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New records of weedy *Phyllanthus* spp. in Hawai‘i

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New records of *Phyllanthus* spp. were found across several islands during both casual botanizing and roadside grass surveys. *Phyllanthus amarus* and *Phyllanthus leucanthus* are reported as naturalized for the first time in Hawai‘i and several new island records are recorded for *Phyllanthus urinaria*. 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.

Phyllanthus amarus Schumach. & Thonn. **New state record**

Phyllanthus amarus was found naturalized in a *Megathyrsus maximus* and *Samanea saman* pasture at Kualoa Ranch on O‘ahu. The plant was spotted out of a car window and a specimen was quickly grabbed, but only approximately 5 square meters were examined and ca. 30 plants were found. It is likely that many more plants exist at this site. A second population was also found consisting of hundreds of plants growing in Koko Crater Botanical Garden and along the road leading into it.

Phyllanthus amarus is a native to Central & South America but is well adapted to disturbance and transport by man and now has a pantropical distribution (Webster 1957). *Phyllanthus amarus* is likely the most common tropical species of *Phyllanthus* worldwide (Webster 1970). Given the notorious weediness of this species, it will likely spread rather rapidly across Hawai‘i.

Phyllanthus amarus can be distinguished from the other weedy *Phyllanthus* of Hawai‘i by its 5 tepals, short pedicels, and its male and female flowers occurring at the same nodes and not segregated in different parts of the inflorescence. A key is also provided to help identify these species. The plant is overall most similar to *P. debilis*, but differs in the characters mentioned above, along with *P. debilis* having narrowly elliptic leaves with acute tips, whereas *P. amarus* has oblong leaves with a blunt tip (Figure 2E).

The following description is from Webster (1970: 69): "Glabrous annual herbs, 1–5 dm high; main stems smooth, terete, cataphylls spirally arranged; stipules of cataphylls deltoid, acuminate, entire, not auriculate, 1.3–2.1 mm long; deciduous branchlets 4–12 cm long, subterete (not winged nor sharply angled), smooth or at most slightly thickened, elliptic-oblong or somewhat obovate, obtuse or rounded and often apiculate at tip, obtuse or rounded and sometimes slightly inequilateral at base, paler or glaucous beneath, the veinlet reticulum delicate or obscure; stipules ovate-lanceolate or lanceolate, acuminate, 0.8–1.3 mm long. Monoecious; proximal 1 or 2 axils of branchlet with unisexual cymules of 1 or 2 ♂ flowers,

distal axils with bisexual cymules of 1 ♂ and 1 ♀ flower. Staminate flowers with pedicels 0.6–1.3 mm long; calyx lobes 5 (very rarely 6), ovate or elliptic, abruptly acute, entire, 1-veined, 0.3–0.6 mm long; disk segments 5, roundish, entire, ca. 0.1 mm across; stamens 3 (rarely 2), filaments completely connate into a column 0.2–0.3 mm high; anthers sessile atop column (1 anther sometimes reduced), dehiscing obliquely to horizontally, 0.2–0.3 mm across; pistillate flowers with pedicels becoming (1.0–)1.2–2.0 mm long in fruit; calyx lobes 5 (very rarely 6), obovate-oblong, acute, entire, herbaceous with broad pale margins, 1-veined, 0.8–1.1 mm long; disk deeply 5-lobed (rarely lobes 6 or 7); ovary smooth; styles free, erect or ascending, ca. 0.1–0.15 mm long, very shallowly bifid, the tips blunt. Capsules 1.9–2.1 mm broad; seeds light brown, with 5–7 straight longitudinal ribs and many fine transverse striae on back, 0.9–1.0 mm long."

Material examined. **O'AHU**: Kualoa Ranch, ca. 1 km N of ranch headquarters, monkeypod and Guinea grass pasture, partly sunny area, area not examined in detail but ca. 30 plants briefly seen, grazed by cattle, 21.530236, -157.837666, 07 Mar 2023, *K. Faccenda & J. Lee 3056;* Koko Crater Botanical Garden, *Plumeria* garden at entrance to garden, dry, sunny area in partial shade of *Plumeria*, starting to die from lack of moisture, hundreds of plants seen scattered in the eastern part of the crater floor and also along the road leading into the crater, 21.293146, -157.678154, 28 Apr 2023, *K. Faccenda & M. Ross 3094.5.*

Phyllanthus leucanthus Pax **New state record**

A new weedy species of *Phyllanthus* was observed growing abundantly in gardens, nurseries, and disturbed areas around O'ahu, and to a lesser extent on Kaua'i, Maui, and Hawai'i. No misidentified specimens of this species could be found in the BISH herbarium, making it unclear when it first appeared on the islands. The earliest record is an iNaturalist.org observation dated from 2017 (https://www.inaturalist.org/observations/8332079), although it is likely that this plant naturalized much earlier. Identification of this species proved quite difficult; it could not be identified using keys from North America, South America, Asia, or India. Only after a key from Central Africa (Pope 1996) was used, could this species be identified as *Phyllanthus leucanthus,* a species native to East Africa from Sudan to Mozambique and west to Gabon. *Phyllanthus leucanthus* has not previously been documented outside of its native range, although it is predicted that reports will soon be published of this species naturalizing in other parts of the world. As this plant is a common nursery weed in Hawai'i, it was likely imported into Hawai'i via nursery stock and will likely be exported via the same mechanism.

Phyllanthus leucanthus can be differentiated from other weedy species of *Phyllanthus* by its large, whitish green tepals that enclose the fruit (Figure 2A). The key below will also separate it from other weedy *Phyllanthus* that occur in Hawai'i. It is taller than most other weedy *Phyllanthus* in Hawai'i, reaching a height of almost 1 meter, and becomes rather woody at the base. In its native range it is found in shady places in riverine or lakeshore vegetation, high rainfall miombo woodlands, evergreen forest margins, dambos, submontane grasslands, and disturbed and cultivated ground (Pope 1996). In Hawai'i it is found in dry to wet, sunny or partly sunny areas along roadsides and in gardens and nurseries. It has not been observed in any abundance in natural areas, but

Figure 1. *Phyllanthus leucanthus* habit. Photograph by James Bailey (https://www.inaturalist.org/photos/230494603)

scattered plants are occasionally seen. Outside of garden settings, it is usually seen as scattered plants or a small colony less than a few meters wide. *Phyllanthus leucanthus* has been observed forming dense patches in gardens and nurseries, however, and it is likely that its main impacts will be felt there (Figure 1).

The following description is from Pope (1996: 61): "A scaberulous or glabrous erect annual or perennial herb up to 90 cm tall, usually much less, monoecious or rarely dioecious; stems reddish or purplish later becoming wiry. Lead shoots angular. Lateral shoots up to 15 cm long, narrowly 2-winged, the older ones often co-axillary with secondary shoots. Short shoots sometimes developing. Scale leaves c. 1 mm long, narrowly triangular-lanceolate to subulate; stipules triangular-lanceolate, otherwise similar to scale leaves. Foliage leaves distichous; petioles 0.5–1 mm long; stipules c. 1 mm long, narrowly triangular-lanceolate, pallid. Leaf blades 0.5–3.5 × 0.4–1.5 cm, elliptic to oblong, subacute, obtuse or rounded, cuneate or rounded at the base, firmly membranaceous, light to medium green above, paler and somewhat glaucescent or purplish-tinged beneath; lateral nerves in 5–8(10) pairs, usually looped near the margin, not prominent above, slightly so beneath. Male flowers in few-flowered clusters in the lower parts of the lateral shoots, female flowers pendulous and solitary in the upper parts of the lateral shoots. Male flowers: pedicels 0.5 mm long; sepals 6, c. 1 × 1 mm, suborbicular-obovate, rounded, cream-coloured with a greenish midrib; disk glands 6, free, 0.3 mm in diameter, flat or somewhat verruculose, minutely lobulate; stamens 3, filaments connate in the lower two-thirds, 0.75 mm long, anthers 0.3 mm long, vertically

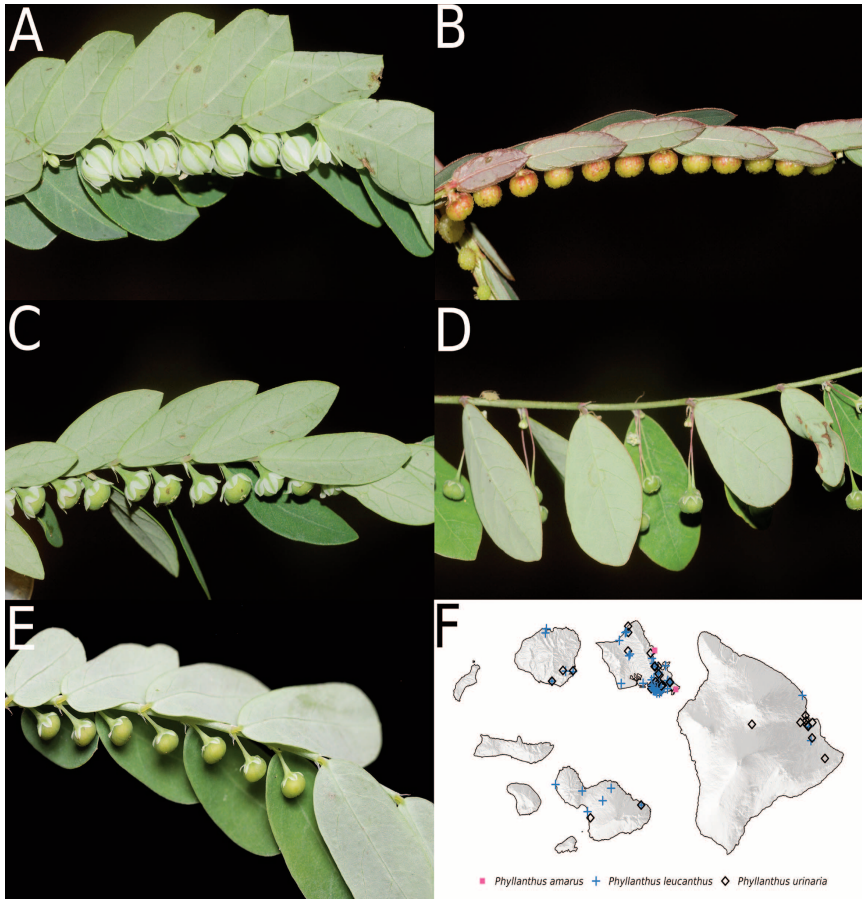

Figure 2. **A**, *Phyllanthus leucanthus*. **B**, *Phyllanthus urinaria*. **C**, *Phyllanthus debilis*. **D**, *Phyllanthus tenellus*. **E,** *Phyllanthus amarus.* Note that the male flowers are deciduous and have already fallen from this branch. **F,** Currently known distribution of *P. amarus*, *P. leucanthus*, & *P. urinaria*. Distribution data from iNaturalist.org observations reviewed by the author. Photos A–D were taken at the same magnification at the National Tropical Botanical Garden, where they were growing together as weeds in a garden bed, June 2022. *Phyllanthus amarus* was photographed at Kualoa, O‘ahu, and is not at the same magnification.

held, longitudinally dehiscent. Female flowers: pedicels 1 mm long, extending to 2 mm in fruit, somewhat flattened; sepals 6, in 2 whorls of 3, 1.5 × 1 mm, accrescent to 3 × 2 mm in fruit, the outer broadly elliptic and rounded to cordate at the base, the inner obovate and attenuate-cuneate at the base, white with a narrow green midrib; disk 0.75 mm in diameter, shallowly 6-lobed, the lobes entire; ovary 0.5 mm in diameter, shortly stipitate, 6-lobed, subglobose, smooth; styles 3, 0.67 mm long, united at the base, closely appressed

to the top of the ovary, deeply bifid, the stigmas slender, recurved. Fruit 1.8 × 2.8 mm, depressed 3-lobed to subglobose, smooth, olivaceous, enclosed by the persistent sepals. Seeds 1.5 × 1.2 × 1 mm, segmentiform, light to dark brown, with 7–9 shallow longitudinal ridges on the dorsal facet, and 6–7 concentric ridges on each ventral facet, with innumerable faint transverse striae between them."

Material examined. **KAUA'I**: Kalāheo, National Tropical Botanical Garden, McBryde Garden, near fern tunnel, moist, partly shaded garden bed, rare in garden, only a small patch of ca. 50 plants seen, 21.902117, -159.507042, 03 Jun 2022, *K. Faccenda & D. Lorence 2471*; Wainiha Valley, back of valley near hydroelectric plant, infrequently mowed roadside, part shade, moist, rare, only 3 plants seen, 22.196130, -159.556573, 30 May 2022, *K. Faccenda 2425*; Kaua'i Landscape and Nursery off of Kaumuali'i Hwy just W of Puhi, weed around garden center area, seen growing only in pots of plants for sale, ca. 50 plants seen, 100 m, 21.963308, -159.404212, 08 Jul 2022, *K. Faccenda & S. Vanapruks 2520*. **O'AHU**: Hale'iwa, near intersection of Kamehameha Hwy and Emerson Rd, weed in flower bed, several plants seen, 7 m, 21.590742, -158.103047, 16 Jan 2022, *K. Faccenda 2201*; Honolulu, Bishop Museum campus, weed along road behind Castle Bldg., partial sun, uncommon weed, 21.333506, -157.871972, 24 Jun 2021, *K. Faccenda 2008*; Nu'uanu Pali Drive, above where the housing development ends, roadside, shaded, moist, infrequent along road, 21.347769, -157.823219, 29 May 2021, *K. Faccenda 1902*; Makiki Heights Drive & Mott Smith Drive, sunny, weedy areas, common, 21.312340, -157.833388, 22 May 2021, *K. Faccenda 1840*; N side of Frear Hall, UH Mānoa campus along Dole St., partly shaded flower beds, abundant weed, 21.293010, -157.813672, 19 May 2021, *K. Faccenda 1831*. **MAUI**: Hāna Hwy ca. 4 km W of Wai'ānapanapa State Park at roadside coconut stand and restaurant, wet, shady area, growing as weed in garden bed, rare, only spot plant was observed along Hāna Hwy, 169 m, 20.794373, -156.051771, 23 Oct 2022, *K. Faccenda 2749.5*; Kahului, Wai'inu Rd, weed in irrigated flower bed, shady area under ornamentals, common, over 50 plants, 81 m, 20.879999, -156.495534, 21 Oct 2022, *K. Faccenda 2723*. **HAWAI'I**: Hilo, intersection of East Kahaopea St and Kīlauea Ave, in infrequently mowed abandoned lot, uncommon, small colony of ca. 30 plants, other colonies also seen nearby, 42 m, 19.689879, -155.068077, 07 Aug 2022, *K. Faccenda 2583;* 'Imiloa Astronomy Center grounds, growing as weed in flower bed, 19.699994, -155.088556, 25 Aug 2019, *C. Warneke 315*.

Key to weedy herbaceous *Phyllanthus* in Hawai'i

1. Fruits and flowers long-pedicellate, pedicel >4 mm; stamens 5, distinct .... *P. tenellus*
1′. Fruits and flowers sessile or with pedicel <2 mm; stamens 3, fused
    2. Tepals 5; male and female flowers both borne at all flowering nodes (the male flower falling by the time the female has matured, examine branch tips) ..... *P. amarus*
    2′. Tepals 6; male and female flowers borne separately
        3. Male flowers distal, female proximal; seeds with sharp transverse ridges on the dorsal side; leaves hispidulous-margined ..... *P. urinaria*
        3′. Male flowers proximal, female distal; seeds striate; leaves not hispidulous-margined
            4. Pistillate tepals ~2 mm long, enclosing fruit at maturity; leaves widest near apex, obovate, blunt to obtuse at tip; leaves >6 mm wide ..... *P. leucanthus*
            4′. Pistillate tepals ~1 mm long, surpassed by fruit at maturity; leaves widest at middle, elliptic, acute at tip; leaves <6 mm wide ..... *P. debilis*

Phyllanthus urinaria L. **New island records**

First published as occurring on Kauaʻi (Brock *et al.* 2023), *Phyllanthus urinaria* is now known to also occur on Oʻahu, Maui, and Hawaiʻi. The first collection in the state was from a garden (*Neal s.n.*) in 1948, and this species continues to be found in nurseries and garden centers, but has also spread along roadsides and also into natural areas. *Phyllanthus urinaria* material at BISH was previously identified by Christopher Warneke and confirmed by the author.

Material examined. **Oʻahu**: Honolulu, 42 Coelho Way, in garden border, shaded, weed, 23 May 1948, *M.C. Neal s.n.* (BISH 664835); UH Mānoa, behind St. John Bldg., weed in flower bed, only one plant seen, 30 m, 21.302267, -157.815514, 12 Jan 2022, *K. Faccenda 2197*; Honolulu, Kakaʻako, JABSOM medical school off of Ilalo St., weed in flower bed, ca. 10 plants seen, uncommon, 21.296319, -157.863191, 08 Jun 2022, *K. Faccenda 2489;* Kāneʻohe, Valley of the Temples, weed around temple on edge of path, shady area, common, 55 m, 21.431060, -157.832469, 23 Aug 2022, *K. Faccenda & T. Chapin 2684*. **MAUI**: East Maui, Kihei, nursery, volunteer in pot on ground, naturalized, previously collected on Big Island, nursery imports from Big Island are likely source, 30 ft, 20° 43’ N, 156° 26’ W, 05 May 2004, *F. Starr 040505-3*. **HAWAIʻI**: Hilo International Airport, garden beds at main terminals, weed, uncommon, 15 m, 19.714685, -155.040672, 28 Feb 2022, *K. Faccenda 2248*; North Hilo Distr., Humuʻula, near head of Wailuku River, herb growing under *Sophora* tree, 9100 ft, 10 Jul 1978, *D. Herbst 6141*; Near UH-Hilo, coming up in stream bed, erect annual herb, <10 cm tall, naturalized, common in stream bed, 60 m, 19° 42’ N, 155° 05’ W, 01 Aug 2001, *F. Starr 010801-7*; Keaʻau, Shipman Park, edge of wooded area on edge of park, uncommon, one plant seen, 6 m, 19.620553, -155.043178, 14 Aug 2022, *K. Faccenda & M. Murphy 2646*.

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