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Neal L. Evenhuis
and
Lucius G. Eldredge, editors

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Cover photo: Lake Waiau on the summit of Mauna Kea, July 2012, surveying for introduced beetles (see page 57). Photo Clyde Imada.

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BISHOP MUSEUM
The State Museum of Natural and Cultural History
1525 Bernice Street
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IN MEMORIAM

This issue of the
Records of the Hawaii Biological Survey
is dedicated to its co-editor since 1999

LUCIUS G. ELDREDGE
(1 March 1938–1 May 2013)

RECORDS OF THE HAWAII BIOLOGICAL SURVEY FOR 2011

Editor's Preface

We are pleased to present the annual compilation of *Records of the Hawaii Biological Survey;* this year for the year 2012. This *Records* volume is a combined one containing records pertaining to both animals and plants.

The Hawaii Biological Survey, established by the Hawaii State Legislature in 1992 as a program of Bishop Museum, is an ongoing natural history inventory of the Hawaiian Archipelago. It was created to locate, identify, and evaluate all native and nonnative species of flora and fauna within the state; and by State Law to maintain the reference collections of that flora and fauna for a wide range of uses. In coordination with related activities in other federal, state, and private agencies, the Hawaii Biological Survey gathers, analyzes, and disseminates biological information necessary for the wise stewardship of Hawaii's biological resources.

An intensive and coordinated effort has been made by the Hawaii Biological Survey to make our products, including many of the databases supporting the papers published here, available to the widest user-community possible through our web server. Products currently available include taxonomic authority files (species checklists for terrestrial arthropods, flowering plants, nonmarine snails, marine invertebrates, fossil taxa, and vertebrates), bibliographic databases (vascular plants, nonmarine snails, and insects), specimen databases (fungi, fish, invertebrates, portions of the insect collection) and type specimens (entomology; botany—including algae and fungi; and vertebrates), collections data (lists of holdings for select groups of flies as well as Cicadellidae and Pentatomidae), detailed information and/or images on endangered, threatened, and extinct plants and animals; as well as our staff publication lists. Additional reference databases include: the list of insect and spider collections of the world (based on Arnett, Samuelson & Nishida, 1993, *Insect and spider collections of the world*) with links to institutional web pages where known; and the historical world Diptera taxonomists list with names of over 5,400 authors who have described flies.

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The *Records of the Hawaii Biological Survey for 2012* were compiled with the assistance of Clyde Imada (botany), David Preston (entomology), and other anonymous reviewers who helped referee papers; and was partially supported by funds from the John D. and Catherine T. MacArthur Foundation. Many of the new records reported here resulted from curatorial projects and field surveys funded by the National Science Foundation, the U.S. Geological Survey Biological Resources Division, the U.S. Fish & Wildlife Service, and the Hawaii Department of Land and Natural Resources.

We encourage authors with new information concerning flora or fauna occurring in the Hawaiian Islands to submit their data to the editor for consideration for publication in the next *Records.* Submission and format of papers must follow our guidelines. Information on submission of manuscripts and guidelines for contributors may be obtained on the web (via pdf format) at:

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or by mail from: Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817-2704, USA.

——*N.L. Evenhuis, editor*
[email: neale@bishopmuseum.org]

Records of the Hawaii Biological Survey for 2012. Edited by Neal L. Evenhuis & Lucius G. Eldredge. *Bishop Museum Occasional Papers* 114: 5–16 (2013)

New plant records for the Hawaiian Islands 2011–2012[1]

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We document 8 new naturalized records, 4 new state records, 9 new island records, one range extension, and two corrections found by us and other individuals and agencies. In addition, several species showing signs of naturalization are mentioned. A total of 21 plant families are discussed. Areas surveyed to document these records include sites in and around botanical gardens on O'ahu. Many of the records reported here have likely been naturalized for a considerable amount of time, in particular those that are likely escapes from cultivation. On the other hand, the accidental introductions reported here may be recent introductions.

Information regarding the formerly known distribution of flowering plants is based on the *Manual of the Flowering Plants of Hawai'i* (Wagner *et al.* 1999) and information subsequently published in the *Records of the Hawaii Biological Survey*. Voucher specimens are deposited at Bishop Museum's *Herbarium Pacificum* (BISH), Honolulu, Hawai'i.

Araceae

Dieffenbachia maculata (Lodd.) Sweet **New island record**

Dieffenbachia maculata, a frequently cultivated plant already collected as naturalized on the islands of Maui and Kaua'i, was found on O'ahu spreading extensively in localized patches in an unmanaged portion of Wahiawā Botanical Garden.

Material examined. **O'AHU**: Wahiawā Botanical Garden, in unmanaged areas west of collection, 21.500577°N, 158.021°W. Upright herb to 3.2 m growing in dense shade. Patch of 6–10 in localized area, occasional in gulch, sometimes forming thickets. Mesic lowland secondary forest, canopy dominated by *Ficus* sp., understory primarily *Odontonema cuspidatum*, *Costus* sp., *Megaskepasma erythrochlamys*, 9 Jul 2012, *OED 2012070904*.

Asclepiadaceae

Dischidia ovata Benth. **New naturalized record**

Native to Queensland and Papuasia, *Dischidia ovata* is an attractive epiphytic plant used only rarely in cultivation. A small patch of it was spotted in an unmaintained portion of a botanical garden on O'ahu. In addition to this patch, garden staff mentioned it had spread to and established in scattered locations in the garden. Description of this species, from the *Flora of Australia* (Forster & Liddle 1996):

> "Vine. Leaves with petiole 2–9 mm long; lamina succulent, ovate, 2–5 cm long, 0.5–3.5 cm wide, rounded at base, apiculate, light green to brownish, cream-mottled on upper surface, not mealy; colleters 2. Inflorescence of 1 or 2 fascicles. Flowers 5–6 mm long, 3.5–4 mm diameter; pedicels 2–3 mm long. Corolla broadly urceolate, white; lobes ovate, c. 2 mm long, 1 mm wide, minutely papillose outside .... Staminal corona lobes stalked with obcordate incurved apices. Follicles 55–65 mm long."

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1. Contribution No. 2013-001 to the Hawaii Biological Survey.
2. Research Associate, Hawaii Biological Survey, Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817-2704, USA.

Material examined. **O‘AHU**: Waimea Valley, 21.634N, 158.058W. Epipetric/epiphytic vine covering a 3 x 3 m area, rooting at nodes and clinging to rock, growing in dappled shade. Leaves thick, medium-green, white along the veins, purple-tinged throughout; flowers tightly packed, bell-shaped, light green to light yellow with orange striations; no fruits seen. No seedlings seen in area. Lowland cultivated setting, up side gulch in unmaintained area, canopy dominated by *Cordia alliodora, Aleurites moluccana, Ficus* sp., understory of *Urochloa maxima,* 23 Oct 2012, *OED 2012102301.*

Cactaceae

Cereus uruguayanus R. Kiesling **New island record**

Cereus uruguayanus, or hedge cactus, native to South America and cultivated worldwide, was found sparingly naturalized in Koko Crater Botanical Garden. It has been found as naturalized previously on Maui and Kaua‘i, and is widespread on the island of O‘ahu. Both the typical and ‘Monstrosus’ forms (typified by its misshapen stems) were seen spreading in the crater.

Material examined. **O‘AHU**: Koko Crater Botanical Garden, near trailhead of Crater Rim Trail, near *Plumeria*. Upright succulent 2 m tall, branches upright or flopping over, tightly clustered and twisted, ‘Monstrosus’ form. Very sparingly naturalized throughout crater, a few large individuals growing on crater slopes. *Leucaena*-dominated mixed-alien scrub, 8 Mar 2012, *OED 2012030802;* Koko Crater Botanical Garden, east side of crater, 21.28669°N, 157.678538°W. Tree cactus with several ascending branches, about 3 m tall, naturalized in crater, with a scattered distribution. Dry lowland *Prosopis/Leucaena* forest, 12 Mar 2012, *A. Lau & D. Frohlich 2012031201*.

Costaceae

Costus scaber Ruiz & Pav. **New island record**

Costus scaber, a species native to Mexico, the West Indies, Central America, and South America, was previously described as naturalizing in a pasture on Kaua‘i (Frohlich & Lau 2012). It was found to be well established in a botanical garden on O‘ahu, spreading in a gulch, downstream from the currently maintained collection. This species has been seen escaping in several other areas of O‘ahu as well.

Material examined. **O‘AHU**: Wahiawā Botanical Garden, down gulch from currently maintained area, 21.501°N, 158.0188°W. Over 50 plants seen in localized area, locally common, forming dense thickets in deep shade, primarily in gulch bottom, no seedlings seen. Lowland mesic secondary forest, canopy dominated by *Ficus* sp., understory primarily *Odontonema cuspidatum, Dieffenbachia maculata*, and *Megaskepasma erythrochlamys,* 28 Jun 2012, *OED 2012062802.*

Cupressaceae

Juniperus bermudiana L. **New island record**

This gymnosperm, previously collected as naturalized from Maui and Lāna‘i, was found on O‘ahu in a disturbed roadside area, as well as in several forested areas off the road.

Material examined. **O‘AHU**: Pālehua Road above second gate in residential area, in *Eucalyptus*-dominated understory, m any plants along road in several places and in forested areas off road, 4 Jun 2012, *US Army 288.*

Euphorbiaceae

Euphorbia ingens E. Mey. ex Boiss. **New naturalized record**

Euphorbia ingens, a succulent tree native to eastern Angola, eastern South Africa, and Swaziland, where it is common in dry montane and wooded grasslands from 10–1600 m elevation (Flora Zambesiaca Online 2011), was found naturalizing throughout Koko Crater Botanical Garden, and is well established on much of the inner crater walls.

Although *E. ingens* is popular as an ornamental in rock gardens in South Africa and the mainland United States, Koko Crater is the only known location for this species in the Hawaiian Islands. This species received a score of 7 (High Risk) on the Hawai‘i-Pacific Weed Risk Assessment (Chimera 2009c). *Euphorbia ingens* is a distinctively large succulent, reaching heights from 4 to as much as 15 m. Terminal branches rebranch to form a large, broadly rounded crown; the terminal branches are fleshy and square in cross-section, with stout wings up to 3 cm wide. Spine shields are corky, 6 x 5 mm, and very obtusely triangular, with stout spines up to about 5 mm long. Leaves are deltoid on older growth and soon deciduous, while oblanceolate leaves can be found on seedlings and young growth. Golden yellow cyathia are clustered in cymes towards the apices of the branches, 1–3 at each flowering eye. Fruit is a 2–3-locular capsule exserted on a stout pedicel 5 mm long. Seeds are grayish brown speckled with paler brown and compressed. [Full description at Flora Zambesiaca Online (2011)].

Material examined. **O‘AHU**: Koko Crater Botanical Garden, crater floor about 10 m off of main path, 21.294°N, 157.678°W. Individuals scattered extensively throughout crater, seedlings/small unbranched plants as well as larger, well-formed trees, very likely an escape from an accessioned plant. Succulent tree 2 m tall, trunk gray with copious milky sap, branching from 1 m above base. Area dominated by *Leucaena leucocephala, Cenchrus ciliaris*, 8 Mar 2012, *OED 2012030803.*

Euphorbia tirucalli L. **New island record**

Euphorbia tirucalli, or Pencil tree, a curiosity plant sometimes seen in home gardens and previously collected as naturalized on the islands of Kaua‘i and Hawai‘i, has now been spotted on O‘ahu spreading sparingly in a local botanical garden.

Material examined. **O‘AHU**: Koko Crater Botanical Garden, NW side of main crater floor, 21.288°N, 157.682°W. Sparingly naturalized in the crater, well scattered, dense thickets forming in areas where its planting status is unclear. Plant 2–3 m tall, a knocked-over tree resprouting. Dry Lowland *Leucaena* forest/shrubland, 22 Mar 2012, *OED 2012032202.*

Fabaceae

Albizia adianthifolia (Schum.) WWight **New state record**

This naturalized record is the first collection of *Albizia adianthifolia* in the state. Over 100 individuals were found in a localized area along a forested roadside on military land. It is possible that this species was originally introduced to the area as a forestry species, since it is known to be used for erosion control and for timber in its native range in tropical Africa (Orwa *et al.* 2009); however, the planting history is unknown. This species is known to be highly adaptable to a range of environmental conditions and occurs most frequently in secondary forest, forest edges, roadsides, and abandoned farmland in its native range (Flora Zambesiaca Online 2011). It received a score of 9 (High Risk) on the Hawaii-Pacific Weed Risk Assessment (Chimera 2009a). Its limited distribution on O‘ahu and high weed ranking make this species an excellent candidate for control.

Albizia adianthifolia can reach up to 30 m in height, and has branchlets covered in dense, rather coarse, rusty pubescence, which sometimes turns gray as the branchlets age. Leaves are pinnate, with 5–8 pairs of pinnae per leaf; leaflet of the two distal pinnae are in 9–17 pairs, mostly about 7–17 $\times$ 4–9 mm, and are rhombic-quadrate to rhombic-oblong. Stipules and bracts at the base of the peduncles are ovate, peduncles are pubescent. Flowers are subsessile, on pubescent pedicels about 1 mm (up to 2 mm) long; corollas are white or greenish white, and pubescent on the inside. Fruit is a flattened, sometimes plicate, pale brown, dehiscent pod. [Full description at Flora Zambesiaca Online (2011)].

Material examined. **O‘AHU**: Schofield Barracks, Kolekole Pass Road. Naturalized in area, over 100 individuals of various size classes. Large tree over 10 m tall with compound leaves, flowers in clusters with exserted staminal tubes, honey fragrance, *Albizia*-type flat pods. Mixed alien tree overstory, *Panicum maximum* understory, 21 Jan 2011, *J. Beachy & K. Kawelo US Army 248.*

Erythrina speciosa Andrews **New naturalized record**

Erythrina speciosa is native to southern Brazil, and has been introduced elsewhere in the world as an ornamental. It has escaped cultivation on Norfolk Island, and is well-adapted to subtropical climates (Green 1994). This self-compatible species has bright red corollas and is primarily pollinated by hummingbirds, although it is capable of being pollinated by a range of taxa, including bees (Vitali-VeigaI & Machado 2000). *Erythrina speciosa* can be differentiated from other species of *Erythrina* by a tubular corolla, where the keel petals are much longer than the wings; both keel and wing petals are auriculate-sagittate at the base. It is a shrubby tree armed with spines, with subterminal, upright inflorescences. Despite its moderate popularity as an ornamental in other parts of the world, in Hawai‘i it is presumably quite rare in cultivation (the only record of it in the *Herbarium Pacificum* prior to this collection is from a local botanical garden). A small naturalized population was found in Pālolo Valley, spreading down a shady gulch. Plants in this population are treelike, some stems growing upright to 8+ m tall, others arching and occasionally trailing along the ground or forming thickets, although the latter is likely due to impacts of flooding in the stream. One local resident reported attempting to control the plant near his yard, with little success. It received a score of 11 (High Risk) on the HP-WRA (Chimera 2009b), and due to its limited distribution, would be an excellent candidate for control.

Material examined. **O‘AHU**: Pālolo Valley, along La‘i Rd, in Pükele Stream, 21.316°N, 157.783°W. Locally naturalized at this site, occasionally forming thickets due to arching branches over stream, likely an escape from cultivation. Lowland wet secondary forest/roadside area, 11 Apr 2012, *M. O’Conner s.n.* (BISH 752430).

Iridaceae

Sisyrinchium exile E.P. Bicknell **New island record**

This species has previously been documented as naturalized on Moloka‘i, Maui, and Hawai‘i Island, and has now been found in open, disturbed areas of a military landing zone on O‘ahu.

Material examined. **O‘AHU**: Schofield East Range, Ku Tree Landing Zone. Mostly open area, growing among *Acacia confusa, Citharexylum caudatum, Andropogon virginicus*. Herbs to ca. 10 cm tall, blades flat, 14 May 2012, *J. Gustine-Lee & J. Beachy US Army 280*.

Moringaceae

Moringa stenopetala (Baker f.) Cuf. **New naturalized record**

This species has been given the common name Cabbage tree, for its use as a leaf vegetable in its presumed native range in Ethiopia and Kenya. It is likely very rare in cultivation in Hawai‘i, perhaps only grown locally in botanical gardens, where it was first collected in 1992. It appears to be relatively rare in general cultivation outside its presumed native range, and information about it as a naturalized species is lacking. It can be distinguished from other members of the family by its tree habit; 2–3-pinnate leaves; irregular, perigynous flowers; leaflets 3.3–6.5 × 1.7–3.3 cm; and fruits 20–57 cm long (Verdcourt 1985). It was seen spreading in a dry lowland botanical garden along the slopes of Koko Crater, locally established with scattered small trees and saplings establishing at least 70 m from planted individuals.

Material examined. **O‘AHU**: Koko Crater Botanical Garden, growing on crater wall with *Leucaena leucocephala* in mixed alien scrub. Small tree about 3.5 m tall. Inflorescences immature, leaves strongly scented, bark smooth and grey, fruits twisted, 12 Mar 2012, *A. Lau & D. Frohlich 2012031202.*

Myrsinaceae

Ardisia kusukusensis Hayata **New state record**

This species as treated here is endemic to Taiwan (Yang & Lu 1998), though it has been treated as a synonym of *Ardisia crenata* Sims by recent floral treatments outside its range (Chen & Pipoly 1994). These two species as seen in Hawai‘i differ significantly in both their descriptions in these floras as well as their morphology, including diagnostic features such as habit and inflorescence characters. It appears to be rarely cultivated worldwide, including in Hawai‘i, where it was very likely introduced as an ornamental at a botanical garden. It was not previously known to be naturalized anywhere else in the world. It has become naturalized on O‘ahu in wet to mesic non-native forest, where scattered individuals are found occasionally both in and well outside of a botanical garden on the windward side. It grows in well-shaded, open understory among *Oplismenus hirtellus* and common weedy tree species such as *Schefflera actinophylla*. It can be distinguished from other species of *Ardisia* in Hawai‘i by its habit as a low-growing, often stoloniferous subshrub to about 30 cm, with very short (1–2 cm long in Hawai‘i) inflorescence branches. A description and key can be found in the *Flora of Taiwan* (Yang & Lu 1998), which is paraphrased here: “Suffrutescent subshrubs ... stems erect, short puberulous when young. Leaves oblanceolate, elliptic, or oblong-obovate, 10–17 cm long, 2.5–3.8 cm wide ... margins crenate, green and glabrous above, grey green and glabrescent beneath; petioles 3–5 mm long, slightly short puberulous when young. Inflorescences umbellate, axillary and/or terminal; peduncle 6–7 mm long, puberulous flowering branches to 10 cm long .... Flowers pinkish or white; calyx lobes linear-triangular ... pedicels ca. 1 cm long, puberulous. Fruit globose, red.”

Material examined. **O‘AHU**: Kāne‘ohe, Likeke Trail, mauka of Ho‘omaluhia Botanical Garden. Low-growing, somewhat woody shrub, mature stems only about 30 cm tall (or less). Inflorescences usually on very short (1–2 cm) side branches, usually leafless but occasionally with leaves; flower petals white, 4- or 5-merous with black dots. Fruit ripening red, single-seeded. Wet/mesic secondary vegetation among *Oplismenus, Psidium cattleianum, Ardisia elliptica*, other common weeds, 17 Jun 2011, *A. Lau & D. Frohlich OED 2011101702*.

Myrtaceae

Eugenia brasiliensis Lam. **New island record**

This species has previously been recorded as naturalized on Maui and Hawai‘i islands, establishing in at least wet disturbed sites. It is not common in cultivation on O‘ahu, and may not have been planted in forest reserves (not recorded in Skolmen [1980]), yet was found established in what appeared to be one rather extensive population in lowland, mesic to wet, non-native forest in the southern Ko‘olau Mountains.

Material examined. **O‘AHU**: On ridge between Pauoa and Nu‘uanu Valleys, at about 395 m (1300 ft) elev, mesic to wet lowland non-native forest, 5 Apr 2012, *T. Marsh 20120405Misspe.*

Poaceae

Schizachyrium condensatum (Kunth) Nees **New island record**

This name had previously been misapplied to populations of *Andropogon glomeratus* (Walter) Britton, Sterns & Poggenb. var. *pumilus* (Vasey) L.H. Dewey on O‘ahu (Snow & Lau 2010), and although it has been recorded as an invasive species on Hawai‘i Island and is thoroughly naturalized on Kaua‘i, it was not known to occur on O‘ahu until the collection documented here. It was found along non-public, military access and/or training roads in open, disturbed roadside areas in Schofield Barracks East Range, from at least two relatively small, disjunct populations. These dirt roads are subject to occasional soil movement through road widening and maintenance activities, which may make for an additional dispersal mechanism. It has been targeted for control with the goal of eradication.

Material examined. **O‘AHU**: Schofield Barracks East Range, on road leading up to Schofield-Waikāne Trail, roadside through mixed native/non-native forest, ca. 425 m (1400 ft) elev. Caespitose grass 1 m tall, 27 Feb 2012, *J. Beachy US Army 268*.

Urochloa decumbens (Stapf) R.D. Webster **New island record**

This species has previously been documented as naturalized on Hawai‘i, Kaho‘olawe, and Kaua‘i islands. It is documented here as naturalized in open, highly disturbed areas at a military landing zone on O‘ahu.

Material examined. **O‘AHU**: Schofield Barracks East Range, at “Lower 72” landing zone. Weedy, open area cleared for landing zone operations, surrounding area is mesic mixed native/non-native forest. Grass 0.5 m tall, 15 Mar 2012, *J. Beachy, J. Hawkins, M. Akiona, D. Frohlich & A. Lau US Army 272.*

Polygonaceae

Homalocladium platycladum (F. Muell.) L.H. Bailey **New naturalized record**

Common names for this species include Ribbon bush or Centipede plant, in reference to the appearance of the segmented, flat stems of this plant. It is native to the Solomon Islands, but is now grown in tropical areas worldwide as an accent plant. It has escaped cultivation and become naturalized in some tropical areas. It was introduced to Hawai‘i by 1917 (Staples & Herbst 2005), where it is at least occasional in cultivation, but until now has not been recorded as naturalized here. This species is readily distinguished from other members of Polygonaceae in Hawai‘i by its habit as a mound-forming shrub, and especially by its flattened, ribbon-like stems that appear jointed. Its leaves appear on young shoots and are soon deciduous. The fruit is a smooth, triangular achene enclosed in a fleshy, deep red to purplish floral receptacle (Staples & Herbst 2005). It was collected here naturalized in mesic secondary forest adjacent to sites of home cultivation, most likely as a garden escape.

Material examined. **O‘AHU**: Pālehua, on road leading to Mike Myers’ house and abandoned house area, growing with *Eucalyptus* sp. and introduced grasses in understory. Flat, somewhat succulent plant to 2.5 m tall, no flowers or fruit, 24 Jul 2012, *OISC 2012072401*.

Polypodiaceae

Drynaria rigidula (Sw.) Bedd. **New naturalized record**

One common name applied to this species is Basket fern, presumably in reference to its habit of catching significant amounts of plant material at its base wherever this epiphytic fern establishes along tree trunks and branches. Although it is cultivated in and outside its native range (which includes Australia, Malaysia, and some Pacific islands), it apparently

has not previously been documented as naturalized anywhere else in the world. In Hawai‘i it seems to be rare in cultivation, perhaps only found in botanical gardens. It is documented here as escaping from cultivation throughout secondary forest and on planted botanical garden tree species in Wahiawā on O‘ahu. It is distinguished from other members of the genus by having fully pinnate foliar fronds (stalked pinnae). Further description from the *Flora of Australia* is paraphrased here: “Rhizome c. 1 cm thick, deciduous-scaly .... Nest fronds narrowly ovate to ovate, 4–39 cm or more long, 3.5–14 cm wide, shallowly or deeply lobed; lobes rounded. Foliage fronds 20–120(–200) cm long .... Lamina narrowly ovate, 1-pinnate; pinnae linear, 4–25 cm long, 0.4–3 cm wide ... with a short narrowly winged stalk ... margins shallowly incised (1 incision between each pair of main lateral veins) .... Sori round, 1–2 mm diam ... impressed into the laminal surface, producing small rounded protuberances on the upper surface.” (Bostock & Spokes 1998)

Material examined. **O‘AHU**: Wahiawā Botanical Garden, Hawaiian section. UTM 601689, 2378186. Mesic lowland botanical garden setting in open area, canopy of *Hibiscus* cf. *arnottianus*. Epiphytic fern with rhizome curling around branch, ca 30 cm tall. Fronds green, basal shield fronds light green when young, quickly becoming dry, light brown, papery, persistent, 12 Jun 2012, *D. Frohlich & A. Lau 2012071201*.

Tiliaceae

Grewia truncata Mast. **New naturalized record**

This species from southeastern Africa was first collected in Hawai‘i in 1992 from an O‘ahu botanical garden. It is apparently very rare if at all cultivated elsewhere in the world, and therefore has very little information available about weed behavior. It is likely very rare in cultivation in Hawai‘i, possibly limited to the botanical garden where it was first collected. Though it occasionally forms dense thickets in its native range, where it is most commonly found in riparian areas (Flora Zambesiaca Online 2011), it was seen naturalized on O‘ahu with a very scattered, low-density distribution over a large area in a dry, lowland tuff cone crater among *Leucaena leucocephala* scrub vegetation. It can be distinguished from other species of *Grewia* in Hawai‘i by its oblong or obovate-oblong leaves with a retuse to truncate apex; white sepals (1.5–2.5 cm long) and petals (10–16 mm long); and relatively large (1.5 cm diam), deeply 4-lobed fruit (Flora Zambesiaca Online 2011). A full description and keys to the genus are currently available at Flora Zambesiaca Online (2011).

Material examined. **O‘AHU**: Koko Crater Botanical Garden. Saplings, seedlings, matures scattered along slope above Madagascar section in *Leucaena*-dominated scrub. Shrub ca. 2 m tall, sepals white inside, petals less conspicuous, white, curled down, flowers mildly fragrant mid-day, some fruits persisting, dry, deeply lobed, 12 Mar 2012, *D. Frohlich & A. Lau 2012031204*.

Urticaceae

Laportea aestuans (L.) Chew **New state record**

Laportea aestuans, a species that had not been known to be in the state until it was collected by the Hawaii Department of Agriculture (HDOA) staff, has been found in several nurseries on the windward side and North Shore of the island of O‘ahu, and on Hawai‘i Island. It is believed to be popping out of potting mix, but it is still unclear where the soil may have originated (B. Azama, 2012, HDOA, pers. comm.). *Laportea aestuans* is an agricultural weed, invading banana plantations in its native range of Central America and the West Indies, and is naturalized in Florida. It is shade tolerant, matures rapidly, reproduces prolifically, and is covered in stinging hairs (Clifford 2009). *Laportea aestuans* is an annual herb,

about 1–10 dm tall, with sparse to dense stinging hairs and stipitate, non-stinging glandular hairs. Leaf bases are rounded to abruptly attenuate or auriculate, and margins are regularly serrate or toothed. Inflorescences are in panicles; female flowers are appressed, with a persistent hooked, beaklike style that becomes knoblike in fruit. Fruits are strongly compressed, and more or less orbicular, about 0.9 × 1.3 mm (Boufford 1997). HDOA staff are working with nurseries to ensure this species is being controlled where found.

Material examined. **O‘AHU**: Waimānalo, in a nursery. Naturalized, somewhat established at this site, seen at another Waimānalo nursery as well. Upright herb to ca. 1 m, leaves variable in size, up to ca. 15 cm. Flowers greenish, held on upper side of inflorescence branches. Fruits appearing tan-colored. Stinging hairs not causing noticeable reaction to collectors, 3 May 2012, *D. Arakaki s.n.* (BISH 752428).

Pilea hyalina Fenzl **New state record**

Pilea hyalina, a species in the Urticaceae that lacks stinging hairs, was reported to the Hawai‘i Department of Agriculture by a nursery grower on the Big Island, where it was found growing in the pots of plants shipped from Costa Rica (B. Azama, 2012, pers. comm.). It grows from sea level up to 1800 m in its native range in Central America and is a weed of coffee plantations in Guatemala. The only known record of it as a weed (other than this record from Hawai‘i) is from Belgium, where it is occasionally seen naturalizing in greenhouses. *Pilea hyalina* is shade tolerant, can form thickets in the understory of forests, and has very small seeds that can easily be accidentally introduced. This annual herb has angulate, hyaline stems with elliptic cystoliths (frequently obscure); the leaves are ovate to nearly rhomboid with serrate margins, membranous to sub-chartaceous, with three nerves from the base, and lateral nerves that are visible for 3/4 or more of the leaf length, never reaching the leaf apex. Inflorescences are axillary, 1–2 per axil, and bisexual, bearing 1–7 staminate and 30–330 pistillate flowers. The fruit is a sub-compressed, ovoid achene, 0.5–0.7 mm long (Monro 2009).

Material examined. **HAWAI‘I**: Kea‘au, volunteer plant in nursery, growing in container with potted palm. Herb ca. 30 cm long, stems fleshy, no stinging hairs, flowers minute, clustered in leaf axils, fruit present, 1 Apr 2012, *K. Onuma& R. Kihara s.n.* (BISH 751164).

Zygophyllaceae

Guaiacum sanctum L. **New naturalized record**

The common name Holywood lignum-vitae has been applied to this species, whose native range includes Florida and parts of the Caribbean and Central America. It does not appear to be intensively cultivated outside of its native range, and seems to be very rare in Hawai‘i. It was found spreading from a few cultivated individuals in Koko Crater to shaded *Leucaena* and *Prosopis*-dominated areas of dry lowland alien forest on the crater floor. It is also reported to be spreading to open sites along the inner crater walls. This species can be distinguished from the similar-looking *G. officinale* by having more leaflets (6–10) with acute apices (rounded in *G. officinale*) (Staples & Herbst 2005).

Material examined. **O‘AHU**: Koko Crater Botanical Garden, near Cacti/Americas section. Dry Lowland *Prosopis/Leucaena* forest. Small tree/shrub 3 m tall, with spreading branches. Corolla light lavender, in pairs, 29 Mar 2012, *A. Lau & D. Frohlich 2012032901*.

Species showing signs of naturalization

Apocynaceae

Acokanthera schimperi (A. DC.) Schweinf.

Acokanthera schimperi is an economically important plant in Africa, used for ornamental purposes as well as for medicine and as a powerful poison for killing wild animals and stray dogs. On O‘ahu, it is only known from Koko Crater and Foster Garden. This is the first specimen of this species to have been submitted to the Bishop Museum’s *Herbarium Pacificum*. A few individuals of this species were found spreading from planted sites in a local botanical garden, and the species was recommended for removal to prevent its further spread.

Material examined. **O‘AHU**: Koko Crater Botanical Garden, 21.2844°N, 157.6803°W. Spreading in garden, but so far rare. Shrub ca. 2.5 m tall, growing on rock. Leaves glossy, flowers small, white, few, no fruits seen. *Ficus microcarpa*, *Grewia micrantha* overstory, 12 Mar 2012, *OED 2012031206.*

Araceae

Anthurium urbanii Sodiro

This record describes the first specimen of this species to be submitted to the Bishop Museum’s *Herbarium Pacificum*. A single individual was found in a thicket of *Arthrostemma ciliatum* in dense shade well off of a local hiking trail. It is unclear how it got to that location, but it appears not to have been planted.

Material examined. **O‘AHU**: Windward O‘ahu, Kāne‘ohe, off portion of Likeke Trail, 21.3834°N, 157.8115°W. Single individual apparently naturalized among a thicket of *Arthrostemma ciliatum,* in more or less dense shade. Herb 4.5 ft tall with above-ground prop roots. Broken stem initially white, becoming orange when oxidized. Leaf blades glossy green, ca. 0.75 m long, 0.5 m wide, basal lobes overlapping, heart-shaped, with acuminate tips, petiole reddish orange at point of attachment to blade. Peduncle 0.5 m long, spathe light green with purplish markings, curling. Lowland mesic to wet secondary forest understory, 17 Oct 2011, *OED 2011101701.*

Bombacaceae

Pachira aquatica Aubl.

Pachira aquatica, or Guiana chestnut, a species sometimes grown in Hawai‘i as a food source or ornamental (Staples & Herbst 2005)*,* was seen spreading downhill from a small grouping of mature plants. Hundreds of seedlings were spotted in the area along the side of a hiking trail. This is the first record of *P. aquatica* spreading in Hawai‘i. It is unclear whether this species was originally planted in this area, but the number of adventive seedlings was notable.

Material examined. **O‘AHU**: Kāne‘ohe, Likeke Trail, 21.379N, 157.810W. From grouping of 6–10 mature plants 10–15 ft tall with hundreds of seedlings underneath less than 30 cm tall, not spreading beyond the immediate area around matures. Flowers seen on ground, fruit immature. Growing with *Dicranopteris linearis, Oplismenus hirtellus, Clidemia hirta,* 17 Oct 2011, *OED 2011101704.*

Cactaceae

Peniocereus hirschtianus (K. Schum.) D.R. Hunt

This species is not known from cultivation worldwide, and it is rarely seen in its native range in Central America (N Taylor, 2012, Singapore Botanic Gardens, pers. comm.). It was spreading along the crater walls in Koko Crater Botanical Garden, but it was unclear

whether it had been planted in this area. The following description of the species is taken from a description of *Nyctocereus guatemalensis*, which is now considered a synonym of *Peniocereus hirschtianus*, from Britton and Rose (1913):

> "Stems half-erect, arching, creeping, or even prostrate, 3 to 6 cm. in diameter: ribs 8 to 12, very low; radial spines about 10; centrals 3 to 6, usually much longer than the radials, the longer ones 3 to 4 cm. long; flowers very fragrant, 4 to 5 cm. long; ovary somewhat tuberculate, each tubercle crowned by an areole bearing a cluster of pinkish or brownish spines; outer sepals brownish; petals lanceolate, acute, nearly white; stamens much shorter than the petals, attached all along the surface of the wide throat; style stout, 3 cm. long; fruit small (about 2 cm. long), spiny; seeds black, shining, 3 mm. in diameter."

Material examined. **O'AHU**: Koko Crater Botanical Garden, 21.284°N, 157.682°W. Scattered distribution in open rocky areas, dry lowland exposed rocky ridge. Sprawling cactus, stems arching or lying on ground. Stems flat green, ribs strongly compressed, spines usually grey. Flowers open in morning, sweetly fragrant, petals white on inner surface, filaments white, anthers and stigma cream-colored, 22 Mar 2012, *OED 2012032205.*

Euphorbiaceae

Synadenium grantii Hook.f.

Synadenium grantii, a hardy member of the Euphorbiaceae, was seen spreading sparingly near a farm on O'ahu. The two individuals found did not appear to have been planted in the area, but the population is so far not self-perpetuating.

Material examined. **O'AHU**: Wahiawā, Waihī Farms, among roadside shrubbery. Two plants in area, no seedlings or saplings found. Tree 20–30 ft tall with hanging branches, 22 Nov 2011, *OISC 2011112201.*

Fabaceae

Acacia robusta Burch. subsp. ***clavigera*** (E. Mey.) Brenan

This African species of *Acacia* was previously unknown to occur in Hawai'i, and is perhaps only growing in one botanical garden on O'ahu. It commonly forms 6 cm-long stipular spines that can persist in dense aggregations on trunks and branches, particularly on young trees. It was seen spreading sparingly from planted sites where 2 young trees were establishing by seed, one of them at significant dispersal distance. Removal of this species was recommended to garden staff.

Material examined. **O'AHU**: Koko Crater Botanical Garden. Tree 6 m tall with drooping branches, some touching the ground, growing in a cleared area with *Prosopis pallida*. Total of 3–4 cultivated trees, 2 or more adventive saplings/small trees. Stipular spines ranging from less than 1 cm to 7 cm, some persisting on trunk and major branches. Flowers fragrant, filaments white. Leaves and flowers arising from callused, cushion-shaped leaf axils. Pods dehiscent on tree, seeds hanging from arils, 12 Mar 2012, *D. Frohlich & A. Lau 2012031205*.

Lauraceae

Neolitsea cassia (L.) Kosterm.

A single mature tree of this very rarely planted species in Hawai'i was found along a trail at great distance from what is presumed to be a parent plant at a nearby botanical garden in windward O'ahu, growing in wet lowland alien forest. It is possible that a more extensive population of this species exists in the area, as off-trail surveys for this species have not yet been performed.

Material examined. **O'AHU**: Kāne'ohe, Likeke trail near Wilson Tunnel. Lowland wet forest/*Dicranopteris linearis*, with *Pachira aquatica, Schefflera actinophylla*. Tree to 6 m tall, trunk

straight. Leaves glossy green above, pale/glaucous below. Immature fruit green, 17 Oct 2011, *A. Lau & D. Frohlich 2011101703*.

Orchidaceae

***Dendrobium* 'Jaquelyn Thomas'** hybrid

A single individual of what belongs to a complex hybrid of *Dendrobium* species was found well away from any sites of cultivation in native forest in the Wai'anae Mountains. Various hybrids of this complex are common in general cultivation. Further off-trail surveys may reveal a greater population size, though it may be just as likely this is either a rare event of spread, or the population covers an extremely large area at very low density.

Material examined. **O'AHU**: West Makaleha, off of trail to Three Points exclosure, 730 m (2400 ft) elev, growing as an epiphyte next to *Polystachia concreta* on nearly dead *Antidesma platyphylla*, 13 Oct 2011, *K Kawelo US Army 235.*

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Literature Cited

Bostock P.D. & Spokes, T.M. 1998. *Drynaria. Flora of Australia* **48**: 474–478.

Boufford, D.E. 1997. *Laportea*. *Flora of North America* **3**: 405–406.

Britton, NL. & Rose, J.N 1913. Studies in Cactaceae–I. *Contributions from the U.S. National Herbarium* **16**(7): 239–242.

Chen, J. & Pipoly III, J.J. 1994. *Ardisia*. *Flora of China* **15**: 10–29.

Chimera, C. 2009a. *Albizia adianthifolia*. Hawai'i-Pacific Weed Risk Assessment. Available from: http://www.hear.org/pier/wra/pacific/Albizia_adianthifolia.pdf. [Last accessed: 1 Feb 2013]

———. 2009b. *Erythrina speciosa*. Hawai'i-Pacific Weed Risk Assessment. Available from: http://www.hear.org/pier/wra/pacific/Erythrina%20speciosa.pdf [Last accessed: 1 Feb 2013]

———. 2009c. *Euphorbia ingens*. Hawai'i-Pacific Weed Risk Assessment. Available from: http://www.hear.org/Pier/wra/pacific/Euphorbia%20ingens.pdf [Last accessed: 1 Feb 2013]

Clifford, P. 2009. *Laportea aestuans*. Hawai'i-Pacific Weed Risk Assessment. Available from: http://www.hear.org/pier/wra/pacific/Laportea%20aestuans.pdf [Last acces-

sed: 6 Feb 2013]

Flora Zambesiaca Online. 2011. Royal Botanic Gardens, Kew. Available from: http://apps.kew.org/efloras/search.do. [Last accessed: 6 Feb 2013]

Forster, **P**.**I**. **& Liddle**, **D**.**J**. 1996. *Dischidia*. *Flora of Australia* **28**: 237–240.

Frohlich, **D**. **& Lau**, **A**. 2012. New plant records for the Hawaiian Islands. *Bishop Museum Occasional Papers* **113**: 27–54.

Green, **P**.**S**. 1994. *Erythrina*. *Flora of Australia* **49**: 180–181.

Monro, **A**.**K**. 2009. *Pilea*. *Flora Mesoamericana* website. Available from: http://www.tropicos.org/Project/FM. [Last accessed: 6 Feb 2013]

Orwa, **C**., **Mutua**, **A**., **Kindt**, **R**., **Jamnadass**, **R**. **& Simons**, **A**. 2009. Agroforestree database: a tree reference and selection guide version 4.0. Available from: http://www.worldagroforestry.org/af/treedb/. [Last accessed: 6 Feb 2013]

Skolmen, **R**.**G**. 1980. Plantings on the forest reserves of Hawaii 1910–1960. Honolulu, Institute of Pacific Islands Forestry, U.S. Forest Service. 481 pp.

Snow, **N & Lau**, **A**. 2010. Notes on grasses (Poaceae) in Hawai‘i. *Bishop Museum Occasional Papers* **107**: 46–60.

Staples, **G**.**W & Herbst**, **D**.**R**. 2005. *A tropical garden flora.* Bishop Museum Press, Honolulu. xxiv + 908 pp.

Verdcourt, **B**. 1985. A synopsis of the Moringaceae. *Kew Bulletin* **40**(1): 1–23 + ix.

Vitali-VeigaI, **M**.**J**. **& Machado**, **V**.**L**.**L**. 2000. Flowering visitors of *Erythrina speciosa* Andr., Leguminosae. *Revista Brasileira de Zoologia* **17**(2): 369–383.

Wagner, **WL**., **Herbst**, **D**.**R**. **& Sohmer**, **S**.**H**. 1999. *Manual of the flowering plants of Hawai‘i*. Revised edition. 2 vols. University of Hawai‘i Press and Bishop Museum Press, Honolulu. 1919 pp.

Yang, **Y-P**. **& Lu**, **S**.**-Y**. 1998. *Ardisia*. *Flora of Taiwan* **4**: 40–47.

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New Hawaiian plant records for 2012[1]

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In this paper, ten new island records in six plant families are reported; all are introduced non-native taxa. Eight are dicotyledonous angiosperms, and three are monocots. Collections were made on Moloka'i, Lāna'i, and Maui. Information regarding the historic distribution of flowering plants is based on the *Manual of flowering plants of Hawai'i* (Wagner *et al*. 1999) and information subsequently published in the *Records of the Hawai'i Biological Survey* (1994–present). Voucher specimens are deposited at Bishop Museum *Herbarium Pacificum* (BISH), Honolulu, with duplicates at the National Tropical Botanical Garden (PTBG), Lawa'i, Kaua'i.

Acanthaceae

Sanchezia speciosa Leonard **New island record**

An ornamental herb first reported from Kaua'i (Lorence *et al*. 1995: 20) to be spreading vegetatively in a low elevation mesic site, and later from Hawai'i (Parker & Parsons 2012: 65). On Maui it is sparingly naturalized in remnant *hala (Pandanus tectorius)* Forest invaded by dense monotypic stands of *Ardisia elliptica*. It was also observed in several roadside locations in Hana District, some of which may be escapes from cultivation or neglected plantings.

Material examined. **MAUI**: East Maui, Hana District, east side of Hanawi Stream, Honolulunui, 31 m, 13 Aug 2012, *Oppenheimer & Bustamente H81219*.

Asteraceae

Montanoa hibiscifolia Benth. **New island record**

An ornamental shrub naturalized in dry to mesic, disturbed sites on Kaua'i, O'ahu, Lāna'i, Kaho'olawe, Maui, and Hawai'i (Wagner *et al.* 1999: 345; Starr & Starr 2011: 24), tree daisy is also locally naturalized on Moloka'i. The Moloka'i Invasive Species Committee staff has initiated eradication efforts.

Material examined. **MOLOKA'I**: Kahanui, S of Kauluwai, 430 m, naturalized at old homestead, 30 Mar 2010, *Oppenheimer, L. Buchanan, K. Pali, & S. Aruch H31011*

Picris hieracioides L. **New island record**

Previously documented from Moloka'i, Lāna'i, and Hawai'i (Wagner *et al*. 1999: 350; Oppenheimer 2008: 24) this herb was found growing in a mesic shrubland area that had burned three years prior.

Material examined. **MAUI**: West Maui, Lahaina District, slopes of Helu, 1052 m, 16 Feb 2010, *Oppenheimer et al. H21005.*

Senecio madagascariensis Poir. **New island record**

Fireweed is known from Kaua'i, O'ahu, Lāna'i, Kaho'olawe, Maui, and Hawai'i islands (Lorence *et al*. 1995: 24; Starr *et al.* 1999: 11; Oppenheimer & Bartlett 2002: 4; Herbst *et*

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al. 2004: 4; Starr *et al.* 2006: 33). On Moloka‘i it was recently found in a pasture near Kalae (B. Garnett, pers. comm.). A single plant was found on the eastern south slope in remnant *Diospyros* Forest, and there are reports of other locations but no specimens have been collected. The Moloka‘i Invasive Species Committee is responding to this new threat to island livestock as it is poisonous to cattle and horses.

Material examined. **MOLOKA‘I**: Keawanui, 600 m, single plant in dense shade near gulch bottom, 11 Apr 2012, *Oppenheimer, Perlman & Coelho H41209.*

Tithonia diversifolia (Hemsl.) A. Gray **New island record**

Originally grown in Hawai`i as an ornamental, now naturalized in low elevation sites on Kaua‘i, O‘ahu, Maui, and Hawai‘i islands (Wagner *et al*. 1999: 370), tree marigold was recently collected outside of cultivation on Lāna‘i.

Material examined. **LĀNA‘I**: Lāna‘i City, south end of Queens Street, 500 m, naturalized, forming small patches and scattered plants in overgrown grassy area, 28 Nov 2012, *Oppenheimer & Perlman H111230.*

Orchidaceae

***Epidendrum* × *obrienianum* Rolfe** **New island record**

A hybrid dating back to 1888, and popular in cultivation, sometimes becoming naturalized, this orchid has been known from Kaua‘i, O‘ahu, Lāna‘i, Maui, and Hawai‘i islands (Wagner *et al*. 1999: 1472). It was recently collected on Moloka‘i.

Material examined. **MOLOKA‘I**: Keawanui, 800 m, terrestrial in windswept, short-statured *Metrosideros/ Dicranopteris* shrubland, 11 Apr 2012, *Oppenheimer, Perlman, & Coelho H41208.*

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

First collected on O‘ahu (Staples *et al*. 2003: 17), this epiphyte had not been previously documented in Hawai‘i. On West Maui, it is found growing 1.5–3.0 m above ground level, mostly on *Dodonaea viscosa* Jacq., and less frequently on *Metrosideros polymorpha* Gaudich., in degraded *Metrosideros/Dicranopteris* Lowland Wet Forest. As on O‘ahu, the site is also in the vicinity of a hiking trail but is obviously not under cultivation. All size classes are present. It has also been observed recently in Hilo (F. Duvall, pers. comm.). *Polystachya* Hook. is a genus of 150–200 species (LaCroix 2008: 376), and *P. concreta* is possibly the most widespread orchid known (Shuttleworth *et al.* 1989: 83), with its distribution reported to be Brazil to Florida and the Caribbean, Africa, and parts of Asia (Pridgeon 2006: 238). As such, it apparently has the potential to be weedy, and its distribution in Hawai‘i seems to support this assumption.

Material examined. **MAUI**: West Maui, Lahaina Distr, Pu‘u Ka‘eo, between Honolua Valley & Mokupe‘a Gulch, 396 m, epiphytic on dying *Dodonaea viscosa*, 7 Aug 2010*, J. Ward & K. Marchello 1* (BISH); leeward slope of Pu‘u Ka‘eo, 500 m, 3 Sep 2010, *Oppenheimer H91005*.

Poaceae

Tragus berteronianus Schult. **New island record**

This annual grass has been documented in Hawai‘i from O‘ahu, Moloka‘i, Maui, and Kaho‘olawe along roadsides and in arid disturbed sites (Wagner *et al.* 1999: 1601; Snow & Davidse 2011: 20). This is consistent with observations and collections from Lāna‘i.

Material examined. **LĀNA‘I**: Manele, near Leinohaunui Pt, 10 m. Naturalized in sandy soil under *kiawe* trees. 17 Feb 2011, *Oppenheimer H21114.*

Solanaceae

Physalis angulata L. **New island record**

Naturalized in disturbed sites on Kauaʻi, Oʻahu, Molokaʻi, and Hawaiʻi (Wagner *et al*. 1999: 1265; Imada *et al*. 2000:15; Oppenheimer 2003: 26; Staples *et al.* 2006: 8), this annual herb was recently collected on Lānaʻi.

Material examined. **LĀNAʻI**: north side rim of Maunalei Gulch, south of Keomuku Rd, Hinuhinu Pali, 150 m. Naturalized on rocky soil in degraded *Dodonaea* Dry Shrubland. 16 Feb 2011, *Oppenheimer H21109.*

Zygophyllaceae

Tribulus terrestris L. **New island record**

Known from Kauaʻi, Oʻahu, Molokaʻi, Maui, and Hawaiʻi Islands (Wagner *et al*. 1999: 1344; Oppenheimer 2003: 27) where it is sparingly naturalized in low elevation sites, often in sandy soils. This is consistent with observations of puncture vine on Lānaʻi.

Material examined. **LĀNAʻI**: Manele, near sea level, 17 Feb 2011, *Oppenheimer H21113.*

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Literature Cited

Herbst, **D**.**R**., **Staples**, **G**.**W & Imada**, **C**.**T**. 2004. New Hawaiian plant records for 2002–2003. *Bishop Museum Occasional Papers* **78**: 3–12.

Imada, **C**.**T**., **Staples**, **G**.**W & Herbst**, **D**.**R**. 2000. New Hawaiian plant records for 1999. *Bishop Museum Occasional Papers* **63**: 9–16.

LaCroix, **I**. 2008. *The new encyclopedia of orchids.* Timber Press, Portland. 524 pp.

Lorence, **D**.**H**., **Flynn**, **T**.**W & Wagner**, **WL**. 1995. Contributions to the flora of Hawaiʻi. III. *Bishop Museum Occasional Papers* **41**: 19–58.

Oppenheimer, **H**.**L**. 2003. New plant records from Maui and Hawaiʻi counties. *Bishop Museum Occasional Papers* **73**: 3–30.

———. 2008. New Hawaiian plant records for 2007. *Bishop Museum Occasional Papers* **100**: 22–38.

———. **& Bartlett**, **R**.**T**. 2002. New plant records from the main Hawaiian Islands. *Bishop Museum Occasional Papers* **69**: 1–14.

Parker, **J**.**L**. **& Parsons**, **B**. **2012**. New plant records from the Big Island for 2010–2011. *Bishop Museum Occasional Papers* **113**: 65–74.

Pridgeon, **A**. ed. 2006. *The illustrated encyclopedia of orchids.* Timber Press, Portland. 304 pp.

Shuttleworth, **F**.**S**., **Zim**, **H**.**S**. **& Dillon**, **G**.**W** 1989. *Orchids.* Rev. ed. Golden Press, New York. 160 pp.

Snow, **N & Davidse**, **G**. 2011. Notes on grasses (Poaceae) in Hawaiʻi: 3. *Bishop Museum Occasional Papers* **110**: 17–22.

Staples, **G**.**W**, **Imada**, **C**.**T**. **& Herbst**, **D**.**R**. 2003. New Hawaiian plant records for 2001. *Bishop Museum Occasional Papers* **74**: 7–21.

———. 2006. New Hawaiian plant records for 2004. *Bishop Museum Occasional Papers* **88**: 6–9.

Starr, **F**., **Martz**, **K**. **& Loope**, **L**.**L**. 1999. New plant records from east Maui for 1998.*Bishop Museum Occasional Papers* **59**: 11–15.

———. **Martz**, **K**. **& Loope**, **L**.**L**. 2006. New plant records from the Hawaiian Archipelago. *Bishop Museum Occasional Papers* **87**: 31–43.

———. **& Starr**, **K**. 2011. New plant records from Midway Atoll, Maui, and Kaho‘olawe. *Bishop Museum Occasional Papers* **110**: 23–35.

Wagner, **WL**., **Herbst**, **D**.**R**. **& Sohmer**, **S**.**H**. 1999. *Manual of the flowering plants of Hawai‘i*. Revised edition. 2 vols. University of Hawai‘i Press & Bishop Museum Press, Honolulu. 1919 pp.

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Freshwater algae associated with high elevation bogs in the Hawaiian Islands[1]

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As part of the Hawaiian Freshwater Algae Biodiversity Survey (2009–2012) we have been documenting algae (with a focus on macroalgae) associated with numerous habitats, including high elevation bogs on the main Hawaiian Islands. Bogs represent a very different environment from streams, where most of our collections originated, in that they have much lower (or absent) water flow, lower temperatures due to high elevation, and usually acidic pH conditions. This paper provides an updated taxonomic checklist for high elevation bog-associated algae in Hawai'i and compares our identifications to historical literature records.

Hawaiian bog ecosystems are characterized as small, isolated and permanently wet areas, which tend to be scarce (only 1–2 present on each large island), consisting of hummocks of native sedges and dwarf individuals of native plant species (Ziegler 2002). In general, bogs represent acidic, dystrophic environments that have a very characteristic littoral flora (Wetzel 2001). It has long been recognized that bogs host a diverse and interesting biota. The microflora of this habitat is typically characterized by a great diversity of algal species, although few of these are ubiquitous. Amongst the algae, desmids are typically species-rich in bog habitats (often several hundred species), while cyanobacteria, chrysomonads, dinoflagellates and diatoms are typically present though less diverse (Wetzel 2001).

The algal flora of Hawaiian bogs has not been studied in great detail. As far back as the early 1900s it was recognized that high elevation bogs likely harbored interesting species, and that further taxonomic attention was due:

> "It is to be regretted that the algal flora of the summit bogs has not received careful investigation." (MacCaughey 1918a, p. 55)

Since that time, very few algal collections have been made from these habitats in the Hawaiian Islands. Filkin *et al.* (2003) reported a survey of stream macroalgae from Hawai'i and included four sites from the Alaka'i Swamp on Kaua'i; seven species in total were recorded, including the green alga *Microspora pachyderma* (Wille) Lagerheim,

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which was a new record for the Hawaiian Islands and was common to three of the four sites from the Alakaʻi Swamp. Likewise, Main (2004) documented the diatoms of a stream draining the Alakaʻi Swamp and described three new taxa (*Eunotia abbottiae* Main, *E. smithiae* Main and *Actinella punctata* var. *alakaiensis* Main). Aside from these few reports, however, very little has been published recently.

Specimens examined for this study were collected by the authors and other members of the Freshwater Algal Biodiversity group (Dr. Rex Lowe, Bowling Green State University; Dr. Pat Kociolek and Carrie Graeff, University of Colorado; Dr. Jeff Johansen and Melissa Vaccarino, John Carroll University) between July 2009 and November 2010. Samples of microalgae from the sediment surface as well as visible macroalgae (free floating or attached) were collected from high elevation bogs on the islands of Kauaʻi, Oʻahu, Molokaʻi and Hawaiʻi. Samples were collected using either long-handled forceps or a turkey baster. Although macroalgae were targeted in the survey, microalgae were identified when collected in quantity. Identifications were made using taxonomic literature most pertinent for each lineage (see Sherwood 2006 for a list of taxonomic references). Sherwood Lab accession numbers (ARS) are given in Table 1 to enable data for each sample to be accessed *via* the Hawaiian Freshwater Algae Database (*http://algae.manoa.hawaii.edu/hfwadb/*). Microscope slides have been accessioned at the Bernice P. Bishop Museum (BISH) for representative specimens from our own survey collections, and those accession numbers are also included in Table 1. Algal taxonomy was updated following AlgaeBase (Guiry & Guiry 2012).

Some trends were observed from our checklist of freshwater algal flora of Hawaiian bogs, which was assembled from both literature records and our own identifications (Table 1). Species richness was dominated by the green algae (especially the desmids) and cyanobacteria, but a few other groups were also encountered. Thirteen cyanobacteria, 86 green algae, one yellow-green alga, one euglenoid and four diatoms were reported in total (Table 1); these total 105 taxonomic records. Records from the literature only comprised 58.1% of the total, while 37.1% were from our collections only and 4.8% were shared.

Given the isolation of these unique habitats and the native or endemic vascular plants that characterize Hawaiian bogs, it is likely that endemic species of algae are present as well. Many of the macroalgal species are being studied in greater detail using molecular methods as part of the ongoing research of the Hawaiian Freshwater Algae Biodiversity Survey, and this comparative work will allow further insight into the origins and degree of genetic isolation of the Hawaiian high elevation bog algal flora. In addition, many microalgae were encountered that could not be confidently identified and were not included in the checklist. The total diversity of algae occurring in these habitats probably exceeds the list provided below.

Acknowledgments

We thank our freshwater algal colleagues for their field assistance, intellectual stimulation and algal expertise. This research was supported by a grant from the National Science Foundation (DEB-0841734). Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Literature Cited

Filkin, **NR**., **Sherwood**, **A**.**R**. **& Vis**, **M**.**L**. 2003. Stream macroalgae of the Hawaiian Islands: 23 Additional Collection Sites. *Pacific Science* **57**: 421–431.

Guiry, **M**.**D**. **& Guiry**, **G**.**M**. 2012. *AlgaeBase*. World-wide electronic publication, National University of Ireland, Galway. Available from: http://www.algaebase.org; [Last accessed: 08 February 2012].

Lemmerman, **E**. 1905. Die Algenflora der Sandwich-Inseln. Ergebnisse einer Reise nach dem Pacific. H. Schauinsland 1896/97. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* **34**: 607–632.

MacCaughey, **V**. 1918a. Algae of the Hawaiian Archipelago I. *Botanical Gazette* **65**: 42–57.

———. 1918b. Algae of the Hawaiian Archipelago II. *Botanical Gazette* **65**: 121–149.

Main, **S**.**P**. 2004. Observations of diatoms from Hawaii: morphological features of infrequently reported taxa and descriptions of new taxa. *Proceedings of the Seventeenth International Diatom Symposium 2002, Ottawa, Canada (M. Poulin, Ed.)*, pp. 203-221.

Nordstedt, **C**.**F**.**O**. 1878. De Algae aquae dulcis et de Characeis ex insulis Sandvicensibus a Sv. Berggren 1875 reportatis. *Minesskr Fysisk Sallsk Lund* **7**: 1–24.

Sherwood, **A**.**R**. 2006. Stream macroalgae of the Hawaiian Islands: a floristic survey. *Pacific Science* **60**: 191–205.

Wetzel, **R**.**G**. 2001. *Limnology – lake and river ecosystems.* 3rd edition. Academic Press, San Diego, California. 1006 pp.

Ziegler, **A**.**C**. 2002. *Hawaiian natural history, ecology, and evolution*. University of Hawai‘i Press, Honolulu. 477 pp.

Table 1. Checklist of freshwater algae associated with high elevation bogs in the Hawaiian Islands.

Algal taxon	Collecting location	Source	Representative accession
Cyanobacteria			
Chroococcus macrococcus (Kützing) Rabenhorst	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
C. turgidus (Kützing) Nägeli	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
Hapalosiphon fontinalis (C.Agardh) Bornet (as *H. braunii* Nägeli and *H. pumilis* (Kützing) Kirchner)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
Phormidium retzii C. Agardh ex Gomont	Stream exiting Alaka‘i Swamp, Kaua‘i	Filkin *et al*. (2003)	
Schizothrix sp.	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
Scytonema calothrichoides Kützing	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
S. chiastum Geitler	Stream exiting Alaka‘i Swamp, Kaua‘i	Filkin *et al*. (2003)	
S. coactile Montagne ex Kützing	Stream exiting Alaka‘i Swamp, Kaua‘i	Filkin *et al*. (2003)	
S. mirabile (Dillwyn) Bornet (as *S. figuratum* C. Agardh)	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
S. tolypothricoides Kützing	Stream exiting Alaka‘i Swamp, Kaua‘i	Filkin *et al*. (2003)	
Sirosiphon ocellatum (Dillwyn) Kützing	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
Stigonema ocellatum Thuret ex Bornet & Flahault	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
Tolypothrix muscicola var. *hawaiiensis* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Actinotaenium cruciferum (De Bary) Teiling	Stream draining bog in Kohala State Forest Reserve, Hawai‘i		BISH 754175 (ARS 07050-00005)

Table 1. (Continued)

Algal taxon	Collecting location	Source	Representative accession
Chlorophyta			
A. cucurbita (Brébisson ex Ralfs) Teiling	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754176 (ARS 07041-00001)
A. displosporum var. *americanum* (WWest & G.S.West) Teiling	Stream draining bog in Kohala State Forest Reserve, Hawai‘i		BISH 754177 (ARS 07056-00004)
A. palangula (Brébisson ex Ralfs) Teiling (as *Cosmarium palangula* Brébisson ex Ralfs)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
A. subglobosum (Nordstedt) Teiling (as *Cosmarium subglobosum* Nordstedt)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Aphanochaete repens A.Braun	Swamp on O‘ahu	Lemmermann (1905)	`
Closterium acutum Brébisson ex Ralfs	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754178 (ARS 07050-00006)
C. bailyanum var. *multinucleatum* (Nordstedt) Grönblad (as *C. didymotocum* Corda var. *multinucleatum* Nordstedt)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
C. dianae Ehrenberg ex Ralfs	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
C. gracile Brébisson ex Ralfs	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754179 (ARS 07042-00010)
C. lineatum var. *sandvicense* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
C. moniliferum Ehrenberg ex Ralfs	Mt. Ka‘ala Rd., Mt. Ka‘ala, O‘ahu		BISH 754180 (ARS 07122-00003)
C. navicula (Brébisson) Lütkemüller (as *Penium navicula* Brébisson)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Closterium parvulum Nägeli	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
C. parvulum f. *minor* Nägeli	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
C. setaceum Ehrenberg ex Ralfs	Swamp on Mauna Kea, Hawai‘i, and Kohala State Forest Reserve, Hawai‘i	Lemmermann (1905)	BISH 754181 (ARS 07057-00004)

Table 1. (Continued).

Algal taxon	Collecting location	Source	Representative accession
Chlorophyta			
C. striolatum Ehrenberg ex Ralfs	Mt. Ka‘ala, O‘ahu		BISH 754182 (ARS 07112-00002)
Closterium sp.	Mt. Ka‘ala, O‘ahu		BISH 754183 (ARS 07112-00001)
Cosmarium anceps P. Lundell	Kohala State Forest Reserve, Hawai‘i		BISH 754184 (ARS 07053-00004)
C. anisochondrum Nordstedt	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
C. annulatum (Nägeli) De Bary (as *Dysphinctium annulatum* Nägeli)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
C. botrytis Ralfs	Kohala State Forest Reserve, Hawai‘i		BISH 754185 (ARS 07053-00005)
C. caelatum Ralfs	Kohala State Forest Reserve, Hawai‘i		BISH 754186 (ARS 07053-00006)
C. connatum (Brébisson) Ralfs (as *Dysphinctium connatum* (Brébisson) De Bary)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
C. depauperatum Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
C. obliquum Nordstedt	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754187 (ARS 07047-00009)
C. pachydermum P. Lundell	Mt. Ka‘ala Rd., Mt. Ka‘ala, O‘ahu		BISH 754188 (ARS 07124-00007)
Cosmarium pseudoprotuberans var. *sulcatum* (Nordstedt) Coesel (as *C. sulcatum* Nordstedt)	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
C. pyramidatum Brébisson ex Ralfs	Kohala State Forest Reserve, Hawai‘i		BISH 754189 (ARS 07053-00003)
C. regnelli Wille	Pepe‘opae Bog, Moloka‘i		BISH 754190 (ARS 06679-00004)
C. subcucumis Schmidle	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754191 (ARS 07043-00004)

Table 1. (Continued).

Algal taxon	Collecting location	Source	Representative accession
Chlorophyta			
C. subgranatum (Nordstedt) Lütkemüller (as *C. granatum* var. *subgranatum* Nordstedt)	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
Cosmarium sp.	Kohala State Forest Reserve, Hawai‘i		BISH 754192 (ARS 07057-00003)
Cylindrocystis cf. *brebissonii* De Bary*	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754193 (ARS 07041-00003)
C. gracilis Hirn	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754194 (ARS 07043-00002)
Cylindrocystis sp.	Ka‘ala Bog, Mt. Ka‘ala, O‘ahu and Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754195 (ARS 07090-00002)
Euastrum ansatum Ehrenberg ex Ralfs	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
E. binale (Turpin) Ralfs	Swamp on Mauna Kea, Hawai‘i, and Kohala State Forest Reserve, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	BISH 754196 (ARS 07050-00007)
E. sinuosum Lenormand	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Euastrum sp.	Mt. Ka‘ala, O‘ahu		BISH 754197 (ARS 07118-00003)
Geminella minor (Nägeli) Heering	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754198 (ARS 07048-00007)
Gloeocystis gigas (Kützing) Lagerheim (also as *G. ampla* (Kützing) Rabenhorst)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905), MacCaughey (1918b)	
Gonatozygon kinahani (WArcher) Rabenhorst	Mt. Ka‘ala Rd., Mt. Ka‘ala, O‘ahu		BISH 754199 (ARS 07120-00005)
Haplotaenium minutum (Ralfs) T.Bando	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754200 (ARS 07042-00002)
Klebsormidium sp.	Alaka‘i Swamp, Kaua‘i		BISH 754201 (ARS 04445-00001)
Mesotaenium sp.	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754202 (ARS 07041-00012)

* Species of *Cylindrocystis* can only be confidently identified when spores are present. Spores were absent for this collection.

Table 1. (Continued).

Algal taxon	Collecting location	Source	Representative accession
Chlorophyta			
Micrasterias adscendens Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
M. truncata (Corda) Brébisson ex Ralfs	Swamp on Mauna Kea, Hawai‘i, and Alaka‘i Swamp, Kaua‘i	Nordstedt (1878), Lemmermann (1905)	BISH 754203 (ARS 04449-00001)
Microspora pachyderma (Wille) Lagerheim	Stream exiting Alaka‘i Swamp, Kaua‘i	Filkin *et al*. (2003)	
Microspora sp.	Kohala State Forest Reserve, Hawai‘i, Alaka‘i Swamp, Kaua‘i and Pepe‘opae Bog, Moloka‘i		BISH 754204 (ARS 07055-00001)
Microthamnion kuetzingianum Nägeli ex Kützing	Alaka‘i Swamp, Kaua‘i		BISH 754205 (ARS 04445-00002)
Mougeotia capucina (Bory) Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Mougeotia sp.	Stream exiting Alaka‘i Swamp, Kaua‘i,Pepe‘opae Bog, Moloka‘i and Kohala Bog, Kohala State Forest Reserve, Hawai‘i	Filkin *et al*. (2003)	BISH 754206 (ARS 06665-00002)
Mucidosphaerium pulchellum (H.C.Wood) C.Bock, Proschold & Krienitz	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754207 (ARS 07047-00006)
Netrium digitus Itzigsohn & Rothe	Pepe‘opae Bog, Moloka‘i		BISH 754208 (ARS 06665-00003)
Nitella havaiensis Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Oocystis naegeli A.Braun	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905), MacCaughey (1918b)	
Oedogonium acrosporum var. *majusculum* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905), MacCaughey (1918b)	
O. crispum var. *havaiense* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	

Table 1. (Continued).

Algal taxon	Collecting location	Source	Representative accession
Chlorophyta			
O. pringsheimii f. *pachydermatosporum* (Nordstedt) Hirn	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905), MacCaughey (1918b)	
Oedogonium sp.	Swamp on Mauna Kea, Hawai‘i and Ka‘ala Bog, Mt. Ka‘ala, O‘ahu	Nordstedt (1878)	
Pediastrum bidentulum var. *ornatum* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Pleurotaenium indicum (Grunow) Lundell	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
P. nodulosum (Brébisson ex Ralfs) Rabenhorst	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
P. trabecula (Ehrenberg) Nägeli	Swamp on Mauna Kea, Hawai‘i, and Mt. Ka‘ala, O‘ahu	Lemmermann (1905)	BISH 754209 (ARS 07120-00006)
Scenedesmus quadricauda (Turpin) Brébisson	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
Spirogyra sp.	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
Spirotaenia kirchneri Lütkemüller	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754210 (ARS 07049-00004)
Staurastrum scabrum Brébisson (as *S. subscabrum* Nordstedt)	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
S. margaritaceum (Ehrenberg) Meneghini	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
S. monticulosum var. *duplex* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
S. muricatum Brébisson ex Ralfs	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754211 (ARS 07041-00010)
S. muticum Brébisson ex Ralfs	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
S. spongiosum var. *griffithianum* (Nägeli) Lagerheim	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	

Table 1. (Continued).

Algal taxon	Collecting location	Source	Representative accession
Chlorophyta			
S. subtile Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
S. trihedrale Wolle	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754212 (ARS 07041-00006)
Staurastrum sp.	Kohala State Forest Reserve, Hawai‘i		BISH 754213 (ARS 07057-00006)
Stigeoclonium subsecundum (Kützing) Kützing	Stream exiting Alaka‘i Swamp, Kaua‘i	Filkin *et al*. (2003)	
Tetmemorus brebissonii Ralfs	Pepe‘opae Bog, Moloka‘i		BISH 754214 (ARS 06671-00002)
T. granulatus f. *minor* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
T. laevis var. *continuus* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Lemmermann (1905)	
Tetraspora sp.	Alaka‘i Swamp, Kaua‘i and Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754215 (ARS 04440-00001)
Xanthidium armatum var. *fissum* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878), Lemmermann (1905)	
X. octocorne var. *majus* f. *havaiensis* Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
Zygnema spontaneum Nordstedt	Swamp on Mauna Kea, Hawai‘i	Nordstedt (1878)	
Zygnema sp.	Kohala Bog, Kohala State Forest Reserve, Hawai‘i		BISH 754216 (ARS 07112-00003)
Ochrophyta – Bacillariophyceae (diatoms)			
Actinella punctata var. *alakaiensis* Main	Alaka‘i Swamp, Kaua‘i	Main (2004)	
Eunotia abbottiae Main	Alaka‘i Swamp, Kaua‘i	Main (2004)	
E. smithiae Main	Alaka‘i Swamp, Kaua‘i	Main (2004)	
Tabellaria flocculosa (Roth) Kützing	Stream exiting Alaka‘i Swamp, Kauai, and Kohala State Forest Reserve, Hawai‘i	Filkin *et al.* (2003)	BISH 754217 (ARS 07054-00005)

Table 1. (Continued).

Algal taxon	Collecting location	Source	Representative accession
Ochrophyta – Xanthophyceae (yellow-green algae)			
Tribonema sp.	Kohala State Forest Reserve, Hawai‘i and Hanalilo Trail exiting Pepe‘opae Bog, Moloka‘i		BISH 754218 (ARS 07052-00003)
Euglenozoa			
Euglena sp.	Alaka‘i Swamp, Kaua‘i		BISH 754219 (ARS 04456-00006)

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New Plant Records from Maui and Hawai‘i

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The following contributions include new island, state, and range extension records from Maui and Hawai‘i. All records are for nonindigenous species. Images of the material examined can be seen at <www.hear.org/starr>. Voucher specimens and collections mentioned in the text are housed in Bishop Museum's *Herbarium Pacificum* (BISH), Honolulu, Hawai‘i.

Acanthaceae

Justicia spicigera Schltdl. **New island record**

Justicia spicigera, commonly called firecracker plant or Mexican honeysuckle for its attractive small orange flowers, is a small shrub grown as a landscaping plant. In Hawai‘i, it was previously reported as naturalized on the islands of O‘ahu and Moloka‘i (Staples *et al.* 2002). It is now also known from Maui, where it was found spreading in the understory of dry coastal scrub at Waihe‘e Coastal Preserve, escaping from an abandoned house site along the inland back road.

Material examined: **MAUI**: West Maui, Waihe‘e Coastal Preserve, spreading in *kiawe* (*Prosopis pallida*) understory near an abandoned house site, other vegetation in the area included *Carmona retusa*, *Bougainvillea* sp. and *Aristolochia littoralis*, 30 ft [9 m], 13 May 2012, *Starr & Starr 120513-01*.

Thunbergia vogeliana Benth. **New state record**

An upright deep purple-flowered shrub native to Africa from the following regions: West-Central Tropical Africa: Cameroon; Equatorial Guinea - Bioko; West Tropical Africa: Benin; Ghana; Nigeria (GRIN 2012). According to the owner of the botanical garden where this collection was made, the plant spreads by seeds in the garden. *Thunbergia vogeliana* can be distinguished by the following characteristics: "Erect or scandent shrub to 4 m tall; young branches subquadrangular, with scattered to dense sessile glands, with dense tufts of brownish hairs in axils. Leaves with petiole 3–8 mm long, glabrous; lamina elliptic to slightly obovate, largest 8–19(–22)≈3.5–7.5 cm, apex acuminate to cuspidate, base cuneate to rounded (rarely attenuate), margin dentate (often irregularly) along whole length, glabrous. Flowers solitary (Uganda) or in 2–6-flowered racemes on short dwarf-shoots (Tanzania); pedicels 2.3–5 cm long, glabrous (Uganda) or glandular-puberulous (Tanzania); bracteoles pale green or greenish white with pink tinge, ovate to elliptic, 2.7–4.5≈1.2–1.5 cm, acuminate to cuspidate (rarely obtuse), glabrous with finely ciliate margin (Uganda) or glandular-puberulous (Tanzania). Calyx rim to 3 mm high, segments to 1.7 cm long. Corolla limb pale mauve to pale violet or blue, tube whitish, throat yellow; tube 4–6 cm long; lobes 2–2.5 cm long. Filaments 8–10 and 12–14 mm long, with scattered glands along whole length; anthers 4–6 mm long. Capsule ± 3≈1.5 cm, finely glandular-puberulous. Seed dark brown." (JSTOR Plant Science 2012).

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Material examined: **MAUI**: East Maui, Enchanting Floral Gardens of Kula, in association with various other botanical garden exotics, 2300 ft [701 m], 24 Apr 2012, *Starr, Starr & Takeda 120424-02*.

Asteraceae

Coreopsis lanceolata **L.** **Range extension**

This prolific daisy (lanceleaf coreopsis) has been previously documented as naturalized on Lānaʻi, West Maui, and Hawaiʻi (Wagner *et al.* 1999, Meidell *et al.* 1997). It is here reported as naturalized on East Maui, where it was spreading aggressively by seeds from plantings in a botanical garden. Noted as invasive by the garden owner.

Material examined: **MAUI**: East Maui, Enchanting Floral Gardens of Kula, mass plantings with naturalized plants spreading in various locations, in association with various other botanical garden exotics, 2300 ft [701 m], 24 Apr 2012, *Starr, Starr & Takeda 120424-01*.

Bromeliaceae

Guzmania monostachia (L.) Rusby ex Mez **New island record**

Guzmania monostachia (West Indian tufted air plant) was first reported as naturalized in the state from Oʻahu (Frohlich & Lau 2010). This epiphyte is here reported as also being naturalized on Maui, where it was sparingly naturalized in a botanical garden.

Material examined: **MAUI**: East Maui, Enchanting Floral Gardens of Kula, spreading as an epiphyte, in association with various other botanical garden exotics, 2300 ft [701 m], 1 Mar 2012, *Starr, Starr & Takeda 120301-02*.

Tillandsia gardneri Lindley **New island record**

This garden ornamental, commonly called air plant, was first documented as naturalizing in Hawaiʻi on Oʻahu by Frohlich & Lau (2010). They note that this species is self-fertile and easily wind-dispersed, forming thick coverings on tree branches and other structures. On Maui, this species was observed doing much the same at a botanical garden in Kula, where it was seeding profusely and spreading downwind, alighting on plants and structures in its path. This collection represents a new island record for Maui.

Material examined: **MAUI**: East Maui, Enchanting Floral Gardens of Kula, many plants of all sizes being grown on *hāpuʻu* (*Cibotium* sp.) and spreading to nearby areas downwind and growing on other plants in its path, in association with various other botanical garden exotics, 2300 ft [701 m], 1 Mar 2012, *Starr, Starr & Takeda 120301-01*.

Euphorbiaceae

Jatropha curcas L. **Range extension**

Jatropha curcas, known as jatropha or physic nut, has been documented as naturalized on Maui (Wagner *et al.* 1999) and more recently on Hawaiʻi from the North Kona region (Parker & Parsons 2012). During a field assessment of invasiveness of various proposed biofuels, jatropha was observed as naturalized in the Kaʻu area, where hundreds of scattered plants, some quite large, were observed in dry scrub, pastures, and along the roadside. This population was apparently spread downhill by a flood decades ago, from plantings in an old sugar cane plantation town.

Material examined: **HAWAIʻI**: Kaʻu, dry scrub and pasture, along with *Leucaena leucocephala*, *Megathyrsus maximus*, and *Samamea saman*, 100 ft [30 m], 17 Jul 2012, *Starr, Starr & Ely 120717-01*.

Lamiaceae

Salvia procurrens Benth. **New state record**

Salvia procurrens, blue creeper or ground ivy, is native to Uruguay, southern Brazil, and northeastern Argentina, where it is naturally found by stream banks, ponds, and other moist areas, and is sometimes cultivated as a groundcover for its attractive foliage and small blue flowers, though it can become invasive (Salvias.com.ar 2012; Terra Nostra 2010). It is also used medicinally in its native region (Terra Nostra 2010). This blue-flowered creeper was observed as a flowering groundcover forming a dense mat in a shady section of a botanical garden. It had spread from just a few plants to cover a large area and was spontaneously found over wide-ranging parts of the garden. It can be distinguished by the following characteristics: "Perennial creeping stems, radicantes knots, glandular-pubescent or glabrous. Leaves opposite, long petiole, leaf blade circular edge crenate, glabrous or puberula on the upper side, the lower glandulosa. Bilabiadas flowers arranged in long axis (resembling ears) glandular calyx, corolla bluish." (Terra Nostra 2010).

Material examined: **MAUI**: East Maui, Enchanting Floral Gardens of Kula, sparingly naturalized over widely separated parts of the garden, in association with various botanical garden exotics, 2300 ft [701 m], 12 Mar 2012, *Starr, Starr & Takeda 120312-01*.

Myrtaceae

Rhodomyrtus tomentosa (Aiton) Hassk. **New island record**

Hill guava is previously known from the islands of Kauaʻi, Oʻahu, Lānaʻi and Hawaiʻi (Wagner *et al.* 1999, Staples *et al.* 2002). This invasive shrub is also naturalized on Maui, where it is being targeted for control by the Hawaiʻi Department of Agriculture and Maui Invasive Species Committee. The collection noted here was from plants that had sprouted from seeds of a plant that had been removed sometime around the year 2000. Now in 2012, collections were made from four saplings (all less than 1 m tall) that were flowering and fruiting at the time. These were again removed. Hill guava was previously naturalized and removed in the Haʻiku area as well.

Material examined: **MAUI**: East Maui, Enchanting Floral Gardens of Kula, four small saplings in area of previously known and controlled plant, in association with various other botanical garden exotics, 2300 ft [701 m], 19 Mar 2012, *Starr, Starr & Takeda 120319-02*.

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We thank Kazuo Takeda of Enchanting Floral Gardens of Kula for allowing us to collect and document specimens from his diverse botanical garden, and for identification of *Salvia procurrens* and *Thunbergia vogeliana*; and the Bishop Museum staff and volunteers for identifying specimens, curating vouchers, and publishing new records.

Literature Cited

Frohlich, **D**. **& Lau**, **A**. 2010. New plant records from Oʻahu for 2008. *Bishop Museum Occasional Papers* **107**: 3–18.

GRIN (**Germplasm Resources Information Network**). 2010. Online Database. United States Department of Agriculture, Agricultural Research Service, National Germplasm Resources Laboratory, Beltsville, Maryland. Available at: http://www.ars-grin.gov/ (Accessed: 24 Sep 2012).

JSTOR Plant Science. 2012. Entry for *Thunbergia vogeliana*, by Kaj Vollesen, in: Flora of Tropical East Africa. Available at: http://plants.jstor.org/flora/ftea009960 (Accessed: 24 Sep 2012).

Meidell, **J**.**S**., **Oppenheimer**. **H**.**L**. **& Bartlett**, **R**.**T**. 1997. New plant records from Pu‘u Kukui Watershed and adjacent areas, Maui. *Bishop Museum Occasional Papers* **49**: 17–19.

Parker, **J**.**L**. **& Parsons**, **B**. 2012. New plant records from the Big Island for 2009. *Bishop Museum Occasional Papers* **113**: 55–63.

Salvias.**com**.**ar**. 2012. Informative site on ornamental salvias in Argentina. Available at: http://www.salvias.com.ar/ (Accessed: 24 Sep 2012).

Staples, **G**.**W**, **Imada**, **C**.**T**. **& Herbst**, **D**.**R**. 2002. New Hawaiian plant records for 2000. *Bishop Museum Occasional Papers* **68**(1): 3–18.

Terra Nostra. 2010. Blog: Creeping sage - *Salvia procurrens*. Available at: http://terra-nostra-terranostra.blogspot.com (Accessed: 24 Sep 2012).

Wagner, **WL**., **Herbst**, **D**.**R**., **& Sohmer**, **S**.**H**. 1999. *Manual of flowering plants of Hawai‘i.* 2 vols. University of Hawai‘i Press & Bishop Museum Press, Honolulu.

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Rediscovery of *Lysimachia venosa* (Wawra) H. St. John on Kaua‘i, Hawaiian Islands[1]

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Primulaceae

Lysimachia venosa (Wawra) H. St. John **Rediscovery**

The elusive *Lysimachia venosa* was originally discovered by Heinrich W Wawra in 1870 around the summit of Mt. Wai‘ale‘ale, Kaua‘i, and was not observed again until 1911 when Joseph Rock also made a collection around Mt. Wai‘ale‘ale (Wagner *et al.* 1990; Marr & Bohm 1997; Wood 2012). Although no living plants of this taxon had been documented since Rock’s 1911 observation, a small dried branch representing *L. venosa* was found after a severe storm in 1991 at the base of a 1000 m tall cliff below Wai‘ale‘ale in a region called ‘the blue hole’. This fragment still left botanists with no indication as to where any living populations might occur, or if in fact any living individuals survived the storm (Marr & Bohm 1997; Wood 2012). During a 2012 U.S. Fish and Wildlife Service funded survey, and 101 years after any living plants had been documented, ca. 30 plants of *L. venosa* were rediscovered on Kaua‘i’s windward slopes just below the summit peak of Kawaikini. The region of rediscovery is known for its very steep, wet, and windy conditions making access and biotic surveys difficult. The habitat can be described as a *Dubautia-Sadleria* shrubland/fernland plant community associated with plants of *Psychotria mariniana, Kadua affinis, Melicope clusiifolia, M. waialealae, Vaccinium calycinum, Coprosma kauaense, Dubautia laxa, D. paleata, D. imbricata* subsp. *acronaea, Machaerina angustifolia, Sadleria cyatheoides, Sadleria pallida,* and *Sphenomeris chinensis*. Threats to the region include pigs, rats, goats, slugs, and non-native plant taxa such as *Clidemia hirta, Rubus rosifolius, Axonopus fissifolius, Juncus planifolius, Cyperus meyenianus, Paspalum conjugatum, Psidium cattleianum, Melastoma candidum, Rhodomyrtus tomentosa, Sphaeropteris cooperi,* and *Sacciolepis indica*. There are near future plans to monitor and gather seed and cutting collections of *L. venosa* for *ex situ* conservation and to conduct further vascular plant surveys around adjacent slopes were there is very high potential for additional individuals.

Material examined. **KAUA‘I**: Summit of Mt. Wai‘ale‘ale, 1600 m elev, Mar 1870, *Wawra 2165* (holotype, W; isotypes, W, BISH); Summit of Mt. Wai‘ale‘ale, 1911, *Rock 8881* (BISH, GH); Wailua headwaters, north fork, Blue Hole, small branch found after storm at bottom of 1000 m tall cliff, 600 m elev, 7 May 1991, *Wood 784* (PTBG); Summit Ridge just south of Kawaikini, shrub, up to 1 m tall, stems yellow-brown or yellow-orange, ca. 7 branched at base, upper stems with few branching, leaves light green, corolla burgundy, 50 deg. NE aspect, steep slope below ascending ridge to Kawaikini, terrain difficult and steep, ca 30 plants in general area, 1180 m elev, 11 Jan 2012, *Wood 14845* (BISH, PTBG, US).

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Lysimachia venosa (Wawra) H. St. John from ridge below Kawaikini; *Wood 14845*

Program of Hawai‘i; The Nature Conservancy of Hawai‘i, and Airborne Aviation—all of whom have assisted me with aspects of this research.

Literature Cited

Marr K.L. & Bohm, B.A. 1997. A taxonomic revision of the endemic Hawaiian *Lysimachia* (Primulaceae) including three new species. *Pacific Science* **51**: 254–287.

Wagner, WL., Herbst, D.R. & Sohmer, S.H. 1990. *Manual of the flowering plants of Hawai‘i.* 2 vols. University of Hawai‘i Press & Bishop Museum Press, Honolulu. 1853 pp.

Wood, K.R. 2012. Possible Extinctions, Rediscoveries and New plant records within the Hawaiian Islands. *Bishop Museum Occasional Papers* **113**: 91–102.

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Hawaiian land snail records: *Lyropupa cookei* Clench, 1952 (Pulmonata: Vertiginidae) and *Strobilops aeneus* Pilsbry, 1926 (Pulmonata: Strobilopsidae)

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This note clarifies the status of two taxa of land snails that have been reported to occur in the Hawaiian Islands. *Lyropupa cookei* Clench, 1952, is shown to be a synonym of *Lyropupa anceyana* Cooke & Pilsbry *in* Pilsbry & Cooke, 1920. The sole Hawaiian record for the North American *Strobilops aeneus* Pilsbry, 1926, is almost certainly based on a mislabeled specimen, and accordingly this species should be removed from the Hawaiian faunal list.

Lyropupa cookei Clench, 1952

Lyropupa Pilsbry, 1900, is a genus of pupilloid land snails endemic to the Hawaiian Islands. In their monograph of the genus, Pilsbry & Cooke (1920 *in* 1918–1920: 253–254, pl. 26, figs. 3, 6) published a description of "*Lyropupa anceyana* C. & P., n. sp.," based on specimens from Ola'a on the Island of Hawai'i held in the collections of Bishop Museum and the Academy of Natural Sciences of Philadelphia. They stated that their new species had previously been misidentified by Ancey (1904:124) as *Lyropupa lyrata* (Gould, 1843). Several pages earlier, in their systematic treatment of that species, Pilsbry & Cooke (1918–1920: 235) had also set forth their conclusion that Ancey had misidentified Gould's species and stated that in fact Ancey's "description of *lyrata* was based on specimens of an unnamed species for which the name *L. anceyana* is proposed".

In his list of the species described by Cooke, Clench (1952) treated the references to *L. anceyana* on pp. 235 and 253–254 of Pilsbry & Cooke (1918–1920) as constituting two independent taxonomic acts creating two separate new taxa with the same name (*i.e.*, two simultaneously published homonyms) but with different authorship ("Pilsbry & Cooke" for the text reference on p. 235, "C. & P." [= Cooke & Pilsbry *in* Pilsbry & Cooke] for the description on pp. 253). Accordingly, in a footnote noted by Johnson (2003) but overlooked by Cowie *et al.* (1995) and Pokryszko (1997), Clench (1952: 32, fn. 2) proposed the new name *L. cookei* for "*Lyropupa anceyana* Cooke and Pilsbry, 1920, Manual of Conchology II, **25**: 253, non *Lyropupa anceyana* Pilsbry and Cooke, idem., p. 235."

Clench's belief that Pilsbry and Cooke intended to erect two separate taxa bearing the same name is without foundation; clearly, their reference to *L. anceyana* on p. 235 was not intended to stand alone as the establishment of a new taxon but was instead a mere cross-reference to the subsequent description of *L. anceyana* on p. 253–254. This is demonstrated by the fact that they listed only a single *L. anceyana* in their tabular summary of the distribution of the genus *Lyropupa* and in their key for the identification of its species (Pilsbry & Cooke 1918–1920: 229 and 230, respectively). Clench's new name *L.*

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cookei is thus superfluous and is a synonym of *L. anceyana* Cooke & Pilsbry *in* Pilsbry & Cooke, 1920.

***Strobilops aeneus* Pilsbry, 1926**

Haas (1945:14) reported that "[a]mong a lot of minute insects collected in the Waianae Range, about 1.5 miles north of Ekahanui Gulch, Oahu, Hawaiian Islands by Mr. [Henry] Dybas, there was one specimen of the North American land shell *Strobilops aenea*; with it were collected the Hawaiian land shells *Tornatellina* (*Tornatellina*) *baldwini* Ancey, and *T.* (*Laminella*) *cylindrica* Sykes." He went on to add that "Mr. Dybas did not use strainers for collecting his minutia, collecting by picking up every object individually, so there is no possibility of introduction of the specimen by him. We must assume that *Strobilops aenea* is now established in the Hawaiian Islands."

Pursuant to Article 30.1.4.3, International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999), the gender of the genus-group name *Strobilops* is masculine, not feminine as assumed by Pilsbry and Haas, and accordingly the spelling "*aeneus*" is used here.

Haas's report was cited by Pilsbry (1948), and reports of its presence in Hawai'i by Cowie (1997, 1998, 2001) and Ziegler (2002) are based upon it; there are no independent records of the species' occurrence in the Hawaiian Islands.

Strobilops aeneus and its subspecies are widely distributed in eastern North America and Mexico (Pilsbry 1927–1935, 1948; Hubricht 1985). Other than Haas' report, no confirmed records of the occurrence of *S. aeneus* outside its American homeland have been located. Although Climo (1979) concluded that the description of *Laoma elegans* Suter, 1896, a supposed New Zealand species, was based on a mixed lot of *S. aeneus* and *S. labyrinthicus* (Say, 1817), another North American species, he considered it highly probable that Suter's specimens were mislabeled. Subsequent reviews of the introduced land mollusks of New Zealand (Barker 1982, 1999) have not included *Strobilops* in that nation's fauna.

Dr. C. Montague Cooke, Jr., then Malacologist at Bishop Museum, visited Chicago in 1947 (letter dated March 7, 1947, from Cooke to Fritz Haas) and examined Dybas's specimen of *S. aeneus* in the collection of the Chicago Museum of Natural History (now Field Museum). In a memorandum dated April 26, 1947, in the files of Bishop Museum's malacological collections, Cooke stated: "Had a talk with Dybas, who collected the specimen. He admitted that there was a possibility that the tube in which the shell was preserved might not have been clean. The fresh appearance of the shell, unlike most of the shells from this area, leads me to the opinion that it is not authentic."

Notwithstanding Haas's endorsement of Dybas's field techniques, the latter's statement to Cooke raises questions as to the authenticity of this specimen. Furthermore, careful field techniques do not negate the possibility of mislabeling during subsequent processing, as may have happened with another land snail collected by Dybas. Solem & Haas (1964) concluded that the report by Haas (1947) of the occurrence in South Carolina of the Central American cyclophorid *Adelopoma costaricense* Bartsch and Morrison, 1942, was based on a mislabeled and misidentified specimen of a Mariana Islands diplommatinid, *Palaina taeniolata taeniolata* Quadras & Moellendorf, 1894. They noted that the South Carolina specimen was identical to those in a large series of that species collected by Dybas in 1945 on Guam and attributed the discrepancy to a curatorial error in Chicago.

In light of doubts as to the authenticity of Dybas's specimen, the absence of subsequent collections confirming the presence of *S. aeneus* in the Hawaiian Islands, and the lack of evidence that this species has become established elsewhere as an introduced species, it is highly probable that the only record of its occurrence here is erroneous. Accordingly, it should be removed from the Hawaiian faunal list.

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Literature Cited

Ancey, **C**.**-F**. 1904. On some non-marine Hawaiian Mollusca. *Proceedings of the Malacological Society of London* **6**: 117–128, pl. 7.

Barker, **G**.**M**. 1982. Notes on the introduced terrestrial Pulmonata (Gastropoda: Mollusca) of New Zealand. *Journal of Molluscan Studies* **48**:174–181.

———. 1999. Naturalised terrestrial Stylommatophora (Mollusca: Gastropoda). *Fauna of New Zealand* **38**, 253 p.

Clench, **W.J**. 1952. Bibliography. *In:* Kondo, Y. & Clench, W.J. Charles Montague Cooke, Jr., a bio-bibliography. *Bernice P. Bishop Museum Special Publication* **42**: 31–56.

Climo, **F**.**M**. 1979. The systematic status of some land snails mistakenly assigned to the New Zealand fauna. *New Zealand Journal of Zoology* **6**: 407–410.

Cowie, **R**.**H**. 1997. Catalog and bibliography of the nonindigenous nonmarine snails and slugs of the Hawaiian Islands. *Bishop Museum Occasional Papers* **50**: 1–66.

———. 1998. Patterns of introduction of non-indigenous non-marine snails and slugs in the Hawaiian Islands. *Biodiversity and Conservation* **7**: 349–368.

———. 2001. Invertebrate invasions on Pacific Islands and the replacement of unique native faunas: a synthesis of the land and freshwater snails. *Biological Invasions* **3**: 119–136.

———., **Evenhuis**, **N**.**L**. **& Christensen**, **C**.**C**. 1995. *Catalog of the native land and freshwater molluscs of the Hawaiian Islands*. Backhuys Publishers, Leiden. vi + 248 pp.

Haas, **F**. 1945. Malacological notes—IV. *Fieldiana, Zoology* **31**: 3–14.

———. 1947. *Adelopoma costaricense* found in Charleston, S.C. *Nautilus* **61**: 33–34.

Haas, **L**. 1985. The distributions of the native land mollusks of the eastern United States. *Fieldiana, Zoology* (n.s.) **24**, viii + 191 p.

International Commission on Zoological Nomenclature. 1999. International Code of Zoological Nomenclature (Fourth Edition). International Trust for Zoological Nomenclature, London. xxix + 306 p.

Johnson, **R**.**I**. 2003. Molluscan taxa and bibliographies of William James Clench and Ruth Dixon Turner. *Bulletin of the Museum of Comparative Zoology* **158**: 1–46.

Pilsbry, **H**.**A**. 1927–1935. *Manual of Conchology. Second Series: Pulmonata*. Vol. **28**. Academy of Natural Sciences, Philadelphia. xii + 226 p., 31 pls.

———. 1948. Land Mollusca of North America (north of Mexico). *Monographs of the Academy of Natural Sciences of Philadelphia* **3** 2(2) xvii + 1113 pp.

———. **& Cooke**, **C**.**M**., **Jr**. 1918–1920. Pupillidae (Gastrocoptinae, Vertigininae). *Manual of Conchology. Second Series: Pulmonata.* Vol. **25**. Academy of Natural Sciences,

Philadelphia. ix + 401 p., 34 pls.

Pokryszko, **B**.**M**. 1997. *Lyropupa* Pilsbry, 1900. Systematics, evolution and dispersal (Gastropoda: Pulmonata: Pupilloidea). *Genus* **8**: 377–487.

Solem, **A**. **& Haas**, **F**. 1964. *Adelopoma costaricense* Bartsch and Morrison, 1942, not an inhabitant of the United States. *Nautilus* **78**: 68–69.

Ziegler, **A**.**C**. 2002. *Hawaii's natural history, ecology, and evolution.* University of Hawai'i Press, Honolulu. xviii + 477 p.

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Pupoidopsis hawaiensis Pilsbry & Cooke, 1921 (Gastropoda: Pupillidae): extirpated in Hawai‘i but a possible survivor in Kiribati and French Polynesia

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Pupoidopsis hawaiensis Pilsbry & Cooke, 1921, was described as an apparently extinct genus and species of land snail that had inhabited coastal lowlands on the islands of O‘ahu, Moloka‘i, and Maui in the Hawaiian Islands (Pilsbry & Cooke 1921 in Pilsbry 1920-1921). Subsequently, a living population of the species was found on the island of Kiritimati (formerly Christmas Island) in the Republic of Kiribati (Cooke in Gregory 1925, Anonymous 1926, Cooke & Neal 1928), and Pilsbry (1927-1935) added Kaua‘i and the Tuamotu Archipelago of French Polynesia to the known range of the species. Cooke (in Gregory 1935) and Christensen & Kirch (1986) reported its occurrence on Hao Atoll in the Tuamotu Archipelago, and, most recently, Gargominy & Meyer (2012) reported the discovery of a subfossil specimen on Toau Atoll, also in the Tuamotus.

Pupoidopsis hawaiensis is noteworthy in that it is one of only four species of land snails that are native to the Hawaiian Islands but that also occur elsewhere (Cowie *et al.* 1995). The others are the Holarctic species *Vitrina pellucida* (Müller, 1774), formerly known as *Vitrina tenella* Gould, 1846 (Baker 1941, 1958, Forcart 1955, Roth & Sadeghian 2006), the North American *Striatura pugetensis* (Dall, 1895) (Baker 1941), and *Lamellidea gracilis* (Pease, 1871), which occurs also on Wake Island (Cooke & Kondo 1961).

This paper discusses the range of this species in the Hawaiian Islands and the chronology of its extirpation, provides the first records of its occurrence on Tabuaeran (Fanning) Island in Kiribati and on Niau and Fakarava Atolls in the Tuamotu Archipelago, and supplements previously available information regarding the possible survival of this rare species on Kiritimati (where living specimens were last collected in 1965) and perhaps elsewhere in Kiribati and the Tuamotus.

Collecting data for a geographically representative sample of Bishop Museum’s Hawaiian collections and for all non-Hawaiian material examined are presented in an Appendix. Catalog numbers are BPBM Malacology Collections numbers, except that specimens from the collection of the Academy of Natural Sciences of Philadelphia are identified by the acronym “ANSP”. Lots containing alcohol-preserved specimens (and that were thus certainly live-collected) are indicated by “(L)”. Collections were made by Donald Anderson (DA), S.C. Ball (SCB), C.M. Cooke, Jr. (CMC), T.T. Dranga (TTD), C.N Forbes (CNF), H.A. Pilsbry (HAP), J.F.G. Stokes (JFGS), d’Alte A. Welch (DAW), G.P. Wilder (GPW) and others, as indicated.

Pupoidopsis hawaiensis in the Hawaiian Islands

In the Hawaiian Islands, subfossil specimens of *Pupoidopsis hawaiensis* have been found in a number of locations in the coastal lowlands of Kaua‘i, O‘ahu, Moloka‘i, and Maui. Bishop Museum holds 97 catalogued lots from these islands in addition to the uncataloged material from archaeological and paleontological sites at Barbers Point (Honouliuli), O‘ahu, studied by Christensen & Kirch (1986) and Christensen (1995).

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As only a limited number of specific localities have been cited thus far in the literature, a geographically representative sampling of these 97+ records is presented below in the Appendix. Based on the known distribution of fossil occurrence of *P. hawaiensis* in the Hawaiian Islands and the limited information available on its habitat preferences elsewhere, it appears that the species inhabited the "Coastal Dry Communities" formerly widespread in the Hawaiian lowlands but now much reduced in range (Wagner *et al*. 1985, Gagné & Cuddihy 1999). The "*Lepturus* Grassland" vegetation type (similar to the observed habitat of living *P. hawaiensis* on Kiritimati) now survives only in the Northwestern Hawaiian Islands (Gagné & Cuddihy 1999).

Although there is no doubt that *P. hawaiensis* no longer inhabits the Hawaiian Islands, the chronology of its extirpation has been the subject of some misunderstanding. Pilsbry & Cooke (in Pilsbry 1920-1921: 108) opined that *P. hawaiensis* "belonged to the lowland fauna, which has been almost wholly destroyed by deforestation since the discovery of the islands by Europeans," and Cooke & Neal (1928: 29) stated that "since the advent of the white man the abundant fossil material [in the Hawaiian Islands containing *P. hawaiensis*] has come into existence." More recently, however, it has become clear that the ecological changes that adversely impacted the native flora and fauna of Hawai'i, including its native land snails, began soon after the initial human settlement of these islands and are not solely a phenomenon of the post-A.D. 1778 era (*e.g.,* Kirch 1982, 1985, Olson & James 1982, Athens *et al.* 1992, 2002, Athens & Ward 1993). The prehistoric introduction of the Polynesian rat, *Rattus exulans*, has had a particularly heavy impact on lowland and coastal vegetation (Athens 2009). Several studies have demonstrated the apparent extirpation of some of the native land snails formerly inhabiting Hawaiian coastal areas during the prehistoric period (Christensen & Kirch 1986, Christensen 1995, Dixon *et al*. 1997, Burney *et al*. 2001), and *R. exulans* was undoubtedly among the causative agents of these events. *P. hawaiensis* survived into the period of prehistoric human settlement in the 'Ewa Plain of southeastern O'ahu (Christensen & Kirch 1986, Christensen 1995), but stratigraphic disturbance of sediments in the sinkhole sites studied thus far (Athens *et al.* 2002) makes it impossible to determine with certainty whether its extirpation there took place before or after the advent of European influence in A.D. 1778. The identity of the particular agent (or agents) of its demise there and elsewhere is similarly unknown, although presumably many of the influences leading to the destruction of the native lowland vegetation (Wagner *et al*. 1985, Athens *et al*. 2002, Athens 2009) and native land bird species (Steadman 1995, Boyer 2008) had similar effects on *P. hawaiensis* and other native land snails. In light of the recent recognition of the important role of *R. exulans* in the prehistoric modification of the Hawaiian environment (Athens 2009, Drake & Hunt 2009), however, it is worth noting that the survival of *P. hawaiensis* on Kiritimati notwithstanding the presence there of *R. exulans* since prehistoric times (Anderson *et al*. 2002) indicates that the introduction of this alien predator to the Hawaiian Islands was probably not, by itself, sufficient to cause the extirpation of *P. hawaiensis*.

New Island Records in Kiribati and the Tuamotu Archipelago

Henry A. Pilsbry of the Academy of Natural Sciences of Philadelphia visited the Tuamotu Archipelago as a member of the 1929 Pinchot South Sea Expedition (Pilsbry 1930) and collected specimens of *Pupoidopsis hawaiensis* on Toau, Niau, and Fakarava Atolls. Although this material was undoubtedly the basis for Pilsbry's statement (1927-1935: 159) that *P. hawaiensis* occurred in the Tuamotus, these records are reported here in full for the first time.

Members of Bishop Museum's 1934 Mangarevan Expedition also visited the Tuamotus, and their collections of *P. hawaiensis* from Hao Atoll were the basis for the report by Christensen & Kirch (1986) that the species occurred there. They also visited Tabuaeran Island and collected *P. hawaiensis* there, a record that has not previously been reported.

Conservation Status

Pupoidopsis hawaiensis is listed as "data deficient" in the International Union for the Conservation of Nature's *Red List of Threatened Species* (IUCN 2012); Gargominy & Meyer (2012: 130) suggest, however, that the species may be "globally in danger of extinction." Bishop Museum's malacological collections contain information that may assist in the assessment of the conservation status of possibly extant populations. Although *P. hawaiensis* does not survive in the Hawaiian Islands, it has fared better elsewhere in its range. Members of the *Whippoorwill* Expedition found *P. hawaiensis* to be abundant on Kiritimati in 1924. Although that island suffered considerable disturbance in World War II (Morrison & Woodroffe 2009), in 1965 G.A. Samuelson, a Bishop Museum entomologist, obtained living specimens of *P. hawaiensis* on Kiritimati, and the species may well survive there. Specimens collected on Toau, Niau, and Fakarava Atolls by Pilsbry in 1929 appear to have been living or only recently dead, and living specimens were obtained on Tabuaeran and Hao Atoll in 1934 by Bishop Museum personnel (see List of Material). Any or all of these islands may still support living populations of this rare land snail species. The species does not appear to be generally distributed in the islands in and near Kiribati or in the Tuamotus, however. Members of the 1924 expedition searched for it unsuccessfully on Malden and Washington Islands (Teraina) in Kiribati, on Penrhyn (Tongareva) in the Cook Islands, and on Palmyra Atoll in the northern Line Islands (Cooke & Neal 1928), and it is not represented in collections made in 1934 on Flint Island, Kiribati, or in Bishop Museum's collections made in the Tuamotus during the period 1929 to 1934 from Makatea (Cooke 1934) and from Anaa, Fakahina, Hikieru, South Marutea, Takaroa, Tatakotu, and Tepoto Atolls. Accordingly, efforts to verify the survival of the species should concentrate on those islands identified above where live-collected material was obtained during the twentieth century or on nearby islands where no observations of the land snail fauna have yet been undertaken.

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Literature Cited

Anderson, **A**., **Martinsson-Wallin**, **H**.**S. & Wallin**, **P**. 2002. The prehistory of Kiritimati (Christmas) Island, Republic of Kiribati: excavations and analysis. *The Kon-Tiki Museum Occasional Papers* **6**: 1–144.

Anonymous. 1926. *Pupoidopsis hawaiensis* on Christmas Island. *The Nautilus* **39**: 144.

Athens, **J**.**S**. 2009. *Rattus exulans* and the catastrophic disappearance of Hawai'i's native lowland forest. *Biological Invasions* **11**: 1489–1501.

———. **Tuggle**, **H**.**D**., **Ward**, **J**.**V**. **& Welch**, **D**.**J**. 2002. Avifaunal extinctions, vegetation change, and Polynesian impacts in prehistoric Hawai'i. *Archaeology in Oceania* **37**: 57–78.

———. **& Ward**, **J**.**V**. 1993. Environmental change and prehistoric settlement in Hawai‘i. *Asian Perspectives* **32**: 205–223.

———., **Ward**, **J**.**V**. **& Wickler**, **S**. 1992. Late Holocene lowland vegetation, O‘ahu, Hawai‘i. *New Zealand Journal of Archaeology* **14**: 9–34.

Baker, **H**.**B**. 1941. Zonitid snails from Pacific islands parts 3 and 4. 3. Genera other than Microcystinae. 4. Distribution and indexes. *Bernice P. Bishop Museum Bulletin* **166**: 203–370, pls. 43–65.

———. 1958. Land snail dispersal. *The Nautilus* **71**: 141–148.

Boyer, **A**. **G**. 2008. Extinction patterns in the avifauna of the Hawaiian Islands. *Diversity and Distributions* **14**: 509–517.

Burney, **D**.**A**., **James**, **H**.**F**., **Burney**, **L**.**P**., **Olson**, **S**.**L**., **Kikuchi**, **W.**, **Wagner**, **W.L**., **Burney**, **M**., **McCloskey**, **D**., **Kikuchi**, **D**., **Grady**, **F**.**V**., **Gage**, **R**., **II & Nishek**, **R**. 2001. Fossil evidence for a diverse biota from Kauai and its transformation since human arrival. *Ecological Monographs* **71**: 615–641.

Christensen, **C**.**C**. 1995. Analysis of nonmarine mollusks, pp. 206-256. *In:* Archaeological and paleontological investigations at the Barbers Point Deep Draft Harbor, ‘Ewa District, Honouliuli Ahupua‘a, O‘ahu Island, Hawai‘i, Vol. 2. Technical Reports. Department of Anthropology, Bishop Museum, Honolulu.

———. **& Kirch**, **P**.**V**. 1986. Nonmarine mollusks and ecological change at Barber’s Point, O‘ahu. *Bishop Museum Occasional Papers* **26**: 52–80.

Cooke, **C**.**M**., **Jr**. 1934. Land shells of Makatea. *Bernice P. Bishop Museum Occasional Papers* **10**: 3–11.

———. **& Kondo**, **Y**. 1961. Revision of Tornatellinidae and Achatinellidae (Gastropoda, Pulmonata). *Bernice P. Bishop Museum Bulletin* **221**[1960]: 1–303.

———. **& Neal**, **M**.**C**. 1928. Distribution and anatomy of *Pupoidopsis hawaiiensis*. *Bernice P. Bishop Museum Bulletin* **47**: 28–33.

Cowie, **R**.**H**., **Evenhuis**, **N**.**L**. **& Christensen**, **C**.**C**. 1995. *Catalog of the native land and freshwater molluscs of the Hawaiian Islands*. Backhuys Publishers, Leiden. vi + 248 pp.

Dixon, **B**., **Soldo**, **D**. **& Christensen**, **C**.**C**. 1997. Radiocarbon dating land snails and Polynesian land use on the Island of Kaua‘i, Hawai‘i. *Hawaiian Archaeology* **5**: 52–62.

Drake, **D**.**R**. **& Hunt**, **T**.**L**. 2009. Invasive rodents on islands: integrating historical and contemporary ecology. *Biological Invasions* **11**: 1483–1487.

Forcart, **L**. 1955. Die nordischen Arten der Gattung *Vitrina*. *Archiv für Molluskenkunde* **84**: 155–166.

Gagné, **W.C**. **& Cuddihy**, **L**.**W** 1999. Vegetation, pp. 45–114. *In*: Wagner, W.L., Herbst, D.R. & Sohmer, S.H. (eds.), *Manual of the flowering plants of Hawai‘i* (revised edition). University of Hawai‘i Press and Bishop Museum Press, Honolulu.

Gargominy, **O**. **& Meyer**, **J**.**-Y**. 2012. Disjunct distribution in the Pacific Ocean: *Pupoidopsis haiwiensis* in French Polynesia, Kiribati, and Hawaii, South Pacific Islands. *Journal of Conchology* **41**: 123–124.

Gregory, **H**.**E**. 1925. Report of the Director for 1924. *Bernice P. Bishop Museum Bulletin* **21**, 55 pp.

———. 1935. Report of the Director for 1934. *Bernice P. Bishop Museum Bulletin* **133**, 71 pp.

International Union for the Conservation of Nature. 2012. *IUCN Red List of Threatened Species*. Version 2012.2. Available at: Http://www.iucnredlist.org (Last accessed: 16 May 2013).

Kirch, **P**.**V**. 1982. The impact of prehistoric Polynesians on the Hawaiian ecosystem. *Pacific Science* **36**: 1–14.

———. 1985. *Feathered gods and fishhooks: an introduction to Hawaiian archaeology and prehistory.* University of Hawai‘i Press, Honolulu. x + 348 pp.

Morrison, **R**.**J**. **& Woodroffe**, **C**.**D**. 2009. The soils of Kiritimati (Christmas) Island, Kiribati, Central Pacific: new information and comparison with previous studies. *Pacific Science* **63**: 397–411.

Olson, **S**.**L**. **& James**, **H**.**F**. 1982. Fossil birds from the Hawaiian Islands: evidence of wholesale extinction by man before Western contact. *Science* **217**: 633–635.

Pilsbry, **H**.**A**. 1920–1921. Pupillidae (Vertigininae, Pupillinae). *Manual of Conchology* (2) **26**: 1-254, pls. 1–24.

———. 1927–1935. Geographic distribution of Pupillidae; Strobilopsidae, Valloniidae and Pleurodiscidae. *Manual of Conchology* (2) **28**: 1–226, pls. 1–31.

———. 1930. With the Pinchot South Sea Expedition. *1929 Yearbook*, *Academy of Natural Sciences of Philadelphia*, pp. 43–52.

Roth, **B**. **& Sadeghian**, **P**.**S**. 2006. Checklist of the land snails and slugs of California. Second edition. *Santa Barbara Museum of Natural History Contributions in Science* **3**, 82 pp.

Steadman, **D**.**W.** 1995. Prehistoric extinctions of Pacific islands birds: biodiversity meets zooarchaeology. *Science* **267**: 1123–1131.

Wagner, **W.L**., **Herbst**, **D**.**R**. **& Yee**, **R**.**S**.**N.** 1985. Status of the native flowering plants of the Hawaiian Islands, pp. 23–74. *In*: Stone, C.P. & Scott, J.M. (eds.), *Hawai‘i’s terrestrial ecosystems: preservation and management.* Cooperative National Park Resources Studies Unit, University of Hawai‘i, Honolulu.

APPENDIX: Material Examined

HAWAIIAN ISLANDS, **Kaua‘i**: S side of Wailua River, CMC, 5 Mar 1910 (20928, 1 spm); Kōloa, Makahū ‘ena Pt, JFGS, Nov 1911 (35806, 1 spm); Māhā ‘ulepū, 1st dune from Kapunakea Pond, JFGS, 30 Jan 1916 (52096, 69 spms); Kealia, sand bank between mill & road, CMC, 18 Oct 1922 (77853, 1 spm); S Wailua, flat, along road & in sand cuttings, CMC, 10 Sep 1930 (100121, 28 spms); Waipouli, CMC, 10 & 16 Sep 1930 (100171, 2 spms); Māhā‘ulepū, ‘Aweoweonui, CMC, 23 Oct 1930 (100549, 2 spms); Hanamā‘ulu flat, roadside cutting for fill of detour, 100–150 ft N of Hole #1 of golf course, just N of golf course fence, CMC, 8 Apr 1933 (116663, 1 spm); Hanamā‘ulu, 20 yds E of new road & W of ditch, CMC & HAP, 20 Jul 1933 (119011, 16 spms); Wailua, 3/10–4/10 mi S of Wailua River, above 300 ft from beach, G.F. Arnemann, 1 Feb 1947 (210172, 1 spm). **O‘ahu**: Kaipapa‘u, CMC *et al*., Sep–Oct 1912 (33561, 1 spm); ‘Ewa, coral plain below Sisal, in coral pits, CMC & CNF, 16 Feb 1912 (35631, 8 spms); Kailua, Kawailoa, base of coral ridge about 1 mi from shore, CMC *et al*., 23 Jun 1912 (35731, 61 spms); Kailua, Mōkapu Point, CFN & JFGS, 20 Apr 1912 (35784, 1 spm); Wai‘anae Mts, Lualualei, face and top of ... coral ridge S of Mt Pu‘uohulu, CMC & CNF, 17 Apr 1914 (40866, 3 spms); Kāne‘ohe, Heleloa sand dunes, JFGS, 24 May 1915 (40935, 5 spms); Mālaekahana, sand dunes mauka of govt. road, CMC *et al*., 6 Apr 1917 (44794, 21 spms); Kahuku, coral bluff 1–1/2 mi W of mill, CMC & HAP, 18 Jan 1913 (45238, 6 spms); Kāne‘ohe Bay, Kapapa Islet, JFGS, 12 Sep 1917 (52517, 1 spm); just W of Lā‘ie Stream, CMC & HAP, 18 Jan 1913 (52970, 1 spm); Waimānalo sand dunes mauka of Kalaniana‘ole Highway, DAW, 22 Mar 1933 (172811, 112 spms); Wailele, Lā‘ie Hill, quarry 2/10 mi from Kamehameha Highway and N of Wailele Gulch, on top slope of hill, S side, DAW & G.W Russ, 31 May 1933 (173075, 82 spms); Pūpūkea, along road to beach and in bank near Waimea Station, DA & M. Real, 5 Dec 1935 (175640, 1 spm); Mōkapu Point, BPBM Anthropology Dep, 8 Apr 1938 (180834, 14 spms). **Moloka‘i**:

"Kalaeokalio" [probable error for Kalaeoka'ilio] Paddock, coral hill just W of where pipeline crosses shifting sands, CMC *et al*., 19 Mar 1914 (37484, 106 spms); Maunaloa slope, above Mo'omomi, CMC, 16 Feb 1915 (40111, 20 spms); Maunaloa slope, above Mo'omomi, Kalainawawae, CMC, 16 Feb 1915 (40137, 2 spms); Kalainawawae, CMC, 15 Dec 1916 (42551, 1 spm); Kaiehu, W of Mo'omomi, inland 350 yds ±, alt 20–60' ±, N of old windmill, DA *et al*., 8 Aug 1933 (184479, 95 spms); Kaiehu, W of Mo'omomi, inland 200 yds ±, alt 30' ±, DA *et al*., 8 Aug 1933 (184529, 300 spms); Kalani, W of Mo'omomi, inland 150 yds, alt 20–30' ±, DA *et al*., 8 Aug 1933 (184556, 2 spms). **Maui**: Wailuku, sand hills from back of Wailuku Electric Light station, opp. Wailuku baseball park, CMC, 21 May 1915 (39994, 1 spm); Waihe'e, sand dunes W of Penhallow's beach house, CMC *et al*. 22 May 1915 (40005, 16 spms); Wailuku, sand hills below town, from cut, D.T. Fleming, 20 Dec 1920 (59787, 250 spms); Waihe'e, back of heiau, JFGS, Nov 1916 (77719, 9 spms); Waiehu golf course, in sand dunes just above 1st hole, D.T. Fleming, 1 Dec 1932 (115921; 10 spms); near 'Alaeloa, in sandy soil, CMC & H. Stearns, 6 Feb 1937 (167900, 2 spms).

KIRIBATI, **Tabuaeran** (**Fanning**) **Island**: NE. islet, flat, inland 30 yds, "under stones, logs, on tree trunks, bunchgrass & dead leaves," DA, H. St. John, & R. Fosberg, 23 Apr 1934 (136184, 1 spm (L)). **Kiritimati** (**Christmas**) **Island**: Pologne, "under coconut trees in bunch grass," TTD, 6 Aug 1924 (77799-77800, 4 spms); Motu Manu, "on bunch grass", TTD, 3 Aug 1924 (77802–77813, 1535 spms (L)); R2, Rapa, "bunch grass," D. Rogers, 10 Dec 1924 (79436–79440, 281 spms (L)); S. of 'Abalone,' "under bunch grass near beach," D. Rogers, 10 Dec 1924 (79442–79447, 83 spms (L)); W of 'Abalone', "under bunchgrass," SCB, 10 Dec 1924 (79450, 12 spms); Pologne, "under bunchgrass," SCB, 10 Dec 1924 (79452–79453, 113 spms (L)); 1/2 mi N of London settlement, "on 1 tuft of bunchgrass," SCB & GPW, 13 Dec 1924 (79457–79477, 195 spms (L)); 1 mi N of London, "low flats, on bunchgrass," SCB, 15 Dec 1924 (79481–79485, 40 spms (L)); near Palone, GPW, 20 Dec 1924 (79486, 1 spm); "Moku Manu (probably; original label discolored)," SCB, 15? Dec 1924 (79487–79493, 588 spms (L)); "original label discolored," SCB, Dec 1924 (79499–79503, 308 spms (L)); near airport, G.A. Samuelson, 14 Mar 1965 (276959–276960, 3 spms (L)).

FRENCH POLYNESIA, **Tuamotu Archipelago**: **Toau Atoll**: HAP, Pinchot Expedition, 3 Oct 1929 (10016 *ex* ANSP 150974, 1 spm; ANSP 150973, 14 spms; 118511 *ex* ANSP 150973, 4 spms). **Niau Atoll**: "purchased from natives," HAP, Pinchot Expedition, 3 Oct 1929 (ANSP 156351, 64 spms, 118518 *ex* ANSP 156351, 18 spms). **Fakarava Atoll**: HAP, Pinchot Expedition, 3 Oct 1929 (ANSP 150834, 6 spms, 118526 *ex* ANSP 150834, 1 spm). **Hao Atoll**: 3/4 mi S.E. of village, dry, flat, inland 200 yds,"on tree trunks & twigs," DA & CMC, 18 May 1934 (136562–136563, 6 spms (L)); Te Ketika, 50 yds from lagoon, "under or near *Tournefortia* tree," DA & CMC, 19 May 1934 (36597–136599, 20 spms (L)).

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New species of *Campsicnemus* Haliday (Diptera: Dolichopodidae) from the Kohala Mountains, Hawai‘i Island[1]

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The Hawaiian Islands are home to an incredible diversity of species of the predatory dolichopodid genus *Campsicnemus* Haliday with an estimated 250–275 species found only on this island archipelago. Recent studies on this group in the Hawaiian Islands (e.g., Evenhuis, 2003, 2007, 2011, 2012a, 2012b; Evenhuis & O'Grady, 2010) have shown that even since the revision of the genus in Hawai‘i by Hardy & Kohn (1964), there are still a large number of new species being discovered on all the islands.

The current study is restricted to just the Kohala Mountains of the Big Island of Hawai‘i. It is the oldest of the existing emerged volcanoes on the Big Island (0.43 mya; Clague & Dalrymple, 1987), harbors an interesting diversity of species, and a number of new species have been discovered through Malaise and yellow pan trapping in recent years. Of the 17 species of *Campsicnemus* known to occur in the Kohala Mountains, five of them, *C. azyx* Evenhuis, n. sp.; *C. kariae* Evenhuis, n. sp.; *C. kohala* Evenhuis, n. sp.; *C. marilynae* Evenhuis, n. sp.; *C. puuoumi* Evenhuis, n. sp., are here described as new to science. The new species are described and illustrated here to allow their names to appear in forthcoming publications of the genus in Hawai‘i and the Pacific.

Material and Methods

Specimens examined in this study derive primarily from collections of the Bishop Museum (BPBM) and recently collected material funded in part by the National Science Foundation (DEB-0842348), with vouchers deposited in BPBM. Morphological terminology, description format, and abbreviations used in the description follow Evenhuis (2012b). Holotypes and paratypes of all new species are deposited in BPBM. As length of series allow, duplicate paratypes are deposited in University of California, Berkeley (UCB).

Taxonomy

Genus ***Campsicnemus*** Haliday

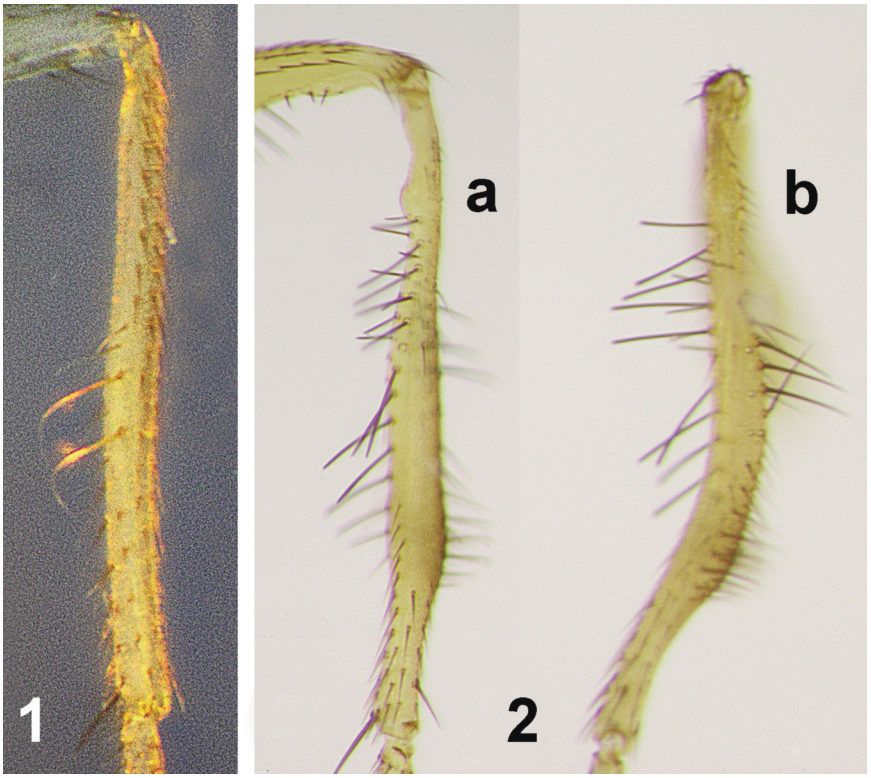
Medeterus (Camptosceles) Haliday, 1832: 357. Type species: *Dolichopus scambus* Fallén, 1823 (by subsequent designation of Coquillett, 1910: 518). Suppressed by I.C.Z.N, 1958: 349 (Opinion 531).

Leptopezina Macquart, 1835: 554. Type species: *Diastata gracilis* Meigen, 1820, by monotypy. *Nomen oblitum* (see Evenhuis, 2003: 3).

Campsicnemus Haliday *in* Walker, 1851: 187. Type species: *Dolichopus scambus* Fallén, 1823, by validation of I.C.Z.N, 1958: 351. *Nomen protectum* (see Evenhuis, 2003: 3).

Camptoscelus Kertész, 1909: 306 (unjustified replacement name for *Camptosceles* Haliday). Type species: *Dolichopus scambus* Fallén, 1823, automatic.

1. Contribution No. 2013-008 to the Hawaii Biological Survey.



Figs. 1–2. *Campsicnemus* male mid tibiae. **1.** *C. azyx*, n. sp.; **2**. *C. kariae*, n. sp., **a**. posterior view; **b**. lateral view.

There are currently 179 described species of Hawaiian *Campsicnemus* (all endemic) known from this remote island group in the Pacific Ocean, with many more new species awaiting description. Preliminary study of specimens of this genus from French Polynesia (Societies, Marquesas, and Australs) show a similar high biodiversity with over 50 undescribed species having been discovered in recent surveys from these islands (over 30 from the Marquesas alone) (see Evenhuis 2000, 2008, 2009 for keys to proposed species groups and descriptions of some of the newly discovered species). Additional species occur westward as far as Fiji (undescribed species are known from Tonga and Fiji). As more trapping and collecting is done in suitable habitats on the south Pacific islands, more new species should be found.

***Campsicnemus azyx* Evenhuis, n. sp.**
(Fig. 1)

Diagnosis. Similar to *C. parvulus* Hardy & Kohn but differs from it by possessing a short row of 3–4 curved hairs on the male mid tibia restricted to the apical one-third (these hairs uncurved and along the entire length of the mid tibia in *C. parvulus*) and 4–5 long hairs on IIt_2 (these hairs absent in *C. parvulus*).

Figs. 3–5. *Campsicnemus* male mid tibiae. **3**. *C. kohala*, n. sp.; **4**. *C. marilynae*, n. sp.; **5**. *C. puuoumi*, n. sp.

Description. **Male**: Body length: 1.8 mm. Wing length: 2.0 mm. **Head**: Face, front and clypeus yellow, gray tomentose; oc and vt black, about two-thirds length of antennal arista; occiput, and vertex black with blue-gray highlights; postgena with long fine white hairs; face constricted at middle, holoptic for a length of 4 ommatidia; palpus small, brown; proboscis brown, extending below eye in lateral view; antenna with all segments yellowish brown; scape subcylindrical, length subequal to width; pedicel obconical, with ring of short spiky black setae subapically; postpedicel subtriangular, length subequal to width, acute apically; arista slightly longer than head height. **Thorax**: Mesonotum and pleura (except dark brown anepimeron) brown, paler on postalar callus, scutellum brownish dorsally, yellowish laterally; disc of mesonotum darker brown than surrounding mesonotum; thoracic setae black: 4 dc; 2 np; 2 ph; 1 + 1 pa; 1 sc; 7 ac; halter stem yellow, knob white. **Legs**: Coxae brownish yellow basally, remainder of legs yellowish; coxae with normal anteroapical setation; fore and hind legs unmodified and without MSSC; FII with row of 5 black hairs along mesoventral surface; TiII (Fig. 1) long, straight, with 3–4 long yellowish curved setae medially, (MSSC), lateral surface with short, stiff black spiky hairs along entire length (MSSC), apex with pair of strong long black setae on mesal surface. IIt_1 about 3 × length of IIt_2, with row of 5–6 long apically curved white hairs along entire length, long straight hair at apex of row (MSSC). Remaining leg segments unmodified and without MSSC. **Wing**: Subhyaline, veins yellowish; posterior crossvein length less than 1/2 apical segment of CuA_1. **Abdomen**: Brown, tergite VII darker brown along posterior margin; tergal vestiture black. Hypopygium dark brown with brown cerci, not dissected. **Female**: Unknown.

Material Examined. *Type*. HOLOTYPE ♂ (BPBM 17,551) from HAWAIIAN ISLANDS: **HAWAI'I**: Kohala Mountains: Puu O Umi Natural Area Reserve, 20°4.524N, 155°43.140'W 5203 ft [1586 m], 8 Jul 2008, Malaise trap #4, R. Peck (BPBM).

Etymology. The specific epithet derives from the Greek "*ἄζυγοσ*" = solitary, unmarried, alone; referring to the discovery of only one specimen of this species while sorting hundreds of specimens from Malaise traps at the same locality.

Campsicnemus kariae Evenhuis, **n**. **sp**.
(Fig. 2)

Diagnosis. Similar to *C. terracola* Hardy & Kohn (which is also found in the Kohalas), but can be distinguished by the shape of the mid tibia (bend in *C. kariae* is near the middle; that *in C. terracola* is on the basal third) and the setation of the mid tibia with *C. kariae* lacking a dense row of long setae on apical fourth (this row of long hairs present in *C. terracola*).

Description. **Male**: Body length: 2.0–2.2 mm. Wing length: 2.0–2.2 mm. **Head**: Face, front and clypeus brown, gray tomentose; oc and vt black, about two-thirds length of antennal arista; occiput, and vertex black with blue-gray highlights; postgena with long fine white hairs; face constricted at middle, almost holoptic for a length of 2 ommatidia; palpus small, brown; proboscis brown, extending below eye in lateral view; antenna with scape and pedicel yellow, postpedicel brown; scape subcylindrical, length subequal to width; pedicel obconical, with ring of short spiky black setae subapically; postpedicel elongate subtriangular, length about 2.5 × width, acute apically; arista slightly longer than head height. **Thorax**: Yellow, except dark brown anepimeron; dorsum of mesonotum with pair of very thin brown admedian vittae; thoracic setae black: 4 dc; 2 np; 2 ph; 1 + 1 pa; 1 sc; 4 ac; halter stem and knob white. **Legs**: CI, CIII white, CII brown basally, white apically. Remainder of legs yellow; coxae with normal setation; fore and hind legs unmodified and without MSSC; FII with row of 6–8 very long, stiff spiky black setae along ventral surface; subapically with 3 small peglike setae on small ventral bump. TiII (Fig. 2) contorted, bent near middle, with small subbasal subtriangular process mesally; mesally with row of 10–12 long, straight, blunt setae oriented variously (MSSC) intermixed with row of 10 much shorter, stiff black blunt setae on basal two-thirds (MSSC); laterally with basal row of 6–7 strong pointed setae, row beginning away (distally) from subbasal mesal process; apex of lateral surface with row of 6–7 long curved black setae; short hairs in irregular rows subapically; single strong black seta at apex of tibia. IIt_1 about 1.5 × length of IIt_2, without MSSC. Remaining leg segments unmodified and without MSSC. **Wing**: Subhyaline, veins brown; posterior crossvein length less than 1/2 apical segment of CuA_1. **Abdomen**: Brown dorsally with yellowish white color laterally and posterolaterally, this pale color most extensive on basal tergites, becoming less extensive on succeeding tergites; sternites with brown medially and basally, otherwise yellowish white; tergal vestiture black, sparse. Hypopygium yellowish brown with yellow cerci, not dissected. **Female**: As in male except for lack of MSSC.

Material Examined. *Types*. HOLOTYPE ♂ (BPBM 16,948) and 3♂,2♀ *paratypes* from HAWAIIAN ISLANDS: **HAWAI'I**: Kohala Mountains: Kohala Forest Reserve, 20°04.699'N, 155°40.218'W, 1213 m, 15 Jan 2011, pan traps in low bog vegetation, K.R. Goodman (KRG007.4B) (BPBM). *Other paratypes*: HAWAIIAN ISLANDS: **HAWAI'I**: 2♂, Kohala Mountains: Kohala Forest Reserve, 20°04.882'N, 155°40.410'W, 1244 m, K.R. Goodman (KRG007.4B); 2♂, Puu O Umi Natural Area Reserve, 20°4.340'N, 155°43.260'W, 4998 ft [1523 m], 5 Aug 2008, Malaise trap #2, R. Peck; 3♂♀, Puu O Umi Natural Area Reserve, 20°4.524'N, 155°43.140'W, 5203 ft [1586 m], 8 Jul 2008, Malaise trap #4, R. Peck; 5♂♀, Puu O Umi Natural Area Reserve, 20°4.524'N, 155°43.140'W,

5203 ft [1586 m], 3 Sep 2008, Malaise trap #4, R. Peck; 6♂♀, Puu O Umi Natural Area Reserve, 20°4.340'N, 155°43.260'W, 4998 ft [1523 m], 8 Jul 2008, Malaise trap #2, R. Peck. Holotype (preserved in fluid) and paratypes in BPBM. Duplicate paratypes in UCB.

Etymology. The species is named for Kari Roesch Goodman for collecting the holotype and for her valuable contributions to the molecular phylogeny of *Campsicnemus* and genera related to *Eurynogaster*.

Campsicnemus kohala Evenhuis, **n**. **sp**.
(Fig. 3)

Diagnosis. Similar to *C. obscurus* Parent from Moloka'i based on the short IIt1 with an apical spine. It can be distinguished from *C. obscurus* by the male mid femur lacking ventral setation on the apical third (this ventral setation present along the entire length of the femur in *C. obscurus*) and the medial long comb of thin blunt setae oriented in different positions (these stiff setae all directed mesally in *C. obscurus*).

Description. **Male**: Body length: 2.0–3.0 mm. Wing length: 2.2–3.2 mm. **Head**: Black; oc and vt black, about two-thirds length of antennal arista; occiput, and vertex black with blue-gray highlights; postgena with long fine white hairs; eyes dichoptic, face width subequal to frons width, inner eye margin straight, not constricted medially; palpus large, brown; proboscis dark brown, extending below eye in lateral view; antenna with all segments dark brown; scape subcylindrical, length subequal to width; pedicel small, obconical, with ring of short spiky black setae subapically; postpedicel wider than pedicel, overlapping dorsally, subtriangular, length slightly less than width, rounded apically; arista slightly longer than head height. **Thorax**: Black; thoracic setae black dorsally, white laterally: 3 (small, weak) + 4 (strong) dc; 2 np; 2 ph; 1 + 1 pa; 1 sc; 4–6 ac medially on disc, absent anteriorly; halter stem white, knob brown. **Legs**: Dark brown except for brown CI and FI; CI and CII with row of strong black setae anteroapically; CII bare; all femora with row of 10–12 strong black setae along ventral surface; TiII (Fig. 3) long, straight, with comb-like arrangement of 8–10 long black setae basomesally with blunt apices (MSSC), anterolateral surface with row of 4 long black hairs on subapical one-fourth; posterolateral surface with 2 long hairs: uppermost at basal one-fourth, lowermost slightly distad of middle (MSSC); fine cilia on all surfaces; apex with pair of strong long black setae on mesal surface. IIt_1 shortened, about 1/3 length of IIt_2, with curved black spine apically (MSSC); row of 3–4 long hairs posterolaterally. IIt_2inserted subapically on IIt_1. Remaining leg segments unmodified, without MSSC. **Wing**: Faint smoky brown throughout, veins dark brown; posterior crossvein length 1/3 of apical segment of CuA_1. **Abdomen**: Dark brown to black; tergal vestiture black, strongest along posterior margin of tergite I. Hypopygium dark brown with dark brown cerci, not dissected. **Female**: As in male except for lack of MSSC.

Material Examined. *Types*. HOLOTYPE ♂ (BPBM 16,817) and 10♂,22♀ paratypes from HAWAIIAN ISLANDS: **HAWAI'I**: Kohala Mountains: Puu O Umi Natural Area Reserve, Upper Alakahi Stream, 26 Jan 1992, 1150 m, pools in bog, D.A. Polhemus (BPBM). Other paratypes: **Hawai'i**: 9♂,1♀, Kohala Mountains: Puu O Umi Natural Area Reserve, same data as holotype except 26 Jan 1992; 1♂,1♀, Kohala Forest Reserve, Upper Hamakua Ditch Trail, 20°05.109'N, 155°40.753'W, 15 Jan 2011, B. Ort, B. Bennett, K.R. Goodman (B041.1). Holotype (preserved in fluid) and paratypes in BPBM.

Etymology. The specific epithet derives from the type locality in the Kohala Mountains of the Big Island of Hawai'i.

Campsicnemus marilynae Evenhuis, **n. sp.**
(Fig. 4)

Diagnosis. Similar to *C. kariae* based on the mid tibial setation but can be separated from it by the distinct mesonotal pattern of dark brown and yellowish white (mesonotum yellow with admedian vittae in *C. kariae*), the darkened apices of the otherwise whitish femora (femora all yellow in *C. kariae*), and the upper row of 8 lateral long black setae beginning at distal end of basomesal triangular flap (this row with only 4 strong lateral setae and beginning further distal to small triangular basomesal flap in *C. kariae*).

Description. **Male**: Body length: 2.0–2.2 mm. Wing length: 2.3–2.5 mm. **Head**: Face, front and clypeus black, silvery tomentose; oc and vt black, about two-thirds length of antennal arista; occiput, and vertex black with blue-gray highlights; postgena with long fine white hairs; face constricted at middle, almost holoptic for a length of 2 ommatidia; palpus small, brown; proboscis brown, extending below eye in lateral view; antenna with scape and pedicel yellow, postpedicel brown; scape subcylindrical, length subequal to width; pedicel subspherical, with ring of short spiky black setae subapically; postpedicel subtriangular, length about 1.5 × width, slightly rounded apically; arista length subequal to head height. **Thorax**: Mesonotum dark brown with yellow on following: humeral callus, antehumeral spot, postalar callus, prescutellar spot, base of scutellum, laterotergite surrounding posterior spiracle, and spot on postnotum; pleura yellow with clouds of brown on all sclerites except anepimeron black, scutellum brownish dorsally, yellowish on posterior margin and ventrally; thoracic setae black: 4 dc; 2 np; 2 ph; 1 + 1 pa; 1 sc; 4–6 ac; halter stem and knob white. **Legs**: White except for smoky brown on following: CII medially, apices of femora, tibiae (prominently brown on apical 1/4 of TiII) and tarsi; coxae with normal setation; fore and hind legs unmodified, without MSSC; FII with row of 6–8 very long, stiff spiky black setae along basal half of ventral surface, patch of dense short stiff setae subapically; TiII (Fig. 4) contorted as in *C. kariae* (see Fig 2b for shape), with small subbasal subtriangular process mesally; mesally with row of 6–8 long, straight, blunt setae oriented variously (MSSC) intermixed with row of 10–12 much shorter, stiff black blunt setae on basal two-thirds (MSSC); laterally with basal row of 4–6 strong pointed setae, row beginning near distal end of subbasal mesal process; lateral surface at distal end of bend (subapical third of TiII) with dense patch of short and long hairs; apex of lateral surface with short hairs in irregular rows subapically; single strong mesally oriented black seta at apex of TiII. IIt_1 about 2 × length of IIt_2, without MSSC. Remaining leg segments unmodified and without MSSC. **Wing**: Subhyaline, veins dark brown; posterior crossvein length less than 1/2 apical segment of CuA_1. **Abdomen**: Brown; tergal vestiture black, strongest along posterior margin of tergite I. Hypopygium brown with black surstylus and yellow cerci, not dissected. **Female**: Unknown.

Material Examined. *Types*. HOLOTYPE ♂ (BPBM 17,560) and 2♂ *paratypes* from HAWAIIAN ISLANDS: **HAWAI'I**: Kohala Mountains: Kohala Forest Reserve, headwaters of Alakahi stream, 3940 ft [1201 m], 20°03.951'N, 155°40.096'W, 6–8 Aug 2012, yellow pan traps near flume under stunted *Metrosideros polymorpha* in bog, N.L. Evenhuis, M.L. Nicholson (BPBM). *Other paratypes*: HAWAIIAN ISLANDS: **HAWAI'I**: 2♂ (one headless), Kohala Mountains: Kohala Forest Reserve, 3783 ft [1153 m], 20°03.398'N, 155°40.421'W, 6–8 Aug 2012, yellow pan traps near under large *Metrosideros polymorpha* near stream, N.L. Evenhuis, M.L. Nicholson (BPBM). Holotype and paratypes in BPBM.

Etymology. The species is named for my wife, Marilyn Nicholson, who helped with the collection of the type series and for her encouragement and support throughout the years for my studies on Diptera.

Campsicnemus puuoumi Evenhuis, **n**. **sp**.
(Fig. 5)

Diagnosis. Similar to *C. tibialis* Van Duzee but differs from it by the mesal comb of setae being much sorter an pointed (long and blunt in *C. tibialis*), by the generally brown colored femora (black in *C. tibialis*), and by the dense patch of spiky setae mesoventrally on FII (no such patch present in *C. tibialis*).

Description. **Male**: Body length: 1.8 mm. Wing length: 2.0 mm. **Head**: Face, front and clypeus black, silvery tomentose; oc and vt black, about two-thirds length of antennal arista; occiput, and vertex black with blue-gray highlights; postgena with long fine white hairs; face constricted at middle, almost holoptic for a length of 4 ommatidia; palpus small, brown; proboscis brown, extending below eye in lateral view; antenna with all segments yellow; scape subcylindrical, length subequal to width; pedicel subspherical, with ring of short spiky black setae subapically; postpedicel small, subtriangular, length subequal to width, rounded apically; arista length slightly less than head height. **Thorax**: Mesonotum, pleura (except dark brown anepimeron), and scutellum brown, paler brown laterally on mesonotum; thoracic setae black: 4 dc; 2 np; 2 ph; 1 + 1 pa; 1 sc; 5 ac medially, absent anteriorly; halter stem yellow, knob white. **Legs**: CII and CIII brown; rest of legs yellowish brown except for CI and all femora yellow; CI with 3–4 strong black setae anteriorly on apical one-third; remainder of coxae with normal setation; TiI dense spicate on anterior surface (MSSC); It_1 dense setose (MSSC); hind legs unmodified, without MSSC; FII with dense row black hairs along ventral surface subapically, with dense patch of long spiky setae medially on mesal; surface; TiII (Fig. 5) long, straight, with mesolateral row of adpressed setae basally, becoming longer and erect medially, and longest apically, 3–4 apicalmost setae long, curved apically (MSSC), anterior surface with single strong seta at basal one-third (MSSC), apex with 3 strong long black setae. IIt_1 about 1.5 $\times$ length of IIt_2, without MSSC. Remaining leg segments unmodified, without MSSC. **Wing**: Faint pale brown, veins brown; posterior crossvein length less than 1/2 apical segment of CuA_1. **Abdomen**: Black; tergal vestiture black, strongest along posterior margin of tergite I. Hypopygium yellowish brown, surstyli black, cerci yellow, not dissected. **Female**: Unknown.

Material Examined. *Types*. HOLOTYPE ♂ (BPBM 17,644) from HAWAIIAN ISLANDS: **HAWAI'I**: Puu O Umi Natural Area Reserve, 20°4.340'N, 155°43.260'W, 4998 ft [1523 m], 8 Jul 2008, Malaise trap #2, R. Peck. (BPBM).

Etymology. The specific epithet derives from the type locality in the Puu O Umi Natural Area Reserve.

Acknowledgments

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References

Clague, **D**.**A**. **& Dalrymple**, **G**.**B**. 1987. The Hawaiian-Emperor volcanic chain, Part 1: Geologic evolution. *United States Geological Survey, Professional Paper* **1350-1**: 5–54.

Coquillett, **D**.**W** 1910. The type-species of the North American genera of Diptera. *Proceedings of the United States National Museum* **37**: 499–647.

Evenhuis, **N.L**. 2003. Review of the Hawaiian *Campsicnemus* species from Kaua‘i (Diptera: Dolichopodidae), with key and descriptions of new species. *In*: Evenhuis, N.L. & Eldredge, L.G. (eds.), Records of the Hawaii Biological Survey for 2002. Supplement. *Bishop Museum Occasional Papers* **75**, 34 pp.

———. 2007. New species of Hawaiian *Campsicnemus* (Diptera: Dolichopodidae). *In*: Evenhuis, NL. & Eldredge, L.G. (eds.), Records of the Hawaii Biological Survey for 2006. *Bishop Museum Occasional Papers* **95**: 9–16.

———. 2008. The *Campsicnemus lobatus* and *zigzag* groups in the Society Islands, French Polynesia (Diptera: Dolichopodidae). *Zootaxa* **1910**: 27–44.

———. 2009. Review of *Campsicnemus* (Diptera: Dolichopodidae) of the Marquesas, French Polynesia, with description of four new species groups. *Zootaxa* **2004**: 25–48.

———. 2011. New species of *Campsicnemus* from East Maui, Hawaiian Islands (Diptera: Dolichopodidae). *In*: Evenhuis, N.L. & Eldredge, L.G. (eds.), Records of the Hawaii Biological Survey for 2009–2010. *Bishop Museum Occasional Papers* **109**: 15–22.

———. 2012a. New species of *Campsicnemus* (Diptera: Dolichopodidae) from the Ko‘olau Mountains of O‘ahu, Hawaiian Islands. *In*: Evenhuis, N.L. & Eldredge, L.G. (eds.), Records of the Hawaii Biological Survey for 2011. Part I: animals. *Bishop Museum Occasional Papers* **112**: 9–16.

———. 2012b. Review of the *Campsicnemus fumipennis* group (Diptera: Dolichopodidae) in the Hawaiian Islands, with descriptions of new species and corrections of misidentifications. *Zootaxa* **3497**: 1–16.

———. **& O’Grady**, **P**.**M**. 2010. Morphological and molecular evidence supports the synonymy of *Emperoptera* Grimshaw with *Campsicnemus* Haliday (Diptera: Dolichopodidae). *In*: Evenhuis, N.L. & Eldredge, L.G. (eds.), Records of the Hawaii Biological Survey for 2008. Part II: animals. *Bishop Museum Occasional Papers* **108**: 35–44.

Haliday, **A**.**H**. 1832. The characters of two new dipterous genera, with indications of some generic subdivisions and several undescribed species of Dolichopidae. *Zoological Journal* **5**: 350–367.

Hardy, **D**.**E**. **& Kohn**, **M**.**A**. 1964. Dolichopodidae. *Insects of Hawaii* **11**: 1–256.

International Commission on Zoological Nomenclature (1958) Opinion 531. Validation under the Plenary Powers of the generic name Campsicnemus Haliday, 1851 (Class Insecta, Order Diptera). *Opinions and Declarations of the International Commission on Zoological Nomenclature* **19**: 349–360.

Kertész, **K**. 1909. *Catalogus dipterorum hucusque descriptorum*. Volumen VI. Empididae, Dolichopodidae, Musidoridae. Museum Nationale Hungaricum, Budapestini [= Budapest]. 362 pp.

Macquart, **P**.**J**.**M**. 1835. *Histoire naturelle des insectes*. Diptères. Tome deuxième. Ouvrage accompagné de planches. Roret, Paris. 703 pp.

Walker, **F**. 1851. *Insecta Britannica, Diptera*. Volume 1. Reeve & Benham, London. vi + 314 pp.

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New records of nonindigenous Carabidae (Coleoptera) from the Big Island

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Recent surveying for alien threats to populations of the *wēkiu* bug (*Nysius wekiuicola* Ashlock & Gagné) on the slopes and summit of Mauna Kea on the Big Island have revealed additional populations of two carabids, previously thought to be restricted to higher elevations. Their presence at these additional localities, including a new island record, imply that both species may be much more widespread than previously thought. Additional surveying in similar habitat types is recommended and may turn up further specimens. All specimens collected during this survey are vouchered in the entomological collections of the Bishop Museum (BPBM).

***Trechus obtusus* Erichson, 1837** **New island record**

Liebherr & Takumi (2002) published the first Hawaiian record of this species from the high elevations of Haleakalā on Maui. The species subsequently expanded its range to a lower elevation at Polipoli, Maui where it was documented to supplant native *Mecyclothorax* spp. (Liebherr & Krushelnycky, 2007). As part of the survey for alien species threats to populations of the native *wēkiu* bug *Nysius wekiuicola* on the summit of Mauna Kea, we collected 3 specimens in an area with grass about 10 meters from the shoreline of Lake Waiau by overturning large rocks and small boulders. In an effort to find more localities for this species, we conducted a short survey along Mana Road at around the 6600-foot level of the eastern slope of Mauna Kea and found a number of specimens of this species in similar rock-and-grass habitats using the same hand-collecting methods as were used at Lake Waiau. The Mana Road survey was unfortunately protracted in order to catch a return flight to Honolulu, but since we found specimens at each of the only four spots we stopped, we estimate that further stops would have provided even further locality data.

Given the fact that this species occurs in a number of localities on the Big Island in less than pristine habitats where few entomologists have ventured to survey for carabids, especially in the last 30 years, it might be possible that it has inhabited the slopes of Mauna Kea in pasture areas for quite some time. Further collecting should be done throughout the Big Island and on Maui in these pasture areas to better ascertain the full range of this species on these islands.

Material Examined. **HAWAI'I**: 1, Mana Road, Wailuku River headwaters (dry), 6825 ft [2080 m], 19.75008°N, 155.37399°W, 15 Jul 2012, hand collected under rock, N.L. Evenhuis & C. Imada (BPBM); 1, Mana Road, adjacent to entrance of Hakalau National Wildlife Reserve, 6679 ft [2036 m], 19.81906°N, 155.33698°W, 15 Jul 2012, hand collected under rock, N.L. Evenhuis & C. Imada (BPBM); 1, Mana Road, south of entrance of Hakalau National Wildlife Reserve, 6660 ft [2030 m], 19.80050°N, 155.33755°W, 15 Jul 2012, hand collected under rock, N.L. Evenhuis & C. Imada (BPBM); 2, Mana Road, south of entrance of Hakalau National Wildlife Reserve, 6657 ft [2029 m], 19.78540°N, 155.34248°W, 15 Jul 2012, hand collected under rock, N.L. Evenhuis & C. Imada

1. Contribution No. 2013-009 to the Hawaii Biological Survey.

(BPBM); 3, Lake Waiau, 10 m E of shoreline, 13,022 ft. [3970 m], 19.8112°N, 155.4774°W, 14 Jul 2012, under rocks and boulders in grassy area, N.L. Evenhuis, C. Imada (BPBM) [identification verified by G.A. Samuelson].

***Agonum muelleri* (Linnaeus, 1758) Range extension**

On the same survey along Mana Road we also collected a single specimen of the alien ground beetle *Agonum muelleri* under a large partially embedded rock in a pasture. This marks the first record of this carabid from below the summit region of Mauna Kea where is was previously reported by Liebherr *et al.* (2010), although Preston *et al*., (2012) stated it might possibly occur at lower elevations. The supposition by Preston *et al*. (2012) has been fulfilled; additional surveys in similar pasture habitats searching under rocks and boulders may produce further specimens of this species, which may be more widespread than previously thought. Since relatively few surveys in pasture areas on the slopes of Mauna Kea such as this for alien carabids have been conducted prior to ours, it is equivocal as to whether this species has been present but unnoticed on the Big Island at the lower elevations and made its way up to the summit where it was first collected in 2006, or if the species was originally introduced at the summit and made its way down to the Mana Road pasture areas.

Material Examined. **HAWAI'I**: 1, Mana Road, south of entrance of Hakalau National Wildlife Reserve, 6660 ft [2030 m], 19.80050°N, 155.33755°W, 15 Jul 2012, hand collected under rock, N.L. Evenhuis & C. Imada (BPBM).

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Literature Cited

Liebherr. **J**.**K**. **& Krushelnycky**, **P**.**D**. 2007. Unfortunate encounter? Novel interactions of native *Mecyclothorax*, alien *Trechus obtusus* (Coleoptera: Carabidae), and Argentine ant (*Linepithema humile*, Hymenoptera: Formicidae) across a Hawaiian landscape. *Journal of Insect Conservation* **11**: 61–73.

Liebherr, **J**.**K**. **& Takumi**, **R**. 2002. Introduction and distributional expansion of *Trechus obtusus* (Coleoptera: Carabidae) in Maui, Hawai'i. *Pacific Science* **56**: 365–375.

Liebherr, **J**.**K**, **Montgomery**, **S**.**L**., **Englund**, **R**.**A**. **& Samuelson**, **G**.**A**. 2009. First recorded occurrence of the alien ground beetle *Agonum muelleri* (Coleoptera: Carabidae), from the summit of Mauna Kea, Hawaii Island. *Proceedings of the Hawaiian Entomological Society* **41**: 97–103.

Preston, **D**.**J**., **Englund**, **R**.**A**., **Myers**, **S**., **Imada**, **C**. **& Garcia**, **J**. 2012. Results of the 2011 alien species and *wēkiu* bug (*Nysius wekiuicola*) surveys on the summit of Mauna Kea, Hawai'i Island. Final Report prepared for Office of Mauna Kea Management, University of Hawaii at Hilo. 42 pp.

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The nuisance marine midge, *Kiefferulus longilobus*, is established in Hawai‘i (Diptera: Chironomidae)[1]

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Chironomidae

***Kiefferulus longilobus* (Kieffer, 1916)** **New state record**

On 13 December 2012, we were invited to investigate a potentially pestiferous midge inhabiting sea urchin rearing tanks at the Anuenue Fisheries Research Center on Sand Island, O‘ahu. The midge was breeding in large numbers in rearing tanks containing seawater, and the adults were annoying workers there. Collected adults proved to belong to *Kiefferulus longilobus* (Kieffer)—a species new to the Hawaiian Islands. A subsequent search of collections at Bishop Museum produced additional specimens from the island of Maui, which had been reported as *Chironomus* sp. nr. *hawaiiensis* in Howarth *et al.* (2012). The species may already be widespread in coastal habitats in Hawai‘i.

This non-biting midge is widespread in coastal and marine incursion habitats in the Indo-Pacific Region. Swarming adults occasionally become nuisances in saline aquaculture farms and marine resort areas in the western Pacific from the Ryukyu Is. to Australia (Cranston *et al*. 1990). The larvae are blood worms, which live in dirt-covered mucous cases in highly saline benthic situations. They occasionally occur in huge numbers and cover large areas of the walls and floor of seawater ponds and aquaculture tanks where they may interfere with commercial operations. Emerging adults may annoy persons visiting or working near breeding areas (Sasa 1987).

Living adults of *K. longilobus* are mostly pale green to light brown in color and resemble the native *Chironomus hawaiiensis* Grimshaw except for their smaller size (wing length 2.10–2.75 mm for *K. longilobus* vs. 3.0–3.5 mm for *C. hawaiiensis*) and by the conspicuously dark brown *r-m* crossvein in wings of *C. hawaiiensis* vs. the pale veins in *K. longilobus.* The male genitalia are very different especially the presence of elongate dark-brown, blade-like superior volsella, which are diagnostic for this species. Tokunaga (1964) re-described the adults and figured the male genitalia under the combination *Chironomus longilobus*. Cranston *et al*. (1990) described all stages and reassessed its taxonomic status placing it in the genus *Kiefferulus*.

The insect fauna of shallow marine habitats in Hawai‘i remain poorly known; thus the date of arrival as well as distribution of this species in the islands are unknown. Since marine adapted species are better able to disperse across oceans than are freshwater or terrestrial species, this species might be native. However, its emerging pest status indicates that it is most likely adventive and became established in Hawai‘i recently. The expansion of aquaculture farms and artificial canals and lagoons at coastal resorts during the past few decades has provided the midge with abundant new habitats both in the source areas in the western Pacific and in Hawai‘i. Recent large tsunamis have also created new habitats (Cranston 2007). The increase in habitats would be expected to intensify the propagule

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pressure and facilitate the establishment of the midge in new areas. Emerging adults are attracted to lights, and one can envision that during population outbreaks, numerous individuals could become stowaways on craft at nearby airports and shipping ports where they can be transported to new areas. Another possible pathway is via larvae attached to marine vessels either in crevices or within ballast holds.

Material Examined. **O'AHU**: Sand I; 21°18'N; 157°52.2'W, 13 Dec 2012, in DLNR/DAR, Anuenue Fisheries Research Center, FG Howarth, DE Oishi collectors, 8 males, 2 females at large in building and many larvae in seawater tanks (HDOA); **MAUI**: Kahului Airport Environs, Kanahā Pond State Wildlife Sanctuary, 20°53'49"N; 156°27'23"W, 19 Sep 2006, MV bulb in wetland, FG Howarth, DJ Preston, collectors, 6 males, 3 females (HBS/ BPBM voucher KA-0060); same data except 20°53'48"N; 156°27'22"W, 14 Nov 2006, 7 males, 4 females (HBS. BPBM voucher KA-0168).

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Literature Cited

Cranston, **P**.**S**. 2007. The Chironomidae larvae associated with the tsunami-impacted waterbodies of the coastal plain of southwestern Thailand. *The Raffles Bulletin of Zoology* **55**: 231–244.

Cranston, **P**.**S**., **Webb**, **C**.**J**. **& Martin**, **J**. 1990. The saline nuisance chironomid *Carteronica longilobus* (Diptera: Chironomidae): a systematic reappraisal. *Systematic Entomology* **15**: 401–432.

Howarth, **F**.**G**., **Preston**, **D**.**J**. **& Pyle**, **R**. 2012. Surveying for terrestrial arthropods (insects and relatives) occurring within the Kahului Airport environs, Maui, Hawai'i: Synthesis Report. *Bishop Museum Technical Report* **58**, 215 pp.

Sasa, **M**. 1987. Recent advances in the environmental and medical sciences achieved by the biosystematic studies—with special reference to the chironomids. *Pure & Applied Chemistry* **59**: 505–514.

Tokunaga, **M**. 1964. Chironomidae. *Insects of Micronesia* **12**(5): 485–628.

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Notes on alien and native bees (Hymenoptera: Apoidea) from the Hawaiian Islands[1]

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Four introduced bees are recorded from the Hawaiian Islands for the first time, along with notes on previously recorded species, including rediscovery of the endemic *Hylaeus anomalus* (Perkins, 1899). Both of the new *Lasioglossum* species are relatively recent arrivals, but their precise date of introduction is not known because the alien *Lasioglossum* are often ignored by collectors and are poorly represented in collections. It had been assumed that all were *L. impavidum* (Sandhouse, 1924), which has been present in the islands since at least 1957 (Beardsley 1958, Beardsley 1959). A recent survey of O'ahu lowland disturbed sites by SD found three distinct species – *L. impavidum*, *L. imbrex* Gibbs, 2010, and *L. microlepoides* (Ellis, 1914) – prompting a review of earlier specimens. Unless otherwise noted, specimens listed below were collected by KNM; specimens are deposited at the Bishop Museum (BPBM) and University of Hawai'i–Mānoa Insect Museum (UHIM).

Colletidae

Hylaeus (Hylaeus) leptocephalus **Possible rediscovery**
(Morawitz, 1871)

This introduced species had not been recorded for several decades and was presumed extirpated. More-recent specimens were found in the Bishop Museum, indicating that it may still be present. However, it has still not been documented in the past 18 years. It may be persisting at low numbers in urban areas without spreading into forested or native sites.

Material examined. **O'AHU**: Honolulu, Aug 31 1994, taken on *Meserschmitia argentia* [sic; *Heliotropium foertherianum*], D. Hopper, 1♂ 2♀ (BPBM).

Hylaeus (Indialaeus) strenuus **New host records, range extension**
(Cameron, 1897)

This species was previously recorded only from *Scaevola taccada* at a few coastal sites between Honolulu and Koko Crater (Magnacca *et al*. 2011). It has now been found at similar sites around the island visiting both *Scaevola* and *Heliotropium foertherianum* (=*Tournefortia argentea*), though it remains somewhat scattered and localized relative to the available habitat. However, it has also been found in association with *Erythrina* spp., including both the native *wiliwili* (*E. sandwicensis*) and cultivated introduced species, and

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was collected at all four localities where flowering *Erythrina* were found. This is extremely unusual, since *Erythrina* exhibits a strong bird pollination syndrome, with predominantly reddish coloration, large flowers, and large quantities of dilute nectar (Bruneau 1997). Females of *H. strenuus* were observed collecting both nectar and pollen. Several individuals, including males, were seen resting on branches and extruding a droplet of nectar from their mouths, a common method of concentrating nectar by bees. No other bees were seen visiting *Erythrina* in Hawai‘i, although honeybees and carpenter bees have occasionally been recorded visiting them (Toledo & Hernández 1979), nor have the endemic *Hylaeus* been observed performing this behavior.

The presence of *H. strenuus* at relatively isolated sites with *Erythrina*, and their absence from neighboring areas, suggests that it may be a favored food plant. If so, the peculiar broad, flat, but thin mandibles of both sexes characteristic of the subgenus *Indialaeus* (Dathe 2011) may be an adaptation for concentrating the nectar of bird-pollinated flowers, and suggests where to look for these rare species in their native range. While this niche is not occupied by any native bees, some of the new coastal locations are sympatric with or in close proximity to the few remaining populations of the candidate endangered endemic *Hylaeus (Nesoprosopis) anthracinus*.

We also record it for the first time from submontane areas in association with the dominant native tree, *Metrosideros polymorpha* (*‘ōhi‘a lehua*). Although currently found at only two relatively close sites in similar habitat, below the elevation where native *Hylaeus* are found, it suggests that *H. strenuus* may eventually become widespread in a variety of habitats and potentially a serious competitor with native bees.

Material examined. **O‘AHU**: BPBM: Kaloko inlet, Makapu‘u, at *Heliotropium foertherianum*, 21.2930°N 157.6597°W, 19 Feb 2012, 2♀. Mokulē‘ia beach, at *Heliotropium foertherianum*, 21.5818°N 158.2052°W, 20 May 2012, 1♂ 1♀. Kea‘au Valley, 100–160 m, at *Erythrina sandwicensis*, 21.502°N 158.219°W, 28 Aug 2012, 6♂ 4♀. Lā‘ie beach, at *Heliotropium foertherianum*, 21.6294°N 157.9206°W, 29 Oct 2012, 1♂. UHIM: UH–Mānoa campus, at *Erythrina crista-galli*, 21.2987°N 157.8162°W, 31 Aug 2012, 2♀. Keālia Trail, at *Erythrina sandwicensis*, 31 Aug 2012; 100 m, 21.5737°N 158.2093°W, 1♀; 200 m, 21.5728°N 158.2102°W, 1♀. Koko Crater Botanical Garden, 100 m, 21.285°N 157.681°W, 2 Sep 2012; 1♀ at *Erythrina sandwicensis*, 2♂ at *Myoporum sandwicense*. Mālaekahana, at *Heliotropium foertherianum*, 29 Oct 2012; 2♀, 21.6575°N 157.928°W; 1♂, 21.66°N 157.9275°W. Halapepenui Trail, 400 m, at *Metrosideros polymorpha*, 21.4152°N 157.9093°W, 19 Jan 2013, 1♀. Tripler Ridge, 280 m, at *Metrosideros polymorpha*, 21.3684°N 157.8779°W, 20 Jan 2013, 1♀.

Hylaeus (Nesoprosopis) anomalus (Perkins, 1899) **Rediscovery**

This enigmatic O‘ahu endemic species was relatively common in early collections from the Ko‘olau range, but had not been seen since 1930. Recently, two specimens from the 1970’s were found in the UHIM collection, and soon afterward it was collected for the first time in the Wai‘anae range. Unlike most Hawaiian *Hylaeus*, most of the collecting records are late in the year (October–February). It may be associated with *Acacia koa*, which has not been in flower for most of the past year.

Material examined. **O‘AHU**: Tantalus, 17 Oct 1977, P. Kbshi [Kobayashi?] 1♂ (UHIM). ‘Aiea, 2 Dec 1978, in flight, C. Fujii, 1♀ (UHIM). Kamaileunu Ridge, 800 m, at *Acacia koa*, 21.5023°N 158.1637°W, 22 Jan 2013, 1♂ 1♀ (UHIM).

***Hylaeus (Prosopisteron)* sp.** **Interception**

A single female belonging to this Australasian subgenus was taken in a bowl trap. Without the male, it cannot be identified further, and even so this polyphyletic group has many

undescribed species (Houston 1981). Since the location was near the cargo piers and further searching, both in the near vicinity and elsewhere, has failed to turn up additional specimens, it is uncertain if it is established. It is quite distinct from both the native and introduced species in Hawai‘i, with broad, pale yellow paraocular marks up to the antennal sockets, and the clypeus reddish brown with a narrow longitudinal pale yellow stripe (probably variable in size). The pronotal collar and lobes, tegula, and humeral plate of the forewing are conspicuously marked with yellow, as are the front tibia, basal quarter of the middle tibia, basal half of the hind tibia, and all basitarsi. The setae of the head and mesonotum are very short and inconspicuous. The metasoma is distinctly setose, particularly on tergites 3–6, but not obviously punctate. The basal area of the propodeum (metapostnotum) is smooth and rather short, just over half as long as the metanotum; the propodeal declivity is nearly vertical and slightly concave.

Material examined. **O‘AHU**: Kalihi Kai, in bowl trap, 21.3213°N 157.886°W, 1–2 Mar 2012, S. Droege, 1♀ (BPBM).

Halictidae

Lasioglossum (Dialictus) imbrex Gibbs, 2010 **New state record**

As a member of the *tegulare* species group, this species is readily distinguished by the large, elongate, opaque, punctate tegula; in the other two species, the tegula is smaller, brown, semi-transparent, and mostly smooth. Like *L. impavidum*, the metasoma is brownish and non-metallic. The *tegulare/parvum* species group is widespread in the New World ranging from southern Canada to Chile (Engel 2001, Gibbs 2010). The COI DNA “barcode” sequence is a 100% match for *L. imbrex*, and females match the description of that species (males were not described). Related species including *L. tegulare*, *L. tegulariforme*, and *L. puteulanum* are separable by both morphology and DNA. Like the other *Lasioglossum* species on the Hawaiian Islands, it is native to the western United States and Canada (Gibbs 2010). Despite being found in much smaller numbers than *L. microlepoides* on O‘ahu, it likely arrived first since it is also found on Moloka‘i and Hawai‘i, and specimens date from at least 2005. On the latter island it occurs primarily at the coast, closely interdigitated with *L. impavidum* but actually sympatric at only one site, Kuamo‘o. There has been only one montane collection there so far, from Pōhakuloa Training Area. On O‘ahu, it is widespread and sympatric with *L. microlepoides* at coastal disturbed sites but occurs in much lower numbers, and is also broadly sympatric with *L. impavidum* in both the Wai‘anae and Ko‘olau mountains.

Material examined. **O‘AHU**: Mililani, family farm, 22 Sep 2007, S. Fang, 1♀ (UHM teaching collection). BPBM: Manuwai ridge, 550 m, at *Dodonaea viscosa*, 21.5205°N 158.1253°W, 4 Apr 2012, 2♀. Ka‘ena Point, 20 m, at *Chamaesyce celastroides kaenana*, 21.5744°N 158.2742°W, 29 Aug 2012, 1♀. Wailupe W. Ridge, 200 m, at *Passiflora*, 21.3061°N 157.7536°W, 7 Oct 2012, 1♀. Lā‘ie beach, at *Scaevola taccada*, 21.6294°N 157.9206°W, 29 Oct 2012, 2♂. UHIM: Pāhole, Wai‘anae crest, 670 m, at *Bidens torta*, 21.5393°N 158.1924°W, 28 Jul 2012, 2♀. Lā‘ie beach, at *Scaevola taccada*, 21.6294°N 157.9206°W, 29 Oct 2012, 2♂. Mau‘umae Trail, 440 m, at *Santalum freycinetianum*, 21.3106°N 157.7748°W, 5 Nov 2012, 1♀. **MOLOKA‘I**: Kalaupapa, Ho‘olehua beach, at *Heliotropium foertherianum*, 21.209°N 156.965°W, 29 Aug 2005, 1♀ (BPBM). Kalaupapa, Kaupikiawa, at *Heliotropium foertherianum*, 21.204°N 156.959°W, 31 Aug 2005, 1♂ (BPBM). **HAWAI‘I**: BPBM: Kohanaiki, at *Heliotropium foertherianum*, 19.6916°N 156.0389°W, 3 Feb 2012, 1♀. Kona Village Resort, at *Heliotropium foertherianum*, 19.8327°N 155.9863°W, 30 Dec 2011, 1♂. Keawaiki, at *Heliotropium foertherianum*, 19.8853°N 155.9102°W, 5 Jan 2012, 1♀. Keāhole Point, at *Heliotropium foertherianum*, 19.7186°N 156.0524°W, 6 Jan 2012, 2♂. Pōhakuloa Training Area, Area 22, 1600 m, at *Bidens menziesii*, 19.7453°N 155.6509°W, 1♀. UHIM: Hilton Waikoloa, at

Heliotropium foertherianum, 19.9271°N 155.8877°W, 29 Dec 2011, 2♂. Keauhou, Kuamoʻo, at *Heliotropium foertherianum*, 19.5515°N 155.9637°W, 13 Jan 2012, 1♂. Wawaloli beach, at *Heliotropium foertherianum*, 19.7174°N 156.0507°W, 6 Jan 2012, 1♀. Old Kona Airport, at *Heliotropium foertherianum*, 19.6431°N 156.0092°W, 13 Jan 2012, 1♀.

Lasioglossum (Dialictus) microlepoides **New state record**
(Ellis, 1914)

This is likely the most recent arrival of the *Lasioglossum* species, since it is only found on Oʻahu at present and the earliest specimen appears to be from 2010. However, it has quickly become the most abundant bee in lowland disturbed and urban environments, where it has been taken in large numbers in pan trap samples. In native and semi-native habitats it is relatively uncommon. Given these habits, it can be expected to spread to the other islands soon. In its native range in the western United States and northern Mexico, *L. microlepoides* is one of the most commonly collected *Lasioglossum* (JG pers. obs.). It can be readily distinguished from the other two *Lasioglossum* in Hawaiʻi by the distinctly metallic blue-green gaster (rarely appearing black); the gaster of *L. impavidum* is shining black in the male and tomentose brown in the female. The tegula is similar to *L. impavidum*, small, transparent brown, and more or less smooth. Both sexes also lack tomentose setae on the face and frons, which is abundant on the faces of other male *Lasioglossum* on the islands.

Material examined. **Oʻahu**: Makiki, 13 Nov 2010, M. Blackwell, 1♂ (UHM teaching collection). BPBM: Sand Island beach, at *Scaevola taccada*, 21.3012°N 157.8787°W, 25 Jun 2012, 3♀. Kaʻena Point, at *Myoporum sandwicense*, 21.5747°N 158.2749°W, 29 Jun 2012, 3♂. Kalaeloa, at *Myoporum stellatum*, 21.2985°N 158.0837°W, 5 Sep 2012, 1♂ 2♀. UHIM: Makapuʻu beach, at *Heliotropium foertherianum*, 21.315°N 157.6618°W, 30 Jun 2012, 1♀. Kaʻena Point, 20 m, at *Chamaesyce celastroides kaenana*, 21.5744°N 158.2742°W, 29 Aug 2012, 1♀. Keālia Trail, 100 m, at *Myoporum sandwicense*, 21.574°N 158.2104°W, 31 Aug 2012, 1♂. Koko Crater Botanical Garden, 100 m, at *Myoporum sandwicense*, 21.2852°N 157.6819°W, 2 Sep 2012, 1♂. Kalaeloa, at *Myoporum stellatum*, 21.2985°N 158.0837°W, 5 Sep 2012, 1♂ 1♀.

KEY TO *LASIOGLOSSUM* SPECIES OF THE HAWAIIAN ISLANDS

1. Tegula enlarged, distinctly punctate; tarsi of males black ..... ***L. imbrex***
–. Tegula small, indistinctly punctate; tarsi of males yellow to pale brown 2

2. Metasoma brown; female: anterior surface of T1 with adpressed setose fan, T3–4 with abundant tomentose setae, mesonotum shining; male: head slightly elongate, distinctly protruding below the eyes, with abundant tomentose pubescence on the face and frons obscuring the cuticle ..... ***L. impavidum***
–. Metasoma metallic blue-green (rarely appearing nearly black); female: anterior surface of T1 with erect setae only, T3–4 with little or no tomentose setae, mesonotum dull; male: head nearly circular, not protruding below the eyes, with sparser, erect facial pubescence not obscuring the cuticle ..... ***L. microlepoides***

Megachilidae

Megachile (Pseudomegachile) lanata **New state record**
(Fabricius 1775)

Originally native to India, this species is now widespread in the Caribbean and south Florida as well as Africa. This is the first record for Oceania, a significant range expan-

sion. The Hawaiian population could potentially have come from either east or west. It is superficially similar to the long-established *M. umbripennis*, but is considerably larger, with the orange-brown hairs extending from the mesosoma onto the second metasomal segment instead of only the first, and with very conspicuous white apical bands on metasomal tergites 3–5, rather than thin or interrupted bands on tergites 2–4 or none.

Material examined. **O'AHU**: Waipi'o Peninsula, open weedy area behind soccer fields, in bowl trap, 21.3734°N 158.0008°W, 2–3 Mar 2012, S. Droege, 1♂. Waipahu, roadside bowl trap, 21.3800°N 158.0047°W, 2–3 Mar 2012, S. Droege, 1♂.

Acknowledgments

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Literature Cited

Beardsley, **J**.**W**. 1958. Notes and exhibitions: *Halictus (Chloralictus)* sp. *Proceedings of the Hawaiian Entomological Society* **16**(3): 337.

———. 1959. Notes and exhibitions: *Halictus (Chloralictus)* sp. *Proceedings of the Hawaiian Entomological Society* **17**(1): 2.

Bruneau, **A**. 1997. Evolution and homology of bird pollination syndromes in *Erythrina* (Leguminosae). *American Journal of Botany* **84**(1): 54–71.

Dathe, **H**.**H**. 2011. Studies on the systematics and taxonomy of the genus *Hylaeus* F. (7) *Indialaeus* subgen. nov., a new subgenus of *Hylaeus* from the Oriental Region (Hymenoptera: Anthophila, Colletidae). *Beiträge zur Entomologie* **61**(2): 243–258.

Engel, **M**.**S**. 2001. A new *Lasioglossum* from the Juan Fernandez Islands (Hymenoptera: Halictidae). *Revista Chilena de Entomologia* **27**: 5–10.

Gibbs, **J**. 2010. Revision of the metallic species of *Lasioglossum (Dialictus)* in Canada (Hymenoptera, Halictidae, Halictini). *Zootaxa* **2591**: 1–382.

Houston, **T**.**F**. 1981. A revision of the Australian hylaeine bees (Hymenoptera: Col letidae). II. *Australian Journal of Zoology, Supplemental Series* **80**: 1–128.

Magnacca, **K**.**N**., **Nagamine**, **W**.**T**., **& Dathe**, **H**.**H**. 2011. *Hylaeus strenuus* (Hymenoptera: Colletidae), a new alien bee on O'ahu. *Bishop Museum Occasional Papers* **109**: 23–24.

Toledo, **V**.**M**. **& Hernández**, **H**.**M**. 1979. *Erythrina oliviae*: a new case of oriole pollination in Mexico. *Annals of the Missouri Botanical Garden* **66**(3): 503–511.

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Notes on a recently established darkling beetle (Coleoptera: Tenebrionidae) in Hawai‘i[1]

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Strongylium cultellatum Mäklin, 1867 **New state record**
(Fig. 1)

This Asian species has turned up on O‘ahu but not yet from any of the other Hawaiian Islands. *Strongylium cultellatum* was described from Hong Kong and has been reported extensively from Japan, including the Ryukyu Islands, and Korea.

Interestingly, *S. cultellatum* has also been reported from Florida, marking the first record for the continental United States and North America; record: US: Florida: Dade Co., 25 May 2010, A.I. Derksen & K.M. Griffiths collectors, USDA (det. M.C. Thomas). Actually, many of the O‘ahu records precede the Florida record. Thomas & Okins (2011) state that *Strongylium* species are associated with fungus-infested dead wood and should not be an economic problem; they point out that the pathway used by this species to enter Florida is not known; also, they did not note that it was already established in Hawai‘i. Hawai‘i could be a possible intermediate location on the spread of the species to the continent. In another example, the cerambycid, *Sybra alternans* Wiedemann, a long-time adventive resident in the Hawaiian Islands, also eventually showed up in Florida in recent

Fig. 1. *Strongylium cultellatum* Mäklin: lateral-oblique view of living specimen in Honolulu, Hawai‘i. (Photo: F.G. Howarth).

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times; in this instance, examples were sent to BPBM for comparison and one of us (GAS) found that Hawaiian specimens of this species were identical to those collected from Homestead AFB in Florida. Thus, for *S. alternans*, the mode of entry to Florida could have been via military flights from O‘ahu bases to Homestead.

Material examined. **O‘AHU**: Kāne‘ohe, 20 May 2006, in house, M. Chun collector (1 ex, first record of this species in Hawai‘i, HDOA); Honolulu (Kalihi Val.) 120 m, 21°20.65'N; 157°51.6'W, 13–15 Nov 2007, 9 Jun 2008, 13 Jun 2008, 25 Jun 2009, 27 Sep 2009, 5 Jun 2011, all at light by F.G. Howarth collector, 6 ex (BPBM); same data but 19 Jun 2007, 1 ex (to W. Steiner for identification; deposited in NMNH), and 31 Aug 2012, 1 ex (HDOA).

Acknowledgments

We thank Warren Steiner of the National Museum of Natural History, Washington, DC (NMNH) for identifying this species.

Literature Cited

Chûjô, **Michitaka & Lee**, **C**.**E**. l993. Korean Tenebrionidae (Insecta, Coleoptera). *Esakia* **33**: 109–122. [Distribution table for region.]

Thomas, **M**.**C**. **& Okins**, **E**. 2011. An Asian species of *Strongylium* Kirby (Coleoptera: Tenebrionidae) established in south Florida, U.S.A. *Coleopterists Bulletin* **65**: 147–152. [This article keys all species of *Stronglium* reported for Florida and includes a dorsal habitus illustration of each species.]

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New Insect Records from Maui[1]

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The following contributions include two new island records from Maui, one endemic and one nonnative. Voucher specimens mentioned in the text are housed in Bernice Pauahi Bishop Museum (BPBM), Honolulu and the University of Hawaii Insect Museum (UHIM), Honolulu.

Diptera: **Tephritidae**
Trupanea pantosticta Hardy **New island record**
Previously known the island of Hawai'i (Nishida, 2002), this native fly is now also known from Maui where it was reared from shoot tips of *Dubautia scabra* in the ecotone between subalpine shrubland and rain forest at the top of the Ko'olau Gap.

Material examined. **MAUI**: East Maui, Ko'olau Gap, along fenceline, reared from shoot tips of *Dubautia scabra*, 6336 ft [1931 m], 16 Sep 2010, *Starr & Starr 100916-18* (1 male) UHIM; 6230 ft [1898 m], 16 Sep 2010, *Starr & Starr 100916-20* (1 female) UHIM.

Hymenoptera: **Formicidae**
Pheidole moerens Wheeler **New island record**
Possibly native to Puerto Rico and first record from the state in 2000 (Krushelnycky *et al.,* 2005), *Pheidole moerens* was previously only known from the island of Hawai'i (AntWeb, 2012) and is now known from Maui.

Material examined. **MAUI**: East Maui, Ha'ikū, Ha'ikū Maui Orchid Society, collected by MISC, 350 ft [107 m], 26 Jul 2011, *Starr & Starr 110726-01* (10 specimens) BPBM. Kihana Nursery, Kihei, collected by MISC, 30 ft [9 m], 29 Jul 2012, *Starr & Starr 120729-01* (12 specimens) BPBM.

Acknowledgments
We thank the Maui Invasive Species Committee staff for collecting *Pheidole moerens*, Paul Krushelnycky (University of Hawai'i) for his determination of *Pheidole moerens*, Jonathan Brown (Grinnell College) for his confirmation of *Trupanea pantosticta*, and the University of Hawai'i and Bishop Museum staff and volunteers for curating specimens and publishing new records.

Literature Cited
AntWeb. 2012. AntWeb. The California Academy of Sciences. Available at: http://www.antweb.org (Accessed: 20 Sep. 2012)

Krushelnycky, **P**.**D**., **L**.**L**. **Loope**, **& N**.**J**. **Reimer**. 2005. The ecology, policy, and management of ants in Hawai'i. *Proceedings of the Hawaiian Entomological Society* **37**: 1–25.

Nishida, **G**.**M**. 2002. Hawaiian terrestrial arthropod checklist. Fourth edition. *Bishop Museum Technical Report* 22, 313 pp.

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Records of the Hawaii Biological Survey for 2012

Table of Contents