

Updates to the Hawaiian grass flora and selected keys to species: Part 2

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This paper continues work by Faccenda (2022) to revise the introduced grass flora of Hawai‘i and expands upon it by visiting and critically reviewing specimens from the remainder of the herbaria located in Hawai‘i, including HALE, HAVO, and PTBG. The US herbarium was not visited, but all photographed specimens of Hawaiian grasses at US were examined, and selected specimens were loaned and examined in Hawai‘i.

As part of this work, a database of all Poaceae specimens from Hawai‘i was created by combining digitized collection data from BISH, HALE, HAVO, PTBG, US, and various herbaria that have contributed data to GBIF (gbif.org 2022). This database was compared to the published island distribution of all grasses to identify any specimens that would constitute new state or island records. Each of these potential new records were examined to determine if they were misidentified, cultivated, or correctly identified material representing new records. The inverse was also done, looking for any published records lacking a supporting voucher. Many new records were found using this methodology. Several published records lacking naturalized voucher specimens were also found and are retracted from the checklist herein.

New keys have been prepared for *Bothriochloa/Capillipedium/Dichanthium* (combined key), *Cenchrus*, *Chloris*, *Digitaria* (with photos), *Paspalum*, *Saccharum*, *Schizachyrium/Andropogon* (combined key) and *Setaria*. The following species are reported for the first time in the United States: *Bothriochloa macra*, *Chloris pycnothrix*, *Dichanthium caricosum*, *Digitaria henryi*, *D. mollicoma*, *D. scalarum*, *D. velutina*, *Dinebra retroflexa* var. *retroflexa*, *Echinochloa haploclada*, *Paspalum jesuiticum*, *Saccharum* × *sinense*, and *Sporobolus coromandelianus*. Of these, *Chloris pycnothrix*, *Digitaria henryi*, *D. mollicoma*, *Paspalum jesuiticum*, *Schizachyrium sanguineum* and *Sporobolus domingensis* are reported for the first time outside of their native range. *Eriochloa acuminata* var. *acuminata* and *Paspalum langei* are native to the continental United States and are also reported for the first time outside of their native range. The following names have been misapplied in Hawai‘i and correct names are reported herein: *Gastridium ventricosum*, *Hordeum brachyantherum*, *Schizachyrium condensatum*, *Schizachyrium scoparium*, and *Setaria verticillata*.

Fieldwork across Kaua‘i, O‘ahu, Maui, Moloka‘i, and Hawai‘i was conducted over 2022–2023 which discovered many new records of grasses across the archipelago. A total of 6 days were spent on Kaua‘i, 13 days on O‘ahu (supplemented by additional opportunistic surveys), 5 days on Moloka‘i, 11 days on Maui, and 16 days on Hawai‘i Island. This fieldwork consisted largely of roadside surveys where stops were made along public roads at approximately 1–5 mile intervals. During these stops I walked about 100–200 meters along the road margins on both sides of the road and examined every species of grass. If an unrecognized plant was seen out the window while driving, it was also investigated if it was safe to pull over.

If an unknown species or new distribution record was found, a herbarium specimen was made. Sometimes, extra time was able to be spent attempting to determine the extent of the population of some new state records, but in most cases this was not assessed. Approximately 700 vouchers were made during these surveys and were deposited principally at BISH, with some duplicates going to PTBG, HAW, HAVO, and US. Most of these specimens were not new records but were instead uncommon or common species collected to fill in gaps in the herbarium record. At each stop, each species of grass seen was photographed and the coordinates recorded; in total, ~9,300 data points were recorded (Fig. 1). This full dataset was uploaded to *inaturalist.org* and is also available upon request. These surveys covered a woeful volume of each island, yet identified 17 new state records and 59 new island records of grasses. Not all of these new records are published herein; some will be published in part three. Many non-grass records were also found and will be published separately. This underscores the fact that introduced grasses are under-collected and it is certain, in the author's opinion, that further effort would reveal even more species, especially on Hawai'i Island, where survey coverage was poorer than on other islands. In total, 174 species of non-native grasses were seen during this fieldwork, out of 239 species currently documented as naturalized on the islands.

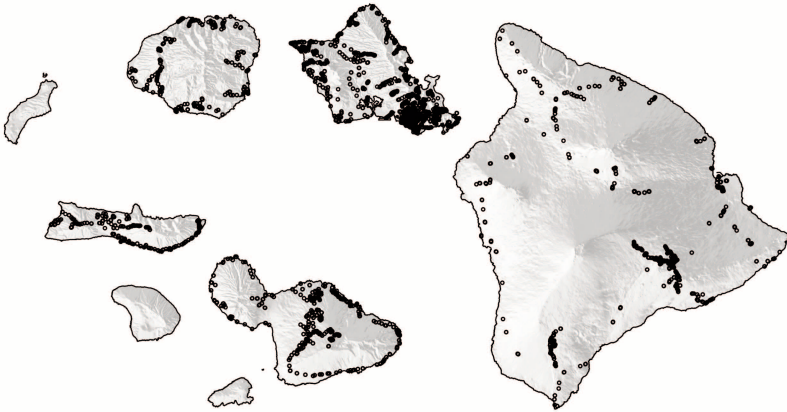


Figure 1. Areas covered by roadside surveys and other surveys during 2021–2023. Each black circle represents an area where grasses were surveyed.

All identifications were made by the author, unless otherwise noted. This work documents 126 new island records, 45 island level corrections, 34 new state records, 9 species deleted from the state checklist, 8 new questionable naturalizations, 8 confirmations of species previously reported as questionable naturalizations, and contributes several notes. A breakdown of these records by island is reported in Table 1. All herbarium specimens cited are deposited at BISH, unless otherwise noted.

Table 1. Summary of new grass records presented here, broken down by island.

* Including one native species.

Island	NIR	Corrections	Total spp.	TNQ
Kure Atoll	2	2	13	13
Midway	3	1	35	33
Pearl And Hermes Reef	1	1	3	3
French Frigate	2	2	7	7
Nihoa	1	1	2	2
Ka'ula Rock	1	1	5	5
Lehua	1	1	8	7
Ni'ihau	2	2	16	15
Kaua'i	17	6*	124	120
O'ahu	28	7	184	163
Moloka'i	15	3	106	97
Lāna'i	3	3	72	68
Maui	19	6	168	156
Kaho'olawe	4	3	35	34
Hawai'i	27	7	181	160
Total	126	45	273	239

Abbreviations: NIR = New Island Records; TNQ = Total non questionable

Avena barbata* Pott ex Link*New island record**

Avena barbata, formerly known from O'ahu and Hawai'i (Imada 2019), is now known from several collections on East Maui, where it has been present since 1937.

Material examined. **MAUI:** East Maui, Makawao Distr, Kalialinui, south gulch along road near edge of pasture, 2 m tall grass, locally common, 878 m, 20.792098, -156.308096, 16 Feb 2006, *H. Oppenheimer H20611* (PTBG); On roadside going to Makawao from Kahului, local patches, 500 ft [152 m], 20 Jan 1937, *E.Y. Hosaka 1708*; Kula, Crater Rd heading to Haleakalā, weed from yard of residence just before road enters Haleakalā Ranch, wet, sunny area, 5 plants seen, only this one colony seen, 20.767529, -156.294802, 27 Oct 2022, *K. Faccenda 2809*.

Bothriochloa bladhii* (Retz.) S.T. Blake*New island record; Correction**

Bothriochloa bladhii, previously reported as questionably naturalized on Hawai'i Island (O'Connor 1990), is now fully naturalized and is widespread on the island. It was found both in the Kahuku and Volcano Units of the Hawaii Volcanoes National Park, as well as along the belt road south of Waimea. In one area visited by the author (intersection of the Hawai'i Belt Road and Waikoloa Rd.), recently affected by a fire, this species was dominant, regenerating from large clumps in the burned area, indicating that *B. bladhii* is both flammable and fire adapted.

Examination of the only vouchered specimen (*Starr 030730-1*, BISH) identified as *B. bladhii* from Kaho'olawe revealed it to be a misidentified specimen of *Dichanthium annulatum* var. *annulatum*. No other specimens have been collected from the island, so it must be removed from the checklist for Kaho'olawe.

Material examined. **HAWAII:** Hawaii Volcanoes National Park, Kahuku Unit, in grounds of ranch house, few scattered grasses seen on edge of lawn of ranch house, ca. 0.6 m tall, 650 m, 11 Oct 2005, *L.W. Pratt 3545* (HAVO); Junction of Waikoloa Rd and Hwy 190, recently burned area, open, dry, sunny area, strongly regenerating after the fire with *Hyparrhenia rufa*, dominant in many areas and therefore likely this species was one of the main fuels for the fire, 770 m, 19.877252, -155.722274, 03 Mar 2022, *K. Faccenda 2288*; Saddle Rd, about 1 km away from its intersection with Rt 190, dry roadside, full sun, uncommon, mixed with the dominant *Cenchrus setaceus* and the less common *C. ciliaris*, 828 m, 19.926750, -155.678760, 04 Mar 2022, *K. Faccenda 2311*; Rt 190 about 2 km S of Waimea near the airport, pastures and roadsides in sunny dry areas, locally dominant in some areas, uncommon in others, 797 m, 20.002103, -155.677323, 05 Mar 2022, *K. Faccenda 2326*; Hawaii Volcanoes National Park, Chain of Craters Rd, near Hi'iaka Crater, roadside, sunny, dry area, rare, only 2 plants seen along road, 1003 m, 19.371192, -155.225656, 19 Aug 2022, *K. Faccenda 2681*.

***Bothriochloa ischaemum* (L.) Keng**

New island records

Bothriochloa ischaemum is now known from O'ahu and Moloka'i. This species was formerly known only from Hawai'i Island (Faccenda 2022). A single individual was found growing along King St. in urban Honolulu from dry, compressed soil adjacent to a sidewalk. Another individual was found along Rt. 72 and Kalani'iki St. between Honolulu and Hawai'i Kai. Over the course of this fieldwork only two plants were observed, making this grass apparently quite rare on O'ahu. A population on Moloka'i also exists at Lā'au Point.

Material examined. **O'AHU:** Honolulu, along Kalākaua Ave near King St, dry area between road and sidewalk, near *Bothriochloa pertusa*, 21.297625, -157.838172, 22 Jun 2021, *K. Faccenda 2000*; Between Honolulu and Hawai'i Kai, just W of Kalani'iki St along Rt 72, dry, sunny soil on edge of sidewalk, irregularly mowed area, rare, only one patch of this grass seen, but not every clump was examined in great detail in this area, all inflorescences lacked pits, clump-forming, 21.277837, -157.777651, 14 May 2022, *K. Faccenda 2373*. **MOLOKA'I:** West end of Lā'au Point, in coastal *Cressa* herbland, locally common, 21.101292, 157.309075, 15 m, *H. Oppenheimer H50632*.

***Bothriochloa macra* (Steud.) S.T. Blake**

New state record

Critical examination of the specimens filed as *Bothriochloa pertusa* at BISH revealed two distinct types of plants, one with smaller florets and a pitted pedicellate floret, and another with larger florets and a pedicellate floret lacking a pit (Fig. 2). This second type with the larger florets is actually *Bothriochloa macra* from Australia, commonly called Redleg Grass (Blake 1944). *Bothriochloa macra* may also lack glands on its glumes (Blake 1944), but all Hawaiian specimens collected to date do have glands. See the combined key to *Bothriochloa*, *Capillipedium*, and *Dichanthium* below to identify this species.

Bothriochloa macra was actually published as occurring on the islands in 1954 (Hosaka & Thistle 1954; cited as *B. ambigua*), but despite publication of this as a naturalization in 1954, no specimens could be found in any herbaria annotated with that name. This species has supposedly existed on the islands since 1916 (Hosaka & Thistle 1954), but the earliest specimen is from 1936, where it was first collected on O'ahu. *Bothriochloa macra* is currently known to occur on Ni'ihau, O'ahu, Moloka'i, Maui, Kaho'olawe, and Hawai'i from 15–1300 m elevation.

This grass has previously only been recorded as naturalized in New Zealand (Edgar & Shand 1987), but little information could be found regarding its weed potential or ecology in New Zealand. In Australia it is associated with disturbance in grassy woodlands (Prober *et al.* 2002), can handle drought and thrives on low fertility soils (Blake 1944), and can be a dominant species in grazed areas (Mitchell *et al.* 2021).



Figure 2. *Bothriochloa macra*. **A**, close-up of florets photographed at Pu'uwa'awa'a; **B**, inflorescences photographed at Ho'olehua.

The following description is taken from Blake (1944: 29; cited as *B. ambigua*):

“Loosely to densely tufted, green or brownish, 30–100 cm high; innovations extravaginal or mixed. Culms geniculately ascending, glabrous, smooth, shining, finely striate, 2–8 (usually 3–7)-noded, branched from many of the nodes with erect branches, the internodes (uppermost excepted) with one side furrowed. Leaf-sheaths soon gaping, keeled, striate, smooth, glabrous or the nodes sometimes puberulent or pubescent, shorter than the internodes except for the lowermost; ligules membranous, truncate, 1.5–2.5 mm. long, minutely and sparsely ciliolate at apex; blades at length more or less flat or revolute, up to 30 cm. long, about 2.5–5.5 mm. wide, margins scaberulous, asperulous on the upper surface, smooth beneath, both sides (particularly at the auricles) sparsely hairy with long tubercle-based hairs, primary nerves 9–11, narrowly keeled beneath. Inflorescence of 3–6 subdigitate racemes; common axis terete, somewhat bearded at the nodes otherwise glabrous, 0.7–2 cm. long; peduncles solitary or opposite, erect, rigid, terete and glabrous or the upper ones similar to the joints of the racemes, 4–7 or up to 9 mm. long. Racemes erect, appressed or somewhat flabellate, 5–10 cm. long, white-villous; joints and pedicels, 4–4.5 mm. long, the hyaline middle line sometimes becoming opaque and disappearing, the margins ciliate with hairs up to 4.5 mm. long. Sessile spikelet lanceolate-linear, narrowed upwards from about the middle to the lower third, narrowly rounded. at the tip, 5–7 mm. long, green or pallid, rarely purplish; callus about $\frac{3}{4}$ mm. long, densely

bearded with hairs up to 1 mm. long. Glumes thinly coriaceous; upper narrowly rounded at the tip, with 5–7 intracarpal nerves, loosely hairy in the lower $\frac{1}{3}$ or rarely glabrous, the keels spinulose-scabrous above the middle, the back above the middle punctate or smooth, sometimes with a more or less circular small pit; upper glume slightly smaller, spinulose-scabrous on the keel, otherwise smooth. Lower lemma lanceolate-oblong or ovate-lanceolate, jagged at the apex, 4–5 mm. long, about as long as the glumes. Upper lemma stipe-like, 2.5–2.75 mm. long; awn with stipe 20–23 mm. long, the brown scabrous column about as long as the scaberulous fulvous bristle, palea absent. Stamens 3; anthers 1.35–1.75 mm. long. Grain 3–3.25 mm. long, about 1 mm. wide. pedicelled spikelet neuter, lanceolate acute, 4.5–6 mm. long; lower glume scaberulous with the keels scabrous in the upper part and with 11 intracarpal nerves; upper glume much shorter, 3-nerved, ciliate; remainder absent.“

Material examined. **NI‘IHAU:** [no specific location], tall grass, 02 Nov 1939, *Anonymous s.n.* (BISH 117913); Ki‘eki‘e, cult. pasture grass, 50 ft [15 m], 16 Aug 1947, *H. St. John* 22845; Pānī‘au, introduced range grass, 1100 ft [335 m], 30 Mar 1949, *H. St. John* 22385. **O‘AHU:** Honolulu, University of Hawai‘i campus, weed in lawn behind Miller Hall, by *Euphorbia neriifolia*, 80 ft [24 m], 29 Apr 1966, *D. Herbst* 85; University of Hawai‘i Mānoa campus, outside Bilger Hall, mowed lawn, moist, sunny, seemingly irrigated, over 100 plants seen in area, with *Bothriochloa pertusa*, *Cynodon dactylon*, 23 m, 21.299817, -157.816904, 19 Apr 2023, *K. Faccenda* 3098; Waiawa, 500 ft [152 m], 31 Aug 1936, *A.F. Judd s.n.* (BISH 117914); Honolulu, Judd St., residence of A.F. Judd, transplanted from Waiawa, 26 Oct 1936, *A.F. Judd s.n.* (BISH 117911). **MOLOKAI:** Waiakoa, Dr. Cooke’s place, 13 Apr 1939, *Anonymous s.n.* (BISH 786589); Maunaloa town, intersection of Maunaloa Rd and North Wai‘eli St, in mowed lawns around town, rather dry, sunny areas, common in town, over 100 plants seen but not dominant, 309 m, 21.132911, -157.212683, 26 Dec 2022, *K. Faccenda* 2903; Rt 450 ca. 1 km S of the Pu‘u o Hoku Ranch headquarters (as the ‘alalā flies), along edge of large pasture spanning both sides of road, 192 m, 21.134650, -156.730070, 29 Dec 2022, *K. Faccenda* 2955. **MAUI:** Makawao, ‘Ulupalakua, occasional in pasture (local patch), growing nicely, 1800 ft [548 m], 08 Apr 1937, *E.Y. Hosaka* 1794; ‘Ulupalakua, bunch grass ca. 2.5 ft [76 cm] in height in pasture above Kula Hwy, 2000 ft [609 m], 08 Jan 1976, *J. Resnick* 213 (HAW); Kanaio, above Kula Hwy, on ‘a‘ā lava, bunch grass, 1800 ft [548 m], 16 Jan 1976, *J. Resnick* 294 (HAW); ‘Ulupalakua, grassland near Mākena Rd, bunch grass ca. 1 ft [30 cm] tall, 1600 ft [487 m], 18 Jan 1976, *J. Resnick* 348 (HAW); Ahuwai [Auwahi], near boundary with Kanaio, bunch grass to 1 ft [30 cm] in height, 2400 ft [731 m], 16 Jan 1976, *J. Resnick* 270 (HAW); ‘Ulupalakua, on slopes of Pu‘u o Kanaloa, above La Perouse Bay, steep slope, cindery soil, dry conditions, 150 ft [45 m], 27 Aug 1975, *J. Resnick* 112 (HAW); Pā‘ia, Holomua Rd, Old Maui High School, MISC Baseyard, mowed lawn, full sun, unirrigated, common in lawn, with *Cynodon* and *Bothriochloa pertusa*, 20.915056, -156.347798, 22 Oct 2022, *K. Faccenda* 2784. **KAHO‘OLAWA:** Bordering west side of LZ-1, UTM 752300-2275800, 09 Apr 1987, *S. Warren* K-7. **HAWAI‘I:** Mauna Loa Strip Road about 4 miles from intersection with Kona-Hilo Hwy, drive through Kīpuka Kī, just before the roadside pulloff at left of road (plot 40), 1340 m, 13 Jul 1966, *C.L. Newell* 56, 57, 58; Pu‘u Wa‘awa‘a, roadside, dry, open area dominated by *Cenchrus setaceus*, 659 m, 19.800794, -155.839116, 03 Mar 2022, *K. Faccenda* 2283; Ka‘ū, Pākinī Iki, Ka‘alu‘alu Ranch, pasture, occasional in local patch, 1000 ft [304 m], *E.Y. Hosaka s.n.* (BISH 786739); Saddle Rd, ca. 1 km away from its intersection with Rt 190, dry roadside, 968 m, 19.905982, -155.674917, 04 Mar 2022, *K. Faccenda* 2312; Hawai‘i National Park, between Keauhou Trail and Kīpuka Nēnē on jeep road, open exotic grasslands, Sept 1987 burn area, 24 Nov 1987, *P.K. Higashino* 10618 (HAVO); South Kohala Distr, Pōhakuloa, Ke‘āmuku Unit, old substrate near MSR Rd., uncommon in shrubland with alien grasses, bunchgrass, 1300 m, 08 May 2013, *L.W. Pratt* 3949 (HAVO).

Bothriochloa pertusa (L.) A. Camus

Correction

Bothriochloa pertusa is no longer known from Ni‘ihau, as all specimens have been reidentified as *Bothriochloa macra*. It is likely that *B. pertusa* does occur on the island, but no vouchers exist, as the island is largely inaccessible.



Figure 3. *Bouteloua dactyloides* male inflorescence from the Hale‘iwa.

***Bouteloua dactyloides* (Nutt.) Columbus**

New state record

During roadside surveys on O‘ahu, a small population of *Bouteloua dactyloides* was found growing in a mowed roadside along the Kamehameha Hwy. near Hale‘iwa Beach Park. This colony covered approximately 20 square meters of ground and was mixed with *Cynodon dactylon* and *Bothriochloa pertusa*. *Bouteloua dactyloides* is a dioecious species (Barkworth *et al.* 2003) and all inflorescences observed were staminate (Fig. 3), making it possible that this population was all only one staminate clone. However, when I was examining this grass in the field, I did not know that the male and female inflorescences were dimorphic and did not examine below the leaves for female flowers.

Bouteloua dactyloides is commonly called American Buffalo Grass and is native to short grass prairies of the central United States, where it is one of the most dominant species. This plant is adapted to fire, providing both flammable fuels and regenerating after fire (Howard 1995). In some areas, it has value as a turf grass (Wu 2000). It has previously been reported as naturalized in China, Spain, and Greece (POWO 2023). *Bouteloua dactyloides* is considered a valuable forage grass (Barkworth *et al.* 2003) and has previously been intentionally introduced into Hawai‘i for trial as a forage grass at least 5 times (von Tempisky 1905; HAES n.d.), making it very likely that this population descends from material intentionally imported into the islands. American buffalo grass can be identified by its stoloniferous habit, short stature, dioecious habit, and <3 mm wide hairy leaves.

The following description is taken from Barkworth *et al.* (2003: 270; cited as *Buchloë*, a monotypic genus):

“Plants perennial; usually dioecious; strongly stoloniferous, sometimes mat-forming. Culms 1–30 cm, erect, solid, mostly unbranched, those of the pistillate inflorescences much shorter than those of the staminate inflorescences; nodes mostly glabrous.

Leaves basally tufted, not clustered or strongly distichous; sheaths open, rounded, often sparsely pilose near the collar; ligules membranous or of hairs; blades usually flat basally, curling when dry, glabrous or sparsely pilose, apices involute. Staminate inflorescences terminal, usually exceeding the upper leaves, panicles of 1–3(4) racemously arranged, unilateral, pectinate branches; branches not enclosed at maturity, spikelets densely crowded in 2 rows. Staminate spikelets with 2 florets; glumes unequal, glabrous, 1- or 2-veined; lemmas 3-veined, glabrous, unawned; anthers brownish to red or orange. Pistillate inflorescences terminal, panicles, partially hidden within bracteate leaf sheaths; branches 2–3(4), 2.5–4.5 mm, burlike, with 3–5(7) spikelets; disarticulation at the base of the panicle branches. Pistillate spikelets with 1 floret, almost completely enclosed by the upper glumes; lower glumes irregular and reduced; branch axes and lower portion of upper glumes globose, white, indurate, terminating in 3 awnlike teeth; lemmas firmly membranous, glabrous, 3-veined, unawned or shortly 3-awned. $x = 10$.”

Material examined. **O‘AHU:** Hale‘iwa, along main highway just N of Hale‘iwa Beach Park near intersection of Kamehameha Hwy and Rt 83, mowed roadside on E side of road, only patch encountered during roadside surveys in this area, stoloniferous grass which was mostly sterile, but a limited number of flowers could be found, covering over 20 sq. meters with *Cynodon* and *Bothriochloa*, forming a dense turf, 2 m, 21.604326, -158.099059, 22 Dec 2022, K. Faccenda 2882.

***Bromus diandrus* Roth**

Correction

Bromus diandrus is no longer known to be naturalized on Lāna‘i, as the specimen published by Oppenheimer (2008) has been redetermined to *B. madritensis*. *Bromus diandrus* is now known to be naturalized on Kaua‘i, O‘ahu, Moloka‘i (questionable), Maui, and Hawai‘i (Imada 2019; Imada & Kennedy 2020; Faccenda 2022).

***Bromus hordeaceus* L.**

Correction

Bromus hordeaceus was previously reported on Moloka‘i by Wyszong *et al.* (2007); however, the specimen cited was a misidentification of *Bromus madritensis*. As there are no other specimens documenting *B. hordeaceus* from Moloka‘i, the record is herein retracted. *Bromus hordeaceus* is now known to occur only on Kaua‘i, O‘ahu, Maui, and Hawai‘i (Imada 2019).

***Bromus tectorum* L.**

New island record

Bromus tectorum, formerly known only from Maui, is now known on Hawai‘i Island from the Saddle area. This collection from the Rock Herbarium at the University of Hawai‘i was only recently identified as *B. tectorum*.

Material examined. **HAWAII:** In forest near pu‘u at mile 30 of Saddle Rd, 6000 ft [1828 m], 15 May 1995, C. Morden 1342 (HAW).

***Cenchrus ciliaris* L.**

Note

Fieldwork on Hawai‘i Island discovered a rhizomatous form of *Cenchrus ciliaris* with glaucous leaves. These differences were so striking that it was initially thought to be a different species, based on its rhizomatous habit and larger, glaucous leaves without hairs. However, after fruitless attempts to identify it, and keys repeatedly keying it as *C. ciliaris*, it was realized that these plants are likely escaped cultivars (Hosaka & Carlson 1957; Marshall *et al.* 2012). This cultivar was also found naturalized on Kaua‘i, O‘ahu, Moloka‘i, and Hawai‘i. Little information could be found on this cultivar and how it could differ

ecologically from the wild type *C. ciliaris*, although it has been noted that the rhizomatous form can tolerate heavier soils (Marshall *et al.* 2012).

Material examined. **KAUAI:** Rt 50, ca. 5 km NW of Kekaha, roadside weed, sunny dry area, leaves glaucous, rhizomatous, typical form of this grass occurring right next to it, this is apparently a cultivar, 4 m, 21.998607, -159.756583, 04 Jun 2022, *K. Faccenda 2480*. **O'AHU:** Kapolei, Kualakai Pkwy about 500 m N of its intersection with Kapolei Pkwy, roadside along bike trail, full sun, area dominated by *Cenchrus ciliaris* rare, only this one clump seen in area, all other plants had green leaves, 22 m, 21.339635, -158.052806, 19 Feb 2023, *K. Faccenda 3036*. **MOLOKA'I:** Ho'olehua, end of pavement on W end of Mo'omomi Ave, disturbed roadside, dry sunny area, rhizomatous blue-leaved form, common in this area along 100s of meters of road, aside from this patch the green-leaved caespitose form dominant, 117 m, 21.168326, -157.114454, 27 Dec 2022, *K. Faccenda & C. Daehler 2919*. **HAWAII:** Rt 190 about 6 km S of Waimea, dry sunny roadside, rhizomatous grass with glaucous blue leaves and culms, uncommon in area, 760 m, 19.959988, -155.680848, 05 Mar 2022, *K. Faccenda 2322*; South Point, South Point Rd about 200 m N of final "Y" in road, roadside ditch, seemingly slightly moister than nearby areas as this grass was green whereas all other vegetation was dry and brown at this time, forming monoculture along road for about 20–30 m, 28 m, 18.925054, -155.681573, 02 Mar 2022, *K. Faccenda 2271*.

***Cenchrus longisetus* M.C. Johnst.**

Correction

Cenchrus longisetus is no longer known to be naturalized on Hawai'i Island, as the specimen cited by Herbst & Clayton (1998) was apparently cultivated next to a house. *Cenchrus longisetus* is not currently known to be naturalized on any Hawaiian island, although it has been recorded in cultivation on most of the islands.

***Cenchrus setigerus* Vahl**

New island record

Cenchrus setigerus was found during roadside surveys on Moloka'i, where two populations were noted in the vicinity of Kaunakakai. One population was found in the housing development mauka of downtown Kaunakakai and consisted of over 100 plants, while the other was a small clump of around 10 plants at the intersection of Hoawa Rd. and Rt. 460. *Cenchrus setigerus* was reported as adventive on Moloka'i by O'Connor (1990) and is now clearly naturalized. *Cenchrus setigerus* is now known to be naturalized on Kaua'i and Moloka'i (Imada 2019).

Material examined. **MOLOKA'I:** Kaunakakai, Kupa Place and along other roads in subdivision, from cracks in sidewalks and strips of dirt between sidewalks and road along with yards, rather dry, sunny area in residential area, uncommon, over 100 plants seen in this area and also further W, mixed with *Cenchrus ciliaris*, 37 m, 21.092738, -157.012177, 30 Dec 2022, *K. Faccenda 2979*.

***Cenchrus setosus* Sw.**

Corrections; taxonomic note

It has recently been revealed that the name *Cenchrus polystachios* has been widely misapplied, as in 1917 the name was lectotypified to be *Setaria flava*, an entirely different species (Turner *et al.* 2019). Therefore, the correct name for *Cenchrus polystachios* as it has been applied in Hawai'i (as well as most places in the world) is *Cenchrus setosus*.

Cenchrus setosus is also no longer known to be naturalized from Kaua'i or Maui, as the records published by Starr *et al.* (2002, 2003, 2004) and Starr & Starr (2011) were based on misidentifications of *Cenchrus ciliaris*. However, during roadside surveys on Maui, a *C. setosus* plant was photographed in Kaupō (Fig. 4), but was not vouchered; as no voucher was made, it must be considered a **questionable naturalization**. *Cenchrus setosus* is currently known to be naturalized on O'ahu, Lāna'i, and Hawai'i, and questionably naturalized but unvouchered on Maui.



Figure 4. *Cenchrus setosus* photographed at Kaupō, Maui, 20.631154, -156.154758, 26 Oct 2022.

KEY TO *CENCHRUS* IN HAWAII

Cenchrus is part of the bristle clade of Paniceae, and all species have bristles subtending the florets. *Setaria* is also a member of this clade, and the two genera can be distinguished by whether the spikelets fall with or without the bristles. The bristles are persistent on the inflorescence in *Setaria* but fall with the spikelet in *Cenchrus*. *Cenchrus americanus* is an exception to this rule and is also found in the key to *Setaria* in this paper. The genus *Pennisetum* is now included in *Cenchrus* based on molecular evidence; if the name dramatically changed when it was moved to *Cenchrus*, the former *Pennisetum* name is also provided below.

1. Leaves consistently pink to red; cultivated or uncommonly escaped plants [also compare to *Cenchrus americanus* × *purpureus* (bana grass), a sterile, cane-like grass resembling *C. purpureus* vegetatively, but with purple leaves and occurring only in cultivation]
2. Leaves >20 mm wide; all bristles scabrous ... *C. elegans* [*Pennisetum macrostachys*]
- 2'. Leaves <11 mm wide; at least one of innermost bristles plumose
..... *C. ×cupreus* [*Pennisetum advena*] (in part)
- 1'. Leaves green, occasionally reddish when stressed; wild or cultivated plants
3. Plants rhizomatous or stoloniferous
 4. Plants decumbent, long creeping, stoloniferous; conspicuously hairy; inflorescence concealed in leaf sheaths *C. clandestinus*
 - 4'. Plants erect, rhizomatous; glabrous or inconspicuously hairy; inflorescence prominently exserted *C. ciliaris* (in part; uncommon glaucous-leaved cultivar)

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- 3'. Plants clump-forming (caespitose)
5. Spikelets enclosed in a spiny burr composed of stiff, flattened bristles
6. Spines hooked at tip [potentially mistaken for *Cenchrus*] *Tragus berteronianus*
- 6'. Spines never hooked at tip
7. Burs with spines in two distinct series, the outer <3 mm and terete; the inner stiff and flattened
8. Burr 8–18 mm long; burr with conspicuous flaring pedicel ~2 mm long [endemic] *C. agrimonioides*
- 8'. Burr 4–7 mm long; burr with pedicel <1 mm *C. echinatus*
- 7'. Burs with only one series of stiff spines
9. Spines grooved; burs 5–7 mm long; burrs scabrous *C. setigerus*
- 9'. Spines not grooved; burs >1 cm long; burrs conspicuously hairy *C. tribuloides*
- 5'. Spikelets subtended by relatively soft, terete bristles (or bristles slightly flattened in *C. ciliaris* but not spiny)
10. Bristles glabrous, scabrous, or with very sparse hairs
11. Annual; bristles persistent after spikelets fall; bristles <1 cm long; waif occurrences from birdseed or use as soil stabilization *C. americanus* [*Pennisetum glaucum*] (in part)
- 11'. Perennial; bristles deciduous; bristles >1 cm; naturalized
12. Canelike plants up to 4 m tall (but may flower before appearing canelike); inflorescence axis conspicuously hispid pubescent; bristles golden yellow *C. purpureus*
- 12'. Not canelike; inflorescence axis scabrous or minutely pubescent; bristles typically brownish purple *C. complanatus*
- 10'. Most bristles conspicuously ciliate
13. Fascicle of spikelets sessile or on pedicel <0.5 mm long
14. Inner whorl of bristles fused at base into minute cup 0.2–1 mm tall; inner whorl of bristles flattened and grooved longitudinally, weakly ciliate, cilia generally not obscuring spikelets; bristles generally wavy *C. ciliaris*
- 14'. Inner whorl of bristles not fused for any length; inner whorl of bristles terete and without groove, densely ciliate, cilia generally entirely obscuring spikelets; bristles generally straight *C. setosus* [*Pennisetum polystachion*]
- 13'. Fascicle of spikelets borne on a pubescent pedicel >1 mm long
15. Leaves stiff, V-shaped, <3.5 mm wide *C. setaceus*
- 15'. Leaf soft, flat, >4 mm wide
16. Panicle <15 cm long
17. Panicle partially inserted into subtending leaf sheath *C. clandestinus* × *C. setaceus*
- 17'. Panicle long-exserted from subtending leaf [not yet naturalized] *C. longisetus* [*Pennisetum villosum*]

16'. Panicle longer

18. Annual; bristles persistent, <1 cm long; waif occurrences from birdseed or soil stabilization

..... *C. americanus* [*Pennisetum glaucum*] (in part)

18'. Perennial; bristles deciduous, >1 cm; cultivated or naturalized ...

..... *C. × cupreus* [*Pennisetum advena*] (in part)

***Chloris divaricata* R. Br.**

Nomenclatural note; new island record

Chloris divaricata was formerly treated as having two varieties in Hawai'i (*C. d.* var. *divaricata* and *C. d.* var. *cynodontioides*) following the treatment *Chloris* by Lazarides (1972). However, recent fieldwork has shown that these varieties entirely intergrade in Hawai'i. An identical conclusion was reached by Anderson (1974) who also chose not to recognize these varieties. As such, they are no longer recognized in the Hawaiian flora.

Chloris divaricata is now known to be naturalized on Moloka'i at Waihānau, Ho'olehua, and 'Ualapu'e. It is also known from a single old collection from Kahuku, Hawai'i. Persistence of this record from Hawai'i Island should be considered questionable, as this species has not been observed in the past 70 years. *Chloris divaricata* is now known to be naturalized on Midway, Ni'ihau Kaua'i, O'ahu, Moloka'i, Lāna'i, and Maui, Kaho'olawe, and Hawai'i (Imada 2019).

Material examined. MOLOKA'I: Waihānau, 02 Dec 2004, G.D. Hughes 1105; Rt 450, ca. 8 km E of 'Ualapu'e, roadside weed in dry sunny area, common in this area along the compressed soil along the road, 13 m, 21.094306, -156.762759, 29 Dec 2022, *K. Faccenda 2953*; Ho'olehua, intersection of Rt 482 and Ala Elua St, partly shady, moist roadside, common in sunny and partially shaded locations in this area, weakly stoloniferous grass in mowed areas, 245 m, 21.172906, -157.056016, 27 Dec 2022, *K. Faccenda & C. Daehler 2930. HAWAI'I (Questionable record):* Ka'ū, Kahuku, Kahuku Ranch, rare local patch in dry pasture, 1500 ft [457 m], 29 Sep 1950, *E.Y. Hosaka 3615*.

***Chloris gayana* Kunth**

New island record

Chloris gayana, previously reported on Ni'ihau, O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i (Imada 2019), is now also known from Kaua'i. It was found in two spots around Kalāheo in weedy situations.

Material examined. KAUA'I: Kalāheo, National Tropical Botanical Garden off of Papalina Rd, weedy area near powerline outside of headquarters building, full sun, rare, only 2–3 plants seen, 113 m, 21.906012, -159.511124, 29 May 2022, *K. Faccenda 2384*; Kalāheo, Pu'u Rd about 0.5 km S of Pu'u Lani Pl., roadside weed, sunny dry area on poor soil on side of road, small colony seen only in this area, 187 m, 21.916021, -159.535793, 02 Jun 2022, *K. Faccenda 2452*.

***Chloris pycnothrix* Trin.**

New state record

An unusual *Chloris* was found by Mike Ross (Kapi'olani Community College) growing out of the gutter on the side of the road while botanizing at the Mililani Mauka Park. He then uploaded photos of the grass to inaturalist.org, where they struck the author as strange due to their inflorescence with two whorls of inflorescence branches (Fig. 5), a character not seen on the common *Chloris divaricata*. Subsequently, a specimen was made and the floret anatomy proved that it could not be *Chloris divaricata*, as the sterile lemma was too short and not bilobed. Using the keys in Pope (1999) and Clayton *et al.* (1974), this grass was identified as *Chloris pycnothrix*. All material at BISH and HAW was examined and no

further material was found. Further populations were found on Kunia Rd. and Wahiawa District Park; each population was rather small, consisting of less than 30 plants.

Chloris pycnothrix is native to Africa (Pope 1999) and South America (Molina & Agrasar 2004) and has previously been introduced in Central America, India, China, and Japan (POWO 2023). It is a common weed of disturbed ground in its native range (Pope 1999). It is very similar to *Chloris divaricata*, but can be distinguished by the sterile lemma being <0.7 mm and very shallowly bilobed (compared to >1 mm and strongly bilobed in *C. divaricata*). These two species are not distinguishable without microscopic examination of the sterile lemmas. A key to *Chloris* in Hawai‘i has been prepared to aid in the identification of this grass.



Figure 5. *Chloris pycnothrix* seen at Mililani Mauka Park. The two-whorled inflorescence is atypical as most plants only have one whorl.

The following description is from Flora Zambesiaca (Pope 1999: 210):

“Annual up to 45 cm tall, erect or geniculately ascending, often rooting from the nodes; leaf sheaths keeled; leaf laminas 3–11 cm × 3–5 mm, abruptly obtuse at the apex. Inflorescence of 3–12 digitate or subdigitate racemes 1.5–7 cm long. Spikelets 2-flowered, 1–2-awned; inferior glume 1.3–1.4 mm long; superior glume 2–2.4 mm long; floret callus rounded; fertile lemma 2.4–2.8 mm long, narrowly elliptic in profile, pallid, scabrid on the margins, keel and flanks, the awn 11–27 mm long; 2nd lemma 0.1–1 mm long, borne upon an internode 2–3 mm long, awnless or with an awn up to 8 mm long.”

Material examined. **O‘AHU:** Kunia Rd, about 500 m S of NSA facility, roadside in sunny dry area, common in area, 309 m, 21.471126, -158.053058, 18 Jan 2023, *K. Faccenda 3007*; Mililani, Ukuwai St on E side of Mililani Mauka Park, from accumulated leaves and detritus next to curb, on road in moist sunny area, 231 m, 21.470629, -158.005759, 08 Dec 2022, *K. Faccenda & M.C. Ross 2865*; Wahiawā, Wahiawā District Park, at base of stadium lights, weed in mowed lawn, sunny, moist, uncommon, only one clump of ca. 30 plants seen, leaves blunt at tip, stoloniferous, 282 m, 21.499531, -158.022974, 20 Feb 2023, *K. Faccenda & M.C. Ross 3045*.

KEY TO *CHLORIS* IN HAWAII

Eustachys petraea has been reported on Midway Island and is easily confused with *Chloris*, and is therefore also included in this key.

1. Florets with 3 awns approximately equal in length, these awns all pointing in different directions; sterile florets inflated *C. barbata*
- 1'. Florets with 0–3 awns, progressively reduced in length, these awns aligned with the axis of the inflorescence branch; sterile florets not inflated
2. Florets lacking awns or with awns up to 6 mm; florets 2–3; rather robust perennials up to 300 cm tall
 3. Upper glume acute; awns up to 6 mm or absent *C. gayana*
 - 3'. Upper glume bilobed; awns up to 1.2 mm or absent [easily confused with *Chloris*, currently only known from Midway] *Eustachys petraea*
- 2'. Florets with awns 4–25 mm long; florets 2; annual or perennial, rarely surpassing 50 cm tall
4. Lowest lemma with dense tuft of hairs 2–3 mm long at its apex; panicle branches usually held closely together and erect *C. virgata*
- 4'. Lowest lemma with short hairs <1 mm or glabrous; panicle branches usually spreading
5. First sterile lemma truncate *C. truncata*
- 5'. First sterile lemma not truncate
6. First sterile lemma >1 mm long, bilobed for $\frac{1}{4}$ – $\frac{1}{2}$ its length; panicle with 3–9 branches, all branches typically from one whorl, rarely plants are seen with a single branch arising below the main whorl *C. divaricata*
- 6'. First sterile lemma minute, <0.7 mm, scarcely bilobed; panicle with 3–15 branches, branches from 1–4 whorls
7. Panicle branches 3–12, divergent, from 1 or 2 whorls; fertile lemma 2–2.5 mm long, lacking tuft of hairs *C. pycnothrix*
- 7'. Panicle branches 5–15, ascending, from 2–4 whorls; fertile lemma 2.5–3.3 mm long, often with a tuft of hairs at its apex *C. radiata*

Cortaderia selloana (Schult. & Schult. f.)

Asch. & Graebn.

New island record

Cortaderia selloana was previously reported as naturalized on Maui by Loope & Medeiros (1992); however, they did not cite a voucher, leading to their report being considered unconfirmed by Imada (2019). However, specimens had been made and stored at PTBG. Vouchers are reported below, confirming that the species is naturalized on Maui. This species is an eradication target of the Maui Invasive Species Committee (MISC), and all wild plants should be reported to them for control. Over the past 20 years, 144 wild plants have been killed by MISC (Brooke Mahnken, pers. comm.).

Material examined. MAUI: Crater Rd, through Haleakalā Ranch on road embankment (vertical cliff of dirt), plants about 9 ft tall, sparingly naturalized, 1676 m, 19 Oct 1989, *B. Gagne & R. Hart s.n.* (PTBG 006659); Kula [precise locality redacted], cultivated and spreading into adjacent feral lands, soon to be killed by MISC, grass to 3 m tall, clumps up to 2 m wide, leaves sharp on margins, 1020 m, 24 Oct 2022, *K. Faccenda 2780*.

***Cynodon aethiopicus* Clayton &**

J.R. Harlan

Correction

Cynodon aethiopicus is no longer known from O‘ahu as the specimens published by Herbst & Clayton (1998) have been redetermined to be *Cynodon dactylon*. *Cynodon aethiopicus* is now known to be naturalized only on Maui, Kaho‘olawe and Hawai‘i (Imada 2019; Faccenda 2022).

Dichanthium annulatum* (Forssk.) Stapf**var. *annulatumNew state record**

No infraspecific taxa of *Dichanthium annulatum* have previously been recognized as occurring in Hawai‘i, but examination of specimens at BISH showed two distinct forms of this grass exist on the islands, one with acutely tipped, lanceolate lower glumes (*D. annulatum* var. *annulatum*) and another with bluntly tipped, obovate to oblong glumes (*D. annulatum* var. *papillosum*). These varieties also differ in their pubescence, as var. *papillosum* has papillose-based hairs on its lower glume, whereas var. *annulatum* lacks papillose-based hairs on its glumes.

These two varieties of *D. annulatum* have been extensively studied in cytological and breeding studies (e.g., Singh *et al.* 1962; Mehra 1964; Singh & Mehra 1965). The varieties form a polyploid series, with var. *annulatum* (referred to as both the Mediterranean and tropical type) having 20 or 40 chromosomes, whereas var. *papillosum* (referred to as the South African type) has 60 (Mehra 1964). Breeding studies have shown that *D. a.* var. *papillosum* can be created artificially via crosses of plants that would be classified as *D. a.* var. *annulatum*, and that the two varieties can hybridize (Mehra 1964).

It is unclear how *D. a.* var. *annulatum* arrived in Hawai‘i, as there are no records of its importation, nor specimens made from introduction gardens. As there is no evidence of intentional introduction, it may have been of accidental introduction. Ecological studies rarely report which variety of *D. annulatum* was encountered, making it difficult to compare the ecology of the two varieties.

Material examined. **KAUAI:** Port Allen, Waialo Rd just S of Rt 50, roadside, dry sunny area, several plants seen, generally uncommon in this area, 17 m, 21.903582, -159.585211, 03 Jun 2022, *K. Faccenda* 2475; Ninini Point road running along edge of Lihue Airport, roadside weed, sunny dry area, common, also seen inside airport, 45 m, 21.971297, -159.352440, 29 May 2022, *K. Faccenda* 2418. **O‘AHU:** Honolulu, Ko‘olau summit, Air Defense Nike Site 3-4 Kamehame Ridge, growing in lawns and along sides of buildings at lower installation, 1100 ft [335 m], 08 Nov 1976, *K.M. Nagata* 1409; Honolulu, Pi‘ikoi St and Kinau St, roadside weed from crack in sidewalk, abundant weed in urban Honolulu from cracks in sidewalks, 7 m, 21.302409, -157.842954, 08 Apr 2022, *K. Faccenda* 2357; Lunalilo St and Ke‘eaumoku St, weedy roadside in area not recently mowed or sprayed, common in sunny areas, 21.302643, -157.838358, 01 Dec 2020, *K. Faccenda* 1698. **MOLOKA‘I:** Ho‘olehua Airport, mixed grassland or open field, ascending perennial grass 0.5 m tall, naturalized in lawns, fields, roadsides, occasional, 24 Feb 1992, *G.D. Hughes* 24; Airport, edge of wetland on side of airport road, perennial grass, frequent along roadside, 08 Feb 2005, *M.L. Wysong* 608; near airport, Apr 1977, *R.W. Hobdy s.n.* (BISH 768175). **MAUI:** East Maui, ‘Ulupalakua, 1500 ft [457 m], 18 Jan 1976, *J. Resnick* 346 (HAW); West Maui, Wailuku Distr, Kahului, weed in roadway medial strip, 20 ft [6 m], 20°53’17”N, 156°28’02”W, 02 July 2001, *H. Oppenheimer* H70101 (PTBG); East Maui, S side of Kahului Airport, roadside, 01 Dec 1995, *R. Hobdy* 3911. **KAHO‘OLAWA:** Lua Makika, N rim, side of road, windswept shrub/grassland, hardpan substrate, 20°33’N, 156°34’W, 1450 ft [440 m], 30 Jul 2003, *F. Starr* 030730-1. **HAWAI‘I:** Ka‘ū, Kahuku, Kahuku Ranch, rare, local patch in dry pasture, 1800 ft [548 m], 29 Sep 1950, *E.Y. Hosaka* 3614.

Dichanthium annulatum* var. *papillosum

(A. Rich.) de Wet & Harlan

New state record

Dichanthium annulatum var. *papillosum* is now known in Hawai'i from O'ahu, Moloka'i, Maui, and Hawai'i. It was an intentional introduction, as the first specimen was collected at an agricultural experiment station. See further discussion under *Dichanthium annulatum* var. *annulatum*.

Material examined. **O'AHU:** Honolulu, Pensacola St, along roadside near Experiment Station, 06 Jun 1940, *E.Y. Hosaka* 2525; Honolulu, Pensacola St, Hawaii Agri[cultural] experimental station, weed in cultivated field, 23 Oct 1940, *R. Wong* s.n. (BISH 785796); H.A.E.S. [Hawaii Agricultural Experimental Station], Pensacola St, 24 Jul 1931, *W.C. Davis* s.n. (BISH 785797); Honolulu, Pi'ikoi St and Kinau St, roadside weed from crack in sidewalk, uncommon, in close proximity to the much more common *Dichanthium annulatum* var. *annulatum*, 8 m, 21.302901, -157.842723, 08 Apr 2022, *K. Faccenda* 2356; Between Honolulu and Hawai'i Kai, intersection of Rt 72 and Laukani St, strip of grass between road and sidewalk, seemingly irrigated area, one patch seen, 5 m, 21.277287, -157.772162, 14 May 2022, *K. Faccenda* 2368. **MOLOKA'I:** Moloka'i Ranch, Mo'omomi, 200 m, 23 Mar 1992, *G. Hughes* 317 (US); Māloelāu, *Bidens menziesii*–*Dodonaea* shrublands, occasional grass growing in small tufts, naturalized weed in pastures as shrublands, 750 m, 16 Mar 1992, *G.D. Hughes* 31; Western end of island, Ahiu Rd about 1 km from Kalua Ko'i Rd, roadside weed, very sunny and dry area, one flowering culm seen in this area, 58 m, 21.163777, -157.246504, 26 Dec 2022, *K. Faccenda* 2898; Rt 450, ca. 7 km E of Kaunakakai near intersection with 'Uluānuī Rd, roadside weed in sunny, dry area, rare, only 10 plants seen in this area, 20 m, 21.066772, -156.953600, 30 Dec 2022, *K. Faccenda* 2974. **MAUI:** West Maui, Lāhainā Distr, Hanaka'ō'ō, near old Ka'anapali Airport, 20°56'N, -156°41'W, ca. sea level, 29 May 2000, *H. Oppenheimer* H40028. **HAWAII:** Ka'ū, Pakini Iki, Ka'alu'alu Ranch, occasional in local patch in pasture, good growth, 1000 ft [304 m], 24 Feb 1950, *E.Y. Hosaka* s.n. (BISH 786738).

Dichanthium caricosum* (L.) A. Camus*New state record**

Dichanthium caricosum was found by Mike Ross growing at the Ka Iwi shoreline, where approximately 200 plants were found growing along a trail in an area otherwise dominated by *Cenchrus ciliaris*. This grass is morphologically identical to *Dichanthium aristatum* except that the latter has a hairy peduncle, while *D. caricosum* has a glabrous peduncle. A colony of *Dichanthium aristatum* was also seen within 300 m of the *D. caricosum* colony at Ka Iwi, but the two colonies did not overlap geographically. Some authors have suggested that *D. aristatum* is simply a hairy form of *D. caricosum* (Lakshminarasimhan 1996; Wu *et al.* 2006), but cytological and hybridization experiments by de Wet & Harlan (1968) suggest they are distinct species. *Dichanthium caricosum* is native from India through Southeast Asia but has been introduced in scattered areas across the tropics (POWO 2023).

Material examined. **O'AHU:** Ka Iwi Shoreline Trail, growing in full sun in a very dry, open grassy area dominated by *Cenchrus ciliaris*, ca. 50–60 plants seen, <3m, 21.175404, -157.392386, 09 Feb 2023, *M.C. Ross* 1887; Ka Iwi shoreline, about 100 m E of the small beach, ca. 200 plants, 1 m, 21.298514, -157.656283, 07 Apr 2023, *K. Faccenda* & *M. Ross* 3093

Dichanthium tenue* (R. Br.) A. Camus*New island record**

Dichanthium tenue is now known to be naturalized on Hawai'i Island based on specimens from HAVO collected south of the park along Hwy 11. *Dichanthium tenue* was formerly known to be adventive on Hawai'i Island (O'Connor 1990). It is now known from O'ahu, Maui, Hawai'i, and questionable on Ni'ihau (Imada 2019).

Material examined. **HAWAII:** Hawaii Volcanoes National Park, Ka'ū Distr, Ke'āmuku Lava Flow near Hwy 11, bunchgrass scattered on ash in *Metrosideros*/native

shrub scrub, ca. 3200 ft [957 m], 03 Jun 1985, *L.W. Cuddihy* 1993 (HAVO); Hwy 11 west of Hawaii Volcanoes National Park on edge of Kapāpala Ranch, Kaʻū Distr (mile 43–44), disturbed area on side of highway, bunchgrass with dark brown awns, 700 m, 29 May 2001, *K. Bio 1-10-02* (HAVO).

COMBINED KEY TO *BOTHRIOCHLOA*, *CAPILLIPEDIUM*, AND *DICHANTHIUM* IN HAWAII

This key is designed to minimize reliance on one specific, difficult characteristic: the translucent medial groove of the pedicel. The presence of this groove defines the difference between *Dichanthium* and the other genera. The groove is present in *Bothriochloa* and *Capillipedium*, but not *Dichanthium*. Examining plants for this character can be very difficult and postponing its use until late in the key should help to make this group more approachable. Molecular evidence also suggests that these genera are artificial and further justifies inclusion of all these genera in one key (Sumadijaya 2015).

Examination of a specimen for a translucent medial groove is best done using a dried specimen as it tends to make the groove more visible, but can still be done on fresh material. The specimen should be placed under strong magnification, ideally dissecting scope at 20–40×. It is sometimes possible to locate the groove using a 10× hand lens, but is *very* difficult, in the author’s experience. The easiest way to find the groove is to use forceps and tear away a pedicellate spikelet, taking care to grab it at the base of the pedicel. Once it is extracted, the groove (if present) will be visible running through the middle. The groove may not be truly translucent and it is often more red or purple than the edges of the pedicel. The groove will be visible from both faces of the pedicel. If a very fine needle is at hand (the author uses a 1RL tattoo needle for this task), it is possible to puncture the translucent medial line and easily split the pedicel in two down its length (at least in all specimens examined by the author). The groove can also be seen on the same internodes (axis of the raceme of spikelets; the structures that connect the spikelet pairs) but is easiest to observe on the pedicels of the pedicellate spikelets. In *Dichanthium* the pedicels and same internodes are typically convex with no groove, but in *Bothriochloa* and *Capillipedium* they tend to be shaped more like a compressed serifed “I” in cross section, since the groove acts as a depression on both sides.

- 1. Racemes of spikelets with less than 8 spikelets each; panicle loosely branched with many secondary branches *Capillipedium spicigerum*
- 1'. Racemes of spikelets with >8 spikelets each; panicle uncommonly with secondary branches
- 2. Glumes pitted
- 3. Axis of inflorescence longer than or equalling length of lowest panicle branch *Bothriochloa bladhii* (in part)
- 3'. Axis of inflorescence shorter than lowest panicle branch
- 4. Pedicellate spikelets reduced in width compared to sessile spikelets; pedicellate spikelets lacking a pit; sessile florets 4.75–7.00 mm long; panicle branches usually held stiffly erect and parallel to inflorescence axis *Bothriochloa macra* (in part)
- 4'. Pedicellate spikelets generally similar to sessile spikelets, occasionally slightly reduced; pedicellate spikelets with or without a pit; sessile florets 3–4 mm long; panicle branches usually held weakly erect to strongly divergent from inflorescence axis *Bothriochloa pertusa*

- 2'. Glumes not pitted
5. Pedicellate spikelets reduced in width compared to sessile spikelets
6. Hairs of inflorescence <2 mm, not obscuring florets; panicles reddish or whitish when mature
7. Spikelets 4.75–7.00 mm long; axis of inflorescence shorter than lowest panicle branch *Bothriochloa macra* (in part)
- 7'. Spikelets 3.0–4.5 mm long; axis of inflorescence longer than or equalling length of lowest panicle branch *Bothriochloa bladhii* (in part)
- 6'. Hairs of inflorescence >4 mm long, obscuring florets; panicles whitish when mature
8. Sessile spikelets 4.5–7.3 mm long; nodes pubescent *Bothriochloa barbinodis*
- 8'. Sessile spikelets 2.5–4.5 mm long; nodes glabrous [questionably naturalized as of 2023] *Bothriochloa laguroides*
- 5'. Pedicellate spikelets similar in width compared to sessile spikelets
9. Lower glume apex blunt, obtuse, or rounded; lower glume typically oblong or obovate
10. Peduncle of inflorescence pubescent just below inflorescence *Dichanthium aristatum*
- 10'. Peduncle of inflorescence glabrous
11. Glumes nearly glabrous to shortly pubescent, hairs <1 mm, uniformly covering glumes *Dichanthium caricosum*
- 11'. Glumes with hairs 1–4 mm long, concentrated towards edges
12. Hairs of glumes 4 mm or longer, partially obscuring florets, hairs not papillose-based; inflorescence branches umbellate or with inconspicuous internodes *Dichanthium sericeum*
- 12'. Hairs of glumes 2 mm or less, not obscuring florets, hairs usually papillose-based around edge of glume; inflorescence branches separated *Dichanthium annulatum* var. *papillosum*
- 9'. Lower glume apex acute; lower glume typically lanceolate, elliptic, or obovate
13. Glumes entirely glabrous *Dichanthium tenue*
- 13'. Glumes with at least some hairs
14. Pedicles of pedicellate spikelets lacking a translucent medial line (see key caption) *Dichanthium annulatum* var. *annulatum*
- 14'. Pedicles of pedicellate spikelets with a translucent medial line
15. Axis of inflorescence longer than or equalling length of lowest panicle branch *Bothriochloa bladhii* (in part)
- 15'. Axis of inflorescence shorter than lowest panicle branch *Bothriochloa ischaemum*

***Digitaria abyssinica* (Hochst.**

ex A. Rich.) Stapf

Correction

Most specimens of *Digitaria abyssinica* from the Hawaiian Islands have been redetermined to *Digitaria scalarum* (see notes under that species). As such, *Digitaria abyssinica* is now known to occur only on Maui in the vicinity of Olinda at Waihou Spring

Forest Reserve, and a small colony on Kauaʻi at Kōkeʻe. No populations are currently known from Oʻahu.

***Digitaria bicornis* (Lam.) Roem. & Schult. New island records**

During roadside surveys on Molokaʻi, a single plant of *Digitaria bicornis* was found on Mahalo Pl. in Kaunakakai growing as a weed in the yard of a residence. A population of between 100–200 plants was also found on Oʻahu on the edge of the University of Hawaiʻi West Oʻahu campus. *Digitaria bicornis* is now known to be naturalized on Lehua, Kauaʻi, Oʻahu, Molokaʻi, and Maui (Faccenda 2022).

Material examined. **OʻAHU:** E end of University of Hawaiʻi West Oʻahu campus, open, weedy, undeveloped area, full sun, dry, 100–200 plants here, population about 10 m diam., 21.358237, -158.054490, 13 Mar 2023, *K. Faccenda & M.C. Ross 3068*. **MOLOKAʻI:** Kaunakakai, Mahalo Pl. at end of road, outside house in unmaintained area, rather sunny and somewhat moist, only one plant seen in this area, but area only surveyed very briefly, 21 m, 21.096027, -157.023016, 30 Dec 2022, *K. Faccenda 2977*.

***Digitaria ciliaris* (Retz.) Koeler Correction**

Digitaria ciliaris is no longer known to occur on French Frigate Shoals or Kure Atoll, as all specimens formerly identified as *D. ciliaris* from those islands have been reidentified to *Digitaria henryi*. *Digitaria ciliaris* is now known from all the main islands and Midway (Imada 2019).

***Digitaria didactyla* Willd. New state record**

Digitaria didactyla is now known to be naturalized in Hawaiʻi, where it has appeared as a weed in mowed lawns on both Kauaʻi and Hawaiʻi. The population on Hawaiʻi Island was found growing in a narrow strip of grass along the edge of a parking lot in Waiākea, along with another population outside of Waiākea Elementary School. Another population was also discovered by a turf manager at the Kukuiula and Puakea golf courses on Kauaʻi, where it was growing as an unsightly weed in a putting green planted with *Paspalum distichum*.

Digitaria didactyla was intentionally introduced to Hawaiʻi at least four times between 1916 and 1964, according to the Hawaiʻi Agricultural Experiment Station accession list (HAES n.d.), presumably to be trialed as a forage species. *Digitaria didactyla* is native to Madagascar, Mozambique, and other islands in the Indian Ocean (POWO 2023). It has been introduced to scattered localities across the tropics for use as both a lawn grass and pasture grass (Loch *et al.* 2013).

The common name for this species is Blue Couch, due to the bluish tinge often present in its leaves. This grass typically has two or three inflorescence branches, but does not have any easy single characters to differentiate it from other Hawaiian *Digitaria* species; identification is best done using the key below. This species may also be confused with *Paspalum distichum*, as they both typically have two inflorescence branches and similar stoloniferous habit, but differ in spikelet size, along with *P. distichum* lacking a lower glume and *D. didactyla* having one.

The following description is taken from Barkworth *et al.* (2003: 376):

“Plants perennial; stoloniferous and rhizomatous, mat-forming. Culms 15–40(63) cm, rooting and branching from the lower nodes. Sheaths densely to sparsely hairy, with 3–5 mm papillose-based hairs; ligules 1–1.5 mm; blades 2.5–7 cm long, 1–3

mm wide, flat or folded, usually glabrous, green to bluish-green. Panicles with 2–4 spikelike primary branches digitately arranged; primary branches 2–7 cm, axes wing-margined, wings at least 1/2 as wide as the midribs, spikelets somewhat imbricate, in unequally pedicellate pairs; secondary branches rarely present; pedicels not adnate to the branches; shorter pedicels 1–1.5 mm; longer pedicels 2–3 mm; axillary panicles not present. Spikelets homomorphic, 2–2.8 mm long, about 0.8 mm wide. Lower glumes to 0.3 mm, triangular; upper glumes from 1/2–3/4 as long as the spikelets, 3-veined, pilose on the margins and sometimes between the veins; upper lemmas equaling the spikelets, prominently 7-veined, veins equally spaced, margins and sometimes the intercostal regions pilose, hairs 0.3–0.5 mm; upper lemmas slightly shorter than the lower lemmas, almost smooth, gray, sometimes purple-tinged, at maturity. $2n$ = unknown.”

Material examined. **KAUAI:** Koloa, The Club at Kukui‘ula, weed in ‘Seadwarf’ seashore *Paspalum* turf, 18 Aug 2022, *G. Araki s.n.* (BISH 788657). **HAWAII:** Hilo, shopping center at Mamalahoa Hwy and East Kahaopea St, weed in mowed grass on edge of parking lot, leaves bluish glaucous, glabrous, stoloniferous, two small patches observed about 1 m wide each in a lawn otherwise consisting of *Axonopus* sp., 35 m, 19.692136, -155.066703, 07 Aug 2022, *K. Faccenda* 2590.

Digitaria henryi Rendle

New state record

Digitaria henryi was synonymized with *D. ciliaris* by Veldkamp (1973), who stated: “Another small form [of *Digitaria ciliaris*] with a \pm persistently contracted panicle has been described as *D. henryi* (but the racemes may become spreading!). Except for this feature I can not find any other morphological difference.”

However, during my fieldwork and examination of the Hawaiian *Digitaria* I was unable to reach the same conclusions as Veldkamp and found many features reliably separating these species. The species differ in spikelet length, panicle branch length, and presence of hairs on the leaf sheaths. Photographs of the type specimens of both species were also examined to confirm that they matched Hawaiian material. Furthermore, no material was found during the course of this work that could be considered intermediate between the two species. Based on this I am treating *D. henryi* as a valid species and following the taxonomy of authors from the native range of *Digitaria henryi* who never accepted its synonymization (Huang 2000; Wu *et al.* 2006).

The differences observed between *D. ciliaris* and *D. henryi* include a difference in leaf sheath pubescence, spikelet lengths, panicle lengths, and panicle structure. All information recorded below was based on observation of material from Hawai‘i. Approximately 20 measurements were made per trait per species; variation is reported in units of standard deviation. *Digitaria ciliaris* has consistently ciliate leaf sheaths, spikelets ranging from 2.5–3.5 mm long (average 2.85 ± 0.31), panicles ranging from 5–17 cm long (average 10 ± 3.2), panicle branches held perpendicularly or slightly ascending, and pubescent lowest node of the panicle. *Digitaria henryi* has consistently glabrous sheaths, spikelets ranging from 2.1–2.7 mm long (average 2.48 ± 0.12), panicles ranging from 2–9 cm long (average 5 ± 1.8), panicle branches strongly ascending and held closely together, and glabrous lowest node of the panicle.

Digitaria henryi was first collected in Hawai‘i in 1923 on Maui and has since been documented on Kure, Midway, French Frigate Shoals, Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, Kaho‘olawe, and Hawai‘i. At the time of its introduction in Hawai‘i, it was immediately recognized as a different species from *D. ciliaris* (Whitney 1937) and was

synonymized only after the publication of Veldkamp's 1973 treatment of *Digitaria*. As over 70 specimens of this grass exist from Hawai'i, only the earliest record for each island is cited below. Recent fieldwork has shown that *D. henryi* is currently widespread on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i at low elevations and is expected to be similarly widespread on the other islands.

The following description is from the Flora of China (Wu *et al.* 2006: 543):

"Perennial. Culms tufted, slender, prostrate, often rooting at lower nodes, 20–50 cm tall. Leaf sheaths glabrous; leaf blades narrowly lanceolate, 3–8 × 0.2–0.5 cm, glabrous or sparingly hispid near base, apex acute; ligule 1–2 mm. Inflorescence subdigitate, axis short; racemes 3–9, erect and clustered, never divergent, 4–8 cm; spikelets paired; rachis flat, winged ca. 0.5 mm broad, margins scaberulous. Spikelets lanceolate, 2.2–2.8 mm, acuminate; lower glume ca. 0.2 mm; upper glume lanceolate, 1/2 as long as spikelet, 3-veined, pilose; lower lemma slightly longer than upper lemma, 7-veined with broader intervein spaces flanking the midvein, pilose along lateral intervein spaces and margins; upper lemma yellowish green to gray, apex acute. Fl. and fr. summer–autumn. $2n = 36$."

Material examined. **KURE:** Green Island, used as lawn around quarters, also in a few open places throughout island, on beach near pier, 14 Aug 1964, *C.H. Lamoureux 2777*. **MIDWAY:** Sand Island, common roadside weed, 19 Jun 1980, *D. Herbst 6346*. **FRENCH FRIGATE SHOALS:** Tern Island, common, especially along edges of runway, 31 Aug 1968, *D. Herbst 1211*. **KAUA'I:** PTBG [Pacific Tropical Botanical Garden], Lāwa'i Valley, occasional in valley, 26 Jan 1972, *D. Herbst 2335*. **O'AHU:** East Mānoa Rd, 25 Feb 1930, *O.H. Swezey s.n.* (BISH 118607). **MOLOKA'I:** Top of Mauna Loa, 03 Sep 1936, *L.D. Whitney 4228*. **LĀNA'I:** Lālākoa, 13 Apr 1928, *G.C. Munro 314a*. **MAUI:** Hiku, 1923, *G.C. Munro 516*. **KAHO'OLAWA:** Northeastern part of island between Lua Makika and Lua Keālia Luna, 1300 ft [396 m], 24 Apr 1980, *L.W. Cuddihy 397*. **HAWAII:** north of Ka'ahola Lighthouse, Hāwī, growing on soil near ocean, 08 Feb 1952, *O. Degener 21807*.

Digitaria longiflora (Retz.) Pers.

New state record

Digitaria longiflora was found during roadside surveys on O'ahu, where only a single plant was found growing in Whitmore Village. This area we resurveyed several months after the original collection and no more plants were found, suggesting there is no population established at Whitmore. This species is still published as a full naturalization as it is possible that this was a satellite population of a yet-undiscovered source population. *Digitaria longiflora* has previously been erroneously reported to occur in Hawai'i by Hitchcock (1922), Rotar (1968), & St. John (1973), but these were based on misidentifications of *D. violascens*. *Digitaria longiflora* has stolons and light brown fertile lemmas at maturity, whereas *D. violascens* is caespitose and has fertile lemmas that are very dark purple and sometimes approaching black.

Digitaria longiflora is native to Africa, Southeast Asia, and Malesia, and has become naturalized in Florida and much of South and Central America (POWO 2023). In its introduced range it grows in grasslands, field margins, and weedy places (Wu *et al.* 2006). *Digitaria longiflora* is very similar to *D. fuscescens*, as the species differ only based on presence of hairs on the floret (present in *D. longiflora*, absent in *D. fuscescens*). It is possible they could be considered the same species (Wu *et al.* 2006; Cope 1982), but most authors currently consider them distinct (Veldkamp 1973; Wu *et al.* 2006; Boonsuk *et al.* 2016).

The following description is taken from Barkworth *et al.* (2003: 370):

“Plants of indefinite duration; stoloniferous, stolons long and branching. Culms 10–60 cm, occasionally branching from the lower nodes. Leaves 3–4, clustered near the base; sheaths usually glabrous; ligules 0.5–1 mm; blades 1.5–4 cm long, 3–5 mm wide, mostly glabrous, bases subcordate and ciliate, with 0.6–1 mm papillose-based hairs. Panicles with 2(–4) spikelike primary branches, digitate; primary branches 2–5 cm, strongly divergent; branch axes about 1 mm wide, wing-margined, wings wider than the central midribs, bearing spikelets in unequally pedicellate groups of 3; secondary branches rarely present; shortest pedicels about 0.3 mm; middle pedicels about 1 mm; longest pedicels 1.5–2 mm, adnate to the branch axes basally; axillary panicles not present. Spikelets 1.2–1.5 mm, elliptic or slightly obovate, acute. Lower glumes absent; upper glumes equaling or almost equaling the spikelets, 5-veined, minutely pubescent between the veins and on the margins; lower lemmas subequal to the upper glumes, 7-veined, usually pubescent on the margins and lateral veins, occasionally glabrous, hairs, if present, 0.2–0.4 mm; upper lemmas about 1.2 mm, pale brown or pale gray, becoming light brown at maturity, acute; anthers 0.8–0.8 mm. $2n = 18$.”

Material examined. **OʻAHU:** Whitmore Village, Ahaehe Ave and Ehoeho Ave, from crack in pavement in shady area, only one plant seen, with stolons, mature lemmas yellow, 309 m, 21.511494, -158.020323, 18 Jan 2023, *K. Faccenda 3008*.

***Digitaria mollicoma* (Kunth) Henrard**

New state record

Digitaria mollicoma is now known from Hawaiʻi Island, where it was found naturalized on the edge of a parking lot in Waiākea. Only one small colony less than one meter wide was seen mixed with *Axonopus compressus*, *Cynodon dactylon*, *Digitaria didactyla*, and *D. fuscescens*. It is likely this grass is more widespread around Hilo, but it is very easily overlooked due to its small size.

Digitaria mollicoma is native to Southeast Asia including most countries between China, Indonesia, and the Philippines (Boonsuk *et al.* 2016). This is the first report of this species outside of its native range. *Digitaria mollicoma* is most similar to *D. fuscescens* but has visibly hairy florets and sheaths, whereas these structures on *D. fuscescens* are glabrous or nearly so (Boonsuk *et al.* 2016). It is also similar to *D. longiflora*, but differs as *D. longiflora* has glabrous leaf sheaths and smaller florets.

The following description is taken from Boonsuk *et al.* (2016: 262):

“Annual or perennial. Culms decumbent and creeping, 30–40 cm high; nodes pilose. Sheaths 1.2–3 cm long, densely pilose. Ligules 1–1.2 mm long. Blades linear to lanceolate, 2–5.5 cm by 3–5 mm, chartaceous, both surfaces densely pilose, apex acute. Inflorescences composed of racemes; peduncles glabrous; common axis absent. Racemes 2–3, longest 5–7.5 cm long, digitate; rachis ribbon-like, winged, margins serrulate, 0.7–0.8 mm wide. Pedicels terete to trigonous, glabrous; abscission discoid to cupuliform. Spikelets ternate, homomorphous, lanceolate, 2.1–2.3 long, apex acute; hairs smooth or verrucose with acute apex. Lower glume 0.1–0.2 mm long, membranous. Upper glume elliptic to slightly lanceolate, 1.9–2 mm long, chartaceous, apex acute, pubescent between nerves but with glabrous interspaces beside the midnerve or pubescent only on the margins, nerves 3. Lower lemma lanceolate, as long as the spikelet, chartaceous, apex acute, pubescent with glabrous interspaces beside the midnerve or pubescent only on the margins, nerves 7, equidistant. Upper lemma lanceolate, 2–2.1 mm long, coriaceous, apex acute or apiculate, yellowish. Anthers 0.6–0.8 mm long, yellowish. Caryopsis ellipsoid, 0.9–1 mm long, yellowish.”

Material examined. **HAWAII:** Hilo, shopping center at Mamalahoa Hwy and East Kahaopea St, weed in mowed grass on edge of parking lot, 34 m, 19.692284, -155.066719, 07 Aug 2022, K. Faccenda 2591.

***Digitaria nuda* Schumach.**

Questionable new island record

A single individual of *Digitaria nuda* was found growing in a flower bed at the Wavecrest Resort on Moloka'i, where it was likely introduced as a contaminant in nursery stock. As only a single plant was found, and it was a weed in a flower bed, this record should be treated as a questionable naturalization until *D. nuda* can be found growing in a more natural context or as part of a larger population. *Digitaria nuda* is now known to be naturalized on Kure Atoll, Kaua'i, O'ahu, Lāna'i, Maui, Kaho'olawe, and Hawai'i (Faccenda 2022), and questionably naturalized on Moloka'i.

Material examined. **MOLOKA'I:** 'Ualapu'e, Wavecrest Resort, weed in garden bed at resort on edge of parking lot, one plant seen in shady, irrigated area, 11 m, 21.054531, -156.840664, 30 Dec 2022, K. Faccenda 2969.

***Digitaria radicata* (J. Presl) Miq.**

New island record

Digitaria radicata is now known to be naturalized on Moloka'i, where a small colony of ca. 5 plants was found on a roadside near 'Ualapu'e. *Digitaria radicata* is now known from Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i (Imada & Kennedy 2020).

Material examined. **MOLOKA'I:** Rt 450, ca. 1 km E of 'Ualapu'e, roadside weed in partly sunny, moist area, rare along the road, only this one colony seen, about 1 m in diam. mixed with *Axonopus* and other weeds, 11 m, 21.065705, -156.822280, 29 Dec 2022, K. Faccenda 2944.

***Digitaria scalarum* (Schweinf.) Chiov.**

New state record

Critical examination of herbarium specimens identified as *Digitaria abyssinica* has revealed two distinct phenotypes: one with wide, hairy leaves, and another with narrow, largely glabrous leaves. Further research into the African *Digitaria* literature revealed that the narrow-leaved plants are best treated as *D. scalarum*. *Digitaria scalarum* was formerly synonymized with *D. abyssinica* based on the similarity of their florets (Clayton & Renvoise 1982), but more recent work supports them being treated as separate species that do not overlap in their morphology (Goetghebeur & Van der Veken 1989; Fish *et al.* 2015). During this work I examined photographed types of both species and confirmed that Hawaiian material matches each of them.

Digitaria scalarum was intentionally introduced by the agricultural experimental stations in the 1940s and planted on O'ahu, Maui, and Hawai'i. Most of the specimens formerly treated as *D. abyssinica* in Hawai'i are actually *D. scalarum*, and as such *D. scalarum* is now known to be naturalized on Kaua'i, O'ahu, Maui, and Hawai'i. The record for Hawai'i Island, where large colonies were found during surveys of the 'Ainahou Ranch in the Hawaii Volcanoes National Park, is reported for the first time. This species is an aggressive weed in Hawai'i, where it has been observed forming thick mats and seems to be more aggressive than *D. abyssinica*. *Digitaria scalarum* is also listed as a federal noxious weed (USDA 2010).

Digitaria scalarum is one of the most easily identified species of *Digitaria*, as no other grasses from the islands have a similar growth habit of rhizomatous and stoloniferous growth in combination with narrow leaves (3–6 mm wide), which are held



Figure 6. *Digitaria scalarum* climbing up to 2 m tall when supported by vegetation. Note the dense thatch of dead culms. Photo taken in Ha'ikū, Maui.

erectly. *Digitaria scalarum* is almost always observed forming monotypic or nearly monotypic stands and is also frequently observed climbing fences, trees, and other vegetation (Fig. 6). The mats formed by this grass are, at times, thick enough that I was able to stand on top of one and not touch the ground, as the stems were supporting my entire weight.

The following description is taken from (Goetghebeur & Van der Veken 1989: 161):

“A rhizomatous perennial, rhizome conspicuously well developed, growing deeply, straight with vertically growing offshoots, much branched at groundlevel, sometimes stoloniferous. Culms (10)20–40 cm., ascending from a creeping base, glabrous, nodes dark, glabrous or hairy. Leaf sheaths often with many bulbous based bristles, sometimes scaberulous. Ligule 1–3 mm. long, truncate, erose or subentire. Leaf laminae 5–10 × 0.3–0.6 cm., linear, flat or involute, glabrous or sometimes loosely hairy on both surfaces, scabrous along the crisped margin. Inflorescence composed of (2)4–10(12) racemes, (1)3–10 cm. long, erect to patent, sometimes branched at the base, solitary along a well developed common axis. Rhachis triquetrous, narrowly winged, up to 0.4 mm. broad, smooth to scaberulous, with scaberulous margins. Pedicels 2 nate, 0.5–2.5 mm. long, subterete to triangular, scaberulous, scarcely broadened at the apex. Spikelets (1.6)1.7–2.2(2.4) mm. long, oblong-ovate, swollen. Inferior glume 1/10–1/4 of the spikelet, conspicuously heteromorphic, often erose or truncate, nerveless, glabrous, hyaline, sometimes purplish. Superior glume c.4/5 of to as long as the spikelet, ovate to oblong, 5(7)-nerved, glabrous or with some short, fine

hairs in a marginal row, pale green, often purplish tinged. Inferior lemma as long as the spikelet, ovate-oblong with recurved margins, 7-nerved, glabrous or with a marginal row of short, fine hairs, pale green, often purplish tinged. Superior lemma as long as the spikelet, ovate-oblong, apiculate, swollen, bluish green to dark brown. Habitat: Sandy flood plains, wet spots in disturbed sandy soils, weed in gardens.”

Material examined. **KAUAI:** Kapaka St about 1 km S of Rt 56 (Kūhiō Hwy), roadside, sunny, moist-dry area, only one patch seen on this road, but abundant on Kahilihōlo Rd, 114 m, 22.200358, -159.459839, 30 May 2022, *K. Faccenda 2431*; Kapa’a Valley, Waiakea Rd, roadside weed, sunny, moist, occasionally mowed area, only one patch seen in this area, 122 m, 22.100174, -159.374390, 29 May 2022, *K. Faccenda 2399*; W of Puhi, ca. 1.7 W of Kaumuali’i Hwy intersection with Kipu Rd, 0.4 mi N of Halfway Bridge, mixed planted pasture of alien grasses, 12 Apr 2012, *W.C. Fleming s.n.* (BISH 764509). **O’AHU:** Kawaiolo, Drum Rd, mesic roadside setting, naturalized, 09 Mar 2016, *US Army 427*. **MAUI:** Ha’ikū, Kaupakalua Rd, near Ulumalu & Calassas, ‘Ōpaepilau Gulch, carpet-forming grass, 20°53’N, -156°17’W, *F. Starr & K. Martz 020130-2*; East Maui, Makawao Distr, Honokalā, roadside and pasture, 20°47’N, 156°04’W, 14 Jun 2002, *H. Oppenheimer H70205*; East Maui, Kokomo, very common wet pasture grass between Makawao and Hāna, 1 or 2 ft tall in open areas, but when supported by fences or vegetation can go to over 10 ft [3 m], Nov 1995, *R.W. Hobdy 3888*. **HAWAII:** Hawaii Volcanoes National Park, ‘Āinahou area, about 2 km S of Chain of Craters Rd, dry, partly sunny area along road, abundant, forming large monocultures along road and going over 10 m away from road, with *Digitaria eriantha* and *Cenchrus clandestinus*, 925 m, 19.347653, -155.226526, 17 Aug 2022, *K. Faccenda & J. Gross 2667*.

***Digitaria velutina* (Forssk.) P. Beauv.**

New state record

Digitaria velutina, a federal noxious weed (USDA 2010), is now known from Maui, where it is widespread and abundant on roadsides between Makawao and ‘Ulupalakua. At this point, it is certainly too widespread to be controlled on Maui. *Digitaria velutina* is native to Africa and has formed naturalized populations scattered throughout the tropics.

Digitaria velutina is similar in habit to other annual weedy species such as *D. abyssinica*, *D. ciliaris*, and *D. nuda*, but differs in often bearing secondary branches coming from the base of the lowest inflorescence branches. These secondary branches, when present, are a unique feature among Hawaiian *Digitaria*. Although not all inflorescences have them, when multiple inflorescences across a plant/population are examined they are very likely to be found. It also tends to have more inflorescence branches and smaller florets than the other annual *Digitaria* species found in Hawai’i. *Digitaria velutina* populations on Maui displayed two phenotypes in terms of their inflorescence structure: some had inflorescences where the branches were held nearly perpendicular to the main axis, but other populations had all their inflorescence branches held ascendant and parallel to the inflorescence axis (Fig. 7). Those populations with ascendent branches also have secondary branches, but they are also held ascendent, and are thus hidden within all the other branches. Both of these forms were also observed in herbarium material from this species’ native range.

The following description is taken from Barkworth *et al.* (2003: 378) but the duration was edited as they erroneously report it as having indefinite duration:

“Plants annual; loosely caespitose to straggling. Culms 15–80 m, decumbent, rooting and branching at the lower nodes. Sheaths pilose, with papillose-based hairs; ligules 1.8–2 mm; blades 4–15 cm long, 3–10 mm wide, pilose, with papillose-based hairs. Panicles with 5–18 spikelike primary branches on 2.5–5 cm rachises, lower branches usually verticillate; primary branches 3.5–10 cm long, 0.3–0.5 mm wide, narrowly



Figure 7. *Digitaria velutina* photographed on Maui. **A**, open panicle form with conspicuously divergent secondary branches; **B**, closed panicle form where secondary branches are appressed to primary branches.

wing-margined, wings less than 1/2 as wide as the midribs, bearing spikelets in unequally pedicellate pairs; secondary branches often present, often highly divergent; shorter pedicels 0.2–0.5 mm; longer pedicels 0.8–1.1 mm. Spikelets 1.5–2 mm long, about 0.5 mm wide, elliptic-lanceolate. Lower glumes absent or to 0.2 mm; upper glumes 1.5–1.7 mm, usually to 3/4 as long as the spikelets, 3-veined, villous between the veins, hairs tapering or parallel-sided; lower lemmas about as long as the spikelets, 7-veined, veins unequally spaced, 2 veins crowded together near each margin, 3 inner veins well-separated, pubescent on the margins and between the inner lateral veins, hairs about 0.2 mm, sometimes sparse, lateral veins smooth throughout or scabridulous only on the distal 1/3; upper lemmas 1.5–1.7 mm, usually gray at maturity, sometimes brown; anthers about 0.5 mm. $2n = 18$.”

Material examined. MAUI: ‘Ulupalakua, main highway ca. 8 km S of Kēōkea, roadside weed in disturbed areas in full sun, 515 m, 20.627955, -156.393667, 26 Oct 2022, *K. Faccenda* 2798; Kēōkea, along main highway, roadside weed in moist sunny areas, 809 m, 20.700420, -156.366421, 26 Oct 2022, *K. Faccenda* 2804; Kula, Kekaulike Ave near Puanani Pl., roadside in sunny area, 1068 m, 20.765807, -156.306126, 29 Oct 2022, *K. Faccenda & S. Vanapruks* 2835; Olinda, Hawea Pl., side of road in gulch, mesic mid-elevation, semi-shade, growing with *Persea*, *Ipomoea indica*, *Melinis minutiflora*, scattered clumps, semi-erect, furry leaves, some plants in area with secondary branching on inflorescence, naturalized, 2700 m, 20.823854, -156.293584, 05 Nov 2022, *F. Starr et al.* 221105-01.

KEY TO *DIGITARIA* IN HAWAII

The inflorescence of *Digitaria* consists of a panicle of 2 to many branches arranged digitately or paniculately. The flowers are needed to identify these with certainty, but with practice, the majority can be differentiated based on largely vegetative characters and inflorescence structure. If an identification of a *Digitaria* needs to be made with certainty, a pressed specimen should be made, as identification using only a hand lens in the field is not possible for all species. Florets of all species naturalized in Hawai'i are photographed in Figs. 8–11 for reference.

1. Spikelets ternately arranged (in groups of 3) at least in lower part of panicle branches; rachis with 2 wings; spikelets <2.5 mm long
 2. Fertile lemma whitish, straw, or light tan; plants decumbent with stolons; inflorescence branches typically 2–3, rarely up to 5
 3. Spikelets 1.7–2.5 mm long; sheaths conspicuously pubescent; spikelets hairy (look at mature spikelets) *D. mollicoma*
 - 3'. Spikelets 1.2–1.6 mm long; sheaths largely glabrous; spikelets entirely glabrous or hairy
 4. Florets entirely glabrous *D. fuscescens*
 - 4'. Florets with hairs *D. longiflora*
 - 2'. Fertile lemma dark brown to violet, occasionally lighter colored when immature; plants upright, caespitose; inflorescence branches 2–9
 5. Apex of pedicel without any hairs; florets with pilose hairs or appearing nearly glabrous *D. violascens*
 - 5'. Apex of pedicel with a corona of hairs surpassing tip of pedicel; sterile lemma with conspicuous clavate hairs (use >20× to view hairs) *D. stricta* var. *stricta*
- 1'. Spikelets paired; rachis usually 3-winged or triangular and lacking wings; spikelets typically >2 mm long (<2 mm in *D. orbata* & *D. velutina*)
 6. Perennials; caespitose, culms upright, without rhizomes or stolons, rarely rooting at nodes
 7. Spikelets long-hairy with brown and white hairs clearly visible to naked eye *D. insularis*
 - 7'. Spikelets glabrous to pubescent, lacking brown hairs
 8. Lower glume absent; spikelets <2 mm long *D. orbata*
 - 8'. Lower glume present; spikelets >3 mm long
 9. Panicle branches barren on lower 1/4–1/3 of their length; spikelets remotely spaced above and typically not overlapping *D. divaricatissima*
 - 9'. Panicle branches with spikelets uniformly distributed from base to apex; spikelets typically close and overlapping *D. eriantha* (in part)
 - 6'. Perennials or annuals; culms decumbent, with rhizomes, stolons, or rooting at nodes
 10. Panicle branches triangular, lacking wings of green tissue on edges (Fig. 11d–e)
 11. Spikelets entirely glabrous, with distinct lower glume
 12. Lower glume without a hyaline margin; upper glume 3 (rarely 5)-nerved; leaves 5–12 mm wide, hairy; panicle branches generally held horizontally or weakly ascending *D. abyssinica*
 - 12'. Lower glume with a hyaline margin; upper glume 5 (rarely 7)-nerved; leaves 2–6 mm wide, glabrous or sparsely hairy; panicle branches strongly ascending *D. scalarum*

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- 11'. Spikelets with white hairs, with or without lower glume
13. Inflorescence branches 2–4; leaves 1–6 mm wide, often bluish; densely stoloniferous and/or rhizomatous, forming a tightly matted turf
..... *D. didactyla*
- 13'. Inflorescence branches >4; leaves 2–17 mm wide; stoloniferous or not, not forming a tight turf
14. Annual; sometimes rooting at nodes but not stoloniferous; lower inflorescence branches usually compound at their base
..... *D. velutina* (in part)
- 14'. Perennial; strongly stoloniferous; inflorescence branches always simple *D. eriostachya*
- 10'. Panicle branches triangular, with wings of green tissue coming from the three edges
15. Sessile and pedicellate spikelets dimorphic (check middle to apex of panicle branches), sessile spikelet with nerves equally spaced, and pedicellate spikelet with nerves close to margins; pedicellate spikelets often with dense, spreading hairs when mature, these hairs not present on immature material (Fig. 9a–b) *D. bicornis*
- 15'. Not as above (florets of *D. ciliaris* occasionally dimorphic in pubescence but not venation)
16. Panicle branches held strongly ascending and parallel from inflorescence axis, diverging from axis by 20° at most
17. Upper glume up to 1/3 as long as floret; lower glume always absent
..... *D. setigera* (in part)
- 17'. Upper glume >1/2 as long as floret; lower glume present or absent
18. Sheaths & leaf blades glabrous; spikelets 2.1–2.7 mm long
..... *D. henryi*
- 18'. Sheaths & leaf blades hairy; spikelets 1.5–2.0 mm long
..... *D. velutina* (in part)
- 16'. Panicle branches strongly divergent from inflorescence axis, diverging by at least 30°
19. Veins of sterile lemma unequally spaced with a large area between midvein and adjacent vein compared to spacing between marginal veins (e.g. Fig. 9e)
20. Lower glume absent; upper glume up to 1/3 as long as spikelet
..... *D. setigera* (in part)
- 20'. Lower glume present or absent; upper glume >1/2 as long as spikelet
21. Panicle branches scabrous on margins; lower glume always present; delicate or coarse grasses with culms 1–2 mm diam. at base
..... *D. ciliaris*
- 21'. Panicle branches smooth on margins; lower glume absent or present; delicate grasses with culms ~1 mm diam. at base
..... *D. radicata*

- 19'. Veins of sterile lemma equally spaced (e.g. Fig. 10d)
22. Spikelets 2.8–3.5 mm long; stoloniferous perennial; inflorescence branches without cilia *D. eriantha* (in part)
- 22'. Spikelets <2.4 mm long; annual; inflorescence branches sometimes with 1–4 mm long cilia
23. Panicle with secondary branches from base of lower panicle branches; florets <2 mm long; upper glume $>3/4$ as long as floret *D. velutina* (in part)
- 23'. Panicle without secondary branches; florets 1.7–2.4 mm long; upper glume $1/3$ – $4/5$ as long as floret
24. Upper leaf surface glabrous or with a few hairs near base; upper glume $2/5$ – $4/5$ as long as floret; lower glume usually absent on most florets *D. nuda*
- 24'. Upper leaf surface usually hairy; upper glume $1/3$ – $1/2$ as long as floret; lower glume usually present on most florets *D. horizontalis*

***Dinebra retroflexa* (Vahl) Panz.**

var. *retroflexa*

New state record

Dinebra retroflexa var. *retroflexa* was found during roadside surveys on O‘ahu in ‘Āhuimanu, where one patch approximately 20 m long was found, running along the edge of Ahilama Road. Only this one colony was located during roadside surveys. *Dinebra retroflexa* most closely resembles *Oplismenus hirtellus*, but *D. retroflexa* is distinguished by its annual habit, lack of stolons, and deciduous inflorescence branches (Fig. 12).

This species is native from Africa through the Middle East to India and Pakistan (Barkworth *et al.* 2003). *Dinebra retroflexa* has also been introduced to the continental United States, China, Japan, Australia, and several other countries (POWO 2023). Throughout its range, this species has been recognized as an aggressive weed of agriculture (Tanji 2020). For example, in the Nile Delta region, *D. retroflexa* is such a common weed it was used to name a weed community (Shaltout *et al.* 1992). In India, it is a dominant weed in soybean fields (Panda *et al.* 2015).

The following description is taken from Barkworth *et al.* (2003: 64):

“Plants loosely tufted. Culms 13–120 cm, decumbent, straggling, often rooting at the lower nodes. Leaves sometimes glandular, particularly on the sheaths; blades 4.5–28 cm long, 4–8 mm wide, finely pointed. Panicles 8–34 cm; branches 0.6–5(7) cm, stiff, initially ascending, reflexed at maturity; disarticulation at the base of the branches. Spikelets 5.7–9 mm, with 1–3 florets. Glumes 5.7–9 mm, asymmetric, coriaceous, keels glandular, apices caudate-curving; lemmas 2.1–2.9 mm, narrowly ovate, appressed pubescent on the lateral veins and adjacent to the lower $1/2$ of the central vein; paleas appressed pubescent on the flaps adjacent to the keels. $2n = 20$.”

Material examined. O‘AHU: ‘Āhuimanu, 300 m N of intersection of Ahilama Rd and Waihe‘e Rd, roadside weed from irregularly mowed area, in sun, rather dry, dominated by invasive grasses, patch extended around 20 m long along road, hundreds of plants, 10 m, 21.460071, -157.847848, 20 Sep 2022, K. Faccenda 2707.

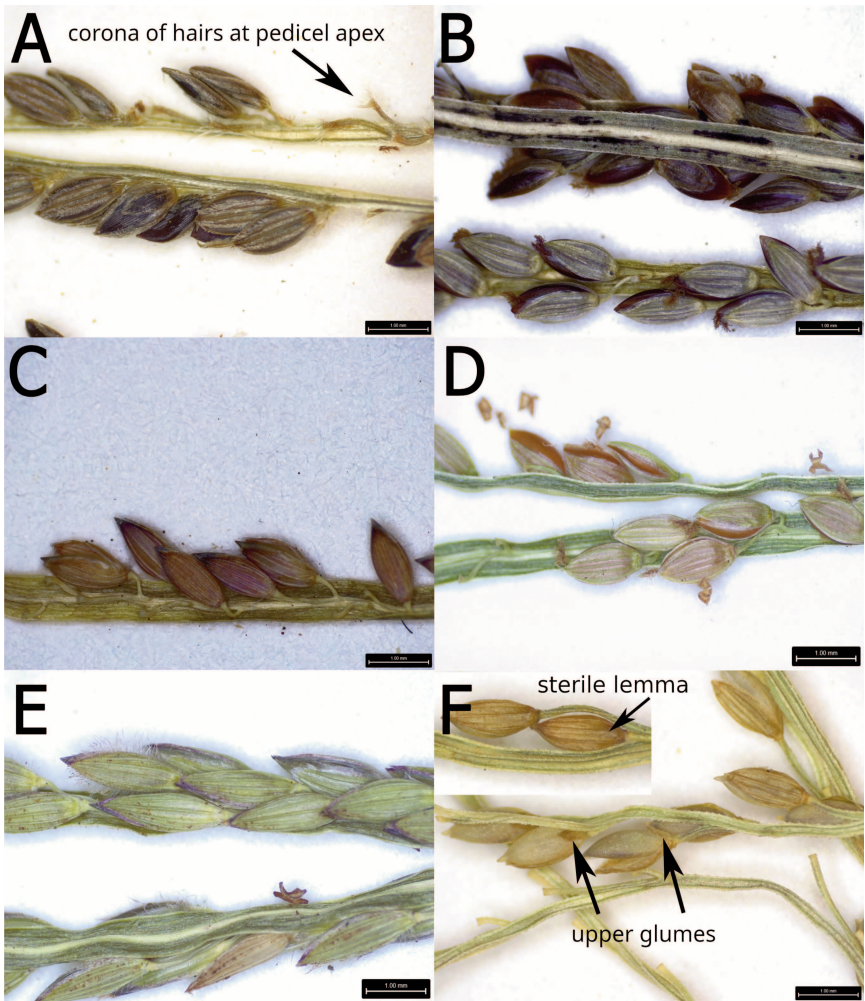


Figure 8. *Digitaria* spikelets. **A**, *D. stricta* var. *stricta* (Kawelo s.n., BISH 704712). **B**, *D. violascens* (T. Flynn 2720). **C**, *D. fuscescens* (D.R. Herbst 248). **D**, *D. longiflora* (K. Faccenda 3008). **E**, *D. mollicoma* (K. Faccenda 2591). **F**, *D. orbata* (R.W. Hobdy s.n., BISH 767427). All scale bars are 1 mm long. All photos were taken at BISH at 20 \times .

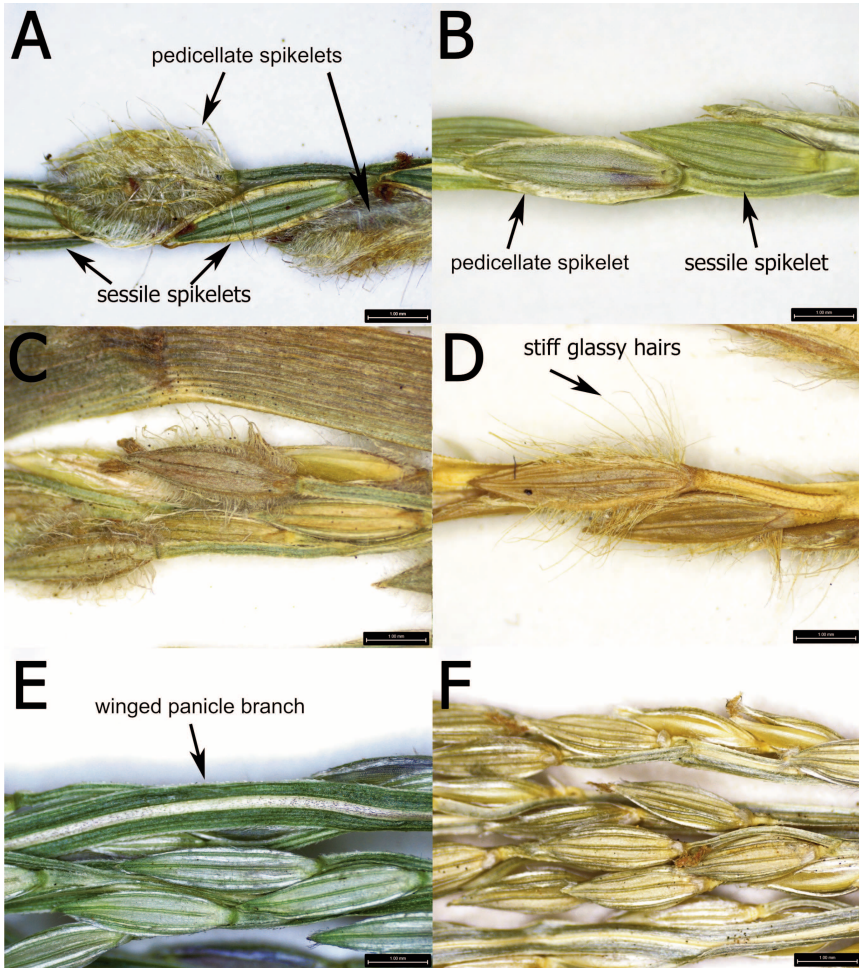


Figure 9. *Digitaria* spikelets. **A–B**, *D. bicornis*: **A**, spikelets at maturity with fimbriate hairs (Starr 020112-1); **B**, spikelets not yet mature (T. Flynn 2701). **C–E**, *D. ciliaris*: **C**, mature spikelets resembling *D. bicornis* (Starr 05334-18); **D**, form with glassy hairs on the florets, which is only found in the NW islands (Cornelison s.n., BISH 118638); **E**, most often encountered form (A. Ainsworth WNR005). **F**, *D. henryi* (Stone 1241). All scale bars are 1 mm long. All photos were taken at BISH at 20×.

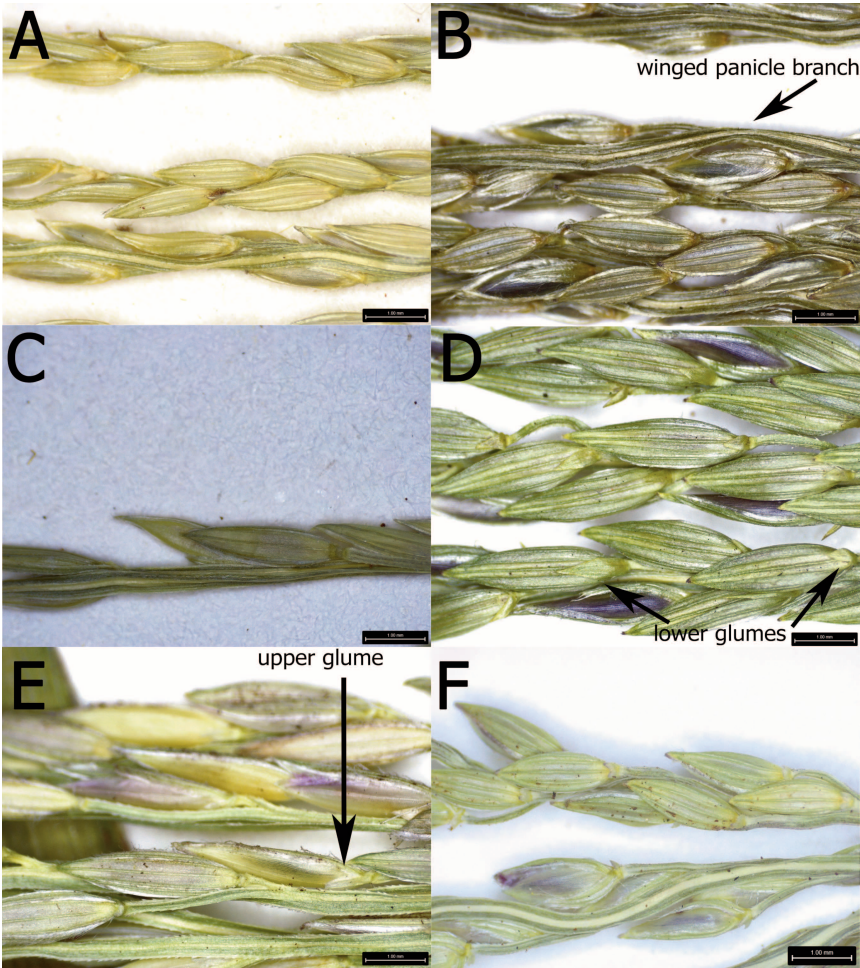


Figure 10. *Digitaria* spikelets. **A**, *D. horizontalis* (D.R. Herbst 696). **B**, *D. nuda* (D.R. Herbst 4027). **C**, *D. radicata* (T. Flynn 625). **D**, *D. eriantha* (T. Flynn 6134). **E**, *D. setigera* (K.M. Nagata 3854). **F**, *D. didactyla* (K. Faccenda 2590). All scale bars are 1 mm long. All photos were taken at BISH at 20 \times .

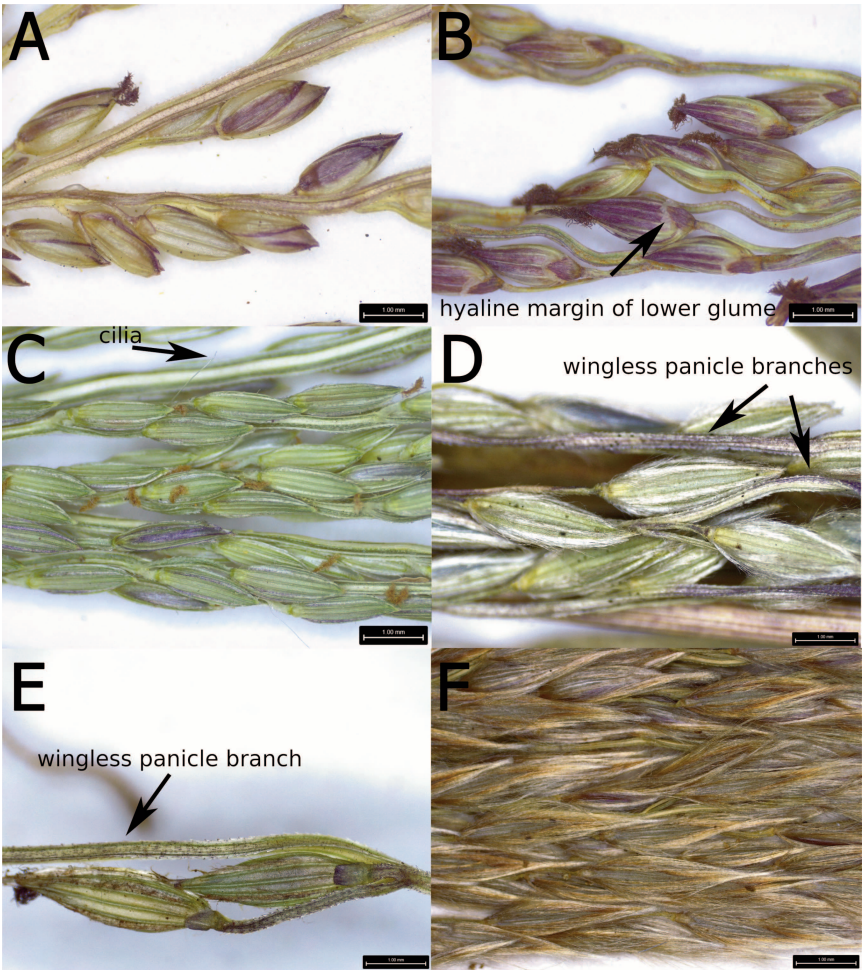


Figure 11. *Digitaria* spikelets. **A**, *D. abyssinica* (R.W. Hobdy 434). **B**, *D. scalarum* (W.C. Fleming 764509). **C**, *D. velutina* (K. Faccenda 2799). **D**, *D. eriostachya* (K.F. Bio 03-0016-01). **E**, *D. divaricatissima* (C. Imada 2002-39). **F**, *D. insularis* (F.R. Fosberg 29542). All scale bars are 1 mm long. All photos were taken at BISH at 20 \times .



Figure 12. *Dinebra retroflexa* var. *retroflexa* inflorescence from the Ahilama Rd. population.

***Echinochloa haploclada* (Stapf) Stapf**

New state record

Echinochloa haploclada was found growing in the Wāwāmalu channel at Ka Iwi, O‘ahu, where over 200 plants were seen growing in a concrete-lined portion of the channel (Fig. 13). It was identified as *E. haploclada* using the keys in Barkworth *et al.* (2003) and Clayton & Renvoize (1982). *Echinochloa haploclada* can be identified by its perennial habit and 1–2 m tall height. All other naturalized *Echinochloa* in Hawai‘i are annual and rarely surpass 1 m height.

In its native range of Eastern Africa, *E. haploclada* occurs in stream banks, dry river beds, and floodplains (Launert & Pope 1989). This is the second time this species has been reported outside of its native range, with the first being Trinidad and Tobago (POWO 2023). There are no records of intentional importation of the grass, nor any other obvious introduction mechanisms, making it unclear how this grass arrived in Hawai‘i.

The following description is from Launert & Pope (1989: 56):

“Tussocky perennial. Culms 30–300 cm. high, arising from a short oblique rhizome, often wiry; ligule absent or a line of hairs; leaf laminae occasionally marked with purple bars. Inflorescence 7–25 cm. long, lanceolate (occasionally linear); racemes 1–5 cm. long, densely crowded with appressed spikelets. Spikelets small, 1.5–2.5(3) mm. long, subglobose to elliptic, ± hispid. Inferior floret male, its lemma acute or with a short curved awn up to 5(15) mm. long. Superior lemma 1.5–2.3 mm. long.”

Material examined. **O‘AHU:** Ka Iwi area, Wāwāmalu channel, where it goes under the road, in the concrete channelized streambed and area where the concrete disappears and a paragrass-filled streambed appears, over 200 plants seen, caespitose perennial, almost 2 m tall, inflorescence reddish purple, from saturated soil in full sun, 5 m, 21.297434, -157.662533, 07 Apr 2023, *K. Faccenda & M. Ross 3092*.



Figure 13. *Echinochloa haploclada* habit in the Wāwāmalu channel.

***Ehrharta erecta* Lam.**

New island record

Formerly known to be naturalized only on Maui (Imada 2019), *Ehrharta erecta* is now known on Hawai'i Island from one collection made on the side of Rt. 250 in Kohala. It is likely that this plant came from a seed transported by vehicles, as the habitat was unlike where this was seen on Maui. The source population on Hawai'i Island has yet to be discovered.

Material examined. **HAWAII:** Kohala, Rt 250, about 8 km away from Rt 19, edge of road, sunny dry area, rare, one plant seen, 1047 m, 20.072859, -155.760952, 05 Mar 2022, K. Faccenda 2331.

***Enneapogon cenchroides* (Licht.)**

C.E. Hubb.

New state record

Enneapogon cenchroides is now known from O'ahu, where it was found growing in Mākaha Valley about 600 m makai of the resort along the roadside. Over 500 plants were seen. This grass was growing in an area otherwise dominated by *Cenchrus ciliaris*. *Enneapogon cenchroides* was largely confined to infrequently mowed areas along the roadside, as it apparently could not compete with *C. ciliaris*; however, a few unmowed areas where the soil was shallow and rocky were dominated by *E. cenchroides* rather than *C. ciliaris*. Based on this behavior of growing from shallow and rocky soils, it is likely that this grass will spread up the ridge separating Mākaha and Mākua-Kea'au valleys, if it has not done so already, as the ridge was not surveyed.

Enneapogon cenchroides is native to Africa through the Middle East and India, but has become naturalized in Brazil and Arizona (POWO 2023). It is found in woodlands, grasslands, and disturbed areas, where it usually grows from poor, rocky or sandy soils (Fernandes *et al.* 1971). *Enneapogon cenchroides* can be identified by its annual habit, spicate to racemose inflorescence (Fig. 14), and lemmas with nine awns that are plumose at maturity



Figure 14. Inflorescences of *Enneapogon cenchroides* from the Mākaha population. Note that while most inflorescences were panicleate, other plants in the population had more spikelike inflorescences.

The following description is taken from Fernandes *et al.* (1971: 148):

“A loosely caespitose annual or rarely shortly lived perennial, densely glandular-pubescent all over. Culms 15–100 cm. tall, 2–5-noded, rather stout, geniculately ascending, seldom erect, sometimes decumbent, simple or branched below. Leaf-sheaths relatively tight, usually slightly shorter than the internodes, striate, smooth or somewhat asperulous towards the mouth. Leaf-laminae 3–25 × (0.1)0.3–0.7(1) cm., linear to lanceolate-linear, long-tapering to a fine point, expanded or convolute (often only towards the apex), rigid to subflaccid, scaberulous on the upper surface and along the margins. Panicle 3–15(20) cm. long, spike-like, usually dense and contracted, rarely somewhat open below, compact, rarely interrupted. Spikelets 3–5 mm. long, usually crowded, 3-flowered. Glumes slightly unequal, light to dark grey or grey-green; the inferior 2.8–4(5.1) mm. long, 5–7-nerved, ovate; the superior 3.2–5.5(6.8) mm. long, 3-nerved, oblong, often with the apex somewhat truncate. Fertile lemma (the inferior) 1.5–2 mm. long (excluding the awn), dorsally shortly villous; awns 3–4.25 mm. long, plumose up to or beyond the middle. Palea 2–2.25 mm. long, with the keels ciliolate. Anthers 0.8–1.8(2.3) mm. long.”

Material examined. **O‘AHU:** Mākaha, Kili Dr, about 600 m SW of the resort, dry, occasionally mowed roadside area, full sun, 38 m, 21.479400, -158.208981, 16 Jan 2023, *K. Faccenda & M.C. Ross 2983*.

***Eragrostis atropioides* Hillebr.**

Note

A large colony of *Eragrostis atropioides* was observed on Saddle Road at about 1680 m growing vigorously from a recently burned area. In this area the grass was forming a near monoculture. On the burned side of the road, the number of flowering culms appeared greater than on the unburned side, suggesting that the growth of this species is promoted by fire, a trait not commonly observed in Hawaiian species. Promotion of this species by fire has also been reported by Banko & Farmer (2014). Shaw (1995) also reported *E. atropioides* regenerating after fire. Invasive grasses such as *Cenchrus setaceus* were also observed in this area, and the *E. atropioides* was successfully competing with them. *Dactylis glomerata* was growing mixed with *E. atropioides*, although it was uncommon.

***Eragrostis barrelieri* Daveau**

New island records

Eragrostis barrelieri is now also known to occur on Kaua‘i, where it was found in the vicinity of Waimea. *Eragrostis barrelieri* was also very frequently encountered during roadside surveys on Moloka‘i, where it was a dominant component of the annual communities of dry areas around the island. Given that millions of individuals were estimated to be germinating from the seedbank across the island during recent rains, it is likely that this grass has been present on the island for at least 20 years. The populations seen on Moloka‘i were much more extensive than any seen during roadside surveys on any other island. It was often seen with other annuals, including *Lepidium didymum*, *Malva parviflora*, and *Dysphania carinata*. *Eragrostis barrelieri* is now known to be naturalized on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Kaho‘olawe (Faccenda 2022).

Material examined. **KAUAI:** Waimea, Russian Fort Elizabeth, at recently installed statue of Kaumuali‘i, irrigated area around statue in otherwise very dry, sunny landscape, about 15 plants seen, 4 m, 21.952671, -159.663661, 07 Jul 2022, *K. Faccenda 2512*. **MOLOKA‘I:** western end of island, Papapa Rd off of Kalua Ko‘i Rd, roadside weed in shoulder, very dry, sunny area, annual popping up and flowering after only about 1 week since the first winter rains, hundreds of plants in this area, very common across the island, 34 m, 21.159249, -157.264829, 26 Dec 2022, *K. Faccenda 2895*; Ho‘olehua, Moloka‘i Airport, long-term parking lot, weedy area around parked cars, rarely mowed, sunny, 138 m, 21.156067, -157.094023, 26 Dec 2022, *K. Faccenda 2886*.

***Eragrostis curvula* (Schrad.) Nees**

New island records

Eragrostis curvula is now known to be naturalized on Moloka‘i, Lāna‘i, and Hawai‘i. This species was previously reported only on O‘ahu, Maui, and Kaho‘olawe (Imada 2019).

Material examined. **MOLOKA‘I:** W-facing slopes at Mākoīelau, numerous plants present, 530 m, 18 Mar 1992, *J.K. Normann s.n.* (US 1052776). **LĀNA‘I:** Hi‘i Flats, along unimproved road in waste area, 20.813223, -156.895002, 600 m, 11 May 2006, *H. Oppenheimer H50618* (PTBG); Manele Rd ca. 700 m S of intersection with Kaunalapau Hwy, roadside, moist sunny, occasionally mowed area, 6 plants seen, rare, only patch observed on entire island, 20.810132, -156.913167, 20 Jun 2023, *K. Faccenda & J. Sprague 3144*. **HAWAI‘I:** Hawaii Volcanoes National Park, ‘Āinahou area, about 4 km S of Chain of Craters Rd, dry open area on roadside, about a dozen plants seen along road, 858 m, 19.338004, -155.224522, 17 Aug 2022, *K. Faccenda & J. Gross 2668*.

Eragrostis multicaulis* Steud.*New state record**

Previously reported as questionably naturalized on Hawai'i Island by Faccenda (2022) based on a specimen from 1943, *Eragrostis multicaulis* is now known to have persisted, as a specimen was found from 1973.

Material examined. **HAWAI'I:** Volcano, Wright Rd, naturalized in bulldozed area, 23 Aug 1973, O. Degener & I. Degener 33429 (NY).

Eragrostis pilosa* (L.) P. Beauv. var. *pilosa**New island records**

Eragrostis pilosa, an easily overlooked annual weed, was found naturalized on Moloka'i, Maui, and Hawai'i during roadside surveys. On Hawai'i Island, it has been found growing as a weed in Hilo and Captain Cook, growing from cracks or edges of pavement. Another population was also collected in the vicinity of Pu'u Wa'awa'a along the roadside, and was seen along the trail to the crater. On Maui it was found along Hāna Highway and in Ha'ikū. On Moloka'i, a population of many hundreds of plants was found along Rt. 460. *Eragrostis pilosa* is now known from Kaua'i, O'ahu, Moloka'i Maui, and Hawai'i (Imada 2019; Faccenda 2022).

Material examined. **MOLOKA'I:** Maunaloa, 3 km E of intersection of Rt 460 and Kalua Ko'i Rd, mowed roadside, sunny, rather dry area, large colony in this area composed of hundreds of plants, one other colony seen about 1 km down the road of similar size, these two colonies the only ones encountered on the island, 333 m, 21.148147, -157.163256, 27 Dec 2022, K. Faccenda & C. Daehler 2914. **MAUI:** Hāna Hwy ca. 200 m E of Wai'anapanapa State Park, wet, sunny roadside dominated by weeds, 53 m, 20.781917, -156.007264, 23 Oct 2022, K. Faccenda 2773; Ha'ikū, Hog Back Rd, weed from crack in pavement in moist, sunny area, 252 m, 20.903950, -156.310079, 30 Oct 2022, K. Faccenda & S. Vanapruks 2839. **HAWAI'I:** Captain Cook, along Hwy 11, weed from crack in pavement of parking lot, 19.499973, -155.919894, 03 Mar 2022, K. Faccenda 2290; Hilo, Kīlauea Ave N of East Kahaopea St, on edge of parking lot, 36 m, 19.692374, -155.068099, 07 Aug 2022, K. Faccenda 2587; Pu'u Wa'awa'a, roadside of Hwy 190, dry, sunny area from roadside gravel, common locally, 585 m, 19.796586, -155.862398, 03 Mar 2022, K. Faccenda 2287.

***Eragrostis tenuifolia* (A. Rich.)**

Hochst. ex Steud.

New island record

Roadside surveys on Moloka'i found that *Eragrostis tenuifolia* was widespread and common as a roadside weed across most of the island. This grass has surely been present on the island for many years given how widespread it is and must have been overlooked by past botanists. *Eragrostis tenuifolia* is now known to be naturalized on Kaua'i, O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i (Imada 2019).

Material examined. **MOLOKA'I:** Ho'olehua, Moloka'i Airport long-term parking lot at airport, weedy area around parked cars, rarely mowed, sunny, abundant from compressed soil on edges of roads, very common across entire island, 138 m, 21.156214, -157.094385, 26 Dec 2022, K. Faccenda 2888.

Eragrostis unioides* (Retz.) Nees ex Steud.*New island record**

Eragrostis unioides was previously reported as naturalized on Hawai'i Island (Herbst & Wagner 1999), and was erroneously reported on Maui (Oppenheimer 2008; Faccenda 2022). Now *Eragrostis unioides* is known from Maui, where it was found along the Hāna Highway. Only two plants were seen during roadside surveys, making the plant currently rather rare on the island.

Material examined. **MAUI:** Hāna Hwy ca. 4 km W of Wai‘ānapanapa State Park at roadside coconut stand and restaurant, 170 m, 20.794499, -156.052268, 23 Oct 2022, *K. Faccenda* 2753.

***Eremochloa ophiuroides* (Munro) Hack. New state record**

Previously reported as a questionable naturalization on O‘ahu, where it may have been planted (Faccenda 2022). *Eremochloa ophiuroides* has now been documented as naturalized on Kaua‘i and Hawai‘i, where it was found on roadsides and in pastures.

Material examined. **KAUAI:** Wailua Game Reserve, above Wailua, vegetation on plots stripmined for bauxite in 1958–60, Jul 1983, *S. Lum* 72 (PTBG); Kalāheo, National Tropical Botanical Garden off of Papalina Rd, along main road heading down valley into garden, before road starts heading steeply downhill, on exposed steep soil of roadcut where no other vegetation is growing, sunny, several colonies along road, not seen growing in mowed areas nearby but only on roadbank slopes, suggesting that this is a naturalized population, 112 m, 21.905595, -159.511015, 29 May 2022, *K. Faccenda* 2385. **HAWAII:** Kahuku Unit of Hawaii Volcanoes National Park, near main parking lot and toilet, in both compressed soil of parking area and spreading into nearby scrubby area, growing over 10 m from edge of parking area, naturalized and spreading, strongly stoloniferous, 651 m, 19.063700, -155.678216, 08 Aug 2022, *K. Faccenda* 2598; Hawaii Volcanoes National Park, old horse pastures about 200 m N of Tree Molds Rd at base of Mauna Loa Strip Rd, old pasture land, now mostly dominated by *Cenchrus clandestinus*, one colony, about 5 m wide in sunny, dry area, 1218 m, 19.435196, -155.284374, 16 Aug 2022, *K. Faccenda* 2659; Hawaii Volcanoes National Park, ‘Āinahou area, about 4 km S of Chain of Craters Rd, dry open area on roadside, one patch seen along road, about 50 m long, growing into shrubby areas away from road as well as from the dirt road itself, 860 m, 19.338351, -155.224088, 17 Aug 2022, *K. Faccenda* 2669.

***Eriochloa acuminata* (J. Presl) Kunth**

var. *acuminata*

New state record

Eriochloa acuminata var. *acuminata* is now known to occur on West Maui, where it was collected once in 2000 at Lāhainā. *Eriochloa acuminata* can be identified by the small beadlike structure subtending the floret, annual habit, and acute (never acuminate) spikelets 3.8–5 mm long. *Eriochloa acuminata* is native to the southern United States and northern Mexico (Barkworth *et al.* 2003). This is the first time this species has been reported outside of its native range. Shaw & Webster (1987) note that *E. acuminata* is a noxious weed in the southwestern U.S., and often infests field crops.

The following description is from the Flora of North America (Barkworth *et al.* 2003: 515):

“Plants annual; caespitose. Culms 30–120 cm, erect or decumbent, sometimes rooting at the lower nodes; internodes glabrous or with scattered hairs; nodes glabrous or pilose. Sheaths sometimes conspicuously inflated, glabrous or pubescent; ligules 0.2–1.2 mm; blades 5–12(18) cm long, (2)5–12(16) mm wide, linear, flat or folded, straight or lax, glabrous or sparsely pubescent adaxially. Panicles 7–16 cm long, 1–6 cm wide, loosely contracted; rachises scabrous or hairy; branches 5–20, 1–5 cm long, 0.4–0.6 mm wide, appressed to divergent, pubescent, sometimes setose, not winged, with 20–36 spikelets, spikelets mostly in unequally pedicellate pairs, solitary distally; pedicels 0.1–1 mm, hairy. Spikelets 3.8–5(6) mm long, 1.1–1.4 mm wide, lanceolate to ovate. Lower glumes absent; upper glumes equaling the lower lemmas, lanceolate to ovate, hairy, 5(7)-veined, acuminate to acute, unawned or awned, awns to 1.2 mm; lower lemmas 3.6–5 mm long, 1.1–1.4 mm wide, lanceolate to ovate, setose, 5(7)-veined, acuminate to acute, unawned; lower paleas absent; anthers absent; upper lemmas 2.3–3.3 mm, 0.7–0.9 times as long as the lower lemmas, indurate, elliptic, rounded, 5-veined, awned, the awns 0.1–0.3 mm; upper paleas indurate, blunt, rugose. $2n = 36$.”

Material examined. **MAUI:** West Maui, Lāhainā Town, roadside waste area, 20 ft [6 m], 20°52'N, 156°40'W, 25 Jun 2000, *H. Oppenheimer H90002*.

***Festuca rubra* L.**

New island record; Note

Festuca rubra is now known to be naturalized on O'ahu, where it was found at the Ka'ala summit along the road. The colony extends along approximately 10 m of roadside and is at least 2–3 m deep. It is unclear how many plants were in this population, as this species spreads extensively via rhizomes, but it is clear that this population had been there for quite some time. *Festuca rubra* is now known to be naturalized on O'ahu, Maui, and Hawai'i (O'Connor 1990).

Material examined. **O'AHU:** Pu'u Ka'ala summit, roadside at summit, colony covering at least 20 m square of disturbed roadside, 1,213 m, 21.507916, -158.144288, 06 May 2023, *K. Faccenda & T. Chambers 3099*.

During recent fieldwork on Hawai'i in August 2022, two populations of *Festuca rubra* were found producing viviparous inflorescences in Hawaii Volcanoes National Park, one in Volcano at 1217 m and another in the Kahuku Unit at 1392 m. Further viviparous plants were found on the slopes of Haleakalā but were outnumbered by seminiferous plants. This is the first time vivipary has been observed in this species in Hawai'i, as all 45 prior collections produced seminiferous flowers. Viviparous inflorescences on *Festuca rubra* have been well documented and can be caused by both environmental conditions, or in plants with abnormal chromosome counts (Aiken *et al.* 1988). In *Festuca rubra*, links have been made between vivipary and high temperatures (Heide 1990) and even the presence of endophytes (Gundel *et al.* 2014). It is currently unknown what the underlying cause of vivipary is in these plants, or if they are capable of producing seminiferous flowers.

***Gastridium phleoides* (Nees & Meyen)**

C.E. Hubb.

New state record

Gastridium ventricosum was first published as naturalized in Hawai'i by Hitchcock (1922). However, the name has been misapplied in Hawai'i; after critical examination of specimens and consulting the keys in Barkworth *et al.* (1993) and Tutin *et al.* (1980), it was determined that all the Hawaiian material is a better match to *Gastridium phleoides*. This is not the first time these species have been confused, as an identical misapplication happened across the continental United States, as well (Barkworth *et al.* 1993).

This species was published as occurring on O'ahu by Hitchcock (1922) but never synthesized into modern checklists. As this species has not been recollected in the past 100 years it must be treated as a questionable naturalization. *Gastridium phleoides* is/was known to occur on Kaua'i, O'ahu (as questionable), Moloka'i, Maui, and Hawai'i. Only the first collection on each island is cited below.

Material examined. **KAUAI:** Kahōluamano, 21 Oct 1916, *A.S. Hitchcock 15435*. **O'AHU:** Schofield Bar[racks] - parade grounds, 12 Jul 1916, *A.S. Hitchcock 14048* (US). **MOLOKA'I:** Waiakoa, 13 Apr 1937, *L.D. Whitney 4479*. **MAUI:** Haleakalā, 2500 ft [762 m], Aug 1909, *U. Faurie 1356*. **HAWAI'I:** Mauna Loa, open pasture, 01 Apr 1936, *L.D. Whitney 4107*.

***Gastridium ventricosum* (Gouan)**

Schinz & Thell.

Correction

Gastridium ventricosum is no longer known to occur in Hawai'i, as all specimens have been redetermined to *G. phleoides*. See note above.

Hordeum brachyantherum* Nevski*Correction**

Hordeum brachyantherum is no longer known to occur in Hawai'i, as the specimen has been reidentified as *Hordeum depressum*. See further notes under that species.

***Hordeum depressum* (Scribn. &**

J.G. Sm.) Rydb.

Questionable new state record

Hordeum brachyantherum was first published in Hawai'i by Herbst & Clayton (1998). However, this identification was erroneous, as a duplicate specimen at US was annotated by Wray M. Browden, a Triticeae expert, as *H. depressum*. There is only one specimen of *H. depressum*, collected last in 1936 on Hawai'i Island; therefore, this species must be considered a questionable naturalization.

Material examined. **HAWAII:** Waiki'i, South Kohala, rare in open pasture, 1,219 m, 18 Sep 1936, *E.Y. Hosaka* 1623.

Hyparrhenia hirta* (L.) Stapf*New island record**

Hyparrhenia hirta is now known from Hawai'i Island, where it has occurred since at least 1963 at an ambiguous location on Mauna Loa. A recent collection from Pu'u Ke'eke'e in 2013 confirms that the species is still established on Hawai'i Island. Fieldwork on Maui also found this species naturalized on Copp Rd. on East Maui in Kula. This species is now known to be naturalized on Moloka'i, Lāna'i, Maui, and Hawai'i (Imada 2019).

Material examined. **MAUI:** Kula, Copp Rd & Holomakani Dr, roadside weed in occasionally mowed area, two clumps seen, leaves blueish, perennial, 944 m, 20.752984, -156.323601, 29 Oct 2022, *K. Faccenda* & *S. Vanaprucks* 2824. **HAWAII:** South Kohala Distr, Pōhakuloa Training Area, Ke'āmuku Unit on Pu'u Ke'eke'e, alien grassland with native shrubs, perennial bunchgrass with pubescent inflorescence, 1,700 m, 23 Jul 2013, *L.W. Pratt* 3968 (HAVO 20688a); Mauna Loa, 26 Apr 1962, *S. Uehara* s.n. (US 00425709).

Lolium arundinaceum* (Schreb.) Darbysh.*New island record**

During creation of a database of all grass records in Hawai'i it was realized that *Lolium arundinaceum* has only been treated as an adventive record on Hawai'i Island (O'Connor 1990). However, this species is naturalized at mid-elevations on Hawai'i Island. Six recent specimens exist of this grass from the Kahuku Unit of Hawaii Volcanoes National Park (HVNP), and one from Hakalau National Wildlife Refuge; it was also observed (but not vouchered) during roadside surveys in the HVNP Volcano Unit. *Lolium arundinaceum* is now known to be naturalized on Kaua'i, O'ahu, Maui, and Hawai'i.

Material examined. **HAWAII:** Ka'ū Distr, Hawaii Volcanoes National Park, Kahuku Unit, east of main road in pasture, 1000 m, 02 Feb 2004, *L.W. Pratt* 3362 (HAVO); Hakalau NWR, near koa plantings, 6500 ft [1981 m], 16 May 2003, *L.W. Pratt* 3313.

Lolium perenne* L.*New island record**

Lolium perenne, recorded as naturalized on O'ahu, Maui, and Hawai'i (Imada 2019), has now been found naturalized on Kaua'i at the National Tropical Botanical Garden, where it was collected in 1984.

Material examined. **KAUAI:** Lāwa'i Valley, PTBG [Pacific Tropical Botanical Garden], Pump Six, lawn grass, 31 Jul 1984, *T. Flynn* 903 (PTBG).

Lolium pratense* (Huds.) Darbysh.*Correction**

Critical examination of the specimen published as *Lolium pratense* by Snow (2008) found that the specimen has scabrous lemmas, awns on the lemmas up to 4 mm long, and short and wide auricles, all characters of *Lolium arundinaceum* (Terrell 1979; Tutin *et al.* 1980; Barkworth *et al.* 1993), and was therefore identified erroneously. As this was the only specimen of *L. pratense* known from Hawai‘i, this species should be removed from the Hawai‘i checklist.

Lolium temulentum* L.*Questionable new island record**

An old specimen of *Lolium temulentum* was discovered in the US herbarium collection documenting it on Hawai‘i Island. As it has not been recollected in the past 100 years, it should be considered a questionable naturalization. *Lolium temulentum* is now known to be questionably naturalized on Kaua‘i, O‘ahu, Maui, and Hawai‘i.

Material examined. **HAWAI‘I:** Near Hilo, 1917, *Bro. Matthias s.n.*¹. (US 1039015).

Melinis scabrida* (K. Schum.) Hack.*New island record**

Melinis scabrida, previously reported on O‘ahu by Faccenda (2022), is now known on Maui, where one collection had been made in Haleakalā National Park at Kaupō Gap. This plant had glumes and a sterile lemma that were nearly glabrous, but were otherwise a perfect match with the material found on O‘ahu.

Material examined. **MAUI:** Kaupō, under *Schinus*, 5000 ft [1524 m], 12 Dec 2005, *P. Welton s.n.* (HALE 3151).

Microlaena stipoides* (Labill.) R. Br.*Correction**

Microlaena stipoides was published as occurring on Kaho‘olawe by Herbst & Clayton (1998); however, the specimen cited (*Ellshoff 196*, BISH) represents *Flaveria trinervia*. There are no specimens of *M. stipoides* known from Kaho‘olawe; therefore, the species should not be treated as occurring on the island.

Moorochloa eruciformis* (Sm.) Veldkamp*New state record**

An unusual grass was located and brought to my attention by Allen Allison, which turned out to be *Moorochloa eruciformis*, a new state record, after using the keys in Barkworth *et al.* (2003) and Clayton & Renvoize (1982). This species is monotypic in its genus and is native from the Mediterranean to South Africa and east to China and has become naturalized in scattered localities on all other continents (POWO 2023). In Australia, *M. eruciformis* is a noxious weed of agriculture, especially in unirrigated systems (Salgotra & Chauhan 2021).

Moorochloa eruciformis was found naturalized next to a driveway on Alaeloa St. on Wai‘alae Ridge above Kahala. Only about a dozen plants were found in a small patch and no other patches were reported by Allen Allison as occurring nearby. *Moorochloa eruciformis* most closely resembles *Urochloa*, based on its inflorescence (Fig. 15), but can be recognized as distinct from all other naturalized *Urochloa* by its annual habit, creeping growth form rooting at the nodes, densely hairy florets, and shiny fertile lemma.

¹ Brother Matthias Newell (1854–1939) was the government Agricultural Inspector in Hilo from 1896–1923; hence, this could have been an interception from material deriving from elsewhere. — Editor



Figure 15. *Moorochloa eruciformis* inflorescence.

The following description is from Barkworth *et al.* (2003: 28):

“Plants mat-forming. Culms (10)19–60 cm, decumbent, rooting at the lower nodes before geniculate ascending, sometimes branching from the upper nodes; nodes pubescent; internodes glabrous. Sheaths glabrous or pubescent; ligules to 1 mm; blades 2–6(12) cm long, 3–6 mm wide, pubescent (rarely pilose) on both surfaces, bases subcordate. Panicles 4–9 cm long, 0.5–1 cm wide, exserted, with 3–15 erect to appressed branches; branches 1–2 cm, hispidulous; pedicels 0.1–0.5 mm, pubescent. Spikelets (1.6)2–2.6 mm long, 0.8–1 mm wide, ovate. Lower glumes 0.3–0.5 mm, to 1/5 the spikelet length; upper glumes (1.6)2–2.5 mm; lower lemmas longer than the paleas, 5-veined, without cross-venation; upper lemmas (1.4)1.7–1.8 mm long, 0.6–0.9 mm wide; anthers 0.5–1 mm, reddish. Caryopses 1–1.5 mm. $2n = 18, 36$.”

Material examined. **O‘AHU:** Honolulu, Alaeloa St near its intersection with Halekoa Dr, in weedy area next to driveway in front of house, sunny, rather dry area, stoloniferous annual to around 15 cm tall, small patch of around a dozen plants, area, 216 m, 21.288733, -157.778489, 24 Mar 2023, K. Faccenda & B. Najarain 3080.

***Muhlenbergia paniculata* (Nutt.)**

P.M. Peterson

Correction

Muhlenbergia paniculata was initially published based on a specimen from an agricultural experiment station (O’Connor 1990; cited as *Schedonnardus paniculatus*). While the label does not explicitly state that it was cultivated, Poamoho is also listed as the sole description on many other specimens from grass introduction gardens. Therefore, this species should not be listed as naturalized or even questionably naturalized in Hawai‘i.

Oplismenus hirtellus* (L.) P. Beauv.**subsp. ***undulatifolius* (Ard.) U. Scholz*Correction**

Oplismenus hirtellus subsp. *undulatifolius* was published as occurring in Hawai'i by Snow & Lau (2010), where they had delimited *O. hirtellus* subsp. *undulatifolius* from the typical variety by the presence of hairs on the sheaths, as described by Barkworth *et al.* (2003). However, the sheath pubescence is not considered diagnostic by Davey & Clayton (1977), Scholz (1981), Clayton & Renvoize (1982), Launert & Pope (1989), or Peterson *et al.* (1999). These authors all diagnose the subspecies based on the inflorescence structure, and using that character, all specimens formerly annotated as *O. hirtellus* subsp. *undulatifolius* have been redetermined to *O. hirtellus* var. *hirtellus*. As such, *O. hirtellus* subsp. *undulatifolius* should be deleted from the Hawai'i checklist.

Panicum coloratum* L.*Correction**

Panicum coloratum was first reported as naturalized on Maui by O'Connor (1990) based on Hosaka 2448; however, the label of that specimen states that it was grown at an experimental farm in Makawao. As this species was not naturalized at the time of the Hosaka collection, and has no present evidence of naturalization, it should be removed from the checklist for Maui.

Panicum dichotomiflorum* Michx.*Correction**

Similar to the two entries above, *Panicum dichotomiflorum* is only known on O'ahu from one collection at the Poamoho Experiment Station, where it was almost certainly cultivated. Therefore, it should not be considered naturalized on O'ahu.

Panicum pygmaeum* R. Br.*New state record**

Panicum pygmaeum, an Australian species, is recorded for the first time outside of its native range on Hawai'i Island in 'Ōla'a at Hawaii Volcanoes National Park, where it was found near houses. Its introduction method is unclear but was likely an accidental introduction. Emmet Judziewicz (University of Wisconsin-Stevens Point) initially identified this grass and his identification was confirmed by the author.

Panicum pygmaeum can be identified by its decumbent stoloniferous habit <30 cm tall, and small "Panicum-type" panicles 2–8 cm long. It is most similar to *Cyrtococcum patens* but differs in its spikelets, as the spikelets on *P. pygmaeum* are dorsoventrally compressed, whereas *C. patens* has laterally compressed florets.

The following description is taken from Simon & Alfonso (2011):

"Perennial. Rhizomes absent. Stolons present. Culms decumbent, stature slender to delicate, 8–29 cm tall, 2–5-noded. Mid-culm internodes glabrous. Mid-culm nodes glabrous or pubescent. Lateral branches sparsely branched. Leaf-sheaths hairy. Leaf-sheath auricles absent. Ligule a fringe of hairs, 0.5 mm long. Leaf-blades spreading, linear or lanceolate, 1–4.5 cm long, 1–6 mm wide. Leaf-blade surface smooth or scabrous, indumented. Inflorescence compound, a panicle. Panicle ovate, 2–8 cm long, evenly furnished. Spikelets: spikelets pedicelled. Fertile spikelets 2-flowered, the lower floret barren (rarely male), the upper fertile, comprising 1 basal sterile florets, comprising 1 fertile floret(s), without rachilla extension, lanceolate or elliptic or ovate, dorsally compressed, 1.7–2.3 mm long. Rachilla internodes brief up to lowest fertile floret. Glumes thinner than fertile lemma. Lower glume ovate,

membranous, without keels, 0-nerved. Lower glume apex muticous. Upper glume elliptic or ovate, 1.7–1.9 mm long, membranous, without keels, 5(–7)-nerved. Upper glume surface smooth or asperulous. Basal sterile florets 1, barren, without significant palea. Lemma of lower sterile floret 100 % of length of spikelet, membranous, 5-nerved, mucronate. Fertile lemma 1.5–1.9 mm long, without keel. Lemma apex mucronate. Anthers 3”.

Material examined. **HAWAII:** Puna Distr, Hawaii Volcanoes National Park, ‘Ōla’a Forest, small tract fenced unit, patch near fence line adjacent to house and garden, stoloniferous grass, 1180 m, 07 Aug 1989, *L.W. Pratt* 2282 (HAVO).

***Panicum repens* L.**

New island record

Panicum repens is now known from Moloka‘i, where it was found along Rt. 450 4–7 km west of ‘Ualapu‘e. Several large colonies were found, the largest of them being over 10 m long paralleling the road. It was surprising to see this species occurring on the coastal plain in a leeward area, when all other populations seen by the author on other islands have been from windward or otherwise much moister sites. It appears that this population must instead be getting its moisture from groundwater. *Panicum repens* is now known from O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i (Imada 2019).

Material examined. **MOLOKA‘I:** Rt 450, ca. 7 km W of ‘Ualapu‘e, roadside weed in wet, sunny area, colony about 5 m long along road, from moist ditch and not seen in drier areas in this location, rhizomatous, 7 m, 21.056070, -156.900483, 29 Dec 2022, *K. Faccenda* 2966; Rt 450, ca. 4 km W of ‘Ualapu‘e, roadside weed from rather dry, sunny area, large colonies present in this area extending over 20 m along road, 12 m, 21.047704, -156.874559, 29 Dec 2022, *K. Faccenda* 2959.

***Panicum tenuifolium* Hook. & Arn.**

Correction

As in part one of this series (Faccenda 2022), only one distributional change was accidentally found for a native grass. *Panicum tenuifolium* was published as occurring on Kaua‘i by Herbst & Clayton (1998) based on only one specimen (*Henrickson 4060*). However, this specimen is simply an aberrant *P. nephelophilum* with narrower leaves than typical; the duplicate specimen at US has wider leaves than the BISH specimen and is a match for *P. nephelophilum*. *Panicum tenuifolium* is now known to occur on O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i (O’Connor 1990).

***Paspalum distichum* L.**

New island record

Paspalum distichum, a stoloniferous grass from coastal areas, is now known to be naturalized on Hawai‘i Island, where it was collected on Coconut Island in Hilo. *Paspalum distichum* is now known from Kaua‘i, O‘ahu, and Hawai‘i (Imada 2019).

Material examined. **HAWAII:** Hilo, Coconut Island, mowed grass and spreading onto rocks in salt spray area, dominant grass on lawn and edge of ocean of islet, growing from lava and sand, naturalized from lawn and many unique individuals seen, with *Paspalum vaginatum*, 19.729708, -155.068245, 06 Mar 2022, *K. Faccenda* 2338.

***Paspalum jesuiticum* Parodi**

New state record

Paspalum jesuiticum is now known to be naturalized in Hawai‘i, having been naturalized since at least 2003 when it was first collected in Volcano on Hawai‘i Island; roadside surveys in 2022 showed that the species is widespread and abundant (1000s–10000s of plants seen) in the Volcano area, with a smaller number of plants seen at Ke‘eau. The

second known observation of the species was on Kauaʻi in 2018 at by iNaturalist user seakangaroo (<https://www.inaturalist.org/observations/17392613>) at Keāhua Arboretum, which alerted the author to its presence on Kauaʻi and led to a specimen being made from the same location where it was first reported in 2018. Further populations were found on the north side of Kauaʻi. During roadside surveys on Maui, only one colony was found on Hāna Hwy. One single plant was also found in the rear of Pālolo Valley on Oʻahu.

Paspalum jesuiticum is native to southern Brazil and Argentina and no records were found indicating that it was intentionally imported into Hawaiʻi. Its introduction mechanism is unclear; it may have been introduced as material misidentified as *Paspalum lividum*, a morphologically similar species that was intentionally imported for forage purposes. It is a well regarded forage species in Brazil (Descamps & Tcacenco 2000; Boldrini 2011) and may have also been introduced as a forage grass. This is the first time *P. jesuiticum* has been reported outside of its native range. There is limited information about the ecology of this grass available, but in Hawaiʻi, this grass was found most often in wet, sunny to partly shady areas that are often mowed, but was also seen in unmowed areas, where it was less common.

Paspalum jesuiticum is best identified using the new key to *Paspalum* below, but its unique features are 4–8 inflorescence branches, a strongly stoloniferous habit, and glabrous, acute spikelets (Fig. 16). The leaf sheaths on this species are variable; on most plants seen in Hawaiʻi, they are glabrous, but plants with strongly hirsute sheaths are also frequently seen, even in the same population.

The following description is from Parodi & Nicora (1969: 104) and was translated from Spanish:

“Perennial, creeping, with vigorous intravaginal innovations that arise from the rooted nodes; flowering culms ascending, 2–3-noded, 40–60 cm tall; blackish and glabrous nodes. Sheaths shorter than the internodes, grooved, hairy; ligule membranous, ochraceous, glabrous, 2–3 mm long; leaf blades flat, linear-lanceolate, 6–12 cm long by 6–10 mm wide, glabrous, with long, white, papillose based hairs scattered on both sides, usually with partially wavy edges. Panicles 7–8 cm long, formed by 7–8 greenish branches 3–6 cm long, divergent when fruiting, with a pubescent axis endowed with a few long hairs in the axils. Rachis mostly glabrous, dorsoventrally compressed, 1.6–1.8 mm wide, bearing 4 series of briefly pedicellate spikelets; pedicels compressed, glabrous with denticulate-scarious sides. more or less than 0.5 mm on one spikelet, somewhat less on the other. Spikelets paired, ovate-lanceolate, 2.8 mm long by 1.5 mm wide, flat on the front face, convex on the back; lower (front) glume absent, upper 3-veined, barely mucronate, glabrous, similar in size to the spikelet; sterile lemma similar, 3-veined, as long as glume, without palea; fertile lemma ovate-lanceolate, 2.5 mm long, with a greenish or straw-colored back, finely dotted; palea embraced within. Bisexual flower with three yellow-orange anthers of 1–1.4 mm; lodicules 2, cuneiform, 0.4 mm.”

Material examined. **KAUAI:** Kapaʻa Valley, Keāhua Arboretum, roadside in the arboretum, 158 m, 22.071795, -159.417195, 29 May 2022, *K. Faccenda* 2387; Hanalei Valley, roadside at parking lot for ʻŌkolehao Trail, sunny moist roadside, 9 m, 22.201184, -159.472378, 30 May 2022, *K. Faccenda* 2434.5. **OʻAHU:** Pālolo Valley, rear of valley where road enters agricultural lots, at mailboxes, roadside weed in wet, partly sunny area on road shoulder, one plant seen, only two inflorescences, rare in area, 21.312048, -157.785706, 04 Mar 2023, *K. Faccenda* 3051. **MAUI:** Hāna Hwy, ca. 2 km E of Wailua, wet, shady roadside dominated by weeds, 368 m, 20.820957, -156.134018, 23 Oct 2022, *K. Faccenda* 2767. **HAWAIʻI:** Puna Distr, Wright Rd, 3–4 mile marker,



Figure 16. Inflorescence and spikelets (inset) of *Paspalum jesuiticum*.

along roadside, wet open disturbed area, rhizomatous, 4,000 ft [1,220 m], 06 Oct 2003, *K.F. Bio 03-0015*; Puna Distr, Hwy 11 near Kurtistown, mile 14, disturbed roadside, 1,500 ft [457 m], 12 Jun 2003, *L.W. Pratt 3321*; Hawaii Volcanoes National Park, roadside near the Volcano House, wet, frequently mowed area, 1209 m, 19.428054, -155.257711, 10 Aug 2022, *K. Faccenda 2608*.

***Paspalum langei* (E. Fourn.) Nash**

New state record

Roadside surveys on O‘ahu at Pūpūkea found that *Paspalum langei* is naturalized in the subdevelopment above Pūpūkea, where thousands of plants were seen along roadsides. *Paspalum langei* is native from the southern United States through Central America (POWO 2023). Discovery of this population in Hawai‘i marks the first time it has been found outside of its native range (POWO 2023). In its native range, this grass is found in tropical, deciduous, or subevergreen forests, along paths, on floodplains, and as a weed associated with agriculture (Denham 2005). It has also been reported as useful as a forage species (Denham 2005).

Paspalum langei is similar to *P. botterii* (E. Fourn.) Chase and was synonymized by Denham (2005); however, the two species are now largely regarded as distinct (POWO 2023). *Paspalum botterii* differs from *P. langei* in lacking a lower glume on the lower floret of the lower spikelet in the pair (Davidse *et al.* 1994).

Paspalum langei is identified by its annual habit, inflorescence with 1–3 (usually 2) branches, frequent presence of axillary inflorescences, and presence of dimorphic lower glumes between its paired florets (Fig. 17). Look-alike species include *P. pilosum*, which differs in having only one inflorescence branch and a perennial habit. *Paspalum setaceum* is also similar, but differs in having no lower glumes on any spikelets.



Figure 17. *Paspalum langei* inflorescences and spikelets (inset) from the Pūpūkea population. Inset photo courtesy of Mike Ross.

The following description is from the Flora of North America (Barkworth *et al.* 2003: 588):

“Plants perennial; caespitose. Culms 23–125 cm, erect; nodes glabrous or pubescent. Sheaths glabrous or pubescent; ligules 0.6–1.9 mm; blades to 38 cm long, 4–18 mm wide, flat, glabrous or pubescent, dark green. Panicles terminal, with 1–3(4) racemously arranged branches; branches 2.3–13.4 cm, erect to divergent, terminating in a spikelet; branch axes 0.2–1 mm wide, glabrous, margins scabrous. Spikelets 2.1–3.3 mm long, 1.3–1.6 mm wide, paired, imbricate, appressed to the branch axes, elliptic to obovate, stramineous to brown. Lower glumes 0.4–1.2(1.8) mm, stramineous to brown; upper glumes with papillose-based short pubescence, 3- or 5-veined, margins entire, lower lemmas with papillose-based short pubescence, lacking ribs over the veins, 3-veined, margins entire; upper florets light stramineous. Caryopses 1.3–1.5 mm, light to dark brown. $2n = 40, 60$.”

Material examined. **O‘AHU:** Pūpūkea, Pu‘u o Mahuka Rd leading to heiau, about halfway along road, moist, partly shaded roadside, 93 m, 21.642699, -158.057310, 08 Dec 2022, *K. Faccenda & M.C. Ross 2861*; Pūpūkea, Pūpūkea Rd and Alapio Rd, roadside, near to top of a driveway, sunny moist area, uncommon in subdivision, only a few colonies seen above heiau, 171 m, 21.646187, -158.047419, 08 Dec 2022, *K. Faccenda & M.C. Ross 2866*.

***Paspalum mandiocanum* Trin.**

var. *mandiocanum*

New island record

Paspalum mandiocanum was encountered during recent fieldwork on Hawai‘i Island at Kalōpā State Recreation Area, where it was found near the parking lot in moist woods. This species has now been documented on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i (Imada 2019; Faccenda 2022).

Material examined. **HAWAII:** Kalōpā State Recreation area, near parking lot, disturbed forest, stoloniferous, colony ca. 5 m wide, shady forest, moist, 20.038153, -155.435370, 06 Mar 2022, K. Faccenda 2344.

***Paspalum minus* E. Fourn.**

New state record

Roadside surveys around Hilo found *Paspalum minus* growing abundantly from mowed roadsides and lawns moist areas. The population along Railroad Ave. was the largest seen, spanning over 1 km of mowed roadside. *Paspalum minus* is native to the Americas and is found in the southeastern United States through Central America to Paraguay (Barkworth *et al.* 2003), and has been previously introduced to Japan (POWO 2023).

This species is most similar to *Paspalum notatum* and *Axonopus compressus*, and these three species were seen growing sympatrically in some areas around Hilo. *Paspalum minus* differs from each of these in spikelet size, being intermediate between *P. notatum* and *A. compressus* (Fig. 18).

The following description is from the Flora of North America (Barkworth *et al.* 2003: 577):

“Plants perennial; shortly rhizomatous. Culms 3–60 cm, erect; nodes glabrous. Sheaths glabrous or pubescent; ligules 0.2–0.7 mm; blades 8–18 cm long, 2–7.1 mm wide, flat, glabrous or pubescent. Panicles terminal, usually composed of a digitate pair of branches, a third branch sometimes present below the terminal pair; branches 1.8–6.4 cm, diverging to erect; branch axes 0.5–1.3 mm wide, narrowly winged, glabrous, margins scabrous, terminating in a spikelet. Spikelets 1.9–2.3 mm long, 1.2–2 mm wide, solitary, appressed to the branch axes, broadly elliptic to ovate to obovate, glabrous, stramineous, apices obtuse. Lower glumes absent; upper glumes 3-veined, lower lemmas faintly 3-veined; upper florets stramineous. Caryopses 1.8–2.2 mm, white. $2n = 20, 40, 50$.”



Figure 18. *Paspalum notatum* on left, *P. minus* on right, both plants collected in Hilo.

Material examined. **HAWAI'I:** Hilo, Railroad Ave though Hawaiian Homeland Agricultural lots, 42 m, 19.687861, -155.053947, 07 Aug 2022, *K. Faccenda 2579*; Hilo, intersection of East Kahaopea St and Kīlauea Ave, in infrequently mowed abandoned lot, along edge of road, 44 m, 19.689748, -155.068712, 07 Aug 2022, *K. Faccenda 2584*.

***Paspalum plicatulum* Michx.**

New island record

Reported as occurring on Kaua'i by Faccenda (2022), another specimen of *Paspalum plicatulum* was identified from Hawai'i Island, where it was collected near Kurtistown in 2003. Roadside surveys on Maui also found that it is naturalized at the beginning of the road to Hāna. The Maui population extended for about one kilometer along the road, where it was common but not abundant on the roadside. *Paspalum plicatulum* is now known from Kaua'i, Maui, and Hawai'i.

Material examined. **MAUI:** Hāna Hwy heading towards Hāna, ca. 1 km after the road loses its shoulder and becomes windy with blind curves, roadside in sunny, wet, infrequently mowed areas, 221 m, 20.892643, -156.216742, 28 Oct 2022, *K. Faccenda 2821*. **HAWAI'I:** Puna Distr, Hwy 11 near Kurtistown, grass growing on disturbed areas on roadside, 650 ft [200 m], 12 Jun 2003, *L.W. Pratt 3322*.

KEY TO *PASPALUM* IN HAWAI'I

The inflorescence of *Paspalum* is a panicle composed of one to many spikelike branches, simply referred to as branches in this key. *Paspalum* is closely related to, and similar to, *Axonopus*, which is also included in this key.

1. Inflorescences both terminal and axillary on same culm (sometimes manifesting as 2 inflorescences that appear to arise terminally since they arise out of the same leaf sheath, but are not united at the base); each panicle composed of 1–2 (rarely 3–6) branches
 2. Lower glumes present and dimorphic between paired spikelets
 3. Panicle branch single; rachis of panicle branch usually with scattered setae; spikelets 2.6–3.2 mm long; spikelets glabrous; lower glume of lower spikelet the larger of the pair *P. pilosum*
 - 3'. Panicle with 1–2 (rarely 3–4) branches; rachis of panicle branch without setae; spikelets 2.2–2.6 mm long; spikelets minutely pubescent, at least on upper glume; lower glume of upper spikelet the larger of the pair *P. langei* (in part)
 - 2'. Lower glumes absent on all spikelets
 4. Plant caespitose or rhizomatous; spikelets round, blunt at apex [only known from Midway as of 2023] *P. setaceum*
 - 4'. Plant stoloniferous; spikelets ovate to lanceolate, acute at apex . *Axonopus* spp.
- 1'. Inflorescence terminal, never axillary; each panicle composed of 2–70 branches
 5. Plants stoloniferous
 6. Panicle branches alternately arranged; panicle with ≥ 3 branches
 7. Florets with obtuse apex; plant erect or decumbent and rooting at nodes *P. mandiocanum* var. *mandiocanum* (in part)
 - 7'. Florets acute; plant strongly stoloniferous *P. jesuiticum*
 - 6'. Panicle branches paired (or approximately so) at apex of inflorescence; panicle with 2 branches on most individuals (uncommonly with a 3rd lower branch)
 8. Spikelets 1–2 mm long; upper glume pilose around edges *P. conjugatum*

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- 8'. Spikelets >2 mm long; upper glume without hairs concentrated on edges
 - 9. Stolons 3–8 mm diam. with internodes <1 cm; leaves concentrated at tip of stolon; spikelets elliptic to ovate, obtuse at apex; not found in saline situations and not growing aquatically
 - 10. Florets >2.5 mm long; leaves flat or folded *P. notatum*
 - 10'. Florets <2.3 mm long; leaves flat *P. minus*
 - 9'. Stolons 1–3 mm diam. with internodes typically >1 cm; leaves evenly distributed along stolon; spikelets elliptic-lanceolate, acute at apex; often (but not always) found in saline situations or growing as an emergent aquatic
 - 11. Spikelets 2.4–3.2 mm long; upper glume obscurely hairy
..... *P. distichum*
 - 11'. Spikelets 3.0–4.5 mm long; upper glume glabrous *P. vaginatum*
 - 5'. Plants caespitose, rarely rooting at lower nodes
 - 12. Panicle with 1–10 branches
 - 13. Upper glume fringed with hairs or a lacerate wing
 - 14. Upper glume fringed with a lacerate, papery wing *P. fimbriatum*
 - 14'. Upper glume fringed with hairs
 - 15. Upper glume fringed with stiff, spreading hairs; spikelets 2.5–2.8 mm long *P. humboldtianum*
 - 15'. Upper glume fringed with soft hairs; spikelets 1.8–4.5 mm long
 - 16. Hairs on florets minute, usually not visible without magnification '
..... *P. virgatum* (in part)
 - 16'. Hairs on florets long and wispy (at least some 1 mm long), visible without magnification
 - 17. Panicle branches <7, held widely spreading from panicle axis; florets 2.5–4.5 mm long *P. dilatatum*
 - 17'. Panicle branches >7, ascending, loosely appressed to panicle axis; florets <2.8 mm long *P. urvillei* (in part)
 - 13'. Upper glume without fringe of hairs or lacerate wing around its edge
 - 18. Spikelets borne singly, rarely with some spikelets paired, if so, these are the minority of florets in an inflorescence [native?] *P. scrobiculatum*
 - 18'. Spikelets borne in pairs, all florets consistently paired, although the lower of the pair may be aborted in some parts of the inflorescence
 - 19. Florets with lower glumes present, these glumes dimorphic between the spikelets of the pair *P. langei* (in part)
 - 19'. Florets with lower glumes absent
 - 20. Leaves linear, their width uniform or tapering from base; fertile lemma dark glossy brown; leaves <9 mm wide ... *P. plicatulum* (in part)
 - 20'. Leaves lanceolate, their width greatest above the base; fertile lemma pale; at least some leaves >10 mm wide
 - 21. Leaf margins scabrous or smooth, without cilia; spikelets glabrous or with limited hairs on edge of glume; leaves appressed pilose
..... *P. mandiocanum* var. *mandiocanum* (in part)
 - 21'. Leaf margin ciliate; spikelets evenly pubescent on glume; leaves glabrous or pubescent *P. macrophyllum*

- 12'. Panicle with >10 branches (occasionally with <10 branches if mowed or grazed)
22. Spikelets ~1 mm thick, with a noticeable bulge in central portion; spikelets of dried material often bicolored with a brown center portion and green rims *P. plicatulum* (in part)
- 22'. Spikelets ~0.5 mm thick, relatively uniform in thickness, or hemispherical in *P. paniculatum*; color uniform when dried
23. Spikelets entirely glabrous
24. Sterile lemma ribbed over veins; both glumes lacking; weaker grasses with culms typically <6 mm diam. at base *P. malacophyllum*
- 24'. Sterile lemma smooth; upper glume present; robust grasses with culms ~1 cm diam. at base *P. arundinaceum*
- 23'. Spikelets with at least some hairs visible under 10× magnification
25. Spikelets evenly pubescent; spikelets 1.00–1.3 mm long .. *P. paniculatum*
- 25'. Spikelets with hairs concentrated on glume edge; spikelets 2–3 mm long
26. Glume with a long-ciliate fringe around their edge, this obvious without magnification *P. urvillei* (in part)
- 26'. Glume with a short-ciliate fringe around the edge, the hairs only visible under magnification *P. virgatum* (in part)

Phalaris canariensis* L.*Correction**

Phalaris canariensis was noted as occurring on Hawai'i and Maui by O'Connor (1990); however, the labels on the material cited indicate the plant was cultivated on these islands. *Phalaris canariensis* is now only known as a questionable naturalization on O'ahu, where it was only collected once as a volunteer in a Nu'uuanu garden and is likely extirpated.

Phalaris paradoxa* L.*Questionable new island record**

Phalaris paradoxa was first published as occurring on O'ahu by Hitchcock (1922), but the specimen and citation have been overlooked by recent authors. As the species has not been seen in the past 100 years, it is considered a questionable naturalization.

Material examined. O'AHU: Nu'uuanu Pali, 17 Jun 1916, *A.S. Hitchcock 13780* (US).

Phleum pratense* L.*Questionable new island record**

Previously reported as naturalized on Kaua'i, O'ahu, and Maui (Imada 2019), *Phleum pratense* is now known from an old collection on Hawai'i Island. As the collection is 80 years old and has not been relected since, it is considered questionably naturalized.

Material examined. HAWAII: Hawaii Volcanoes National Park, park residence street, few plants only, along roadside, 06 Jun 1943, *G.O. Fagerlund & A.L. Mitchell 667* (HAVO).

Saccharum ×sinense* Roxb.*New state record**

A curious species of cane was found while reviewing photos from inaturalist.org; it was subsequently visited in the field and determined to be *Saccharum ×sinense* using the key to *Saccharum* in Wu *et al.* (2006) and Backer & van den Brink (1968). *Saccharum ×sinense* has been naturalized on Hawai'i Island along the Hāmākua coast since at least

2019, when it was first photographed by iNaturalist user csk (<https://www.inaturalist.org/observations/19581157>). Hundreds of plants were observed by the author along the road leading to ‘Akaka Falls.

Saccharum × *sinense*, (commonly called Uba Cane) has been variously treated as a hybrid or full species depending on the author, but it is likely of hybrid origin, perhaps derived from *S. spontaneum* and *S. barberi* as parents (Amalraj & Balasundaram 2006). *Saccharum* × *sinense* is closely related to domestic sugarcane and is likely an ancestor of modern hybrid cultivars (Wu *et al.* 2006). *Saccharum* × *sinense* was intentionally imported to Hawai‘i for sugarcane breeding experiments as early as 1905 (Rotar 1968).

Material examined. **HAWAII:** Outside ‘Akaka Falls State Park, roadside, common along the road for over 1 km leading to park, cane to 3 m tall, dominant in area along road, naturalized, 378 m, 19.851510, -155.150403, 06 Mar 2022, K. Faccenda 2350.

Key to *Saccharum* in Hawai‘i

1. Inflorescence axis glabrous (pilose in some hybrid cultivars); cultivated and not currently known to naturalize *S. officinarum*
- 1'. Inflorescence axis densely pilose; naturalized
 2. Plant rhizomatous; leaf blades 0.2–0.8 cm wide *S. spontaneum*
 - 2'. Plant clump-forming; leaf blades 1–6 cm wide *S. × sinense*

Schizachyrium condensatum (Kunth) Nees **Correction**

Schizachyrium condensatum was first published as occurring in Hawai‘i by O’Connor (1990). However, this identification was erroneous, as all specimens and populations previously referred to as *S. condensatum* in Hawai‘i have now been reidentified as *S. microstachyum*. True *S. condensatum* is not known to occur in Hawai‘i. See further comments under *S. microstachyum*.

Schizachyrium microstachyum (Desv.)

Roseng., B.R. Arrill. & Izag.

New state record

After a critical review of the collections at BISH, PTBG, US, and HAW, all specimens formerly identified as *Schizachyrium condensatum* from Hawai‘i have been reidentified as *S. microstachyum*, based on a recent revision of the group showing that the name *S. condensatum* has been widely misapplied to a complex of closely related, but unique, species (Welker & Peichoto 2015). In Hawai‘i, *S. microstachyum* is often and easily confused with *Andropogon bicornis* and *A. tenuispathus*. A new key is provided below to help with their identification.

The plants now called *Schizachyrium microstachyum* have had a frustratingly tortuous nomenclatural history in Hawai‘i: they were first recognized as *Andropogon glomeratus* (Degener & Degener 1983) until O’Connor (1990) placed them in the correct genus as *Schizachyrium condensatum*, but now the name must change again, as *S. condensatum* was misapplied in Hawai‘i as well as throughout much of the species native range. It must also be noted that true *Andropogon glomeratus* var. *pumilus* (now *Andropogon tenuispathus*) is also naturalized in Hawai‘i and is an entirely different species from *S. microstachyum*.

According to Degener & Degener (1983), which was then cited by O’Connor (1990), *S. microstachyum* was first introduced in O‘ahu in 1932. However, neither source

provides evidence to support this date, and I have found no evidence to support it as the first collection from O‘ahu is dated 2012. It is almost certain that the Degeners were confusing *S. microstachyum* with *Andropogon virginicus*, as there are several specimens of *A. virginicus* from O‘ahu dated as 1932. The first reliable evidence of *S. microstachyum* occurring in Hawai‘i is from herbarium material dated 1961. According to *O. Degener* 35273 (BISH), it was apparently imported into the islands with hay for mule feed after WWII, contradicting their supposed 1932 introduction date.

During roadside surveys on Maui, the first population of this grass was found on the island in the Ha‘ikū area, consisting of approximately 500 plants. *Schizachyrium microstachyum* is abundant on Hawai‘i Island, with most of the population centered between Hilo and Kahuku, with very large stands of this grass occurring in the Volcano area; smaller populations are found on Kaua‘i, where this grass is widespread but relatively uncommon. Small populations also exist on O‘ahu and Maui. Only the first record from each island is cited below.

Material examined. **KAUA‘I:** Summit of Mt. [Mauna] Kapu, Kalepa Ridge, 207 m, 19 Aug 1989, *L. Hume* 411 (PTBG). **O‘AHU:** Schofield Barracks East Range, on road that loops up to Schofield-Waikāne Trail, 1,400 ft [426 m], 21.498107, -157.968028, 27 Feb 2012, *US Army* 268. **MAUI:** Ha‘ikū, ‘Awalau Rd about 700 m away from Kaupakalua Rd, 393 m, 20.884063, -156.288203, 30 Oct 2022, *K. Faccenda & S. Vanaprucks* 2837. **HAWAII:** Ka‘ū, Kapāpala Ranch, occ[asional] in dry pasture, 2000 ft [609 m], 29 Apr 1961, *E.Y. Hosaka s.n.* (BISH 786575).

***Schizachyrium sanguineum* (Retz.) Alston New state record**

During roadside surveys on Moloka‘i a population of at least several hundred individuals of *Schizachyrium sanguineum* was found on Rt 450 about 1 km south of the Pu‘u O Hoku Ranch headquarters (Fig. 19). After this population was seen, naturalized specimens from O‘ahu and Kaua‘i previously identified as the morphologically similar species, *S. scoparium*, were critically examined and all were found to be *S. sanguineum*. *Schizachyrium sanguineum* can be identified by its fertile lemma being bilobed $\frac{2}{5}$ – $\frac{7}{8}$ of its length and having pubescent or glabrous glumes, whereas *S. scoparium* has a fertile lemma that is bilobed up to $\frac{1}{2}$ its length, and glumes that are always glabrous (Barkworth *et al.* 2003). As such, *S. sanguineum* is now known to be naturalized on Kaua‘i, O‘ahu, and Moloka‘i.

There are no records of *S. sanguineum* being intentionally imported to Hawai‘i, making it likely that this was an accidental introduction. This species was first collected in Hawai‘i on O‘ahu in 1987. *Schizachyrium sanguineum* is native from the southern United States through Central and most of South America, as well as most of Africa and India through most of Southeast Asia (POWO 2023). It has never before been reported outside of its native range (POWO 2023). In its native range, *S. sanguineum* occupies many habitat types, including meadows, cerrado, and forest edges and interiors, but is generally restricted to dry and sunny areas on rocky soils (Peichoto 2010; Cope 2002). *Schizachyrium sanguineum* is a fire-tolerant species, as it occurs in fire-prone cerrado vegetation in South America (Peichoto 2010) and is associated with annually burned firebreaks in South Africa (Bachinger *et al.* 2016).

The following description is taken from Barkworth *et al.* (2003: 674):

“Plants caespitose. Culms 40–120 cm, erect, not rooting or branching at the lower nodes, glabrous. Sheaths glabrous, rounded; ligules 0.7–2 mm; blades 7–20 cm long, 1–6 mm wide, usually with long, papillose-based hairs basally, glabrous elsewhere,

sometimes scabrous, without a longitudinal stripe of white, spongy tissue. Peduncles 4–6 cm; rames 4–15 cm, not open, usually almost fully exerted at maturity; internodes 4–6 mm, straight, from mostly glabrous with a tuft of hairs at the base to densely hirsute all over. Sessile spikelets 5–9 mm; calluses 0.5–1 mm, hairs to 2 mm; lower glumes glabrous or densely pubescent; upper lemmas cleft for $(2/3)3/4$ – $7/8$ of their length; awns 15–25 mm. Pedicels 3–6 mm long, 0.3–0.5 mm wide at the base, gradually widening to about 0.6–0.8 mm at the top, straight. Pedicellate spikelets 3–5 mm, usually evidently shorter than the sessile spikelets, sterile or staminate, awned, awns 0.3–6 mm.”



Figure 19. Inflorescence of *Schizachyrium sanguineum* from the Moloka'i population.

Material examined. **KAUAI:** Hanalei Distr, Waipā, ahupua'a on SW of Waipā Stream, pasture land and secondary forest giving way to *Metrosideros*-dominated forest near base of ridge that forms natural boundary of area, dominant grass in heavily grazed pasture lands, 150–960 ft [46–292 m], 02 Dec 1988, *T. Flynn & L. Hume* 3220. **O'AHU:** Ko'olauloa, Pūpūkea-Paumalū, uncommon in periphery of *Casuarina* forest in sunny sites, 600 ft [183 m], 05 Dec 1987, *K.M. Nagata & W. Takeuchi* 3743. **MOLOKA'I:** Rt 450 ca. 1 km S of Pu'u o Hoku Ranch headquarters (as the 'alalā flies), about 400 m W of a large pasture spanning both sides of road, growing on steep slopes of poor soil on roadcut in rather dry, exposed, sunny location with assorted invasive weeds, over 100 individuals present, 168 m, 21.134355, -156.734510, 29 Dec 2022, *K. Faccenda* 2957.

***Schizachyrium scoparium* (Michx.) Nash**

Correction

Schizachyrium scoparium is now known only from old, cultivated collections from grass gardens in 1939 & 1941 (*Hosaka* 2459, 2612) and is not known to be naturalized in Hawai'i. The specimens previously published as naturalized by Herbst & Clayton (1998) and Lorence *et al.* (1995) have been redetermined as *Schizachyrium sanguineum*. See further discussion under that species.

COMBINED KEY TO NATURALIZED *SCHIZACHYRIUM* AND *ANDROPOGON* IN HAWAII

The genera *Schizachyrium* and *Andropogon* are most reliably distinguished by the tip of the rame internodes having a concave cuplike structure at their apex on *Schizachyrium* and no such structure existing on *Andropogon* (Fig. 20a–b). However, that character is difficult to use in the field and this key was designed to avoid using it. The grasses in these genera in Hawai‘i have a history of misidentification; hopefully, this key will help towards reducing misidentifications in the future.

1. Inflorescence uniformly narrow (Fig. 20e–f)
 2. Florets fluffy and with conspicuous hairs; racemes paired, 3–5 cm long and <0.5 mm diam. *Andropogon virginicus* var. *virginicus*
 - 2'. Florets with minute hairs, these not visible to the naked eye; racemes single, 4–15 cm long and 0.8–1.5 mm diam. *Schizachyrium sanguineum*
- 1'. Inflorescence narrow at base and expanding in width towards tip with profuse branching (Fig. 20g–i)
 3. Leaves stiff and strongly scabrous on margins; culms circular at base (Fig. 20c); flowering culms 1.5–2.5 m tall *Andropogon bicornis*
 - 3'. Leaves usually rather soft, weakly scabrous or smooth-margined; culms circular or strongly laterally compressed at base; flowering culms rarely surpassing 1.5 m tall
 4. Base of culms circular; inflorescence held stiffly upright, rarely drooping; plants often with strong brick-red coloration on leaf sheaths; leaves evenly distributed along culm at flowering time ... *Schizachyrium microstachyum* [formerly *S. condensatum*]
 - 4'. Base of culms strongly laterally compressed due to distichously arranged leaf sheaths (Fig. 20d); inflorescence often drooping (Fig. 20i); plants typically without reddish coloration on leaves or sheath; leaves basally disposed on culms at flowering time *Andropogon tenuispathus* [formerly *A. glomeratus* var. *pumilus*]

Setaria adhaerens* (Forssk.) Chiov.*New state record**

The species *Setaria verticillata* and *S. adhaerens* have long been considered closely related and synonymized by many authors, including Clayton & Renvoize (1982) and Morrone *et al.* (2014). Other authors, such as Barkworth *et al.* (2003) and more recently Crespo *et al.* (2020), accept the name *S. adhaerens* as distinct from *S. verticillata* and their treatment is followed here. *Setaria adhaerens* is a $2n = 18$ species with glabrous leaf sheaths and margins, whereas *Setaria verticillata* is a $2n = 36$ species with hairy leaf sheaths and margins (Crespo *et al.* 2020). The species also differ in their distribution, with *S. adhaerens* being tropical and *S. verticillata* being temperate.

All herbarium specimens at BISH and HAW (approximately 150 (BISH) + 40 (HAW) in total) were examined and all were found to have glabrous leaf sheaths, indicating that all Hawaiian material formerly called *Setaria verticillata* should now be referred to as *S. adhaerens*. *Setaria adhaerens* is known from all islands where *S. verticillata* was previously reported, including Kure Atoll, Midway, Pearl and Hermes, French Frigate Shoals, Nihoa, Ka'ula Rock, Lehua, Ni'ihau, Kaua'i, O'ahu, Moloka'i, Lāna'i, Maui, Kaho'olawe, and Hawai'i (Imada 2019). As numerous specimens of this grass exist from Hawai'i, only the earliest record for each island is cited below.

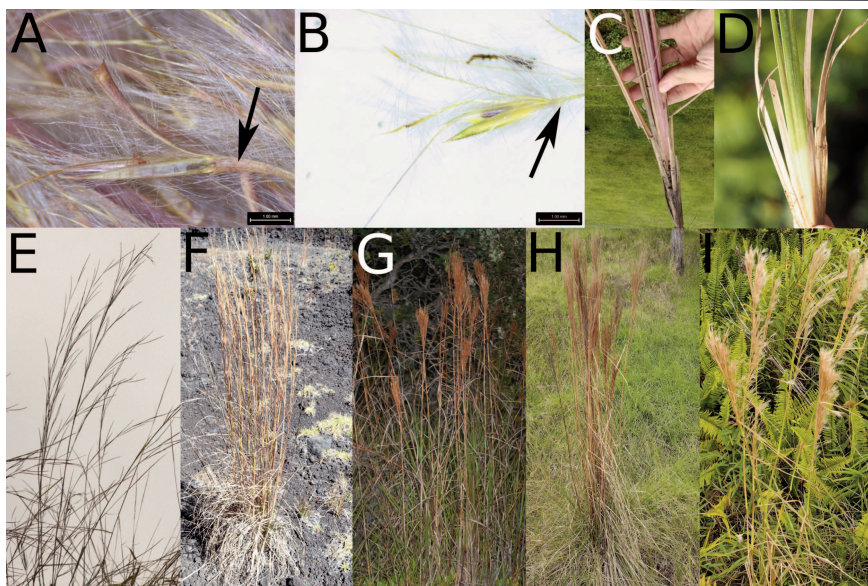


Figure 20. Comparison of *Schizachyrium* spp. and *Andropogon* spp. in Hawai'i. **A**, *Schizachyrium microstachyum* floret, arrow indicating rame internode (Iltis 132). **B**, *Andropogon tenuispathus* floret, arrow indicating rame internode (Lau OISC002). **C**, *A. bicornis* culm base. **D**, *A. virginicus* culm base, the culm base is very similar in shape to *A. tenuispathus*. **E**, *Schizachyrium sanguineum* habit. **F**, *Andropogon virginicus* habit. **G**, *Schizachyrium microstachyum* habit. **H**, *Andropogon bicornis* habit. **I**, *A. tenuispathus* habit.

Material examined. **KURE:** Under the tower on east side of island, 14 Sep 1964, *C.R. Long* 2246. **MIDWAY:** Eastern Island, also found on Sand Island, Nov 1954, *J.A. Neff & P.A. DuMunt* 7. **PEARLAND HERMES REEF:** Common on east portion of island (Southeast Island), 16 Sep 1964, *C.R. Long* 2269. **FRENCH FRIGATE SHOALS:** Tern Islet, *H.I. Rainwater s.n.* (BISH 120406). **NIHOA:** Near S coast, May 1969, *D.E. Yen* 1012. **KA'ULA ROCK:** Ka'ula Rock, 21 Jan 1976, *R. Daehler* 6. **LEHUA:** Lehua Rock, 19 Apr 1931, *E.L. Caum* 20. **NI'HAU:** Ni'ihau, Jan 1912, *J.F.G. Stokes s.n.* (BISH 120389). **KAUAI:** Makaweli, Apr 1903, *A. Robinson* 3. **O'AHU:** Honolulu, Waikiki, 20 Mar 1895, *A.A. Heller* 1961. **MOLOKA'I:** Near Kaunakakai, in cultivated field, 03 Sep 1936, *L.D. Whitney* 4456. **LANA'I:** Kō'ele, 02 Feb 1916, *G.C. Munro* 513. **MAUI:** Kanahā Pond, near S side adjacent to the parking area & observation point, 22 Jun 1962, *C.H. Lamoureux* 2035. **KAHO'OLAWA:** Transect c4 along secondary road to area above lighthouse, 25 Nov 1978, *W.P. Char* 78.06. **HAWAII:** Kohala, 12 Sep 1924, *C.C. Barnum* 59.

Setaria distans (Trin.) Veldkamp

New island record

Formerly reported on Ni'ihau and Moloka'i (Faccenda 2022), *Setaria distans* is now known on Kaua'i.

Material examined. **KAUAI:** Awa'awapuhi, Nā Pali Valley, lowland dry secondary forest, very common, 200 ft [61 m], 23 Aug 2004, *K.R. Wood* 10921 (PTBG).

Setaria verticillata (L.) P. Beauv.

Correction

Setaria verticillata is no longer known to occur in Hawai‘i. All material from all islands of Hawai‘i formerly identified as this have been reidentified as *Setaria adhaerens*; see further comments above.

Setaria viridis (L.) P. Beauv.

Questionable new state record

A single plant of *Setaria viridis* was recently found growing from the strip of dirt between sidewalk and road in urban Honolulu. Nearby, *Panicum miliaceum* and a new state record dioecious *Amaranthus* were found, suggesting that the species may have been imported with bird seed. Given that urban Honolulu has been relatively heavily botanized recently by both the author and M. Ross, and no other populations have been seen, this should be considered a questionable naturalization unless more plants are found.

Setaria viridis is native to much of Afroeurasia and has become widely naturalized across much of the Americas, where it is an aggressive weed of agriculture (Barkworth *et al.* 2003). *Setaria viridis* can be identified by its annual habit, spikelets with only a faintly transversely rugose fertile lemma, and 1–5 bristles below each spikelet, or by using the key below.

The following description is from Barkworth *et al.* (2003: 554):

“Plants annual. Culms 20–250 cm; nodes glabrous. Sheaths glabrous, sometimes scabridulous, margins ciliate distally; ligules 1–2 mm, ciliate; blades to 20 cm long, 4–25 mm wide, flat, scabrous or smooth, glabrous. Panicles 3–20 cm, densely spicate, nodding only from near the apices; rachises hispid and villous; bristles 1–3, 5–10 mm, antrorsely scabrous, usually green, rarely purple. Spikelets 1.8–2.2 mm. Lower glumes about as long as the spikelets, triangular-ovate, 3-veined; upper glumes nearly equaling the upper lemmas, elliptical, 5–6-veined; lower lemmas slightly exceeding the upper lemmas, 5-veined; lower paleas about as long as the lower lemmas, hyaline; upper lemmas very finely and transversely rugose, pale green, 5–6-veined; upper paleas similar to the upper lemmas. $2n = 18$.”

Material examined. O‘AHU: Algaroba St, near intersection with Makahiki Way, growing in dirt near sidewalk, 21.173503, -157.494117, M. Ross 1861.

KEY TO *SETARIA* IN HAWAI‘I

- 1. Only one (or sometimes zero) bristle(s) subtending each spikelet
 - 2. Leaves strongly plicate (resembling a palm seedling), >15 mm wide *S. palmifolia*
 - 2'. Leaves flat, <10 mm wide
 - 3. Bristles inconspicuous; inflorescence of racemes *S. distans*
 - 3'. Bristles conspicuous; inflorescence spikelike [this is currently treated as an endemic genus but is likely instead a member of *Setaria*] *Dissochondrus biflorus*
- 1'. Multiple bristles subtending each spikelet
 - 4. Bristles retrorsely barbed, sticky to touch *S. adhaerens*
 - 4'. Bristles antrorsely barbed, not sticky to touch
 - 5. Spikelets fascicled, fascicle subtended by >30 bristles [potentially confused with *Setaria*] *Cenchrus americanus*
 - 5'. Spikelets not fascicled (but may have fused pedicles), subtended by <12 bristles

6. Fertile lemma smooth or minutely rugose; annual; bristles green
7. Fertile lemma smooth and shiny; inflorescence with secondary branches
..... *S. italica*
- 7'. Fertile lemma dull, finely rugose; inflorescence without secondary
branches [questionably naturalized as of 2023] *S. viridis*
- 6'. Fertile lemma conspicuously rugose; perennial; bristles yellow, orange,
green, or purple
8. Inflorescence >10 cm; bristles typically yellow, orange, or purple;
rhizomes stout *S. sphacelata*
- 8'. Inflorescence <10 cm; bristles typically yellow to green; rhizomes knotty
..... *S. parviflora*

Sorghum arundinaceum* (Desv.) Stapf*Correction**

Examination of the specimens of *S. arundinaceum* published by Snow & Lau (2010) shows that it is no different than *Sorghum × drummondii*. True *Sorghum arundinaceum* can be identified by its leaves >2 cm wide and readily disarticulating racemes, and deciduous pedicelled florets (Barkworth *et al.* 2003; Fish *et al.* 2015). As these vouchers were the only record of the species in Hawai'i, *S. arundinaceum* should be removed from the Hawai'i checklist and be considered a misapplied name in Hawai'i.

***Sorghum × drummondii* (Nees**

ex Steud.) Millsp. & Chase

New island records

Sorghum × drummondii was previously reported as questionably naturalized on Hawai'i Island (Herbst & Clayton 1998), but is now known to be established in the Puna District based on herbarium material and populations found during roadside surveys. It was also found on Kaua'i at Kalāheo during roadside surveys. This species is now known to be naturalized on Kaua'i, O'ahu, Lāna'i, and Hawai'i (Imada 2019).

Material examined. **KAUAI:** Kalāheo, National Tropical Botanical Garden, weed in native plant section of garden, only 4 plants seen in small clump, 49 m, 21.904084, -159.508360, 01 Jun 2022, *K. Faccenda 2444*; Kalāheo, intersection 200 m S of Rt 540 and 50, roadside, dry sunny area, associated with other weeds including *Panicum maximum*, rare, only one patch seen, 197 m, 21.922522, -159.536588, 03 Jun 2022, *K. Faccenda 2479*; Līhu'e, 14 Oct 1916, *C.N. Forbes 591.K* (US). **HAWAII:** Puna Distr, Hwy 130, 14–15 mile marker, 19 May 2005, *K.F. Bio 05-0002*; Ka'ū Distr, Hwy 11, 49–50 mile marker, 04 Jun 2001, *K.F. Bio 01-0029-01*; Hwy 11 about halfway between Kea'au and Kurtistown, near Kamehameha School, overgrown grassy roadside, full sun, moist, lacking rhizome, about 10 plants seen, 173 m, 19.608643, -155.048779, 14 Aug 2022, *K. Faccenda & M. Murphy 2647*.

Sporobolus coromandelianus* (Retz.) Kunth*New state record**

Sporobolus coromandelianus is now known from O'ahu and Maui, where it was found during roadside surveys only at Lāhainā on Maui and is widespread on O'ahu, where five locations were found between Wai'anae and Kalihi on O'ahu. On Maui, about 20 plants were seen; on O'ahu, each of the populations found consisted of between 10 and 1000 plants.

Sporobolus coromandelianus is native to Africa through the Middle East, Asia, and into Malesia (POWO 2023). It has previously been reported as introduced only in Australia (Simon & Jacobs 1999), making this the second time this species has been found

outside of its native range. In its native range it is associated with calcareous or saline conditions in seasonally dry areas (Baaijens & Veldkamp 1991). In Australia, this species is associated with gardens and roadsides (Simon & Jacobs 1999).

Sporobolus coromandelianus is morphologically similar to and may be confused with *S. pyramidatus*, as they are both found in dry, low-elevation areas. However, based on the populations seen by the author, *S. pyramidatus* prefers more coastal saline habitats, whereas *S. coromandelianus* was generally found further inland. Morphologically, *S. pyramidatus* has glabrous leaves with scabrous margins, and tightly closed inflorescences that are almost linear when immature; *S. coromandelianus* has leaves often with papillose-based hairs on their upper surface, spines on the margins of its leaves, and usually open-paniculate immature inflorescences (Fig. 21).



Figure 21. *Sporobolus coromandelianus* inflorescence & spikelets (inset) from the Lāhainā population.

The following description is taken from Pope (1999: 172):

“Caespitose annual; culms up to 25 cm tall, erect or ascending, branched or unbranched; leaf sheaths chartaceous, usually glabrous, sometimes with tubercle-based hairs near the margins above, lightly compressed; leaf laminas 2–10 cm × 2–4 mm, flat, glabrous or scattered tuberculate-pilose on the surface, scabrid on the margins or with a few long stiff tubercle-based hairs below, acute or subacute at the apex. Panicle 2–8 cm long, ovate; branches in a succession of whorls, smooth, with numerous elongated viscid glandular patches, the spikelets 2–3 on secondary branchlets, these ± confined to the distal part of the primary branches. Spikelets (1)1.2–1.4(1.6) mm long, greyish-green; inferior glume 1/4–1/3 the length of the

spikelet, oblong, nerveless, glabrous, obtuse at the apex; superior glume as long as the spikelet, oblong-elliptic, 1-nerved, glabrous to scaberulous or minutely asperulous, acute at the apex; lemma as long as the spikelet or almost so, oblong-elliptic; anthers 3, (0.2)0.3–0.55 mm long. Grain obovate, 0.7–0.8 mm long, terete or lightly laterally compressed.”

Material examined. **O‘AHU:** Waipahu, Waipi‘o Point Access Rd where it crosses over canal at base of peninsula, common annual weed in area, 2 m, 21.383181, -157.992487, 20 Jan 2023, *K. Faccenda 3017*; Wai‘anae, intersection of Government Rd and Kuwale Rd, roadside weed in dry area, rare, panicle rather reddish purple, 28 m, 21.454998, -158.152484, 16 Jan 2023, *K. Faccenda & M.C. Ross 2990*; Kapolei Community Park, near baseball dugout in shade with *Euphorbia, Eleusine*, and *Sida*, ca. 20–30 plants observed, 21 m, 21.195764, -158.467380, 25 Nov 2022, *M.C. Ross 1850*; Sand Island Beach, Honolulu, growing near main parking lot in full sun, not irrigated, ca. 50 plants seen, <3m, 21.181398, -157.521789, 28 Jan 2023, *M.C. Ross 1883*; ‘Ewa Beach, ‘Ewa Mahiko District Park, growing near parking lot in mowed lawn, soil compact, full sun, not irrigated, several colonies, ca. >100 plants seen, 13–14 m, 21.201366, -158.212822, 06 Feb 2023, *M.C. Ross 1884*. **MAUI:** Lāhainā, Lāhainā Recreation Center off of Shaw St, southern end of park along closed dirt road, from edge of dirt road, 5 m, 20.867175, -156.669034, 22 Oct 2022, *K. Faccenda 2735*.

***Sporobolus diandrus* (Retz.) P. Beauv.**

Correction

Sporobolus diandrus is no longer known to be naturalized on Lāna‘i, as the only specimen has been reidentified as *S. elongatus*. *Sporobolus diandrus* is now known to be naturalized on Kaua‘i, O‘ahu, and Hawai‘i (Imada 2019).

***Sporobolus domingensis* (Trin.) Kunth**

New state record

Sporobolus domingensis is now known from Midway and O‘ahu. On O‘ahu, it has been present for at least 31 years and is now widespread, having been vouchered from around the Honolulu Harbor, Pearl Harbor, Barbers Point, and photographed, but unvouchered, at the Marine Corps Base in Kāne‘ohe (<https://www.inaturalist.org/observations/119164683>) and at Moanalua Bay Beach Park (<https://www.inaturalist.org/observations/151105654>).

Sporobolus domingensis is commonly called Coral Dropseed (Barkworth *et al.* 2003), a fitting name given that all the locations it has been found at in Hawai‘i have coral or limestone substrate. This grass is native to the Gulf of Mexico and Caribbean, where it occurs on sandy, rocky, or alkaline soils below 20 m in elevation (Barkworth *et al.* 2003; POWO 2023), and this is the first time it has been reported outside of its native range. *Sporobolus domingensis* can be identified by its perennial habit, affinity for saline coral or calcareous situations, and nonwhorled lower inflorescence node (Fig. 22).

The following description is from the Flora of North America (Barkworth *et al.* 2003: 126):

“Plants perennial; caespitose, not rhizomatous. Culms 20–100 cm. Sheaths rounded below, distal margins and apices hairy, hairs to 3 mm; ligules 0.2–1.2 mm; blades 5–20 cm long, 3–8 mm wide, flat to loosely involute, glabrous abaxially, scabridulous adaxially, margins scabridulous. Panicles 10–25(35) cm long, 1–5 cm wide, usually some-what contracted, sometimes spikelike, often interrupted below; primary branches 0.7–7 cm, appressed or spreading to 30° from the rachis, spikelet-bearing to the base; secondary branches appressed; pedicels 0.2–1.4 mm, appressed. Spikelets 1.6–2 mm, yellowish-green to grayish. Glumes unequal, linear-lanceolate to ovate, membranous; lower glumes 0.5–1.1 mm, usually without veins; upper glumes 1.1–2



Figure 22. *Sporobolus domingensis* habit along Lagoon Rd. & closeup of florets (inset).

mm, subequal to the lemmas; lemmas 1.1–2 mm, ovate, membranous, glabrous (occasionally minutely pubescent), acute; paleas 1–2 mm, ovate, membranous; anthers 2 or 3, 0.5–1 mm, yellowish or purplish. Fruits 0.7–1.1 mm, ellipsoid, laterally flattened, light brownish. $2n$ = unknown.”

Material examined. **MIDWAY:** Sand Island, in large field along road to Cargo Pier, perhaps a few dozen clumps, naturalized, coastal grass and herbland with *Scaevola*, *Cynodon*, and *Lobularia*, 28.216400, -77.369703, 10 ft [3 m], 27 Jun 2022, *F. Starr & K. Starr 220627-01*. **O‘AHU:** Lagoon Rd near the Honolulu airport, end of road, dry, sandy substrate on edge of harbor, obviously perennial, lower inflorescence node not whorled, common, hundreds of plants seen along this road and up to Ke‘ehi Beach Park, *Sporobolus pyramidatus* also seen here and a bit more common than *S. domingensis*, 2 m, 21.312213, -157.919749, 20 Jan 2023, *K. Faccenda 3015*; former Naval Air Station Barbers Point, Northern Trap & Skeet Range, on bare scraped limestone, 21.314234, -158.049024, 04 May 2021, *BISH staff BP046*; Fort Kamehameha [east side of entrance to Pearl Harbor], 07 Feb 1992, *E. Funk s.n.* (BISH 767442).

***Sporobolus tenuissimus* (Mart.**

ex Schrank) Kuntze

New state record

A new, annual, weedy species of *Sporobolus* was found during roadside surveys on O‘ahu, where it is well naturalized around Waimānalo on roadsides. Surveys on Maui found it in Lāhainā as a weed in a flower bed. It was also collected at Kaua‘i Nursery & Landscaping (KNL) in Līhu‘e, Kaua‘i, growing as a weed in pots and from soil around the nursery. Given that it was growing in many of the potted plants for sale, it is certainly distributed around the island at this point. Given that it was found in the nursery at KNL, a garden bed in Maui, and that there are dozens of nurseries in Waimānalo, it is almost certain that

this was introduced as a contaminant in potted plants. This species is also often found as a garden weed in other regions (Barkworth *et al.* 2003). While it has yet to be observed on Hawai‘i Island, it is likely present and overlooked.

Sporobolus tenuissimus is easily differentiated from most other *Sporobolus* in Hawai‘i, as it is both an annual and does not have a spikelike inflorescences like the other weedy *Sporobolus* (Fig. 23). It is similar to *S. pyramidatus*, but differs in not have whorled panicle branches. It is most similar to *Eragrostis amabilis*, as they are similar-sized plants with a similar inflorescence structure; however, *Sporobolus* has only one floret per spikelet, whereas *E. amabilis* has at least three. *Sporobolus tenuissimus* is native to Central and South America and has previously been introduced widely across the tropics. As it is a small annual, it seems unlikely to have major environmental impacts in Hawai‘i.



Figure 23. *Sporobolus tenuissimus* inflorescence and florets (inset) photographed at KNL on Kaua‘i.

The following description is from the Flora of North America (Barkworth *et al.* 2003: 118):

“Plants annual; tufted. Culms 30–100 cm. Sheaths glabrous, including the apices; ligules 0.2–0.3 mm; blades 5–23 cm long, 2–4 mm wide, flat or folded, glabrous on both surfaces, margins glabrous. Panicles (8)15–30 cm long, 3.5–8 cm wide, open, diffuse, cylindrical; lower nodes with 1–2(3) branches; primary branches 0.6–5 cm, capillary, spreading 30–70° from the rachises, without spikelets on the lower 1/2; secondary branches spreading; pedicels 0.5–5 mm. Spikelets 0.7–1.1 mm, plumbeous to purplish. Glumes unequal, obovate to ovate, membranous; lower glumes 0.1–0.4 mm, occasionally absent; upper glumes 0.2–0.5 mm; lemmas 0.7–1.1 mm, elliptic, membranous, glabrous, acute to obtuse; paleas 0.7–1.1 mm, elliptic, membranous; anthers 0.2–0.3 mm, yellowish. Fruits 0.4–0.7 mm, pyriform or quadroid, somewhat laterally flattened, light brownish to whitish. $2n = 12$.”

Material examined. **KAUAI:** Kaua'i 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, annual, hundreds of plants seen, 102 m, 21.963143, -159.405698, 08 Jul 2022, *K. Faccenda & S. Vanapruks 2516*. **O'AHU:** Waimānalo, at end of Mahailua St, moist, shady roadside, common, hundreds of plants seen, small annual, 67 m, 21.332724, -157.736100, 02 Aug 2022, *K. Faccenda & E. Peterson 2562*; Waimānalo, at end of Kakaina St, moist, shady roadside, common, 78 m, 21.335615, -157.742117, 02 Aug 2022, *K. Faccenda & E. Peterson 2565*; Waimānalo, Mahiku Pl., shady roadside, common weed along roadside, 36 m, 21.346756, -157.737971, 02 Aug 2022, *K. Faccenda & E. Peterson 2569*. **MAUI:** Lāhainā, Dickenson St & Waive'e St, weed in irrigated flower bed in shady area, 1 m, 20.874477, -156.676776, 22 Oct 2022, *K. Faccenda 2736*.

***Themeda quadrivalvis* (L.) Kuntze**

Questionable new state record

A specimen of *Themeda quadrivalvis* from Honolulu has been on deposit at BISH for over 70 years and has never been mentioned or published by any previous grass researchers. That omission is herein corrected by publication of it as a questionable naturalization on O'ahu. Seed of *Themeda quadrivalvis* was imported for trial as a forage grass from New Guinea in 1939 (Acc # 3954; HAES n.d.) and may have spread from that original planting to a yard in Kaimuki where it was collected in 1951. It is likely extinct on O'ahu, as it has not been recollected in the past 70 years despite urban Honolulu being relatively well studied botanically. Pukulani St and surrounding roads were also visited in Feb 2023 specifically to search for this grass, but it was not found. Publication of this record, regardless of its status, is largely in case the species is not extinct, as most grasses are undercollected in Hawai'i, making the herbarium record incomplete and field surveys rarely thorough enough to determine whether it is extinct.

Themeda quadrivalvis is native to India and Southeast Asia, but has been introduced to many tropical regions (Keir & Vogler 2006). It has also become a major weed in overgrown or disturbed regions of Australia (Keir & Vogler 2006). It is best recognized by its annual habit, long bracts 1.7–5 cm long subtending the florets, and awns 4–5 cm long.

The following description is from the Flora of North America (Barkworth *et al.* 2003: 684):

“Plants annual. Culms to 2 m, glabrous. Sheaths glabrous, flattened at the base; ligules 1–2.5 mm; blades to 60 cm long, 1–6 mm wide, usually folded. False panicles to 130 cm; sheaths subtending the rame clusters 17–50 mm, distal sheaths shorter and more strongly keeled, margins tuberculate; rames 1–3 per cluster, 8–10 mm, with 1–2 heterogamous spikelet pairs. Homogamous spikelets 4–7 mm; lower glumes many-veined, hairy distally, hairs papillose-based; upper glumes subequal to the lower glumes, 3-veined. Sessile heterogamous spikelets 4–6 mm; calluses 0.5–3 mm; lower glumes glabrous or sparsely hirsute; upper glumes 4.5–5.5 mm; awns 4–5 cm; pedicellate spikelets 4.5–5.5 mm, sterile. $2n = 18$.”

Material examined. **O'AHU:** Honolulu, Kaimuki, in yard, A. Suehiro's home [likely 3746 Pukulani St], 29 Nov 1951, *A. Suehiro s.n.* (BISH 120541).

***Urochloa arrecta* (Hack.)**

Morrone & Zuloaga

New state record

Urochloa arrecta was found during roadside surveys growing at Pa‘ani Mini Park in Hāna on Maui. The colony was about 5 m long, growing along the road, and was likely only one plant as the species is aggressively stoloniferous and rather similar in growth habit to *Urochloa mutica* (Fig. 24). The area was not surveyed rigorously so the true extent of the population is likely greater. It has been used as a forage grass in other regions of the tropics (Barkworth *et al.* 2003) and could have potentially been introduced for forage purposes. However, no reports could be located stating that this species was intentionally imported.

Urochloa arrecta is native to tropical Africa and has also been reported as naturalized in Florida and South and Central America (POWO 2023). In Brazil, it is considered an aggressive invasive weed, where it grows as an emergent aquatic from margins of water bodies and forms dense monotypic stands that outcompete nearly all native vegetation (Fernandes *et al.* 2013; Fares *et al.* 2020). In Hawai‘i, *Urochloa mutica* fills an identical niche and it is unclear which will be most competitive if they are both growing at the same site.

Urochloa arrecta can be differentiated from *U. mutica* by its glabrous sheaths and leaf blades. It is also similar to *U. plantaginea*, but *U. arrecta* is distinguished by its stoloniferous habit and lack of internode between the glumes, while *U. plantaginea* is caespitose and has a conspicuous internode 0.3–0.5 mm long between the glumes. *Urochloa plantaginea* also has a sterile lower floret, whereas *U. arrecta* has a staminate lower floret.

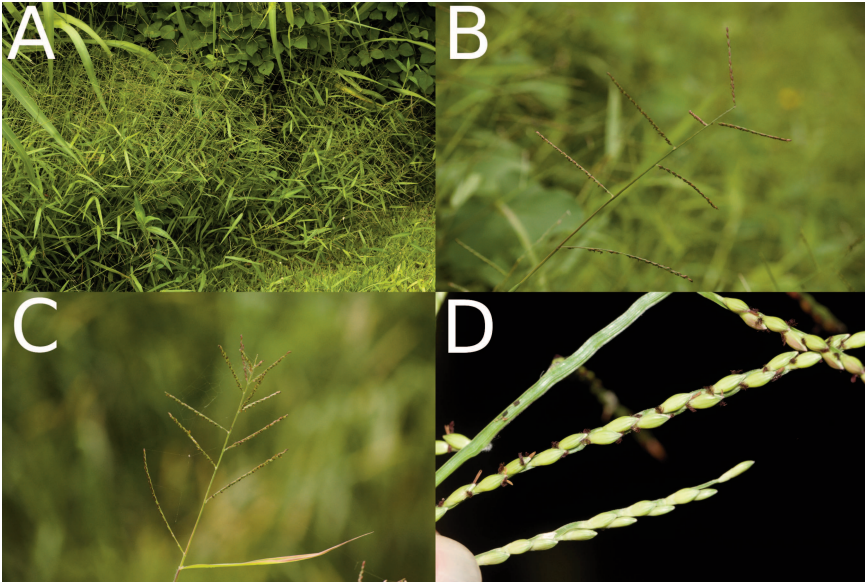


Figure 24. *Urochloa arrecta* photographed at Hāna. A, habit; B–C, inflorescence; D, florets.

The following description is from the Flora of North America (Barkworth *et al.* 2003: 505):

“Plants perennial; stoloniferous. Culms 50–120 cm, branching and rooting at the lower nodes; nodes glabrous. Sheaths glabrous, margins ciliate; ligules about 1 mm; blades 5–15 cm long, 7–15 mm wide, glabrous, bases subcordate, margins scabrous. Panicles (5)9–18(25) cm long, 3–4 cm wide, with 4–10(15) spike-like primary branches in 2 ranks; primary branches (1)2–5(10) cm, axes 0.5–2 mm wide, glabrous, margins scabrous; secondary branches rarely present, pedicels shorter than the spikelets, mostly scabrous, apices with hairs. Spikelets (3)3.3–4.4 mm long, 1.4–1.7 mm wide, ellipsoid, solitary, imbricate, in 2 rows, appressed to the branches. Glumes scarcely separated; lower glumes 1.5–1.8 mm, glabrous, 5-veined, not clasping the base of the spikelets; upper glumes 3.4–4.1 mm, glabrous, 7-veined; lower florets staminate; lower lemmas 3.4–4.1 mm, glabrous, 5-veined; upper lemmas 2.7–3.5 mm long, 1.3–1.6 mm wide, apices rounded, incurved; anthers 1.6–1.8 mm. $2n =$ unknown.”

Material examined. **MAUI:** Hāna, Pa‘ani Mini Park, wet, sunny roadside dominated by weeds, stoloniferous grass to 1 m tall, colony ca. 10 m wide, only observed at this one locality, 40 m, 20.758727, -155.991200, 23 Oct 2022, K. Faccenda 2777.

***Urochloa distachya* (L.) T.Q. Nguyen**

New island record

Urochloa distachya was published by O’Connor (1990) as occurring on Moloka‘i, but there were no herbarium specimens to support this, so the record was withdrawn by Faccenda (2022). However, recent fieldwork on Moloka‘i has shown that this grass is widely naturalized in disturbed areas across the island. *Urochloa distachya* is now known from Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i (Imada 2019; Oppenheimer & Bogner 2019; Faccenda 2022).

Material examined. **MOLOKA‘I:** Ho‘olehua, Moloka‘i Airport, long-term parking lot at airport, weedy area around parked cars, rarely mowed, sunny, uncommon across the island in disturbed areas, 138 m, 21.156223, -157.094359, 26 Dec 2022, K. Faccenda 2892.

***Urochloa eminii* (Mez) Davidse**

New island record

Formerly reported on Kaua‘i, O‘ahu, Moloka‘i, Kaho‘olawe, and Hawai‘i (Imada 2019), *Urochloa eminii* is now known from Maui, where it was found in Ha‘ikū, Makawao, and Kula.

Material examined. **MAUI:** Pukalani, ca. 1.2 km N of King Kekaulike High School along Rt 337, roadside weed in infrequently mowed area, sunny, rather dry, 695 m, 20.821225, -156.311528, 27 Oct 2022, K. Faccenda 2811; Kula, Kekaulike Ave near Puanani Pl, roadside in sunny area, 1066 m, 20.766022, -156.306194, 29 Oct 2022, K. Faccenda & S. Vanapruks 2834; Ha‘ikū, Hog Back Rd, edge of road in weedy area, 252 m, 20.903991, -156.309865, 30 Oct 2022, K. Faccenda & S. Vanapruks 2840.

***Urochloa ramosa* (L.) T.Q. Nguyen**

New state record

Another new species of *Urochloa* was found during roadside surveys in Wai‘anae, where over 500 plants were seen along Kuwale Rd., where the main population ran along the roadside for about 20 m. Some plants were found on the roadside itself, while many hundreds of others were growing in irrigated farmland adjacent to the road. Some scattered plants were also found along Lualualei Homestead Rd. about 500 m away from the main population. After consultation with Barkworth (2003), Wu *et al.* (2006), and

Clayton & Renvoize (1982), the plant was identified as *Urochloa ramosa*. This species can be identified by its annual habit, spikelets in pairs, racemose panicle, and setae on the pedicel of the florets (Fig. 25).

Urochloa ramosa is native from Africa through Asia (POWO 2023). It has become naturalized rather widely across the tropics (POWO 2023) and has previously been reported as weedy (Barkworth *et al.* 2003). It is fast growing, reaching maturity in ~90 days, and is tolerant of semi-arid areas (Kingwell-Banham & Fuller 2014). In India, it is cultivated as a grain and forage crop (Kingwell-Banham & Fuller 2014), and cultivation as a forage crop also occurs in the United States. The grain is also sometimes used as birdseed (Barkworth *et al.* 2003); however, it is unclear how it arrived in Hawai'i.



Figure 25. *Urochloa ramosa* inflorescence and spikelets (inset) from the Kuwale Rd. population.

The following description is taken from Barkworth *et al.* (2003: 497):

“Plants annual; tufted. Culms 10–65 cm, decumbent, rooting or not at the lower nodes; nodes pubescent. Sheaths usually puberulous, sometimes glabrous or sparsely pilose, margins ciliate; ligules 0.8–1.7 mm; blades 2–25 cm long, 4–14 mm wide, glabrous, margins scabrous. Panicles 3–13 cm, simple, with 3–15 spikelike primary branches; primary branches 1–8 cm, divergent, axils glabrous, axes 0.4–0.6 mm wide, triquetrous, glabrous, scabrous, or pubescent, with or without some papillose-based hairs; secondary branches, if present, confined to the lower branches; pedicels shorter than the spikelets, scabrous or pubescent. Spikelets 2.5–3.4 mm long, 1.3–2 mm wide, ellipsoid, apices broadly acute to acute, paired, appressed to the branches. Glumes scarcely separated, rachilla internode between the glumes not pronounced; lower glumes 1–1.5 mm, 1/3 – 1/2 as long as the spikelets, glabrous, 3–5-veined; upper glumes 2.5–3.4 mm, usually puberulent, sometimes glabrous, margins

sometimes somewhat pubescent, 7–9-veined, without evident cross venation; lower florets sterile, lower lemmas 2.4–3.3 mm, usually puberulent or occasionally glabrous, margins not ciliate, without cross venation, 5-veined; upper lemmas 2.3–3.3 mm, acute, mucronate; anthers 0.7–1.2 mm. Caryopses 1.2–2.3 mm; hila punctiform. $2n = 36$ (usually); also 14, 28, 32, 42, 46, 72.”

Material examined. **O‘AHU:** Wai‘anae, Kuwale Rd, ca. 200 m S of intersection with Pu‘uhulu Rd, from unmaintained roadside and farmland along road, very common for about 20 m of the roadside in both the unirrigated roadside, and the irrigated farmland., 24 m, 21.446452, -158.150683, 16 Jan 2023, *K. Faccenda & M.C. Ross 2988*.

Zoysia matrella (L.) Merr.

New state record

Previously reported as a questionable naturalization on O‘ahu (Faccenda 2022), more populations have been found, demonstrating that this is truly naturalized. *Zoysia matrella* was also recently found growing on a beach near Kapa‘a on Kaua‘i, where it is unlikely to have been planted. The colony was over 10 m long, growing on sand along a footpath and not in proximity to any structures or roads. It seems that *Z. matrella* germinates best in coastal situations, as most of the colonies seen that appear most certain to be wild were all found near beaches.

Material examined. **KAUA‘I:** Kapa‘a, beach where Kapa‘a Stream empties into ocean, sand on beach, full sun, strongly rhizomatous plant forming a turf from sand as its substrate, 6 m, 22.091604, -159.306712, 29 May 2022, *K. Faccenda 2410*. **O‘AHU:** ‘Ewa, One‘ula Beach Park, growing on sand about 20 m from waterline, dry, full sun area, one colony about 5 m wide \times 10 m long, no cultivated *Zoysia* seen nearby, 21.306672, -158.026639, 13 Mar 2023, *K. Faccenda & M.C. Ross 3071*; Kualoa Ranch, Ka‘a‘awa Valley, near rear of valley, moist pasture land, full sun, mixed with assorted weeds, colony over 50 m wide, movie set structure nearby a possible source, but not centered around structure, also seen on both sides of road, possibly planted (Julia Lee, pers. comm.), 21.520058, -157.863130, 07 Mar 2023, *K. Faccenda & J. Lee 3061*; 4WD road to Poamoho Trail, about 4 km from start of road, wet area on side of road, near large gravel pile, potentially moved with the gravel along with other weeds growing near the gravel pile not encountered on other areas of the trail, colony about 3 m wide by about 1 m deep, climbing up to 50 cm tall into some weeds, 467 m, 21.535792, -157.982027, 23 Dec 2022, *K. Faccenda 2884*; He‘e‘ia, just outside of state park, sandy coastal site within 5 m of ocean, small colony about 1 m wide growing on sand and rubble on coast, obviously not planted given its location, 1 m, 21.440176, -157.809038, 20 Sep 2022, *K. Faccenda 2702*.

Zoysia pacifica (Goudsw.)

M. Hotta & Kuroki

New island record

Zoysia pacifica has been observed growing wild in the Kahuku Unit of Hawaii Volcanoes National Park, where it appeared far from any planted patches (Linda Pratt, pers. comm.). This species is now known to be naturalized on Kaua‘i, O‘ahu, and Hawai‘i (Faccenda 2022).

Material examined. **HAWAI‘I:** Ka‘ū Distr, Hawaii Volcanoes National Park, Kahuku Unit, upslope of Hawai‘i Ocean View, on cinder in open area with low native shrubs, one patch of dry stoloniferous grass, 1500 m, 19 Dec 2008, *F. Duvall s.n.* (HAVO 14706).

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