NUMBER 74, 78 pages 20 June 2003

BISHOP MUSEUM
OCCASIONAL PAPERS

RECORDS OF THE HAWAII BIOLOGICAL SURVEY FOR 2001–2002
PART 2: NOTES

NEAL L. EVENHUIS
AND
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BISHOP MUSEUM PRESS
HONOLULU

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Cover: .*Pheidole moerens* Wheeler, head of worker; a new ant inrtoduction into Hawai‘i (see p.35)

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ISSN 0893-1348

BISHOP MUSEUM
The State Museum of Natural and Cultural History
1525 Bernice Street
Honolulu, Hawai‘i 96817-2704, USA

RECORDS OF THE HAWAII BIOLOGICAL SURVEY FOR 2001–2002
Part 2: Notes[1]

This is the second of 2 parts to the *Records of the Hawaii Biological Survey for 2001–2002* and contains the notes on Hawaiian species of plants and animals including new state and island records, range extensions, and other information. Larger, more comprehensive treatments are treated in the first part of this *Records* [*Bishop Museum Occasional Papers* 73].

New records of freshwater macroalgae from the Hawaiian Islands. 1. Chlorophyta

ALISON R. SHERWOOD (Dept. of Botany, 3190 Maile Way, University of Hawaii, Honolulu, Hawai'i, 96822, USA; email: asherwoo@hawaii.edu), MICHAEL H. KIDO (Hawaii Stream Research Center, University of Hawaii, Center for Conservation Research and Training, 7370A Kuamo'o Rd., Kapa'a, Hawai'i, 96746, USA) & CLIFFORD W. MORDEN (Center for Conservation Research and Training and Dept. of Botany, University of Hawaii, Honolulu, Hawai'i, 96822, USA)

The following represent new records of chlorophyte freshwater macroalgae from the Hawaiian Islands that were made during initial survey efforts on the islands of O'ahu, Hawai'i, and Kaua'i. Macroalgae are here defined as benthic algae with a mature thallus that is a discrete structure discernable to the naked eye (Sheath & Cole, 1992). Voucher specimens of all newly reported taxa are deposited in the Bishop Museum. All determinations are by A.R. Sherwood. Literature used to identify the samples included Smith (1950), Prescott (1951), Islam (1961), Bourrelly (1966) and Kargupta & Sarma (1992).

Order Chaetophorales

Cloniophora spicata (Schmid.) Islam **New state record**

Cloniophora is a predominantly tropical and subtropical green algal genus, and currently contains four species (Islam, 1961; Sarma, 1986), one of which (*C. macrocladia*) was originally described from the Hawaiian Islands. *Cloniophora spicata* has been reported from numerous locations worldwide, including North, South and Central America, Europe, Australia, West Sumatra and New Caledonia, but this is the first time it has been identified from Hawaiian collections. Three of the four species of *Cloniophora* have now been reported from Hawai'i.

Material examined: **O'AHU**: Kahalu'u Str. at Melekula Rd., off Hwy 83, 19 Feb 2001, A. Sherwood & S. Stephens, *Sherwood 06* (BISH); Hālawa Str., Honolulu, 27 Apr 2001, A. Sherwood, *Sherwood 68* (BISH).

Schizomeris leibleinii Kütz. **New state record**

This is the first record of the genus *Schizomeris* in Hawai'i. *Schizomeris leibleinii* is the most commonly reported species within the genus, and is widely distributed in the conti-

1. All notes in this issue constitute Contribution No. 2003-011 to the Hawaii Biological Survey.

nental U.S.A., Europe, South America and India. The phylogenetic affinities of the genus have been long debated, but most evidence indicates that *Schizomeris* is a member of the Chaetophorales (*e.g.,* Mattox *et al.*, 1974).

Material examined: **O'AHU**: Hālawa Str., Honolulu, near animal quarantine station, 27 Apr 2001, A. Sherwood, *Sherwood 65* (BISH).

Order Cladophorales

Basicladia chelonum (Collins) Hoffmann & Tilden **New state record**

This is the first record of the genus *Basicladia* in Hawai'i. Members of the genus are usually reported growing epizooically on the backs of freshwater turtles, although it occasionally grows on other substrata, such as rocks, as is the case here. *Basicladia* is widely distributed in the continental U.S. and has also been reported from Canada, China, Saudi Arabia, and Australia. The alga may have been introduced to Hawai'i through the importation of freshwater turtles.

Material examined: **O'AHU**: Kū'ou Str. in Ho'omaluhia Botanical Garden, 19 Feb 2001, A. Sherwood & S. Stephens, *Sherwood 08* (BISH).

Rhizoclonium hieroglyphicum var. ***hosfordii*** (Wolle) Collins **New state record**

This variety of the commonly reported species, *Rhizoclonium hieroglyphicum*, was previously known from the continental U.S. Although the species has been reported from Hawai'i in the past, the collection listed below represents the first material of the variety *hosfordii* to be identified from this state.

Material examined: **O'AHU**: Mānoa Falls, Honolulu, 26 Mar 2001, A. Sherwood & S. Stephens, *Sherwood 47* (BISH).

Order Ulotrichales

Binuclearia tatrana Wittrock **New state record**

This is the first record of the genus *Binuclearia* in Hawai'i. The previously known distribution included the continental U.S.A. and Argentina.

Material examined: **KAUA'I**: Limahuli Stream, in outflow of pool below falls, Hā'ena, 13 May 2001, A. Sherwood, *Sherwood 96* (BISH).

Order Zygnematales

Spirogyra plena (W.West et G.S.West) Czurda **New state record**

Spirogyra is an extremely widespread genus of green algae that is commonly recognized by its spiraling chloroplasts. Species-level identifications are often not possible since the taxonomy of the genus relies on sexual reproductive characteristics, and thus most collections are reported as *Spirogyra* sp. Reproductive structures were observed for two species, neither of which has been previously reported for Hawai'i. This species of *Spirogyra* was previously known from India, West Bengal and the continental U.S.A.

Material examined: **HAWAI'I**: Waikoloa Stream, M. LeGrande & K. Wood, 24 Oct 2001, *Sherwood 179* (BISH).

Spirogyra rivularis (Hass.) Rabenhorst **New state record**

Spirogyra rivularis was previously known from the continental U.S.A. and India.

Material examined: **KAUA'I**: Limahuli Str., Hā'ena, on exposed rock face, A. Sherwood, 21 Feb 2001, *Sherwood 22* (BISH).

Order Desmidiales

Hyalotheca dissiliens (Smith) Bréb. **New state record**

Hyalotheca is a moderately sized genus with approximately 12 species, and *H. dissiliens* is an especially widespread taxon. Previous geographical reports for this alga include numerous locations in North America, Europe, and Australia.

Material examined: **O'AHU**: Helemano Ditch on southern edge of Dole Plantation field, on submerged vegetation, A. Sherwood & J. Dasinger, 18 Oct 2001, *Sherwood 128* (BISH).

Acknowledgments

This research was supported by a postdoctoral fellowship to ARS from the Natural Sciences and Engineering Research Council of Canada and the Hawaii Stream Research Center. We thank James Dasinger, Maya LeGrande, Sonia Stephens, and Ken Wood for help with field collections.

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New records of freshwater macroalgae from the Hawaiian Islands. 2. Cyanophyta

ALISON R. SHERWOOD (Dept. of Botany, 3190 Maile Way, University of Hawaii, Honolulu, Hawai'i, 96822, USA), MICHAEL H. KIDO (Hawaii Stream Research Center, University of Hawaii – Center for Conservation Research and Training, 7370A Kuamo'o Rd., Kapa'a, Hawai'i, 96746, USA) and CLIFFORD W. MORDEN (Center for Conservation Research and Training and Dept. of Botany, University of Hawaii, Honolulu, Hawai'i, 96822, USA)

This represents the second contribution in a series of new records of freshwater macroalgae from the Hawaiian Islands. Here we report four new records of Cyanophyta (blue-green) freshwater macroalgae that were made during 2001 survey efforts on the islands of Kaua'i, Maui, and Hawai'i. Macroalgae are here defined as benthic algae with a mature thallus that is a discrete structure discernable to the naked eye (Sheath & Cole, 1992). Voucher specimens of all newly reported taxa are deposited in Bishop Museum. All deter-

minations are by A.R. Sherwood. Literature used to identify samples included Prescott (1951), Desikachary (1959), Drouet (1968), Anagnostidis & Komárek (1988) and Komárek & Anagnostidis (1989).

Order Nostocales

Scytonema fritschii Ghose **New state record**

This uncommonly reported alga was previously known from India and Pakistan. It differs from other species of *Scytonema* in having the following combination of characters: filaments 15–20 µm broad, trichomes 7–8 µm broad, cell walls without constrictions, sheath with parallel lamellations, cells usually longer than broad, heterocysts intercalary and cylindrical, up to 35 µm long.

Material examined: **HAWAI'I**: unnamed stream at Laupahoehoe Nui (collection location A.R.S. Hawaii 6), 21 May 2001, A. Sherwood, *Sherwood 145* (BISH).

Order Oscillatoriales

Leptolyngbya tenuis (Gomont) Anag. & Komár. **New state record**

This is a very widespread species of blue-green algae, and has been previously reported from North America, various parts of Europe, South Korea, Japan, India, Egypt, China, Pakistan, and Morocco. Most prior reports were as *Phormidium tenue* Gom., which was the correct name for the alga before Anagnostidis and Komárek's (1988) revision of the Oscillatoriales, and their establishment of the new genus *Leptolyngbya*.

Material examined: **KAUA'I**: Hanakāpī'ai Stream, mid site, lower reach, 23 Jun 1999, M. Kido, *Sherwood 183* (BISH).

Microcoleus lacustris (Rabenh.) Farlow **New state record**

Previously known from Pakistan and both tropical and temperate areas of North America, this represents the first report of *Microcoleus lacustris* from Hawai'i. It was originally described from American collections. *Microcoleus lacustris* differs from other species in that the apical cells of the trichomes are bluntly rounded, cells are slightly constricted at the cross walls, and filaments are 4-5 µm in diameter.

Material examined: **HAWAI'I**: 'Ōhi'ahu'ea Stream, Laupahoehoe Nui, 21 May 2001, A. Sherwood, *Sherwood 138* (BISH).

Phormidium corium var. ***capitatum*** N.L. Gardner **New state record**

The nominate variety of this taxon has a wide distribution, including Hong Kong, the Arabian Gulf, Turkey, Bermuda, and Spain. The variety reported in this contribution was previously known from various locations in India, Europe, and North America.

Material examined: **MAUI**: Honomanū Stream mouth, 19 Mar 2001, L. Hodgson, *Sherwood 43* (BISH).

Acknowledgments

This research was supported by a postdoctoral fellowship to ARS from the Natural Sciences and Engineering Research Council of Canada and the Hawai'i Stream Research Center. We thank Lynn Hodgson for field collections presented in this contribution.

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New records of alien pteridophytes for Hawai‘i[2]

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Since the publication of the paper "*Alien Ferns in Hawai‘i*" (Wilson, 1996), three additional ferns species have been found to be naturalized in Hawai‘i and are reported here. In addition, two new island records are reported as well as an earlier date of first collection for one species.

Azollaceae

Azolla filiculoides Lam. **New island record**

The occurrence of this floating aquatic fern had been documented on all of the major islands except Hawai‘i. A collection made in 1999 now documents its presence on Hawai‘i.

Material examined. **HAWAI‘**I: Hāmākua Dist., Waipi‘o Valley, taro farm ca. 2 mi into the valley, 19 Jun 1999, *Imada 99-16* (BISH).

Schizaeaceae

Lygodium japonicum (Thunb.) Sw. **New island record**

This species is established north of Hilo were it can be found scrambling on grasses and shrubs on roadside banks at the southern end of Pepe‘ekeo Scenic Drive (Wilson, 1996). It has persisted there since it was first reported and does not seem to have spread substantially or to have been particularly damaging.

This species has now been found growing on O‘ahu in grassy hills above He‘eia State Park.

Material examined. **O‘AHU**: Grassy hills above He‘eia State Park, 20 Dec 1998, *Staples et. al. 1166* (BISH).

Marsileaceae

Marsilea crenata Sw. **New state record**

This aquatic species is well established in the demonstration taro patches at the Hawai‘i

2. Since this paper was submitted, Dan Palmer's "*Hawaii's fern and fern allies*" was published (2002, University of Hawaii Press), in which some of these records are listed. Since Wilson's paper was submitted before Palmer's book was published, these records are kept here to honor the intention of the author in noting these as new. —Editors.

Nature Center, Makiki Valley, O‘ahu. The presence of *Marsilea crenata* in the Nature Center taro patches was first recorded in the Center’s journals on 18 May 1994 by Marie Bruegmann. It is native of the Philippines, Malaysia, Indonesia, and Australia where it grows in shallow freshwater and in drying mud, and is often found in rice paddies.

Material examined. **O‘AHU**: Honolulu, Makiki Valley, Hawai‘i Nature Center, in demonstration taro patches, 1 Jun 1995, *D. Palmer 2275* (BISH).

Selaginellaceae

Selaginella stellata Spring **Earlier date of first collection**

A collection of this species has come to my attention that was made in August 1969 at Akaka Falls State Park, much earlier than the 1990 date reported previously (Wilson, 1996).

Material examined. **HAWAI‘I**: ‘Akaka Falls State Park, 30 Aug 1969, *Lehto & Lehto 19429* (RSA).

Selaginella umbrosa Lem. ex Hieron. **New state record**

Selaginella umbrosa was found growing on shady, wet cinder walls along the ‘Akaka Falls trail, ‘Akaka Falls State Park in June 2000. It is not yet widespread in the area. This species is easily identified by having a bright red, unbranched, erect lower stem and a flat, much-branched upper portion. It is not infrequently found in cultivation, often as a ground cover.

Material examined: **HAWAI‘I**: ‘Akaka Falls State Park, in shady areas on wet cinder walls, 15 Jun 2000, *Kay Lynch s.n.* (LAM).

Salviniaceae

Salvinia molesta D.S. Mitch. **New state record**

Salvinia molesta was discovered in 1999 growing on O‘ahu in Enchanted Lake, Kailua, and in Lake Wilson, Wahiawa, and on Hawai‘i from localities near Hilo. It is a free floating fern that is sexually sterile but reproduces rapidly by fragmentation and is capable of doubling in volume in 2 to 3 days to form extensive mats. These dense mats clog waterways and irrigation canals, block passage, obstruct irrigation pumps, prevent light from reaching aquatic plants, reduce the oxygen content of the water and seriously degrade the quality of the water. *Salvinia molesta* is listed on the Federal Noxious Weed list (see references).

The leaf surface is covered with minute stalks each bearing 3 or 4 hairs joined at the tips to form a cage-like structure, the whole unit resembling an inverted kitchen whisk. This fern is grown in garden ponds and aquaria and is known to be in cultivation in the Islands. Its first documented occurrence in cultivation in Hawai‘i was in 2 July 1991. It escapes from cultivation and invades aquatic freshwater bodies where it grows aggressively, rapidly becoming a serious pest.

Material examined. **O‘AHU**: Honolulu, Bishop Museum campus [cultivated], 2 Jul 1991, *K. Wilson & G. Staples s.n.* [cultivated], (BISH 606163, LAM); Honolulu, Kaimuki neighborhood, cultivated in bucket in full sun, 6 Apr 1993, *W. Hoe 5351* (BISH); Windward side, Kailua, cultivated in water garden, 209 Oneawa Kai Place, 16 Dec 1996, *G. Staples 1137* (BISH); Kailua, Enchanted Lakes area, canal and upper end of Ka‘elepulu Pond, adjacent to Kiuke‘e Pl., freshwater,“mitigative” wetland, 1 Apr 1999, *J. Cook s.n.* (BISH 655219); same loc, 14 Apr 1999, *Nakahara, Heu, & Matayoshi 99-01* (BISH, LAM); same loc., 17 Apr 1999, *C. Imada 99-12* (BISH, LAM); Kailua, Enchanted Lake, in canal entering lake from the south, floating mats covered nearly entire canal, 17

Apr 1999, *D.D. Palmer 3123* (BISH, LAM); Waimanalo, 41-665 Kumuhau Street, growing in taro patch, being removed, 21 Apr 1999, *M. Buck s.n.* (BISH 655286, LAM); Waiāhole Valley, at end of N branch of Waiāhole Valley Road, inside locked gates, 29˚ 13' N, 157˚ 51' W, in small rivulet of fresh water crossing dirt road, ferns growing with roots barely submerged, 5 Sep 1999, *Staples & Ahsing 1185* (BISH 658380, LAM); Wahiawā area, Lake Wilson, S. end of lake, population ca 1 acre in extent, 15 Apr 1999, *Higashi s.n.* (BISH 655127, LAM); Wahiawā, S end Lake Wilson, forming floating mats 1 acre across, 22 Apr 1999, *F. Kraus s.n.* (BISH 655218, LAM); Wahiawā, south fork of Lake Wilson, in fishing area at end of Cypress Ave, 24 Jun 1999, *G. Higashi et al. s.n.* (BISH 657219, LAM). **HAWAI'I**: Hilo, Garden Exchange, using plants for display, given to customers free, 28 May 1999, *Shishido s.n.* (BISH 657222); Onomea[cultivated], in fish pond at Hawai'i Tropical Botanical Garden that drains to ocean, fast-growing aquatic, 25 Jun 1999, *C. Hirayama & L. Nakahara s.n.* (BISH 657220, LAM); Waiākea-uka residential lots [cultivated], in lily tank where owner raises plants for sale, plant came in as contaminants 1–2 years ago, 25 Jun 1999, *C. Hirayama & L. Nakahara s.n.* (BISH 657221, LAM).

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Web Sites

Noxious Weed Home page — *http://www.aphis.usda.gov/ppq/weeds/weedhome.html*
USGS *Salvinia molesta* — *http://nas.er.usgs.gov/ferns/*

New Hawaiian plant records for 2001

STAPLES, GEORGE W., CLYDE T. IMADA, & DERRAL R. HERBST (Hawaii Biological Survey, Department of Natural Sciences, Bishop Museum, 1525 Bernice St., Honolulu, Hawai'i 96817–2704, USA; email: gstaples@bishopmuseum.org)

These previously unpublished Hawaiian plant records report 8 new state records, 21 new island records, 5 new naturalized records, 2 range extensions, and 7 nomenclatural and taxonomic changes that affect the flora of Hawai'i. The ongoing incorporation of the state Endangered Species Program herbarium developed by the Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR/DoFaW) into the BISH herbarium has brought to light a number of voucher specimens from the 1970s and 1980s that are first records for the state or for particular islands. These records supplement information published in Wagner *et al.* (1990, 1999) and in the *Records of the Hawaii Biological Survey* for 1994 (Evenhuis & Miller, 1995), 1995 (Evenhuis & Miller, 1996), 1996 (Evenhuis & Miller, 1997), 1997 (Evenhuis & Miller, 1998), 1998 (Evenhuis & Eldredge, 1999), 1999 (Evenhuis & Eldredge, 2000), and 2000 (Evenhuis & Eldredge, 2002). All identifications were made by the authors except where noted in the acknowledgments, and all supporting voucher specimens are on deposit at BISH except as otherwise noted.

Acanthaceae

Pseuderanthemum variabile (R. Br.) Radlk. **New island record**

Apparently an inadvertent arrival in nursery material, *P. variabile* was first identified from naturalizing plants collected in an O'ahu orchid nursery in 1996 (Herbarium Pacificum

Staff, 1998). At that time, it was incorrectly called *P. fasciculatum* (Oerst.) Leonard, but was subsequently reidentified as *P. variabile* (Herbst & Wagner, 1999). The following recently identified collection from a Kauaʻi greenhouse pushes the earliest known year of introduction of this species into Hawaiʻi back to 1994.

Material examined. **KAUAʻI:** Kōloa Distr., Lāwaʻi, National Tropical Botanical Garden, weedy herb below benches in NTBG greenhouse, 4 Nov 1994, *T. Flynn 5652*.

Araceae

Alocasia cucullata (Lour.) G. Don **New naturalized record**

Chinese taro ranges from India to Sri Lanka and Myanmar, and has been cultivated in Hawaiʻi as an ornamental ground cover or container plant since at least the 1930s. The dark green, leathery, glossy leaves are heart-shaped with an acuminate tip, with 4–5 pairs of veins radiating from near the peltate base. According to Staples & Herbst (in press), plants grown in Hawaiʻi have abnormal pistillate flowers, which may be the reason fruits are rarely seen here. However, Chinese taro suckers freely and can spread vegetatively in that manner. Even small pieces of stem, root, or rhizome in the soil are enough to give rise to new plants and the species appears to reach new localities through movement of soil by humans.

Material examined. **MAUI**: Hāna Distr., Keʻanae Arboretum, sparingly naturalized in shady understory of surrounding forests, 23 Jan 1986, *R. Hobdy 2490.* **HAWAIʻI:** Hāmākua Distr., Waipiʻo Valley, common herb on roadside bank across from Araki hotel in understory of alien forest, ubiquitous along roads throughout the valley, 13 Mar 2001, *C. Imada 2001-20.*

Asteraceae

Centaurea cyanus L. **New island record**

Wagner & Herbst (1995) added the bachelor's button to the naturalized Hawaiian flora based on a voucher collected in 1986 along a roadside on Lānaʻi (*R. Hobdy 2576*). The following collection adds a new island to the known distribution.

Material examined. **HAWAIʻI:** Hāmākua Distr., Umikoa Ranch, on pond bank on bare soil, montane wet kikuyu pastureland, 1585 m, 2 Jul 2001, *K. Uyehara s.n.* (BISH 773179).

Erechtites valerianifolia (Wolf) DC. **New island record**

Reported in the *Manual* (Wagner *et al.*, 1990: 314) to occur on all main Hawaiian Islands except for Niʻihau and Kahoʻolawe, the following specimen documents the presence of this naturalized weed on the latter island. However, the specimen is sterile and was the only plant seen by the collectors that day, so whether *E. valerianifolia* persists on Kahoʻolawe requires further investigation.

Material examined. **KAHOʻOLAWE:** Lua Keālia Lalo, crater with standing water in center of western third of island, ca. 242 m, 22 Apr 1980, *L.W. Cuddihy & W.P. Char ESP 358.*

Erigeron bellioides DC. **New island record**

Previously known from the islands of Oʻahu (Nagata, 1995) and Maui (Oppenheimer *et al.*, 1999) the following specimen documents the presence of this diminutive lawn weed on Molokaʻi as well. Oppenheimer (elsewhere in these *Records*) records it from the island of Hawaiʻi. It is to be expected that *E. bellioides* is present by now on all inhabited islands where suitable moist conditions exist.

Material examined. **MOLOKA'I**: Kalaupapa National Historical Park, headquarters building, 24 Aug 2001, *J. Trainer s.n.* (BISH 684256).

Eupatorium capillifolium (Lam.) J. K. Small **New state record**

Native to the southeastern U.S. from Louisiana to New Jersey (Long & Lakela, 1976), dog fennel is a foetid, branched herb to 2.5 m tall, with leaves (opposite near base, alternate above) finely divided into filiform divisions 5–10 cm long, and tiny heads of 3–6 white or greenish florets grouped in large, terminal, paniculate inflorescences. In its natural range *E. capillifolium* is commonly found in vacant lots, fallow fields, and other disturbed sites; it would thrive in such environments in Hawai'i and should be eradicated before it becomes established. The collector of this voucher, made more than 25 years ago, reported the single plant was a volunteer in a container. The Nānāwale area should be surveyed to see if plants have become established there.

Material examined. **HAWAI'I**: Puna Distr., south of Hilo, Nānāwale, volunteer in a potted plant of *Passiflora,* 27 Oct 1975, *C. Corn s. n.* (BISH 634272).

Hypochoeris glabra L. **New island record**

Recorded as naturalized on all of the main Hawaiian Islands except Ni'ihau and Lāna'i by Wagner *et al.*(1999: 327), the following 3 old collections from Lāna'i were apparently overlooked. A note about one place name is warranted: Munro did not use diacritics on his label and the locality "Kaa" may refer to either Ka'a, a point in northeastern Lāna'i, or , Ka'ā, a large land section in western Lāna'i (Pukui *et al.,* 1974).

Material examined. **LĀNA'I:** "Kaa", 22 Feb 1916, *G. C. Munro 504;* Lālākoa, 26 Jul 1929, *G. C. Munro 430;* in fairly dry pineapple field, Lāna'i City, 23 Jul 1931, *E. Y. Hosaka 471*.

Brassicaceae

Coronopus didymus (L.) Sm. **New island record**

Reported in the *Manual* (Wagner *et al.,* 1990: 403) to occur on all the main Hawaiian Islands as well as Midway and Pearl and Hermes atolls, the following specimen is the first documentation for *C. didymus* from Laysan.

Material examined. **LAYSAN:** Pacific Remote Islands National Wildlife Refuge, ca. 200 m from beach in flat rocky area, near sea level, 12 Mar 2002, *A. Martin 2.*

Raphanus raphanistrum L. **New naturalized record**

The *Manual* (Wagner *et al.,* 1990: 412) noted this species' presence on Kaua'i and Hawai'i but stopped short from including it as a naturalized element in the Hawaiian flora, noting the difficulty in distinguishing *R. raphanistrum* and *R. sativus.* In 1993 and 2000, Ihsan Al-Shehbaz identified a number of Hawaiian Brassicaceae specimens and this revealed that *R. raphanistrum* is in fact widely distributed across five of the main Islands and should be considered a fully naturalized species. The following selected vouchers document the localities where the species has been collected since it was first found as a roadside weed in 1916.

Representative material examined. **KAUA'I:** Waimea Distr., Kōke'e State Park, Mōhihi Road near Camp Sloggett, disturbed roadside, ca. 1100 m, 26 May 1984, *W. L. Wagner et al. 5371, 5372;* Līhu'e Distr., Puhi Camp, west of Kaua'i Community College, from yard of abandoned homesite, 4 Apr 1986, *T. Flynn & L. Hume 1650.* **O'AHU**: Honolulu Distr., roadside at Kaimuki, 6 Feb 1916, *C. N. Forbes 2286.O.* **MOLOKA'I**: Hālawa Valley, Mar 1964, *N.L.H. Krauss s. n.* (BISH 43318).

MAUI: Makawao Distr., Ulupalakua, roadside near T.B. sanitarium, 23 Jun 1927, *O. Degener 35834.* **HAWAI'I**: South Hilo Distr., Kaūmana, in plowed field, 365 m, 8 Jun 1939, *H. Vollrath s.n.* (BISH 43292); Hāmākua Distr., land of Mahukuolo, roadside weed, ca. 1000 ft., 20 Apr 1976, *D. Herbst 5823;* Kapulena, 20° 03' N, 155° 28' W, 12 Jul 1996, *D. Herbst 9790;* Ka'u Distr., Hawaii Volcanoes National Park, near Hilina Pali lookout sign post, 27 Jun 1974, *T. Herat, R. Herat, & P. Higashino 805.*

Chenopodiaceae

Atriplex canescens (Pursh) Nuttall **New state record**

First observed by Rick Warshauer, the following collection was made by retracing his route back to the population. A few scattered shrubs up to 1.5 m tall and 2.1 m wide were noted in the subalpine habitat. The following description is adapted from *The Jepson Manual* (Hickman, 1993): erect shrub up to 2 m tall, with many spreading to ascending branches; leaf blades 8–50 mm long, linear to oblanceolate, densely white-scaly; fruit ovoid to spherical, bracts forming 4 fused wings, each 3–6 mm wide. It is native from western Canada through northern Mexico. Listed common names include fourwing saltbush and shad-scale.

Material examined. **HAWAI'I:** Hāmākua Distr., western slope of Mauna Kea, ca. 0.8 mi. above Pu'u Lā'au cabin, just off dirt road on right side (going uphill), in open *Sophora/Myoporum* subalpine forest on rocky soil, along with *Holcus lanatus, Hypochoeris, Rumex acetosella,* ca. 2333 m, 21 Oct 2000, *C. Imada, W. Char, C. Morden & M. Legrande 2000-23.*

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

Naturalized on all of the main Hawaiian Islands except O'ahu (Wagner *et al.*,1999: 537; Lorence & Flynn, 1997: 10), a specimen of *C. carinatum* from O'ahu documents the species' presence on all islands. Collected in 1938, this voucher only recently came to light in the course of curation efforts by BISH staff. It would be worthwhile to search the locality to see if *C. carinatum* persists there today.

Material examined. **O'AHU:** Ko'olauloa Distr., Lā'ie, Makahoa Point, 2 Aug 1938, *M.C. Neal & C. Hartt s. n.* (BISH 618401).

Cyperaceae

Cyperus eragrostis Lam. **New state record**

This sedge is similar in appearance to *Cyperus virens* Michx., and keys to that taxon in the *Manual* (Wagner *et al.,* 1999: 1394). According to Munz & Keck (1973: 1425), the two species differ in that *C. virens* has scaberulous, more sharply triangular culms and short-stipitate, oblong-elliptic achenes, the stipe not broadened at the base.

Material examined. **HAWAI'I:** Hāmākua Distr., Umikoa Ranch, ca. 1 acre stock pond, montane wet pasture, some koa, 27 Sep 1999, *K. J. Uyehara & A. Engilis 99092706.*

Cyperus papyrus L. **New island record**

This large, distinctive wetland sedge had previously been found naturalized only on Kaua'i (Wagner *et al.,* 1999: 1398). This collection represents the first such documentation for Hawai'i.

Material examined. **HAWAI'I:** Hāmākua Distr., Waipi'o Valley, large monodominant patch growing in wetland area on east side near mouth of valley, stems over 2 m tall, margins with *Eichhornia crassipes, Commelina diffusa, Schoenoplectus californicus,* 13 Mar 2001, *R. Englund sub C. Imada 2001-16.*

Epacridaceae

Revisionary study of the genera *Styphelia* Sm. and *Cyathodes* Labill. led to the erection of a new genus, *Leptecophylla* C. M. Weiller, to accommodate 12 species distributed in Australia, New Zealand, and several Pacific islands, including Hawai‘i (Weiller, 1999). The common and widespread *pūkiawe* thus has a change of scientific name.

Leptecophylla tameiameiae (Cham. & Schltdl.) C. M. Weiller **Taxonomic change**

[Syn. *Styphelia tameiameiae* (Cham. & Schltdl.) F. Muell.]

Fabaceae

Caesalpinia bonduc (L.) Roxb. **New island record**

Reported in the *Manual* (Wagner *et al.,* 1990: 647) to be found on all of the main Hawaiian Islands except for Lāna‘i and Kaho‘olawe, *C. bonduc* has not previously been found on any of the Northwestern Hawaiian Islands. The following collection documents the first known occurrence for this species on Laysan.

Material examined. **LAYSAN:** Pacific Remote Islands National Wildlife Refuge, ca. 100 m from beach in relatively flat area, near sea level, 6 Nov 2001, *A. Martin 1.*

Crotalaria juncea L. **New island record**

First reported to be naturalized on O‘ahu and Hawai‘i as recently as 1997 (Wagner *et al.,* 1997), additional specimens have come to light that document the presence of sunn hemp as a naturalized species on Maui as well. Specimens of *C. juncea* have been confused in the herbarium with *C. assamica* Benth., and reidentification of these vouchers has recently clarified the distribution for both species in the Hawaiian Islands. Although not yet known to be naturalized on Kaua‘i, *C. juncea* was documented in cultivation there in 2001 (voucher: *Imada 2001-71,* BISH) and it will likely be found naturalized there in the future.

Material examined. **MAUI**: Mokulele Hwy., upper junction with Kīhei Hwy., growing as a weed in a seed corn field, 12 Sep 1993, *R. Hobdy 3593.*

Desmodium intortum (Mill.) Urb. **New island record**

Previously known to be naturalized on O‘ahu (Herbarium Pacificum Staff, 1998: 9; Imada *et al.,* 2000: 12) and Hawai‘i (Wagner *et al.,* 1999: 667), this is the first record of this weedy legume on Kaua‘i.

Material examined. **KAUA‘I:** Hanalei Distr., Princeville, old nursery area between hwy and Hanalei Valley, abundant, growing between overgrown nursery plantings, 23 Aug 2000, *W. Char s. n.* (BISH 669055).

Macrotyloma axillare (E. Mey.) Verdc. **New state record**

Native in a wide range across sub-Saharan Africa, *M. axillare* is also found on several Indian Ocean islands as well as Madagascar and Sri Lanka (Wiersema *et al.,* 1990). The cited voucher specimen was misidentified as *Lablab purpureus.* The two genera are separable based on floral characters: *Macrotyloma* has flowers in greenish to yellow shades, the style not thickened and tending to be inconspicuous; *Lablab* (and *Dolichos*) has flowers in purple shades, the style conspicuous and thickened (Gillett *et al.,* 1971).

It is possible that *M. axillare* is more widespread in the Hawaiian Islands than the

single voucher specimen indicates; this species is used as a forage and fodder crop and it may have been planted for similar purposes in the islands. The following description is adapted from the papilionoid legume account for the *Flora of Tropical East Africa* (Gillett *et al.,* 1971). Plants are twining perennial herbs from a stout rootstock; the leaves trifoliolate, the leaflets varying from elliptic to subrhombic, 1–7.5 cm long and 0.7–4.2 cm wide; the flowers 1.2–2.4 cm long, whitish or green to yellow, the standard petal with a central red or purplish spot. Fruits are linear-oblong pods, 3–8 cm long and 6–8 mm wide, containing round to ellipsoid, black-mottled, buff to dark red seeds, each 3–4.2 mm long.

Three varieties are recognized (Gillett *et al.,* 1971); Hawaiian plants are referable to var. *glabrum* (E. Mey.) Verdc.

Material examined. **O'AHU**: Waialua Distr., Waialua, Keālia Trail, in overgrown grazing land, 390 m, 16 Jun 1985, *J. Lau 1096.5.*

Senna obtusifolia (L.) H.S. Irwin & Barneby **New island record**

Previously documented as naturalized since at least 1960 only on the Greenwell Ranch, Hawai'i (Wagner *et al.,* 1999: 700), this is the first such record of this species on O'ahu, and it pushes back the year of naturalization by 20 years. Called *habucha,* the seeds were roasted for tea by Japanese.

Material examined. **O'AHU:** Ko'olaupoko Distr., Kailua, west margin of Ka'elepulu Pond, 11 Jun 1940, *M.C. Neal & C. Hartt s. n.* (BISH 614694).

Vigna luteola (Jacq.) Benth. **New state record**

The *Manual* (Geesink *in* Wagner *et al.,* 1990: 720) acknowledged the similarity between the widespread marine littoral species *Vigna marina* (J. Burm.) Merr. and the pantropical, inland riparian and marsh species *V. luteola,* claiming the latter does not occur in the Hawaiian Islands. However a recent collection demonstrates that *V. luteola* does occur on O'ahu, perhaps as a recent introduction, the species never having been reported in cultivation here before. The two species are currently accepted as distinct (Maréchal *et al.,* 1978; Wiersema *et al.,* 1990; Pasquet, 2001). They may be distinguished as follows:

Leaflets ovate-elliptic or ovate-lanceolate, apex acute; peduncle not thickened; pods linear, ± pubescent; seeds 3–6 × 3 mm .....*V. luteola*

Leaflets rounded-obovate, apex rounded; peduncle thickened; pods linear-oblong, ± curved, glabrous; seeds 6–7 × 5 mm .....*V. marina*

Material examined. **O'AHU**: Ko'olaupoko Distr., Kailua, Kawainui Marsh, near Kapa'a Quarry Rd., 21° 23' N, 157° 45' W, 5 Dec 1999, *D. K. Britton s. n.* (BISH 661761, K, NY).

Hydrocharitaceae

Ongoing surveys in freshwater and riparian habitats continue to uncover naturalized aquatic plant species. Two more naturalized aquarium ornamentals are documented here.

The genus *Vallisneria* has undergone worldwide taxonomic revision in recent years and the number of species has been reduced to two, each comprising two varieties (Lowden, 1982). A number of other names have been reduced to synonymy, though they persist in the horticultural literature. Both species, in a bewildering array of phenotypes, are sold as aquatic plants for use in aquaria and water gardens; one robust race of *V. americana* is eaten as a potherb and it appears to have escaped from cultivation in Hawai'i,

where it is grown for that purpose (Staples & Herbst, in press). These are stoloniferous, submerged aquatic plants that grow rooted in the bottom substrate, have rosettes of ribbon-like leaves from a few centimeters to nearly one meter in length, and separate male and female flowers, the male shed from a basal spathe and free-floating on the water surface, the female rising to the surface but attached to a long peduncle that later recoils and draws the developing fruit underwater after pollination. The species can be distinguished only using rather hard-to-discern floral characters (Lowden, 1982; Haynes & Holm-Nielsen, 2001). Both species are reported here as newly naturalized in the Hawaiian Islands; species descriptions and distributional information are available in the recent literature and are not repeated here (Lowden, 1982; Haynes & Holm-Nielsen, 2001).

Vallisneria americana Michx. **New naturalized record**

This species is well documented in cultivation in the Hawaiian Islands, the earliest collection in BISH dating from 1933 (*A. Suehiro s.n.*, BISH 120710). Two distinct phenotypes are represented among Hawaiian plants: a diminutive plant with leaves only 15–40 cm long and 6–10 mm wide; and a robust plant with leaves exceeding 1 m in length and 3 cm wide (giant val, or *balάiba* in Pilipino). Both phenotypes are sold as aquatic ornamentals; the latter is also eaten as a potherb and is sold for that purpose in local produce markets.

The following two specimens document the occurrence of *V. americana* as a naturalized element in the Hawaiian flora; it is likely to occur on other islands in suitable fresh and brackish water habitats.

Material examined. **KAUA‘I:** Līhu‘e Distr., north fork of Wailua River, behind dam at mouth of ‘Ili‘ili‘ula North Wailua Ditch intake, 18 Jul 1984, *T. Flynn 897;* Kōloa Distr., Kōloa, Lāwa‘i Valley, National Tropical Botanical Garden, apparently naturalized in Lāwa‘i Stream near the Bamboo Bridge area, 12 Aug 1997, *T. Flynn 6196.*

Vallisneria spiralis L. **New naturalized record**

This species has never been reported from the Hawaiian Islands until the following vouchers, gathered during freshwater stream survey projects in 2000–2001, revealed that *V. spiralis* is locally naturalized and abundant on O‘ahu, forming dense underwater mats that are the dominant vegetation in areas where found. The lack of cultivated voucher specimens is surely an artifact of collecting bias; *V. spiralis* is abundant in the aquarium trade and has surely been grown ornamentally in the Islands for many years or decades. It should be sought on other islands in suitable freshwater habitats where it may be naturalized.

Material examined. **O‘AHU:** Waialua Distr., Hale‘iwa, lotus farm behind Hale‘iwa Shopping Plaza, submerged in small irrigation ditch, common and naturalized, 18 Mar 2000, *C. Imada, L. Roth, C. N. Lee 2000-1;* Ko‘olaupoko Distr., Kāne‘ohe, growing in flowing water in Kamo‘oali‘i Stream, not far below Ho‘omaluhia Reservoir, ca. 15 m, 23 Feb 2000, *R. Englund s. n.* (BISH 666333); Kāne‘ohe Stream adjacent to public library, ca. 55 m, 10 May 2001, *C. Imada & D. Preston 2001-25, 2001-26;* Kāne‘ohe Stream downstream from the public library, ca. 8 m, 5 Jun 2001, *C. Imada, R. Englund & D. Preston 2001-44.*

Iridaceae

Aristea gerrardii Weim. **Reidentification**

[*Aristea* cf. *compressa* sensu Herbarium Pacificum Staff (1999).]

Following the report of a second taxon of *Aristea* from the island of Hawai‘i (Herbarium

Pacificum Staff, 1999), it proved possible to have Hawaiian voucher material of *Aristea* examined by a specialist undertaking revisionary study of the South African taxa. The conclusion reached is that all plants from Hawai‘i are referable to *A. gerrardii* sensu lato (L. Vincent, pers. com. 2001).

Lamiaceae

Leonurus japonicus Houtt. **Nomenclatural change**

[Syn. *Leonurus heterophyllus* Sweet]

[Misapplied: *Leonurus sibiricus* of many authors, not Linnaeus (1753)]

In a recent note, Harley & Paton (2001) pointed out that the name *L. sibiricus*, used for a widespread ruderal weed, must correctly be applied to a different species. Although the Russian botanical literature noted this decades ago and took up the name *L. japonicus*, taxonomists elsewhere have continued to use *L. sibiricus* inappropriately. The name *L. sibiricus* has been widely used in Hawaiian and Pacific botanical literature and the correction is here noted.

Mentha suaveolens Ehrhart **Reidentification**

[Misapplied: *Mentha* ×*villosa* Hudson, *M.* ×*rotundifolia* (L.) Hudson]

The *Manual* (Wagner *et al.*,1990: 807) applied the name *M.* ×*villosa*, with reservation, to one naturalized taxon of mint, pointing out that the Hawaiian plants are most similar to *M. suaveolens.* Subsequently vouchers were reidentified as *M. suaveolens* by Ray Harley, Royal Botanic Gardens, Kew. The name change is noted here.

Loganiaceae

Labordia waialealae Wawra **? New island record**

This apparently overlooked specimen represents the first—and perhaps only—Moloka‘i record for this endemic wet forest/bog species. It is otherwise known only from the island of Kaua‘i (Wagner *et al.*,1990: 862). It is possible that Faurie’s specimen label is incorrect (T. Motley, pers. comm. 1997). Field collectors are encouraged to look for this species on Moloka‘i to determine whether it exists there or not.

Material examined. **MOLOKA‘I**: Kamolo [Kamalō], Jun 1910, *U. Faurie 452*.

Malvaceae

Hibiscus ovalifolius (Forssk.) Vahl **Taxonomic change**

[Syn. *Hibiscus calycinus* Willd., *H. calyphyllus* Cav., *H. rockii* O. & I. Degener, *H. brackenridgei* A. Gray var. *kauaiana* Caum]

The conspecificity of *H. calyphyllus* with the earlier described *H. ovalifolius* was only established after examination of Forsskål’s type material and reconsideration of Vahl’s description with its confusing mention of woolly seeds (Hepper & Wood, 1983). The reduction to synonymy has escaped notice until now. Hawaiian populations were described as an endemic taxon; there is continuing debate over their status, with some horticulturalists asserting that the Hawaiian plants are sufficiently different from African and Madagascan ones that specific rank is warranted (Bornhorst, 1996).

Sida ciliaris L. **New island record**

First collected in 1987 and reported as naturalized on O‘ahu (Wagner *et al.*,1997: 59) and later on Maui (Oppenheimer & Bartlett, 2000: 6), this is the first record of this species on

Kaua‘i, where the species appears to be well established in the Po‘ipū area.

Material examined. **KAUA‘I:** Kōloa Distr., Po‘ipū, Po‘ipū Beach Park, forming low mats in dirt and gravel parking lot and in lawn, 17 Aug 2001, *W. Char et al.s. n.* (BISH 683118); same loc., 22 Nov 2000, *W. Char 20.031;* Kalanipo Park, just N of parking area in secondary vegetation, elev. ca. 6 m, 20 Mar 2001, *T. Flynn 6793* (BISH, MO, NY, PTBG, US).

Melastomataceae

A recent comprehensive taxonomic revision of the genus *Melastoma* L. (Meyer, 2001) resulted in a number of taxonomic rearrangements and description of three new taxa. One consequence is that the name used for a widespread naturalized species in the Hawaiian Islands has changed.

Melastoma septemnervium Lour. **Taxonomic change**

[Syn. *M. candidum* D. Don]

The natural range of *M. septemnervium* is Taiwan, southern China, and northern Vietnam (Meyer, 2001). It does not appear to have escaped and naturalized anywhere except the Hawaiian Islands, where it is known to occur on the islands of Kaua‘i, O‘ahu, and Hawai‘i.

Nyctaginaceae

Boerhavia acutifolia (Choisy) J. W. Moore **New island records**

[Misapplied: *Boerhavia glabrata* Bl.]

A number of *Boerhavia* specimens on loan to US for study by the late Ray Fosberg were returned to BISH after the latter’s death in 1993. Among them were two new island records for *B. acutifolia* from the Northwestern Hawaiian Islands. The species was previously known from all the main Hawaiian Islands (Wagner *et al.*, 1990: 978; Lorence & Flynn, 1999) but had not been documented in the northwestern chain.

Material examined. **LAYSAN**: widespread prostrate herb growing in sandy soil near a *Casuarina* tree, 5 m, 25 Jul 1983, *S. Conant 177*; prostrate on sandy substratum near *Casuarina*, 4 Dec 1963, *R. Tsuda 490*. **PEARL & HERMES**: Southeast Island, prostrate plant growing in sandy soil on E side, 21 Jul 1983, *S. Conant 142*.

Nymphaeaceae

Ongoing surveys in freshwater and riparian habitats continue to uncover naturalized aquatic plant species. Two more naturalized populations of waterlilies are documented here. Despite their beauty, waterlilies should be eradicated before they spread further into freshwater systems in the Hawaiian Islands.

Nymphaea capensis Thunb. **Range extension**

First documented from Kawaihau District, Kaua‘i in 1998 (Herbarium Pacificum Staff, 1998), the first population of *N. capensis* found was determined as var. *zanzibarensis* (Caspary) Conard. In 2000 a second population, seemingly representing a distinct species was located in Hanalei District. This second population is referable to the typical var. *capensis*, characterized by leaves with smooth or undulate margins, petals with acute apices, and 30–100 (or more) stamens. Although plant size, flower size, and petal color are not taxonomically significant characters in this highly variable species (Verdcourt,

1989), the second population of *N. capensis* on Kaua‘i is distinct from that previously documented in the plants petite size, violet flowers about 6 cm in diameter that stand well above water, and glossy green leaves.

Material examined. **KAUA‘I**: Hanalei Distr., Hanalei Natl. Wildlife Refuge, in pond on south side of wetland area, 22° 12' N, 159° 28' W, 30 m, 1 Nov 2000, *C. Imada, T. Flynn, M. Silbernagle, & T. Alexander 2000-26* (BARC, BISH).

Nymphaea lotus L. *sensu lato* **New state record**

Native almost throughout sub-Saharan Africa, with disjunct populations in Madagascar, Europe, Australia, and widely cultivated in the Americas (Verdcourt, 1989), *N. lotus* is a vigorous aquatic that spreads aggressively if not kept in check. The reddish green leaves reach 35 cm in diameter and have repand-dentate margins, with each tooth mucronate; the flowers are nocturnal (lasting well into the day), stand above the water, typically are white or cream (or pink), and the anther-connectives have no, or very weakly developed, appendages.

At the Kahuku location, wildlife refuge management staff stated that repeated mechanical removal of plants from the canal induced vigorous regrowth that quickly reestablished cover. Plants growing intermixed in the canal population had white or pinkish flowers. Flower color is not taxonomically significant, however, in this variable species. Collectors are urged to look for other naturalized populations of the species.

Material examined. **O‘AHU**: Ko‘olaupoko Distr., Kailua, southwestern margin of Kawainui Marsh along Kapa‘a Quarry Rd., ca. 100 m W of radio-controlled airplane field, 30 Apr 2002, *V. Daubenspeck s. n.* (BISH 687341); Kahuku Distr., Kahuku, James Campbell Natl. Wildlife Refuge, Ki‘i unit, in channelized waterway through refuge, 3 m, 21° 41' N, 157° 57' W, 13 Jul 2000, *C. Imada, L. Roth, M. Silbernagle 2000-8, 2000-9;* same loc., 16 Sep 2000, *C. Imada 2000-16, 2000-17* (BARC, BISH).

Oleaceae

Ligustrum lucidum Ait. **New naturalized record**

Long cultivated as a hedge plant and small shade tree in the Hawaiian Islands, *L. lucidum* is abundant on the island of Hawai‘i. The following specimen represents the first naturalized record for the state. *Ligustrum lucidum* differs from the other naturalized privet (*L. sinense* Lour.) in its larger plant size; leaves 7.5–15 cm long, ovate, leathery, glossy, and smooth; terminal panicles up to 25 cm long, with 4-parted flowers 3–4 mm long, the corolla tube equal in length to slightly shorter than the lobes. The glossy blue-black drupes are bird dispersed.

Material examined. **HAWAI‘I:** Hāmākua Distr., above Waipi‘o Valley, near river feeding Hakalaoa Falls, off jeep road by old corral near Hāmākua forest reserve boundary, trees naturalizing and spreading along small stream, ca. 550 m, 24 Feb 1991, *T. Motley, W. Char, B. Pang & C. Imada 1001*.

Orchidaceae

Rather few orchid taxa have been documented as naturalized in Hawai‘i (Wagner *et al*., 1999: 1468), despite the large number of species and hybrids grown throughout the islands by hobbyists and commercial growers. The following species had not previously been reported from Hawai‘i, either cultivated or naturalized.

Polystachya concreta (Jacq.) Garay & Sweet **New state record**

Native across a vast area in tropical America and Asia, this variable species has an extensive synonymy that reflects multiple namings in various places where it was "discovered" (Bechtel *et al.,* 1992). This smallish epiphyte has slender pseudobulbs 4–6 cm tall with 2–4 joints; 3 or 4 oblong-lanceolate leaves 5–14 cm long; and terminal racemes of small, fleshy, green (or pinkish, or dull red) flowers about 0.75 cm across, with a white lip, bearing 4 pollinia on the column. It is the only exclusively epiphytic orchid so far documented as naturalized in the Hawaiian Islands.

The collector's notes state that the plant was growing epiphytically on a dead tree trunk about 2 m above the ground. The plant was in flower when collected; the flowers were green. However the plant was kept alive in a terrarium for some time before it was brought to Bishop Museum for identification; there were no flowers remaining by the time it was delivered. How this unobtrusive orchid came to be growing in mixed native forest along a hiking trail is unknown. Collectors are encouraged to look for this and other naturalized orchid taxa.

Material examined. **O'AHU:** Wahiawā Distr., Schofield-Waikāne trail, in mixed native forest, 30 Apr 1998, *M. Furuya, M. Sakamoto & S. Riley s. n.* (BISH 652756).

Passifloraceae

Ongoing studies of the genus *Passiflora* continue to elucidate relationships among the complex of species in subgenus *Tacsonia* (Coppens *et al.,* 2001). This has permitted the resolution of a long-standing debate over the identity of banana poka, which has heretofore been called *P. mollissima* (Kunth) L. H. Bailey in the Hawaiian Islands and many other places, even though there is general agreement that naturalized and cultivated populations differ in several respects from those in the presumed area of origin. Hawai'i populations were given the cultivar name 'Banana Poka' (Green *in* Grierson & Green, 1996) to distinguish them from the wild plants native to the South American Andes.

Passiflora tarminiana Coppens & Barney **Taxonomic change**

[Syn. *Passiflora mollissima* 'Banana Poka' Green *in* Grierson, *Hawaiian Florilegium* 92. 1996]
[Misapplied: *Passiflora mollissima* (Kunth) L. H. Bailey]

Reported to be naturalized on Kaua'i and Hawai'i (Wagner *et al.,* 1990), banana poka was only documented as naturalized on Maui in 2000 (Oppenheimer & Bartlett, 2000) although the species was known to exist there since the early 1970s. An isotype specimen for the new species (*Coppens IPGRI-AM 72*) has been deposited in BISH.

Poaceae

Digitaria eriantha Steud. **New island record**

[Syn. *D. pentzii* Stent]

Digitaria eriantha previously had been documented from the islands of O'ahu, Kaho'olawe, Maui, and Hawai'i, although it was considered naturalized only on the island of Hawai'i (O'Connor *in* Wagner *et al.,* 1999: 1530 [as *D. pentzii*]; Herbst & Clayton, 1998: 23). The following collection documents the presence of pangola grass on the island of Kaua'i, where it appears to be naturalized.

Material examined. **KAUA'I**: occasional along road and cleared areas near wet cave, 16 Jun 1978, *C. Corn s. n.* (BISH 667056).

Digitaria radicosa (J. Presl) Miq. **New island record**

Previously documented from the islands of Kauaʻi and Oʻahu (O'Connor *in* Wagner *et al*., 1999: 1530; Herbst & Clayton, 1998: 23), the following collection extends the range of *Digitaria radicosa* to the island of Hawaiʻi.

Material examined. **HAWAIʻI**: South Hilo Distr., Hilo, hotel grounds, waste area in shallow ditch, with tree canopy above, 3 Jun 1991, *W. R. Sykes 358/91*.

Paspalum longifolium Roxb. **New state record**

The specimen cited below documents the first occurrence of the species in the Hawaiian Islands. It is native to the tropics of Asia and north Australia. *Paspalum longifolium* differs from the other species of the genus in Hawaiʻi in that the spikelets are arranged in 3 or 4 rows, rather than the usual 2. The spikelets of this species usually are densely packed, but Derek Clayton noted that on this specimen they were ". . . atypically loose, but I can't find a better match." The collector notes indicate the grass forms clumps, has erect inflorescences, and was growing in mixed alien vegetation along a roadside. It was common there and in adjacent mown lawn areas.

Material examined. **KAUAʻI**: Kōloa Distr., Kāhili Mountain Park, roadside vegetation with *Sida, Sacciolepis, Emilia, Bidens,* and *Paspalum,* common along roadside and in mown "lawn" area, clump-forming herb with erect inflorescence, 14 Jul 2000, *T. Flynn 6727* (BISH, K, PTBG).

Setaria palmifolia (J. König) Stapf **New island record**

Previously recorded from the islands of Oʻahu, Lānaʻi, Maui, and Hawaiʻi, *Setaria palmifolia* is now documented as naturalized on the island of Kauaʻi. Although the grass is common on Kauaʻi and has been naturalized on the island for many years, this is the first time that it has been collected on the island.

Material examined. **KAUAʻI**: Hanalei Distr., near coast adjacent to Pohaku Malumalu, 22° 12' N, 159° 21' W, 6 m, 28 Sep 2001, *C. Imada 2001-73* (BISH, K, PTBG).

Sapotaceae

Sideroxylon persimile (W. Hemsl.) T. D. Pennington **Range extension**

[Misapplied name: *Bumelia buxifolia* Willd.]

First reported from East Maui and Oʻahu (Starr *et al.,* 2002: 24), the following specimen represents the second naturalized collection and a significant range extension for *S. persimile*. Between 1928 and 1960 over 2,700 plants of bumelia were used in reforesting efforts on Oʻahu, mainly in Schofield Barracks, Honouliuli, and ʻEwa (Skolmen, 1980). Plants in the back part of Mākaha Valley are scattered and apparently the fleshy fruits are dispersed by birds. The following description is adapted from Staples & Herbst (in press): small tree 4.5–18 m tall, often with spiny branches, sap milky; leaves alternate, broadly elliptic, 5–13 cm long, 2.5–4 cm wide, dark green, glossy; inflorescences in dense clusters; flowers tiny, sweetly fragrant, greenish yellow, with projecting stamens; fruit ellipsoid-ovoid, 1.3–1.9 cm long, blue-black or dark purple, single-seeded.

Material examined. **Oʻahu:** Waiʻanae Distr., Mākaha Valley, along Board of Water Supply access road in back of valley, alien mesic forest, 19 May 2001, *C. Imada, A. Tsuneyoshi, B. Koebele, J. Lau, J. Preble, & C. Peterson 2001-46.*

Scrophulariaceae

Castilleja arvensis Cham. & Schltdl. **New island record**

Previously known to be naturalized on the islands of Kauaʻi, Maui, and Hawaiʻi (Wagner *et al.*, 1999: 1240), the following specimen documents Indian paintbrush from Oʻahu.

Material examined. **Oʻahu**: Honolulu Distr., Wiliwilinui Trail, alongside receiver station near summit, uncommon trailside weed, 560 m, 21° 19' N, 157° 45' W, 26 Aug 2001, *J. Smith, C. Imada, & V. Caraway 1.*

Solanaceae

Solanum seaforthianum Andrews **New island record**

Previously known to be naturalized on Kauaʻi, Oʻahu, Molokaʻi, and Maui (Wagner *et al.*, 1999: 1275), this is the first record of star potato vine on the island of Hawaiʻi.

Material examined. **HAWAIʻI:** Hāmākua Distr., Waipiʻo Valley, on weedy roadside cliff face adjacent to small boat dock near mouth of valley, 13 Mar 2001, *C. Imada, T. Kelley & C. Puttock 2001-18.*

Typhaceae

Following the publication of the *Flora of North America* account for the Typhaceae (Smith, 2000), it proved possible to have the identity for Hawaiian voucher material of *Typha* confirmed by a specialist. Recent stream survey work added a new island record for one of the two naturalized species of *Typha*.

Typha latifolia L. **New island record**

Wagner *et al.*(1999: 1614) list the common cattail as sparingly naturalized on Kauaʻi and Oʻahu, "and perhaps also on Hawaiʻi." The following collection verifies the species' presence on the Big Island.

Material examined. **HAWAIʻI:** Hāmākua Distr., Waipiʻo Valley, common in fallow taro *loʻi*, 13 Mar 2001, *C. Imada & R. Englund 2001-13.*

Acknowledgments

We thank the collectors of the cited specimens and our many BISH volunteers for assisting us in making them available for study. The authors gratefully acknowledge specimen identifications made by I. Al-Shehbaz (MO, *Raphanus*), E. A. Christensen (NY, *Polystachya*), W. D. Clayton (K, Poaceae), R. M. Harley (K, *Mentha*), R. R. Haynes (UNA, *Vallisneria*), G. P. Lewis (K, *Macrotyloma, Vigna*), T. Motley (NY, *Labordia*), H. Robinson (US, *Eupatorium*), S. G. Smith (*Typha*), M. T. Strong (US, *Cyperus*), L. Vincent (UMO, *Aristea*), D. Wasshausen (US, *Pseuderanthemum*), S. L. Welsh (BRY, *Atriplex*), and J. H. Wiersema (BARC, *Nymphaea*). The Hawaiʻi Department of Land and Natural Resources, Division of Forestry and Wildlife, is thanked for its financial, material, and staff support for the ongoing integration of the state Endangered Species Program herbarium into the BISH herbarium. The U.S. Fish and Wildlife Service (Amy Martin, Cindy Rehkemper, Richard Young) provided specimens and observations from Laysan Island. Financial support from the National Park Service permitted taxonomic research on alien plants towards developing a comprehensive list of all plant species cultivated in the Hawaiian Islands.

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Begonia fusca (Begoniaceae), a new naturalized species for Hawai‘i

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Field collecting and herbarium research has brought to light another naturalized species of *Begonia* new to the Hawaiian Islands. Cultivated in the islands since at least the 1930s, *Begonia fusca* Liebmann has now been found naturalized on Kaua‘i and O‘ahu and further survey work may locate populations on other islands as well.

In a recent survey paper of cultivated plants that are or could become invasive in the Hawaiian Islands, four *Begonia* species were included (Staples *et al*., 2000). The tiny, dust-fine seeds of many begonias are primarily dispersed by wind and secondarily by rainwash (Lange & Bouman, 1999), making begonias likely candidates for escape from gardens into surrounding natural environments. Collectors are encouraged to look for begonias growing outside of cultivation so that we may better assess the presence, distribution, and abundance of these non-indigenous species throughout the Islands.

Begonia fusca Liebm. **New naturalized record**

Native to southern Mexico and adjacent Guatemala (Burt-Utley, 1985), *B. fusca* is a robust species with flowering scapes that attain one meter in height, standing taller than the leaves. Plants have a fleshy rhizome up to 20 cm tall and 3 cm thick that produces leaves with petioles 25–40 cm tall, obliquely cordate blades 15–30 cm long and 7.5–23 cm wide, deep dull green above, paler on the underside, the margins scalloped to shallowly lobed. Inflorescences are leafless, taller than the foliage, and bear forked clusters of white to pale pinkish flowers about 1.3 cm in diameter, with 2 tepals that are hairy outside. The male flowers have ± circular tepals and a mass of stamens in the center; female flowers have a hairy ovary with 3 unequal, ciliate wings.

Collector’s notes indicate that the Kalihi Valley population consisted of three plants, growing intermixed with *Begonia semperflorens-cultorum*; no conspecifics were known to be in the vicinity. These plants persisted at the site through at least 2000, when monitoring ceased[4]. It is worth noting that the oldest specimen in BISH (*Judd et al. s.n.*, in 1932), was collected on Kapālama Heights, atop the ridge just above and to the east of Kalihi Valley, which suggests that *B. fusca* has been cultivated in this part of O‘ahu for at least 70 years.

All Hawaiian specimens in BISH, cultivated and naturalized, are cited below to guide collectors in searching for further evidence of naturalized populations. The last-cited specimen is a mixture of flowers from *B. fusca* and a leaf from what may be *B. urophylla* Hook.

Material examined. **KAUA‘I**: Hanalei Distr., along edge of road near Maniniholo Cave, just W of cave entrance, where it appears to be naturalized, 25 Feb 1986, *T. Flynn & M. Bergau 1558* (BISH, PTBG); Kōloa Distr., Kalāheo, cultivated in garden of Kukuiolono Golf Course, 16 Feb 1990, *L. Hume & T. Flynn 478* (BISH, PTBG). **O‘AHU**: Honolulu Distr., Kalihi Valley, 3060 Papali Street, volunteer on steep rocky slope dominated by ferns and *Passiflora*, elev. 150 m, 21 Feb 1996, *S. Miller*

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4. Plants are still persisting at this locality as of April 2003 — Editors.

11 (BISH); Kapālama Heights, Kamehameha Girls School, 6 Jun 1932, *A. F. Judd, E. H. Bryan Jr., & M. Neal s.n.* (BISH 42874); Ko‘olau Loa Distr., Sunset Beach, common ornamental or pot flower, elev. 5 m, 25 Mar 1975, *D. Afualo s.n.* (BISH 580134).

Acknowledgments

Jan Doorenbos (WAG) identified numerous voucher specimens of cultivated *Begonia* from BISH, which provided an excellent reference base for ongoing identification of new specimens received by Herbarium Pacificum.

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New plant records from the Hawaiian Archipelago

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The following contributions include new island records, new state records, and range extensions of plants located on Kure Atoll, Midway Atoll, Maui, and Hawai‘i. Voucher specimens are housed in the Bishop Museum’s *Herbarium Pacificum*, Honolulu.

Agavaceae

Sanseviera trifasciata Prain **New island record**

Previously known to be naturalized on O‘ahu where several extensive roadside populations were found (Imada *et al.*, 2000), *S. trifasciata* (mother-in-law’s tongue) is now also known to be naturalized on Maui where it is similarly distributed.

Material examined: **MAUI**: E. Maui, Ho‘okipa, roadside populations on coast, 5 ft [2 m], 15 Sep. 2000, *Starr & Martz 000915-2*.

Aizoaceae

Tetragonia tetragonioides (Pall.) Kuntze **Range extension**

Previously known from coastal sites on Midway Atoll, Nihoa, Kaua‘i, O‘ahu, West Maui, and Hawai‘i (Wagner *et al*. 1990; Oppenheimer *et al.*, 1999; Starr & Martz, 2000), *T. tetragonioides* (New Zealand spinach) is now also know from East Maui where it can be found from sea level to 3500 ft [1065 m], especially in Paia and Kula.

Material examined: **MAUI**: E. Maui, Kula, on roadcut near Rice Park, 3000 ft [915 m], 21 Aug 2001, *Starr & Martz 010821-1*; E. Maui, Kula, telephone sub-station near Kekaulike Ave, 3050 ft [930 m], 21 Aug 2001, *Starr & Martz 010821-2*; E. Maui, Kula, side of Kolohala Rd, 3500 ft [1065 m], 21 Aug 2001, *Starr & Martz 010821-3*; E. Maui, Paia Bay, in sand near parking lot, 9 Jan 2002, 10 ft [3 m], *Starr & Martz 020109-2*.

Annonaceae

Artabotrys hexapetalus (L. f.) Bhandari **New island record**

Previously reported as naturalized on Oʻahu (Nagata, 1995), *A. hexapetalus* (climbing ylang ylang) [syn. *A. uncinatus* (Lam.) Merr] is sparingly naturalized within the Kipahulu section of Haleakalā National Park and in pastures nearby in Popoloa. Native to India (St. John, 1973), this woody climber is distinguished by its fragrant green flowers that grow singly or paired, with six, one-inch long petals converging at the base and spreading above; flower stems are flattened and hooked; leaves are thick, pointed, shiny, oblong 5–10 inches [12–25 cm] by 2–3 inches [5–8 cm]; and fruits are four to ten, yellow, fragrant, and inedible, each about an inch long and clustered like grapes on a stem (Neal, 1965).

Material examined: **MAUI**: E. Maui, Kīpahulu, Haleakalā National Park, near headquarters, vine growing up into trees, 100 ft [30 m], 21 Nov 2000, *Starr & Martz 001122-1*.

Apiaceae

Ciclospermum leptophyllum (Pers.) Sprague

Previously known from disturbed areas such as gardens, pastures, and roadsides on Midway Atoll and all the main islands (Wagner *et al.* 1999), *C. leptophyllum* (fir-leaved celery). It was also documented from Kure Atoll, where it is common in lawn areas, runways, and other open areas, in an anonymous survey (1979) and in Herbst & Wagner (1992), but not in Wagner *et al.* (1999).

Material examined: **KURE ATOLL**: Green Island, near quarters and nearby lawn, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-7*.

Hydrocotyle bowlesioides Mathias & Constance **Range extension**

Previously reported from Kauaʻi, Oʻahu, Lānaʻi, West Maui, and Hawaiʻi (Wagner *et al.*, 1999; Oppenheimer & Bartlett, 2002), *H. bowlesioides* (marsh pennywort) is now also known from East Maui where it can be found in moist lawns in the Wailea area.

Material examined: **MAUI**: E. Maui, Wailea, at base of rock trellis and in lawn at end of Piʻilani Hwy, 300 ft [90 m], 24 Apr 2001, *Starr & Martz 010424-1*.

Araliaceae

Hedera helix L. **New island record**

Previously reported as sparingly naturalized on Kauaʻi, Oʻahu, and Hawaiʻi (Wagner *et al.*, 1999), *H. helix* (English ivy) commonly escapes cultivation in Olinda, Maui where it can be found in *Eucalyptus* forest along Piʻiholo Rd Fruits have recently been collected on both cultivated and naturalized plants. According to Pat Bily (pers.comm.), the seeds are viable.

Material examined: **MAUI**, E. Maui, Olinda, climbing 3–4 m high in *Eucalyptus* trees at the top of Olinda Rd, 3800 ft [1158 m], 18 Dec 2000, *Starr & Martz 001218-1*; E. Maui, Kula, cultivated hedge bearing fruit on Old Kula Hwy near Copp Rd, 2900 ft [880 m], 19 Apr 2001, *Starr & Martz 010419-1*; E. Maui, Piʻiholo, naturalized along power line cut, bearing fruit, 3700 ft [1127 m] 26 Oct 2001, *Starr & Martz 011026-1*.

Schefflera arboricola (Hayata) Hayata **New naturalized record**

Native to Taiwan (Whistler, 2000), and not previously reported to be naturalized in the Hawaiian Islands, *S. arboricola* (dwarf umbrella tree) is widely cultivated on Maui and has recently been observed naturalizing in moist areas of Haiku on trees, fence posts, and steep banks. This common plant can be distinguished by its shrubby habit; alternate,

palmately compound leaves that are similar to *S. actinophylla* (octopus tree) but smaller with six to nine oblanceolate leaflets that are leathery and dark glossy green; flowers with five small yellow petals 3–4 mm long and 5 white stamens borne on long, spreading branches of a terminal panicle; and fruits that are small orange drupes (Whistler, 2000).

Material examined: **MAUI**: E. Maui, Hāʻiku, growing as epiphyte on tree, 1250 ft [381 m], 28 Nov. 2000, *Starr & Martz 001128-3*.

Aristolochiaceae

Aristolochia littoralis Parodi **New island record**

Previously reported from Oʻahu and Kauaʻi (Wagner *et al.,* 1999; Imada *et al.,* 2000), *A. littoralis* (calico flower) is now also known from Maui where it is sparingly naturalized in Kīpahulu, East Maui. It was also observed to be spreading in Waikapū, West Maui.

Material examined: **MAUI**: E. Maui, Kīpahulu, near Hāʻōʻū, growing on rock walls and along road, 160 ft [48 m], 21 Nov 2000, *Starr & Martz 001121-3*.

Asclepiadaceae

Calotropis gigantea (L.) W. Aiton **New naturalized record**

Previously reported as persisting near old home sites and escaping in Kohala and Kona, Hawaiʻi, and on Kahoʻolawe but not known to be naturalized (Wagner *et al.,* 1999), *C. gigantea* (crown flower) is widely cultivated on Maui, has been observed spreading from ornamental plantings, and is occasionally found far away from any known plants in Kīhei, Kahului, and Wailuku. Native to India and Southeast Asia (St. John, 1973; Whistler, 2000), this popular lei flower is distinguished by a large erect habit up to 13 ft [4 m]; milky sap; white powdery opposite leaves 3.5–9.0 in [8–23 cm] long; and axillary umbels of white to pale purple, crown-like flowers (Whistler, 2000). The feral form seems to most often have purple flowers.

Material examined: **MAUI**: E. Maui, North Kīhei, S. Kīhei Rd on sand dunes, 5 ft [1.5 m], 9 Mar 2001, *Starr & Martz 010309-1*; E. Maui, Kīhei, just *mauka* of the Maui Research and Technology Park, on mauka side of gate, coming up in pasture area recently disturbed to install a culvert, 250 ft [75 m], 3 May 2001, *Starr & Martz 010503-2*. W. Maui, Kahului, in abandoned sugar cane field, 100 ft [30 m], *Starr & Martz 010701-1*.

Boraginaceae

Carmona retusa (Vahl) Masamune **Range Extension**

Previously reported from Kauaʻi and West Maui (Lorence *et al.,* 1995), *C. retusa* is now also known from Hāʻiku, East Maui where it can be found in lawns, along fences, and in hedges, often producing a carpet of seedlings.

Material examined: **MAUI**: E. Maui, Hāʻiku, scattered over mostly urban areas along Hāʻiku Rd, 500 ft [152 m], 28 Nov 2000, *Starr & Martz 001128-1*.

Brassicaceae

Brassica nigra (L.) W. Koch

Previously reported from Oʻahu, Maui, and Hawaiʻi (Wagner *et al.* 1999), *B. nigra* (black mustard) is also known from Midway Atoll where it is widespread in the southeast corner of Eastern Island, forming monotypic stands. It was also observed on Sand Island, where a few plants persist in gardens. Previously reported from Midway in Apfelbaum *et al.* (1983) and in Bruegmann (1998), but not in Wagner *et al.* (1999).

Material examined: **MIDWAY ATOLL**: Eastern Island, Kat Hokama collector, 15 ft [5 m], 26 May 2001, *Starr & Martz 010526-1*.

Lepidium virginicum L.

Previously reported from Midway Atoll, Oʻahu, Molokaʻi, Maui, and Hawaiʻi (Wagner *et al*. 1999), *L. virginicum* (pepper grass), it was also documented from Kure Atoll where it is locally common near the camp in the center of the island, in Woodward (1972), and in Herbst & Wagner (1992), but not in Wagner *et al.* (1999).

Material examined: **KURE ATOLL**: Green Island, in with other common lawn weeds near camp, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-1*.

Buddleiaceae

Buddleia davidii Franch. **New island record**

Previously reported as sparingly naturalized on Kauaʻi (Shannon & Wagner, 1996), *B. davidii* (butterfly bush) is spreading from plantings into nearby pastures and gulches in Kula, East Maui.

Material examined: **MAUI**: E. Maui, Kula, by electric station near the crest of Kekaulike Ave, seedlings and juveniles seen in pasture and gulch near hedge, 3740 ft [1140 m], 31 Aug 2000, *Starr & Martz 000831-9*.

Caryophyllaceae

Sagina japonica (Sw.) Ohwi **New island record**

Previously reported from a single collection at Honolulu International Airport (Wagner *et al*., 1999), *S. japonica* (pearlwort) is now also known from Midway Atoll where it is uncommon on the hard-packed coral runway.

Material examined: **MIDWAY ATOLL**: Sand Island, on sandy part of north-south coral runway, 20 ft [6 m], 10 May 1999, *Starr & Martz 990510-6*.

Stellaria media (L.) Vill. **New island record**

Previously reported from Kure Atoll, Kauaʻi, Oʻahu, Lānaʻi, Maui, and Hawaiʻi (Wagner *et al.*, 1999), *S. media* (chickweed) is now also known from Midway Atoll where it is uncommon in the lawn in the north part of Sand Island.

Material examined: **MIDWAY ATOLL**: Sand Island, near abandoned Pacific Cable Company buildings, 20 ft [6 m], 20 May 2001, *Starr & Martz 010520-2*.

Commeliniaceae

Callisia fragrans (Lindl.) Woodson **New island record**

Previously known to be sparingly naturalized in urban areas of Kauaʻi and Oʻahu (Wagner *et al.* 1999), *C. fragrans* (inch plant), is now also known from Maui. This plant was brought to our attention by Dr. Fern Duvall and was collected from a population that had apparently volunteered behind his house.

Material examined: **MAUI**: E. Maui, Makawao, Kailua Gulch, volunteering in yard, sprawling down bank into gulch, 1500 ft [457 m], 13 Feb 2001, *Starr & Martz 010213-1*.

Convolvulaceae

Ipomoea pes-caprae (L.) R. Br.

Previously reported from Midway Atoll, Lisianski, Laysan, French Frigate Shoals, Nihoa, and all the main islands (Wagner *et al.* 1999), *I. pes-caprae* (pohuehue, beach morning glory). It was also documented from Kure Atoll, where it is uncommon near the coast, in an anonymous survey (1979), and Herbst & Wagner (1992), but not Wagner *et al.* (1999).

Material examined: **KURE ATOLL**: Green Island, scattered in area near coast on west point, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-9*.

Cyperaceae

Cyperus gracilis R. Br. **New island record**

Previously known to be sparingly naturalized on Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, and Maui (Wagner *et al.*, 1990; Hughes, 1995; Oppenheimer & Bartlett, 2002), *C. gracilis* (McCoy grass) is now also known from the island of Hawaiʻi, where it can be found in moist lawns in the Hilo area.

Material examined: **HAWAIʻI**: Hilo, in waste areas on University of Hawaii campus, 200 ft [60 m], 1 Aug 2001, *Starr & Martz 010801-12*.

Euphorbiaceae

Euphorbia peplus L.

Previously reported from Midway Atoll, Kauaʻi, Maui, and Hawaiʻi (Wagner *et al.*, 1990; Lorence *et al.*, 1995), *E. peplus* (petty spurge). It was also documented from Kure Atoll, where it is uncommon near the camp in the center of the island, in an anonymous survey (1979) and Herbst & Wagner (1992), but not Wagner *et al.* (1999).

Material examined: **KURE ATOLL**: Green Island, near camp, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-4*.

Fabaceae

Calopogonium galactioides Benth. ex Hemsl. **New naturalized record**

[Syn. *C. caeruleum* (Benth.) Hemsl.]

Native to Mexico (St John, 1973), *C. galactioides* was previously reported to be cultivated on Maui by the Pineapple Research Institute in 1946 (Wagner *et al.*, 1999). On Maui, this vine-like plant is now common in *Eucalyptus* forest and pastures in Olinda, Piʻiholo, and Kula where it can be observed crawling and twining over itself and other plants. *C. galactioides* can be distinguished from other Fabaceae in Hawaiʻi by its trifoliate leaves, a distinct upper stamen, glandular stipels, blue standard 9–11 mm long, and dark strongly septate seed pods about 2 cm in length.

Material examined: **MAUI**: E. Maui, Olinda, crawling in *Eucalyptus* forest, 2600 ft [792 m], 12 Oct 2000, *Starr & Martz 001012-1*; E. Maui, Piʻiholo, sprawling on ground and climbing *Eucalyptus robusta* near ʻEhu Rd, 2200 ft [670 m], 26 Nov 2000, *Oppenheimer & F. Duvall H110041*.

Centrosema pubescens Benth. **New island record**

Recently reported from Kauaʻi (Flynn & Lorence, 1998), *C. pubescens* is now also known from Maui where it is locally naturalized near "five corners", Hāʻiku.

Material examined: **MAUI**: E. Maui, Hāʻiku, crawling in pasture and waste areas along Peʻahi Rd, 800 ft [245 m], *Starr & Martz 001130-1*.

Falcataria moluccana (Miq.) Barneby & J.W. Grimes **Range extension**

[Syn. *Paraserianthes falcataria* (L.) I. Nielsen]

Previously known from Kauaʻi, Oʻahu, Molokaʻi, West Maui, and Hawaiʻi (Wagner *et al.*, 1990; Oppenheimer & Bartlett, 2002), *F. moluccana* (Moluccan albizia) is now also known from East Maui where it is escaping well beyond forestry plantings in Peʻahi, Hāʻiku.

Material examined: **MAUI**: E. Maui, Hāʻiku, E. Kuʻiaha Rd, escaping from plantations into nearby pastures and gulches, 650 ft [200 m], *Starr & Martz 000526-1*.

Senna alata (L.) Roxb. **Range extension**

[Syn. *Cassia alata* L.]

Previously reported as cultivated and persisting after cultivation or perhaps escaping on Kauaʻi, Oʻahu, and West Maui (Wagner *et al.,* 1999; Oppenheimer & Bartlett, 2000), *S. alata* (candle bush) is escaping into pastures on East Maui in Huelo and Keʻanae.

Material examined: **MAUI**: E. Maui, Huelo, on side of road and in pastures, 450 ft [137 m], 6 Dec 2000, *Starr & Martz 001206-1*.

Grossulariaceae [Saxifragaceae]

Brexia madagascariensis Thouars ex Ker-Gawl. **New naturalized record**

Native to Madagascar and the Seychelles and cultivated in Hawaiʻi since the early 20th century but not known to be naturalized (St. John, 1973), *B. madagascariensis* is now known from Wahinepeʻe, East Maui where it is escaping well beyond plantings in wayside parks. A small, smooth tree with leaves that are evergreen, leathery, long, narrow, stipulate, with entire or sharp-toothed edges, borne on thick, cylindrical branches; greenish flowers which appear clustered at leaf axils, with five stamens attached to a lobed and fringed disk around a superior ovary; and five angled, one celled, hard fruit which contains numerous angular seeds (Neal, 1965).

Material examined: **MAUI**: E. Maui, Wahinepeʻe, Hāna Hwy, 600 ft [182 m], 15 Jul 2001, *Starr & Martz 010715-1*.

Lauraceae

Cassytha filiformis L. **New island record**

Previously reported from all the main islands except Kahoʻolawe (Wagner *et al.,* 1999), *C. filiformis* (kauna'oa pehu) is now also known from Kure Atoll where a small patch of this parasitic vine was observed on the northeastern coast hosting mainly on *Scaevola*.

Material examined: **KURE ATOLL**, northeastern coast in a thicket of *Tournefortia argentea* and *Scaevola sericea*, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-12*.

Malvaceae

Sidastrum micranthum (St. Hil) Fryxell **New island record**

Previously reported from pastures on Oʻahu and Hawaiʻi (Wagner *et al.,* 1999), *S. micranthum* is now also known from Maui where this tall herb is widespread in pastures in the Kaupo area.

Material examined: **MAUI**: E. Maui, Kaupō, widespread along road and in pastures from 200 ft [61 m] to 1000 ft [305 m], collection made at 350 ft [106 m], 20 Nov 2000, *Starr & Martz 001120-1*.

Myrtaceae

Pimenta dioica (L.) Merr. **New island record**

Previously reported from Kauaʻi where it is found in secondary forest and mixed forestry plantings in the hills above Kalāheo (Lorence *et al.,* 1995), *P. dioica* (all spice) is now also known from Maui where this fragrant tree is widely cultivated as an ornamental and has been observed spreading in Haiku, along Baldwin Ave, and in Wailuku. It is also naturalized in Waimanalo, Oʻahu where it is spreading from forestry plantings, but has yet to be collected.

Material examined: **MAUI**: E. Maui, Hāʻiku, near Hāʻiku School on side of road, many seedlings germinating and scattered juveniles coming up in a thicket of guava scrub, 400 ft [120 m], 25 Apr 2001, *Starr & Martz 010425-1*.

Nyctaginaceae

Boerhavia coccinea Mill. **New island record**

Previously known from Kauaʻi, Oʻahu, Maui, Molokaʻi, Lānaʻi, Kahoʻolawe, and Hawaiʻi (Wagner *et al.*, 1999; Oppenheimer & Bartlett, 2002), *B. coccinea* (scarlet Boerhavia) is now also known from Kure Atoll where it is uncommon near the camp in the center of the island.

Material examined: **KURE ATOLL**: Green Island, near quarters, 15 ft [5 m], 23 May 2001, *Starr & Martz 010523-1*.

Oleaceae

Noronhia emarginata (Lam.) Stadman **New island record**

Native to Madagascar and cultivated in the Hawaiian Islands before 1906 (St. John, 1973), *N. emarginata* (Madagascar olive) was previously recorded as naturalized on Kauaʻi (Flynn & Lorence, 2002: 15). On Maui naturalized populations have recently been observed in Makamakaole, Honomanū, Huelo, and Hāʻiku, often on steep gulch walls. This hardy tree resembles the kamani (*Calophyllum inophyllum*), but can be distinguished from it and other Oleaceae in Hawaiʻi by its simple, broad, emarginate, paired leaves up to 6 in [15 cm] long with few indistinct veins; fragrant flowers that grow in clusters at leaf axils; and purplish, egg-shaped fruit about 1 in [2 cm] (Neal, 1965; Dehgan, 1998).

Material examined: **MAUI**: W. Maui, Makamakaole, Waiokila gulch, scattered along road and on steep gulch walls, 900 ft [295 m], 10 Mar 2001, *Starr & Martz 010310-1*; E. Maui, Hāʻiku, near Hāʻiku School on side of road, in thicket of guava, 400 ft [120 m], 25 Apr 2001, *Starr & Martz 010425-2*; E. Maui, Honomanū, spreading from initial plantings down gulch wall on Hāna Hwy, 200 ft [60m], 8 May 2001, *Starr & Martz 010508-1*.

Oxalidaceae

Oxalis corniculata L.

Previously reported from Midway Atoll and all the main islands (Wagner *et al.*, 1999), *O. corniculata* (yellow wood sorrel). It was also documented from Kure Atoll, where it is occasional near the camp in the center of the island, in an anonymous survey (1979) and by Herbst & Wagner (1992), but not Wagner *et al.* (1999).

Material examined: **KURE ATOLL**: Green Island, near quarters in open lawn areas, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-8*.

Poaceae

Arrhenatherum elatius (L.) P. Beauv. ex J. & C. Presl **New island record**

Previously known from a single collection in 1936 from a pasture on Hawaiʻi (Wagner *et al*., 1990), *A. elatius* (tall oatgrass) is now also known from a single collection in a pasture on Maui.

Material examined: **MAUI**: E. Maui, upper Kanaio, on side of pasture road to Auwahi, 4200 ft [1280 m], 21 Jul 2001, *Starr & Martz 010721-2*.

Dichelachne crinita (L.) Hook. f. **New naturalized record**

Native to Australia (Weiller *et al.*, 1995), *D. crinata* was first collected on Maui by Robert Hobdy in 1982. It has since been collected twice in widely separated sites, attesting to its naturalized status on Maui.

Material examined: **MAUI**: E. Maui, Kula, crest of Kekaulike Ave, on side of road, 3640 ft

[1100 m], 1 Sep 1998, *Starr & Martz 980901-1*; E. Maui, Polipoli, on side of road, 5500 ft [1676 m], 21 Dec 2000, *Starr & Martz 001221-1*. Polipoli, erect clumps, grass spreading around hunter check-in station, 6000 ft [1828 m], 1982, *Hobdy 1419*.

Eragrostis amabilis (L.) P. Beauv.
ex Roem. & Schult.

Previously known from Midway Atoll and all the main islands (Wagner *et al.*, 1990; Hughes, 1995; Lorence *et al.*, 1995; Oppenheimer & Bartlett, 2002), *E. amabilis* (love grass). It was also documented from Kure Atoll, where it is locally common near the water tank in the center of the island, by Lamoureux (1961) as naturalized in disturbed areas near quarters. It was recorded again in an anonymous survey (1979) and in Herbst & Wagner (1992), but not in Wagner *et al.* (1999).

Material examined: **KURE ATOLL**: Green Island, near water building, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-5*.

Lolium perenne L. **New island record**

Previously known from grasslands and pastures on the island of Hawai‘i (Wagner *et al.*, 1999), *L. perenne* (perennial ryegrass) is now also known from similar situations on Maui.

Material examined: **MAUI**: E. Maui, Haleakalā National Park, Kalahaku overlook, growing in cinders next to parking area, 9300 ft [2830 m], 26 Oct 2000, *Starr & Martz 001026-2*; E. Maui, Ka‘ono‘ulu, occasional in pastures, 5600 ft [1706 m], 20 May 2001, *Oppenheimer H50123*.

Panicum antidotale Retz. **New island record**

Previously known from O‘ahu, Moloka‘i, and Hawai‘i where it is naturalized in dry, disturbed areas such as pastures and along roads (Wagner *et al.*, 1990), *P. antidotale* (giant panic grass) is now also known from Maui where this robust grass is naturalized in Waikapū and Kīhei.

Material examined: **MAUI**: W. Maui, Waikapū, side of Waiko Rd, 250 ft [76 m], 9 Dec 2000, *Starr & Martz 001209-2*; E. Maui, Kīhei, Kawililipoa, in sand near coast, 10 ft [3 m], 1 Feb 2002, *Starr & Martz 020201-1*.

Pennisetum polystachion (L.) Schult **Range Extension**

Previously known from O‘ahu, Lāna‘i, East Maui, and Hawai‘i (Wagner *et al.*, 1999), *P. polystachion* (blue buffel grass) is now also known from West Maui and from Ōma‘opio, East Maui where it is occasional on roadsides and in waste areas.

Material examined: **MAUI**: W. Maui, Waikapu, side of Waikō Rd, 250 ft [76 m], 9 Dec 2000, *Starr & Martz 001209-1*; E. Maui, ‘Ōma‘opio, side of ‘Ōma‘opio Rd near Piliwale Rd, 1650 ft [500 m], 17 Jan 2002, *Starr & Martz 020117-1*.

Primulaceae

Anagallis arvensis L.

Previously reported from Midway Atoll and all the main islands (Wagner *et al.*, 1999), *A. arvensis* (scarlet pimpernel). It was also documented from Kure Atoll, where it is found on the compacted coral runway, in an anonymous survey (1979) and in Herbst & Wagner (1992), but not in Wagner *et al.* (1999).

Material examined: **KURE ATOLL**: Green Island, on abandoned runway in compacted coral rubble, 15 ft [5 m], 22 May 2001, *Starr & Martz 010522-6*.

Rhamnaceae

Colubrina asiatica (L.) Brongn. **New island record**

Previously known from strand and coastal sites on Niʻihau, Kauaʻi, Oʻahu, and Molokaʻi (Wagner *et al.*, 1990), *C. asiatica* (*ʻanapanapa*) is now also known from Maui where a lone thicket exists near the coast in Launiupoko.

Material examined: **MAUI**: W. Maui, Launiupoko, in *Prosopis* thicket near the coast, 5 ft [2 m], 1 Jul 2001, *Starr & Martz 010701-3*.

Rosaceae

Pyracantha koidzumii Rehder **New island record**

Wagner *et al.* (1990) cited one naturalized species of *Pyracantha* (firethorn) in Hawaiʻi, *P. angustifolia*, which was known to be naturalized on Kauaʻi and Hawaiʻi. Later, Herbarium Pacificum Staff (1999) expanded this to three species, including *P. koidzumii*, which is endemic to Taiwan and apparently the most commonly cultivated firethorn in Hawaiʻi. They cite naturalized plants from Kokeʻe on Kauaʻi and the Volcano transfer station on Hawaiʻi. This thorny, colorful shrub is now also known from Maui where it can be found volunteering in pastures in upper Kula.

Material examined: **MAUI**: E. Maui, Kula, crest of Kekaulike Ave, scattered individuals found throughout pastures, in association with *Pennisetum clandestinum* and *Jacaranda mimosifolia*, 3720 ft [1134 m], 31 Aug 2000, *Starr & Martz 000831-7*.

Rubus glaucus Benth. **New island record**

Native from Mexico to Ecuador (St. John, 1973), *R. glaucus* was previously reported from the Puna district, Hawaiʻi, where fertile material had yet to be collected, but it was apparently naturalized and spreading Wagner *et al.* (1999). On Maui, naturalized populations of *R. glaucus* exist along the Waikamoi Flume Rd, Olinda; Crater Rd, Kula; and Waipoli Rd, Polipoli. At the Olinda site this thorny climber is naturalized over 0.75 mi [1.2 km] of flume road and adjacent forest where it sprawls on vegetation and climbs 20 ft [6 m] into the canopy and is not yet widespread but is definitely locally established and spreading. At the Kula site *R. glaucus* is currently only known from two small patches. At the Polipoli site gulch bottoms and walls are invaded over an undetermined extent. This species is distinguished by its thin white petals, sharp thorns, white undersides of leaves, and thimble-shaped fruits.

Material examined: **MAUI**: E. Maui, Polipoli, Waipoli Rd, at DLNR gate and in Kaʻonoʻulu gulch below hunter check-in station, 5400 ft [1654 m], 21 Feb 2002 *Starr & Martz* 020221-2; E. Maui, Olinda, Waikamoi Flume Rd, near pump house along road, 4200 ft [1280 m], 29 Oct 2000, *Starr & Martz 001029-1*; E. Maui, Kula, Crater Rd, sprawling over bank on side of road, 4000 ft [1220 m], 13 Jan 1999, *Starr & Martz 990113-1 & 990113-2*; E. Maui, Makawao district, Haiku uka, Koʻolau Forest Reserve, above road to Waikamoi flume, along pipeline west of old reservoirs, sprawling plants covering vegetation in wet forest and forming dense thickets, locally common and spreading, collected with Jennifer Geiger, 4300 ft [1310 m], 18 Jun 2001, *Oppenheimer H60144*.

Rubiaceae

Mitracarpus hirtus (L.) DC. **New island record**

Previously known from Hilo, Hawaiʻi (Wagner *et al.*, 1990), *M. hirtus* is now also known from Kaupō, Maui where it is common in the lower reaches of Hāwelewele gulch.

Material examined: **MAUI**: E. Maui, Kaupō, in dry stream bed of Hāwelewele gulch, 40 ft [12 m], 26 Jul 2001, *Starr & Martz 010726-2*.

Rutaceae

Murraya paniculata (L.) Jack **New island record**

Native to tropical Asia, Australia, and Polynesia, *M. paniculata* (mock orange) was previously known to be cultivated in Hawai‘i (Neal, 1965; St. John, 1973; Wagner *et al.*, 1990). Kraus (elsewhere in these *Records*) records it as a new naturalized record from O‘ahu. It is also known to be sparingly naturalized in Kaupō, East Maui. Distinguished from other Rutaceae in Hawai‘i by its small tree or large shrub habit; dense, shiny foliage with 3–7 pinnately compound leaflets; lack of prickles; sweet smelling, white, five parted flowers; and red, inedible, 1–2 seeded fruit about 0.5 inch [1.5 cm] in diameter (Neal, 1965).

Material examined: **MAUI**: E. Maui, Kaupō, all life stages present in pastures and along fence lines near Puka‘auhuhu, 450 ft [137 m], 26 Jul 2001, *Starr & Martz 010726-7*.

Scrophulariaceae

Veronica serpyllifolia L. **New island record**

Previously reported from moist pastures or disturbed areas of wet forest and subalpine woodland of Kaua‘i, Lāna‘i, and Hawai‘i (Wagner *et al.*, 1990; Nagata, 1995), *V. serpyllifolia* (thyme-leaved speedwell) is now also known from Maui where it grows in a similar habitat.

Material examined: **MAUI**: E. Maui, Waikamoi, Ko‘olau Forest Reserve, growing in clumps in soggy soils around the shack at Waikamoi Gulch at end of the Waikamoi flume road to the reservoirs, 4300 ft [1310 m], 29 Oct 2000, *Starr & Martz 001029-2*.

Solanaceae

Cestrum nocturnum L. **New island record**

Previously known from Kaua‘i, O‘ahu, and Maui (Wagner *et al.*, 1990; Oppenheimer & Bartlett, 2000), *C. nocturnum* (night cestrum) is now also known from Hilo, Hawai‘i where it is growing in lowland forest. Near Kamuela/Waimea it was observed to be spreading from cultivated plants.

Material examined: **HAWAI‘I**: Hilo, side of Waiākea stream near University of Hawai‘i Hilo campus, 200 ft [60 m], 1 Aug 2001, *Starr & Martz 010801-5*.

Solanum torvum Sw. **New island record**

Previously known from O‘ahu and Maui (Wagner *et al.*, 1990; Oppenheimer *et al.*, 1999), *S. torvum* (turkeyberry) is now also known from Hilo, Hawai‘i where it was volunteering in waste areas.

Material examined: **HAWAI‘I**: Hilo, University of Hawaii Hilo campus, 200 ft [60 m], 1 Aug 2001, *Starr & Martz 010801-1*.

Acknowledgments

We thank the entire staff of Bishop Museum *Herbarium Pacificum*, particularly George Staples, Derral Herbst, and Chrisopher Puttock, for determination, verification, and archival storage of vouchers. We also thank David Bufford [A] for determination of *Rubus glaucus* and Garrett Crow [NHA] for determination of *Sagina japonica*.

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The status of the cricket parasites *Ormia ochracea* and *Phasioormia pallida* in the Hawaiian Islands (Diptera: Tachinidae)

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In 1989 specimens of a medium-sized fawn-colored tachinid fly were collected at two locations on O‘ahu. Specimens were sent to tachinid specialists Hiroshi Shima in Japan and Bryan Cantrell in Australia for identification soon after collection. Both indicated that the species was a species of the genus *Phasioormia* (an Oriental genus found from Malaysia to India), but could not place it to species. Comparing the specimens at hand to original descriptions of the two species currently in *Phasioormia* [*P. pallida* Townsend, and *P. bicornis* (Malloch)], I identified the species as *Phasioormia pallida*, the type species of the genus. A note indicating the new state record for this species was published by Preston (1993).

Subsequently, Marelene Zuk (Zuk *et al*., 1993, Simmons & Zuk, 1996) conducted work on Hawaiian populations of the field cricket *Teleogryllus oceanicus* (LeGuillou), which were parasitized by a tachinid identified in her work as *Ormia ochracea* (Bigot), an American species. Concurrently to the cricket studies and independent of my sending specimens to specialists in Japan and Australia, a further set of specimens from Hawai‘i were sent by D. Elmo Hardy to John Amoroso in Florida who identified them as *Ormia ochracea* (Bigot). This identification unfortunately resulted in the same specimens having two different names.

Noting that the types of both species existed in The Natural History Museum, London (BMNH), I published in the tachinid specialist newsletter, *Tachinid Times*, a plea for assistance for someone to directly compare the Hawaiian specimens with the two types to confirm the true identity of the species occurring in Hawai‘i (Evenhuis, 1995). However, to date I received no offers of assistance.

Since both names for the same species made it to the published literature and no one could resolve the name confusion, Nishida (1997, 2002) was left with no alternative but to list both names in his Hawaiian terrestrial arthropod checklists, although in reality only one of the names would prove to be correct.

In May 2002, I visited the BMNH and was able to directly compare the types of both *Phasioormia pallida* and *Ormia ochraea*. After making notes on the morphological differences between the two genera and species and comparing my notes with the Hawaiian specimens, I can now confirm that the true identity of the species occurring in Hawai‘i (known from populations on the Big Island, Kaua‘i, and O‘ahu) is *Ormia ochracea*.

Phasioormia pallida should thus be deleted from the Hawaiian checklist.

Ormia ochracea is a phonotactic parasite of crickets. Most flies have auditory organs located in the antennae that are adapted to detecting mating calls and wing beats in the 100 to 500 Hz range. *Ormia* flies have specialized auditory organs on the prosternum (similar in structure to orthopteran tympanal organs) that are used to cue in to the high-frequency (above 3 kHz) call of the male cricket (Robert *et al.*, 1992). The ormiine cricket parasite is not native to Hawai'i nor is the cricket (*Teleogryllus oceanicus*), upon which the fly is a parasite here. It is thought that the parasite was introduced to Hawai'i along with an alien cricket, possibly in the cricket "pet trade" (crickets are kept as pets by some Asians).

Acknowledgment

Thanks to Nigel Wyatt who kindly provided access to the tachinid types in BMNH.

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Two ant species (Hymenoptera: Formicidae) new to the Hawaiian Islands

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Two new ant species records are reported for the Hawaiian Islands. Specimens for both species were first collected in the spring of 2000 by K-12 students and classes as part of an ongoing survey for the little fire ant, *Wasmannia auropunctata* (Roger), on Hawai'i Island. Discovery of the little fire ant on Hawai'i and Kaua'i (Conant & Hirayama, 2000) elicited survey and control activities by the Hawaii Department of Agriculture (HDOA) and stimulated the creation of a traveling educational curriculum through the University

of Hawai‘i. Intermediate and high school students collected ants from their backyard environment with the goal of finding additional infestations of *W. auropunctata*. One of us (DSG) analyzed and identified all ants in these samples, which contained the two species new to Hawai‘i, and mapped their distributions. Details of this program will be reported elsewhere (D. Gruner, unpubl.). Concurrently, HDOA (RAH. & MEC) discovered one of these ant species during surveys on the island of O‘ahu.

Voucher specimens are deposited at the Bishop Museum (BPBM), the Department of Agriculture (HDOA) in Honolulu, the California Academy of Sciences (CAS), Los Angeles County Museum of Natural History (LACM), and Harvard University Museum of Comparative Zoology (MCZ).

Solenopsis sp. **New state record**

Specimens of a minute, slow-moving, yellowish brown ant were collected from samples of seashore paspalum grass and soil from a golf course in Ewa, O‘ahu, in October 2000 by HDOA staff. Neil Reimer (HDOA Plant Quarantine) and one of us (MEC) identified this ant as a species of *Solenopsis* new to Hawai‘i. Specimens collected by students in Hilo and Hawaiian Beaches in May 2000 and March 2001 were later confirmed as the same *Solenopsis* species.

Workers of *Solenopsis* sp. are yellowish with a light brown abdomen. They are just under 1 mm in length, and individuals are monomorphic (Fig. 1). *Solenopsis* sp. are inconspicuous and not easily found. Foraging worker ants have been collected from nearshore soils and grasses, under debris along a parking lot curb, and from several peanut butter baited chopstick collections. We collected two queens from a single excavated nest in Hawaiian Beaches Estates on the island of Hawai‘i (6 Oct 2002). The nest was underneath a large boulder, 6–12 cm deep in damp soil. The queens were sent to Brian Fisher (CAS), but without further determination.

Two other *Solenopsis* species are widespread and common in the Hawaiian Islands: *S. geminata* (Fabricius), a fire ant known for its painful stings; and *S. papuana* Emery, a tiny dark brown species slightly larger than this species. These ants are related to the red imported fire ant, *Solenopsis invicta* Buren, an aggressive and serious pest of agricultural, urban, and native environments found in parts of the mainland U.S. but not in Hawai‘i (Nishida, 2002). Though they have stingers, no complaints on tiny stinging ants have been reported for the two smaller species.

Solenopsis papuana was the most common ant reported from more than 220 student collections on east Hawai‘i, occurring in over half the samples. Students collected the new *Solenopsis* from only 3 localities tightly clustered within 200 m in Hilo. We later collected the ant from another series of locations within a small radius in Hawaiian Beaches. The discrete geographical range of this species, coupled with its distinctive color, behavior, and smaller size, indicates this species is indeed different than the species currently known as *S. papuana* in the islands. Several experts examined specimens but were unable to determine the identity of this species. It is cryptogenic and may be undescribed.

Infestations of *Solenopsis* sp. have been found at a site in Pearl City 8.5 km away from the original golf course collection site in Ewa, O‘ahu, and at four sites separated by more than 30 km on Hawai‘i. This strongly suggests the ant has been established on both islands for years. We believe it is more widely distributed in the Hawaiian Islands, but it

is unlikely this species will be pestiferous on the scale of its relatives, *Solenopsis geminata* and *S. invicta*.

Material examined: **HAWAI'I**: Hilo, Naniakea St., 19º 41' 27" N, 155º 04' 37" W, 70 m, 2 May 2000, peanut butter baits (pbb), T. Benevides of Waiākea High School (BPBM); Hilo, Waiākea Intermediate School, 200 W. Puainako St., 19º41' 45"N 155º04' 52" W 50 m, 24 May 2000, pbb, D.S. Gruner (BPBM); Hawaiian Beaches, Kamanu St., 19º 33' 43" N, 154º 53' 24" W, 15 m, 6 Mar 2001, 6 Oct 2002, hand collected, D.S. Gruner (BPBM; CAS; LACM); Hawaiian Beaches, Moana & Pu'u Makai, 19º 32' 57" N, 154º 57' 24" W, 75 m, 6 Oct 2002, hand collected, D.S. Gruner (MCZ; 2 queens: CAS); **O'AHU**: 'Ewa, Oct 2000, R.A. Heu & M. Chun (HDOA); Pearl City 10 Oct 2002, Spam bait trap, R.A. Heu & D.S. Alontaga (HDOA).

Pheidole moerens Wheeler **New state record**

This little-known ant species was submitted to Neil Reimer and tentatively identified as *Leptothorax* sp. At that time, no major workers of this species had been collected, so the dimorphic quality of the species was not known. In March 2001 we obtained soldiers from a colony in Hawaiian Beaches and immediately revised the determination to *Pheidole* sp. Stephan Cover (MCZ) identified the species as *Pheidole moerens* Wheeler. This species is now known from at least eight localities widely distributed in the Puna District of Hawai'i.

Pheidole moerens is native to the Greater Antilles, first described from Puerto Rico (Wheeler, 1908). It has been recorded from other Caribbean islands, such as the Virgin Islands, Haiti, the Bahamas, and the Florida keys (Kempf, 1972; Pressick & Herbst, 1973; Deyrup *et al.*, 1988). It is widespread in mainland Florida and several other southeastern states (Wojcik *et al.*, 1975; Glancey *et al.*, 1976; Deyrup & Trager, 1986, J. Wetterer, pers. comm.), but first collected from the western U.S. (California) in 1995 (Martínez, 1997). The ant was found nesting only around California fan palms, *Washingtonia filifera* (Lindley) Wendland, in lowland nearshore areas. This suggests an introduction mode to the Hawaiian Islands similar to that hypothesized for the recently introduced little fire ant, *Wasmannia auropunctata* (Conant & Hirayama, 2000). In Hawai'i, *W. auropunctata* is often found in nurseries and in association with planted *Caryota* spp. fishtail palms. Thus, *P. moerens* probably was imported accidentally with commercial plants and soil for horticulture. Its distribution suggests it has been on Hawai'i for a number of years.

Pheidole moerens is related to two species already widespread in the Hawaiian Islands. *Pheidole megacephala* (Fabricius) was introduced in the 19th century (Smith, 1879). It is abundant on all the main islands except Kaho'olawe, as well as several leeward islands. *Pheidole fervens* Smith is recorded from Kaua'i, O'ahu, Maui, and Hawai'i. *Pheidole fervens* is more abundant locally in wet regions, such as the Hilo and Puna districts of Hawai'i Island, than *P. megacephala* (D. Gruner, unpubl. observ.). Both are considered aggressive invaders, and detrimental to native arthropods and agriculture in island and continental systems (Reimer *et al.*, 1993; Hoffman *et al.*, 1999; LaPolla *et al.*, 2000). Five other *Pheidole* species have been intercepted but not recorded as established in the Hawaiian Islands (Nishida, 2002). *Pheidole moerens* had not been intercepted from or known as established in any other location in the Pacific. In comparison, *P. moerens* is not predicted to be a major new, complementary pest or a high priority for containment or eradication.

Soldiers and minor workers of *Pheidole moerens* are significantly smaller than both congeners. The minor worker, light brown in color, is 1.5–1.75 mm in total body length. The major worker is slightly larger, 2.5–2.75 mm in length, somewhat darker, and with a

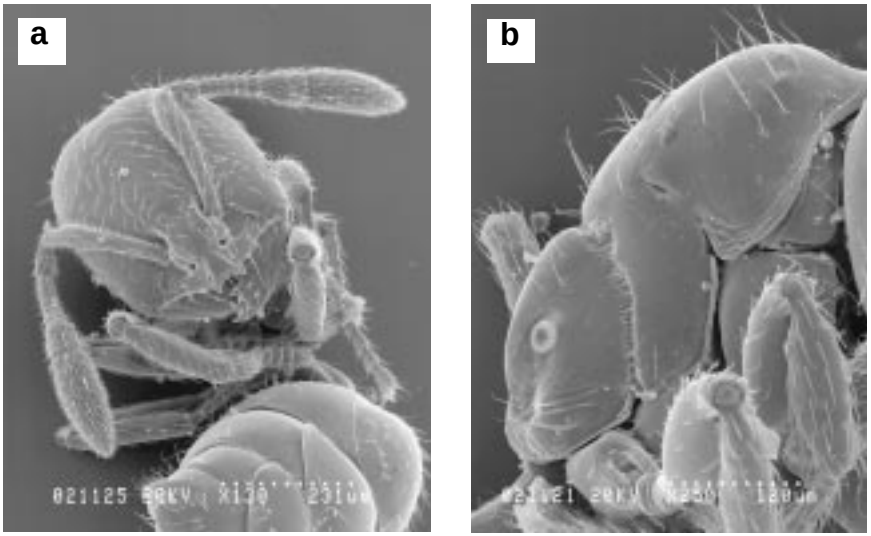

Fig. 1: Scanning electron micrographs of *Solenopsis* sp.; a) head, b) lateral thorax.

larger and broader head as is characteristic with the genus *Pheidole*. The frons surface of the major worker is moderately reticulate (Fig. 2a), intermediate to the smooth *P. megacephala* and the rugose *P. fervens*. The thorax is densely reticulate (Fig. 2b); both the larger species are moderately smooth.

Material examined: **HAWAI'I**: Kea'au, Ha'a Pl., 19º 37' 50" N, 155º 02' 08" W, 80 m, 7 Feb 2001, pbb, R. Badua of Kea'au High School (BPBM); Hawaiian Paradise Park, Kaloli Dr. & 2nd Ave, 19º 36' 43" N, 154º 57' 37" W, 30 m, 7 Feb 2001, pbb, S. Sheffield of Kea'au High School (BPBM); Hawaiian Paradise Park, 5th Ave, 19º 35' 50" N, 154º 57' 05" W, 25 m, 7 Feb 2001, pbb, S. Schulte of Kea'au High School (BPBM); Hawaiian Paradise Park, Paradise Dr. & 13th Ave, 19º 35' 14" N, 154º 57' 47" W, 50 m, 6 Feb 2001, pbb, T. L. Mabry of Kea'au High School (BPBM); Hawaiian Paradise Park, Mākua Dr. & 20th Ave, 19º 34' 02" N, 154º 57' 37" W, 60 m, 7 Feb 2001, pbb, S. Isko of Kea'au High School (BPBM); Hawaiian Beaches, Maiko St., 19º 32' 46" N, 154º 54' 16" W, 60 m, 6 Feb 2001, pbb, K. Kekauoha of Kea'au High School (BPBM); Hawaiian Beaches, Papai St., 19º 33' 38" N, 154º 53' 27" W, 15 m, 2 May 2000, pbb, N. Keohuhu of Pāhoa High School (BPBM); Hawaiian Beaches, Kamanu St, 19º 33' 43" N, 154º 53' 24" W, 15 m, 3 May 2000, pbb, A. Dressler of Pāhoa High School; 6 Mar 2001, 6 Oct 2002, hand collected, D.S. Gruner (BPBM; LACM; MCZ; CAS); Hawaiian Paradise Park, Kaloli Dr. & 2nd Ave, 19º 36' 52" N, 154º 57' 51" W, 45 m, 6 Oct 2002, pbb, D.S. Gruner (BPBM); Hawaiian Beaches, Hawaiian Beaches Park, Manini St., 19º 32' 56" N, 154º 54' 12" W, 75 m, 6 Oct 2002, pbb, D.S. Gruner (BPBM); Pāhoa, May 2000, pbb, anonymous of Pāhoa High School (BPBM).

Acknowledgments

We are grateful to K-12 students and teachers from Waiākea Intermediate, Waiākea High, Kea'au High, and Pāhoa High & Intermediate Schools for their sampling efforts providing the majority of these new records. Student collections and research by D. Gruner was

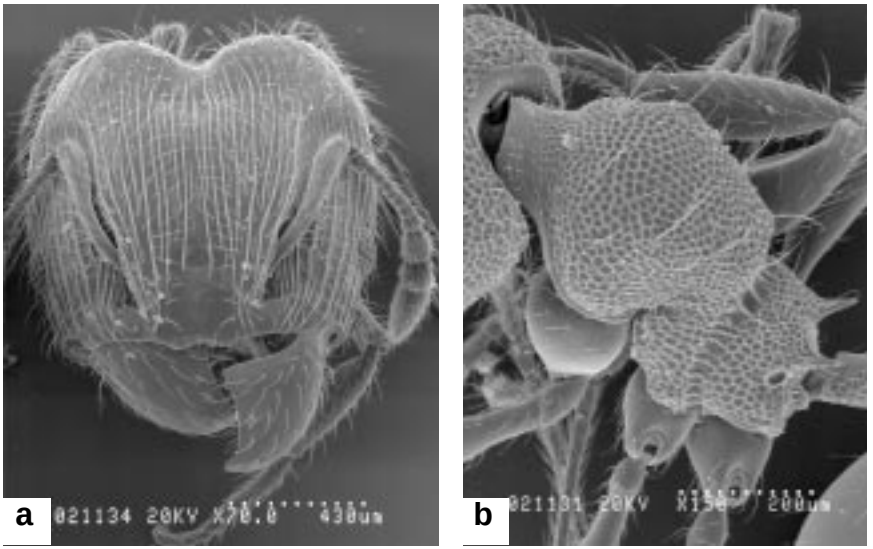

Fig. 2: Scanning electron micrographs of *Pheidole moerens* Wheeler; **a**, head of major worker, **b**, lateral thorax.

supported by NSF DUE-9979656 to the Center for Conservation Research and Training of the University of Hawaii at Mānoa, and by the Environmental Leadership Program. R.A. Heu and M. Chun thank S. Delizo for his help in providing soil samples on O'ahu. Surveys were supported and funded in part by the USDA-APHIS Cooperative Agricultural Pest Survey (CAPS) Program. We are indebted to Dennis Kunkel who prepared the scanning electron micrographs used as figures. Neil Reimer provided the initial diagnosis of new records; Stephan Cover identified species to the level reported here; Ed Wilson, Brian Fisher, Roy Snelling, James Trager, William Mackay, and Katsuyuki Eguchi also examined specimens.

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An immigrant darkling beetle new to Hawaii (Coleoptera: Tenebrionidae)

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A recent collection of beetles suspected to be a new introduction to Hawai‘i has solved a twenty-year-old question of identification. On the western coast of Kaua‘i in 1982, I took a single specimen belonging to the Middle American genus *Ulus* Horn (Coleoptera: Tenebrionidae) but because it was an abraded female, it lacked characteristics that would allow specific identification and I was hesitant to report its discovery. Species of the related genus *Blapstinus* and other opatrine genera are established in the islands (Nishida 1994) and are well represented in collections, but no Hawaiian specimens of *Ulus* were being found. Now, with new material from O‘ahu listed below, the species has been identified as *Ulus hirsutus* Champion. This is the first report of the insect in the Hawaiian Islands and its agricultural pest status.

Ulus hirsutus Champion **New state record**

Recently collected specimens and data were forwarded to Natalia J. Vandenberg, Systematic Entomology Laboratory, USDA, and to me from Bernarr Kumashiro, Hawaii Department of Agriculture, and G.A. Samuelson, Bishop Museum. Dr. Asher Ota, entomologist at Hawaii Agriculture Research Station, provided information on the occurrence and feeding of the beetles, as quoted from B. Kumashiro, below. My fieldwork in 1982 was assisted by Margaret S. Collins, Marianne Early and Dennis Chun.

Material Examined: "**HAWAII**: Kaua'i, Polihale St. Pk., 7 km. N. Mana, 1 January 1982, W. E. Steiner / under leaf litter of spreading plants on sand" (1♀); "Kunia, **OAHU**, 24.x.2001 / Ex sunflower seedling, A. Ota / 01-146" (2♂, 2♀); "Kunia, Oahu. October 2001 / From fruit fly trap, used for non-target insect collection. G. Uchida" (1, not examined by me).

My field notes on the Kaua'i locality list several non-native tenebrionids (*Ammophorus*, *Blapstinus*, *Gonocephalum*, and *Platydema* species) being found under beach drift debris of "piles of sticks, logs & kukui nuts" but the *Ulus* specimen, from this locality but not specifically noted at the time, was taken on dry sand of the upper beach among trailing vines of *Ipomoea pes-caprae* (L.) R. Br. and under deposits of dry leaves and drift wood; a specimen of *Epitragopsis* was found here also.

The four specimens taken by A. Ota are vouchers of the following observations:

> "Prior to the infestation of the tenebrionid, an adjacent 5 acre corn field (15' away) had been recently harrowed. Ota believed that this was the source of the infestation. The first 4–5 rows of young sunflower seedlings (1–2 weeks old) were affected, with the row closest to the corn field being the most damaged. There was a total of 1,000 row feet affected (5 rows × 200 feet/row). The distance between rows was 3', and the total area infested was about 3,000 square feet. The seedlings were cut at the base (soil line). The field was sprayed with an insecticide, and no future infestations were observed."

The specimen taken by Uchida was from a second farm near that infestation.

The Hawaiian specimens have been compared with a paratype of *Ulus hirsutus* from Panama, and other identified specimens from Mexico to Panama, the original known range reported by Champion (1885) for this species. The features fall well within the range of variation in size, vestiture, and other characters seen in Central American specimens. The dorsal habitus of *U. hirsutus* is illustrated by Maes (1998). The genus, badly in need of revision, contains 9 described species from the southern mainland US to Panama (Papp ,1961) and two others from coastal Venezuela (Marcuzzi, 1954). *Ulus* is similar to *Blapstinus* but easily diagnosed by the broadened, truncate apex of the front tibiae and fimbriate body margins (Aalbu & Triplehorn, 1985), and *Ulus* spp. are generally more broadly oval and covered by thick, tapered setae.

Ulus hirsutus has been intercepted at US mainland ports by USDA inspection of various cargo from several Central American countries, as recorded on specimens in the USNM, Smithsonian Institution, demonstrating that the beetle is prone to introduction. Members of the genus occur on pure coastal sand (Champion, 1885; Triplehorn & Valentine, 1979; W. Steiner, unpubl. data) and can be locally abundant on (and burrowing in) sandy soils in xeric habitats inland, and hide under stones, leaf litter or wood during the day. It is reasonable to suppose that such beetles would take refuge in crevices under parcels stationed on the ground at shipping ports and be carried to new destinations. Adult opatrine tenebrionids are long-lived and durable (Steiner ,1999), adding to their success of survival and colonization.

Reports of the pest status of *Ulus* species and members of the closely related genus *Blapstinus* have been given by various authors, mostly involving vegetable crops in semi-arid areas of the southwestern states. Examples include those of Campbell (1924) and Essig (1926) who describe damage by *Ulus crassus* (LeConte) to young or seedling plants including tomatoes, peppers, lima beans, melons and other plants; Cassidy *et al*. (1950) reported the same species injuring or killing seedlings of guayule. *Ulus crassus* also was listed as feeding on stored grain products in the Mojave Desert (Papp & Pierce, 1960). In Texas, *Ulus elongatulus* Casey destroyed or damaged cabbage seedlings in fields (USDA, 1968). *Ulus hirsutus* is capable of similar activity, as shown by the observations on the

Oahu specimens. Therefore, the apparent establishment of the beetle in Hawaii's agricultural areas could prove troublesome.

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Notes on some Nihoa insects (Orthoptera, Diptera)

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The following new or corrected information has come to light as a result of preparing a chapter on insects for an upcoming book on the natural history of Nihoa and Necker islands.

Orthoptera
Gryllidae
Thaumatogryllus conantae Otte **Emendation**
Otte (1994) originally described this species as *Thaumatogryllus conanti*, a giant cricket from the steep scree slope of Devil's Slide on Nihoa and it has appeared in two successive checklists with this species orthography (Nishida, 1997, 2002). However, the original publication stated, "This species was first found by Sheila Conant (after whom it is named)." Thus, the patronymic species epithet honoring its collector requires a feminine, not masculine ending.

Diptera
Ceratopogonidae
Dayhelea calvescens Macfie **New island record**
Although listed by Nishida (2002) as indigenous, this tiny ceratopogonid is found only in the Hawaiian Islands (Midway Atoll, Kauai, O'ahu, and Hawai'i) as is confirmed by the world catalog (Borkent & Wirth, 1997). This marks the first record from Nihoa, where it was collected in West Palm Valley.

Material examined. **NIHOA**: 4, West Palm Valley, 16 Sep 2000, G.M. Nishida (BPBM).

Dolichopodidae
Thambemyia n. sp. **New state record**
The species of *Thambemyia* from the Hawaiian Islands have previously all been placed as one species, *Th. acrostchalis* (Parent)[the genus name has been published in the Hawaiian literature either as *Conchopus*, *Thambemyia*, or *Paraphrosylus*]. The genus is currently under review, and there are a number of new species in material from the Hawaiian Islands. The specimens previously recorded from Nihoa are referable to a new species to be described soon (K. Masunaga, pers. comm.).

Hippoboscidae
Olfersia aenescens Thomson
Nishida (2001) recorded this species in his list of arthropods collected during the NOWRAMP Expedition to the Northwestern Hawaiian Islands. His listing for Nihoa was the first record of the species from that island. The only other species of *Olfersia* from Nihoa, *O. spinifera* (Leach) is commonly found on frigate birds. *Olfersia aenescens* has been recorded from boobies (*Sula* spp.) and terns (*Sterna*) in the Pacific (Maa, 1969). The species collected on Nihoa were taken by beating dead *Pritchardia* fronds. Boobies use *Pritchardia* on Nihoa as a common perch.

Material examined. **NIHOA**: 2, West Palm Valley, 12 Sep 2000, beating dead *Pritchardia* leaves, G.M. Nishida (BPBM).

Acknowledgment
Frank Howarth kindly verified the identification of the ceratopogonid.

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Helminths parasitizing exotic fishes in Maui streams

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Parasites of both native gobioid streamfishes and exotic poeciliid fishes introduced into Hawaiian streams have been reported for the islands of Hawai'i, O'ahu, and Kaua'i (Font & Tate, 1994; Font, 1997; Font, 1998). Hawaiian stream fishes are parasitized by both native helminths, i.e. parasite species that occur naturally in the archipelago, and by alien parasites, i.e., parasites introduced into the archipelago by human activities. However, there are no reports in the literature of parasites of fishes inhabiting streams on Maui. Because numerous species of exotic fishes have been introduced into Maui streams, we hypothesized that these fishes would harbor parasites previously found in stream fishes on other Hawaiian islands. We report the occurrence of 2 species of exotic helminths, the roundworm *Camallanus cotti* and the tapeworm *Bothriocephalus acheilognathi* from livebearers (Poeciliidae) collected in Maui streams. We use the standard terminology of ecological parasitologists to quantify levels of infection (Bush *et al*., 1997). Prevalence indicates the percentage of fish infected with a species of parasite and abundance indicates the average number of parasites per fish.

Camallanus cotti Fugita **New island record**

We necropsied a total of 146 poeciliid fishes collected from aquatic habitats on Maui. In a sample of 44 guppies, *Poecilia reticulata*, from 'Īao Stream, 54.5% were infected with the intestinal roundworm *Camallanus cotti* with a mean abundance of 1.7 parasites per fish. Infections also occurred in mosquitofish, *Gambusia affinis* (n = 50) from Keālia National Wildlife Refuge (prev. = 3.4%, abund. = 0.03). Shortfin mollies, *Poecilia mexicana* from Keālia (n = 10) and from Olowalu Stream (n = 14), and Kahana (n = 28) were uninfected.

Population densities of *C. cotti* were, in general, lower than those previously reported for this roundworm from Hawai'i (Font & Tate, 1994) and O'ahu (Vincent, 2001). Because larger samples sizes are required to detect parasites that occur at low prevalences, *C. cotti* may be more widespread on Maui than these data indicate both with regard to host utilization, e.g. *C. cotti* is known to infect shortfin mollies on O'ahu, and distribution among streams.

Bothriocephalus acheilognathi Yamaguti **New island record**

Each of the 146 fishes examined for *C. cotti* infections was also examined for the presence of the tapeworm *B. acheilognathi*. Only guppies from ʻĪao Stream were infected (prev. = 2.3%, abund. = 0.07). Previous studies (Font & Tate, 1994; Vincent, 2001) have shown that when this parasite occurs syntopically with *C. cotti*, the prevalence of the tapeworm is consistently lower than that of the roundworm. Because of these low prevalences, larger sample sizes of potential host fishes will need to be examined in order to determine the actual distribution of this tapeworm in Maui streams.

We have deposited voucher specimens of these parasites in the United States Parasite Collection, Beltsville, Maryland. Additional voucher specimens will be deposited in the Bishop Museum, Honolulu.

We consider that our hypothesis that helminths parasitize exotic fishes in Maui streams has only been partially confirmed. Although we have discovered the presence of two species of alien helminths in Maui streams, other alien parasites found on Hawaiʻi, Oʻahu, and Kauaʻi were not found on Maui. We also failed to detect native parasites in Maui stream fishes. Some of these native helminths are transmitted by vagile birds like herons and occur on islands on each side of Maui. We conclude that our failure to detect these parasites on Maui is a function of our rather small sample sizes, indicating that further parasitological examination of alien fishes on the island is warranted. More importantly, it has been documented that the exotic parasites, *C. cotti* and *B. acheilognathi* were initially established in streams with the introduction of exotic fishes by human intervention (Font and Tate, 1994) and, because of their broad host specificity, are capable of being transferred to native Hawaiian stream fishes. Therefore, because of the threat to Hawaiian gobioid fishes by exotic parasites, parasitological studies should also include examination of native stream fishes for roundworm and tapeworm infections.

Acknowledgments

We are grateful to William S. Devick for encouraging us to pursue our research on the parasites of Hawaiian fishes and for his sage advice. We thank the Hawaii Division of Aquatic Resources and the U.S. Fish and Wildlife Service Sport Fish Restoration Program for funding our studies. Our sincere appreciation is extended to Charles D. Criscione for his extraordinary efforts in assisting with the collection of fishes in Maui streams.

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Freshwater Rotifera (Monogononta) from Hawai‘i—a preliminary checklist

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Introduction

Except for some groups of insects and molluscs, Hawaiian freshwater invertebrates have received little serious study so far. This is evident from previous compilations by the Hawaii Biological Survey (Eldredge & Miller, 1997), and particularly true of micrometazoa such as Rotifera, which are virtually unstudied taxonomically. Only a few records from the Honolulu resulted from early European workers following voyages or expeditions in the early 20th century (Turner, 1996).

In conducting a first systematic inventory within and among islands, taxocenes from various regions and all vegetation zones of Hawai‘i have been examined. Included were a variety of habitats from 81 streams, pools (natural and artificial), freshwater and mixohaline, ephemeral and perennial ponds and lakes, thermal pools, reservoirs, cave waters, phytotelmata, peat bogs, marshes, and taro fields. This sampling takes into account the great physiographic and climatic variation of the higher main islands with their sequentially younger geological ages (e.g., Kay, 1994). The list below of 140+ monogonont species has been compiled from predominantly live material that was studied from 51 sampling sites within two days after collection from each site. Most likely additional species and more species records will turn up upon analysis of the preserved material, thus the current list must be considered preliminary. Future analysis will include ecology and zoogeography of Hawaiian Rotifera and hitherto unknown species will be described.

Material

Samples were collected on the southeastern islands of Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i. With the exception of Nihoa and Lāna‘i, only the main (‘windward’) islands are high enough to capture enough moisture to generate streams, lacustrine and palustrine habitats. Collecting localities are listed in Appendix I.

Recorded species

Virtually all species are new state records since only four monogonont rotifers were previously known from O‘ahu (Turner, 1996). The following list includes all species so far recorded on Hawai‘i along with their localities of discovery (cf. Figs. 1–5), previously known non-Hawaiian distribution, and major habitat requirements.

Anuraeopsis fissa (Gosse) **New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in eutrophic lakes and ponds, also in potamoplankton; occasionally in bog ponds and inland saline waters; warm stenothermic.

Material examined: **MOLOKA‘I**: Meyer Lake (Mo5); **HAWAI‘I**: pond in Lālākea Swamp (B4), Wai a Pele (Green Lake) (B13).

Aspelta angusta Harring & Myers **New state record**

Zoogeography and ecology: Holarctic. Benthic and periphytic in littoral of lakes, bogs, streams; rare.

Material examined: **O'AHU**: brook along Poamoho Trail (O6), Waiāhole Str (O11); **KAUA'I**: Kaua'ikinana Str (K4), Limahuli Str (K11), Hanalei River (K13); **MAUI**: Kahakuloa Str (Ma5), 'Īao Str (Ma11).

Aspelta curvidactyla Berzins **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Ethiopian region. Benthic, periphytic, in littoral of lakes, ponds, streams; rare.

Material examined: **KAUA'I**: Hanakāpī'ai Str (K9); **HAWAI'I**: Wailoa Str (B1).

Aspelta sp. [undescribed species] **New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i. Among *Sphagnum*.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAI'I**: *Sphagnum* sp. at 'Wailuku Pond' (B6).

Asplanchna brightwelli (Gosse) **New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in eutrophic ponds and lakes, in fresh and brackish water.

Material examined: **MAUI**: Wai'ale Res. (Ma10).

Asplanchna girodi (De Guerne) **New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in warm ponds, also lakes and inland saline waters.

Material examined: **HAWAI'I**: pond at Pu'u Iki (B11), Ahu Noa Marsh (B12).

Beauchampia crucigera (Dutrochet) **New state record**

Zoogeography and ecology: Cosmopolitan. Sessile on submerged plants in stagnant and slowly running waters.

Material examined: **O'AHU**: Inoa'ole Str (O8).

Brachionus plicatilis (Müller) **New state record**

Zoogeography and ecology: Cosmopolitan. Common plankter in brackish and inland saline waters; warm stenothermic.

Material examined: **MAUI**: Coot Pond (Ma7), Keālia Pond (Ma8), Kanahā Pond (Ma9).

Brachionus quadridentatus (Hermann) **New state record**

Zoogeography and ecology: Cosmopolitan. Benthic and semiplanktonic in lakes and ponds, also in brackish waters.

Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18); **HAWAI'I**: pond at Pu'u Iki (B11), Wai a Pele (Green Lake) (B13).

Bryceella stylata **(**Milne) **New state record**

Zoogeography and ecology: Holarctic. Common in peat bogs, among *Sphagnum* and terrestrial mosses, leaf litter, tree holes. Also on sand in littoral of lakes, ponds and streams; oligothermic.

Material examined: **MAUI**: Wai'ele'ele (Ma12).

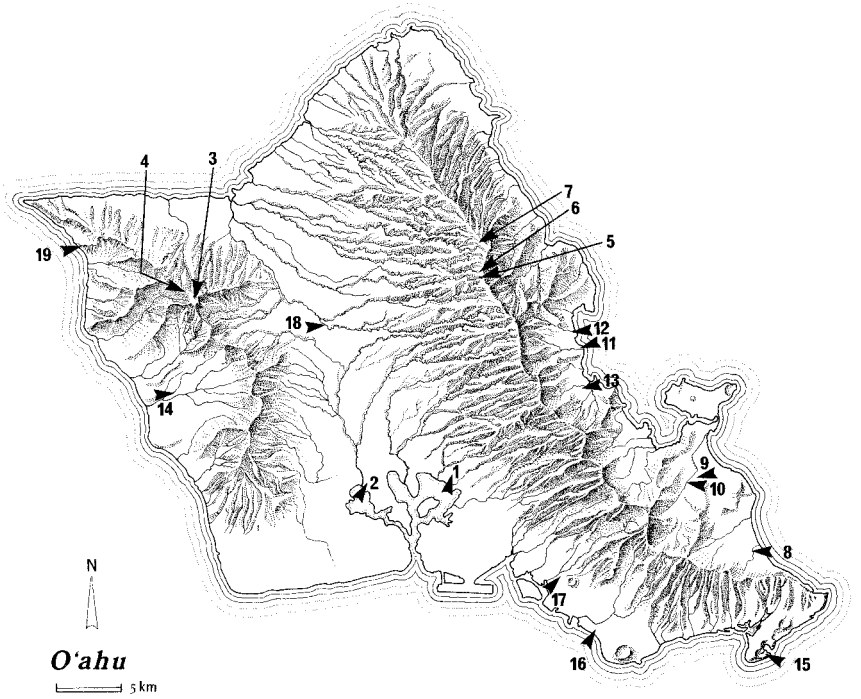

Fig. 1. Collecting stations on O‘ahu.

Cephalodella apocolea Myers **New state record**

Zoogeography and ecology: Cosmopolitan. Common in periphyton and among aquatic vegetation in lakes, ponds and streams, also in psammon and peat bogs; eurythermic.

Material examined: **O‘AHU**: ‘Poamoho Lake’ (O5); **KAUA‘I**: Kaua‘ikinana Str (K4), Limahuli Str (K11), Hanalei River (K13).

Cephalodella bryophila (Pawlovski) **New state record**

Zoogeography and ecology: Palaearctic. Among *Sphagnum* and terrestrial mosses, also in leaf litter; rare.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4).

Cephalodella delicata Wulfert **New state record**

Zoogeography and ecology: Holarctic. Benthic on mud and sand, among periphyton in lakes, ponds, ditches, and streams. Also in peat bogs, brackish and inland saline waters; eurythermic.

Material examined: **MAUI**: ‘Īao Str (Ma11).

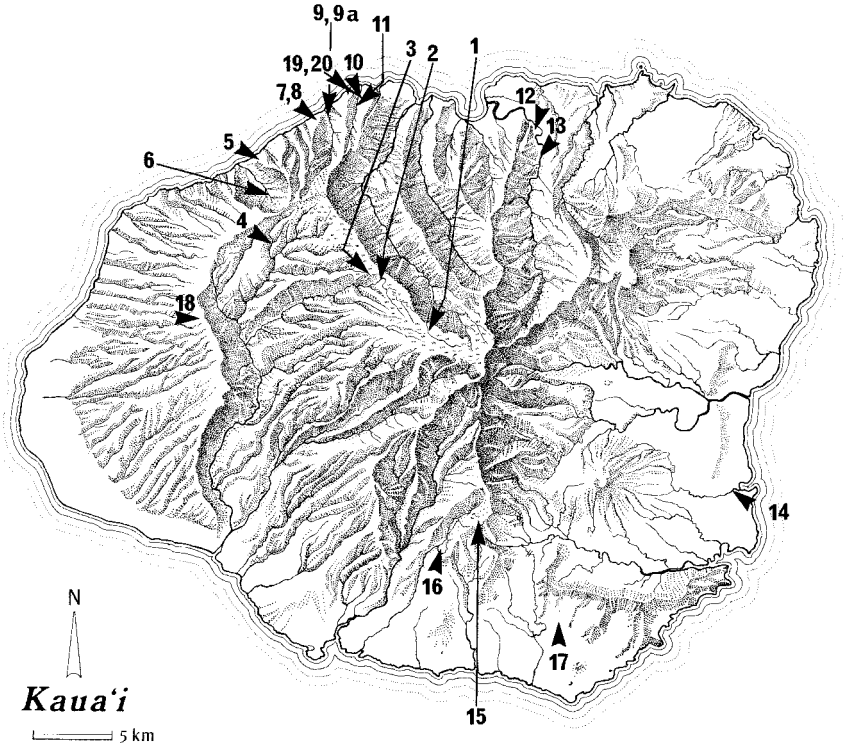

Fig. 2. Collecting stations on Kaua‘i.

Cephalodella eva (Gosse) **New state record**

Zoogeography and ecology: Probably cosmopolitan. In periphyton and among aquatic vegetation in running and stagnant waters, also in littoral psammon and peat bogs; eurythermic.

Material examined: **KAUA‘I**: Kaua‘ikinana Str (K4).

Cephalodella forficata (Ehrenberg) **New state record**

Zoogeography and ecology: Probably cosmopolitan. Common in periphyton of stagnant and running waters; also in psammon and peat bogs.

Material examined: **O‘AHU**: ‘Poamoho Lake’ (O5); **KAUA‘I**: bog pool in Kana‘ele Swamp (K15); **MAUI**: ‘East Bog’ Kaho‘olewa Ridge (Ma1), *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4), Wai‘anapanapa (Ma13).

Cephalodella forficula (Ehrenberg) **New state record**

Zoogeography and ecology: Cosmopolitan. Common on mud in limnosaprobic environments.

Material examined: **O‘AHU**: Inoa‘ole Str (O8); **HAWAI‘I**: Wai a Pele (Green Lake) (B13).

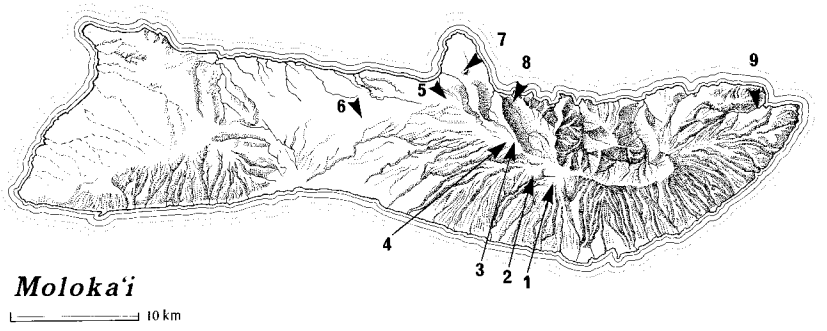

Fig. 3. Collecting stations on Moloka‘i.

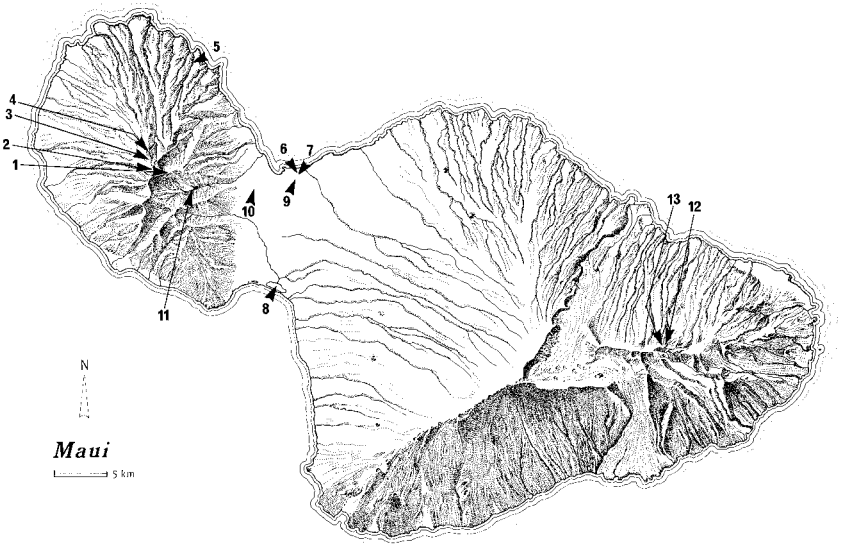

Fig. 4. Collecting stations on Maui.

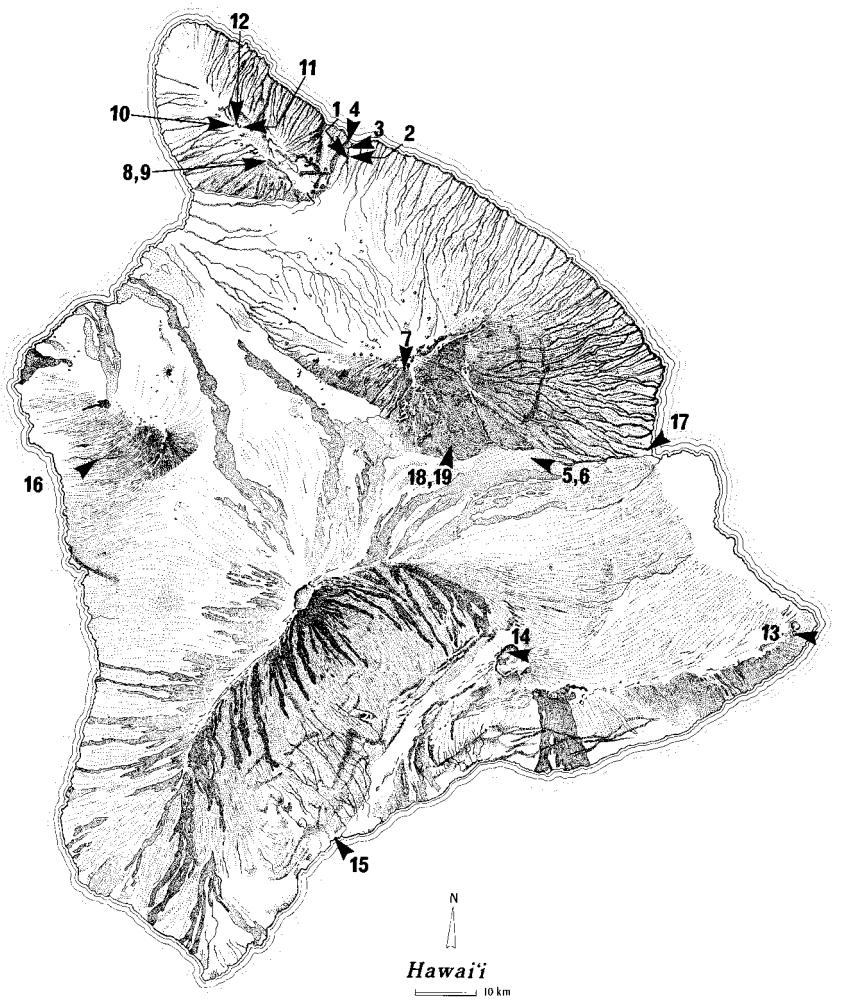

Fig. 5. Collecting stations on Hawai‘i.

Cephalodella gibba Ehrenberg **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters.

Material examined: **O'AHU**: Waiāhole Str (O11), Fong's Taro Farm, Kahulu'u (O13); **KAUA'I**: Hanakāpī'ai Str (K9), Limahuli Str (K11), Diego's Taro Farm, Hanalei (K12), Hanalei River (K13), Hanama'ulu Str (K14); **HAWAI'I**: Wailoa Str (B1), Lake Waiau (B7).

Cephalodella gracilis (Ehrenberg) **New state record**

Zoogeography and ecology: Probably cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters.

Material examined: **O'AHU**: Kahana Iki Str (O10), Waiāhole Str (O11), Fong's Taro Farm, Kahulu'u (O13); **KAUA'I**: Koai'e Str (K2), mosses on Kalalau Trail (K8), Hanakāpī'ai Str (K9), Diego's Taro Farm, Hanalei (K12); **MAUI**: Ditch on Pu'u Kukui boardwalk (Ma2); **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2), *Sphagnum* sp. at 'Wailuku Pond' (B6), *Sphagnum palustre*, Pu'u O'Umi NAR (B9).

Cephalodella cf. ***hoodi*** (Gosse) **New state record**

Zoogeography and ecology (*C. hoodi*): Probably cosmopolitan. Among littoral vegetation of stagnant and running waters, also in psammon, peat bogs and inland saline waters; rare.

Material examined: **KAUA'I**: bog pool in Kana'ele Swamp (K15).

Cephalodella incila Wulfert **New state record**

Zoogeography and ecology: Holarctic. In periphyton and among aquatic vegetation of stagnant and running waters, also in bogs.

Material examined: **O'AHU**: brook along Poamoho Trail (O6), Waiāhole Str (O11); **MAUI**: 'Īao Str (Ma11); **HAWAI'I**: Wailoa Str (B1).

Cephalodella intuta Myers **New state record**

Zoogeography and ecology: Cosmopolitan. In periphyton and among aquatic vegetation of stagnant and running waters, also in bogs and marshes.

Material examined: **HAWAI'I**: 'Wailuku Pond' on Red Lepo Trail (B5), pond at Pu'u Iki (B11), Ahu Noa Marsh (B12).

Cephalodella megalocephala (Glascott) **New state record**

Zoogeography and ecology: Cosmopolitan. Benthic on mud and littoral sand of lakes and streams, among periphyton in fresh and brackish waters.

Material examined: **KAUA'I**: Hanakāpī'ai Str (K9).

Cephalodella nana Myers **New state record**

Zoogeography and ecology: Probably cosmopolitan. Among *Sphagnum*, in peat bogs.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

Cephalodella sp. 1 [undescribed species] **New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

Material examined: **O'AHU**: Waiāhole Str (O11).

Cephalodella sp. 2 [undescribed species] **New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

Material examined: **O'AHU**: Waikane Str (O12).

Cephalodella sp. 3 [undescribed species] **New state record**
Zoogeography and ecology: Possibly endemic to Hawai‘i.
Material examined: **KAUA‘I**: Hanalei River (K13); **MAUI**: Kahakuloa Str (Ma5), Wai‘ale Res. (Ma10).

Cephalodella sp. 4 [undescribed species] **New state record**
Zoogeography and ecology: Possibly endemic to Hawai‘i.
Material examined: **KAUA‘I**: Hanalei River (K13); **HAWAI‘I**: Wailoa Str (B1).

Cephalodella sp. 5 [undescribed species] **New state record**
Zoogeography and ecology: Possibly endemic to Hawai‘i.
Material examined: **MAUI**: Ki‘owaiokiha (Violet Lake) (Ma3).

Cephalodella stenroosi Wulfert **New state record**
Zoogeography and ecology: Holarctic. Common on mud and among littoral vegetation in limnosaprobic, stagnant waters; also in inland saline waters.
Material examined: **MAUI**: Wai‘ale Res. (Ma10).

Cephalodella sterea (Gosse) **New state record**
Zoogeography and ecology: Cosmopolitan. Among periphyton and aquatic vegetation, on mud and sand in stagnant and running waters, also in peat bogs and inland saline waters.
Material examined: **KAUA‘I**: Diego’s Taro Farm, Hanalei (K12); **HAWAI‘I**: pond in Lālākea Swamp (B4).

Cephalodella ventripes (Dixon–Nuttall) **New state record**
Zoogeography and ecology: Probably cosmopolitan. Periphytic and among aquatic vegetation of stagnant and running waters, also in psammon and peat bogs.
Material examined: **KAUA‘I**: Limahuli Str (K11), Hanalei River (K13); **HAWAI‘I**: Wailoa Str (B3).

Collotheca ferox Penard **New state record**
Zoogeography and ecology: Palaearctic. Sessile on submerged plants in stagnant waters, also peat bogs; very rare.
Material examined: **HAWAI‘I**: pond in Lālākea Swamp (B4).

Collotheca ornata (Ehrenberg) **New state record**
Zoogeography and ecology: Cosmopolitan. Sessile on diverse substrates in stagnant and slowly running, also brackish and inland saline, waters; also in peat bogs.
Material examined: **MAUI**: Ki‘owaiokiha (Violet Lake) (Ma3); **KAUA‘I**: Koai‘e Str (K2), Kauaikinana Str (K4).

Collotheca ornata cornuta (Dobie) **New state record**
Zoogeography and ecology: Cosmopolitan. Sessile on diverse substrates in stagnant and slowly running waters, also in inland saline waters and peat bogs.
Material examined: **MAUI**: ‘East Bog’ Kaho‘olewa Ridge (Ma1), Ditch on Pu‘u Kukui boardwalk (Ma2), Wai‘ele‘ele (Ma12), Wai‘anapanapa (Ma13); **HAWAI‘I**: Ahu Noa Marsh (B12).

Colurella adriatica Ehrenberg **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running waters; euryhaline.

Material examined: **MAUI**: Coot Pond (Ma7), Kanahā Pond (Ma9), ʻĪao Str (Ma11).

Colurella denticauda Carlin **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Ethiopian region. Periphytic and among submerged vegetation in stagnant and running waters; rare.

Material examined: **KAUAʻI**: Hanakāpīʻai Str (K9); **HAWAIʻI**: Wailoa Str (B1).

Colurella hindenburgi Steinecke **New state record**

Zoogeography and ecology: Cosmopolitan. Acidophilic soft water species, common in peat bogs and among mosses in lakes and streams; also in psammon and edaphon.

Material examined: **KAUAʻI**: Kauaikinana Str (K4), Hanalei River (K13); **MAUI**: *Sphagnum wheeleri* on Puʻu Kukui boardwalk (Ma4), Kahakuloa Str (Ma5), Waiʻale Res. (Ma10); **HAWAIʻI**: Wailoa Str (B3), 'Wailuku Pond' on Red Lepo Trail (B5), *Sphagnum* sp. at 'Wailuku Pond' (B6), bog pool in Puʻu O 'Umi NAR (B8), *Sphagnum palustre*, Puʻu O 'Umi NAR (B9), Waiakanonula Marsh (B10), pond at Puʻu Iki (B11).

Colurella obtusa (Gosse) **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, also brackish and inland saline, waters.

Material examined: **OʻAHU**: Inoaʻole Str (O8), Waiahole Str (O11), Fong's Taro Farm, Kahuluʻu (O13); **KAUAʻI**: Hanakāpīʻai Str (K9), Limahuli Str (K11), Diego's Taro Farm, Hanalei (K12), Hanalei River (K13); **MAUI**: Kahakuloa Str (Ma5); **HAWAIʻI**: Wailoa Str (B1), Vincent's Taro Farm, Waipiʻo (B2), Wailoa Str (B3) 'Wailuku Pond' on Red Lepo Trail (B5), Wai a Pele (Green Lake) (B13).

Colurella uncinata bicuspidata (Ehrenberg) **New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic in stagnant and slowly running, also brackish and inland saline waters.

Material examined: **OʻAHU**: Inoaʻole Str (O8), Waiahole Str (O11); **KAUAʻI**: Hanalei River (K13); bog pool in Kanaʻele Swamp (K15); **HAWAIʻI**: Vincent's Taro Farm, Waipiʻo (B2); Wailoa Str (B3), Wai a Pele (Green Lake) (B13).

Cyrtonia tuba (Ehrenberg) **New state record**

Zoogeography and ecology: Cosmopolitan. In small stagnant waters, peat bogs and marshes; also inundation areas and psammon; sporadic.

Material examined: **KAUAʻI**: Hanamaʻulu Str (K14).

Dicranophorus grandis (Ehrenberg) **New state record**

Zoogeography and ecology: Probably cosmopolitan. In periphyton and among aquatic vegetation of stagnant and running waters.

Material examined: **OʻAHU**: Inoaʻole Str (O8), Fong's Taro Farm, Kahuluʻu (O13); **KAUAʻI**: Diego's Taro Farm, Hanalei (K12); **MAUI**: ʻĪao Str (Ma11); **HAWAIʻI**: Vincent's Taro Farm, Waipiʻo (B2), pond at Puʻu Iki (B11), Wai a Pele (Green Lake) (B13).

Dicranophorus sp. 1 [undescribed species] **New state record**
Zoogeography and ecology: Probably this undescribed species also occurs on arctic Svalbard (De Smet, pers. comm.). Among moss.
Material examined: **MAUI**: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4).

Dorria dalecarlica **Myers** **New state record**
Zoogeography and ecology: Previously only known from the northeastern U.S., a further unpublished record from southern Australia (Shiel, pers. comm.). Among moss in mountain streams.
Material examined: **KAUA‘I**: Kaua‘ikinana Str (K4), Limahuli Str (K11), Hanalei River (K13).

Elosa worallii **Lord** **New state record**
Zoogeography and ecology: Probably cosmopolitan. In peat bogs and marshes, especially among *Sphagnum*; acidophilic.
Material examined: **HAWAI‘I**: *Sphagnum palustre*, Pu‘u O ‘Umi NAR (B9), Waiākanonula Marsh (B10).

Encentrum sorex Wulfert **New state record**
Zoogeography and ecology: Palaearctic region (Europe). Among wet *Sphagnum* in ditches, springs and peat bogs; rare.
Material examined: **MAUI**: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4).

Epiphanes senta (Müller) **New state record**
Zoogeography and ecology: Cosmopolitan. Common in small eutrophic and polytrophic water bodies; eurythermic.
Material examined: **HAWAI‘I**: Lake Waiau (B7).

Euchlanis dilatata (Ehrenberg) **New state record**
Zoogeography and ecology: Cosmopolitan. Benthic and semiplanktonic in all kinds of stagnant and running water bodies, also peat bogs, brackish and inland saline waters.
Material examined: **KAUA‘I**: Diego’s Taro Farm, Hanalei (K12), Hanalei River (K13), Hanama‘ulu Str (K14), bog pool in Kana‘ele Swamp (K15); **MAUI**: Wai‘ele‘ele (Ma12), Wai‘anapanapa (Ma13); **HAWAI‘I**: pond at Pu‘u Iki (B11).

Euchlanis incisa Carlin **New state record**
Zoogeography and ecology: Cosmopolitan. In periphyton and among macrophytes of stagnant and slowly running waters, also peat bogs.
Material examined: **KAUA‘I**: Hanama‘ulu Str (K14).

Filinia novaezealandiae Shiel & Sanoamuang **New state record**
Zoogeography and ecology: Tropicopolitan. Planktonic in lakes and ponds, also reported from irrigation channels and rice fields; warm stenothermic.
Material examined: **HAWAI‘I**: pond at Pu‘u Iki (B11).

Floscularia janus (Hudson) **New state record**
Zoogeography and ecology: Probably cosmopolitan. Sessile on diverse substrates in stagnant and slowly running waters, also peat bogs.
Material examined: **HAWAI‘I**: bog pool in Pu‘u O ‘Umi NAR (B8).

***Hexarthra mira* (Hudson)** **New state record**
Zoogeography and ecology: Cosmopolitan. Planktonic in lakes and ponds, also brackish and inland saline waters.

Material examined: **MAUI**: Wai‘ele‘ele (Ma12).

Hexarthra oxyuris (Sernov) **New island record**
Zoogeography and ecology: Cosmopolitan. Planktonic in inland saline and brackish waters; euryhaline. Previously reported from a brackish pool on O‘ahu by Hauer (1941), sub *Pedalia fennica* (Levander).

Material examined: **MAUI**: Keālia Pond (Ma8).

Hexarthra cf. ***polychaeta*** Bennetch **New state record**
Zoogeography and ecology (*H. polychaeta*): Previously only known from a moderately alkaline quarry pond in the northeastern U.S., not seen since discovery. Planktonic in freshwater ponds.

Material examined: **MAUI**: Wai‘ale Res. (Ma10).

Keratella tropica (Apstein) **New state record**
Zoogeography and ecology: Cosmopolitan. Planktonic in lakes, ponds and slowly running, also inland saline, waters; warm stenothermic.

Material examined: **MOLOKA‘I**: Meyer Lake (Mo5); **MAUI**: Wai‘ale Res. (Ma10).

Lecane aculeata (Jakubski) **New state record**
Zoogeography and ecology: Cosmopolitan. In periphyton and among macrophytes of stagnant and slowly running waters, also ricefields; warm stenothermic.

Material examined: **O‘AHU**: Wahiawā Res. (Lake Wilson) (O18).

Lecane agilis (Bryce) **New state record**
Zoogeography and ecology: Probably cosmopolitan. Common among *Sphagnum* in peat bogs.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4); **HAWAI‘I**: *Sphagnum* sp. at ‘Wailuku Pond’ (B6).

***Lecane arcuata* (**Bryce**)** **New state record**
Zoogeography and ecology: Cosmopolitan. Among mosses and submerged vegetation in stagnant and running waters, also on mud, in peat bogs, marshes, springs, and phytotelmata; eurythermic.

Material examined: **KAUA‘I**: Mosses on Kalalau Trail (K8); **HAWAI‘I**: Waiakanonula Marsh (B10).

***Lecane bifurca* (**Bryce**)** **New state record**
Zoogeography and ecology: Cosmopolitan. In periphyton and among macrophytes of stagnant and slowly running fresh waters, also in peat bogs; eurythermic.

Material examined: **O‘AHU**: Wahiawā Res. (Lake Wilson) (O18); **MAUI**: Wai‘ale Res. (Ma10), Wai‘anapanapa (Ma13); **HAWAI‘I**: Wai a Pele (Green Lake) (B13).

Lecane bulla (Gosse) **New state record**
Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters, occasionally in plankton.

Material examined: **O'AHU**: bog pond on Mt. Ka'ala (O4), 'Poamoho Lake' (O5), acidic pool on Ko'olau Summit Trail (O7), Inoa'ole Str (O8), Waikane Str (O12), Wahiawā Res. (Lake Wilson) (O18); **KAUA'I**: Diego's Taro Farm, Hanalei (K12), Hanalei River (K13), Hanama'ulu Str (K14), bog pool in Kana'ele Swamp (K15); **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2), Wailoa Str (B3), pond in Lālākea Swamp (B4), Wai a Pele (Green Lake) (B13).

Lecane clara (Bryce) **New state record**

Zoogeography and ecology: Cosmopolitan. Common in acidic waters in bogs, among *Sphagnum*, also in littoral periphyton and psammon of lakes and streams.

Material examined: **KAUA'I**: bog pool in Kana'ele Swamp (K15); **MAUI**: Ki'owaiokiha (Violet Lake) (Ma3), 'Īao Str (Ma11); **HAWAI'I**: bog pool in Pu'u O 'Umi NAR (B8).

Lecane closterocerca (Schmarda) **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters.

Material examined: **O'AHU**: Inoa'ole Str (O8), Waikane Str (O12); **KAUA'I**: Kauaikinana Str (K4), Limahuli Str (K11); **MAUI**: Kahakuloa Str (Ma5), 'Īao Str (Ma11); **HAWAI'I**: Wailoa Str (B3), pond in Lālākea Swamp (B4), Lake Wai'au (B7).

Lecane decipiens (Daday) **New state record**

Zoogeography and ecology: Cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters; also in peat bogs and phytotelmata.

Material examined: **O'AHU**: acidic pool on Ko'olau Summit Trail (O7), Wahiawā Res., Lake Wilson (O18); **HAWAI'I**: 'Wailuku Pond' on Red Lepo Trail (B5).

Lecane elegans Harring **New state record**

Zoogeography and ecology: Tropicopolitan, but also recorded from the Palaearctic. Among submerged vegetation in stagnant and slowly running fresh waters.

Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Lecane flexilis (Gosse) **New state record**

Zoogeography and ecology: Cosmopolitan. Among submerged mosses and macrophytes in stagnant and running fresh waters; also common in peat bogs; eurythermic.

Material examined: **KAUA'I**: Koai'e Str (K2); **MAUI**: 'Īao Str (Ma11), Wai'anapanapa (Ma13); **HAWAI'I**: 'Wailuku Pond' on Red Lepo Trail (B5).

Lecane hamata (Stokes) **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh waters, also in phytotelmata; eurythermic.

Material examined: **O'AHU**: bog pond on Mt. Ka'ala (O4), Inoa'ole Str (O8), Kahana Iki Str (O10), Fong's Taro Farm, Kahulu'u (O13), Wahiawā Res. (Lake Wilson) (O18); **KAUA'I**: rock pool on Kalalau Trail (K7), mosses on Kalalau Trail (K8), Diego's Taro Farm, Hanalei (K12); **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2), Wailoa Str (B3), pond in Lālākea Swamp (B4), Waiakanonula Marsh (B10).

Lecane hastata (Murray) **New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic in fresh and inland saline waters.

Material examined: **MAUI**: Coot Pond (Ma7).

Lecane hornemanni (Ehrenberg) **New state record**
Zoogeography and ecology: Cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters, occasionally in slightly saline inland waters and peat bogs; warm stenothermic.

Material examined: **O'AHU**: 'Poamoho Lake' (O5).

Lecane inermis (Bryce) **New state record**
Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh, inland saline and brackish waters, also in peat bogs, psammon and thermal springs; thermophilic.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2).

Lecane lauterborni Hauer **New state record**
Zoogeography and ecology: Probably cosmopolitan. Common among mosses in stagnant and running fresh waters, especially among *Sphagnum* in peat bogs; eurythermic.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAI'I**: bog pool in Pu'u O 'Umi NAR (B8).

Lecane ludwigii (Eckstein) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation of stagnant and slowly running fresh waters, also at slightly saline conditions; thermophilic.

Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Lecane luna (Müller)
Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh, inland and coastal saline and brackish waters, also psammon; less common in peat bogs and acidic waters. Previously reported from brackish ditches and pools on O'ahu (Weber, 1906).

Material examined: **O'AHU**: Inoa'ole Str (O8), Kahana Iki Str (O10).

Lecane lunaris (Ehrenberg) **New island record**
Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh, inland saline and brackish waters; also common in peat bogs; eurythermic. Previously reported from brackish ditches and pools on O'ahu (Weber, 1906).

Material examined: **O'AHU**: brook along Poamoho Trail (O6), Waiāhole Str (O11); **KAUA'I**: Koai'e Str (K2), Kauaikinana Str (K4), Hanakāpī'ai Str (K9), Limahuli Str (K11), Hanalei River (K13); **MAUI**: Kahakuloa Str (Ma5), 'Īao Str (Ma11), Wai'ele'ele (Ma12), Wai'anapanapa (Ma13).

Lecane lunaris f. ***perplexa*** (Ahlstrom) **New state record**
Zoogeography and ecology: Cosmopolitan. Ecology insufficiently known, probably similar to that of *L. lunaris* typica.

Material examined: **MAUI**: Wai'ale Res. (Ma10).

Lecane monostlya (Daday) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters; also in phytotelmata; warm stenothermic.

Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Lecane papuana (Murray) **New state record**
Zoogeography and ecology: Cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters; warm stenothermic.
Material examined: **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2).

Lecane paxiana Hauer **New state record**
Zoogeography and ecology: Discontinuous range including Palaearctic and Ethiopian region. Rare, ecology insufficiently known.
Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18); **MAUI**: 'Īao Str (Ma11).

Lecane perpusilla (Hauer) **New state record**
Zoogeography and ecology: Eastern Hemisphere (Palaearctic, Australian, Oriental region). Among submerged mosses, especially *Sphagnum* in peat bogs; oligothermic.
Material examined: **O'AHU**: Acidic pool on Ko'olau Summit Trail (O7); **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

Lecane pyriformis (Daday) **New state record**
Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh waters, also in peat bogs, inundation areas and phytotelmata; eurythermic.
Material examined: **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2).

Lecane quadridentata (Ehrenberg) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running, fresh and slightly brackish waters, occasionally in peat bogs; warm stenothermic.
Material examined: **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2).

Lecane signifera (Jennings) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters.
Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Lecane sp. 1 [undescribed species] **New state record**
Zoogeography and ecology: Possibly endemic to Hawai'i. Periphytic and among submerged vegetation in stagnant fresh waters. Current records indicate a wide ecological range.
Material examined: **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAI'I**: steam vent pool in Kīlauea Caldera (B14).

Lecane sp. 2 [undescribed species] **New state record**
Zoogeography and ecology: Possibly endemic to Hawai'i.
Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Lecane stichaea Harring **New state record**
Zoogeography and ecology: Cosmopolitan. Common in peat bogs, especially among *Sphagnum*; acidophilic.
Material examined: **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

Lecane subulata (Harring & Myers) **New state record**

Zoogeography and ecology: Probably cosmopolitan. Common in peat bogs, especially among *Sphagnum*; acidophilic.

Material examined: **O'AHU**: *Sphagnum palustre*, Mt. Ka'ala summit bog (O3); **KAUA'I**: bog pool on Mōhihi Wai'alae Trail (K3); **HAWAI'I**: bog pool in Pu'u O 'Umi NAR (B8), *Sphagnum palustre*, Pu'u O 'Umi NAR (B9).

Lepadella acuminata (Ehrenberg) **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters; also in psammon, springs, peat bogs, leaf litter, edaphon and phytotelmata; eurythermic.

Material examined: **KAUA'I**: Koai'e Str (K2), Kauaikinana Str (K4), rock pool on Kalalau Trail (K7), mosses on Kalalau Trail (K8); **MAUI**: Ki'owaiokiha (Violet Lake) (Ma3), Wai'ale Res. (Ma10), Wai'anapanapa (Ma13); **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2), 'Wailuku Pond' on Red Lepo Trail (B5), bog pool in Pu'u O'Umi NAR (B8), Ahu Noa Marsh (B12).

Lepadella desmeti Segers & Chittapun **New state record**

Zoogeography and ecology: Neotropical and Oriental region. Ecology insufficiently known, seems to prefer peat bogs and marshes.

Material examined: **O'AHU**: Fong's Taro Farm, Kahulu'u (O13); **MAUI**: Ki'owaiokiha (Violet Lake) (Ma3); **HAWAI'I**: Ahu Noa Marsh (B12).

Lepadella elongata Koste **New state record**

Zoogeography and ecology: Circumtropical, recorded from Neotropical, Ethiopian and Oriental region. Among submerged vegetation in stagnant and slowly running fresh water; warm stenothermic.

Material examined: **HAWAI'I**: pond in Lālākea Swamp (B4).

Lepadella minuta (Weber & Montet) **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Ethiopian and Neotropical region. Periphytic and among submerged vegetation in stagnant and running fresh waters, occasionally in psammon; eurythermic.

Material examined: **KAUA'I**: Hanalei River (K13); **HAWAI'I**: Wailoa Str (B3), Wai a Pele (Green Lake) (B13).

Lepadella ovalis (Müller) **New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and running, fresh, brackish, and inland saline waters; less common in peat bogs and inundation areas.

Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Lepadella patella (Müller) **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, brackish and inland saline waters; also in peat bogs, phytotelmata and edaphon; eurythermic.

Localities: **O'AHU**: Kahana Iki Str (O10), Waikane Str (O12), Fong's Taro Farm, Kahulu'u (O13); **KAUA'I**: Hanakāpī'ai Str (K9), Limahuli Str (K11), Diego's Taro Farm, Hanalei (K12), Hanalei River (K13); **MAUI**: Kahakuloa Str (Ma5); **HAWAI'I**: Wailoa Str (B3), Vincent's Taro Farm, Waipi'o (B2), 'Wailuku Pond' on Red Lepo Trail (B5).

Lepadella cf. ***quinquecostata*** (Lucks) **New state record**
Zoogeography and ecology (*L. quinquecostata*): Probably cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters, occasionally in peat bogs and phytotelmata.
Material examined: **HAWAI'I**: Wai a Pele (Green Lake) (B13).

Lepadella sp. near ***acuminata*** (Ehrenberg) **New state record**
Material examined: **O'AHU**: 'Poamoho Lake' (O5), brook along Poamoho Trail (O6), acidic pool on Ko'olau Summit Trail (O7); **KAUA'I**: bog pool in Kana'ele Swamp (K15); **HAWAI'I**: bog pool in Pu'u O 'Umi NAR (B8).

Lepadella sp. near ***rottenburgi*** (Lucks) **New state record**
Material examined: **KAUA'I**: Hanama'ulu Str (K14); **MAUI**: Kahakuloa Str (Ma5).

Lepadella sp. 1 [undescribed species] **New state record**
Zoogeography and ecology: Possibly endemic to Hawai'i.
Material examined: **HAWAI'I**: bog pool in Pu'u O 'Umi NAR (B8).

Lepadella sp. 2 **New state record**
Material examined: **O'AHU**: Inoa'ole Str (O8).

Lepadella triba Myers **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters, occasionally in peat bogs.
Material examined: **KAUA'I**: bog pool in Kana'ele Swamp (K15); **HAWAI'I**: pond in Lālākea Swamp (B4).

Lepadella triptera (Ehrenberg) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh, brackish and inland saline waters; occasionally in peat bogs.
Material examined: **HAWAI'I**: Vincent's Taro Farm, Waipi'o (B2).

Limnias melicerta Weisse **New state record**
Zoogeography and ecology: Cosmopolitan. Sessile on submerged plants in stagnant fresh waters; also in peat bogs and phytotelmata.
Material examined: **HAWAI'I**: pond in Lālākea Swamp (B4), Wai a Pele (Green Lake) (B13).

Lindia pallida (Harring & Myers) **New state record**
Zoogeography and ecology: Probably cosmopolitan. Common in peat bogs, especially among *Sphagnum*; acidophilic.
Material examined: **O'AHU**: *Sphagnum palustre*, Mt. Ka'ala summit bog (O3); **KAUA'I**: bog pool on Mōhihi Wai'alae Trail (K3); **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAI'I**: bog pool in Pu'u O 'Umi NAR (B8), *Sphagnum palustre*, Pu'u O 'Umi NAR (B9), Ahu Noa Marsh (B12).

Lindia truncata (Jennings) **New state record**
Zoogeography and ecology: Probably cosmopolitan. In periphyton and among algal

colonies in stagnant and slowly running fresh waters; also reported from peat bogs and saltwater psammon.

Material examined: **MAUI**: Wai‘ale Res. (Ma10).

Microcodides chlaena (Gosse) **New state record**

Zoogeography and ecology: Probably cosmopolitan. Among submerged vegetation in stagnant and running fresh waters, in peat bogs and occasionally in hyporheon of streams.

Material examined: **O‘AHU**: ‘Poamoho Lake’ (O5), pond in Kawainui Marsh (O9), Kahana Iki Str (O10); **KAUA‘I**: bog pool in Kana‘ele Swamp (K15); **HAWAI‘I**: ‘Wailuku Pond’ on Red Lepo Trail (B5).

Monommata astia Myers **New state record**

Zoogeography and ecology: Probably cosmopolitan. In stagnant fresh waters, acidophilic.

Material examined: **HAWAI‘I**: bog pool in Pu‘u O Umi NAR (B8).

Monommata dentata Wulfert **New state record**

Zoogeography and ecology: Probably cosmopolitan. Among submerged vegetation in acidic and alkaline, stagnant and slowly running freshwaters; also in peat bogs and inland saline waters; eurythermic.

Material examined: **O‘AHU**: pond in Kawainui Marsh (O9); **KAUA‘I**: Hanama‘ulu Str (K14), bog pool in Kana‘ele Swamp (K15).

Monommata maculata (Harring & Myers) **New state record**

Zoogeography and ecology: Probably cosmopolitan. Among submerged vegetation in stagnant and running fresh waters; eurythermic.

Material examined: **O‘AHU**: Brook along Poamoho Trail (O6), acidic pool on Ko‘olau Summit Trail (O7); **MAUI**: ‘East Bog’ Kaho‘olewa Ridge (Ma1), Ki‘owai O Kiha (Violet Lake) (Ma3), Wai‘ele‘ele (Ma12), Wai‘anapanapa (Ma13); **HAWAI‘I**: bog pool in Pu‘u O Umi NAR (B8).

Monommata sp. 1 [undescribed species] **New state record**

Zoogeography and ecology: Possibly endemic to Hawai‘i.

Material examined: **KAUA‘I**: Hanalei River (K13), Hanama‘ulu Str (K14); **HAWAI‘I**: Wailoa Str (B3), ‘Wailuku Pond’ on Red Lepo Trail (B5).

Mytilina ventralis (Ehrenberg) **New state record**

Zoogeography and ecology: Cosmopolitan. Common among submerged vegetation in stagnant and slowly running fresh waters, occasionally in peat bogs and brackish pools.

Material examined: **O‘AHU**: Fong’s Taro Farm, Kahulu‘u (O13); **KAUA‘I**: Diego’s Taro Farm, Hanalei (K12), bog pool in Kana‘ele Swamp (K15) (f. *macracantha*); **HAWAI‘I**: Vincent’s Taro Farm, Waipi‘o (B2) (f. *macracantha*).

Notommata allantois Wulfert **New state record**

Zoogeography and ecology: Probably cosmopolitan. Common is peat bogs; also in marshes and vegetated stagnant water bodies.

Material examined: **HAWAI‘I**: Vincent’s Taro Farm, Waipi‘o (B2).

Notommata contorta (Stokes) **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Australian region. Periphytic and among submerged vegetation in stagnant and slowly

running fresh and inland saline waters; occasionally in peat bogs.

Material examined: **KAUA‘I**: Hanalei River (K13); **HAWAI‘I**: ‘Wailuku Pond’ on Red Lepo Trail (B5).

Notommata cyrtopus (Gosse) **New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh waters; also in peat bogs and inland saline waters; eurythermic.

Material examined: **KAUA‘I**: bog pool in Kana‘ele Swamp (K15); **MAUI**: Kahakuloa Str (Ma5); **HAWAI‘I**: Wailoa Str (B1).

Notommata pseudocerberus de Beauchamp **New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and slowly running fresh waters; occasionally in peat bogs.

Material examined: **HAWAI‘I**: Wailoa Str (B3).

Notommata thopica Harring & Myers **New state record**

Zoogeography and ecology: Previously only known from the northeastern U.S., not seen since discovery. Ecology insufficiently known.

Material examined: **HAWAI‘I**: ‘Wailuku Pond’ on Red Lepo Trail (B5).

Notommata tripus Ehrenberg **New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and running fresh waters, also in peat bogs.

Material examined: **O‘AHU**: Kahana Iki Str (O10).

Pedipartia gracilis (Myers) **New state record**

Zoogeography and ecology: Previously only known from the northeastern U.S., not seen since discovery. Among *Sphagnum* and in hygropsammon.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4).

Platyias quadricornis brevispinus (Daday) **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Ethiopian and Neotropical region. Benthic and semiplanktonic in stagnant and slowly running fresh waters.

Material examined: **KAUA‘I**: Hanama‘ulu Str (K14), bog pool in Kana‘ele Swamp (K15).

Polyarthra cf. ***vulgaris*** Carlin **New state record**

Zoogeography and ecology (*P. vulgaris*): Cosmopolitan. Planktonic in freshwater lakes and ponds, also in potamoplankton and inland saline (soda) lakes.

Material examined: **MAUI**: Wai‘ale Res. (Ma10); **HAWAI‘I**: pond at Pu‘u Iki (B11).

Polyarthra sp. **New state record**

Material examined: **MAUI**: Wai‘ale Res. (Ma10).

Proales fallaciosa Wulfert **New state record**

Zoogeography and ecology: Probably cosmopolitan. Common on mud and among decomposing debries in limnosaprobic environments; also in peat bogs and inland saline waters; eurythermic.

Material examined: **O'AHU**: Waiāhole Str (O11); **MAUI**: Wai'anapanapa (Ma13); **HAWAI'I**: Ahu Noa Marsh (B12).

Proales minima (Montet) **New state record**

Zoogeography and ecology: Holarctic. Among submerged mosses, in limno- and potamopsammon; also in peat bogs.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4), Kahakuloa Str (Ma5), Wai'ele'ele (Ma12).

Proales similis de Beauchamp **New state record**

Zoogeography and ecology: Probably cosmopolitan. Benthic in inland saline, marine and brackish waters.

Material examined: **MOLOKA'I**: Kauhakō Lake (Mo7).

Proalides cf. ***wulferti*** Sudzuki **New state record**

Zoogeography and ecology: Previously known from the Palaearctic region only, but may have been confused with *P. tentaculatus* de Beauchamp. Planktonic in freshwater ponds and lakes, also in inland saline waters.

Material examined: **MAUI**: Coot Pond (Ma7), Kanahā Pond (Ma9).

Proalinopsis caudatus (Collins) **New state record**

Zoogeography and ecology: Probably cosmopolitan. In peat bogs and marshes; acidophilic.

Material examined: **HAWAI'I**: 'Wailuku Pond' on Red Lepo Trail (B5), bog pool in Pu'u O 'Umi NAR (B8).

Ptygura velata (Gosse) **New state record**

Zoogeography and ecology: Probably cosmopolitan. Sessile on submerged plants in stagnant and slowly running fresh waters, also in peat bogs.

Material examined: **O'AHU**: brook along Poamoho Trail (O6).

Ptygura sp. **New state record**

Material examined: **HAWAI'I**: Wailoa Str (B1).

Sphyrias lofuana (Rousselet) **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Ethiopian and Neotropical region. Among submerged vegetation in ponds and littoral of lakes; warm stenothermic, rare.

Localities: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Squatinella lamellaris lamellaris (Müller) **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Ethiopian and Neotropical region. Periphytic among submerged plants in fresh waters, also in bogs.

Material examined: **O'AHU**: Wahiawā Res. (Lake Wilson) (O18).

Squatinella lamellaris mutica (Ehrenberg) **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and

Ethiopian region. Periphytic among submerged plants in fresh waters, also in peat bogs.
Material examined: **KAUA‘I**: Diego’s Taro Farm, Hanalei (K12); **HAWAI‘I**: Wailoa Str (B3).

Squatinella microdactyla (Murray) **New state record**
Zoogeography and ecology: Holarctic. In peat bogs among *Sphagnum*, rare.
Material examined: **MAUI**: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4).

Synchaeta oblonga Ehrenberg **New state record**
Zoogeography and ecology: Cosmopolitan. Planktonic in freshwater lakes and ponds, also in bogs, brackish and inland saline waters, potamoplankton.
Material examined: **MAUI**: Wai‘ale Res. (Ma10).

Taphrocampa clavigera (Stokes) **New state record**
Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Ethiopian region. In peat bogs, among *Sphagnum*, rare.
Material examined: **HAWAI‘I**: bog pool in Pu‘u O ‘Umi NAR (B8).

Testudinella patina (Hermann) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic in stagnant and running, fresh, brackish, inland saline and sea water, also in peat bogs and inundation areas; eurythermic.
Material examined: **O‘AHU**: Inoa‘ole Str (O8), pond in Kawainui Marsh (O9); **HAWAI‘I**: Wailoa Str (B3), pond in Lālākea Swamp (B4), ‘Wailuku Pond’ on Red Lepo Trail (B5), pond at Pu‘u Iki (B11).

Trichocerca (Diurella) intermedia (Stenroos) **New state record**
Zoogeography and ecology: Probably cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters; also in peat bogs and psammon; eurythermic.
Material examined: **KAUA‘I**: Kaua‘ikinana Str (K4); **MAUI**: Kahakuloa Str (Ma5), Wai‘anapanapa (Ma13); **HAWAI‘I**: Wailoa Str (B3), pond in Lālākea Swamp (B4), Ahu Noa Marsh (B12).

Trichocerca (Diurella) montana Hauer **New state record**
Zoogeography and ecology: Discontinuous range including Palaearctic, Australian and Neotropical region. In peat bogs and among littoral vegetation, especially mosses, in stagnant fresh waters.
Material examined: **O‘AHU**: ‘Poamoho Lake’ (O5); **MAUI**: Wai‘ale Res. (Ma10); **HAWAI‘I**: pond in Lālākea Swamp (B4).

Trichocerca (Diurella) relicta Donner **New state record**
Zoogeography and ecology: Probably cosmopolitan. Periphytic and epibenthic, among submerged vegetation in stagnant and running fresh waters; also in peat bogs and marshes; eurythermic.
Material examined: **O‘AHU**: Fong’s Taro Farm, Kahulu‘u (O13); **KAUA‘I**: Diego’s Taro Farm, Hanalei (K12), 15; **HAWAI‘I**: Vincent’s Taro Farm, Waipi‘o (B2), pond in Lālākea Swamp (B4), Ahu Noa Marsh (B12).

Trichocerca (Diurella) similis (Wierzejski) **New state record**
Zoogeography and ecology: Cosmopolitan. Planktonic in freshwater lakes and ponds, also in potamoplankton and in humic acidic bog ponds.

Material examined: **MAUI**: Ki‘owai O Kiha (Violet Lake) (Ma3), Wai‘ele‘ele (Ma12).

Trichocerca (Diurella) tenuior (Gosse) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic, occasionally planktonic, among submerged vegetation in stagnant and running fresh waters; also in peat bogs, inundation areas and psammon; eurythermic.

Material examined: **MAUI**: Kahakuloa Str (Ma5), Wai‘ale Res. (Ma10).

Trichocerca (Diurella) tigris (Müller) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic, among submerged vegetation in stagnant and running fresh waters; also common in peat bogs.

Material examined: **HAWAI‘I**: Wailoa Str (B3).

Trichocerca (Trichocerca) pusilla (Lauterborn) **New state record**
Zoogeography and ecology: Cosmopolitan. Planktonic in meso– and eutrophic lakes and ponds, in potamoplankton; occasionally in bog ponds and brackish water.

Material examined: **MOLOKA‘I**: Meyer Lake (Mo5), Kualapu‘u Res. (Mo6); **MAUI**: Wai‘ale Res. (Ma10); **HAWAI‘I**: pond in Lālākea Swamp (B4), pond at Pu‘u Iki (B11), Wai a Pele (Green Lake) (B13).

Trichocerca (Trichocerca) rattus (Müller) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and slowly running fresh waters; occasionally in bog ponds, inland saline, brackish and coastal sea water.

Material examined: **KAUA‘I**: Diego’s Taro Farm, Hanalei (K12).

Trichocerca (Trichocerca) scipio (Gosse) **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and slowly running fresh waters; also in peat bogs.

Material examined: **HAWAI‘I**: bog pool in Pu‘u O ‘Umi NAR (B8).

Trichocerca Trichocerca) stylata (Gosse) **New state record**
Zoogeography and ecology: Cosmopolitan. Planktonic in lakes and ponds.

Material examined: **MAUI**: Wai‘ale Res. (Ma10).

Trichotria tetractis **(**Ehrenberg**)** **New state record**
Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic, among submerged vegetation in stagnant and running fresh waters, also in peat bogs; eurythermic.

Material examined: **KAUA‘I**: Limahuli Str (K11), Hanalei River (K13), Hanama‘ulu Str (K14); **HAWAI‘I**: Vincent’s Taro Farm, Waipi‘o (B2), pond in Lālākea Swamp (B4).

Tripleuchlanis plicata (Levander)
Previously reported from brackish ditches and pools on O‘ahu (Weber, 1906), but not found during this survey. Zoogeography and ecology: Cosmopolitan. In stagnant and slowly running, fresh, brackish and sea water.

Wierzejskiella vagneri Koniar **New state record**

Zoogeography and ecology: Palaearctic. Among *Sphagnum* and in peat bogs; also in periphyton of freshwater streams and in edaphon.

Material examined: **MAUI**: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4); **HAWAI‘I**: Wailoa Str (B1), Waiākanonula Marsh (B10).

Wulfertia cf. ***kindensis*** Koste & Tobias **New state record**

Zoogeography and ecology (*W. kindensis*): Previously only known from the Oriental Region (Myanmar), not seen since discovery. Ecology insufficiently known.

Material examined: **HAWAI‘I**: Wailoa Str (B1).

Wulfertia ornata Donner **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Ethiopian region. Periphytic among submerged vegetation and benthic on mud and algal mats in stagnant fresh waters.

Material examined: **HAWAI‘I**: Lake Wai‘au (B7).

Zoogeographical remarks

This first inventory obviously supports the dominance of Rotifera currently believed to be true cosmopolites (66 %). This is not surprising, since effective dispersal mechanisms are a prerequisite to reach localities as remote as this Pacific archipelago. However, the discovery of at least 11 undescribed species (8%) to some degree testifies for a distinct rotifer fauna on Hawai‘i. Considering the non-Hawaiian distribution of all other taxa, it appears that most have highly disjunct distributions known previously from only two or three major zoogeographical regions (*Aspelta curvidactyla, Colurella denticauda, Dorria dalecarlica, Lecane paxiana, Lepadella desmeti, Lepadella elongata, Lepadella minuta, Notommata contorta, Platyias quadricornis brevispinus, Sphyrias lofuana, Squatinella lamellaris, Taphrocampa clavigera, Trichocerca montana, Trichocerca relicta, Wulfertia ornata*). Several species were hitherto believed to have a more restricted range and were so far only known from a limited number of localities in the Holarctic (*Aspelta angusta, Bryceella stylata, Cephalodella delicata, C. incila, C. stenroosi, Proales minima, Squatinella microdactyla*), the Palaearctic (*Cephalodella bryophila, Collotheca ferox, Encentrum sorex, Wierzejskiella vagneri*), or the Nearctic region (*Hexarthra polychaeta, Notommata thopica, Pedipartia gracilis*). The occurrence of such rare species in Hawai‘i (and in their proper habitat) highlights both their ability to passively reach even the remotest places on earth and the key criterion of propoer habitat conditions for any establishment of colonizing species. Interestingly, no species restricted to the Australian region (to which Hawai‘i is frequently assigned within the Polynesian subregion) has yet been recorded.

To what extent the current rotifer fauna reflects the natural history of colonization is difficult to evaluate since it is likely that nonindigenous introductions by human agency were superimposed on a native fauna. Aquatic micrometazoans such as Rotifera may have been easily introduced along with intentional releases of aquatic organisms, e.g. exotic fish, clams, or ornamental plants. Moreover, tourists are probably powerful vectors to disseminate microscopic rotifer resting stages in their luggage or on their soles. Nevertheless, considering the high ability of passive dispersal in most Rotifera, local ecological circumstances are probably even more significant in determining the final distribution of a species. Current patterns found in the islands were thus probably affected by both human-

induced introductions on the one hand and extinctions on the other hand, since Hawaiian freshwater environments rapidly disappeared or were altered irreversibly in the course of human colonization.

Acknowledgments

This project was realized during my stay as a post–doctoral Research Associate under the John J. and Anna H. Gallagher Fellowship program at the Philadelphia Academy of Natural Sciences. Invaluable support was offered by Don Azuma, Clyde Goulden, Mark Isaksen, Meredith Lane, Chris Spolsky and Thomas Uzzell. Numerous people helped to manage the Hawaiian jungle of bureaucracy and to get even more collecting permits. I am greatly indebted to them all. Above all I want to acknowledge Randall Bartlett (Maui Pineapple Company, Maui), Bill Eichenlaub (Kalaupapa National Historical Park, Molokaʻi), Lucius Eldredge (Bishop Museum (BPBM), Honolulu), Donald Heacock (Division of Aquatic Resources (DAR), Kauaʻi), Don Hemmes and Susan Cate (University of Hawaii at Hilo) and Edwin Misaki (The Nature Conservancy (TNC), Molokaʻi) who offered logistical support, laboratory space and/or accommodation on their islands. Very special thanks go to Randall Bartlett (Maui Pineapple Company, Maui), Ronald Nagata (Haleakalā National Park, Maui), and Vince Costello (U.S. Army Environmental, Oʻahu), who offered free helicopter rides to areas that would otherwise have been impossible to survey. Further thanks go to Fern Duvall (Division of Forestry & Wildlife (DOFAW), Maui), Ronald Englund and David Preston (BPBM, Honolulu), Tina Lau and Stefanie Loo (TNC, Molokaʻi), Ruben Mateo (DOFAW, Honolulu), Alison Moriguchi (Grove Farm, Kōloa), Hank Oppenheimer (Maui Pineapple Company, Maui), Dan Polhemus (Smithsonian Institution, Washington D.C.), William Puleloa (DAR, Molokaʻi), and Don Swanson (U.S. Geological Survey, Hawaii Volcanoes National Park), who provided valuable information on sampling localities and/or guidance into remote areas, and to Elke Moosleitner and Hubert Blatterer who helped with my sampling on Molokaʻi and in the Kauaʻi Alakaʻi swamps, respectively. Daniel Otte (Academy of Natural Sciences of Philadelphia) generously put his island maps at my disposal.

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Appendix

Collecting localities listed below contain geographical coordinates (Old Hawaiian Datum), altitude (m), limnological classification (in italics) and habitat parameters [T (°C), pH, Electric Conductivity EC (µS cm^{-1} [25 °C]), depth (m; Mo5, Mo7, Ma12, B7, and B13 after Maciolek, 1982)] and collecting dates. Their geographic position is mapped for

all islands in Figs. 1–5. Species identifications are so far available only from localities marked with an asterisk (*).Voucher specimens and permanent slide preparations are deposited at the Philadelphia Academy of Natural Sciences and at the University of Salzburg.

O‘AHU:

O1 – Irrigation channel in Sumida Water Cress Farm at Kalauao Springs, Waimalu (21° 23' 11"N, 157° 56' 49" W, 5 m): Spring–fed *water cress field*, artificially fertilized; pH 7.6, EC 990, d 0.2 [01 Feb 01].

O2 – Open pond in Waipahu Marsh, Pearl Harbor, Waipahu (21° 22' 52"N, 158° 00' 34" W, 1 m): *mixohaline coastal marsh*; T 25.0, pH 7.8, EC >10000 (sal. 14 ppt), d 0.3 [01 Feb 01].

O3* – Mt. Ka’ala summit bog, among *Sphagnum palustre*, Wai‘anae Range (21° 30' 31"N, 158° 09' 02" W, 1180 m): Sphagnum *hummock in montane bog*; T 14.5–16.0, pH 4.0, EC 90 (water squeezed from mosses), [02 Feb 01].

O4* – Bog pond, Mt. Ka‘ala summit region, Wai‘anae Range (21° 30' 42"N, 158° 08' 57" W, 1180 m): *montane bog pond*; T 17.5–22.0, pH 5.3, EC 40, d ~0.5 [02 Feb 01].

O5* – ‘Poamoho Lake’, Ewa Forest Reserve, Ko‘olau Range (21° 31' 59"N, 157° 55' 33" W, 670 m): *Dystrophic upland lake*, densely covered with floating vegetation; T 20.8, pH 6.4, EC 50, d ~3 (?) [05 Feb 01].

O6* – Brook along Poamoho Trail (upper end), Ko‘olau Range (21° 32' 13"N, 157° 55' 31" W, 730 m): *Intermittent upland brook*; T 16.1, pH 5.1, EC 50, d 0.2 [06 Feb 01].

O7* – Acidic pool on Summit Trail, Ko‘olau Range (21° 33' 35"N, 157° 55' 37" W, 840 m): *Dystrophic upland pool*; T 15.1, pH 4.4, EC 70, d 0.2 [08 Feb 01].

O8* – Inoa‘ole Str, east of Waimānalo, among water ferns (*Salvinia molesta, Azolla* sp.) (21° 20' 58"N, 157° 42' 51" W, 5 m): *Polluted drainage ditch*; d ~0.5 [11 Feb 01].

O9* – Open pond in Kawainui Marsh, among *Eichhornia crassipes*, Kailua (21° 23' 40"N, 157° 45' 39" W, 4 m): *Coastal freshwater marsh*; T 22.4, pH 6.9, EC 260 [12 Feb 01].

O10* – Kahana Iki Str, among *Elodea canadensis*, Kawainui Marsh, Kailua (21° 23' 12"N, 157° 45' 54" W, 4 m): *Perennial lowland stream*; T 22.8, pH 7.6, EC 180, d ~0.5 [12 Feb 01].

O11* – Waiāhole Str, lower reach (21° 29' 10"N, 157° 50' 50" W, 3 m): *Perennial lowland stream*; T 20.2, pH 7.9, EC 120, d ~0.4 [15 Feb 01].

O12* – Waikane Str, lower reach (21° 29' 45"N, 157° 51' 13" W, 4 m): *Perennial lowland stream*; T 20.8, pH 7.8, EC 180, d ~0.4 [15 Feb 01].

O13* – Fong’s Taro Farm, Kahalu’u (21° 27' 26"N, 157° 50' 53" W, 12 m): *Taro cultivation pond (lo’i kalo)*; T 22.7, pH 6.6, EC 310, d 0.1 [15 Feb 01].

O14 – Lualualei Res., Wai‘anae (21° 26' 28"N, 158° 09' 54" W, 10 m): *Ephemeral impoundment*, currently dry [16 Feb 01].

O15 – ‘Ihi‘ihilauakea Preserve, Koko Head (21° 16' 03"N, 157° 41' 54" W, 60 m): *Ephemeral coastal wetland*, currently dry [18 Feb 01].

O16 – Bromeliaceae, Royal Hawaiian Shopping Ctr., Waikīkī (21° 16' 52"N, 157° 49' 49" W, 2 m): *Phytotelmata*; T 20.6–21.9, pH 7.0–7.4, EC 620, d 0.15 [14 Mar 01].

O17 – Bromeliaceae, Foster’s Botanical Garden, Honolulu (21° 19' 11"N, 157° 51' 37" W, 10 m): *Phytotelmata*; T 21.4, pH 6.8–7.2, EC 800–1080, d 0.3 [17 Mar 01].

O18* – Wahiawā Res. (Lake Wilson), Wahiawā (21° 29' 48"N, 158° 03' 03" W, 252 m): *Manmade reservoir, perennial*; d 25 [01 VII 97].

O19 – Kane‘ana Cave, Ka‘ena State Park (21° 31' 22"N, 158° 13' 50" W, 12 m): *Intermittent cave puddle*; d <0.02 [02 VII 97]

KAUA‘I:

K1 – ‘Black water Stream’(upper reach of Koai‘e tributary) on Mōhihi–Wai‘alae Trail, Alaka‘i Swamp (22° 05' 39"N, 159° 33' 15" W, 1300 m): *Dystrophic perennial montane stream*; T 13.6, pH 4.7, EC 30, d 0.4 [22 Feb 01].

K2* – Koai'e Str ('black water'), near Koai'e Cabin, Mōhihi–Wai'alae Trail, Alaka'i Swamp (22° 06' 58"N, 159° 33' 54" W, 1140 m): *Dystrophic perennial montane stream*; T 13.7, pH 5.8, EC 20, d 0.5 [23 Feb 01].

K3* – Bog pool on Mōhihi–Wai'alae Trail, Alaka'i Swamp (22° 07'01"N, 159° 34' 11" W, 1250 m): *Montane bog pool*; T 14.3, pH 4.1, EC 70, d 0.2 [23 Feb 01].

K4* – Kaua'ikinana Str, midreach, Koke'e State Park (22° 08' 09"N, 159° 38' 02" W, 1010 m): *Perennial montane stream*; T 14.4, pH 6.8, EC 30, d 0.3 [24 Feb 01].

K5* – Treehole (*kukui*, *Aleurites moluccana*) with leaf litter, Kalalau Trail, Nā Pali Coast State Park (22° 11' 03"N, 159° 38' 33" W, 19 m): *Phytotelmata*; T 19.9, pH 7.8, EC 600, d 0.05 [28 Feb 01]. **K6** – Kalalau Str in upper Kalalau Valley, Nā Pali Coast State Park (22° 10' 06"N, 159° 38' 15" W, 275 m): *Perennial upland stream*; T 18.8, pH 8.0, EC 100, d 0.4 [01 Mar 01].

K7* – Rock pool on Kalalau Trail, Hono O Nā Pali Natural Area Reserve (NAR), Nā Pali Coast (22° 12' 27"N, 159° 36' 24" W, 180 m): *Stream pool*; T 19.6, pH 8.3, EC 170, d 0.3 [02 Mar 01].

K8* – Mosses on dripping rocks, Kalalau Trail, Hono O Nā Pali NAR, Nā Pali Coast (22° 12' 27"N, 159° 36' 24" W, 180 m): *Wet mosses on dripping rocks*; T 19.9, pH 8.6, EC 180 (water squeezed from mosses) [02 Mar 01].

K9* – Hanakāpī'ai Str, Kalalau Trail, Nā Pali Coast (22° 12' 41"N, 159° 36' 00" W, 5 m): *Perennial lowland stream*; T 20.8, pH 8.1, EC 90, d 0.3 [02 Mar 01].

K9A – Pool in Hanakāpī'ai Str, Kalalau Trail, Nā Pali Coast (22° 12' 42"N, 159° 36' 00" W, 5 m): *Stream pool*; d 0.3 [13 VII 97].

K10 – Taro patch in Limahuli Gardens, National Tropical Botanical Garden (NTBG) (22° 13' 19"N, 159° 34' 46" W, 42 m): *Taro cultivation pond (lo'i kalo)*; T 19.3, pH 8.7, EC 80, d 0.1 [21 Mar 01].

K11* – Limahuli Str, lower reach, NTBG (22° 13' 17"N, 159° 34' 48" W, 45 m): *Perennial lowland stream*; T 18.1, pH 8.2, EC 70, d 0.3 [21 Mar 01].

K12* – Diego's Taro Farm, Hanalei Valley (22° 12' 06"N, 159° 28' 18" W, 6 m): *Taro cultivation pond (lo'i kalo)*; T 23.8, pH 7.5, EC 140, d 0.1 [22 Mar 01].

K13* – Hanalei River, lower reach (22° 11' 01"N, 159° 28' 07" W, 22 m): *Perennial lowland river*; T 19.7, pH 8.4, EC 90, d 0.3 [22 Mar 01].

K14* – Hanama'ulu Str, among *Eichhornia crassipes*, west of Hanama'ulu (21° 59' 48"N, 159° 20' 52" W, 8 m): *Perennial lowland stream*; T 23.7, pH 7.3, EC 190, d 1 [25 Mar 01].

K15* – Bog pool in Kana'ele Swamp, Wahiawa Valley (21° 58' 11"N, 159° 30' 46" W, 620 m): *Upland bog pool*; T 21.1, pH 5.3, EC 40, d 0.5 [26 Mar 01].

K16 – Alexander Res., Wahiawa Valley (21° 57' 33"N, 159° 31' 40" W, 475 m): *manmade reservoir, perennial*; T 24.8, pH 7.2, EC 50, d 19 [26 Mar 01].

K17 – Waita Res., Kōloa (21° 55' 15"N, 159° 27' 37" W, 72 m): *manmade reservoir, perennial*; T 28.4, pH 8.0, EC 130, d 7 [26 Mar 01].

K18 – Lua Res., Waimea Canyon State Park (22° 05' 30"N, 159° 40' 51" W, 980 m): *manmade reservoir, perennial* [12 VII 97].

K19 – Waikanaloa Wet Cave, Ha'ena State Park (22° 13' 25"N, 159° 35' 00" W, 6 m): *Underground cavern pool*; T 20.6, pH 7.6, EC 450, [14 VII 97, 02 Mar 01].

K20 – Waikapala'e Wet Cave, Ha'ena State Park (22° 13' 24"N, 159° 34' 56" W, 45 m): *Underground cavern pool*; T 20.5, pH 8.0, EC 150, [14 VII 97, 02 Mar 01].

MOLOKA'I:

Mo1 – Brook south of Kolekole Cabin, Kamakou Preserve (21° 06' 38"N, 156° 53' 59" W, 1190 m): *Perennial montane brook*; T 13.9, pH 5.1, EC 50, d 0.1 [05 Mar 01].

Mo2 – Pool in Kawelo Str, upper reach west fork, Kamakou Preserve (21° 06' 53"N, 156° 54' 37" W, 1110 m): *Dystrophic montane stream pool*; T 13.1, pH 5.3, EC 40, d 1 [06 Mar 01].

Mo3 – Wet mosses along boardwalk trail, Pēpē'ōpae Bog, Kamakou Preserve (21° 07' 20"N, 156° 54' 14" W, 1265 m): *Wet mosses in open bog*; T 15.9–23.3, pH 4.0, EC 80 [06 Mar 01].

Mo4 – Pool on boardwalk, Pēpē'ōpae Bog, Kamakou Preserve (21° 07' 17"N, 156° 54' 25" W, 1230 m): *Montane pool*; T 14.3, pH 6.0, EC 30, d 0.15 [06 Mar 01].

Mo5 – Meyer Lake (21° 10' 05"N, 156° 59' 06" W, 611 m): *Eutrophic impoundment in natural basin*; T 20.0, pH 5.8, EC 70, d 1.5 [07 Mar 01].
Mo6 – Kualapu‘u Res., Kualapu‘u (21° 09' 11"N, 157° 03' 01" W, 246 m): *manmade impoundment, perennial*; T 22.4, pH 7.9, EC 120, d 15 [07 Mar 01].
Mo7 – Kauhakō Lake, Kalaupapa National Historical Park (21° 11' 27"N, 156° 58' 08" W, 0 m): *Meromictic, mixohaline crater lake*; T 24.0, pH 8.2, EC >10000, d 248 [08 Mar 01].
Mo8 – Waikolu Str, lower reach, Kalaupapa National Historical Park (21° 10' 18"N, 156° 55' 59" W, 10 m): *Perennial lowland stream*; T 19.0, pH 8.2, EC 110, d 0.4 [10 Mar 01].
Mo9 – Hālawa Str, lower reach (21° 09' 40"N, 156° 44' 38" W, 5 m): *Perennial lowland stream*; T 21.8, pH 7.5, EC 250, d 1.5 [12 Mar 01].

MAUI:
Ma1* – ‘East Bog’, Kaho‘olewa Ridge, Mauna Kahalawai (20° 53' 52"N, 156° 34' 44" W, 1695 m): *Montane bog pool*; T 12.2, pH 5.3, EC 10, d 0.15 [30 Mar 01].
Ma2* – Shallow pool in former ditch on Pu‘u Kukui boardwalk, Mauna Kahalawai (20° 53' 46"N, 156° 35' 22" W, 1705 m): *Abandoned drainage ditch*; T 15.5, pH 4.8, EC 45, d 0.05 [05 Apr 01].
Ma3* – Ki‘owai O Kiha (Violet Lake), Mauna Kahalawai (20° 54' 27"N, 156° 35' 41" W, 1502 m): *Dystrophic montane bog pond*; T 15.2–19.2, pH 4.8, EC 20, d ~2 [05 Apr 01].
Ma4* – *Sphagnum wheeleri* on Pu‘u Kukui boardwalk, Mauna Kahalawai 20° 54' 51"N, 156° 35' 41" W, 1365 m): Sphagnum *hummock in montane bog*; T 18.2, pH 4.0, EC 160 (water squeezed from mosses) [05 Apr 01].
Ma5* – Kahakuloa Str, lower reach (20° 59' 48"N, 156° 33' 03" W, 15 m): *Perennial lowland stream*; T 21.6, pH 7.8, EC 70, d 0.3 [04 Apr 01].
Ma6* – Makaloa Pond, Kanahā Wildlife Sanctuary (20° 53' 52"N, 156° 27' 22" W, 1 m): *Mixohaline ‘black water’pool, ephemeral (?)*; T 35.3, pH 9.2, EC >10000, d 0.1 [06 Apr 01].
Ma7* – Coot Pond, Kanahā Wildlife Sanctuary (20° 53' 47"N, 156° 27' 21" W, 1 m): *Mixohaline pond, ephemeral (?)*; T 28.0, pH 9.3, EC >10000, d 0.75 [06 Apr 01].
Ma8* – Keālia Pond, Keālia National Wildlife Refuge (20° 47' 52"N, 156° 28' 33" W, 0 m): *Mixohaline coastal pond*; T 28.4, pH 9.2, EC >10000, d 0.75 [06 Apr 01].
Ma9* – Kanahā Pond, Kanahā Wildlife Sanctuary (20° 53' 32"N, 156° 27' 28" W, 0 m): *Mixohaline coastal pond*; T 21.7, pH 8.8, EC >10000, d 0.75 [11 Apr 01].
Ma10* – Wai‘ale Res., Wailuku (20° 52' 53"N, 156° 29' 54" W, 55 m): *manmade reservoir, perennial*; T 22.4, pH 7.9, EC 70, d 5 [11 Apr 01].
Ma11* – ‘Īao Str, midreach (20° 53' 06"N, 156° 32' 34" W, 250 m): *perennial upland stream*; T 18.5, pH 8.2, EC 70, d 0.2 [15 Apr 01].
Ma12* – Wai‘ele‘ele, Haleakalā National Park (20° 44' 21"N, 156° 07' 08" W, 2020 m): *dystrophic montane lake*; T 12.1, pH 6.9, EC 10, d 6.4 [16 Apr 01].
Ma13* – Wai‘anapanapa, Haleakalā National Park (20° 44' 16"N, 156° 07' 22" W, 2065 m): *montane pond*; T 13.8, pH 7.0, EC 10, d 2 [16 Apr 01].

HAWAI‘I ISLAND:
B1* – Wailoa Stream, upper Waipi‘o Valley (20° 06' 14"N, 155° 36' 34" W, 11 m): *perennial lowland river*; T 20.7, pH 8.2, EC 90, d 0.4 [19 Apr 01].
B2* – Vincent’s Taro Farm, Waipi‘o Valley (20° 06' 15"N, 155° 36' 29" W, 10 m): *taro cultivation pond (lo’i kalo)*; T 22.6, pH 7.2, EC 80, d 0.1 [19 Apr 01].
B3* – Wailoa Stream, *Eichhornia crassipes*, lower Waipi‘o Valley (20° 07' 06"N, 155° 35' 44" W, 2 m): *Perennial lowland river*; T 21.0, pH 8.0, EC 90, d ~1 [21 Apr 01].
B4* – Pond in Lālākea Swamp, lower Waipi‘o Valley (20° 07' 27"N, 155° 36' 06" W, 2 m): *coastal freshwater pond*; T 23.6, pH 8.0, EC 170, d ~2 [21 Apr 01].
B5* – ‘Wailuku Pond’ on Red Lepo Trail, SW slope of Mauna Kea, Hilo Forest Reserve (19° 42' 31"N, 155° 16' 23" W, 1085 m): *Montane marsh*; T 16.0–21.0, pH 6.5, EC 10, d 0.2 [23 Apr 01].

B6* – *Sphagnum* sp. hummock at 'Wailuku Pond' on Red Lepo Trail, Hilo Forest Reserve (19° 42' 32"N, 155° 16' 21" W, 1085 m): *Sphagnum hummock in montane marsh*; T 19.5, pH 4.5, EC 40 (water squeezed from mosses) [23 Apr 01].

B7* – Lake Waiau, Mauna Kea Ice Age NAR, summit region of Mauna Kea (19° 48' 54"N, 155° 28' 48" W, 3969 m): *Tropical alpine lake*; T 13.0, pH 10.2, EC 160, d 3 [25 Apr 01].

B8* – Bog pool in Pu'u O 'Umi NAR, Kohala Mts. (20° 04' 44"N, 155° 43' 29" W, 1545 m): *Montane bog pool*; T 15.0, pH 5.7, EC 20, d 0.2 [26 Apr 01].

B9* – *Sphagnum palustre*, Pu'u O 'Umi NAR, Kohala Mts. (20° 04' 43"N, 155° 43' 29" W, 1545 m): Sphagnum *hummock in montane bog*; T 18.0, pH 4.6, EC 70 (water squeezed from mosses) [26 Apr 01].

B10* – Waiākanonula Marsh, Kohala Mts. (20° 07' 44"N, 155° 46' 46" W, 1140 m): *Montane marsh*; T 19.9, pH 4.9, EC 60 [27 Apr 01].

B11* – Pond at Pu'u Iki, Kohala Mts. (20° 07' 47"N, 155° 45' 59" W, 1125 m): *Montane pond*; T 20.7, pH 7.1, EC 40, d >2 m [27 Apr 01].

B12* – Ahu Noa Marsh, Kohala Mts. (20° 07' 57"N, 155° 46' 29" W, 1175 m): *Montane marsh*; T 20.9, pH 6.2, EC 30, d 0.2 [27 Apr 01].

B13* – Wai a Pele (Green Lake), Kapoho Crater (19° 30' 21"N, 154° 50' 30" W, 1 m): *Freshwater crater lake*; T 26.8, pH 8.3, EC 410, d 6.4 [01 May 01].

B14* – Steam vent pool in Kīlauea Caldera, Hawaii Volcanoes National Park (19° 25' 13"N, 155° 17' 11" W, 1080 m): *Thermal pool*; T 39.0, pH 4.7, EC 10, d 0.05 [01 May 01].

B15 – 'Ice Pond' at Punalu'u, Ka'u District (19° 08' 23"N, 155° 30' 24" W, 0 m): *Coastal freshwater pond*; T 24.0, pH 8.0, EC 990, d 1 [04 May 01].

B16 – Luawai Res., SW slope of Hualalai (19° 38' 08"N, 155° 55' 47" W, 775 m): *manmade reservoir, perennial (?)*; T 23.3, pH 8.9, EC 80, d 1 [05 May 01].

B17 – Pukihae Str, lower reach, Hilo (19° 44' 06"N, 155° 05' 46" W, 12 m): *Perennial lowland stream*; T 22.0, pH 8.1, EC 80, d 0.2 [05 May 01].

B18 – 'Waikoloa Pond', SW slope of Mauna Kea, Pu'u Ō'ō Ranch (19° 42' 12"N, 155° 23' 34" W, 1740 m): *Pond in montane pasture land* [08 Jul 97].

B19 – 'Waikoloa Puddle', SW slope of Mauna Kea, Pu'u Ō'ō Ranch (19° 42' N, 155° 24' W, 1760 m): *Road puddle in montane pasture land* [08 Jul 97].

New helminth records for the orange-spotted day gecko, *Phelsuma guimbeaui* and the gold dust day gecko, *Phelsuma laticauda* (Gekkonidae) from Hawai'i

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The orange-spotted day gecko, *Phelsuma guimbeaui* Mertens, 1963 is native to the island of Mauritius, in the Indian Ocean (Henkel & Schmidt, 2000). It is now well established in parts of O'ahu where it was first observed in the mid-1980s and is thought to have become established from escaped pets (McKeown, 1996). The gold dust day gecko, *Phelsuma laticauda* (Boettger) is native to the north of Madagascar, Nosy Bé and the Comoro Islands (Henkel & Schmidt, 2000). It is widespread in localized areas of Hawai'i, Maui and O'ahu and was originally released near the University of Hawaii on O'ahu in 1974 (McKeown, 1996). New host records for helminths of *P. guimbeaui* and *P. laticauda* from Hawai'i and O'ahu are given in this note.

Between 1998 and 2000, 6 *Phelsuma guimbeaui* were collected on O‘ahu and 173 *Phelsuma laticauda* were collected on Hawai‘i (n = 161) and O‘ahu (n = 12). The body cavity was opened by a longitudinal incision from vent to throat. The gastrointestinal tract was removed and searched for helminths. The body cavity was also examined for helminths. Trematodes and cestodes were regressively stained with Delafield’s hematoxylin and mounted in Canada balsam for study. Nematodes and pentastomes were placed in glycerol on glass slides, allowed to clear and examined under a light microscope. Sixty five *P. laticauda* from Hawai‘i were deposited in the herpetology collection of the Natural History Museum of Los Angeles County, Los Angeles (LACM 144815–144879); 62 from Hawai‘i were deposited in the herpetology collection of the Bishop Museum, Honolulu, Hawai‘i (BPBM 14794, 14795, 14798–14805, 14968, 14970–14975, 14977, 14979–14987, 15008–15021, 15027, 15028, 15030–15048); 46 were deposited in the herpetology collection of the Museum of Zoology, University of Michigan, Ann Arbor, (n = 12, O‘ahu, UMMZ 225319–225327, 226927–225929; n = 34, Hawai‘i 226930–226963). Six *P. guimbeaui* were deposited in the BPBM (15022–15026, 15029). Voucher helminths were placed in vials of alcohol and deposited in the Bishop Museum, Honolulu (BPBM) and the U.S. National Parasite Collection (USNPC), Beltsville, Maryland. *Phelsuma guimbeaui* and *P. laticauda* represent new host records for the helminth species reported below.

Trematoda: **Dicrocoeliidae**

Platynosomum fastosum Kossack **New host record**

Platynosomum fastosum is a cosmopolitan species known from Puerto Rico, Brazil, Cuba, United States and Africa (Yamaguti, 1958) and was first reported in Hawai‘i by Ash (1962). On O‘ahu, Loo (1971) reported the lizards *Anolis carolinensis, Hemidactylus frenatus* and *Hemidactylus garnotii* as intermediate hosts. Goldberg & Bursey (2000a) reported larvae of *P. fastosum* in the lizard *Anolis sagrei.* Prevalence (number infected hosts/number hosts examined): *Phelsuma laticauda* Hawai‘i 2/161 (1%); mean intensity (mean number parasites per infected host): 2.0; range (lowest to highest number of parasites present): 1–3.

Material examined: **HAWAI‘I** (specimens lost).

Cestoda: **Linstowiidae**

Oochoristica javaensis Kennedy, Killick & Beverly-Burton **New host record**

Oochoristica javaensis was described from the small intestines of geckos, *Gehyra mutilata, Cosymbotus platyurus,* and *Hemidactylus frenatus* from Java, Indonesia (Kennedy *et al*., 1982). It was found in *H. frenatus* in Hawai‘i by Goldberg & Bursey (2000b). *Phelsuma laticauda* Prevalence Hawai‘i 5/159 (3%); mean intensity 2.0 ± 1.2; range 1–5; Prevalence O‘ahu 1/12 (8%); mean intensity 2.

Material examined: **HAWAI‘I** (BPBM: F221; USNPC 92424).

Cestoda: **Nematotaeniidae**

Cylindrotaenia allisonae Schmidt **New host record**

Cylindrotaenia allisonae was originally described from the gecko *Hoplodactylus maculatus* collected on New Zealand (Schmidt, 1980). It was also found in the gecko *Heteronotia binoei* and the skink *Hemiergis peronii* from Australia (Jones, 1987). Goldberg & Bursey

(1997) found it in the gecko *Lepidodactylus lugubris* from Hawai'i. *Phelsuma laticauda* Prevalence Hawai'i 2/159 (1%); mean intensity 1.

Material examined: **HAWAI'I** (BPBM: F220).

Nematoda: **Pharyngodonidae**

Pharyngodon lepidodactylus Bursey & Goldberg **New host record**

Pharyngodon lepidodactylus was originally described from the large intestine of the gecko *Lepidodactylus lugubris* collected in Hawai'i (Bursey & Goldberg, 1996a). *Phelsuma guimbeaui* Prevalence O'ahu 1/6 (17%); mean intensity 1.

Material examined: **O'AHU** (BPBM H75).

Spauligodon hemidactylus Bursey & Goldberg **New host record**

Spauligodon hemidactylus was originally described from the large intestine of the gecko *Hemidactylus frenatus* from American Samoa by Bursey & Goldberg (1996b) who also reported it from *H. frenatus* of Fiji, Guam, O'ahu, Marshall Islands, Palau, Philippines, Western Samoa, Solomon Islands, Society Islands, Vanuatu and Thailand. *Phelsuma laticauda* Prevalence Hawai'i 5/161 (3%); mean intensity 1.4 ± 0.5 SD; range 1–2.

Material examined: **HAWAI'I** (BPBM: H80).

Nematoda: **Spirocercidae**

Physocephalus sp. (larvae) **New host record**

Adults of *Physocephalus* have been found in the stomachs of swine, horses, cattle and rabbits; infective larvae have been recovered from dung beetles and are found in terrestrial vertebrates which have ingested infected beetles (Anderson, 2000). Larvae of *Physocephalus* sp. were first reported from O'ahu in *H. frenatus* by Hanley *et al.* (1998). *Phelsuma guimbeaui* O'ahu Prevalence 2/6 (33%); mean intensity 8.5 ± 0.7 SD; range 8–9. *Phelsuma laticauda* Hawai'i Prevalence 23/161 (14%); mean intensity 4.9 ± 7.2 SD; range 1–27. O'ahu Prevalence 2/12 (17%); mean intensity 2.

Material examined: **HAWAI'I** (BPBM: H81; USNPC: 92425), **O'AHU** (BPBM: H76).

Nematoda: **Physalopteridae**

Physaloptera sp. (larvae) **New host record**

Species of physalopterid nematodes require an insect intermediate host. They occur as adults in the stomachs of mammals, snakes, and a few lizard species; larvae are common in amphibians and some lizard species (Anderson, 2000). *Physaloptera muris-brasiliensis* Diesing, a parasite of rats, and *Physaloptera praeputialis* Linstow, a parasite of cats, have been reported from Hawai'i by Alicata (1964). *Physaloptera squamatae* Harwood, a parasite of lizards, was reported from O'ahu by Goldberg & Bursey (2000a). Adult male individuals are required for species designation. Larvae of *Physaloptera* sp. were first reported from *H. frenatus* on O'ahu by Hanley *et al.* (1998). *Phelsuma guimbeaui* O'ahu Prevalence 2/6 (33%); mean intensity 1.5 ± 0.70 SD, range 1–2. *Phelsuma laticauda* Hawai'i 1/161 (1%); mean intensity 1.

Material examined: **O'AHU** (BPBM: H77).

Nematoda: **Acuariidae**

Undetermined genus and species **New host record**

Acuariid nematodes typically occur in aquatic birds; they require an arthropod intermedi-

ate host to complete the life cycle (Anderson, 2000). They were first reported in Hawai‘i in *Anolis sagrei* by Goldberg *et al*. (2002) and are best considered as artifacts of diet. *Phelsuma guimbeaui* O‘ahu Prevalence 1/6 (17%); mean intensity 6. *Phelsuma laticauda* Hawai‘i Prevalence 2/161 (1%); mean intensity 1.

Material examined: **HAWAI‘I** (BPBM: H78). **O‘AHU** (BPBM: H82).

Pentastomida: **Cephalobaenidae**

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

Raillietiella frenatus was originally described from the lungs of *H. frenatus* collected in Malaysia by Ali *et al.* (1981) who reported it from the same host from the Philippine Islands, South Vietnam, Taiwan and Thailand. *Raillietiella frenatus* was first reported from O‘ahu by Hanley *et al.* (1998). *Phelsuma laticauda* Prevalence Hawai‘i 21/161 (13%); mean intensity 2.2 ± 2.0 SD; range 1–8; O‘ahu 4/12 (33%); mean intensity 3.0 ± 2.7 SD; range 1–7.

Material examined: **HAWAI‘I** (BPBM: S12247; USNPC: 92426), **O‘AHU** (BPBM: S12246).

Acknowledgments

We thank E. Campbell, D. Cravalho, R. Crombie, and L. Oberhofer for collecting assistance and I. Steinwascher for permission to collect on her property.

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New records of alien plants and animals in Hawai‘i

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New alien species records of plants and animals in Hawai‘i follow. All specimens are deposited in the relevant collections at the Bishop Museum.

Plants

Crassulaceae

Kalanchoe lateritia Engl. **New state record**

This species is native to eastern Africa. In Hawai“i, it is an erect herb up to 80 cm height, with 4–16 cm succulent, opposite, densely hairy, ovate, subsessile leaves with crenate to subentire margins. Internodes are short and the leaves are close to the ground in young plants; internodes become more widely spaced as the stem lengthens prior to flowering. Inflorescence a panicle approximately 5 cm in diameter, composed of erect orange flowers with a corolla tube approximately 8–14 mm long and attenuate lobes half that length.

Found growing in a ruderal area dominated by *Panicum* sp. and *Leucaena leucocephala*, with *Bryophyllum pinnatum*, *Asystasia gangetica*, and *Hylocereus undatus* common. Population appears restricted to approximately a 1 ha area and is reproducing by seed. Over 2700 plants, most of them seedlings, have been removed from the site since the population’s discovery.

Material examined: **O‘AHU**: Honolulu, on W slope of Punchbowl Crater, 8 Feb 2001, F. Kraus, *Kraus 01* (BISH).

Liliaceae

Asparagus densiflorus (Kunth) Jessop **New island record**

Previously reported from Kaua‘i (Lorence & Flynn, 1999) and Maui (Oppenheimer &

Bartlett, 2000), this widely planted ornamental native to southern Africa is common at its newly reported locality on O‘ahu.

Material examined: **O‘AHU**: Honolulu: Makiki, eastern slope of east side of Maunalaha Trail, 30 Mar 2001, F. Kraus, *Kraus 02* (BISH).

Rutaceae

Murraya paniculata (L.) Jack **New naturalized record**

This small evergreen tree is native to China and Southeast Asia and is one of the most widely utilized hedge plants in Honolulu and elsewhere in Hawai‘i. Several dozen individuals of varying sizes are scattered across the western slopes of Punchbowl Crater and are successfully fruiting. Trees attain a height of 4 m, have pinnate, glossy, dark green, ovate to rhombic leaflets; a terminal corymb of fragrant 1–2 cm white flowers with recurved petals; and 1 cm oblong red drupes. This species’ escape from cultivation in Hawai‘i is expected (Staples *et al*., 2000).

Material examined: **O‘AHU**: Honolulu: on W slope of Punchbowl Crater, 11 Nov 2001, F. Kraus, *Kraus 04* (BISH).

Animals

Polygyridae

Polygyra cereolus (Mühlfeld) **New island record**

Previously recorded from Hawai‘i, Kaua‘i, and O‘ahu (Cowie, 1996, 1998), this native to the southeastern United States is commonly transported in horticultural material. The present record from Maui comes from a landscaped apartment complex.

Material examined: **MAUI**: Kīhei: condominium complex S of Uwapo Rd, between Pi‘ilani Hwy and South Kīhei Rd, 30 Dec 2001, F. Kraus (BPBM 264013).

Iguanidae

Anolis sagrei Duméril & Bibron **New island record**

Previously known only from O‘ahu (Kishinami & Kishinami, 1996; McKeown, 1996; Kraus, 2002), this abundant tramp species has now colonized Kaua‘i. These lizards are easily moved in horticultural material and on vehicles (Godley *et al*., 1981; Campbell, 1996, Kraus, 2002) and probably arrived on Kaua‘i via one of those routes. The high densities this species attains and its tolerance for hot conditions make it a potential threat to remaining coastal strand insect populations.

Material examined: **KAUA‘I**: Kalāheo, 12.vii.2001, R. Caires (BPBM 14191-92).

Acknowledgments

I thank G. Staples for providing identifications of plant specimens and C. Kishinami for alerting me to the population of *A. sagrei*.

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