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PART II: PLANTS

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Cover photo: *Sadleria cyatheoides* Kaulf., *'ama'u*, from 'Iliahi Trail in Hawaii Volcanoes National Park on the Big Island. Photo: William P. Mull. @Bishop Museum.

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New Records of Naturalized Orchids for the Hawaiian Islands

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We present data for two new records of naturalized Orchidaceae, *Cymbidium dayanum* from the island of Hawai‘i, and a hybrid population of *Dendrobium* from O’ahu. We report fruit and seed set for both species and evidence of pollinator visitation for the *Dendrobium*.

Orchidaceae

Cymbidium dayanum Rchb. f. **New naturalized record**

Cymbidium dayanum, a native of Bhutan, Burma, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Philippines, Ryukyus, Taiwan, Thailand and Vietnam (http://www.tropicos.org/NameDistributions.aspx?nameid=23513279; Du Puy & Cribb 1988), was first noted on the island of Hawai‘i by Caccia (2005) who had photographed plants in flower in the Kalopa State Recreation Area but had not made a collection. We found plants in two areas in the north Hamakua coast region: Akaka Falls State Park, loop trail; and Kalopa State Recreation Area in the garden-like grounds, and along the road just outside the entrance to the park. We observed only juveniles and fruiting individuals (early July). At Kalopa, we found 11 plants with fruits, and average fruit set was 31.5%. Seed set (proportion of seeds with visible embryos) was 91.5%. Very little is known of *Cymbidium* pollination but most, if not all species offer no reward, and use deception to attract bee pollinators (Kjellsson *et al.* 1985; Sugahara & Tsutsui 1998; Tsuji & Kato 2010). However, the callus ridges on the lip of *C. dayanum* have a pubescence of glandular hairs with swollen tips. Conceivably, these may serve either as a reward or as a means of attraction through fragrance production to bees (Sasaki *et al*. 1991; Sasagawa *et al*. 2004; Sugahara 2006; Tsuji & Kato 2010). In Hawai‘i the pollinators are likely introduced *Apis mellifera* (Apidae). there are native Hylaeus bees (see Magnacca 2007), but all are substantially smaller and less robust than Apis. The most likely alternative is onew of the introduced megachilid bees, but they are uncommon and most frequently seen along the coast (K. Magnacca, pers. comm.). Alternatively, *C. dayanum* in Hawai‘i may be self-pollinating as is another naturalized Asiatic orchid in Hawai‘i, *Spathoglottis plicata* Bl. Evidence from fruit set is equivocal: it is relatively low for autogamous plants, fairly high for deception species, but closer to that observed in orchids offering rewards (Tremblay *et al*. 2005). An abridged version of the *C. dayanum* description published by Du Puy & Cribb (1988) is as follows: Plants epiphytic herbs. Pseudobulbs fusiform, 4 x 2.5 cm, covered by persistent leaf sheaths. Leaves distichous, 4–8 per pseudobulb, linear, asymmetrically acute to acuminate, 30–115 x 0.7–2.4 cm. Inflorescence suberect to horizontal (pendent in fruit), 18–35 cm long, 5–20 flowered. Flowers 4–5 cm wide; pedicellate ovary green, 2–4 cm long; sepals white or cream, rarely suffused maroon, with a median maroon stripe, narrowly elliptic to oblong-lanceolate, 21–34 x 5–8 mm; petals similarly colored, narrowly oblong to elliptic, 18–28 x 5.0–7.5 mm;

lip white, strongly marked with maroon, yellow or orange spotted at base, tri-lobed, 15–22 x 10–15 mm when flattened, lateral lobes as long as column, erect and weakly clasping the column with porrect triangular tips, mid lobe with yellow stripe, entire, strongly recurved, callus ridges white or cream, 2, from the base of the lip to the base of the midlobe, covered in glandular hairs ca 0.2 mm long; column dark maroon with a pale yellow anther cap, arching, 11–14 mm long, pollinia 2, triangular. Capsules ellipsoidal, tapering to pedicel and apical beak, 4–6 x 1.5–2.0 cm.

Material examined. **HAWAI'I**: Honoka'a, Waka'alulu Rd, ca 400 m N of Kalopa State Recreation Area, N20.04225, W155.43316, 570 m, occasional on *Eucalyptus* tree trunks and logs along roadside, more common in the recreation area, 11 Jul 2010, *J.D. Ackerman, W. Recart, & W. Falcón 4534* (UPRRP).

Dendrobium hybrid (antelope-type) **New naturalized record**

Dendrobiums are native to tropical Australasia and have been popular in the horticultural trade. Frohlich & Lau (2010) reported naturalized populations of two *Dendrobium* species on O'ahu, one of which was *D. antennatum* L., an antelope-type dendrobium characterized by erect, twisted petals (*Frohlich & Lau 2009101401*, BISH!). Such species have been commonly cultivated in Hawai'i and have been used extensively in the formation of artifical hybrids (Kamemoto *et al*. 1999). We report a highly variable population of hybrid antelope dendrobiums, naturalized along the Mau'umae Ridge Trail above Honolulu. Based on a sample of photographs that we took of flowers from various plants Phillip Cribb, an authority on *Dendrobium* taxonomy, thought that the hybrids may involve *D. lasianthera* J.J. Sm., *D. conanthum* Schltr., *D. discolor* Lindl., and/or *D. lineale* Rolfe parentage (personal communication 2010). We estimate that there were approximately 50 adult and juvenile plants scattered in the area growing on rocks among *u'ulei*, *Osteomeles anthyllidiflolia* (Sm.) Lindl. (Rosaceae). We examined 101 flowers from 9 plants (all those that had flowers) and noted 57.4% had their pollinaria removed. This is an extraordinarily high rate of pollinarium removal. At the National Tropical Botanical Garden on Kaua'i, we observed *Apis mellifera* inside a similar sized flower of a hybrid antelope *Dendrobium* where the bee had died, not being strong enough to back itself out with the pollinarium attached to its thorax. *Apis* may well be the pollinators of this hybrid population of dendrobiums along Mau'umae Ridge Trail. Despite the high pollinarium removal rates, fruit set was only 11.4% suggesting that either pollinator return visits were uncommon or some pollinations resulted in abortions. Seed set was variable (range: 39.3–87.2) and averaged 62.6%. Along this trail, we found four other naturalized orchids: *Epidendrum* ×*obrienanum* Rolfe, *Spathoglottis plicata*, and two other *Dendrobium*. One was an erect *Dendrobium phalaenopsis* Fitzg. hybrid type (only one plant seen in flower which had no evidence of pollinator visitation–pollinarium removals, pollinations or fruits), and the other was a small population of a rock-dwelling pendent species (or hybrid) perhaps of the *D. nobile* type, that lacked either flowers or fruits during our visits (July–August). We made no herbarium collections of either one. Our description is based on material we had collected and photographed. Plants epilithic herbs. Pseudobulbs cane-like, erect, asymmetrically fusiform, apically attenuate, 0.50–1.00 (–2) m, 1–2 cm diam. Leaves 16–48, sheaths persistent, scarious with age, blades deciduous, distichous, thick, coriaceous, stiff, broadly elliptic, smaller towards apex of stem, ca 10 x 5 cm. Inflorescences lateral from upper nodes of pseudobulbs, produced in succession, racemose, 10–30-flowered, usually about half in flower at one time. Flowers

resupinate; sepals and petals vary from yellow to yellow-brown, dark brown or pale greenish brown with yellow margins, usually twisted, rarely, flat, with both types sometimes on the same plant; sepals similar to petals but much shorter, ca 21 × 6 mm; petals extended as horns of an antelope, often darker than sepals, ca 38 × 7 mm; lip similar in color to sepals and petals, sometimes darker, sometimes concolorous, or with reddish veins, and/or a purple disc, its longitudinal ridges sometimes white, lip trilobed, overall ca 24 mm long, mentum ca 10 mm long, apical half a narrow spur, lateral lip lobes elongate, flanking column, ca 9 mm long, isthmus ca 2 mm long, mid lobe broadly ovate, apiculate, margins undulate, ca 6 mm long; column semiterete, straight, greenish, ca 5 mm long. Fruits pendulous, pedicels ca 35 mm long, capsules green, obovoid, ca 35 × 12 mm.

Material examined. **O'AHU**: Honolulu, Mau'umae Ridge Trail above Maunalani Circle. N21°18.276', W157°46.750', 320 m, open area, along ridge tops, mostly on the east side, on rocks and among *Osteomeles anthyllidifolia* (Rosaceae), 30 Jun 2010, *J.D. Ackerman, W. Recart & W. Falcón 4531* (UPRRP).

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Records of the Hawaii Biological Survey for 2009–2010. Edited by Neal L. Evenhuis & Lucius G. Eldredge. *Bishop Museum Occasional Papers* 110: 5–10 (2011)

New Hawaiian plant records for 2009

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Ongoing field work, collections, and research continue to produce new, previously unpublished distributional records for the Hawaiian flora. In this paper, one new naturalized record, 17 new island records, two notable rediscoveries, and three range extensions are reported. A single correction is made regarding previous records. A total of 21 taxa in 17 plant families are discussed. Fourteen are dicotyledonous angiosperms, eight are monocots, and one is a pteridophyte. Four of the taxa are endemic. Collections were made on Kaua'i, O'ahu, Moloka'i, Lāna'i, and Maui. Information regarding the formerly known 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 Hawaii Biological Survey*. Distribution and taxonomy of ferns follows *Hawai'i's ferns and fern allies* (Palmer 2003).

Voucher specimens are deposited at the Bishop Museum *Herbarium Pacificum* (BISH), Honolulu, with duplicates at the National Tropical Botanical Garden (PTBG), Lawa'i, Kaua'i. A few specimens may be at only one facility; only in these cases will the herbarium acronym be cited.

Aloeaceae

Aloe vera (L.) Burm.f. **New island record**

Cultivated in tropical areas worldwide including Hawai'i, this succulent spreads both vegetatively and produces seeds on Kaua'i (Lorence *et al*. 1995: 21), O'ahu (Herbarium Pacificum staff 1999: 3), Maui (Oppenheimer 2003: 4–5), and Moloka'i (Wysong *et al*. 2007: 1). On Lāna'i it was found scattered in an arid, rocky area, escaping from nearby older residences with other succulents such as *Kalanchoë tubiflorum*, *K. daigremontianum*, and *Hylocereus undatus*.

Material examined. **LĀNA'I**: N side of Kaumalapau Gulch, 65 m, 19 Mar 2009*, Oppenheimer H30922*.

Apocynaceae

Thevetia peruviana (Pers.) K. Schum. **New island record**

An ornamental small tree naturalized in Hawai'i on the islands of Kaua'i, O'ahu, Moloka'i, and Maui, and probably on the other main islands (Wagner *et al.* 1999: 215; Wysong *et al*. 2007: 2). The change in name from *Cascabela thevetia* (L.) Lippold was reported by Wagner *et al*. (1999: 1858). This species is poisonous to humans (Staples & Herbst 2005: 127), and apparently at least axis deer, based on observations on Moloka'i and Lana'i, where the plants are not browsed.

Material examined. **LĀNA'I**: due N of Kanepu'u, near road at Lapa Iki, in *Diospyros/Nestegis* Forest, 520 m, 27 Oct 2009, *Oppenheimer & J. Penniman H100911*.

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Araceae

Syngonium podophyllum Schott **New island record**

Commonly cultivated on most of the main islands and naturalized on Maui (Oppenheimer 2006:10); this aroid was recently found outside of cultivation on Oʻahu. Plants were apparently escaping from discarded yard waste, and climbing trees, as well as sprawling on the ground and covering large areas.

Material examined. **OʻAHU**: Waialua Distr, Kauwalu Gulch, 315 m, 22 Jul 2009, *Oppenheimer H70914.*

Arecaceae

Archontophoenix alexandrae **New island record**

(F.v. Muell.) H.A. Wendl. & Drude

Commonly cultivated in Hawaiʻi, the King Palm has been found naturalized on Hawaiʻi Island from Hilo to Hamakua (Wagner *et al.* 1999: 1362) and on Oʻahu (Daehler & Baker 2006: 4–5). On East Maui it is spreading from cultivated specimens into low elevation mesic to wet, alien dominated forest.

Material examined. **MAUI**: East Maui, Hana Distr, N of Puʻu Hinai, 312 m, 14 Mar 2009, *Oppenheimer H30910* (BISH).

Livistona chinensis (Jacq.) R.Br. ex Mart. **New island record**

Widely cultivated, and in Hawaiʻi persisting and sparingly naturalized where previously cultivated on Oʻahu and West Maui but perhaps elsewhere (Wagner *et al.* 1999: 1364; Oppenheimer 2003: 5 ; Daehler & Baker 2006: 12). These observations are consistent with its occurrence on Kauaʻi, where all size classes were observed, including large plants, on nearly vertical gulch walls.

Material examined. **KAUAʻI:** Hanalei Distr, Kīlauea Str., 79 m, 12 Nov 2008, *Oppenheimer H110819.*

Asteraceae

Cotula australis (Sieber ex Spreng.) Hook.f. **New island record**

This delicate annual herb is known from relatively dry areas on Kauaʻi, Oʻahu, Maui, and Hawaiʻi islands (Wagner *et al.* 1999: 289; Lorence *et al*. 1995: 23; Oppenheimer 2003: 6). On Lānaʻi it was found growing in a newly landscaped area in a dry coastal area.

Material examined. **LĀNAʻI**: Manele Harbor, 10 m, 16 Apr 2009, *Oppenheimer H40920.*

Galinsoga parviflora Carv. **New island record**

A slender annual herb known to be naturalized on Kauaʻi, Oʻahu, Lānaʻi, Maui, Kahoʻolawe, and Hawaiʻi (Wagner *et al*. 1999: 319–320; Oppenheimer 2008: 24) now known from Molokaʻi as well.

Material examined. **MOLOKAʻI**: along road to Puʻu Kolekole, on E side of E Kawela, 700 m. Locally common in rocky goat-ravaged area, appearing with winter rains, 13 Jan 2009, *Oppenheimer & Perlman H10906.*

Caricaceae

Carica papaya L. **New island record**

Commonly cultivated for its edible fruit, the papaya has been previously found to be sparingly naturalized on Kauaʻi, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi (Wagner *et al*. 1999: 497; Oppenheimer & Bartlett 2000: 3; Oppenheimer 2010: 34).

Material examined. **OʻAHU**: Waialua Distr, Kauwalu Gulch, 315 m, 22 Jul 2009, *Oppenheimer H70915.*

Casuarinaceae

Casuarina glauca Siebold ex Spreng. **New island record**

A forestry tree, planted on all the main islands except Niʻihau, but spreading vegetatively via root suckers on Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi Islands (Wagner *et al*. 1999: 529; Oppenheimer & Bartlett 2000:3; Oppenheimer 2008: 26). On Kauaʻi it was found forming locally dense thickets, mixed with *C. equisetifolia* L.

Material examined. **KAUAʻI**: Hanalei Distr, Kīlauea Str., 72 m, 12 Nov 2008, *Oppenheimer H110818.*

Cuscutaceae

Cuscuta campestris Yunker **New island record**

This parasitic vine has been previously documented on Oʻahu, Maui, and Hawaiʻi (Wagner *et al*. 1999: 582; Oppenheimer 2003: 10; Starr *et al*. 2004: 22). On Lanaʻi it was found in a landscaped area; the host was a cultivated hedge of the indigenous strand plant *Vitex rotundifolia* L. fil. (Verbenaceae). This dodder has also been found in Hawaiʻi on Acanthaceae, Asteraceae, Euphorbiaceae, and Fabaceae.

Material examined. **LĀNAʻI**: Hulopoe, 60 m, 11 Dec 2008, *Oppenheimer & Perlman H120821*.

Dryopteridaceae

Dryopteris fusco-atra (Hillebr.) W.J. Rob **Range extension**
var. ***lamoureuxii*** Fraser-Jenk.

A rare taxon previously known only from Makawao and Koʻolau Forest Reserves on windward East Maui (Palmer 2003: 140), a small population of this terrestrial fern was found recently on leeward West Maui. The nominate variety is common in the area.

Material examined. **MAUI**: West Maui, Lahaina Distr, Kauaʻula Valley, 1034 m, local and rare terrestrial fern in dense shade in gulch bottom, 4 Dec 2008, *Oppenheimer & Perlman H120815* (BISH).

Fabaceae

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

Used medicinally and the roasted seeds are used by Japanese for tea, *habucha* is naturalized on the Big Island (Wagner *et al*. 1999: 700) and Oʻahu (Staples *et al*. 2003: 12). On Lānaʻi it was found growing in sandy soil near sea level. There were hundreds of plants scattered in dense patches along several hundred meters of roadside. It did not appear that *Axis* deer were browsing the plants, nor were plants observed in shady habitat directly adjacent.

Material examined. **LĀNAʻI**: Keomuku Rd, Nahoko, 5 m. Locally common yellow flowered herbs, growing in sandy soil at edge of unpaved road and dense *Prosopis* thickets, 20 Jan 2009, *Oppenheimer H10919*.

Lamiaceae

Phyllostegia haliakalae Wawra **Notable rediscovery**

In the most recent review of *Phyllostegia* Benth. (Wagner 1999), populations of *P. mollis* Benth. from Maui and Molokaʻi were treated as synonyms for *P. haliakalae*, a much older name. It was thought to be extinct, with the last collections cited made in 1928. Recent fieldwork in Haleakalā National Park resulted in the discovery of a single individual of this species. Seeds were collected and are in cultivation in the Park's nursery.

Material examined. **MAUI**: East Maui, Hana Distr, Kīpahulu Valley, Palikea Str. 1050 m. Single subshrub on disturbed talus slope on S side, above perennial stream near waterfall, 11 May 2009, *Oppenheimer, Wood, Welton, & Haus H50912* (BISH).

Liliaceae

Zephyranthes grandiflora Lindley **New naturalized record**

Only *Zephyranthes citrina* Baker has been documented outside of cultivation in the Hawaiian Islands (Lorence *et al*. 1995: 40; Staples *et al*. 2002: 12). However, *Z. grandiflora* (large pink rain lily) was listed as potentially invasive (Staples *et al*. 2000: 23). Native to Mexico and Guatemala, it is naturalized in the West Indies, South America, and China (Staples & Herbst 2005: 694). This species is somewhat ephemeral, but plants have been observed scattered in this general area of Lānaʻi for more than a decade. It differs from *Z. citrina* with its large pink flowers, taller stature, and longer leaves.

Material examined. **LĀNAʻI**: Kanepuʻu, 525 m. Sparingly naturalized and local herbs from underground bulbs, 29 May 2008, *Oppenheimer & Perlman H50817*.

Lythraceae

Cuphea hyssopifolia Kunth **New island record**

A common landscaping ornamental, used as a ground cover and bedding plant, false heather has been collected outside of cultivation on Maui and Hawaiʻi islands (Wagner *et al.* 1999: 866; Imada 2007: 37).

Material examined. **OʻAHU**: Koʻolauloa Distr, Pūpūkea, 312 m, naturalized in wet lawns and pastures, 22 Jul 2009, *Oppenheimer H70912*.

Malvaceae

Abutilon menziesii Seem. **Range extension**

An endangered species previously documented from dry forest on Lānaʻi, East Maui, Hawaiʻi and possibly Oʻahu (Wagner *et al*. 1999: 873; Herbarium Pacificum staff 1999: 4). On West Maui, a single population was discovered in 2001 by Joel Q.C. Lau. It was recently relocated and consists of two patches totaling approximately 25 plants, consistent with initial observations and a site visit in March 2002. Threats include fire, axis deer, goats, extended drought, landslides, rats, and alien plant species such as *Leucaena leucocephala, Panicum maximum, Cenchrus ciliaris, Lantana camara,* and *Neonotonia wightii.*

Material examined. **MAUI**: West Maui, Wailuku Distr, Pohakea Gulch, 1400 ft [ca 425 m], 17 Apr 2009, *Oppenheimer & D. Ting H40924.*

Malvaviscus penduliflorus DC **New island record**

Cultivated throughout the tropics and sparingly naturalized in Hawaiʻi in disturbed mesic sites on the islands of Kauaʻi, Molokaʻi, Maui, and Hawaiʻi (Wagner *et al*. 1999: 895; Oppenheimer 2007: 26). Turks cap was recently found on Oʻahu under similar conditions.

Material examined. **OʻAHU**: Waialua Distr, Kauwalu Gulch, 315 m, 22 Jul 2009, *Oppenheimer H70913.*

Sidastrum paniculatum (L.) Fryxell **New island record**

Known only from Hawaiʻi Island (Wagner *et al.* 1999: 901), this small shrub was found to be locally naturalized on windward Lānaʻi.

Material examined. **LĀNAʻI**: Keomuku, 5 m, naturalized shrubs to 1.5 m tall, in sandy substrate along roadside, at sunny edges of *Prosopis* forest, 18 Mar 2009, *Oppenheimer H30917*.

Onagraceae

Epilobium ciliatum Raf. **Range extension**

A weedy species known from Hawaiʻi Island (Wagner *et al.* 1999: 995) and more recently East Maui (Wood 2007: 16), this species was found in a highly disturbed riparian area on West Maui.

Material examined. **MAUI**: West Maui, Lahaina Distr, Kauaʻula Valley, 1053 m, common weed

along perennial stream in NW fork of valley, among boulders, in open disturbed areas, 3 Dec 2008, *Oppenheimer & Perlman H120813*.

Poaceae

Festuca rubra L. **Correction**

Reported in error as new island records for Kauaʻi (Wagner *et al*. 1997: 60) and Molokaʻi (Oppenheimer 2008: 33), *F. rubra* should be considered naturalized only on Maui and Hawaiʻi islands. Closer examination of the specimens cited reveals them to represent two endemic species, newly described as *Festuca aloha* Catalán, Soreng, & P.M. Peterson, and *F. molokaiensis* Soreng, P.M. Peterson, & Catalán, from Kauaʻi and Molokaʻi respectively. The latter is known only from the type location in mesic forest (Catalán *et al*. 2009).

Phyllostachys nigra (Lodd. ex Lindl.) Munro **New island records**
var. ***henionis*** (Mitford) Stapf ex Rendle

An aggressive "running" bamboo, native to China and forming extensive, dense stands on moist, shaded slopes and stream banks, 0–400 m on Oʻahu, Molokaʻi, and Maui (Wagner *et al.* 1999:1582). On Kauaʻi, this species was commonly found under similar conditions along Kīlauea Stream. Although first collected in Hawaiʻi on Oʻahu in 1951 (*ibid)* it has undoubtedly occurred on Kauaʻi for quite some time, judging by the extent and size of the stands. On Lānaʻi it is found in several additional areas, including below the old fog-drip station and Maunalei Valley. It is surprising this conspicuous species has not been documented from other islands in the 20+ years since the original publication of the *Manual.*

Material examined. **KAUAʻI**: Hanalei Distr, Kīlauea Str., 49 m, 12 Nov 2008, *Oppenheimer H110816*; **LĀNAʻI**: between Waiakeakua and Haʻalelepaʻakai, 980 m, running bamboo forming thickets, culms <1m apart, to 6 m tall, green, 6 Jan 2009, *Oppenheimer H10901*.

Pontederiaceae

Monochoria vaginalis (N.L. Burm.) K. Presl **New island record**

This aquatic plant is known from the islands of Kauaʻi, Oʻahu (Wagner *et al*. 1999: 1606), and Hawaiʻi (Wagner & Herbst 1995: 23). On Molokaʻi it was found in a dormant *loʻi kalo*, and growing in standing water and adjacent muddy areas, forming patches.

Material examined. **MOLOKAʻI**: Wailau Valley, 90 m, 11 Oct 2009, *Oppenheimer & Perlman H100903.*

Thymelaeaceae

Wikstroemia villosa Hillebr. **Notable rediscovery**

A Maui endemic, this species has not been documented for several decades. Recently a single tree was discovered on East Maui; seeds have been collected and a few plants have been outplanted nearby in The Nature Conservancy Waikamoi Preserve.

Material examined. **Maui**: East Maui, Koʻolau FR, W headwater of Haipuaena Str, 1329 m, single 4-m tree, 30 Jan 2007, *Oppenheimer H10719* (BISH).

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Taxonomic changes in Hawaiian ferns and lycophytes[1]

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This article touches briefly on taxonomic changes that are occurring in vascular plants. It also summarizes some needed changes in nomenclature for Hawaiian ferns and lycophytes. The two nomenclatural innovations (see below) are *Asplenium dielpallidum* N. Snow, **nom**. **nov**., *Asplenium* ×*lauii* (W.H. Wagner) N. Snow, **comb**. **nov**., and *Cyclosorus pendens* (D.D. Palmer) N. Snow, **comb**. **nov**.

Families of flowering plants (angiosperms) in the *Herbarium Pacificum* of the Bishop Museum presently are organized following a system developed by Cronquist (1981). Thousands of papers published in the intervening three decades have clarified many aspects of the classification of plants at all taxonomic levels. The sources of data for the changes have varied, but most studies have relied heavily on DNA sequence data.

The field of systematics also has developed new methods for data analysis, including evolutionary models that can specify the probabilities associated with changes in DNA sequences at the base-pair level. These models are incorporated in software programs that taxonomists use to infer the phylogenies (= evolutionary histories) on which classifications are based. A relative strength of these approaches is the ability to place confidence estimates on each branch of the evolutionary trees. Generally speaking, most systematists do not propose or accept changes in classifications and nomenclature unless branches in the phylogenetic trees are well supported. It is neither possible nor desirable in this article to discuss details behind the methodological advances. However, it is important at some point for botanists to incorporate the new scientific data into their classifications and have them be reflected in how herbaria are organized internally.

A series of papers for angiosperms (cited in APG III 2009) and a dictionary of plant genera (Mabberley 2008) summarize taxonomic changes at the ordinal (e.g., Asterales) and familial (e.g., Asteraceae) levels. Together, these resources (and others) provide a workable basis to taxonomically reorganize a herbarium in a manner that reflects the extensive new data. Many herbaria are in the process of reorganizing their holdings to reflect the newer classification of flowering plants, including many of the world's larger institutions in the US, United Kingdom, Switzerland, France, and the Netherlands (APG III 2009: 106).

This paper, however, concerns the taxonomic reorganizations for Hawaiian ferns and lycophytes. A recent paper by Smith *et al.* (2006) synthesized a large body of data that clarified many of the generic, familial, and ordinal boundaries of ferns. This system of classification, or something similar, already has been adopted by some workers (e.g.,

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Gómez and Arbeláez 2009). As with nearly all studies of generic- and specific-rich families, some of the studies cited by Smith *et al.* (2006) had somewhat limited sampling breadth, and modifications in their proposed classification no doubt will be proposed by various authors in the future. Hawai‘i, with its rich diversity of ferns, is fortunate to have the recent treatment by Palmer (2003).

In this paper we propose two new combinations and one new name for Hawaiian ferns. The changes largely reflect the familial classification of Smith *et al.* (2006). Some changes suggested by Ebihara *et al.* (2006) for Hymenophyllaceae are also followed. Classification and organization of the world ferns in the *Herbarium Pacificum* also will largely follow the families and genera recommended by Smith *et al*. (2006).

Aspleniaceae

The genus *Diellia* Brack., considered endemic to Hawai‘i (Palmer 2003), will be included in *Asplenium*. Fortunately, many of the necessary combinations in *Asplenium* were made previously (Viane & Reichstein 1991). The names used by Palmer (2003) are indicated as synonyms; more complete synonymies for each taxon can be found in Palmer (2003). The new name *Asplenium dielpallidum* (below) is proposed for *Diellia pallida*, as this was apparently overlooked by Viane & Reichstein (1991). As molecular-based phylogenetic studies and fieldwork of the *Asplenium dielerectum* complex are currently in progress, the status of the forms of *Diellia erecta* Brack. will be addressed in a forthcoming publication.

Asplenium dielfalcatum Viane

Syn. *Diellia falcata* Brack.

Asplenium leucostegioides Baker

Syn. *Diellia leucostegioides* (Baker) W.H. Wagner

Asplenium dielmannii Viane

Syn. *Diellia mannii* (D.C. Eaton) W.J. Rob.

Asplenium dielpallidum N. Snow, **nom**. **nov**.

Syn. *Diellia pallida* W.H. Wagner, Contr. Univ. Michigan Herb. 19:66. 1993. – Type: Hawai‘i: Kaua‘i, Mahanaloa Valley, 10 Aug 1949, *W.H. Wagner, Jr. 5805* (holotype: MICH (sheet no. 1259996)).

The new name is necessary given the existence of *Asplenium pallidum* Blume. The new specific epithet suggests the phylogenetic group to which this species evidently belongs.

Asplenium unisorum (W.H. Wagner) Viane

Syn. *Diellia unisora* W.H. Wagner

Asplenium* ×*lauii (W.H. Wagner) N. Snow, **comb**. **nov**.

Syn. *Diellia* ×*lauii* W.H. Wagner, Contr. Univ. Michigan Herb. 22: 171. 1999. –Type: Hawai‘i: Honolulu, Wai‘anae Mts, Honouliuli Preserve, South Palawai Gulch, 17 Jun 1991, *J. Lau & G. Uchida 3395* (holotype: MICH (sheet no. 1287204)).

Cibotiaceae

Cibotiaceae Korall was recently elevated from subfamilial status under Dicksoniaceae to the family level (Smith *et al*. 2006). Palmer (2003) also treated members of *Cibotium* in Dicksoniaceae, which are transferred to Cibotiaceae. The transfer of binomials can be made between families without changes in authorship. The species recognized for Hawai‘i are unchanged from Palmer (2003) and Imada (2008), the latter of which can be consulted for island occurrences.

Dicksoniaceae
The circumscription of *Dicksonia* L'Her. is narrowed in Smith *et al.* (2006), but it includes the naturalized alien species *Dicksonia fibrosa* Col. (Lorence & Flynn 2006; Imada 2008), which was discovered after publication of Palmer (2003). In contrast, members of *Cibotium* are transferred to Cibotiaceae (see above).

Dryopteridaceae
The genus *Nothoperanema* (Tagawa) Ching has been synonymized under *Dryopteris* Adans. (Smith *et al.* 2006), which affects only one species in Hawai'i. The genus *Elaphoglossum* Schott ex J. Sm. was included by Palmer (2003) in Lomariopsidaceae and by Imada (2008) in Elaphoglossaceae. Smith *et al.* (2006) also placed *Elaphoglossum* in Dryopteridaceae, but no changes in Latin binomials are required. *Tectaria* Cav. has been transferred to Tectariaceae (see below).

Dryopteris rubiginosum (Brack.) H. Mann
Syn. *Nothoperanema rubiginosum* (Brack.) A.R. Sm. & D.D. Palmer

Hymenophyllaceae
The study of Ebihara *et al.* (2006) summarized different classifications of Hymenophyllaceae, proposed recognition of nine genera, and indicated the generic placement of all taxa based on their basionyms. Species that remain unchanged include *Callistopteris baldwinii* (D.C. Eaton) Copel., *Vandenboschia cyrtotheca* (Hillebr.) Copel., *V. davallioides* (Gaudich.) Copel. Ebihara *et al.* (2006) noted the combination *Vandenboschia tubiflora* F.S. Wagner (p. 280) but did not include it among the recognized taxa for that subgenus (pp. 241–242). Changes to the Hawaiian ferns include transfers from *Gonocormus*, *Mecodium*, *Sphaerocionium,* and *Vandenboschia* (Palmer 2003).

Crepidomanes draytonianum (Brack.) Ebihara & K. Iwats.
Syn. *Trichomanes draytonianum* Brack.; *Vandenboschia draytoniana* (Brack.) Copel.
Crepidomanes minutum (Blume) K. Iwats.
Syn. *Trichomanes minutum* Blume; *Gonocormus minutus* (Blume) Bosch
Crepidomanes proliferum (Blume) Bostock
Syn. *Trichomanes proliferum* Blume; *Gonocormus prolifer* (Blume) Prantl. Ebihara *et al.* (2006: 238) merge *C. minutum* under *C. proliferum*, but given that Palmer (2003: 160) indicated that the two taxa in Hawai'i are "quite distinct", we continue to recognize both taxa.
Hymenophyllum recurvum Gaudich.
Syn. *Mecodium recurvum* (Gaudich.) Copel.
Hymenophyllum lanceolatum Hook. & Arn.
Syn. *Sphaerocionium lanceloatum* (Hook. & Arn.) Copel.
Hymenophyllum obtusum Hook. & Arn.
Syn. *Sphaerocionium obtusum* (Hook. & Arn.) Copel.

Lomariopsidaceae
Nephrolepis Schott, which in Hawai'i presently includes three species, two cultivars derived from two other wild species, and two hybrid taxa (Imada 2008), was placed in Nephrolepidaceae by Palmer (2003) and Imada (2008) but has been transferred into Lomariopsidaceae (Smith *et al.* 2006). Given the transfer of *Elaphoglossum* (Palmer 2003) out of Lomariopsidaceae (see above), *Nephrolepis* is now the sole generic member of Lomariopsidaceae in Hawai'i.

Lygodiaceae
Palmer (2003) and Imada (2008) placed *Lygodium* Sw. in Schizaeaceae. Smith *et al.* (2006) recognize Lygodiaceae as a separate family, with *Lygodium* as its sole genus. In Hawai‘i this affects only *L. japonicum* (Thunb.) Sw. (Palmer 2003).

Ophioglossaceae
Sceptridium Lyon is merged into *Botrychium* (Smith *et al.* 2006). The one species in Hawai‘i is probably extinct (Palmer 2003).

Botrychium subbifoliatum (Brack.) Lyon
Syn. *Sceptridium subbifoliatum* Brack.; *Botrychium daucifolium* E. Bailey, non Wall.; *B. ternatum* (Thunb.) Sw. subsp. *australasiaticum* Milde forma *subbifoliata* Milde

Polypodiaceae
Smith *et al.* (2006) merged Grammitidaceae Newman (often misspelled as Grammitaceae) into Polypodiaceae. This decision has not met with universal acceptance (Parris 2009), and new genera are being described (Parris 2007) in Grammitidaceae. The justification (Smith *et al.* 2006) for merging Grammitidaceae into Polypodiaceae is because the recognition of Grammitidaceae makes Polypodiaceae paraphyletic, and the most generally accepted principles of classification now require the elimination of demonstrably paraphyletic taxonomic groups if an alternative, well-supported monophyletic alternative exists.

Some generic changes have been proposed for grammitids (Parris 2007; Ranker 2008). In Hawai‘i this involves three genera (Palmer 2003; Imada 2008): *Adenophorus* (ca. 15 taxa), *Grammitis* (2 species), and *Lellingeria* (1 species). Although some of the genera proposed by Parris (2007, 2009) have some cladistic support from the DNA sequences from two chloroplast genes (Ranker, unpublished), many species are not fully resolved in phylogenetic trees, and greater sampling among Hawaiian taxa is desirable before additional changes are implemented. With the transfer of *Grammitis tenella* Kaulf. to *Adenophorus* (Ranker 2008), there are now three species of *Grammitis* in Hawai‘i.

Adenophorus tenellus (Kaulf.) Ranker
Syn. *Grammitis tenella* Kaulf.

Pteridaceae
Haplopteris elongata (Sw.) E.H. Crane, placed in Vittariaceae by Palmer (2003) and Imada (2008), is transferred into Pteridaceae by Smith *et al.* (2006).

Salviniaceae
Azollaceae was recognized as a distinct family by Palmer (2003) and Imada (2008), but was submerged into Salviniaceae by Smith *et al.* (2006). In Hawai‘i this affects only one species, *Azolla filiculoides* Lam.

Tectariaceae
The family as recognized by Smith *et al.* (2006) includes *Tectaria* Cav., which in Hawai‘i includes two species (Palmer 2003; Imada 2008).

Thelypteridaceae

Following Smith *et al.* (2006) the genera *Christella* H. Lév. and *Pneumatopteris* Nakai are merged into *Cyclosorus* Link, and *Amauropelta* Kunze is merged into *Thelypteris* Adans. *Pseudophegopteris* Ching and *Macrothelypteris* (H. Itô) Ching are maintained as distinct genera.

Cyclosorus boydiae (D.C. Eaton) W.H. Wagner

Syn. *Christella boydiae* (D.C. Eaton) Holttum; *Aspidium boydiae* D.C. Eaton; more synonymy in Palmer (2003).

Cyclosorus cyatheoides (Kaulf.) Farw.

Syn. *Christella cyatheoides* (Kaulf.) Holttum; *Aspidium cyatheoides* Kaulf.; more synonymy in Palmer (2003).

Cyclosorus dentatus (Forssk.) Ching

Syn. *Christella dentata* (Forssk.) Brownsey & Jermy; *Polypodium dentatum* Forssk.; *Thelypteris dentata* (Forssk.) E.P. St. John

Cyclosorus hudsonianus (Brack.) Ching

Syn. *Pneumatopteris hudsoniana* (Brack.) Holttum; *Nephrodium hudsonianum* Brack; more synonymy in Palmer (2003).

Cyclosorus ×intermedius W.C. Shieh & J.L. Tsai

Syn. *Christella ×intermedia* (W.C. Shieh & J.L. Tsai) D.D. Palmer; *Thelypteris ×incesta* W.H. Wagner; more synonymy in Palmer (2003).

Cyclosorus parasiticus (L.) Farw.

Syn. *Christella parasitica* (L.) H. Lév.; *Polypodium parasiticum* L.; more synonymy in Palmer (2003).

Cyclosorus ×palmeri (W.H. Wagner) W.H. Wagner

Syn. *Christella cyatheoides* × *C. dentata*; *Thelypteris ×palmeri* W.H. Wagner

Cyclosorus pendens (D.D. Palmer) N. Snow, **comb. nov.**

Syn. *Pneumatopteris pendens* D.D. Palmer, American Fern Journal 95(2): 81, fig. 1. 2005. –Type: Hawai‘i, Hawai‘i Island, Hawaii Volcanoes National Park, Puna District, Thurston Lava Tuba, ca 1158 m, 2 Apr 2003, *L.W. Pratt 3306* (holotype: BISH).

Cyclosorus sandwicensis (Brack.) Copel.

Syn. *Pneumatopteris sandwicensis* (Brack.) Holttum; *Stegnogramma sandwicensis* Brack.; more synonymy in Palmer (2003).

Cyclosorus wailele (Flynn) W.H. Wagner

Syn. *Christella wailele* (Flynn) D.D. Palmer; *Thelypteris wailele* Flynn

Thelypteris globulifera (Brack.) C.F. Reed

Syn. *Amauropelta globulifera* (Brack.) Holttum; *Lastrea globulifera* Brack.; *Dryopteris globulifera* (Brack.) Kuntze; *Nephrodium globuliferum* (Brack.) Hook.

Woodsiaceae

Palmer (2003) and Imada (2008) included four genera in Athyriaceae (*Athyrium*, *Cystopteris, Deparia*, and *Diplazium*), all of which are treated under Woodsiaceae by Smith *et al.* (2006).

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Notes on grasses (Poaceae) in Hawai‘i: 3[1].

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Additional new records for the grass family (Poaceae) are reported for Hawai‘i, including five state records, three island records, one corrected island report, and one cultivated species showing signs of naturalization. We also point out minor oversights in need of correction in the *Flora of North America* Vol. 25 regarding an illustration of the spikelet for *Paspalum unispicatum*. Herbarium acronyms follow Thiers (2010). All cited specimens are housed at the *Herbarium Pacificum* (BISH) apart from one cited from the Missouri Botanical Garden (MO) for *Paspalum mandiocanum,* and another from the University of Hawai‘i at Mānoa (HAW) for *Leptochloa dubia*.

Anthoxanthum odoratum L. **New island record**

This perennial species, which is known by the common name vernalgrass, occurs naturally in southern Europe but has become widespread elsewhere (Allred & Barkworth 2007). Of potential concern in Hawai‘i is the aggressive weedy tendency the species has shown along the coast of British Columbia, Canada, where it is said to be rapidly invading moss-covered bedrock of coastal bluffs, evidently to the exclusion of native species (Allred & Barkworth 2007). The species has been recorded previously on Kaua‘i, Moloka‘i, Maui, and Hawai‘i (Imada 2008).

Material examined. **O‘AHU**: Mt Ka‘ala Road, west mesic roadside, without date, *US Army 123* (BISH 738557).

Deschampsia caespitosa (L.) P. Beauv. **New state record**
subsp. ***beringensis*** (Hultén) W. E. Lawr.

As treated by many recent authors, *Deschampsia caespitosa* is widespread and ecologically common across much of the boreal and north-temperate zones (Wu & Phillips 2006; Barkworth 2007). This circumboreal species, known as Beringian hairgrass or tufted hairgrass, occurs on the American mainland at higher elevations into southern California east through New Mexico, and in the Appalachian Mountains south through Alabama. The native distribution of subspecies *beringensis* is said to be the “northwest coast of North America” (Barkworth 2007). The taxonomy of *D. caespitosa* is complicated, and it has not been studied adequately across its range (Barkworth 2007; Wu & Phillips 2006). Wagner *et al*. (1999) discussed the differences of taxonomic opinion in Hawai‘i regarding *D. caespitosa* and the Hawai‘ian endemic *D. nubigena* Hillebr. As presently understood, *Deschampsia caespitosa* subsp. *beringensis* can be diagnosed from *D. nubigena* by its wider leaves (2–4 mm, versus 0.5–1.5 mm in *D. nubigena*), longer spikelets (4.5–8.0 mm, versus 3.5–5.5 mm in *D. n.*), longer first glume (4.3–7 mm, versus ca 3.5 mm in *D. n.*), longer second glumes (4.4–7.5 mm, versus ca 4 mm in *D. n.*), longer lemmas (3–5(–7) mm, versus ca 4 mm in *D. n.*), and shorter caryopsis (0.5–1.0 mm, versus ca 1.6 mm in

1. Contribution No. 2011-007 to the Hawaii Biological Survey.

D. n). The specimen cited below was said to be common in subalpine shrubland where it was collected. The subspecies is not considered to have weedy tendencies.

Material examined. **MAUI**: East Maui, Makawao Distr, Kula Forest Reserve, Waiakoa Ahupuaʻa, 6220 ft [ca 1895 m], 20.725713°N, 156.292432°W, 15 Jun 2009, *H. Oppenheimer H60916 & E. Molina*.

Dichelachne micrantha (Cav.) Domin **New island record and correction**

Lorence and Flynn (1999) reported *Garnotia acutigluma* (Steud.) Ohwi as an island record for Kauaʻi. While reviewing duplicate material at K, Dr. JeF Veldkamp (L) suggested that I compare the specimen cited below to the genus *Dichelachne*. The specimen keys easily to *D. micrantha* (Clayton & Snow 2010) and compares well to other material at the *Herbarium Pacificum*. The changed identification means that *G. actuigluma* is not known from Kauaʻi. In contrast, this report is the first for *D. micrantha* from Kauaʻi, which has been reported previously for Lānaʻi (Imada 2008).

Material examined. **KAUAʻI**: Waimea District, Waimea Canyon State Park, Hwy 550 near mile 12, elev. ca 1030 m, ca 22°6'N, 159°40'W [coordinates added *post facto*], 28 Apr 1997, *T. Flynn & D.H. Lorence 6145*.

Leptochloa dubia (Kunth) Nees **New state record**

The native range of this perennial species includes the southwestern USA and northern Mexico, southern Florida, and portions of the Caribbean and South America (Snow 2003). Unlike some annual taxa in the genus (Snow & Simon 1999; Snow 2004), *L. dubia* lacks invasive or weedy tendencies and its potential to spread or become aggressively weedy in Hawaiʻi probably is low. Its occurrence in Hawaiʻi also represents the first report for the Pacific (Clayton & Snow 2010). The first specimen cited was collected from open, mixed scrub. The second was collected in exclosure plots where re-vegetation studies are being conducted by the U.S. Geological Survey, probably within 3 km from the first collection.

Material examined. **MOLOKAʻI**: Molokaʻi Project – Transect 9, Makakupaʻia Ridge, 1900 ft [ca 580 m], 28 Nov 1982, *Char et al. 82.046* (HAW). Kawela, east of road TRA, A-1300 plot, 27 Apr 2010, *J.D. Jacobi s.n.* (BISH 745611).

Paspalum arundinaceum Poir. **New state record**

Snow and Lau (2010) reported on the uncertain identity of the specimen cited below and suggested affinities to *Paspalum laxum* Lam. The second author has compared the specimen to material at MO and is confident of its identity as *P. arundinaceum*. The species ranges from Belize and Mexico and the Caribbean south to Colombia and Brazil (Zuloaga et al. 2005; Pohl & Davidse 2001). This report is the first for Hawaiʻi (Imada 2008) and the Pacific (Clayton & Snow 2010), and the absence of reports elsewhere (Koyama 1987; Sharp & Simon 2002; Chen & Phillips 2006) suggests the species does not have invasive tendencies. Users of the key to species of *Paspalum* for Hawaiʻi (Snow & Lau 2010) can substitute *P. arundinaceum* in the second half of couplet 15 for *P.* aff. *laxum*.

Material examined. **MAUI**: East Maui, Hāna Distr., Kīpahulu, between Koukouai and ʻŌpelu, Maʻulili *ahupuaʻa*, 20.660187°N, 156.067674°W, 207 m [ca 680 ft], 16 Oct 2005, *H.L. Oppenheimer H100509*.

Paspalum mandiocanum Trin. var. ***mandiocanum***

New state record

Despite having been collected as early as 1987, specimens of this taxon in Hawaiʻi have

remained unidentified confidently until now. The typical variety of *Panicum mandiocanum* is now widely distributed in Hawai‘i, and has been confirmed for Maui, O‘ahu, and Moloka‘i. The native range of the species is Brazil, Uruguay, Paraguay and Argentina. Zuloaga & Morrone (2005) included it in their informal subgeneric group *Corcovadensia*, and recognized also *P. mandiocanum* var. *subaequiglume* Barreto. The latter variety differs from *P. mandiocanum* var. *mandiocanum* by its shorter and narrower leaves, and especially by its upper glume, which is noticeably shorter than the spikelet. Surprisingly, in our effort to identify this species, a previously unidentified collection from Hong Kong (see below) also was discovered to be this species, which evidently also represents the first frecord for China (Chen & Phillips 2006). Users of the key to species of *Paspalum* for Hawai‘i (Snow & Lau 2010) can substitute *P. mandiocanum* in the first half of couplet 10 in place of *P.* aff. *thunbergii*.

Material examined. HAWAI‘IAN ISLANDS: **MAUI:** Kuhiwa Rd, 28 Jul 1987, *R.W. Hobdy 2913, R.W. Hobdy 2914*. East Maui, lower Waikamoi along pipeline, Dec 2006, *R.W. Hobdy 4281*. Keopuka, UTM NAD 83 Zone 4, 2310977 N, 794198E, 5 Apr 2005, *F. Starr 050405-50*. East Maui, Makawao District, Honokala, 20º47’N, 156º04’W, 540 ft, 14 Jul 2002, *H.L. Oppenheimer H70202*. E. Amui, Hana District, Keopuka, 2310574N, 793587W, 640 ft, 23 Aug 2007, *H.L. Oppenheimer H80703*. **MOLOKA‘I**: Moloka‘i FR, junction of Forestry Rd and rd to Pu**'**u Kauwa, 21.137779ºN, 156.948179ºW, 25 Sep 2008, *H.L. Oppenheimer H90820*. **O‘AHU:** Pupukea-Paumalu, Ko‘olauloa, Ko‘olau Mountains, ca 500 ft, 6 Dec 1987, *K.M. Nagata & W. Takeuchi 3750*. CHINA: **Hong Kong**: Sheung Shui Government Agr. Exp. Sta., 21 Jul 1993, *Hu & But 22518* (MO).

Paspalum unispicatum (Scribn. & Merr.) Nash **New state record**

The specimen cited below was sent to the first author by Matt Stevenson, who tentatively identified the species correctly. The native range of the species is from Texas southwards through Central America, parts of the Caribbean, to Argentina, typically in sandy soils (Allen & Hall 2003). This record also appears to be the first from the Pacific region (Clayton & Snow 2010). The vegetative and reproductive characters of the specimen generally matched well with descriptions (Hitchcock 1951; Gould 1975; Allen & Hall 2003), although its rhizomes are somewhat less scaly and prominent compared to images on TROPICOS® (2010) [*Stanford et al. 2315*; *Pringle 6717* [an isotype]). In most cases *Paspalum unispicatum* should be distinguishable from congenerics in Hawai‘i (Snow & Lau 2010) by the combination of rhizomes, culms less than 1 meter tall, and its prominent terminal inflorescence, which consists of a single branch that bears a spikelet at the tip. In addition, the leaf margins are conspicuously papillose-ciliate and the upper leaf surface is conspicuously hairy. The rachis (central axis of the inflorescence) is flattened but also somewhat curved around the two rows of spikelets. The spikelet illustrated for *P. unispicatum* in *Flora of North America* (Allen & Hall 2003: 600; right-center of the illustration for the species overall) is labeled incorrectly: “lower glume” should read “upper glume”, and the drawing should include two lateral nerves to the right of the midnerve (similar to the two nerves left of the midnerve).

According to Stevenson (pers. comm., 2009), the area from which the specimen was collected has had extensive erosion control measures applied to help stabilize the trail, and that *Paspalum unispicatum* has been effective in this regard. Seed mixtures for re-vegetation were obtained from Koolau Seed and Supply of Kane‘ohe. At the time of the collection the population of *P. unispicatum* was restricted to the trailside, along the upper third of the half-mile long area that had been treated.

Material examined. **KAUA‘I**: Hanalei, ‘Ōkolehao Trail, ca 22°11.992'N, 159°28.566'W, 175-325 ft, 30 Jun 2009, *M. Stevenson & M. Rosener 35* (BISH 746803).

Tragus berteronianus Schult. **New island record**

This non-native species has stout hooked prickles arising from the upper glume. In Hawai‘i it also has been collected on Kaua‘i, Moloka‘i, and Maui, but it otherwise has not spread across the Pacific (Clayton & Snow 2010). The label lacks a collection date. *SESP* is an abbreviation for *State Endangered Species Program*, and *SESP* collections at the *Herbarium Pacificum* were made from July 1977 to January 1997. Since the Bishop Museum accession number for this collection label is from 2000, and since two collections of *Eragrostis* also were made by *SESP* on the northern rim of Diamond Head on 30 January 1997, this specimen likely was collected about 14 years ago.

Material examined. **O‘AHU**: Diamond Head, northern rim, 21°15'N, 157°48'W, no collection date, *SESP s.n.* (BISH 667204).

Cultivated but with potential to naturalize

Melinis nerviglumis (Franch.) Zizka

This species recently has been observed in cultivation in Wailupe area, Waipi‘o, and Hawai‘i Kai on O‘ahu. At the Wailupe and Waipi‘o localities it was reseeding itself in the areas immediately adjacent to where it was being cultivated. In Hawai‘i Kai there was no evidence that it was reseeding itself in the one yard where it was found growing along the sidewalk (Snow, pers. obs., 2009). These plants were removed later by the homeowners after having been contacted about their potential to spread (Snow, pers. obs., 2010). The species has not been documented elsewhere in the state, but clearly has shown the ability to self-perpetuate from seed on O‘ahu, and as such is a potential weed in Hawai‘i. Future reports for Hawai‘i are encouraged to follow the terminological recommendations regarding the process of naturalization as summarized by Pyšek *et al*. (2004). The native distribution of *M. nerviglumis* is Madagascar and southern Africa (South Africa, Lesotho, and Swaziland), where it can be locally abundant (Gibbs-Russell *et al.* 1990). The species closely resembles the widespread weedy species *M. repens* (Willd.) Zizka, but can be distinguished from that species by its tightly overlapping basal leaf sheaths, strongly involute leaves, and awns mostly ≤2 mm long. The panicles on specimens from O‘ahu were somewhat more contracted than that typically seen for the weedy *M. repens*, although Lyn Fish (pers. comm., 2009) in Pretoria indicated this is a subtle and not always reliable character for separating *M. nerviglumis* and *M. repens*. Vouchers were not pressed for the plants found at Waipio and Hawai‘i Kai. However, they were an excellent match for the voucher cited below, and compared favorably to specimens housed at MO, seen by the first author in May 2010.

Material examined. **O‘AHU**: Wailupe, at 1132 Waianiani, sparingly adventive, 24 Mar 2009, *Oahu Early Detection 2009032402*.

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New Plant Records from Midway Atoll, Maui, and Kahoʻolawe

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

Agavaceae

Furcraea foetida (L.) Haw. **New island record**

Furcraea foetida (Mauritius hemp) is widely cultivated for fiber and often becomes naturalized. In Hawaiʻi, it is previously documented as naturalized, often locally abundant in dry to mesic disturbed sites where it spreads from bulbils rather than seeds, on all the main islands except Niʻihau and Kahoʻolawe (Wagner *et al.* 1999). It has recently also been found to be naturalized on Kahoʻolawe where it is locally abundant along the road to Kūheia in dry scrub.

Material examined: **KAHOʻOLAWE**: Kūheia, just off of Kūheia Road, plants spreading from patch about 50 m on a side, in association with *Leucaena leucocephala, Heteropogon contortus,* and *Prosopis pallida*, 1197 ft [365 m], 10 Feb 2008, *Starr, Starr, & Higashino 080210-02*.

Amaranthaceae

Alternanthera brasiliana (L.) Kuntze **New island record**

Alternanthera brasiliana (ruby leaf, Brazilian joyweed, alligator weed) is native from Mexico to Brazil and the West Indies, and has been reported as naturalized in Hawaiʻi on Oʻahu (Wagner & Herbst 1995) and on Molokaʻi (Wagner *et al.* 1999). This upright plant with ruby red leaves and attractive small rounded spiky flowers is occasionally cultivated as a specimen or bedding plant. It occasionally escapes and is naturalized in south Florida (USDA 2009). In Arkansas, all *Alternanthera* spp., including *A. brasiliana*, are listed as noxious weeds (USDA 2009). *A. brasiliana* is here reported as a new island record for Maui where it was observed spreading from cultivated plants in and around a botanical garden.

Material examined: **MAUI**: East Maui, Kula, Enchanting Floral Gardens of Kula, a few patches and scattered individuals, germinating in hedges, appeared to be spreading, in association with a wide variety of ornamental plants in botanical garden, 2350 ft [716 m], 19 Feb 2008, *Starr & Starr 080219-05*.

Asteraceae

Arctotheca calendula (L.) Levyns **New state record**

Arctotheca calendula (Capeweed, Cape dandelion) is native to coastal and disturbed areas of western and eastern Cape extending to Natal, Africa (Letsela & Turner 2002). It is an annual herb or sprawling perennial growing up to 25 cm high, with basal leaves that form

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a rosette, are woolly above and have deeply divided margins; and daisy-type flowers up to 6 cm across that are a striking yellow (Letsela & Turner 2002). It is cultivated as an ornamental groundcover at least in upland areas of East Maui. Though previously not mentioned as being cultivated in Hawai‘i (Staples & Herbst 2005; Imada *et al.* 2005), we first observed this species being cultivated in a botanical garden located in Kula, Maui, where it was covering large areas and scattered here and there. During follow up roadside surveys, we found this species widely cultivated and sparingly naturalized in lawns and yards in the Upcountry East Maui area from Makawao to Kēōkea. This collection represents a new state record for Hawai‘i.

Material examined: **MAUI**: East Maui, Kula, Enchanting Floral Gardens of Kula, widely established on botanical garden grounds, sparingly naturalized, spreading by budding plants, growing with wide variety of ornamentals in upcountry botanical garden, 2350 ft [716 m], 19 Feb 2008, *Starr & Starr 080219-01*.

Crassocephalum crepidioides (Benth.) S. Moore **New island record**

A widely naturalized species throughout the Old World, documented from relatively dry to wet areas of Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and O‘ahu (Wagner *et al.* 1999; Nagata 1995), *Crassocephalum crepidioides* (redflower ragweed) is now also documented from Kaho‘olawe where it was found in a seed germination planter bail.

Material examined: **KAHO‘OLAWE**: Pu‘u Mōiwi, along bypass Rd, coming up in *Heteropogon contortus* and *Eragrostis variabilis* planter bails, in association with *Dodonaea viscosa, Asclepias physocarpa,* and *Chenopodium oahuense*, 1115 ft [340 m], 8 Feb 2008, *Starr, Starr, & Higashino 080208-03*.

Montanoa hibiscifolia (Benth.) Standl. **New island record**

In Hawai‘i, *Montanoa hibiscifolia* (tree daisy) was first introduced in 1919 to the island of O‘ahu. It has since naturalized in disturbed dry to mesic areas on Kaua‘i, O‘ahu, Lāna‘i, Maui, and Hawai‘i (Wagner *et al.* 1999). It is reported for the first time as a new island record from Kaho‘olawe, where several large flowering plants were scattered in a gully in the Upper Kaulana area near restoration plantings.

Material examined: **KAHO‘OLAWE**: Upper Kaulana, just off Park Rd, upland dry shrubland, growing in association with *Prosopis pallida*, *Pluchea carolinensis, Cenchrus ciliaris*, and *Casuarina equisetifolia*, scattered patches in gully, 1100 ft [335 m], 30 Dec 2008, *Starr, Starr, & Higashino 081230-01*.

Boraginaceae

Cynoglossum amabile Staph & J.R. Drumm. **New island record**

Cynoglossum amabile (Chinese forget-me-not) is previously recorded from Hawai‘i island where it is locally common in grasslands and pastures (Wagner *et al.* 1999). On Maui, it appears to be a new ornamental that readily reseeds itself and spreads beyond where it is planted. This collection represents a new island record for Maui.

Material examined: **MAUI**: East Maui, ‘Ulupalakua Ranch, planted in herb garden in front of store, spreading locally, 1900 ft [579 m], 25 Mar 2006, *Starr & Starr 060325-01*.

Casuarinaceae

Casuarina glauca Siebold ex. Spreng. **New island record**

In Hawai‘i, *Casuarina glauca* (longleaf ironwood, she oak) has been planted for ornament and in forestry and erosion control efforts and is known to persist and spread extensively

through root suckering on the islands of Midway Atoll, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi (Wagner *et al.* 1999; Oppenheimer & Bartlett 2000; Starr *et al.* 2002; Oppenheimer 2008). Here, it is reported as a new island record for Kahoʻolawe where it is also spreading and suckering from planted material in the Upper Hakioawa area.

Material examined: **KAHOʻOLAWE**: Upper Hakioawa, along access road, scattered patches, suckering from parent trees, in association with *Melinis repens*, *Cenchrus ciliaris*, and *Tamarix aphylla*, 1246 ft [380 m], 8 Feb 2008, *Starr*, *Starr, & Higashino 080208-02*.

Cyperaceae

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

Cyperus gracilis (McCoy grass) is cultivated in Hawaiʻi as a ground cover and reported as sparingly naturalized on Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi (Hughes 1995; Wagner *et al.* 1999; Oppenheimer & Bartlett, 2002; Starr *et al.* 2003). This small grass like sedge is reported here as a new island record for Kahoʻolawe.

Material examined: **KAHOʻOLAWE**: Puʻu Moaʻulanui, Ukumehame rain koa, North rim of Lua Makika, small patch a few meters on a side, growing amongst grasses, in association with *Dodonaea viscosa, Santalum ellipticum,* and *Melinis repens*, 1443 ft [445 m], 9 Feb 2008, *Starr*, *Starr, & Higashino 080209-01*.

Fabaceae

Acacia retinodes Schltdl. **New naturalized record**

Native to Australia, *Acacia retinodes* (water wattle) was first collected in Hawaiʻi in 1917 by J. Rock from the island of Oʻahu (Bishop Museum 2010). In addition, forestry records show that 50 trees were planted in 1927 in the Honouliuli Forest Reserve on Oʻahu (Skolmen 1980). It was not collected again in Hawaiʻi until 1999 on the island of Maui along Waipoli Rd. where several plants were found spreading from cultivated plants located nearby in a cool, moist woodland setting. This small to medium sized tree, which bears numerous small fragrant golden pompom-like flowers and attractive linear leaves, is cultivated in warm climates and has been known to escape in at least California and Florida (USDA 2009). Due to its limited distribution on Maui and potential for invasiveness, it was targeted for eradication in 2003 by the Maui Invasive Species Committee (MISC), who had removed the cultivated and naturalized plants by late 2004. After initial control, the site was occasionally monitored for seedlings with no signs of regeneration for several years. In 2009 during roadside surveys, plants were again found in the area where the naturalized plants had been removed. Though trees were only a few meters tall, they had already gone to seed again, and the site will likely need to be monitored for several years until the seed bank no longer persists. Water wattle is distinguished by the following characteristics. “Shrub or small tree; phyllodes linear-lanceolate, to 5 in long, nearly straight, with gland near base; fl. heads 1/4 in. across, in branched racemes shorter than phyllodes; fr. narrow, to 8 in. long” (Bailey & Bailey 1976).

Material examined: **MAUI**: East Maui, Kula, Waipoli Rd, along old road cut, mesic mid-elevation residential, farm, unmaintained area, few dozen seedlings and small trees, in association with *Pittosporum viridiflorum*, *Asparagus asparagoides*, *Eucalyptus* sp., and *Acacia mearnsii*, 3300 ft [1005 m], 13 May 2009, *Starr & Starr 090513-01.*

Adenanthera pavonina L. **New island record**

Adenanthera pavonina (false *wiliwili*, red sandalwood) is widely cultivated and naturalized in warm climates, and is occasionally cultivated in Hawaiʻi as an ornamental or shade

tree and for reforestation. The red seeds of this species can be strung into lei (Staples & Herbst 2005). It was first reported as a new naturalized record on the island of Kauaʻi where it was spreading locally from planted trees (Wagner & Herbst 1995). It is here reported as a new island record for Maui from Nāhiku where regeneration was noted near large trees along an old trail and road.

Material examined: **MAUI**: East Maui, Nāhiku, East Maui, Nāhiku, trail to Hanawī, lowland, wet, nonnative tall forest, in association with *Miconia calvescens*, *Ardisia elliptica*, *Costus* sp, and *Mangifera indica*, two tall old trees and lots of seedlings and saplings (<1m tall), curly pods observed in canopy, 100 ft [30 m], 23 Jun 2009, *Starr & Starr 090623-01*.

Bauhinia monandra Kurz **New island record**

Bauhinia monandra (pink bauhinia, orchid tree, Napoleon's plume) is a medium sized tree with attractive green foliage and numerous pink flowers. It is widely cultivated in the tropics and occasionally escapes (Staples & Herbst 2005). In Hawaiʻi, it was first reported as naturalized on the island of Hawaiʻi from the south Kona district where it was observed in secondary vegetation and pasture land (Lorence & Flynn 1999). In Hāna Maui, *B. monandra* is now spreading into similar habitat from nearby park plantings, representing a new island record.

Material examined: **MAUI**: East Maui, Hāna, Pāʻani Mai Park, park and lowland, wet, semi-abandoned pasture, in association with *Spathodea campanulata*, *Digitaria insularis*, *Delonix regia*, *Artocarpus altilis*, and *Clusia rosea*, a few cultivated adults in park with a few dozen small trees in nearby pasture and lots of seedlings, 100 ft [30 m], 23 Jun 2009, *Starr & Starr 090623-02*.

Calliandra surinamensis Benth. **New naturalized record**

An evergreen shrub to small tree native to South America, *Calliandra surinamensis* (Surinam powderpuff, pink powderpuff) is widely cultivated for its fragrant pink powderpuff like blooms (GRIN 2010; Gilman & Watson 1993), and is known to escape from cultivation in Australia (PIER 2009). This colorful legume is also cultivated in Hawaiʻi and is here reported as a new naturalized record from the island of Maui where it was observed to be spreading from cultivated plants to nearby unmaintained areas in a yard and into scrub areas across the street. It can be distinguished by the following characteristics. "Spreading shrub or small tree about 2 m high (up to 6 m elsewhere). It has leaves with short petioles 6–15 mm long and 1 (infrequently 2 or 3) pair of pinnae, these 3–7 cm long and with 7–10 pairs of leaflets 10–17 x 3–5 mm. The flowers are sessile in showy heads, the calyx and corolla are green to yellowish, the filament tube is white, and the free parts of filaments are red to crimson. The fruits are oblong from a narrow base, thick-margined, 7–10.5 cm long, and 8–13 mm broad" (Smith 1985).

Material examined: **MAUI**: West Maui, Launiupoko, residential area and scrub areas nearby, in association with *Leucaena leucocephala* and *Panicum maximum*, few plants here and there, some in yard, some across street, 700 ft [213 m], 8 Jul 2009, *Starr & Starr 090708-02*.

Cassia javanica L. var. ***indochinensis*** Gagnepain **New naturalized record**

Cassia javanica var. *indochinensis* (pink shower tree), native to northeastern India, Indochina, and southern China to Java and Sumatra, is a well known ornamental tree in Hawaiʻi (Staples & Herbst 2005). It is previously not recorded as naturalized in Hawaiʻi, but was recently found spreading in the wet lowland area of Hāna, Maui. Many small seedlings and saplings were noted in the adjacent un-maintained property, appearing to have spread from nearby large adult planted trees. This variety is also known to be natu-

ralized in Florida (USDA 2009). This common ornamental tree is distinguished by the following characteristics: tree to 35' tall; leaves about 1' long; leaflets 5–15 pairs, elliptic-oblong to oval, 1–2" long; inflorescences of racemes 6–7" long, from old bran, bracts and bractlets persistent until flowers open; flower sepal ovate, about .25" long, slightly pubescent, petals pink, fading to white, .75–0.50" long, filament of 3 longest stamens about 1.5" long, swollen near middle into ellipsoid nodule; fruit 1–2' long, straight, dark brown, ridged; seeds 50–100, reddish brown, separated by partitions, each in dry, disc-shaped capsule (Staples & Herbst 2005).

Material examined: **MAUI**: East Maui, Hāna, Hāna Hospital, wet lowland jungle / pasture bordering urban area, associated with *Spathodea campanulata* and *Pilea microphylla*, many seedlings and saplings in this area, along with some old looking original trees, 125 ft [38 m], 2 Jul 2009, *Starr & Starr 090702-02.*

Macroptilium atropurpureum (DC) Urb. **New island record**

Macroptilium atropurpureum (twining cow pea) is previously known from the islands of Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi (Wagner *et al.* 1999; Oppenheimer 2003; Lorence & Flynn 2006; Oppenheimer 2008). This creeping legume is here reported as a new island record for the island of Kahoʻolawe. Several patches were noted at the collection site and it is also known from the summit area and continues to spread (P. Higashino, pers. comm.).

Material examined: **KAHOʻOLAWE**: LZ1, along road, patches here and there, with seedpods and numerous flowers that were being visited by monarch butterflies and white lined sphinx moths, in association with *Nicotiana glauca* and *Cenchrus ciliaris*, 1394 ft [425 m], 8 Feb 2008, *Starr*, *Starr, & Higashino 080208-01*.

Trifolium campestre Schreb. **New state record**

Trifolium campestre (field clover) is not previously known from Hawaiʻi. We initially identified this species (unpubl.) as *Trifolium dubium*, but the error was called to our attention by Bram D'houdt (Ghent University, Belgium) who identified the species as *T. campestre*. It is distinguished from *T. dubium* by having the following characteristics. "Corolla clearly striate; infl 0.8–1.3 cm wide, generally >20 flowered; petioles, exc of uppermost lvs, >lflts." Full description: "Annual, puberulent. Stem decumbent to erect. Leaves 1-pinnate, cauline; stipules ovate; leaflets 0.6–1.5 cm, obovate. Inflorescence head-like, ovoid to spheric; flowers quickly reflexed. Flower: calyx 1.5–2 mm, upper lobes < lower; corolla 4–5.5 mm, bright yellow, becoming brown, striate. Fruit fragile; style persistent, <1 mm. Seed 1." (Jepson Herbarium 1993). This collection represents a new state record for Hawaiʻi from the island of Maui.

Material examined: **MAUI**: East Maui, Polipoli, Kaʻonoʻulu, occasional along side of road, forest / pasture, growing in association with *Acacia mearnsii*, *Lotus subbiflorus*, and *Medicago lupulina*, 5000 ft [1524 m], 19 Mar 2009, *Starr & Starr 090319-01;* East Maui, Polipoli, Kaʻonoʻulu, occasional along side road, open pasture, growing in association with *Pennisetum clandestinum*, 4200 ft [1280 m], 19 Mar 2009, *Starr & Starr 090319-02.*

Fumariaceae

Fumaria officinalis L. **New state record**

Fumaria officinalis (drug fumitory, common fumitory) is an interesting looking purple flowered herb native to Africa, temperate Asia, and Europe that is cultivated for its medicinal properties to treat stomach, liver, kidney, and skin conditions (GRIN 2010; Wikipedia

2009; Brown 1878). It is widely naturalized throughout Canada and the United States and is listed as a seed contaminant (USDA 2009). In Hawai‘i, this species is previously not known and was recently found naturalized along a roadside on Maui in a pastoral / residential roadside setting. This new state record can be distinguished by the following characteristics. “Plants 1–7 dm. Inflorescences, excluding peduncle, 3–7 cm; bracteoles 1/2 to nearly as long as pedicels. Flowers : pedicel straight and ascending in fruit, ca 3 mm; corolla 6–9.5 mm, spur ca 2.5 mm; petals purplish pink or white near base, deep reddish purple to maroon apically. Capsules subglobose, sometimes slightly depressed, 1.5–2 mm diam., ± warty or pebbled. 2*n* = 32, 48.” (FNA, 2009).

Material examined: **MAUI**: East Maui, Olinda, Meha Rd, sprawling herb in horse pasture near residential area, in association with *Tecoma stans*, *Pennisetum clandestinum,* and *Senecio madagascariensis*, few clumps along road, 1900 ft [38 m], 2 Jul 2009, *Starr & Starr 090702-02.*

Grossulariaceae

Brexia madagascariensis Thou. ex Ker Gawl. **Range extension**

Brexia madagascariensis was previously known from East Maui, where it was spreading from forestry planting in a wet lowland setting (Starr *et al.* 2003). The same is occurring on West Maui, where this tree with distinctly different juvenile and adult leaves is spreading from a forestry planting at ‘Iao Valley State Park. The original planting consisted of six trees planted in 1956 (Skolmen, 1980).

Material examined: **MAUI**: West Maui, ‘Iao Valley State Park, in plantings by stream, few large planted trees with scattered saplings nearby, in association with *Enterolobium cyclocarpum*, *Schefflera actinophylla*, and *Ficus pseudopalma*, 1000 ft [304 m], 30 Apr 2010, *Starr & Starr 100430-01*.

Lamiaceae

Hyptis verticillata Jacq. **New state record**

Hyptis verticillata (John Charles weed) originates from Central and South America (Cornell University 2009; GRIN 2010). The plant grows to a height of about 2 m and has oval leaves and white flowers (Cornell University 2009). This species was first collected on East Maui by R.W. Hobdy, S. Perlman & K.R. Wood on July 19, 1991 at Maliko Gulch off Hāna Hwy (BISH 611502), and was determined by G. Staples to probably be *H. verticillata*. The identity was later confirmed when a specimen collected by the authors in the same general area on 21 September 2002 (BISH 697612) was determined by a specialist from Kew, R.M. Harley. A third collection, again in the same general area, was made on 28 September 2002 by H.L. Oppenheimer (BISH 707311) (Bishop Museum, 2010).

Material examined: **MAUI**: East Maui, Ha‘iku Hill, Ha‘iku, scattered plants in abandoned pasture, in association with *Peltophorum pterocarpum* and *Psidium guajava*, 450 ft [137 m], 21 Sep 2002, *Starr & Starr 020921-01*.

Myrtaceae

Eucalyptus goniocalyx F. v. Muell. ex. Miq. **New island record**

Eucalyptus goniocalyx (mountain gray gum) was previously known to be planted and regenerating within or near plantations on the islands of O‘ahu and Hawai‘i (Wagner *et al.*, 1999). It is now also known from Maui where it is spreading from large *Eucalyptus* plantings within sub-alpine shrubland on East Maui.

Material examined: **MAUI**: East Maui, Pohakuokala Gulch, near hunter cabin, spreading from large planted grove, in gulch with *Metrosideros polymorpha*, *Leptecophylla tameiameiae*, *Vaccinium reticulatum,* 6450 ft [1965 m], 17 Mar 2010, *Starr & Starr 100317-01*.

Myrtaceae

Eugenia brasiliensis Lam. **New naturalized record**

Eugenia brasiliensis (Spanish cherry, Brazilian plum, grumichama) is native to southern coastal Brazil and has been widely cultivated in the tropics and subtropics for its edible fruit (Staples & Herbst, 2005). Introduced in Hawai‘i perhaps as early as 1791, it was once a popular ornamental plant and likely persists today in older gardens and collections (Staples & Herbst, 2005). The earliest collection from Maui is from 1932 from cultivated specimens at the old Baldwin home in Wailuku (Bishop Museum 2010). Though long cultivated in Hawai‘i, this species has not previously been recorded as naturalized. It was recently found to be naturalized in wet, disturbed lowland secondary forests and gulches in the Ha‘ikū vicinity of East Maui, representing a new naturalized record for the state of Hawai‘i. Though recorded as a host of the rust fungus *Puccinia psidii* as early as 1918 in its native Brazil (Simpson *et al*., 2006), we did not observe *E. brasiliensis* to be infected with the rust, though *Syzygium jambos* nearby in Ha‘iku was infected. Staples & Herbst (2005) provided the following description. “Slender tree 25–35' tall. Leaf blades oblong-ovate, 3.5–5" long, 1–2.25" wide, leathery, glossy, both sides minutely pitted, margins recurved. Inflorescences in terminal cluster on bran, or flowers solitary, pedicels 1.25–2" long. Flower sepals 4, green; petals 4, white; stamens to 100; anthers pale yellow. Fruit flattened-globose, 0.5–0.75", red turning dark purple-black when ripe, flesh juicy, apex capped by persistent sep. Seeds 1–3, to 0.5" wide, pale tan to greenish grey.”

Material examined: **MAUI**: East Maui, Ha‘ikū, Ulumalu Gulch, lowland, wet, disturbed forest roadside and gulch, in association with *Schinus terebinthifolius*, *Leucaena leucocephala*, and *Syzygium jambos*, lining roadside and spreading into nearby shaded gulch, tasty purple to black fruits, 550 ft [178 m], 16 Jun 2009, *Starr & Starr 090616-01.*

Onagraceae

Oenothera speciosa Nutt. **New naturalized record**

Oenothera speciosa (pink evening primrose) is reported as cultivated in Hawaii (Staples & Herbst 2005), and there are specimens from O‘ahu and Hawai‘i islands (Bishop Museum 2010). Here we document the presence of this pink prostrate perennial on Maui, where it was found during botanical garden surveys, and identified by W. Wagner. In the botanical garden, this pink primrose has spread beyond where it was originally planted, over-running nearby plants. This is one of the most commonly cultivated species of *Oenothera*, and is listed as escaped in many parts of the world, however is generally self-incompatible, so cannot produce seed, and is instead usually spreading through a great system of rhizomes (W. Wagner, *pers. comm.*).

Material examined: **MAUI**: East Maui, Enchanting Floral Gardens of Kula, spreading locally in botanical garden, 2360 ft [719 m], 30 Apr 2009, *Starr, Starr & Takeda 090430-01*.

Piperaceae

Piper auritum Kunth **New island record**

A widespread weed of the Pacific, *Piper auritum* (false *‘awa*) is cultivated for medicinal or culinary purposes, or because it is mistaken for ‘awa (*Piper methysticum*). It was first reported as a new state record for Hawai‘i from the islands of Kaua‘i and O‘ahu where it was spreading rapidly from cultivated plants (Staples *et al.* 2006). Staples *et al.* (2006) added that this species would likely naturalize everywhere it was planted. This hardy plant is also known from Maui where it readily spreads from cultivated plants, thrives in wet

lowland disturbed sites, is becoming more common in the landscape, and is difficult to remove once established.

Material examined: **MAUI**: East Maui, Nāhiku, lowland wet disturbed forest, cultivated patch in yard, spreading into nearby areas, 500 ft [152 m], 12 Dec 2000, *Starr & Starr 001212-02.*

Poaceae

Eragrostis superba Peyr. **New island record**

Herbst & Clayton (1998) first reported *Eragrostis superba* (Wilman love grass) as a new state record from the island of Hawai‘i where it was growing in a pasture. On Maui, this grass was also recently collected from naturalized plants along a dry lowland roadside on Maui representing a new island record.

Material examined: **MAUI**: East Maui, Haleakalā Hwy and North Firebreak Rd, scattered plants on side of road and down embankment, plants about 1 m tall, growing in association with *Cenchrus ciliaris* and *Cynodon dactylon*, 100 ft [30 m], 20 Feb 2008, *Starr & Starr 080220-01*.

Eriochloa procera (Retz.) C. E. Hubb. **New state record**

Eriochloa procera (tropical cupgrass) [also known as *E. fatmensis*] is previously not known from Hawai‘i. It is reported here as a new state record for Hawai‘i from Midway Atoll. Tropical cupgrass is native to southeastern Asia, Burma, India, Ceylon and Tropical Africa (Smith 1979). This species is naturalized in tropical Asia, a few of the United States (California, Arizona, and Mississippi), and Pacific Islands, such as Fiji where it is a fairly common weed of gardens, roadsides, and other disturbed lowland sites (GRIN 2010; USDA 2009; PIER 2009). On Midway Atoll, this grass was locally abundant in and limited to a grassy lawn area located near the Cargo Pier. This site is where other new grass records have also been recorded. FWS crews are currently working to control this new grass. It is distinguished by the following characteristics. “Annuals or perennials; panicle terminal, of several to many racemes, these spreading or appressed, generally approximate along a common axis; spikelets pubescent, solitary, occasionally in pairs, short-stalked or subsessile, in 2 rows on one side of a narrow rachis, the lower rachilla joint thickened, forming a dark-colored, ringlike callus below upper glume; fertile lemma indurate, mucronate or awned, the margins slightly inrolled.” (Smith 1979).

Material examined: **MIDWAY ATOLL**: Sand Island, Cargo pier, field *makai* of Nimitz Ave. between Roberts and Cannon Ave., filling large area of the field on the *makai* side, at least dozens of clumps, in field with other grasses and weeds including *Cenchrus ciliaris*, *Cynodon dactylon*, *Desmanthus pernambucanus*, 10 ft [3 m], 11 Jun 2008, *Starr & Starr 080611-01.*

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

Previously reported by Starr *et al.* (2002) from the Kahului area of Maui, *Pennisetum polystachion* (blue buffel grass) was also recently collected from Olowalu, representing a range extension of this lowland grass.

Material examined: **MAUI**: West Maui, Olowalu, dry roadside, growing in association with *Cenchrus ciliaris* and *Pithecellobium dulce*, 10 ft [3 m], 8 Jul 2008, *Starr & Starr 090708-01.*

Pennisetum purpureum Schumach. **New island record**

Pennisetum purpureum (elephant grass, napier grass), a widely cultivated African pasture grass, is previously reported in Hawai‘i from the islands of Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i (Wagner *et al.* 1999; Oppenheimer 2003). This robust grass is now reported as a new island record for Kaho‘olawe where a single clump was found in the Upper Kaulana area.

Material examined: **KAHOʻOLAWE**: Upper Kaulana, just off Park Rd., upland dry shrubland and restoration area, growing in association with *Lantana camara*, *Dodonaea viscosa*, and *Waltheria indica*, one clump a few meters tall, 1246 ft [380 m], 8 Feb 2008, *Starr*, *Starr, & Higashino 081230-02*.

Sporobolus pyramidatus (Lam.) Hitchc. **New island record**

Wagner *et al.* (1999) listed *Sporobolus pyramidatus* (dropseed) as adventive in coastal areas of Kure Atoll, Laysan, French Frigate Shoals, and Oʻahu. It has since also been documented from Midway Atoll, Kauaʻi, and Molokaʻi (Starr *et al.* 2009; Wood 2006; Starr *et al.* 2006). In 2008, a collection was made from a patch of this grass that was found at Honokanaiʻa in a sandy area near the access road and recent restoration plantings. This collection represents a new island record for Kahoʻolawe.

Material examined: **KAHOʻOLAWE**: Honokanaiʻa, just between beach and boneyard, several dozen plants scattered along the back side of the beach in association with *Sporobolus virginicus*, *Verbesina encelioides*, and *Sida fallax*, 10 ft [3 m], 10 Feb 2008, *Starr, Starr, & Higashino 080210-01*.

Polygalaceae

Polygala virgata Thunb. **New state record**

Polygala virgata (purple broom) is slender shrub with sprays of purple pea like flowers and linear leaves that is drought tolerant and can be grown as an ornamental plant. It is native to tropical and East Africa southwards through Natal, Transvaal, and into the Cape, growing at elevations between 820–5905 ft [250–1800 m] (Jodamas 2004). Though previously not reported from the state of Hawaiʻi, this species was found spreading from cultivated plants in a botanical garden on Maui. It was also reported by Patti Welton (NPS) who had observed this species on the side of the road, also in the Kula area, but a bit further west and higher in elevation. It is here reported as a new state record for Hawaiʻi from the island of Maui. It is distinguished by the following characteristics. "*Polygala virgata* is an erect, evergreen shrub and grows to a height of 1,5 to 2,5 m. A single stem is formed at the base of the plant and slender hairless branches occur at the top. Simple leaves are alternately arranged on younger branches and usually drop before flowering. The leaves are narrow in shape, dark green with a velvety texture and 10 mm in length. Drooping racemes of deep purple magenta flowers are borne at the ends of branches. The flowers look similar to that of a pea family Fabaceae, but are different. The flower is enclosed by 2 large purple bonnet-like bracts and streaked with darker veins. These open to show that the flower has a purple tuft of tiny hairs at the top of the lower keeled petal. The outer two petals surround the lowest petal like a bonnet. The purple tuft of hairs is a distinctive characteristic to identify all polygalas. Peak flowering time is from September to February. The fruit is a two-celled capsule and the seed is small, black and oval shaped." (Jodamas 2004).

Material examined: **MAUI**: East Maui, Kula, Enchanting Floral Gardens of Kula, local in one area of garden with many 2–4 m tall plants suckering, growing in association with a wide variety of ornamental plants in botanical garden, 2350 ft [716 m], 19 Feb 2008, *Starr & Starr 080219-10*.

Rubiaceae

Galium aparine L. **New island record**

Galium aparine (stickywilly) is soon to be reported as a new state record from Molokaʻi. It is also known from Maui where it was found sprawling about the vegetation along a road in Kula.

Material examined: **MAUI**: East Maui, Kula, Kepa Rd, locally common, growing in dry, grass scrub, along road and under trees in association with *Acacia mearnsii*, *Hedera helix*, and *Jacaranda mimosifolia*, 3250 ft [991 m], 19 May 2009, *Starr & Starr 090519-02*.

Rubus discolor Weihe & Nees **New island record**

Previously mentioned as present on Maui (Kaulalewelewe and between Kahanaiki & Mahinahina Streams, West Maui), but only known to be naturalized on O‘ahu (Lanipo Trail) (Conant, 1996; Wagner *et al.*, 1999; Bishop Museum, 2010), this spiny vine with pale leaf undersides is indeed naturalized in multiple locations on Maui, where it can be found in mesic to wet areas.

Material examined: **MAUI**: East Maui, in pasture off Crater Rd, *Pennisetum clandestinum* is dominant in this actively grazed area, 4600 ft [1402 m], 23 Nov 2005, *Starr & Starr 051123-01*.

Sapindaceae

Cupaniopsis anacardioides (A. Rich.) Radlk. **New naturalized record**

Cupaniopsis anacardioides (carrotwood), native to Australia, Indonesia, and New Guinea, is cultivated in tropical areas as a landscape tree with attractive pinkish bark (Lockhart, 2009). It readily spreads from cultivation via bird dispersed fruit and is naturalized in a variety of habitats in Florida where it is now listed as a state noxious weed (Lockhart, 2009). In Hawai‘i, carrotwood is cultivated as a street tree and in yards. After roadside surveys on Maui in 2009 it was found to be not that common in landscaping though did show signs of reproduction and spread in a few areas where it was found, including Wailea. It can be distinguished by the following characteristics. “Carrotwood is a fast-growing evergreen tree that grows to a height of about 35 feet. The leaves are large and compound, made up of four to ten oblong leaflets, each 4 to 8 inches long, and attached by a swollen stalk. Leaflet edges tend to be wavy with rounded tips that are often indented. Leaves alternate along the stems. In Florida, flowering occurs in the winter, from January to March. Clusters of small, greenish-white flowers are borne on stalks that emerge from leaf axils. Flowers are unisexual, with each flower cluster containing both male and female flowers. The brightly colored fruit is a yellow, three-lobed capsule which, when ripe (May to June) splits open to expose three shiny black seeds encased in red or orange fleshy tissue.” (Lockhart, 2009). This collection represents a new naturalized record for Hawai‘i from the island of Maui.

Material examined: **MAUI**: East Maui, Wailea, Keawakapu, beach park, planted near parking area and spreading locally, mature trees with scattered seedlings and saplings in area, growing in association with *Nerium oleander* and *Ipomoea obscura*, 30 ft [9 m], 19 Aug 2009, *Starr & Starr 090819-01*.

Range extensions

The following specimens were collected at an elevation of 10,000 ft [3050 m] at the Haleakalā Observatories facility on Pu‘u Kolekole, on the summit of East Maui. These new high elevation records extend the known altitudinal range of these species in Hawai‘i. Previous high elevations are from Wagner *et al.*, 1999.

Family	Species	Prev. High Elev.	Date	Voucher
Fabaceae	***Vicia sativa*** L. **ssp**. ***nigra***	6988 ft [2130 m]	4 May 2009	*090504-06*
Malvaceae	***Malva neglecta*** Wallr.	7086 ft [2160 m]	4 May 2009	*090504-07*
Poaceae	***Bromus diandrus*** Roth	7447 ft [2270 m]	28 June 2009	*090628-01*

Family	Species	Prev. High Elev.	Date	Voucher
Poaceae	***Dactylis glomerata*** L.	7513 ft [2290 m]	28 June 2009	*090628-02*
Poaceae	***Festuca rubra* vel. aff.** L.	7020 ft [2140 m]	4 May 2009	*090504-01*
Poaceae	***Poa annua*** L.	6000 ft [1830 m]	4 May 2009	*090504-03*
Poaceae	***Vulpia bromoides*** (L.) Gray	8500 ft [2590 m]	4 May 2009	*090504-05*
Poaceae	***Vulpia myuros*** (L.) C. Gmelin	8500 ft [2590 m]	4 May 2009	*090504-04*

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