H. Mann. The species previously has been known only from the type locality; Kanaio, Maui. The Molokai and Wailupe Valley, Oahu specimens agree quite closely with the type material. The number of cerarii present in specimens of these lots varies mostly between 5 and 8 pairs, although a few specimens have as many as 10 discernible pairs. Some specimens have the multilocular disc pores restricted to the venter of abdominal segments 8 and 9, as in Ferris' figure, but others have 2 to 4 additional pores along the posterior margin of abdominal segment 7. Most specimens possess a few oral rim tubular ducts in the medio-dorsal areas of the thorax and abdomen. Although tubular ducts in these areas are not indicated in Ferris' figure of the type, examination of the type slide in the Bishop Museum revealed the presence of a few such ducts.

Specimens from behind Wahiawa, Oahu, differ more noticeably from the type material than do those from the two lots previously discussed. Wahiawa specimens possess from 10 to as many as 15 discernible pairs of cerarii. Multilocular disc pores also are slightly more numerous, there being 4 to 6 or so along the posterior margin of the venter of abdominal segment 7. As in the other two lots, most of these specimens possess a few medio-dorsal oral rim tubular ducts on both abdomen and thorax.

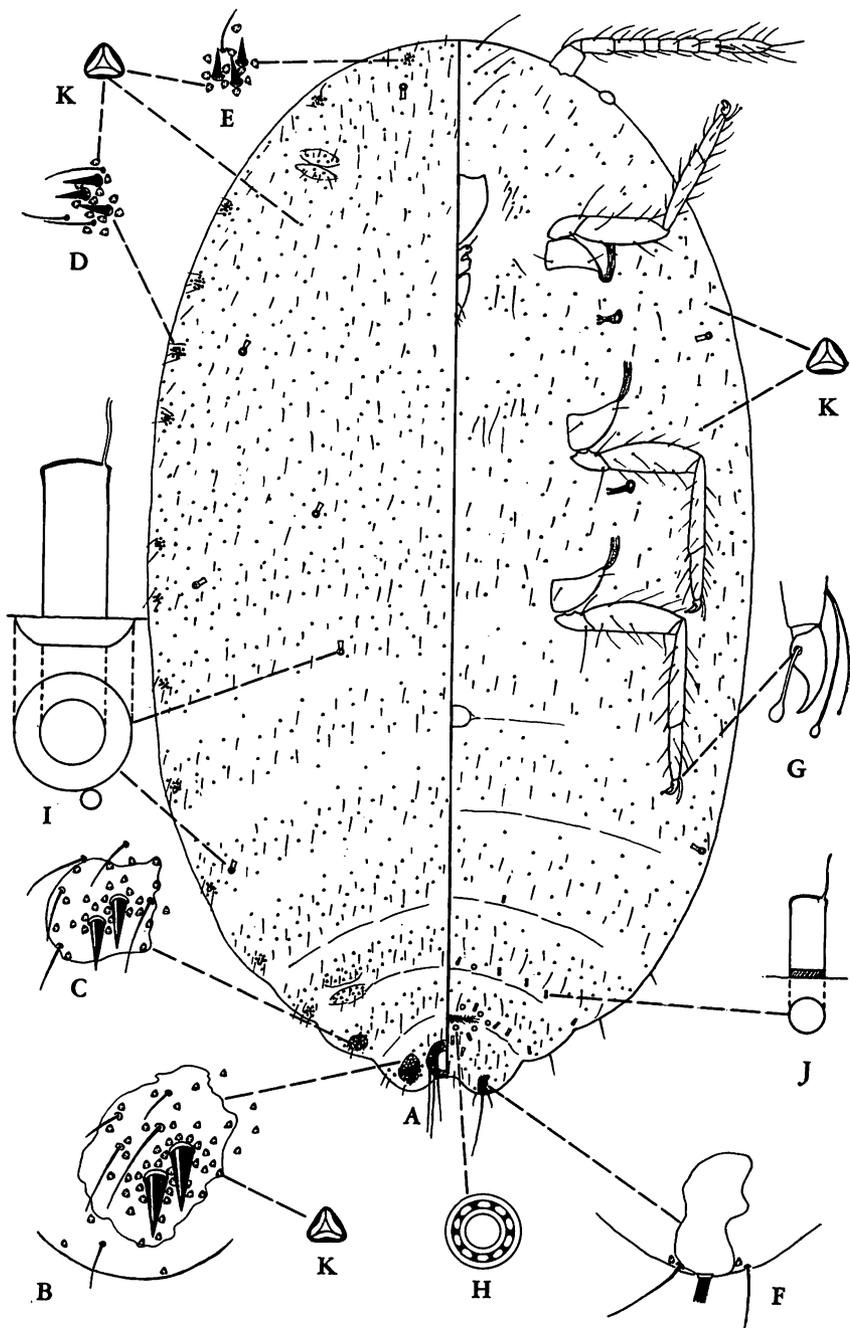
This appears to be a somewhat variable species, particularly with respect to such characters as the number of pairs of cerarii developed and the number of multilocular pores present. However, the absence of the circulus plus the presence of numerous marginal tubular ducts will serve to distinguish it from any other described Hawaiian species of *Pseudococcus*.

*Pseudococcus lycopodii*, new species (fig. 2)

Female. With 14 to 16 pairs of lateral cerarii; all 8 abdominal pairs present, but 1 to 3 of the thoracic and cephalic pairs absent. Anal cerarii each with 2 conical setae about 20 to 24  $\mu$  long, 4 or 5 slender accessory setae 18 to 36  $\mu$  long, surrounded by a concentration of about 40 to 50 trilocular pores, and borne on a well-defined sclerotized area (fig. 2, B). Penultimate cerarii each with 2 conical setae about 14 to 16  $\mu$  long, plus 4 or 5 slender accessory setae about 18 to 27  $\mu$  long, surrounded by a concentration of about 25 to 30 trilocular pores, and borne on a well-defined sclerotized area (fig. 2, C). Anterior abdominal cerarii each with 2 conical setae 10 to 14  $\mu$  long, plus 1 to 3 slender accessory setae 12 to 18  $\mu$  long, surrounded by a concentration of about 10 to 15 trilocular pores; surrounding derm unsclerotized. Existing thoracic and cephalic cerarii with 2 or 3 conical setae 10 to 14  $\mu$  long, plus 1 to 3 slender accessory setae about 12 to 18  $\mu$  long, and a concentration of a few (usually 4 to 12) trilocular pores (fig. 2, D, E). Dorsum always with a few prominent oral rim tubular ducts, the exact number variable (4 to 12 in specimens of the type series). These mostly along the lateral margins near the cerarii, but many specimens with at least 1 or 2 such ducts situated submedially on 1 or more segments of thorax and/or abdomen. Individual ducts (fig. 2, I) with outside diameter of rim about 9  $\mu$ , diameter of orifice about 5  $\mu$ , length about 12  $\mu$ . One or more very small circular pores, about 1.5  $\mu$  in diameter, frequently located near margins of tubular ducts; such pores also sometimes found on the dorsum well away from tubular ducts, particularly along the lateral margins near the cerarii. Trilocular pores moderately densely scattered over dorsum, slightly more concentrated on lips of dorsal ostioles. Dorsum sparsely clothed with fine setae ranging from about 9  $\mu$  to about 27  $\mu$  in length. Two pairs of dorsal ostioles present.

Venter of anal lobes with a small irregularly elongate area of weak sclerotization (fig. 2, F). Most specimens with a few oral rim tubular ducts (from 1 to 6 in type series) like those of the dorsum located along the lateral margins of the venter of the thorax and abdomen; these absent in a few specimens. A few small tubular ducts (10 to 20 or so in type series) present on venter of posterior abdominal segments, mostly around the vulvar opening, a few along the posterior margin of abdominal segment 7, and 1 or 2 on the posterior margin of segment 6 in some specimens. These ducts about 3  $\mu$  in diameter, about 6  $\mu$  long, and with a weak oral collar (fig. 2, J). About 8 to 14 multilocular disc pores (fig. 2, H) around the vulvar opening, plus 1 or 2 along the posterior margin of

FIG. 2. *Pseudococcus lycopodii*, n. sp. A, dorsal and ventral aspects of mature female; B, anal cerarius; C, penultimate cerarius; D, thoracic cerarius; E, cephalic cerarius; F, ventral sclerotized area of anal lobe; G, claw of hind tarsus; H, multilocular disc pore; I, dorsal oral rim tubular duct; J, ventral tubular duct; K, trilocular pores.



abdominal segment 7 in some specimens. Scattered trilocular pores of venter a trifle less dense than on dorsum. Ventral body setae sparsely scattered, a trifle longer than those of the dorsum; mostly 10 to  $38\mu$  in length. Longer setae of venter of head about 80 to  $90\mu$  long. Apical setae of anal lobes about  $110\mu$  long; anal ring setae about  $125\mu$  long.

Circulus present in all specimens of type series, small (about  $80\mu$  wide by about  $35\mu$  long in type, considerably smaller in some specimens), extending across the fold between the fourth and fifth abdominal segments. Antennae 8-segmented in type and most other specimens; one or both 7-segmented or incompletely 8-segmented in a few specimens; about  $360\mu$  long in type. Beak 2-segmented, about  $120\mu$  long by about  $75\mu$  maximum width in type. Legs moderately small; hind femora of the type about  $180\mu$  long by about  $60\mu$  maximum width; the upper surface of each with about 10 or so very small translucent dots discernible. Upper surface of hind tibiae with 15 or so similar dots.

Type 1.75 mm. long by 1.0 mm. maximum width; largest slide-mounted specimen 1.9 mm. long.

Described from 20 specimens (type and 19 paratypes on 13 slides) from club-moss, *Lycopodium cernuum* L., North Halawa Ridge, Oahu, March 15, 1958, J. W. Beardsley collector.

Some morphological characters of this species exhibit a considerable range of variation. The circulus, while present in all specimens of the type series, is considerably reduced in size in some of the paratypes. In a series of specimens which I collected on the type host near the summit of the Poamoho Trail, Oahu, all but one show no trace of the circulus; and this structure is very small in the exceptional specimen. A single individual from *Lycopodium* collected in the mountains above Kawela, Molokai, during 1958, also lacks the circulus. These specimens have been assigned tentatively to *P. lycopodii* as it appears that the presence of the circulus may not be a stable character in this species.

The number of dorsal tubular ducts varies from as few as 4 to as many as 12 in specimens of the type series. A single specimen from the type host taken at Pupukea, Oahu, Nov. 2, 1958, and which is otherwise similar to typical *P. lycopodii*, has about 20 discernible dorsal tubular ducts. Additional material is needed to establish the limits of variability in this species.

*Pseudococcus lycopodii* appears to be closely allied to *P. swezeyi* Ehrhorn, but differs in several respects from the three specimens of the latter species (ex *Acacia koa* Gray, Mt. Tantalus, Oahu, E. M. Ehrhorn collector) which I have seen. *P. lycopodii* is considerably smaller and has fewer rim tubular ducts than does *P. swezeyi*. The circulus of the latter species is quite large (about  $120\mu$  by  $120\mu$  in the specimens seen) and the conical setae of the anal and penultimate cerarii are somewhat larger than those of *P. lycopodii*. In addition, the ventral setae of *P. swezeyi*, particularly those around the vulva, are noticeably longer than those

of *P. lycopodii*.

The living specimens of *P. lycopodii* were found at the bases of the awl-shaped "leaves" of the club-moss host. The mealybugs were grayish in color and their dorsal surfaces lightly covered with powdery wax. Short wax filaments extended from the cerarii of undisturbed specimens. The length of each of the caudal pair of filaments was equal to about four-fifths the maximum width of the dorsum, and each of the penultimate pair was about one-half as long. The anterior filaments were even shorter. Male cocoons were present on the host and winged males emerged from several of these. A single mummified individual found on *Lycopodium* at Pupukea, Oahu, yielded an adult of a small, black, apparently endemic species of *Anagyrus*.

### ***Pseudococcus montanus* Ehrhorn**

*Pseudococcus montanus* Ehrhorn, 1916, PROC. HAW. ENT. SOC. 3 (3) :242

This species was reported from the island of Hawaii by Ehrhorn (1922), but Zimmerman (1948) listed the record as questionable as apparently no Hawaii specimens were available to him for study. Specimens which I collected from *Freycinetia arborea* Gaudichaud along the Kalapana Road, Hawaii, at the margin of the 1955 lava flow, August 16, 1958, agree well with Ferris' (1948) figure (INS. HAWAII 5, fig. 126) and with Oahu specimens in my collection. The species was also listed by Ehrhorn from *Astelia veratroides* Gaudichaud from Oahu, but I have been unable to find it on that host. On Hawaii, I found a similar but distinct new species infesting *Astelia*.

### ***Pseudococcus peleae*, new species (fig. 3)**

Female. With but 2 or 3 definite pairs of cerarii; an anal pair, a metathoracic pair, and sometimes an interantennal pair. Anal cerarii each with 2 conical setae 21 to 24  $\mu$  long, plus 5 to 7 slender accessory setae about 27 to 45  $\mu$  long, surrounded by a concentration of from 25 to 30 trilocular pores, and borne on a moderately well sclerotized area (fig. 3, B). Metathoracic cerarii each bearing 2 small conical setae about 10  $\mu$  long, plus 5 to 7 slender accessory setae 18 to 30  $\mu$  long, surrounded by a group of 10 to 15 trilocular pores only slightly more concentrated than on the dorsum; surrounding derm without evident sclerotization (fig. 3, C). Interantennal cerarii sometimes absent on one or both sides; when present, represented by 2 conical setae about 12  $\mu$  long plus 2 or 3 slender accessory setae about 30  $\mu$  maximum length (fig. 3, D). Lateral margins of dorsum with conspicuous tubular ducts in segmentally arranged groups of from 2 to 4 (fig. 3, D, E); these ducts about 6  $\mu$  in diameter at mouth, about 12  $\mu$  long, usually with a faint oral collar, occasionally with a poorly-defined oral rim (fig. 3, I). Trilocular pores (fig.

3, K) moderately densely, evenly, scattered over dorsum; slightly more concentrated on lips of dorsal ostioles. Two pairs of dorsal ostioles present.

Venter of anal lobes with an elongate moderately well sclerotized area (fig. 3, F). Ventral tubular ducts absent. Multilocular disc pores (fig. 3, J) very few, 2 to 4 discernible just behind the vulvar opening in the specimens available. Venter with scattered trilocular pores; these a bit more numerous in the lateral areas. Ventral body setae sparsely scattered, slightly longer than those of the dorsum, 25 to 40  $\mu$  long (fig. 3, G); longer setae of venter of head about 120  $\mu$  maximum length. Apical setae of anal lobes about 120  $\mu$  long; anal ring setae about 130  $\mu$  long.

Circulus present, small, about 60  $\mu$  wide by about 25  $\mu$  long; lying across the fold between the fourth and fifth abdominal segments. Antennae 8-segmented in all specimens, 480  $\mu$  long in type. Beak 2-segmented, about 100  $\mu$  long, 84  $\mu$  maximum width. Legs well developed, rather slender; hind femora of type 254  $\mu$  long, 51  $\mu$  maximum width. About 20 translucent dots discernible on upper surface of each hind femur.

Type 1.7 mm. long by 0.86 mm. maximum width; largest slide-mounted specimen 2.2 mm. long.

Described from 10 specimens. Type and 9 paratypes on 9 slides: on *Pelea* sp., North Halawa Ridge, Koolau Mts., Oahu, 2,000 ft., March 15, 1958, J. W. Beardsley collector.

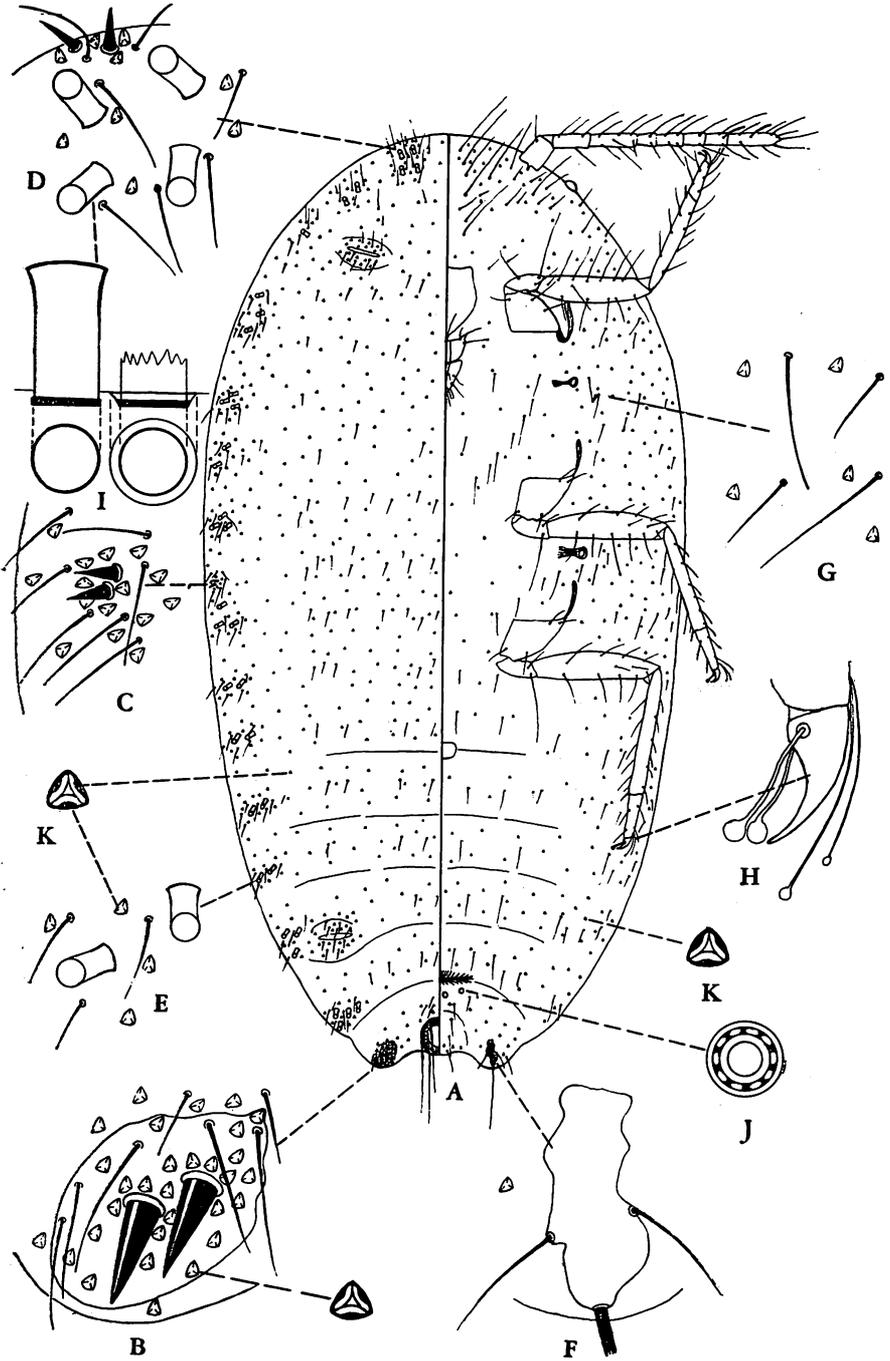
The living mealybugs were found exposed on the under surfaces of the host leaves around the openings of old psyllid galls. The insects were pale greenish in color and their dorsa were lightly dusted with powdery wax. Each specimen possessed two conspicuous pairs of peripheral wax filaments; a caudal pair one-half to nearly as long as the body, plus a shorter pair, each equal in length to about one-half to two-thirds the maximum width of the body, which extended laterally from metathoracic cerarii. In addition to the cerarial wax filaments, each specimen bore numerous, fine, hair-like wax strands which extended from the lateral margins of the body. The longest of these was equal to about one-half the length of the body. These strands appeared to arise from the large tubular ducts along the lateral margins of the dorsum.

#### *Pseudococcus syzygii*, new species (fig. 4).

Female: With from 3 to 6 discernible pairs of cerarii. Anal cerarii each with 2 conical setae about 23 to 27  $\mu$  long, plus 5 to 7 slender ac-

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FIG. 3. *Pseudococcus peleae*, n. sp. A, dorsal and ventral aspects of mature female; B, anal cerarius; C, metathoracic cerarius; D, interantennal cerarius and associated tubular ducts; E, marginal abdominal tubular ducts; F, ventral sclerotized area of anal lobe; G, detail of ventral derm; H, claw of hind tarsus; I, details of dorsal tubular ducts; J, multilocular disc pore; K, trilocular pores.



cessory setae 21 to 42  $\mu$  long, surrounded by a concentration of about 40 to 50 trilocular pores, and borne an area of weak sclerotization (fig. 4, B). Penultimate cerarii each with 2 conical setae about 15  $\mu$  long, 2 to 4 slender accessory setae about 18 to 25  $\mu$  long, plus a slight concentration of about 6 or 8 trilocular pores around the bases of conical setae; without evident sclerotization. Cerarii of seventh abdominal segment present in all specimens at hand; each with 2 conical setae about 9 to 12  $\mu$  long, 1 or 2 slender accessory setae 12 to 15  $\mu$  long, plus a very few trilocular pores, and no evident sclerotization. Cerarii present on fifth and sixth abdominal segments in some specimens (fig. 4, C), similar to those of seventh segment, frequently absent. Interantennal pair of cerarii present on some specimens, each with 1 to 3 small slender conical setae about 10 to 12  $\mu$  long, plus 1 to 3 slender accessory setae (fig. 4, D).

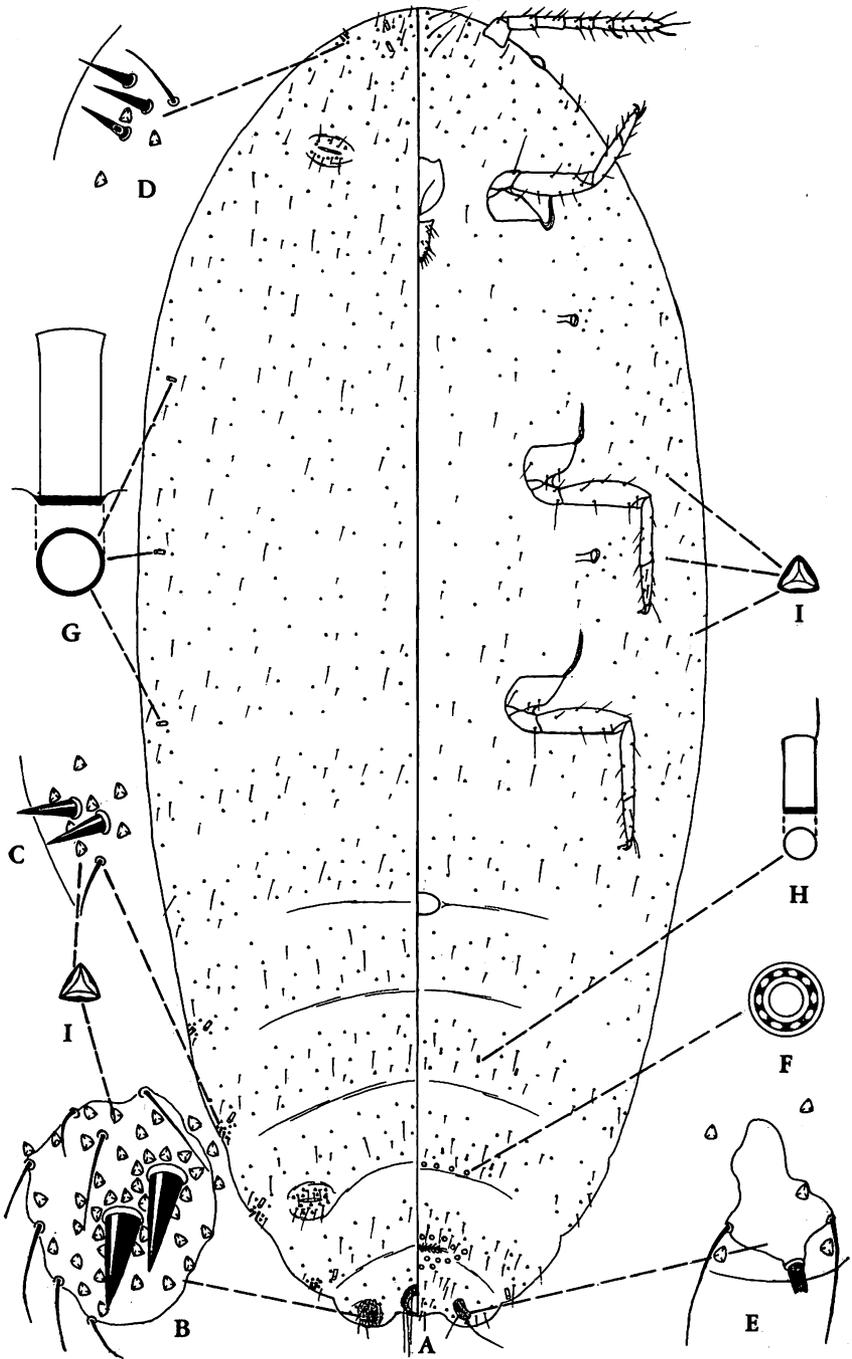
Large tubular ducts present along lateral margins of dorsum; usually one near each cerarius on abdominal segments 5 to 8, plus two or three on each side of the thorax, and two to four interantennally on the head. These ducts each with a narrow oral rim, about 6  $\mu$  in diameter at mouth, about 12 to 14  $\mu$  long (fig. 4, G). Trilocular pores evenly, fairly densely, scattered over dorsum; slightly more concentrated on lips of ostioles. Dorsum sparsely clothed with fine setae about 8  $\mu$  to about 27  $\mu$  long. Two pairs of dorsal ostioles present.

Venter of anal lobes with an irregularly elongate area of weak sclerotization (fig. 4, E). A single large tubular duct similar to those of the dorsum located near the lateral margin of each side of the venter of abdominal segment 8. A few small tubular ducts located on venter of abdominal segments 6 and 7, about 6 or 7 per segment; these each with a very fine oral collar, about 2.5 to 3  $\mu$  in diameter at mouth, 6  $\mu$  or 7  $\mu$  long (fig. 4, H). Multilocular disc pores (fig. 4, F) limited to a few about the vulvar opening, (18 to 28 in specimens at hand) plus a row of about 4 to 8 along the posterior margin of abdominal segment 7. Trilocular pores scattered over venter at about the same density as on the dorsum. Ventral body setae sparsely scattered, from about 10  $\mu$  to about 36  $\mu$  long; longer setae of venter of head up to about 64  $\mu$  long. Anal ring setae about 110  $\mu$  to about 120  $\mu$  long; anal lobe setae about 110  $\mu$  long.

Circulus present, about 60  $\mu$  wide by about 40  $\mu$  long, extending across fold between fourth and fifth abdominal segments. Antennae 8-segmented in most specimens; 7-segmented in one paratype; about 330  $\mu$  long in type. Beak 2-segmented, about 90  $\mu$  long by about 56  $\mu$  maximum width. Legs moderately short and stout; hind femora of type 156  $\mu$

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FIG. 4. *Pseudococcus syzygii*, n. sp. A, dorsal and ventral aspects of mature female; B, anal cerarius; C, cerarius of sixth abdominal segment; D, interantennal cerarius; E, ventral sclerotized area of anal lobe; F, multilocular disc pore; G, dorsal marginal tubular duct; H, ventral tubular duct; I, trilocular pores.



long by  $54\ \mu$  maximum width. Upper surface on hind femora and tibiae with scattered small translucent dots.

Body from elongate; type 2.4 mm. long by 1.0 mm. maximum width.

Described from 16 specimens. Type and 2 paratypes on 3 slides: ex leaves of *Syzygium sandwicensis* (Gray) Niedenzu, Williwilini Ridge Road, Koolau Mts., Oahu, 2,000 ft., March 25, 1956, J. W. Beardsley collector. Nine paratypes on 6 slides: same host, locality, and collector, Dec. 26, 1956 and May 30, 1958. Four paratypes on 4 slides: same host, summit, Pupukea Trail, Koolau Mts., Oahu, Nov. 2, 1958, J. W. Beardsley collector.

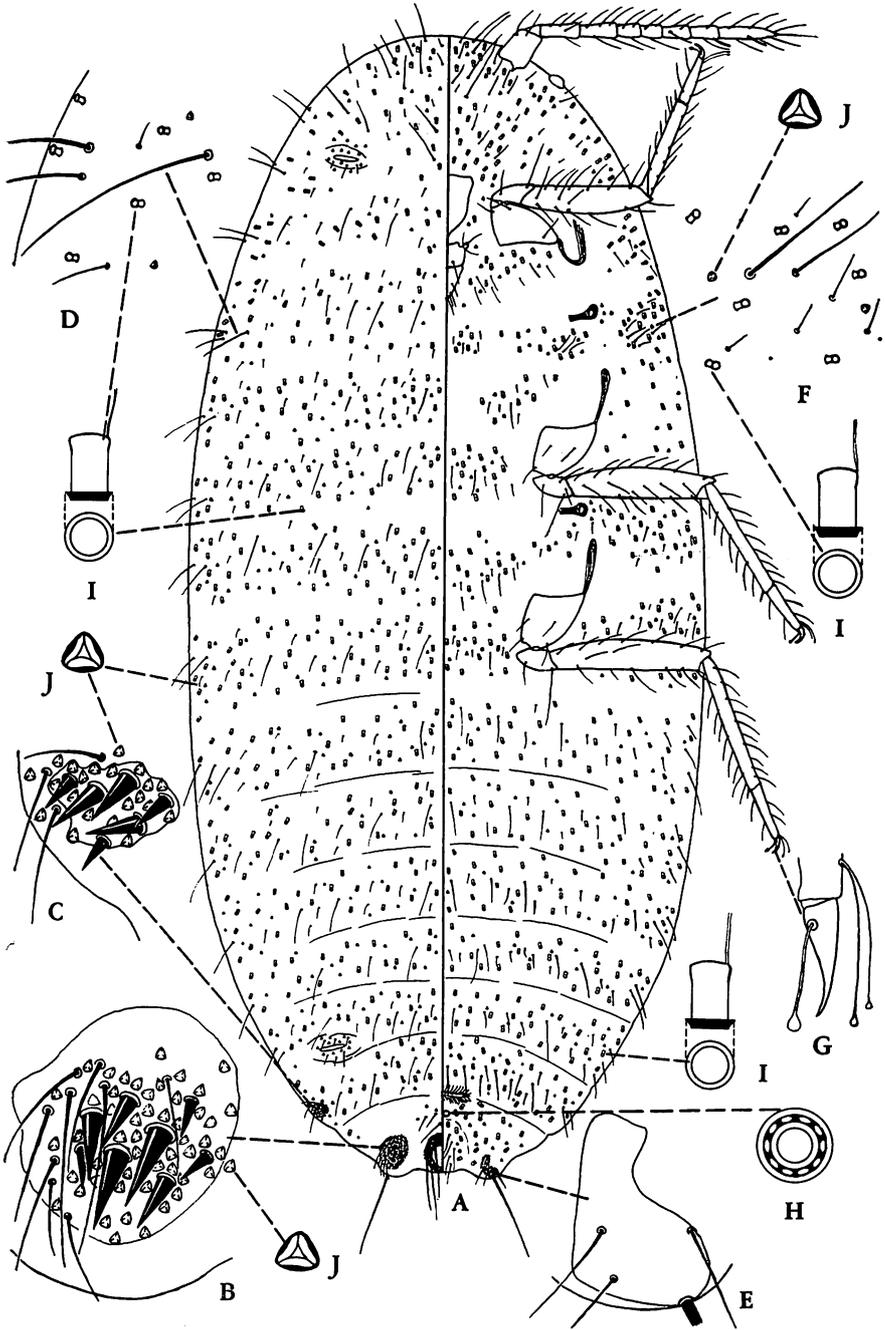
The marked reduction in the number of discernible pairs of cerarii present sets this species apart from all other Hawaiian *Pseudococcus* save *P. floriger*. The latter species lacks the circulus and has a great many more marginal tubular ducts than does *P. syzygii*.

This mealybug was found together in mixed colonies with *Trionymus refertus* Ferris in tightly rolled-over edges of the leaves of the host tree. The living mealybugs were grayish or grayish-yellow in color, elongate and slender in shape, and dusted dorsally with powdery wax. Each possessed a pair of short caudal wax filaments about one-fourth as long as the body, plus a very short pair of wax filaments arising from the penultimate cerarii. An unidentified and presumably endemic species of *Anagyrus* was reared from mummified specimens of *P. syzygii* held in the laboratory.

### ***Trionymus multiductus*, new species (fig. 5)**

Female. With 2 pairs of well-developed cerarii; the anal pair each with 6 to 10 conical setae 13 to  $25\ \mu$  long, 8 to 10 slender accessory setae 27 to  $54\ \mu$  long, surrounded by a fairly dense concentration of about 60 trilocular pores, and borne on a moderately sclerotized area (fig. 5, B). Penultimate cerarii each with 6 to 8 conical setae 10 to  $18\ \mu$  long, 3 or 4 slender accessory setae 27 to  $35\ \mu$  long, and a concentration of about 20 trilocular pores borne on a small, moderately sclerotized area (fig. 5, C). Anterior cerarii absent except for a single slender conical seta on the seventh abdominal segment in a few specimens. Dorsum evenly, fairly densely scattered with small, short, tubular ducts. These of uniform size and shape, each about 4 to  $5\ \mu$  in diameter at mouth, 5 or  $6\ \mu$  long, with a distinct oral collar (fig. 5, I). Trilocular pores (fig. 5, J) sparsely scattered over dorsum, less numerous than tubular ducts. Dorsum with scattered long body setae 40 to  $65\ \mu$  in length, particularly conspicuous along lateral margins (fig. 5, D); smaller dorsal body setae

FIG. 5. *Trionymus multiductus*, n. sp. A, dorsal and ventral aspects of mature female; B, anal cerarius; C, penultimate cerarius; D, detail of dorsal derm; E, ventral sclerotized area of anal lobe; F, detail of ventral derm; G, claw of hind tarsus; H, multilocular disc pore; I, tubular ducts; J, trilocular pores.



6 to 18  $\mu$  long; longer setae of dorsum of head up to about 90  $\mu$  in length. Two pairs of dorsal ostioles present.

Venter of anal lobes with a moderately well developed sclerotized area (fig. 5, E). Small tubular ducts like those of the dorsum fairly densely scattered over entire venter. Multilocular disc pores apparently lacking in some specimens; represented by a single pore behind the vulva in others (fig. 5, H). Trilocular pores sparsely scattered as on dorsum. Venter moderately densely clothed with fine setae 15 to 60  $\mu$  long (fig. 5, F); longer setae of venter of head up to about 90  $\mu$ . Apical setae of anal lobes about 160  $\mu$  long; anal ring setae 110 to 120  $\mu$  long.

Circulus absent. Antennae 8-segmented in all available specimens; 490 to 540  $\mu$  long. Beak 2-segmented, about 105  $\mu$  long by 80  $\mu$  maximum width. Legs moderately large, rather slender; hind femora about 330  $\mu$  long by 62  $\mu$  maximum width in type. Tarsal claws slender and elongate (fig. 5, G). Upper surface of hind femora with a scattering of poorly defined translucent dots of variable size.

Body form elongate; type 2.1 mm. long by 0.96 mm. maximum width.

Described from 30 specimens. Type and 18 paratypes on 8 slides: in folded leaves of *Syzygium sandwicensis*, North Halawa Ridge, Koolau Mts., Oahu, 1,500 ft., March 15, 1958, J. W. Beardsley collector. Nine paratypes on 5 slides: from the same host, summit, Pupukeya Trail, Koolau Mts., Oahu, Nov. 2, 1958, J. W. Beardsley collector. Two paratypes on 2 slides: same host, Palolo, Oahu, June 12, 1918, O. H. Swezey collector.

This species appears to be closely related to *Trionymus refertus* Ferris from which it differs principally in the possession of greater numbers of conical setae in both pairs of cerarii, a well defined sclerotized area on the venter of each anal lobe, many more tubular ducts on both dorsum and venter, and much larger appendages. The legs and antennae of the *T. refertus* specimens at hand are quite short; the hind femora being on the order of 150  $\mu$  to 170  $\mu$  in length, or about one-half those of *T. multiductus*. None of my *T. refertus* specimens have more than 2 conical setae in each penultimate cerarius, and in several specimens there are no conical setae anterior to those of the anal cerarii. The tubular ducts of both *T. refertus* and *T. multiductus* are of nearly identical form, but in *T. refertus* they are relatively few in number, being much less numerous than the trilocular pores. Well stained specimens of *T. refertus* show some slight sclerotization of the anal cerarii, but this is not so well developed as in *T. multiductus*. The hind femora of *T. refertus* possess translucent dots as do those of *T. multiductus*, but multilocular disc pores were not found in any of the *T. refertus* specimens examined.

*Trionymus multiductus* and *T. refertus* probably do not properly belong in the genus *Trionymus*. The presence of multiple conical setae in the existing cerarii and the complete, or nearly complete, absence of multilocular disc pores seem to set these two species apart from other

forms assigned to *Trionymus*. Typical *Trionymus* apparently are confined to grasses, sedges, and a few other monocotyledons so that the presence of two species definitely attached to a dicotyledonous tree seems to be anomolous host relationship for the genus.

Living specimens of *T. multiductus* resembled those of *T. refertus* except that the two pairs of wax filaments present were much longer. In *T. multiductus* the caudal pair of filaments were from about as long as to nearly twice as long as the body, and the penultimate pair of filaments were about half the length of the caudal pair. In living specimens of *T. refertus* which I have collected the caudal pair of filaments were each about one-fourth or less as long as the body.

At Pupukea, Oahu, I found both *T. refertus* and *T. multiductus* present on a group of *Syzygium* trees along the trail. Laboratory examination of this material revealed that each of these species was apparently responsible for a particular type deformation of the infested host leaves. All colonies of *T. multiductus* were confined to leaves folded over longitudinally near the midrib so that the entire leaf was formed into a rather spacious pocket. Specimens of *T. refertus*, on the other hand, were found only within narrow pockets along the leaf margins formed by the tightly rolled-over leaf edges.

#### **Nesococcus pipturi** Ehrhorn

*Nesococcus pipturi* Ehrhorn, 1916, PROC. HAW. ENT. SOC. 3 (3):246.

This species has been recorded previously from Oahu and Molokai. During August of 1958 I collected a series of specimens from the leaves of *Pipturus* growing within Kilauea-Iki Crater on the island of Hawaii.

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