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THE CAVERNICOLOUS FAUNA OF HAWAIIAN LAVA TUBES

12. A new species of blind troglobitic earwig (Dermaptera: Carcinophoridae), with a revision of the related surface-living earwigs of the Hawaiian Islands[1]

By **A. Brindle**[2]

Abstract. The first known species of blind troglobitic earwig, *Anisolabis howarthi*, is described from a pair found in caves on the island of Hawaii. The species is related to a complex of surface-living species hitherto known under the name of *Anisolabis perkinsi*. This complex has been found to include, in addition to *A. perkinsi*, 4 new species, *A. hawaiiensis, A. mauiensis, A. oahuensis,* and *A. breviforceps*. Each of these species is restricted to separate islands except for the last 2, which both occur on the island of Oahu. A less closely related species, *Anisolabis eteronoma*, is included in a revision of the endemic apterous earwigs of the Hawaiian Is belonging to the family Carcinophoridae. A key to these species is presented; the key also includes 2 cosmopolitan species which occur on the Hawaiian Is, *Anisolabis maritima* and *Euborellia annulipes*, since these can be confused with the endemic species. Notes on the distribution and possible affinities of the endemic species are given.

Although 3 species of blind earwigs have been previously described, these live in soil or humus (Brindle 1968, 1975) and not in caves. They are small or very small earwigs, from 3–9 mm in length, pale in color, and 1 species each is recorded from the island of Reunion in the Indian Ocean, from Sunchales in the province of Sante Fe in Argentina, and from the island of Santa Cruz in the Galapagos Is. The species from Reunion belongs to the family Labiidae, but the larger species from Argentina and the Galapagos Is belong to a single genus, *Anophthalmolabis* Brindle, of the family Carcinophoridae, the family to which the new troglobitic earwig from Hawaii belongs. No close relationship exists, however, between the small, blind, soil-living earwigs and the troglobitic earwig, and the male genitalia are much different in structure.

A number of species of earwigs have been recorded from caves in various countries, but with 1 exception these do not differ in structure or color from surface-living species and almost all are such species. The almost black *Chelisoches bimammatus* Hebard, from Batu Caves, Selangor, Malaysia, is hardly separable from the common Australasian and Pacific species *Chelisoches morio* (Fabricius) (Chelisochidae), while the

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black and orange *Carcinophora percheroni* (Guerin-Meneville & Percheron) (Carcinophoridae) is found widely as a surface-living species in South and Central America but occurs in caves, often in the dark zones, in Trinidad and Cuba, unaltered morphologically. The only previously described species of earwig which is to any extent adapted for a cave life is *Diplatys milloti* Chopard (Diplatyidae) from Grotte Sagea, Kindia, Guinea, West Africa (Chopard 1940). In this species the antennae, body, and legs are more slender and more elongated than is usual in the genus and the cuticle is pale, but the eyes are normal in size and evidently functional. It is not a troglobitic form (Vandel 1964), and it is evidently a species which has only comparatively recently adopted a life in caves and in which only slight changes have yet occurred.

The pair of blind earwigs from caves on the island of Hawaii, sent to me by Dr F. G. Howarth, are the first known troglobitic earwigs and the new species shows considerable adaptation to cave life.

Anisolabis howarthi Brindle, **new species** FIG. 1–3, 12, 14, 15

Yellowish brown, abdomen darker brown; antennae paler distally. Cuticle of head and thorax impunctate, of ♂ abdomen more or less uniformly and finely punctured, distal part of each tergite impunctate, and this smooth area more extensive on anterior tergites; head, 1st antennal segment, palpi, and femora with long sparse setae; pronotum with 3 setae near each anterolateral angle; mesonotum with lateral setae, and abdomen with very short, yellow, depressed hairs, which are sparse and inconspicuous; tibiae pubescent ventrally and with setae; tarsi pubescent and with numerous short setae ventrally and with thicker short cylindrical processes; claws long, curved and bluntly pointed apically.

♂ (FIG. 1). Head longer than broad, clypeal area swollen, epicranial sutures distinct; eyes whitish, narrow, evidently degenerate since the surface is without regular facets but has a few irregular pits. First antennal segment longer than the distance between the antennal bases, 2nd segment transverse; proportions of segments 3–5 = 2.25:1.25:1.35. Distal segments missing from holotype. Pronotum longer than broad, widened posteriorly, lateral margins sinuate; mesonotum and metanotum translucent, transverse. Legs long and slender, apex of hind tarsi reaching the apex of the abdomen. Abdomen parallel-sided, narrow, sides of tergites with fine punctures, and neither rugose nor with lateral longitudinal ridges; last tergite long, irregularly punctured, punctures tending to form sinuous longitudinal irregular rows medially; median furrow distinct but shallow; sides of tergites almost smooth but with slight vertical striations. Penultimate sternite elongated (FIG. 2), with a few long setae, mainly towards margins. Pygidium short, rounded. Each branch of forceps trigonal basally, elliptical in cross section distally, a dorsal ridge at base crenulated, inner margin crenulated for basal ⅔; branches asymmetrical. Genitalia (FIG. 14) simple, with 2 basal penes which are united at base (P); 2 distal lobes (DL), 1 directed forwards, the other backwards; virga (V) slender; parameres (PA) elongated, with outer margin sinuous (FIG. 15), median membrane (MM) widened on basal ½, inner membrane (IM) with margin straight. Length of body 20 mm, forceps 3 mm.

♀. Similar to ♂; abdominal tergites coriaceous, less smooth than in ♂ but almost impunctate; last tergite with median furrow deeper and wider, and cuticle scarcely punctured; each branch of forceps mainly straight; dorsal ridge prominent at base, inner margin strongly crenulated and darkened, and widened on basal ½, this wider part ending in a blunt tooth (FIG. 3). Length of body 20 mm, forceps 4 mm.

Distribution. Known only from Pahoa and Kazumura Caves, Hawaii I.

Holotype ♂, HAWAIIAN IS: Hawaii I, Pahoa, Pahoa Cave, dark zone, 20.VIII.1977, F.G. Howarth (BISHOP 11,450). Allotype ♀, Hawaii I, Mountain View, Kazumura Cave, dark zone, 1219 m from entrance, 13.VII.1972, J. Jacobi, F.G. Howarth (BISHOP).

I have much pleasure in naming this species after the discoverer of the male specimen, Dr F. G. Howarth, in recognition of his work on the caves of Hawaii and for his interest in the apterous species of endemic earwigs.

The adaptations of *A. howarthi* for a troglobitic life are best appreciated by a comparison of this species to the related surface-living apterous endemic earwigs of Hawaii (FIG. 1, 4, 12, 13). The body of *A. howarthi* is much more slender and narrow, and the legs and antennae correspondingly narrow. The basal antennal segments are similar to those of the surface species and it is the distal segments which have become greatly elongated; there may be more segments in the antennae, but this is difficult to check since the antennae of most specimens are broken, as is usual in preserved earwigs. The body color is paler but not greatly so. The main features are on the head, and the head itself is much narrower and elongated (FIG. 1, 4). The main cause of this elongation is the elongation and swelling of the clypeal area [FIG. 12, 13 (CL)]. The maxillo-labium (MX) is enlarged and extends much more anteriorly, so that the base of the maxillary palpus (MP) is on a level with the base of the antenna [FIG. 12 (A)], whereas in the surface species (FIG. 13) the base of the maxillary palpus is on a level with the eyes. The effect is to push the ventral mouthparts forwards, together with the associated sensory organs, so that they project well beyond the labrum (L) and thus are well sited for locating food in total darkness. The eyes are reduced in size and slitlike and show no evidence of facets. According to Vandel (1964) the corneal facets and the crystalline cones below are usually the structures most markedly affected in cavernicolous insects, and this reduction always precedes reduction of the deeper regions of the eyes. Another sensory adaptation is the increase in number and length of the setae on the head, mainly on the clypeal and occipital areas, and ventrally (FIG. 12, 13). In consequence of the elongation of the abdomen the penultimate sternite (FIG. 2) is much longer and relatively narrower than in the surface species.

The relationship of *A. howarthi* to the surface-living endemic apterous species is close and clearly shown in the similarity of the male genitalia, including the parameres. All have male genitalia as in FIG. 14; the parameres vary to a limited extent (FIG. 15–20), except in *A. eteronoma* Borelli in which the parameres are much different (FIG. 23).

The taxonomy of the surface species has been confused, earlier records attributing some to species known from other areas. Bormans (1882) recorded *Anisolabis littorea* White, a New Zealand species, from Oahu and Maui islands, while Brunner von Wattenwyl (1895) added *A. pacifica* Erichson, an Australian species. Borelli (1909) described 2 new species, *A. eteronoma* and *A. aporonoma,* from Oahu I, and Burr (1910a) described *A. perkinsi* from Kauai I. Burr (1910b) recorded *A. xenia* Kirby, a Norfolk I species from Hawaii I.

Hebard (1922) clarified the taxonomic position of these earwigs, and recognized only 2 endemic species, *A. eteronoma* and *A. perkinsi,* a position which was retained by Zimmerman (1948). Hebard was a most competent worker and much of his synonymy is still accepted.

Neither *A. littorea* nor *A. pacifica* occur on the Hawaiian Is, being restricted to New Zealand and Australia, respectively. Although Burr (1910a) thought that both *A. eteronoma* and *A. aporonoma* were indistinguishable from the cosmopolitan *Euborellia annulipes* (Lucas), Hebard (1922) regarded the former as distinct and synonymized *A. aporonoma* with *E. annulipes.* From my own study of the original descriptions, Hebard is correct. The key characters are the presence of some white distal antennal segments in both *A. eteronoma* and *A. aporonoma* (which agrees with *E. annulipes*), and, more significant, the presence of lateral longitudinal ridges on the abdomen of the male of *A. aporonoma* but not on the male abdomen of *A. eteronoma.* Since *E. annulipes* has such ridges while no endemic Hawaiian species has them, *A. eteronoma* is clearly distinct. The sizes given by Borelli (1909) correspond with this conclusion, except that the female of *A. aporonoma* is quoted as 23 mm in body length, which is far too large for *E. annulipes* and could be an error in the assignment of the female, which lacks abdominal ridges. *A. xenia* is closely related to the endemic Hawaiian species (except *A. eteronoma*) but is clearly specifically distinct. *A. xenia* is only known from 3 specimens from Norfolk I.

Anisolabis Fieber, the genus to which the Hawaiian endemic apterous earwigs belong, is a difficult genus taxonomically, since the relatively few external characters are usually applicable to males only. The male genitalia are important in classification and determination of genera and species. The determination of female specimens is usually impossible with any certainty unless they are associated with males. I am indebted to Dr F. G. Howarth for arranging the loan of available specimens from the Bishop Museum, and for his suggestion that segregation of species by islands seemed likely. A study of the material from the Bishop Museum indicates that each island has its own species and some islands have more than one.

A. eteronoma as treated here is that accepted by Hebard (1922) and it agrees with the original description. *A. perkinsi* as accepted here agrees with the types in the British Museum (Natural History). Hebard (1922, Pl. XXVI, fig. 1) illustrated the male forceps of typical *perkinsi* but included with it what I now consider *hawaiiensis,* n. sp. (Hebard, 1922, Pl. XXVI, fig. 2) together with *mauiensis,* n. sp., *oahuensis,* n. sp., and *breviforceps,* n. sp. Hebard (1922) did, however, note the differences and suggested that *A. perkinsi* is a plastic species that may include several island races; these I consider to be distinct species.

The separation of these species is based on the structure of the parameres of the male genitalia, which are normally reasonably constant in shape, although variations can occur in genitalia taken from teneral specimens or unusually small males. Each paramere [FIG. 15 (PA)] consists of an outer more sclerotized part; the inner membrane (IM); and a median membrane (MM), which extends diagonally across the paramere and usually appears darker due to its superposition over the paramere.

Each paramere articulates on the distal external angle of the main basal part of the genitalia, the basal penes (A). Although the differences are small, they are constant in the material available; only in *A. perkinsi* is there any large difference in the shape of the forceps.

The genitalia as a whole are simple (FIG. 14), consisting of basal penes (P) from each of which arises a distal lobe (DL); in each distal lobe is a slender virga (V). At rest 1 distal lobe projects forwards and 1 projects backwards. The genitalia of *Euborellia* are similar, but the virga may be scarcely visible and each distal lobe has a prominent dark sclerotized denticulated end [FIG. 34 (DE)] and usually a denticulated lateral pad (DP). In the shorter lobe, these lie within the distal lobe until the lobe is everted.

The following key includes all the endemic Hawaiian apterous earwigs (Carcinophoridae), as well as the cosmopolitan *A. maritima* and *E. annulipes,* which are liable to be confused with the endemic species. These species form the subfamily Psalinae of Hebard (1922) and Zimmerman (1948); this subfamily is correctly Carcinophorinae (Carcinophoridae).

KEY TO SPECIES

1. Eyes reduced, slitlike, nonfunctional; body, legs, and antennae long and slender (FIG. 1) .... **Anisolabis howarthi, n. sp.**

Eyes normal in size and function; less slender species (FIG. 4, 7) 2

2. Antennae dark in color with 1 or more distal segments white; usually blackish in color; parameres of ♂ genitalia short and broad 3

Antennae unicolorous; usually paler in color; parameres of ♂ genitalia elongated 4

3. Eyes large (FIG. 7); larger, body length 13–17 mm; legs yellowish brown, femora not darkened; abdomen of ♂ without lateral longitudinal ridges on posterior tergites; ♂ penultimate sternite with a broad posterior margin (FIG. 8); genitalia as FIG. 14 but parameres short and broad (FIG. 23) .... **Anisolabis eteronoma**

Eyes smaller (nearly as FIG. 4); smaller, body length 9–11 mm; legs yellowish, femora darkened basally or with a dark ring; abdomen of ♂ with lateral longitudinal ridges on posterior tergites; ♂ penultimate sternite similar to FIG. 5; genitalia FIG. 34 .... **Euborellia annulipes**

4. Abdomen finely punctured, sometimes almost impunctate, but with isolated sparse large shallow punctures; ♂ forceps usually strongly curved and asymmetrical (FIG. 33), rarely simple in small ♂ (FIG. 10); forceps of ♀ simple (FIG. 11 or more slender); parameres of ♂ genitalia almost always with a narrowed apical part (FIG. 22), rarely without (FIG. 21) .... **Anisolabis maritima**

Abdomen obviously and closely punctured, the puncturation regular and without isolated sparse large shallow punctures; ♂ forceps otherwise; parameres of ♂ genitalia without a narrowed apical part 5

5. Male and ♀ forceps usually dissimilar, without teeth or swellings on the inner margins, those of ♂ arcuate (FIG. 28), those of ♀ simple and slender (FIG. 30); parameres of ♂ genitalia FIG. 20 ... Kauai I .... **Anisolabis perkinsi**

Male and ♀ forceps usually similar, with median teeth or swellings on inner margins 6

6. Forceps of both sexes short and broad (FIG. 26, 27); parameres of ♂ genitalia FIG. 19 ... Oahu I, Mt Tantalus .... **Anisolabis breviforceps, n. sp.**

Forceps of both sexes usually straight, relatively narrow, sometimes curved 7

7. Median membrane of ♂ paramere narrow (FIG. 16), ♂ and ♀ forceps usually more slender ... Hawaii I .... **Anisolabis hawaiiensis, n. sp.**

Median membrane of ♂ parameres wider; ♂ and ♀ forceps usually broader 8

8. Paramere of ♂ genitalia more rounded at tip (FIG. 18) ... Oahu I ... **Anisolabis oahuensis, n. sp.**

Paramere of ♂ genitalia less rounded at tip (FIG. 17) ... Maui I ..... **Anisolabis mauiensis, n. sp.**

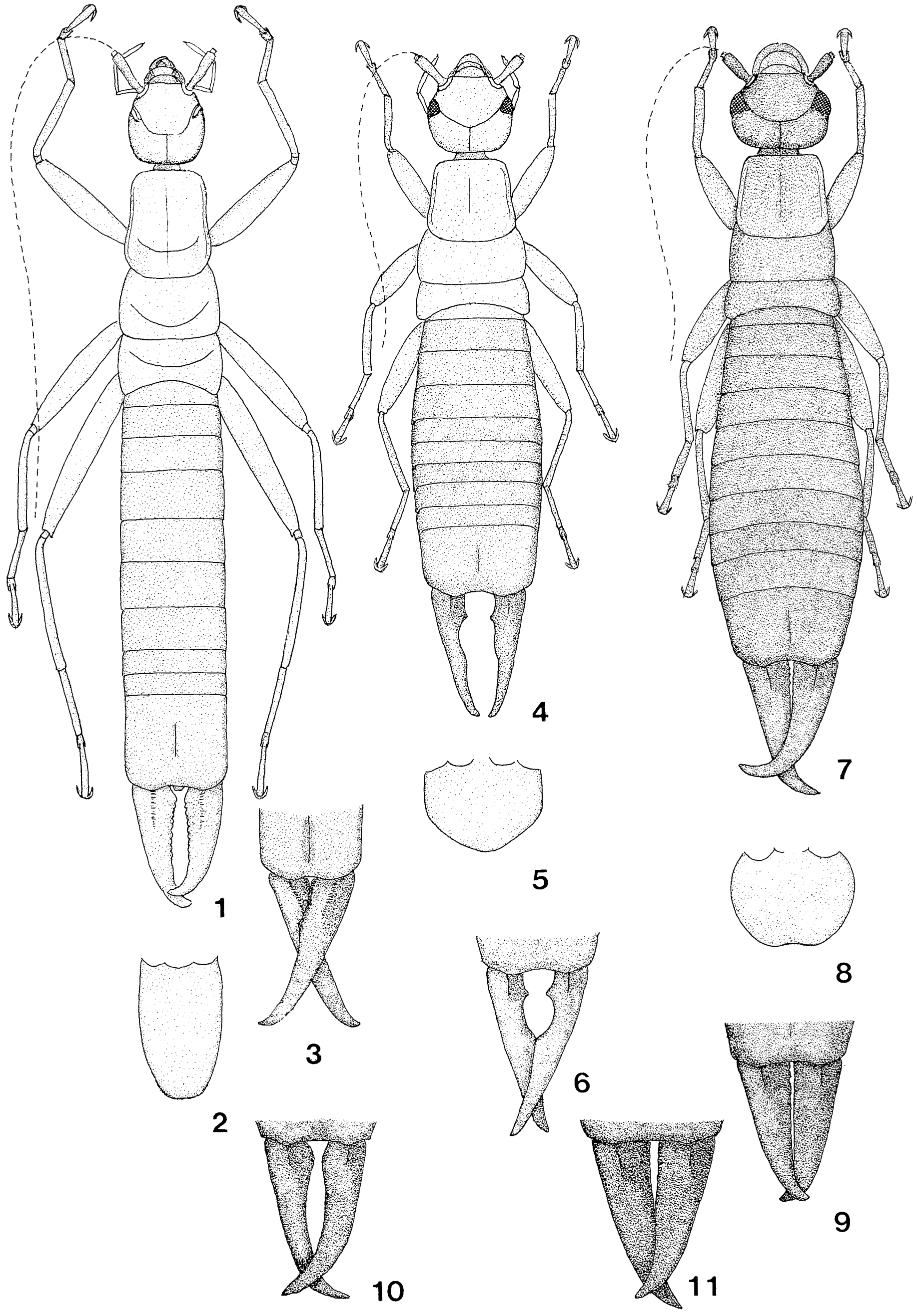

FIG. 1–11. **1–3,** *Anisolabis howarthi*: **1,** ♂, dorsal view; **2,** ♂ penultimate sternite; **3,** ♀ forceps. **4–6,** *A. hawaiiensis*: **4,** ♂, dorsal view; **5,** ♂ penultimate sternite; **6,** ♀ forceps. **7–9,** *A. eteronoma*: **7,** ♂, dorsal view; **8,** ♂ penultimate sternite; **9,** ♀ forceps. **10–11,** *A. maritima*: **10,** ♂ forceps, small form; **11,** ♀ forceps.

All specimens listed below are in the Bishop Museum, except for those noted for the British Museum (Natural History) (BMNH) and the Manchester Museum (MM).

Anisolabis eteronoma Borelli FIG. 7–9, 23

Anisolabis eteronoma Borelli, 1909, Boll. Lab. Agric. Zool. Portici **3:** 315.—Hebard, 1922, Occ. Pap. Bernice P. Bishop Mus. **7**(14): 309.—Zimmerman, 1948, Insects of Hawaii, Vol. 2: 200.

Black, shining; legs yellowish brown; antennae dark brown or blackish, segments 13–15 white or partially white; eyes large; pronotum almost quadrate; abdominal puncturation mainly fine but closer on posterior tergites, sides of tergites 7–9 more strongly punctured and tergite 8–9 almost rugose but without lateral longitudinal ridges. ♂ penultimate sternite broad, posterior margin somewhat concave or excised (FIG. 8); ♂ forceps broad, apices curved (FIG. 7); those of ♀ less curved at apices (FIG. 9). ♂ parameres short (FIG. 23), similar to those of the genus *Euborellia,* but the distal lobes lack the sclerotized dark ends and pads of this genus. Length of body 13–17 mm, forceps 3–3.5 mm.

Distribution. Hawaii I, Maui I, Oahu I, Kauai I.

Material examined. HAWAIIAN IS. Maui I: E Maui, 1♀, Hana, 30 m Offal Cave, 2.VIII.1977, rotting wood, dark zone, F.G. Howarth. Oahu I: 2♀, rotting logs with eggs; 1♂, Koolau Mts, 597 m, 10.V.1977, G.K. Uchida (det. *A. eteronoma,* F.G. Howarth); 1♀, Manoa, 4.VII.1938, N.L.H. Krauss; 1♀, Manoa Val, 16.VI.1963, cow dung; 1♂, Honolulu Mts, 549 m, R.C.L. Perkins; 1♀, Tantalus, under log, 29.I.1959; 1♂, Manoa, 1938 (MM); 1♀, rotting logs (MM). Kauai I: 1♂, nr Hanalei, side of Highway 56, 13 km before end of road, sea level, 13.V.1969, mango trees.

Anisolabis hawaiiensis Brindle, **new species** FIG. 4–6, 13, 16, 24, 25, 31

Anisolabis perkinsi Burr: Hebard, 1922, Occ. Pap. Bernice P. Bishop Mus. **7**(14): 310 (partim, Pl. XXVI, fig. 2).—Zimmerman, 1948, Insects of Hawaii, Vol. 2: 201 (records from Hawaii I only).

Reddish brown, abdomen darker, or with all body generally darker; antennae yellowish brown or brown; legs brownish. Cuticle glabrous and almost smooth anteriorly; abdominal tergites closely and regularly punctured and with sparse short yellow depressed hairs.

♂ (FIG. 4). Head transverse, clypeal area slightly swollen, epicranial sutures distinct, eyes small; 1st antennal segment as long as distance between the antennal bases, 2nd segment transverse, ratio of segments 3:4:5 = 2.5:1.5:1.5. Pronotum transverse, slightly widened posteriorly; mesonotum with sparse minute punctures; metanotum with more numerous punctures. Abdomen slightly widened medially and depressed; puncturation weak on 1st and 2nd tergites, stronger and closer on others; puncturation regular and close dorsally, closer and deeper laterally, sides of tergites 5–9 rounded and slightly rugoso-striate but without lateral longitudinal ridges. Last tergite with median furrow deep and wide, puncturation weak and irregular, sides of tergite almost smooth. Penultimate sternite triangular distally with rounded apex (FIG. 5). Pygidium small, flat. Each branch of forceps trigonal at base, dorsal ridge prominent but almost smooth; elliptical or circular in cross section distally; 1 inner tooth on basal ½, rest of branch swollen about midpoint (FIG. 4, 24), sometimes more strongly curved (FIG. 31). Genitalia as FIG. 14 with parameres shaped as FIG. 16, median membrane narrow. Length of body 13 mm, forceps 3.5 mm.

♀. Similar to ♂; abdominal tergites less closely punctured, sides of posterior tergites not rugoso-striate; median furrow on last tergite shallow; pygidium not visible. Each branch of forceps as in ♂ but straighter (FIG. 6, 25). Length of body 13 mm, forceps 3 mm.

Distribution. Hawaii I.

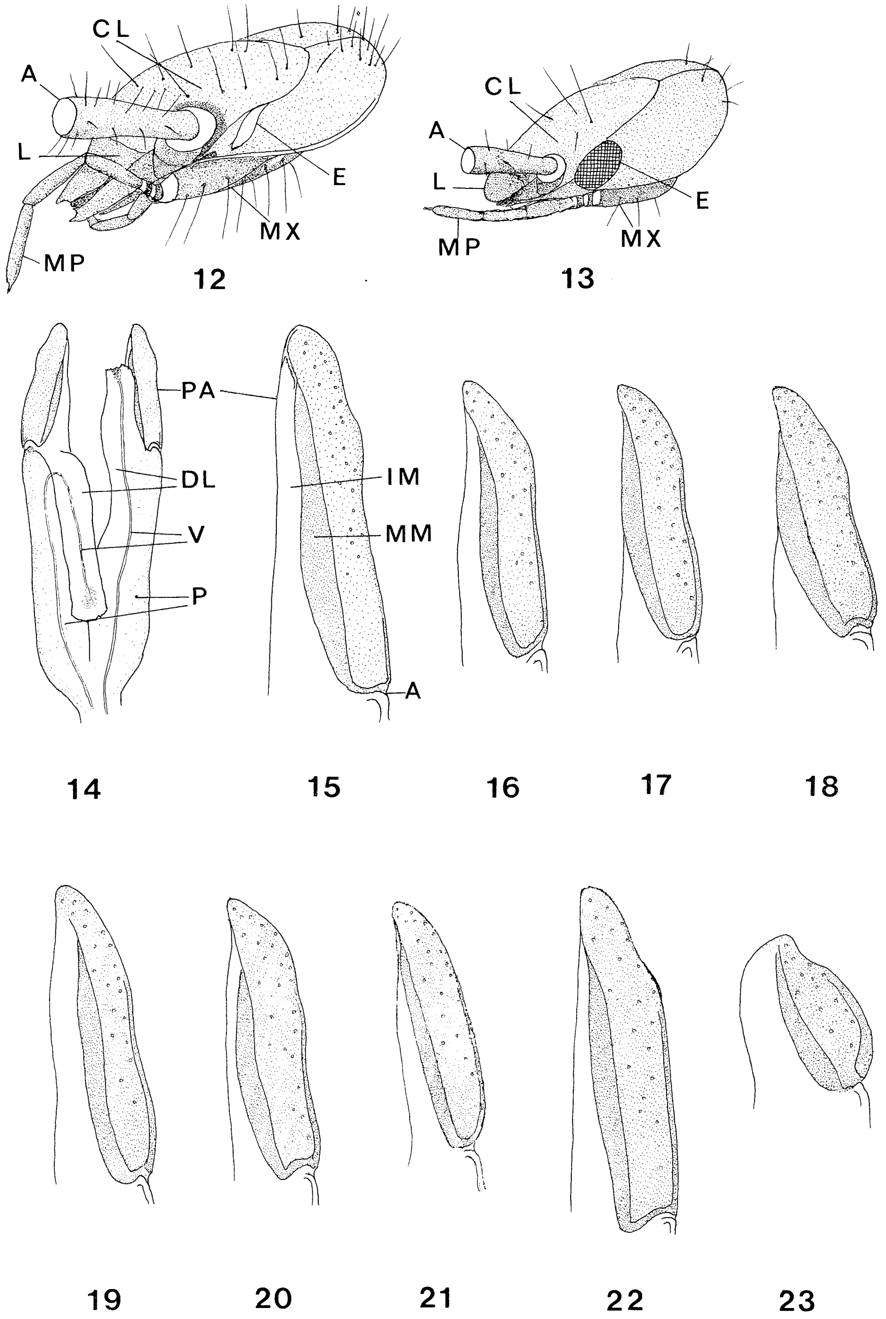

FIG. 12–23. **12,** head of *Anisolabis howarthi,* antero-lateral view. **13,** head of *A. hawaiiensis,* antero-lateral view. **14,** ♂ genitalia, *A. howarthi.* **15–23,** ♂ parameres: **15,** *A. howarthi*; **16,** *A. hawaiiensis*; **17,** *A. mauiensis*; **18,** *A. oahuensis*; **19,** *A. breviforceps*; **20,** *A. perkinsi*; **21,** *A. maritima,* small form; **22,** *A. maritima*; **23,** *A. eteronoma.*

Holotype ♂, HAWAIIAN IS: Hawaii I, Olaa, IX.96[=1896] (Fauna Hawaiiensis Coll., Bishop 11,451). Allotype ♀, Hawaii I, Olaa, 1500 ft (450 m), XII.[18]96 (data on underside of mount) (Fauna Hawaiiensis Coll.). Paratypes, 1♂,1♀, Hawaii I, Pohakuloa, IV.1963, F.A. Bianchi (Bd. of Agric. Honolulu).

Anisolabis mauiensis Brindle, **new species** Fig. 17

Anisolabis perkinsi Burr: Hebard, 1922, Occ. Pap. Bernice P. Bishop Mus. **7**(14): 310 (partim).—Zimmermann, 1948, Insects of Hawaii, Vol. 2: 201 (records from Maui I only).

Very similar to *A. hawaiiensis*; the forceps tend to be relatively shorter; the ♂ parameres are narrower and the median membrane wider (Fig. 17). Length of body 13–14 mm, forceps 2.6–2.8 mm.

Distribution. Maui I.

Holotype ♂, HAWAIIAN IS: Maui I: Iao Val, 1896, Perkins (Fauna Hawaiiensis Coll., Bishop 11,452). Allotype ♀, same data (Bishop). Paratype ♀, same data (BMNH).

Anisolabis oahuensis Brindle, **new species** Fig. 18

Anisolabis perkinsi Burr: Hebard, 1922, Occ. Pap. Bernice P. Bishop Mus. **7**(14): 310 (partim).—Zimmerman, 1948, Insects of Hawaii Vol. 2: 201 (records from Oahu I only).

Very similar to *A. hawaiiensis*; the forceps tend to be thicker and the ♂ parameres are more rounded apically (Fig. 18). Length of body 12–14 mm, forceps 3–3.25 mm.

Distribution. Oahu I.

Holotype ♂, HAWAIIAN IS: Oahu I, Mt. Kaala, 2000 ft [610 m], 27.V.1928, A.M. Adamson (Bishop 11,453). Allotype ♀, Oahu I, Honolulu Mts, 1901, winter months, R.C.L. Perkins. Paratypes: Oahu I: 1♀, Honolulu, 2000 ft [610 m], 1896 (Fauna Hawaiiensis Coll.); 1♂, Waianae Mts, Lee side, 2000 ft [610 m], II.1896, Perkins, 543; 1♂, Waianae Mts, 13.III.1910 (Bd. of Agric. Honolulu).

Anisolabis breviforceps Brindle, **new species** Fig. 19, 26, 27

Anisolabis xenia Kirby: Burr, 1910b, Proc. U.S. Natl. Mus. **38:** 448 (misidentification).
Anisolabis perkinsi Burr: Hebard, 1922, Occ. Pap. Bernice P. Bishop Mus. **7**(14): 310 (partim, records from Mt Tantalus only).

Similar to *A. hawaiiensis*, but more robust, abdomen more strongly widened, forceps short and broad, apices blunt and curved ventrally (Fig. 26, 27); parameres well-rounded apically and membrane shorter (Fig. 19). Length of body 14–16 mm, forceps 2–2.75 mm.

Distribution. Oahu I (Mt Tantalus).

Holotype ♂, HAWAIIAN IS: Oahu I, Mt Tantalus, XII.1891, R.C.L. Perkins (Bishop 11,454). Allotype ♀, Mt Tantalus, VIII.1900, Perkins (det. *xenia*) (Perkins Coll.). Paratype, 1♂, no data (det. *A. maritima*) (Fauna Hawaiiensis Coll.).

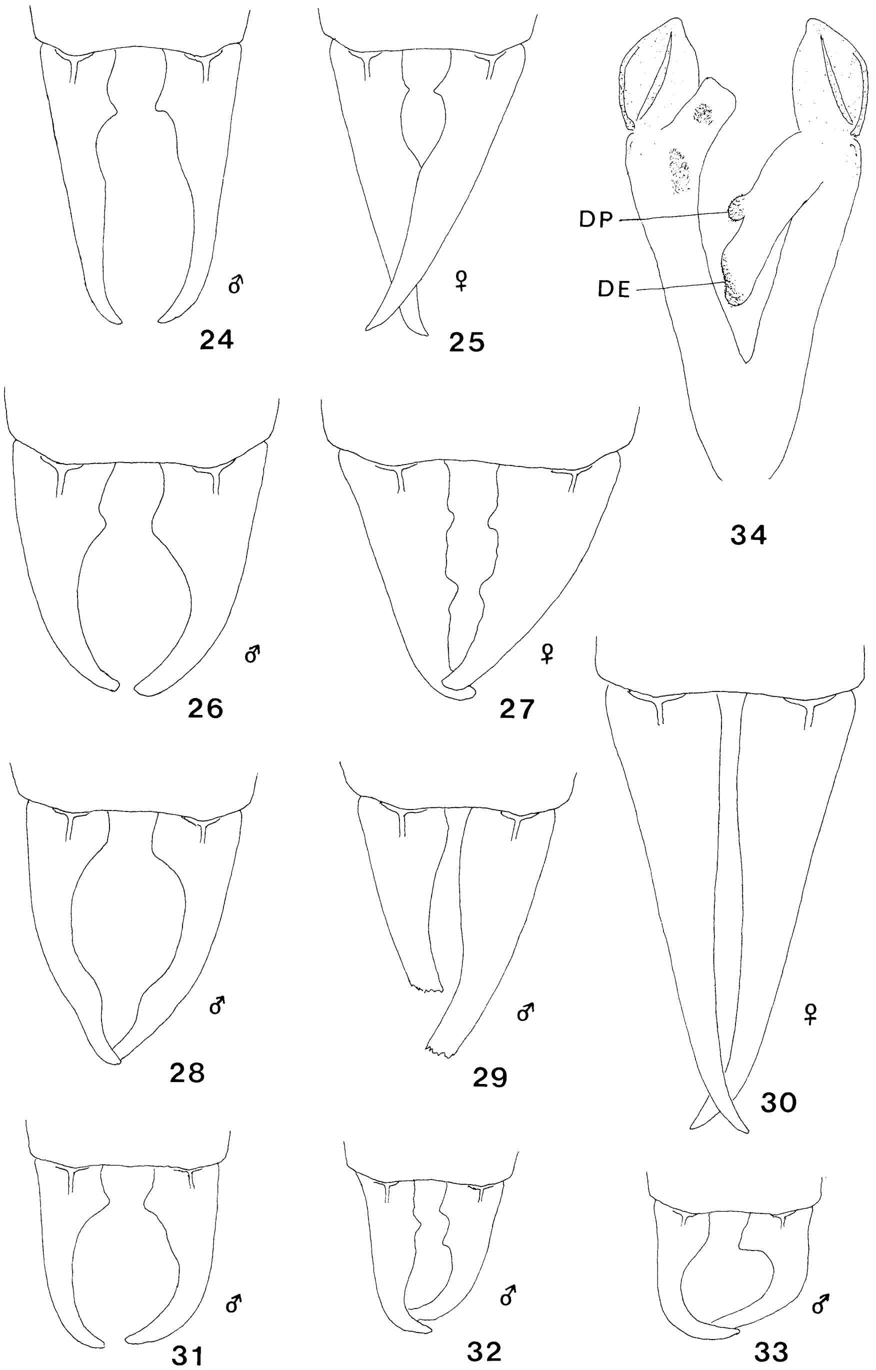

FIG. 24–34. **24–33,** forceps: **24–25, 31,** *A. hawaiiensis*; **26–27,** *A. breviforceps*; **28–30,** *A. perkinsi* (FIG. 29 from holotype); **32,** *A. xenia* (from holotype); **33,** *A. maritima*. **34,** ♂ genitalia, *Euborellia annulipes*.

There is also 1 ♀ from Oahu, Tantalus, R.C.L. Perkins collection, which I have determined as this species; it is much smaller and not so robust as the type material; it was determined as *xenia,* presumably by Perkins.

Anisolabis perkinsi Burr FIG. 20, 28–30

Anisolabis perkinsi Burr, 1910a, Trans. Entomol. Soc. London, **1910:** 178.—Hebard, 1922, Occ. Pap. Bernice P. Bishop Mus. **7**(14): 310 (partim, Pl. XXVI, fig. 1).—Zimmerman, 1948, Insects of Hawaii, Vol. 2: 201 (records from Kauai I only).

Similar to *A. hawaiiensis* but usually more uniformly colored reddish brown or darker; sides of tergites 5–9 scarcely rugoso-striate in ♂ and scarcely more strongly punctured laterally than dorsally; ratio of antennal segments 3:4:5 = 2.25:1.25:1.5, but there is some variation here as in *hawaiiensis.* Distal antennal segments, which are missing in *hawaiiensis,* narrow and long, much different from the basal segments. Male forceps usually arcuate, with a basal inner projection on each branch and distal part sometimes recurved (FIG. 28), branches sometimes asymmetrical. Female forceps long and slender, branches close together (FIG. 30). Parameres of ♂ genitalia FIG. 20. Length of body 12–19 mm, forceps: ♂, 2.5–2.9 mm; ♀, 3–4.5 mm.

Distribution. Kauai I.

Material examined. HAWAIIAN IS: Kauai I: Kaholuamanu, 1220 m, IV.1895, R.C.L. Perkins (holotype ♂, BMNH) (branches of forceps broken apically, FIG. 29); Waimea, 1220 m, VII.1896, Perkins (allotype ♀, BMNH); 1♀, Waimea, 1220 m, VIII.1896, Perkins (det. *A. pacifica* Erichson) (BMNH). 1♂, Kauai, 610–1220 m, II–III.1919, J.A. Kusche (det. *A. perkinsi* by Hebard, 1925); 1♂, Kauai, 1220 m, 1897 (det. *A. pacifica*); 2♂,5♀, Kauai, 1220 m, III.1919, Kusche (1♀ det. *A. perkinsi* by Hebard, 1921); 1♂, Haulamano, III.1919, Kusche (det. *A. perkinsi* by Hebard, 1925); 1♀, Kaholuamanu, 1220 m, IV.1895 (det. *A. pacifica*); 1♂,1♀, Kaholuamanu, 1067 m, Kusche; 1♀, Kokee, II.1919, Kusche (det. *A. perkinsi* by Hebard, 1921); 1♂, 1♀, Kauai, 1919, Kusche (MM).

The forceps of the holotype are broken (FIG. 29), therefore the typical arcuate shape is not shown. The apical part of the ♂ forceps is sometimes more strongly recurved and sometimes the forceps appear to be somewhat malformed.

Anisolabis maritima (Bonelli) FIG. 10, 11, 21, 22, 33

Forficula maritima Bonelli *in* Gene, 1832, Ann. Sci. Regn. Lomb.-Venet. **2:** 224.
Anisolabis maritima: Fullaway, 1914, Proc. Hawaii. Entomol. Soc. **3:** 22 (Laysan I).

Generally black, with entirely yellow legs, and with distal antennal segments unicolorous, dark; abdominal puncturation as given in the key usually characteristic, as are the strongly curved ♂ forceps (FIG. 33); the ♂ parameres almost always have a distinct narrowed apical part (FIG. 22). The ♀ forceps are simple. Length of body 14–18 mm, forceps 2.5–3 mm (usual sizes).

Distribution. Cosmopolitan, mainly coastal.

Material examined. HAWAIIAN IS. Laysan I: 1♂,1♀, and immatures. Oahu I: 1♂,1♀, and immatures, Kaalaea Beach, 3.V.1953, Kondo; 1♂,2♀, W Loch Pearl Harbor, in beach litter, 2.II.1974, F.G. Howarth.

The specimens from Laysan I are unusual in their large size and reddish-brown color, while those from Kaalaea Beach, Oahu are unusually small but of the normal black color. The ♂ measures only 11.5 mm in body length with forceps 2 mm; the forceps are only weakly curved (FIG. 10), and the parameres lack the typical narrowed distal part (FIG. 21). The last feature suggested that this may be a distinct species. However, examination of material of *A. maritima* in the Manchester Museum has shown that unusually small males may have much less strongly curved forceps than those of normal size, and in the small males examined from Turkey and from Rodriquez I in the Indian Ocean, the apical part of the parameres is much less distinctly narrowed though still observable. The male from Oahu is therefore considered as an extreme form of *A. maritima* in which the apical narrowed part of the parameres is not observable.

A. maritima is apparently scarce in the Hawaiian Is, and I have only found the one previous record by Fullaway. The species is not listed in Zimmerman (1948).

Euborellia annulipes (Lucas) FIG. 34

Forficesila annulipes Lucas, 1847, Ann. Soc. Entomol. Fr. (2)**5:** 84.
Euborellia annulipes (Lucas): Hebard, 1922, Occ. Pap. Bernice P. Bishop Mus. **7**(14): 312.—Zimmerman, 1948, Insects of Hawaii, Vol. 2: 202.

Generally shining black, the legs yellow with a broad dark ring on each femora; the distal antennal segments are dark with one or more segments white. The color may be paler, especially in specimens preserved in alcohol. The ♂ forceps are weakly curved and those of the ♀ almost straight except at apices.

Distribution. Cosmopolitan.

Material examined. HAWAIIAN IS. Laysan I: 1♂. Oahu I: 1♂,2♀, Waianae Mts, 1973.

This species is the most common species in the Hawaiian Is (Zimmerman 1948, F. G. Howarth, in litt.). Zimmerman (1948) notes that rare specimens of *E. annulipes* with elytra have occurred in the Hawaiian Is, but this must be an error. Neither *A. maritima* nor *E. annulipes* have any trace of elytra, and if specimens similar to *E. annulipes* but with elytra occur, these belong to another species. If the elytra are relatively large and meet along the midline of the mesonotum, the most likely species is *E. tegminata* (Caudell) described from Fiji, one which could be introduced into the Hawaiian Is. If the elytra are only represented by lateral flaps, the species is almost certainly *E. stali* (Dohrn), which resembles a small *E. annulipes* and which is widely distributed in the Western Pacific.

DISCUSSION

The Hawaiian Dermaptera are well summarized in Zimmerman (1948) and the nomenclature used is still correct with 3 exceptions as follows. *Prolabia arachidis* (Yersin) (p. 204) is now *Marava arachidis* (Yersin), and *Sparattina nigrorufus* (Burr) (p. 210) is now *Hamaxas nigrorufus* (Burr); the synonymy of these 2 species is dealt with in

Brindle (1972). The 3rd exception is the status and composition of the Psalinae (p. 200).

The name Psalinae derives from *Psalis* Serville 1831 (Dermaptera) but this name is preoccupied by *Psalis* Huebner 1823 (Lepidoptera). Scudder (1876) proposed the name *Carcinophora* to replace *Psalis,* but this seems to have been overlooked since Burr (1910a, 1910b, and all his numerous papers) retained the preoccupied name. Psalinae thus is correctly Carcinophorinae, and is now also elevated to family rank.

Zimmerman (1948) lists 3 species of this family, *Anisolabis perkinsi, A. eteronoma,* and *E. annulipes,* to which should be added *A. maritima.* In the present paper, *A. perkinsi* of Zimmerman is shown to include 5 species, *A. perkinsi, A. oahuensis, A. breviforceps, A. mauiensis,* and *A. hawaiiensis,* each of which is restricted to a single island. The troglobitic *A. howarthi* is a new find. *A. maritima* and *E. annulipes* are the only species known from any other area and both are cosmopolitan.

The 7 endemic species of the family on the Hawaiian Is form 2 groups—the *eteronoma* group with a single species, *A. eteronoma,* and the *perkinsi* group, which includes the other 6 species. Although *A. eteronoma* is distributed throughout the islands and does not yet show evidence of forming island races, the species of the *perkinsi* group show clear evidence of segregation by island and are regarded here as distinct species. For this reason it appears that the *perkinsi* group comprises the older inhabitants of the islands; this would also account for the specialized *A. howarthi.*

Separation of the species of the *perkinsi* group is largely by the shape of the ♂ parameres (FIG. 15–20) and locality. Some external differences occur, as in the key, but these may be subject to variation. One ♂ of *A. hawaiiensis* from Pohakuloa has strongly curved forceps (FIG. 31) unlike the holotype ♂ (FIG. 26), but the ♂ parameres are identical.

The species of the *perkinsi* group now appear to be rare; the specimens examined date from 1891 to 1928 and Dr F. G. Howarth (in litt.) has mentioned that some species may now be extinct.

The only known Pacific species which clearly seems to be closely related to the *perkinsi* group is *A. xenia* from Norfolk I. The ♂ genitalia of this latter species have still to be examined, but the forceps of both species are remarkably similar as well as all other external features. *A. xenia,* known from the holotype ♂ (FIG. 32) and allotype ♀ in BMNH, can be separated from members of the *perkinsi* group by its larger size (body length 18–19 mm, forceps 4.25 mm ♂, 4.75 mm ♀) and by its darker color, being almost blackish anteriorly with the abdomen dark reddish brown; the legs are yellowish brown with the femora darkened apically, especially in the ♂. A 3rd specimen, a ♀, in the collection of the Copenhagen Museum, has also been examined.

The relationships of the 2 groups of the Hawaiian endemic *Anisolabis* with *Anisolabis* from other areas, except *A. xenia,* are somewhat obscure, partly due to our lack of knowledge of the Carcinophoridae of some areas. The western Pacific is characterized by a group of small species of *Anisolabis* (from 6–9 mm in body length), the *verhoeffi* group, which occurs in New Guinea, the Bismarck Is, the Solomon Is, Micronesia, and the New Hebrides, but this group is not closely related to the *perkinsi* group. The 2 known species of *Anisolabis* from New Caledonia also appear to have no clear affinities to the *perkinsi* group. The eastern and southern Pacific are not known to have related species, and the only possible affinities seem to lie in the Australian fauna which is yet poorly known. The relationship of *A. xenia* with the *perkinsi* group does suggest a southwestern affinity, but why the Hawaiian Is and Norfolk I have almost identical species is unknown.

The possible affinities of *A. eteronoma* are also obscure. Almost identical species occur in Africa and SE Asia; this may suggest that the affinities of *A. eteronoma* lie toward the west on the mainland of Asia rather than toward the southwestern Pacific, as seems possible for the *perkinsi* group. Much more research on the Carcinophoridae of Eastern Asia and Australia is necessary before any affinities of the Hawaiian fauna are likely to become clear.

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