

Possible Extinctions, Rediscoveries, and New Plant Records within the Hawaiian Islands¹

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Eleven possible new extinctions are reported for the Hawaiian flora, in addition to 5 island records, 3 range rediscoveries, 1 rediscovery, and 1 new naturalized record. The remarkable range rediscoveries of *Ctenitis squamigera* (Dryopteridaceae) and *Lysimachia filifolia* (Primulaceae) give hope toward their future conservation, as both are federally listed as endangered and were undocumented on Kaua'i for ca 100 years. Yet there is great concern over numerous possible plant extinctions in Hawai'i. Two extinctions were recently reported from Kaua'i (i.e., *Dubautia kenwoodii* and *Cyanea kuhihewa*) (Wood 2007), and an additional 11 are now reported to have no known living individuals in the wild. Species abundance will naturally fluctuate, yet for very rare taxa there is little room for decline. The ongoing decline of native pollinators (Kearns *et al.* 1998) and seed dispersers (Milberg & Tyrberg 1993), in combination with other primary extrinsic factors such as invasive nonnative plants, predation by introduced vertebrates, loss and fragmentation of natural habitats, and devastation by severe storms, are leading to an increase in extinctions throughout the islands of Oceania (Sakai *et al.* 2002; Wood 2007; Kingsford *et al.* 2009). The assertion of extinction is potentially fallible and can only be inferred from absence of sighting or collection records (Solow & Roberts 2003). Although extensive field surveys have failed to produce evidence that these possibly extinct taxa still occur in the wild, there is still suitable habitat and future field surveys are being planned and funded. Because of the enormity of Hawai'i's conservation dilemma, it is urgent that we have the most current information possible (Wagner *et al.* 1999). This paper is a call for biologists and conservation agencies to make concerted efforts to familiarize, re-find, and attempt to acquire conservation collections of these elusive species, many of which are hard to recognize, especially when they are not in flower or fruit.

Campanulaceae

Clermontia grandiflora Gaudich.

subsp. *maxima* Lammers

Rediscovery

Lammers (1991) described *Clermontia grandiflora* subsp. *maxima* from a single collection made in 1973 on the windward slopes of Haleakalā in montane cloud forest (i.e., Gagné & Montgomery 386), with no other collections reported since then. Lammers notes the new taxon differs from all other specimens of *C. grandiflora* by its much larger flowers and he indicates that *C. grandiflora* has seldom been collected above 1275 m. Collections that fit Lammers diagnosis of *C. grandiflora* subsp. *maxima*, especially filaments 8.0–8.6 cm long, were made at ca. 1700 m elev. in Hanawī, just west of the

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Helele'ike'ōhā headwaters. Evidently trees of *C. grandiflora* in this region have various floral structures that range in their linear measurements to fit both *C. grandiflora* subsp. *munroi* and *C. g.* subsp. *maxima*, dependent on floral anthesis. Further research is needed to better understand the quantitative differences that may separate these two taxa.

Material examined. MAUI: East Maui, Hanawā, above State Camp, just west of Helele'ike'ōhā headwaters, *Metrosideros-Cheirodendron* montane wet forest associated with *Kadua axillaris*, *Broussaisia arguta*, *Melicope clusiifolia*, rich in pteridophytes, 20+ trees along 1700 m (5600 ft) contour trail, 3 m tall, moderately branched, in flower and fruit, observed with *C. arborescens* and *C. tuberculata*, 4 Oct 1997, Wood 6788 (PTBG, US); *loc. cit.*, 5 Oct 1997, Wood 6798 (PTBG); *loc. cit.*, 5 Oct 1997, Wood 6799 (NY, PTBG).

***Cyanea eleeleensis* (H. St. John) Lammers Possibly extinct**

Harold St. John (1987) originally described this species as a *Delissea*, and Lammers (1992) subsequently transferred it over to *Cyanea*. Wagner *et al.* (1999) noted this species to be endangered and the USFWS (2010) has recently listed it as endangered. Only known from Wainiha Valley, Kaua'i, where Charles Christensen made the holotype collection, no living individuals of this species are currently known.

Material examined. KAUA'I: Wainiha Valley, on side of intermittent stream below Pali 'Ele'ele, shaded gulch in wet forest, 700 ft elev., 19 Jul 1977, Christensen 261 (holotype, BISH).

***Cyanea kolekoleensis* (H. St. John) Lammers Possibly extinct and taxonomic note**

Originally placed in *Delissea* by Harold St. John (1987), and later transferred to *Cyanea* by Lammers (1992), *Cyanea kolekoleensis* has always been considered rare and restricted to the Wahiawa Mountains of southern Kaua'i where biologists monitored four sites totaling less than ten individuals. Last observed in a gulch to the northeast of Hulua peak in 1996, there are currently no living individuals known of this Kaua'i endemic.

Cyanea kolekoleensis was previously thought to be an unbranched shrub, and its berries and seeds were unknown. Three additional herbarium collections deposited at PTBG after Lammers (1992) made the new combination allow for a more expanded circumscription. Seed size and non-rugose testa morphology support its placement within *Cyanea*.

Cyanea kolekoleensis (H. St. John) Lammers, *Novon* 2: 130. 1992. Basionym: *Delissea kolekoleensis* H. St. John, *Phytologia* 63: 344. 1987. TYPE: U. S. A. Hawaiian Islands. Kaua'i: Wahiawa Valley, 765 m, 23 Sep 1979, S. Perlman 498 (holotype, BISH; isotypes, BISH — 2 sheets).

Shrub, single stemmed or few branched, 1.5–2 m tall, glabrous. Lamina narrowly elliptic, 15.5–30 cm long, 2.7–5.7 cm wide, upper surface green, glabrous, lower surface greenish white, glabrous or the midrib minutely and sparsely pubescent, margin minutely serrulate, apex acuminate, base cuneate, petiole terete, 3.5–10 cm long, 4 mm diam., glabrous. Inflorescence 4–8-flowered, glabrous, peduncle deflexed, 10.5–20 cm long, 2–4 mm diam., rachis 3–6.5 cm long, pedicels sharply recurved, 18–27 mm long, reduced in length toward apex of rachis; hypanthium obconic or obovoid, 6–13 mm long, 6–11 mm diam., densely short-pubescent; calyx lobes narrowly triangular or deltoid, 1.5–3 mm long, 1.5–3.5 mm wide, the apex acute; corolla bilabiate, white shading to purple on the lobes, 50–52 mm long, densely short-pubescent, tube curved, 30–39 mm long, 5.5–9 mm diam., cleft dorsally for ½ its length, dorsal lobes linear, 13–19 mm long, 1.5–3 mm wide, acute at apex; ventral lobes linear, 10–15 mm long, 1.5–3 mm wide, acute at apex; staminal column exerted; filaments 3.7–4.9 cm long, purple, glabrous; anther tube dark purple, 9–11 mm long, 2.5–4.0 mm diam., the lower 2 anthers with tufts of white hairs at apex. Berry (slightly immature) globose, 7 mm long, yellow-green with persistent calyx lobes. Seeds (immature), testa tan-brown, striate-verruculate, 0.5–0.7 mm long × 0.3–0.5 mm diam.

Material examined. **KAUAI:** Kōloa Distr, Līhu'e-Kōloa Forest Reserve, northwest of Wahiawa Bog, along tributary of Wahiawa Stream, northwest of stream and southeast of Hulua, wet forest dominated by *Metrosideros*, *Antidesma*, *Cyrtandra* spp., and *Athyrium*, with *Diplazium* and *Deparia*, single stemmed shrub of 5 ft, along edge of stream, leaves dark, semi-glossy green above with whitish-green midrib, below silvery, whitish-green with yellow-green midrib, inflorescence pendulous, fruit erect, 650–730 m elev., 7 Dec 1988, *Flynn & Wood 3229* (PTBG); Wahiawa, south of Kapalaoa, below and along west ridge, *Metrosideros* wet forest with *Psychotria hexandra*, *Kadua affinis*, *Perrottetia sandwicensis*, *Broussaisia arguta*, *Cibotium glaucum*, *Diplazium sandwichianum*, *Diplopterygium*, *Psidium cattleianum*, *Rubus rosifolius*, *Pritchardia flynnii*, *Labordia lydgatei*, *Myrsine linearifolia*, *Dubautia imbricata*, *Cyrtandra pickeringii*, *Platydesma rostrata*, 2 meter tall, branching 2–3 times, leaves dull green above, pale below, petiole and costa yellow-green, peduncle light green, corolla white with purple stripes, 805 m elev., 8 Sep 1998, *Wood et al. 7470* (PTBG); Wahiawa drainage, side drainage below rope trail, *Metrosideros-Dicranopteris* lowland wet forest with *Cheirodendron*, *Kadua affinis*, *Broussaisia*, *Ilex anomala*, *Pittosporum glabrum*, wind swept forest and shrublands along upper ridges, threats include pigs, *Rubus rosifolius*, *Psidium cattleianum*, 3 clumps multi-trunked, up first side gulch north of main stream, east side of gulch. 760 m elev., 26 Mar 1993, *Wood 2119* (PTBG); Wahiawa Mts., northeast of Hulua, near Waimea-Kōloa District boundary, *Metrosideros-Cheirodendron* spp. lowland wet forest with *Broussaisia*, *Melicope*, *Kadua*, *Freycinetia*, *Pritchardia*, *Antidesma*, *Psychotria*, *Elaphoglossum*, *Viola helenae*, *Cyrtandra*, *Hesperomannia*, *Dubautia imbricata*, *Dicranopteris*, 1 plant observed in gulch with 2 seedlings, plant 6 ft, with flowers, 2420 ft elev., 6 Sep 1991, *Perlman et al. 12235* (F, PTBG, US); Wahiawa Mts., Kapalaoa Peak, gulch south of peak, *Metrosideros-Dicranopteris linearis* wet forest with *Cheirodendron*, *Broussaisia*, *Machaerina angustifolia*, *Dubautia laxa*, *Polyscias*, *Embelia*, *Myrsine*, *Scaevola*, *Psychotria*, *Labordia waialealae*, *Syzygium sandwicensis*, *Sadleria*, *Rubus rosifolius*, *Dubautia imbricata*, *Perrottetia*, 2440 ft. elev., 4 Oct 1996, *Perlman et al. 15606* (PTBG).

Convolvulaceae

Merremia

Two species of *Merremia* were recorded by Wagner *et al.* (1990: 563) as being naturalized in the Hawaiian Islands, namely *M. aegyptia* (L.) Urb. and *M. tuberosa* (L.) Rendle. Imada *et al.* (2000: 11) report a third species, *M. umbellata* (L.) Hallier f. as being fully naturalized on windward O'ahu and *Merremia peltata* (L.) Merr. is now recorded for the first time as being naturalized in the archipelago. The four *Merremia* species in Hawai'i can be separated by characters given in the following key.

Key to *Merremia* in the Hawaiian Islands

1. Leaves palmately lobed to palmately compound (2).
1. Leaves neither palmately lobed nor compound (3).
 - 2(1). Leaves palmately compound; plants usually reddish hirsute ... *M. aegyptia*
 2. Leaves palmately lobed but not compound; plants glabrous ... *M. tuberosa*
 - 3(1). Leaves peltate (except rarely on distal leaves), rounded at base ... *M. peltata*
 3. Leaves not peltate, truncate to cordate or hastate at base ... *M. umbellata*

Merremia peltata (L.) Merr.

New naturalized record

This twining vine with broadly ovate-orbicular, peltately attached leaves has not been previously recorded as naturalized in the Hawaiian Islands. It is currently reported in two locations ½ mile apart in Wainiha Valley, Kaua'i, where it is a rampant climber covering numerous acres and quickly smothering vegetation. Fosberg & Sachet (1977) describe its distribution as Indo-Pacific, from Africa to Tahiti [Society Islands]. My observation of this species in Micronesia leads me to believe that *Merremia peltata* is a very serious invasive species that should be closely watched and managed here in Hawai'i.

Material examined. **KAUAI:** Wainiha Valley, south side of river, between power house and Maunahina, sterile, 152 m elev., 27 Oct 1999, *Keith Robinson s.n.* (BISH, PTBG).

Dryopteridaceae

Ctenitis squamigera (Hook. & Arn.) Copel. **Range rediscovery**

Ctenitis squamigera was historically recorded from Kaua'i, O'ahu, Moloka'i, Lana'i, and Maui (HBMP 2011), but considered possibly extinct on Kaua'i (Palmer 2003: 102). Amos Heller made the only collection on Kaua'i in 1896 above Waimea at 2000 ft elev. He notes that the plant was on the face of a perpendicular rock in gulch and exposed directly to the afternoon sun. Heller also indicates that *C. squamigera* was not observed in other locations during his research on Kaua'i (Heller 1897). After 115 years of not being observed on Kaua'i, recent field research within mesophytic forests of Kōke'e has unveiled two new locations for this federally listed endangered fern, namely Nu'ololo and Awa'awapuhi Valleys. The following collections represent this exciting rediscovery.

Material examined. **KAUAI:** Nu'ololo, north facing slopes above drainage, *Metrosideros-Acacia* montane mesic forest, 70–80% canopy cover, ca. 80% understory, 35–40 degree slope, 40 degree north aspect, up to 20 m tall canopy, with *Pouteria*, *Xylosma hawaiiensis*, *Claoxylon*, *Wikstroemia furcata*, *Dodonaea*, *Kadua affinis*, *Melicope ovata*, *Pleomele*, *Polyscias kavaensis*, *Psychotria greenwelliae* & *P. mariniana*, *Zanthoxylum dipetalum*, *Nestegis*, *Diplazium*, immediate area has 20% *Myrsine lanaiensis*, 5% *Pittosporum kauaiensis*, some *Alphitonia ponderosa*, *Carex meyenii*, *Dianella sandwicensis*, threatened by deer, rats, 10% cover of *Lantana camara*, with *Rubus argutus*, *Hedychium gardnerianum*, *Kalanchoë pinnata*, *Sphaeropteris cooperi*, *Adiantum hispidulum*, *Psidium cattleianum*, rhizome terrestrial sub-erect with abundant staminate scales which continue up stipe and rachis, 5 fronds, protected on steep slope with boulder outcrops, adjacent *Dryopteris sandwicensis*, *Doodia*, *Microlepia strigosa*, single plant, 1006 m (3300 ft), 19 Feb 2011, *Wood & Query 14524* (BISH, PTBG); Awa'awapuhi, north facing slopes, *Metrosideros-Acacia* montane mesic forest, with *Pouteria*, *Xylosma hawaiiensis*, *Antidesma*, *Diospyros sandwicensis*, *Wikstroemia furcata*, *Leptecophylla tameiameia*, *Kadua affinis*, *Melicope ovata*, *M. barbiger*, *Euphorbia atrococca*, *Pleomele*, *Polyscias kavaensis*, *Psychotria greenwelliae*, *Zanthoxylum dipetalum*, *Nestegis*, rhizome terrestrial, 4 cm wide × 7 cm long, 7 healthy fronds with skirt of old fronds, under 90% forest cover, with *Microlepia strigosa*, *Hillebrandia sandwicensis*, *Lepidium serra*, *Melicope pallida*, *Remya kauaiensis*, *Pritchardia minor*, 1 plant on steep rock outcrop with soil pockets, large 12 m tall *Alphitonia ponderosa* near-by, with adjacent *Psychotria mariniana*, *Dodonaea viscosa*, *Myrsine lanaiensis*, single plant, threatened by pig, deer, rats, *Erigeron karvinskianus*, *Psidium cattleianum*, *Lantana camara*, *Rubus argutus*, *R. rosifolius*, *Adiantum hispidulum*, *Blechnum appendiculatum*, *Hedychium gardnerianum*, *Kalanchoë pinnata*, *Sphaeropteris cooperi*, 951 m (3120 ft), 5 May 2011, *Wood & Query 14639* (PTBG).

Euphorbiaceae

Euphorbia prostrata Aiton

New island record

Previously recorded on Midway, Kaua'i, O'ahu, Moloka'i, Lāna'i, Maui, Kaho'olawe, and the Big Island of Hawai'i (Wagner, Herbst *et al.* 1999; Hughes 1995), the prostrate spurge is now documented on Ni'ihau's offshore islet of Lehua.

Material examined. **NIHAU:** Lehua Islet, West Horn, *Sida fallax* shrubland with *Tribulus cistoides*, *Waltheria indica*, *Jacquemontia ovalifolia* subsp. *sandwicensis*, several native grasses such as *Panicum torridum*, *Panicum fauriei* var. *latius*, and *Panicum pellitum*, relatively bare with ca 75% of the ground being exposed barren tuff along with many hundreds of naturally hallowed burrows, decumbent stems pink or green-purple, leaves green or green-red, cyathial gland white, uncommon, island record, 30 m elev., 2 May 2009, *Wood 13714* (BISH, PTBG, US).

Lamiaceae***Phyllostegia knudsenii*** Hillebr.**Possibly extinct**

Previously known only from the type collection made in the woods of Waimea (*Knudsen 190, B*) and listed as extinct by Wagner *et al.* (1990: 819), *Phyllostegia knudsenii* was rediscovered May 1993 (Lorence *et al.* 1995) in Koai'e Canyon and subsequently found in upper Kawai Iki Valley on 25 Sep 2001. Unfortunately, both wild populations have since died, and there are no cultivated plants of this Kaua'i endemic mint.

Material examined. **KAUA'I:** Waimea Distr, Koai'e Canyon, upper canyon, in forest 21 m (70 ft) above stream, north-facing slope, 692 m (2270 ft) elev., 24 May 1993, *Wood & Perlman 2583* (PTBG); *loc. cit.*, 31 Aug 1994, *Perlman & Wood 14365* (PTBG); Kawai Iki, upper drainage above twin falls of Koai'e Canyon, *Metrosideros polymorpha* mixed mesic forest with *Gahnia beecheyi*, *Dianella sandwicensis*, *Dubautia laevigata*, *Kadua affinis*, *Cheirodendron trigynum*, *Psychotria mariniana*, *Poa sandwicensis*, *Bidens cosmoides*, *Peperomia membranacea*, *Peperomia latifolia*, and *Peperomia kokeana*, threats include goats, pigs, rats, *Rubus argutus*, *Kalanchoë pinnatum*, *Psidium cattleianum*, *Grevillea robusta*, *Myrica faya*, *Cyperus meyenianus*, *Passiflora mollissima*, *Lantana camara*, and *Setaria parviflora*, shrub 1 m tall, young plant with old inflorescence, 4 immature plants observed in general area, 330 deg aspect, 20 deg slope, in side-gulch bottom near main drainage, 1015 m elev. (3330 ft), 25 Sep 2001, *Wood 9115* (PTBG).

Lycopodiaceae***Huperzia filiformis*** (Sw.) Holub**New island record**

This delicately pendulous fern is considered indigenous to Hawai'i and Central and South America to Bolivia (Mickel & Smith 2004). In Hawai'i *Huperzia filiformis* was previously thought to be restricted to O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i (Palmer 2003). Further field research now indicates that *H. filiformis* is also present on Kaua'i, yet quite rare, within the headwater drainages of Wainiha and Wailua.

Material examined. **KAUA'I:** Hanalei Distr, headwaters of Wainiha River, northeast fork, just southwest of Mahinakehau Ridge, lowland wet forest with *Metrosideros polymorpha* dominant, also *Antidesma*, *Syzygium*, *Broussaesia*, *Boehmeria*, & *Perrottetia*, with understory of pteridophytes, *Cyrtandra*, & *Cyanea*, epiphyte on *Perrottetia* tree 1.5 m above ground in moderate shade, stems pendulous, light green, very rare, a single plant seen at 825 m elev., 30 Jan 1993, *Lorence et al. 7346* (PTBG); Blue Hole, headwaters of Wailua River, below Wai'ale'ale and Kawaikini, near south facing cliffs below Blue Hole proper, ridge running 300 degrees down to stream, *Metrosideros* lowland wet forest with *Psychotria mariniana*, *Antidesma platyphyllum* var. *hillebrandii*, *Dianella sandwicensis*, *Polyscias oahuensis*, *Freycinetia arborea*, *Diplazium sandwichianum*, *Microlepia strigosa*, and *Sadleria pallida*, threatened by pigs, *Rubus rosifolius*, *Psidium guajava*, *Paspalum urvillei*, and *Mariscus meyenianus*, epiphytic rhizome on *Melicope paniculata*, stems pendulous, leaves medium green, sporangia yellow-white, rare, 610 m elev., 10 Dec 1998, *Wood 7631* (PTBG).

Malvaceae***Hibiscadelphus woodii*** Lorence &

W.L. Wagner (Fig. 1)

Possibly extinct

Four shrubs of *Hibiscadelphus woodii* were discovered in March 1991 clustered on a vertical cliff in Kalalau Valley, Kaua'i, increasing the total number of species for the endemic *Hibiscadelphus* to seven (Wood 1992; Lorence & Wagner 1995). Subsequent efforts to propagate *H. woodii* by air layering, cuttings, and grafting trials onto con-generic cultivated individuals had failed. Tests for *H. woodii* pollen viability proved negative, and cross pollination trials from *H. distans* showed no success. Micropropagation attempts at *in vitro* protocol development for apical and lateral meristem culture, callus culture uti-



Figure 1. *Hibiscadelphus woodii*. Kalalau cliffs, Kauaʻi. Photo: K.R. Wood.

lizing leaf and internode explants, and propagation by tip and stem cuttings had also failed. Although no fruit set was ever observed, flowering was documented during the months of March, April, July, and September. Flower visitations by birds include the native 'amakihi (*Hemignathus virens*). Introduced Japanese white eye (*Zosterops japonicus*) regularly pierced the corollas of *H. woodii* above the calyx, presumably robbing nectar. Three individuals of *H. woodii* were apparently crushed by a large fallen boulder and died between 1995 and 1998. On 17 August 2011, the last remaining *H. woodii* was observed dead. Previously, the final wild *H. hualalaiensis* died on the Big Island in 1992 (Wood & Perlman, pers. observ.). A total of six species of *Hibiscadelphus* are now extinct in the wild, two of which are maintained through cultivation (i.e., *H. giffardianus* and *H. hualalaiensis*). Only one species of *Hibiscadelphus* still survives in the wild, being *H. distans* from the dry to mesic canyon cliffs of Koai'e, Kaua'i.

Material examined. **KAUA'I:** Hanalei Distr, Kalalau Rim, north of Kahuama'a Flat, lowland mesic cliffs, 990–1020 m, 3 March 1991, Wood, Query & Montgomery 629 (holotype, PTBG, a flower also in spirit collection; isotypes, BISH, K, MO, NY, US).

Piperaceae

Peperomia subpetiolata Yunck.

Possibly extinct

Peperomia subpetiolata is an East Maui narrow endemic species known only from around the Kula Pipeline of lower Waikamoi (Yuncker 1933; Wagner *et al.* 1990). In the early 1990s it was estimated that around 40 individuals occurred in that region, both above and below the road. A putative hybrid between *P. subpetiolata* and *P. cookiana* was also documented in that area. The dense invasion of *Hedychium gardnerianum* below a nonnative forest canopy of *Eucalyptus* has left little open soil for herbaceous terrestrial species such as *P. subpetiolata* to survive. Recent field research has failed to locate any individuals of

P. subpetiolata and only hybrid individuals were observed (Wood 2001, 2009a; Oppenheimer & Perlman pers. observ.).

Material examined. MAUI: East Maui, Kula pipeline, Waikamoi, 5–6 Sep 1919, *Forbes 1283-M* (holotype, BISH); Kula pipeline, woods, 4500 ft elev., 11 Feb 1930, *St. John 10299* (BISH).

Poaceae

Dichanthelium cynodon (Reichardt) C.A.

Clark & Gould

New island record

Gon (1994) describes a true bog on O‘ahu where several island plant records were observed (Kennedy *et al.* 2010: 21), including two endemic species of *Dichanthelium*, both of which were documented during the discovery of the bog in February 1993. *Dichanthelium cynodon* was previously recorded from Kaua‘i, Moloka‘i, and Maui (Wagner *et al.* 1990), and now reported on O‘ahu in association with *D. hillebrandianum*.

Material examined. O‘AHU: Ko‘olau Mountains, just below summit ridge, north of Pe‘ahināi‘a and south of Castle Trail, *Metrosideros-Rhynchospora* lowland bog with *Lobelia gaudichaudii* subsp. *koolauensis*, *Viola oahuensis*, *Dichanthelium hillebrandianum*, *D. koolauense*, *Vaccinium dentatum* & *V. reticulatum*, *Metrosideros rugosa*, threatened by pigs, *Clidemia hirta*, *Axonopus fissifolius*, *Pterolepis glomerata*, *Juncus planifolius*, growing in tussocks within bog with *D. hillebrandianum*, common in bog, 25 Feb 1993, *Wood & Lau 2428* (PTBG, MO).

Dichanthelium hillebrandianum (Hitcch.)

C.A. Clark & Gould

New island record

Dichanthelium hillebrandianum was previously recorded from Kaua‘i, Moloka‘i, Maui, and Hawai‘i (Wagner *et al.* 1990) and is now documented on O‘ahu.

Material examined. O‘AHU: Ko‘olau Mountains, just below summit ridge, north of Pe‘ahināi‘a and south of Castle Trail, *Metrosideros-Rhynchospora* lowland bog with *Dichanthelium hillebrandianum*, growing in tussocks within bog, east aspect, common only in bog, 25 Feb 1993, *Wood & Lau 2421* (PTBG, US).

Primulaceae

Lysimachia filifolia C.N. Forbes & Lydgate

Range rediscovery

Previously recorded on O‘ahu and Kaua‘i, yet not seen on Kaua‘i since 1912 when Lydgate made the holotype collection in upper Olokele below the Kawaikini summit (Wagner *et al.* 1990; Marr & Bohm 1997), *Lysimachia filifolia* was recently rediscovered below Kamanu ridge, eastern Kaua‘i, in the headwater region of Waikoko. Plants of this federally listed endangered species are being cultivated by the National Tropical Botanical Garden (NTBG). Wagner *et al.* (1990) report collections of *L. filifolia* from the Blue Hole region of Wailua, Kaua‘i, but these plants were subsequently described as a new species (i.e., *L. pendens* Marr). *Lysimachia filifolia* can be distinguished from *L. pendens* by its narrower leaves and non-tomentose stems, pedicels, and leaves (Marr & Bohm 1997). It is worth noting that plants of *L. filifolia* on Kaua‘i can be erect up to 1.5 m tall as compared to the O‘ahu plants which are smaller, more delicate, and only known to be pendulous. Further studies are needed to better understand their relationship.

Material examined. KAUA‘I: upper Olokele Valley, Jan 1912, *Lydgate 2* (holotype, BISH); Waikoko headwaters, below Kamanu ridge, S of Wailua River and above Wailua ditch, associated with *Cheirodendron*, *Pipturus* spp., *Dubautia*, *Cyrtandra*, *Kadua centranthoides*, *K. elatior*, *K. foggiana*, *Psychotria*, *Melicope*, *Machaerina*, *Isachne*, with ferns of *Microlepia*, *Asplenium*, *Cyclosorus*, *Deparia*, terrestrial in *Diplazium* with *Boehmeria grandis*, 1.5 m tall with erect stems brown-red, pendent corolla light purple, terrestrial near land slide and on wet cliff, ca 30 plants, threats include pigs, landslides, *Buddleia asiatica*, *Erigeron karvinskianus*, 732 m elev., 12 Jan 2008, *Wood 12774* (BISH, PTBG).

***Lysimachia venosa* (Wawra) H. St. John** **Possibly extinct**

Lysimachia venosa was originally discovered by Heinrich W. Wawra in 1870 on the summit of Mt Wai'ale'ale. This species was not observed again until 1911 when Joseph Rock also made a collection around Mt. Wai'ale'ale summit. In 1991 a small branch representing this taxon was found after a storm at the bottom of a 1000 m tall cliff (i.e., Blue Hole, below Wai'ale'ale, at the headwaters of Wailua River), with no indication of where the living plant might be located. *Lysimachia venosa* is presently considered possibly extinct since no living individuals are known.

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).

Rosaceae***Acaena exigua* A. Gray** **Possibly extinct**

After not being observed since 1957 a single plant of *Acaena exigua* was rediscovered in a West Maui bog in 1997 (Meidell *et al.* 1998; Oppenheimer *et al.* 2002; Wood 2005). During the period of 1997 to 2000, attempts at propagation failed and in early 2000 the only known plant died. Historically, *A. exigua* occurred in bogs on West Maui where its Hawaiian name is *liliwai*, and also on the island of Kaua'i where it was known as *nani* Wai'ale'ale. Numerous surveys have since been conducted around the West Maui bogs and throughout most of the summit bogs of Alaka'i and Nāmoloakama, Kaua'i, yet no other individuals of *A. exigua* have been documented (Wood 2006). Heinrich Wawra was the last one to observe it on Kaua'i in 1870. The extremely small size of *A. exigua*, with stems 1–4 cm long (Wagner *et al.* 1990) make it extremely difficult to locate. Although there is excellent bog habitat being protected on the summits of Kaua'i and West Maui indicating that there could be more individuals waiting to be discovered, *A. exigua* is now considered possibly extinct with no known living plants extant.

Material examined. **MAUI:** Lahaina Distr, Honokōhau, 1719 m elev., among bryophytes in mixed 'ōhi'a montane bog, 19 Mar 1997, *Meidell & Oppenheimer 194* (BISH).

Rubiaceae***Kadua haupuensis* Lorence & W.L. Wagner** **Possibly extinct**

Recently described and known only from a single location on the north side of Mt Ha'upu, Kaua'i, *Kadua haupuensis* was last observed in the wild when discovered in 1998 (Lorence *et al.* 2010). Plants from the holotype region of the mountain were evidently destroyed by a small rock slide and numerous attempts to locate additional plants of this species have failed. With no known wild individuals remaining, *K. haupuensis* is now considered possibly extinct. The quality of its habitat is rapidly declining due to animal disturbance such as rats, pigs, and goats, and invasive alien plant species including *Caesalpinia decapetala*, *Rhodomlyrtus tomentosa*, and *Passiflora laurifolia*. At the time of discovery, seeds were collected and plants are being cultivated at the NTBGS.

Material examined. **KAUA'I:** Kōloa Distr, Ha'upu Range, north facing mesic forest, just below and along cliffs w of summit, 366 m, 23 Sep 1998, *Wood 7492* (BISH, MO, NY, PTBG, US).

Rutaceae***Melicope macropus* (Hillebr.) T.G. Hartley**
& B.C. Stone **Possibly extinct**

A Kaua'i endemic, *Melicope macropus* was historically known from the Kahōluamano

region of Waimea where Heller made a collection in 1885 and Faurie in 1910 (Stone 1969). Most recently it was observed in Kalalau in 1987, Honopū in 1991, and the upper Nu'ololo stream region in 1995. This taxon is poorly understood (Wagner *et al.* 1990) and the type designated by Hillebrand (i.e., *Knudsen 189*) was destroyed in Berlin (Stone 1969). Wagner *et al.* (1990) considered *M. macropus* to be rare and related to *M. kavaiensis* from which it differs in its puberulent exocarp, less overall pubescence and predominantly smaller leaves (Stone 1969). No living individuals of this species are known at this time.

Material examined. **KAUAI:** Hanalei Distr, Nā Pali-Kōna Forest Reserve, Kalalau Valley, steep, southwest slope between Kalalau and Pu'u O Kila lookouts, diverse forest of *Metrosideros*, *Xylosma*, *Nestegis* and *Cryptocarya*, elev. 3900–4100 ft, sprawling shrub of 4 ft, with *Cibotium*, *Dubautia*, and *Rubus*, 20 Mar 1987, Flynn *et al.* 2116 (PTBG); Hanalei District, Honopū, south of Kalalau lookout, by stream on west side of road, *Metrosideros* diverse montane mesic forest with *Labordia*, *Dubautia*, *Kadua*, *Nothocestrum peltatum*, and *Myrsine*, scandent shrub, in fruit, attractive and vigorous, threatened by pigs, *Rubus rosifolius*, *Hedychium gardnerianum*, 1200 m elev., 29 Aug 1991, Wood & Perlman 1182 (PTBG, US); Waimea Distr, upper Nu'ololo Stream, north branch, *Acacia-Metrosideros* montane mesic forest with *Psychotria grandiflora*, *Xylosma crenatum*, *Poa siphonoglossa* & *P. sandvicensis*, *Myrsine knudsenii*, *Nothocestrum peltatum*, *Dubautia latifolia*, *Bobea brevipes*, *Melicope macropus*, *Lobelia yuccoides*, *Alyxia stellata*, threats include pigs, deer, *Rubus argutus*, *Hedychium gardnerianum*, *Kalanchoë pinnata*, 3700–3800 ft, 1 m tall, diffusely branched shrub, sprawling stems 1 m long, stems dark-brown, petiole brown, leaves shiny, dark-green above, paler below, peduncle yellow-green, immature flower brown-red, branches with tan or white pubescence at apical tips, det. W.L. Wagner, 23 Nov 1995, Wood & Davis 4806 (PTBG).

Melicope nealae (B.C. Stone) T.G. Hartley

& B.C. Stone

Possibly extinct

Considered rare by Wagner *et al.* (1990), *Melicope nealae* was known from the Kahōluamano and Kumuwela regions of Kaua'i. Last observed in 1960 around Kumuwela, no living individuals are known of this taxon. *Melicope nealae* differs from *M. puberula* in its shrubby stature, glabrous endocarp, larger capsules, and predominantly obovate leaves (Stone 1969). Wagner *et al.* (1990) relate it to the *M. kavaiensis* complex, differing by its combination of puberulent exocarp, glabrous endocarp, and carpels connate ca. ½ their length.

Material examined. **KAUAI:** Kahōluamano, behind Waimea, Sep 1909, Forbes 341 (BISH); Kōke'e Plateau, level forested area north of Kumuwela Lookout, under *Psychotria*, *Zanthoxylum*, and *Platydesma*, a subscented low shrub with green pubescent capsules and pubescent leaves, elev. 3500 ft, 12 Apr 1960, B. C. Stone *et al.* 3359 (BISH, L, US).

Melicope quadrangularis (H. St. John &

E.P. Hume) T.G. Hartley & B.C. Stone

Possibly extinct

Melicope quadrangularis is a Kaua'i endemic known from the holotype collection made in 1909, and rediscovered in the same general region of Wahiawa in May 1991 (Lorence *et al.* 1995). The rediscovered population was subsequently destroyed by Hurricane Iniki in September 1992 (Wood 2009b, 2011). *Melicope quadrangularis* is easily distinguished on Kaua'i by its large 12–14 mm long × 19–22 mm wide, cube-shaped capsules with central depression at apex. Numerous surveys in the Wahiawa region have failed to relocate any living individuals of this species.

Material examined. **KAUAI:** Vicinity of Wahiawa Swamp, Aug 1909, C. N. Forbes 273.K (holotype, BISH); Līhu'e Distr, Wahiawa, drainage between Hulua and Kapalaoa, *Metrosideros-Dicranopteris* lowland wet forest with *Syzygium*, *Polyscias oahuensis* & *P. waialealae*, *Labordia*, *Perrottetia*, area rich with bryophytes, threats include severe storms, pigs, rats, *Psidium cattleianum*

& *P. rosifolius*, *Melastoma candidum*, 820 m, 2 m tall, branches ascending, collected below *M. quadrangularis* population of 9 trees, 4 trees in immediate area, 20 May 1991, *Wood et al. 0859* (PTBG); *loc. cit.*, with *Broussaïsia*, *Eurya*, *Cyanea coriacea*, *Labordia hirtella*, *Syzygium*, 850 m, 4 m tall tree, single tree in fruit, 13 cm diameter at base, vigorous, east aspect, 20 May 1991, *Wood et al. 0858* (PTBG).

Thelypteridaceae

Cyclosorus pendens (D.D. Palmer) N. Snow

[Syn. *Pneumatopteris pendens* D.D. Palmer]

Range rediscovery

Recently described by Palmer (2005), yet historically known from the islands of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i, *Cyclosorus pendens* has been taxonomically confused with *C. sandwicensis* by numerous collectors and botanists. The genus *Pneumatopteris* was recently merged into *Cyclosorus* (Snow *et al.* 2011). Collections date back to 1909 when it was first documented by C. N. Forbes in Olokele Valley, Kaua'i. Palmer considered *C. pendens* to be extinct on Kaua'i and only cited recent collections on O'ahu, Moloka'i, Maui, and Hawai'i (Palmer 2005). The following collection made around the falls of Hanakāpī'ai indicates that it is still extant on Kaua'i.

Material examined. **KAUAI:** Na Pali coast, Hanakāpī'ai falls, base of wet cliff, to left of falls along narrow ledge, growing with *Selaginella arbuscula*, *Deparia petersenii*, *Blechnum appendiculatum*, very small plants of *Tectaria gaudichaudii*, also *Christella cyatheoides* and a native *Deparia* sp. in the area, det. A. Smith, 6 Apr 2007, *A. R. Smith 2918* (PTBG, UC).

Zingiberaceae

Curcuma longa L.

New island record

An Indian perennial herb, semi-wild populations of turmeric ('ōlena) have been previously recorded from Moloka'i, Maui, and Hawai'i (Wagner *et al.* 1990). Recent research around the remote headwater region of Wainiha has documented *Curcuma longa* growing adjacent to ancient rock walls. Rhizomes have been collected and are being cultivated at the NTBG.

Material examined. **KAUAI:** Wainiha Valley, around confluence of upper east and west fork, *Metrosideros* 40-60% closed forest with 12-15 m tall canopy, understory of *Perrottetia*, *Psychotria* spp, *Dubautia* spp, *Labordia* spp, *Polyscias kavaïensis*, *P. oahuensis*, rich fern and bryophyte understory, 472 m elev., 18 Jun 2008, *Wood et al. 13135* (BISH, PTBG).

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