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RECORDS OF THE HAWAII BIOLOGICAL SURVEY FOR 1996
Part 2: Notes[1]

This is the second of 2 parts to the *Records of the Hawaii Biological Survey for 1996* and contains the notes on Hawaiian species of protists, fungi, plants, and animals including new state and island records, range extensions, and other information. Larger, more comprehensive treatments and papers describing new taxa are treated in the first part of this *Records* [*Bishop Museum Occasional Papers* 48].

Foraminifera of Hawaii: Literature Survey

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The result of a compilation of a checklist of Foraminifera of the Hawaiian Islands is a list of 755 taxa reported in the literature below. The entire list is planned to be published as a *Bishop Museum Technical Report.* This list also includes other names that have been applied to Hawaiian foraminiferans. Loeblich & Tappan (1994) and Jones (1994) disagree about which names should be used; therefore, each is cross referenced to the other.

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The Genus *Septoria* (Fungi: Deuteromycetes) in Hawai'i

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Among the pathogenic fungi under consideration as potential biocontrol agents of invasive alien plants in Hawai'i, species of the genus *Septoria* (classified in the order Sphaeropsidales of the form-class Deuteromycetes) have received perhaps a disproportionate amount attention. *Septoria* is a large, ubiquitous genus with over 1,500 species occurring as pathogens on a wide variety of both dicotyledonous and monocotyledonous host genera, representing a number of families, primarily causing leaf lesions which often lead to defoliation. The fungus reproduces by microscopic asexual spores (conidia) which are several-celled and narrowly elongate (i.e., threadlike) in appearance. As is common of

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other fungi which produce a proliferation of microscopic spores, *Septoria* spp. are primarily disseminated by wind, possibly aided in local dispersal by air currents and dripping or splashing rain. Insects or other biotic agents are of less, or little importance in dispersal. These fungi are characterized by their host-specificity, most being limited to a single species, or closely related hosts within a single genus, and are not known to cross into other plant families. Reflecting this host specificity, the species concept within *Septoria* is defined to a significant degree by the host upon which a given isolate occurs. *Septoria* spp. are not likely to be encountered in nature apart from the host with which they are associated. This factor considered together with spore dimensions and, secondarily, dimensions and morphology of pycnidial conidiomata (flask-shaped fruiting bodies) are the traditional basis for species delimitation (Alexopoulos & Mims, 1979). Accordingly, specific epithets within *Septoria* are most frequently derivations of the generic, specific, or common name of the host. Aside from their host specificity, *Septoria*-caused diseases are frequently virulent, leading to leaf death and/or defoliation, which can place the host under significant stress, subsequently decreasing vigor and aggressiveness. Species of *Septoria* sporulate readily *in vivo* and can be readily cultured artificially, lending to their usefulness as biocontrol agents. Their genetic stability is indicated by the fact that of the several species known in Hawai‘i since the late 1800s and early 1900s, none has been known to expand its host range or otherwise shift to other hosts.

Although the origins of microorganisms such as fungi are often more difficult to establish than are those of higher plants or animals, most species of *Septoria* currently known to occur in Hawai‘i are pathogens of introduced crops or ornamentals and, it can be reasonably assumed, were introduced with their hosts. On the other hand, some *Septoria* spp. have been described on endemic species and may be themselves endemic. Although some cases are known of attack of an endemic host by a fungal pathogen known to occur elsewhere, in most cases it is thought that fungi occurring on endemic hosts are also endemic.

Septoria **reported from Hawai‘i (listed in order of host family)**

Apiaceae

S. apiicola Speg.—Causes late blight of celery (*Apium graveolens*). Reported in Hawai‘i as both *S. apii* (Briosi & Cav.) Chester and *S. apii-graveolentis* Dorogin (Carpenter, 1918; Raabe *et al.*, 1981). According to Farr *et al*. (1989), both of the latter species are currently considered synonyms of *S. apiicola*. Pycnidial conidiomata (referred to by Saccardo as perithecia) 60–80 µm diam.; conidia 30–45 × 1.5 µm, 3–7 septate (Saccardo, 1892: 366).

S. petroselini Desm.—Causes leaf spots on parsley (*Petroselinum crispum*), a cultivated crop in Hawai‘i (Carpenter, 1918). Pycnidial conidiomata small; conidia 35–40 × 1–2 µm, indistinctly septate (Saccardo, 1884: 530).

Septoria sp.—Causes leaf spots on Asiatic pennywort [*Centella erecta* (= *C. asiatica*)] (Raabe *et al*., 1981; Parris, 1939). No identifying characteristics were given by Parris.

Arecaceae

Septoria sp.—Causes leaf spots on coconut palm (*Cocos nucifera*) (Unpubl. Univ. Hawai‘i Pl. Dis. Clinic Files).

Asteraceae

S. callistephi Gloyer—Causes leaf blight on China aster (*Callistephus chinensis*) (Parris, 1939). Pycnidial conidiomata 76–95 µm diam.; conidia (28–)33.5(–42) × 1–1.5 µm, 3-septate (Gloyer, 1921).

S. chrysanthemi Allesch.—Causes leaf spots on chrysanthemum (*Chrysanthemum sinense*, *C. morifolium*, *C. monfolium*) (Unpubl. Univ. Hawai'i Pl. Dis. Clinic Files). Conidia 40–50 × 2–2.5 µm (no other measurements given by Saccardo (1895: 542).

S. obesa Syd.—Causes leaf spots on chrysanthemum (*Chrysanthemum morifolium*) (Unpubl. Univ. Hawai'i Pl. Dis. Clinic Files). Pycnidial conidiomata 120–160 µm diam.; conidia 50–100(–120) × 3–4.5 µm, 5–12 septate (Saccardo, 1931: 415; Punithalingam, 1967).

S. lactucae Pass.—Causes leaf spots on lettuce (*Lactuca sativa*) (Parris, 1936; Martin, 1943; Raabe *et al.*, 1981). The host is a commonly cultivated crop in Hawai'i and elsewhere. Pycnidial conidiomata 90 µm diam.; conidia 25–30 × 1.7–2 µm, septation was not described (Saccardo, 1884: 551–52). A species described as *S. lactucae* Peck., with minute pycnidial conidiomata and conidia measuring 20–38 µm in length, but with no other characteristics given, was also listed with which *S. lactucae* Pass. may be confused (Saccardo, 1884: 552). It is not known whether both of these forms occur in Hawai'i, or only *S. lactucae* Pass.

S. leucanthemi Sacc. & Speg.—Causes leaf spot on shasta daisy (*Chrysanthemum maximum*), a cultivated ornamental not considered naturalized in Hawai'i (Raabe, 1966; Wagner *et al*., 1990). Pycnidial conidiomata 200–300 µm diam.; conidia 100–130 × 4–5 µm, septation obscure (Saccardo, 1884: 549).

S. rostrupii Sacc. & Syd. (= *S. chrysanthemum* Rostr.)—Causes leaf spots on *Chrysanthemum indicum*, a host not naturalized in Hawai'i. Stevens (1925) described this fungus with pycnidial conidiomata 45–70 µm diam.; conidia 15–40 × 2–3 µm, 1–3 septate; whereas the description given by Saccardo & Sydow (1899: 973) described the conidia as 40–50 × 2 µm, with no other dimensions given. Stevens (1925) noted this discrepancy in conidial measurements, but stated that ". . . it is not thought best to give this fungus a new specific name." The listing by Raabe *et al.* (1981) of *S. rostrupii* on *C. frutescens* rather than *C. indicum*, with reference to Stevens (1925), was apparently in error.

S. sonchifolia Cooke—Causes leaf spots on sow thistle (*Sonchus oleraceus*) (Raabe *et al.*, 1981). This host is an annual weed of European origin occurring in variety of disturbed habitats in Hawai'i, and widely naturalized prior to 1871 (Wagner *et al.*, 1990). Conidia 20 µm long, with no other descriptive characteristics given by Saccardo (1884).

Campanulaceae

S. clermontiae F. Stevens & P.A. Young—Causes leaf spots on *Clermontia kakeana*, an endemic species. As noted above, the fungus itself also may be endemic. Pycnidial conidiomata 55–145 µm diam.; conidia 10–20 × 1 µm, 1–2 septate (Stevens, 1925).

S. rollandiae F. Stevens & P.A. Young—Causes rotting of leaf tissue, and eventually holes in leaves of *Rollandia crispa* (= *R. lanceolata; Lobelia crispa*) (Stevens, 1925). The host is endemic and rare, having been collected only twice since 1946

(Wagner *et al.*, 1990). As discussed above, the fungus also may be considered endemic and rare. *S. rollandiae* appears similar but distinct from *S. clermontiae*, also reported on an endemic host of the Campanulaceae, in that the fruiting bodies and conidia of *S. rollandiae* do not reach the larger size limits of *S. clermontiae*. Pycnidial conidiomata 55–110 µm diam.; conidia (7–)9–14(–16) × 1–1.5 µm, 1–2 septate, septa sometimes obscure (Stevens, 1925).

Caryophyllaceae

S. cerastii Roberge & Desm.—Causes leaf spots on mouse-ear chickweed (*Cerastium fontanum*), a weedy host native to Eurasia and introduced to Hawai'i prior to 1871, now widely naturalized (Stevens, 1925; Wagner *et al*., 1990). Pycnidial conidiomata 80 µm diam.; conidia 30–40 × 1 µm; septation was not reported (Saccardo, 1884: 518).

S. dianthi Desm.—Causes leaf spots on carnation (*Dianthus caryophyllus*). Since carnation is not naturalized in Hawai'i, and the pathogen has not been reported on the naturalized species of *Dianthus* (i.e., *D. armeria*) (Wagner *et al*., 1990; Raabe *et al.*, 1981), reports of *S. dianthi* in Hawai'i may be limited to incidental occurrences on flowers imported for ornamental purposes. Dimensions of pycnidial conidiomata not given; conidia 30–44 × 4 µm, septation not given (Saccardo, 1884: 516).

Convolvulaceae

S. bataticola Taubenh.—Causes leaf spots on sweet potato (*Ipomoea batatas*) (Carpenter, 1918). Pycnidial conidiomata 70–130 µm diam.; conidia 15–80 × 0.35–0.50 µm; septation not given (Saccardo, 1931: 419–20).

Ericaceae

S. azaleae Voglino—Causes leaf scorch of rhododendron (*Rhododendron* sp.) (Raabe, 1966). No dimensions given for pycnidial conidiomata; conidia 12–18 × 1.5–2.5 µm, 1–3 septate (Saccardo & Sydow, 1899: 976).

Septoria sp.—Causes leaf spots on *'ohelo* (*Vaccinium reticulatum*), an endemic host, with the fungus itself being probably endemic. Pycnidial conidiomata about 90 µm diam.; conidia 50–65 × 3 µm, 5–7 septate (Gardner & Hodges, 1988).

Septoria sp.—Causes leaf spots on tree *'ohelo* (*Vaccinium calycinum*), an endemic host, with the fungus itself being probably endemic. Pycnidial conidiomata about 60 µm diam.; conidia 30–50 × 1.5 µm, 3–4 septate (Gardner & Hodges, 1988).

Fabaceae

S. canavaliae Lyon—Causes leaf spots on jack bean (*Canavalia ensiformis*) (Lyon, 1913; Gardner, 1982). *S. canavaliae* was described as a new species on *C. ensiformis* in Hawai'i, although the host is not native to Hawai'i, being cultivated in the West Indies. Pycnidial conidiomata 60–90 µm diam.; conidia 30–50 × 2–2.8 µm, 3–7 septate (Saccardo, 1931: 436).

S. molleriana Bres. & Roum.—Causes leaf spots on *Canavalia kauensis*, an ecologically notable endemic species currently considered a synonym of *C. hawaiiensis* (Wagner *et al.*, 1990). Pycnidial conidiomata 80 µm diam.; conidia (15–)20–40(–46) × 1.5–4.5 µm; (1–)2–5(–6) septa (Gardner, 1982). The *Septoria* parasitizing *C. hawaiiensis* may well represent a new, endemic species. However, for

the purpose of reporting the leaf spot disease itself, this pathogen was referred to *S. molleriana*, a species described from Italy on a *Canavalia* host (i.e., *C. obtusifolia*) and whose description (pycnidial conidiomata 70–80 µm diam.; conidia 25–30 × 3–4 µm, 3–5 septate) closely approximates that of the Hawaiian fungus (Saccardo, 1892: 362). Therefore, as currently defined, the occurrence of *S. molleriana* on *C. hawaiiensis* represents an example of an introduced species of *Septoria* parasitizing an endemic host. It should be noted that the fungus described here appears clearly distinct from *S. canavaliae*, described above.

Septoria sp.—Causes leaf spots on yardlong bean (*Vigna sesquipedalis)* (Unpubl. Univ. Hawai'i Pl. Dis. Clinic Files).

Heliconiaceae

Septoria sp.—Causes leaf spots on heliconia (*Heliconia bihai*) (Unpubl. Univ. Hawai'i Pl. Dis. Clinic Files).

Lamiaceae

S. salviae-pratensis Pass.—Causes leaf spots on Texas sage (*Salvia coccinea*) (Stevens, 1925). This host is native from the southeastern US to South America and has been naturalized in Hawai'i prior to 1871 (Wagner *et al.*, 1990). Stevens (1925) described *S. salviae-pratensis* from 'Iao Valley, Maui, with pycnidial conidiomata 35–80 µm diam.; conidia 25–40 × 2 µm, few-septate. This description differs somewhat in conidial dimensions from that given by Saccardo (1892: 375), with conidia 30–32 µm long (but no other descriptive characteristics given). Stevens (1925) acknowledged this variation, but nevertheless considered the fungus in question to be *S. salviae-pratensis*.

Marantaceae

Septoria sp.—Causes leaf spots on *Calathea vaginata* (Unpubl. Univ. Hawai'i Pl. Dis. Clinic Files).

Poaceae

S. cynodontis Fuckel—Causes leaf spots on Bermuda grass (*Cynodon dactylon*) (Ellis & Everhart, 1897; Saccardo, 1884: 562). Pycnidial conidiomata minute, stromatic; conidia 50–60 × 1.7–2 µm, septation not reported.

S. poae-trivialis Cocconi—Causes leaf spots on annual bluegrass (*Poa annua*) (Stevens, 1925). According to Stevens: ". . . found on *Poa annua* (at Kilauea, Hawai'i), and although it varies somewhat from the brief description given by Saccardo & Sydow (1899: 980), since it agrees in host it is considered as the same fungus. The measurements were found to be both shorter and longer than the original, and ranged from 0.7–1.2 µm wide." Pycnidial conidiomata 76–85 µm diam.; conidia 26–29 µm long (no other characteristics given by Saccardo).

Septoria sp.—Causes leaf spots on corn (*Zea mays*) (Unpubl. Univ. Hawai'i Pl. Dis. Clinic Files).

Polemoniaceae

S. phlogis Sacc. & Speg.—Causes leaf spots on phlox (*Phlox drummondii*) (Parris, 1940). Phlox is locally cultivated but has not become naturalized in Hawai'i (Wagner *et al.*, 1990). Pycnidial conidiomata 150–200 µm diam.; conidia 40–60 × 1–2 µm, 1–3 septate (Saccardo, 1884: 533). A species described as *S. phlogis* Syd.,

with conidia measuring 30–52 × 1.5–2 µm (no other characteristics given) is also listed by Saccardo & Sydow (1902: 967) with which *S. phlogis* Sacc. & Speg. may be confused.

Polygonaceae

S. vulcani Gardner—Causes leaf spots on *Rumex skottsbergii* and *R. giganteus*, endemic hosts (Wagner *et al.*, 1990). The fungus itself therefore may be endemic. Pycnidial conidiomata 50–80 µm diam.; conidia (20–)23–28(–40) × 2–3 µm, 1–4 septate (Gardner, in press; R. Wright, Unpubl. Univ. Hawai'i Plant Dis. Clinic Files).

Polypodiaceae

Septoria sp.—Causes leaf spots on fern (Unpubl. Univ. Hawai'i Pl. Dis. Clinic Files).

Rubiaceae

S. gouldiae F. Stevens & P.A. Young—Causes leaf spots on *Gouldia lanceolata* [=*G. terminalis* var. *lanceolata)* and *Hedyotis* (=*Kadua) grandis*], endemic hosts (Stevens, 1925). The genus *Gouldia* currently is considered a synonym of *Hedyotis*, resulting in the binomial *H. terminalis* (Wagner *et al.*, 1990). The fungus may also be endemic. Pycnidial conidiomata 90–115 µm diam.; conidia 50–90 × 2 µm; septation obscure (Stevens, 1925).

S. hawaiiensis F. Stevens & Plunkett—Causes leaf spots on *Hedyotis* sp. (= *Gouldia*), an endemic host (see above). The fungus itself therefore may be endemic. Pycnidial conidiomata 25–40 µm diam.; conidia 14–18 × 2–2.5 µm; septation not given (Stevens, 1925).

Scrophulariaceae

S. exotica Speg.—Causes leaf spots on shrubby veronica [*Hebe* (=*Veronica*) *speciosa*], a flowering shrub cultivated at higher elevations, but not naturalized in Hawai'i (Raabe, 1966; Wagner *et al.*, 1990). Pycnidial conidiomata 80–90 µm diam.; conidia 15–30 × 1–1.5 µm; septation was not reported (Saccardo, 1884: 533–34).

Solanaceae

S. lycopersici Speg.—Causes leaf spots on tomato (*Lycopersicon esculentum*) and eggplant (*Solanum melongena*), commonly cultivated crops in Hawai'i (Carpenter, 1918; Parris, 1936). No dimensions given for pycnidial conidiomata; conidia 70–110 µm long, 3–many septate (Saccardo, 1884: 535).

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New Naturalized Plant Records for Kaua'i

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The following collections represent new records based on information published in Wagner *et al.* (1990), Imada *et al.* (1989), and supplemental information from papers published in *Records of the Hawaii Biological Survey for 1994, part 2* (Evenhuis & Miller, 1995) and *Records of the Hawaii Biological Survey for 1995, parts 1 & 2* (Evenhuis & Miller, 1996). Ten new island records for naturalized species as well as new state records for 4 species previously unrecorded as being naturalized in the Hawaiian Islands are reported. All of the identifications have been made by the authors.

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Chenopodiaceae

Chenopodium carinatum R. Br. **New island record**

Also naturalized on Niʻihau, Molokaʻi, Lanaʻi, Maui, Kahoʻolawe, and Hawaiʻi, this is the first record of *Chenopodium carinatum* from Kauaʻi. It was found growing as an aggressive weed in a garden.

Material examined. KAUAʻI: Waimea District, Kekaha, from garden at 8597 Kaumualii Hwy., ca. 10 ft [3 m], 15 May 1994, *Carroll 2* (PTBG).

Combretaceae

Conocarpus erectus L. **New island record**

The button mangrove or buttonwood was recorded as sparingly naturalized in coastal areas on Oʻahu, Lanaʻi, and Maui by Wagner *et al*. (1990). The following collection represents a new island record for Kauaʻi, where this species is naturalized locally forming a small population.

Material examined. KAUAʻI: Koloa District, Kukuiula small boat harbor, littoral vegetation on lava flow, near sea level, 18 Apr 1996, *Lorence 7767* (PTBG).

Commelinaceae

Tradescantia zebrina Hort. ex Bosse **New state record**

The following collection represents a new state record for the commonly cultivated wandering Jew or *honohono*. This creeping, nodally-rooting herb is represented by the color form having the leaves mostly purple with two silvery white bands above and purple-pink flowers. Probably an escape from cultivation, it is now naturalized and covers large areas of ground in secondary forest.

Material examined. KAUAʻI: Koloa District, W side of Lawai Valley, along Lawai Stream above NTBG's Lawai Garden and waterfall near convergence of two streams, in secondary vegetation of *Hibiscus tiliaceus, Samanea saman, Aleurites moluccana,* and *Epipremnum pinnatum,* ca. 300 ft [91 m], 30 Dec 1995, *Lorence & Lorence 7743* (PTBG).

Fabaceae

Medicago rugosa Desr. **New island record**

The following collection represents a new island record for Kauaʻi. This species is also naturalized on Hawaiʻi and Oʻahu.

Material examined. KAUAʻI: Waimea District, Hanapepe, Port Allen just north of Burns Field [airport] at junction of Lokokai Road and Lele Road; secondary vegetation dominated by *Cenchrus ciliarus* with *Eragrostis*, *Eleusine*, and *Echinochloa*, ca. 35 ft [11 m], 11 Jan 1996, *Flynn 5922* (PTBG).

Heliconiaceae

Heliconia latispatha Benth. **New island record**

Previously recorded as naturalized on Hawaiʻi and Maui, the following collection represents a new island record for Kauaʻi. This collection represents the color form of this species with orange-yellow bracts.

Material examined. KAUAʻI: Lihue District, on bank of east branch of Wailua River, collected in May 1988 by L. Hume and grown to flowering at Queen's Acres (Wailua), 27 Jul 1989, *Hume 398* (BISH, PTBG).

Malvaceae

Sida spinosa L. **New island record**

The following collections represent a new island record for Kauaʻi. *Sida spinosa* is

also naturalized on Hawai‘i and O‘ahu.

Material examined. KAUA‘I: Waimea District, Public Hunting Area #1 above Waimea; along road just off of Waimea Canyon Drive, 1 Apr 1985, *Flynn 1047* (PTBG); Mana, Lio Road at boundary of the Pacific Missile Range Facility (Barking Sands), elev. ca 30 ft [9 m]; weedy roadside vegetation with *Boerhavia coccinea* and *Cenchrus ciliaris*, 23 Mar 1996, *Flynn & Fosberg 3296* (PTBG); Hanapepe, Port Allen, just north of Burns Field [airport] at junction of Lokokai Road and Lele Road; secondary vegetation dominated by *Cenchrus ciliaris*, with *Eragrostis, Eleusine*, and *Echinochloa*, ca. 35 ft [11 m], 11 Jan 1996, *Flynn 5927* (PTBG).

Poaceae

Aira caryophyllea L. **New island record**

The following collection represents a new record for Kaua‘i. This species is locally common and probably was introduced unintentionally by visitors who frequent this popular viewpoint. A number of weed records have been recorded from this site in recent years.

Material examined. KAUA‘I: Hanalei District, Koke‘e State Park, Pu‘u O Kila lookout along path just below viewing area, secondary vegetation of small herbs and grasses, i.e.. *Hypocharis, Poa annua, Veronica*, and *Epilobium*, 4100 ft [1250 m], 15 Sep 1995 *Flynn 5843* (PTBG).

Bromus wildenowii Kunth **New island record**

The following collection represents a new record for Kaua‘i. *Bromus willdenowii* is widespread in the islands, having previously been recorded from Midway, O‘ahu, Moloka‘i, Maui, and Hawai‘i.

Material examined. KAUA‘I: Waimea District, Waimea Canyon State Park. Hwy 550 near mile 9, ca 2900 ft [884 m], locally common along roadside, 4 May 1987, *Flynn 2180* (PTBG).

Dactyloctenium aegyptium (L.) Willd. **New island record**

Previously recorded as naturalized on five of the main islands (Hawai‘i, Maui, Moloka‘i, Kaho‘olawe, and O‘ahu), the following collections represent a new island record for Kaua‘i.

Material examined. KAUA‘I: Waimea District, Barking Sands, Pacific Missile Range Facility, 22 Jul 1974, *Willett 14* (PTBG); Hanapepe, Port Allen, just north of Burns Field [airport] at junction of Lokokai Road and Lele Road; secondary vegetation dominated by *Cenchrus ciliaris*, with *Eragrostis, Eleusine*, and *Echinochloa*, ca. 35 ft [11 m], 11 Jan 1996, *Flynn 5924* (PTBG).

Sporobolus diander (Retz.) P. Beauv. **New island record**

This perennial grass was previously known from the islands of O‘ahu, Lana‘i, and Hawai‘i. It is apparently quite common in the lower, dryer areas of Lawai valley.

Material examined. KAUA‘I: Koloa District, Lawai Valley, the Allerton Estate at Lawai-Kai, weed in lawn behind and between main house and guest house, ca 5 ft [1.5 m], 25 Aug 1995, *Flynn 5833* (PTBG).

Panicum miliaceum L. **New island record**

This erect annual grass grows as an adventive from spilled bird seed (“Feeder’s Choice Gourmet Wild Bird Food Mixture™”) and represents a new island record for Kaua‘i. It has been recorded as naturalized on O‘ahu and Maui, and cultivated on Hawai‘i.

Material examined. KAUA‘I: Koloa District, Kalaheo, plants from yard at 4543A Puuwai Road, growing from seed spilled from bird feeder, commercial bird food mix, ca. 700 ft, 12 Jul 1996, *Flynn 5989* (PTBG).

Solanaceae

Streptosolen jamesonii (Benth.) Miers **New state record**

This collection represents a new state record for the naturalized flora of the Hawaiian Islands. Native to Andean South America, *Streptosolen jamesonii* is an unarmed shrub up to 2 m tall with arching branches, a pubescence of simple hairs, simple alternate leaves with elliptic blades 2.5-5 cm long, showy, salverform corollas with a yellow tube 2.5 cm long and red-orange lobes 1.5-2 cm long, and dry, capsular fruits with numerous minute seeds. It is occasionally cultivated as an ornamental in the Koke‘e area and has become naturalized along the roadside with other weedy species at least in Halemanu Valley.

Material examined. KAUA‘I: Waimea District, Koke‘e State Park, Halemanu Valley Road ca. 0.4 miles NE of turnoff from NASA tracking station on Hwy. 550; mesic forest with *Acacia koa* dominant, invaded by *Morus, Corynocarpus, Rubus, Myrica, Hedychium, Fuchsia* and other weeds, 1040 m, 12 Aug 1996, *Lorence , Endress & Endress 7801* (PTBG).

Verbenaceae

Clerodendrum macrostegium Schauer **New state record**

This collection represents the record for a second species of *Clerodendrum* naturalized in the Hawaiian Islands, the other being *C. chinense* (Osbeck) Mabberly (syn. *C. philippinum* Schauer). *Clerodendrum macrostegium* is a large shrub or tree of up to 20 ft tall with large, velvety leaves, white and lilac flowers subtended by large, showy, lilac and pale green bracts. As the fruit matures the calyx becomes engorged, thickens and turns a dark glossy purple, splitting into a star shape that presents the glossy, blue-black fruits. This collection was made from a naturalized plant that “appeared” at Alexander’s Nursery in Wailua some time after Hurricane Iniki struck Kaua‘i in Nov. 1992. It seems to be spreading locally by root suckers (as does *C. quadriloculare* (Blanco) Merrill in cultivation). Similar naturalized plants of *C. macrostegium* have been found throughout Olu Pua Gardens in the years since the hurricane, although a parent plant is known to occur there. The Olu Pua plants seem to be multiplying at least in part by seed, perhaps spread by birds.

Material examined. KAUA’I: Kawaihau District, Wailua Homesteads, Kuamo‘o road, Alexander’s Nursery, ornamental escape, 31 May 1995, *Nishek s.n.* (PTBG).

Vitaceae

Cissus rotundifolia (Forssk.) Vahl **New state record**

The following collection represents the first naturalized record of this species from the Hawaiian Islands. It differs from *C. nodosa* Blume, the only other naturalized species of *Cissus* in the archipelago, in having older stems with four thick, corky wings, circular to ovate, brittle, fleshy, waxy leaves up to 8 x 8 cm with crenate margins, flowers with green petals, and smaller berries ca. 15 x 13 mm.

Material examined. KAUA‘I: Waimea District, Waimea, along Hwy. 550 just beyond the 1 mile marker on either side of the road, in secondary vegetation dominated by *Leucaena leucocephala* and *Cenchrus ciliaris* with *Abutilon incanum* and *Acacia farnesiana*, ca. 400 ft [122 m], 3 Jul 1995, *Flynn & Hanna 5810* (PTBG).

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An Overlooked Naturalized Aroid for the Hawaiian Flora

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Introduction

In 1990 the Bishop Museum published (with the University of Hawaii Press) the *Manual of the Flowering Plants of Hawai‘i* (Wagner *et al.*, 1990) and thereby ushered in a new era of botanical endeavor in the Hawaiian Islands. The publication of any definitive reference work seems inevitably to result in an outpouring of information not included in the reference. This has certainly been the case with the *Manual*. From many quarters botanists, conservationists, and land stewards came forward with information not contained in the *Manual* concerning the occurrence, identity, abundance, distribution, ecology, and reproductive biology of native and naturalized plant species. The principal authors are now compiling these new data in preparation for a revised second edition of the *Manual* (D. Herbst, pers. comm.).

In particular, a number of taxa were pointed out as “missing” from the *Manual* or at least not recorded from islands where they are well known to occur. Some of these seeming omissions are attributable to the criterion for inclusion in the *Manual* that was established by the authors at the start of their work. In deciding the scope of coverage, they adopted a conservative approach: they included taxa only if they were supported by voucher specimens deposited in herbaria. Thus, absence of a plant taxon from the *Manual* may be an artifact based on the paucity of that taxon in the herbaria that were consulted and bears no relation to the taxon’s abundance in the environment.

This note reports a naturalized aroid common in the Hawaiian flora that was omitted from the *Manual*, apparently because there were no voucher specimens for it in the herbarium of the Bishop Museum (BISH), the principal repository for the vouchers on which the *Manual* was based. While it seems incredible that a conspicuous and widespread species, present in the Hawaiian Islands for at least half a century, has never previously been vouchered for the BISH herbarium, that is the case insofar as we can determine.

Statement of the Problem

As early as 1993, one of us (KW) pointed out that a large aroid of the “elephant ear” type, widespread in the Hawaiian Islands as a naturalized plant, was missing from the *Manual*. Two similar-sized aroid species having this habit of growth are abundant in sunny places along roadsides, in pastures, wet meadows, and forest margins in mesic habi-

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tats. Both are called by the Hawaiian name *'ape*; Neal (1965) identified one as *Alocasia macrorrhiza*[1] (L.) Schott and the other as *Xanthosoma robustum* Schott [Syn. *X. roseum* Schott], noting however that *'ape* is applied to other species of *Xanthosoma* as well. After comparing living plants with the descriptions, keys, and illustration presented in the *Manual* (Croat *in* Wagner *et al.,* 1990) it was clear that *A. macrorrhizos* was treated there with no mention of any species of *Xanthosoma*.

In order to identify the naturalized *Xanthosoma* with certainty it was necessary to collect and photograph fertile plants. In our experience, these plants flower erratically and some populations we observed do not seem to flower at all. The few flowering events we have detected all occurred during short-day months between November and February. Fruits have not been observed. After more than 2 years of observation, flowering material was finally collected in 1995 from plants cultivated at the Waimea Arboretum and Botanical Gardens, which had been accessioned from a naturalized population growing along the stream that runs through the Arboretum grounds. These vouchers and 35 mm color slides were sent to the Smithsonian Institution, Department of Botany, for identification. This single fertile collection was identified as *Xanthosoma roseum* Schott by Dan Nicolson, an aroid specialist.

The application of the name *X. roseum* must be considered provisional, as there is no comprehensive monograph of *Xanthosoma* presently available that sorts out the taxonomy and nomenclature for the genus. Furthermore, the Hawaiian botanical and horticultural literature contains a number of names that have to be investigated and satisfactorily placed before the name *X. roseum* can be confidently accepted as the correct one for these naturalized Hawaiian plants. It is possible that more than one species, or hybrids, may be involved. We feel it worthwhile to call attention to the problem in order to encourage field collectors to make additional vouchers, photographs, and observations of the plants here provisionally called *X. roseum* in order to generate sufficient new information to make a better identification.

The account of the Araceae that appears in the *Manual* (Croat *in* Wagner *et al.,* 1990) should be modified to include the genus *Xanthosoma* and the naturalized species *X. roseum*. Preparation of full descriptions and revised keys must await the second edition of that work, and also, hopefully, the completion of the revisionary study of *Xanthosoma* currently underway by Sue Thompson, Carnegie Museum of Natural History, Pittsburgh, PA. In the interim, the following diagnoses present the characters we have found useful for differentiating the genus *Xanthosoma* from *Alocasia* and *X. roseum* from the similar-appearing *Alocasia macrorrhizos*. Living material or good color photographs are essential for making an identification.

Diagnosis of genera:

Spadix with a sterile appendage, fertile staminate flowers confined to a narrow band in the lower portion, sterile staminate flowers extending to the apex; ovary 1-celled; ovules 1–few per cell; berries 1–few-seeded ..... **Alocasia**

Spadix without a sterile appendage, fertile staminate flowers extending all the way to apex; ovary 2–4-celled; ovules several to many per cell; berries many-seeded ..... **Xanthosoma**

1. D. Nicolson (*Taxon* 35: 326–28, 1986) pointed out that the correct orthography for this species epithet should be spelled *macrorrhizos.* It is so spelled throughout the remainder of this paper.

Diagnosis of *'ape* species (elephant ear) naturalized in Hawaii:
Leaves erect to arching, blade and petiole forming one smooth arc, apex (especially of youngest leaves) upward-pointing; petiole and underside of blade glossy green, not at all glaucous, upperside of blade glossy medium green; open portion of spathe whitish to yellowish ..... **Alocasia macrorrhizos** (L.) Schott

Leaves spreading or deflexed, the blade set at an angle to the petiole, apex usually downward-pointing; petiole and underside of blade glaucous with a ± dense whitish bloom, upperside of blade dull (not glossy) dark green; open portion of spathe cream flushed pinkish ..... **Xanthosoma roseum** Schott

Distribution in the Hawaiian Islands

Xanthosoma roseum is commonly naturalized in mesic habitats such as roadside swales, banks of freshwater courses (streams, canals, ponds, etc.), moist forest margins, and disturbed sites near human habitations and agricultural fields on Oahu and Kauai; it is also sparingly cultivated. On Kauai, *X. roseum* has been observed in several localities (T. Flynn, pers. comm.) and one of these has been vouchered. It has also been observed at several locations on Maui (R. Hobdy, pers. comm.) though no herbarium vouchers exist to document these sight records. Its status on the other Hawaiian Islands is uncertain, though we suspect it is present and naturalized on all islands where suitably moist habitats are found. Further vouchers and observations are desirable to broaden our knowledge of the existence, identity, and precise distribution of this naturalized aroid in the Hawaiian Islands. Despite the plants presence here for more than half a century, the following recent voucher specimens appear to be the first documentation for this species' existence in Hawaii.

Material examined. KAUAI: Halelea Distr., Hwy. 55 fronting Maniniholo Cave, 15 Feb 1990, *T. Flynn 3768* (2 sheets PTBG). OAHU: Haleiwa, Waimea Arboretum & Botanical Gardens, cultivated in the living collections (accession 73p59)[2], 16 Jun 1995, *K. Woolliams s.n.* (BISH sheets 641379, 641380), same loc., 2 Nov 1995, *Waimea Arboretum staff [D. Orr] s.n.* (BISH sheets 642260–642266); Kane'ohe, roadside along Kamehameha Hwy., just E of H-3 Hale Kou interchange, 5 Nov 1996, *G. Staples 1131* (5 sheets BISH).

Ethnobotanical Observations

For several years we have seen unidentified aroid petioles sold in Southeast Asian markets in Honolulu's Chinatown. These are 3–6 feet in length, as much as 4 or 5 inches in diameter at the base, deeply grooved in the lower half and elliptical in cross-section in the upper half. The outer surface is covered in a whitish waxy bloom that rubs off when the petiole is handled while the inner core is spongy, with large air spaces embedded in a translucent whitish matrix that has a texture like plastic bubble-wrap. The petioles are sold as vegetable and one of us (GS) has eaten them in Vietnamese restaurants. The petiole is peeled, thinly sliced cross-wise and laid on the surface of very hot soup; the steam rising from the soup lightly cooks the slices, which retain a crisp texture that contrasts with the cooked vegetables and seafood in the soup itself. We were unable to identify the source of this aroid petiole for several years, but it seems to us that they can only be *X. roseum*. The size, color, and texture of the market product matches exactly those of the plants we have observed and collected. It is quite possible that the petioles sold in Chinatown are being gathered from naturalized populations by enterprising businessmen.

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2. This accession was obtained from a naturalized population that occurs wild along the Kamananui Stream, which runs through Waimea Falls Park, between Waihe'e Falls (often called Waimea Falls) and the river estuary.

We found no mention of *Xanthosoma* petioles being eaten in recent local literature but a much older publication on oriental vegetables in Hawaii contained an interesting reference that caught our eye. In the booklet *Utilization and composition of oriental vegetables in Hawaii* (Chung & Ripperton, 1929) an edible petiole is described thus: "The variety which is known on the market as Tow-Imo is 4 to 6 feet long and 2 to 4 inches thick at the base. It is light green and may or may not be covered with a bloom or whitish substance. This variety is cultivated primarily for the edible petioles." Interestingly, Chung and Ripperton thought this large petiole was a cultivated form of *Colocasia esculenta*, the taro plant. We have never seen taro petioles 4–6 feet long and suspect that these edible petioles are actually *X. roseum*.

Conclusion

One fact is clear: much work remains to be done to adequately document the naturalized component of the Hawaiian flora. The 6 years that have elapsed since publication of the *Manual* (Wagner *et al*., 1990) have demonstrated that, generally speaking, while there is adequate representation for endemic and indigenous Hawaiian taxa in herbaria, inadequate voucher material exists for many of the plant species introduced to the Hawaiian Islands. This applies to taxa considered to be adventive weeds, naturalized, and cultivated. Preparing adequate voucher material of **all** plant taxa that occur in the Hawaiian Islands and depositing those vouchers in recognized herbaria where they form a permanent record for the existence, identity, distribution, and abundance of those taxa is a highly desirable goal for the botanical community.

We do not think that the example described here is unique by any means. While it is true that "Aroids make notoriously bad herbarium specimens . . . " (Hay & Wise, 1991) and for that reason collectors tend to avoid them, other equally conspicuous taxa may be overlooked or deliberately avoided by collectors. In Hawaii, as in many places, there seems to be a bias against collecting introduced plants in general, yet this is shortsighted. If it is true that introduced plants comprise the single greatest biotic threat to the Hawaiian flora, then we can scarcely expect to understand the extent and depth of the problems introduced plants cause without adequate documentation for what they are, where they are, and how abundant they are, can we?

Acknowledgements

We thank David Orr, Waimea Arboretum staff member, for obtaining flowering material of *Xanthosoma* and Dan Nicolson at the Smithsonian Institution, Department of Botany, for identifying it. Field observations were provided by Derral Herbst, Bob Hobdy, and Tim Flynn; the last facilitated the loan of specimens from the herbarium of the National Tropical Botanical Garden. We appreciate comments on the manuscript received from Tim Flynn, David Lorence, and Warren L. Wagner.

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New Plant Records from Pu‘u Kukui Watershed and Adjacent Areas, Maui

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The following are new plant records based on recent collecting activity by us in the Maui Pineapple Co. /Pu‘u Kukui Watershed and adjacent areas.

Phytolaccaceae

Rivina humilis L. **New island record**

Wagner *et al*. (1990:1017) documents the naturalized range of this taxon as being Kaua‘i, O‘ahu and Hawai‘i Islands. A significant population of hundreds of plants was located in Honokowai Valley, West Maui, at 146m ASL. The known distribution of this population precludes any reasonable possibility of deliberate cultivation in this area, indicating that this taxa has become naturalized on Maui.

Material examined. MAUI: Lahaina District -West Maui, Honokowai Valley, 146 m, in alien dominated lowland riparian zone, 15 May 1996, *Meidell & Oppenheimer 112* (BISH).

Asteraceae

Coreopsis lanceolata L. **New island record**

Wagner *et al.* (1990:289) document the naturalized range of this taxa as Lana‘i and Hawai‘i Islands. A collection was obtained along the roadside at the Honokowai Ditch Trail head, 464m ASL, West Maui. Specimens were ubiquitous among alien vegetation supplanting the natural components of Lowland Mesic Shrubland. The distribution of this population precludes any reasonable possibility of deliberate cultivation in this area, indicating that this taxa has become naturalized on Maui.

Material examined. MAUI: Lahaina District, West Maui, 464 m, South rim of Honokowai Valley, 29 July 1996, *Meidell & Oppenheimer 124* (BISH).

Myricaceae

Myrica cerifera L. **New state record**

Wagner *et al*. (1990:929) document *Myrica faya* as the only naturalized member of Myricaceae in Hawai‘i. *Myrica cerifera* was introduced to West Maui by David T. Fleming in December 1932 as a component of the Maunalei Arboretum project. Recent surveys indicate the proliferation of this taxon well beyond the original planting site. Current estimates put the naturalized population of *M. cerifera* at 200+ individuals in an area between Honolua and Honokahua Valleys, 395–490 m. Range and population data are likely to be revised as additional surveys are expected to reveal more plants. In light of current problems encountered with *M. faya* at Hawai‘i Volcanoes National Park and elsewhere, this taxon will be monitored very closely. Aggressive eradication efforts are under way by Maui Pineapple Co. / Pu‘u Kukui Watershed staff.

Material examined. MAUI: Lahaina District - West Maui, 427 m, near original planting site within Maunalei Arboretum, 31 October 1996, *Meidell & Oppenheimer 127* (BISH).

Lauraceae

Cinnamomum burmannii Blume **New island record**

Wagner *et al*. (1990:846) document the naturalized range as O‘ahu. Introduced to northern West Maui c. 1920–1935, *C. burmannii* has become extensively naturalized in the area between Honokohau and Honokahua Valleys, 245m–610 m, and is viewed by Pu‘u Kukui Watershed Management staff as a serious pest. The number of individuals is estimated to be in the thousands, with current eradication efforts focused on satellite populations.

Material examined. MAUI: Lahaina District - West Maui, 396 m, ridge between Honolua and Honokahua Valleys, 20 October 1996, *Meidell & Oppenheimer 128* (BISH).

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New Hawaiian Plant Records for 1996

HERBARIUM PACIFICUM STAFF (Hawaii Biological Survey, Bishop Museum, 1525 Bernice St., Honolulu, HI 96817, USA).

These previously unpublished Hawaiian plant records include 2 new island records to supplement information published in Wagner *et al.* (1990) and in *Records of the Hawaii Biological Survey* for 1994 (Evenhuis & Miller, 1995) and 1995 (Evenhuis & Miller, 1996). Recent voucher specimen identifications provided 2 new records, reported here. All supporting voucher specimens are on deposit at BISH.

Cuscutaceae

Cuscuta sandwichiana Choisy **New island record**

This endemic species was previously known from all the main islands except Kauai and Kahoolawe (Wagner *et al.* 1990: 583). The following voucher represents a new island record for Kaua‘i.

Material examined. KAUAI: Waimea District, Kekaha, along Hwy. 50 fronting the beach, coastal strand vegetation, June 1989, *Koske & Gemma s.n.* (BISH sheet 641436).

Poaceae

Bothriochloa bladhii (Retz.) S. T. Blake **New island record**

This species was mentioned in passing in the Wagner *et al.* (1990: 1502) as a taxon needing further study; its known distribution at that time was from Moloka‘i and the island of Hawaii. This collection is the first record from Maui.

Material examined. MAUI: East Maui, south side of Kahului Airport, on roadside, 1 Dec 1995, *R. Hobdy 3911*.

Acknowledgments

These records were compiled by the staff of the Herbarium Pacificum (BISH) of Bishop Museum. In alphabetical order the contributors are Clyde T. Imada, Barbara

Kennedy, and George W. Staples. We thank Derral Herbst for confirming the identifications.

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Rediscovery of *Apterocyclus honoluluensis* Waterhouse on Kauai (Coleoptera: Lucanidae)

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Apterocyclus honoluluensis Waterhouse **Notable rediscovery**

The last reported collection of the Kauaian lucanid, *A. honoluluensis* appears to have in 1979 (G.M. Nishida, pers. comm.). On 21 May 1996, a single male (det. Abbott) was collected at dusk while walking along a ridge foot-trail on private property, southwest of the Alakai Swamp in the Waimea District, ca. 1000 m, coll. M. Trimmingham. A review of the known collection records, morphological variation, and biology of *A. honoluluensis* with photographs and illustrations is currently underway by the authors.

New Records for Hawaiian Insects

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All specimens examined in this paper are vouchered in the Hawaii Department of Agriculture (HDOA) collection, unless otherwise noted. BPBM = Bernice Pauahi Bishop Museum; SEL = Systematic Entomology Laboratory, U.S. Department of Agriculture, Beltsville, Maryland; USNM = National Museum of Natural History [formerly United States National Museum]. Authorship of each record, if different than above, is given at the end of the record.

Coleoptera: Nitidulidae

Lasiodactylus sp. prob. ***tibialis*** (Boheman) **New state record**

Specimens of a large nitidulid (7 mm x 4 mm) were submitted by Cooperative

Extension Service agent, Howard Hirae. It was collected from ripe guava at the Waiakea Experiment Farm, Hawaii I., on 30 April 1996. Terry Seeno, California Dept. of Food and Agriculture, determined it as *Lasiodactylus* sp. prob. *tibialis* (Boheman). *L. tibialis* was described from Natal (South Africa), but there is little additional literature.

Material examined: HAWAII: Waiakea, 30.iv.96 and 30.v.96, ex. guava, H. Hirae.

Diptera: Periscelididae

Stenomicra n. sp. **New state record**

A specimen of this fly was collected by W. D. Perreira near Honomuni Stream, Molokai, during 14–28 October 1994 on yellow sticky board traps. The determination was made by Curtis Sabrosky, formerly with SEL. He notes that it is near his *Stenomicra* n. sp. #21 from Costa Rica and Panama, but will have to be confirmed with examination of male genitalia. Subsequently, it was collected on Hawaii I. during 20 October 1995 to 3 November 1995, Maui during 18 November to 2 December 1995, and Oahu during 15–28 May 1996.

Material examined: MOLOKAI: nr. Honomuni Stream, 10 ft, 14–28.x.1994. HAWAII: Kauhiula, Hilo, 60–80 ft, 20.x-3.xi.1995. MAUI: Keanae, 3 ft, 18.xi–2.xii.1995. OAHU: Pupukea and Malaekahana Park, 160 ft and 3–10 ft, 15-28.v.1996. All collected on yellow sticky board traps by W.D. Perreira. —**W.D. Perreira & B. Kumashiro**.

Heteroptera: Nabidae

Alloeorhynchus maculosus Kerzhner **New state record**

Shin Matayoshi, HDOA entomologist, submitted specimens of a nabid that he and Clyde Hirayama collected from lawn grass at Paukaa on Hawaii I. on 28 February 1996. It was sent to SEL, where T.J. Henry made the determination. This represents the first collection of this species outside the Eastern Hemisphere.

Alloeorhynchus maculosus was originally described by I.M. Kerzhner (1992, *Bonn. Zool. Beitr*. 43: 247) from 2 females collected in India and Sumatra. It may be distinguished from all other nabids known to occur in Hawaii by its small size, compact form, and bicolored pronotum, with the anterior lobe dark yellow and the posterior lobe black. The black hemelytra marked with dark yellowish maculations are also distinctive.

Nabids are general predators, but there are no confirmed prey. However, there is an implication that they may have been preying on the lygaeid, *Cligenes marianensis* Usinger, which occasionally is found in large numbers on Hawaii I.

Material examined: 4 females, HAWAII: Paukaa, 28.ii.1996, on lawn grass, S. Matayoshi and C. Hirayama (USNM, BPBM, HDOA). —**D. Polhemus & B. Kumashiro**.

Homoptera: Aleyrodidae

Aleurocanthus woglumi Ashby **New state record**

Specimens of a whitefly collected by a resident in Aiea on 17 July 1996 were submitted to the Insect Diagnostic Clinic, University of Hawaii at Manoa. These were collected from a very heavy infestation on a pummelo tree, *Citrus grandis*. Dick Tsuda at the clinic made the determination of the whitefly and it was confirmed by Sueo Nakahara,

SEL. According to "Pests Not Known to Occur in the United States or of Limited Distribution, No. 15: Citrus Blackfly", this whitefly is considered the most injurious insect infesting citrus trees. It can reduce a citrus tree to nonproductivity more quickly than any other known citrus pest. This whitefly is native to India and is also known to occur in Asia, Africa, Mexico, Central and South America, West Indies (Jamaica), and the United States (Florida and Texas). Worldwide, immatures of *A. woglumi* have been found on approximately 155 species of plants. Specimens were subsequently collected from Waialae Iki on 24 July 1996, and Ewa on 29 July 1996. On other islands, it was first collected at Hilo, Hawaii I. on 5 August 1996 and at Kihei, Maui on 20 August 1996.

Material examined: OAHU: Aiea, 17.vii.96, Ex. citrus (pummelo), S. Ishizaki. OAHU: Waialae Iki, 24.vii.96, ex. Meyer lemon, V. Blanks. OAHU: Ewa, 29.vii.96, ex. Washington Navel orange, R. Uchida. HAWAII: Hilo, 5.viii.96, ex. citrus, S. Matayoshi and H. Hirae. MAUI: Kihei, 20.viii.96, ex. citrus, C. McGrath. —**D. Tsuda**, **R. Heu & B. Kumashiro**.

Homoptera: Halimococcidae

Thysanococcus pandani Stickney **New state record**

The first specimens of this scale insect were received from Dean Jamieson, Hawaii Dept. of Health, Lihue, Kauai. They were collected by D. Lorence on the premises of the National Tropical Botanical Gardens at Hana, Maui on 15 November 1995. Determination of the scale was made by D.R. Miller (SEL). *Thysanococcus pandani*, which is new to Hawaii and the rest of the U.S., is only known to occur in Java and Singapore. This group of halimococcids occur only on species of palms or on plants in the genus *Pandanus*, which plant morphologists consider to be the primitive stock from which palms arose. As of October 1996, the infestation was still confined to within a half mile strip along the Hana coast.

Material examined: MAUI: Hana, Kahanu Gardens, National Tropical Botanical Garden, 17.iv.1995, ex. *Pandanus*, D. Lorence.

Hymenoptera: Pteromalidae

Trichomalopsis viridescens (Walsh) **New state record**

In May 1995, Asher Ota, Hawaii Agricultural Research Center (HSPA) [formerly Hawaiian Sugar Planters' Association], submitted specimens of a hyperparasitic wasp that he had found attacking the diamondback moth parasitoid, *Cotesia plutellae* (Kurdjumov). The specimens were collected in a planting of golden mustard at the HSPA Substation in Kunia. E. Grissell, SEL, made the determination. According to Grissell, this species has been reared from a number of lepidopteran parasitoids.

Material examined: OAHU: Kunia, HSPA Experimental Station, 1–16.v.1995, ex. *Cotesia plutellae*, A. Ota.

Gnathaphanus picipes, an Established Adventive in Hawaii (Coleoptera: Carabidae)

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Gnathaphanus picipes (**Macleay**) **New state record**

This ground beetle (Carabidae) is reported for the first time in the state, with records from all the main Hawaiian islands except Kauai. This is an Australian species that ranges into SE Papua New Guinea, and apparently has not been reported elsewhere until now. It appears to be very common in certain lowland, open areas. The first specimen examined (by GAS) was a unique from the Kapiolani area of Honolulu, Oahu, 24.ii.1996, Rolf Röber (Sandviksv, Sweden), followed by numerous specimens from Wailea, Maui, 15.iv.1996, Clyde Iwami (HDOA No. 96-097), and numerous specimens from Oahu, Ko Olina Hotel, Kapolei, week of 2.v.1996, A. Nowinski & R. Heu (BPBM, HDOA). The earliest Oahu record appears to be a specimen from a light trap at the Honolulu International Airport, 21.iv.1989, R. Kunishi (USDA-APHIS-PPQ).

Further specimens examined (mainly HDOA, UH) with earliest data noted: MOLOKAI: Kepuhi, 28.viii.1992, R.S. Beal. LANAI: Maunalei Gulch, 27.iv.1995, D. Preston. KAHOOLAWE: 29.iv.1996, V. Mozina. HAWAII: Hawi, 23.v.1996, P. Breeze.

This is the second *Gnathaphanus* to be reported for Hawaii. The first reported one was *Gnathaphanus upolensis* Csiki, another Australian-Papuan species. It ranges through the south Pacific and reaches Malaysia and the Philippines. It was initially reported in Hawaii by Beardsley & Funasaki (1976) as a species of *Selenophorous* collected from Oahu with specimens taken as early as 1972; it was later identified by George Ball as *G. upolensis* Csiki (Beardsley, 1983). Nishida (1994) listed *G. upolensis* from 3 islands: Oahu, Maui, and Hawaii.

Specimens of *Gnathaphanus picipes* from Hawaii and New Guinea and specimens of *G. upolensis* also from Hawaii and New Guinea (both species in the BPBM collection) readily key to their respective species in Darlington (1968). *Gnathaphanus upolensis* is distinguished by having legs yellow and elytral puncture series associated with intervals 3 and 5; *G. picipes* has darker (brownish) femora with remaining leg parts brownish yellow and elytral puncture series essentially restricted to interval 3 but sometimes with one or two punctures apically on interval 5.

Gnathaphanus upolensis appears to be far less common than *G. picipes* on islands where both have been reported or recently collected. Only 1 specimen of *G. upolensis* was noted from the light trap collection at Ko Olina Hotel, Oahu. This same trap probably captured hundreds of *G. picipes* at the time the hotel was "under siege" by *G. picipes* (many specimens were discarded due to their poor condition in the light trap).

Gnathaphanus picipes is now abundant on most of the main Hawaiian islands and many specimens have been observed in hotels at lights at night where they have been a general nuisance.

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First Record of the Genus *Platydracus* (= *Staphylinus* in Part) from Hawaii, with Notes on Hawaiian *Creophilus* (Coleoptera: Staphylinidae: Staphylininae: Staphylinini)

ALFRED F. NEWTON (Department of Zoology, Field Museum of Natural History, Chicago, IL 60605, USA)

The 835 species of the worldwide staphylinid subtribe Staphylinina are among the largest predatory staphylinids, averaging 15 mm long. None are considered endemic or indigenous to Hawaii, but two species of *Creophilus* are listed as adventive and widespread by Nishida (1994). In addition to reviewing the occurrence of these species in Hawaii, this note calls attention to the first records of the genus *Platydracus* (formerly part of *Staphylinus*) from Hawaii. This is evidently the first record of the spread of any species of this large genus (>440 known species worldwide) outside of its original range.

This report is done in the context of a revision of all New World species and preparation of a world checklist for the subtribe Staphylinina. Specimens mentioned here are deposited in the entomological collections of the Bishop Museum (BPBM), University of Hawaii at Manoa (CTAM), University of California at Berkeley (EMEC), Field Museum of Natural History (FMNH), and National Museum of Natural History (USNM), although many additional specimens from other collections were studied as part of the overall revision.

Platydracus caliginosus (Erichson), **New state record new combination**

Staphylinus caliginosus Erichson, 1839: 388.

Staphylinus ejulans Tottenham, 1939: 170, **new synonymy**.

This species, which apparently has never been formally moved from *Staphylinus* to *Platydracus* although these genera have been considered distinct by many authors, has been recorded from Mexico and Guatemala (Blackwelder, 1944). However, based on my unpublished studies (Newton, 1973, later work) it has a much wider (and apparently natural) occurrence in the New World, from the southwestern USA (southern Nevada, Arizona, New Mexico and western Texas) through Mexico and Central America to Columbia. Specimens from the USA have commonly been misidentified as *P. tarsalis* (Mannerheim) or *P. mysticus* (Erichson), closely related species from western and eastern

North America, respectively; *Staphylinus ejulans* Tottenham was described from Costa Rica. The species may be definitively identified by the shape of the median lobe and extremely short paramere of the aedeagus (Tottenham, 1939) but both sexes can also be clearly recognized externally (Newton, 1973).

Material examined: OAHU: Manoa, 17 February 1971, "genus? ex student collection - could be mislabel" [last three words crossed off] (E. Smith) (CTAM); Manoa, 11 April 1976 (G. Luke) (CTAM). More than 400 collections and 600 specimens from throughout the mainland range given above, including types of both names, were also examined.

Although the first specimen above was indicated as possibly mislabelled (but this comment later canceled), the second collection by another collector from the same locality seems to confirm the presence of this species in Hawaii. Each record is based on a single female specimen.

This discovery is significant not only as the first report of this genus from Hawaii, but apparently as the first record of any species of *Platydracus* being found outside its "natural" range. Although *Platydracus* species are numerous and the genus widespread (nearly 200 species in the New World from Canada to central Argentina, and 245 in the Old World throughout Eurasia and Africa), the genus is remarkable in its virtual absence from non-continental areas (exceptions are 3 species endemic to Madagascar and a North American species, *P. tomentosus* (Gravenhorst), also found in Cuba). This curious distribution and lack (until now) of evidence of introductions elsewhere stands in strong contrast to the situation in the related genera *Creophilus* (see below) and *Staphylinus* (Newton 1987: seven introduced species in North America alone). My unpublished data indicate that, at least in the New World, *Platydracus* species are mostly confined to indigenous forests and fare poorly in heavily human-influenced habitats; they are unlikely travelers. How *P. caliginosus*, a widespread but basically temperate montane inland species, came to be found in tropical Hawaii is thus a mystery.

Creophilus maxillosus (Linnaeus) **New island record**

This species, widespread throughout the northern hemisphere and adventive during the past century in southern South America, was reported as introduced and "plentiful in decaying carcasses all over the Hawaiian Islands" by Blackburn & Sharp (1885), who specifically cited the islands of Kauai, Oahu, Lanai, Maui and Hawaii; the same islands were listed by Nishida (1994). Apparently this species was widespread before human contact, and shows some geographic variation, e.g., North American specimens can be distinguished morphologically, as the subspecies *C. m. villosus* (Gravenhorst), from Palearctic specimens of the nominal subspecies. However, it is still not clear if the wide occurrence of *C. maxillosus* on most large northern hemisphere islands, including Hawaii, is human-influenced (as usually assumed) or natural. Hawaiian specimens match North American specimens in structure and can be referred to *C. m. villosus*.

Material examined: MOLOKAI: 21 March 1907 (D. L. Van Dine) (CTAM, USNM); same, August 1909 (J. Kotinsky) (EMEC); same, Kainalu Gulch, 9 April 1963 (D. E. Hardy) (CTAM). The only "Kainalu Gulch" I could locate is on Maui, suggesting that the island in the last record may be mislabelled. Many collections from other already-noted islands were also examined, and this species continues to be found frequently in both highly disturbed urban areas and minimally-disturbed forests, e.g., HAWAII: Hawaii Volcanoes N. P., Kipuka Kulalio, 1880 m, carrion trap in *Acacia koa* forest (A. Newton & M. Thayer) (FMNH).

Creophilus erythrocephalus (Fabricius)

This Australian species is listed by Nishida (1994) as adventive in Hawaii, occurring on five large islands (Kauai, Oahu, Molokai, Maui and Hawaii). However, I have seen no specimens collected in Hawaii in BPBM and CTAM, or in more than 100 other collections from which Staphylinina have been studied. The species was purposely introduced in 1921 from Australia by J.F. Illingworth as a predator of fly larvae (Fullaway, 1923; Swezey, 1923); the Hawaiian Terrestrial Arthropod database at BPBM cites more than a dozen technical reports detailing the release of thousands of specimens on the above five islands during the following decade for control of dung flies. There are no records of recaptures, and *C. erythrocephalus* evidently never became established in Hawaii, although it has spread (with or without human assistance) across many southern Pacific islands to Chile in historical times.

Acknowledgements

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Ammophorus insularis in Hawaii: A Galapagos Islands Species Immigrant to Hawaii (Coleoptera: Tenebrionidae)

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The flightless tenebrionid beetle *Ammophorus insularis* was described by Boheman in 1858 from material collected at an unnamed locality on Oahu, Hawaiian Islands, but probably from the port of Honolulu. The genus was described by Gúerin-Méneville in 1830 based on *A. peruvianus* Gúerin-Méneville from coastal Peru. Several other species occur at coastal and inland localities in Peru and Ecuador. Other species have been described from the Galapagos Islands. It is interesting that *A. insularis* was not reported again from Hawaii until 1920. It escaped mention in the *Fauna Hawaiiensis*. Based on these facts alone, one could suppose that this is an example of one of the few New World insect genera which have naturally colonized the Hawaiian Islands.

After *A. insularis* was discovered in Hawaii, it was later found to occur on several islands of the Galapagos Archipelago, and was first reported from there by Van Dyke (1953). As a result of past collecting by others (material in Bernice P. Bishop Museum (BPBM), California Academy of Sciences (CAS), the US National Museum of Natural History (USNM)), and my own 14 months of Galapagos field work (Peck & Kukalova-Peck, 1990), it is now known from Islas Isabela, San Cristobal, Santa Cruz, and possibly Floreana in the Galapagos.

In his pioneering summary of Galapagos beetles, E.C. Van Dyke (1953) reviewed specimens from both the Galapagos and Hawaiian Islands and was convinced of the accuracy of the identification as *A. insularis*. He discounted natural dispersal of the beetles to Hawaii and believed that early whaling ships were the mode of transport of the beetles from Galapagos to Hawaii. It is well known that whaling ships called at San Cristobal in the Galapagos (Slevin, 1959) and then went on to Oahu (Honolulu).

The beetles are general scavengers on dry organic matter. In both the Galapagos and Hawaii they are found by day under stones, dry cow dung, boards, boxes, and refuse. They emerge from hiding at night and wander on the soil surface. They can be best baited by sprinkling dry oatmeal along trails at dusk and looking for the beetles a few hours later that night. I have collected them this way on several trails in scrub forest in both the Galapagos and on the south side of Diamond Head, Oahu.

Records of the species in the Hawaiian Islands have been frequently mentioned in the *Proceedings of the Hawaiian Entomological Society* (Swezey, 1921, 1935; Timberlake, 1922; Hadden, 1926; Ehrhorn, 1927; Illingworth, 1935; Van Zwaluwenburg, 1936, 1941, 1952,1954; Krauss, 1944; Toyama & Ikeda 1976) and in the book *Common Insects of Hawaii* (Fullaway & Krauss, 1945: 86).

I have recently studied Hawaiian collections of the species in the Bishop Museum and other museums (Table 1). It is now known to occur on all 6 of the large islands of the Hawaiian Archipelago. All records from Hawaii before 1940 are from Oahu except for one from Ukulele, Maui (1932), one from Upolu Field, Kohala, Hawaii (1934), and one from central Maui (1934). All the other non-Oahu records are from the 1940s and later.

I suggest that the total breadth of its distribution throughout the Hawaiian Archipelago was achieved during and after World War II, when there was an incredible movement of materials and supplies throughout the archipelago. The beetles lend them-

Table 1. Known Hawaiian Island localities of *Ammophorus insularis* (Boheman). (Specimens in Bishop Museum, unless otherwise indicated.)

Island	Place	Date (as on label)	Collector (or reference)	No. of spcms (museum)
Hawaii	Kawaikae	XII.50	N.L.H. Krauss	3
	Saddle Road, 7000 ft	15.VI.65	T. Suman	1
	South Point	X.1950	N.L.H. Krauss	15
	South Point, 7-8 m	19.IX.76	C.J. Davis	5
	Upolu Field, Kohala	I.18.34	Illingworth	4
Kauai	Kokee	4-6.VIII.61	Maa, Miyatake	12
Lanai	SW coast	X.27.47	N.L.H. Krauss	1
	W coast	X.30.47	N.L.H. Krauss	4
Maui	Central Maui, near reservoir	10.XII.34	Van Zwaluwenburg (1936)	?
	Koka(Koha?) Crater	Nov. 1974	no name	7 (CAS)
	Makena, 1.5 mi N	May 1957	no name	6 (CAS)
	Makena	III.67	N.L.H. Krauss	1
	Olowalu	21.III.67	N.L.H. Krauss	2
	Ukulele	30.VIII.32	N.L.H. Krauss	5
	Waiehui, NW Kahului	8.XII.76	P. Opler	47 (CAS)
Molokai	Airport	14.II.1951	Van Zwaluwenburg (1952)	?
	Airport	4.55	E.J. Ford	5
	Hoolehua	26.VII.67	P. Schaefer	1
	Kaunakakai	III.64	N.L.H. Krauss	5
	Kaunakakai	29.V.1943	N.L.H. Krauss(1944)	2
	Mapulehu	1949	Van Zwaluwenburg (1954)	?
	Molokai Ranch	III.68	N.L.H. Krauss	6
	Momomi Beach	20.VI.62	K. Yano	1
	Papohaku Beach, flood debris	17.V.92	D. Polhemus & J. Liebherr	18
Oahu	Barbers Point	1940	Van Zwaluwenburg (1954)	?
	Barbers Point	1.49	E.J. Ford	3
	Bellows Beach	28.VIII.1982	J. Doyen	1 (CAS)
	Damon Tract	6.53	E.J. Ford	5
	Diamond Head	1-17-23	E. Van Dyke	11
	Diamond Head	1-19-32	Solander	23
	Diamond Head	V.11.35	E.H. Byran Jr.	5
	Diamond Head	2-26.37	no name	2
	Diamond Head	21.XI.63	E. Creutz	2
	Diamond Head	2.26.27	no name	1
	Diamond Head	25.VIII.1993	S.B. Peck	60 (SBPC)
	Diamond Head Park	28.IX.76	P. Opler	11 (CAS)
	Dole Park	20.III.82	Y. Ching	1
	Ewa Coral Plain	V.8.32	N.L.H. Krauss	2
	Ewa Coral Plain	Jan.18.33	E.H. Bryan	1
	Ewa Coral Plain	9.2.25	O.H .Swezey	?
	Ewa Coral Plain	3-32	E.J. Ford	8
	Ewa Coral Plain	X.30.25	no name	1
	Gilbert(west of Ewa)	1925	Van Zwaluwenburg (1954)	?
	Honolulu	8.II.1932	F.X. Williams	53 (CAS)

Table 1 (continued). Known Hawaiian Island localities of *Ammophorus insularis* (Boheman). (Specimens in Bishop Museum, unless otherwise indicated.)

Island	Place	Date (as on label)	Collector (or reference)	No. of spcms (museum)
Oahu	Honolulu	3.1932	O. Bryant	11
	Honolulu	V.6.45	E.C. Zimmerman	30
	Honolulu	12.IX.1952	J. Bache	1 (USNM)
	Honolulu	30.IV.41	Y. Kondo	4
	Honolulu	IX.1.25	no name	7
	Honolulu (Pier 27) (in old wood)	1927?	Ehrhorn (1927)	?
	Iwilei (in termitarium)	not reported	Ehrhorn (1927)	?
	Kaena Point	4.55	E.J. Ford	1
	Kaena Point dunes	5.XII.1976	P. Opler	2 (CAS)
	Kaimuki	5.IV.1920	H. Sharp (Swezey, 1921)	4
	Kaimuki	no date	H.K.F.Lee	1
	Kaimuki	8.VI.1921	P.H. Timberlake (1922)	1
	Kalihi	no date	A. Suehiro	1
	Koko Head	3.III.1932	F.C. Hadden	26 (CAS)
	Koko Head	Feb. 1934	O.H. Swezey (1936)	?
	Koko Head Region	6.III.61	L.W. Quate	12
	Koko Crater	1932	Van Zwaluwenburg (1954)	?
	Lualualei	4.XII.1940	Van Zwaluwenburg (1941)	?
	Makua	XI.25.31	N.L.H. Krauss	5
	Manana Isle, dead bird	16.III.70	M.L. Goff	12
	Manana Isle	18.VIII.67	R.D. Spadoni	2
	Manana Isle	12.IX.67	R.D. Spadoni	1
	Oahu	11.VII.1946	Maehler	4
	Oahu	6 Oct.44	G. Hagen	1
	Oahu	5.XII.1955	R.O. Parsons	2 (USNM)
	Oahu	XI.56	G. Frey	1
	Punahou (in pasture)	no date	Weber (1936)	?
	San Pedro	4.XII.1945	no name	1 (USNM)
	Waikiki	1-16.I.1923	Van Dyke (1953)	100 (CAS)

selves well to transport in soils, soil ballast, and in materials such as boxes and shipping crates that are left on the ground overnight. On many occasions I have found that they have crawled into camping equipment and other material placed on the ground in the Galapagos.

There is no present evidence that this species is having any negative impact on the native fauna of the Hawaiian islands.

This is the only example I know of in which a species naturally endemic to the Galapagos Islands has been a successful colonist, after human introduction, to habitats outside of the Galapagos Archipelago. If an allozyme or other biochemical-genetic marker could be found that is unique to populations of individual islands of the Galapagos, it would be possible to determine if the Hawaiian populations come from one of more islands of the Galapagos, and which these were.

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New Records, Synonymies, and Range Extensions of Two-Winged Flies (Diptera) from the Hawaiian Islands

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The following represent new state or island records, synonymies, or significant range extensions of Diptera for the Hawaiian Islands. Voucher specimens of all species are deposited in the Bishop Museum unless otherwise specified. Determinations were made by the author unless indicated otherwise. Authorship for each record, if different than above, is given at the end of the record.

Dolichopodidae

Condylostylus longicornis Fabricius **New state record**

This species is a native of the southern United States and the Neotropical Region, and

was known in the Pacific only from the Marquesas, Society Islands, Tuamotus, and Austral Islands in French Polynesia (Bickel, D.J., 1994, *Rec. Aust. Mus. Suppl*. 21: 108). The collection record below marks the first time this species has been found in the Hawaiian Islands.

Material examined: OAHU: Barber's Point, freshwater marsh near corner of Kalaeloa Boulevard and Malakole Street, 24.x.1996, resting on leaves, P. Grootaert (determination by P. Grootaert). — **P**. **Grootaert & N**.**L**. **Evenhuis**.

Campsicnemus miser Parent **Range extension**

This species was previously only known from the single type specimen from Mt. Olympus, in the Koolau Mountains of Oahu. The collections below mark the first published record of this species from the Waianae Mountains.

Material examined: OAHU: Waianae Mountains: Lualualei Naval Magazine, Halona Valley, 16.ii–14.iv.1996, ex Malaise trap in *Sapindus* grove, G.A. Samuelson; same locality, 31.i.1996, 24.iv.1996, 3.vii–1.viii.1996, 460 m, Malaise trap, D.J. Preston; same locality, 3.i.1996, Malaise trap, D.J. Preston & G.M. Nishida; [Waianae Mountains], Palehua, 2000 ft [671 m], 18.iv.1970, ex sap flux, S.L. Montgomery (Univ. Hawaii Manoa).

Tachytrechus angustipennis Loew **New island record**

The first record of this species from Hawaii was from collections from Kauai published in the *Records of the Hawaii Biological Survey for 1995* (Evenhuis, N.L., 1996, *Bishop Mus. Occas. Pap*. 46: 27). At that time, the species identification was unknown. since then, the species has been identified as *T. angustipennis* by Henk Meuffels, Royal Belgian Institute of Natural Science, Brussels. This species was originally described from Washington, D.C. and ranges throughout North America and as far south as Chile (Robinson, H., 1970, *Cat. Dipt. Am. S. U.S*. 40: 53). The following collections mark the first record of this species from Oahu.

Material examined: OAHU: Waianae Mountains: Lualualei Naval Magazine, Puhawai Falls, 15.x.1996, from splash zone on vertical cliff near falls, N.L. Evenhuis; stream east of Puhawai Spring, 220 m, 7.ii.1996, D.A. Polhemus. — **H**. **Meuffels & N**.**L**. **Evenhuis**.

Drosophilidae

Drosophila tamashiroi Hardy, 1965: 477.

Drosophila insignita Hardy, 1965: 326. **New synonymy**

Recent collections from Lualualei Naval Magazine have prompted examination of specimens of these two species. A direct comparison of the types of these two species shows them to be conspecific. At the time of the original description of *D. tamashiroi*, the male genitalia of that species were not studied. The male genitalia of specimens collected below were studied and shown to be the same as those of *D. insignita*, hence the new synonymy here of *D. insignita* under *D. tamashiroi*.

The species was previously known from the type localities of the 2 species: Palikea (*insignita*) and Makaleha Valley (*tamashiroi*) in the Waianae Mountains. The collections reported here extend the distribution into the Lualualei Naval Magazine.

Material examined: OAHU: Waianae Mountains: Lualualei Naval Magazine: Pohakea Spring, 475 m, 14.iii.1996, Malaise trap, D.J. Preston; same locality, 24.iv–16.v.1996, Malaise, D. Preston & F. Howarth (determinations by K. Arakaki & N.L. Evenhuis). — **K**. **Arakaki & N**.**L**. **Evenhuis**.

Ephydridae

Ochthera circularis Cresson **New island records**

A native of Taiwan, this species, easily characterized by its fossorial front legs, is distributed throughout the Oriental Region from India and Sri Lanka to the Philippines and Ryukyu Islands. It has previously been reported from Makiki and Manoa, Oahu (Hardy, D.E., 1985, *Proc. Hawaii. Entomol. Soc*. 25: 12), but was inadvertently omitted from the Australasian/Oceanian Diptera Catalog (Mathis, W.N., 1989, Ephydridae, *in*: Evenhuis, N.L., ed., *Cat. Dipt. Australas. and Oceanian Reg*., p. 647). The two records below represent new island records for this species in the Hawaiian Islands.

Material examined: KAUAI: Makaleha Stream at Makaleha Spring, 8.xi.1994, D.A. Polhemus; Lower Hanakapiai Stream, 0-70 m, 24.x.1992, on sand bar beside stream, D.A. Polhemus. MAUI: East Maui, Maliko Gulch, near sea level, 22.ix.1996, R. Englund & R. Filbert.

It has also been recently observed at a second locality on Oahu, listed below.

Material examined: OAHU: Mt. Kaala summit bog, pools near FAA tower, 25.x.1996, D.J. Preston.

Nostima niveivenosa Cresson **New state record**

A native of Puerto Rico, this species is known from Florida south through the Neotropics. The collection from Lualualei on Oahu listed below marks the first time this species has been recorded from the Hawaiian Islands.

Material examined: OAHU: Waianae Mountains: Lualualei Naval Magazine, Pohakea Springs, 14.iii.1996, G.M. Nishida & G.A. Samuelson (determination by Keith Arakaki). — **K. Arakaki**.

Lauxaniidae

Poecilominettia sexseriata Hendel **New island record**

This species was previously known from Kauai and Oahu in the Hawaiian Islands (Hardy, D.E., 1995, *Proc. Hawaii. Entomol. Soc*. 32: 8). It was described from Paraguay and is known from Bolivia and Panama. The collection below marks the first record of this species from Hawaii Island.

Material examined: HAWAII: Hualalai: Kaloko Mauka, 4100 ft. [1250 m], 20-21.x.1996, yellow pans in *'ohi'a* forest, N.L. Evenhuis.

Otitidae

Euxesta stigmatias Loew **New state record**

This species of ulidiine picture-winged flies, whose type locality is Cuba, is found throughout South America northward to Mexico, the Caribbean, and Florida. The collection below is the first record of this species from the Hawaiian Islands.

Material examined: OAHU: Lualualei Naval Magazine, Halona Valley, 1120 ft [341 m], 9.v.1994, at MV light, G.M. Nishida (determination by Keith Arakaki). — **K. Arakaki**.

Scenopinidae

Scenopinus lucidus Becker **New island record**

The treatment in D.E. Hardy (1960, *Insects of Hawaii* 10: 326) and the listing in G.M. Nishida (1994, *Bishop Mus. Tech. Rep*. 4: 111), record this species from Kaula, Niihau, Kauai, Oahu, Molokai, Lanai, and Kure Islands in Hawaii. It is native to Egypt and is also known from throughout the Afrotropical region and Christmas Island in the Indian Ocean. The collection below marks the first record of this species from Hawaii Island.

Material examined: HAWAII: Parker Ranch, 0.4 mi. [0.64 km] w. east side access gate near Pohakuloa Training Area, 21.ix.1996, swarming above wheel ruts in fine sand near stand of *Dodonaea viscosa*, N.L. Evenhuis.

Is the Parthenogenetic Hawaiian Fly *Diaphorus parthenus* (Hardy & Kohn) (Diptera: Dolichopodidae) an Australian Stowaway?

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Abstract

Diaphorus parthenus (Hardy & Kohn), **n**. **comb**. (Diptera: Dolichopodidae) was described from females collected at relatively high elevations on the main islands of Hawaii. The species' distinctive coloration and absence of acrostichal setae make it readily identifiable among other Diaphorinae. Females have since been found on Norfolk Island, and widely in temperate Australia where males sometimes occur. The male is here described, and the species is now considered to be facultatively parthenogenetic. It probably originated in Australia and was inadvertently introduced to Norfolk Island and Hawaii, a pattern known for another dolichopodid species.

Introduction

When sorting Australian Dolichopodidae, I have frequently noted this distinctive species of the subfamily Diaphorinae. Although not described from the Australian fauna, it is easily recognized by its dense grey thoracic pruinosity with a broad bronze median band, and total absence of acrostichal setae. Despite having seen hundreds of females, especially those taken in light traps at Black Mountain, Canberra, very few males were in collections.

Subsequently at the Bishop Museum, I saw female paratypes of the Hawaiian *Chrysotus parthenus* Hardy & Kohn, which immediately reminded me of the Australian species. I borrowed specimens for comparison and found the Hawaiian and Australian specimens to be identical in every respect. After scanning Australian collections, I found more specimens from many localities, including a few more males. This paper describes the male, transfers the species to the genus *Diaphorus*, notes the species' probable facultative parthenogenetic nature and discusses its unusual distribution.

Materials and Methods

Institutional abbreviations for study material cited are listed in the Acknowledgements.

The genitalic drawing was made with a camera lucida attached to a compound microscope. In describing the hypopygium, 'dorsal' and 'ventral' refer to morphological position prior to genitalic rotation and flexion. Thus, in figures showing a lateral view of the hypopygium, the top of the page is morphologically ventral, while the bottom is dorsal. Morphological terminology follows McAlpine (1981). Measurements are in millimeters.

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Body length is measured from the base of the antennae to the tip of the seventh abdominal segment. Wing length is the perpendicular distance to the apex from an imaginary extension of the humeral crossvein; wing width is measured from the junction of R_1 with the costa to the opposite side of the wing, perpendicular to the wing's long axis. The CuAx ratio is the length of the m-cu crossvein/ distal section CuA. The position of features on elongate structures such as leg segments is given as a fraction of the total length, starting from the base. The relative lengths of the podomeres should be regarded as representative ratios and not measurements.

The following abbreviations and terms are used: MSSC = Male secondary sexual character(s), the non-genitalic characters found only on the male body; ad = anterodorsal; av = anteroventral; dv = dorsoventral; pd = posterodorsal; pv = posteroventral.

Systematics

Diaphorus parthenus Hardy & Kohn, **new combination** Figs. 1–2

Chrysotus parthenus Hardy & Kohn, 1964: 241.

Diagnosis: Both sexes of this species can be distinguished from almost all other described *Diaphorus* by the total absence of acrostichal setae and a dense grey dorsal thoracic pruinosity with a broad bronze band between the dorsocentral setae.

Redescription.

Male (based on Australian specimens). length, 2.2–2.6; wing: 1.8×0.8 to 2.3×1.0.

Head: vertex and frons mostly covered with a light brown pruinosity, giving a bronze appearance; frons wide; setae black; 3 pairs strong postverticals, with median pair converging; vertical seta strong and proclinate; pair strong diverging ocellars and pair of short weak postocellars present; face and clypeus broad, as wide as frons and not narrowed, and covered with grey pruinosity; palp dark brown with some grey pruinosity and black setae; proboscis dark brown; antenna dark brown-black; first flagellomere subtriangular; arista dorsal, bare and shorter than head height; ventral postcranium with numerous white setae.

Thorax: ground color dark metallic green, and mostly covered in dense grey pruinosity, except for broad band of light brown pruinosity between the dorsocentral rows and extending onto the scutellum, appearing bronze, and with some brownish pruinosity also over notopleural and humeral area (Fig. 1b); setae black; acrostichal setae totally absent; 5 strong dorsocentral setae present; 1 postalar seta, 2 postsutural supra-alar setae, 2 presutural intra-alar setae, 2 notopleural setae, 1 postpronotal seta, and 1 presutural supra-alar seta present; proepisternum with strong seta on lower part and 1–2 short pale hairs on upper part; median scutellars strong, laterals present as short hairs.

Legs: coxae, femora, tibiae, and tarsi mostly dark metallic green to black with some grey pruinosity; trochanters and femoral "knees" yellowish; setae black and legs with short black vestiture; coxa I with some black distolateral setae; coxa II with strong basal anterolateral seta and some shorter anterior setae; coxa III with strong lateral seta; short unmodified claws and short pulvilli present on all tarsi; femora with only short ventral hairs; femur I with 3 subapical pv setae; tibia I with offset ad-pd setal pair near 1/4 and with short apicoventral seta; tibia II with very strong ad seta and weaker pd seta at 1/5, with pd seta at 1/2, and with some strong apical setae; femur III with 3 strong av setae in distal fifth; tibia III with strong ad seta at 1/4 and with 3-5 dorsal seta along length of tibia.

Wing: hyaline; R_{4+5} and M subparallel; M with slight flexion near "bosse alaire;"

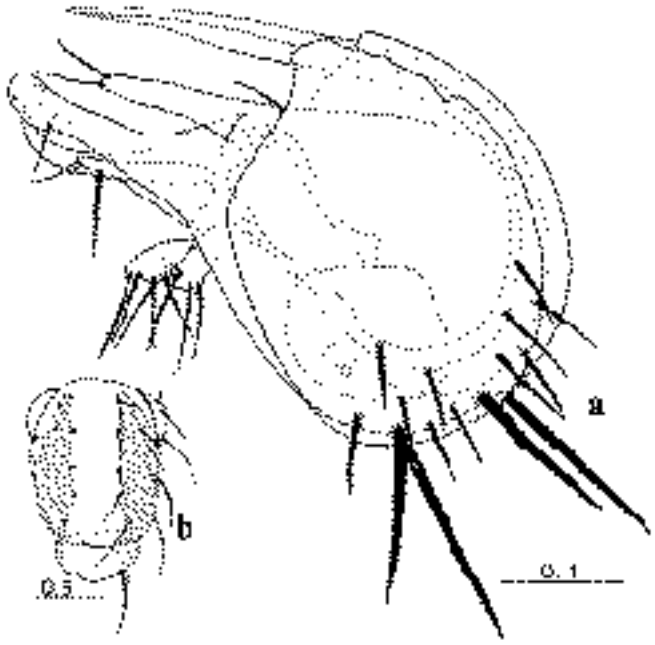

Fig. 1. *Diaphorus parthenus*: (a) sternum 8 and hypopygium, left lateral (Ponds Ck nr Armidale, NSW). (b) thorax of female, dorsal: stippling is grey pruinosity, blank area is light brown.

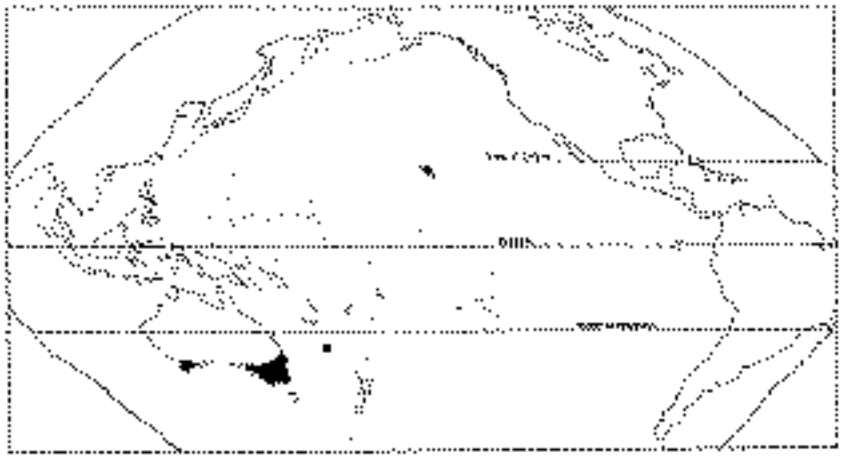

Fig. 2. Distribution, *Diaphorus parthenus*, showing its known occurrence in Australia, Norfolk Island and the Hawaiian Islands.

CuAx ratio: 0.3; lower calypter yellowish with fan of black setae; halter yellow.

Abdomen: green-bronze with some whitish pruinosity; vestiture black; sternum 8 (Fig.1a) with 4 strong black projecting setae; hypopygium (Fig. 1a) dark brown with brownish cercus; epandrium circular; epandrial lobe elongate with 2 apical setae, and subtended by strong basal seta; surstylus comprising three overlapping arms with setae as shown; cercus short and bilobate with long setae.

Female: wing length 1.8-2.6; similar to male except as noted: frons slightly wider; all tibia yellow to yellowish; basal tarsomeres yellowish, but becoming dark brown distally; leg chaetotaxy similar.

Types. The holotype is a female from Paliku, Haleakala Crater, Maui (BPBM 4189, examined). About 300 paratypes, all female, were designated from the major islands of the Hawaiian Archipelago (see Hardy & Kohn, 1964).

Additional records.(all females except where indicated) **AUSTRALIA:** *AUSTRALIAN CAPITAL TERRITORY*: Black Mountain, 35.16'S 149.06'E, light trap, 1955–1968 (114 specimens, all ♀♀, recorded from all months except July and August, with most specimens occurring from March-May and September–October); Cotter River & Murrumbidgee River, jct., 21.xi.1962; Blundells, 10.x.1930; Pine Island 35.26'S 149.04'E, 8.ii.1934 (ANIC); Canberra, 35.18'S 149.08'E, 21.xi.1956 (USNM); Condor Ck, Brindabella Range, 7.iii.1984 (AMS). *NEW SOUTH WALES:* 20km E of Forbes, 9.iv.1977, *Callitris* forest; Araluen, 35.39'S 149.49'E, 11.iv.1966 (ANIC); Broulee, 12km NE of Moruya, 35.51'S 150.11'E, 12.iv.1966, 14.vii.1978, 12.iv; Collarenebri, 29.33'S 148.35'E, 9.x.1963; Eugowra, 15.xi.1962; Gwydir Highway, 32km E of Glen Innes, 29.39'S 152.00'E, 1100 m, 20.iv.1970; New England Nat. Park, 30.30'S 152.23'E, 1300 m, wet sclerophyll forest, 11.ii.1968 (3♂♂, ♀); Ponds Ck, E of Armidale, 13.x.1962 (2♂♂, ♀); Porters Dam Rd, 9.ii.1974; Wallaga Lake, Bermagui, 36.22'S 150.56'E, 24 to 27.ii.1974; 14 km W of Braidwood, 4.xi.1975; Bilpin, 6.x.1963; Eucumbene Dam, 18.xi.1962; Coolabah, 12.x.1963; 30 mls S of Singleton, 6.ii.1968; 27 km N of Dubbo, 17.vi.1976; 16 km E of Bungendore, 10.xi.1973; Shoalhaven Bridge, nr Braidwood, 9.i.1968; Colo Heights, Putty Rd, 6.ii.1968; Kiora, nr Moruya, 6.iii.1976; 4 miles E of Nimmitabel, 8.iii.1963; 40 miles W of Moree, 9.x.1963; Sweetwater, Kain 24.ix.1960 (ANIC); Corunna Lake, near Narooma, 36.17'S 150.07'E, on tree trunk, 21.xi.1980; Ashton Park, Mosman, 33.50'S 151.15'E, 23.ix.1980, on *Angophora* trunk; Blue Mountains, Katoomba Ck., 20.ix.1980 (3♂♂, ♀); Royal Nat Park, 18.i.1964; 19 km SE of Mudgee, 14.iv.1979; Goonoo State For., 9 km S of Mendooran, 31.54'S 149.07'E, 1 to 3.v.1970; Colo Vale, 34.24'S 150.29'E, 27.x.1957; Spring Ridge, 17 km NW of Gulgong, 5.iv.1979; 6 km SE of Robertson, 24.x.1970; Heathcote, 24.x.1970 (AMS); Kanangra Boyd Nat Park, Boyd River, 26.xi.1994, montane swamp (CNC). *SOUTH AUSTRALIA*: 11 km NW of Hawker, 3.x.1975 (ANIC); Ferris-McDonald Nat. Park, 1.xi.1970 (SAM). *VICTORIA:* Youngs Ck & Bonang Hwy, 9.xi.1976; 6 km NE of Erica, 4.iii.1981; Warrandyte, 21.x.1920, 5.iv.1969 (ANIC); Alpine Nat Park, Bogong High Plains, alpine meadow, 1600m, 30.xi.1994 (CNC). *WESTERN AUSTRALIA*: 13km N of Bunbury, 1.x.1970 (1♂); Circular Pool, Nornalup Nat. Park, 9.x.1970 (1♂); Porongorup Nat. Park, 31.39'S 116.42'E, 150m, 11.x.1970; Cannington, 2.ix.1954; 9 mi W of Pemberton, 4.x.1970; Stirling Ranges Nat. Park, 5 km E of Mt.Hassell, 34.22'S 118.08'E, 23.x.1981; Stirling Ranges Nat. Park, 54.Mile Post, 12.x.1970 (ANIC); Porongorup Nat. Park, Yate Flats, 9.xi.1987 (CAS). *NORFOLK ISLAND*: Philip Island, Upper Long Valley, 29.07'S 167.59'E, Malaise, 26.iii to 2.iv.1984 (ANIC).

Discussion

Although originally described as *Chrysotus parthenus*, the species is newly referred to *Diaphorus* based on the following characters: upper part of proepisternum with fine setae, the male face with parallel sides, and male sternum 8 with four strong projecting

setae. These characters were used in the key by Robinson & Vockeroth (1981) to distinguish *Diaphorus* from *Chrysotus*. As well, this species is similar to other *Diaphorus* in size and overall habitus.

Diaphorus parthenus is unusual in lacking any trace of acrostichal setae. Most of the more than 250 described *Diaphorus* species have biseriate acrostichals of varying strength, which sometimes are variously lost or reduced in size. While searching for Australian specimens of *D. parthenus*, I found 2 more species of *Diaphorus* which also lacked acrostichals, both undescribed, from Tasmania and montane northern New South Wales, respectively. These three species possibly form a clade in Australia.

This species shows some intraspecific variation in body size (females collected at Black Mountain, A.C.T. have a wing length from 1.8–2.6), and in the intensity and distribution of the grey and brown pruinosity on the mesonotum, although the appearance of the thorax is also affected by age, amount of rubbing and state of preservation of specimens. As well, some specimens have four dorsocentral setae instead of five, and one specimen from Black Mountain had five left dorsocentrals and four on the right. Males have no strongly developed secondary sexual characters, and the major somatic difference between the sexes is tibial color, which is dark metallic green to black in males and yellow in females.

Diaphorus parthenus occurs widely across the southeastern and southwestern Australian mainland, and on Norfolk Island and the Hawaiian Islands (Fig.2). In Australia, it is distinctly temperate, and occurs on the eastern ranges and tablelands where cold winters predominate. Nevertheless, the species has also been collected at warmer lowland sites, such as Sydney Harbour. Most specimens were collected in eucalypt sclerophyll habitats, and some specimens were collected off *Eucalyptus* and *Angophora* tree trunks. Almost all Hawaiian records (Hardy & Kohn, 1964) are from cooler montane localities above 1,000 meters.

Females clearly dominate collections, and comprise all specimens taken in the Hawaiian Islands and Norfolk Island, and in 51 of the 56 Australian sites. Of note is the Black Mountain site which has been extensively collected for years but has so far only yielded females. Males are known from only five Australian samples, taken in the Blue Mountains and New England Tablelands in New South Wales, and in southwestern Australia. The predominance of females strongly suggests that the aptly named *Diaphorus parthenus* is facultatively parthenogenetic, and at times is able to reproduce without males. Parthenogenesis is known from a wide range of dipteran families (see Hennig, 1973 for overview) and this a plausible case for the Dolichopodidae. Probably the Hawaiian and Norfolk Island populations of *Diaphorus parthenus* are fully parthenogenetic, which would invite further investigation of the species' reproductive biology.

A further problem remains. How did this seemingly cool-adapted species achieve such a far-flung distribution? *Diaphorus parthenus* undoubtedly arose on the Australian continent where it is widely distributed and has congeners which also lack acrostichal setae. Its presence on Hawaii and Norfolk Island can be explained as a result of accidental human transport. Hawaii is known to harbor many naturalized species of insects, the full extent of which is being increasingly revealed. For example, Miller & Eldredge (1995) list 2,527 nonindigenous species from a total of 7,862, almost one-third of the entire Hawaiian fauna. At least one other Australian dolichopodid, the common eastern Australian sciapodine *Austrosciapus connexus* (Walker) is also known from Norfolk

Island and Hawaii (and French Polynesia, as well), and was probably transported as immatures in soil associated with the horticultural trade or in general debris (Bickel, 1994, 1997). Although an ability to reproduce parthenogenetically would aid a stowaway's future success, fully sexually reproducing dolichopodids such as *A. connexus* have also been widely spread by human transport.

In the Hawaiian islands, *Diaphorus parthenus* appears to have reproduced rapidly only in the mountains, in climatic conditions more like its temperate homeland than the intervening the lowland tropics. The species secondarily colonized all the high islands in the Hawaiian archipelago, possibly from a single founder event.

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Two New Hawaiian Bird Mite (Acari) Records

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Except for few studies of mite ectoparasites on *'amakihi* (*Hemignathus virens virens*) (Passeriformes: Fringillidae) (van Riper, 1975), pigeons, and doves (Wilson, 1966), birds from Laysan Island (Wilson, 1964), and from birds at Hawaii Volcanoes National Park (Goff, 1980), the mite diversity of the Hawaiian avifauna is poorly studied. Two mite species: *Pellonyssus reedi* (Zumpt & Patterson, 1952) (Macronyssidae) and *Laminalloptes phaetontis* (Fabricius, 1775) (Alloptidae) are reported for the first time associated with the Java Sparrow (*Padda oryzivora*) and the Redtailed Tropicbird (*Phaethon rubricauda*), respectively. No mite associations with these birds are previously reported from the Islands.

Parasitiformes
Mesostigmata: Macronyssidae
Pellonyssus reedi Zumpt & Patterson **New state record**

This mite was initially identified as *Pellonyssus passeri* Clark & Yunker, 1952, which is a subjective synonym of *P. reedi* Zumpt & Patterson, 1952 (Till, 1964). This species is widely distributed in South Africa (Transvaal, Cape Province and Orange Free State) on various avian hosts (Till, 1964). In the United States (Maryland), the species was described as *P. passeri* Clark & Yunker from *Passer domesticus*. This is the first record in Hawaii of a mite associated with the introduced Java Sparrow (*Padda oryzivora*) (Passeriformes: Estrildidae). The specimen was submitted to the author for identification by Dr. Roy Furumizo of Vector Control Branch, Hawaii Department of Health.

Material examined. OAHU: Honolulu, 28.x.1994, ex bird nest of java sparrow (*Padda oryzivora*), G. Marushige, coll., 2♀ (1 slide).

Acariformes
Astigmata: Alloptidae
Laminalloptes phaetontis (Fabricius) **New state record**

This species was collected from a dead redtailed tropicbird (*Phaethon rubricauda*)(Pelecaniformes: Phaethontidae) from Midway Atoll. Mites of all stages were found on the tail and wing feathers. This relatively large ectoparasitic mite species is associated with *Phaethon* and *Fregata* (Pelecaniformes) bird species (Atyeo & Peterson, 1967), predominant inhabitants in the Northwestern Hawaiian Islands, including Midway Atoll. Carla Kishinami, Bishop Museum, alerted SFS of the presence of feather mites on the dead bird. The 4 specimens were identified by Dr. Warren T. Atyeo of the University of Georgia, Athens.

Material examined. MIDWAY ATOLL: (prob. Sand Island) ex feathers of dead *Phaethon rubricauda*, 14.xi. 1994, N. Seto, USFWS, BPBM 179791 (1♂,1♀, 2 nymphs).

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First Records of Mites in the Family Eupalopsellidae (Acari: Prostigmata: Raphignathoidea) in the Hawaiian Islands

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The Eupalopsellidae species *Exothorhis caudata* and *Saniosulus nudus*, described by Summers (1960) from Florida and Mexico respectively, are reported for the first time from the Hawaiian Islands from materials collected on Oahu. The family was first reported by Swift (1996), but without details. As currently understood, the Eupalopsellidae consist of 6 genera and about 30 species (Gerson, 1994). Characterized by having long, attenuate palpi, absence of peritremes and having fused cheliceral bases, members of this family are usually associated with scale insects of economic plants and are therefore potential biocontrol agents of scales (Gerson & Smiley, 1990). Specimens are kept at the Acarology Collection of the J. Linsley Gressitt Center for Research in Entomology, Bishop Museum.

Exothorhis caudata Summers **New state record**

The smallest representative in the eupalopsellid family, this single specimen has a body length of 256 and width of 178 microns. The idiosoma of *E. caudata* is covered with a thin skeletal sheath with robust, coarse and denticulate dorsal body setae set on tubercles. The dorsal setae on the proximal leg segments originate on tubercles, also coarse and denticulate as the idiosomal setae. Other characters that will identify this species from other species in the genus are the downwardly curved tailpiece on the posterior tip of the opisthosoma and the presence of minute sensillum (ϕ) on the distal part of tibia I. The type of *E. caudata* shows that it has a single seta on genu IV missed by Summers in his description. The spine-like seta κ of genu I is on its own tubercle and set close to the tubercle base of coarsely denticulate dorsal seta, contrary to Summers' description and drawing showing the two setae originating from a single alveolus.

Species in the genus *Exothorhis* are associated with plants where they feed on scale insects (Zaher & Yousef, 1973) and probably some other small phytophagous arthropods and their immatures. According to Muma (1975) this species is fairly common on citrus leaves and fruits and is called spiny red mite. This is the first time *E. caudata* has been recorded outside of Florida and collected from a non-citrus host.

Material examined. OAHU: Kaneohe, Hoomaluhia Botanical Park, 5.vi.1989, ex moss, R. Brown (1♀).

Saniosulus nudus Summers **New state record**

This species is characterized by an elongated idiosoma, with fine striation throughout except for a pair of small, ill-defined plates on the propodosoma and the suranal area. The 13 pairs of short dorsal body setae and the widely spaced *sci*, each seta displaced laterally to postocular position are other distinguishing characters of *S. nudus*.

Saniosulus nudus resembles the genus *Storchia* Oudemans, 1923 and some *Stigmaeus* species of the family Stigmaeidae by virtue of its fusiform idiosoma, small propodosomal plates and short dorsal body setae. However, the elongate, slender palptarsus and characteristic pair of unequal tenent hairs on a short arolium of the tarsal empodium conform with the characters of the family Eupalopsellidae. Summers (1960) indicated the palptibia has "one minute spine-like seta close beside its longer dorsal seta" but this character could not be verified in the type specimen and the other specimens examined. He might have referred to the dorsal base of the claw that has a dark, spine-like, sclerotized area, actually part of the curved claw; thus there are only 2 setae in the palptibia of *S. nudus*. Slightly posterior of the eupathidial terminal seta of the palptarsus is another seta slightly thicker, seemingly eupathidial, with slightly blunt tip, compared to aciculate configuration of the other 4.

This species was reported in Israel feeding on chaff scale, *Parlatoria pergandii* Comstock, a pest of citrus trees (Gerson & Blumberg, 1969). Although this species has biocontrol potential against scales, it can also reach pest status in laboratory rearings of Diaspididae necessitating eradication measures (Gerson, 1968). In the Hawaiian Islands, *S. nudus* and *E. caudata* have been collected only on Oahu.

*Distribution***:** Mexico, USA (Texas, California), Egypt, India, Hawaiian Islands (Oahu).

Material examined. OAHU: Honolulu, Univ. Hawaii Campus, Manoa, 9.X.1965, ex soil with litter, F.H. Haramoto (1♀); Honolulu, 19.XI.1959, ex feeding on cactus scales, F.H. Haramoto (4♀); Univ. Hawaii Campus, Manoa, Henke Hall, 12.XI.1967, ex grass litter, P. Vaivanijkul (1♀); Honolulu, Hawaii Kai, Mariner's Ridge, 213 m, 3.VI.1990, ex *Eragrostis variabilis* with scales, J. Strazanac (4♀, 1♂, 1 larva); Waianae Beach, 30.III.1972, ex *kiawe* litter, D.M. Tsuda (1♀).

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Corrections and Additions to the Spider Fauna of Hawaii

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These contributions include new state and island records, changes, deletions and corrections noted since the publication of the revised edition of the *Hawaiian Terrestrial Arthropod Checklist* (Nishida, 1994) and the *Records of the Hawaii Biological Survey for 1994* (Evenhuis & Miller, 1995) and the *Records for 1995* (Evenhuis & Miller, 1996). Unless otherwise indicated, all new records are represented by voucher specimens in the Bishop Museum and are identified by the senior author.

Agelenidae

Hololena curta (McCook) **New state record**

Chamberlin & Ivie (1942) redescribed this species. It is common in southern California and makes funnel webs on bushes and buildings. It is also recorded from Canada and Alaska.

Material examined: HAWAII: Pohakuloa State Park, 2000 m, 6 June 1982 (F.G. Howarth), 1 female; 18 December 1989 (D.J. Preston), 1 female; no date, 7000 ft (2134 m) (D.J. Preston), 1 female; Puulaau: Mauna Kea, 2200 m, 9 December 1987 (D. Preston & S. Montgomery), 1 female; some on *Sophora* trunks, 3 males, 3 females.

Tegenaria domestica (Clerck) **New island record**

Tegenaria domestica has been previously recorded from Kauai, Oahu, and Hawaii islands.

Material examined: MAUI: Kula, 16 April 1986, on house (P. Conant), 6 juveniles; Haleakala Natl. Park: Paliku, 1945 m, 24 June 1976, in cabin (F.G. Howarth), 1 female; 7000 ft, 17 July 1965 (J.W. Larson), 3 males, 2 females; Auwahi, 3700 ft, 19 July 1965 (T. Suman), 1 male.

Anapidae

Pseudanapis aloha Forster **Change of status**

Pseudanapis aloha was listed as endemic in the Hawaiian Terrestrial Arthropod Checklist. It may be an immigrant to the Hawaiian Islands (Platnick & Forster, 1989) as it is also known from Yap and Queensland, Australia.

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Araneidae

Argiope amoena L. Koch **Deletion from fauna**

This record was based on old (1963–64), unvouchered literature references prior to a revision of the genus and was likely misidentified. No specimens are on hand in the Bishop Museum collection and no other records have been published since 1964. Levi (1983) listed only Japan and China in the species distribution.

Argiope bruennichi (Scopoli) **Deletion from fauna**

This 1980 identification was based on specimens from Kauai located in the Hawaii Department of Agriculture collections, Honolulu (HDOA). The specimens were reexamined using Levi's (1983) revision of this genus. They are large [as indicated in the original note in the *Proc. Hawaii. Entomol. Soc.* 23(2): 170] and similar to the syntype of *A. avara kauaiensis* Simon, a synonym of *A. trifasciata* (Forsskål).

Argiope appensa (Walckenaer) **New island record**

A. appensa was first recorded from the Hawaiian Islands in 1951. It was previously reported from Kauai, Oahu, Molokai, and Hawaii islands.

Material examined: MAUI: Haiku, 20 March 1960 (N.L.H. Krauss), 1 female with egg sac.

Neoscona hentzii (Keyserling) **Deletion from fauna**

All records of this species were based on identifications made prior to Berman and Levi's (1971) revision of *Neoscona*. Currently, *hentzii* is restricted to eastern US extending to Arizona and south into Mexico. Specimens misidentified as *N. hentzii* or *N. benjamini* (Walckenaer), a synonym of *hentzii*, belonged to *N. oaxacensis* or *N. theisi.*

Neoscona nautica (L. Koch)

On the basis of collection records, it appears that the following 2 species of *Neoscona* are displacing *N. nautica* in the islands as only a single recent specimen was found of this species. *Neoscona nautica* was previously reported (Simon, 1900) as the only representative of this genus in the Hawaiian Islands.

Material examined: HAWAII: Waikoloa, 13 May 1986, in various vegetation (S. Matayoshi), 1 female (HDOA).

Neoscona oaxacensis (Keyserling) **New island record**

Neoscona oaxacensis has been recorded previously from Kure, Midway, Oahu, and Hawaii islands.

Material examined: LANAI: edge of pineapple field, 2–9 February 1985 (V. & B. Roth), 3 females, 1 male.

Neoscona theisi (Walckenaer) **New island records**

Neoscona theisi has been previously recorded only from Hawaii island.

Material examined: LISIANSKI: 18 September 1964 (J.W. Beardsley), 2 females, 6 males; LAYSAN: 19 November 1964 (J.W. Beardsley), 1 female, 1 male; MOLOKAI: Forest Reserve, 10 July 1968, ex mainly dandelion (D.M. Allred); Palaau Park, 2 January 1983 (V. & B. Roth), 1 male, juveniles; LANAI: edge of pineapple field, 2–4 February 1985, (V. & B. Roth), 1 female, 2 males; MAUI: Lahaina, April 1967 (N.L.H. Krauss), 1 male.

Barychelidae

Nihoa hawaiiensis (Raven) **Name change**

The genus *Nihoa* was established by Churchill & Raven (1992) for *Idioctis hawaiiensis* Raven from Necker Island.

Clubionidae

Cheiracanthium mordax L. Koch **Name change**

Cheiracanthium diversum L. Koch was synonymized under *C. mordax* (Dondale, 1966). The species is known from Australia to Samoa, Vanuatu, and Solomon Islands.

Desidae

Badumna longinqua (L. Koch) **New state record**

This widespread species is known from eastern Australia, New Zealand, and the western US.

Material examined: MAUI: Kula, 10 August 1985, on house (P. Conant), 1 female; 16 April 1986, house and bushes (P. Conant), 5 males, 5 females (HDOA).

Dictynidae

Dictyna sp., ***volucripes*** group **New island record**

This is the same species reported from Oahu as *Dictyna* sp. by Suman (1964).

Material examined: MOLOKAI: Ona Alii Park, near Kaunakakai, 5 January 1983 (V. & B. Roth), 1 male, 1 female.

Dysderidae

Dysdera crocata C.L. Koch **New island records**

Dysdera crocata was previously known from Kauai, Oahu, and Hawaii islands.

Material examined: MAUI: Waihee, 16 March 1967 (N.L.H. Krauss), 1 juvenile; MOLOKAI: Ona Alii Park nr. Kaunakakai, 5 January 1983 (V. & B. Roth), 3 females.

Filistatidae

Kukulcania sp. **New state record**

Probably adventive. Requires further identification, but this is a new state record for the genus.

Material examined: MAUI: Makawao, 28 July 1989, in bldg. (F. Howarth & F. Stone), 1 juvenile.

Wandella bakeri (Berland) **Name change**

Gray (1994) recently described *Wandella* and included *Pritha bakeri* in the genus. *Wandella bakeri* is known from the Cook Islands and Vanuatu. The Hawaiian record is based on an immature female collected in Honolulu "in flower pot soil." Since many species of *Wandella* are known from the Pacific area, this record needs confirmation with the collection of adult specimens.

Gnaphosidae

Camillina elegans (Bryant) **New island records**

Platnick & Murphy (1987) previously listed this species from Oahu, Lanai, Maui, and Hawaii islands.

Material examined: MIDWAY: Sand Island, 13 May 1973 (W. Gagné), 2 females; MOLOKAI: Ona Alii Park, near Kaunakakai, 5 January 1983 (V. & B. Roth), 4 females.

Trachyzelotes jaxartensis (Kroneberg) **New island record**

Trachyzelotes jaxartensis was recorded only from Oahu by Platnick & Murphy (1987).

Material examined: MOLOKAI: Palaau Park, 2 January 1983 (V. & B. Roth), 1 male, 1 female.

Urozelotes rusticus (L. Koch) **New island records**

U. rusticus was previously known from Laysan, Oahu, and Hawaii islands.

Material examined: KAUAI: Russian Fort, 19 August 1964, under rocks (T. Suman), 1 female. MOLOKAI: Ona Alii Park, near Kaunakakai, 5 January 1983 (V. & B. Roth), 1 male. LANAI: Holopoe Bay, 9 February 1985 (V. & B. Roth), 1 juvenile (tentative identification by N. Platnick).

Zelotes reformans Chamberlin **New island records**

Platnick & Shadab (1983) reported this species from Oahu.

Material examined: MOLOKAI: Ona Alii Park, near Kaunakakai, 5 January 1983 (V. & B. Roth), 1 male; HAWAII: Kawaihae Park, 13 June 1965 (T. Suman), 1 female.

Heteropodidae

Pandercetes petulca (Karsch) **Deletion from fauna**

A *nomen dubium* and misidentified genus for *Pedinopistha*. See Roth (1995).

Linyphiidae

Erigone dentosa O. Pickard-Cambridge **New state record**

Roewer (1942) lists this adventive species from Guatemala, Antigua, and the western US.

Material examined: HAWAII: Mauna Kea: Lake Waiau, 3950 m, 6 July 1971 (J.L. Gressitt), 6 males, 21 females.

"***Labulla***" ***graphica*** Simon and "***L.***" ***torosa*** Simon

Hormiga (1994: 11) stated "The Hawaiian . . . *Labulla* probably require a new genus" but does not describe the genus nor confirm its family placement. It is retained in Linyphiidae until it is formally revised.

Principalpus palmarius (Marples) **New state record**

This species is also known from Western Samoa, Cook Islands, Fiji, and the Mariana Islands.

Material examined: MAUI: Hana District: Waianapanapa, 16 December 1976, from debris near cave (V. Roth & B. Schroepfer), 1 male, 1 female; MOLOKAI: Palaau Park, 2 January 1983, V.& B. Roth, 1 female.

Loxoscelidae *see* Sicariidae

Lycosidae

Lycosa is an European genus and the Hawaiian species should be left in "*Lycosa*" until their generic classification can be confirmed.

Ochyroceratidae

Theotima radiata (Simon) **New state record**

This adventive species is listed by Roewer (1942) from Venezuela, Puerto Rico and Cuba.

Material examined: OAHU: Kaneohe Bay, 15 January 1983, in mangrove litter (V. Roth), 1 female.

Oecobiidae

Oecobius navus Blackwall **New island records**

Previously recorded only from Oahu.

Material examined: HAWAII: Kawaihae Park, 13 June 1965 (T. Suman), 1 immature male, 1 female. LANAI: Holopoe Bay, 2–9 February 1985 (V. & B. Roth), 2 females, 7 juveniles.

Pholcidae

Smeringopus pallidus (Blackwall) **Name clarification**

S. elongatus (Vinson 1863) is a junior synonym of *S. pallidus* according to Mello-Leitão (1946).

Physocyclus globosus (Taczanowski) **New state record**

This cosmopolitan species is adventive.

Material examined: OAHU: Pearl City, 28 March 1968 (B. Chambers), det. J. Beatty 1989, 2 females.

Hedypsilus culicinus Simon **New island record**

This species was redescribed and recorded by Gertsch & Peck (1992) as being "distributed by trade vehicles into the Hawaiian Islands and Marshall Islands." It is also known from the Galapagos Islands, Venezuela, and Texas.

Material examined: OAHU: N side of Kaena Point, 8 January 1985 (V .& B. Roth), det. W. Gertsch 1986, 1 male, 1 female; Honolulu, Tripler Army Medical Center, August 1995, in litter (S.F. Swift), 1 female.

Prodidomidae

Prodidomus singulus Suman **Family change**

Transferred back from Gnaphosidae by Platnick (1990).

Salticidae

Habronattus mustaciata (Chamberlin & Ivie) **New state record**

This species is known from the central coastal area of California.

Material examined: MOLOKAI: Ona Alii Park: near Kaunakakai, 5 January 1983 (V. & B. Roth), det. W. Maddison 1993, 1 female.

Menemerus bivittatus (Dufour) **New island record**

Previously known from Midway, Laysan, and Oahu islands.

Material examined: KAUAI: Waimea Distr.: Polihale State Park, 9 December 1976 (V. Roth & B. Schroepfer), det. W. Maddison 1993; 2 females.

Messua cf. ***felix*** (Peckham & Peckham) **Name change**

Suman (1964) listed this species as *Dendryphantes* sp. based on 2 records (1911, 1921). W. Maddison (1996) identified a collection of this adventive species and commented in that revisionary work, "*Dendryphantes felix* G.& E. Peckham might be considered either a *Bagheera* or *Messua* depending on any future lectotype designation . . .."

Material examined: KAUAI: Waimea Dist. Polihale State Park, 9 December 1976 (V. Roth & B. Schroepfer), det. W. Maddison 1993, 1 male.

Phidippus audax (Hentz) **New island record**

Previously recorded from Oahu and Maui.

Material examined: HAWAII: S Kona District, Honomalino, 2000 ft (610 m), 4 August 1981, in long pasture grass (W. Gagné), 1 male.

Phidippus regius C.L. Koch **New state record**

This species was previously reported (Swift, 1993), but the reference is repeated here owing to the limited circulation of that publication.

Material examined: OAHU: Honolulu, Campbell Estate, 28 December 1992 (R. Lum), 1 male.

Phintella versicolor (C.L. Koch) **New state record**

This species is adventive and is also recorded from Burma, Indonesia, Annam, China, Korea, Taiwan, Japan, and Sumatra.

Material examined: OAHU: Lualualei: N of Kolekole Pass Road at waterfall, 7 February 1996 (V. & B. Roth), 1 female, 2 juveniles.

Zenodorus microphthalma (L. Koch) **New island record**

Berry *et al.* (1996) transferred this species from *Mollica* to *Zenodorus*. Previously recorded only from Oahu.

Material examined: KAUAI: Kawaihau Distr.: Lydgate State Park, 6 December 1976 (V. Roth & B. Schroepfer), det. W. Maddison 1993; 1 male, 1 female.

Scytodidae

Scytodes fusca Walckenaer **New island records**

Previously recorded from Midway, Oahu, and Hawaii islands.

Material examined: KAUAI: Port Allen, 16 October 1942 (N.L.H. Krauss), 1 female. MOLOKAI: Palaau Park, 2 January 1983 (V. & B. Roth), 2 females.

Scytodes longipes Lucas **New island record**

Recorded previously from Kauai, Oahu, Molokai, Lanai, and Hawaii.

Material examined: MAUI: Makawao Dist., Poli Poli State Park, 14 December 1976 (V. Roth & B. Schroepfer), 1 male.

Segestriidae

Ariadna perkinsi Simon **New island records**

Known previously from Kauai, Oahu, Lanai, and Hawaii islands.

Material examined: MOLOKAI: Puu Kolekole region, 3000–3500 ft. (915–1067 m), 3 August 1965 (T. Suman), 1 juvenile. MAUI: W Maui, Puu Kukui, 950 m, 9 October 1971 (J.L. Gressitt), 1 juvenile.

Sicariidae **Family position change**

Loxoscelidae was reduced to subfamily status, Loxoscelinae by Platnick *et al.* (1991).

Loxosceles rufescens (Dufour) **New island record**

Listed previously from Kauai, Oahu, and Maui islands.

Material examined: LANAI: Holopoe Bay, 2-9 February 1985 (V. & B. Roth), 2 males, 1 female, 5 immatures.

Tetrablemmidae

Tetrablemma deccanensis (Tikader) **New state record**

This is the first record for the family in the Hawaiian Islands. The tiny species was found on the bottom side of volcanic rocks in a wash. Females were collected with their tiny, truncated, cone-shaped, multiple egg sacs, each containing a single 0.3 mm diameter egg. Adult females measure 1.3 mm in length and the spiderlings as they emerge about

0.75 mm. P. Lehtinen (pers. comm.) suggests this may be a species other than *deccanensis*, but has not justified this comment. This species is known from India.

Material examined: LANAI: Holopoe Bay, 2–9 February 1985 (V. & B. Roth), 2 females and egg sacs. Additional specimens and egg sacs are in the collections of the senior author and Pekka Lehtinen, University of Turku, Finland.

Teragnathidae

Leucauge venusta (Walckenaer) **Deletion from fauna**

No specimens of this species exist in the Bishop Museum collection. Other than a single mention in Roewer's catalog (1954), no published records of this species for Hawaii exist. Bonnet (1957) who gives references to all distribution records did not include Hawaii for this species. Accordingly, the species name is hereby deleted from the fauna.

Theridiidae

Steatoda erigoniformis (O. Pickard-Cambridge) **New state record**

This Palestinian species is accidentally introduced. This cosmopolitan species was originally described from Palestine.

Material examined: MAUI: Haleakala National Park (V. & B. Roth), 1 female.

Theridion melanostictum (O. Pickard-Cambridge) **New state record**

Very common on Oahu. Adventive. Levi (1980) gave a good description of this species under the name *T. miami* which was recognized later as *T. melanostictum*, a species introduced into Florida. *T. melanostictum* was originally described from the Mediterranean region.

Material examined: LANAI: 2–9 February 1985 (V. & B. Roth), 1 male, 1 female. OAHU: Lualualei: Puhawai Falls, 7 February 1996 (V. & B. Roth), 1 male; Wahiawa, in house, 13 March 1996 (V. Roth), 1 male; Makiki Heights, 19 June 1964, sweeping (T. Suman), 1 female; Schofield Barracks dump, February 1963, fly trap (B. Sugarman), 1 male.

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Deletion of Two Enigmatic Milliped Species from the Hawaiian Fauna (Diplopoda: Spirostreptida)

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As the result of both deliberate and unintentional introductions, the arthropod fauna of the Hawaiian Islands has become saturated with a wide diversity of exotic elements including species of both Diplopoda and Chilopoda. As though this kind of miscegenation was not *per se* bad enough, the list of the insular biota has been complicated by a number of species reputedly collected on Hawai‘i but never subsequently verified as either native or established synanthropes. Sometimes these spurious records were so transparently incorrect that serious doubt could be reflected on the credibility of the source person. Sometimes the original reference was so vaguely documented that not even a guess could be made as to the identity of the species implicated as being Hawaiian.

A good start has been made toward cleaning up the records with regard to “myriapods”. Shelley (1991) carefully reviewed the evidence concerning the presence of *Theatops* (Wood) in Hawai‘i, finding no tangible basis for accepting the single original record (which was surely based upon a mislabeled specimen). Some years ago (1975), I removed the supposedly endemic genus and species *Pelmatotylus tristriatus* (Attems, 1938) by showing that its published type locality “Impolvani” was not a Hawaiian place, but in fact a settlement in Natal, South Africa. Attems was working on collections from both Hawai‘i and Natal at the time, and either transposed a description into the wrong manuscript or placed a vial of material into the wrong jar. Why this possibility did not occur to him, in the face of the utter improbability of a dalodesmid genus occurring in the mid-Pacific, cannot be imagined. Clearly, an atlas was never consulted!

Some other diplopod names have been lurking in Hawaiian lists, or at least in the literature somewhere, for a long time, and 2 of them can be expunged quickly and easily. One was proposed by F. Karsch (1880), and I am very much indebted to my colleague Dr. Manfred Moritz for access to the type material in the Zoological Museum of the Humboldt University, Berlin (ZMB). The second is attributable to Attems, and I was able to examine its type specimen in the Vienna Natural History Museum (NHMW) through the courtesy of Dr. Jürgen Gruber.

Julus anguinus Karsch **Deletion from fauna**

This name was published to denominate 2 specimens labelled “Hawai: Olinda (Finsch leg.)” and immediately slipped into total obscurity. Attems carried the name in his 1914 list without comment, and in 1938 listed it as *Iulus anguinus*, with a “?”.

I examined the type material (ZMB 791) in 1992. Although both are females, and in rather bad condition, it was possible to see enough of the gnathochilarium structure to refer the specimens to the Neotropical genus *Pseudonannolene* with complete confidence. Whether they can ever be associated with an adequately known species seems doubtful. Olinda is a common place name in Brazil, one such being a city near Recife, Pernambuco, another being a district now part of Rio de Janeiro but probably a separate town prior to 1880. In any event, *J. anguinus* can safely be stricken from the Hawaiian list. The specimens were surely mislabeled as to provenance, a not uncommon event in the last century.

Scaphiostreptus caperanus Attems **Deletion from fauna**

This name was published for a milliped which in the original description was given no further data than "Honolulu". The label of this specimen however carries the name of the collector, F.X. Williams, which gives some credibility to the stipulated provenance. The same label states further "War mit dem sp. a" but since I could find no way to discover what Attems intended by the designation "sp. a" this possible clue proved useless. Regrettably Williams' original label is no longer present, so any potential insights from that source are also lost.

I cannot match the gonopod structure of "caperanus" exactly with any species known to me, but it comes very close to one of the local variants recorded for *Orthoporus ornatus* (Girard), the most common and widespread spirostreptid of southwestern United States and northern Mexico.

The occurrence of an endemic spirostreptid on the Hawaiian islands is totally improbable biogeographically. In my opinion, the most likely explanation is that the type of *caperanus* was accidentally transported to Honolulu in plant material and taken to the Bishop Museum by whomever found it after offloading. Williams then included the specimen in the collection of Hawaiian material he was preparing for shipment to Attems (and upon which the 1938 paper was based).

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New Records of Peracarid Crustacea in Hawaii (Crustacea: Peracarida)

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Recent investigations of peracarid Crustacea collected from various sites in the Hawaiian Islands have resulted in the establishment of new records for the islands, and at least 2 new peracarid species, which are currently being described elsewhere. All vouchers are deposited in Bishop Museum.

Gammaridea: **Aoridae**

Grandidierella bispinosa Schellenberg **New state record**

Specimens of *Grandidierella bispinosa* Schellenberg were recovered in Pearl Harbor at a brackish water site on the northern shores of East Loch. *Grandidierella bispinosa* has been recorded elsewhere at the Bismarck Archipelago, Fiji, and the Marianas Islands (Myers, 1985). Congeners of this species have been recorded before in the Hawaiian Islands: *Grandidierella koa* Barnard and *Grandidierella palama* Barnard are endemic brackish water species which have been recovered from anchialine ponds on Maui and Hawaii (Barnard, 1977).

Material examined: OAHU: Pearl Harbor: Legacy Project, Station 14 (12 March 1996).

Grandidierella japonica Stephensen **New state record**

Specimens of *Grandidierella japonica* Stephensen have been recovered from sites on the northern shores of Pearl Harbor, Oahu at West, Middle, and East Loch. *Grandidierella japonica* is endemic to brackish water sites in the north-west Pacific (Stephensen, 1938) and is believed to be an introduced species in Hawaiian waters.

Barnard (1970) described a new species from the Hawaiian Islands as *Neomicrodeutopus makena* (BPBM S7264). The genus was later synonymized with *Grandidierella* (Barnard 1971, 1991). It has been suggested that *Grandidierella makena* is, in fact, synonymous with *Grandidierella japonica* (Chapman & Dornan, 1975). I disagree—the holotype of *Grandidierella makena* was obtained from Makapuu Point, Oahu, and is clearly fully marine, while *Grandidierella japonica* is noted as a brackish water species, both by Stephensen (1938) and as evidenced by sampling in Pearl Harbor. Re-examination of the holotype of *Grandidierella makena* suggests clear differences to the description of *Grandidierella japonica*—in particular, proportions of gnathopod 1 are different, and *Grandidierella makena* lacks stridulation sculptures characteristic of *Grandidierella japonica*, which are present in males recovered from Pearl Harbor.

Material examined: OAHU: Pearl Harbor: Legacy Project, Stations 5 (16 April 1996) 12 (27 March 1996).

Gammaridea: **Phoxocephalidae**

Mandibulophoxus sp. **New state record**

Specimens of an apparently new species of *Mandibulophoxus* Barnard were recovered from soft bottomed sediments in Hanalei Harbor, Kauai. These appear to be closely related to *Mandibulophoxus uncirostratus* Giles, which is endemic to India (Pillai, 1957), and are congeners also with *Mandibulophoxus gilesi* Barnard, endemic to the California coast (Barnard, 1957, 1960). The genus has never been previously reported from Hawaii.

Material examined: KAUAI: Various samples from 10-30m depth, Hanalei Bay..

Gammaridea: **Leucothoidae**

Paraleucothoe ?flindersi Stebbing **New state record**

Leucothoid amphipods are commonly recovered in coastal Hawaiian samples, particularly where sponges and ascidians are abundant. Species found are most commonly either *Leucothoe hyhelia* Barnard or *L. tridens* Stebbing, species that are widely distributed in the Pacific and are characterized by a narrow, gracile article 6 of gnathopod 1, and a long, slender dactyl.

Sampling in Pearl Harbor recovered a leucothoid unlike any other in the Bishop

Museum collections. This species has a squat, short article 6 on gnathopod 1 and a very short, thick dactyl. There is marked sexual dimorphism, which is unusual in the leucothoids, and the species is characterized by a distinct and elegant fringe of long setae on the lower margin of the 5th article, apparently unique to this species. This fringe clearly allies it to *Paraleucothoe flindersi*, described by Stebbing (1888) from a single specimen taken in the Flinder's Passage during the HMS *Challenger* voyage, which appears not to have been found again or redescribed. Again, some confusion attends its systematics—it has alternatively been synonymized with *Leucothoe brevidigitata* (Barnard, 1974), reinstated as a species (Barnard, 1972), and finally re-synonymized with *Paraleucothoe novaehollandae* (Barnard, 1991). Examination of these specimens shows, however, that there are very clear distinctions that separate it from *Paraleucothoe novaehollandae*, though it is clearly part of that group of leucothoids with a squat article 6 and short dactyl on gnathopod 1. These characters of the first gnathopod also suggest that the species may be related to *Leucothoe lihue* Barnard, which is endemic to the Hawaiian Islands. It is clearly and easily distinguished from *Leucothoe lihue*, however by the possession of the setal fringe (on the margin of article 5) which is entirely absent in *Leucothoe lihue*.

While only recovered from Pearl Harbor so far in these studies, it is doubtful that this species of *Paraleucothoe* is endemic or indigenous to Hawaii. In my opinion, it is most probably an introduced species from the South Pacific.

Material examined: OAHU: Pearl Harbor: Legacy Project, Stations 2 (16 April 1996), 6 (30 April 1996), 8 (21 March 1996), 9 (27 March 1996), 13 (21 March 1996), 15 (11 January 1996).

Tanaidacea: **Apseudidae**

Parapseudes pedispinis Boone **New state record**

The genus *Parapseudes* Sars is distinguished from other apseudids by the possession of 4 pleopods. Miller (1940) identified a new species of the genus in Hawaiian waters (*P. neglectus*), which is commonly found in shallow waters here. In samples from Pearl Harbor, a congener, *Parapseudes pedispinis* Boone was found, which is easily distinguished from *P. neglectus* by the structure of the first gnathopod and rostrum. The species was originally very poorly described by Boone (1923), and was redescribed by Menzies (1953) who defined its range from California to Ecuador. Therefore, it is probable, that this species is an introduction to Hawaii from the eastern Pacific.

Material examined: OAHU: Pearl Harbor: Legacy Project, Stations 1 (13 February 1996), 4 (16 April 1996).

Apseudes, n. sp. **New state record**

Miller (1940) describes *Apseudes tropicalis* as the only member of the genus endemic to the Hawaiian Islands. Another member of the genus has now been discovered, very widely distributed in Kaneohe Bay and in Pearl Harbor, which clearly differs from *Apseudes tropicalis* in body form (it is larger and more robust), in rostrum shape, and in the structure of the chelipeds. It appears most closely related to *Apseudes nipponicus* from Japan, but has sufficient differences to warrant its probable designation as a new species.

Material examined: OAHU: Kaneohe Bay Sand Bar, various samples, 1996.

Cumacea: **Nannastacidae**

Nannastacus sp. **New state record**

Low diversity is a feature of the marine fauna of Hawaii and many groups, common elsewhere, are absent. The relatively low diversity of peracarid crustacea in particular is

thought be a reflection of the paucity of pelagic dispersal mechanisms (Barnard, 1970, 1971; Myers, 1991, 1993). To date, the Cumacea were believed to be absent from Hawaiian waters. Recent sampling, however, has shown that, though relatively uncommon, cumaceans are widely distributed, particularly in medium to fine grain, carbonaceous sediments. Specimens have so far been recovered from Kaneohe Bay and Pearl Harbor, Oahu, and Hanalei Bay, Kauai.

The specimens await full identification, but have been tentatively assigned to the genus *Nannastacus* (Les Watling pers. comm.). These collections mark the first record of the order and the genus from the Hawaiian Islands.

Material examined: OAHU: Kaneohe Bay: Sand Bar, various samples, 1996.

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New Helminth Records for the Mourning Gecko, *Lepidodactylus lugubris* (Gekkonidae) from Hawaii

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The mourning gecko, *Lepidodactylus lugubris* (Duméril & Bibron) has a wide geographic range which includes Oceania, much of Asia, Australia and the United States (Welch *et al*., 1990). It presumably reached Hawaii from Asia via other Pacific Islands with the early Polynesian settlers. In this note new host and locality records for helminths from *L. lugubris* are given.

Some 280 *Lepidodactylus lugubris* were collected in Hawaii: Hawaii, 1991 (N = 35) southeast corner (19°43'N, 155°05'W); Oahu, 1991 (N = 18) eastern shore (21°20'N, 157°52'W) from sea level to ca. 375 m elev.; Oahu, 1992 (N = 44) various sites on the northern, eastern, western, and southeastern shores from sea level to 100 m elev.; Oahu, 1993 (N = 183) various sites on the northern, eastern and western shores from 5–100 m elev. The body cavity was opened by a longitudinal incision from vent to throat and the gastrointestinal tract was removed. The gastrointestinal tract and body cavity were examined for helminths. Cestodes were stained with Delafield's hematoxylin and mounted in Canada balsam for study as a whole mount. Nematodes and pentastomes were placed in glycerol, allowed to clear and examined under a light microscope. Helminth specimens were placed in vials of alcohol and deposited in the U.S. National Parasite Collection (USNPC), Beltsville, Maryland and the Bishop Museum Collection (BPBM).

Cestoda: Nematotaeniidae

Cylindrotaenia allisonae Schmidt **New state and host record**

This species was originally described from a single specimen taken from the small intestine of *Hoplodactylus maculatus* (Sauria: Gekkonidae) collected on Stephens Island, New Zealand (Schmidt, 1980). It has also been found in *H. maculatus* from Ward Island and Turakirae, New Zealand and from *Heteronotia binoei* and *Hemiergis peronii* from Australia (Jones, 1987). The presence of this species in Hawaii extends the range of this helminth ca 800 km northeast to Hawaii. Prevalence (number infected hosts/number hosts

examined): Hawaii 3/35 (9%); Oahu 44/245 (18%); mean intensity (mean number parasites per infected host): Hawaii 2.3 ± 1.5 SD, Oahu 2.0 ± 2.3 SD; range (lowest to highest number of parasites present); Hawaii 1-4; Oahu 1-12. USNPC 86410 Hawaii; USNPC 86413 Oahu; BPBM F208 Oahu.

Nematoda: Pharyngodonidae

Pharyngodon lepidodactylus Bursey & Goldberg

This species was originally described from *L. lugubris* collected in Hawaii (Bursey & Goldberg, 1996). Prevalence: Hawai 5/35 (14%), Oahu 23/245 (9%); mean intensity: Hawaii 1.6 ± 0.9 SD, Oahu 2.5 ± 2.2 SD; range: Hawaii 1-3, Oahu 1-8. USNPC 86412 Hawaii; 86415 Oahu; BPBM H67 Oahu.

Nematoda: Seuratidae

Skrjabinelazia machidai Hasegawa **New state and host record**

This species was originally described from 65 nematodes taken from the stomach and small intestine of *Gekko japonicus* (Sauria: Gekkonidae) collected on Okinawa Island, Japan; number of hosts was not given (Hasegawa, 1984). Of the 57 *G. japonicus* examined, 26 (46%) were infected. This report of *S. machidai* in Hawaii extends the range of this helminth ca 6400 km eastward. Prevalence: Oahu 2/245 (1%); mean intensity 1. USNPC 86416 Oahu.

Pentastomida: Cephalobaenidae

Raillietiella frenatus Ali, Riley & Self **New state and host record**

This species was originally described from 47 specimens taken from the lungs of *Hemidactylus frenatus* (Sauria: Gekkonidae) collected at Kuching, Sarawak, Malaysia; the number of hosts was not given (Ali *et al*., 1981). Other specimens, previously described as *Raillietiella hebitihamata* (= *R. hemidactyli*) by Self & Kuntz (1960) are included in this taxon. *Raillietiella frenatus* has also been reported from *H. frenatus* from the Philippine Islands, Taiwan, South Vietnam and Thailand and from the agamid lizard, *Japalura swinhonis* and the scincid lizard, *Mabuya longicaudata* from Taiwan (Ali *et al*., 1981). This report of *R. frenatus* extends the range of this helminth ca. 7050 km northeast to Hawaii. Prevalence: Oahu 8/245 (3%); mean intensity 1.1 ± 0.4 SD; range 1-2. USNPC 86417 Oahu; BPBM H68 Oahu.

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Distribution of Helminth Parasites of Native and Introduced Stream Fishes in Hawaii

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The first report of helminth parasites of native Hawaiian stream fishes was published by Font & Tate (1994). Their results were summarized by Miller & Eldredge (1995) in a tabulation of species known from Hawaii. Distribution records of these helminth parasites from both native and introduced fish hosts in Hawaiian streams are presented here. Table 1 lists abbreviations of Hawaiian streams from which fishes were collected and examined for parasites. Table 2 provides abbreviations of scientific names of parasites. These abbreviations are used in Table 3, which records the occurrence of fish parasites in streams of Hawaii, Oahu, and Kauai. Notes on significant aspects of the biology of these parasites are provided below. Voucher specimens of these parasites have been deposited in the United States National Parasite Collection (Font & Tate, 1994). Additional voucher specimens are deposited in the Bishop Museum.

Platyhelminthes

Trematoda: Heterophyidae

Ascocotyle tenuicollis Price, *Centrocestus formosanus* (Nishigori), and *Stellantchasmus falcatus* Onji & Nishio use introduced melanid snails as their first intermediate hosts, fishes as second intermediate hosts for the metacercarial stage, and piscivorous birds as definitive hosts for adult parasites. *Centrocestus formosanus* and *S. falcatus* have been reported from Oahu by Martin (1958). On the island of Hawaii, *A. tenuicollis* was the only introduced heterophyid that parasitized a native stream gobioid. Metacercariae were found in the hearts of both introduced mosquitofish, *Gambusia affinis* (Baird & Girard) and native *ʻoʻopu akupa, Eleotris sandwicensis* Vaillant & Sauvage.

Strigeiformes

Because of its immaturity, a strigeiform metacercaria that parasitized *ʻoʻopu nakea*,

Awaous guamensis (Valenciennes) could not be identify below the ordinal level. This parasite was rare (i.e. in <1% of fishes), possibly because pulmonate snail intermediate hosts are not common in Hawaiian streams. Piscivorous birds likely harbor the adult parasite.

Didymozoidae

Unequivocally a native parasite, adult didymozoids parasitize many marine fishes in Hawaii (Yamaguti, 1970). Juvenile didymozoids occasionally infect larvae of the amphidromous Hawaiian gobioids, including *A. guamensis* and *ʻoʻopu alamoʻo*, *Lentipes concolor* Gill, during the planktonic marine phase of the life cycles of these stream fishes. Their rare occurrence in stream fishes represents a dead end for these marine parasites without ecological or evolutionary importance.

Cestoda: Bothriocephalidae

Bothriocephalus acheilognathi Yamaguti, the Asian fish tapeworm, has been disseminated globally with carp aquaculture and by introductions of poeciliid fishes for mosquito control (Font & Tate, 1994). This tapeworm has broad host specificity, occurring in several species of introduced fishes in Hawaii and has been found in 2 of the 5 species of native Hawaiian gobioid stream fishes. Numerous workers have documented the pathogenicity of this tapeworm in fish hosts.

Tetraphyllidea

Incorrectly identified as a proteocephalid metacestode by Font & Tate (1994), these tapeworm larvae, which occur uncommonly in native stream fishes, are actually the larval stage of marine tetraphyllidean cestodes which are collectively referred to as *Scolex polymorphus* Rudolphi. Adult gobioid fishes from Hawaiian streams that were infected with these larval tapeworms were *E. sandwicensis*, *L. concolor*, and *ʻoʻopu naniha*, *Sicyopterus stimpsoni* Gill. The Order Tetraphyllidea is marine. Sharks, skates and rays serve as definitive hosts for the adult tapeworms when they eat marine teleosts infected with the larval tapeworms. The true identity of this parasite became apparent when thousands of specimens were found to parasitize peppered squirrelfish (*ʻalaʻihi*), *Sargocentron punctatissimum* (Cuvier), and other marine fishes located in tidepools and on coral reefs adjacent to stream mouths. Its occasional occurrence in native stream gobioids results from infections acquired during the marine phase of the life cycle of these amphidromous gobioids. Conversely, its absence from poeciliid fishes in Hawaiian streams is due to the complete restriction of these exotic fishes to fresh water. Clearly, *Scolex polymorphus* is native to Hawaii, and like didymozoids, the rare occurrence in streams of this parasite which requires elasmobranchs to complete its life cycle is without ecological consequence.

Cyclophyllidea

Metacestodes of an unidentified tapeworm in the body cavity of native fishes were assigned to the Order Cyclophyllidea on the basis of the presence of a scolex having 4 circular muscular suckers and a rostellum armed with hooks. These rare parasites were recovered from *E. sandwicensis* and *A. guamensis.* Cyclophyllideans use birds as definitive hosts. The presence of these metacestodes in streams is patchy, as would be expected of a parasite disseminated by birds.

Table 1. Abbreviations of streams, rivers, agricultural ditches, and ponds of Hawaii, Oahu, and Kauai from which native and exotic fishes were collected and examined for helminth parasites.

HAWAII	
Hakalau Stream	H-HAKA
Hamakua Ditch (Upper)	H-HAMA
Honolii Stream	H-HONO
Keanuimano Stream	H-KEAN
Kohala Ditch	H-KOHA
Kohakohau Stream	H-KOKH
Kolekole Stream	H-KOLE
Lokoaka Pond	H-LOKO
Manoloa Stream	H-MANO
Nanue Stream	H-NANU
Wailuku River	H-WAIK
Wailoa River	H-WAIL
Waikaumalo Stream	H-WAIM
Waiulaula Gulch	H-WAIU
OAHU	
Hakipuu Stream	O-HAKI
Kahana Stream	O-KAHA
Kahuku Stream	O-KAHU
Kaipapau Stream	O-KAIP
Kaiwainui Marsh	O-KAIW
Kaluanui Stream	O-KALU
Kamooalii Stream	O-KAMO
Waiahole Stream	O-WAIA
Waianu Stream	O-WAIN
Waihee Stream	O-WAIH
Waikane Stream	O-WAIK
Waimea River	O-WAIM
KAUAI	
Hanakapiai Stream	K-HANA
Nualolo Stream	K-NUAL
Wainiha River	K-WAIN

Monogenea: Dactylogyridae

Salsuginus seculus (Mizelle & Arcadi) parasitized gill filaments of the introduced mosquitofish, *Gambusia affinis.* The strict host specificity of monogenes is well documented. Other syntopic poeciliids were not parasitized by *S. seculus*, but occasionally harbored other species of *Salsuginus*. Significantly, although many species of Monogenea have been described from native Hawaiian marine fishes (Yamaguti, 1968) none of these

Table 2. Names, life cycle stages, and abbreviations of helminth parasites from native and introduced stream fishes in Hawaii.

Name	Stage	Abbreviation
Platyhelminthes		
Trematoda		
Ascocotyle tenuicollis Price	metacercaria	*Aste*
Centrocestus formosanus (Nishigori)	metacercaria	*Cefo*
Didymozoidae	larva	*Disp*
Stellantchasmus falcatus Onji & Nishio	metacercaria	*Stfa*
Strigeiodea	metacercaria	*Srsp*
Cestoda		
Bothriocephalus acheilognathi Yamaguti	adult	*Boac*
Cyclophyllidea	metacestode	*Ccsp*
Scolex polymorphus Rudolphi	metacestode	*Scpo*
Monogenea		
Salsuginus spp.	adult	*Sasp*
Nematoda		
Camallanus cotti Fujita	juvenile, adult	*Caco*
Spirocamallanus istiblenni Nobel	adult	*Spis*
Acanthocephala		
Southwellina hispida (Van Cleave)	cystacanth	*Sohi*
Annelida		
Cystobranchus sp.	adult	*Cysp*
Myzobdella lugubris Leidy	adult	*Mylu*

parasitize amphidromous gobioids, even though these stream fishes transit the marine habitats of these reef fishes during their planktonic larval stages.

Nematoda

Secernentea: Camallanidae

Without question, *Camallanus cotti* Fujita is the most widespread helminth parasite of Hawaiian stream fishes (Table 3). Native to the Orient, this broadly specific roundworm has been disseminated widely by human activities including mosquito control and the aquarium fish trade. Swordtails, guppies, mosquitofish, and shortfin mollies that have been introduced into Hawaiian streams are commonly infected, and this pernicious helminth is known to parasitize 4 of the 5 native Hawaiian stream fishes. *Camallanus cotti* is a known pathogen, and Font & Tate (1994) regarded it as the most important and dangerous helminth parasite that threatens native freshwater fishes in the archipelago. They urged that any conservation and management plan formulated for the protection of these

Table 3. Occurrence of helminth parasites in native gobioid stream fishes and introduced fishes in Hawaii. Abbreviations of stream names (capital letters) are presented in Table 1. Abbreviations of scientific names of parasites (italics) are given in Table 2.

	Caco	*Boac*	*Mylu*	*Disp*	*Scpo*	*Sohi*	*Aste*	*Cefo*	*Stfa*	*Srsp*	*Sasp*	*Cysp*	*Ccsp*	*Spis*
HAWAII														
H-HAKA	X	X	X	X								X	X	
H-HAMA	X													
H-HONO	X		X											
H-KEAN	X													
H-KOHA	X													
H-KOKH	X		X											
H-KOLE	X	X												
H-LOKO		X	X			X	X	X	X		X			X
H-MANO	X													
H-NANU	X			X										
H-WAIK	X													
H-WAIL	X	X	X			X								X
H-WAIM	X													
H-WAIU	X													
OAHU														
O-HAKI	X	X				X		X				X		
O-KAHA	X					X						X		
O-KAHU		X								X				
O-KAIP														
O-KAIW								X						
O-KALU	X		X			X					X	X		
O-KAMO	X													
O-WAIA	X	X	X			X		X			X			
O-WAIN	X	X	X			X		X						
O-WAIH	X	X	X			X		X						
O-WAIK	X	X	X			X		X						
O-WAIM			X											
KAUAI														
K-HANA					X	X								
K-NUAL					X	X								
K-WAIN		X		X	X					X				

5 species of native fishes include a consideration of this parasite.

A second species of Camallanidae occurs in the marine environment. *Spirocamallanus istiblenni* Nobel may parasitize native stream fishes when they enter stream mouths that are adjacent to tidepools or near-shore coral reef habitats that harbor infected marine fishes. The sleeper *Eleotris sandwicensis* habitually occurs in stream mouths and serves as a host for *S. istiblenni.* Initially, *S. istiblenni* was regarded as a native parasite in Hawaii because the species was originally described from native zebra blennies (*pao'o*), *Istiblennius zebra* (Vaillant & Sauvage). However, Rigby & Font (in press) reported this roundworm from bluestripe snapper (*ta'ape*), *Lutjanus kasmira* (Forsskål) collected in Moorea. Because *ta'ape* were introduced into Hawaii by man, it is problematic whether *S. istiblenni* should be regarded as a native or exotic species of parasite in the Hawaiian Archipelago.

Acanthocephala

Palaeacanthocephala: **Polymorphidae**

The cystacanths identified by Font & Tate (1994) only to the level of phylum have been determined to be larvae of *Southwellina hispida* (Van Cleave) by Dr. Brent B. Nickol of the University of Nebraska-Lincoln. These common but sporadically distributed parasites of both native and exotic stream fishes serve as an excellent example of one mechanism by which a freshwater parasite can colonize an oceanic island by natural means. Adults of *S. hispida* are found in herons in both the Palaearctic (Japan and Russia) and Nearctic (southeastern USA). The natural colonization of Hawaii by herons (Pratt *et al.*, 1987) may have served as the source of introduction of this parasite into the Hawaiian Archipelago. If this hypothesis is correct, then *S. hispida* should be regarded as a native parasite. Indeed, *S. hispida* has been reported from herons in the Galapagos Archipelago (Schmidt, 1973), a testament to the powers of parasite dispersal associated with avian hosts.

Annelida

Hirudinea: Piscicolidae

A single specimen of *Cystobranchus* sp. was found parasitizing *'o'opu akupa*, *E. sandwicensis*, collected from the mouth of Hakalau Stream, Hawaii. Until additional specimens of this leech are obtained, nothing can be said with regard to its specific identification or ecology.

Although the fish leech *Myzobdella lugubris* Leidy is not as abundant in Hawaiian streams as is the roundworm *Camallanus cotti* (Font and Tate, 1994), it is much better known than the latter because this ectoparasite is readily visible on skin and fins of *'o'opu* caught by Hawaiian fishermen. The source of its introduction into Hawaiian waters is problematic since its initial colonization of streams may have been associated with any one of many species of exotic fishes parasitized by this broadly specific leech that was transported by man to the archipelago. Alternatively, Font & Tate (1994) considered the possibility that blue crabs, *Callinectes sapidus* Rathbun, which often carry the egg cocoons of this leech cemented to the carapace, may have been the source of its introduction. Eldredge (1995) reported the presence of *C. sapidus* in Kaneohe Bay, Oahu. He described importation into Hawaii since 1967 for the food industry of blue crabs from the Gulf of Mexico where *M. lugubris* occurs naturally. Although it is uncertain whether the

source of introduction of *M. lugubris* into Hawaii was blue crabs or fishes, it is clear that blue crabs are not required to maintain this leech in Hawaiian streams where this ectoparasite of fishes is both widespread and abundant.

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Discovery of the Native Stream Goby, *Lentipes concolor*, Above Hawaii's Highest Waterfall, Hiilawe Falls

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Introduction

An assessment was conducted of the fauna of Waipio Stream, Hawaii County, Hawaii and its tributaries. The assessment was part of the Native and Exotic Stream Organisms Study, Phase I for the Lower Hamakua Ditch Watershed Project, USDA-NRCS contract No. 53-9251-6-275. Historically, baseflow in Lalakea/Hiilawe, Koiawe, Alakahi, and Kawainui Streams, the major tributaries of Waipio Stream, has been diverted at the point of the irrigation diversions on these streams. We discuss the aquatic macrofauna of Lalakea/Hiilawe Stream above Hiilawe Falls and the implications of these findings. On USGS topographic maps, Lalakea Stream undergoes a name change to Hiilawe Stream downstream of Hiilawe Falls. Sampling protocol and habitat classification conformed to Hawaii Division of Aquatic Resources (HDAR) fish sampling methodology (Baker & Foster, 1992).

Study Area

Lalakea Stream originates at approximately 850 m in the Kohala mountains. Two major diversions exist on Lalakea Stream. The first diversion is located near the source of the stream and supplies water for Puukapu reservoir, and a second diversion feeds Lalakea reservoir. The Lower Hamakua Ditch passes underneath Hiilawe Falls but does not actually divert water from the stream.

We sampled immediately upstream of the concrete diversion structure for Lalakea Reservoir at 610 m. All stream flow was diverted from this structure into Lalakea Reservoir ditch. With the exception of several small pools, Lalakea Stream is completely dry for 0.8 km to Hiilawe Falls. Above the diversion the stream flows through a bedrock lava channel. Substrate consisted mainly of bedrock and boulders. Stream flow at the reservoir diversion was low and visually estimated at 0.05 m^3/sec.

Results

Thirty random point counts and one snorkel transect were conducted in Lalakea Stream above 610 m in November 1996. During the point count observations, one adult male *Lentipes concolor* (Gill, 1860) 44 mm in length was observed. During the snorkel transect where aquatic macrofauna except *Atyoida bisulcata* (Randall, 1840) were counted, another 50 mm male *Lentipes concolor* was observed. The introduced *Xiphophorus helleri* (Heckel, 1848) was also observed in high densities in a few scattered pools below the diversion. Above the diversion, densities of both *Xiphophorus helleri* and *Lentipes concolor* were low (Table 1) in all habitats. We did not include standard error for fish and crayfish in Table 1 because the low densities of these animals resulted in standard errors equaling or exceeding the mean. Respectively, *Lentipes concolor* and *Xiphophorus helleri* had a density of <0.1 m^2 and 0.3 m^2 in the one pool snorkel transect.

The native crustacean, *Atyoida bisulcata* carpeted the substrate and their densities were high, but comparable to other Waipio Valley streams. These numbers should be considered approximate. The introduced *Procambarus clarki* (Girard, 1852) was also observed in both point counts and transects. *Procambarus clarki* densities in the transect sample were 0.2 m^2. Native *Megalagrion* spp. were not observed in over 6 hours of sampling on upper Lalakea Stream. Weather conditions were suitable for collecting damselflies, and it was occasionally sunny and warm during the six hours of sampling.

Discussion

Previously, the highest waterfall that *Lentipes concolor* was known to successfully ascend was Akaka Falls, at 140 m (Devick *et al*., 1992). With a vertical drop of nearly 300 m, Hiilawe Falls is the highest free-fall waterfall in Hawaii and also one of the highest in the world (Macdonald *et al*., 1983). It is remarkable that *Lentipes concolor* can ascend a single waterfall of this height. Two other factors make this climb more arduous. First, Lalakea/Hiilawe Stream above Hiilawe Falls is dry and diverted for 0.8 km. The main Hiilawe Falls flows now only infrequently during storms because of the diversion 0.8 km upstream of the start of the falls. Postlarval *Lentipes concolor* successfully navigating Hiilawe Falls must reach the undiverted stream area before the diverted section of stream dries out. Additionally, postlarvae must avoid entrainment in the diversion grates. This is a likely scenario during periods of high flow, as the square boxlike configuration of the ditch provides little refuge from high velocity water. However, it is probable that *Lentipes*

Table 1. Average point count densities (±1 standard error) of fish in Lalakea Stream, Hawaii during November 1996. Sampling at 610 m, above diversion.

	Species Density (m^2)				
Species	**Cascade**	**Pool**	**Side Pool**	**Riffle**	**Run**
Lentipes concolor	0	0.3	0	0	0
X. helleri	0	0	0	0	0.3
P. clarki	0	0.3	0	0	0
Atyoida bisulcata	29 ± 29	223.5 ± 34.8	118 ± 25.8	124.3 ± 32.3	263.8 ± 37.8
Megalagrion spp.	Absent	Absent	Absent	Absent	Absent

concolor could navigate the ditch intake during baseflow, as streamflow is quite low.

The second major factor is that there were several permanent pools and shallow runs containing high densities of *Xiphophorus helleri* in the diverted stretch of Lalakea Stream. Any postlarval *Lentipes concolor* stranded in these pools would face heavy predation by green swordtails. This is due to their diurnal behavior and propensity of postlarval *Lentipes concolor* to swim near the surface of the water (Tate, 1995). Introduced parasites from green swordtails are another problem threatening *Lentipes concolor* in Lalakea Stream. *Lentipes concolor* have been exposed to parasites brought with recent introduced fish species (Font & Tate, 1994). The increase in disease exposure of *Lentipes concolor* from parasitism undoubtedly adversely impacts the survival rates for these fish (Font & Tate, 1994).

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Prehistoric Status and Distribution of the Hawaiian Hawk (*Buteo solitarius*), with the First Fossil Record from Kauai

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Introduction

Although listed as an endangered species, the Hawaiian Hawk or *'io* (*Buteo solitarius* Peale, 1848) is widely distributed on the island of Hawaii (Scott *et al*., 1986), where it now feeds mainly on introduced rodents and thus may even have benefited from anthropogenic changes in the fauna and flora. That this relatively large, seemingly vagile predator has not been recorded with certainty in the historic period on any of the other Hawaiian islands has long been puzzling. The diverse deposits of fossil birds in the Hawaiian Islands (Olson & James, 1982, 1991; James & Olson, 1991) have hitherto yielded scant information on the Hawaiian Hawk, the only record away from the island of Hawaii being a single occurrence on Molokai (Olson & James, 1982).

First Kauai Occurrence

Here we report the first fossil record of Hawaiian Hawk for Kauai, from the same area in the Makawehi dunes near Poipu where almost all other fossil birds have been found so far on Kauai (Olson & James, 1982). Fossils from these dunes represent an interesting but far from complete avifauna, most of which was recovered in 1976 and 1977, with little new being added in subsequent years.

On 1 March 1996, Olson, with D.A. and L.P. Burney, located a new fossil site in the Makawehi Dunes, here designated K-4 (coordinates taken by Global Positioning System = 21°52'48"N, 159°26'03"W). This site faces south on a cliff overlooking the ocean where it is exposed to onshore winds. Near the top of the cliff, these winds are eroding unconsolidated, clean, yellowish sand that is overlain by an extremely indurated layer of light grayish sandstone about 25 cm thick. The wind creates hollows under this indurated layer, which is sometimes held up temporarily by pillars of more consolidated sand, until the indurated layer becomes too cantilevered to support the overlying strata and breaks off in large blocks that litter the slopes of the cliff.

Bones at this site are weathering out of the hollows beneath the indurated layer and occur both in place and scattered through the sand that has cascaded down the slope. They appear to be mineralized and are heavily encrusted with sand. Although the nature of dunes makes it notoriously difficult to derive meaningful stratigraphic inferences, we believe that it is likely that the bones from this site are older than Holocene. Because they occur at the windward edge of a sea-cliff, there now exists no source for the sand under which the bones were buried. Therefore, the deposition of the bones must have taken place during a lower sea-level stand when the dunes originally formed and before the dunes became perched above cliffs by the erosion of a rising sea.

Almost all of the bones collected at site K-4 are of Wedge-tailed Shearwaters (*Puffinus pacificus*), a seabird that still attempts to breed in the area. The only exception was a complete left coracoid of a hawk. This was originally heavily encrusted with sand, which was removed with dilute acetic acid. The specimen (Fig. 1) was found to be of a size compatible with females of *Buteo solitarius* (Table 1), with which it agrees in all other details of morphology, so we identify it with that species.

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Table 1. Measurements (mm) of comparative skeletons of *Buteo solitarius* and fossils.

	Coracoid		Humerus	
	Length	Width of sternal facet	Length	Distal width
Females	34.2–34.8	12.6–12.9	82.0–84.6	14.6–14.9
Males	30.3–32.3	10.9–12.6	71.6–77.9	12.9–13.8
Kauai fossil	34.3	12.6+		
Molokai fossil			83.7	14.6

Scarcity of the Hawaiian Hawk in the Fossil Record

Remains of the Hawaiian Hawk are encountered occasionally in lava tubes on the leeward slopes of the island of Hawaii (S. Olson & H.F. James, unpubl. data). In almost all instances, however, these are in an archeological context, among the refuse of human occupation, suggesting that Hawaiians caught these birds and presumably ate them or used their feathers. We have encountered only a single individual, a skeleton in a lava tube on Mt. Hualalai, that evidently was not preserved as a result of human agency.

On Maui, natural accumulations of bones of birds have been found in numerous lava tubes on the leeward slopes of Mt. Haleakala. Although a considerable variety of species is represented, not a single bone of a hawk has yet been found. This negative evidence is inconclusive for *Buteo*, especially considering that the endemic harrier *Circus dossenus*, which is known from Molokai and probably occurred on Maui as well, is likewise absent from the fossil record there.

In the extensive dune systems of Molokai, where large samples of fossil birds have been obtained at the Moomomi Dunes and at Ilio Point, we have encountered remains of *Buteo* only once. These were 3 bones (see "Material examined") which may well have come from a single individual, found in a large, steep, sheltered depression in the dunes known as Site 6 (Olson & James, 1982). Large concentrations of bones of Bonin Petrel (*Pterodroma hypoleuca*), along with remains of fish and shells of edible mollusks such as opihi and pipipi, indicate former human occupation of this site, so that most bird bones here may derive from midden deposits. It is possible, though unlikely, that a hawk could have been brought to Molokai from Hawaii. More probably it was a local bird that became incorporated into the dunes as a result of human activity. Because its possible human associations make the record somewhat equivocal, the fossil from Kauai, which must antedate the arrival of humans in the islands, becomes the more significant.

The island of Oahu has a particularly rich fossil record. Bones of birds occur primarily in Holocene sediments trapped in limestone sinkholes at Barbers Point, and in a Pleistocene lake bed at Ulupau Head that is more than 120,000 yr old (James, 1987). In the Pleistocene site, bones of *Buteo* are unusually common, the birds apparently having been attracted to the lakeshore environment. However, these bones are not identifiable as *Buteo solitarius* but are from a larger species of as yet undetermined affinities. Either the hawk represented at Ulupau evolved into the modern Hawaiian Hawk, or the species became extinct in the islands. In either case, not a single bone of *Buteo* has yet been found

Fig. 1. Left coracoids of Hawaiian Hawk (*Buteo solitarius*) in ventral view. The larger specimen on the left (USNM 490733) is a fossil from the Makawehi dunes on Kauai, presumably from a female, contrasted with that from a modern skeleton of a male, which is the smaller sex (BPBM 147954). The scale is in mm.

in the very extensive accumulations of Holocene bones from Barbers Point.

Several historical and ecological factors may explain the scarcity of *Buteo solitarius* in the fossil record of the Hawaiian Islands, apart from the fact that predators usually occur in lower numbers than prey. Two extinct lineages of raptors once occurred in the archipelago that had diverged greatly from their ancestral stock, the long-legged owls of the genus *Grallistrix*, and the harrier *Circus dossenus*. Both had evolved the proportions of bird-catching hawks of the genus *Accipiter* and were well adapted for preying on small forest birds (Olson & James, 1991). In addition, a sea-eagle (*Haliaeetus* sp.) once lived in the islands. No remains of these other predators have yet been found on the island of Hawaii.

Buteo solitarius may be a relatively recent arrival in the islands because it has not differentiated greatly from other species of *Buteo*. Like many species in that genus, it may have been restricted to more open environments and edge situations. The combination of the effects of active volcanism on vegetation and the possible absence of competitors may mean that the island of Hawaii was always the principle redoubt of *Buteo solitarius*.

The fossil record from Kauai shows that the Hawaiian Hawk is capable of dispersing naturally anywhere in the main Hawaiian archipelago, though whether it ever established viable populations anywhere besides Hawaii proper remains undetermined. The species should have benefited from Polynesian creation of more open habitats and the introduction of *Rattus exulans*, so its historical restriction to the island of Hawaii is a little difficult to understand unless it was hunted to extinction on the smaller islands. If the mention of "two large brown hawks or kites" from Kauai on Cook's voyage (Medway, 1981:107) refers to this species, then it disappeared from Kauai shortly after 1778.

Conservation implications

The restriction of the Hawaiian Hawk to the island of Hawaii in historical times and possibly before may have been the result of a combination of factors both natural and human-caused that are no longer in effect. The original forested environments of the islands and their native predatory birds are largely or entirely vanished. The introduction of rats (*Rattus*) by both Polynesian and European colonizers provided a food source for *Buteo* that may be as good or better than existed in prehistoric times, and there is more open habitat in the islands than existed at first human contact. Furthermore, human predation for food or shooting as "vermin" has been almost entirely eliminated. Because populations of Hawaiian Hawk could probably survive on Hawaiian islands other than Hawaii proper, introduction, or re-introduction as the case may be, to other localities may be worth considering as a possibility in further management of the species.

Material examined. KAUAI: Makawehi dunes, Site K-4: nearly complete left coracoid (USNM 490733). MOLOKAI: Moomomi dunes, Site 6: complete right humerus (USNM 386108), a left radius (USNM 386110, length 83.5 mm), and an ungual phalanx (USNM 386109, length 20.5 mm). The humerus falls well within the size range for females of *Buteo solitarius* (Table 1), and we assign all 3 bones to that species. HAWAII: various sites on the leeward side, mostly archeological midden, specimens in USNM and BPBM. Modern comparative material from the Bishop Museum comprised 11 complete skeletons (5 males and 6 females after unsexed and missexed individuals were assigned on size): BBM-X 147198 147954; BPBM 159018, 159514, 175751, 177085, 178144, 178298, 179417, 179418, 179419.

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New Record of Branchiostomidae from the Hawaiian Islands (Chordata: Cephalochordata)

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The subphylum Cephalochordata presently includes 20 described species in the Indo-Pacific Region. Two species are now known from Hawaiian waters. *Epigonichthys maldivensis* (Forster Cooper, 1903) was reported from Barber's Point, Oahu, at a depth of 32-40m in 1962 (Eldredge, 1967) and is a widespread species, ranging from East Africa to New Caledonia. Cephalochordate larvae, species unknown, have been collected in plankton samples between Oahu and Hancock Seamount at depths to 200m (Boehlert & Mundy, 1992).

Epigonichthys lucayanum (Andrews) **New state record**

Epigonichthys lucayanum is also known historically as *Asymmetron lucayanum* Andrews, 1893 and *Asymmetron caudatum* Willey, 1896 (see Richardson & McKenzie, 1994). This species is widespread with a discontinuous distribution on the east coast of the Americas and in the tropical parts of the central Indo-Pacific region from Madagascar to eastern Australia and the Solomon Islands. The present record reflects a significant

range extension for this species. The form and meristic characteristics of the Hawaiian specimens fall within the range previously observed elsewhere for this species (see Gibbs & Wickstead, 1996). The values obtained at different localities, not to mention the disjunct distribution of the species, make it possible that a species complex rather than a single species is involved (Richardson & McKenzie, 1994). This species is likely to be widespread in shallow water to 100m depth on coarse and sand bottoms. *Epigonichthys lucayanum* is frequently found in association with other chephalochordates, and *Branchiostoma belcheri*, *B. malayana*, and *E. cultellus* may well be collected in Hawaii.

Material examined: KAUAI: Hanalei Bay, July 1994, 50m from reef edge at 30m in medium-sized carbonate sand (BPBM Y263, 5 specimens), R. DeFelice. OAHU: Kaneohe Bay, March 1995, at 20m on Ahu o Laka sandbank (BPBM Y264, 6 specimens), D. Muir.

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Taxonomic Changes Published in This Volume

Insecta
Coleoptera: Staphylinidae

Platydracus caliginosus (Erichson, 1839), **new combination** is transferred from *Staphylinus.*

Staphylinus ejulans Tottenham, 1939 is a **new synonym** of *Platydracus caliginosus* (Erichson).

Diptera: Dolichopodidae

Diaphorus parthenus Hardy & Kohn, 1964, **new combination**, is transferred from *Chrysotus.*

Diptera: Drosophilidae

Drosophila insignita Hardy, 1965 is a **new synonym** of *Drosophila tamashiroi* Hardy, 1965.