

## Updates to the Hawaiian grass flora and selected keys to species: Part 1

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As part of my studies looking at the history of grass invasions in Hawai'i, a critical examination was given to much of the grass material stored at herbaria across Hawai'i. Over the summer of 2021, I spent considerable time in the Herbarium Pacificum (BISH) as well as the Rock Herbarium at University of Hawai'i at Mānoa (HAW). Selected specimens were also loaned from the National Tropical Botanical Garden (PTBG). The Hawai'i Volcanoes National Park Herbarium (HAVO) was also visited.

The grass specimens in the old University of Hawai'i Agronomy Herbarium, donated to the Bishop Museum in 2004, were entirely examined and annotated over the course of this research. That collection contains ~1,000 specimens of grasses collected between 1900 and 1960, most of which are from the old agricultural experiment stations. It has a mixture of endemic species, wild-collected introduced species, and cultivated species from grass field trials and introduction gardens. Numerous new records were found from the wild-collected material in this collection.

Additionally, limited field work and collecting by the author in the vicinity of Honolulu revealed three potential naturalizations, two new state records, two new island records, one new naturalization, and many specimens supporting species that were already vouchered in herbaria. Field work consisted of collecting material from roadsides and weedy areas and was focused around Honolulu.

All identifications were made by the author unless otherwise noted. This work identified 68 new island records, 31 corrections, 22 new state records, 9 species deleted from the checklist, 5 new naturalizations, 3 potential naturalizations, 1 new noxious weed species, 1 eradication, and several notes. A breakdown of these records by island is reported in Table 1. Three species were also found to be published erroneously as occurring in Hawai'i based on misidentified material; however, vouchers of different material were found showing that those three species actually do occur in Hawai'i. The principal focus of this work was on grasses introduced post-1778; however, one new island record was found for a Hawaiian endemic species (*Koeleria inaequalis*). All voucher specimens examined for this paper are on deposit at Herbarium Pacificum (BISH), except as otherwise noted.

The following species are detected for the first time growing wild in the United States: *Capillipedium spicigerum*, *Cyrtococcum patens*, *Digitaria eriostachya*, *D. orbata*, *D. stricta* var. *stricta*, *Ischaemum aristatum*, *I. polystachyum*, *Melinis scabrida*, *Paspalum*

*humboldtianum*, and *Urochloa glumaris*. Of these species, only *Ischaemum aristatum*, *I. polystachyum*, and *Urochloa glumaris* have previously been reported outside of their native range, making Hawai'i the first place worldwide to experience introductions and naturalizations of most of these species.

New keys to naturalized and native species are also provided for *Aristida*, *Bromus*, *Eragrostis*, *Ischaemum*, *Leptochloa* (sensu lato), *Melinis*, *Urochloa*, and *Zoysia*. The order of the characters in the couplets are arranged from most diagnostic first, to least diagnostic last.

**Table 1. Summary of new grass records and corrections reported here, by island.**

Island	NIR	Corrections (spp. removed from checklist)	Total introduced <sup>†</sup>	Average Year of New Records
Kure	1	0	13	1961
Midway	1	2	33	1962
Lehua	1	0	6	1992
Kaua'i	10	5 <sup>††</sup>	113	1973
O'ahu	14 <sup>†††</sup>	6	146	1984
Moloka'i	7	4	90	1931
Lāna'i	4	3	67	1975
Maui	11	8	146	1983
Kaho'olawe	3	2	32	1987
Hawai'i	16	1	144	1953
Total	68	31	252	1968

NIR = New Island Record. <sup>†</sup>Including questionably naturalized species. <sup>††</sup>Not including one variety that was removed, but the species is still present on the island. <sup>†††</sup>Including one native species.

During the course of this work, it was noticed that Hawai'i Island is very under-collected in terms of grasses; 16 new island records, mostly from the old Hawai'i Agronomy Herbarium collection, were discovered for Hawai'i Island. These are likely still persistent, but have not been collected recently. The average collection date of grasses from Hawai'i Island was 1953, compared to 1984 and 1983 on O'ahu and Maui. The older average collection date means there is a longer lag time between when a species is collected and when it is actually reported in the literature. Future efforts should be made by botanists to collect grass specimens on Hawai'i Island and submit them to the Bishop Museum for identification.

Identification of new grasses in Hawai'i is quite difficult due to the many possible regions from which new colonizers could arrive. The following resources should help any future worker in attempting to identify new grass state records. The keys are ordered in descending usefulness in the opinion of the author. Due to historical and political factors,

most new state records can be identified in the *Flora of North America* (vols. 24 & 25), making it the most useful reference for new state records. Relevant monographs and regional treatments should also be searched for specific grasses, as these may be more up-to-date than some floristic treatments mentioned below. If the genus of the plant is not known, the keys to grass genera in Kellogg (2015) and *Genera Graminum* (Clayton & Renvoize 1986) should be helpful.

- *A Key to Pacific Grasses* (Clayton & Snow 2010)
- *Flora of North America*, vols. 24 & 25 (Barkworth *et al.* 1993; Barkworth *et al.* 2003)
- *Flora of China*, vol. 22 (Wu *et al.* 2006)
- *Ausgrass / Flora of Australia*, vols. 44a & 44b (ABRS 2005; ABRS 2009; Simon & Alfonso 2011)
- *Flora of Tropical East Africa* (Clayton 1970; Clayton *et al.* 1974; Clayton & Renvoize 1982)
- *The grasses of Burma, Ceylon, India, and Pakistan* (Bor 1960)
- *Grasses of Southern Africa* (Russell *et al.* 1991)

***Andropogon tenuispathus* (Nash) Nash      Taxonomic note**

Formerly treated as *Andropogon glomeratus* var. *pumilus*, this variety is now recognized at the species level as *A. tenuispathus* (Weakley *et al.* 2011). This species is found on Midway, O‘ahu, and Hawai‘i (Imada 2019).

***Andropogon virginicus* L. var. *virginicus*      Taxonomic note**

All specimens of *Andropogon virginicus* at BISH were examined and were revealed to be the variety *A. virginicus* var. *virginicus*, per the key in Weakley (2020).

***Aristida adscensionis* L.      Correction**

*Aristida adscensionis* is no longer known from O‘ahu. The specimen cited by Imada (2019) has since been identified as *A. divaricata*.

***Aristida divaricata* Humb. & Bonpl. ex Willd.      New state record**

*Aristida divaricata* is now known from O‘ahu and Hawai‘i. On O‘ahu it was collected twice at the Poamoho experimental farm as a volunteer in a grass introduction garden, and at an unspecified location in the 1930s. A collection was also made on Hawai‘i Island in 1949 in a sheep paddock at Ke‘āmuku. Since no recent collections have been made and it is unknown if this species has persisted, it is perhaps best to consider this species of uncertain naturalization status unless further evidence suggests it has been established. This species represents the specimen (*Hosaka 2418*) referred to by Herbst & Clayton (1998) as an unidentified species of *Aristida*.

*Aristida divaricata* is native to the southwestern United States and ranges south through Mexico into Honduras. It tends to grow in dry areas. This is the first time this species has been detected outside of its native range.

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 323).

“Plants perennial; caespitose. Culms 25–70 cm, erect or prostrate, unbranched or sparingly branched. Leaves tending to be basal; sheaths longer than the internodes, glabrous except at the summit; collars densely pilose; ligules 0.5–1 mm; blades 5–20 cm long, 1–2 mm wide, flat to loosely involute, glabrous. Inflorescences paniculate, 10–30 cm long, 6–25 cm wide, peduncles flattened and easily broken; rachis nodes glabrous or with hairs, hairs to 0.5 mm; primary branches 5–13 cm, stiffly divaricate to reflexed, with axillary pulvini, usually naked on the basal 1/2; secondary branches usually well-developed. Spikelets overlapping, usually appressed, sometimes divergent and the pedicels with axillary pulvini. Glumes 8–12 mm, 1-veined, acuminate or shortly awned, awns to 4 mm; calluses about 0.5 mm; lemmas 8–13 mm long, the terminal 2–3 mm with 4 or more twists when mature, narrowing to 0.1–0.2 mm wide just below the awns, junction with the awns not evident; awns (7–)10–20 mm, not disarticulating at maturity; central awns almost straight to curved at the base, ascending to somewhat divergent distally; lateral awns slightly thinner and from much to slightly shorter than the central awns, ascending to divergent; anthers 3, 0.8–1 mm. Caryopses 8–10 mm, light brown.  $2n = 22$ .”

*Aristida divaricata* can be distinguished from *Aristida adscensionis* via the following key:

1. Awns with obvious twist at the base; glumes equal or subequal ..... *A. divaricata*
1. Awns without any twist at base; glumes unequal ..... *A. adscensionis*

*Material examined.* O‘AHU: Waialua, Poamoho, volunteer in grass plot, growing nicely, 650 ft [198 m], 29 Oct 1938, *E.Y. Hosaka 2418*; Poamoho, 03 Mar 1939, *R. Lyman s.n.* (BISH 782361). HAWAII‘I: South Kohala, Keamoku [Ke‘āmuku], rare in one dry spot in shearing paddock, 19 Jul 1949, *Y. Kimura s.n.* (BISH 785684).

***Arrhenatherum elatius* (L.) P. Beauv.**

ex J. Presl & C. Presl

**New island record**

This grass has been recorded once on Hawai‘i Island (O‘Connor 1990) and was treated as questionably naturalized in Imada (2019); however, it was both vouchered in 2004 from Mauna Kea and noted on a survey by Ainsworth & Drake (2020), suggesting that the species is, in fact, widely naturalized. This species was introduced as a pasture grass in the early 1900s (Ripperton *et al.* 1933). It is also known to be naturalized on Maui (Starr *et al.* 2003).

*Material examined.* HAWAII‘I: Pu‘u Mali, Mauna Kea, subalpine scrub/abandoned pasture, ‘a‘a substrate, 2,000 m, 19°55‘4”N, 155°25‘41”W, 23 Jul 2004, *F. Starr 040723-3*; Kanaloaleonui[sic] [ed.: possibly Pu‘u Kanakaleonui], Mauna Kea Forest Reserve, roadside in subalpine shrubland, tall annual grass [KF: this is not an annual], 11 June 1990, *T. Pratt s.n.* (HAVO 3473a).

***Avena sativa* L.**

**New island record**

*Avena sativa* is now known from Moloka‘i, where it was possibly planted for soil conservation purposes at Kamiloloa Heights. It has been previously collected on O‘ahu, Maui, and Hawai‘i (Imada 2019).



*Material examined.* **MOLOKA'I:** Kamiloloa Heights, burnt shrublands, grass 1 m tall, stem glabrous, this may be a species introduced by USDA Soil Conservation Service after fire for erosion control, 520 m, 07 Mar 1992, *G.D. Hughes 35*.

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

**New state record**

*Bothriochloa ischaemum*, commonly known as Big Ranch Bluestem in the continental United States, appears to be an escape/contaminant from pasture plantings. It is native to southern Europe and most of Asia. This species is quite invasive in Texas, where it can be very competitive in dry areas and reduce community diversity (Gabbard & Fowler 2007).

The species is very similar to the common *Bothriochloa pertusa* but differs in not having glandular pits on its glumes, whereas *B. pertusa* has obvious glandular pits. *Bothriochloa ischaemum* is also quite similar to *Dichanthium annulatum* but differs from it in having more acute tips of its glumes and a transparent line running along the axis of the spikelet pedicels and inflorescence axis (Fig. 1).

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 646).

“Plants usually cespitose, occasionally stoloniferous or almost rhizomatous under close grazing or cutting. Culms 30–80(–95) cm, stiffly erect; nodes glabrous or short hirsute. Leaves tending to be basal; ligules 0.5–1.5 mm; blades 5–25 cm long, 2–4.5 mm wide, flat to folded, glabrous or with long, scattered hairs at the base of the blade. Panicles 5–10 cm, fan-shaped, silvery reddish-purple; rachises 0.5–2 cm, with (1–)2–8 branches; branches 3–9 cm, longer than the rachises, erect to somewhat spreading from the axillary pulvini, usually with only 1 rame; rame internodes with a central groove narrower than the margins, margins ciliate, with 1–3 mm hairs. Sessile spikelets 3–4.5 mm, narrowly ovate; lower glumes hirsute below, with about 1 mm hairs, lacking a dorsal pit; awns 9–17 mm, twisted, geniculate; anthers 1–2 mm. Pedicellate spikelets about as long as the sessile spikelets, but usually narrower, sterile or staminate.  $2n = 40, 50, 60$ .”

*Material examined.* **HAWAI'I:** Kailua, Hinahou, very rare, in small local patch in semi-dry pasture, 3,500 ft [1,066 m], 27 Oct 1950, *E.Y. Hosaka 3599*; South Kohala, Keamoku [Ke‘āmuku], Pue Hinai [ed.: probably Pu‘u Hina‘i] paddock, local planted patches in dry place, good growth, grazed by stock, 3,000 ft [914 m], 04 Jul 1956, *E.Y. Hosaka 4009*; ‘Āinahou Ranch House area, Hawai‘i Volcanoes National Park, 3,000 ft [914 m], 14 May 1991, *C. D’Antonio s.n.* (HAVO 6713).

***Bothriochloa laguroides* (DC.) Herter**

**New island record**

This species is now known from Hawai‘i Island from one collection in a “grass plot” (pasture?) collection from 1960 near Kapāpala. This should be considered a questionable naturalization until it is recollected. *Bothriochloa laguroides* has previously been reported only on Maui (Imada 2019).

*Material examined.* **HAWAI'I:** Ka‘ū, Kapāpala, very rare, volunteer in grass plot, 3,500 ft [1,066 m], 13 Jun 1960, *E.Y. Hosaka 4055*.



**Fig. 1.** Comparison of similar species of bluestems. **A–B**, *Bothriochloa ischaemum* (Hosaka 4009). **C–D**, *Bothriochloa pertusa*, **C** (*W. Teraoka 291*); **D** (*P.J. O'Connor s.n.*, BISH 510052). **E–F**, *Dichanthium annulatum* (Nagata 1409).

***Bromus carinatus* Hook. & Arn.**

**New state record**

*Bromus carinatus* is now known from Hawai‘i Island, where it has been collected twice at middle to high elevations on Mauna Kea, specifically at Hāmākua and Waipāhoehoe Gulch as well as Mauna Loa at the end of Mauna Loa Strip Rd. *Bromus carinatus* is native from western North America to Central and South America, and it is also introduced in Europe. In California, it extends from sea level to 11,000 ft [3,350 m] and prefers sunny areas with

well-drained soils. In its native range, this species is competitive and can hold its own against invasive plants, and it also displays weedy characteristics when growing among agricultural crops (Daris 2007). The fact that this species has been established for ~80 years and has only been properly identified now may indicate it is not very weedy here.

This species is quite similar to *Bromus catharticus* and can be distinguished by the often hairy lemmas, and the lemma veins not being as prominent as on *B. catharticus*. The key presented below can distinguish it from all other species of *Bromus* in Hawai‘i.

The following description is from *Flora of North America* (Barkworth *et al.* 1993: 203).

“Plants annual, biennial, or perennial; loosely caespitose. Culms 45–120(–180) cm tall, usually less than 3 mm thick, erect. Sheaths mostly glabrous or retrorsely soft pilose, throats usually hairy; auricles sometimes present on the lower leaves; ligules 1–3.5(–4) mm, glabrous or sparsely hairy, acute to obtuse, lacerate or erose; blades 8–30 cm long, 1–12 mm wide, flat or becoming involute, glabrous or sparsely pilose to pubescent on 1 or both surfaces. Panicles 5–40 cm, lax, open or erect; lower branches usually shorter than 10 cm, 1–4 per node, ascending to strongly divergent or reflexed, with 1–4 spikelets variously distributed. Spikelets 20–40 mm, shorter than at least some pedicels and branches, elliptic to lanceolate, strongly laterally compressed, not crowded or overlapping, sometimes purplish, with 4–11 florets. Glumes glabrous or pubescent; lower glumes 7–11 mm, 3–7(–9)-veined; upper glumes 9–13 mm, shorter than the lowest lemma, 5–9(–11)-veined; lemmas 10–16(–17) mm, lanceolate, laterally compressed, strongly keeled distally, usually more or less uniformly pubescent or pubescent on the margins only, sometimes glabrous or scabrous, 7–9-veined, veins usually not raised or riblike, apices entire or with acute teeth shorter than 1 mm; awns 4–17 mm, sometimes slightly geniculate; anthers 1–6 mm.  $2n = 28, 42, 56$ .”

*Material examined.* **HAWAI‘I:** South-southeast slopes of Mauna Kea, just below the silversword enclosure in Waipāhoehoe Gulch, shaded gully under mamane tree, growing in a spreading clump and reached about 80 cm, (248964E and 2192173N, UTM zone 5Q), 9,400 ft [2,865 m], [no day or month] 1998, *S. Dougill s.n.* (BISH 778206); Kūka‘iau, Hāmākua, in pasture under koa trees, very good growth, 4,500 ft [1,371 m], 28 Aug 1936, *E.Y. Hosaka 1536*; Hawaii Volcanoes National Park, about 200 m up Mauna Loa trail at the summit of Mauna Loa Strip Road, shrubby, dry, open area, 6 total plants seen, 2,086 m, 19.498705, -155.385470, 15 Aug 2022, *K. Faccenda 2654*; Mauna Kea Forest Reserve, Kanakaleonui Kipuka, mamane woodland, common and widespread, 8,600 ft [2,620 m], 29 Mar 1997, *L.W. Cuddihy 2480* (HAVO).

### ***Bromus diandrus* Roth**

### **New island record**

*Bromus diandrus* is now known from Moloka‘i from a single 1903 collection from Kauluwai. It is uncertain if this species has persisted to the present day and should be considered a questionable naturalization. *Bromus diandrus* has previously been reported on Kaua‘i, O‘ahu, Lāna‘i, Maui, and Hawai‘i (Imada 2019; Imada & Kennedy 2020).

*Material examined.* **MOLOKA‘I:** Kawokekai [?], a single plant of this appearance at Kauluwai, 1,200 ft [365 m], April 1903, *G.C. Munro 115*.

***Bromus japonicus* Thunb.****New state record**

*Bromus japonicus* is now known from one collection from a pasture on Hawai‘i, and once from an experimental planting on Maui, both in the 1930s. Based on the fact that it was described as “rare,” it may have been a contaminant in the grass plot. Similar specimens of grasses from these grass gardens often describe the specimens as cultivated and do not include any sort of abundance information, which leads me to think it was a contaminant. *Bromus japonicus* should be considered questionably naturalized on both islands until more recent collections can demonstrate that it has persisted. *Bromus japonicus* is most similar to *B. sterilis* or *B. tectorum*; however, it differs in having a lower glume with more than one vein.

*Bromus japonicus* is a Eurasian species that has naturalized across North America and displayed invasive tendencies across the continental United States, where it is especially problematic on rangelands and prairies where there is ample light and soil moisture (Howard 1994). The fact that it has not been collected in the past 70 years may indicate that this has failed to establish, or it has simply been overlooked.

The following description is from *Flora of North America* (Barkworth *et al.* 1993).

“Plants annual. Culms (22–)30–70 cm, erect or ascending. Sheaths usually densely pilose; upper sheaths sometimes pubescent or glabrous; ligules 1–2.2 mm, pilose, obtuse, lacerate; blades 10–20 cm long, 2–4 mm wide, usually pilose on both surfaces. Panicles 10–22 cm long, 4–13 cm wide, open, nodding; branches usually longer than the spikelets, ascending to spreading or somewhat drooping, slender, flexuous, sometimes sinuous, often with more than 1 spikelet. Spikelets 20–40 mm, lanceolate, terete to moderately laterally compressed; florets 6–12, bases concealed at maturity; rachilla internodes concealed at maturity. Glumes smooth or scabrous; lower glumes 4.5–7 mm, (3)5-veined; upper glumes 5–8 mm, 7-veined; lemmas 7–9 mm long, 1.2–2.2 mm wide, lanceolate, coriaceous, smooth proximally, scabrous on the distal 1/2, obscurely (7)9-veined, rounded over the midvein, margins hyaline, 0.3–0.6 mm wide, obtusely angled above the middle, not inrolled at maturity, apices acute, bifid, teeth shorter than 1 mm; awns 8–13 mm, strongly divergent at maturity, sometimes erect, twisted, flattened at the base, arising 1.5 mm or more below the lemma apices; anthers 1–1.5 mm. Caryopses equaling or shorter than the paleas, thin, weakly inrolled or flat.  $2n = 14$ .”

*Material examined.* MAUI: Haleakalā substation, Makawao, grass plot, occasional, 11 Apr 1939, *E.Y. Hosaka* 2464; *loc. cit.*, in grass garden, rare, 2,000 ft [609 m], 10 Apr 1939, *E.Y. Hosaka* 2463. HAWAI‘I: Mauna Kea, Waiki‘i, occasional in pasture, 4,500 ft [1,371 m], Sep 1937, *E.Y. Hosaka s.n.* (BISH 118161).

***Bromus madritensis* L.****New island records**

*Bromus madritensis* is now known from Kaua‘i and Lāna‘i from specimens that were previously misidentified as other *Bromus* species. *Bromus madritensis* has previously been reported from Moloka‘i, Maui, and Hawai‘i (Imada 2019). See further discussion under *Bromus rubens*.

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*Material examined.* **KAUAI:** Waimea Distr., Waimea Canyon, Kukui Trail, near top of trail, degraded *Grevillea*-dominant mesic forest, clumping at beginning of trail, flowers pubescent, inflorescence green, older dark purple, 782 m, 04 Jun 2009, *N. Tangalin 2027*. **LĀNAI:** Wahane Gulch, locally common in open, rocky areas, vegetation: *Metrosideros*, *Diospyros*, *Dodonaea*, *Pouteria*, *Nestegis*, *Leptecophylla*, *Wikstroemia*, *Psidium*, *Morella*, *Schinus*, *Lantana*, northing 2306659, easting 719566, 550 m, 07 Feb 2013, *H. Oppenheimer H21303*; 'Āwehi Road, in *Gardenia brighamii* outplanting enclosure, locally common, 2,500 ft [762 m], 21 Mar 2007, *H. Oppenheimer H30714* (PTBG).

### ***Bromus rubens* L.**

### **Correction**

*Bromus rubens* and *B. madritensis* are both tetraploids in an allopolyploid species complex. Each species shares half of its DNA with *B. fasciculatus* C. Presl, and the other half descends from *B. tectorum* and *B. sterilis* for *B. rubens* and *B. madritensis*, respectively (Fortune *et al.* 2008). This close relationship makes identification of these two grasses quite difficult. These species are traditionally distinguished by inflorescence structure (Tutin *et al.* 1980; Barkworth *et al.* 2003). This characteristic, however, is tricky for Hawaiian material, which often has a reduced number of spikelets and does not develop the characters needed to distinguish these species based on inflorescence structure alone. However, upon a review of the literature, it was found that there are several more subtle characters that can distinguish between these two species. Rivas Ponce (1988) showed that the two species can be delimited by *B. rubens* having a minute notch at the tip of the palea and *B. madritensis* having a rounded palea tip. Sales (1994) showed that in *B. rubens* the lemmas are imbricated, while in *B. madritensis* the lemmas are distichous at maturity. Both of these characters were checked and appeared to be consistent with the material from outside of Hawai'i in the Bishop Museum world collection, as well as photographs of independently verified specimens of *B. madritensis* and *B. rubens* examined online.

*Bromus rubens* has previously been reported on Moloka'i (Herbst & Wagner 1999) as well as Kaua'i and Maui (Imada & Kennedy 2020), but careful examination of the specimens showed they were all misidentifications of *B. madritensis*. *Bromus rubens* is now only known in the state from two collections on Hawai'i Island and should be treated as questionably naturalized until it is recollected.

*Material examined.* **HAWAII:** South Kohala, Waiki'i, rare in grass plot, 6,000 ft [1,828 m], 16 May 1940, *E.Y. Hosaka 2521*; Pu'u 'O'o Ranch, [no day] May 1921, *Anon. s.n.* (US 00430090).

### ***Bromus squarrosus* L. var. *villosus* J.G. Gmel. Note**

An effort was made to locate the specimen referred to by Hillebrand (1888) from Maui. GBIF was searched as well as the Berlin Herbarium index, and it was not found. It was almost certainly destroyed in the bombing of the Berlin Herbarium in 1943, with no duplicates made. Since no other collections of *B. squarrosus* have been made in Hawai'i in the nearly 150 years since then, the species was not included in the following key and is likely best considered to be extinct in Hawai'i, or a misidentification, and should be removed from the checklist.



***Bromus sterilis* L.****Correction**

*Bromus sterilis* was previously reported as occurring on Maui and Moloka'i (Oppenheimer 2008). These specimens were examined and found to be misidentifications of *B. madritensis*. *Bromus sterilis* is now only known from Hawai'i Island.

**Key to *Bromus* in Hawai'i**

The following key is based off of the key to *Bromus* in *Flora of North America* (Barkworth *et al.* 1993) and Clayton & Snow (2010).

1. Lemmas 20–35 mm long; awns 3–6 cm long ..... *B. diandrus*
1. Lemmas < 20 mm; awns < 3 cm long
  2. Lower glume 3–7-veined
    3. Lemmas strongly keeled, at least near their apex; spikelets generally strongly laterally compressed; lemmas acuminate with lemma body, gradually tapering into the awn and lacking lateral teeth or with very reduced teeth < 1 mm long
      4. Lemmas 9–13-veined, occasionally with hairs near the apex; veins often raised and riblike at least toward the tip of the lemma; lemma usually glabrous ..... *B. catharticus*
      4. Lemmas 7–9-veined; veins usually flush with lemma surface; lemma typically pubescent, occasionally glabrous ..... *B. carinatus*
    3. Lemmas rounded on the back, spikelets generally weakly compressed; lemma body 2-lobed at tip, with an awn arising between teeth
      5. Lemma margins inrolled, exposing the rachilla and floret bases at maturity; lemmas typically glabrous, rarely pubescent ..... *B. secalinus*
      5. Lemma margins not inrolled, rachilla and floret bases obscured at maturity; lemma glabrous or pubescent
        6. Panicle open, pedicels equaling or longer than spikelets; lemma glabrous ... *B. japonicus*
        6. Panicle contracted, its pedicels shorter than spikelets; lemma pubescent ... *B. hordeaceus*
  2. Lower glume 1–3-veined
    7. Panicle branches drooping; at least some panicle branches longer than spikelets
      8. Lemmas [excluding awn] 14–20 mm long; panicle branches rarely with more than 3 spikelets each ..... *B. sterilis*
      8. Lemmas [excluding awn] 9–12 mm long; panicle branches often with 4–8 spikelets each ..... *B. tectorum*
    7. Panicle branches upright, not drooping; panicle branches shorter than spikelets
      9. Panicle densely contracted, panicle branches < 10 mm; lemmas typically contracted at maturity; palea apex lobed ..... *B. rubens*
      9. Panicle open to contracted, panicle branches 10–30 mm long; lemmas spreading at maturity; palea apex obtuse to rounded ..... *B. madritensis*

***Calamagrostis arenaria* (L.) Roth****Taxonomic note**

Formerly treated as *Ammophila arenaria* in Hawai'i, molecular evidence now shows that this species is actually a member of *Calamagrostis* (Peterson *et al.* 2022).

***Capillipedium spicigerum* S.T. Blake****New state record**

The first record of *Capillipedium* in Hawai'i has been identified after sitting unidentified for almost 70 years in the Agronomy collection as well as in the US National Herbarium. This grass was first collected in the 1950s at Wahiawa, as well as "Pamaluu, Kaneohe,

1200 ft” on O‘ahu. This second location is problematic as that place does not seem to exist. The closest place name I could identify is Punalu‘u. The pasture that does exist there does not extend to 1,200 feet, however, so I suspect the elevation is erroneous. A more recent collection from 2000 at the Red Hill area confirms that the species has persisted.

*Capillipedium* is part of the Old World bluestem group comprising *Bothriochloa* and *Dichanthium* and is most similar to those genera in Hawai‘i. *Capillipedium* can be distinguished from those genera by its spikelets in triplets of one sessile and two pedicellate spikelets; the other species all have spikelets in pairs, with one sessile and one pedicellate spikelet along with its more paniculate inflorescence. *Capillipedium* also has a translucent medial line in its pedicels and rachises in the same way that *Bothriochloa* does (Fig. 1).

The following description is from *Flora of China* (Wu *et al.* 2006: 607).

“Perennial. Culms tufted, up to 150 cm tall, unbranched, nodes bearded. Leaf sheaths usually pilose, ciliate at mouth; leaf blades 15–40 × 0.5–0.8 cm, scaberulous or pubescent, usually hispid with tubercle-based hairs toward base, base rounded, apex acuminate; ligule 0.5–1 mm. Panicle oblong-ovate in outline, 10–18 × 5–8 cm; branches untidily flexuous, pilose in axils; racemes composed of 3–7 spikelet pairs below the terminal triad, purple; rachis internodes and pedicels ciliate. Sessile spikelet 3–4 mm; lower glume oblong-lanceolate, slightly glossy, back 4–5-veined, scarcely depressed along midline, sparsely hispidulous, margins keeled, pectinate-ciliate above middle, apex narrowly obtuse; upper glume ciliate along upper margins; awn of upper lemma 1.2–1.8 cm. Pedicelled spikelet equaling the sessile and often staminate, or smaller and barren. Fl. and fr. autumn. 2n = 40.”

*Material examined.* **O‘AHU:** Pamaalu [Punalu‘u?], Kāne‘ohe, ricegrass–guava pasture, good growth, rare, 1,200 ft [365 m], 12 Oct 1954, *E.Y. Hosaka s.n.* (BISH 785678); Red Hill fuel storage area, a few clumps growing in middle of jeep trail along ridge, mauka of Board of Water Supply tanks, with *Desmodium incanum*, Guinea grass, and other weedy ruderal species, 21°21'N 157°54'W, 06 Jan 2000, *W. Char s.n.* (BISH 669057); Wahiawa, on forest trail, Aug 1951, Sahara s.n. (US 2181456).

### ***Cenchrus complanatus* (Nees) Morrone      New island record**

*Cenchrus complanatus* may now be naturalizing on East Maui near Pi‘iholo. It has previously been documented as naturalized on O‘ahu, Lāna‘i, and Hawai‘i (Imada 2019).

*Material examined.* **MAUI:** East Maui, Makawao Distr., Pi‘iholo, growing in open field, clumping grass, bristles purple, may be naturalized or persisting from old agricultural experiment plots, (20°50'N 156°17'W), 2,100 ft [640 m], 12 Jun 2003, *H. Oppenheimer H603306*.

### ***Cenchrus ×cupreus* (Thorpe) Govaerts      New state record**

*Cenchrus ×cupreus* (syn. *Cenchrus ×advena* (Wipff & Veldkamp) Morrone; *Pennisetum advena* Wipff & Veldkamp) is now known from Maui. *Cenchrus ×cupreus* may now be naturalizing on West Maui, where it is spreading aggressively from an area by Lahainaluna High School that was planted for soil stabilization purposes. The grass is also known from cultivated collections on O‘ahu, Maui, and Kaua‘i, giving this plant a clear introduction pathway.

This is the first time that this hybrid has been recognized as occurring in Hawai‘i, as previously all specimens were erroneously identified as *Cenchrus orientalis* (Rich.) Morrone and *C. complanatus*. This grass has reddish purple leaves and is most likely to be confused with *C. elegans*, as cultivars of that species also commonly have red-pigmented leaves. The two can be easily differentiated by leaf width: *C. elegans* has leaves that are 20–30 mm wide, whereas *C. ×cupreus* leaves are narrower, only 3–11 mm wide. The flowers bear resemblance to *C. complanatus*, as both of these species have one bristle longer than all the others; the two species can be distinguished by *C. ×cupreus* having a panicle greater than 13 cm long and having at least some ciliate bristles surrounding the florets (at least the central bristles are ciliate, other bristles are occasionally ciliate, use at least 20× magnification), compared to a panicle less than 12 cm long and all bristles being scabrous on *C. complanatus*.

This grass is sold as *Pennisetum setaceum* ‘Rubrum’ (Barkworth *et al.* 2003); however, it is not easily confused with *Cenchrus setaceus* (= *Pennisetum setaceum*) due to the latter having very narrow leaves only 2–3.5 mm wide. *Cenchrus ×cupreus* is seemingly apomictic but can also backcross with *C. setaceus* (Simpson & Bashaw 1969). *Cenchrus ×cupreus* seems to be an artificial hybrid, given that it does not occur outside of horticulture (Wipff & Veldkamp 1999), but has been reported as a natural species, nonetheless (Wipff & Veldkamp 1999; van Valkenburg *et al.* 2021).

The following Lucid key should be useful for identification of *Cenchrus ×cupreus* from other cultivated *Cenchrus* (<https://keys.lucidcentral.org/keys/v3/pennisetum/en/>).

The following description is from *Flora of North America* (as *Pennisetum advena*) (Barkworth *et al.* 2003: 527).

“Plants perennial, or annual in temperate climates; caespitose. Culms 1–1.5 m, erect, sometimes branching above, pubescent beneath the panicle; nodes glabrous. Leaves burgundy (rarely green); sheaths glabrous, margins ciliate; ligules 0.5–0.8 mm; blades 33–52 cm long, 6–11 mm wide, flat, antrorsely scabridulous, margins ciliate basally, midvein not noticeably thickened. Panicles 23–32 cm long, 30–58 mm wide, fully exerted from the sheaths, flexible, drooping, burgundy (rarely pale or whitish-green); rachises terete, pubescent. Fascicles 10–17 per cm, disarticulating at maturity; fascicle axes 1–2 mm, with 1–3 spikelets; outer bristles 43–68, 1.2–18.5 mm, terete, scabrous; inner bristles 4–10, 11.7–25 mm, long-ciliate; primary bristles 21.3–33.6 mm, ciliate, noticeably longer than the other bristles. Spikelets 5.3–6.5 mm; pedicels 0.1–0.3 mm; lower glumes 0.5–1 mm, veinless; upper glumes 1.9–3.6 mm, 0–1-veined; lower florets staminate; lower lemmas 4.7–6.1 mm, 5(6)-veined; lower paleas 4.5–5 mm; anthers 2–2.5 mm; upper florets not disarticulating at maturity; upper lemmas 5.2–6.1 mm, 5-veined; anthers 2.5–2.7 mm. Caryopses concealed by the lemma and palea at maturity.  $2n = 54$ .”

*Material examined.* MAUI: West Maui, Lahainaluna High School, by agriculture facility, on steep bank, associated vegetation: *Samanea saman*, *Thunbergia fragrans*, decumbent, sprawling grass 1.5 m tall, purple leaves, roots at nodes, planted to stabilize steep slope, very aggressive growth, (20°53'N, 156°39'W), 159 m, 20 Jun 2002, *F. Starr 020620-03* [two sheets]; Makawao, growing on roadside next to retail shop, full sun in town, clumping perennial grass to 4 ft tall, inflorescence purple, may have been cultivated but store employee says it appeared on its own, (20°51'N, 156°18'W), 501 m, 11 Aug 2000, *J. Barangan s.n.* (BISH 664561).



***Cenchrus elegans* (Hassk.) Veldkamp** **New island record**

Two overlooked specimens of *Cenchrus elegans* from the Bishop Museum Herbarium suggests that *C. elegans* (= *Pennisetum macrostachyum*) may be naturalized on O'ahu. *Cenchrus elegans* has been reported previously as naturalized on Hawai'i Island and is known to be cultivated on Kaua'i, O'ahu, and Hawai'i based on BISH specimens, although it is likely cultivated on other islands as well.

*Material examined.* **O'AHU:** Honolulu, Nu'uauu Valley, Luakaha, edge of shaded stream, 12 Jun 1941, *M.C. Neal s.n.* (BISH 120143); Ko'olaupoko Distr., 'Āhuimanu Rd. ca. 100 yds [90 m] N of Okano Rd, about 5 ft [1.5 m] tall, on shaded road cut, 20–25 ft [6–7.5 m], 17 Jun 1967, *D.R. Herbst 513*.

***Cynodon aethiopicus* Clayton & J.R. Harlan** **New island record**

*Cynodon aethiopicus* is now known from Kaho'olawe from a 1978 collection. It has previously been reported on O'ahu, Maui, and Hawai'i (Imada 2019).

*Material examined.* **KAHO'OLAWA:** Fenced forestry planting near Lua Makika, 23 Nov 1978, *W. Char & L. Yoshida 78.044* (HAW).

***Cyrtococcum patens* (L.) A. Camus** **New state record**

*Cyrtococcum patens* is a grass widely distributed throughout the Pacific and Southeast Asia, and it is now known from Schofield Barracks on O'ahu. This is the first time this species has been found outside of its native range. It is a low-growing, creeping grass that superficially resembles *Panicum*, as it has small spikelets reminiscent of *Panicum*, as well as a paniculate inflorescence. This grass is identifiable based on its laterally compressed spikelets and bone white lemmas. All other *Panicum*-like grasses in Hawai'i have dorsally compressed spikelets.

The species was identified using Clayton & Snow (2010) and confirmed using *Flora of China* (Wu *et al.* 2006). Comparison to specimens in the Bishop Museum Herbarium showed that the specimen was the closest match to material from Taiwan, as the leaf pubescence was slightly different from material in other parts of the Pacific.

The following description is from *Flora of China* (Wu *et al.* 2006: 513).

“Culms creeping, smooth and glabrous, 15–60 cm tall. Leaf sheaths loosely pilose with tubercle-based hairs; leaf blades lanceolate, 3–15 × 0.3–2 cm, pubescent on both surfaces or subglabrous, basal margins with a few long, stiff, tubercle-based hairs, apex acuminate; ligule 0.5–2 mm, subrounded. Panicle 5–30(–40) cm, often diffuse, branches loosely ascending to widely spreading, very slender, glabrous; pedicels filiform, longer than spikelets. Spikelets purplish at maturity, 1.3–1.8 mm, varying from glabrous to appressed-pubescent or shortly hispid with stiff, conspicuously tubercle-based hairs; glumes 3-veined, the lower ca. 1/2 spikelet length, the upper 2/3 spikelet length; lower lemma subequalling spikelet, margins ciliate, apex obtuse; upper lemma minutely pitted. Anthers ca. 0.8 mm. Fl. and fr. Sep–Feb. 2n = 18, 36.”

*Material examined.* **O'AHU:** Schofield Barracks, South Range, at bottom of hill just below SR1 gate, at first road junction, on SW side of intersection, roadsides heavily impacted by mowing and heavy traffic, creeping grass ca. 20 cm tall, leaves ca. 4 cm long, leaf sheath with fringe of hairs,

inflorescence ca. 5 cm long, small patch ca.  $2 \times 2$  m on edge of pull off next to road, doesn't appear to be planted, (UTM 594627 2376082), 980 ft [298 m], 12 Feb 2019, *J. Beachy USARMY 509*.

***Dichantherium acuminatum* (Sw.) Gould**

& C.A. Clark

**New state record**

The first introduced member of *Dichantherium* now joins the four endemic species in the Hawaiian Islands. *Dichantherium acuminatum* was first collected in a pasture in Kahuku, Hawai'i Island in 1951, and subsequently in Volcano in 1973. This grass is of the typical "Panicum" type and can be distinguished from the other species of native *Dichantherium* that occur here by its hairy florets, as all native species have glabrous florets. It is also more likely confused with native rather than introduced *Panicum*, as all of the species of introduced *Panicum* have glabrous florets, whereas several natives have hairy florets. This species has a lower glume that is  $\sim 1/4$  as long as the spikelet, compared to  $1/2$ – $3/4$  as long in the native *Panicum*.

*Dichantherium acuminatum* is quite variable in habitat preferences in its native habitat, ranging from forests, bog edges, prairies, beaches, roadsides, riverbanks, and others (Walsh 1995). As evidenced by its habitat preferences in North America, it can grow in dry to mesic sites, but so far has only been collected at moist to wet sites in Hawai'i.

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

"Plants more or less densely caespitose. Basal rosettes usually well-differentiated; blades ovate to lanceolate. Culms 15–100 cm (rarely taller), usually thicker than 1 mm, weak and wiry or relatively stout and rigid, erect, ascending or decumbent; nodes occasionally swollen, glabrous or densely pubescent, often with a glabrous or viscid ring below; internodes purplish or olive green or grayish-green, to yellowish-green, variously pubescent, with hairs of 2 lengths or glabrous; fall phase erect, spreading, or decumbent, usually branching extensively at all but the uppermost nodes, ultimately forming dense fascicles of branchlets with reduced, flat or involute blades and reduced secondary panicles with few spikelets. Cauline leaves 4–7; sheaths usually shorter than the internodes, glabrous or densely and variously pubescent with hairs shorter than 3 mm, margins ciliate or glabrous; ligules and pseudoligules 1–5 mm, of hairs; blades 2–12 cm long (rarely longer), 2–12 mm wide (rarely wider), firm or lax, spreading to reflexed or stiffly ascending, yellowish-green or grayish-green to olivaceous, densely to sparsely and variously pubescent, margins similar or occasionally whitish-scabridulous, margins often with papillose-based cilia, at least basally, bases rounded or subcordate. Primary panicles 3–12 cm,  $1/4$ – $3/4$  as wide as long, usually open, well-exserted, rather dense; rachises glabrous, puberulent, or more or less densely pilose, at least basally. Spikelets 1.1–2.1 mm, obovoid to ellipsoid, yellowish-green to olivaceous or purplish, variously pubescent, obtuse or subacute. Lower glumes usually  $1/4$ – $1/2$  as long as the spikelets, obtuse to acute; upper glumes and lower lemmas subequal, equaling the upper florets at maturity, or occasionally the upper glumes slightly shorter, not strongly veined; lower florets sterile; upper florets 1.1–1.7 mm long, 0.6–1 mm wide, ellipsoid, obtuse to acute or minutely umbonate or apiculate.  $2n = 18$ ."

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*Material examined.* **HAWAII'I:** Ka'ū, Kahuku, rare in open pasture, in moist location, 3,500 ft [1,066 m], 30 Jul 1951, *E.Y. Hosaka 3636*; Volcano, roadside, Jade & Fourth Streets, newly bulldozed humus and lava in fog belt, 1,097 m, 31 Mar 1971, *O. Degener & I. Degener 33369*.

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

*Dichanthium sericeum* is now known from Moloka'i at Maunaloa. This species is now known from all of the main islands except Kaua'i.

*Material examined.* **MOLOKA'I:** Maunaloa, 14 Mar 1940, *T. Cooke s.n.* (BISH 785765).

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

*Dichelachne micrantha* is now known from Maui near Olinda, where it was growing in lawns and pastures. It has previously been collected on Kaua'i and Lāna'i (Imada 2019).

*Material examined.* **MAUI:** East Maui, Olinda, Hawea Place, on margin of lawn, a few, sticking out above other grasses, naturalized, mesic lawn and pasture, 2,700 ft [822 m], 31 Mar 2011, *F. Starr & K. Starr 110331-01*.

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

Reexamination of all Hawaiian specimens of *Digitaria* revealed new island records of *Digitaria bicornis* from Lehua and Kaua'i. *Digitaria bicornis* was previously only reported from Maui. The specimen cited by Imada & Kennedy (2020) as *Digitaria bicornis* from Midway has been reidentified as *D. ciliaris*, thus limiting the species to only the main Hawaiian Islands.

*Digitaria bicornis* can be very similar to *D. ciliaris* (Webster 1983), and almost all of the specimens cited below were misidentified as *D. ciliaris*. *Digitaria bicornis* can be identified by its dimorphic sessile and pedicellate spikelets (check the middle to apex of the panicle branches), with the sessile spikelet having nerves equally spaced, and pedicellate spikelet with nerves close to the margins. *Digitaria ciliaris* has spikelets with uniform venation. These species can also be separated by the hairs at the lowest node of the inflorescence (where the lower panicle branches all converge): on *D. ciliaris* the hairs are up to 1 mm long and on *D. bicornis* they are less than 0.4 mm long (Fig. 2); thus, if hairs present in this region are greater than 0.4 mm long, it is *D. ciliaris*. Under strong magnification the longer hairs on *D. ciliaris* are noticeable when comparing material side-by-side. When mature, *D. ciliaris* can also have somewhat pectinate hairs on its spikelets (Werier 2020); when spikelets like this exist they can be distinguished from *D. bicornis* by the venation of the sterile lemmas.

*Material examined.* **LEHUA:** Small, crescent-shaped cinder cone island (N of Ni'ihau) composed of volcanic tuff, scattered to dense vegetation of shrubs (*Pluchea* spp.) and herbs (*Jacquemontia*, *Ageratum*, *Sicyos*, and grasses), perennial herb, culms decumbent, occasional on N slope, naturalized, 0–186 m, 10 Jan 1992, *D.H. Lorence 7137* (PTBG). **KAUA'I:** Barking Sands Pacific Missile Range Facility, U.S. Navy, main road between Kokole Point and base housing, common, 10 ft [3 m], 18 Jan 1988, *T. Flynn 2701*.



**Fig. 2.** Lowest node of the inflorescence in *Digitaria*. **A**, *Digitaria bicornis* showing short, fuzzy hairs (T. Flynn 2701). **B**, *Digitaria ciliaris* showing a mixture of short and long hairs and with an arrow pointing to long hairs (G.C. Munro 47). Scale bars are 1 mm long. Photos taken at BISH.

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

**Note**

Examination of *Digitaria ciliaris* specimens from Papahānaumokuākea revealed that some specimens display phenotypes that have not been collected in the main Hawaiian Islands. Some specimens have glassy, almost spinelike hairs on the sterile lemma. *Flora of North America* (Barkworth *et al.* 2003) stated that those can occur on *D. ciliaris* in the controversial variety *D. ciliaris* var. *chrysoblephara* (Fig. & De Not.) R.R.Stewart, which I do not recognize here (Wilhelm 2009). Some specimens, such as the specimen erroneously identified as *D. bicornis* from Midway, have hairs on the spikelet that look pectinate and very similar to *D. ciliaris*; however, close examination can separate *D. bicornis* from *D. ciliaris*, as *D. bicornis* has heteromorphic spikelet pairs where venation or pubescence differ between the sessile and pedicellate. Also, see the discussion under *D. bicornis* for other differences between the species.

***Digitaria eriantha* Steud.**

**New naturalized record**

*Digitaria eriantha* has previously been reported on Kauaʻi, Maui, and Hawaiʻi, and has been listed as questionably naturalized on Oʻahu from an experimental farm (Imada 2019). It is now known to be naturalized on Oʻahu from the vicinity of Kahuku, as well as Waimānalo and Makiki. It is likely more widespread than that, however.

*Material examined.* OʻAHU: Koʻolau Mountains, Kahuku Training Area near Canes LZ, 27 Jul 2011, A. Lau 2011072701; Kahuku, along roadways through abandoned sugar cane field and *Leucaena* thickets, 21 Dec 1988, K.M. Nagata 3936; Across stream from base of Sacred Falls foot path, 75 ft [22 m], 09 May 1978, C. Corn s.n. (BISH 667066); Kahuku, Kahuku Training Range, 520 ft [158 m], 19 Oct 2011, J. Beachy 236; UH Experimental farm at Waimānalo, weed on side of road, common, 21.333892, -157.711778, 10 Jul 2021, K. Faccenda 2041; Makiki Valley Loop Trail, trailhead outside of DLNR buildings, full sun, moist, large colony, 21.314658, -157.829383, 14 Jul 2021, K. Faccenda 2051.

***Digitaria eriostachya* Mez****New state record**

*Digitaria eriostachya* was first collected on Hawai'i Island in 2001 and was not correctly identified until recently. Three collections have been made, all in the Volcano area from roadsides; fieldwork in 2022 showed that this species is abundant in the Volcano area and is spreading along Hwy 11. It would be unsurprising if this species moves towards Hilo or the Hāmākua coast. This species was likely an intentional introduction, as it was cited in Rotar (1968) as occurring in Hawai'i before any specimens were made. *Digitaria eriostachya* is most similar to *D. eriantha*, but differs in having panicle branches that are triangular with no wings, as well as *D. eriostachya* having no lower glume and an upper glume that is as long as the spikelet. *Digitaria eriostachya* is native to Paraguay and Argentina (Webster & Hatch 1990), and this is the first time it has been reported outside of its native range. Little information exists about its ecology or weed potential.

The following description is from Webster & Hatch (1990).

“Plants perennial; stoloniferous; rhizomatous or lacking rhizomes. Nodes glabrous. Sheath auricles 1–2 mm long. Sheaths glabrous. Ligule 1–3 mm long. Leaf blades flexuous; spreading; 3–20 cm long; 3–8 mm wide; glabrous on the lower surface; glabrous on the upper surface; with the midrib not obviously differentiated. Main axis 20–40 mm long; with quaquaversal primary branches. Primary branches appressed to the main axis to spreading; not whorled; 4–7 on the main axis; 0.2–0.3 mm wide. Pedicels 2–3 mm long. Cleistogamous inflorescence absent. Spikelets 36–60 on a typical primary branch; lanceolate or elliptic; (2.2–)2.4–2.9 mm long; 0.6–0.8 mm wide. First glume absent (occ. present as a minute scale ca. 0.1 mm long). Second glume 1 times spikelet length; 3–5-nerved; hairy; acuminate to acute. Lemma of lower floret 7-nerved; acuminate to acute; hairy. Lower lemma hairs overtopping the upper floret (by 0.2–0.5 mm); white. Upper floret 0.92–1 times the length of the lower floret. Lemma of upper floret grey or yellow; acuminate. Distribution: Paraguay and Argentina.”

*Material examined.* **HAWAII:** Puna Distr., Wright Road, 3–4 mile marker, along the highway, wet open disturbed, mixed with other non-native plant species, ~4,000 ft [~1,219 m], 06 Oct 2006, *K.F. Bio 03-0016-01*; Ka'ū Distr., Hawai'i Volcanoes National Park, Crater Rim Road, between entrance and Research Center turn off, rare on side of road in disturbed vegetation adjacent to *Metrosideros polymorpha* forest, tall grass with green inflorescences, 1,200 m, 23 Jul 2001, *L.W. Pratt 3261* (HAVO); Volcano, junction of Volcano Rd. and Kalanina'uli Rd., moist roadside, common, stoloniferous or some plants appearing caespitose, 19.433951, -155.225701, 02 Mar 2022, *K. Faccenda 2262*.

***Digitaria horizontalis* Willd.****Correction**

*Digitaria horizontalis* was previously reported on Lāna'i by O'Connor (1990). The specimen (*Herbst 4027*) was re-examined and found to be a misidentification of *D. nuda*. *Digitaria horizontalis* is now only known in Hawai'i from two collections on O'ahu.

***Digitaria nuda*** Schumach.**New state record**

*Digitaria nuda* has been collected since 1930 but had been erroneously identified as *D. ciliaris* or *D. setigera*. *Digitaria nuda* is now known from Kure Atoll, Kaua‘i, O‘ahu, Lāna‘i, Maui, Kaho‘olawe, and Hawai‘i. This species is unique in having no lower glume, spikelets <2.5 mm long, and an upper glume 2/5–4/5 as long as the lemma.

*Digitaria nuda* is an African and Southeast Asian native that has become naturalized throughout Central and South America. This species is similar to the common *Digitaria ciliaris* in its weedy tendencies (especially as a weed in agriculture) but grows more slowly (Souza *et al.* 2012). *Digitaria nuda* is allelopathic and has resistance to certain herbicides that kill the more common *D. ciliaris* (Dias *et al.* 2007; Hugo *et al.* 2014).

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 378).

“Plants annual or of indefinite duration. Culms 20–60 cm, glabrous, decumbent, rooting and branching from the lower nodes, geniculate above. Sheaths glabrous or with long hairs near the base; ligules 0.8–2.5 mm; blades 2–13.5 cm long, 1.5–2.5 mm wide, glabrous on both surfaces or the adaxial surface with a few long hairs near the base. Panicles with 3–8 spikelike primary branches, these digitate or with rachises to 2 cm long; lower panicle nodes with hairs at least 0.4 mm; primary branches 4–15.5(–20) cm long, 0.4–0.8 mm wide, axes wing-margined, wings more than 1/2 as wide as the midribs, proximal portions of the branches often with scattered 1–4 mm hairs, bearing spikelets in unequally pedicellate pairs on the lower and middle portions of the branches; secondary branches absent; pedicels not adnate to the branches. Spikelets homomorphic, 1.7–2.8 mm long, 0.5–0.8 mm wide. Lower glumes absent or to 0.2 mm; upper glumes 1–2.2 mm, 0.4–0.8 times as long as the spikelets; lower lemmas about as long as the spikelets, 7-veined, veins smooth, lateral veins usually equally spaced, sometimes the inner lateral veins more distant from the other 2, intercostal regions adjacent to the midveins glabrous, those between the lateral veins with 0.5–1 mm hairs, hairs initially appressed, sometimes strongly divergent at maturity; upper lemmas yellow to gray when immature, becoming brown at maturity; anthers 0.3–0.6 mm. 2n = unknown.”

**Material examined.** **KURE:** Kure Atoll, weed around quarters, 12 Sep 1961, *C.H. Lamoureux 1865* (HAW). **KAUA‘I:** Līhu‘e plantation land between Hanamā‘ulu and Hanahanapuni cone, weed along haul cane road off dirt banks of sugar cane fields, 21 Aug 1937, *S. Ishikawa 285*; Hanalei, in moderately wet pineapple field, 01 Aug 1931, *E.Y. Hosaka 480*; [no location], Dec 1946, *C.W. Schwartz 1145*; Līhu‘e, along ditches and around sugar cane fields, 05 Jun 1994, *C. Morden 1187* (HAW [in HPDL collection]). **O‘AHU:** Mountains back of Punalu‘u, forest, 01 Mar 1936, *L.D. Whitney 4074*; Makiki Heights, 12 Jan 1936, *L.D. Whitney 4018*; Honolulu, Pensacola St., 24 Apr 1936, *L.D. Whitney 4181*; Honolulu, Ke‘eaumoku St., 05 Jan 1936, *L.D. Whitney 4013*; Honolulu, Dowsett Highlands, weed in yard, 10 Sep 1950, *E.H. Bryan Jr. s.n.* (BISH 22079); Wheeler Airbase, common weed of pineapples, 07 Jan 1976, *J.T. Swarbrick H.61*; Grounds of H.S.P.A. Experiment station, Ke‘eaumoku St., 27 Dec 1947, *P.W. Weber s.n.* (BISH 118667); Pali Hwy., vicinity of the Queen Emma Summer Palace, growing from lawn, common, 21.335811, -157.839828, 29 May 2021, *K. Faccenda 1938*; Honolulu, Bishop Museum campus, weed along road behind Castle Building, partial sun, uncommon, 21.333245, -157.871761, 24 Jun 2021, *K. Faccenda 2007*; Honolulu, end of Queen St. at harbor, weed in irrigated flower bed, partial sun, only a few plants seen, not growing from full sun, 21.308597, -157.864211, 07 Aug 2021, *K. Faccenda 2077*. **LĀNA‘I:** Pālāwai Basin,

along road in pineapple field, common tufted grass, 1,100 ft [335 m], 11 Jun 1974, *D.R. Herbst 4027*. **MAUI:** West Maui, Lahaina Distr., Honokahua, between Kahauiki and Honolulu, 04 Aug 2019, *H. Oppenheimer H81902*; Central Maui, Kahului, forestry nursery, 24 Jun 1938, *R.W. Hobdy 1774 & 1775*; East Maui, Mākena, ¼ mile inland from Mākena Beach, very dry conditions with *Cenchrus echinatus*, *Eragrostis*, bunchgrass to 5 inch height, 40 ft [12 m], 17 Jan 1976, *Resnick 299b & 322 (HAW)*. **KAHO‘OLAWĒ:** Transect C4, along secondary road that runs from main road to lighthouse, *Prosopis* with *Tragus* groundcover [this was a mixed collection with *D. ciliaris*], 500 ft [152 m], 25 Nov 1978, *W.P. Char 78.064*. **HAWAI‘I:** South Kohala Distr., east of Queen Ka‘ahumanu Hwy. between Mauna Lani Drive and Puakō turn off, dry area with scant vegetation, open grassland with scattered *Prosopis pallida*, 04 Feb 1991, *E.J. Funk s.n.* (BISH 662889); South Kona Distr., Nāpo‘opo‘o Rd. & Kanele St., S of Captain Cook, roadside weed, dry, partly shaded area, frequent weed along the road, 19.464792, -155.900923, 02 Mar 2022, *K. Faccenda 2276*.

### *Digitaria orbata* Hughes

### New state record

A new species of *Digitaria* for Hawai‘i was recently identified from material collected 30 years ago on Lāna‘i. After consulting Henrard (1950), Webster (1983), and photographed material on the Australian Virtual Herbarium site, it was identified as *D. orbata*. *Digitaria orbata* is an Australian native, and this is the first time this species has been found growing wild outside of Australia. Its native habitat consists of rainforest and subtropical woodlands (Webster 1983), and no other information can be found regarding its ecology. It is likely that G. Munro introduced this plant (intentionally or otherwise), as he imported many plants from Australia and New Zealand into Lāna‘i.

This species is unique among all species of *Digitaria* known to occur in Hawai‘i as it is an upright, clump-forming plant without stolons; has spikelets < 2 mm long; lacks a lower glume; has a minute upper glume about 0.25× as long as the spikelet; and has a very roughly textured fertile lemma.

The following description is from Webster (1983: 196).

“Nodes on erect culm, 3–5. Mid-culm nodes glabrous (setaceous hairs occasionally present on lower nodes). Axillary inflorescences normally absent from lower nodes. Mid-culm leaf sheath glabrous. Mid-culm leaf blade 60–250 mm long. Mid-culm leaf blade 1.8–5.5 mm wide (average 3.0). Adaxial surface of leaf blade glabrous (nerves scabrous). Spicules well developed on leaf margins to poorly developed on leaf margins. Papillose-based hairs absent or rare in throat of collar region. Ligule 1.6–4 mm long (average 2.4). Lowermost primary branch 70–160 mm long. Pronounced spicules present on margins of primary branches. Lowermost pulvinus glabrous or hairs shorter than 0.4 mm long. Spikelets imbricate to not imbricate. Spikelets elliptic (approaching obovate). Spikelets 1.3–1.8 mm long (average 1.6). Spikelets 0.47–0.8 mm wide (average 0.70). First glume 0–0.15 mm long (mostly absent). Second glume 0.2–0.6 mm long (average 0.4). Second glume glabrous. Nerves on second glume, 0 (not distinctly nerved). Ratio of second glume length to spikelet length, 0.12–0.34 (mostly under 0.25). Lower lemma 1.1–1.6 mm long. Lower lemma shorter than upper lemma (tip of grain protruding). Nerves of lower lemma anastomosing apically. Nerves on lower lemma, 3–5 (mostly 3). Nerves of lower lemma of lowermost spikelet per node spaced to produce a relatively wide first interspace and narrow second interspace; or equidistant. Lower lemma with scattered fine pubescence to glabrous. Upper lemma muricate at maturity, papillae pronounced. Upper lemma acute.”



*Material examined.* LĀNA'I: ca. 1 mile north on Kaunalapau Hwy., *Leucaena-Dodonaea-Panicum maximum* scrub, occasional, 1,000–1,100 ft, 1990, *R.W. Hobdy s.n.* (BISH 767427).

***Digitaria stricta* Roth var. *stricta***

**New state record**

*Digitaria stricta* var. *stricta* is now known from O‘ahu, where it is now widely distributed across the island and has been present since at least 2003. This grass is native to India and Southeast Asia, and this is the first time it has been detected outside of its native range. Little information is available about habitat preferences or ecology of this plant. It is morphologically quite similar to *Digitaria violascens* but differs in having very hairy florets and a corona of hairs at the apex of the pedicel.

The following description is from *Flora of China* (Wu *et al.* 2006: 544).

“Annual. Culms tufted, slender, erect, 20–40 cm tall. Leaf sheaths loose, keeled, glabrous or papillose-pilose, especially at mouth; leaf blades linear, soft, 5–20 × 0.3–0.5 cm, adaxial surface tuberculate-hispid in lower 1/3, apex finely acuminate; ligule 1–1.5 mm. Inflorescence subdigitate, axis 1–3 cm; racemes 2–8 or more, 5–12 cm; spikelets ternate; rachis triquetrous, narrowly winged, margins scabrous; pedicels scabrous, tips slightly dilated with overtopping spicules up to 1 mm. Spikelets elliptic, 1.2–1.4 mm, hairs clavate, rarely glabrous; lower glume absent; upper glume variable, 1/4–1/2 as long as spikelet, rarely vestigial or absent, veinless or 1–3-veined; lower lemma slightly shorter than spikelet, 3–5-veined, intervein spaces and margins sparsely pubescent to villous; upper lemma chestnut brown to purplish black with a paler, apiculate, slightly protruding apex. Anthers ca. 0.3 mm. Fl. and fr. autumn.”

*Material examined.* O‘AHU: Waikīkī, along Ala Moana Blvd., weed in irrigated flower bed, full sun, caespitose, common in this flower bed [initially a mixed collection with *D. violascens*], 21.284578, -157.837214, 22 Jun 2021, *K. Faccenda 2003.5*; Kahuku Training Area, ‘Ō‘io Gulch, gravel pile by NIKE site, RS-KTA-01, naturalized, UTM 604933 2396374. 600 ft [ca. 183 m], 30 Jan 2018, *K. Kawelo US ARMY 474*; Schofield Barracks East Range, roadside vegetation, 01 Oct 2003, *K. Kawelo s.n.* (BISH 704712); Ala Moana Park, west portion near harbor and volleyball courts, mowed, irrigated grass, locally common in this portion of the park, but not seen outside of this colony, spikelets with clavate hairs, 21.291860, -157.854915, 02 Feb 2022, *K. Faccenda 2218*; Road connecting Nu‘uanu Pali lookout to Pali Hwy. towards Honolulu, roadside weed, mowed area, sunny, moist, uncommon, 21.365379, -157.796837, 05 Feb 2022, *K. Faccenda 2223*.

***Echinochloa oryzoides* (Ard.) Fritsch**

**New island record**

*Echinochloa oryzoides* has been collected once on Moloka‘i, 120 years ago. It may not have persisted and should be treated as questionably naturalized unless it is recollected. This species has previously been collected on O‘ahu (Imada 2019).

*Material examined.* MOLOKA‘I: American Sugar Co., a plant of this grew last year in a Japanese yard, it seeded a number of plants “au” [*sic*] then now it seeds quickly, 800 ft [243 m], Feb 1903, *G.C. Munro 92*.

***Elymus repens* (L.) Gould**

**Correction**

*Elymus repens* was previously published for the state by Oppenheimer (2016); however, the specimen supporting this (*Oppenheimer H50609*) was examined and it represents a



misidentification of *Dactylis glomerata*. Serendipitously, new specimens were found to replace it in the BISH unidentified Poaceae folder. *Elymus repens* is now known from East Maui in the vicinity of Hosmer Grove based on two collections from 1989 and 1991, which were only recently deposited at BISH. *Elymus repens* (as the synonym *Elytrigia repens* (L.) Nevski) is listed as a state noxious weed (State of Hawaii 1992).

*Material examined.* MAUI: Haleakalā National Park, near Hosmer Grove in dump area, 6,900 ft [2,103 m], 27 Nov 1989, *B. Gagne s.n.* (BISH 582449 & 58448 [2 sheets]); *loc. cit.*, near Hosmer Grove, 03 Jan 1991, *B. Gagne 1036*.

### *Eragrostis barrelieri* Daveau

### New state record

*Eragrostis barrelieri* has been collected from O‘ahu, Maui, and Kaho‘olawe and has been present on the islands since 1977. This species is widespread on O‘ahu, occurring in dry, low elevation areas. It is a short annual with abundant glands throughout the inflorescence and is most easily confused with *E. leptostachya*, as that is what almost all specimens were misidentified as. The two species can be separated by *E. barrelieri* being an annual with rounded seeds and *E. leptostachya* being a perennial with grooved seeds.

The Hawaiian vouchers of *E. barrelieri* were not able to be correctly identified in *Flora of North America* (Barkworth *et al.* 2003) due to an error in the *Eragrostis* key. The key states that *E. barrelieri* does not have glands on the pedicels, but Hawaiian material consistently has glandular pedicels. Other authors recognize that *E. barrelieri* has glandular pedicels (Cope 1982).

*Eragrostis barrelieri* is a European, African, and West Asian species that has become widely naturalized though the Americas and Australia. This species is a weed of disturbed habitat, including roadsides, gardens, and agricultural areas.

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 83).

“Plants annual; tufted, without innovations. Culms (5–)10–60 cm, erect or decumbent, much-branched near the base, with a ring of glandular tissue below the nodes, rings often shiny or yellowish. Sheaths hairy at the apices, hairs to 4 mm; ligules 0.2–0.5 mm, ciliate; blades 1.5–10 cm long, 1–3(–5) mm wide, flat, abaxial surfaces glabrous, adaxial surfaces glabrous, sometimes scabridulous, occasionally with white hairs to 3 mm, margins without crateriform glands. Panicles 4–20 cm long, 2.2–8(–10) cm wide, ovate, open to contracted, rachises with shiny or yellowish glandular spots or rings below the nodes; primary branches 0.5–6 cm, diverging 20–100° from the rachises; pulvini glabrous; pedicels 1–4 mm, stout, stiff, divergent, without glandular bands. Spikelets 4–7(–11) mm long, 1.1–2.2 mm wide, narrowly ovate, reddish-purple to greenish, occasionally grayish, with 7–12(–20) florets; disarticulation acropetal, paleas persistent. Glumes broadly ovate, membranous, 1-veined; lower glumes 0.9–1.4 mm; upper glumes 1.2–1.6 mm; lemmas 1.4–1.8 mm, broadly ovate, membranous, apices acute to obtuse; paleas 1.3–1.7 mm, hyaline, keels scabrous, scabridities to 0.1 mm, apices obtuse to acute; anthers 3, 0.1–0.2 mm, reddish-brown. Caryopses 0.4–0.7 mm, ellipsoid, not grooved, smooth to faintly striate, light brown.  $2n = 40$ .”

*Material examined.* O‘AHU: Honolulu, bus stop at intersection of South King and Punchbowl Streets, weed from crack in sidewalk, 2 plants seen, 21.305297, -157.858628, 27 Aug 2021, K.

*Faccenda 2096*; Ka'ena Point State Park, parking lot on the Wai'anae side, edge of parking lot, sunny, common weed, 21.565131, -158.263067, 11 Nov 2021, *K. Faccenda 2161*; Pali Hwy., vicinity of Kawānanakoa Pl., from crack between road and curb, sunny area, infrequent on road, 21.326033, -157.847672, 29 May 2021, *K. Faccenda 1937*; Base of highrise at University Ave. and Kapi'olani Blvd., moist, cool shaded area, cold air was blowing out of a vent in this area artificially lowering the temperature, 21.286967, -157.826406, 08 May 2021, *K. Faccenda 1793*; Former Air Naval Station Barbers Point, Northern Trap & Skeet Range, outplanting site on firebreak scrape, 28 Apr 2021, *BISH staff BP006*; Barber's Point, near storage tanks by harbor, 26 May 1977, *W. Char 77.057* (HAW). **MAUI**: East Maui, Makawao Distr., Pā'ia, sidewalk crack, 40 ft [12 m], 20 Jan 2010, *H. Oppenheimer H11009*; West Maui, Lahaina Distr., Laniupoko, unpaved road below the reservoirs, 840 ft [256 m], 02 Apr 2002, *H. Oppenheimer H40701*; West Maui, Wailuku Distr., vicinity of Waihe'e Ditch, foot of Kaunaohua Ridge, locally common in dry area formerly grazed, 320 ft [97 m], 17 Apr 2009, *H. Oppenheimer 40925*. **KAHO'OLAWA**: Honokanai'a, at base camp, 20 ft [6 m], 20 Jan 2004, *H. Oppenheimer H10404*.

***Eragrostis elongata* (Willd.) J. Jacq.**

**Correction; New naturalized record**

*Eragrostis elongata* has previously been listed as adventive on Hawai'i Island, but recent collections show that it is now widely naturalized on the windward side of the island. *Eragrostis elongata* was previously described as occurring on Moloka'i (Oppenheimer 2003), but this specimen (*Oppenheimer H110140*) has now been redetermined as *E. brownii*. *Eragrostis elongata* is now known only from Kaua'i, O'ahu, and Hawai'i.

*Material examined*. **HAWAI'I**: Mauna Kea, herb along roadside of Saddle Road, (UTM 264933, 2179397), 950 m, 01 Jun 2008, *C. Angelo 002* (HAW); North Kūlani Road, 'Ōla'a, assoc. with *Hypericum mutilum*, flat tufts, inflorescence with purplish cast, 1,500 ft [457 m], 15 Dec 1975, *D.R. Herbst 5591*; Kea'au, along dirt road on south side of old sugar mill, 04 Apr 1997, *E.J. Funk s.n.* (BISH 767375); South Hilo Distr., Waiākea, buffer zone collections along Stainback Hwy., 3,000 ft [914 m], 15 Jul 1998, *E.J. Funk s.n.* (BISH 662851); Saddle Road, approximately 30 km mauka from Hilo, roadside weed in a moist, open area, uncommon, clump-forming, flower bright purple, florets breaking apart from apex to base, 19.677200, -155.329180, 04 Mar 2022, *K. Faccenda 2303*.

***Eragrostis leptostachya* (R. Br.) Steud.**

**New island record; Correction**

This species was erroneously published for O'ahu and Kaho'olawe (Imada & Kennedy 2020); the specimens supporting these records were all misidentifications of *E. barrelieri*. Most specimens from BISH previously identified as *E. leptostachya* from Maui were also actually *E. barrelieri*, with only one specimen representing true *E. leptostachya*. *Eragrostis leptostachya* is now known from Kaua'i at Hanapēpē and East Maui at 'Ulupalakua. It was previously reported only from Moloka'i (Imada 2019).

*Material examined*. **KAUAI**: Hanapēpē, in pasture, local patch, dry place, 250 ft [76 m], 31 Oct 1936, *E.Y. Hosaka 1647*. **MAUI**: East Maui, 'Ulupalakua, adjacent to Tedeschi Winery, NW of Pu'u Māhoe, open mesic slope with overstory of *Acacia mearnsii*, *Grevillea robusta*, *Cinnamomum camphora*, groundcover dominated by *Bryophyllum pinnatum*, occasional bunchgrass growing with *Cyperus gracilis*, 20° 38'N 156° 23'W, ca. 2,100 ft [640 m], 16 Jul 2003, *C.T. Imada et al. 2002-24*.

***Eragrostis multicaulis* Steud.****New state record; Note**

*Eragrostis multicaulis* is now known from Hawai'i Volcanoes National Park on Hawai'i Island, growing from a driveway. The 80 year-old specimen was misidentified as *E. pectinacea*, and because it has not been recollected since, should be treated as questionably naturalized until recollected. This species is quite similar to *Eragrostis pilosa* and likely has similar ecology, being a weed of moist disturbed areas, especially urban areas and paddy fields (Chang & Kim 1990; Kim & Pyon 1998), and has not been reported as an environmental weed.

*Eragrostis multicaulis* is a species with a contested taxonomy, which I reviewed during the course of identifying this specimen. Some authors recognized it as a valid species (Hitchcock & Chase 1950; Scholz 1988; Huang 2000; Veldkamp 2002; Hohla 2006; Wu *et al.* 2006), while others treated it as a variety, form, or entirely synonymous with *E. pilosa* (Koch 1974; Tsvelev 1983; Ryves *et al.* 1996; Barkworth *et al.* 2003). Various characteristics have been used to separate *E. multicaulis* from *E. pilosa*, including axils of inflorescence branches lacking hairs (Chen & Peterson 2006; Kuoh & Chen 2000; Tsvelev 1983; Veldkamp 2002); the leaf sheath mouths (collars) lacking hairs (Chen & Peterson 2006; Kuoh & Chen 2000; Veldkamp 2002; Fernald 1950; Scholz 1988); the pedicels of the spikelets being shorter than the spikelets (Chen & Peterson 2006; Veldkamp 2002; Hohla 2006); the panicle being less than 3 cm wide (Veldkamp 2002); pedicels appressed to secondary panicle branches (divergent in *E. pilosa*) (Koch 1974); more delicate panicle branches (Hohla 2006); and indistinct lemma lateral nerves (Hohla 2006). Some of these characters have more utility than others for reliable identification. Van der Meijden & Weeda (1982) discussed the differences between *E. multicaulis* and *E. pilosa*; they noted that the type specimen of *E. multicaulis* has an almost naked leaf collar, but other specimens have significant variation in this character, with some having hairy and almost naked sheath mouths on the same individual. Hügin (1999) clarified this and says that only the leaf collar of the uppermost leaf should be examined for hairs and that lower leaf collars can be variable. Jauzein (1995) also clarified that the axils of the inflorescence may have 1–2 long hairs.

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

“Annual. Culms tufted, erect or ascending, geniculate at base. Leaf sheaths glabrous at summit or with a few short hairs, compressed; ligules a line of hairs, 0.2–0.1 mm; leaf blades usually flat, 3–9 cm × 0.5–2.5 mm, glabrous. Panicle open, 4.5–9 × 1.5–3 cm; branches solitary or in pairs but base branches nearly whorled, glabrous in axils; pedicels usually shorter than spikelets. Spikelets dark green, 2.5–4.5 mm, 3–10-flowered. Glumes membranous, falling off at maturity, lower glume narrow, veins obscure, ca. 0.6 mm, upper glume oblong-ovate, 1-veined, ca. 1 mm. Lemmas membranous, semi-ovate in side vein, ca. 1.5 mm, middle vein keeled, falling off at maturity. Palea membranous, ca. 1 mm, apex blunt, along 2 keels ciliolate, persistent or tardily falling off at maturity. Stamens 3; anthers ca. 0.2 mm. Caryopsis ca. 0.8 mm, striate. Fl. and fr. late summer. 2n = 40.”

**Material examined.** HAWAII: Hawai'i National Park, Kilauea, several clumps found in driveway of Observatory & Naturalist Building, 20 Aug 1943, *G.O. Fagerlund & A.L. Mitchell 818*.

*Eragrostis parviflora* (R. Br.) Trin.

**Correction; New island records**

In the process of writing the key to species for *Eragrostis* it was noticed that there were no distinguishable features separating *E. pectinacea* and “*E. parviflora*” (*sensu* the key in Herbst & Clayton 1998), aside from the presence of scattered glands on the leaves. Communication with Dave Albrecht at the Australian National Herbarium and the use of the key in Lazarides (1997) revealed that the three Hawaiian specimens identified as “*E. parviflora*” did not match Australian material.

The only character that delimits these sheets from *E. pectinacea* is the presence of scattered glands on the leaves (Herbst & Clayton 1998; Faccenda, pers. observ.). Glands are not found on the culms, sheaths, or anywhere in the inflorescences. In his monograph of the *Eragrostis pilosa* complex, Koch (1974) stated that *E. pectinacea* does not have glands. However, I believe that based on the lack of any other features that distinguish these specimens from *E. pectinacea*, they are simply aberrant specimens of *E. pectinacea*. Paul Peterson (pers. comm.) has also supported this opinion. *Eragrostis parviflora* was first published as naturalized by Flynn & Lorence (1998) based on two specimens from Kaua‘i, and a specimen from O‘ahu was more recently published (Imada & Kennedy 2020). All of these specimens were misidentifications of *E. pectinacea* var. *pectinacea*.

Serendipitously, two specimens that actually represent *E. parviflora* were discovered from Ka‘a and Kō‘ele on Lāna‘i, as well as from Kahuku on Hawai‘i Island. Therefore, *E. parviflora* is now only known from Lāna‘i and Hawai‘i. As the Lāna‘i collections are 90 years old, they should be considered questionable naturalizations until recollected. The presence of glands on *E. parviflora* is a variable trait; only a minority of individuals seem to have them scattered along the abaxial leaf veins and along the sheaths (Dave Albrecht, pers. comm.).

As no description for this plant was provided when it was first erroneously published by Flynn & Lorence (1998), one is provided here from ABRS (2005: 387).

“Annuals or short-lived perennials. Culms erect to decumbent, terete or lower internodes compressed, 30–90 (–135) cm high. Leave with ribbed sometimes glandular veins, mostly glabrous and smooth; ligule a ciliate membrane, 0.3–0.6 mm long; blade flat and to 4.5 mm wide or convolute, straight, with capillary apex. Panicles loose or open, sometimes drooping, 20–60 cm long, 11–30 cm wide, scabrous; axils glabrous or bearded; lower branches usually ± whorled; branches divided, naked in the lower 1–4 cm. Spikelets pedicellate, linear to oblong, (2.5–) 4.5–9 (–16) mm long, 0.8–1.5 mm wide, olive-green when young, sometimes cleistogamous; rachilla flexuous; florets (3–) 7–15 (–30), soon loosely overlapping, usually falling entire; apical floret vestigial. Glumes unequal, hyaline; lower glumes ovate to triangular, 0.7–1.5 mm long; upper glume lanceolate, 1.2–1.8 mm long. Lemma lanceolate, 1.5–2 mm long, obtuse, membranous; lower lemma often longer than upper lemmas. Palea hyaline; body spatulate, entire or notched by short keels, apically ciliate; keels sparsely scaberulous; flaps ± as wide as body. Stamens 3; anthers 0.2–0.3 mm long. Grain terete to trigonous, flat or slightly concave on the back, oblong ellipsoid, 0.4–1 mm long, sometimes striate-reticulate, reddish to dark brown with a minute stipe.”

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*Material examined.* LĀNA'I: Kō'ele, 1,740 ft [530 m], 20 Dec 1929, *G.C. Munro 552*; Ka'a, a grass introduced some years ago, 1,500 ft [450 m], 21 Nov 1929, *G.C. Munro 446*. HAWAI'I: Kahuku Ranch, rare, local patch in rocky pasture, 2,500 ft [762 m], 29 Sept 1950, *E.Y. Hosaka 3613*.

***Eragrostis pectinacea*** (Michx.) Nees var. ***miserrima*** (E. Fourn.) Reeder

**Correction**

The specimen identified as *Eragrostis pectinacea* var. *miserrima* by Snow & Lau (2010) has been redetermined to be *E. leptostachya*, based on the presence of abundant glands. There are now no known occurrences of *E. pectinacea* var. *miserrima* in Hawai'i, and this variety should be removed from the checklist.

***Eragrostis pectinacea*** (Michx.) Nees var. ***pectinacea***

**Correction**

*Eragrostis pectinacea* var. *pectinacea* was previously published for Kaho'olawe (Oppenheimer 2006), however this represented a misidentification of *E. barrelieri*. *Eragrostis pectinacea* was also previously published for Lāna'i (O'Connor 1990), but those specimens have been redetermined as *E. parviflora*. Thus, no specimens of *E. pectinacea* var. *pectinacea* are now known from Lāna'i or Kaho'olawe, and its documented distribution is restricted to Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i.

***Eragrostis pilosa*** (L.) P. Beauv. var. ***pilosa***      **Correction; Note**

*Eragrostis pilosa* is no longer known from Lāna'i, as the only specimen documenting its presence on the island was a misidentification of *E. parviflora*. *Eragrostis pilosa* var. *pilosa* is therefore now only known from Kaua'i and O'ahu.

All specimens examined represent *Eragrostis pilosa* var. *pilosa*. No specimens of the glandular variety (*E. pilosa* var. *perplexa* (L.H. Harv.) S.D. Koch) have been collected in Hawai'i.

***Eragrostis sessilispica*** Buckley      **Correction**

*Eragrostis sessilispica* was noted by Snow (2008) as a waif record from an agricultural experiment station and the species was then incorporated into the Imada (2019) checklist. Over the course of this research, I examined many specimens collected at such stations and believe that this label is consistent with cultivated material from grass introduction gardens rather than a weed or contaminant. Many plants that were cultivated in these gardens were not initially identified to species by their collectors, which Snow (2008) used as justification that it wasn't planted. This species has been excluded from the following key to *Eragrostis* species and should be removed from the naturalized checklist.

***Eragrostis tef*** (Zuccagni) Trotter      **Note**

*Eragrostis tef* was collected twice on O'ahu and has eluded the recent checklists of *Eragrostis* despite being published in 1922 (Hitchcock 1922). One collection was a natural-

ization at an experimental farm from 1916 (*Hitchcock 14123*, US), and another was naturalized on Palawai Ridge from 1936 (*O. Degener 10672*, US). It should be considered questionably naturalized, as it has not been documented for over 80 years.

***Eragrostis uniolooides* (Retz.) Nees ex Steud.      Correction**

*Eragrostis uniolooides* was previously reported from Maui (Oppenheimer 2008). This was a misidentification of *E. brownii* (Oppenheimer H90639). There are no other known occurrences of *E. uniolooides* on Maui and the species appears to be only found on Hawai‘i Island at this time.

**Key to *Eragrostis* in Hawai‘i**

The following key is presented for *Eragrostis* in Hawai‘i and is based on modifications from the keys presented in Clayton & Snow (2010), as well as O’Connor (1990). For native species, the islands they are currently known from are indicated; distributions are not presented for introduced species, as they are likely present on more islands than have been reported as of the writing of this key. *Eragrostis* has been described as “a large and cumbersome genus that can present insurmountable difficulties” (Cope 1999). In Hawai‘i, identification of *Eragrostis* is, by far, the most difficult of all the genera of grasses. Identification is particularly challenging due to the diversity of species and often subtle differences between them. Identification of this genus is greatly aided by having mature material with well-developed seeds/caryopses (referred to as grains in this key) and also having spikelets that have begun to break up. Annual and perennial grasses can often be distinguished by their bases: perennial species typically retain dead leaves at their bases and are often branched below the soil line.

As mentioned by Snow (2010), the endemic Hawaiian *Eragrostis* species are in need of revision, and many specimens examined during the production of this key are intermediate between two species as they currently are defined. They may not key out easily in this key, as was also the case for the previous keys by O’Connor (1990) and Clayton & Snow (2010), due to somewhat fuzzy species concepts.

1. Lower glume longer than first lemma on at least some spikelets
  2. Inflorescence very narrowly contracted and spikelike, typically < 1 cm wide
    3. Plants often with hard rhizomes, but also often without; leaves primarily cauline; panicles primarily > 15 cm long; flowering stems typically > 50 cm tall; inflorescence axis scabrous or smooth (Lāna‘i, Maui, Hawai‘i) ..... *E. leptophylla*
    3. Plants never with hard rhizomes; leaves primarily basal; panicles 5–15 cm long; flowering stems typically < 30 cm tall; inflorescence axis smooth (Moloka‘i, Lāna‘i, Maui, Hawai‘i) ..... *E. monticola*
  2. Inflorescence wider, often still contracted, but at least a slightly open panicle, typically > 2 cm wide
    4. Pedicels of spikelets often > 1 cm long [only known from one collection as a contaminant at an agricultural experiment station on O‘ahu; likely extirpated] ..... *E. trichodes*
    4. Pedicels of spikelets < 1 cm long

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- 5. Leaves > 4 mm wide, flat; spikelets with 8–15 florets; lemma apex often obtuse (O'ahu, Moloka'i, Lāna'i, Maui, Hawai'i) ..... *E. atropioides*
  - 5. Leaves < 4 mm wide, folded or flat; spikelets with 4–7 florets; lemma apex often acute (O'ahu, Moloka'i, Lāna'i, Maui, Hawai'i) ..... *E. deflexa*
  - 1. Lower glume shorter than or almost equaling first lemma
    - 6. Plants with obvious woody rhizomes when culm is removed from ground, the rhizomes mostly short-creeping and the plants still caespitose; leaves strongly scabrous on upper surface
      - 7. Glumes and sometimes lemmas long-ciliate (O'ahu, slopes of Ka'ala) ..... *E. fosbergii*
      - 7. Glumes and lemmas without cilia
        - 8. Panicle typically contracted; lower panicle branches < 6 cm long; spikelets clustered along branches; panicle branches typically narrowly diverging from panicle rachis and ascending upwards (all islands and well distributed in Papahānaumokuākea) ..... *E. variabilis*
        - 8. Panicle typically wide; lower panicle branches typically > 6 cm long; panicle branches typically diverging from panicle rachis widely and often perpendicularly (all main Hawaiian islands except Ni'ihau) ..... *E. grandis*
    - 6. Plants lacking strong rhizomes; leaves scabrous or not; plants of various heights
      - 9. Plants with glands on clumps, leaves, sheaths, inflorescence, and/or lemma keels (see Fig. 3)
        - 10. A single glandular band present in each inflorescence below lowest whorl of branches, no other glands present; lowest inflorescence branches whorled; leaf sheaths glabrous or hairy with papillose-based hairs; seeds grooved ..... *E. trichophora*
        - 10. Glands not as above; lower inflorescence branches various; leaf sheaths without papillose-based hairs; seeds grooved or not
          - 11. Palea keels long-ciliate, these cilia typically visible without dissecting florets; glands present on inflorescence branches and/or as a weak annular ring of circular glands below the culm nodes ..... *E. amabilis* (in part)
          - 11. Palea keels not long-ciliate; glands various
            - 12. Plants without annular rings of glands below culm nodes, glands scattered mainly on sheaths ..... *E. parviflora* (in part)
            - 12. Plants with annular rings of glands on below culm nodes
              - 13. Glands present on lemma keels; spikelets 2–4 mm wide; annuals; nodes typically very darkly colored ..... *E. cilianensis*
              - 13. Glands absent on lemma keels; spikelets typically < 2 mm wide; duration various; nodes various
                - 14. Perennials; seeds deeply grooved; plants 30–60 cm tall ..... *E. leptostachya*
                - 14. Annuals; seed rounded, not grooved; plants 5–20 cm tall ..... *E. barrelieri*
      - 9. Plants without glands
        - 15. Plants typically < 20 cm tall; leaves firm, needlelike; spikelets often >15 mm long
          - 16. Culms < 20 cm long, erect; spikelets typical straight (indigenous, Papahānaumokuākea) ..... *E. paupera*
          - 16. Culms > 20 cm long, often trailing; spikelets often curved ..... *E. dielsii*
  - 15. Plant height various; leaves softer; spikelets < 20 mm long (may be longer in *E. brownii*)
    - 17. Spikelet rachilla breaking up from the apex downward at maturity; pedicels <3 mm long
      - 18. Panicle branches < 2 cm long, panicle contracted with all florets clustered and aggregated; spikelets 3–7 mm long ..... *E. elongata*
      - 18. Panicle branches 2–7 cm long, panicle more open with spikelets not closely aggregated; spikelets 4–40 mm long ..... *E. brownii*
  - 17. Spikelet rachilla persistent after spikelets fall; pedicels various
    - 19. Spikelets ≥ 2 mm wide; spikelets ~2× as long as wide
      - 20. Spikelets 2.5–9 mm wide, spikelets falling as a whole unit at maturity ..... *E. superba*
      - 20. Spikelets 2–4 mm wide, spikelets breaking up at maturity ..... *E. uniolooides*



19. Spikelet < 2 mm wide, if wider, spikelets > 3× as long as wide
21. Palea keels ciliate, these cilia typically visible without dissecting florets; florets typically < 3 mm long
22. Inflorescence a contracted spikelike panicle ..... *E. ciliaris*
22. Inflorescence an open panicle ..... *E. amabilis* (in part)
21. Palea keels smooth or scabrous, never ciliate; florets typically > 3 mm long (sometimes < 3 mm long in *E. pilosa*)
23. Lower glume acuminate, 2 mm long, almost as long as lowest lemma (known from low elevations on Maui and Lānaʻi, last collected in 1838, presumed extinct) ..... *E. mauiensis*
23. Not as above
24. Plant perennial; grain dorsally **or strongly** laterally compressed; grain strongly to weakly grooved or without groove
25. Panicles without substantial secondary branches (inflorescence appearing to be of racemes); spikelets with pedicel < 1 mm long (easily confused with *Eragrostis*) ..... *Diplachne fusca* ssp. *uninervia*
25. Panicles with secondary branches; pedicels typical > 1 mm long
26. Axils of inflorescence branches pilose; grain strongly laterally compressed and grooved; lower glume 0.5–1 mm long; basal leaf sheaths glabrous at the soil line; plants typically from compressed soil such as roads, trails, and lawns ..... *E. tenuifolia*
26. Axils of inflorescence branches glabrous; grain dorsally compressed and grooved; lower glume 1–1.8 mm long; basal leaf sheaths pubescent at the base of the plant near the soil line (this character is unreliable for young plants); plants not typically from compressed soil ..... *E. curvula*
24. Plant annual or short-lived perennial; grain weakly laterally compressed; grain without a groove (sometimes younger seeds may contract unevenly when drying and seem to have a groove, be careful when using immature seeds from dried material)
27. Lemmas 1.6–3 mm long, acuminate; grains brown to white; grains falling before lemmas and glumes, lemmas eventually falling after ... *E. tef*
27. Lemmas 1–2.2 mm long, acute; grains brown; glumes shortly deciduous, falling before lemmas, lemmas falling before seed
28. Lemma with very obscure lateral veins; primary panicle branches without hairs in axils ..... *E. parviflora* (in part)
28. Lemmas with clearly visible lateral veins; primary panicle branches with or without hairs in axils
29. Lower glume > ½ the length of the lowest lemma; lower glume 0.5–1.5 mm long; lower panicle branches typically single or paired; palea persistent after lemmas fall ..... *E. pectinacea* var. *pectinacea*
29. Lower glume < ½ the length of the lowest lemma; lower glume 0.3–0.6 mm long; lower panicle branches typically whorled; palea shortly deciduous after lemmas fall
30. Collars all pilose; axils almost all inflorescence branches pilose with multiple hairs, pedicels > 3 mm long ..... *E. pilosa* var. *pilosa*
30. Collar of the uppermost leaf sheath on each culm glabrous; axils of inflorescence branches typically glabrous or with 1–2 hairs; pedicels < 3 mm long ..... *E. multicaulis*

### Alternate key to *Eragrostis*

This keys Hawaiian *Eragrostis* to groups of similar species using less technical characteristics than the key above.



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1. Plants typically < 20 cm tall; leaves stiff, needlelike; spikelets often >15 mm long

*E. dielsii*

*E. paupera*

1. Not as above

2. Spikelets > 2 mm wide

*E. cilianensis*

*E. superba*

*E. uniolooides*

2. Spikelets < 2 mm wide

3. Panicle contracted and spikelike at maturity, < 1.5 cm wide

*E. ciliaris*

*E. elongata* (in part)

*E. leptophylla*

*E. monticola*

3. Panicle wider than 1.5 cm at maturity

4. Mature culms with silky white hairs at the soil line (these typical absent on immature material)

*E. curvula* (in part)

4. Bases of mature culms without silky hairs

5. Plants clump-forming perennials, with distinct woody rhizomes [natives]

6. Inflorescence 2–6 cm wide

*E. atropioides*

*E. fosbergii*

*E. variabilis*

6. Inflorescence > 6 cm wide

*E. grandis*

5. Plants without woody rhizomes

7. Sheaths with papillose-based hispid hairs

*E. trichophora*

7. Sheaths without papillose-based hairs

8. Plants without hairs from axils of any primary panicle branches

9. Spikelet pedicels mostly < 3 mm

*E. brownii*

*E. curvula* (in part)

*E. elongata* (in part)

*E. multicaulis*

*E. trichodes*

9. Spikelet pedicels mostly > 3 mm

*E. barrelieri*

*E. maiensis*

*E. parviflora*

*E. tef* (in part)

8. Plants with hairs from axils of at least some primary panicle branches

10. Annuals

*E. amabilis*

*E. pectinacea* var. *pectinacea*

*E. pilosa* var. *pilosa*

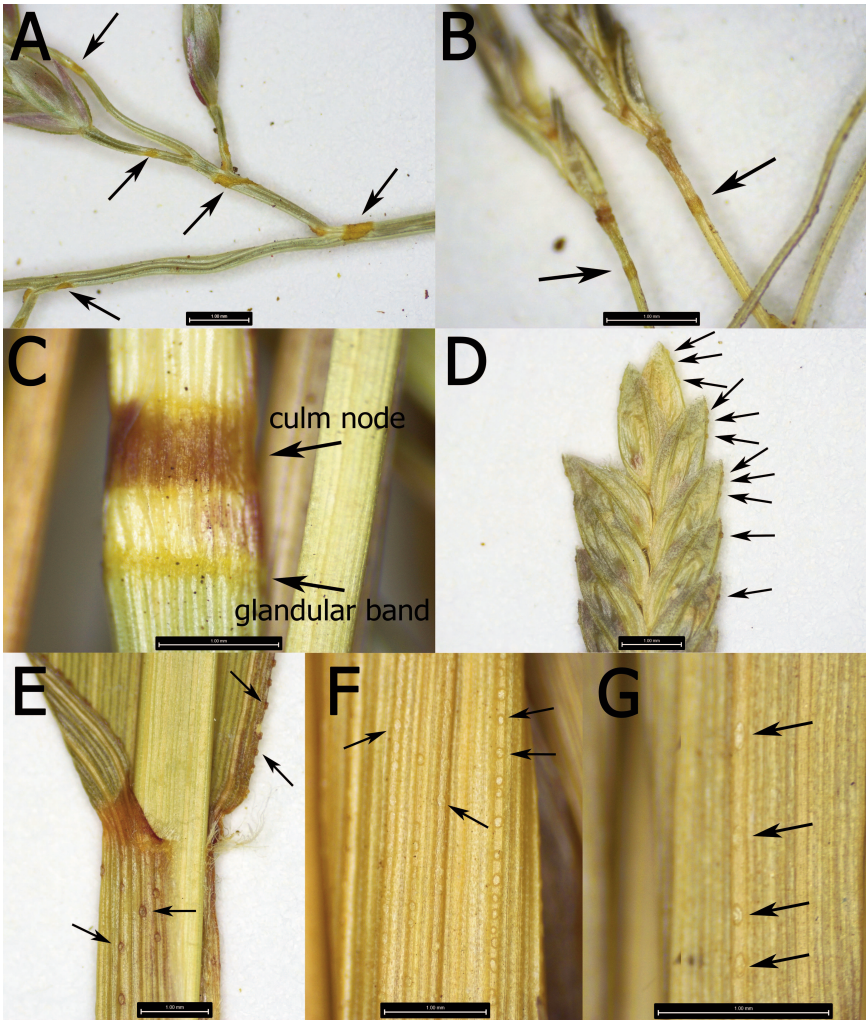
*E. tef* (in part)

10. Perennials

*E. deflexa*

*E. leptostachya* (hairs in axils more subtle than most species)

*E. tenuifolia*



**Fig. 3.** Glands on *Eragrostis*. **A**, *Eragrostis barrelieri* (H. Oppenheimer H40701) glands on inflorescence (not all glands are indicated with arrows). **B–C**, *Eragrostis leptostachya* (C. Imada 2002-24), **B**, Glands on inflorescence; **C**, Glandular band below culm nodes. **D–E**, *Eragrostis cilianensis* (Anon s.n., BISH 59338), **D**, Glands on lemma keels (all glands on the right side are indicated with arrows); **E**, Glands in the collar region on sheath and leaf margins, not all glands are indicated with arrows. **F–G**, *Eragrostis parviflora* (G.C. Munro 446), **F**, Glands on leaf sheath (not all indicated with arrows); **G**, Glands on lead midvein on abaxial surface (all glands indicated with arrows). All material photographed from BISH, all scale bars 1 mm long.

***Eremochloa ophiuroides* (Munro) Hack. Potentially naturalizing**

A population of Centipede grass, *Eremochloa ophiuroides*, was observed by the author growing on the Mau‘umae Trail near Kaimukī, Honolulu. The population consisted of only what appeared to be one individual, covering an area of about 2 m<sup>2</sup>. The habitat was a dry, fully exposed ridge top, within an *Osteomeles anthyllidifolia*, *Dodonaea viscosa*, and weed-dominated area. This grass was also growing within 5 meters of the large patch of *Zoysia pacifica* described at the end of this paper, and this proximity raises questions of whether these populations were planted. The area was not especially open or flat and is not located where a lawn would be desirable along the trail. As this grass has never been observed naturalizing before, and only one population exists, it is best to consider this questionably naturalized until demonstration of reproduction is observed.

This grass is a well-known lawn grass (Staples & Herbst 2005) that has earned the name centipede grass in reference to its expansive, creeping stolons. It has been extensively used as a lawn grass around Hawai‘i (Staples & Herbst 2005).

*Material examined.* O‘AHU: Mau‘umae Trail, about 600 m mauka of the trailhead, dry, sunny, exposed ridge top, small colony less than 2 m wide, strongly stoloniferous, in proximity to *Zoysia pacifica*, 21.302178, -157.781373, 23 Jan 2022, K. Faccenda 2212.

***Gastridium ventricosum* (Gouan)**

Schinz & Thell.

**New island record**

*Gastridium ventricosum* is now known from one collection from Waiakoa, Moloka‘i made in 1937. This species is also known from Kaua‘i, Maui, and Hawai‘i (Imada 2019).

*Material examined.* MOLOKA‘I: Waiakoa, 13 Apr 1937, L.D. Whitney 4479.

***Hordeum murinum* L.**

subsp. *leporinum* (Link) Arcang.

**New island record**

*Hordeum murinum* is now known from a single collection from Kauluwai, Moloka‘i. As this was collected in 1903, it should be treated as a questionably naturalized record unless it is recollected.

*Material examined.* MOLOKA‘I: American Sugar Co., annual growing in limited quantity at Kauluwai, evidently introduced, would like to know if of any value as a pasture grass, 15 Feb 1903, G.C. Munro 61.

***Imperata cylindrica* (L.) Raeusch.****Note; Eradication**

*Imperata cylindrica* (Cogongrass) was detected as spreading via rhizomes up to 3 m away from a cultivated plant in Kāne‘ohe, O‘ahu in 2007. As of 2021, the individual from Kāne‘ohe had been eradicated over 10 years ago (Danielle Frohlich & Alex Lau, pers. comm. 2021). This species was never published as it was never truly naturalized. This note serves as a warning that this species may appear again and should be promptly controlled. Cogongrass is one of the world’s 10 worst weeds (Global Invasive Species Database 2021), and its naturalization in Hawai‘i could be catastrophic.

This plant is sold as *Imperata cylindrica* cv. ‘Red Baron’ or “Japanese Bloodgrass,” which is a form with leaves that are a bright red on the upper half or so of the leaf, and green at the base of the leaf. This coloration is unique, as other grasses with red leaves (e.g., *Cenchrus* spp.) are uniformly red in color. It can also be identified as having leaf midveins that are often located off-center. Cogongrass and its seed heads have also been reported at ports of entry being used as a bulk packing material, giving this plant a second potential introduction pathway (Alex Lau, pers. comm. 2021).

*Material examined.* O‘AHU: Kāne‘ohe, in landscaped area in front of house, escaping into lawn, grass ~1 ft [0.3 m] tall, red-tinged at tip, sterile, ‘Red Baron’ cultivar?, 20 Aug 2007, D. Frohlich & A. Lau 20070920030.

***Ischaemum aristatum* L.**

**New state record**

*Ischaemum aristatum* was first collected on East Maui at Kīpahulu in 1994, but the specimen was only very recently deposited at BISH for identification. No description of the population size was reported on the voucher. This species can be distinguished from other *Ischaemum* via the key below.

*Ischaemum aristatum* is native to East Asia, from Korea and Japan through eastern China and Vietnam. It has shown aggressive tendencies in Japan, where it can become dominant in wetlands (Nishimoto 2016). This grass has shown aggressive tendencies in Trinidad and Tobago, where it grows vigorously, even on very poor soils (Smith 1950). It can spread by runners but is mainly clump-forming (Smith 1950).

The following description is from *Flora of China* (Wu *et al.* 2006: 610).

“Perennial. Culms loosely tufted, erect or geniculately ascending, 40–80 cm tall, simple or branching, nodes glabrous. Leaf sheaths glabrous or pilose; leaf blades linear-lanceolate, 5–25 × 0.4–1 cm, glabrous or thinly pilose, margins smooth becoming scabrid toward apex, base attenuate or contracted, apex acuminate; ligule 2–3 mm. Racemes terminal, paired, appressed back to back, 4–7 cm; rachis internodes clavate, triquetrous, scabrid or ciliate along outer angle, inner angles glabrous or shortly ciliate. Sessile spikelet oblanceolate to obovate, 5.5–8 × 2–2.3 mm; lower glume leathery with rounded flanks below middle, herbaceous, broader and 2-keeled above, 5–7-veined, keels narrowly to broadly winged, wing margin scabrid; upper lemma awnless or shortly awned; awn well developed or imperfect, up to 1.2 cm. Pedicelled spikelet dorsally compressed, resembling sessile, asymmetrical, 2-keeled, keels winged, one wing incurled. Fl. and fr. Jul–Oct. 2n = 56, 72.”

*Material examined.* MAUI: East Maui, Kīpahulu, below Three Sisters waterfall in Kaumakani pasture, 300 ft [91 m], 05 May 1994, P. Welton 1855-002.

***Ischaemum polystachyum* J. Presl**

**New state record**

First collected in 1961, *Ischaemum polystachyum* is now widespread on Hawai‘i Island. It has been collected from both Kona, Pāhoa, Orchidland, and near Honomū. This species was first identified as *I. polystachyum* by J.F. Veldkamp in 2011 (as the synonym *I. digitatum* Brongn.), when the specimen was of uncertain naturalization status; a later collection by Hobby in 2012 shows that not only is the species naturalized, but is

displaying invasive tendencies by forming monotypic stands. Further collections by the author expand the known range of this species, with two more populations found on the windward side of Hawai‘i. This grass was noted as occurring in Hawai‘i as early as 1955 (under the synonym of *I. digitatum*; Rotar 1968). Frustratingly, the date is the only specific information provided and no citation is given.

This grass is quite similar to *Urochloa mutica*, as both are very hairy, strongly stoloniferous grasses to about 1.5 m tall and have overlapping habitat preference, evidenced by them often growing sympatrically in many spots. The two can be differentiated easily by their inflorescence structure (Fig. 4), but both flower infrequently. Vegetatively, *Ischaemum polystachyum* has reddish purple internodes on the lower culm nodes, whereas *Urochloa mutica* seems to be consistently greenish. The ligule also differs, as *U. mutica* has a ligule of hairs, whereas *I. polystachyum* has a membranous ligule.

*Ischaemum polystachyum*, commonly called Paddle Grass, is native to Africa, India, Southeast Asia, and Australia. It has become naturalized on several other Pacific Islands, including Pohnpei, Vanuatu, and New Caledonia. On Pohnpei, it has become common in disturbed areas (Space & Falanruw 1999) and grows in full sun to partial shade in moist to wet areas, where it is ubiquitous and forms monotypic stands. The grass also accumulates large amounts of fuel and is a significant fire hazard (Dana Lee Ling, pers. comm. [<https://www.youtube.com/watch?v=zV2YkcZ7vIA>]).

The following description is from *Flora of China* (Wu *et al.* 2006: 611).

“Perennial, rhizomatous. Culms loosely tufted, sometimes stoloniferous and rooting at lower nodes, 60–100 cm tall, nodes bearded or glabrous. Leaf sheaths glabrous or sparsely to densely pilose with tubercle-based hairs; leaf blades broadly linear, 5–20 × 0.5–1.5 cm, pubescent, rarely glabrescent, base rounded to subcordate, apex acute; ligule 1–2 mm. Racemes (2–)3–6 or more, mostly terminal, subdigitate, 2–9 cm; rachis internodes and pedicels broadly linear, triquetrous, ciliate on outer angle, shortly ciliate on inner angles. Sessile spikelet lanceolate, 4–5 × 1.2–1.4 mm; lower glume leathery with expanded rounded flanks below middle, herbaceous, strongly veined and sharply 2-keeled above, glabrous or villous, keels usually winged, apex 2-toothed; upper glume attenuate into mucro or awnlet to 2 mm; awn of upper lemma 1.2–1.5 cm. Pedicelled spikelet laterally compressed, similar to sessile, upper lemma awned.”

*Material examined.* **HAWAI‘I:** Kona, Ed Johnston’s place, Jan 1961, *E.L. Guenther s.n.* (BISH 19539); Puna, Pāhoā town, nearly monotypic in wet pastures over large areas west of Pāhoā County Park, forming dense stands 1–2 m tall from stock, reddish, decumbent stems that form thick mats, 25 Jul 2012, *R.W. Hobdy 4342*; Puna Distr., Hwy. 130 between Pāhoā and Kalapana, mile marker 11–12, uncommon on side of road in disturbed vegetation, low-growing spreading grass with pink and green inflorescences, 800 m, 19 May 2005, *L.W. Pratt s.n.* (HAVO 16499b); Outside ‘Akaka Falls State Park, roadside, just outside park, forming a large colony ca. 20 m wide, stoloniferous, internodes reddish, to about 1.5 m tall, forming a monoculture, 19.854089, -155.151909, 06 Mar 2022, *K. Faccenda 2349*; Puna, Orchidland subdevelopment, Orchid Land Dr. and 38<sup>th</sup> Ave., disturbed roadside, sunny, moist, large colony ca. 20 m long along the road, monotypic, about 1.5 m tall, strongly stoloniferous, stolon internodes red, on the other side of the road climbing up through uluhe and shrubs up to 3 m, 19.551769, -155.008837, 28 Feb 2022, *K. Faccenda 2253*.



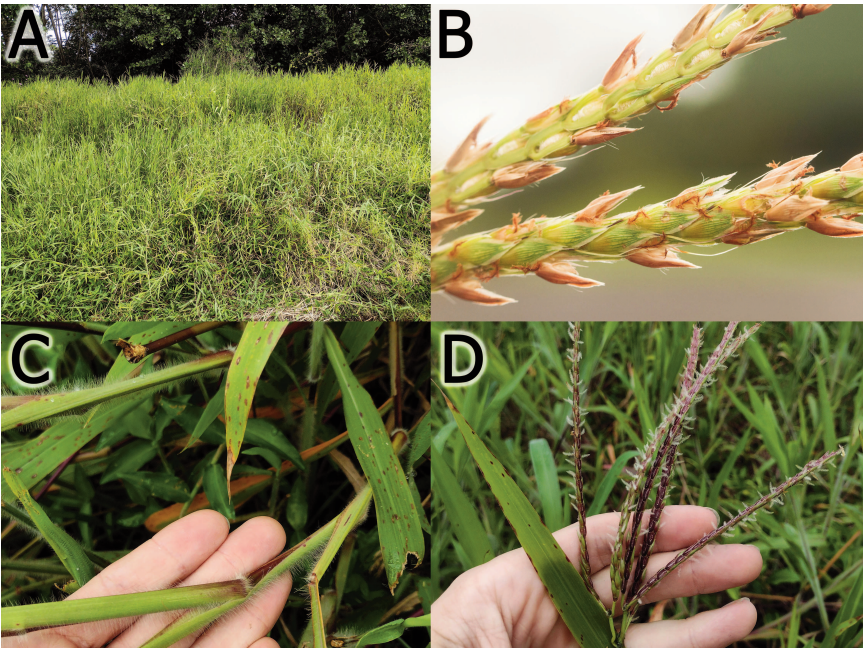


Fig. 4. *Ischaemum polystachyum* photographed at Pāhoa District Park. A, Habit. B, Spikelets. C, Lower culm nodes and internodes. D, Inflorescence.

*Ischaemum timorense* Kunth

**Correction**

Examination of specimens identified as *Ischaemum timorense* at BISH revealed all Hawaiian specimens to be misidentified and are actually *I. ciliare* Retz. *Ischaemum timorense* was first published as occurring in Hawai‘i by Herbst & Wagner (1996). There are now no known collections of *I. timorense* in Hawai‘i, and this species should be removed from the checklist. *Ischaemum ciliare* is currently known only from Maui.

**Key to *Ischaemum* in Hawai‘i**

1. Inflorescences with > 2 racemes ..... *I. polystachyum*
1. Inflorescences with exactly 2 racemes
  2. Inflorescences very hairy; at least some awns > 1.5 cm long [native] ..... *I. byrone*
  2. Inflorescences shortly hairy only on edges of pedicels; awns < 1 cm long or absent
    3. Leaves glabrous; spikelets with minute awns that barely exceed the florets; florets 5–6 mm long ..... *I. aristatum*
    3. Leaves tuberculate-villous; spikelets with obvious awns 0.5–1.5 cm long; florets 3–4 mm long on Hawaiian material ..... *I. ciliare*

***Ixophorus unisetus* (J. Presl) Schltldl.****New island record**

*Ixophorus unisetus* is now known from a single collection from Hawai'i Island at Kamuela in 1928. This species should be treated as questionably naturalized until it is recollected; up to now, it has been treated as questionably naturalized on Kaua'i, O'ahu, Lāna'i, and Hawai'i.

*Material examined.* **HAWAI'I:** Kamuela, 17 Jul 1928, R.A. Goff 7.

***Koeleria inaequalis* (Whitney) Barberá,  
Quintanar, Soreng & P.M. Peterson****Nomenclatural note; New island  
record**

Recent molecular work by Barbera *et al.* (2019) has shown that the Hawaiian endemic species *Trisetum inaequale* is best treated as a member of the genus *Koeleria*. They have published the combination *Koeleria inaequalis* to this end.

This work primarily focused on introduced species; however, one new range extension for a native species was discovered. *Koeleria inaequalis* is now known from O'ahu from a single collection from Palikea, which was only recently identified. This species is now known from O'ahu, Lāna'i, and Maui (O'Connor 1990).

*Material examined.* **O'AHU:** Waianae Distr., Palikea, ridge between Nānākuli and Lualualei, lowland mesic forest and cliffs, collected on cliff, 330° NW aspect, rare, 815 m, 19 May 1992, K.R. Wood 1934 (PTBG).

**Key to *Leptochloa sensu lato* in Hawai'i**

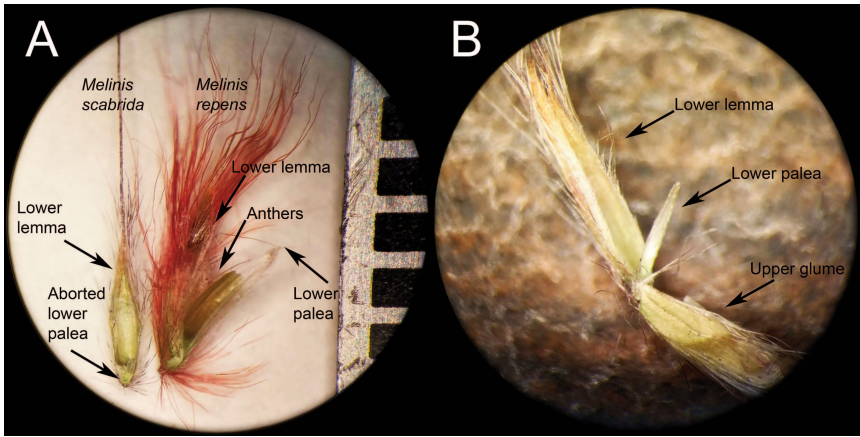
After *Disakisperma dubia* (= *Leptochloa dubia*) was published by Snow & Davidse (2011), no key was provided to distinguish it from other members of *Leptochloa sensu lato*; the following key is provided to resolve this.

1. Lemma apex acute
  2. Panicle branches (including spikelets) 0.5–1 mm wide; panicle elongate; leaf sheaths papillose hispid; annual ..... *Leptochloa panicea* subsp. *brachiata*
  2. Panicle branches (including spikelets) 2–4 mm wide; panicles slightly elongate to digitate; leaf sheaths glabrous; perennial ..... *Leptochloa virgata*
1. Lemma apex obtuse to blunt, emarginate, or blunt mucronate
  3. Ligule 1–2 mm long, ciliate ..... *Disakisperma dubia*
  3. Ligule 2–8 mm long, membranous and shredding to fibers at maturity .....  
..... *Diplachne fusca* subsp. *uninervia*

***Lolium temulentum* L.****New island records**

*Lolium temulentum* was collected on Kaua'i and Maui in 1903; there are no recent collections, and it is quite possible that it is now extirpated and should therefore be treated as questionably naturalized. Hillebrand (1888: 525) also mentioned this species as occurring on Maui. This species is a serious weed of wheat, and it is possible that a decline in wheat production may have eliminated the core populations.

*Material examined.* **KAUA'I:** Makaweli, Feb 1903, D.L. Van Dine s.n. (BISH 785681). **MAUI:** Makawao, Mar 1903, L. Von Tempisky 16.



**Fig. 5. A**, Comparison of the spikelets of *Melinis repens* and *Melinis scabrada*; note that on *M. repens* the arrow is pointing to the tip of the lower palea (palea of the sterile floret); the divisions on the scale are 1 mm. **B**, A dissected spikelet of *Melinis scabrada* with the upper (fertile) lemma and palea removed, in this floret the lower palea is well developed and is approximately 1 mm long. Parts A and B were taken at different magnifications. The florets of *Melinis scabrada* in both parts A and B were both taken from the same inflorescence, the florets with where the lower palea was aborted were much more common than those without aborted lower paleas.

***Melinis scabrada* (K. Schum.) Hack.**

**New state record**

A new species of *Melinis* was observed growing sympatrically with *Melinis repens* and *M. minutiflora* on the southern side of Kaluakauila Gulch in the Wai'anae Mountains on O'ahu. I observed a population of about 20–50 plants along a fence line, but did not do an exhaustive search of the area and likely overlooked many plants. The habitat was dry, dominated by *Melinis minutiflora*, *Schinus terebinthifolius*, *Leucaena leucocephala*, *Megathyrsus maximus*, and other weeds.

This grass was identified as *Melinis scabrada* using the key in *Flora of Tropical East Africa* (Clayton & Renvoize 1982), as well as the key in *Flora of Tropical Africa* (Oliver 1920). *Melinis scabrada* is identified by the palea of the lower floret being aborted or <1 mm long and with scabrous keels; the lower floret is also barren, and the anthers are held in the upper floret. This grass is quite similar to *M. repens*; however, that species has a well-developed lower palea ~2 mm long with ciliate keels (Fig. 5). On Hawaiian material observed by the author, the lower floret of *M. repens* also contains 3 anthers and the upper floret is bisexual, although Clayton & Renvoize (1982) also report that the lower floret may be barren, but the palea is never aborted.

This species is recognized by Zizka (1988) in his monograph of the tribe Melinideae; however I must wonder whether it would be more parsimonious to assume that this is an extreme morph of *Melinis repens*, rather than assuming that this species somehow made it from Africa to O'ahu with no clear dispersal vector. But, as the species is currently circumscribed, the population of plants from O'ahu is a clear match.



The following description is from *Flora of Tropical East Africa* (Clayton & Renvoize 1982: 511).

“Loosely tufted perennial; culms 30–60 cm high, geniculately ascending. Leaf-blades flat 5–15 cm long; pedicels glabrous or pilose. Spikelets oblong, 2–3 mm long, pubescent to pilose with hairs exceeding the tip by up to 1 mm; lower glume a little oblong scale 0.3–0.5 mm long, inserted close to the upper glume; upper glume gently curved on the back, thinly chartaceous with a membranous tip, scaberulous on the margins, emarginate, with or without an awn up to 2 mm long; lower floret barren, with or without a palea (its keel scaberulous) the lemma similar to the upper glume with an awn 2–7 mm long.”

*Material examined.* O‘AHU: Kaluakauila Gulch, north-facing side of gulch along fence line, sunny, dry area dominated by weeds including *Melinis minutiflora*, *Schinus*, *Leucaena*, *Megathyrus*, uncommon, around 20–50 plants observed while walking along the fence line, but the population likely extended beyond the fence, growing in close proximity to both *Melinis repens* and *M. minutiflora*, 21.545697, -158.223786, 11 Dec 2021, *K. Faccenda 2180*.

**Key to *Melinis* in Hawai‘i**

- 1. Florets glabrous; pedicels glabrous ..... *M. minutiflora*
- 1. Florets hairy; pedicels hairy, at least at their apex
  - 2. Basal leaves bristlike, inrolled, 2–3 mm wide [questionably naturalized as of 2022] ..... *M. nerviglumis*
  - 2. Basal leaves flattened, > 4 mm wide
    - 3. Lower floret sterile, its palea reduced or developed; sterile lemma with an awn from 2–7 mm long ..... *M. scabrida*
    - 3. Lower floret male or sterile, its palea clearly developed; sterile lemma typically with awn < 3 mm, rarely longer ..... *M. repens*

***Microlaena stipoides* (Labill.) R. Br. Taxonomic note**

Previously referred to in Hawai‘i as *Ehrharta stipoides*, this species is best referred to as *Microlaena stipoides* (Edgar & Connor 2000). The generic placement of this grass has been controversial, but in its native range, the genera *Microlaena* and *Ehrharta* are well defined, and the generic placement by Edgar & Connor (2000) is followed here.

***Oloptum miliaceum* (L.) M. Röser & H.R. Hamasha**

**Taxonomic note; New island record**

Formerly known as *Piptatherum miliaceum*, molecular evidence has now placed this grass in a new genus, *Oloptum* (Hamasha *et al.* 2012). *Oloptum miliaceum* was also recently collected on East Maui in Ka‘ono‘ulu for the first time. This species is now known from Maui and Hawai‘i.

*Material examined.* MAUI: East Maui, Ka‘ono‘ulu, along Kawehi Road, dry soil along roadside, erect culms to 1 m tall in loose clumps, 3,400 ft [1,036 m], 20 Jan 2010, *R.W. Hobdy s.n.* (BISH 763644).

***Oryza sativa* L. Questionable naturalization**

*Oryza sativa* (Rice) is now known from two collections on O‘ahu, where it was likely growing from erosion control logs that were assumed to be filled with rice hulls. As it is

unlikely that this population of domestic rice will persist out of cultivation, this species is best treated as questionably naturalized. Rice displays the same non-persistent naturalization status displayed by millet (*Panicum miliaceum*), where all known records from Hawai‘i are from waif individuals, spilled birdseed, or other ephemeral populations.

The following description is from *Flora of North America* (Barkworth *et al.* 1993).

“Plants usually annual, sometimes perennial; cespitose, not rhizomatous. Culms 0.3–2 m tall, 4–20 mm thick, erect or ascending, branching at the base, usually rooting at both the lower and submerged upper nodes. Sheaths smooth, glabrous, lowest sheaths usually longer than the internodes, upper sheaths shorter than the internodes; auricles often present, 1–5 mm; ligules (4–)10–36 mm, acute; blades 20–70 cm long, 5–20 mm wide, glabrous, sometimes scabrous. Panicles 10–50 cm long, 1–8 cm wide, often nodding; branches 2–13 cm, ascending or divergent; pedicels 1–7 mm. Spikelets 6–11 mm long, 2.5–4 mm wide, broadly elliptic, sometimes with obvious rows of white papillae, persistent, obliquely articulated with the pedicels. Sterile florets 1.5–3(–10) mm long,  $\frac{1}{4}$ – $\frac{1}{2}$ (–9/10) as long as the spikelets, 0.5–1.5 mm wide. Functional florets: lemmas 6–11 mm long, 2–3 mm wide, glabrous or with stiff hairs to 1.5 mm, apices beaked, beaks 0.3–1(–2) mm, rigid, usually unawned, sometimes awned, awns to 6(15) cm; paleas 1–1.7 mm wide, acute to acuminate or mucronate to 0.5 mm; anthers 1–2.5 mm, white or yellow; styles white, yellow, red, or blackish-purple. Caryopses 4.5–8 mm long, 2–3.5 mm wide, broadly elliptic or broadly oblong, brown, tan, or white; embryos 1.4–1.7 mm. Haplome A.  $2n = 24$ .”

*Material examined.* O‘AHU: Drum Road, erosion control area, 24 Apr 2007, *J. Gustine USArmy 51*; Wai‘anae Kai-Kūmaipō Ridge, growing out of erosion control log, the state installed erosion control logs along Kūmaipō Ridge after a burn destroyed vegetation, 07 Oct 2004, *J. Beachy USARMY 3*.

### *Panicum capillare* L.

### New state record

*Panicum capillare* (Witchgrass) is now known from Hawai‘i Island from a single collection collected at Waimea in 1951 and should be considered questionably naturalized until recollected. The label states that it was found in a seeded pasture and was likely a seed contaminant. This species was reported as occurring in Hawai‘i as early as 1922 (Rotar 1968), but no further details were given besides the date. *Panicum capillare* is native to North America but has been widely introduced across Europe and South America. This plant can be identified via the key in Clayton & Snow (2010). It differs from other species of naturalized *Panicum* by being an annual, having a diffusely branched panicle, presence of both terminal and axillary panicles, and profusely hairy leaves and leaf sheaths. *Panicum capillare* is a weed of disturbed areas, including pastures, roadsides, gardens, and agriculture, but has not been reported as an environmental weed (Clements *et al.* 2004).

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 457).

“Plants annual; hirsute or hispid, hairs papillose-based, often bluish or purplish. Culms 15–130 cm, slender to stout, not woody, erect to decumbent, straight to zigzag, simple to profusely branched; nodes sparsely to densely pilose. Sheaths rounded, hirsute or hispid,

hairs papillose-based; ligules membranous, ciliate, cilia 0.5–1.5 mm; blades 5–40 cm long, 3–18 mm wide, linear, spreading. Panicles 13–50 cm long, 7–24 cm wide, usually more than ½ as long as the plants, included at the base or exerted at maturity, disarticulating at the base of the peduncles at maturity and becoming a tumbleweed; branches spreading; pedicels 0.5–2.8 mm, scabrous, pilose. Spikelets 1.9–4 mm, ellipsoid to lanceoloid, often red-purple, glabrous. Lower florets sterile; lower glumes 1/3–½ as long as the spikelets, 1–3-veined; upper glumes 1.8–3.1 mm, 7–9-veined, midveins scabridulous; lower lemmas 1.9–3 mm, extending 0.4–1.1 mm beyond the upper florets, often stiff, straight, prominently veined distally; upper florets stramineous or nigrescent, sometimes with a prominent lunate scar at the base, often disarticulating before the glumes, leaving the empty glumes and lower lemmas temporarily persisting on the panicles.  $2n = 18$ .”

*Material examined.* **HAWAII:** North Kohala, Waimea, rare in seeded pasture, 16 Aug 1951, *E.Y. Hosaka 3647*.

***Panicum coloratum* L.**

**New island record**

*Panicum coloratum* is now known from Hawai‘i Island from a pasture at Ka‘alualu Ranch. This species is now known from both Maui and Hawai‘i (Imada & Kennedy 2020).

*Material examined.* **HAWAII:** Ka‘ū, Nā‘ālehu, occasional in pasture (Ka‘alualu Ranch) in semi-moist section, upright, 1.5–2 ft [0.45–0.6 m] tall, 02 Oct 1950, *E.Y. Hosaka 3602*.

***Pappophorum bicolor* E. Fourn.**

**New state record**

*Pappophorum bicolor* (called Pink Pappusgrass in the continental United States) is now known from one collection on Maui from the Kanounou Point area. This is the first collection of this genus in Hawai‘i, and it was identified using the key in Reeder & Toolin (1989). This grass is identifiable by the fact that it is a bunchgrass with a spikelike panicle and lemmas with 11–15 awns. It would most likely to be confused with a *Cenchrus*, but *Cenchrus* has bristles that arise below the florets, rather than bristles (awns) arising from the tips of the florets. This species is native from Texas to northern Mexico and has not been introduced elsewhere. It prefers dry habitats with 10–20 inches [25–50 cm] of rain per year (Lloyd-Reilley 2010).

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 286). “Plants perennial, caespitose. Culms 30–80(–100) cm. Sheaths mostly glabrous, apices with a tuft of hairs on either side; ligules about 1 mm; blades 10–20(–30) cm long, 2–5 mm wide, flat to involute. Panicles 12–20 cm, narrow but usually with some slightly spreading branches, pink- or purple-tinged. Spikelets with the lower 2 or 3 florets bisexual, distal 1–2 florets sterile. Glumes 3–4 mm, thin, glabrous, apices acute or minutely notched and mucronate; lemmas somewhat firm, usually faintly 7-veined, with 11–15 awns; lowest lemma bodies 3–4 mm, midveins and margins pubescent from the base to about midlength, awns about 1.5 times as long as the lemma bodies; paleas subequal to the lemma bodies or slightly longer. Caryopses about 2 mm.  $2n = 100$ .”

*Material examined.* **MAUI:** Northern West Maui, Kanounou Point, west side, about 20–30 plants on a grassy slope above cliffs, densely tufted, 40–50 cm tall, inflorescence a spikelike panicle tapering to a narrow point, florets with 2 pubescent glumes [note by KF, glumes are glabrous on specimen], lemmas separating into several awnlike points, 200 ft [60 m], 15 Aug 2008, *R.W. Hobdy 4300*.

***Paspalum humboldtianum*** Flüggé**New state record**

*Paspalum humboldtianum* was collected once on Kauaʻi in 1953. It is unknown if the population has persisted and should be treated as a questionably naturalized record until recollected. It was keyed out using Chase (1929) and can be identified by its spikelets having ciliate to setose hairs around the circumference of the spikelet. It is most similar to *Paspalum fimbriatum* in outward appearance, but *P. fimbriatum* has no hairs on the spikelets.

This species is native to Central and South America, and this introduction in Hawaiʻi is apparently the first time this plant has been found outside of its native range. Little information is known about its ecology and none about its invasive potential. Chase (1929) states that it grows in “stony open or brushy slopes in the highlands from Mexico to Argentina.”

The following description is taken from Chase (1929: 22).

“A tufted perennial, erect or ascending from a woody decumbent base, and sometimes producing strongly scaly rhizomes; culms 40–80 cm, rarely nearly 1 m tall, commonly branching from the lower and sometimes middle nodes; nodes from densely bearded with appressed white hairs to glabrate; sheaths mostly overlapping, papillose-pilose along the margin and usually toward the summit, sometimes throughout, rarely nearly glabrous; ligule membranaceous, brown, 1–2 mm long; blades flat, firm, spreading, 8–18 cm long, 6–15 mm wide, slightly narrowed toward the base, acuminate into a stiff more or less involute point, the midnerve prominent beneath (the lower blades and those of the branches small, the uppermost reduced to a mere point) sparsely to rather densely pubescent to glabrate on the upper surface, the epidermis loosely cellular, a fringe of stiff white hairs back of the ligule, appressed—pubescent beneath with occasional long stiff hairs intermixed, the margins usually prominently papillose-ciliate; panicles consisting of 2–5 rarely 7 or 8, ascending to nodding, lax glistening silky racemes, 5–10 cm long, about 7 mm wide, 1–3 cm distant on a slender flattened axis; rachis narrowly winged, 2–3 mm wide, minutely scabrous or glabrous and with a tuft of long white hairs at the base; spikelets commonly solitary toward both ends of the raceme (the secondary spikelet undeveloped), in pairs in the middle, excluding the cilia about 3.2 mm long, 1.1 mm wide, elliptic, abruptly pointed; glume and sterile lemma equal, the glume 3-nerved, pubescent and edged with a fringe of glistening white hairs arising from papillae, at maturity becoming thick and corky, the hairs radiating like a corona, the lemma 3-nerved, strigulose or glabrous, papery and wrinkled toward the base; fruit about 2.8 mm long, narrowly obovoid, smooth and shining.”

*Material examined.* **KAUAʻI:** Kalāheo, one single clump on road-bank in semi-moist area, 18 Nov 1953, *E.Y. Hosaka s.n.* (BISH 785764).

***Paspalum lindenianum*** A. Rich.**Correction**

*Paspalum lindenianum* was initially published as occurring on Kauaʻi by Wagner *et al.* (2005) and then incorporated into the checklist by Imada (2019). This species does not exist in the Hawaiian flora and was accidentally added to the checklist due to a confusion with a synonym of *Paspalum longifolium*.

***Paspalum longifolium* Roxb.****Correction**

*Paspalum longifolium* was published for Maui by Oppenheimer (2004), but the same specimen (*Oppenheimer H70202*) was then reidentified as *P. mandiocanum* var. *mandiocanum* by Snow & Davidse (2011) and published as a new island record without retracting the *P. longifolium* island record for Maui. *Paspalum longifolium* was also published for Kauaʻi (Staples *et al.* 2003); however, this represented a misidentification of *P. plicatulum*. *Paspalum longifolium* is therefore not known to occur on any of the Hawaiian Islands, as no other specimens could be found.

***Paspalum malacophyllum* Trin.****New island record**

*Paspalum malacophyllum* is now known from Hawaiʻi Island in the vicinity of Keaʻau at low elevations based on a collection from 1951. *Paspalum malacophyllum* has previously been documented on Maui (Imada 2019).

*Material examined.* **HAWAII:** Keaʻau, growing in W. Shipman's Keaʻau place, local clumps in moist places, 10 ft [3 m], 23 Jul 1951, *E.Y. Hosaka 3637*.

***Paspalum mandiocanum* Trin.**var. ***mandiocanum*****New island record; Note**

*Paspalum mandiocanum* var. *mandiocanum* has now been detected on Kauaʻi from the parking lot area at Puʻu Hinahina. This colony was visited by the author in July 2022 and was approximately 20 m wide and growing only at the Waimea Canyon trailhead. Only one colony was found in the area, suggesting it has not spread over the past 18 years. It has previously been collected on Oʻahu, Molokaʻi, and Maui (Imada 2019).

The key to *Paspalum* in Snow & Lau (2010) has an error in it regarding this species: the key indicates that this species has spikelets borne singly, but the spikelets are actually borne in pairs on all specimens in the BISH collection.

*Material examined.* **KAUAʻI:** Puʻu Hinahina, Canyon Trailhead parking area, clumping grass along flat grassy borders of parking lot, 3,600 ft [1,097 m], 12 Aug 2004, *K.R. Wood 10915* (PTBG).

***Paspalum notatum* Flügge****New island record**

*Paspalum notatum* is now known from multiple collections in the vicinity of Honolulu. It had previously been planted as a pasture grass on Oʻahu (*Lyman s.n.*, BISH 782364), giving the grass a clear introduction pathway. *Paspalum notatum* has previously been collected on Kauaʻi, Molokaʻi, Maui, and Hawaiʻi.

*Material examined.* **OʻAHU:** Honolulu, along King St. between Punahou and Keʻeaumoku St., in irrigated turf grass, large colony ca. 5 m wide, 21.298333, -157.839436, 22 Jun 2021, *K. Faccenda 1998*; Honolulu, intersection of Keʻeaumoku St. & Nehoa St., edge of road, mowed grass, colony ca. 2 m wide, not seen in other locations along road, 21.307809, -157.833200, 14 Jul 2021, *K. Faccenda 2053*; Diamond Head (Lēʻahi) Crater, edge of visitor parking lot, sunny, irrigated mowed grass, common, large patch, confined to irrigated areas, 21.263603, -157.805378, 15 Jul 2021, *K. Faccenda 2056*; University of Hawaiʻi, pasture near residence, back of office, 26 Nov 1938, *R. Lyman s.n.* (BISH 782364).





Fig. 6. *Paspalum pilosum* along the Mau'umae Trail, O'ahu, 23 Jan 2022.

*Paspalum pilosum* Lam.

**New island records**

Previously identified on Moloka'i, this grass was found by the author growing as an abundant weed along the Mau'umae Trail near Pālolo on O'ahu (Fig. 6). The population consists of thousands of plants and extends from about 0.5 mile from the trailhead all the way to the Ko'olau summit, occupying approximately 2 miles of the ridgeline and ranging from approximately 1,000–2,400 ft [300–730 m] of elevation. The grass displays a concerning tolerance to different environmental conditions; the lowest-elevation populations were growing amongst dry *Osteomeles*, *Casuarina*, and *Dodonaea*-dominated habit, through intermediate-moisture areas, and was successfully competing with *Dicranopteris* in the wet, native-dominated high-elevation areas. It ranged from common to abundant throughout the entire length of the trail. Based on its behavior in this area, this grass has the potential to be a significant environmental weed.

*Paspalum pilosum* is also now known from Kaua'i, based on a specimen that was previously misidentified as *P. unispicatum* by Snow & Davidse (2011).

*Material examined.* **KAUA'I:** Hanalei, 'Ōkolehao Trail, 22° 11'N, 159° 28'W, 175–325 ft [50–100 m], 30 Jun 2009, *Stevenson 35*. **O'AHU:** Mau'umae Trail, ca. 1.5 km from trailhead, dry area, uncommon along trail at this elevation, 21.304104, -157.779649, 15 Aug 2021, *K. Faccenda 2083*; *loc. cit.*, ca. 1 km from trailhead, along trail, common, dominant grass along trail from this elevation upward, 21.305392, -157.778211, 15 Aug 2021, *K. Faccenda 2084*.

***Paspalum plicatulum* Michx.****New state record**

*Paspalum plicatulum* (known as Brownseed Paspalum in North America) is now known from Kauaʻi from two specimens, one of which was previously identified as *P. longifolium*. This species was reported as occurring in Hawaiʻi as early as 1935 but without any specific details (Rotar 1968). *Paspalum plicatulum* is native from the southern United States through most of South America. This grass has previously been introduced to Asia and New Guinea. Its effects as an invasive do not seem to have been reported. It can be distinguished from other species of *Paspalum* by its glossy, dark brown fertile lemma and its spikelets that tend to be green around the margin and brown in their center at maturity. In the southeastern U.S., *P. plicatulum* occurs in wet meadows, roadsides, ditches, and prairies, where it can become abundant (USGS 2021).

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 581).

“Plants perennial; shortly rhizomatous, often indistinctly so. Culms 30–110 cm, stout, erect; nodes glabrous. Sheaths glabrous; ligules 2–3 mm; blades to 35 cm long, 2–5.4 mm wide, conduplicate (rarely flat). Panicles terminal, with 2–7 racemously arranged branches; branches 1.6–7.1 cm, usually divergent, rarely merely ascending; branch axes 0.6–1.1 mm wide, glabrous, terminating in a spikelet. Spikelets 2.5–3 mm long, 1.5–2.2 mm wide, paired, appressed to the branch axes, elliptic-ovate, light to dark brown. Lower glumes absent; upper glumes usually with short, appressed pubescence, rarely glabrous, 5-veined, margins entire; lower lemmas with short, appressed pubescence or glabrous, 3-veined, margins entire; upper florets dark glossy brown. Caryopses 1.4–1.6 mm, brown.  $2n = 20, 40, 60.$ ”

*Material examined.* **KAUAI:** Kōloa Distr., Kāhili Mountain Park, common along roadside and in mown “lawn” area, clump-forming with erect inflorescences, 800 ft [ca. 244 m], 14 Jul 2000, *T. Flynn* 6727; *loc. cit.*, near water tank at beginning of mountain trail, tufted grass, base of culms (sheath) purple, blades medium green ± glossy above, silvery in middle channel, locally common, 293 m, 21°57'52", -159° 29'4", 23 Jun 2005, *T. Flynn* 7252 (PTBG).

***Paspalum setaceum* Michx.****Correction**

Examination of specimens from Maui previously published by Oppenheimer (2007) reveals that all BISH specimens from Maui were misidentifications of *Paspalum mandiocanum*. *Paspalum setaceum* is now only known in Hawaiʻi from Midway Island.

***Paspalum unispicatum* (Scribn. & Merr.) Nash** **Correction**

While constructing a key to *Paspalum*, it was noticed that there was no observable difference between *Paspalum pilosum* and “*P. unispicatum*.” Further research revealed that the specimen previously published by Snow & Davidse (2011) is actually *P. pilosum*, based on the presence of dimorphic lower glumes. True *P. unispicatum* is not known from Hawaiʻi and should be removed from the checklist.



***Rytidosperma caespitosum*** (Gaudich.)

Connor &amp; Edgar

**Correction**

*Rytidosperma caespitosum* was previously reported for the state by Darbyshire *et al.* (2010) based on two specimens (*E.Y. Hosaka 1767 & 2472*). Examination of these two specimens reveals that they are no different from *Rytidosperma biannulare* after consulting keys in AusGrass2 (Simon & Alfonso 2011), *Flora of New Zealand* (Edgar & Connor 2000), and the key within Darbyshire *et al.* (2010). In all of these keys the specimens previously annotated as *R. caespitosum* keyed to *R. biannulare*. Therefore, there are now no known records of *R. caespitosum* for the state and the species should be removed from the checklist.

***Setaria distans*** (Trin.) Veldkamp**Taxonomic note; New island record**

Formerly treated as *Paspalidium distans*, molecular work now shows the entire genus of *Paspalidium* to be embedded within *Setaria* (Morrone *et al.* 2014). Therefore, *Paspalidium distans* is now a synonym of *Setaria distans*.

Previously recorded from Ni‘ihau, *Setaria distans* is now known from Moloka‘i at Pauwulu. It is quite similar in outward appearance to *Echinochloa colona*, but differs in having a ciliate ligule, a rugose lemma, glabrous spikelets, and inflorescence branches that end in a small spine rather than a spikelet.

*Material examined.* **MOLOKA‘I:** Pauwulu, occasional in open pasture, forming tufts, grazed by animals, 19 Apr 1937, *E.Y. Hosaka 1858*.

***Setaria italica*** (L.) P. Beauv.**New state record**

*Setaria italica* has previously been collected from cultivated occurrences on Hawai‘i Island and O‘ahu during the 1920s. It is now known to be naturalized on Kaua‘i. Two duplicates of this specimen were independently identified by both W.D. Clayton (BISH specimen) in 2001 and Zelda V. Akulova-Bartow (PTBG specimen) in 2002. These specimens have sat in the herbarium collections, unrecognized as a new state record until now.

*Setaria italica* is a species of human origin that is now found almost worldwide. It is cultivated as a grain used in bird seed, which may have been its introduction pathway. As a weed, it is mainly found in disturbed areas, including roadsides, pastures, and agricultural lands (Barkworth *et al.* 2003; Li & Brutnell 2011).

The following description is from *Flora of North America* (Barkworth *et al.* 2003: 556).

“Plants annual. Culms 10–100 cm. Sheaths mostly glabrous, margins sparsely ciliate; ligules 1–2 mm; blades to 20 cm long, 1–3 cm wide, flat, scabrous. Panicles 8–30 cm, dense, spike-like, occasionally lobed below; rachises hispid to villous; bristles 1–3, to 12 mm, tawny or purple. Spikelets about 3 mm, disarticulating between the lower and upper florets. Lower glumes 3-veined; upper glumes 5–7-veined; lower paleas absent or ½ as long as the lower lemmas; upper lemmas very finely and transversely rugose to smooth and shiny, exposed at maturity. 2n = 18.”

*Material examined.* **KAUA‘I:** Kawaihau Distr., Hwy. 56 in Wailua between Halelio and Kapa‘a bypass roads, ruderal vegetation with *Chloris*, *Macropitilium*, and *Panicum*, clumping grass of 3 ft [0.9 m] with nodding heads, only seen in this location, 10 ft [3 m], 31 Jul 1997, *T. Flynn 6195*.

***Sporobolus elongatus* R.Br.****New island record**

A new range extension for a species in Papahānaumokuākea was found while examining specimens in the course of this research. *Sporobolus elongatus*, a common weedy grass from the main islands, is now known from Midway on Sand Island.

*Material examined.* **MIDWAY:** Sand Island, weed in lawns in living areas of island, 17 Dec 1962, C.H. Lamoureux 2301 (HAW).

***Sporobolus jacquemontii* Kunth****Correction**

*Sporobolus jacquemontii* was initially entered into the Smithsonian Flora of the Hawaiian Islands online checklist by Wagner *et al.* (2005), and that record was then incorporated into the Imada (2019) checklist. This species does not exist in the Hawaiian flora and was added in error due to confusion with a synonym of *Sporobolus pyramidalis* (Warren Wagner, pers. comm.).

***Sporobolus piliferus* (Trin.) Kunth****Correction**

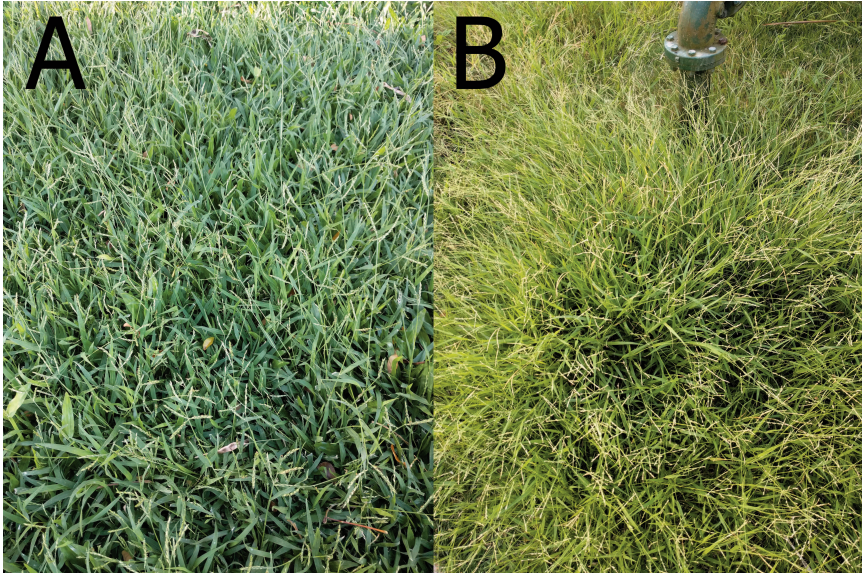
*Sporobolus piliferus* was published as occurring on O‘ahu and Midway (Snow 2008; Starr *et al.* 2010), where it was distinguished from *Sporobolus pyramidatus* by having a closed panicle. Field observations by the author have shown that plants with open and closed panicles grow side-by-side. Examination of the specimens of *S. piliferus* from Hawai‘i shows that they do not match photographed material of that species from its native range and that their habitat is also not as published in the literature; in Hawai‘i, specimens identified as *S. piliferus* all come from saline coastal areas, whereas in their native range *S. piliferus* only occurs above 1,300 m (Giraldo-Cañas & Peterson 2009). Examination of photographed specimens of *S. pyramidatus* from the National Herbarium (US) confirms that the species often has a closed panicle and grows in coastal habitats. Therefore, it must be concluded that *S. piliferus* does not occur in Hawai‘i and represents a misidentification of *S. pyramidatus*.

***Urochloa brizantha* (A. Rich.) R.D. Webster****Correction**

*Urochloa brizantha* was reported from O‘ahu by Imada & Kennedy (2020), but careful examination shows that it is based on a misidentification of *U. eminii*. These two species are difficult to separate, so the following key should prove useful to future workers; however, comparison to verified material at BISH is highly recommended as the species are very similar. *Urochloa brizantha* has been cultivated at experimental farms on O‘ahu, but no wild material was found for this species from O‘ahu. Therefore, *U. brizantha* is now only known to be naturalized on Maui.

***Urochloa distachya* (L.) T.Q. Nguyen****New island records; Correction**

This species is known to be well established on Kaua‘i, O‘ahu, Lāna‘i, and Maui (Oppenheimer & Bogner 2019). It is now known from a single collection on Hawai‘i Island from 1938. O‘Connor (1990) listed *U. distachya* (as the synonym *U. subquadrifera*) as occurring on Moloka‘i. No specimens from US, HAW, PTBG, or BISH support this record and it should be removed from the checklist.



**Fig. 7.** *Urochloa glumaris* growing at the UH Mānoa campus. **A.** *U. glumaris* growing in turf grass that is mowed weekly, with *Axonopus*. **B.** *U. glumaris* forming a mound about 40 cm tall in a sunny, neglected area.

*Material examined.* **HAWAII:** North Hilo, Humu'ula, Humu'ula Sheep Station, occasional in rocky places, 6,600 ft [2,011 m], 13 Jun 1938, *E.Y. Hosaka 2341*.

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

**Taxonomic note**

The species formerly treated as *Urochloa decumbens* in Hawai'i has now been lumped with *U. eminii* and *U. ruzizensis* (R. Germ. & C.M. Evrard) Crins, as all three of these species overlap morphologically as well as not being molecularly distinct (Sosef 2016; Masters 2021). As *U. eminii* was published first, that name must be the accepted one, due to priority.

***Urochloa glumaris* (Trin.) Veldkamp**

**New state record**

*Urochloa glumaris* (syn. *Brachiaria paspaloides* (J. Presl) C.E. Hubb.) has been collected by the author in the vicinity of the University of Hawai'i campus in Mānoa, urban Honolulu, Waimānalo, 'Āhuimanu, and Hau'ula. The grass was found largely in urban areas, mostly in lawns and edges of sidewalks, but on the windward side of the island, plants were found on roadsides in moist forests. The population is well established, especially at UH Mānoa, where many thousands of plants exist in lawns and flowerbeds in moist to dry areas throughout the campus, where it grows as a weed.

This grass is outwardly most similar to *Urochloa distachya*, but differs in having a distinct mucro on the sterile lemma and having a lower glume that is 0.75–0.80× as long as the spikelet (the lower glume is 0.33–0.50× as long as the spikelet in *U. distachya*).

*Urochloa glumaris* is native to India, Southeast Asia, and much of the Pacific. In its native range, this species is common in disturbed areas at low elevations (Veldkamp 1996). It has also been documented as a weed of corn when grown in the dry season in the Philippines (Pamplona 1988). The following description from *Flora of China* describes it as an annual, but it can also grow as a perennial (Veldkamp 1996).

The following description (under the synonym *Urochloa paspaloides* J. Presl) is from *Flora of China* (Wu *et al.* 2006: 523).

“Annual. Culms slender, spreading, branching and rooting at lower nodes, 20–60 cm or more tall, nodes pubescent. Leaf sheaths glabrous or loosely pilose; leaf blades linear, 5–20 × 0.3–0.8 cm, thinly pilose on both surfaces with tubercle-based hairs, apex acuminate; ligule ca. 1 mm. Inflorescence axis 1.5–4 cm; racemes 2–4, 2–5 cm, rather stiffly ascending; rachis narrow, triquetrous, scabrous; spikelets usually paired, loosely overlapping. Spikelets lanceolate, 3.5–4 mm, glabrous, sharply acute; lower glume lanceolate, 2/3–3/4 spikelet length, 5–7-veined, acute and apiculate; upper glume 5–7-veined, sharply acute; lower lemma obscurely 5-veined, palea very small; upper lemma elliptic-oblong, only slightly shorter than spikelet, finely rugulose, mucro 0.4–0.5 mm. Fl. and fr. May–Oct.  $2n = 36$ .”

*Material examined.* **O‘AHU:** University of Hawai‘i Mānoa campus, near Varney Circle, in flower bed, weed, several clumps, each about 0.7 m wide, 21.300325, -157.818564, 06 Jul 2021, *K. Faccenda 2027*; *loc. cit.*, vicinity of Gilmore Hall, shaded lawn, not recently mowed, infrequent, 21.292435, -157.815396, 08 May 2021, *K. Faccenda 1763*; *loc. cit.*, weed in lawn in the vicinity of the basketball court by Hale Wainani, mowed grass, sunny area, moist, not recently mowed, abundant, 21.293010, -157.813672, 19 May 2021, *K. Faccenda 1834*; *loc. cit.*, lower campus road by trailers, sunny waste areas, abundant, somewhat trailing grass to almost 30 cm tall, 21.293782, -157.819850, 19 May 2021, *K. Faccenda 1839*; Honolulu, Lili‘uokalani Botanical Garden, weed in mowed grass, partly sunny, irrigated, uncommon, 21.318367, -157.856317, 12 Jun 2021, *K. Faccenda 1978*.

### *Urochloa reptans* (L.) Stapf

### **New naturalized record**

This grass was not listed as naturalized by Imada (2019), due to being known from only one collection in the Bishop Museum Herbarium as of 2019. However, this grass has persisted and was recollected from several localities around O‘ahu. One population was observed by the author in the lawn in the Lili‘uokalani Botanical Garden in Honolulu. The grass was forming one small clump ~2 m across in a shaded lawn. No other populations were found despite considerable effort by the author in searching urban Honolulu, although one was found online on iNaturalist in the vicinity of Kaimukī at 3770 Sierra Drive (<https://www.inaturalist.org/observations/63451538>). This Kaimukī population has not yet been vouchered, but the photos are of sufficient quality to make a confident identification. Yet another population is known from Kailua, discovered in the HAW herbarium.

An older record from 1936 was also found in the Agronomy Collection, setting the first known collection of this grass 10 years earlier than had previously been reported by Herbst & Clayton (1998). The Kamehameha Boys School was located on the Bishop Museum campus, making this locality the same as the 1946 specimen. This grass has supposedly been present in Hawai‘i since 1860 (Whitney *et al.* 1939; cited as *Panicum reptans*), although no specimens exist from that period.

*Material examined.* O‘AHU: Kailua, mauka of Kawaiui Swamp Regional Park, several small patches, HPDL#317, 27 Oct 1994, C. Morden 1221 [in HPDL collection]; Honolulu, Lili‘uokalani Botanical Garden, N edge of garden, weed at edge of mowed grass, partly sunny, moist area, only one colony seen, colony ca. 1 m wide, 21.320464, -157.855306, 12 Jun 2021, K. Faccenda 1984; Honolulu, lawn of Kamehameha Boy’s School, 06 Nov 1936, L.D. Whitney 4463.

### Key to *Urochloa* in Hawai‘i

1. Margins of primary panicle branch rachises tuberculate-ciliate
  2. Raceme branches solid, crescent-shaped, 0.5–1.2 mm wide; inflorescence branches 2–16; clump-forming, without stolons; spikelets *often* appearing in 1 row on racemes [do not make identification solely based on the last character, as it is not always reliable] ..... *U. brizantha*
  2. Raceme branches flat, ribbonlike (may be curled and appearing crescent-shaped), 1–1.7 mm wide; inflorescence branches 3–10; *often* with stolons; spikelets *often* appearing in 2 rows on racemes ..... *U. eminii* (= *U. decumbens*)
1. Margins of primary panicle branch rachises scabrous to pubescent, not tuberculate
  3. Strongly stoloniferous or culms decumbent and rooting at nodes; perennial; robust, typically 90–200 cm tall; panicles often with secondary branches; panicles with spikelets *often* arranged in disorderly fashion; nodes villous ..... *U. mutica*
  3. Stoloniferous or not; annual or perennial; smaller, typically < 90 cm tall; panicles rarely with secondary branches; spikelets neatly arranged in panicles; nodes glabrous or villous
    4. Primary panicle branch rachises triquetrous (3-angled), without wings
      5. Spikelets 1.5–2.2 mm long; spikelets glabrous ..... *U. reptans*
      5. Spikelets 3–4 mm long; spikelets pubescent ..... *U. mollis*
    4. Primary panicle branch rachises flattened or crescent-shaped, *often* winged
      6. Fertile lemma with a short mucro ~1 mm long; lower glume > 0.7× as long as the spikelet ..... *U. glumaris*
      6. Fertile lemma without a mucro; lower glume < 0.5× as long as the spikelet
        7. Spikelets 4–5.5 mm long; panicle branches 2–11 cm long; primary axis of panicle 10–20 cm long ..... *U. plantaginea*
        7. Spikelets 2.4–3.7 mm long; panicle branches 1–6 cm long; primary axis of panicle 3–10 cm long ..... *U. distachya* (= *U. subquadripara*)

### *Zoysia matrella* (L.) Merr.

### Potentially naturalizing

*Zoysia matrella* is a species of lawn grass widely planted across Hawai‘i and now may be potentially naturalizing on O‘ahu, where it has been collected along a road, a trail, and from exposed limestone at Lā‘ie Point. No evidence of sexual reproduction has been observed, however, and these populations are spreading purely vegetatively, although they flower prolifically.

A population of *Zoysia matrella* was observed along the Mau‘umae Trail, where it was growing on a flat section of the trail about 2 × 3 m in size that is probably used for camping. Based on the presence of this grass in one of the only flat spots on this section of the trail, it is distinctly possible that the population was planted, but it is also possible that seeds stuck to the bottom of tents helped move it.

A single small clump of *Z. matrella* was observed by the author at Lā‘ie Point growing from a fully exposed area on almost bare limestone. It seems unlikely that this was planted given the extreme dry, exposed, and saline conditions. The plant observed was not



reproductive, but a section was removed and cultivated until flowers appeared for positive identification. Another specimen was collected in 1984 on a roadside in Kahuku, which may also have been naturalized.

*Material examined.* O‘AHU: Kahuku Point, 1 mile east along Marconi Road, Jun 1984, *J. Barta s.n.* (BISH 471879); Mau‘umae Trail, about 1,200 m mauka the trailhead, dry, sunny, exposed ridge top, small flat area on the right side of trail when ascending, one of the few flat areas along trail, probably used for camping, colony about 2 × 3 m in size, strongly rhizomatous, 21.305494, -157.778067, 23 Jan 2022, *K. Faccenda 2214*; Lā‘ie Point, sand on exposed limestone, full sun, saline, 21.648275, -157.912970, sterile at time of collection on 15 Jul 2021, so cultivated until a flowering voucher could be made, 26 Nov 2021, *K. Faccenda 2169*.

### *Zoysia pacifica* (Goudsw.)

M. Hotta & Kuroki

Formerly treated in Hawai‘i as *Zoysia matrella* var. *pacifica*, this taxon is now generally accepted at the species level based on molecular and morphological traits (Anderson 2000; Chandra *et al.* 2017). This species was previously reported as naturalizing on Kaua‘i (Flynn & Lorence 1998).

*Zoysia pacifica*, a common lawn grass, has now been found potentially naturalized on O‘ahu, where it has been collected along the Mau‘umae Trail and in Kawainui Marsh. However, there is not currently strong evidence that this species is reproducing and therefore fully naturalized, as this patch may be either planted, or the signs of a newly naturalizing species. This note is published to bring awareness to the species on O‘ahu so more evidence can be obtained.

A population/ramet was observed by the author along the Mau‘umae Trail near Kaimukī, Honolulu. The population was ca. 20 m long and ca. 2–4 m wide. It grew along both sides of the trail where the trampled areas were mat-forming, about 1–2 cm tall, and up to 20 cm tall as it started mounding off the ridge trail. This population/ramet was within 3 m from the clump of *Eremochloa ophiuroides* reported previously, and the proximity suggests they could have been planted together, but the difference in size between the two means they are of vastly different age. There was only one colony seen, and it was spreading entirely vegetatively with no satellite colonies observed.

Another population was observed in the Kawainui Marsh near Kailua; this population was growing on the edge of flowing water on a hillside in full sun. The population was about 4 m long by 1–2 m wide and ran parallel along the stream.

*Material examined.* O‘AHU: Mau‘umae Trail, about 600 m mauka of trailhead, dry, sunny, exposed ridge top along trail, large colony ca. 10 m long × 2–4 m wide following the trail, growing as a turf where trampled, and forming mounds to 20 cm tall in *Osteomeles* where not trampled, 21.302178, -157.781373, 23 Jan 2022, *K. Faccenda 2213*; Kawainui Marsh, along walking path on N side of marsh, growing on bank of stream south of the path, sunny, moist due to proximity to water, dense turf-forming grass covering an area about 2 × 4 m in area, only this one colony observed, 21.402154, -157.755680, 09 Jan 2022, *K. Faccenda 2192*.

### Taxonomic note; Potentially naturalizing

### Key to *Zoysia* in Hawai'i

This key is based entirely on the key in Anderson (2000).

1. Inflorescences with < 15 spikelets; leaves < 0.5 mm wide ..... *Z. pacifica*
1. Inflorescences with > 15 spikelets; leaves > 0.5 mm wide
  2. Pedicels > 1.75 mm long; leaf blades 2–4 mm wide when flattened (not yet known to be naturalized) ..... *Z. japonica*
  2. Pedicels < 1.75 mm long; leaf blades < 2 mm wide when flattened ..... *Z. matrella*

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### REFERENCES

- ABRS.** 2005. *Flora of Australia*. Volume 44b. Poaceae 3. Australian Biological Resources Study, Canberra and CSIRO Publishing: Melbourne. 486 pp.
- ABRS.** 2009. *Flora of Australia*. Volume 44a. Poaceae 2. Australian Biological Resources Study, Canberra and CSIRO Publishing: Melbourne. 410 pp.
- Ainsworth, A. & Drake, D.R.** 2020. Classifying Hawaiian plant species along a habitat generalist-specialist continuum: Implications for species conservation under climate change. *PLOS ONE* **15**(2): e0228573.  
<https://doi.org/10.1371/journal.pone.0228573>
- Anderson, S.J.** 2000. Taxonomy of *Zoysia* (Poaceae): morphological and molecular variation. Unpublished PhD Dissertation, Texas A & M University, College Station. 335 pp.
- Barbera, P., Quintanar, A., Peterson, P.M., Soreng, R.J. & Romaschenko, K.** 2019. New combinations, new names, typifications, and a new section, sect. *Hispanica* in *Koeleria* (Poeae, Poaceae). *Phytoneuron* **46**: 1–13.  
<http://www.phytoneuron.net/2019Phytoneuron/46PhytoN-KoeleriaNames.pdf>



- 
- Barkworth, M.E., Capels, K.M. & Long, S.** (eds.) 1993. *Flora of North America, north of Mexico*. Volume 24. Magnoliophyta: Commelinidae (in part): Poaceae, Part 1. Oxford University Press, New York. 911 pp.
- Barkworth, M.E., Capels, K.M., Long, S. & Piep, M.B.** (eds.) 2003. *Flora of North America, north of Mexico*. Volume 25. Magnoliophyta: Commelinidae (in part): Poaceae, Part 2. Oxford University Press, New York. 783 pp.
- Bor, N.L.** 1960. *The grasses of Burma, Ceylon, India, and Pakistan*. Pergamon Press, Ltd., Oxford & London. 767 pp.
- Chandra, A., Milla □ Lewis, S. & Yu, Q.** 2017. An overview of molecular advances in zoysiagrass. *Crop Science* **57**(S1): S-73.  
<https://doi.org/10.2135/cropsci2016.09.0822>
- Chang, N.K. & Kim, E.** 1990. Analysis of vegetation on the pavements and under the street trees in Seoul. *Korean Journal of Ecology* **13**(4): 331–342.  
<https://koreascience.kr/article/JAKO199011919968312.pdf>
- Chase, A.** 1929. *The North American species of Paspalum*. *Contributions of the United States National Herbarium* **28**(1), 310 pp.
- Chen, S.L. & Peterson, P.M.** 2006. *Eragrostis*, pp. 471–479. In: Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.), *Flora of China*. Volume. 22. Poaceae. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis. 752 pp.
- Clayton, W.D.** 1970. *Flora of Tropical East Africa*. Gramineae (Part 1). Crown Agents for Oversea Governments and Administrations, London. 176 pp.
- Clayton, W.D., Phillips, S.M. & Renvoize, S.A.** 1974. *Flora of Tropical East Africa*. Gramineae (Part 2). Crown Agents for Oversea Governments and Administrations, London. 274 pp.
- Clayton, W.D. & Renvoize, S.A.** 1982. *Flora of Tropical East Africa*. Gramineae (Part 3). A.A. Balkema, Rotterdam. 448 pp.
- Clayton, W.D. & Renvoize, S.A.** 1986. Genera graminum. Grasses of the world. *Kew Bulletin Additional Series* **13**, 389 pp.
- Clayton, W.D. & Snow, N.** 2010. *A key to Pacific grasses*. Kew Publishing, Royal Botanic Gardens, Kew. 107 pp.
- Clements, D.R., Di Tommaso, A., Darbyshire, S.J., Cavers, P.B. & Sartonov, A.D.** 2004. The biology of Canadian weeds. 127. *Panicum capillare* L. *Canadian Journal of Plant Science* **84**(1): 327–341.  
<https://doi.org/10.4141/P02-147>
- Cope, T.A.** 1982. No. 143. Poaceae. In: Nasir, E. & Ali, S.I. (eds.), *Flora of Pakistan*. Pakistan Agricultural Research Council and University of Karachi, Islamabad and Karachi, Pakistan. 678 pp.
- Cope, T.A.** 1999. *Flora Zambesiaca*. Volume ten. Part two. Royal Botanical Gardens, Kew, London. 261 pp.
- Darbyshire, S.J., Connor, H.E. & Ertter, B.** 2010. The genus *Rytidosperma* (Poaceae) in the United States of America. *Journal of the Botanical Research Institute of Texas* **4**(2): 663–676.  
<https://www.jstor.org/stable/41972090>

- Daris, D.** 2007. California Brome Plant Factsheet. USDA. Available at: [https://plants.usda.gov/DocumentLibrary/factsheet/pdf/fs\\_brca5.pdf](https://plants.usda.gov/DocumentLibrary/factsheet/pdf/fs_brca5.pdf) (Accessed 26 September 2022).
- Dias, A.C.R., Carvalho, S.J.P., Nicolai, M. & Christoffoleti, P.J.** 2007. Problemática da ocorrência de diferentes espécies de capim-colchão (*Digitaria* spp.) na cultura da cana-de-açúcar. *Planta Daninha* **25**: 489–499.  
<https://www.scielo.br/j/pd/a/HdwTGJNrM4hkmfYSHJTJFcQC/>
- Edgar, E. & Connor, H.E.** 2000. *Flora of New Zealand*. Volume V. Grasses. Manaaki Whenua Press, Lincoln, New Zealand. 650 pp.
- Fernald, M.L.** 1950. *Gray's manual of botany*. Eighth (Centennial) edition—Illustrated. American Book Co., New York. lxiv + 1,632 pp.
- Flynn, T. & Lorence, D.H.** 1998. New naturalized plant records for the Hawaiian Islands. *Bishop Museum Occasional Papers* **56**: 5–6.  
<http://hbs.bishopmuseum.org/pdf/op56.pdf>
- Fortune, P.M., Pourtau, N., Viron, N. & Ainouche, M.L.** 2008. Molecular phylogeny and reticulate origins of the polyploid *Bromus* species from section *Genea* (Poaceae). *American Journal of Botany* **95**(4): 454–464.  
<https://doi.org/10.3732/ajb.95.4.454>
- Gabbard, B.L. & Fowler, N.L.** 2007. Wide ecological amplitude of a diversity-reducing invasive grass. *Biological Invasions* **9**(2): 149–160.  
<https://doi.org/10.1007/s10530-006-9012-x>
- Giraldo-Cañas, D. & Peterson, P.M.** 2009. Revision of the genus *Sporobolus* (Poaceae: Chloridoideae: Sporobolinae) for northwest South America: Peru, Ecuador, Colombia, and Venezuela. *Caldasia* **31**(1): 41–76.  
[http://www.scielo.org.co/scielo.php?script=sci\\_arttext&pid=S0366-52322009000100006](http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0366-52322009000100006)
- Global Invasive Species Database** 2021. Species profile: *Imperata cylindrica*. Available at: <http://www.iucngisd.org/gisd/species.php?sc=16> (Accessed 26 September 2022)
- Hamasha, H.R., Hagen, K.B. von & Röser, M.** 2012. *Stipa* (Poaceae) and allies in the Old World: molecular phylogenetics realigns genus circumscription and gives evidence on the origin of American and Australian lineages. *Plant Systematics and Evolution* **298**(2): 351–367.  
<https://doi.org/10.1007/s00606-011-0549-5>
- Henrard, J.T.** 1950. *Monograph of the genus Digitaria*. Universitaire Pers Leuven, Leiden. 999 pp.
- Herbst, D.R. & Clayton, W.D.** 1998. Notes on the grasses of Hawai'i: new records, corrections, and name changes. *Bishop Museum Occasional Papers* **55**(1): 17–38.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op55.pdf>
- Herbst, D.R. & Wagner, W.L.** 1996. Contributions to the flora of Hawai'i. V. *Bishop Museum Occasional Papers* **46**: 8–12.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op46.pdf>

- 
- Herbst, D.R. & Wagner, W.L.** 1999. Contributions to the flora of Hawai'i: VII. *Bishop Museum Occasional Papers* **58**: 12–36.  
<http://hbs.bishopmuseum.org/pdf/herbst&wagner99.pdf>
- Hillebrand, W.** 1888. *Flora of the Hawaiian Islands: A description of their phanerogams and vascular cryptogams*. Carl Winter, Heidelberg, Germany; Williams & Norgate, London; B. Westermann & Co., New York. 673 pp.
- Hitchcock, A.S.** 1922. *The grasses of Hawaii*. Bishop Museum Press, Honolulu. 230 pp.
- Hitchcock, A.S. & Chase, A.** 1950. *Manual of the grasses of the United States*. Revised by Agnes Chase. US Government Printing Office, Washington, D.C. 1,051 pp.
- Hohla, M.** 2006. Neues über die Verbreitung von *Eragrostis albensis*, *E. multicaulis* und *E. pilosa* in Österreich. *Linzer Biologische Beitrag* **38**(2): 1233–1253
- Howard, J.L.** 1994. *Bromus japonicus*. In: Fire effects information system, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at: <https://www.fs.fed.us/database/feis/plants/graminoid/brojap/all.html> (Accessed 5 November 2021)
- Huang, T.-C.** (ed.). 2000. *Flora of Taiwan*. Volume five. Second edition. Editorial Committee of the Flora of Taiwan, Taipei. 1,143 pp.
- Hügin, G.** 1999. Anmerkungen zur Unterscheidung von *Eragrostis multicaulis* und *Eragrostis pilosa*. *Botanik und Naturschutz in Hessen* **11**: 91–93.
- Hugo, E., Morey, L., Saayman-Du Toit, A.E. & Reinhardt, C.F.** 2014. Critical periods of weed control for naked crabgrass (*Digitaria nuda*), a grass weed in corn in South Africa. *Weed Science* **62**(4): 647–656.  
<https://doi.org/10.1614/WS-D-13-00152.1>
- Imada, C.T.** 2019. Hawaiian naturalized vascular plant checklist (February 2019 update). *Bishop Museum Technical Report* **69**, 203 pp.  
<http://hbs.bishopmuseum.org/publications/pdf/tr69.pdf>
- Imada, C.T. & Kennedy, B.H.** 2020. New Hawaiian plant records from Herbarium Pacificum for 2019. *Bishop Museum Occasional Papers* **129**: 67–92.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op129p67-92.pdf>
- Jauzein, P.** 1995. *Flore des champs cultivés*. INRA, Paris. 898 pp.
- Kellogg, E.A.** 2015. Flowering plants. Monocots. Poaceae. In: Kubitzki, K. (ed.), *The families and genera of vascular plants*. Volume XIII. Springer Nature, New York. xv + 416 pp.
- Kim, H.H. & Pyon, J.Y.** 1998. Weed occurrence and yield loss due to weeds in different direct-seeded rice paddy fields. *Korean Journal of Weed Science* **18**(1): 12–19.  
<https://koreascience.kr/article/JAKO199834056679926.pdf>
- Koch, S.D.** 1974. The *Eragrostis pectinacea-pilosa* complex in North and Central America (Gramineae: Eragrostoideae). *Illinois Biological Monographs* **48**, 74 pp.
- Kuoh, C-S. & Chen, C-H.** 2000. Pooideae, pp. 336–402. In: Huang, T.-C. (ed.), *Flora of Taiwan*. Volume five. Second edition. Editorial Committee of the Flora of Taiwan, Taipei. 1,143 pp.

- Lazarides, M.** 1997. A revision of *Eragrostis* (Eragrostideae, Eleusininae, Poaceae) in Australia. *Australian Systematic Botany* **10**(1): 77–187.  
<https://doi.org/10.1071/SB96002>
- Li, P. & Brutnell, T.P.** 2011. *Setaria viridis* and *Setaria italica*, model genetic systems for the panicoid grasses. *Journal of Experimental Botany* **62**(9): 3031–3037.  
<https://doi.org/10.1093/jxb/err096>
- Lloyd-Reilley, J.** 2010. Plant guide for pink pappusgrass (*Pappophorum bicolor*). USDA-Natural Resources Conservation Service, E. “Kika” de la Garza Plant Materials Center. Kingsville, Texas. Available at: [https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg\\_pabi2.pdf](https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_pabi2.pdf) (Accessed 26 September 2022)
- Masters, L.** 2021. Diversity and evolution in *Urochloa* grasses for the application in sustainable tropical forage systems. Unpublished Masters thesis, Queen Mary University of London.  
<https://doi.org/10.34885/ava5-x886>.
- Middleton, D.J., Leong-Škornicková, J., & Lindsay, S.** (eds.) 2019. *Flora of Singapore*. Volume 7. Poales. Singapore Botanic Gardens, Singapore. 525 pp.
- Morrone, O., Aliscioni, S.S., Veldkamp, J.F., Pensiero, J.F., Zuloaga, F.O. & Kellogg, E.A.** 2014. Revision of the Old World species of *Setaria* (Poaceae: Panicoideae: Paniceae). *Systematic Botany Monographs* **96**: 1–161.  
<https://www.jstor.org/stable/24774245>
- Nishimoto, T.** 2016. Vegetation changes over 20 years following transplantation from a natural to an artificial wetland. *Bulletin of the Okayama Prefecture Nature Conservation Center* **23**: 19–36.  
[https://www.researchgate.net/profile/Takasshi-Nishimoto-2/publication/301608121\\_Vegetation\\_changes\\_over\\_20\\_years\\_following\\_transplantation\\_from\\_a\\_natural\\_to\\_an\\_artificial\\_wetland/links/571c7c2d08ae7f552a481b6d/Vegetation-changes-over-20-years-following-transplantation-from-a-natural-to-an-artificial-wetland.pdf](https://www.researchgate.net/profile/Takasshi-Nishimoto-2/publication/301608121_Vegetation_changes_over_20_years_following_transplantation_from_a_natural_to_an_artificial_wetland/links/571c7c2d08ae7f552a481b6d/Vegetation-changes-over-20-years-following-transplantation-from-a-natural-to-an-artificial-wetland.pdf)
- O’Connor, P.J.** 1990. Poaceae, pp. 1481–1604. In: Wagner, W.L., Herbst, D.R. & Sohmer, S.H. (eds.), *Manual of the flowering plant of Hawai’i*. Volume 2. University of Hawai’i Press & Bishop Museum Press, Honolulu.
- Oliver, D.** 1920. *Flora of tropical Africa*. Vol. 9, Pt. 4. L. Reeve & Co., Ltd, London. Pp. 577–768.
- Oppenheimer, H.** 2003. New plant records from Maui and Hawai’i counties. *Bishop Museum Occasional Papers* **73**: 3–30.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op73.pdf>
- Oppenheimer, H.** 2004. New Hawaiian plant records for 2003. *Bishop Museum Occasional Papers* **79**: 8–20.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op79.pdf>
- Oppenheimer, H.** 2006. New Hawai’i plant records for 2004. *Bishop Museum Occasional Papers* **88**: 10–15.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op88.pdf>

- 
- Oppenheimer, H.** 2007. New plant records from Moloka‘i, Lāna‘i, Maui, and Hawai‘i for 2006. *Bishop Museum Occasional Papers* **96**: 17–34.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op96.pdf>
- Oppenheimer, H.** 2008. New Hawaiian plant records for 2007. *Bishop Museum Occasional papers* **100**: 22–38.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op100.pdf>
- Oppenheimer, H.** 2016. New Hawaiian plant records for 2015. *Bishop Museum Occasional Papers* **118**: 23–28.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op118p23-28.pdf>
- Oppenheimer, H. & Bogner, K.K.** 2019. New Hawaiian plant records from Lāna‘i for 2019. *Bishop Museum Occasional Papers* **129**: 21–25.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op129p21-25.pdf>
- Pamplona, P.P.** 1988. Weed control management in corn in the Philippines, pp. 148–159. In: De Leon, C., Granados, G. & Weddeburn, R.N. (eds.), *Proceedings of the Third Asian Regional Maize Workshop* (Kunming and Nanning, China, 8–15 June, 1988). [Unknown publisher or city], Mexico. 196 pp.
- Peterson, P.M., Soreng, R.J., Romaschenko, K., Barberá, P., Quintanar, A., Aedo, C. & Saarela, J.M.** 2022. Phylogeny and biogeography of *Calamagrostis* (Poaceae: Pooideae: Poaeae: Agrostidinae), description of a new genus, *Condilorachia* (Calothecinae), and expansion of *Greeneochloa* and *Pentapogon* (Echinopogoninae). *Journal of Systematics and Evolution* **60**(3): 570–590.  
<https://doi.org/10.1111/jse.12819>
- Reeder, J.R. & Toolin, L.J.** 1989. Notes on *Pappophorum* (Gramineae: Pappophoreae). *Systematic Botany* **15**(3): 349–358.
- Ripperton, J.C., Goff, R.A., Edwards, D.W. & Davis, W.C.** 1933. Range grasses of Hawaii. *Bulletin of the Hawaii Experiment Station* **65**, 58 pp.
- Rivas Ponce, M.A.** 1988. Nuevos datos para la diagnosis de *Bromus rubens* L. y *B. madritensis* L. (Poaceae). *Lagascalia* **15**(1): 89–93.  
<https://idus.us.es/bitstream/handle/11441/62183/06%20rivas%20ponce.pdf>
- Rotar, P.P.** 1968. *Grasses of Hawaii*. University of Hawaii Press, Honolulu. 355 pp.
- Russell, G.E.G., Watson, L., Koekemoer, M., Smook, L., Barker, N.P., Anderson, H.M. & Dallwitz, M.J.** 1991. *Grasses of Southern Africa*. National Botanic Garden, Pretoria. 437 pp.
- Ryves, T.B., Clement, E.J. & Foster, M.C.** 1996. *Alien grasses of the British Isles*. Botanical Society of the British Isles, London. 181 pp.
- Sales, F.** 1994. A reassessment of the *Bromus madritensis* complex (Poaceae): A multivariate approach. *Israel Journal of Plant Sciences* **42**(3): 245–255.  
<https://doi.org/10.1080/07929978.1994.10676577>
- Scholz, H.** 1988. Zwei neue taxa des *Eragrostis pilosa*-komplexes (Poaceae). *Willdenowia* **18**(1): 217–222.  
[https://www.jstor.org/stable/3996402#metadata\\_info\\_tab\\_contents](https://www.jstor.org/stable/3996402#metadata_info_tab_contents)

- Simon, B.K. & Alfonso, Y.** 2011. AusGrass2. Available at: <http://ausgrass2.myspecies.info/> (Accessed 12 June 2021)
- Simpson, C.E. & Bashaw, E.C.** 1969. Cytology and reproductive characteristics in *Pennisetum setaceum*. *American Journal of Botany* **56**(1): 31–36.  
<https://doi.org/10.1002/j.1537-2197.1969.tb07503.x>
- Smith, R.B.** 1950. Tabaquite grass. *Ischaemum aristatum*. *Proceedings of the Agricultural Society of Trinidad and Tobago* **50**: 335–40.
- Snow, N.** 2008. Notes on grasses (Poaceae) in Hawai'i. *Bishop Museum Occasional Papers* **100**: 38–43. <http://hbs.bishopmuseum.org/pubs-online/pdf/op100.pdf>
- Snow, N. & Davidse, G.** 2011. Notes on grasses (Poaceae) in Hawai'i: 3. *Bishop Museum Occasional Papers* **110**: 17–22.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op110p17-22.pdf>
- Snow, N. & Lau, A.** 2010. Notes on grasses (Poaceae) in Hawai'i: 2. *Bishop Museum Occasional Papers* **107**: 46–60.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op107p46.pdf>
- Sosef, M.S.** 2016. Taxonomic novelties in central African grasses (Poaceae), Paniceae 1. *Plant Ecology and Evolution* **149**(3): 356–365.  
<https://doi.org/10.5091/plecevo.2016.1221>
- Souza, R.C., Dias, A.C., Figueiredo, M.R.A., Obara, F.E.B. & Christoffoleti, P.J.** 2012. Growth of the crabgrass species *Digitaria ciliaris* and *Digitaria nuda*. *Planta Daninha* **30**: 317–325.  
<https://www.scielo.br/j/pd/a/Wctsvjj5zg6TJqgLYsdpL8F/abstract/?lang=en>
- Space, J.C. & Falanruw, M.** 1999. *Observations on invasive plant species in Micronesia*. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry, Davis, California. 32 pp.  
[http://www.hear.org/AlienSpeciesInHawai'i/articles/pier/pier\\_micronesia\\_report.pdf](http://www.hear.org/AlienSpeciesInHawai'i/articles/pier/pier_micronesia_report.pdf)
- Starr, F., Starr, K. & Loope, L.L.** 2003. New plant records from the Hawaiian archipelago. *Bishop Museum Occasional Papers* **74**: 23–34.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op74.pdf>
- Starr, F., Starr, K. & Loope, L.L.** 2010. New plant records from the Hawaiian Archipelago. *Bishop Museum Occasional Papers* **107**: 61–68.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op107p61.pdf>
- Staples, G.W. & Herbst, D.R.** 2005. *A tropical garden flora: plants cultivated in the Hawaiian Islands and other tropical places*. Bishop Museum Press, Honolulu. 908 pp.
- Staples, G.W., Imada, C.T. & Herbst, D.R.** 2003. New Hawaiian plant records for 2001. *Bishop Museum Occasional Papers* **74**: 7–21.  
<http://hbs.bishopmuseum.org/pubs-online/pdf/op74.pdf>
- State of Hawaii.** 1992. Hawai'i administrative rules title 4, Department of Agriculture subtitle 6, Division of Plant Industry chapter 68, noxious weed rules. Available at: <https://hdoa.hawaii.gov/pi/files/2013/01/AR-68.pdf> (Accessed 26 September 2022)

- 
- Tsvelev, N.N.** 1983. *Grasses of the Soviet Union*. 2 vols. Oxonian Press Pvt., Ltd, New Delhi. 1,196 pp.
- Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A.** 1980. *Flora Europaea Volume 5, Alismataceae to Orchidaceae (Monocotyledones)*. Cambridge University Press, Cambridge. 452 pp.
- USGS** 2021. *Paspalum plicatulum*, Plants of Louisiana. Available at: <https://warccaps.usgs.gov/PlantID/Species/Details/3525> (Accessed 26 September 2022).
- Van der Meijden, R. & Weeda, E.J.** 1982. *Eragrostis pilosa* (L.) Beauv. en *E. minor* Host in Nederland. *Gorteria* **11**(5): 106–113.  
<https://natuurtijdschriften.nl/pub/536472>
- Van Valkenburg, J.L.C.H., Costerus, M. & Westenberg, M.** 2021. *Pennisetum setaceum* or *Pennisetum advena* cultivars, what ornamental do we have in our garden. *Ecology and Evolution* **11**(16): 11216–11222.  
<https://doi.org/10.1002/ece3.7908>
- Veldkamp, J.F.** 1996. *Brachiaria, Urochloa* (Gramineae-Panicaceae) in Malesia. *Blumea* **41**(2): 413–437.  
<https://repository.naturalis.nl/pub/524895/BLUM1996041002012.pdf>
- Veldkamp, J.F.** 2002. Revision of *Eragrostis* (Gramineae, Chloridoideae) in Malesia. *Blumea* **47**(1): 157–204.  
<https://repository.naturalis.nl/document/566247>
- Wagner, W.L., Herbst D.R. & Lorence D.H.** 2005. Flora of the Hawaiian Islands website. Available at: <https://naturalhistory2.si.edu/botany/Hawaiianflora/> (Accessed 26 September 2022).
- Walsh, R.A.** 1995. *Dichantherium acuminatum*. In: Fire effects information system, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at: <https://www.fs.fed.us/database/feis/plants/graminoid/dicacu/all.html> (Accessed 26 September 2022).
- Weakley, A.S., LeBlond, R.J., Sorrie, B.A., Witsell, C.T., Estes, L.D., Gandhi, K., Mathews, K.G. & Ebihara, A.** 2011. New combinations, rank changes, and nomenclatural and taxonomic comments in the vascular flora of the southeastern United States. *Journal of the Botanical Research Institute of Texas* **5**(2): 437–455.  
<https://www.jstor.org/stable/41972288>
- Weakley, A.S.** 2020. *Flora of the southeastern United States*. University of North Carolina at Chapel Hill Herbarium, 1848 pp.
- Webster, R.D.** 1983. A revision of the genus *Digitaria* Haller (Paniceae: Poaceae) in Australia. *Brunonia* **6**(2): 131–216.  
<https://doi.org/10.1071/BRU9830131>
- Webster, R.D. & Hatch, S.L.** 1990. Taxonomy of *Digitaria* section *Aequiglumae* (Poaceae: Paniceae). *SIDA, Contributions to Botany* **14**(2): 145–167.  
<https://www.jstor.org/stable/41966865>



- Werier, D.** 2020. The nonnative crab grasses (genus *Digitaria*) of New York. Available at: <https://nyflora.org/the-nonnative-crab-grasses-digitaria-of-new-york/> (Accessed 26 September 2022)
- Whitney, L.D., Hosaka, E.Y. & Ripperton, J.C.** 1939. *Grasses of the Hawaiian ranges. Bulletin of the Hawaii Agricultural Experiment Station* **82**, 148 pp.
- Wilhelm, T.** 2009. *Digitaria ciliaris* in Europe. *Willdenowia* **39**(2): 247–259.  
<https://www.jstor.org/stable/20699175>
- Wipff, J.K. & Veldkamp, J.F.** 1999. *Pennisetum advena* sp. nov. (Poaceae: Paniceae): a common ornamental grass throughout the southern United States. *SIDA, Contributions to Botany* **18**(4): 1031–1036.  
<https://www.jstor.org/stable/41967714>
- Wu, Z.Y., Raven, P.H. & Hong, D.Y.** (eds.) 2006. *Flora of China*. Vol. 22: Poaceae. Missouri Botanical Garden Press, St. Louis. 733 pp.
- Zizka, G.** 1988. *Revision der Melinideae Hitchcock (Poaceae, Panicoideae)*. E. Schweizerbart, Stuttgart. 149 pp.