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Report of 24 new naturalized weeds across the islands of Hawai'i

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Between 2021 and 2023, extensive roadside plant surveys were conducted across the islands of Hawai'i. While the goal of these surveys was to identify and map grasses, many new non-grass plants were also found. For further details about these surveys, see Faccenda (2023). This paper enumerates 12 new state records (species never before reported in the islands of Hawai'i) and 10 new naturalizations (species recorded reproducing outside of cultivation for the first time), along with confirmation of naturalization for 2 species previously published as questionably naturalized, and 5 new questionable naturalizations.

The citizen science platform inaturalist.org was quite useful for this work for both identifying other populations of naturalized plants not seen by the author, and drawing attention to certain new naturalizations. Naturalizations of *Euphorbia ophthalmica*, *Lindernia rotundifolia*, *Pilea nummulariifolia*, *Solanum chaoense*, and *Thalia geniculata* were all brought to the attention of the author through the iNaturalist platform and proved to be legitimate.

Among the 24 new naturalized records reported herein, *Aneilema beniniense*, *Dracaena aubryana*, *Epidendrum calanthum*, *Galianthe brasiliensis*, *Hedychium greenii*, *Lobelia xalapensis*, and *Thalia geniculata* are reported as naturalized for the first time outside of their native range. All identifications were made by the author, unless otherwise noted. Voucher collections mentioned are housed in Bishop Museum's Herbarium Pacificum (BISH), Honolulu, Hawai'i.

New state record

Aizoaceae

Tetragonia echinata Aiton

Tetragonia echinata was found during casual botanizing in Kapolei, where hundreds of plants were found in three scattered populations along Kualakai and Kapolei Parkways. A further population was later found in 'Ewa at One'ula Beach Park. The identity of this species was determined using the keys in Adamson (1955). *Tetragonia echinata* is native to South Africa and has previously been reported as naturalized in the Canary Islands (Padrón-Mederos *et al.* 2009). In its native range, it is described as a pioneer plant, and is reported growing from roadsides and open areas (Adamson 1955). From where it has been observed in Hawai'i, it was only common on shallow, rocky soils where *Cenchrus ciliaris* was unable to establish, or from disturbed areas, making this plant unlikely to have a major environmental impact in Hawai'i. During roadside surveys on Hawai'i Island, *T. echinata* was also encountered and photographed at Waikoloa Village [link], but was unfortunately not collected. *Tetragonia echinata* differs from *T. tetragonides* (the only other naturalized *Tetragonia* in Hawai'i) by its smaller leaves, only four anthers per flower, minute flowers with sepals only 2 mm long, and multiple fruits per node (Figure 1).



Figure 1. *Tetragonia echinata* photographed in Kapolei, O'ahu. A, habit and leaves. B, flower. C, fruits.

The following description is taken from Adamson (1955: 144):

"A more more less prostrate many stemmed papulose slightly succulent annual. Stems up to 40 cm long, with raised decurrent lines from the leaf bases. Leaves petiolate, the blades oval, rhombic or deltoid, or occasionally almost orbicular, 1–2.5 cm long, 0.8-1.75 cm wide, obtuse; petiole 0.3-0.8 cm long. Flowers small, 2 mm long, in axillary groups of 2–4 on very short pedicels. Perianth densely papulose, the segments 3–5, erect, triangular, obtuse, concave inside. Stamens 3–5, alternate with the perianth segments but occasionally paired: anthers oval. Styles usually 3 less often 4 or 5, not longer than the stamens. Ovary densely papulose, 3-5 mm long and wide, round or partly truncate at the top with 3–5 projecting ridges each with few or many spine like outgrowths."

Material examined. **O'AHU**: Kapolei, intersection of Kinoiki St and Kapolei Pkwy, in undeveloped, grassy area outside fire station, from shallow, rocky soil where buffelgrass wasn't growing, full sun, unirrigated, over 400 plants seen at this location, populations also seen about 0.7 km E of this location and 1 km N of here, flowers minute, greenish yellow, most of them 4-merous, but about 1/4 3-merous, fruits covered in conspicuous "ice" cells, 18 m, 21.336208, -158.053663, 18 Feb 2023, *K. Faccenda 3028*; 'Ewa, One'ula Beach Park, northwestern edge of park along park boundary, from gravelly substrate, full sun, dry, around 100 plants seen, 3 m, 21.307346, -158.030940, 13 Mar 2023, *K. Faccenda & M. Ross 3072*.



Figure 2. Crinum asiaticum naturalized north of Swanzy Beach Park, O'ahu.

Amaryllidaceae

Crinum asiaticum L.

New naturalized record

New naturalized record

Crinum asiaticum is naturalized on O'ahu, where it has been observed naturalizing in coastal areas on the windward side of the island. The main population examined by the author consisted of around 20 plants growing amongst driftwood from wet sandy soil within 10 meters of the ocean (Figure 2). Further populations exist on the beach at Ahupua'a 'O Kahana State Park nearby. *Crinum asiaticum* is also naturalized on the north shore of Kaua'i, based on observations from iNaturalist [link], but has not yet been collected. *Crinum asiaticum* was imported to Hawai'i as an ornamental and is still widely grown in gardens across the islands (Staples & Herbst 2005). It has been present on O'ahu since at least 1928 (*F.B.H. Brown 1468*).

Material examined. **O'AHU**: Along Hwy 83 about 1 km N of Swanzy Beach Park, about 10 m from beach, coastal, about 20 plants seen, naturalized and spreading, 1 m, 21.557790, -157.866925, 23 Aug 2022, *K. Faccenda & T. Chapin 2687.*

Asparagaceae

Dracaena aubryana Brongn.

A small patch of about five individuals of *Dracaena aubryana* was found about 15 meters away from a road in the back of Kalihi Valley. The plants were far enough from the road that it seemed unlikely they were dumped (dumped plants were noticed closer to the road). Plants of *D. aubryana* have also been posted to iNaturalist from forested areas of



Figure 3. Dracaena aubryana seen in Kalihi, Oʻahu.

Waimānalo along the Maunawili Ditch Trail, and Moanalua valley where they also are naturalized [link] [link] [link]. Fruits were found on the plant in Kalihi and were photographed on one of the plants from Waimānalo, giving further evidence that this species is reproducing sexually and spreading.

Dracaena aubryana is a small shrub identified by its distinctive lanceolate leaf shape (Figure 3). This species is native to tropical Africa and was imported to Hawai'i for ornamental use; it has been present on O'ahu since at least 1955 (*H.F. Clay s.n.*, BISH147007).

The following description is from Mwachala & Mbugua (2007: 1):

"Shrub 0.4–2.5 m high, usually unbranched; stem erect, often twisted spirally. Leaves distichous, often asymmetric, ovate to narrowly ovate, 10-40(-60) cm long, (1.5-)4-10(-15) cm wide, base rounded or cuneate, apex acute to cuspidate; petiole 5-30(-100) cm long. Inflorescence erect, spicate or paniculate, 9-70 cm long, unbranched or with a few branches near the base; flowers in groups of 1-3(-7) on distinct knobs with a single triangular bract to 10 mm long; pedicel 0-2 mm long, articulated below the middle. Flowers white or greenish-white, each lobe often with purple-red central band, (10-)15-30(-55) mm long, tube 5-10(-30) mm long, lobes 10-20 mm long, to 2.5 mm wide. Fruits shiny bright orange, deeply 1-3-lobed, lobes ovoid, 8-18 mm long, 4-9 mm in diameter; seeds dirty white, ovoid, 6-14 mm wide, 5-7 mm long."

Material examined. **O'AHU**: Kalihi Valley, Kalihi St in back of valley, roadside, wet, full shade, about 30 ft into woods off road, a few plants seen, 138 m, 21.362912, -157.847049, 19 May 2022, *K. Faccenda & B. Najarian 2377.*

Asphodelaceae

Aloe aff. littoralis Baker

New naturalized record

An *Aloe* species has escaped from cultivation from the Koko Crater Botanical Garden and now is well naturalized on the southern slope of the crater, especially at the upper elevations. At least 400 plants have been observed, although the population is likely in the thousands, as red inflorescences could be seen up and down the slope of the crater when scanning with binoculars (Figure 4D). Given the size of this population and the size of the plants, it has likely been established for a minimum of 10–20 years.

Some inflorescences on this population had many fruits, but none of the inflorescences flowering in April 2023 made fruit, suggesting it is not being pollinated sufficiently at all times of the year. Some plants also had their leaves and flowers severely galled, likely by the Aloe mite (*Aceria aloinis*). Observations on iNaturalist.org also suggest that 1 to 2 other species of *Aloe* have also escaped on the upper slopes of the crater, but have yet to be vouchered or identified.

Identification of this *Aloe* proved challenging, even with the aid of the accession list of the Koko Crater Botanical Garden, as around 70 species have been accessioned and planted in the garden (Talia Portner, pers. comm.). The key and photographs in Carter *et al.* (2011) were principally used to attempt to identify this plant, but no satisfying match could be found. Attempts to contact *Aloe* experts for assistance were unsuccessful, so only a tentative identity is published at this time.

Based on the keys in Carter *et al.* (2011), the closest match for this plant is *Aloe littoralis*, a species of shrubby or shorter tree aloe that often flowers before growing an upright trunk. The Koko Crater plants principally differ from *A. littoralis* in the length of their corolla and how deeply the sepals are cut, but otherwise are a reasonable match. The seedlings of this *Aloe* have spotted leaves, while the adult plants do not, which is also a match for *Aloe littoralis* (Walker 2018).



Figure 4. *Aloe* aff. *littoralis* seen at the base of Koko Crater arch, O'ahu. **A**, leaves. **B**, inflorescence. **C**, flowers; note that increments on scale bar tattoo are 5 mm. **D**, habit showing at least 35 plants naturalized on the tuff slopes, largely from cracks in rock.

It is also possible that this population is a hybrid swarm. Carter *et al.* (2011) stated that "most *Aloes* are self incompatible ... therefore, plants grown from seed arising from uncontrolled pollination in the garden are likely to be hybrids." There is certainly the germplasm in Koko Crater for such hybridization, and the inability to match these plants to any pure species also suggests it may be a hybrid.

Material examined. **O'AHU**: Koko Crater, Koko Crater arch on N side of tuff cone, seen at base of arch, dry, sunny areas from cracks in rocks on cliffs and shallow soil, from base of arch to nearly sea level, 86 m, 21.281124, -157.681956, 07 Apr 2023, *K. Faccenda & M. Ross 3094*.

Brassicaceae

Rorippa indica (L.) Hiern

New state record

An unusual brassicoid was noticed along Kapi'olani Blvd. near the Ala Wai Community Park while walking to go get Chinese food for dinner. Approximately 40 plants were seen growing as weeds in an irrigated flower bed along the road. No other colonies have been observed around Honolulu. This plant was subsequently identified as *Rorippa indica* using the key in Al-Shehbaz (2010) and comparison to photographed specimens. *Rorippa indica* is native to much of South and Southeast Asia, Egypt, and the Democratic Republic of the Congo and neighboring countries (POWO 2023). It has become naturalized in scattered localities in the United States and Central and South America (POWO 2023).



Figure 5. Rorippa indica seen at Kapi'olani Blvd, O'ahu. A, inflorescence and fruits. B, leaves.

Rorippa indica can be identified by its lyrate-serrate leaves, annual habit, yellow petals that only shortly surpass the sepals, and linear fruits (Figure 5). The following description is from Al-Shehbaz (2010: 501):

"Annuals; usually glabrous, rarely sparsely pubescent. Stems erect, unbranched or branched proximally or distally, (0.6-)2-6(-7.5) dm. Basal leaves not rosulate; blade margins pinnatifid. Cauline leaves petiolate (to 4 cm) or (distal) sessile; blade lyrate-pinnatipartite or undivided, obovate, oblong, or lanceolate, (lobes 0 or 1–5 (or 6) on each side), (2.5-)3.5-12(-16) cm × (8-)15-40(-50) mm, base auriculate or not, margins entire, irregularly crenate, or serrate, (entire or denticulate distally). Racemes elongated. Fruiting pedicels usually ascending or divaricate, rarely slightly reflexed, straight, (2-)3-10(-15) mm. Flowers: sepals ascending, oblong-ovate, 2– $3 \times 0.8-1.5$ mm; petals yellow, obovate or spatulate, $(2.5-)3-4(-4.5) \times 1-1.5$ mm; median filaments 1.5-3 mm; anthers oblong, 0.5-0.8 mm. Fruits siliques, often curved-ascending, linear, $(7-)10-24(-30) \times 1-1.5(-2)$ mm; ovules (60-)70-110 per ovary; style (0.5-)1-1.5(-2) mm, (slender, narrower than fruit). Seeds biseriate or nearly so, reddish brown, ovate or ovate-orbicular, 0.5-0.9 mm (0.4-0.6 mm diam.), foveolate. 2n = 16, 24, 32, 48."

Material examined. **O'AHU**: Honolulu, intersection of Pa'ani St and Kapi'olani Blvd, on Ala Wai Park side of road, in irrigated garden plot between road and sidewalk, full sun, 1 m, 21.288457, -157.829865, 03 Apr 2023, *K. Faccenda 3090.*

Campanulaceae

Lobelia xalapensis Kunth

New state record

A strange, annual, weedy *Lobelia* was found growing as a weed at Kauai Nursery & Landscaping, where it was common growing in both pots and from the ground in the nursery. It was identified as *Lobelia xalapensis* by Tina Ayers (ASC). This species is native to Central and South America and is the first time it has been reported outside of its native range. Given that it was found in a nursery, it is almost certain this species was introduced as a contaminant in soil of nursery stock. In its native range, *L. xalapensis* has also been described as weedy (Senterre & Castillo-Campos 2008) or a weed in agriculture (De Egea *et al.* 2016), and inhabits riverbanks, forest edges, rocky slopes, and open moist places (Daly *et al.* 2006).

The following description is from (Jeppesen 1981: 135):

"Erect, often profusely branched herb 15-60 cm high with terete, often striate, puberulent stems, glabrate with age. Lower leaves sessile or petiolate; petiole when present 5-20 mm, narrowly winged; blade ovate, 30-50 mm long, up to 40 mm wide, obtuse to acute, cordate, truncate, or attenuate at base, margin coarsely crenate-sinuate with irregularly spaced, minute, callose teeth, at least basally ciliate; glabrous to strigose above, glabrous or pubescent beneath. Upper leaves gradually smaller and narrower. Flower in lax, terminal, few- to 30-40-flowered racemes. Bracts linear-subulate, 2-5 mm, entire, ciliate. Pedicels 5-10 mm, ascending, appressed puberulent, with two minute bracteoles at base. Hypanthium very short, hemispherical, 0.3-0.6 mm long, glabrous or puberulent. Sepals erect, subulate, 2-4 mm, entire. Corolla blue or purple, sometimes almost white, 3-5 mm; tube 2-2.5mm, dorsally cleft two thirds to the base; limb bilabiate, the two dorsal lobes erect, c. 1.5 mm, linear, the three ventral lobes united into an erect lip with two longitudinal swellings at base. Filaments connate into a tube for the distal third only, glabrous, ciliate on the free margins. Anther tube 0.5-1 mm, dorsally pilose, rarely glabrous, the two shorter anthers penicillate at tips. Capsule one-quarter or less covered by the hypanthium, ellipsoid, $4-6 \text{ mm} \times 2-3 \text{ mm.}$ "

Material examined. **KAUA'I**: Kauai Nursery & Landscaping off of Kaumuali'i Hwy just W of Puhi, weed around garden center area, seen growing in both pots of plants for sale as well as from the ground, common, hundreds of plants seen, small annual, 101 m, 21.962828, -159.405831, 08 Jul 2022, *K. Faccenda & S. Vanapruks 2517.*

Cleomaceae

Cleome rutidosperma DC.

New state record

Cleome rutidosperma is now widely naturalized across O'ahu but is currently rather uncommon. It was first found at Iwilei in 2009 by Bob Hobdy, and subsequently in Chinatown and at the University of Hawai'i Waimānalo Research Station by the author. It was also observed in Lā'ie in 2023 (Danielle Frohlich, pers. comm.). The largest population of at least 30 plants was that seen in Waimānalo. It can be identified by its trifoliate leaves, trailing habit, typical *Cleome* fruits, and purple flowers (Figure 6).

Cleome rutidosperma is native from Africa through India and has become widely naturalized across the tropics in both the Americas and Southeast Asia. It is an invasive weed throughout most lowland wet tropical areas of Asia and Australia (Chamara *et al.* 2017). In China, it is reported growing from lowland areas including paddy fields, streamsides, and wetlands. It has documented allelopathic abilities (Mutmainna *et al.* 2021).

The following description is from Wu et al. (2008: 430):

"Herbs, annual or rarely perennial, 30–100 cm tall. Stems branched, often with decumbent branches, glabrous or glabrescent to slightly scabrous but sometimes glandular pubescent. Stipules ca. 0.5 mm, scalelike or absent. Petiole 0.5–3.5 cm, proximally winged; leaflets 3; leaflet blades oblanceolate to rhomboid-elliptic, 1– $3.5 \times 0.5-1.7$ cm, abaxially with curved trichomes on veins especially when young, adaxially glabrous, margins entire or serulate-ciliate, apex acute, obtuse, or sometimes acuminate. Inflorescences terminal and axillary, 2–4 cm but 8–15 cm in fruit, 3–6-flowered; bracts leaflike, 3-foliate, 1–3.5 cm. Pedicel 1.1–2.1 cm but 1.8–3 cm in fruit. Sepals yellow, narrowly lanceolate, 2.5–4 × 0.2–0.3 mm, \pm persistent, glabrous, margin ciliate. Petals white or speckled with purple, oblong to narrowly ovate, 7–10 × 1.5–2.3 mm; central 2 petals outside with a yellow transverse bad.

Filaments yellow, 5–7 mm; anthers purplish brown, 1–2 mm. Pistil 2–3 mm, glabrous; style 0.5–1.4 mm. Fruit with a 4–12 mm gynophore; capsule 40–70 × 3–4 mm, striate. Seeds 4–25 per capsule, reddish brown to black with white funicular aril, 1–1.5 mm, slender, striately vertucose. Fl. and fr. Jun-Sep. 2n = 20, 30."

Material examined. **O'AHU**: Waimānalo, University of Hawai'i Research Station, flowers purple, trailing herb growing in mulched flower bed near aquaponics area, only seen in this flower bed but common within it, at least 30 plants seen, 17 m, 21.336089, -157.711126, 02 Aug 2022, K. *Faccenda 2557*; Honolulu, Chinatown municipal parking across street from Maunakea Marketplace, weed in small neglected garden area, flower lilac, about a dozen plants seen, 6 m, 21.313328, -157.862160, 24 Sep 2020, K. *Faccenda s.n.*; Iwilei, growing as weeds along a fence at Flora Dec business site, 29 Jan 2009, *R.W. Hobdy s.n.* (BISH 755418).



Figure 6. Cleome rutidosperma habit and flower from the plants seen in Waimānalo, O'ahu.

Commelinaceae

Aneilema beniniense (P.Beauv.) Kunth New state record

A strange commelinaceous plant was found growing wild at Lyon Arboretum, where it was growing in weedy, wet, sunny areas in flower beds. Photographs were sent to Robert Faden (US), who graciously identified the plant as *Aneilema beniniense*, a species widespread across much of tropical Africa. It is unclear how it arrived at Lyon Arboretum, as it was never intentionally imported, according to the Arboretum's accession list. In its native range it is described as abundant, especially in wet areas near watercourses or areas where sunlight reaches the forest floor (Morton 1966). Given that this species is quite competitive in its native range, and was growing as a rather aggressive weed at Lyon, it would be best to eradicate this species before it spreads further. The inflorescence of *A. beniniense* is dramatically distinct among the Commelinaceae found in Hawai'i, making identification easy (Figure 7).



Figure 7. Aneilema beniniense inflorescence photographed at Lyon Arboretum, O'ahu.

The following description is from Faden (2012: 105):

"Perennial, decumbent, rooting at the nodes; roots thin, fibrous; shoots erect to ascending, (15-)40-130 cm tall, densely branched below, usually unbranched distally, glabrous. Leaves spirally arranged; sheaths 1-4 cm long, glabrous or very sparsely puberulous along the fused edge distally, sparsely ciliolate or eciliolate at apex; lamina (sub-) petiolate, narrowly lanceolate to elliptic, $(5-)7-15(-18.5) \times$ (1.2-)2-5(-6.7) cm, base cuneate to \pm rounded, margins scabrid distally, apex acuminate; both surfaces glabrous or the abaxial sparsely puberulous. Thyrses terminal and occasionally on a short shoot from a distal leaf or inflorescence bract. very dense, ovoid or cylindric, $2-6 \times 1.5-6$ cm, of (10–)18–55 ascending cincinni (or the lowest patent); inflorescence axes glabrous or sparsely puberulous; peduncles 2-4 cm long with a bract halfway; cincinni to 3 cm long and 9-flowered; bracteoles cup-shaped, perfoliate, prominently glandular subapically, glabrous. Flower bisexual and male, 7-10(-13) mm wide; pedicels 3-6 mm long in flower, 4-7 mm long and erect to strongly recurved in fruit, glabrous. Sepals with the medial slightly larger, green or greenish white, ovate or elliptic, $2-3 \times 2-2.5$ mm, convexoconcave, hooded apically, glandular subapically, glabrous; paired petals white or pale lilac, lavender or violet, $4-5 \times 2.5-4$ mm of which the claw 1-1.5 mm long; medial petal white or greenish white, ovate or broadly ovate, $3-4 \times 2-3$ mm; staminodes 2–3, yellow, antherode bilobed; lateral stamens with filaments 3.5–5 mm long, sigmoid, sparsely bearded, anthers 0.8-1 mm long; medial stamen filament 3–3.5 mm long, anther 0.8–0.9 mm. Ovary $1.5-2 \times 1$ mm, glabrous; style arcuate-descending, ± 4 mm long; stigma capitellate. Capsules dark brown or greybrown, oblong-ellipsoid, $(4.5-)5-7 \times 2.5-3.5$ mm, bi- or trilocular, bivalved, glabrous; dorsal locule 0-1-seeded, ventral locules (1-)2-3-seeded. Ventral locule seeds broadly ovoid to reniform, 1.3-2.4 × 1.2-1.8 mm, testa pinkish brown, orange-brown or grey."

Material examined. **O'AHU**: Lyon Arboretum, Mānoa, garden beds just N of main visitor parking lot, weed in flower beds, common weed in these beds only, not seen further back in arboretum, erect to 50 cm tall, rooting at nodes, petals 2, strongly clawed, very pale blue, almost white in color, 165 m, 21.333798, -157.803195, 29 Sep 2022, *K. Faccenda 2717*.

Crassulaceae

Kalanchoe ×*houghtonii* D.B. Ward

New naturalized record

Kalanchoe ×*houghtonii* is a hybrid between *K. delagoensis* and *K. daigremontiana* that is now naturalized in disturbed lowland areas on Kaua'i, O'ahu, and Maui. *Kalanchoe* ×*houghtonii* has been reported as naturalized in Florida (Ward 2006), Portugal (Smith *et al.* 2015), Spain, Italy (Herrando-Moraira *et al.* 2020), and China (Wang *et al.* 2016). It is rather weedy and has a tendency to spread from gardens to natural areas in many regions where it has escaped (Sukhorukov *et al.* 2018).

The leaves of *K*. ×*houghtonii* are generally intermediate between the two parents: narrow like *K. delagoensis*, but bearing plantlets along its entire length like *K. daigremontiana* (Figure 8). The key below should help separate the hybrid from its parents. *Kalanchoe* ×*houghtonii* has been reported to arise spontaneously when its parents are grown in proximity (Herrando-Moraira *et al.* 2020) but is also extensively cultivated. Several cultivars exist, some being fertile diploids and others being infertile triploids (Ward 2006). The ploidy of the Hawaiian populations is unknown, but this hybrid generally reproduces asexually, while sexual reproduction is less common. It is also unknown whether these populations formed via spontaneous hybridization by the naturalized parents, or were derived from cultivated plants. As the hybrid is common in cultivated plants.

Material examined. **KAUA'I**: Waimea Canyon Dr, about 400 m up road from edge of town, makai of Panini Ln, dry exposed roadside, from hard soil on a S-facing slope, large clump of plants about 2 m wide and reproducing asexually by plantlets, at least 200 plants present in this clump, most very young and only 2 flowering, 21.964294, -159.666144, 02 Jun 2022, *K. Faccenda 2468.* **O'AHU**: Ridge between Pia Valley and Kuli'ou'ou (Kulepeamoa), along trail, dry sunny area at low elevations, small clump present in dry grass and *Leucaena* area, 21.292706, -157.736006, 23 Oct 2021, *K. Faccenda 2127*; Upper Makakilo, adjacent to Palehua Heights subdivision, on SW slope of Kalo'I Gulch, 800 ft [243 m] 30 Mar 2004, *C. Imada et al. 2004-34.* **MAUI**: East Maui near Puu Pīmoe, Kanaio, 1500 ft [457 m], 20° 36' N 156° 22' W, 31 Mar 2004, *F. Starr et al. 040331-3.*

KEY TO DIFFERENTIATE KALANCHOE ×HOUGHTONII FROM ITS PARENTS

1. Leaves bearing plantlets only at the tip, smooth along most of its margin; leaves terete or cylindrical *K. delagoensis* 1'. Leaves bearing plantlets along their entire length, serrated or rough along most of its margin; leaves flattened or V shaped



Figure 8. Kalanchoe ×houghtonii from the O'ahu population on Kulepeamoa Ridge, O'ahu.

Euphorbiaceae

Euphorbia ophthalmica Pers.

New state record

Euphorbia ophthalmica is now known to be naturalized in Hawai'i from collections on O'ahu and Maui, and has been found growing in potted plants for sale at Kauai Nursery & Landscaping on Kaua'i and is likely also naturalized on that island. This species also occurs on Hawai'i Island, where it has been photographed [link] but not yet vouchered. While visiting nurseries on Kaua'i and O'ahu, this plant was observed as a common or uncommon weed growing in the soil of potted plants for sale, suggesting that as the mechanism of introduction. Many (but not all) plants collected were also from recently planted flower beds, showing that seeds are moving via nursery stock.

Euphorbia ophthalmica is native to the Americas from Florida though South America and has previously been reported as naturalized in Australia, Sicily, and the Galapagos (POWO 2023). It is most similar to the common *Euphorbia hirta* but differs from that species in that *E. hirta* has axillary inflorescences, whereas *E. ophthalmica* has only terminal inflorescences (Figure 9).

The following description is from Steinmann et al. (2016: 280):

"Herbs, usually annual, rarely short-lived perennial, with slender to slightly thickened taproot. Stems usually prostrate, rarely ascending, 6–22 cm, usually both strigillose and hirsute. Leaves opposite; stipules distinct, subulate-filiform, undivided or divided into 2-4 narrowly triangular to linear-subulate segments, no dark, circular glands at base of stipules, 0.9-1.5 mm, pilose or strigillose; petiole 0.3–1.2 mm, glabrescent, strigillose, or sericeous; blade usually ovate or oblong, rarely subrhombic, $4-13 \times 3-7$ mm, base asymmetric, one side usually angled and other side rounded, margins coarsely serrulate, apex acute, surfaces often with red spot in center, strigillose or sericeous, or adaxial surface glabrescent; 3-veined from base. Cyathia in dense, terminal, capitate glomerules, with reduced, bractlike leaves subtending cyathia; peduncles 0-0.8 mm. Involuce obconic, $0.5-0.7 \times 0.4-0.6$ mm, strigillose; glands 4, yellow green to pink, circular to slightly oblong, $0.1-0.2 \times 0.1-$ 0.2 mm; appendages absent or white to pink, forming thin rim around edge of gland or oblong, $0.1-0.2 \times 0.1-0.3$ mm, distal margin entire or shallowly lobed. Staminate flowers 2–8. Pistillate flowers: ovary strigillose, often canescent when young; styles 0.1–0.3 mm, 2-fid $\frac{1}{2}$ to nearly entire length. Capsules ovoid, 1–1.2 × 1–1.3 mm, strigillose; columella 0.7–1.1 mm. Seeds orange-brown to pinkish, narrowly ovoid, 4-angled in cross section, $0.7-0.9(-1.1) \times 0.5$ mm, usually rugulose, with 3-6 faint, low, transverse ridges, rarely almost smooth."

Material examined. KAUA'I: Kauai Nursery & Landscaping off of Kaumuali'i Hwy just W of Puhi, weed around garden center area, seen growing only in pots of plants for sale, rare, only 2 plants seen, 101 m, 21.962923, -159.405685, 08 Jul 2022, K. Faccenda & S. Vanapruks 2519. O'AHU: Bishop Museum, along road connecting main entrance to staff parking, irrigated flower bed, sunny area, abundant in flower bed, 21.330680, -157.868744, 17 May 2021, K. Faccenda 1828; Honolulu, intersection of Punchbowl St and King St, crack from sidewalk, 4 plants present, 21.304325, -157.859861, 07 Aug 2021, K. Faccenda 2074; Kapolei, intersection of Kinoiki St and Kapolei Pkwy, weed in irrigated flower bed, full sun, about 30 plants seen, 19 m, 21.335387, -158.055547, 18 Feb 2023, K. Faccenda 3026; Kapolei, Lowe's Garden Center at intersection of Kapolei Pkwy and Kapolei Blvd, weed around garden center area, seen growing only in pots of plants for sale, uncommon weed in pots, 21 m, 21.328793, -158.088990, 10 Jul 2022, K. Faccenda & S. Vanapruks 2534; Waimānalo, Sharon's Plants Nursery, weed growing out of both pots and soil around nursery, uncommon,<10 plants seen, 54 m, 21.333019, -157.723747, 02 Aug 2022, K. Faccenda & E. Peterson 2559; Waimānalo, intersection of Makakalo St and Mokulama St, growing from gravel on roadside in sunny area, seed possibly moved with what appears to be recently deposited gravel, common only from this gravel, over 100 plants, 26 m, 21.337160, -157.721966, 03 Aug 2022, K. Faccenda 2575; Honolulu, east side of Kulamanu Pl, about halfway down the street, growing from cracks in sidewalk and rock planter beds, ca 40-50 plants observed, 7-8 m, 21.152825, -157.474604, 10 Mar 2023, M.C. Ross 1908. MAUI: Olowalu, Luawai St, ca 1000 m up from highway, irrigated roadside, uncommon weed in grassy area, 59 m, 20.818726, -156.616451, 22 Oct 2022, K. Faccenda 2731.



Figure 9. Euphorbia ophthalmica growing in a pot at Koba's Nursery in Waimānalo, O'ahu.

Fabaceae

Arachis pintoi Krapov. & W.C. Greg.

New naturalized record

Arachis pintoi, commonly called the perennial peanut or pintoi peanut, is now showing evidence of naturalization on O'ahu and Kaua'i, where plants have been found in areas where they obviously weren't planted. For example, a single plant was found on a rarely used trail in the back of Lyon Arboretum. Many plants were also seen by the author growing as weeds in mowed lawns at Wiliwilinui and Mau'umae ridges and also at Whitmore Village. Plants have also been found growing on roadsides in Kapa'a Valley on Kaua'i and at Tantalus on O'ahu. A large population is also found along Drum Rd in the northern Ko'olau where it was hydroseeded and spread from initial plantings. The earliest evidence of naturalization of this plant is from a plant found on a pile of waste soil in Waimānalo in 2005. So far, it has only been seen in disturbed areas such as roadsides, lawns, and trails.

Arachis pintoi was introduced into Hawai'i around 1993 by Frankie's Nursery in Waimānalo (*F. Sekiya s.n.*, BISH 644875) from the Kuching Sarawak Research Station in Malaysia. Perennial peanut was then quickly promoted as a cover crop and green mulch in Hawai'i (Hensley *et al.* 1997) and the Pacific (Glover 1994). It was ranked as a 4 on the Hawai'i Pacific Weed Risk Assessment [link]. Perennial peanut is native to Brazil and has become naturalized across much of South America as well as Australia, Sri Lanka, and Honduras (POWO 2023). *Arachis pintoi* is considered an excellent tropical forage legume (Staples & Herbst 2005) and much of its spread worldwide was for forage purposes (Krapovickas & Gregory 1994), although it seems it is rarely used in pastures in Hawai'i.

The following description is from Krapovickas & Gregory (1994: 81) and has been machine translated from Portuguese.

"Perennial. Root axonomorphic, without thickening. Stems first erect, then creeping, rooting at the nodes, cylindrical. Branching distichous. Leaves quadrifoliolate. Stipules with portion fused to petiole $10-15 \text{ mm long} \times 3 \text{ mm wide}$, setae rigid on back; free portion 10-12 mm long \times 2.5 mm wide at the base, longitudinal veins marked, both sides glabrous and margin with silky hairs. Petiole up to 6 cm long, canaliculate, back with rigid setae, glabrous depression and fine, silky hairs on the margins. Rachis 10-15 mm long, canaliculate, back with few setae. Pulvini pubescent. Leaflets obovate, distal pair up to 50 mm long × 32 mm wide, and proximal pair up to 45 mm long × 28 mm wide; upper leaf surface glabrous, with a slightly marked margin; lower leaf surface with scattered setae, margin slightly marked, with silky hairs and some short setae. Axillary spikes, 4–5 flowered, very short, covered by the fused portion of the stipules. Sessile flowers, protected by two bracts, the basal one 12 mm long × 5 mm wide, silky hairs on the midvein and on the margin, the upper bract forked, 10 mm long \times 2.5–3 mm wide, silky hairs on the two veins and on the margin. Hypanthium 6.5 (3.5-9.5) cm long, with long silky hairs. Calyx bilabiate, with silky hairs somewhat stiffer than those of the hypanthium and with setae; lower lip 5 mm long, tridentate; upper lip 6 mm long, narrow, falcate, yellow corolla banner 11 mm long × 13 mm wide with yellow veins; wings 8 mm long × 6 mm wide, keel 6-7 mm long, falcate. Four oblong, basifixed anthers, four spherical, dorsifixed anthers, and one staminode. Bi-jointed fruit; nail 5-32.5 cm long, slightly pubescent towards base; proximal stud somewhat smaller than distal, $11-13 \text{ mm} \log \times 6-7 \text{ mm}$ wide; isthmus $1-8.5 \text{ cm} \log$; distal stud 12–14 mm long \times 7 mm wide; smooth pericarp, covered with fine hairs that retain the soil."

Material examined. **KAUA'I**: Kapa'a Valley, Olohena Rd 500 m E of Hono Ohala Pl, roadside, with assorted weeds, sunny, moist, spreading on roadside, near house, naturalizing, flowers yellow, very delicate, rooting vigorously at nodes, unsure if this was fruiting as I didn't have a shovel to dig it up, 22.078620, -159.375678, 29 May 2022, *K. Faccenda 2391.* **O'AHU**: Mau'umae Ridge, intersection of Sierra Dr and Mariposa St, weed in mowed, unirrigated lawn, 211 m, 21.293629, -157.789783, 04 Mar 2023, *K. Faccenda 3053*; Lyon Arboretum, Mānoa, in wet rainforest along trail, weed along trail, unlikely planted, small colony 1 m wide, 216 m, 21.337572, -157.805319, 29 Sep 2022, *K. Faccenda 2719*; Whitmore Village, Ahaehe Ave and Ehoeho Ave, in mowed lawn, moist, sunny area, only one clump seen, about 2 m wide and circular, 308 m, 21.511347, -158.020698, 18 Jan 2023, *K. Faccenda 3010*; Tantalus, Round Top Rd near Pu'u Kakea Pl, moist, partly shady roadside, near houses, naturalizing on side of road in mowed grass and in unmowed weedy area, 21.322443, -157.815472, 27 May 2022, *K. Faccenda 2381*; Drum Rd, Helemano Reservation end, Kakaina St, vacant lot, growing on piles of red clay topsoil among weeds and grasses, 21°20.138', -157°44.4264', 17 Feb 2005, *G. Staples 1224*.

Linderniaceae

Lindernia rotundifolia (L.) Alston

A new species of *Lindernia* was noticed by the author in Mānoa growing as both a weed in lawns and also as a weed in a lo⁴ kalo in Mānoa. It was further found to be widely distributed on Hawai⁴ Island between Volcano, Honomū, and Pāhoa, where it grows as a weed in lawns, roadsides, and other moist, sunny areas. Using the keys in Wannan (2019)

New state record

and Lewis (2000) it was identified as *L. rotundifolia*, a species native to the American tropics from Guatemala to the West Indies and Brazil, as well as India, Bangladesh, Sri

Lanka, and Madagascar (Lewis 2000). It has become naturalized in Australia, Fiji, Jamaica, and Cuba (POWO 2023). This species is used in the aquarium trade, as it can grow fully submerged, and was likely imported to Hawai'i for that use.

Lindernia rotundifolia is a prostrate annual with opposite, orbicular leaves and whitish flowers with blue markings (Figure 10). It can be differentiated from the other *Lindernia* in Hawai'i by its flowers with blue markings and usually entire leaves, as other species have whitish or purplish flowers and toothed leaves.

The following description is from Lewis (2000: 108):

"Annual trailing herb. Stems green, 2.5-36(-56) cm long, rooting at the lower or most or all nodes, glabrous; branching only from the base to throughout the stem. Leaves cauline, sessile, minutely glandular-punctate on both surfaces (sometimes inconspicuously so); lamina elliptic, ovate, obovate, or orbicular, 2-16 mm long, 1-12 mm wide, largest leaves usually near the middle of the stem; base cuneate- to rounded- or less commonly attenuate-clasping; margin entire, serrate or remotely toothed; apex acute, obtuse or rounded; palmately 3-5 veined. Flowers chasmogamous, solitary in the axils of well developed or slightly reduced leaves; pedicels alternate or occasionally opposite, $2-18 \text{ mm} \log$, half to $3 \times$ the length of the subtending leaf, glabrous to stipitate-glandular, especially near the base of the pedicel; erect to spreading, often reflexed in fruit. Calyx zygomorphic or irregular, occasionally 3 long + 2 short sepals, or nearly actinomorphic, 1.0-3.1 mm long, sepals basally connate, the tube 0.1–0.7 mm long; lobes lanceolate, acuminate; glabrous or stipitate-glandular, often only along sepal margin. Corolla white or light blue with darker blotches on the throat and purple on the lower lobes, tufts of trichomes at the base of the anterior lobes; tube 4–9 mm long; posterior lip ca. half the length of the anterior (longer in Old World material seen), apex emarginate. Androecium of 2 fertile stamens and 2 staminodes; free part of the staminodial filament 0.9-2.3 mm long (including the appendage), staminodes slightly exserted from corolla tube, setose, distal portion of filament lacking; fertile anthers coherent, filaments 0.9-1.3 mm long, glabrous. Style 3-5.7 mm long, often persisting until capsule dehisces; stigma 0.3-0.6 mm long, 0.3-0.8 mm wide, 2-parted, appearing capitate. Capsule tan to gold, 1.2-3.7 mm long, approximately equaling to infrequently exceeding the length of the calyx, 1-2.8 mm in diameter, broadly ellipsoid to globose, glabrous, smooth. Seeds vellow to gold or reddish-gold, 0.22-0.43 mm long, 0.11-0.30 mm in diameter, compressed-oblong to rectangular or irregularly tetragonal in outline, usually 4- or 6-angled or ribbed or occasionally terete; seed coat areolate (or appearing nearly smooth under magnification to $70\times$), minutely tuberculate, and often with waxy cuticular projections or ridges. Flowering and fruiting throughout the year."

Material examined. **O'AHU**: University of Hawai'i Mānoa, lo'i kalo off of Dole St, sunny, saturated soil, common, stoloniferous, rooting at nodes, covering large areas of saturated soil, 20 m, 21.295653, -157.812658, 11 Jan 2022, *K. Faccenda 2195*; Lyon Arboretum, Mānoa, weed in lo'i kalo, from saturated soil, creeping and rooting at nodes, flowers largely white with bluish throat and purple spots at base of lobes, small population in lo'i, 132 m, 21.334049, -157.801504, 29 Sep 2022, *K. Faccenda 2716*. **HAWAI'1**: Pāhoa Park, near skatepark, weed in mowed grass, full sun, moist, associated with *Axonopus*, corolla mostly white but tube purplish-blue, each of the lower 3 lobes with 2 bluish spots at their base, common weed in lawn, 208 m, 19.492407, -154.946489, 28 Feb 2022, *K. Faccenda 2249*.



Figure 10. Lindernia rotundifolia habit and flowers in mowed grass at Hilo, Hawai'i.

Malvaceae

Malvastrum corchorifolium (Desr.)

Britton ex Small

New state record

During casual botanizing in Kapolei near University of Hawai'i West O'ahu, an unusual *Malvastrum* was found with smaller, bright yellow flowers. Between 50 and 100 plants were seen along a roadside where they had survived the summer dry spell, unlike the *M. coromandelianum* seen nearby, which was regenerating from seed. Examination of the fruits of this plant revealed they have no spine, matching them with *Malvastrum corchorifolium* (Hill 2006). *Malvastrum corchorifolium* is native from the southeastern United States through the Caribbean and Central America. It has previously been reported as naturalized in New York and Ghana (POWO 2023).

Malvastrum corchorifolium is most similar to *M. coromandelianum* but principally differs in its mericarp, as *M. corchorifolium* has a spine 0.1–0.4 mm long, while *M. coromandelianum* has a spine 0.5–2.3 mm long (Figure 17; Hill 2006). This species is likely a stabilized allopolyploid hybrid between *M. americanum* and *M. coromandelianum* and likely originated multiple times in its native range (Hill 2006). No investigation was undertaken to determine if the population discovered in Hawai'i arose independently, or if seed was somehow introduced from a continental population. No *M. americanum* was seen nearby—the closest population on O'ahu known by the author is over 15 km away—but that is not reliable evidence that this did not form spontaneously, as it could have formed on a different part of the island where the species do overlap and then dispersed to this spot.



Figure 11. *Malvastrum* spp. Seen near University of Hawai'i West O'ahu. A, *M. corchorifolium* mericarps. B, *M. coromandelianum* mericarps. C, *M. corchorifolium* flowers and leaves. The lines on the scale bar tattoo are separated by 5 mm.

The following description is from Hill (2006: 297):

"Herbs, annual or perennial, suffruticose in age, 0.6-1.5 m, sparsely branched in proximal 1/2, usually with 1 main stem. Stems erect, hairs scattered, appressed, distinctly bilateral, 4-rayed, not sublepidote, swollen-based, or few, minute, marginal, simple hairs. Inflorescences axillary, solitary flowers at first, later congested or loose terminal spikes 1-2 cm, these in distal leaf axils or terminating each branch; floral bracts usually 2-fid, $3-6 \times 1$ mm, or flowers subtended by leaf and stipules. Pedicels 0.5-2 mm; involucellar bractlets basally adnate to calyx for 0.5–1 mm, lanceolate, subfalcate, $4-6 \times 0.8-1$ mm, \pm equaling calvx lobes, apex acuminate. Flowers: calyx connate for 1/4-1/3 its length, broadly campanulate, 5-6 mm, to 7-11 mm in fruit, surface moderately hairy, hairs simple, 2-4-rayed, mixed with scattered, 4-6-rayed, stellate, minute hairs; corolla campanulate to widespreading, yellow to pale yellow-orange, 12-17 mm diam., petals obovate, asymmetrically lobed, $6-7 \times 3-4$ mm, exceeding calvx by 2 mm; staminal column 2-2.5 mm, sparsely stellate-puberulent; style (9-)11-13(-16)-branched. Schizocarps 4–7 mm diam.; mericarps tardily shed from calyx, (9-)11-13(-16), $2.5-3 \times 2-2.5 \times 1.1$ mm, margins angled, sides radially ribbed, narrowly-notched, with 3 minute, apical cusps 0.1-0.4 mm, 1 at proximal-apical surface, 2 at distalapical surface, moderately hairy on dorsal 1/3, hairs erect, minute, simple or 2rayed, and erect, simple, rigid hairs 0.5-1 mm, minutely hirsute with ascending, simple hairs 0.1-0.5 mm mixed with minute, simple or 2- or 3-rayed, stellate hairs. Seeds 1.5–1.7 mm. 2n = 48."

Material examined. **O'AHU**: Kapolei, off of Ho'omohala Ave between community college and rail station, along road, in partial shade of *Leucaena*, about 50 plants seen, 40 m, 21.357667, -158.053937, 19 Feb 2023, *K. Faccenda 3035*.



Figure 12. *Thalia geniculata* as seen at Akumu St ditch, O'ahu. A, full plant with author for scale. B, flower. C, fruits and bracts.

Marantaceae

Thalia geniculata L.

New naturalized record

While identifying iNaturalist observations from O'ahu in 2021, an observation of *Thalia geniculata* posted by Adam Almeida was noted as unusual, as it appeared naturalized. The locality reported in the observation was subsequently visited in 2022 and voucher specimens were made. A small population of likely 5–20 plants was seen growing in a ditch under Keolu Dr. near Akamu St. in Kailua (Figure 12). It was difficult to estimate the population size as the clumps were rather large and some were merged together. *Thalia geniculata* is native to most of the tropical Americas and Africa (POWO 2023). In Florida, this species is called Alligator flag and is a rather common wetland species in the Everglades and other wet, lowland areas (Kennedy 2000). This is the first time it is reported as naturalized outside of its native range.

Thalia geniculata can be recognized by its *Heliconia*-like leaves; erect, branched inflorescences up to 3.5 m tall bearing many pinkish flowers; and its obligate wetland habitat (Figure 12). This plant was introduced into Hawai'i as an ornamental as the earliest specimen was from Foster Botanical Garden in 1943 (*M.C. Neal s.n.* BISH 649598) and has also been collected at Waimea Botanical Garden in 1986 (*J. Lau & C. Cory 2325*).

The following description is taken from Kennedy (2000: 319):

"Plants 1–3.5 m. Leaves: basal 2–6, cauline 0–1(–2); sheath green or occasionally red-purple, glabrous; petiole green or occasionally red-purple, glabrous; pulvinus caramel-colored, olive-green, or red-purple, 0.3-2.5 cm, glabrous; blade ovate to

narrowly ovate, 19–60 × 4–26 cm, firm, stiff-papery, base rounded to subtruncate, apex acute to acuminate, occasionally obtuse with acuminate tip, abaxial surface green, faintly pruinose, glabrous, adaxial surface glabrous. Inflorescences lax, broadly spreading to pendant, paniclelike array, up to ca. 0.6×1 m; scapes 0.8-2.5 m; rachis not pruinose; internodes 5–20 mm; bracts not pruinose, green or streaked or tinged with purple, narrowly ovate, 1.3-2.8 cm, herbaceous, sparsely to densely villous. Flowers: sepals 0.5-2 mm; outer staminode faint lavender to purple, $15-20 \times 5-10$ mm; callose staminode base yellow, apex purple, apical rim, reflexed, petallike. Fruits ellipsoid, $9-12 \times 6-7$ mm. Seeds smooth dark brown to black, ellipsoid, $7-10 \times 5-6$ mm. 2n = 18 (Senegal) 2n = 26 (in cultivation)."

Material examined. **O'AHU**: Kailua, ditch near intersection of Akumu St and Keolu Dr, emergent in ditch, partly shaded by trees, growing on both sides of ditch, emergent or from saturated soil, unsure how many plants since the clumps merged together, but probably 20–30 stems seen, petals white, inner part of flower lavender, 3 m, 21.380672, -157.728833, 09 Jan 2022, *K. Faccenda & S. Vanapruks 2187*.

Onagraceae

Ludwigia erecta (L.) H.Hara

New state record

Ludwigia erecta is now known to be naturalized on Kaua'i, O'ahu, and Hawai'i. On Kaua'i it was found at Hulē'ia National Wildlife Refuge. On O'ahu it can become common in canals, natural stream beds, and at Kawainui Marsh. It is common in streams and canals around Mānoa. A single plant was also found growing as a weed in a potted plant at a nursery in Waimānalo, and on a roadside in a wet forest above Honoli'i Stream on Hawai'i Island. The single plant found in the nursery was unusual and perhaps suggests that it was introduced as a contaminant with nursery stock, but given how widespread this species is across the islands, it is surely not a recent introduction.

Ludwigia erecta grows from wet to saturated soil in sunny sites. It can be identified by its height, as it reaches almost 3 m at maturity, far taller than the common *L. octovalvis*; and by its flowers being 1 cm in diameter with 4 petals, which are very readily deciduous (Figure 13). *Ludwigia erecta* is native to the tropical areas of the Americas and has become naturalized across almost all of Africa (POWO 2023). In its native range it grows on pond margins, ditches, and depressions (Hoch 2021).

The following description is from Hoch (2021: 78):

"Herbs annual, rarely persistent a second year from woody base. Stems erect, 4angled, rarely 4-winged, sometimes basally terete, 40-280 cm, simple to densely branched, branches often ascending, glabrous. Leaves: stipules deltate, $0.2-0.3 \times$ 0.15–0.2 mm; petiole 0.2–2.2 cm, somewhat flattened and continuous with ridges or wings on stem; blade elliptic to narrowly lanceolate, $2-20 \times 0.2-4$ cm, base cuneate, margins minutely scabrid, apex acute or acuminate, membranous, surfaces glabrous or sometimes minutely strigillose along abaxial veins; bracts often reduced. Inflorescences leafy spikes, flowers solitary in distal axils; bracteoles attached at base of ovary or on lower 1/2, without subtending glands, deltate, $0.3-0.5 \times 0.2-0.3$ mm, apex acute. Flowers: sepals ovate or lanceolate, $3-6 \times 1-2$ mm, apex acute or short-acuminate, surfaces usually glabrous, sometimes strigillose; petals obovate, $3.5-5 \times 2-2.5$ mm; stamens 8 in 2 subequal series, filaments 1.3-1.5 mm, anthers oblong, 0.6-1 × 0.4-0.5 mm; ovary obconic, 4-angled, 4-10 × 2-4 mm, usually glabrous, rarely strigillose; nectary disc plane on ovary apex, 3-4 mm diam, 4lobed, glabrate; style $0.5-1.5 \times 0.5-0.6$ mm, stigma globose, $0.8-1 \times 1-1.2$ mm, not exserted beyond anthers and pollen shed directly on it. Capsules oblong-linear to squarish-cylindric, 4-angled, $10-22 \times 2-4$ mm, thin-walled, irregularly dehiscent, subsessile. Seeds elongate-ovoid, $0.3-0.5 \times 0.2-0.3$ mm, raphe very reduced and inconspicuous. 2n = 16."

Material examined. **KAUA'I**: Hulē'ia National Wildlife Refuge, Management Unit #H4N, a single shrub or possibly a few more, first record of the species in the State, 17 Dec 2014, *K.J. Uyehara & M. Milinichik s.n.* (BISH 764375). **O'AHU**: Honolulu, Kahana Stream (tributary to Makiki Stream), completely channelized area N of Wilder Ave, full sun, moist substrate, dominant, 21.306733, -157.838156, 12 Jun 2021, *K. Faccenda 1959*; Kawainui Marsh State Wildlife Sanctuary, palustrine emergent wetland, germinates during spring drawdown, 1–2.5 m tall, growing in thick monospecific stands or individually especially in disturbed moist soil 21.383556, -157.758979, 16 Oct 2022, *L. Nietmann s.n.* (BISH 779017); Waimānalo, Sharon's Plants Nursery, weed seen growing in a pot, 49 m, 21.333003, -157.723209, 02 Aug 2022, *K. Faccenda & E. Peterson 2561*; Hawai'i Kai, Kamilo'iki Park off of Lunalilo Home Rd, from concrete stormwater canal running along the N edge of park, 2 plants seen, ca 1.5 m tall, 3 m, 21.297636, -157.687754, 03 Dec 2022, *K. Faccenda 2858*; Ka Iwi area, Wāwāmalu Channel where it goes under the road, at least 100 plants seen, up to 3 m tall, 3 m, 21.297310, -157.662740, 07 Apr 2023, *K. Faccenda & M. Ross 3091*. **HAWAI'I**: Honoli'i, Kahoa St along Honoli'i Stream, weed on roadside, wet, shady forest, 2 plants seen, 10 m, 19.756412, -155.093194, 14 Aug 2022, *K. Faccenda & M. Murphy 2644*.



Figure 13. *Ludwigia erecta*. **A**, plants approximately 2.5 m tall to the left of the author at the Wāwāmalu Stream, O'ahu. **B**, flowers seen in the Kahana Stream, O'ahu. Increments on the scale bar tattoo are 5 mm.

Orchidaceae

Dendrobium 'Jaquelyn Thomas'

Confirmation of naturalization

Dendrobium 'Jaquelyn Thomas' was previously reported as a questionable naturalization on O'ahu by Lau & Frohlich (2013) based on a single collection at West Makaleha. A



Figure 14. Dendrobium 'Jaquelyn Thomas' seen at Kulepeamoa Ridge, O'ahu.

population of at least 2 plants was seen along trails on the sides and summit of Kulepeamoa Ridge (Figure 14). Two further plants were found on Mau'umae Ridge, but were not collected.

Material examined. **O'AHU**: Ridge between Pia Valley and Kuli'ou'ou (Kulepeamoa), along trail, from strawberry guava scrubland, full sun, growing above scrub, windy, one plant seen, very robust, stem about 3 cm at its widest, 21.302664, -157.737728, 23 Oct 2021, *K. Faccenda 2133*.

Epidendrum calanthum Rchb. f. & Warsz. New naturalized record Approximately 100 plants of *Epidendrum calanthum* were seen growing along the Hawai'i Loa Ridge Trail about 200 m mauka from the trailhead in dry, open areas along the trail. *Epidendrum ×obrienianum* was also seen in this area. Photos of these plants were sent to James Ackerman, who confirmed the author's tentative identification. A plant of *E. calanthum* from Hawaii Volcanoes National Park has also been posted to iNaturalist [link] showing that the species is also naturalized on Hawai'i Island, but it has yet to be vouchered.

Epidendrum calanthum is native to most of northern South America (POWO 2023) and this is the first naturalization of this species outside of its native range. There were no specimens of *E. calanthum* at BISH, so it is unclear how long this species has been present on O'ahu. It is certain that this species was imported as an ornamental. *Epidendrum calanthum* can be distinguished from the other naturalized *Epidendrum* in Hawai'i by its pink flowers (Figure 15).

Material examined. **O'AHU**: Hawai'i Loa Ridge Trail, ca 0.2 km mauka from trailhead, dry, sunny, invasive-dominated area, flowers pink, ca 100 plants present, flowering and fruiting, common, 21.299144, -157.745731, 29 Aug 2021, *K. Faccenda 2105*.



Figure 15. Epidendrum calanthum flower photographed at the Hawai'i Loa Ridge Trail, O'ahu.

Vanilla planifolia Andrews

Confirmation of naturalization

Vanilla planifolia was reported as questionably naturalized at Lyon Arboretum, where it was forming dense patches near 'Aihualama (Daehler & Baker 2006). No specimen was collected by Daehler & Baker (2006), as they hypothesized that it was spreading via vegetative reproduction only. However, in 2022 a lone plant was found on the 'Aihualama Trail distant from any other plants and far above Lyon Arboretum, suggesting that this species is reproducing via seed. Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16). It is unclear if *V. planifolia* is being insect-pollinated or selfing, but selfing seems more probable given that it has been reported to occur at up to 6% of flowers of *V. planifolia* in Mexico, although some *V. planifolia* cultivars are sterile (Bory *et al.* 2008). As such, *V. planifolia* should now be considered naturalized on O'ahu. *Vanilla planifolia* has also been reported as naturalized in 37 countries scattered throughout the tropics (POWO 2023).

Material examined. **O'AHU**: 'Aihualama switchback trail descending from Tantalus to Mānoa Falls, disturbed moist forest, full shade, climbing vine, only one plant seen along trail, 309 m, 21.341354, -157.803010, 29 Jan 2022, *K. Faccenda 2217.5.*

Plantaginaceae

Plantago rugelii Decne.

New state record

Plantago rugelii has been present on Hawai'i Island since at least 1974 but was misidentified as the morphologically similar *Plantago major* until now. Its known range on Hawai'i Island spans much of the eastern side of the island, from Hilo through much of the Ka'ū District. Recent collections also show that it is also naturalized across mid- to



Figure 16. Vanilla planifolia photographed along the 'Aihualama Trail in Mānoa Valley, O'ahu.

high-elevation areas of O'ahu in both the Ko'olau and Wai'anae Ranges, where it is mostly found along roadsides and trails.

Plantago rugelii is native to the continental United States and Canada to the east of the Rocky Mountains (POWO 2023). It has previously been introduced to Cuba. *Plantago rugelii* is easily confused with *P. major*, and fruits must be examined to reliably separate these species. On *P. rugelii* the fruits are 4–6 mm long, dehisce proximal to the middle, contain 4–5 (rarely up to 8) seeds, and have bracts 2 mm long. On *P. major* the fruits are 4–5 mm long, dehisce at the middle, contain 5–35 seeds that are 0.5–1 mm long, and have bracts 0.5–1 mm long (Shipunov 2019).

The following description is from Shipunov (2019: 292):

"Perennials, sometimes annuals; caudex absent; roots fibrous, thick. Stems 0–20 mm. Leaves $20-150 \times 10-120$ mm; petiole to 200 mm; blade ovate to cordate-ovate, margins entire or toothed, veins conspicuous, surfaces glabrous or hirsute. Scapes 50–250 mm, glabrous or hirsute. Spikes brownish or greenish, 50–300 mm, densely or loosely flowered; bracts narrowly lanceolate, 2 mm, length 1–1.2 times sepals. Flowers: sepals 1.5–2 mm; corolla radially symmetric, lobes reflexed, 0.5–1 mm, base obtuse; stamens 4. Fruits 4–6(–8) mm, dehiscing proximal to middle. Seeds 4 or 5(–8), 1.5–2 mm. 2n = 24."



Figure 17. Veronica persica seen at Kahilu Rd, Hawai'i.

Material examined. **O'AHU**: Pu'u Ka'ala summit, roadside, moist, cool, open area, common, 1216 m, 21.507878, -158.143864, 21 Jan 2022, *K. Faccenda 2203*; Kōnāhuanui, summit, along trail, locally common at summit, 894 m 21.352333, -157.788900, 29 Jan 2022, *K. Faccenda 2217*. **HAWAI'I**: Ka'ū Distr., Kiolaka'a-Kea'ā Homesteads addition, Ka'ū Forest Reserve, in jeep road, 2000 ft, 13 Aug 1980, *L.W. Cuddihy & J. Davis 523*; Puna Distr., ahupua'a of Halepua'a, common on dirt roads on Puna Trail, 08 Mar 1979, *L. Yoshida 79.071*; Disappointment Rd, near Pu'u Maka'ala, locally abundant, 06 Sep 1980, *F.R. Fosberg 60577*; Puna Distr., 'Ōla'a Forest Reserve, along jeep track 6.4 km from junction of Stainback Hwy & Hwy 17 towards Kulani Prison, common, 870 m, 06 Jul 1974, *T. Herat et al. 954*; Pāhoa Park, near skatepark, weed in mowed grass, full sun, moist, 207 m, 19.492125, -154.946383, 28 Feb 2022, *K. Faccenda 2253*; Hawai'i Volcanoes National Park, effices near Visitor Center, wet, shady areas, common, 1207 m, 19.427340, -155.256357, 18 Aug 2022, *K. Faccenda & J. Gross 2665*; Hawai'i Volcanoes National Park, *Saccenda & J. Gross 2673*.

Veronica persica Poir.

New state record

Veronica persica was found during a roadside grass survey on Hawai'i Island, where it was naturalized on a roadside in Waimea. The area was not exhaustively surveyed, but approximately 10 plants were found along approximately 200 m of mowed roadside. *Veronica persica* is native to the Middle East but is now naturalized throughout much of the world (Albach 2019). It is associated with disturbed areas such as gardens, lawns, fields, and roadsides.

This species can be differentiated from the other naturalized *Veronica* principally by its large, solitary, blue flowers 8–14 mm wide, and serrated leaves (Figure 17). Of the other naturalized species, *Veronica plebeia* appears the closest to this, but has flowers in short racemes and leaves that are coarsely dentate, rather than serrate.

The following description is from Albach (2019: 319):

"Annuals. Stems creeping to decumbent, 10–50(–60) cm, eglandular-hairy. Leaves: blade suborbiculate, broadly ovate, or broadly lanceolate, $(6-)9-18(-30) \times (5-)8-15(-20)$ mm, base truncate, margins serrate, apex acute, surfaces sparsely eglandular-hairy. Racemes 1–6, terminal, 100–500(–600) mm, 5–30-flowered, axis eglandular-hairy; bracts suborbiculate or broadly ovate or broadly lanceolate, (6-)9-18(-25) mm. Pedicels spreading, deflexed in fruit, (12-)15-27(-38) mm, length 1–2(–3) times subtending bract, densely eglandular-hairy. Flowers: calyx lobes (4.5–)5.5–8(–9.5) mm, (1.7-)2.4-3.6(-4.2) mm wide, apex acuminate, eglandular-hairy; corolla intense bright blue, 8–14 mm diam.; stamens 1.2 mm; style (1.5-)2-2.8(-3.2) mm. Capsules compressed in cross section, broadly obcordiform, 4–6 × (5–)6–8.5(–9.5) mm, apex acute, sinus angle $(80-)90-120(-150)^\circ$, reticulate with prominent veins, \pm sparsely to densely eglandular- and/or glandular-hairy or glabrate. Seeds (10-)12-18(-20), pale brownish yellow, ellipsoid to globular, cymbiform, $(1.3-)1.4-2.3(-2.5) \times (0.8-)0.9-1.6(-1.9)$ mm, 0.5–1 mm thick, cristate-rugose. 2n = 28."

Material examined. **HAWAI'I**: Waimea, Kahilu Rd, about 700 m from Mana Rd, moist, sunny, mowed roadside, uncommon, 855 m, 20.023110, -155.643197, 05 Mar 2022, *K. Faccenda 2317*.

Rubiaceae

& Bacigalupo

Galianthe brasiliensis (Spreng.) E.L. Cabral

New naturalized record

Galianthe brasiliensis has now been documented as naturalizing on O'ahu and Hawai'i, where it was found in the rear of Pālolo Valley and Kalopā Rd. in the Hāmākua District, respectively. Both populations were found growing on wet, partly sunny to shady areas on roadsides. Approximately 20 plants were seen in Pālolo and at least a dozen were seen at Kalopā Rd. A population of 40 plants has also been observed at the University of Hawai'i Hilo campus [link].

Galianthe brasiliensis was introduced to Hawai'i as an ornamental; two specimens exist in cultivation from BISH, the first from Foster Botanical Garden in 1960 (*C. Potter 9476*) and the second from Wahiawa Botanical Garden in 1986 (*J. Lau 2541*). Photos of these wild plants were sent to Dave Lorence (PTBG), who graciously identified this species.

Galianthe brasiliensis is native from Mexico south to northern Argentina (POWO 2023), and this is the first time it has been reported as naturalized outside of its native range. In its native range it grows in low grasslands, river margins, forests, and forest edges (Florentín *et al.* 2017). It can be identified by its low shrubby habit, narrowly winged stems, prototypical Rubiaceae flowers, and elliptic to obovate leaves (Figure 18).

The following description is from Florentín et al. (2017:624):

"Shrub erect, branched, 0.25-1.5 m tall, with xylopodium; stems tetragonal, angles narrowly winged. Stipular sheath hispidulous, with 5–7 fimbriae. Leaves frequently pseudoverticillate, leaf blades elliptic or obovate, $3-35 \times 0.7-11$ mm, middle vein glabrous on the adaxial surface and scabridulous on the abaxial surface, with only

primary nerve visible. Inflorescences thryrsoid-spiciform, with oral node of fasciculate flowers of main and secondary branches. Flowers shortly pedicellate; hypanthium turbinate, hispidulous; calyx 4-lobed, with 2 large lobes; corolla internally with ring of moniliform hairs. LS flower with corolla 1.9–2.2 mm long. SS flower with corolla 2.7 mm long. Capsule 1.5 (2.5) mm long, turbinate, dorsoventrally compressed, hispidulous, with indehiscent valves. Seeds 1.8–2 mm long, ventral face with a small strophiole; testa reticulate."

Material examined. **O'AHU**: Pālolo Valley, agricultural lots at rear of valley, roadside, wet, very shady area, about 20 plants on roadside, 21.295196, -157.797552, 04 Mar 2023, *K, Faccenda 3052*. **HAWAI'I**: Hāmākua Distr., Kalopā Rd near intersection with Kalopā Mauka Rd, ditch on side of road, shady, moist, plant uncommon in area, only growing in shady areas, at least a dozen present, naturalized, 313 m 20.062522, -155.431474, 06 Mar 2022, *K. Faccenda 2346*.



Figure 18. *Galianthe brasiliensis* photographed in Pālolo Valley, O'ahu. A, leaves. B, fruits. C, flowers. D, fruits and calyx, side lateral view.

Solanaceae

Solanum chacoense Bitter

New state record

Several hundred wild potato plants were found during roadside surveys on East Maui along Kawehi Pl. growing on an unmowed roadside, and as a weed under pomegranate trees cultivated on a nearby property, where it was being mowed by the property owner (Figure 19). These were initially assumed to be domestic potato (*Solanum tuberosum*), but this identification was corrected thanks to iNaturalist user @plantperson7654.

Comparisons between the specimen and the description and key from from Spooner *et al.* (2016) further confirmed this ID. *Solanum chacoense* can be separated from domestic potato as *S. chacoense* has stellate to pentagonal corollas whereas domestic potato has rotate to rotate-pentagonal corollas. *Solanum chacoense* is closely related to the domestic potato, and is reproductively compatible with it but it is not an ancestor of the domestic potato (Spooner *et al.* 2016).

Solanum chacoense is native from southern Brazil and Peru to central Argentina and Uraguay where it is found in wide ranging climates from deep shade, to full sun, savannas, subtropical forests, and rocky slopes from 0 to 3700 m (Spooner *et al.* 2016). In its native range it is also found as a weed on roadsides, cultivated fields, and banana plantations. It has also become naturalized in Australia, China, New Zealand, United Kingdom and the United States where it has been exclusively found escaping from botanical gardens and agricultural research stations (Simon *et al.* 2010). No published reports or herbarium material could be found reporting the importation of *S. chacoense* to Hawai'i, and the site is 1.5 miles away from the nearest agricultural research station. It is unclear how this arrived in Hawai'i, but an intentional importation seems most likely. *Solanum chacoense* has several qualities which predispose it to invasiveness including being the only known *Solanum* which can self-pollinate, production of large volumes of seed, insect & disease resistance, and broad climatic adaptability (Simon *et al.* 2010). If not managed, it is expected that this potato will spread further across Maui. Its limited population size would make it a worthwhile eradication target.

The following description is taken from Spooner et al. 2016: 95):

"Herbs 0.5–2 m tall, erect. Tubers typically borne singly at the end of each stolon. Stems 3.5-10 mm in diameter at base of plant, unwinged or with wings up to 2 mm wide, green to purple or green and purple mottled, glabrous to densely shortpubescent. Pseudostipules 3-20 mm long, pubescent with hairs like those of the stem. Leaves 10-39 cm long, 6-24 cm wide, odd-pinnate, green, glabrous to densely short-pubescent adaxially and abaxially with hairs like those of the stems; petioles 1-4 cm long, glabrous to densely short pubescent; lateral leaflet pairs 4-7, often subequal except for the most proximal 1 or 2 pairs, which are greatly reduced in size; distalmost lateral leaflets 2.7-9 cm long, 0.9-3.5 cm wide, narrowly to broadly ovate to elliptic, apex acute to acuminate, base typically oblique, rounded to truncate, petiolules 0-5 mm long; terminal leaflet 4.1-9.4 cm long, 0.9-4.3 cm wide, ovate to elliptic, apex acute to acuminate, base truncate to attenuate; interjected leaflets 0-20, ovate to orbicular, sessile to short petiolulate. Inflorescences 2-15 cm long, usually forked, with 8-25 flowers, the axes pubescent with hairs like stem; peduncle 0.5-10.5 cm long; pedicels 12-23 mm long in flower and fruit, articulated at or slightly distal to the midpoint. Calyx 3-5 mm long, with hairs like those of the stem; lobes 1-4 mm long, acute to long attenuate, acumens 0.5-2 mm long. Corolla 1.6-3.7 cm in diameter, pure white to creamy yellow-white adaxially and abaxially, deeply stellate to pentagonal, acumens 2-5 mm long. Anthers 5–7 mm long. Style 8–15 mm long, exceeding stamens by 3–6 mm; stigma clavate to capitate. Fruit 1.5-2 cm in diameter, globose to slightly ovoid, green to green with purple streaks when ripe, often with scattered white dots, glabrous."

Material examined. **MAUI**: Kula, Kawehi Pl, roadside weed in unmowed area, appears naturalized, growing on roadside and under pomegranate trees in orchard, not intentionally planted as the owners of the olive trees have been mowing/weed whacking it, 1012 m, 20.736255, -156.327185, 24 Oct 2022, *K. Faccenda 2781*.



Figure 19. Solanum chacoense growing as a weed under pomegranate trees at Kawehi Pl, Maui.

Urticaceae

Pilea nummulariifolia (Sw.) Wedd.

New naturalized record

A new naturalized species of *Pilea* has been observed in moist areas around O'ahu, and comparison to specimens at BISH reveals that it is *Pilea nummulariifolia*, a species previously only known from cultivation in Hawai'i. *Pilea nummulariifolia* has been cultivated on O'ahu since at least 1961 (G. *Ing et al. s.n.*, BISH 71306) and cultivated specimens also exist from Kaua'i and Hawai'i. *Pilea nummulariifolia* is native from the Caribbean south to Peru and has also become naturalized on several tropical and subtropical islands including Bermuda, the Cook Islands, Taiwan, Trinidad-Tobago, and the Tubuai Islands, along with the Democratic Republic of the Congo (Friis 1989; POWO 2023). Pilea *nummulariifolia* can be identified by its sprawling habit and pubescent, ovate leaves with impressed veins (Figure 20).

Naturalized vouchers have been made from populations on Nu'uanu Pali Dr. and from several spots along Telephone Rd on Tantalus. The two populations at Tantalus extended over 20 m along the side of the road, growing in wet, shady areas mostly along the road margin. Sexual reproduction was observed, as many small seedlings were seen. The Nu'uanu population was smaller, only several meters wide. An apparently naturalized population was also seen on Maui along the Hāna Hwy., but was not collected [link]. Several other populations that appear to be naturalized have been reported on iNaturalist.org at Wahiawā [link], Hilo [link], and Hualālai [link], but none of these were visited by the author.



Figure 20. Pilea nummulariifolia seen at Tantalus Rd, O'ahu.

The following description is from Friis (1989: 598):

"Perennial herbs, with prostrate and erect stems, up to c. 15 cm high or more, internodes 5–30 mm long, puberulous. The two leaves of a pair usually of same size; stipules ovate to orbicular, 2–3 mm long, translucent, ciliolate petioles 0.3–1.2 cm long, pubescent; lamina very broadly ovate to suborbicular, c. 1 cm diam., rounded, truncate or subcordate at base, margin finely crenate, apex rounded or broadly obtuse, pubescent on both sides, cystoliths often obscure, lateral nerves obscure. Inflorescences axillary and apparently terminal (axillary in the uppermost two pairs of leaves), paniculate, with the flowers in small, cymose clusters, up to c. 1 cm long. Flowers up to 0.8 mm long. Achene c. 0–5 mm long, compressed ovoid, brown, smooth."

Material examined. **O'AHU**: Nu'uanu Pali Dr, above where the housing development ends, roadside, shaded, moist, small patch along road in shade, 21.347486, -157.823822, 29 May 2021, *K. Faccenda 1927*; Tantalus road between Telephone Rd and large parking lot for Pu'u 'Ōhi'a Trail, wet ginger and invasive-dominated area, large colony ca 20 m long present along road, 21.331294, -157.819444, 01 Aug 2021, *K. Faccenda 2070.*



Figure 21. *Hedychium greenii* growing in a ditch surrounded by uluhe at Kawailehua Rd, Volcano, Hawai'i.

Zingiberaceae

Hedychium greenii W.W. Sm.

New naturalized record

Hedychium greenii was commonly seen around Volcano on Hawai'i Island; many were in the vicinity of houses and may have been planted, but most were found in overgrown areas and seemed rather unlikely to have been planted. However, one plant was found growing in a roadside ditch over 20 m from any house and was entirely surrounded by weeds, giving a high confidence that this plant dispersed and germinated in place (Figure 21). Further colonies were later found in 'Ō'hia Estates across the Highway from Volcano village also found not in immediate proximity to houses. As such *Hedychium greenii* should now be considered naturalized on Hawai'i Island. This species was imported to Hawai'i as an ornamental and can be distinguished from other *Hedychium* by its bright orange flowers and pink to purple leaf undersides. *Hedychium greenii* has been cultivated in Hawai'i since at least 1958 at Foster Botanical Garden on O'ahu (*C. Potter s.n.*, BISH 147214)

Material examined. **HAWAI'I**: Volcano, Kawailehua Rd, roadside ditch, partly sunny area, flowers reddish orange, underside of leaves purple, 1127 m, 19.449714, -155.233682, 13 Aug 2022, *K. Faccenda 2624.*

TAXA SHOWING SIGNS OF NATURALIZATION

Brassicaceae

Diplotaxis tenuifolia (L.) DC.

Showing signs of naturalization

Diplotaxis tenuifolia was found growing from a crack between a building and the sidewalk along King St. near Cedar St. in urban Honolulu (Figure 22). Only one plant was seen at this site, and no other plants have been seen in any other locations. Given that only one individual was found and urban Honolulu has been relatively heavily botanized recently, this should be considered a questionable naturalization until more plants are found. *Diplotaxis tenuifolia* is native to Europe but has become naturalized across the Americas, Australia, New Zealand, Japan, and much of Eastern Europe (POWO 2023). It can be identified by its perennial habit (most mustards in Hawai'i are annual), yellow flowers ca. 1 cm in diameter, and pinnately lobed leaves (sometimes entire) with 1–5 lobes on each side. In its introduced range it grows in waste places, disturbed areas, beaches, shores, wet woods, and mountain slopes (Martínez-Laborde 2010).

The following description is from Martínez-Laborde (2010: 433):

"Perennials, (usually suffrutescent, roots with shoots from adventitious buds), strongly scented (with glucosinolates), (glaucescent). Stems erect, 2-7(-10) dm, glabrescent or sparsely pubescent basally. Basal leaves: blade elliptic to obovate, 2-15 cm $\times 10-60(-80)$ mm, margins sinuate to deeply pinnatifid, (2–5 lobes each side). Cauline leaves petiolate; similar to basal, (distal cauline shortly petiolate, blade similar, with narrower segments), surfaces usually glabrescent. Fruiting pedicels 8–35 mm. Flowers: sepals 4–6 mm, glabrous or pubescent, trichomes straight; petals yellow, $7-11(-13) \times 5-8$ mm, (apex rounded); filaments 4–8 mm; anthers 2.5–3 mm; gynophore 0.5–3 mm. Fruits usually erect, rarely ascending, (somewhat torulose, slightly compressed), 2–5 cm $\times 1.5-2.5$ mm; terminal segment (stout), beaklike, 1.5–3 mm, seedless; (ovules 20–32(–46) per ovary). Seeds 1–1.3 $\times 0.6-0.9$ mm. 2n = 22."

Material examined. **O'AHU**: King St, near Cedar St, from crack in sidewalk near business, apparently perennial with rather thick taproot, flowers yellow, only a single plant seen, 5 m, 21.298889, -157.841527, 09 Jan 2023, *K. Faccenda 2980*.



Figure 22. Diplotaxis tenuifolia seen along King St, O'ahu. A, leaves. B, flower.



Figure 23. *Premna serratifolia* seen at the Pawaina St bridge over Mānoa Stream, O'ahu. A, habit. B, flowers. C, fruits.

Lamiaceae

Premna serratifolia L.

Showing signs of naturalization

A single, mature *Premna serratifolia* tree was found in Mānoa growing from a crack in concrete under a bridge over Mānoa Stream. Given that the tree was growing from a crack in concrete, it was obviously not planted. The tree was flowering and fruiting heavily. The nearby area was not surveyed for more trees.

Premna serratifolia was imported to Hawai'i in 1930 by the Lyon Arboretum from the Singapore Botanical Garden (Jesse Adams, pers. comm). Given that the plant was found in a streambed that drains from the Lyon Arboretum and is a close morphological match to specimens from those trees, the tree at Lyon was likely the parent of this naturalized individual.

Premna serratifolia is native from East Africa, India through Southeast Asia and Malesia, Australia, and much of the Pacific (POWO 2023). This tree grows in coastal locations in its native range (de Kok 2013), and if further plants are found in Hawai'i they will likely be more makai than the one reported herein. *Premna serratifolia* can be identified by its opposite, coriaceous leaves, and corymbose inflorescence of white flowers and orbicular fruits that turn black or dark purple at maturity (Figure 23).

The following description is from de Kok (2013: 74):

"Shrub or small tree, sometimes scandent or creeping, 1–10 m tall, DBH 3–40(80) cm. Bark green to (dark or reddish) brown or grey, smooth to scaly or fissured. Sapwood cream coloured, hardwood brown. Twigs sometimes with conspicuous interpetiolar ridges, hairy when young, becoming more glabrous as they mature, patches often remaining on interpetiolar ridges, bracts absent at base of new shoots.

Leaves opposite to subopposite, ovate or obovate $(2)4-21 \times (1)3-16$ cm, apex obtuse to acuminate, base cuneate to cordate, margins entire or rarely serrate, characteous [chartaceous] to membranous, glabrous sometimes with hairs on veins and/or in axil of the main-vein with the side-veins, dull to glossy, crushed leaves with foetid smell; glands yellow or brown, sessile; venation 4–9 main side-veins, often tri-veined from base; petioles 0.5-7 mm long, channeled, glabrous to the channeled filed with hairs, becoming more glabrous as they mature. Inflorescence 2-20 cm long, corymbose cymes, glabrous to velutinous; bracteoles linear, <5 mm long. Flowers: calyx 0-5-lobed, clearly to obscurely two-lipped, outer surface glabrous or sparsely pubescent, not to slightly accrescent, shortly pedicellate, green to yellow-white; lobe apex rounded to acute; glands yellow, sessile; flowering calyx 1-2 mm, variously lobed; fruiting calyx 2-4 mm long, variously lobed. Corolla tube $1.2-5 \times 1-2$ mm, slightly two-lipped to lobes iso-morphous, glabrous to sparsely hairy on lobes, (greenish-)white to reddish, scent absent or slightly lemon-like; glands yellow, sessile; central lobe of lower lip orbicular to oblong or spathulate, $0.8-3.5 \times 0.5-2$ mm, apex rounded, sometimes reflexed; other lobes $0.8-1.7 \times 0.5-2$ 1.5 mm, apex rounded, erect to reflexed. Stamens 1-5 mm long, just exserted from the tube, \pm didynamous, white; anthers 0.2–0.6 mm long, brown to yellowish green. Ovary globose, 0.5-1.3 mm diam, glabrous, sometime with a dense patch of glands at apex; style 2-7 mm long, exserted, white; stigma 0.5-1 mm long, apex acute. Fruit globose, $3-8 \times 3-5$ mm, glabrous, outer surface sometimes warty, glossy, green turning sometimes white, then black, purple or dark red when mature, endocarp smooth. Seeds four, equally developed when mature."

Material examined. **O'AHU**: Mānoa, where Mānoa Stream runs under Pawaina St, growing from channelized area of Mānoa Stream, from crack in concrete placed to channelize stream, tree to 4 m tall, reaching up from stream bed to road level, flowers white, fruits pale green when immature, turning black when ripe, 73 m, 21.323151, -157.802536, 29 Sep 2022, *K. Faccenda 2721*.

Salvia reflexa Hornem.

Showing signs of naturalization

Two plants of *Salvia reflexa* were found in Kaimuki at Pukalani Place growing from mowed grass on the edge of the road, where they obviously were not planted. *Salvia reflexa*, commonly called mint weed, is native from the midwestern United States through Mexico and has become naturalized in temperate and tropical regions across almost all continents (POWO 2023). It is considered a rather aggressive weed in much of its introduced range (Shao *et al.* 2019) and releases allelopathic chemicals (Lovett & Lynch 1979). *Salvia reflexa* can be identified by its annual habit, blue flowers, strongly laterally compressed perianth (Figure 24), and pleasant, minty smell when crushed.

The following description is from Hussain et al. (2019: 18):

"Annual herb c. 50 cm tall. Tap root fibrous. Stem green, 4-angled, covered with short rigid retrorse hairs. Leaves opposite, decussate, 3-6.5 cm \times 8-14 mm, glabrous on the adaxial surface, sparsely pubescent on the abaxial surface, petiolete, petiole 1–4 cm long, petiole pubescent, lamina lanceolate, obtuse, cuneate, crenate, nerves in 5–6 opposite or alternate pairs. Flowers bracteate, borne in terminal verticillasters. Pedicel c. 2 mm. Bracts 0.4-0.5 cm $\times 1$ mm, acuminate, calyx, green, tubular, 4-8 mm long, hairy along nerves, gland dotted between nerves, throat sparsely hairy, persistent, pale brown at maturity, upper lip acute, 5 nerved, lower lip bifid, 7 nerved. Corolla pale lilac to white, $0.8-1 \times 0.6$ cm, internally pubescent, upper lip smaller, lower lip laterally lobed, apex emarginate. Anthers c. 1 mm long, flament about 2 mm. Carpel c. 7 mm, ovary c. 1 mm. Nutlets oblong, flat, yellowish, c. 1.5 mm long, surface reticulate."



Figure 24. Salvia reflexa calyx and bracts from the plants at Pukalani Pl, O'ahu.

Material examined. **O'AHU**: Kaimuki, Pukalani Pl, weedy roadside, dry, sunny, 2 plants seen, flowers light blue, plant with a rather pleasant mint scent, 92 m, 21.286645, -157.793066, 04 Mar 2023, *K. Faccenda 3054.5*.

Piperaceae

Piper sarmentosum Roxb.

Showing signs of naturalization

Piper sarmentosum (syn. *P. lolot*) is now showing signs of naturalization where it is spreading aggressively via stolons on O'ahu and Maui. On O'ahu it was found forming a large colony of at least 50 square meters at the Judd Trail trailhead off Nu'uanu Pali Dr., where it was likely dumped at one point. Another colony was also found over 100 meters away from the road on the other side of the stream suggesting it may be reproducing via seed. Even larger colonies were seen at Lyon Arboretum, but this was purely vegetative spread from cultivated plants (Figure 25). It was also seen forming large patches on East Maui, where it was spreading from cultivation.

Material examined. **O'AHU**: Lyon Arboretum, Mānoa, in rainforest, shady areas, planted and forming a monotypic understory in several large patches, these patches over 20 m wide, 170 m, 21.334580, -157.803326, 29 Sep 2022, *K. Faccenda 2720*; Nu'uanu, parking lot for Judd Trail on Nu'uanu Pali Dr, wet forest in understory on edge of road and expanding into forest in shady to partially shady areas, forming monocultures and covering at least 50 sq. meters but perhaps more, 223 m, 21.347043, -157.820846, 27 Nov 2022, *K. Faccenda & S. Coles 2852; loc. cit.*, 08 Jan 2023, *N. Walvoord et al. 2023-004.* **MAUI**: East Maui, Hāna Distr., Mokulehua Stream, NW of Pu'u Hinai, cultivated originally but seems to be spreading from large patch by underground rhizomes, unsure at this time if viable seeds are produced, 14 Mar 2009, *H. Oppenheimer H30907*.



Figure 25. *Piper sarmentosum* colony at Lyon Arboretum, where it was cultivated at one point, but has now spread extensively.

Urticaceae

Pilea cadierei Gagnep. & Guillaumin She

Showing signs of naturalization

Pilea cadierei is now showing signs of naturalization on Maui, where a large colony was found covering several hundred square meters along the Hāna Hwy. It was effectively growing under the shade of *Hedychium* sp. and excluding all other species besides the *Hedychium* (Figure 26). It was likely planted in the area given that it is near some driveways, but has begun to spread at least 10 meters away from the driveways. It is likely that most of this spread is vegetative but it is unclear if seeds were also produced. A patch of *Pilea cadierei* was also seen at Lyon Arboretum along the dirt road where it did not appear planted [link], but a specimen was not made of this plant.

Material examined. **MAUI**: Hāna Hwy ca 4 km W of Wai'ānapanapa State Park at roadside coconut stand and restaurant, wet, shady roadside dominated by weeds, likely planted along driveway, but spreading aggressively away from that area, covering hundreds of square meters and forming a monotypic understory in degraded forest, even forming a thick stand in shade underneath *Hedychium flavescens*, leaves dark green with white patch, 175 m, 20.793919, -156.051755, 23 Oct 2022, *K. Faccenda 2751*.



Figure 26. Pilea cadierei seen growing under Hedychium along Hana Hwy, Maui.

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