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Records of the Hawaii Biological Survey for 2022

Neal L. Evenhuis, Editor

Bishop Museum Press
Honolulu

Cover: *Stapelia gigantea* N.E. Br. - newly naturalized on Kaua‘i. Photo: Kelsey Brock (see p. 112).

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The State Museum of Natural and Cultural History
1525 Bernice Street
Honolulu, Hawai‘i 96817-2704, USA

RECORDS OF THE HAWAII BIOLOGICAL SURVEY FOR 2022

Editor's Preface

I am pleased to present the annual compilation of *Records of the Hawaii Biological Survey*; this year for the year 2022. The Hawaii Biological Survey, established by the Hawaii State Legislature in 1992 as a program of Bishop Museum, is an ongoing natural history inventory of the Hawaiian Archipelago. It was created to locate, identify, and evaluate all native and nonnative species of flora and fauna within the state; and by State Law to maintain the reference collections of that flora and fauna for a wide range of uses. In coordination with related activities in other federal, state, and private agencies, the Hawaii Biological Survey gathers, analyzes, and disseminates biological information necessary for the wise stewardship of Hawai'i's biological resources.

An intensive and coordinated effort has been made by the Hawaii Biological Survey to make our products, including many of the databases supporting the papers published here, available to the widest user-community possible through our web server. Products currently available include taxonomic authority files (species checklists for terrestrial arthropods, flowering plants, nonmarine snails, marine invertebrates, fossil taxa, and vertebrates), bibliographic databases (vascular plants, nonmarine snails, and insects), specimen databases (fungi, fish, invertebrates, portions of the insect collection) and type specimens (entomology; botany—including algae and fungi; and vertebrates), collections data (lists of holdings for select groups of flies as well as Cicadellidae and Pentatomidae), detailed information and/or images on endangered, threatened, and extinct plants and animals; as well as our staff publication lists. Additional reference databases include: the list of insect and spider collections of the world (based on Arnett, Samuelson & Nishida, 1993, 'Insect and spider collections of the world') with links to institutional web sites; and an authority file with full names and vital dates of almost 6,900 authors who have described new taxa of flies (Diptera).

The Records for 2022 includes descriptions of two endemic new species, 33 new state records of alien species, 82 new island records of alien species; and most significantly, four rediscoveries of plant species thought to be extinct in he wild.

Our Primary Web Products:
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Hawaii Biological Survey's "Good Guys/Bad Guys" website
http://hbs.bishopmuseum.org/good-bad/

World Diptera taxonomist list
http://hbs.bishopmuseum.org/dipterists/

Many of the new records reported here resulted from curatorial projects and field surveys funded by the National Science Foundation, the U.S. Navy, the U.S. Geological Survey, the U.S. Fish & Wildlife Service, the Hawaii Department of Transportation, and the Hawaii Department of Land and Natural Resources; they are thanked for their support and partnership of the Hawaii Biological Survey over the years.

We encourage authors with new information concerning flora or fauna occurring in the Hawaiian Islands to submit their data to the editor for consideration for publication in the Records. Submission and format of papers must follow format of recent papers. Information on submission of manuscripts and guidelines for contributors may be obtained at: http://hbs.bishopmuseum.org/guidelines.pdf ——*N.L. Evenhuis, editor*

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A new species of *Mesanthura* Barnard (Isopoda, Cymothoida, Anthuridae) from the Hawaiian Islands[1]

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Abstract. A new species of anthurid isopod *Mesanthura kalaeloa* **sp. nov.** is described from Hawai'i. It was collected from an autonomous reef monitoring structure deployed in Barbers Point Harbor, O'ahu. Dorsal pigment patterns immediately distinguish it from all described congeners.

Key words: Crustacea, Isopoda, Anthuridae, taxonomy, new species, Hawai'i

INTRODUCTION

Previously known Hawaiian Anthuridae comprise four species (Poore 2001), including one from the genus *Mesanthura* Barnard, 1914. All were described by Miller & Menzies (1952).

During a study in 2018 of aquatic invasive species, by the State of Hawai'i's Division of Aquatic Resources, a previously undescribed species of *Mesanthura* was discovered at Barbers Point Harbor on O'ahu. The genus is widespread in shallow marine water, with almost 50 known species (Boyko *et al*. 2008). Poore & Lew Ton (1986) provide a current diagnosis of *Mesanthura*. Known species are quickly spotted because of and distinguishable by their pigmentation patterns, which are supported by morphological differences (Poore & Lew Ton 1986, Poore 2001).

MATERIALS AND METHODS

Autonomous reef monitoring structures (ARMS) were used to monitor waters near state harbors for aquatic invasive species. ARMS are standardized structures designed to sample marine cryptofauna passively (Global ARMS Program 2017). A modified ARMS, consisting of four plates rather than the standard nine, was deployed on 11 July 2018 at a depth of 2.44 meters in Barbers Point Harbor on the island of O'ahu, Hawai'i and retrieved approximately 24 months later. All crustaceans retained on a 2-mm sieve were fixed in formalin and preserved in alcohol. These were received on 10 September 2021. Several specimens of an unrecognized anthurid were dissected, body parts were permanently mounted on glass slides with Permount mounting medium, and observed on a Richter Optica UX1D compound microscope outfitted with a 5 megapixel camera. Terminology follows Kensley & Schotte (1989). Material is deposited at Bernice P. Bishop Museum (BPBM).

Abbreviations: A1 = antennule; A2 = antenna; H = head; Md = mandible; Mx = maxilla; Mp = maxilliped; Pe1–7 = pereopods 1–7, Pl1, 2 = pleopods 1, 2; U = uropod; T = telson.

1. Contribution No. 2022-003 to the Hawaii Biological Survey.

SYSTEMATICS

Order ISOPODA Latreille, 1816
Suborder CYMOTHOIDA Wägele, 1989
Superfamily ANTHUROIDEA Leach, 1814
Family ANTHURIDAE Leach, 1814

Mesanthura kalaeloa sp. nov.

(Figs. 1, 2)

Type material. Holotype ♀, 7.5 mm, whole (BPBM S19610). Paratypes: ♀, 6.2 mm, partially dissected (BPBM S19611); ♀, 6.4 mm, partially dissected (BPBM S19612); ♀, 6.8 mm, partially dissected (BPBM S19613); ♀, 5.5 mm and manca, 2.7 mm, whole (BPBM S19614). All from Barbers Point Harbor, O'ahu (21.32475°N, 158.12227°W), 2.44 m, 13 Jul 2020.

Etymology. From the Hawaiian place name of the area in which the species was collected (treated as a noun in apposition).

Description (based on 4 females, 6.2–7.5 mm)

Pigment - Head, pereonites, and pleon have distinct dorsal patches of dark brown pigment with dense well delimited outlines enclosing scattered pigment spots. Head anterior border nearly straight at level of mid-eye, posterior border convex and extending to lateral limits of eyes; pereonite 1 anterior border convex, posterior border concave or nearly linear; pereonite 2 anterior border straight, posterior border convex; pereonites 3–6 anterior and posterior borders convex; pereonite 7 shortest, anterior border concave, posterior border convex; pleon fill evenly scattered; telson with evenly scattered pigment spots within a non-pigmented band around border; uropod with distinct patches of pigment spots on peduncle, endopod, and exopod. Other appendages not pigmented.

Body length about 13× greatest width. Head shorter than pereonite 1, length 1.3× width, rostrum prominent and rounded, length of rostrum and anterolateral projections equal, 0.1× head; eyes anterolateral, black, subtriangular, ommatidia indistinct. Relative length of pereonites: 1<2>3<4=5=6>>7. Telson linguiform, posterior edge with two groups of six setae separated by a small gap on midline, a small seta anterolateral of each group, a pair of statocysts anterior to pigment patch.

Antennule peduncle with 3 articles, proximal to distal proportions 5:2:3; flagellum with 3 articles, slightly shorter than peduncular article 3, distal article with setae and about 5 aesthetascs. Antenna peduncle with 5 articles, article 2 laterally grooved and partially covering article 3, proximal to distal proportions 15:34:12:17:22; flagellum with 3 articles, length 0.7× of peduncular article 5.

Mandible with palp of 3 articles, first and third of subequal length, second longest, third article subfalcate; incisor and lacinia mobilis each with 3 teeth. Maxilla bent apically, with a strong distal tooth and 5 smaller teeth. Maxilliped with palp of 3 articles, the second longest and widest, article 3 with 1 proximomedial robust seta and more distally a closely spaced group of 4 longer robust setae.

Pereopod 1 subchelate, carpus triangular, lower margin with blunt distal angle, propodus enlarged, palm centrally produced with proximal margin entire and distal margin denticulate, dactylus with a group of setae on lower margin. Pereopods 2 and 3 similar, merus noticeably broader than distal articles, carpus triangular with setae at distal angle,

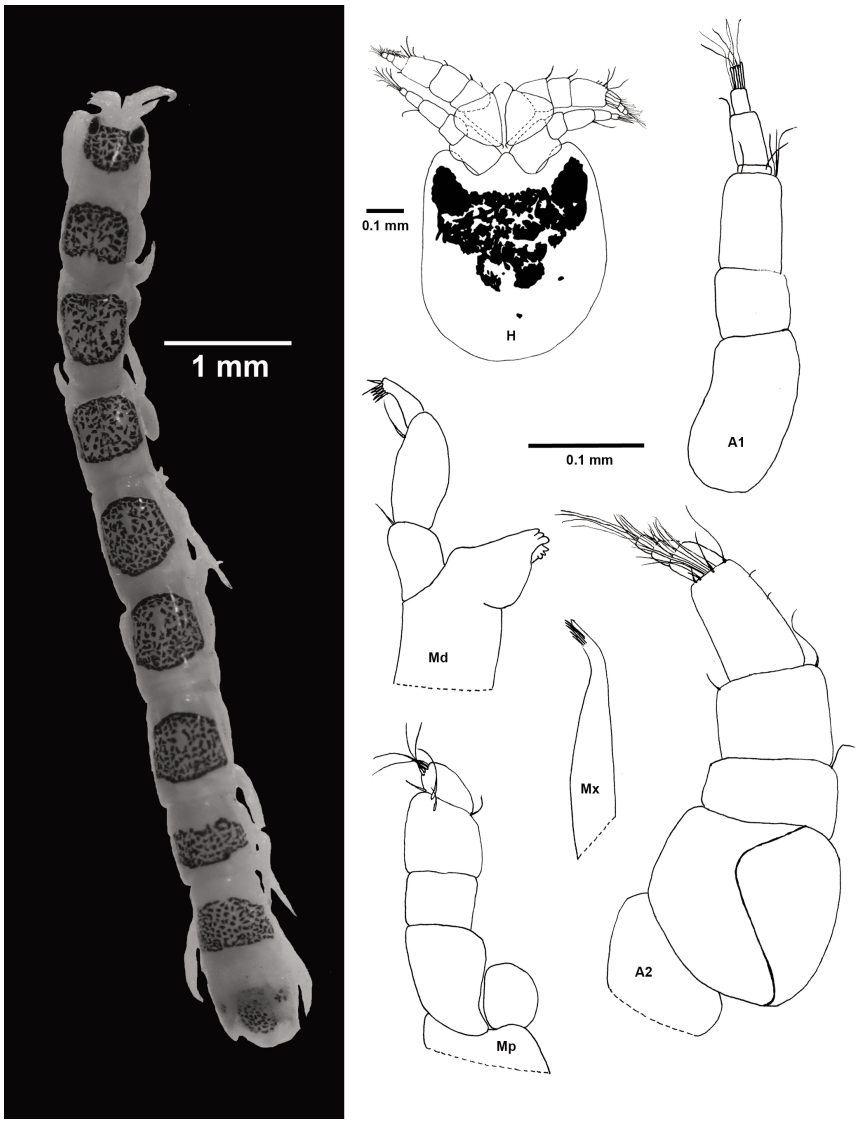

Fig. 1. *Mesanthura kalaeloa* sp. nov.: Left - photograph of holotype, 7.5 mm female (BPBM S19610). Right - 6.4 mm female (BPBM S19612): head, maxilla, mandible; 6.8 mm female (BPBM S19613): antennule, antenna, maxilliped. Scale bar at top left of right pane is for head only.

propodus elongate with setae and a stout serrate spine-like seta at lower distal angle, dactylus with setae and a robust spine-like seta on lower margin. Pereopods 4–6 similar, breadth of merus subequal to distal articles, carpus trapezoidal with setae and a stout

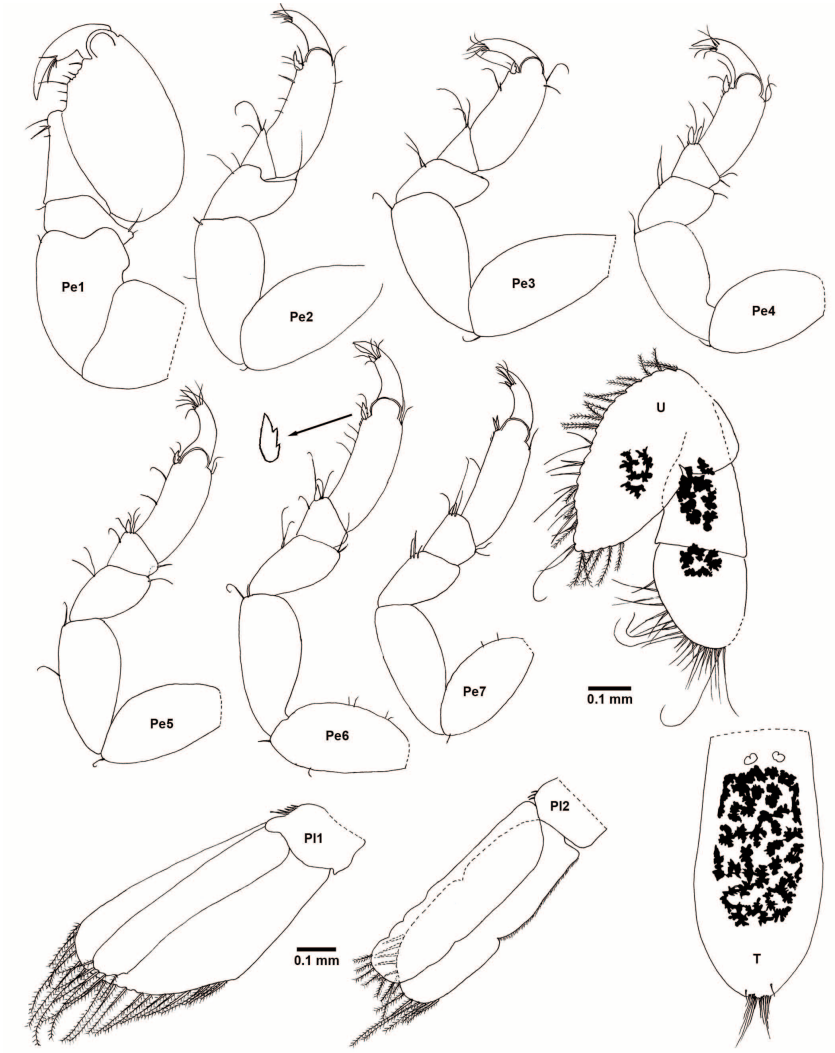

Fig. 2. *Mesanthura kalaeloa* sp. nov.: 6.2 mm female (BPBM S19611): pereopods 1–7, uropod, telson; 6.4 mm female (BPBM S19612): pleopod 1; 6.8 mm female (BPBM S19613): pleopod 2. Scale bar at lower left is for pleopods only.

spine-like seta at distal angle, propodus elongate with setae and a stout serrate spine-like seta at lower distal angle, dactylus with setae and a stout spine-like seta on lower margin. Pereopod 7 merus breadth subequal to distal articles, carpus trapezoidal with setae and a stout spine-like seta at distal angle, propodus elongate with 2 long robust spine-like setae at lower distal angle, dactylus with setae and a robust spine-like seta on lower margin.

Pleopod 1 peduncle with 5 retinaculae; exopod operculiform, length 1.75× width, 19 plumose setae along distolateral margin; endopod slightly shorter than exopod, 0.25× width of exopod, with 5 plumose setae along distal margin. Pleopod 2 peduncle with 3 retinaculae; exopod length 2.75× width, short densely spaced setae along lateral margin proximal to an indentation at mid-length, 13 long plumose setae along distal margin; endopod 0.70× width of exopod, 6 plumose setae along distal margin.

Uropod endopod nearly as wide as long, with long setae along distal margin, length about 0.6× that of peduncle; exopod longer than peduncle, slightly sinuous along distolateral margin, crenulate along lateral and distomedial margins, plumose setae along proximolateral and distomedial margins, simple and plumose setae along distolateral margin.

Habitat. Natural habitat unknown

Distribution. Hawaiian endemic

Remarks. Pigmentation on pereonites 4–7 immediately distinguishes *Mesanthura kalaeloa* from its Hawaiian congener *M. hieroglyphica* Miller & Menzies, 1952. *Mesanthura kalaeloa* has relatively large, well delimited pigment patches, whereas *M. hieroglyphica* has loops (Miller & Menzies, 1952) reminiscent of an upside-down capital omega (Ω). Morphological differences include the relative lengths of pereonites 5 and 6 (equal in *M. kalaeloa*, 5>6 in *M. hieroglyphica*), the upper margin of the merus in Pe2 & 3 (produced to meet the propodus and concealing upper margin of carpus in *M. hieroglyphica*, not so in *M. kalaeloa*), and setation of the lower distal angle of Pe7 propodus (a serrate spine-like seta is present in *M. hieroglyphica*, but absent in *M. kalaeloa*).

Mesanthura kalaeloa most resembles *M. paucidens* Menzies & Glynn, 1968, described from the Caribbean, but lacks the diagnostic five transverse pigment rows on the pleon [although not all illustrations in the redescription by Müller (1991) show these rows]. Additionally, the pigment patches of *M. kalaeloa* are more distinctly outlined and densely filled than *M. paucidens*. Less clear is the significance of pigmentation on the uropods of *M. kalaeloa*, with distinct patches on the peduncle, endopod, and exopod. Menzies & Glynn (1968) mention only that the uropods are scarcely pigmented and show scattered chromatophores rather than distinct pigment patches on the endopod and exopod. Müller (1991) does not discuss pigmentation of the uropod, but shows inconsistent pigmentation on the peduncle and endopod, and no pigment on the exopod.

There are also morphological similarities to *M. paucidens*, especially the blunt distoventral angle of the carpus and shape of the palm of Pe1, and the shape of the carpus and serrate distoventral spine-like seta on the propodus of Pe2–6 in the redescription (Müller 1991). *Mesanthura kalaeloa* differs from *M. paucidens* in the more-strongly projecting rostrum and anterolateral angles of the head; the larger, subtriangular eyes; the subfalcate, rather than semicircular article 3 of the mandibular palp; lack of serration (Menzies & Glynn 1968) or scalation (Müller 1991) on the ventral margin of Pe7; a greater number of retinaculae on the peduncle and longer endopod, relative to exopod, of Pl1; a shorter, relative to width, uropodal endopod; and the two groups of six, rather than two pairs, of setae on the distal margin of the telson.

Mesanthura kalaeloa also resembles *M. miyakoensis* Nunomura, 1979, described from Japan, but can be distinguished by the pigment patch on pereonite 7; a relatively narrow band of evenly scattered pigment with well delimited concave anterior and convex posterior borders in *M. kalaeloa* rather than a well delimited hexagon circumscribing dark irregular markings in *M. miyakoensis*. Additionally, the pigment filling the patches on the

head, pereonites, and pleon is evenly scattered in *M. kalaeloa* rather than irregular markings in *M. miyakoensis*; and the uropodal exopod of *M. kalaeloa* features a distinct pigment patch whereas that of *M. miyakoensis* is unpigmented. Morphologically, *M. kalaeloa* differs from *M. miyakoensis* by having fewer articles in female A1; more articles in female A2; a rostrum equal to, rather than exceeding, the anterolateral projections of the head; larger, subtriangular eyes; a lack of processes on the lower margin of Pe1 dactylus; and the shorter merus on Pe3 and 7.

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New Hawaiian bryophyte records from *Herbarium Pacificum* for 2022

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The continued processing of plant material at Bishop Museum's *Herbarium Pacificum*, as well as new collections from the field, have manifested in five new records for bryophytes on the islands of O'ahu and Maui—*Chiloscyphus greenwelliae*, *C. laceratus, Physcomitrium eurystomum*, *Plagiochila hawaica*, and *Trachypodopsis serrulata* var. *crispatula*. Hawai'i is currently undergoing a renaissance in the study of bryology, and as the collections at Bishop Museum continue apace, more new records will be published.

Funariaceae

Physcomitrium cf. ***eurystomum*** Sendnt. **New island record**

This is the first record of this genus for the island of O'ahu. Plants were first seen at Lyon Arboretum in 2021 and are frequent along trails throughout the gardens, especially on shaded dirt banks under shrubs. This genus was reported for the first time in the Hawaiian Islands on Kaua'i by Shevock *et al.* (2019). The location was described as "a cultivated setting on nylon shade cloth of a greenhouse," and it is no surprise that this species would be found on O'ahu under similar circumstances. It is very similar in general appearance to the endemic *Entosthodon subintegrus*, but can be differentiated using the following key adapted from Crum & Anderson (1955) for the identification of genera in the Funariaceae. The full key can be found at: [efloras.org]

Material examined. **O'AHU:** Mānoa, Lyon Arboretum on dirt hill next to greenhouse and along trails in garden, 200 m, 27 Mar 2022, *M.K. Thomas & J. Adams MKT 300*.

Key to the genera of Funariaceae in Hawai'i [adapted from Crum & Anderson (1955)]

1a. Capsules inclined and asymmetrical, with 2 rows of teeth……***Funaria***

1b. Capsules erect and symmetrical, teeth very rudimentary or absent

2a. Capsules subcylindric to narrowly pyriform; most exothecial cells oblong to oblong-linear, rarely isodiametric; calyptra cucullate, costa not reaching apex of leaf..... ***Entosthodon***

2b. Capsules urn-shaped, broadly pyriform, to cupulate; most exothecial cells irregularly hexagonal, ± isodiametric; calyptra mitrate to irregularly mitrate, sometimes appearing cucullate, costa reaching apex of leaf... ***Physcomitrium***

1. Contribution No. 2022-004 to the Hawaii Biological Survey.

Lophocoleaceae

Chiloscyphus greenwelliae (H.A. Mill.) H.A. Mill. **New island record**

According to Staples & Imada (2006), this species was only known from the islands of Kauaʻi, Maui, and Hawaiʻi. Upon inspection of the liverwort collection at *Herbarium Pacificum*, one specimen was located from the Waiʻanae Mountains collected by E. Funk and annotated as "*Chiloscyphus greenwelliae*, determination in absence of comparative materials." I cross-referenced this specimen with unpublished figures done by H.A. Miller (Miller n.d.), as well as with other verified specimens, and found that this plant is indeed *C. greenwelliae*. Photos from the field were also sent to hepatic experts Emmet Judziewicz and Virginia Friere, who both agreed on the ID (pers. comm.). Field work in the Koʻolau Mountains at Puʻu Eleao and near Puʻu Keahiakahoe revealed that this species is locally abundant, often growing on trees and under shrubs along the Koʻolau summit. It will most likely be found wherever similar habitat exists on all the Hawaiian Islands.

Material examined. **OʻAHU:** Mokuleʻia Distr., northern Waiʻanae Mts., at head of Makaleha Valley in wet *Metrosideros* forest, 1,250 m, 10 Jun 1978, *E. Funk, s.n.* (BISH 478393); Koʻolau Mts., Puʻu Eleao, in mixed native cloud forest along summit ridge growing on shrubs and ground with *Plagiochila deflexa, Chiastocaulon combinatum,* and others, 829 m, 20 Jan 2022, *M.K. Thomas*, *S. Ching-Harbin, K. Togikawa, J. Serrano, D. Sischo, C. Hee, S. Steifel & M. Tsuneshige MKT 228*; Koʻolau Mts., summit of Kauakaulani near Puʻu Keahiakahoe, growing on ground under *Dicranopteris linearis* and *Diplopterygium pinnatum*, 812 m, 28 Ja 2022, *M.K. Thomas, M. LeGrande, C.T. Imada & K. Magnacca MKT 243*.

Chiloscyphus laceratus Steph. **New island record**

Staples & Imada (2006) list this taxon as occurring on the islands of Molokaʻi, Maui, and Hawaiʻi. It has recently been collected at Kōnāhuanui and near the head of Helemano in the Koʻolau Mountains. Numerous observations have also been made in the vicinity of Puʻu Kaiwipoʻo and Wailupe in the same mountain range. This species has probably been overlooked on many occasions because it often grows appressed against tree bark among similar-looking species such as *Cuspidatula* and *Odontoschisma*, and may also be buried or intertwined with species of *Plagiochila, Herbertus, Bazzania,* etc. It is easily identified by the imbricated, rounded, lateral leaves and the smaller, ciliated underleaves with 4–6 long teeth. No observations of this species have been made in the Waiʻanae Mountains, but it will most likely occur there in wet forests.

Material examined. **OʻAHU:** Koʻolau Mts., Puʻu Kōnāhuanui, at summit, epiphytic on *Metrosideros polymorpha* in wet/cloud forest, 940 m, 14 Jan 2022, *M.K. Thomas, M. Brown & G. Nastase MKT 221*; northern Koʻolau Mts., Helemano, growing in *Metrosideros, Cibotium, Sadleria, Antidesma, Cheirodendron, Kadua, Psychotria, Syzygium, Dicranopteris, Diplopterygium*-dominated forest, 960 m, 03 Apr 2022, *M.K. Thomas, S. Ching-Harbin, K. Togikawa, M. Browning, J. Serrano & M. Tsuneshige MKT 305*.

Plagiochilaceae

Plagiochila hawaica Steph. **New island record**

Previously undocumented from the island of Oʻahu, three recent collections document its presence in both mountain ranges: Palikea in the southern Waiʻanae Mountains, Mount Kaʻala in the northern Waiʻanaes, and Kōnāhuanui in the Koʻolau Mountains, where it will most likely be found in other localities along the summit ridge. The material was identified using the key provided in Inoue (1976).

Material examined. **O‘AHU:** Wai‘anae Mts., Palikea, on rocks and trees in mixed alien/native mesic forest, 812 m, 20 May 2021, *M.K. Thomas*, *S. Ching-Harbin, K. Togikawa & J. Serrano MKT 72*; northern Wai‘anae Mts., Ka‘ala, growing in bryophyte mat in native shrubland along the FAA road with *Philonotis sullivantii* and others, 800 m, 01 Mar 2022, *M.K. Thomas*, *S. Ching-Harbin, K. Togikawa, J. Serrano & M. Tsuneshige MKT 280*; southern Ko‘olau Mts., Pu‘u Kōnāhuanui, on *Metrosideros polymorpha* growing intermixed with *Frullania apiculata, Cuspidatula robusta, Herbertus* spp., *Chiloscyphus ciliolatus*, and others, 03 Apr 2022, *M.K. Thomas MKT 315*.

Trachypodaceae

Trachypodopsis serrulata (P. Beauv.) M. Fleisch.

var. ***crispatula*** (Hook.) Zanten **New island record**

According to Staples *et al*. (2004), this taxon was only known from the island of Hawai‘i. A specimen was sent to *Herbarium Pacificum* by Plant Extinction Prevention Program Botanist Hank Oppenheimer and was examined by Bishop staff using a key in a publication by van Zanten (1959). The specimen was also similar in appearance and in habitat with collections made on the island of Hawai‘i.

Material examined. **MAUI:** East Maui, Makawao Distr., Honomanu drainage basin, TNC Waikamoi Preserve & Haleakalā Ranch, along trail & unpaved road in forestry plantings of *Pinus*, *Cryptomeria, Cupressus*, 1,970–2,031 m, 07 May 2021, *H. Oppenheimer H52112*; Kīpahulu Valley, Haleakalā National Park, National Park Service Expedition III, West Camp, transect 5, in *Metrosideros-Cheirodendron-Dryopteris* forest, on *Metrosideros* branch in partial shade, 2,000 m, 28 Feb 1984, *C.A. Russell 522*.

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New plant records from Maui

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The following contributions include new plant records from the island of Maui. All records are for nonindigenous species. Voucher collections mentioned are housed in Bishop Museum's *Herbarium Pacificum* (BISH), Honolulu, Hawai‘i.

Acanthaceae

Asystasia gangetica

subsp. ***micrantha*** (Nees) Ensermu **New island record**

First recorded as newly naturalized in the State on the island of Hawai‘i, along the Waiākea streambed near UH-Hilo (Starr & Starr 2016), *Asystasia gangetica* subsp. *micrantha* is here reported from Maui, where it was found in mesic to wet lowland areas of Huelo, Ha‘ikū, often growing along with the more commonly found *A. gangetica* subsp. *gangetica* in understory areas and along moist roadsides. Subspecies *micrantha* has a similar sprawling habit, but with much smaller flowers.

Material examined. **MAUI:** East Maui, Ha‘ikū, Huelo, Kulike Rd., trail to Pilale Bay, in mesic to wet lowland understory, in association with *Asystasia gangetica* subsp. *gangetica*, *Acacia confusa,* and *Pandanus tectorius*, 100 ft [30 m], (20.933658, -156.257065), 10 Jan 2022, *Starr & Starr 220110-01; loc. cit.,* Waipi‘o Rd., scattered along roadside in mesic to wet lowland vegetation, in association with *Mangifera indica* and *Sphagneticola trilobata*, 500 ft [152 m], (20.911418, -156.230947), 10 Jan 2022, *Starr & Starr 220110-02.*

Amaranthaceae

Celosia argentea L. **New island record**

Celosia argentea (Silver cockscomb) was previously reported as naturalized by Oppenheimer (2003) from the island of Hawai‘i, in the vicinity of Waiākea Stream in Hilo. On Maui, it was recently found in a similar habitat, with numerous plants of all life stages observed along the stream margins of ‘Iao Stream at Kepaniwai Park.

Material examined. **MAUI:** West Maui, ‘Iao Stream, close to and scattered along the stream, in association with *Buddleia asiatica* and *Amaranthus spinosus*, 725 ft [221m], (20.882428, -156.535726), 03 Nov 2020, *Starr & Starr 201103-01.*

Asteraceae

Vernonanthura polyanthes (Spreng.)

A.J.Vega & Dematt. **New state record**

Initially found by retired State Forester Bob Hobdy, who alerted us and the Maui Invasive Species Committee of its presence on Maui, *Vernonanthura polyanthes* (tree aster, assapeixe) is native to Brazil and is a known invasive species in parts of Africa, including Zimbabwe, where it was introduced as a nectar supply for bees, and has since spread along roadsides and forest margins (Wikipedia 2022). Aerial imagery showed this seasonally conspicuous tree was widespread on Maui, having invaded about 1,000 acres of

abandoned pineapple fields, pastures, unmaintained areas, yards, and roadsides in the Haʻikū area from Māliko Gulch to Kaupakalua Gulch, between the elevations of 600 and 1,000 feet. Ground surveys confirmed the distribution, and located another location on West Maui in ʻĪao Valley. The ʻĪao Valley location was just a single small tree that was controlled. This species can be distinguished by the following characteristics: "Shrub or small tree, up to c. 4 m tall. Stems and branches with numerous, verrucose lenticels. Leaves alternate, oblong-lanceolate, up to c. 12 cm long, dull green and mostly hairless above, greyish stellate-hairy beneath; apex acuminate; margin serrate; petiole 5–7 mm long. Inflorescences in large terminal heads. Capitula white, without ray-florets" (Hyde *et al*. 2022).

Material examined. **MAUI:** East Maui, Haʻikū, side of Kokomo Rd., in fence row, in association with *Megathyrsus maximus, Casuarina equisetifolia, Leucaena leucocephala*, 800 ft [244 m], (20.903207, -156.322138), 10 May 2021, *Starr & Starr 210510-01*. West Maui, ʻĪao Valley, side of ʻĪao Stream, lone individual growing among large boulders, in association with *Pluchea carolinensis*, *Casuarina equisetifolia*, and *Melinis repens*, 875 ft [267 m], (20.881318, -156.542884), 11 Aug 2022, *Starr & Starr 220811-01*.

Lamiaceae

Salvia hispanica L. **New state record**

Previously unrecorded as present or naturalized in Hawaiʻi, scattered plants of *Salvia hispanica* (chia) were found along a rural road margin in Piʻiholo, Maui. It is uncertain how these plants got there, or if they will persist. Additionally, an image was posted on iNaturalist in November 2021 of a wild *Salvia hispanica* in ʻĪao Valley, next to ʻĪao Stream. However, field surveys in August 2022 could not relocate it. It is uncertain whether we were searching in the wrong location, if the species is seasonal, or if the species no longer persists in ʻĪao. Chia is an annual herb native to Mexico and Guatemala, where it was cultivated as a crop by pre-Columbian Aztecs and Meso-American Indian cultures for medicinal and religious purposes (Petruzello 2020). In the 1980s chia gained popularity as "chia pets" and in the 1990s was popularized for its nutritious fiber and omega-3 fatty acids, and is now cultivated in various regions of the world. Chia has the following characteristics: "Chia is an annual herbaceous plant that can reach nearly 1 metre (3 feet) in height. Its lime-green leaves are oppositely arranged and have serrated (toothed) margins. The plant bears spikes of small blue, purple, or white flowers that have a high rate of self-pollination. The small oval seeds are about 1 mm (0.04 inch) in diametre and feature a shiny, mottled, or speckled seed coat that ranges in colour from dark brown to gray-white. The seeds produce a mucilaginous gel when soaked in water" (Petruzello 2020).

Material examined. **MAUI:** East Maui, Piʻiholo, Piʻiholo Rd., residential roadside, in association with *Ulex europaeus* and *Melinis minutiflora*, 3,175 ft [968 m] (20.818651, -156.281632), 26 Oct 2020, *Starr & Starr* 201026-01.

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Lectotype designations for Hawaiian Dolichopodidae (Insecta: Diptera)[1]

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Abstract. Studies on types of Hawaiian Dolichopodidae result in the designation herein of lectotypes for the following 11 taxa: *Asyndetus carcinophilus* Parent, 1937; *C. obscurus* Parent, 1938; *C. planitibia* Parent, 1940; *Cymatopus acrosticalis* Parent, 1937; *Eurynogaster apicenigra* Parent, 1940; *E. maculata* Parent, 1940; *E. nigrohalterata* Parent, 1940; *E. retrociliata* Parent, 1940; *Hydrophorus williamsi* Parent, 1938; *Medetera atrata* Parent, 1940; and *Paraliancalus minor* Parent, 1938. A list of species with lectotype designations stemming from validating phraseology Hardy & Kohn (1964) are given to help clarify their status in upcoming works. Images are given for lectotypes in Bishop Museum newly designated here.

Type studies were undertaken for Hawaiian Dolichopodidae, supplementing the paper on lectotypes of *Campsicnemus* Haliday, 1851 by Evenhuis (2007), which has resulted in 11 further lectotype designations to fix the species definitions of taxa in a number of genera. The results are published here to allow more rigorous and detailed taxonomic studies of Hawaiian dolichopodids. In addition, to help with future taxonomic work on Hawaiian dolichopodids, a survey of Hardy & Kohn (1964) was conducted to ascertain all possible lectotype designations therein stemming from phraseology such as "the type", which qualifies as a lectotype designation under I.C.Z.N. (1999) *Code* Art. 74.5.

MATERIAL AND METHODS

Specimens derive from the Bishop Museum, Honolulu (BPBM). Some specimens found in the original Hawaiian Sugar Planters' Association (HSPA) collection in the Hawaii Department of Agriculture (HDOA) that were determined to be syntypic were transferred during this study to BPBM for permanent deposit. Other museums with Hawaiian dolichopodid type material researched and mentioned here include the Natural History Museum, London (BMNH), the Muséum National d'Histoire Naturelle in Paris (MNHN), and the University of Hawaii Insect Museum, Mānoa (UHIM). Format of presentation follows Radovsky *et al*. (1976). Arrangement of entries are alphabetical by species. Original and current generic combinations are given along with as complete as possible literature history of each name. The condition of each type specimen are given along with the numbers upon which the name was based and how many specimens were found in BPBM and other museums.

Label data for lectotypes designated in this study or for other primary types discussed here is given verbatim. Ends of lines on a label are indicated by the use of a solidus (/); beginning and ending of labels are indicated by use of double quotes (" "). Square brackets ([ ]) are used to indicate information added to label data and in other portions of this paper for clarification. All newly designated lectotypes designated here and in BPBM bear a blue or orange LECTOTYPE label.

1. Contribution No. 2022-007 to the Hawaii Biological Survey.

BACKGROUND ON DETERMINATIONS OF TYPE STATUS BY HARDY

As explained in Evenhuis (2007), there exists some confusion as to the type status of many Hawaiian Diptera treated by D.E. Hardy in the *Insects of Hawaii* series because of his use of a phrase such as "Type is in the British Museum (Natural History)" when in actuality the specimen(s) there were often not holotypes but syntypic, having other syntype specimens of the same species in other collections. The confusion stems from the specimens thought by Hardy to be "types" at the time of his visit to the BMNH (in the early 1950s) having a red ringed label with the word "Type". A bit of the history leading to this mistaken identity by Hardy (and others) concerning the type status of material in the BMNH is repeated here from Evenhuis (2007).

As with many other museums across Europe, measures were taken at the BMNH in the early 1940s to protect its natural history collections from bombing raids. Collections were evacuated from the BMNH and transported into the country in two separate moves. The types were housed in one country house and the remainder of the collection scattered elsewhere. Since only one specimen per species would be taken to the type collection locality, an arbitrary decision was made with regard to syntype series as to which specimen would bear the characteristic red ringed BMNH "Type" label (the same as those used for holotypes) while the remainder were given yellow-ringed "paratype" labels. This decision on selection of an arbitrary "type" was left up to the various section curators. In the case of Diptera, that duty resided with F.W. Edwards (C.E. Dyte, pers. comm.), primarily a specialist on Nematocera and not necessarily experienced with families outside of his specialty. Thus, some of the specimens chosen to bear those labels may not have matched up well to the descriptions. When the collections were returned and combined once again after the war, the "type" and "paratype" labels of the syntypic specimens were not immediately removed (in fact in the Diptera collection, no concerted effort was made to remove the labels until the 1990s). Thus for over 50 years, syntype series without a designated lectotype were indistinguishable from type series that had a holotype specimen.

This finding of a single specimen labeled as "Type" is what Hardy (throughout his *Insects of Hawaii* volumes) and others recorded in their papers when researching types in the BMNH, not the fact that they were designating lectotypes. Hardy & Kohn (1964) also used the same phrase for dolichopodid specimens found in the HSPA Collection. This is no doubt because Parent normally only labeled one specimen of his series of specimens with the word "Type" although he never designated such as a holotype in any of his papers (C.E. Dyte, pers. comm.). Hardy & Kohn (1964) were then merely quoting the label data for the Parent specimens in HSPA, the same as they did with those in BMNH. However, because Hardy & Kohn (1964) most often used the phrase "Type in …" and not "The type in …" it is clear that Hardy was not designating lectotypes according to the *Code* and therefore these phraseologies in his papers should not be construed as lectotype designations. However, there are uses of "the type" in Hardy & Kohn (1964). which qualify as a lectotype designation according to ICZN *Code* Art. 74.5. To help clarify what is and what is not a lectotype among phraseologies used by Hardy & Kohn (1964), a survey was conducted of all such uses for dolichopodid species in that work and are summarized at the end of this paper.

Figure 1. Octave Parent (1882–1942).

HAWAIIAN DOLICHOPODIDAE COLLECTIONS AND OCTAVE PARENT

Since a number of specimens treated here were authored by Parent, I thought it would be helpful to explain the reason for syntypic specimens authored by him to be in a number of collections.

Much of the dolichopodid material treated here was collected primarily by entomologist Francis Xavier Williams, who was a prolific worker in Hawai‘i from 1916–1948 (with many travels to various Pacific locales during those years) and who made extensive biological observations, rearings, and excellent illustrations of many insects including being one of the few to do biological studies on Hawaiian Dolichopodidae. The material collected by Williams in the 1930s was deposited in the collections of the Hawaii Sugar Planters' Association (HSPA), at the time the primary entomological research institution in Hawai‘i. After the taxonomic research aspects of the HSPA declined, the HSPA Collection, which contained a great deal of type material described by many entomologists throughout the decades, was transferred in the 1960s to the Hawaii State Department of Agriculture (HDOA) in Honolulu. In 1964, a donation of 150,000 insect specimens from HSPA (Radovsky *et al*. 1976) was given to the BPBM including most but not all of the type material in that collec-

tion. In 1975, BPBM staff went to HDOA to recover an additional set of type specimens deriving from the HSPA Collection. At that time HDOA transferred all the material that were found with "type" labels to the BPBM for permanent deposit, retaining the remainder of the original HSPA Collection as a synoptic reference collection. There are apparently still some syntypic specimens in HDOA (especially those not with "type" labels but matching type localities and dates). Some of those HSPA specimens in HDOA (primarily Dolichopodidae) have been identified during this study as belonging to original type series and have been transferred to BPBM.

The Abbé Octave Parent (1882–1942) (Fig. 1) published five papers describing new species of Hawaiian Dolichopodidae (1934, 1937a, 1937b, 1938, 1940). Material for the last three of these papers were based on specimens sent by F.X. Williams (on behalf of the Hawaiian Entomological Society or the HSPA) directly to Parent, or to the International Institute of Entomology (IIE; the forerunner of today's CABI), who sent material on to Parent as the primary expert in Europe on Dolichopodidae in those days. After identification, identified specimens (thus syntypes for the new species) were returned to Hawai'i, but other specimens were kept by Parent, or IIE, or both.

Much of the Hawaiian material Parent used for descriptions of new species derived from HSPA collections, the Hawaiian Entomological Society collections (which were housed at HSPA), or directly from F.X. Williams. The types of all of the species described in Parent's 1937b paper were returned to the collection of the Hawaiian Entomological Society (then at the same location as the HSPA on Makiki Street in Honolulu), which were subsequently transferred with the HSPA specimens labelled as "types" (in 1964 or 1975) to BPBM for permanent deposit. Much of this returned material has a label (now aged brown over time) with "Type" handwritten by Parent. Other of this material was exchanged with or given (by Parent) to the Imperial Institute of Entomology (IIE) in London, which subsequently transferred this material to BMNH in three accessions (one in 1936; two in 1938) (C.E. Dyte, pers. comm.). Subsequent visits to the HDOA collection by me over the years has resulted in the finding of syntypic material not found previously. This material has been transferred to the BPBM with vouchers of non-primary types (= material other than lectotypes) returned to HDOA.

TYPE STUDIES

acrosticalis (Fig. 2) — **Lectotype** ♂ — BPBMENT 0000017535 pin

Paraphrosylus sp.: Bryan, 1926: 68; Polhemus, 1991: 2, 4.

Cymatopus acrosticalis Parent, 1937a: 144. *Nomen nudum*.

Cymatopus acrosticalis Parent, 1937b: 69. Williams, 1940: 314; McKay, 1945: 206; Hardy, 1952: 454; Smith, 1952: 430; Dyte, 1959: 140; Oldroyd, 1964: 145; Sunose & Satô, 1994: 655.

Paraphyrosylus acrosticalis (Parent): Hardy & Kohn, 1964: 251. Beardsley, 1966: 165; Asquith & Messing, 1993b: 5.

Aphrosylus (*Paraphrosylus*) *acrosticalis* (Parent): Caspers, 1966: 8.

Conchopus acrosticalis (Parent): Takagi, 1965: 52; Tenorio, 1969: 64; Masunaga *et al*., 2005: 439; Masunaga & Saigusa, 2010: 4; Grichanov, 2014: 131, 2017: 151; Abdelsalam, 2019: 90.

Cymatopus acrostichalis: incorrect subsequent spelling of *acrosticalis* (Negrobov, 1977: 354).

Thambemyia acrosticalis (Parent): Meuffels & Grootaert, 1984: 152; Bickel & Dyte, 1989: 406; Nishida, 1992: 98, 1994: 92, 1997: 78, 2002: 95; Grootaert & Evenhuis, 1997: 74; Englund, 2001: 8; Englund *et al*., 2000a: 65; Howarth & Preston, 2002: 55; Englund & Arakaki, 2003: 5; Yang *et al.*, 2006: 255.

Thambemyia acrostichalis: incorrect subsequent spelling of *acrosticalis* (Evenhuis & Eldredge, 2004: 212; Englund *et al*. 2007: 230).

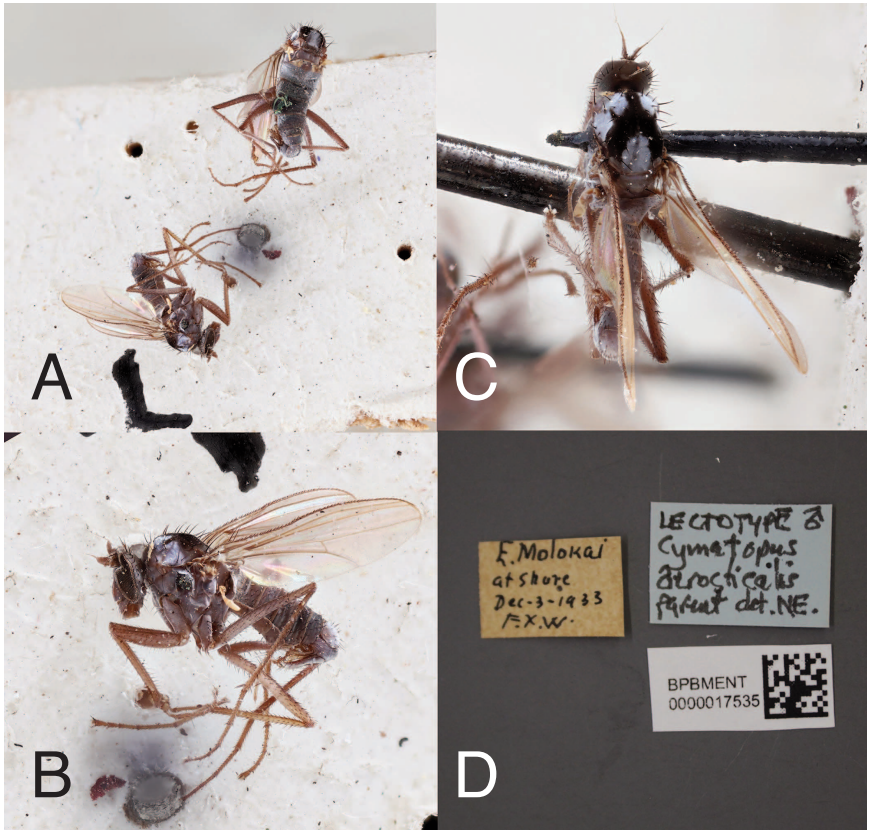

Figure 2. Lectotype male of *Cymatopus acrosticalis* Parent. **A**. Position of type specimens on cork stage (lectotype indicated by an "L"). **B**. Lateral view. **C**. Dorsal view. **D**. Labels.

Published type locality: HAWAIIAN ISLANDS: **Moloka'i**: at shore rocks, 3 Dec 1933, F.X. Williams.

Label data: "E. Molokai / at shore / Dec-3-1933 / F.X.W. [in Williams's handwriting]", "LECTOTYPE ♂ / Cymatopus / acrosticalis / Parent det. N.E. [in Evenhuis's handwriting]" [light blue label].

Current status: *Conchopus acrosticalis* (Parent) [*teste* Masunaga & Saigusa (2010)].

Condition: The lectotype is mounted with another male on a thick square cork stage, each pinned with a minuten. The lectotype is in good condition with only the eyes collapsed from air drying. Slight verdigris starting to appear at the tip of the minuten. There are additional holes on the cork stage indicating that there might have been other specimens once mounted on the stage that are no longer here.

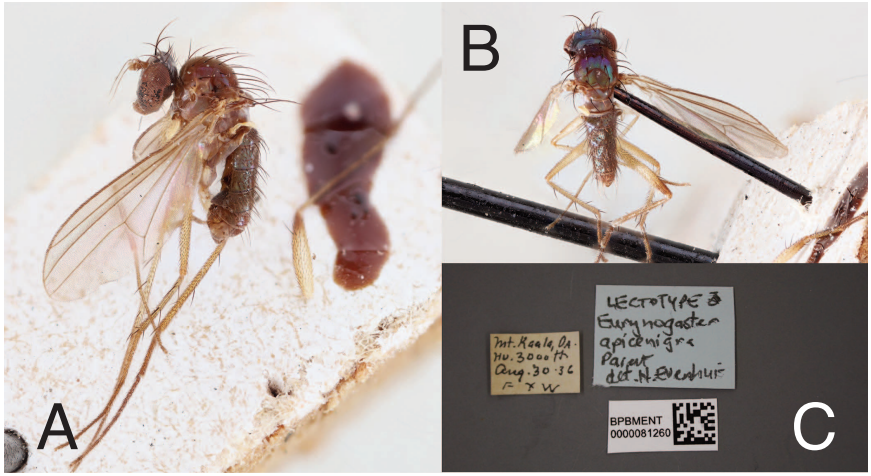

Figure 3. Lectotype male of *Eurynogaster apicenigra* Parent. **A**. Lateral view. **B**. Dorsal view. **C**. Labels.

Remarks: The species was originally described based on an undetermined number of males and females from Molokaʻi taken at rocks along the seashore by F.X. Williams on 3 December 1933. Three male and one female syntype (now paralectotypes) are in BMNH [under the name "*Tambemyia acrostichalis* (Parent)"]. Seven male and one female syntypes mounted on cork stages on three pins matching the above locality data were located in the former HSPA collections at HDOA (since transferred to BPBM). The best preserved of these now in BPBM, a male on the same cork stage with another male, is here designated **lectotype male** and indicated on the cork stage with an inked "L". Parent (1937a) listed this name as *Cymatopus acrosticalis* Par." among species he treated in that paper, referring to an undetermined number of specimens collected by F.X. Williams at Hanauma Bay, Oʻahu, in "muddy shallows" in May 1936. There are no characters given to differentiate the species in that work, so it is a *nomen nudum* there. No doubt, Parent had received the Hanauma Bay material subsequent to submitting his *Konowia* paper (Parent, 1937b), but the *Konowia* work came out a few months later than this one (Parent 1937a).

apicenigra (Fig. 3)	**Lectotype** ♂	BPBMENT 0000081260 pin

Eurynogaster apicenigra Parent, 1940: 240. Hardy, 1952: 454; Hardy & Kohn, 1964: 179; Tenorio, 1969: 41; Bickel & Dyte, 1989: 413; Nishida, 1992: 96, 1994: 90, 1997: 76, 2002: 94; Yang *et al.*, 2006: 451

Adachia apicenigra (Parent): Evenhuis, 2005: 45; Yang *et al.*, 2006: 451; Grichanov, 2014: 26, 2017: 38; Chursina *et al*., 2016: 507; Goodman *et al*., 2016: 3.

Published type localities: HAWAIIAN ISLANDS: (1) **Oʻahu**: [Waiʻanae Mountains], Mt Kaʻala, 3,000 ft; (2) **Oʻahu**: [Koʻolau Mountains], Punaluʻu uplands, dripping bank.

Figure 4. Lectotype male of *Medetera atrata* Van Duzee. **A**. Lateral view. **B**. Dorsal view. **C**. Labels.

Label data: "Mt. Kaala, Oa- / hu, 3000 ft. / Aug. 30 • 36 / F.X.W. [in Williams's handwriting]", "LECTOTYPE ♂ / Eurynogaster / apicenigra / Parent / det. N.Evenhuis [in Evenhuis's handwriting]" [light blue label].

Current status: *Adachia apicenigra* (Parent, 1940) [*teste* Yang *et al.* (2006)].

Condition: Good; left hind leg beyond coxa broken off and glued to cork stage.

Remarks: Parent (1940) originally described this species based on an unspecified number of male and female specimens without selecting a type. One syntype (now paralectotype) was located in BMNH; two specimens in HDOA (in the old HSPA collection) were located during this study and transferred to BPBM. The best preserved of these in BPBM is here designated as **lectotype male.**

atrata (Fig. 4)	Lectotype ♂	BPBMENT 0000004079 pin

Medetera atrata Van Duzee, 1933: 344. Bryan, 1934: 449; Suehiro, 1960: 296; Hardy & Kohn, 1964: 254; Arnaud, 1979: 266; Bickel, 1987: 246; Bickel & Dyte, 1989: 404; Asquith & Messing, 1993a: 154, 1993b: 5; Yang *et al.*, 2006: 278; Grichanov 2017: 332.

Published type locality: HAWAIIAN ISLANDS: **O'ahu**: Honolulu, 7 Aug 1924, O.H. Swezey.

Label data: "H.S.P.A. [handwritten] / Honolulu, T.H. [printed] / quarantine / house 8-7-24 [handwritten]", "Swezey / Coll. [printed]", "Medetera / atrata / [Van Duzee's handwriting] / Holotype. VanDuzee [red printing]" [red-ringed square label], "Medetera [printed] / grisescens / de Meijere [in Bickel's handwriting] / det. DJBickel 1983 [printed except "3" in Bickel's handwriting]", "LECTOTYPE ♂ / Medetera / atrata V. Duzee / det. N. Evenhuis [in Evenhuis's handwriting]" [light blue label].

Figure 5. Lectotype male of *Asyndetus carcinophilus* Parent. **A**. Lateral view. **B**. Dorsal view. **C**. Labels.

Current status: Junior synonym of *Medetera grisescens* Meijere, 1916 [*teste* Yang *et al*. (2006)].

Condition: Very good; eyes and abdomen collapsed from air drying.

Remarks: Described from one male and two females without designating a holotype. The male specimen in BPBM labeled as holotype is here designated **lectotype male**. Synonymized with *M. grisescens* Meijere by Bickel (1987: 246).

carcinophilus (Fig. 5)	**Lectotype** ♂	BPBMBENT 0000016649 pin

Asyndetus carcinophilus Parent, 1937a: 132. Williams, 1938: 126; Parent, 1940: 248; Hardy, 1952: 453; Smith, 1952: 430; Brown, 1956: 235; Dyte, 1959: 140; Hardy & Kohn, 1964: 238; Oldroyd, 1964: 145; Bickel & Dyte, 1989: 407; Nishida, 1992: 93, 1994: 88, 1997: 74, 2002: 91; Bickel, 1996: 1152; Bickel & Sinclair, 1997: 251; Howarth & Preston, 2002: 55; Yang *et al.*, 2006: 40; Grichanov, 2014: 58, 2017: 70; Souza, 2017: 88.

Published type locality: "I. Sandwich" [HAWAIIAN ISLANDS]: **O'AHU**: beach near "blowhole", 22 May 1936, usually at mouth of crab holes, [F.X. Williams].

Label data: "Beach nr "blow hole" / OAHU. V-22-36 / F.X.W usually in mouth of crab holes [in Williams's handwriting]", "LECTOTYPE ♂ / Asyndetus / carcinophilus / Parent / det. n. Evenhuis [in Evenhuis's handwriting]" [light blue label].

Current status: *Asyndetus carcinophilus* Parent, 1937 [*teste* Yang *et al*. (2006)].

Condition: Good; left hind leg beyond trochanter broken off and missing.

Remarks: Described from an undetermined number of males and females from the above published type locality. Hardy & Kohn (1964: 238) indicated two specimens they had located in the MNHN with the correct type locality data but stated that neither

was labeled as a type. Thirteen syntypes (now paralectotypes) are deposited in BMNH but were not mentioned by Hardy & Kohn (1964). Nine males and females in the HDOA collections (originally in HSPA; now transferred to BPBM) under the label data above were located, two of which (a male and female pinned with minutens to a cork stage) are labeled as "cotypes" in Parent's handwriting. The male on the pin is here designated **lectotype male**.

cilifemorata **Paralectotype ♀** pin

Eurynogaster cilifemorata Parent, 1940: 241. Hardy, 1952: 455; Hardy & Kohn, 1964: 185 Tenorio, 1969: 41, 66; Bickel & Dyte, 1989: 413; Nishida, 1992: 97, 1994: 91, 1997: 76, 2002: 94; Yang *et al.*, 2006: 476; Grichanov, 2014: 227, 2017: 250; Goodman *et al*., 2016: 3.

Published type locality: HAWAIIAN ISLANDS: (1) **O'ahu**: Olympus trail, 2,400 ft, Oct [1936], foliage, F.X. Williams. (2) O'ahu: Kōnāhuanui, 2700 ft., November (3) O'ahu: Lulumahu Stream, 1900 ft, September, "slopes of valley".

Label data: "Mt. Olympus / OAHU. 2400 ft / Aug - 16 - 36 / F.X.W. / Foliage [in Williams's handwriting]", "PARALECTOTYPE ♀ / Eurynogaster / cilifemorata Par. / det. N. Evenhuis [in Evenhuis's handwriting]" [light blue label].

Current status: *Eurynogaster cilifemorata* Parent, 1940 [*teste* Yang *et al.* (2006)].

Condition: Good.

Remarks: Parent (1940: 241) based this species on an unspecified number of males and females from three localities in the southern portion of the Koo'lau range on O'ahu, all near Honolulu. Hardy & Kohn (1964: 186) mentioned a male in the Parent collection in MNHN as being "the type", thus qualifies as a lectotype designation. Additionally, 11 syntypes (now paralectotypes) are in BMNH; two females were found in this study in the old HSPA collection in HDOA and transferred to BPBM. These paralectotypes are mounted with a minuten pin on a cork stage.

maculata (Fig. 6) **Lectotype ♂** BPBMENT 2008035010 pin

Eurynogaster maculata Parent, 1940: 242; Hardy, 1952: 455; Hardy & Kohn, 1964: 206; Tenorio, 1969: 41; Bickel & Dyte, 1989: 413; Nishida, 1992: 97, 1994: 91, 1997: 77, 2002: 94; Yang *et al.*, 2006: 475; Grichanov, 2014: 267, 2017: 251; Goodman *et al*., 2016: 3.

Published type localities: HAWAIIAN ISLANDS: (1) O'ahu: Mt. Ka'ala "near spring", 3,600 ft., Sep.; (2) Ko'olau Summit Trail, 2,800 ft., Nov.; (3) Kōnāhuanui, 2750 ft., Nov; (4) Lulumahu Stream, 1900 ft.".

Label data: "Lulumahu Str / OAHU. 1900 ft / of Val. / Sept. 27 - 36 / F.X.W. [in Williams's handwriting]", "Eurynogaster / maculata / O. Parent" [in Parent's handwriting]", "LECTOTYPE ♂ / Eurynogaster / maculata Par. / det. N. Evenhuis [in Evenhuis's handwriting]" [light blue label].

Current status: *Eurynogaster maculata* Parent, 1940 [*teste* Yang *et al.* (2006)].

Condition: Fair; missing both hind legs and left mid leg beyond the coxa.

Figure 6. Lectotype male of *Eurynogaster maculata* Parent. **A**. Lateral view. **B**. Dorsal view. **C**. Labels.

Remarks: The type series consisted of an unspecified number of males and females from a number of high elevation localities in the Wai‘anae and Ko‘olau ranges. Six syntypes were located in the BMNH. Four additional syntypes were located in the BPBM; the best preserved specimen in the BPBM from Lulumahu Valley in the Ko‘olau mountains is here designated **lectotype male**. The lectotype is mounted with a minuten to a coated cork stage. There is an additional hole in the stage indicating there might have been another specimen mounted on the same stage at one time.

minor	**Lectotype** ♀	BPBMENT 0000002065
(Fig. 7)		pin

Paraliancalus minor Parent, 1938: 213. Parent, 1940: 243, 249.

Eurynogaster minor (Parent). Parent, 1940: 243, 249; Williams, 1940: 296, 298, 299, 301, 302, 304, 306; Hardy, 1952: 455; Smith, 1952: 430; Hardy & Kohn, 1964: 206; Tenorio, 1969: 41; Bickel & Dyte, 1989: 413; Nishida, 1992: 95, 1994: 89, 1997: 75, 2002: 92; Polhemus, 1996: 76, 79; Englund *et al*., 1998: 26, 2000b: 102, 104; Englund, 2000b: 5; Englund & Polhemus, 2001: 270.

Major minor (Parent): Evenhuis, 2005: 53; Yang *et al.*, 2006: 480; Englund *et al*., 2007: 229; Grichanov, 2014: 302, 2017: 328; Goodman *et al*., 2016: 3.

Published type locality: HAWAIIAN ISLANDS: **O‘ahu**: Kukuiala Valley, Waianua Stream, 16 Sep 1933, “wet bank”, F.X. Williams.

Label data: “Kukuiala Val. / Waianae Mts / OAHU. Sept 16 - 33 / wet bank / F.X.W. [in Williams’s handwriting]”, “Paraliancalus / minor. n. sp. / Type / O. Parent [unknown hand]”, ‘LECTOTYPE ♀ / Paraliancalus minor / Parent / det. N. Evenhuis [in Evenhuis’s handwriting]” [light blue label].

Current status: *Major minor* (Parent, 1938) [*teste* Yang *et al*. (2006)].

Condition: Good; missing left mid leg beyond the coxa; eyes collapsed from air drying.

Remarks: Transferred to *Major* by Evenhuis (2005: 53). The treatment in Parent (1940:

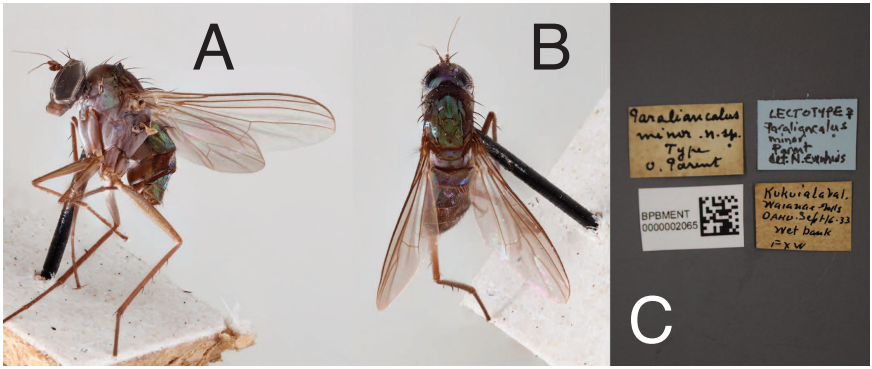

Figure 7. Lectotype female of *Paraliancalus minor* Parent. **A**. Lateral view. **B**. Dorsal view. **C**. Labels.

243) inadvertently resulted in a specimen to be labeled as a type and deposited in the BPBM collection (No. 4075). This is not a type specimen nor is it a part of the original type series of *Paraliancalus minor* Parent, 1938. Instead, it is merely a specimen examined and identified as *Eurynogaster minor* by Parent and labeled by Parent with a "type" label. This apparently stemmed from the asterisk (*) in Parent's (1940) paper indicating that types of new species so marked were in the collection of the Hawaiian Entomological Society (at that time in HSPA). Someone no doubt missed that the specimen marked as such and described in the 1940 paper was not a type. Parent (1938) based this species on an unspecified number of male and female specimens. Specimens matching the type locality and date of collection have been located in HDOA and BPBM. The best preserved of these is designated here as **lectotype female** and deposited in BPBM.

nigrohalterata (Fig. 8) **Lectotype** ♂ BPBMENT 0000016813 pin

Eurynogaster nigrohalterata Parent, 1940: 243. Williams, 1940: 298; Hardy, 1952: 455; Hardy & Kohn, 1964: 210; Tenorio, 1969: 41; Bickel & Dyte, 1989: 413; Nishida, 1992: 97, 1994: 91, 1997: 77, 2002: 94.

Elmoia nigrohalterata (Parent): Evenhuis, 2005: 49; Yang *et al.*, 2006: 475; Grichanov, 2014: 220, 2017: 244.

Published type locality: HAWAIIAN ISLANDS: **Oʻahu**: Mt. Kaʻala, 3,600 ft, Sep [1936], wet bank, [F.X. Williams].

Label data: "Mt. Kaala / OAHU. Sept. 7 – 36 / 3600 ft / wet bank / FXW [Williams's handwriting]", "Eurynogaster / nigrohalterata / n. sp. O. Parent [in Parent's handwriting]", "LECTOTYPE / Eurynogaster / nigrohalterata / Par. Det. NLE [in Evenhuis's handwriting]" [light blue label].

Current status: *Elmoia nigrohalterata* (Parent, 1940) [*teste* Yang *et al*. (2006)].

Condition: The left wing is broken off and missing; otherwise in excellent condition.

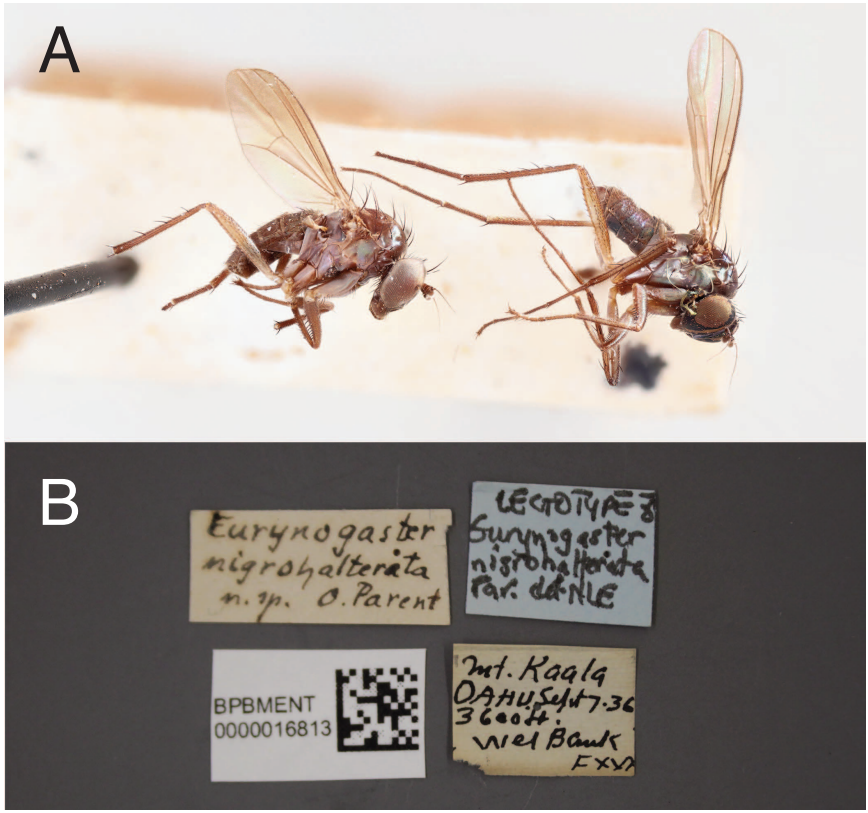

Figure 8. Lectotype male of *Eurynogaster nigrohalterata* Parent. **A**. Lateral view (lectotype on right). **B**. Labels.

Remarks: Parent (1940) based *Eurynogaster nigrohalterata* on an unspecified number of males and females deposited in the Hawaiian Entomological Collection. Seven syntypes (now paralectotypes) were located in the BMNH. Three males and two females were located in this study in the old HSPA collection at HDOA and transferred to BPBM. The best preserved of these now in BPBM is here designated **lectotype male**. It is on the same cork stage as a female and is the outermost (away from the pin) of the two and marked as such. The stage has been glued to the pin to keep it from spinning.

obscurifacies	**Lectotype** ♂	BPMENT 0000004076 pin

Eurynogaster obscurifacies Parent, 1940: 244. Hardy, 1952: 455. Hardy & Kohn, 1964: 212; Tenorio, 1969: 41; Bickel & Dyte, 1989: 413; Nishida, 1992: 97, 1994: 91, 1997: 77, 2002: 94.

Adachia obscurifacies (Parent): Evenhuis, 2005: 45; Yang *et al.*, 2006: 451; Grichanov, 2014: 26, 2017: 38.

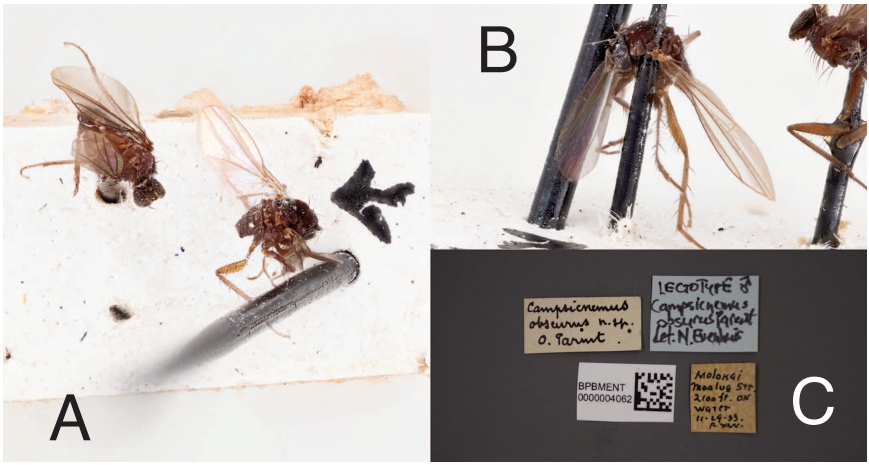

Figure 9. Lectotype male of *Campsicnemus obscurus* Parent. **A**. Dorsal view of type specimens on cork stage (lectotype indicated by arrow). **B**. Lateral view. **C**. Labels.

Published type locality: HAWAIIAN ISLANDS: **O‘ahu**: Mt. Ka‘ala, 3,600 ft, [1936], wet bank, [F.X. Williams]

Label data: “Mt. Kaala / OAHU. Sept. / 13 – 1936 / spring 3600 ft / FW [in Williams’s handwriting]”, “Eurynogaster / obscurifacies / n. sp. O. Parent [in Parent’s handwriting]”, “Type [handwritten]” [square red label], “LECTOTYPE ♂ / Eurynogaster / obscurifacies / Parent / det. H & K. 1964 [in Evenhuis’s handwriting]” [light blue label].

Current status: *Adachia obscurifacies* (Parent, 1940) [*teste* Yang *et al.* (2006)].

Condition: Fair; both wings shriveled possibly from air drying from liquid preservation; arista on right antenna broken off and missing; right hind leg beyond femur broken off and missing; tip of abdomen missing (dissected?).

Remarks: Parent (1940) based this species on an unspecified number of males and females. Two syntypes (now paralectotypes) were located in the BMNH, but the asterisk (*) in Parent’s (1940) paper indicates that the types are in the collection of the Hawaiian Entomological Society (in HSPA at the time). Two specimens (a male and a female) on one cork stage were in the old HSPA collection in HDOA and transferred to BPBM before this study. The male is the lectotype designated by Hardy & Kohn (1964; see list below for discussion).

obscurus (Fig. 9)	**Lectotype** ♂	BPBMBENT 0000004062 pin

Campsicnemus obscurus Parent, 1937b: 78. Parent, 1940: 236; Williams, 1940: 296; Hardy, 1952: 454; Hardy & Kohn, 1964: 129; Tenorio, 1969: 4, 66; Bickel & Dyte, 1989: 411; Nishida, 1992: 95, 1994: 89, 1997: 75, 2002: 93; Yang *et al.*, 2006: 464; Evenhuis, 2007: 30; Grichanov, 2014: 76, 2017: 89.

Published type localities: (1) HAWAIIAN ISLANDS: **Moloka‘i**: Moalua [= Moa‘ula] Stream, 2100 ft, 29 Feb 1933, on water, F.X. Williams; (2) HAWAIIAN ISLANDS:

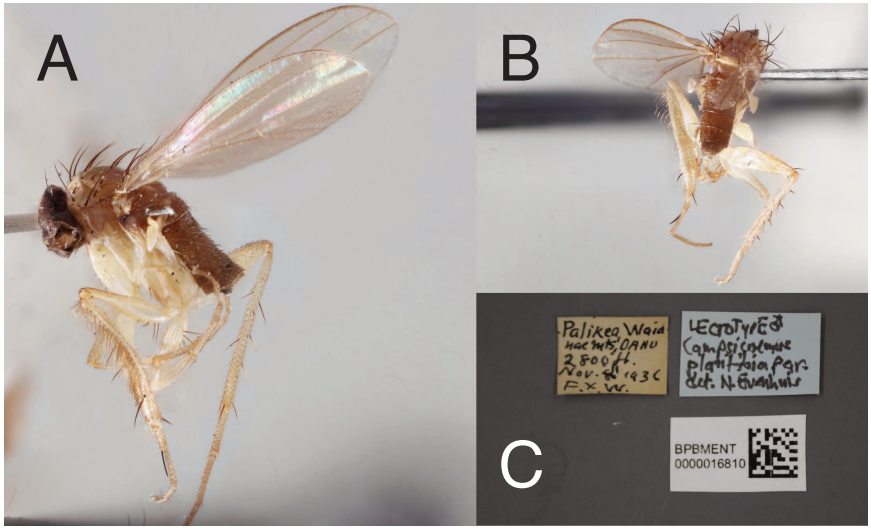

Figure 10. Lectotype male of *Campsicnemus planitibia* Parent. **A**. Lateral view. **B**. Dorsal view. **C**. Labels.

Moloka‘i: East Moloka‘i Mountains, 2,400 ft, 28 Nov 1933, F.X. Williams.

Label data: “Molokai / Moalua Str / 2100 ft. on / water. / II - 29 - 33 / / FXW [in Williams’s handwriting]”, “Campsicnemus obscurus n. sp. / O. Parent [in Parent’s handwriting]”, “LECTOTYPE ♂ / Campsicnemus obscurus Parent / det. N. Evenhuis [in Evenhuis’s handwriting]” [light blue label].

Current status: *Campsicnemus obscurus* Parent, 1938 [*teste* Yang *et al.* (2006)].

Condition: Good; slightly dusted with microscopic debris; most of the mesoscutal setae were broken off when pinned with the minuten.

Remarks: Originally based on an unspecified number of male and female specimens from “Moalua” Stream [= Moa‘ula], 2,100 feet elevation, collected by F.X. Williams on 29 February 1933 and from E. Moloka‘i Mountains, 2,400 feet, collected by F.X. Williams on 28 November 1933. Nine specimens of the type series were located in BMNH; four specimens from Kōnāhuanui Trail were originally deposited in MNHN (two per cork stage), three still survive (two males and one female, only the minuten pin remains of the fourth specimen); one female was found in BPBM (incorrectly labeled as a holotype[2]); and two specimens, a male and a female on the same pin, were found in the old HSPA collection in HDOA (since transferred to BPBM). Hardy & Kohn (1964: 130) stated “Three cotypes (two males, one female) in the Parent Collection at the Museum National d’Histoire Naturelle, Paris; the type is evidently one of these male specimens but it has not been designated. Allotype female and two male cotypes in HSPA”. Evenhuis (2007) abstained from designating a lectotype

[2] This was a specimen originally in the HSPA collection but transferred in 1961 to the BPBM when all specimens with “type” labels in the old HSPA collection were transferred to BPBM. The remaining two specimens in the type series of this species (in HDOA) were inadvertently not transferred because they lacked type labels. Research in this study confirmed that they were indeed a part of the original syntype series.

pending further research. The specimens in the type series have been thoroughly examined in this study and a **lectotype male** in the BPBM is here designated. The lectotype is the innermost (toward the pin) of two males pinned with minutens on the same cork stage. The lectotype is indicated with an inked "L" and an arrow.

planitibia **Lectotype** ♂ BPBMENT 0000016810
(Fig. 10) pin

Campsicnemus planitibia Parent, 1940: 232. Hardy, 1952: 454; Hardy & Kohn, 1964: 135; Tenorio, 1969: 4. Bickel & Dyte, 1989: 411; Nishida, 1992: 96, 1994: 90, 1997: 76, 2002: 93; Yang *et al.*, 2006: 465; Evenhuis, 2007: 32; Goodman *et al*. 2014: 236; Grichanov, 2014: 77, 2017: 90.

Published type localities: (1) HAWAIIAN ISLANDS: **O'ahu**: Mt. Ka'ala, trail, 1,800 ft, Aug 1936, [F.X. Williams]; (2) HAWAIIAN ISLANDS: **O'ahu**: Wai'anae Mountains, Palikea, 2,800 ft, Nov [1936, F.X. Williams].

Label data: "Palikea Waia- / nae Mts, OAHU / 2800 ft / Nov. ~~8~~–11 1936/ FXW" [in Williams's handwriting], "LECTOTYPE ♂ / Campsicnemus / planitibia Par. / det. N. Evenhuis" [in Evenhuis's handwriting] [light blue label].

Current status: *Campsicnemus planitibia* Parent, 1940 [*teste* Evenhuis (2007)].

Condition: Good; occiput and posterior of eyes collapsed due to air drying.

Remarks: Parent (1940) based *Campsicnemus planitibia* on an unspecified number of males and females from the above localities. Since the time that Evenhuis (2007) indicated that 28 syntypes had been located in BMNH, MNHN, and HDOA, three additional male syntypes were located among specimens of the old HSPA collection in HDOA and have been transferred to BPBM. A **lectotype male** is here designated from the best preserved of these. It is pinned with a minuten to a coated cork stage.

retrociliata **Lectotype** ♂ BPBMENT 0000004077
(Fig. 11) pin

Eurynogaster retrociliata Parent, 1940: 244. Hardy, 1952: 455; Hardy & Kohn, 1964: 217; Tenorio, 1969: 41; Bickel & Dyte, 1989: 414; Nishida, 1992: 97, 1994: 91, 1997: 77, 2002: 94; Evenhuis, 2005: 51; Yang *et al.*, 2006: 476; Grichanov, 2014: 228, 2017: 251.

Published type locality: (1) HAWAIIAN ISLANDS: **O'ahu**: Tantalus Crater, 1,800 ft, Aug [1936, F.X. Williams]; (2) HAWAIIAN ISLANDS: **O'ahu**: Mt. Ka'ala Trail, 1,800 ft, Aug [1936, F.X. Williams].

Label data: "Mt. Kaala, OAHU / Trail 1800 ft. / Aug 30 – 36 / F.X.W. [in Williams's handwriting]", "Eurynogaster / retrociliata n. sp. / Type / O. Parent" [in Parent's handwriting]", "Type ♂" [label with bottom half red], "LECTOTYPE ♂ / Eurynogaster /retrociliata / Par. det. NLE [in Evenhuis's handwriting]" [light blue label].

Current status: *Eurynogaster retrociliata* Parent, 1940 [*teste* Evenhuis (2005)].

Condition: Good; left midleg broken off beyond femur and missing; eyes collapsed from air drying.

Remarks: Parent (1940) based this species on an unspecified number of specimens from the two localities listed above. Eleven syntypes (now paralectotypes) were located in the BMNH, but the asterisk (*) in Parent's (1940) paper indicates that the types are in the collection of the Hawaiian Entomological Society (at the time in HSPA). Four such

Figure 11. Lectotype male of *Eurynogaster retrociliata* Parent. **A**. Lateral view. **B**. Dorsal view. **C**. Labels.

syntypes (one female from the Mt. Ka‘ala locality; one male and two females from the Tantalus locality) were located and transferred from the old HSPA collection in HDOA to BPBM. Of the two male and two female syntypic specimens now in BPBM, the best preserved of these is here designated as **lectotype male**. The lectotype is pinned with a minuten on the same coated cork stage as one of the paralectotype females.

ridiculus **Lectotype** ♂ BPBMENT 0000004066 pin

Campsicnemus ridiculus Parent, 1937b: 81. Parent, 1940: 237; Hardy, 1952: 454; Brown, 1956: 464; Hardy & Kohn, 1964: 149; Tenorio, 1969; 4; Bickel & Dyte, 1989: 412; Nishida, 1992: 96, 1994: 90, 1997: 76, 2002: 93; Polhemus, 1992: 2, 5, 1993: 4, 1994: 2, 1996: 37, 38, 39, 41, 42, 45, 49, 50, 53; Englund, 2000: [2], 2001: 8; Englund & Arakaki, 2003: 5; Mitchell *et al*., 2005: 6-36; Yang *et al.*, 2006: 466; Englund *et al*., 2007: 229; Grichanov, 2014: 78, 2017: 91; Moody *et al*., 2017: 147; Evenhuis, 2016: 34.

Published type locality: HAWAIIAN ISLANDS: **Moloka‘i**: near “Molaua” [sic], 2400 ft., 29 November 1933, F.X. Williams.

Label data: “Molokai / near Moalua / 2400 ft ± / Nov. 29 – ’33 / F.X.W. [in Williams’s handwriting]”, “Campsicnemus / ridiculus / Type / O. Parent [in Parent’s handwriting]”, “LECTOTYPE / Campsicnemus / ridiculus Par. / det. H & K. 1964 [in Evenhuis’s handwriting]” [light blue label].

Current status: *Campsicnemus ridiculus* Parent, 1937 [*teste* Evenhuis (2016)].

Condition: Fair; the following legs are broken off and missing: left fore leg including coxa, right fore leg beyond coxa, right mid leg beyond coxa

Remarks: A lectotype male was designated by Hardy & Kohn (1964: 149; see list below). The lectotype was originally in the old HSPA collected at HDOA and was transferred to BPBM, where it is now lodged. The lectotype is pinned with a minuten to a coated cork stage. The specimen appears greasy.

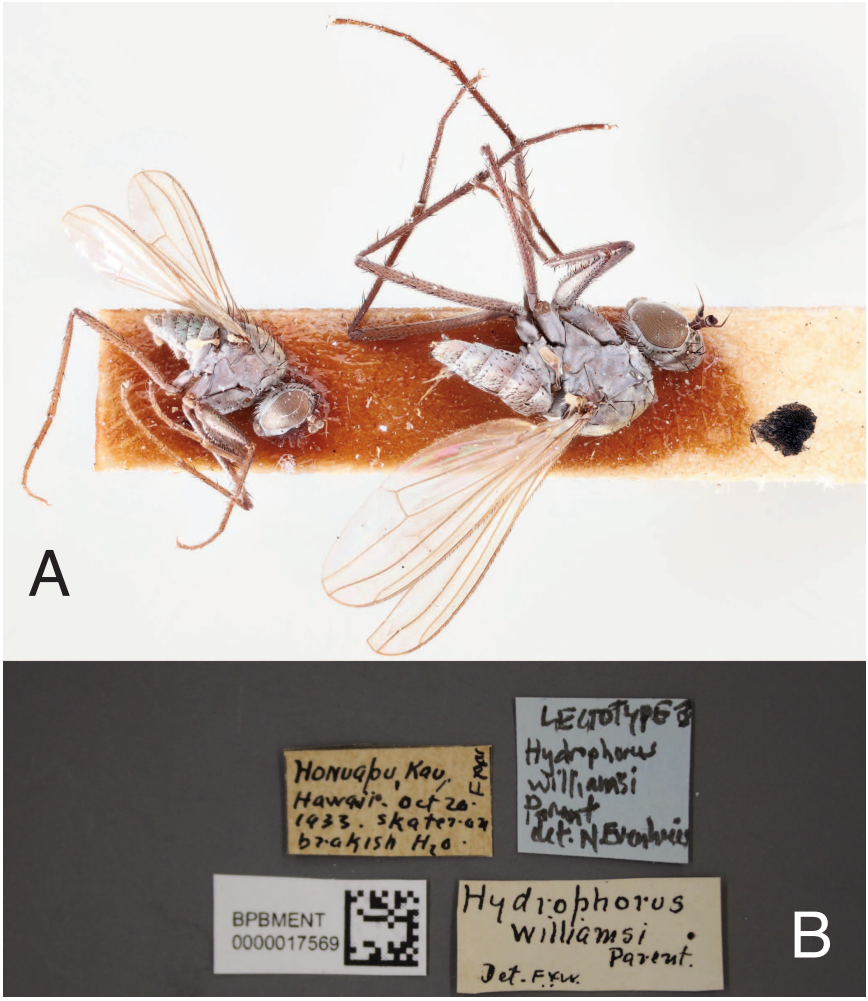

Figure 12. Lectotype female of *Hydrophorus williamsi* Parent. **A**. Lateral view of type specimens on paper point (lectotype on right). **B**. Labels.

williamsi (Fig. 12)	**Lectotype** ♀	BPBMENT 0000017569 pin

Hydrophorus williamsi Parent, 1938: 211. Hardy, 1952: 455; Hardy & Kohn, 1964: 247; Bickel & Dyte, 1989: 405; Nishida, 1992: 98, 1994: 91, 1997: 77, 2002: 95; Grootaert & Evenhuis, 1997: 74; Yang *et al.*, 2006: 245; Grichanov, 2014: 286.

Published type locality: HAWAIIAN ISLANDS: **Hawai‘i**: “Honuapu” [sic], K‘au, 20 October 1933 “brackish water skater”, F.X. Williams.

Label data: "Honuapu, Kau FXW ['FXW' written perpendicular to label text] / Hawaii. Oct 20 - / 1933. skater on / brakish H_2O [in Williams's handwriting], "LECTOTYPE ♀ / Hydrophorus / williamsi / Parent / det. N.Evenhuis [in Evenhuis's handwriting]" [light blue label].

Current status: *Hydrophorus williamsi* Parent, 1938 [*teste* Yang *et al.* (2006)].

Condition: Right wing torn off at tip, otherwise, lectotype in excellent condition.

Remarks: Originally based on an undetermined number of males and females from Honoapu, K'au, Hawai'i Island. Hardy & Kohn (1964: 247) mentioned a single specimen in MHNH not labeled as a type. A male and female syntype (now paralectotypes) were located in the BMNH. Two females glued on their side to a single paper point, originally in the HSPA collection, were located in HDOA and transferred to BPBM. The specimen in best condition is here designated as **lectotype female**. The lectotype is the innermost (toward the pin) of the two and is glued on its right side; the paralectotype on the same point is glued on its left side.

The setation of the lectotype on the fore femur is not as distinct as stated in Hardy & Kohn (1964). The wing characters are better is separating the two species known in Hawai'i (there is brown suffusion along the wing veins in *H. williamsi*; not so in *H. pacificus* Van Duzee).

LIST OF DOLICHOPODIDAE LECTOTYPIFICATIONS BY HARDY & KOHN (1964)

The list below includes all species of Dolichopodidae in which phraseology by Hardy & Kohn (1964) qualifies under ICZN *Code* Art. 74.5 as a lectotype designation. Qualifying words are underlined below in the "Phrase" section for each species.

***Campsicnemus acuticornis* Parent, 1940: 225.**

TYPE DEPOSITORY: Lectotype in BMNH.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "Type in the British Museum (Natural History). [...] The senior author has studied the type and cotypes." (Hardy & Kohn 1964: 39).

REMARKS: Based on an unspecified number of males and females. Two syntypes are in the BMNH. The one that had the red-ringed type label when Hardy saw it in the 1950s is the lectotype.

***Campsicnemus breviciliatus* Parent, 1940: 225.**

TYPE DEPOSITORY: Lectotype in BMNH.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "Type in the British Museum (Natural History). The senior author has studied the type." (Hardy & Kohn 1964: 48).

REMARKS: Based on an unspecified number of males and females. The lectotype designation by Evenhuis (2007: 21) is invalid.

***Campsicnemus fimbriatus* Grimshaw, 1901: 13.**

TYPE DEPOSITORY: Lectotype in BMNH.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "Known only from the type and allotype. Type in the British Museum (Natural History). The following description is based upon the type and allotype". (Hardy & Kohn 1964: 85).

REMARKS: Based on two males and three females.

***Campsicnemus putillus* Parent, 1937b: 80.**

TYPE DEPOSITORY: Lectotype in BMNH.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "Endemic. Molokai (type locality: "E. Molokai"). Known only from the type. Type in the Hawaiian Sugar Planters' Association." (Hardy & Kohn 1964: 144).

REMARKS: Based on an unspecified number of males and females. The lectotype designation by Evenhuis (2007: 21) is invalid. Hardy & Kohn's (1964: 144) wording suffices for a lectotype designation of the same specimen. A new lectotype label has been added to indicate the designation by Hardy & Kohn in 1964.

***Campsicnemus ridiculus* Parent, 1938: 81.**

TYPE DEPOSITORY: Lectotype in BPBM.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "Endemic. Molokai (type locality: near Moaula, 2,400 ft.—misspelled "Molaua" in the original description and "Moalua" on the type "). Type in the Hawaiian Sugar Planters' Association." (Hardy & Kohn 1964: 149).

REMARKS: Based an unspecified number of males. Although only one specimen was located, it is assumed the species description was based on more than one specimen because ranges of numbers of setae are given in the original description.

***Eurynogaster cilifemorata* Parent, 1940: 241.**

TYPE DEPOSITORY: Lectotype in MNHN.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "Type in Parent's collection at the Museum National d'Histoire Naturelle, Paris. The type is the male specimen from Mt. Olympus." (Hardy & Kohn 1964: 186).

REMARKS: Based on an unspecified number of males and females from three localities. Eight syntypes (now paralectotypes) were located in the BMNH. An additional two paralectotype females exist in BPBM (*vide supra*).

***Eurynogaster obscurifacies* Parent, 1937: 244.**

TYPE DEPOSITORY: Lectotype in BPBM.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "Endemic. Oahu (type locality: Mt. Kaala). Known only from the type male and allotype female. Type in the Hawaiian Sugar Planters' Association." (Hardy & Kohn 1964: 212).

REMARKS: Based on an unspecified number of males and females, although Hardy said the species was known from only the type and allotype. Two syntypes (now paralectotypes) were located in the BMNH, but the asterisk (*) in Parent's (1940) paper indicates that types of the new species so marked were in the collection of the Hawaiian Entomological Society (at that time in HSPA). Only two specimens (male and female

on one cork stage) were located in this study in the BPBM (transferred earlier from the old HSPA collection in HDOA). The male is the lectotype designated by Hardy & Kohn (1964) and is marked on the stage to identify it from the female.

***Chrysotus saxatilis* Grimshaw, 1901: 16.**

TYPE DEPOSITORY: Lectotype in BMNH.

PHRASE THAT QUALIFIES AS LECTOTYPE DESIGNATION: "[*Eurynogaster luteihalterata* Parent] **New synonymy** [emphasis in Hardy & Kohn 1964], based upon comparison of type (in the British Museum) with the type of *saxatilis* Grimshaw. [...] Type in the British Museum (Natural History)." (Hardy & Kohn 1964: 218).

REMARKS: Based on an unspecified number of males and females. Three syntype males are in the BMNH. The male that had the red-ringed type label at the time Hardy saw it in the 1950s is the lectotype.

ACKNOWLEDGMENTS

I thank the late C.E. (Peter) Dyte for support, advice and allowing me to pick his brain for information on Dolichopodidae history and taxonomy over the decades. Itemized numbers of specimens of *Eurynogaster* types in BMNH were provided to me long ago by Peter Dyte on a copy of an old dot matrix computer printout (dated 24 September 1985) with his marginalia. A more recent spreadsheet of types provided to me by Ashley Kirk-Spriggs in 2021 corroborated much of Dyte's printout and he is thanked for his assistance. Lisha Jesper is thanked for providing the photographs of the types and labels. Dan Bickel is thanked for his review of and comments on the paper.

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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†	Average Year of New Records
Kure	1	0	13	1961
Midway	1	2	33	1962
Lehua	1	0	6	1992
Kaua‘i	10	5††	113	1973
O‘ahu	14†††	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. †Including questionably naturalized species. ††Not including one variety that was removed, but the species is still present on the island. †††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 tenuispatheus (Nash) Nash **Taxonomic note**

Formerly treated as *Andropogon glomeratus* var. *pumilus*, this variety is now recognized at the species level as *A. tenuispatheus* (Weakley *et al.* 2011). This species is found on Midway, Oʻahu, and Hawaiʻi (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 Oʻahu. 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 Oʻahu and Hawaiʻi. On Oʻahu 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 Hawaiʻi Island in 1949 in a sheep paddock at Keʻāmuku. 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; cespitose. 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). **HAWAI'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'ı 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. **HAWAI'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*; Kanaloleonui[*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*.

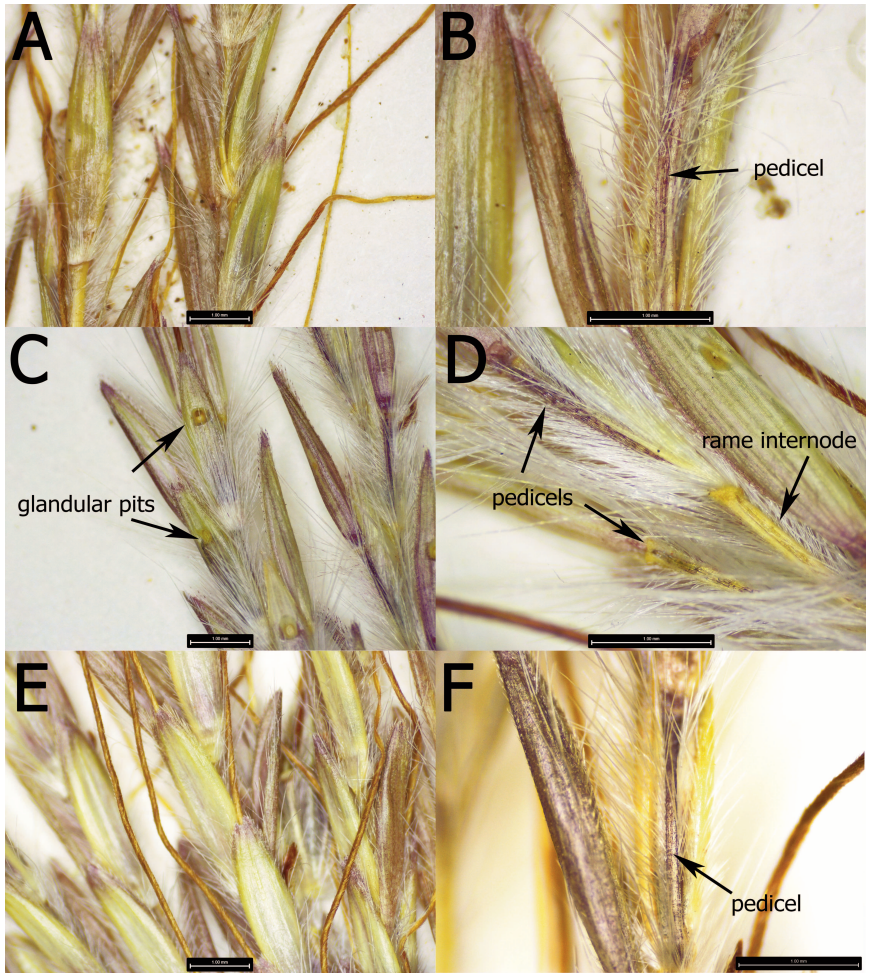

Fig. 1. Comparison of similar species of bluestems. **A–B,** *Bothriochloa ischaemum* (*Hosaka 4009*). **C–D,** *Bothriochloa pertusa*, **C** (*W. Teraoka 291*); **D** (*P.J. O'Connor s.n.,* BISH 510052). **E–F,** *Dichanthium annulatum* (*Nagata 1409*).

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 cespitose. 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*.

Material examined. **KAUA‘I**: 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*. **LĀNA‘I**: 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 exclosure, 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. **HAWAI‘I**: 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**: Pamaluu [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; cespitose. 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 Oʻahu. *Cenchrus elegans* has been reported previously as naturalized on Hawaiʻi Island and is known to be cultivated on Kauaʻi, Oʻahu, and Hawaiʻi based on BISH specimens, although it is likely cultivated on other islands as well.

Material examined. **Oʻahu**: Honolulu, Nuʻuanu Valley, Luakaha, edge of shaded stream, 12 Jun 1941, *M.C. Neal s.n.* (BISH 120143); Koʻolaupoko Distr., ʻĀhuimanu 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 Kahoʻolawe from a 1978 collection. It has previously been reported on Oʻahu, Maui, and Hawaiʻi (Imada 2019).

Material examined. **Kahoʻolawe**: 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 Oʻahu. 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 Hawaiʻi 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 subequaling spikelet, margins ciliate, apex obtuse; upper lemma minutely pitted. Anthers ca. 0.8 mm. Fl. and fr. Sep–Feb. 2n = 18, 36."

Material examined. **Oʻahu**: 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 × 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*.

Dichanthelium acuminatum (Sw.) Gould & C.A. Clark **New state record**

The first introduced member of *Dichanthelium* now joins the four endemic species in the Hawaiian Islands. *Dichanthelium 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 *Dichanthelium* 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 ~¼ as long as the spikelet, compared to ½–¾ as long in the native *Panicum*.

Dichanthelium 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, ¼–¾ as wide as long, usually open, well-exerted, 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 ¼–½ 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."

Material examined. **HAWAI‘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 (Wilhalm 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. **HAWAI‘I**: 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 Kalaninauli 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, Kauaʻi, Oʻahu, Lānaʻi, Maui, Kahoʻolawe, and Hawaiʻi. 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). **KAUAʻI**: Līhuʻe plantation land between Hanamāʻulu 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*; Līhuʻe, along ditches and around sugar cane fields, 05 Jun 1994, *C. Morden 1187* (HAW [in HPDL collection]). **OʻAHU**: Mountains back of Punaluʻu, 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, Keʻeaumoku 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, Keʻeaumoku 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*. **LĀNAʻI**: 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 Honolua, 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). **KAHOʻOLAWE**: 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*. **HAWAIʻI**: South Kohala Distr., east of Queen Kaʻahumanu 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., Nāpoʻopoʻo 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 Hawaiʻi was recently identified from material collected 30 years ago on Lānaʻi. 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 Lānaʻi.

This species is unique among all species of *Digitaria* known to occur in Hawaiʻi 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 Kaumalapau 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; Kaʻena Point State Park, parking lot on the Waiʻanae 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 Kapiʻolani 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., Pāʻia, sidewalk crack, 40 ft [12 m], 20 Jan 2010, *H. Oppenheimer H11009*; West Maui, Lahaina Distr., Launiupoko, unpaved road below the reservoirs, 840 ft [256 m], 02 Apr 2002, *H. Oppenheimer H40701*; West Maui, Wailuku Distr., vicinity of Waiheʻe Ditch, foot of Kaunoahua Ridge, locally common in dry area formerly grazed, 320 ft [97 m], 17 Apr 2009, *H. Oppenheimer 40925*. **KAHOʻOLAWE**: Honokanaiʻa, 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 Hawaiʻi 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 Molokaʻi (Oppenheimer 2003), but this specimen (*Oppenheimer H110140*) has now been redetermined as *E. brownii*. *Eragrostis elongata* is now known only from Kauaʻi, Oʻahu, and Hawaiʻi.

Material examined. **HAWAIʻI**: Mauna Kea, herb along roadside of Saddle Road, (UTM 264933, 2179397), 950 m, 01 Jun 2008, *C. Angelo 002* (HAW); North Kūlani Road, ʻŌlaʻa, assoc. with *Hypericum mutilum*, flat tufts, inflorescence with purplish cast, 1,500 ft [457 m], 15 Dec 1975, *D.R. Herbst 5591*; Keaʻau, 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 Oʻahu and Kahoʻolawe (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 Kauaʻi at Hanapēpē and East Maui at ʻUlupalakua. It was previously reported only from Molokaʻi (Imada 2019).

Material examined. **KAUAʻI**: Hanapēpē, in pasture, local patch, dry place, 250 ft [76 m], 31 Oct 1936, *E.Y. Hosaka 1647*. **MAUI**: East Maui, ʻUlupalakua, adjacent to Tedeschi Winery, NW of Puʻu 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. **HAWAI‘I**: Hawai‘i National Park, Kīlauea, 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 Kauaʻi, and a specimen from Oʻahu 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 Kaʻa and Kōʻele on Lānaʻi, as well as from Kahuku on Hawaiʻi Island. Therefore, *E. parviflora* is now only known from Lānaʻi and Hawaiʻi. As the Lānaʻi 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 spathulate, entire or notched by short keels, apically ciliolate; 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."

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 unioloides (Retz.) Nees ex Steud. **Correction**

Eragrostis unioloides was previously reported from Maui (Oppenheimer 2008). This was a misidentification of *E. brownii* (*Oppenheimer H90639*). There are no other known occurrences of *E. unioloides* 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

5. Leaves > 4 mm wide, flat; spikelets with 8–15 florets; lemma apex often obtuse (Oʻahu, Molokaʻi, Lānaʻi, Maui, Hawaiʻi) ..... *E. atropioides*
5. Leaves < 4 mm wide, folded or flat; spikelets with 4–7 florets; lemma apex often acute (Oʻahu, Molokaʻi, Lānaʻi, Maui, Hawaiʻi) ..... *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 (Oʻahu, slopes of Kaʻala) ..... *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 Niʻihau) ..... *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. unioloides*

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.

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. unioloides
   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. mauiensis
                        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

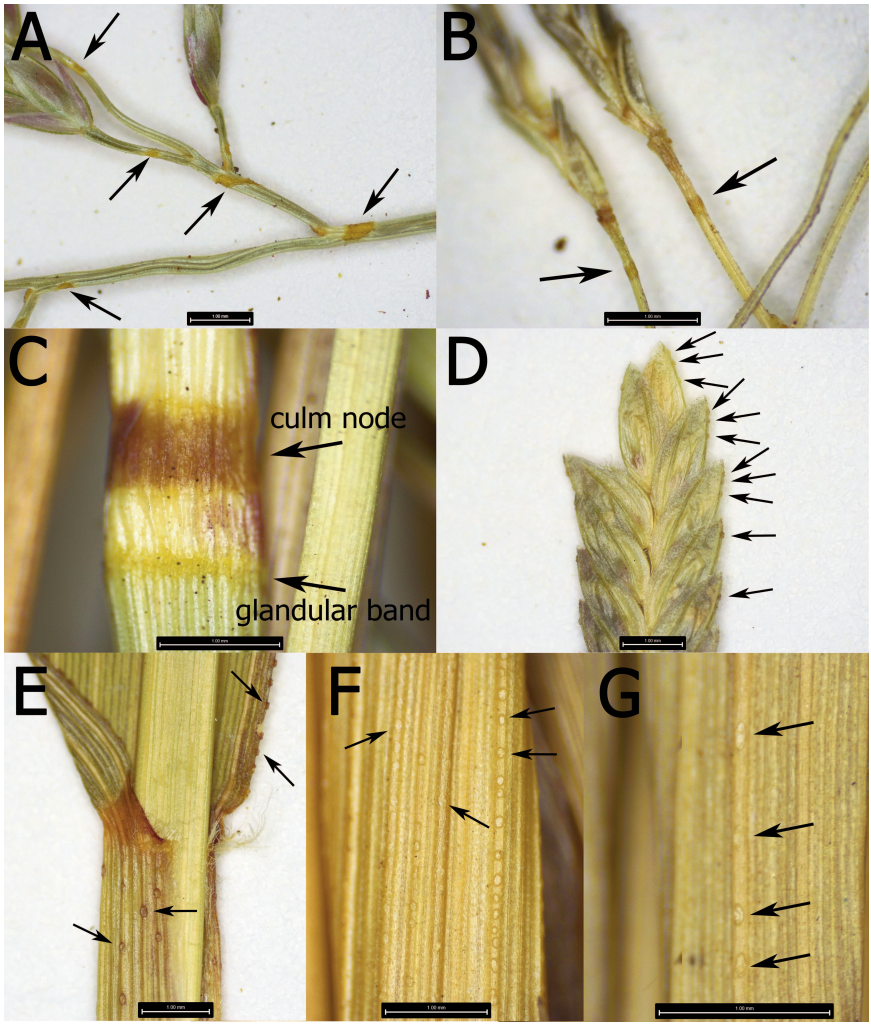

Fig. 3. Glands on *Eragrostis*. **A,** *Eragrostis barrelieri* (*H. Oppenheimer H40701*) glands on inflorescence (not all glands are indicated with arrows). **B–C,** *Eragrostis leptostachya* (*C. Imada 2002-24*), **B,** Glands on inflorescence; **C,** Glandular band below culm nodes. **D–E,** *Eragrostis 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 Mauʻumae Trail near Kaimukī, Honolulu. The population consisted of only what appeared to be one individual, covering an area of about 2 m^2. 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 Hawaiʻi (Staples & Herbst 2005).

Material examined. **Oʻahu**: Mauʻumae 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, Molokaʻi made in 1937. This species is also known from Kauaʻi, Maui, and Hawaiʻi (Imada 2019).

Material examined. **Molokaʻi**: 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, Molokaʻi. As this was collected in 1903, it should be treated as a questionably naturalized record unless it is recollected.

Material examined. **Molokaʻi**: 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 Kāneʻohe, Oʻahu in 2007. As of 2021, the individual from Kāneʻohe 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 Hawaiʻi 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 though 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 polystachyu*m 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. polystachyu*m by J.F. Veldkamp in 2011 (as the synonym *I. digitatum* Brongn.), when the specimen was of uncertain naturalization status; a later collection by Hobdy 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, Pāhoa town, nearly monotypic in wet pastures over large areas west of Pāhoa 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 Pāhoa 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 38th 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*.

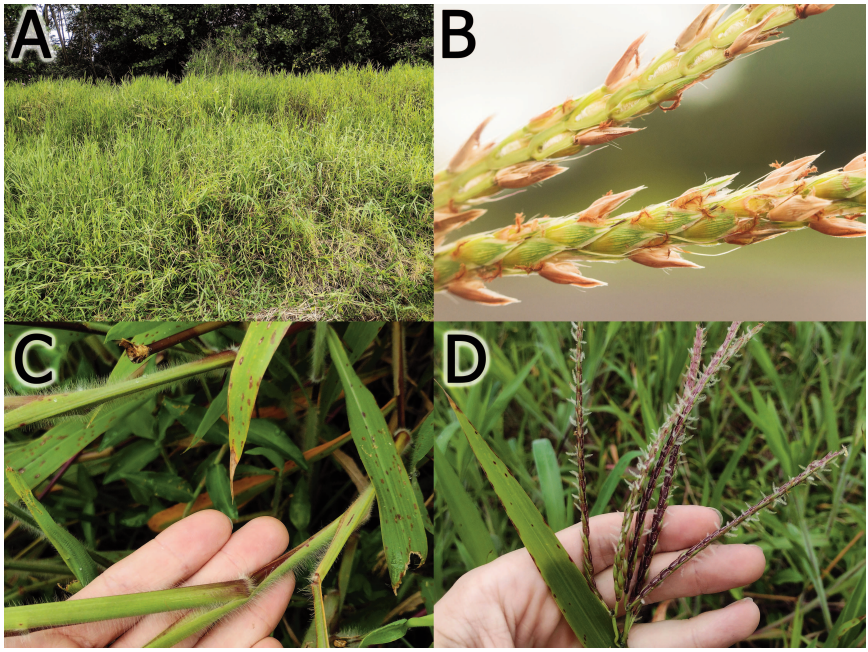

Fig. 4. *Ischaemum polystachyum* photographed at Pāhoa District Park. **A**, Habit. **B**, Spikelets. **C**, Lower culm nodes and internodes. **D**, Inflorescence.

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) Schltdl. **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 Tempsky 16*.

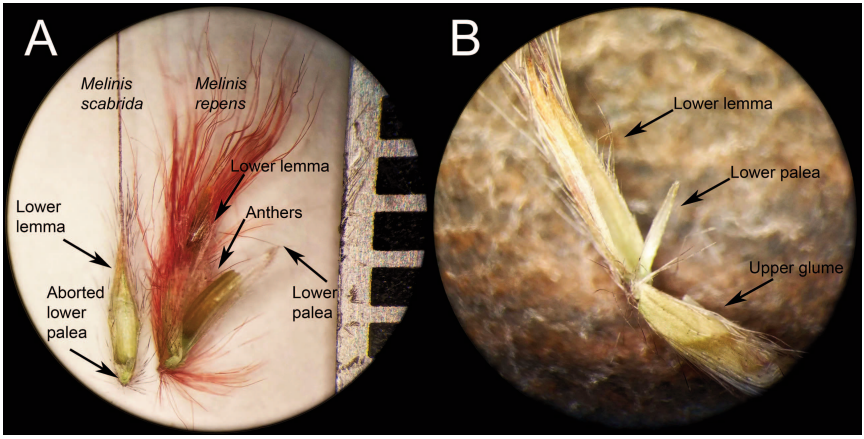

Fig. 5. **A,** Comparison of the spikelets of *Melinis repens* and *Melinis scabrida*; note that on *M. repens* the arrow is pointing to the tip of the lower palea (palea of the sterile floret); the divisions on the scale are 1 mm. **B**, A dissected spikelet of *Melinis scabrida* with the upper (fertile) 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 scabrida* 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 scabrida (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 Waiʻanae Mountains on Oʻahu. 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 scabrida* 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 scabrida* 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 Oʻahu with no clear dispersal vector. But, as the species is currently circumscribed, the population of plants from Oʻahu 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*, *Megathyrsus*, 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 bristlelike, 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, ¼–½(–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. **HAWAI'I**: 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. **HAWAI'I**: 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) sparely 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. **HAWAIʻI**: 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 Flüggé **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 Mauʻumae Trail, Oʻahu, 23 Jan 2022.

Paspalum pilosum Lam. **New island records**

Previously identified on Molokaʻi, this grass was found by the author growing as an abundant weed along the Mauʻumae Trail near Pālolo on Oʻahu (Fig. 6). The population consists of thousands of plants and extends from about 0.5 mile from the trailhead all the way to the Koʻolau 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 Kauaʻi, based on a specimen that was previously misidentified as *P. unispicatum* by Snow & Davidse (2011).

Material examined. **KAUAʻI**: Hanalei, ʻŌkolehao Trail, 22° 11′N, 159° 28′W, 175–325 ft [50–100 m], 30 Jun 2009, *Stevenson 35*. **Oʻ AHU**: Mauʻumae 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 racemosely 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. **KAUAʻI**: 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 & 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 Niʻihau, *Setaria distans* is now known from Molokaʻi at Pauwalu. 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. **MOLOKAʻI**: Pauwalu, 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 Hawaiʻi Island and Oʻahu during the 1920s. It is now known to be naturalized on Kauaʻi. 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. **KAUAʻI**: Kawaihau Distr., Hwy. 56 in Wailua between Halelio and Kapaʻa bypass roads, ruderal vegetation with *Chloris, Macroptilium,* 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 Oʻahu 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 Hawaiʻi 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 Hawaiʻi, 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 Hawaiʻi and represents a misidentification of *S. pyramidatus*.

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

Urochloa brizantha was reported from Oʻahu 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 Oʻahu, but no wild material was found for this species from Oʻahu. 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 Kauaʻi, Oʻahu, Lānaʻi, and Maui (Oppenheimer & Bogner 2019). It is now known from a single collection on Hawaiʻi Island from 1938. O'Connor (1990) listed *U. distachya* (as the synonym *U. subquadripara*) as occurring on Molokaʻi. No specimens from US, HAW, PTBG, or BISH support this record and it should be removed from the checklist.

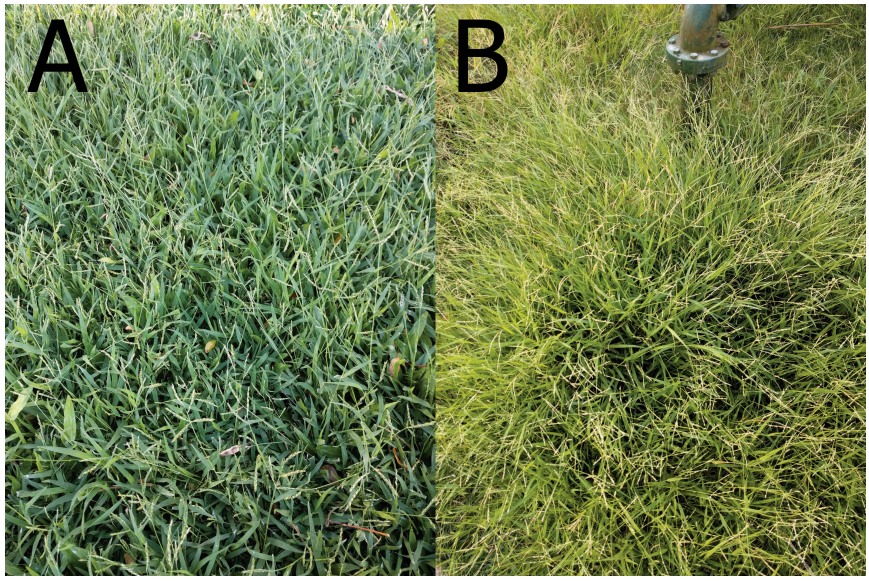

Fig. 7. *Urochloa glumaris* growing at the UH Mānoa campus. **A,** *U. glumaris* growing in turf grass that is mowed weekly, with *Axonopus*. **B,** *U. glumaris* forming a mound about 40 cm tall in a sunny, neglected area.

Material examined. **HAWAI‘I**: 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. ruziziensis* (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. 2*n* = 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 Kawainui 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 — **Taxonomic note; Potentially naturalizing**

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*.

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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On *Psammoecus* Latreille (Coleoptera: Silvanidae: Brontinae) from the Hawaiian Islands

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Abstract. Hawaiian species of the genus *Psammoecus* (Coleoptera: Silvanidae) are reviewed. *Psammoecus t-notatus* Blackburn, 1903 is recorded for the first time from the Hawaiian Islands. A diagnosis of *Psammoecus pradieri* Grouvelle, 1878 is provided. Two new synonymies are discovered: *Psammoecus cruciger* (Waterhouse, 1876) = *Psammoecus insularis* Sharp, 1885 **syn**. **nov**.; *Psammoecus pradieri* Grouvelle, 1878 = *Psammoecus pallidipennis* Blackburn, 1885 **syn**. **nov**.

INTRODUCTION

The Old World beetle genus *Psammoecus* Latreille, 1829 (Silvanidae: Brontinae: Telephanini) is a highly diverse genus with currently 82 described species.

Two species were recorded from the Hawaiian Islands: *Psammoecus insularis* (Sharp, in Blackburn & Sharp 1885), whose description is based on two syntypes collected on Kauaʻi and Oʻahu, and *P. pallidipennis* (Blackburn, in Blackburn & Sharp 1885), described from a specimen collected in Honolulu (Oʻahu). Recent studies of type specimens and of additional material from several collections revealed that three species of the genus *Psammoecus* occur on the Hawaiian Islands, and that both *P. insularis* and *P. pallidipennis* are junior synonyms to previously described species.

MATERIAL AND METHODS

The preparation of genitalia followed the protocol described by Karner (2012, 2020). After examination, genital structures were embedded in dimethylhydantoin formaldehyde resin on the specimen labels or cellulose acetate labels, pinned with the respective specimens.

Observations and measurements were made with an Olympus SZX16 stereo microscope. The habitus photograph was taken with a Canon EOS 7D Mark II digital camera and a Canon MP-E 65mm macro objective. Higher magnifications for photography of head, pronotum, and antennae were obtained with Mitutoyo M Plan Apo objectives (10× and 20×), attached to Asahi Takumar 200 mm and Carl Zeiss MC Sonnar 135 mm telephoto lenses. Genitalia were photographed with a Canon EOS 7D Mark II digital camera attached to an Olympus CH microscope. Images and image layers were processed with Zerene Stacker (Version 1.04), Adobe Lightroom 5.7 and GIMP (Version 2.10.30) software. A total of 100 specimens from the following collections were studied:

BPBM = Bernice P. Bishop Museum, Honolulu, Hawaiʻi, USA
FSCA = Florida State Collection of Arthropods, Gainesville, Florida, USA
MKF = Michael Karner, Frankfurt, Germany

MNHN = Muséum National d'Histoire Naturelle, Paris, France
NHMUK = Natural History Museum, London, UK

Measurements were taken according to the definitions provided by Karner (2020). For holotypes and type material of previous authors, label data are cited verbatim, including uncommon use of interpunction and spaces. Labels are cited beginning with the uppermost one, the respective lines are separated by '|'. Comments on label colors, label shapes, etc. are included in squared brackets. A question mark in squared brackets indicates words or characters that were found to be illegible. Data are condensed for other material.

RESULTS

Three species of *Psammoecus* are recorded from the Hawaiian Islands: *Psammoecus cruciger* (Waterhouse, 1876), *P. t-notatus* Blackburn, 1903, and *P. pradieri* Grouvelle, 1878. Previously, two species of *Psammoecus* were reported from this region: *Psammoecus insularis* (Sharp, 1885) (in Blackburn & Sharp 1885), being a junior synonym of *P. cruciger*, and *P. pallidipennis* (Blackburn, 1885) (in Blackburn & Sharp 1885), a junior synonym of *P. pradieri*.

Psammoecus cruciger (Waterhouse, 1876)

Telephanus cruciger Waterhouse, 1876: 125.
Telephanus insularis Sharp, 1885: 143. **Syn**. **nov**.
Psammoecus upsilon Blackburn, 1903: 155; Arrow 1927: 44.
Psammoecus cephalotes Grouvelle, 1919: 20; Arrow 1927: 44; Hetschko 1930: 82; Pal 1985: 41.
Psammoecus cruciger: Grouvelle 1908: 476; Arrow 1927: 44; Hetschko 1930: 82; Karner 2020: 137.
Psammoechus insularis: Sharp, 1908: 428 (misspelling).
Psammoecus ypsilon: Hetschko 1930: 82; Pal 1985: 41 (misspellings).
Psammoecus insularis: Ford 1961: 318.
non *Psammoecus trimaculatus*: Grouvelle 1908: 476; Pal 1985: 41 (misidentifications).

Distribution. *Psammoecus cruciger* has previously been recorded from Australia (Queensland), Malaysia, and Papua New Guinea (Karner 2020). Among the three species of *Psammoecus* found on the Hawaiian Islands, this is the most frequent one within the studied material.

Material Examined. HAWAIIAN ISLANDS: **Hawai'i Island**: 1 specimen, Kea'au [label saying "Olaa"], 28 Oct 1908, BPBM 2005034587;1 specimen, Pā'auhau [probably near Honoka'a], Jun 1903, Perkins leg., BPBM 2005034603. **Kaua'i**: 1 specimen, Kipu, Jun 1914, BPBM 2005034526; 5 specimens; Wailua; Dec 1956, Isenberg leg., light trap, BPBM 2005034569, 2005034570, 2005034574, 2005034575, 2005034576. **Maui**: 1 specimen, Kīpahulu Valley, Pua'alu'u Stream, 300–500 m, 22 Jul 1980, G.M. Nishida & D. Bishop leg., BPBM 2005034594. **O'ahu**: 1 specimen, 15 Nov 1965, Beardsley leg., light trap, BPBM 2008001918; 1 specimen, same locality, Koebele leg., BPBM 2005034599; 1 specimen, Awāwaloa (Mt. Olympus), 30 m, 19 Jan 1919, Swezey leg., BPBM 2005034525; 1 specimen, 'Ewa, 5 Mar 1949, Ford leg., light trap, BPBM 2005034588; 1 specimen, same locality, Aug 1949, Ford leg., BPBM 2005034537; 3 specimens, same locality, Jan 1950 [hardly legible], Ford leg., light trap, BPBM 2005034534, 2005034535, 2005034536; 1 specimen, same locality, Jan 1952, Ford leg., light trap, BPBM 2005034582; 2 specimens, same locality, 7–11 Jun 1967, light trap, BPBM 2008001909, 2008001910; 2 specimens, same locality, 26 Dec 1967–8 Jan 1968, light trap, FSCA; 2 specimens, 'Ewa, Waipi'o, 10 Feb 1947, light trap, FSCA; 2 specimens, same locality, Sep 1957, Ford leg., light trap, BPBM 2005034572, 2005034573; 6 specimens, same locality, Jun 1960, Beardsley leg., light trap, BPBM 2005034518, 2005034519, 2005034520,

2005034521, 2005034522, 2005034523; 1 specimen, Hickam Air Force Base, 30 Dec 1977, at light, FSCA; 1 specimen, same locality, 6 Jan 1978, at light, FSCA; 1 specimen, same locality, 10 Jan 1978, at light, FSCA; 1 specimen; same locality, 13 Jan 1978, at light, FSCA; 2 specimens, same locality, 16 Jan. 1978, at light; FSCA; 1 specimen, Honolulu, 15 Apr 1941, Y. Kondo leg., light trap, BPBM 2005034583; 1 specimen, same locality, 2 Jul 1919, E.H. Bryan leg., BPBM 2005034527; 1 specimen, same locality, 28 Apr 1943, E.C. Zimmerman leg., beaten from dead coconut fronds, BPBM 2005034533; 1 specimen, same locality, 7–11 Jun 1967, Beardsley leg., light trap, BPBM 2008001916; 2 specimens, Honolulu, Mānoa, 10 May 1929, E.H. Bryan leg., at light, BPBM 2005034529, 2005034530; 4 specimens, Honolulu, Mount Tantalus, 24 Apr 1927, E.H. Bryan leg., BPBM 2005034531 (only fragments), 2005034532, 2005034590, 2005034591; 1 specimen, Lualualei, Oct 1958, light trap, BPBM 2005034589; 2 specimens, same locality, Sep 1960, light trap, BPBM 2005034600, 2005034601; 1 specimen, Mānoa, 17 Oct 1936, N.L.H. Krauss leg., at light, BPBM 2005034602; 1 specimen, Mokulēʻia, Apr 1901, Perkins leg., BPBM 2005034604; 1 specimen, same locality, May 1907, NHMUK; 1 specimen, Pearl City, 8 Apr 1944, W.M. Herms leg., light trap, BPBM 2005034586; 1 specimen, Pearl Harbor Naval Air Site, 24 May 1944, T.C. Russell leg., light trap, BPBM 2005034585; 10 specimens, Salt Lake, Āliamanu Crater, 12 May 1958, C.F. Clagg leg., BPBM 2005034538, 2005034539, 2005034540, 2005034541, 2005034542, 2005034543, 2005034544, 2005034545, 2005034546, 2005034547; 1 specimen, Wai'anae Range, 9 Nov 1919, O.H. Swezey leg., BPBM 2005034528; 2 specimens, Wahiawā, Apr 1907 [hardly legible], Perkins leg., BPBM 2005034592, 2005034593; 1 specimen, same locality, Dec 1953, Ford leg., BPBM 2005034579; 1 specimen; Waolani, 30 m, Apr 1976, Bishop leg., BPBM 2005034524.

Remarks. A redescription of this widely distributed species and new synonymies were given by Karner (2020). The description of *Telephanus insularis* (Sharp, in Blackburn & Sharp 1885: 143) was based on two female specimens. Sharp mentioned its close similarity to *Telephanus cruciger* Waterhouse, 1876 (= *Psammoecus cruciger*): "*This* [species] *is similar to several very closely allied species found in the Indo-Malasian* [sic!] *regions, but does not seem to agree with any of them, although closely allied to T. cruciger, Wat., from New Guinea*." Later, Sharp (1908: 428) hypothesized its synonymy with *Psammoecus trimaculatus* Motschulsky, 1858: "*This insect may prove to be not distinct from P. trimaculatus Motsch., an insect distributed somewhat widely, and probably by commercial means*." This was published on 18 December 1908, and may have been a reaction to Grouvelle (1908: 476) treating *P. cruciger* as junior synonym of *P. trimaculatus*. The examination the type specimens of *Telephanus insularis*, as well as of numerous specimens from the Hawai'ian Islands, as listed above, revealed that all of them are conspecific to *P. cruciger*.

Psammoecus t-notatus Blackburn, 1903

Psammoecus t-notatus Blackburn, 1903: 154.
Psammoecus amoenus Grouvelle 1912: 92.
Psammoecus t-notatus: Hetschko 1930: 84; Karner 2020: 144.

Material examined. HAWAIIAN ISLANDS: **Hawai'i Island**: 1 specimen, Kahaluʻu-Keauhou, int. Aliʻi Dr. & Kaleiopapa St., 19°33′27.1″N, 155°57′33.1″W, 15–27 Jun 2013, T. Smith leg., dry scrub & lava fields, UV light trap, FSCA; 2 specimens, Kahaluʻu-Keauhou, UH Extension Office Farm, 19°32′1.6″N, 155°55′28.1″W, 13–27 Jun 2013, T. Smith leg., macadamia, lychee, coffee, avocado groves, UV light trap, FSCA. **Oʻahu**: 1 specimen, Honolulu, Fort Street, 18 Nov 1950, BPBM; 1 specimen, Honolulu, Univ. Hawaii, 10 Jan 1965, J.W. Beardsley leg., light trap, BPBM; 1 specimen, Mānoa, 2 Nov 1936, N.L.H. Krauss leg., BPBM; 1 specimen, Nuʻuanu Valley, Waolani, 6 May 1971,

F.G. Howarth leg., BPBM; 1 specimen, Wahiawā, Dec 1953, E.J. Ford leg., mouldy coconut bract, BPBM; 1 specimen, same locality, [?] Jul 1958, E.J. Ford leg., light trap, BPBM; 1 specimen, Waipi‘o, Sep 1957, E.J. Ford leg., light trap, BPBM.

Distribution. The data given here represent the first records of *P. t-notatus* from the Hawaiian Islands and from the New World. *P. notatus* is a very widely distributed species. It has been found in Australia (Queensland), Fiji, India, Indonesia, Malaysia, Papua New Guinea, Sri Lanka, Thailand, and Vanuatu (Karner 2020).

Remarks. *Psammoecus t-notatus* was redescribed by Karner (2020). It seems likely that the extremely wide distribution of this species is, at least in part, a result of human trade, and that *P. t-notatus* was imported to the Hawaiian Islands.

The material collected by E. J. Ford listed above in all probability represent the specimens of "*Psammoecus* sp." that Ford (1961) referred to.

***Psammoecus pradieri* Grouvelle, 1878**

Fig. 1 A–H

Psammoecus pradieri Grouvelle 1878:74
Psammoecus pallidipennis (Blackburn 1885:144). **Syn**. **nov**.
Psammoecus pradieri: Hetschko 1930: 82
Telephanus pallidipennis: Blackburn 1885: 144
Psammoechus pallidipennis: Sharp 1908: 428
Psammoecus pallidipennis: Hetschko 1930: 84; Ford 1961: 318.

Diagnosis

The following combination of character states distinguishes this species:
Body (Fig. 1 A) elongate oval, length 2.88 – 3.40 mm; coloration ranging from bright testaceous to castaneous; eyes (Fig. 1 B) large, moderately protruding, unevenly rounded with stronger curvature near temples, separated from vertex and temples by a deep groove; temples short, steep, irregularly curved, somewhat angled near eyes, temple angle appr. 75°; frontal grooves shallow, almost obsolete (in few specimens distinct), curved outwards, short, attaining anterior 1/4 of eyes; vertex with moderate punctation, punctures strongly elongate, most punctures about 1 1/4 as long as eye facet diameter, pubescence directed anteriorly, composed of setae of varying length, longest setae about half as long as eyes, microsculpture on vertex absent; antennae (Fig. 1 D) moderately slender, antennomeres 9 and 10 wider than long, antennomeres 6–7 slightly darkened, 8–10 piceous, 11 yellowish white; pronotum (Fig. 1 C) widest just in front of middle, pronotal disk strongly and densely punctate, punctures widened, pubescence on pronotal disk uniform, shorter than on vertex, setae directed medially on disk and anteromedially near lateral margins, microsculpture mostly absent, in few specimens punctures surrounded by faintly reticulate areas; lateral pronotal margin in most specimen with 6 short teeth (sometimes with 5 or 7 teeth), anterior denticles small, flat, posterior denticle small; elytra (Fig. 1 A) elongate oval, widest at middle, with transverse piceous maculae slightly behind middle, maculae often reduced or absent; elytral striae slightly narrower than interstices, strial and interstrial pubescence moderate, semierect, microsculpture absent; male genitalia (Figs 1 E–H) strongly sclerotized, median lobe lancet-shaped, blunt, tip bent ventrally, parameres in ventral view wide and parallel-sided, in lateral view narrowed and bent ventrally toward apex, with several short setae along dorso-lateral margin and longer setae at apex.

Distribution. *Psammoecus pradieri* is recorded from French Polynesia and Hawai‘i.

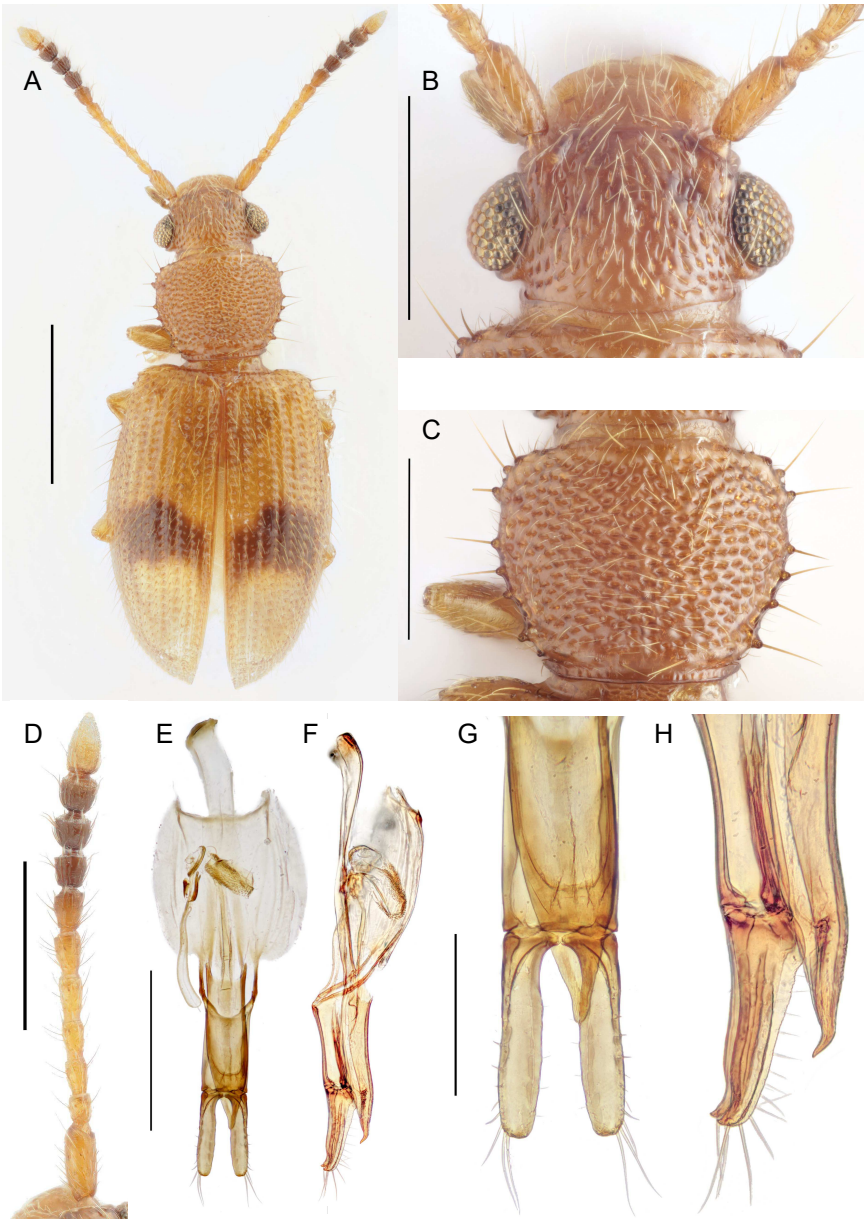

Figure 1. *Psammoecus pradieri* Grouvelle, 1878. A–D, specimen from Moloka'i (coll. BPBM). A, Habitus; B, head; C, pronotum; D, right antenna. E–H, specimen from Guadalcanal, Solomon Islands (coll. NHMUK). E, aedeagus, ventral view; F, lateral view; G, detail of aedeagus, ventral view; H, detail of aedeagus, lateral view (Scale bars: 1: 1.0 mm; 2–6: 0.5 mm; 7–8: 0.2 mm.

Material examined. **Types**. FRENCH POLYNESIA: ♀, holotype of *Psammoecus pradieri* Grouvelle, 1878, Tahiti, Pradier leg., "taiti | Pradier", "Type", "Pradieri | Grouv.", "*Psammoecus* | *Pradieri* | Grouv." [Grouvelle's hand], MNHN. HAWAIIAN ISLANDS: **Hawai'i Island**: ♀, holotype of *Telephanus pallidipennis* Blackburn, 1885, Hawaii, Blackburn leg., "Type" [round label with red border], "Hawaiian Is. | Rev. T. Blackburn. | 1883-30.", "TYPE | *Telephanus* | *pallidipennis* Blkb. | det. R.G. Booth 2016", NHMUK. **Other material examined**. HAWAIIAN ISLANDS: **Hawai'i Island**: 1 specimen, 2 mi east of Pāhoa, 145 m, 7 Feb 1987, W.C. Gagné leg., at UV light, BPBM 2005034596; 1 specimen, Kealakekua, Extension Office Farm, 19°32′1.6″N, 155°55′28.1″W, 13–27 Jun 2013, Trevor Smith leg., macadamia, lychee, coffee, avocado groves, UV light trap, FSCA. **Kaua'i**: 1 specimen, Wailua, Dec 1956, C.A. Isenberg leg., light trap, BPBM 2005034568. **Maui**: 1 specimen, Kīpahulu Valley, Puaaluu Stream. 300 m, 21–22 Dec 1980, at UV light, BPBM 2005034595. **Moloka'i**: 1 specimen, Papio Stream, 180 m, 19 Aug–2 Oct 1994, Perreira leg., yellow sticky board trap, BPBM 2006014159; 4 specimens, same locality, 2–16 Sep 1994, Perreira leg., yellow sticky board trap, BPBM 2006014154 (in coll. MKF), 2006014155 (in coll. MKF), 2006014156, 2006014158; 1 specimen, Pala'au State Park, 150 m, 29 Sep–13 Oct 1995, Perreira leg., yellow sticky board trap, BPBM 2006014157. **O'ahu**: 1 specimen, Honolulu, 'Āina Haina, 15 Feb 1969, Beardsley leg., light trap, BPBM 2008001919; 1 specimen, Honolulu, Kalihi, 120 m, 1–10 Apr 1979, F.G. Howarth leg., BPBM 2005034597; 4 specimens, Honolulu, Univ. Hawaii, 10 Jan 1965, Beardsley leg., light trap, BPBM 2008001911, 2008001912, 2008001913, 2008001914; 1 specimen, same locality, 10 Sep 1965, Beardsley leg., light trap, BPBM 2008001917.

Remarks. The holotypes of *Psammoecus pradieri* and *P. pallidipennis* are female. Studying the Hawai'an material was the first opportunity for the present author to examine the male genitalia and to confirm that small differences in external characters of the different type specimens are well within the range of individual variation.

It is premature to speculate about the distribution range of *P. pradieri*,and wether its ocurrence is limited to the Oceanian Islands of the tropical Pacific, provided the few data currently available. Frequent records of this species at light indicate high mobility, so *P. pradieri* might well be widely distributed, like several other species within the genus *Psammoecus*.

Discussion. None of the three *Psammoecus* species found on the Hawai'ian islands is endemic, and at least two of them – *P. cruciger* and *P. t-notatus* – are very widely distributed.

The data presented here, as well as data published earlier (Karner 2012, 2014, 2020, Yoshida & Hirowatari 2014, Yoshida *et al.* 2018) show that *Psammoecus* are frequently found at light or in light traps, and in flight intercept traps, indicating high mobility and a tendency to accumulate near light sources. This, together with an association with plant detritus, increases the likelyhood of *Psammoecus* species to be distributed by human trade activities. Such distribution still occurs at the present time, as shown e.g. by Thomas & Yamamoto (2007), who report *Psammoecus trimaculatus* being imported to Brazil, and, more recently, by Ouellette (2018), who mentions four species of Silvanidae associated with goods imported to Michigan (U.S.A.). The latter include two species of *Psammoecus*, imported with goods from Hong Kong, and Taiwan, respectively.

The proclivity to being dispersed by means of human trade, combined with the sometimes extremely wide distribution of *Psammoecus* species and the scarcity of faunistical data renders it presently impossible to formulate solid hypotheses regarding the geographical origins of the *Psammoecus* found on the Hawaiian islands.

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New plant naturalization records for Kaua‘i

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In this article we summarize new records of naturalization for nonnative plant species in Kaua‘i, in which most of the vouchers examined were collected during discrete whole–island surveys funded by the Kaua‘i Invasive Species Committee (KISC) and supplemented by continuous opportunistic collections by botanists at the National Tropical Botanical Garden (NTBG). We report a total of 47 new records of naturalized plants for Kaua‘i and correct the record for one species that was previously misidentified. These records include 5 records representing the first instance of naturalization in the Hawaiian archipelago, in which plants completely unknown to the state are denoted as “New state record” while those previously well-recorded in cultivation are denoted as “New naturalized record.” Another 29 records representing the first instance of naturalization on Kaua‘i are denoted as “New island record,” and an additional 13 species possibly showing signs of naturalization are listed alongside a discussion about their uncertain status. Most species that appear to be reproducing solely by vegetative means have been included in the latter category except where numerous widely-distributed occurrences exist, as we acknowledge that a single stochastic event could eliminate colonies of plants contained in a single area, even if that area is relatively large. All records are reported following the guidance offered by Brock *et al.* (2020).

KISC surveys were conducted in 2007, 2015–2017, and 2021 and mainly focused on publicly accessible roads and trails (Brock & Javier 2018). Additionally, most major nursery and landscaping businesses on Kaua‘i were also surveyed, allowing us to include notes on whether cultivated species have recently been offered for sale. Voucher specimens were collected in duplicate in most cases and minimally deposited at the NTBG

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Table 1. Herbarium code and corresponding institution name and location.

Herbarium Code	Institution	Location
AD	State Herbarium of South Australia	Adelaide, Australia
BISH	Bishop Museum	Honolulu, Hawai‘i, USA
CAS	California Academy of Sciences	San Francisco California, USA
HAST	Academia Sinica	Taipei, Taiwan
MBK	Makino Botanical Garden	Kochi, Japan
MO	Missouri Botanical Garden	Saint Louis, Missouri, USA
NY	New York Botanical Garden	Bronx, New York, USA
PTBG	National Tropical Botanical Garden	Kalāheo, Hawai‘i, USA
UBC	University of British Columbia	Vancouver, Canada
UC	University of California	Berkeley, California, USA
US	Smithsonian Institution	Washington, DC, USA

herbarium (PTBG) in Kalāheo, Kaua‘i and at the Bishop Museum’s *Herbarium Pacificum* (BISH), in Honolulu, Hawai‘i unless otherwise indicated. Additional duplicates were sent to various other herbaria and are listed in Table 1 alongside their corresponding codes. Vouchers were not collected at all detected sites, especially if reproductive material was not available to make a representative specimen or if collection required trespassing on private land. However, we discuss the location and naturalization status of unvouchered sites for each record below. Distribution maps of many of these species can be found in KISC’s technical report on the early detection of invasive plant species (Brock & Javier 2018). Photographs of plants in the field, where available, have been included primarily to illustrate the habitat and growth pattern of naturalized plants, but some have also been included as an identification aid. Additional photographs may be available from the corresponding author.

Acanthaceae

Asystasia gangetica (L.) T. Anderson

subsp. ***micrantha*** (Nees) Ensermu **New island record**

Asystasia gangetica subsp. *micrantha* is a herb that has previously been reported as naturalized on East Maui (Starr & Starr 2022) and Hawai‘i (Starr & Starr 2016), although it is possible that this plant has been overlooked on other islands due to its rank as a subspecies. At least one well-established population including hundreds or possibly thousands of plants exists on Kaua‘i, forming dense mats in a pasture over more than two hectares and climbing along fence lines in Kalāheo (Figures 1–2). This plant was likely introduced as an ornamental in the past, although it was not observed for sale during surveys of Kaua‘i nurseries during 2015–2017 (Brock & Javier 2018).

Two subspecies of *A. gangetica* are recognized, both of which have been recorded in Hawai‘i (Imada 2019). Subspecies *micrantha* is easily differentiated from the more common subsp. *gangetica* by having smaller white flowers with distinctive pink–purple blotches on the lower portion of the corolla, with corolla lobes being comparatively

Figure 1. *Asystasia gangetica* subsp. *micrantha*. Field photograph of K. Brock 801.

Figure 2. Dense infestation of *Asystasia gangetica* subsp. *micrantha* in a pasture, climbing up a fence.

Figure 3. Naturalized *Justicia spicigera* along the Hulēʻia River. Field photograph of *K. Brock 795.*

reflexed (Deng *et al.* 2011). Additionally, subsp. *micrantha* appears to be ecologically distinct, indicating that natural resource and agricultural managers should consider these organisms separately in their management plans. In Australia, where both subspecies are present, subsp. *gangetica* is considered a relatively benign garden pest and inhabitant of heavily disturbed areas, whereas subsp. *micrantha* is considered both an agricultural and environmental weed capable of reducing native biodiversity and crop yields (Westaway *et al.* 2016). Consequently, subsp. *micrantha* is targeted by invasive species outreach organizations in Australia, whereas subsp. *gangetica* is not.

Material examined. **KAUAʻI**: Kōloa Distr., northern Kalāheo, naturalized throughout a pasture along Kīkala Rd, very dense along fence lines, 21.935404°N, 159.516624°W, 275 m, 12 Apr 2016, *K. Brock 801* (PTBG, US).

Justicia spicigera Schltdl. **New island record**

Herbarium vouchers indicate that *Justicia spicigera*, commonly called Mexican honeysuckle, has been present on Kauaʻi since at least 1986, when it was noted as a possible remnant of cultivation or potentially naturalizing in Līhuʻe. This plant is cultivated in Hawaiʻi (Staples & Herbst 2005), although it was not observed during surveys of Kauaʻi nurseries during 2015–2017 (Brock & Javier 2018), indicating that it may not currently be a popular ornamental plant on Kauaʻi. More recently, this species was confirmed as naturalized in at least two locations, associated with mostly non-native vegetation, includ-

Figure 4. *Ruellia longipetiolata* naturalized on the edge of a stream. Field photograph of *K. Brock 808.*

ing in the vicinity of the Hulēʻia River and in Kalāheo. While the Kalāheo population appears sparse with approximately 10 plants observed over 2–3 ha, *J. spicigera* appears to be more common around the Hulēʻia River (Figure 3), where numerous individuals representing multiple life stages were observed by boat and from the roadside. The origin for these populations is unclear, as no obviously cultivated areas exist in the immediate vicinity, although the Kalāheo population exists near a popular, but unsanctioned, green waste dumping site within the Līhuʻe–Kōloa Forest Reserve (south section). *Justicia spicigera* has previously been reported as naturalized on Oʻahu, Molokaʻi, Maui, and Hawaiʻi (Wagner *et al.* 1990; Staples *et al.* 2002; Starr & Starr 2013; Parker & Parsons 2016).

Material examined. **KAUAʻI**: Līhuʻe Distr., Līhuʻe, along Hwy 50 just west of Līhuʻe Plantation Mill, cultivated?, apparently naturalized, 03 Apr 1986, *T. Flynn 1619* (PTBG, BISH); Līhuʻe Distr., approximately 20 mature and 7–10 immature naturalized plants scattered throughout understory, growing on south bank of Hulēʻia River, in shaded *Falcataria* and *Syzygium* dominated alien forest adjacent to *Hibiscus tiliaceus* riparian strip, 21.943500°N, 159.392578°W, 1 m, 03 Apr 2016, *K. Brock 795* (PTBG, BISH; Līhuʻe Distr., on Kīpū Rd just before Outfitters Kauaʻi office in barbed wire fence to pasture, northeast of office, steep slope down to grassy pasture and Hulēʻia Stream, with *Eucalyptus robusta*, *Mangifera indica*, *Ficus microcarpa*, *Macaranga tanarius*, *Megathyrsus maximus*, *Alocasia*, *Spathodea campanulata*, 30+ plants in area, heavily grazed by cattle and pruned into small bushes, a few climbing up *Eucalyptus robusta* that branches above level of cattle with bright orange flowers, appears to be naturalizing, 21.9503°N, 159.4208°W, 14 Jul 2021, *N. Tangalin NT5191* (PTBG).

Ruellia longepetiolata (Oerst.) Hemsl. **New island record**

[syn. *R. squarrosa* (Fenzl) Cufod.]

Ruellia longepetiolata, commonly known as creeping ruellia, is cultivated as an ornamental plant and was occasionally observed in the inventory of nurseries during 2015–2017 surveys being sold as a groundcover. Approximately 30 mature plants were observed growing along a hiking trail near the Wailua River and around the base of rocks within a small ephemeral stream (Figure 4). Since these observations in 2016, several iNaturalist users have photographed this plant along different sections of the hiking trail. *Ruellia longepetiolata* has previously been reported as naturalized on Oʻahu (Imada & Kennedy 2020) under the synonym *R. squarrosa* (Fenzl) Cufod. (Fenzl 1868, Walker 1970). However, we use *R. longepetiolata* (Oerst.) Hemsl. (Örsted, 1854, Hemsley 1882), which is the priority synonym according to the International Plant Names Index (IPNI 2022).

Material examined. **KAUAʻI**: Līhuʻe Distr., about 30 plants growing along hiking trail through native-nonnative mixed forest and in a shallow, quick-moving stream, rooted in substrate that has gathered around rock bases, 22.044250°N, 159.363400°W, 7 m, 03 May 2016, *K. Brock 808* (BISH).

Apocynaceae

Stapelia gigantea N.E. Br. **New island record**

Stapelia gigantea, commonly called Zulu giant or giant toad plant, is a cultivated ornamental in Hawaiʻi (Staples & Herbst 2005) and was occasionally observed for sale during 2015–2017 surveys of nurseries on Kauaʻi (Brock & Javier 2018). Multiple mature plants have been observed naturalizing along steep, dry slopes in *Myoporum sandwicense* shrubland habitat north of Polihale State Park (Figures 5–6). Additionally, a colony of at least several dozen plants was noted along the lower stretches of Waimea Canyon Drive in 2020 growing in rocky, degraded dry cliff habitat. This population contained multiple flowering and fruiting individuals, as well as immature plants. A few individuals have also been observed (but not vouchered) growing on rocky cliffs on the east side of Kaumualiʻi Highway at the intersection with Hanapepe Road (at 21.90906° N, 159.58473° W). *Stapelia gigantea* has previously been reported as naturalized on Oʻahu, Molokaʻi, Lānaʻi, Maui, Kahoʻolawe and Hawaiʻi (Wagner *et al.* 1990; Oppenheimer *et al.* 1999; Wysong *et al.* 2007; Oppenheimer 2010; Parker & Parsons 2012a; Starr & Starr 2017; Oppenheimer & Bogner 2019).

Material examined. **KAUAʻI**: Waimea Distr., dry rock and crumbling dirt slope in first drainage past end of Polihale Beach, 22.101858°N, 159.742783°W, 63 m, 25 Jan 2016, *S. Deans SMD023* (PTBG, BISH, US); Waimea Distr., halfway up north-facing slope of Polihale ridge in Hikimoe Valley, 22.101439°N, 159.742045°W, 134 m, 10 Jul 2016, *K. Brock 859* (PTBG).

Araceae

Syngonium podophyllum Schott **New island record**

Syngonium podophyllum, known commonly as arrowhead plant or nephthytis, is a climbing vine that is cultivated as an ornamental and was frequently observed for sale during 2015–2017 nursery surveys (Brock & Javier 2018). Although vegetative reproduction appears to

Figure 5. *Stapelia gigantea* flower. Photograph of *K. Brock 859* (PTBG, BISH).

Figure 6. *Stapelia gigantea* naturalizing in native *Myoporum* shrubland. Field photograph of *K. Brock 859.*

Figure 7. A large colony of *Syngonium podophyllum* (climbing vine at center) growing along 350 m of roadside. Field photograph of *K. Brock 879.*

be its primary method of reproduction, this plant has become common near human settlements in disturbed moist to mesic alien lowland forests on Kauaʻi. Additionally, *S. podophyllum* now occurs outside of human residential areas, including within forest reserves, possibly due to frequent dumping of yard clippings containing viable propagules. This vine often climbs large trees on Kauaʻi and forms large colonies in some areas (Figure 7). More than 10 large colonies (>250 m^3) existing outside of cultivated areas were documented during 2015–2017 KISC roadside surveys. *Syngonium podophyllum* has previously been reported as naturalized on Oʻahu and Maui (Oppenheimer 2006; Oppenheimer 2011).

Material examined. **KAUAʻI**: Wailua, side of Hwy 580, along road and in University of Hawaiʻi Wailua Experiment Station fence, 22.063056°N, 159.406944°W, 175 m, 24 May 2007, *N. Tangalin 1279* (PTBG); Kōloa Distr., Kalāheo, on forest reserve access road off Puʻuwai Rd, growing on several different tree species in alien forest, perhaps introduced from disposed yard cuttings, 21.943204°N, 159.524485°W, 322 m, 12 Apr 2016, *K. Brock 879* (PTBG, BISH, US); Waimea Distr., Waimea rim, just past roadside on rocky outcropping, 21.994800°N, 159.675680°W, 366 m, 30 Oct 2020, *S. Deans & S. Heintzman KP10302001* (PTBG).

Asparagaceae

Yucca aloifolia L. **New naturalized record**

Yucca aloifolia, commonly called Spanish bayonet or Spanish dagger, is a shrub that appears to have been historically cultivated on Kauaʻi because it is cultivated in multiple

Figure 8. *Yucca aloifolia* at Keālia Beach, spreading in *Scaevola taccada*-dominated coastal habitat.

Figure 9. Naturalized population of *Yucca aloifolia* along the coast of Hanalei Bay under *Casuarina equisetifolia*.

yards and resorts. However, 2015–2017 nursery surveys did not find this plant commonly offered for sale, with the exception of one plant that had been sourced from naturalized populations. This species is difficult to distinguish from *Y. gloriosa* (Hess & Robbins 2002; Rentsch & Leebens-Mack 2012), which shares many variable morphological characteristics and is cultivated in Hawai‘i (Staples & Herbst 2005). Kaua‘i plants were identified as *Y. aloifolia* according to Hess and Robbins (2002), based on flower and leaf characteristics. Perhaps the most helpful distinguishing characteristic in the field is its comparatively sprawling habit, which results from the proliferation of horizontal woody stems along the ground to form colonies. Contrastingly, *Y. gloriosa* tends to branch more towards the terminus of main limbs, maintaining a more upright or mounding appearance.

No herbarium records exist for *Y. aloifolia* in Hawai‘i, but plants at Keālia Beach have been present at least since the 1980s (L. Kaneholani, pers. comm.) and it has been reported in cultivation in Hawai‘i (Staples & Herbst 2005). Our surveys indicate that *Y. aloifolia* has naturalized in at least four locations on Kaua‘i, all of which occur within coastal habitats. The largest populations exist along Keālia Beach (Figure 8) and throughout a coastal residential area in ‘Aliomanu, each including numerous adult plants distributed over approximately 3 ha, with densities ranging from sporadic to over 50% cover. Three other small populations were also detected, including one naturalized population on a steep, rocky slope at Hanalei Bay (Figure 9) and another near Po‘ipū, both of which are distant from any possible areas of cultivation, while plants at the third site appear to be spreading vegetatively from a resort planting in Wailua Bay. The current distribution of *Y. aloifolia* suggests that two methods of dispersal are occurring: short-distance dispersal vegetatively by horizontal, re-rooting stems; and longer-distance dispersal, possibly by seed. Seeds are thought to be dispersed by birds, although fruits have so far not been observed. Members of the genus *Yucca* are known for having obligate mutualisms with yucca moths, which would normally prevent their naturalization in Hawai‘i without the subsequent introduction of its pollinator, but recent studies have found that *Y. aloifolia* can be effectively pollinated by more generalist pollinators such as the common honey bee (*Apis mellifera*; Rentsch & Leebens-Mack 2014).

Material examined. **KAUA‘I**: Keālia Beach Park, common and naturalized in coastal strand vegetation next to sandy beach with *Scaevola taccada*, 22.091688°N, 159.306806°W, 6 m, 22 Feb 2017, *K. Brock 947* (PTBG, BISH).

Asteraceae

Soliva sessilis Ruiz & Pav. **New island record**

Soliva sessilis, or lawn burweed, is a low-lying herb with fruits that are often dispersed by clinging to clothing, shoes, or equipment by way of sharp spines that ornament the burr-like fruiting heads (Figure 10). This plant was observed growing as a weed in at least two locations, growing along the edge of the golf course green areas (Figure 11). *Soliva sessilis* has previously been reported as naturalized on Hawai‘i Island (Wagner & Herbst 1995).

Figure 10. Plants of *Soliva sessilis* showing finely divided leaves and burr-like inflorescence heads. Photo of *D.H. Lorence 10803*.

Figure 11. Habit of *Soliva sessilis* along lawn at Kukuiolono Golf Course, Kaua‘i. Photo of *D.H. Lorence 10803*.

Figure 12. Naturalized *Harrisia eriophora* and other cacti in *Leucaena leucocephala* shrubland. Field photograph of *K. Brock 1051.*

Material examined. **KAUA‘I**: Kōloa Distr., Kukuiolono Golf Course, below (west of) picnic pavilion border of mowed lawn and weedy shrubland, growing with weedy grasses, *Erigeron bellioides*, and *Plantago lanceolata,* at edge of weedy shrubland with *Megathyrsus maximus, Leucaena, Psidium, Schinus* and *Casuarina*, perennial herb forming dense mats in lawn, spreading vegetatively, also with flowers and fruits, locally abundant in several areas, 21.911389°N, 159.529444°W, 241 m, 04 May 2020, *D.H. Lorence 10803* (BISH, PTBG, CAS, US, NY).

Cactaceae

Harrisia eriophora (Pfeiff.) Britton **New state record**

Harrisia eriophora, known as fragrant prickly apple or wild yellow dragon apple cactus, is a shrubby cactus endemic to Cuba (Franck 2016) and was first collected on Kaua‘i from a naturalized individual near Po‘ipū in 1995. It is likely an escape from a succulent garden that was established in Po‘ipū during the 1930s (according to informational signage in the garden). Two locations of naturalized plants were recently detected over 0.5 km from the garden, with each having about 10–15 mature fruiting plants alongside approximately 10 immature individuals in a fallow field dominated by *Leucaena leucocephala* and other naturalized cacti (Figure 12). More individuals likely exist but were obscured by *L. leucocephala* canopy during roadside surveys. Numerous fruits containing hundreds of seeds were observed, which are edible and may be dispersible by birds (Taylor *et al.* 2017). Plants were identified using the taxonomy of Franck (2016); *H. eriophora* is distinguishable in the field from other *Harrisia* in Hawai‘i by having 10–12 ribbed stems, rather than

Figure 13. *Poranopsis paniculata* (vine with heart-shaped leaves) growing among *Leucaena leucocephala* (koa haole) shrubland. Field photograph of *K. Brock 982.*

3–5 ribs. This plant does not appear to be common in the nursery trade on Kauaʻi, as it was not found in nurseries or observed in cultivation or in residential areas during 2015–2017 surveys of Kauaʻi.

Material examined. **KAUAʻI**: Kōloa Distr., Poʻipū, along Poʻipū Rd, between turnoffs to Sheraton Kauaʻi hotel (Kapili Rd) and Poʻipū Beach, naturalized locally, occasional, ca. 10 m, 07 Jan 1995, *D.H. Lorence 7623a* (PTBG, MO); *loc. cit,* located in a vacant, roughly 25 acre lot near Waiohai, 02 October 2003, *L. Dunn 298* (BISH, PTBG); *loc. cit,* next to Kiahūnā Plantation Drive across from the Poʻipū Shopping Village, 100 m from intersection with Poʻipū Rd, 21.879870°N, 159.459670°W, 5 m, 05 Jul 2017, *K. Brock 1051* (PTBG, BISH, US).

Convolvulaceae

Poranopsis paniculata (Roxb.) Roberty **New island record**

Poranopsis paniculata, commonly called bridal bouquet or snow creeper, is a vine that is cultivated as an ornamental, although it was not observed for sale during nursery surveys from 2015–2017, and one nursery manager said that he had stopped selling it because he now considers it a pest (Figure 13). This plant appears to be a pest of fruit growers and to those maintaining infrastructure, as dense mats were observed growing over cultivated mango trees and along utility lines in Līhuʻe. Although this plant appears to be reproducing primarily by vegetative means, 10 non-cultivated locations were recorded during KISC surveys, some of which occupy more than 0.5 ha (Brock & Javier 2018). Due to their distance from obviously cultivated areas, it is unclear if they were dispersed to these

Figure 14. *Coccinia grandis* displaying vining habit. Photo credit L. Kaneholani.

locations by seed or if they arose from dispersed vegetative propagules (likely by humans). Alternatively, some of these colonies may be remnants of previously cultivated areas where the vegetation has become so overgrown that it no longer resembles a purposely landscaped area. *Poranopsis paniculata* has previously been reported as naturalized on East Maui (Starr *et al.* 2004) and Hawai‘i (Parker & Parsons 2012a).

Material examined. **KAUA‘I**: Līhu‘e Distr., Puhi/Kīpū, Ha‘ikū Valley Rd no. 2, off of Hulemalu Rd and Kaumuali‘i Hwy, climbing up to 20 ft and covering trees, 26 Sep 2007, *N. Tangalin & C. Trauernicht 1558* (PTBG, MBK, US); Kawaihau Distr., Keālia/Kapa‘a, off of Ka‘ao Rd, 22.10319°N, 159.30608°W, 30 m, 09 May 2017, *K. Brock 982* (PTBG, BISH, US).

Cucurbitaceae

Coccinia grandis (L.) Voigt **New island record**

Coccinia grandis, commonly called ivy gourd, is a vine that is sometimes cultivated as a food plant, although it was not observed for sale during 2015–2017 nursery surveys, possibly because nursery managers now recognize this plant as a formidable pest of landscaped areas. This plant appears to have been naturalized on Kaua‘i for more than a decade but is not well-vouchered for herbaria. More than 30 widely distributed locations of this plant exist on Kaua‘i, with all sites existing in disturbed lowland areas. These sites have been controlled by KISC since 2002, but new non-cultivated populations continue to appear (Figure 14). Recurring detection of this plant suggests that *C. grandis* should be considered naturalized on Kaua‘i, and its status may be revisited in the future if eradication efforts are successful. *Coccinia grandis* has previously been reported as naturalized

Figure 15. *Callitris columellaris* fruits. Field photograph of *K. Brock 1042*.

Figure 16. Sapling recruitment of *Callitris columellaris* next to a forestry planting.

on Oʻahu, Lānaʻi, Maui, and Hawaiʻi (Wagner *et al.* 1990; Starr *et al.* 1999; Oppenheimer & Bartlett 2000; Oppenheimer 2007).

Material examined. **KAUAʻI**: Līhuʻe Distr., Līhuʻe, NW side of Ahukini Rd, across from the airport and in grass parking area for Jack Harder Helicopters, 21.975410°N, 159.507126°W, ca. 30 m, 30 Dec 2010, *N. Tangalin 2468* (PTBG, BISH, NY, UC, US).

Cupressaceae

Callitris columellaris F. Muell. **New island record**

Callitris columellaris is a conifer occasionally cultivated as a forestry tree in Hawaiʻi (Skolmen 1980), and 2015–2017 nursery surveys suggest that is not present (or at least not common) in the nursery trade on Kauaʻi. Common names include white cypress-pine, Murray River cypress-pine, and northern cypress-pine. *Callitris columellaris* in Hawaiʻi has been mistaken for *C. muelleri* (Parl.) Benth. & Hook. f. ex F. Muell., a distinct species that is probably not in cultivation here (Staples & Herbst 2005), and some herbarium collections have been misidentified as the latter. We observed this species naturalizing on Kauaʻi, originating from a forestry plot in a forest reserve. The majority of the offspring from these plantations appear to remain directly under the parent trees within *C. columellaris* plantations (Figures 15–16). However, hundreds of naturalized individuals of multiple age classes were found colonizing the understory of adjacent forestry plots (*Eucalyptus*) and on open, grassy hillsides and disturbed slopes up to 1 km from the original forestry planting site. *Callitris columellaris* has previously been reported as naturalized on Oʻahu and Maui (Oppenheimer 2002; Frohlich & Lau 2012).

Material examined. **KAUAʻI**: Waimea Distr., Puʻu Ka Pele Forest Reserve where Mānā Ridge Rd splits into Kolo Rd, 3.5k m SW from Lua Reservior, 22.071390°N, 159.704560°W, ca. 740 m, 26 Jun 2017, *K. Brock 1042* (PTBG, BISH, US); Waimea Canyon State Park, southern edge of Makaha Ridge at end of forestry road through pine plantations, in area called "Forestry Tree Trial Area," regenerating abundantly under parent trees, 580 m, 28 April 1997, *D.H. Lorence 7983* (BISH, PTBG, US).

Euphorbiaceae

Euphorbia tithymaloides L.

subsp. ***padifolia*** (L.) V.W. Steinm. **New island record**

[syn. *Pedilanthus tithymaloides* subsp. *padifolius* [L.] Dressler]

Naturalized populations of this plant, also referred to as devil's-backbone, exist in at least two locations on Kauaʻi. The westernmost population located northwest of Kekaha is small, consisting of approximately 10 mature plants. However, the population at Māhāʻulepū (east of Poʻipū) is large and well-established, with hundreds of plants (Figure 17–18) forming the dominant vegetation cover along the coast alongside *Lycium sandwicense* (ʻōhelo kai) and *Scaevola taccada* (naupaka) and beneath *Leucaena leucocephala* (koa haole) further away from shore. *Euphorbia tithymaloides* subsp. *padifolia* was reported by longtime resident and Māhāʼulepū preservationist David Chang to have been planted in 1975 at Māhāʼulepū around the movie set for *Islands in the Sun* (B. Blaich,

Figure 17. *Euphorbia tithymaloides* subsp. *padifolius* flowers. Field photograph of *K. Brock 1050.*

Figure 18. *Euphorbia tithymaloides* subsp. *padifolia* naturalizing in coastal area. Field photograph of *K. Brock 1050.*

pers. comm.). Naturalized plants on Kauaʻi were identified to subspecies using the taxonomy of Cacho and Baum (2012), and this plant was frequently observed for sale in nurseries, although subsp. *tithymaloides* (including variegated forms), was more common. Given that other subspecies are present in cultivation in Hawaiʻi (Staples & Herbst 2005) but only subsp. *padifolia* has been reported as naturalized (Imada 2019), it is possible that this subspecies may be more prone to naturalization. *Euphorbia tithymaloides* subsp. *padifolia* has previously been reported as naturalized on Oʻahu (Frohlich & Lau 2012).

Material examined. **KAUAʻI**: Kōloa Distr., Māhāʾulepū, between Kawailoa Bay and Pākamoi, on cliff above ocean with *Scaevola* and *Lantana*, ca. 6 m, 02 Sep 1986, *T. Flynn 1879* (PTBG); *loc. cit.,* between Kāmala Point and Paoʻo Point, shrubby coastal vegetation with *Scaevola taccada* and *Sida fallax* on coastal dunerock, invaded by *Lantana camara*, naturalized locally forming dense clump 20 m in diam., 20 m, 26 Apr 2006, *D. H. Lorence 9512* (BISH, MO, NY, PTBG, US); *loc. cit.,* north side of Kawailoa Bay, dense naturalized population, at least 0.5 ha, forming the dominant vegetation cover in coastal area and forming a dense understory below *Leucaena* shrubland, 21.893070°N, 159.407930°W, ca. 3 m, 05 Jul 2017, *K. Brock 1050* (BISH, US).

Fabaceae

Clitoria ternatea L. **New island record**

Clitoria ternatea, known as blue pea or butterfly pea, was observed naturalizing near Kekaha alongside an irrigation ditch. Multiple plants were observed forming a loose, vining mat among nonnative grasses alongside at least 500 m of the length of the ditch. Additionally, one wild-growing plant was observed from the roadside near Kīlauea (not vouchered). This species was observed for sale during 2015–2017 KISC nursery surveys. *Clitoria ternatea* has previously been reported as naturalized on Oʻahu, Lānaʻi, and Maui (Wagner *et al.*1990; Oppenheimer & Bartlett 2000; Starr *et al.* 2010).

Material examined. **KAUAʻI**: Waimea Distr., Kekaha, near intersection with Kekaha Rd and Akialoa Rd, near irrigation ditch, 21.975352°N, 159.720089°W, ca. 21 m, 17 Oct 2015, *K. Brock 739* (PTBG, BISH).

Crotalaria juncea L. **New island record**

Crotalaria juncea, commonly known as sunn hemp, Indian hemp, or Madras hemp, was observed naturalizing along roadsides and irrigation ditches on Kauaʻi, particularly near where it has been planted as a nitrogen-fixing cover crop. Three locations of wild-growing plants were observed: one near Lāwaʻi and two northwest of Kekaha more than 5 km apart. Less than 5 mature plants were observed in a roadside ditch near Lāwaʻi, while more than 50 mature plants were observed along roadsides and irrigation ditches at each of the Kekaha locations (Figures 19–20). *Crotalaria juncea* has previously been reported as naturalized on Maui (Staples *et al.* 2003) and Hawaiʻi, and questionably naturalized on Oʻahu (Wagner *et al.*1997).

Material examined. **KAUAʻI**: Waimea Distr., north of Kekaha, along an agricultural access road between Old Mānā Rd and Kekaha town limits and west of Kōkeʻe Rd, 21.979930° N, 159.722990° W, ca. 10 m, 24 May 2017, *K. Brock 996* (PTBG, BISH, US).

Figure 19. Close-up of *Crotalaria juncea* flower. Field photograph of *K. Brock 996*.

Figure 20. *Crotalaria juncea* (erect herb, middle) growing with other weeds near roadside. Field photograph of *K. Brock 996*.

Figure 21. *Crotalaria verrucosa* (low, blue-green shrub) growing with nonnative grasses in a pasture.

Crotalaria verrucosa L. **New island record**

Crotalaria verrucosa, commonly called blue rattlepod or blue-flower rattlepod, was first vouchered on Kauaʻi in 2014 from a naturalized population near Kālepa Ridge (Figure 21), and in follow-up surveys in 2018 where at least 500 plants were observed growing throughout a pasture. Although it is sometimes used as a nitrogen-fixing cover crop (Ventosa-Febles 2017), it did not appear to have been purposefully introduced at this location, as the plant was not evenly distributed throughout the pasture as you would expect with mechanical seed broadcasting techniques. Instead, *C. verrucosa* was observed forming the dominant vegetation cover along fence lines and on soils that were highly disturbed due to livestock trampling. *Crotalaria verrucosa* has previously been reported as naturalized on Oʻahu (Wagner & Herbst 1995).

Material examined. **KAUAʻI**: Līhuʻe Distr., between Kālepa Ridge and Hwy 56, with *Urochloa*, *Parthenium*, *Malvastrum*, and *Crotalaria* spp., ca. 20 m, 30 Apr 2014, *T. Flynn 7793* (PTBG, BISH, NY, UC, US).

Flemingia macrophylla (Willd.) Kuntze ex Merr.**New island record**

Flemingia macrophylla, commonly called large-leaf flemingia, is a small tree or shrub that is cultivated throughout the tropics, usually as a cover crop to improve soil fertility (Blair *et al.* 2005). On Kauaʻi there are three recorded sites of *F. macrophylla*, all of them within a 2 km radius of the Kauaʻi Agricultural Research Station, where it was likely cultivated in the past. One site is located at the research station, where it is no longer cultivated but can be seen occasionally in unmaintained areas on the station grounds and along

Figure 22. Habit of *Flemingia macrophylla* in weedy vegetation. Photo by L. Kaneholani, 2014 (KISC staff).

Figure 23. *Flemingia macrophylla* flowers and fruits. Photo by L. Kaneholani, 2014 (KISC staff).

the adjacent Kuamoʻo Road (Figures 22–23). A second site is located 1.5 km east of the research station in a patch of alien forest in Wailua Homesteads, and a third site is located 2 km to the south, naturalized along the edge of an alien forest. *Flemingia macrophylla* has previously been reported as naturalized on Hawaiʻi Island (Parker & Parsons 2012b).

Material examined. **KAUAʻI**: Kawaihau Distr., Wailua Homestead area near Wailua Rise, atop a hillside on side slope of an old road cut, 22.059886°N, 159.383978°W, 99 m, 25 Nov 2013, *KISC s.n.* (PTBG 67519 , BISH 664145, US); Līhuʻe Distr., on an unnamed gravel road accessed from Hwy 583, approximately 2 km south of Wailua Reservoir, 22.049316°N, 159.403732°W, ca. 160 m, 28 Oct 2015, *K. Brock 747* (PTBG, BISH, US).

Heliotropiaceae

Heliotropium amplexicaule Vahl **New island record**

Heliotropium amplexicaule, or blue heliotrope, is naturalized on Oʻahu, Molokaʻi, Maui, and Hawaiʻi (Wagner *et al.*1990). It was first collected on Kauaʻi in 2004 near Līhuʻe Airport and noted to be "locally common." It was recollected in 2021 in the Lydgate State Park area near the Wailua River mouth, where about twenty plants were observed growing in lawn grass between boulders. At Lydgate, this mat-forming herb occurs in clumps, indicating spread by rhizomes, as well as by seed. Flowers are attractive; violet blue with white and yellow centers.

Material examined. **KAUAʻI**: Līhuʻe Distr., behind airport runway near Division of Forestry and Wildlife (DOFAW) Shearwater release pen, locally common, secondary vegetation with *Boerhavia*, *Malvastrum*, *Heliotropium*, and *Panicum maximum*, 24 m, 08 Jun 2004, *T. Flynn 7123*

Figure 24. *Gladiolus dalenii* (with peach-colored flower, center) growing along roadside with other weeds in Kōkeʻe State Park. Field photograph of *K. Brock 1035*.

(PTBG, BISH, AD, MO, NY, US); Kawaihau Distr., Lydgate State Park and across street in Hikinaakalā Heiau, Wailua River State Park, ca. 15 plants in 20 clumps growing in lawn grass between parking lot boulders and pōhaku near heiau, 22.04222°N, 159.33556°W, 6 m, 25 Jun 2021, *N. Tangalin NT5187a* (PTBG).

Iridaceae

Gladiolus dalenii Van Geel **New island record**

Gladiolus dalenii, often simply called gladiolus as a common name, is an herb cultivated as an ornamental on Kauaʻi, although it was not observed for sale during nursery surveys on Kauaʻi between 2015 and 2017. This plant was observed naturalizing at two locations in Kōkeʻe: along Camp 10 Road (Figure 24) and in disturbed areas surrounding cabins. In both locations, more than 15 mature plants were observed scattered among other weeds common to disturbed soils in the area. *Gladiolus dalenii* has previously been reported as naturalized on Oʻahu, Maui, and Hawaiʻi (Starr *et al.* 2004; Oppenheimer 2007; Frohlich & Lau 2014).

Material examined. **KAUAʻI**: Waimea Distr., Kōkeʻe State Park, on Camp 10 Rd, approximately 2.5 km from Hwy 550, 22.130510°N, 159.639630°W, 1,140 m, 25 Jun 2017, *K. Brock 1035* (PTBG, BISH, US).

Figure 25. Vining form of *Volkameria inermis*, climbing up vegetation along a stream near ʻAnini Beach. Field photograph in the vicinity of *N. Tangalin 1406.*

Figure 26. Thick-leaved, shrubby form of *Volkameria inermis*, growing in a large, dense stand along rocky coastline. Field photograph of *K. Brock 832.*

Figure 27. *Torenia glabra* (blue-flowered herb) naturalizing along the Kuilau Trail west of Wailua Homesteads. Field photograph of *K. Brock* 1045.

Lamiaceae

Volkameria inermis L. **New naturalized record**

Volkameria inermis, commonly called glory bower, is widely cultivated as an ornamental on Kauaʻi and was commonly encountered for sale during 2015–2017 nursery surveys, where it is marketed as a salt-tolerant hedge. This plant occurs as two distinct morphs on Kauaʻi, although it is unclear whether these differences reflect environmental variation among sites or genetic distinctions. The first morph is a dense, more upright shrub with thick, bright green leaves, while the second has a more vining habit with thinner leaves. These differences reflect the polymorphic habit of this species in its native range, which is described as an "erect, spreading, or sometimes scandent shrub or small tree to 5 m high or a liana" (Smith 1991). Despite vegetative differences in Kauaʻi plants, floral and fruit characteristics are consistent in both morphs and were identified according to descriptions and dichotomous keys provided by Munir (1989) and Smith (1991). Both morphs of this plant were observed growing in coastal areas, with the vine-like morph naturalizing along a stream near ʻAnini Beach (Figure 25) and the thick-leaved morph naturalized at 3 other sites near Poʻipū, Līhuʻe, and south of Wailua (Figure 26). The Poʻipū population appeared to be crowding out *Scaevola taccada* in remnant native coastal strands. It was also observed growing with *Scaevola taccada* along the beach fronting the Waiohai Beach Resort at Poʻipū, where both species were presumably planted for erosion control.

Material examined. **KAUAʻI**: Kawaihau Distr., ʻAnini Rd, on makai side at east end of ʻAnini Beach Park, lining dry stream bed, 22.223524°N, 159.445616°W, 23 m, 08 Jun 2007, *N. Tangalin*

Figure 28. *Pleiostachya pruinosa* on the edge of an alien forest in Wailua Homesteads.

1406 (PTBG, BISH, NY, US); Kōloa Distr., Poʻipū, in empty lot along coastline, large thicket growing in dry, salt-sprayed area along rocky coast with *Scaevola taccada*, 21.868960°N, 159.444860°W, 7 m, 25 Aug 2016, *K. Brock 832* (PTBG, BISH).

Linderniaceae

Torenia asiatica L. **New island record**

[syn. *T. glabra* Osbeck]

Torenia asiatica, or wishbone flower, is a low, sprawling herb sometimes cultivated as an ornamental. This plant was first collected from a naturalized population in 2017 on Kauaʻi, and was subsequently observed growing in damp, disturbed areas, including a large population along Kuamoʻo Road and its adjoining trails (Powerline Trail and Kuilau Trail; Figure 27), and near Kīlauea. We have followed the treatment of *Torenia* by Fischer *et al.* (2013), where *T. glabra* is subsumed under *T. asiatica*, although Kauaʻi specimens were originally identified as *T. glabra* by having 1–4 flowers per axil and a corolla tube paler than corolla lobes, as indicated by Staples & Herbst (2005). *Torenia asiatica* has previously been reported as naturalized on Oʻahu and Hawaiʻi (Wagner *et al.* 1990; Oppenheimer 2003).

Material examined. **KAUAʻI**: Kawaihau Distr., west of Wailua Homesteads, growing along Kuilau Trail near trailhead off Kuamoʻo Rd, throughout Keāhua Arboretum and roads around Hanahanapuni Crater, 22.071580°N, 159.416490°W, 170 m, 05 Jul 2017, *K. Brock 1045* (PTBG, BISH, US); Kawaihau Distr., Wailua above Keāhua Arboretum and Steps or Loop Rd Powerline Trail from the east side, forming mats on side of trail and growing up into uluhe, flowers purple with a

Figure 29. Mature *Muntingia calabura* growing in an overgrown irrigation ditch. Field photograph of *K. Brock 999.*

lighter white color towards center of corolla, stems intertwined on ground rooting at nodes, 22.08382° N, 159.42665° W, 12 May 2021, *N. Tangalin 5187* (PTBG, BISH).

Marantaceae

Pleiostachya pruinosa (Regel) K. Schum. **New island record**

Pleiostachya pruinosa, or wheat calathea, is a perennial herb cultivated as an ornamental in Hawai‘i. Approximately 30 plants were observed scattered in wet areas and along forest edges (Figure 28) at multiple locations over a large area (at least 30 ha) in Wailua Homesteads, apparently dispersed from cultivated individuals in the area. *Pleiostachya pruinosa* has previously been reported as naturalized on O‘ahu (Daehler & Baker 2006).

Material examined. **KAUA‘I**: Kawaihau Distr., Wailua Homesteads, sparingly naturalizing along forest edges and disturbed streams and ditches, 21.06115°N, 159.39744°W, 130 m, 15 Feb 2017, *K. Brock 950* (PTBG, BISH).

Muntingiaceae

Muntingia calabura L. **New naturalized record**

Muntingia calabura, or Jamaican cherry, is a shrub that is cultivated as an ornamental and for its edible fruits. This plant is present in cultivation on Kaua‘i, and was observed during surveys of Kaua‘i’s nurseries. Naturalized individuals of this plant have been observed on the west side of Kaua‘i, growing in disturbed areas such as agricultural fields, along irrigation ditches, and at the base of eroding cliff sides (Figure 29). *Muntingia calabura* has previously been reported as questionably naturalized on O‘ahu (Wagner *et. al.* 1990).

Figure 30. *Dendrobium* hybrid naturalizing with native/nonnative mixed vegetation with fruit. Field photograph of *N. Tangalin 3847.*

Material examined. **KAUA'I**: Waimea Distr., Kekaha, growing along water dike in neighborhood, 21.966111°N, 159.711389°W, 17 m, 29 Oct 2007, *C. Trauernicht 228* (PTBG, BISH, TAMU); Waimea Distr., northwest of Kekaha, north of Hwy 50, growing in an irrigation ditch, at least 40 mature individuals seen scattered over a broad area near Kekaha, apparently naturalized in disturbed areas, 21.984930° N, 159.737250° W, 10 m, 24 May 2017, *K. Brock 999* (PTBG, BISH).

Orchidaceae

***Dendrobium* hybrid** **New island record**

Dendrobium is a large genus of orchids that have been introduced as ornamentals and have been extensively interbred to produce new hybrid species. Here we report a highly variable hybrid swarm of *Dendrobium* that has naturalized on Kaua'i (Figures 30–31). About 10–20 adult plants with fruit were observed over a distance of 140 m while hiking in the Moloa'a Forest Reserve. These plants were found in a native-non-native mixed shrubland with no cultivated plants nearby, and the closest residential area being >800 m away. Unfortunately, we were unable to determine the parentage of these individuals, but like the population previously reported on O'ahu (Ackerman *et al*. 2011), our collections appear to be categorizable as "antelope-type" or "semi-antelope-type" *Dendrobium*. These orchids are characterized by two erect, twisted petals that give the appearance of antelope horns; however, the length and twisting of the petals varied among our plants as well as among flowers on the same plant. Ten specimens were collected to represent variation in color and morphology among individuals.

Figure 31. Sampling of floral variation observed in *Dendrobium* hybrid swarm. Field photos of *N. Tangalin 3842* (top left), *3848* (top right), *3850* (bottom left), and *3852* (bottom right).

Material examined. **KAUA‘I:** Kawaihau Distr., Anahola, Moloa‘a Forest Reserve, east and south-east side of trail in *Osteomeles-Wikstroemia* shrubland, 21.16° N, 159.33° W, 20 Jun 2014, *N. Tangalin NT3842–3851* (BISH, PTBG, US, UC).

Polystachya concreta (Jacq.) Garay & H.R. Sweet **New island record; Correction**

Polystachya concreta, commonly known as the yellow helmet orchid, has been recorded as naturalized on O‘ahu (Staples *et al.* 2003), West Maui (Oppenheimer 2013), and Moloka‘i (Oppenheimer 2016). Both Kaua‘i collections were found growing on mossy branches of *Metrosideros polymorpha* in lowland wet windward forest. The area between the two collections is largely inaccessible and only occasionally visited by botanists, and thus the distribution and density of the population remain unclear. *Polystachya concreta*

Figure 32. *Phyllanthus urinaria* habit. Photo of *D.H. Lorence 10743*.

Figure 33. *Phyllanthus urinaria* showing underside of stems with subsessile female flowers and fruits. Photos of *D.H. Lorence 10743*.

was initially collected in 2017 but misidentified as *Habenaria rodeiensis*. A second collection in 2018 and a reexamination of the original collection confirm it to be *Polystachya concreta*. These orchids are separated by habitat, with *H. rodeiensis* being terrestrial and *P. concreta* being epiphytic. Additionally, the inflorescence of *H. rodeiensis* is a raceme with flower labellums having a nectar spur, while the inflorescence of *P. concreta* is a panicle with the labellum lacking a nectar spur. Thus, we recommend that this report supersede the new island record reported by Imada and Kennedy (2020), as we know of no naturalized records of *H. rodeiensis* yet collected on Kauaʻi.

Material examined. **KAUAʻI:** Līhuʻe Distr., banks of north fork of Wailua River, adjacent to trail that leads to Blue Hole, epiphytic in moss on branch of *Metrosideros polymorpha,* 387 m, 28 Jan 2015, *A.M. Williams, T. Flynn, & J. Shevock AMW118* (BISH, PTBG: previously identified as *Habenaria rodeiensis*); Kōloa Distr., Kāhili Mountain Range, epiphytic on mossy branch of *Metrosideros polymorpha,* 5 individuals observed, 21.965833° N, 159.498793° W, 04 Oct 2018, *N. Tangalin & S. Walsh NT4982* (PTBG).

Phyllanthaceae

Phyllanthus urinaria L. **New state record**

Phyllanthus urinaria, or leafflower, is a herbaceous plant widely introduced throughout the tropics and subtropics, where it occurs as a weed of crops and human settlements (Wehtje *et al.* 1992). It differs from the other two naturalized herbaceous *Phyllanthus* species in Hawaiʻi (*P. debilis* and *P. tenellus*) by its purple-red tinged stems, sessile or subsessile pistillate flowers and fruits, and transversely ribbed seeds (Figures 32–33). We report the first naturalized occurrence of this plant for the Hawaiian archipelago (Imada 2019).

Material examined. **KAUAʻI**: Kōloa Distr., National Tropical Botanical Garden, McBryde Garden in Lāwaʻi Valley, Biodiversity Trail, naturalized and abundant locally along trail by gymnosperms area, 21.901167° N, 159.506572° W, 27 m, 23 Apr 2018, *D.H. Lorence 10743* (BISH, CAS, NY, PTBG, UC, US).

Plantaginaceae

Veronica plebeia R. Br. **New island record**

Veronica plebeia, or trailing speedwell, is a low, sprawling herb sometimes cultivated as an ornamental. Naturalized individuals of this plant were observed spreading throughout moist–mesic *Metrosideros*-dominated forest and in disturbed soils around cabin sites (Figures 34–35) in Kōkeʻe State Park. One cabin owner noted that it has become a common nuisance in flower beds at multiple cabin sites in the area. *Veronica plebeia* has previously been reported as naturalized on Maui and Hawaiʻi (Wagner *et al.*1990).

Material examined. **KAUAʻI**: Waimea Distr., Kōkeʻe, several patches growing as a weed in disturbed areas around cabin, fence posts, and in pasture, 22.107100° N, 159.676590° W, 1,030 m, 23 Jun 2016, *K. Brock 1025* (PTBG, BISH, US); *loc. cit.,* off of Camp 10 Rd, between ʻElekeniui Stream and Kawaikōī Campground, growing in dense shade under mixed *Metrosideros* forest next to cleared, open area, 22.133040° N, 159.633870° W, 1,100 m, 21 Nov 2016, *K. Brock 931* (PTBG, BISH, US).

Figure 34. *Veronica plebeia* specimen vouchered as *K. Brock 1025.*

Figure 35. *Veronica plebeia* beneath *Metrosideros polymorpha* in Kōkeʻe. Field photograph of *K. Brock 931.*

Figure 36. Naturalized *Platycerium bifurcatum* (epiphytic fern at center) along the Wai Koa Loop trail near Kīlauea.

Polypodiaceae

Platycerium bifurcatum (Cav.) C. Chr. **New island record**

Platycerium bifurcatum, or staghorn fern, is frequently cultivated as an ornamental. Approximately 35 naturalized plants were observed in moist alien forest on the north side of Kauaʻi, growing as epiphytes on *Casuarina equisetifolia* (Figure 36) and *Leucaena leucocephala*. *Platycerium bifurcatum* has previously been reported as naturalized on Oʻahu, Maui, and Hawaiʻi (Palmer 2003).

Material examined. **KAUAʻI**: Hanalei Distr., south of Princeville, ca. 2.3 km up ʻŌhiki Rd next to Hanalei National Wildlife Refuge, epiphytic on *Leucaena leucocephala* in roadside alien forest and throughout adjacent fields to the south, 10–15 individuals, 22.191330° N, 159.468770° W, 15 m, 18 May 2017, *K. Brock 993* (PTBG, US).

Rosaceae

Prunus persica (L.) Batsch **New island record**

Prunus persica, or peach, is a tree frequently cultivated for its edible fruits. Dozens of naturalized individuals were encountered during 2015–2017 surveys throughout Kōkeʻe along roadsides and hiking trails (Figure 37), where it has apparently spread from cultivated sites near cabins. *Prunus persica* has previously been reported as naturalized on Maui, and is questionably naturalized on Oʻahu and Hawaiʻi (Wagner *et al.* 1990; Oppenheimer 2003).

Figure 37. Naturalized *Prunus persica* in mesic *Acacia koa* (koa) forest.

Material examined. **KAUA‘I**: Waimea Distr., Waimea Canyon State Park, along Hwy 550 near mile 10.5, ca. 0.2 miles past Waimea Canyon lookout, *Acacia koa*-dominated forest with *Lantana*, *Psidium*, and *Myrica*, 20 Apr 1989, *T. Flynn 3339* (PTBG); Waimea Distr., Kōke‘e, Nualolo Trail near *Xylosma crenatum* exclosure, 1,021 m, 24 Jun 2005, *N. Tangalin & S. Perlman 401* (PTBG, US); Waimea Distr., Kōke‘e State Park, in the ditch along Mākaha Ridge Road, about 500 m from intersection with Hwy 550, 22.11307° N, 159.67318° W, 1,020 m, 06 Oct 2017, *K. Brock 1062* (PTBG, BISH, US).

Rosa laevigata Michx. **New island record**

Rosa laevigata, commonly called Cherokee rose, is a climbing shrub that is occasionally cultivated as an ornamental in Hawai‘i. It was first collected from a roadside in Kōke‘e in 1987 from a purposely planted individual, illuminating its cultivation history as an ornamental for highway beautification in this area. Thus, it is difficult to determine which plants in Kōke‘e represent planted versus naturalized individuals, especially since plants can become quite large if not maintained, and appear to spread vegetatively as well as by seed. Nonetheless, we contend that the detection of individuals along Camp 10 Road (in addition to Hwy 550), as well as in disturbed clearings or open forests, indicates that this plant should now be considered naturalized on Kaua‘i (Figure 38). Dense blankets of this plant can be observed climbing over trees, including native species, and throughout the understory of *Eucalyptus* plantations. *Rosa laevigata* has previously been reported as naturalized on O‘ahu, Lāna‘i, and Hawai‘i (Nagata 1995; Parker & Parsons 2012a; Frohlich & Lau 2014).

Figure 38. *Rosa laevigata* along roadside native koa-dominated forest (*Acacia koa*) in Kōkeʻe. Field photograph of *K. Brock 959*.

Material examined. **KAUAʻI**: Waimea Distr., Kōkeʻe State Park, ca. 0.5 miles S of Kōkeʻe Natural History Museum and lodge along Hwy 550, 24 Apr 1987, *D.H. Lorence 5255* (PTBG); Waimea Distr., Kōkeʻe, Camp 10 Rd, past Noe Stream, growing along roadside, clambering up adjacent vegetation, 22.12773° N, 159.64971° W, 1,100 m, 21 Nov 2016, *K. Brock 930* (BISH, PTBG, US); Waimea Distr., Kōkeʻe, Hwy 550, south of Puʻu Hinahina lookout, 22.10801° N, 159.67151° W, 1,070 m, 15 Mar 2017, *K. Brock 959* (PTBG, BISH, US); Waimea Distr., road to Kōkeʻe, collected along roadside, 19 Oct 2007, *C. Trauernicht 219* (BISH, NY, PTBG).

Rutaceae

Flindersia brayleyana F. Muell. **New island record**

Flindersia brayleyana, or Queensland maple, is a large tree growing up to 45 m tall that is cultivated in the tropics as a source of high-value timber (Staples & Herbst 2005). A naturalized population of *F. brayleyana* was observed arising from cultivated trees in Keāhua Arboretum, including more than 70 non-cultivated, mature trees of varying age classes, plus hundreds of saplings (Figures 39–40). The majority of the trees were detected immediately surrounding the arboretum and along Keāhua Stream (which runs through the arboretum), although at least 5 mature trees (and numerous saplings) were also observed over 2 km away from the arboretum alongside other non-native forest species. *Flindersia brayleyana* has previously been reported as naturalized on Maui and Hawaiʻi (Wagner *et al.* 1990; Oppenheimer 2003; Starr *et al.* 2004).

Figure 39. Naturalized *Flindersia brayleyana*, showing multiple age classes.

Figure 40. Naturalized *Flindersia brayleyana* along Keāhua stream, with red arrows showing large flowering trees.

Material examined. **KAUA‘I**: Kawaihau Distr., Wailua, west of Wailua Homesteads at end of Kuamo‘o Rd, about 70 trees of various age classes plus numerous saplings naturalized around Keāhua Arboretum, 22.068863° N, 159.416681° W, 160 m, 22 Mar 2016, *K. Brock 794* (PTBG).

Salicaceae

Dovyalis hebecarpa (Gardner) Warb. **New island record**

Dovyalis hebecarpa, commonly called Ceylon gooseberry, is a spiny shrub or small tree usually cultivated for its sour fruits (Staples & Herbst 2005). Two sites of naturalized plants exist on Kaua‘i: one in northern Kalāheo near the Līhu‘e–Kōloa Forest Reserve (Figures 41–42) and another in nonnative-dominated mesic forest next to a golf course in south-central Kalāheo. This distribution pattern, alongside observations of weediness and frugivory of *D. hebecarpa*, indicate that seeds are likely being dispersed by birds (Staples *et al.* 2000). This plant has previously been reported as naturalized on O‘ahu (Frohlich & Lau 2014) and Hawai‘i (Herbst 1998).

Material examined. **KAUA‘I**: Kōloa Distr., Kalāheo, along upper Pu‘uwai Rd, past junction with Pu‘ulima Rd, ca. 60 m beyond junction, secondary forest with *Eucalyptus*, *Heliocarpus*, *Schinus*, *Pennisetum*, and *Sphagneticola*, 21.942484° N, 159.522034° W, 335 m, 19 Jun 2012, *T. Flynn 7502* (PTBG, BISH, NY, US); Kōloa Distr., Kalāheo, Kukuiolono Golf Course, hillside above Papalina Rd and east of main golf course, non-native forested area with planted and naturalized species of *Eucalyptus* and *Casuarina*, with naturalized *Leucaena, Psidium, Schinus, Aleurites*, and weedy understory, naturalized, one large adult and one juvenile seen locally, 21.917778° N, 159.541944° W, 260 m, 26 May 2020, *D.H. Lorence 10809* (PTBG, BISH); *loc. cit*., in fruit, naturalized locally, many juveniles seen, 25 Jan 2021, *D.H. Lorence 10839* (BISH, PTBG, US).

Figure 41. Naturalized tree of *Dovyalis hebecarpa* (center) growing on hillside in secondary vegetation above Papalina Road in Kalāheo. Photo of *D.H. Lorence 10809*.

Figure 42. Stem with leaves and fruit, *Dovyalis hebecarpa*. Photo of *D.H. Lorence 10809*.

Figure 43. Floating mats of *Salvinia molesta* on the the Kīlauea River. Photo of *K. Brock 709*.

Salviniaceae

Salvinia molesta D. Mitch. **New island record**

Salvinia molesta, commonly known simply as salvinia, is a floating aquatic fern that is cultivated as an ornamental. This plant has naturalized in at least three waterways on Kauaʻi, including Puʻukumu Stream, Kapaʻa Stream, and Kīlauea River. The densest infestation of this plant occurs in Kīlauea River, where it forms a dense, persistent mat along the banks that is often anchored to the shoreline by intertwining *Urochloa mutica* (California grass) that encroaches over open water (Figure 43). Kauaʻi plants were differentiated from similar species within the *S. auriculata* complex, according to keys provided in Forno (1983). *Salvinia molesta* has previously been reported as naturalized on Oʻahu and Hawaiʻi (Palmer 2003; Wilson 2003).

Material examined. **KAUAʻI**: Hanalei Distr., Kīlauea Stream, 1.5 km upstream from beach, growing in slow-moving stream and accumulating most densely along inside edges of meander /bend where water is moving slowest, 22.210865° N, 159.394459° W, 1 m, 09 Sep 2015, *K. Brock 709* (PTBG, BISH); Kawaihau Distr., mouth of Kapaʻa Stream, Keālia Beach, found at margins of estuarine zone at Kapaʻa Stream mouth, close to Kūhiō Hwy overpass, floating in shallow water mixed with water hyacinth and California grass along sandy banks of stream, 22.093889° N, 159.306667° W, 1 m, 09 Sep 2015, *A.M. Williams AMW217* (PTBG).

Figure 44. Naturalized *Citharexylum spinosum* (small tree at right). Field photograph of *K. Brock 1006.*

Verbenaceae

Citharexylum spinosum L. **New island record**

Citharexylum spinosum, or large-leaf fiddlewood, is a shrub or small tree that is cultivated as an ornamental, especially as a street tree. Several naturalized individuals of *C. spinosum,* including individuals of all life stages, have been observed along roadsides near Anahola and in nonnative-dominated ecosystems in an abandoned field near Līhuʻe Airport on Kauaʻi (Figure 44). *Citharexylum spinosum* has previously been reported as naturalized on Oʻahu, Molokaʻi, and Maui (Herbarium Pacificum Staff 1998; Starr *et al.* 2002; Starr *et al.* 2006).

Material examined. **KAUAʻI**: Kawaihau Distr., Anahola, common on sides of Hwy 560 and in pastures, 22.140275° N, 159.308983° W, 40 m, 07 Oct 2007, *N. Tangalin & C. Trauernicht 1604A* (PTBG, BISH, MBK, MO, NY, UC, US); Līhuʻe Distr., Līhuʻe Airport, just south of airport in an abandoned golf course, 21.969720° N, 159.339890° W, 35 m, 01 Jun 2017, *K. Brock 1006* (PTBG, BISH, US).

Zingiberaceae

Alpinia mutica Roxb. **New island record**

Alpinia mutica, also known as small shell ginger or false cardamom, is a large herb that is cultivated as an ornamental (Staples & Herbst 2005). Hundreds of plants were observed in Hāʻena Beach Park on Kauaʻi, spreading along a stream for several hundred meters and into the adjacent nonnative-dominated wet forest (Figure 45). It is unclear where these

Figure 45. *Alpinia mutica* (grass-like herb with red fruits) naturalizing under nonnative forest in Hāʻena State Park. Field photograph of *K. Brock 980.*

plants originated. The naturalized status of this plant on Kauaʻi has been discussed before by Staples and Herbst (2005), who note that it was reported from Hāʻena in 1988, although we were unable to track down herbarium specimens that reflect this date. *Alpinia mutica* has previously been reported as naturalized on Oʻahu (Wagner *et al.*1990).

Material examined. **KAUAʻI**: Hanalei Distr., Hāʻena, along Kūhiō Hwy (560), at intersection with Limahuli Stream, in wet, shady alien-dominated forest, apparently naturalized, many individuals present on both sides of hwy, spreading along stream and into forest understory, 22.22018° N, 159.5763° W, 10 m, 09 May 2017, *K. Brock 980* (BISH, PTBG).

Plants Existing Outside of Cultivation and Possibly Naturalizing

Apocynaceae

Carissa macrocarpa (Eckl.) A. DC.

Carissa macrocarpa, commonly called natal plum, is a spiny shrub native to South Africa that is frequently cultivated as a hedgerow plant in Hawaiʻi, and was found to be present in inventories of multiple nurseries. On Kauaʻi, about 10 large, mature plants were found growing in native/nonnative mixed coastal scrub vegetation (Figure 46). Although numerous fruits were visible on these plants, it is unclear whether these individuals originated from seeds or if they established vegetatively from trimmings discarded from nearby cultivated plants. These non-cultivated plants were detected approximately 10–15 m away from a 6 m tall rock wall that formed the perimeter of a golf course, in which hundreds of

Figure 46. *Carissa macrocarpa* growing in coastal scrub vegetation. Field photograph of *K. Brock 1064.*

plants were being cultivated as a hedgerow. *Carissa macrocarpa* has previously been reported as naturalized on Oʻahu (Lau & Frohlich 2012).

Material examined. **KAUAʻI**: Līhuʻe Distr., Māhāʻulepū Trail next to Poʻipū Bay Golf Course, small, adventive population growing in coastal area, 21.87983° N, 159.42981° W, 1 m, 06 Jul 2017, *K. Brock 1064* (BISH, CAS, PTBG).

Commelinaceae

Dichorisandra thyrsiflora J.C. Mikan

Dichorisandra thyrsiflora, or blue ginger, is native to southeastern Brazil and cultivated throughout tropical regions as an ornamental (Staples & Herbst 2005). This tall herb occurs in multiple colonies off of Kuamoʻo Rd below Keāhua Stream. The area is utilized for unauthorized green waste dumping and could be the source of these introductions. It appears to be spreading slowly and locally by vegetative reproduction, with new shoots evident. It has persisted for >5 years and flowers every summer (*N. Tangalin NT5189*). This species has not previously been reported as naturalized in Hawaiʻi (Imada 2019).

Material examined. **KAUAʻI**: Kawaihau Distr., Wailua, Loop Rd or Steps at Keāhua Arboretum, before bridge and Keāhua Stream on mauka side of road, disturbed wet lowland forest with *Falcataria moluccana, Sphagneticola trilobata, Hibiscus tiliaceus, Ludwigia octovalvis, Hedychium coronarium, Commelina diffusa, Cordyline, Megathyrsus maximus, Clidemia hirta, Rubus rosifolius, Psidium guajava,* 22.071777° N, 159.417657° W, 12 May 2021, *N. Tangalin NT5189* (PTBG); Kawaihau Distr., Wailua Homesteads, on north side of road just before Kuilau

Figure 47. *Costus woodsonii* (erect canes) potentially naturalizing in a wet field near Hanalei. Field photograph of *K. Brock 1047*.

Ridge Trail and Keāhua Arboretum, large clump ca. 30 × 20 ft, plants going up a hillside, 22.07088° N, 159.41592° W, 15 Jul 2021, *N. Tangalin NT5196* (PTBG, BISH, CAS); Kawaihau Distr., before Loop Rd and Keāhua Arboretum, just off of road in hau bushes before Kuilau Trail, patch 25 × 15 ft possibly going down the slope under the hau bush, 22.07134° N, 159.41657° W, 15 Jul 2021, *N. Tangalin NT5197* (PTBG, BISH, UBC).

Costaceae

Costus woodsonii Maas

Costus woodsonii, or scarlet spiral flag, is a tall herb that is cultivated as an ornamental and was occasionally observed for sale during nursery surveys. This species appears to spread locally via rhizomes and canes in wet areas, and has formed colonies in at least four areas on Kauaʻi, including along tributaries to the Wailua River, and in Hanalei, Kīlauea, and Moloaʻa. The colony at Hanalei is the largest (Figure 47), where hundreds of stems occupying at least 1 ha were visible from the roadside. *Costus woodsonii* has previously been reported as naturalized on Oʻahu (Daehler & Baker 2006) and Maui (Oppenheimer 2004).

Material examined. **KAUAʻI**: Hanalei Distr., Hanalei, wet coastal road bank, just W of Hanalei Bay, naturalized along roadside, 17 m, 08 Oct 2007, *C. Trauernicht 186* (PTBG, BISH); Hanalei Distr., Kīlauea, Kuawa Rd, driving toward Guava Kai Plantation, on west side of road, planted and spreading along roadside, 125 m, 08 Jun 2007, *N. Tangalin 1410* (PTBG, US); Hanalei Distr., Hanalei, unnamed road directly south of Waiʻoli River mouth, south of Kūhiō Hwy, naturalized behind cemetery and along roadside, 22.197920° N, 159.507070° W, 10 m, 05 Jul 2017, *K. Brock 1047* (PTBG, BISH, US).

Figure 48. *Sesbania grandiflora* (small tree at center) potentially naturalizing in a fallow agricultural field. Field photograph of *K. Brock 855*.

Fabaceae

Sesbania grandiflora **(**L.) Poir.

The white-flowered form of *Sesbania grandiflora*, also known as sesban, agati, dok khae, or katuray, is cultivated for its edible flowers and leaves. Although this plant appears to be widely cultivated across Kaua‘i, only one location in Kekaha appears to be producing viable offspring that mature into fruiting plants (Figure 48). About twenty non-cultivated individuals were observed scattered throughout an abandoned agricultural field, apparently dispersed by seed from plants being cultivated in a nearby yard. The non-cultivated individuals included both saplings as well as mature flowering and fruiting plants that had dispersed approximately 300 m from the cultivated source plants. We propose that this species be considered as potentially naturalizing rather than fully naturalized on Kaua‘i, as it appeared that all non-cultivated individuals may be the first generation of offspring from cultivated plants, and that more time is needed to determine if these non-cultivated individuals will persist to reproduce and form a self-sustaining population. *Sesbania grandiflora* has not previously been reported as naturalized or questionably naturalized in Hawai‘i, according to Imada (2019).

Material examined. **KAUA‘I**: Waimea Distr., Kekaha, along irrigation ditch near intersection of Akialoa Rd and Kekaha Rd, in overgrown vegetation next to irrigation ditch, about 5 cultivated plants and ca. 20 apparently naturalized individuals visible (both mature and sapling age classes) on both sides of irrigation ditch, 21.975884° N, 159.721143° W, ~0 m, 14 Jun 2017, *K. Brock 855* (PTBG, BISH, US).

Tamarindus indica L.

Tamarindus indica, or tamarind, is a tree that is cultivated for its edible fruit and as an ornamental. Although this plant is widely cultivated on Kaua‘i, individuals planted in dry, leeward areas can produce viable saplings, and approximately 5 mature fruiting plants were observed in a pasture near Waimea. We suggest that *T. indica* be considered as potentially naturalizing rather than fully naturalized on Kaua‘i, as it appeared that all non-cultivated individuals were the first generation of offspring from cultivated plants, and that more time is needed to determine if these non-cultivated individuals will persist to reproduce to form a self-sustaining population. This plant has previously been reported as naturalized on O‘ahu (Lau & Frohlich 2012) and Moloka‘i (Wysong *et al.* 2007).

Material examined. **KAUA‘I**: Waimea Distr., 2 km north of Waimea, growing in pasture next to Menehune Rd, approximately 25 trees (~5 mature/fruiting) visible spreading throughout pasture and along ditch from 3 planted trees along roadside, 21.977250° N, 159.657070° W, 25 m, 05 Dec 2016, *K. Brock 942* (PTBG, BISH).

Geraniaceae

Pelargonium ×domesticum L.H. Bailey

Cultivars within the genus *Pelargonium* have arisen from a long and complex history of hybrid breeding, making plants variable in their morphology and difficult to identify. The plants discussed here were identified as *P. ×domesticum* according to Staples & Herbst (2005), which belongs to the *Pelargonium* “Regal Group” originating from crosses with *P. grandiflorum* Willd. In particular, these plants are distinguishable from *P. ×hybridum* (L.) L’Hér. (syn. *P. ×hortorum* L.H. Bailey) by having toothed leaf margins and larger upper petals with darker stripes when compared to lower petals (Figure 49). Herbarium collections indicate that this plant has been cultivated on Kaua‘i at least since 1988, and recent collections from non-cultivated plants reveal that, although plants appear to be reproducing vegetatively, *P. ×domesticum* is capable of spreading extensively where propagules are introduced. This plant was found in Kōke‘e spreading throughout a field of grass from what looked to be an abandoned cabin site, where it occupied almost one hectare and formed a significant portion of the plant biomass (>50% cover) alongside nonnative grasses (Figure 50). However, due to its detection at only a single site so far and the possibility that it is reproducing only by vegetative reproduction, we propose that this plant be considered to be questionably naturalized or potentially naturalizing until follow-up visits can determine whether this plant is capable of dispersing and persisting. *Pelargonium ×domesticum* has not previously been reported as naturalized or questionably naturalized in Hawai‘i (Imada 2019). However, Wagner *et al.* (1990) mention “species in the genus *Pelargonium*” as “persisting and rarely escaping in such places as dump sites and roadsides in Kōke‘e State Park”, with this report substantiating the inclusion of “*Pelargonium* sp.” as questionably naturalized on Kauai in the most recent checklist (Imada 2019). As only *P. ×domesticum* was found during surveys of every roadside in Kōke‘e, we propose that the *Pelargonium* sp. on the checklist be replaced with *P. ×domesticum*. Although, we acknowledge that other *Pelargonium* species are cultivated in the

Figure 49. *Pelargonium ×domesticum* showing morphological characteristics of the corolla. Field photograph of *K. Brock 1063.*

Figure 50. *Pelargonium ×domesticum* forming dense stands in an open field. Field photograph of *K. Brock 1063*.

Figure 51. *Clerodendrum buchananii* (flowering shrub at center) potentially naturalizing in a treed area. Field photograph of *K. Brock 983*.

area and may naturalize in the future and the possibility that already-naturalized populations of other species may have gone undetected.

Material examined. **KAUA‘I**: Waimea Distr., Kōke‘e State Park, Sloggett Rd at State Enforcement Cabin, cultivated, 28 Jan 1988, *T. Flynn 2731* (PTBG, BISH); Waimea Distr., Kōke‘e State Park, growing at an abandoned cabin site near where Mākaha Ridge Rd meets Hwy 550, spreading, apparently vegetatively, from an abandoned cultivation site through an open field among tall grass, 22.111190° N, 159.673470° W, 1,070 m, 07 Jun 2017, *K. Brock 1063* (PTBG, BISH, US).

Lamiaceae

Clerodendrum speciosissimum Jacob-Makoy

[syn. *C. buchananii* (Roxb.) Walp. var. *fallax* (Lindl.) Bakh.]

Clerodendrum speciosissimum, or red clerodendrum, is a mid-sized shrub that is cultivated as an ornamental, and commonly sold in nurseries on Kaua‘i. Approximately six adult flowering plants were observed along a roadside in Kapa‘a (Figure 51). These plants did not appear to be purposefully cultivated because no gardens or landscaped areas were located in the vicinity, and instead may have dispersed there by seed, as birds likely eat and transport their fleshy fruits. However, we suggest that *C. speciosissimum* be considered as potentially or questionably naturalizing rather than fully naturalized on Kaua‘i, because despite the presence of numerous cultivated plants throughout the island, non-cultivated individuals were only found once. Given that members of the genus *Clerodendrum* are readily propagated from cuttings (Riffle 1998), it is possible that the

Figure 52. *Plectranthus verticillatus* growing vegetatively near Kalāheo in nonnative forest. Field photograph of *K. Brock 804.*

observed plants arose from dumped yard trimmings rather than from seed, as plants were observed <5 m from a roadside where dumping is likely to occur. Unlike vines, which are regularly trimmed and dumped in unauthorized areas on Kauaʻi, it is unclear whether this form of dispersal is sufficient to establish multiple, long-lasting populations. *Clerodendrum speciosissimum* has previously been reported as naturalized on Maui (Starr *et al.* 2006) and Hawaiʻi (Parker & Parsons 2010), and questionably naturalized on Oʻahu (Frohlich & Lau 2007; Wagner *et al.* 2012).

Material examined. **KAUAʻI**: Kawaihau Distr., Kapaʻa, plants sparsely distributed along unnamed road running north of, but parallel to, Kapaʻa Stream in Kapaʻa, six mature plants visible from roadside, 22.103050° N, 159.321050° W, 20 m, 09 May 2017, *K. Brock 983* (PTBG, BISH, US).

Plectranthus verticillatus (L.f.) Druce

Plectranthus verticillatus, or Swedish ivy, is a crawling herb that is cultivated as an ornamental and was observed for sale during nursery surveys. This plant appears to reproduce vegetatively and can spread by this mechanism over large distances. For instance, it has spread over 50 m from where vegetative propagules were apparently dumped in a forest reserve near Kalāheo (Figure 52). Two locations comprising large colonies of plants were observed in Kalāheo, and another smaller colony was observed near Moloaʻa. All locations appear to be arising from cultivated remnants or human-dispersed vegetative propagules. *Plectranthus verticillatus* has previously been reported as naturalized on Oʻahu and Maui (Starr *et al.* 2004).

Figure 53. *Vitex trifolia* (dense shrub, left) colonizing eroded soil next to a highway.

Material examined. **KAUA‘I**: Kōloa Distr., North Kalāheo, in Līhu‘e-Kōloa Forest Reserve, naturalizing under *Araucaria* plantation and through illegal dumping site, 21.943500° N, 159.392578° W, 275 m, 13 Apr 2016, *K. Brock 800* (PTBG, US); Kōloa Distr., Kalāheo, north of Hwy 50 on Wāwae Rd, escaped vegetatively from adjacent yard, 21.943500° N, 159.392578° W, 275 m, 13 Apr 2016, *K. Brock 804* (PTBG).

Vitex trifolia L.

Vitex trifolia, or blue vitex, is a shrub that is commonly sold in nurseries and cultivated as an ornamental on Kaua‘i, especially as a hedgerow plant. The plants referred to here may be identified as *V. trifolia* var. *subtrisecta*, a variety recognized by other authors for having both simple and compound leaves, with the terminal leaf being sessile and lateral leaflets often reduced (Staples & Herbst 2005). However, we follow de Kok’s (2007) treatment of the species here, who proposes that petiole length varies too widely within the species to characterize distinct varieties.

Many instances of this plant have been observed persisting after cultivation and spreading as a dense clump on Kaua‘i, apparently by vegetative reproduction, with some of these occurrences forming large thickets. For instance, one colony near Barking Sands beach occupies an area approximately 30×20 m and has begun to spread into adjacent *Prosopis pallida* (mesquite) forest. Plants near Kapa‘a Beach Park occur in at least three disjunct patches in dry, disturbed soil along approximately 500 m of coastline, perhaps suggesting that it is beginning to naturalize in this area (Figure 53). However, we propose

that this plant be considered questionably or possibly naturalized on Kauaʻi, due to the heavy anthropogenic activities associated with the Kapaʻa bike path nearby. Although these plants were observed growing among non-cultivated vegetation, it is possible that the observed distributional pattern may be due to some mixture of failed, overgrown cultivation sites planted to beautify the bike path, followed by vegetative reproduction rather than multiple generations of offspring forming a self-replacing population. Fruits were observed on vouchered plants, although it is unclear whether viable offspring are produced. More monitoring is needed to determine if this plant will persist as a naturalized component of our flora, or if replacement is dependent on cultivated or once-cultivated plants. *Vitex trifolia* has previously been reported as naturalized on Oʻahu (Lau & Frohlich 2012) and Molokaʻi (Wysong *et al.* 2007).

Material examined. **KAUAʻI**: Kawaihau Distr., Kapaʻa, bike path in Kapaʻa just north of Kapaʻa Beach Park, located between bike path and ocean and between bike path and Hwy 56, apparently naturalized, occurring in 3 dense patches along 500 m of bike path, coastal habitat with mostly alien but some indigenous plants, dry, full sun, adjacent plants appear stunted, presumably from wind and salt spray, 22.085159°N, 159.309433°W, 10 m, 17 Aug 2016, *K. Brock 876* (PTBG, BISH, US).

Meliaceae

Cedrela odorata L.

Cedrela odorata, or West Indian cedar, is a tree commonly cultivated around the world for its valuable wood, and was planted on forest reserves in Hawaiʻi during the early 1900s on all of the main islands (Skolmen 1980). On Kauaʻi, one mature plant was found growing on the edge of a dense alien-dominated forest on private land, and did not appear to be cultivated or a remnant of cultivation. Additionally, more than 10 immature plants, ranging from 1–3 m tall, were observed scattered throughout the area. However, as only one mature tree was detected, it is unclear whether this plant has formed a naturalized population on Kauaʻi. More surveys are needed to search for additional plants. *Cedrela odorata* has previously been reported as naturalized on Maui (Starr *et al.* 2006**)**.

Material examined. **KAUAʻI**: Kawaihau Distr., Wailua Homesteads, on Hindu Monastery land, growing on edge of alien-dominated moist–mesic forest, one mature tree found as well as >10 saplings of different size classes, 22.06260°N, 159.39642°W, 130 m, 29 Nov 2017 *K. Brock 1077* (PTBG, BISH, US).

Oleaceae

Jasminum polyanthum Franch.

Jasminum polyanthum, or pink jasmine, is a woody vine (Figure 54) that is cultivated as an ornamental, although it was not detected during nursery surveys. Three occurrences of this plant were noted on Kauaʻi during 2015–2017 surveys, with the largest patch existing at a cabin site in Kōkeʻe, where it was cultivated by the previous owner of the property and has since become a weed managed by the current owners. The size of this patch covers approximately 0.25 hectares, and appears to have spread mainly by vegetative means. The other two locations are less than 10 × 10 m in area, including one in Kalāheo

Figure 54. *Jasminum polyanthum* climbing trees. Field photograph of *K. Brock 1021*.

that is likely a cultivated remnant that has grown into the alien-dominated forest nearby, and another growing along Camp 10 Road in Kōkeʻe, which may not have originated as a cultivated plant. Due to the small number of sites detected and the likely cultivated history for all but one occurrence, we suggest that this species be considered questionably or possibly naturalizing on Kauaʻi until more data on the persistence of these populations are collected. Searches of the literature have yielded no information on the frequency of seed

set in this species outside of its native range, and thus, follow-up surveys should be conducted to see if long-distance dispersal events by seed can occur. *Jasminum polyanthum* has previously been reported as naturalized on Hawai‘i Island (Imada 2007).

Material examined. **KAUA‘I**: Waimea Distr., Kōke‘e State Park, along Camp 10 Rd, found growing along roadside, climbing up nonnative vegetation, 22.127800° N, 159.649390° W, 1,089 m, 21 Nov 2016, *K. Brock 937* (BISH); Waimea Distr., Kōke‘e State Park, cabins north of Camp Hale Koa, once cultivated but now abandoned and has since spread over 0.25 ha, climbing over once landscaped vegetation and into nonnative forest, 22.107390°N, 159.677430°W, 1,010 m, 23 Jun 2017, *K. Brock 1021* (PTBG, BISH).

Rutaceae

Triphasia trifolia (Burm.f.) P. Wilson

Triphasia trifolia, or limeberry, is a shrub or small tree often cultivated as an ornamental, especially as a hedgerow species or for bonsai (Staples & Herbst 2005). It was first vouchered on Kaua‘i as a cultivated plant in Lāwa‘i Valley in 1989, and approximately 10–12 non-cultivated plants have recently been observed in the same area, apparently dispersed from the cultivated parent plant by seed. *Triphasia trifolia* has previously been reported as naturalized on O‘ahu (Lau & Frohlich 2012).

Material examined. **KAUA‘I**: Kōloa Distr., Lāwa‘i Valley, National Tropical Botanical Garden, Lāwa‘i Kai, in fairly heavy shade, cultivated, 19 Apr 1989. *T. Flynn 3336* (PTBG); *loc. cit*., Allerton Garden (Lāwa‘i Kai), on west side of Lāwa‘i Stream just south of palmetum, growing on cliff along road, in secondary vegetation with *Hibiscus tiliaceus, Leucaena, Rivina, Hylocereus, Lantana, Eugenia uniflora*, establishing locally with individuals of different size classes including seedlings observed, 21.893430° N, 159.503260° W, 28 July 2021, *D.H Lorence 10864* (BISH, US, NY, MO).

Scrophulariaceae

Buddleja paniculata Wall.

Buddleja paniculata, or butterfly bush, is a large, woody shrub that is cultivated as an ornamental (Staples & Herbst 2005). It was first vouchered as a cultivated plant in Kōke‘e, Kaua‘i in 1999, although recent surveys indicate that this plant is spreading in this area. Non-cultivated plants were noted during 2015–2017 surveys of Waineki Swamp, Kōke‘e, where it has formed a few large, impenetrable clumps (Figure 55). No seeds have been observed, and the plants appeared to be spreading vegetatively, although it is unclear how it was initially dispersed to Waineki Swamp. Two scenarios seem likely: that seeds were dispersed from nearby cultivated plants in private yards, or that propagules were introduced as improperly disposed yard cuttings. Given that this plant has only been detected outside of cultivation in a small area so far, we propose that this species be considered questionably or potentially naturalized until more surveys are conducted to determine if it will spread and persist. *Buddleja paniculata* has not previously been reported as naturalized in Hawai‘i (Imada 2019).

Material examined. **KAUA‘I**: Waimea Distr., Kōke‘e State Park, by Camp Sloggett just S of Mōhihi Rd, planted ornamental tree and shrub species surrounded by *Acacia koa* mesic forest, 991 m, 27 Mar 1999, *D.H. Lorence 8402* (PTBG, BISH, HAST, MO, US, NY); Waimea Distr., Kōke‘e,

Figure 55. *Buddleja paniculata* (silver shrub at middle) establishing in Waineki Swamp.

along Camp 10 Rd, Waineki Swamp, does not appear to be cultivated, growing along roadside and spreading to lowest-lying area of swamp, 22.125849° N, 159.652160° W, 21 Nov 2016, *K. Brock 923* (PTBG, BISH, UC, US).

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Recent notable plant records and rediscoveries from Kauaʻi, Hawaiian Islands

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We report the rediscovery of two species previously thought extinct, having no known individuals in the wild, namely *Adenophorus periens* (Polypodiaceae) and *Hibiscadelphus woodii* (Malvaceae). Other notable plant finds on Kauaʻi include *Gouania meyenii* (Rhamnaceae), still extant on Oʻahu and rediscovered on Kauaʻi; *Isodendrion pyrifolium* (Violaceae), a new island record for Kauaʻi; and *Silene lanceolata* (Caryophyllaceae), still extant on Oʻahu, Molokaʻi, and Hawaiʻi, but not seen on Kauaʻi since 1840. Some of these records and rediscoveries were made possible by utilizing drone technology. This new method has proven to be valuable in botanical survey and discovery, especially in cliff habitats. The drone we have deployed collects high-resolution photos, which we have found effective for plant identification, population inventory, and, most recently, remote plant collection (La Vigne *et. al.* 2022). Drones equipped with a stabilized cutting mechanism have already had a great impact, with successful conservation collections of many critically endangered plant species on Kauaʻi. With plant extinctions quickly accelerating, it will be important to enhance funding for the further development of these efficient and effective new tools.

Caryophyllaceae

Silene lanceolata A. Gray **Island rediscovery**

Previously known from Kauaʻi, Oʻahu, Molokaʻi Lānaʻi, and Hawaiʻi, *Silene lanceolata* was thought to have gone extinct on Lānaʻi and Kauaʻi. First described by Asa Gray in ca. 1854 from material collected on Kauaʻi in ca.1840, it had not been documented on Kauaʻi until its rediscovery in 2022. While surveying dry-mesic cliff habitat above Koaiʻe Canyon in the interior of Kauaʻi, rappelling techniques were used to access more vertical sections of cliff that invasive ungulates cannot reach and where diverse native vegetation communities remain. On initial discovery, five individuals of *S. lanceolata* were observed, and a cutting was collected from one individual to be grown *ex situ* (Figure 1). On a subsequent survey additional individuals were located, bringing the total to seven mature and ten immature plants in this population, and seed was collected for *ex situ* storage from one individual. While these plants were discovered without the use of drone technology, other

rare plant species in the area were found with drones, and these initial drone discoveries prompted additional targeted exploration via rappel. Nearby vertical cliff bands with native-dominated vegetation should be surveyed for additional individuals, and seed collections should be made from additional plants for *ex situ* storage and restoration. *Silene lanceolata* is still considered extinct on Lānaʻi and has not been documented there since 1930.

Material examined. **LĀNAʻI**: Maunalei Valley, 244 m, 05 Aug 1930, *G.C. Munro 943* (BISH). **KAUAʻI**: ca. 1840, *Wilkes Expedition s.n.* (GH 37956); Cliffs above Koaiʻe, Nā Pali-Kona Forest Reserve, 1,030 m, 29 Apr 2022, *S. Deans, S. Heintzman & A. Williams KP04292206* (PTBG).

Malvaceae

Hibiscadelphus woodii Lorence & W.L. Wagner **Rediscovery**

Hibiscadelphus woodii is a Kauaʻi single-island endemic flowering plant discovered in 1991 (Wood 1992; Lorence & Wagner 1995) and was known from only four individuals on the steep cliffs below Puʻu o Kila, Kalalau. The species was noted as extinct in 2011 when the last individual was found deceased (Wood 2012). Drone surveys were conducted in early 2019 with the intent of relocating the species and were successful in documenting three individuals of *H. woodii* (Figure 1). The location of the new population is on an extremely remote vertical cliff with no safe location above for utilizing rope rappelling techniques for access. Plans are to use drone technology to monitor for flowers and fruit and attempt conservation collections.

Material examined. **KAUAʻI**: Hanalei Distr., Kalalau rim, north of Kahuamaʻa Flat, lowland mesic cliffs, 990–1,020 m, 03 Mar 1991, *K.R. Wood, M. Query & S. Montgomery 629* (holotype, PTBG, a flower also in spirit collection; isotypes, BISH, K, Mo, NY, US).

Polypodiaceae

Adenophorus periens L.E. Bishop **Rediscovery**

A rare but broadly distributed epiphytic fern historically known from all the major islands, *Adenophorus periens* had been declining precipitously across the Hawaiian Islands for several decades. The last known plant perished in the Kahaualeʻa Natural Area Reserve on Hawaiʻi Island in 2016, and attempts at *ex situ* propagation of this delicate pendant species failed, leading to fears it may have gone extinct. Extensive surveys of its former habitat across all the main islands had failed to turn up new populations until, in the summer of 2021, a single individual in a remote valley of North Kauaʻi was rediscovered, not far from one of its historic occurrences. Subsequent surveys have now led to the discovery of additional small, remote populations around northern and eastern Kauaʻi. Sixteen individuals in five populations are currently being monitored for reproductive material, and attempts are underway to cultivate this rare species and establish *ex situ* living collections. Previously known to be epiphytic predominantly on native ʻōhiʻa (*Metrosideros polymorpha*) and hame (*Antidesma platyphyllum*) trees, most of the latest discoveries have been on other native tree species: ʻohe mauka (*Polyscias oahuensis*), kōpiko (*Psychotria* sp.), and one occurrence on hame, but none on ʻōhiʻa. The reasons for its rarity remain unknown.

Material examined. **KAUAʻI**: Waiʻoli Valley, E of main falls below steep cliffs, 487 m, 31 May 2021 (Figure 2); ʻIole headwaters, 975 m, 20 Oct 2021 (Figure 2); Hanalei, in side drainage just south of Kaʻāpoko, 725 m, 16 Aug 2021 (Figure 3); Wahiawa, below Kapalaoa in bottom of drainage, 741 m, 07 Apr 2022 (Figure 3); Hanalei, E side of Nāmolokama, 640 m, 13 May 2022 (Figure 3).

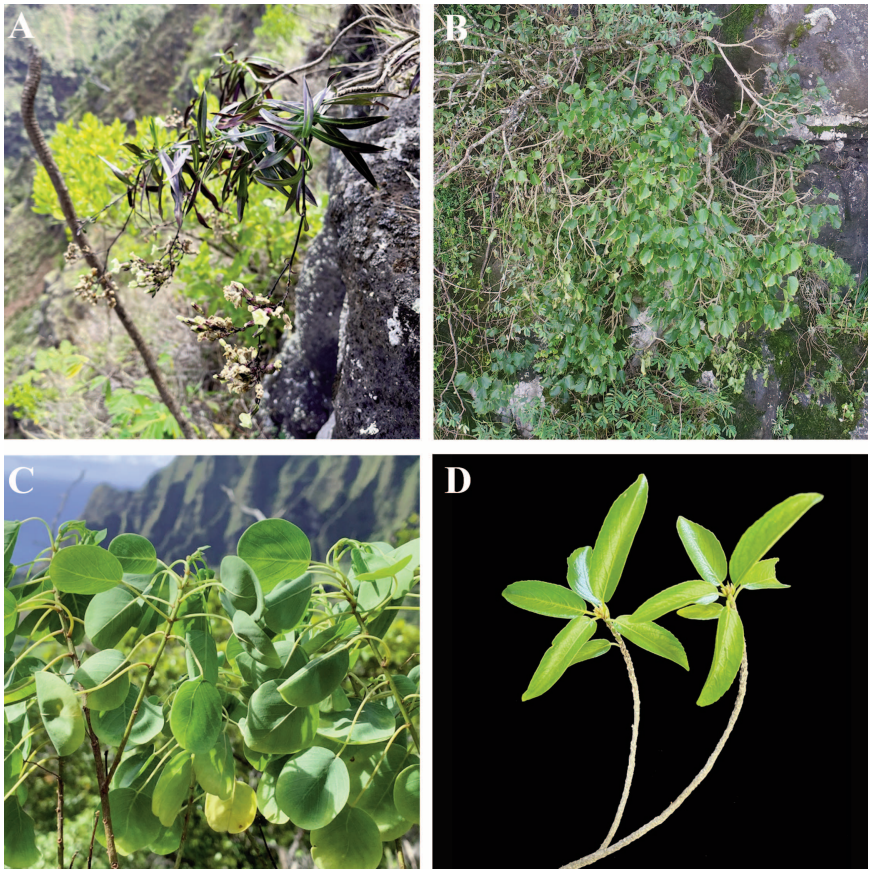

Figure 1. **A**, *Silene lanceolata*, Koaiʻe, Kauaʻi, Hawaiʻi. **B**, *Hibiscadelphus woodii*, Kalalau, Kauaʻi, Hawaiʻi. **C,** *Gouania meyenii*, Kalalau, Kauaʻi, Hawaiʻi. **D**, *Isodendron pyrifolium*, Waiahulu, Kauaʻi, Hawaiʻi.

Rhamnaceae

Gouania meyenii Steud. **Island rediscovery**

Gouania meyenii was discovered on Kauaʻi in 1991 and reported as a new island record by Lorence & Flynn (1995), after previously being considered a single-island endemic on Oʻahu. The Kauaʻi population was known from ca. 20 individuals restricted to two remote cliff locations in Kalalau and a single individual in Hipalau, a small valley within the Koaiʻe Canyon region of central Kauaʻi. Plants were last observed in 1994 and concerted efforts to relocate these individuals were unsuccessful. A previously unrecorded grouping of ca. 12 plants were rediscovered in 2020 by drone survey in Kalalau Valley, below Puʻu o Kila (Figure 1), and conservation collections have now been successful.

Material examined. **KAUAʻI**: Hanalei Distr., Kalalau rim, Kalāhū side below and W of first Kalalau lookout, 790 m, 20 Nov 1991, *K.R. Wood 1393* (BISH, PTBG); *loc. cit*., 22 Nov 1991, *K.R.*

Figure 2. *Adenophorus periens*. A, Waiʻoli, Kauaʻi, Hawaiʻi. B, ʻIole, Kauaʻi, Hawaiʻi.

Wood 1424 (BISH, PTBG, US); *loc. cit*., 13 Mar 1992, *K.R. Wood & S. Perlman 1707* (PTBG), *1708* (PTBG, US); *loc. cit*., 02 Aug 1994, *K.R. Wood & S. Perlman 3383* (NY, PTBG, US); *loc. cit*., 14 Oct 1994, *K.R. Wood 3637* (BISH, NY, PTBG, US); Kalalau Valley, back of valley on cliffs below Puʻu o Kila, 725 m (2,380 ft), 10 Jun 1992, *S. Perlman, T. Flynn & K.R. Wood 12805* (PTBG, US); Waimea Distr., Waimea Canyon drainage, Koaiʻe Canyon, at back of Hipalau Valley, on north-facing cliff, 21 Oct 1992, *S. Perlman & K.R. Wood 13060* (PTBG, US); Kalalau, valley cliffs and slopes below Puʻu o Kila, 620 m, 18 Aug 2020, *K.R. Wood, B. Nyberg & S. Heintzman 18514* (BISH, PTBG); *loc. cit.* 16 Jul 2021, *K.R. Wood, S. Heintzman & S. Deans 18778* (PTBG).

Violaceae

Isodendrion pyrifolium A. Gray **New island record**

Once widely distributed across the archipelago, collections of *Isodendrion pyrifolium* were made on Niʻihau, Oʻahu, Lānaʻi, Molokaʻi, and Hawaiʻi, and reported by Hillebrand from Maui (Wagner *et al.* 1999). This species was thought to be extinct for nearly 120

Figure 3. *Adenophorus periens*. **A**, Nāmolokama, Kauaʻi, Hawaiʻi. **B**, Wahiawa, Kauai, Hawaiʻi. **C**, Kaʻāpoko, Kauaʻi, Hawaiʻi.

years until it was rediscovered on Hawaiʻi Island in 1991. More recently, a population was found on Oʻahu in mid-2016 with 60 individuals. Here we report the discovery of *I. pyrifolium* on Kauaʻi, in the Waiahulu region of Waimea Canyon (Figure 1). The population, which we estimate to number around 10 individuals, was discovered via drone survey, and our specimen was also collected by drone. Material was brought to the NTBG horticultural center as cuttings (which subsequently flowered on the mist bench), and a vegetative specimen was vouchered.

Material examined. **HAWAIʻI**: North Kona, Land of Kealakehe, 73 m, 14 Jul 1991, *K. Nagata 4215* (BISH); *loc. cit.*, 91 m, 21 Jul 1992, *S. Perlman 12897* (PTBG). **KAUAʻI**: Waiahulu, Waimea Canyon, Puʻu Ka Pele Forest Reserve, 671 m, 24 Mar 2022, *B. Nyberg et al. BN014* (PTBG). **LĀNAʻI**: Jul 1870, *W. Hillebrand & J.M. Lydgate s.n.* (holotype, BISH 72088). **NIʻIHAU**: Voyage de M.J. Rémy, 1851, *M.J. Remy 534* (BISH, PTBG). **Oʻ AHU**: 1838, *Wilkes Expedition s.n.* (GH 67059, US 7693); Waiʻanae Kai, 660 m, 11 Jul 2016, *A. Loomis et al. OA-WAI-A-0001* (BISH).

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A curious new species of Hawaiian *Campsicnemus* with modified hind legs (Diptera: Dolichopodidae)[1]

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Abstract. A new species of endemic Hawaiian *Campsicnemus*, *C. anfractus*, **n**. **sp**., from the Big Island of Hawai'i is described and illustrated. It is the only species in Hawai'i with modified hind tibiae.

The genus *Campsicnemus* Haliday in Hawai'i is currently known from 187 species (all endemic) and distributed on all the main islands (Evenhuis, unpubl.). Recent collecting on the Kona side of the Island of Hawai'i recovered an unusual specimen with modified hind legs. Most Hawaiian and French Polynesian species of the genus have the midlegs modified with a few also having the hind femur modified. However, no known species have the most distinctive modifications on the hind tibia. The species, *Campsicnemus anfractus*, **n**. **sp**. is described and illustrated below. The new species does not fit into any of the species groups that have been found in Hawai'i or French Polynesia (which are based primarily on mid-leg modifications) (cf. Evenhuis 2008, 2009, 2012, 2013, 2016; Goodman *et al*. 2014), thus it is here treated as *incertae sedis* within the Hawaiian *Campsicnemus*.

MATERIAL AND METHODS

Material derives from Malaise trap collecting conducted in the Papa area of South Kona on the Island of Hawai'i. The holotype is deposited in the Bishop Museum (BPBM). Photographic images were accomplished by obtaining a series of stacked images using a Leica M165C stereo dissecting scope via the Leica Microsystems LASX Multifocus software (v. 3.0.14.23224) and using Zerene Stacker® stacked focusing software (v. 1.04) (Zerene Systems, LLC, Richmond, Washington, USA) to align and stack-focus each final image.

Morphological terminology, description format, and abbreviations used in the description follow Evenhuis (2012).

TAXONOMY

Campsicnemus Haliday

Campsicnemus Haliday *in* Walker, 1851: 187. Type species: *Dolichopus scambus* Fallén, 1823, by validation of I.C.Z.N., 1958: 351. *Nomen protectum* (see Evenhuis, 2003: 3).

Campsicnemus anfractus Evenhuis, **new species**

(Figs. 1–6)

Type. Holotype male (BPBM ENT 0000081261) from Hawaiian Islands: **Hawai'i**: Pāpā mid road, 1,230 m, 19.2118°N, 155.8169°W, 4 Aug 2022, K.N. Magnacca, Townes Malaise trap, H22080401-102. holotype in BPBM.

1. Contribution No. 2023-001 to the Hawaii Biological Survey.

Figure 1. *Campsicnemus anfractus*, n. sp., male, habitus, lateral.

Diagnosis. Easily separated from the congeners in Hawai‘i by the strongly sinuate hind tibia (other species in Hawai‘i do not have this modification on the hind tibia).

Description. **Male** (Fig. 1). Body length: 2.5 mm. Wing length: 2.8 mm.

Head (Fig. 2). Black; oc and vt black, about one-half length of antennal arista; frons black with silvery tomentum laterally, tomentum extending almost to middle; face constricted at middle, eyes holoptic, contiguous below antennae for length of 6 ommatidia; palp small, white; proboscis pale brown, extending below eye in lateral view; antennal segments white; postpedicel linear-lanceolate, length about 3× greatest width; arista slightly longer than head height, basally pale yellow, brown distally.

Figures 2–3. *Campsicnemus anfractus*, n. sp. **2,** Head, frontal. **3**, Thorax, dorsal.

Thorax (Fig. 3). Dorsum of mesoscutum, scutellum, and mediotergite shiny; mesoscutum yellow with brown on posterior half, broadly extending anteriorly along line of dc; scutellum dark brown; mediotergite pale brown; pleura white except anatergite black; thoracic setae long, strong, black: 3 dc; 2 np; 2 ph; 1 pa; 1+1 sc; 5 ac ; halter stem and knob pale yellowish white.

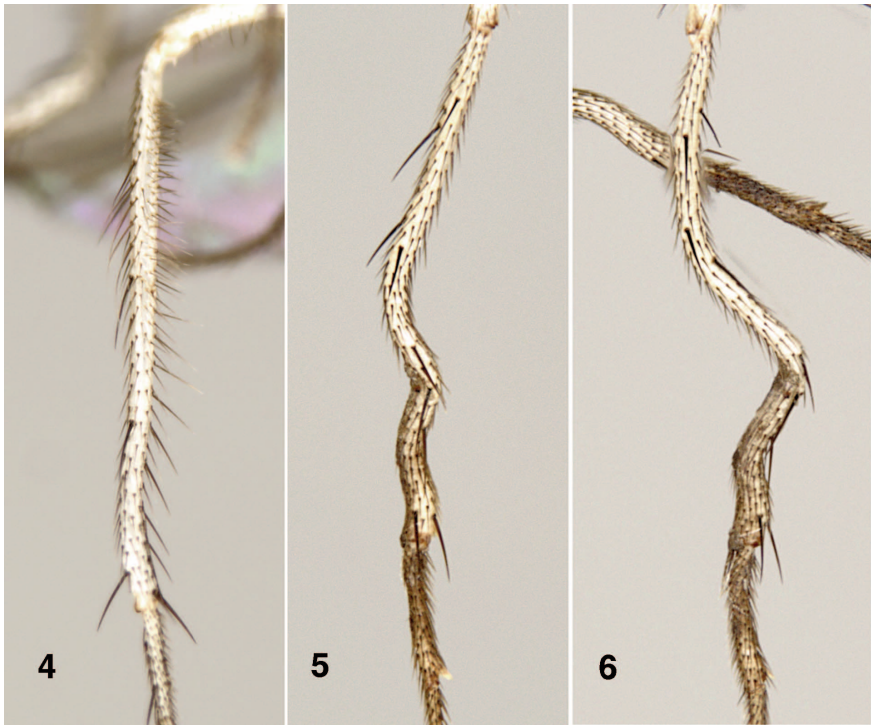
Legs. Yellowish white, except tarsi 3–5 brown; CI with two pale yellow setae apically, numerous smaller curved stiff white setae apically; foreleg unmodified, without MSSC; TiII (Fig. 4) slightly sinuous, with rows of fine black hairs anteriorly and laterally, lateral row short basally, becoming longer toward apex, anterior row with longest and thickest on subbasal third, short and finer elsewhere on that row; 3 strong long black setae on anterior row. $IIt_{1–5}$ unmodified; TiIII (Figs. 5–6) strongly contorted on apical three-fifths, with short hairs in irregular rows, 7 strong black setae along anterior and lateral surfaces, 2 strong black apical setae; remainder of legs without MSSC.

Wing: pale smoky throughout.

Abdomen. Tergites black dorsally, white laterally, with short stiff curved black hairs dorsally on each tergite, uniformly distributed, a few longer hairs laterally, lateral hairs longest on tergite I; sternites white. Hypopygium yellowish white, not dissected.

Etymology. The specific name derives from the Latin, *anfractus* = bending, winding, crooked; referring to the distortion of the hind tibia.

Remarks. Although the phylogenetic study of Hawaiian and Pacific *Campsicnemus* by Goodman *et al*. (2014) analyzed molecularly most major species groups, only two species groups in Hawai‘i have been defined and formally named (e.g., the *fumipennis* group (Evenhuis 2012) and the *ridiculus* group (Evenhuis 2016). Many more groups are known but have not yet been formally named. Seven species groups have thus far been found in French Polynesia [see Evenhuis (2013) for a key to all French Polynesian groups]. A com-



Figures 4–6. *Campsicnemus anfractus*, n. sp., tibiae. **4**, Mid tibia. **5**, Hind tibia, lateral view. **6**, Hind tibiae, anterior view.

parison of *C. anfractus* with all the species in Hawai‘i and French Polynesia has failed to find a species group to which *C. anfractus* belongs. It has a mid tibia that is most similar in appearance to *Campsicnemus hardy* Tenorio and also *C. flexuosus* Hardy & Kohn, but does not have other characters that would place it is the groups to which each of those species belong; and no species yet have been found that have the hind tibia with such strongly sinuate modifications to its shape. Molecular analysis of additional specimens of *C. anfractus* will need to be done to properly assess its placement within the genus. Until then, it is treated as *incertae sedis* within the Pacific clade of *Campsicnemus* species.

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New records of introduced Lepidoptera in the Hawaiian Islands for the year 2022

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Seven new state records and eighteen new island records are reported for introduced Lepidoptera in Hawai'i. Two new species-level identifications, one new correction to a previous identification, and five name changes are noted. Corrections and additions to the lists in Austin & Rubinoff (2022) are provided.

Information regarding the formerly published distributions in Hawai'i of species discussed herein is based on Nishida (2002), Starr *et al*. (2004), Howarth *et al.* (2012), and Austin & Rubinoff (2022). Identifications were made by the first author except where otherwise noted. Label data was transcribed verbatim except for corrections to Hawaiian spelling and orthography. Any other corrections to data labels are provided in brackets following the verbatim label. Atypical coordinates are presented verbatim but more conventional coordinates are provided in brackets. Identifications were based on external morphology, genitalia dissections, and cytochrome oxidase I sequence data (COI barcode; GenBank accession numbers provided). COI sequence data, including data from Austin & Rubinoff (2022), is available as a BOLD dataset (DOI: https://dx.doi.org/10.5883/DS-IHLCR). Specimens were compared with illustrations and figures in the published literature as well as through comparisons with material deposited at the Bernice Pauahi Bishop Museum (BPBM), Hawaii Department of Agriculture (HDOA), and the University of Hawai'i Insect Museum, University of Hawai'i at Mānoa (UHIM). Voucher specimens and other examined material are deposited in these collections as noted.

Blastobasidae

Blastobasis inana (Butler) **New island record**

This species was previously reported from Hawai'i Island, Lāna'i, and O'ahu by Nishida (2002) and Kaua'i by Austin & Rubinoff (2022). We report it from Maui for the first time.

Material examined. **Maui:** 1♀, Makawao F[orest] R[eserve], lower Māliko Gulch, top of cliff, 20.8400, -156.2761, 715 m, 25–25 Oct 2022, K.A. Austin, UV bucket trap (UHIM).

***Pigritia* sp. A** **New state record**

This is the second species of *Pigritia* known from Hawai'i. A 658-bp fragment of COI (GenBank Accession #OQ174441) does not match any sequenced species. All described species of *Pigritia* are known from the Americas, except for *Pigritia uuku* Adamski, 2012, only known from Kaho'olawe (Medeiros & Adamski 2012), but considered questionably native by Austin & Rubinoff (2022). We consider *Pigritia* sp. A introduced.

Material examined. **O'ahu:** 1♀, Honolulu, 2620A Nahaku Place, 21.2869, -157.8197, 19 Jan 2022, K.A. Austin, at porch light / DNA extraction KA0456 / KAA diss[ection] #0713 (UHIM).

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Crambidae

Paraponyx fluctuosalis (Meyrick) **New island record**

This species was previously recorded from Kauaʻi, Oʻahu, and Maui (Nishida 2002). We report it from Hawaiʻi Island for the first time.

Material examined. **Hawaiʻi:** 2♀♀, S[outh] Hilo, Onomea, 3,000 ft [914 m], koa, 13 Jan 2002, S.L. Montgomery, MV light (BPBM).

Dryadaulidae

Dryadaula advena (Zimmerman) **New island records**

Zimmerman (1978) treated this species as introduced and until now was only known from Oʻahu. We report it from Kauaʻi and Maui for the first time. It has not been reported from outside of Hawaiʻi.

Material examined. **Kauaʻi:** 1♀, Haleleʻa F[orest] R[eserve], Upper Hanalei Valley, along Hanalei River, 265 m, 22.1018, -159.4647, 26–27 May 2022, K.A. Austin, J.B. Reil, UVLED light sheet (UHIM). **Maui:** Makawao Forest Res[erve], Site 5, NAD83 04Q 784191 2306032 [20.83261, -156.269334], 945 m, 23–24 Mar 2005, W. Haines, UV light trap (BPBM).

Euteliidae

Penicillaria jocosatrix Guenée **New island record**

This species was previously recorded from Kauaʻi, Oʻahu, Maui, Lānaʻi, and Hawaiʻi Island (Nishida 2002). We report it from Molokaʻi for the first time.

Material examined. **Molokaʻi:** 1♂, Puʻu Kolekole, Sep 1996, M. Heddle, S. Loo (BPBM).

Geometridae

Chloroclystis pyrrholopha Turner **Name change & new island record**

This species was first reported in Hawaiʻi as *Chloroclystis* sp. A by Austin & Rubinoff (2022). A 658-bp fragment of COI sequenced from an Oʻahu specimen (GenBank Accession #OQ174430) is a 99.4% pairwise distance match to *Chloroclystis pyrrholopha* Turner (GenBank Accession #JN273935.1), a species native to Queensland, Australia. We report it from Kauaʻi for the first time.

Material examined. **Kauaʻi:** 1♂, Kōkeʻe State Park, Awaʻawapuhi Trail, 22.1468, -159.6605, 1110 m, 21–22 Mar 2022, K.A. Austin, LED bucket trap (UHIM).

Pleuroprucha asthenaria (Walker) **Name change**

This species was first reported in Hawaiʻi as Geometridae "undetermined genus sp. A" by Matsunaga *et al*. (2019). Austin & Rubinoff (2022) identified it as *Pleuroprucha* sp. A. A 658-bp fragment of COI of an Oʻahu specimen (GenBank Accession #OQ174442) is a 99.7% pairwise distance match to *Pleuroprucha asthenaria* (Walker) (GenBank Accession #JQ571256.1). It is known from Kauaʻi, Oʻahu, and Maui (Austin & Rubinoff 2022). Its native range includes the southern United States, Central America, South America, and the Caribbean.

Heliodinidae

Aetole prenticei Hsu **New state record**

This represents the first record of Heliodinidae in Hawaiʻi; Frank Hsu confirmed our identification. Nishida (2002) listed the purposely introduced *Rubus* biocontrol *Schreckensteinia festaliella* in Heliodinidae, but it is currently placed in its own family

and superfamily (see Austin & Rubinoff 2022). *Aetola prenticei* belongs to the *bella* group of species, all of which develop as leaf miners or in cecidomyiid galls on Portulaceae and Aizoaceae (Hsu & Powell, 2004). *Aetola prenticei* is a specialist on *Sesuvium verrucosum* Raf. (Aizoaceae), which is naturalized on Oʻahu, Molokaʻi, Maui (Imada 2019), and possibly Kauaʻi (KISC 2018). Larvae could also potentially utilize the indigenous *Sesuvium portulacastrum* (L.) L. *Aetole prenticei* is known to natively occur in California, Arizona, and New Mexico (Hsu & Powell 2004).

Material examined. **Oʻahu:** 1♂, 1♀, Barbers Point, 5 ft [1.5 m], 30 Jan 1994, W.D. Perreira / collected sweeping beach *Portulaca* (BPBM).

Lycaenidae

Brephidium exilis (Boisduval) **New island record**

This species was previously known from Kauaʻi, Oʻahu, Maui, and Kahoʻolawe (Nishida 2002; Starr *et al.* 2004; Howarth *et al.* 2012). We report it from Lānaʻi for the first time. It likely occurs on all of the main Hawaiian Islands.

Material examined. **Lānaʻi:** 2♂♂, 1♀, Kalakala, 17 Aug 1998, G.M. Nishida (BPBM).

Noctuidae

Argyrogramma verruca (Fabricius) **New island record**

This species was first reported in Hawaiʻi from Oʻahu and Hawaiʻi Island by Austin & Rubinoff (2022). We report it here from Maui for the first time.

Material examined. **Maui:** 1♂, Makawao Forest Res[erve], 945 m, Site 5, UV light trap, 23–24 Mar 2005, W. Haines, NAD83 784191 2306032 [20.832610, -156.269334] (BPBM).

Nymphalidae

Agraulis incarnata (Riley) **Name change**

Agraulis vanillae (Linnaeus) has recently been recognized as a species complex distributed throughout the Neotropics and adjacent temperate regions (Zhang *et al.* 2020; Núñez *et al.* 2022). Based on the keys and figures in Núñez *et al*. (2022), the taxon present in Hawaiʻi is *Agraulis incarnata* (Riley), which is widely distributed in the southern United States and Central America. True *A. vanillae* is restricted to Panama, northern South America, and parts of the Lesser Antilles (Núñez *et al*. 2022).

Plutellidae

Plutella xylostella (Linnaeus) **New island record**

This global pest of cruciferous crops was previously reported from all of the main Hawaiian Islands except for Niʻihau and Kahoʻolawe as well Kure, Midway, Pearl & Hermes, and Laysan by Nishida (2002). We report it from Kahoʻolawe for the first time.

Material examined. **Kahoʻolawe:** 1♀, Moaulanui, 3 Mar 2013 (UHIM). 1♀, Puʻu Moaulanui, 7 Mar 2013 (UHIM).

Pterophoridae

Diacrotricha fasciola (Zeller) **New state record**

Larvae of this species were found attacking young leaves and growing tips of starfruit (*Averrhoa carambola* L., Oxalidaceae) at a University of Hawaiʻi at Hilo greenhouse as well as trees outside the greenhouse. Material was sent to Mike Melzer (UHM-CTAHR) for COI barcoding and M. Alma Solis (USDA-SEL) for morphological examination. Both confirmed the identification.

Material examined. **Hawai‘i:** 8 specimens, sex undetermined, Hilo, UH Hilo Farm, 19.652107, -155.049920, 20 Jan 2022, ex. *Averrhoa carambola* growing tips, S. Chun / #2022-020 (HDOA).

Hellinsia beneficus (Yano & Heppner) **Name change & new island record**

This species was first released in Hawai‘i in 1973 for control of *Ageratina riparia* (Regel) R.M.King & H.Rob. (Asteraceae) and is listed as present on O‘ahu, Maui, and Hawai‘i Island (Nishida 2002). Originally described in *Oidaematophorus* Wallengren, this species was listed as *Leioptilus beneficus* (Yano & Heppner) in Nishida (2002). Gielis (2011) treated it as *Hellinsia beneficus*, which was overlooked by Austin & Rubinoff (2022). We report it from Kaua‘i for the first time but can find no records of deliberate releases on that island.

Material examined. **Kaua‘i:** 1♂, Halele‘a F[orest] R[eserve], Upper Hanalei Valley, along Hanalei River, 265 m, 22.1018, -159.4647, 26–27 May 2022, K.A. Austin, J.B. Reil, UVLED light sheet (UHIM).

Lioptilodes albistriolatus (Zeller) **Name change**

This species was preliminarily identified as *Lioptilodes* cf. *parvus* by Howarth *et al*. (2012). *Lioptilodes parvus* (Walsingham) was treated as a synonym of *Lioptilodes albistriolatus* (Zeller) by Gielis (2011). We provisionally agree with the identification of Howarth *et al*. (2012) but correct the name to reflect the current accepted taxonomy.

Oecophoridae

“*Leptocroca*” sp. A **New state record**

This species was commonly netted during the day by the authors around the Hosmer Grove Campground parking lot and along the initial portions of the trail leading to the Waikamoi Preserve flying low along the ground and even landing on vehicles. Male genitalia closely resemble some New Zealand species of *Leptocroca sensu* Philpott 1926 such as *Leptocroca vacua* Philpott. Common (2000) wrote that the New Zealand species currently placed in *Leptocroca* likely “belong to another, probably undescribed, genus of the *Barea* group.” According to Common (2000), “the larvae of the great majority of the *Barea* group feed on dead leaf litter from trees belonging to the family Myrtaceae, especially *Eucalyptus*.” Hosmer Grove contains large swaths of *Eucalyptus* that were planted in the early 20th century as part of experimental forestry plots. It is unclear if these moths were introduced at the time of importation and planting of these *Eucalyptus* trees or were accidentally introduced at a later date.

Material examined. **Maui:** 1♂, 7♀♀, Haleakalā N[ational] P[ark], Hosmer Grove parking lot, 20.7683, -156.2381, 2041 m, 3–5 Jun 2022, K.A. Austin, D. Rubinoff, hand collecting (UHIM). 1♂, 3♀♀, Haleakalā N[ational] P[ark], trail to T[he] N[ature] C[onservancy] Waikamoi Preserve boardwalk, 20.7744, -156.2338, 1967 m, 3–5 Jun 2022, K.A. Austin, D. Rubinoff, hand collecting / DNA extraction KA0716 / KAA diss[ection] #0947 (♂) (UHIM).

Pyralidae

Assara albicostalis Walker **New island record**

This species was first reported in Hawai‘i from O‘ahu from specimens identified by Dr. Klaus Sattler (Howarth & Sattler 1982). However, specimens more closely resemble *A. seminivale* (Turner), the macadamia kernel grub, a significant pest of macadamia in Australia and also found elsewhere in the Pacific. Dissection of male and female genitalia revealed subtle differences to those illustrated in Horak (1994), primarily in the shape of the sclerite on the male eighth sternite; a species-level identification may require DNA.

Because the species present in Hawai‘i is currently known as *A. albicostalis*, we use this name for the present, but suggest that this identification may need to be examined more carefully. We report it from Hawai‘i Island for the first time.

Material examined. **Hawai‘i:** 8♂♂, 14♀♀**,** Kainaliu, UH Exp[erimen]t[al] Station, 12 Apr [19]90, ex. macadamia husk, L. Caprio (UHIM). 1♂, 1♀, same as previous except 22 May 1990 / ex. macadamia sticklight (UHIM).

Cryptoblabes adoceta Turner **Correction & new island record**

A 658-bp fragment of COI of an O‘ahu specimen (GenBank Accession #OQ174432) is a 99.8% pairwise distance match to the Australian species *Cryptoblabes adoceta* Turner (GenBank Accession #KF396907.1), commonly known as the sorghum head moth, and only a 93.0% match to the Palearctic but widely introduced species *C. gnidiella* (Millière) (GenBank Accession #MG895658.1). The same specimen (a female, KAA diss. #0633, in UHIM) lacks the two scobinate cups on the wall of the corpus bursae which are present in *C. gnidiella* (Neunzig, 1986). *Cyptoblabes aliena* Swezey, described from Hawai‘i and later synonymized with *C. gnidiella* by Zimmerman (1972), may actually be a synonym of *C. adoceta* Turner. We suggest treating all previous records of *Cryptoblabes gnidiella* (Millière) and *C. aliena* Swezey in Hawai‘i as misidentifications of *C. adoceta* Turner. This species had previously been reported as such from Kaua‘i, O‘ahu, and Hawai‘i Island (Nishida 2002). In addition to these islands, we report it from Maui for the first time.

Material examined. **Maui:** 1♂, Makawao F[orest] R[eserve], edge of gulch nr. Fong Ridge Road, 20.8192, -156.2688, 1035 m, 24–25 Oct 2022, K.A. Austin, UV bucket trap (UHIM). 1♂, Makawao F[orest] R[eserve], lower Māliko Gulch, base of cliff, 20.8400, -156.2762, 705 m, 25–26 Oct 2022, K.A. Austin, UV bucket trap (UHIM).

Ectomyelois ceratoniae (Zeller) **New island record**

This species has previously been reported from Kaua‘i and O‘ahu (Nishida 2002). We report it from Hawai‘i Island for the first time.

Material examined. **Hawai‘i:** 1♀, Ocean View, Maile Drive, 560 m, 19.0744, -155.7585, 17–19 Mar 2021, D. Rubinoff, C. Doorenweerd, K. Austin, R. Rubinoff, MV light (UHIM).

Ephestiodes gilvescentella Ragonot **New island records**

This species has been reported from O‘ahu, Moloka‘i, and Maui (Nishida 2002). We report it from Kaua‘i and Kaho‘olawe for the first time.

Material examined. **Kaua‘i:** 1♂, Na Pali-Kona For[est] Res[erve], Koai‘e Valley, nr. Piwa Exclosure Area, 22.1007, -159.6103, 565 m, 12–13 Oct 2021, K.A. Austin, LED bucket trap (UHIM). 1♂, same as previous except 22.1000, -159.6111 (UHIM). **Kaho‘olawe:** 2♂♂, planted *Erythrina* grove nr. Luamakika, 20.55715, -156.57303, 6 Mar 2013, W. Haines & D. Rubinoff, UV bucket trap (UHIM).

Trachylepidia fructicassiella Ragonot **New island record**

This species was first reported in Hawai‘i from O‘ahu in 2021 by Austin & Rubinoff (2022). We report it from Moloka‘i and Maui for the first time.

Material examined. **Moloka‘i:** 11 adult specimens in ethanol, sex undetermined, Kaluakoi Villas, nr. Kepuhi Beach, 21.1871, -157.2450, 20 m, pods coll. 26 Dec 2022, adults ecl. 26–31 Dec 2022, K. Faccenda / HOST: *Cassia* sp. (Fabaceae), feeding in seedpods fallen on ground (UHIM). **Maui:** 7♂♂, 11♀♀, Paia, Maui Invasive Species Committee (MISC) Bunkhouse, 20.9152, -156.3475, 95 m, pods coll. 26 Oct, adult ecl[osed] 26 Oct – 30 Nov 2022, K.A. Austin / HOST: *Cassia* sp. (Fabaceae), feeding in seedpods fallen on ground (UHIM).

Tineidae

Oinophila v-flava (Haworth) **New island record**

This species was previously only reported from Hawai‘i Island (Nishida 2002). We report it from O‘ahu for the first time.

Material examined: **O‘ahu:** 1♀, Round Top For[est] Res[erve], Mānoa Cliff Restoration Area, 21.3379, -157.8106, 555 m, 26–27 Nov 2021, K. A. Austin, K. Faccenda, LED bucket trap (UHIM).

Tortricidae

Grapholita* nr. *mesosocia Diakonoff **New state record**

Adults of this species were found in a residential area of Honolulu in close proximity to an ornamental *Ochna thomasiana* Engl. & Gilg (Ochnaceae) shrub. An egg mass was also discovered on a leaf of the same plant. Because females lack the orange hindwings of *Grapholita mesoscia* Diakonoff, this species likely belongs to a species complex near *G. mesoscia*, members of which are undescribed (Brown *et al*. 2014). All members of this species complex are associated with Ochnaceae in eastern Africa and the Seychelles (Brown *et al*. 2014), but have not been reported as introduced elsewhere to our knowledge. Given the gaudy colors of the adults, it seems unlikely that it has gone unnoticed for a long period of time. A more precise identification will require a careful taxonomic revision of the species complex.

Material examined. **O‘ahu:** 1♀, Kaimukī, 1237 Palolo Ave., 22.2616, -157.8111, 30 m, 4 Feb 2022, B. Rentz, resting on *Ochna thomasiana* shrub in yard (UHIM). 3♀♀, same as previous except 9 Feb 2022 (UHIM).

Platynota rostrana (Walker) **New state record & correction**

This species has been previously confused with *Platynota stultana* Walsingham in Hawai‘i. However, *P. rostrana* is a much larger species with males that possess complex scaling on the frons and a long, well-developed costal fold. It is known from the southern United States, through much of Central America and the Caribbean (Powell & Brown 2012).

In Hawai‘i, it has been collected on Kaua‘i and O‘ahu and reared from a wide variety of native and non-native plants. Because of the numerous collections of this species on O‘ahu in recent years, we only list a select few records for it, primarily new or noteworthy host records. It has been collected all over O‘ahu, from close to sea level up to 870 m in elevation and occurs in both the Wai‘anae and Ko‘olau Ranges.

The record of *P. stultana* from Kaua‘i in Austin & Rubinoff (2022) was based on a misidentification of *P. rostrana*. *Platynota stultana* is not yet known to occur on Kaua‘i. The other new island records of *P. stultana* in Austin & Rubinoff (2022) are correct.

Material examined. **Kaua‘i:** 1♀, Nā Pali-Kona For[est] Res[erve], Koai‘e Valley, nr. Piwa Exclosure Area, 22.0982, -159.6115, 550 m, 12–13 Oct 2021, K.A. Austin, UVLED light sheet (UHIM). **O‘ahu:** 2♀, Diamond Head State Monument, 22.2616, -157.8111, 135 m; larva coll[ected] 14 Jan 2022, adult ecl[osed] 3 Feb 2022, K.A. Austin, K. Faccenda / HOST: *Santalum album* (Santalaceae), leaf-tier (UHIM). 1♀, Dan Rubinoff’s Yard, Mānoa, larva coll. 30 Sep, pupa 7 Oct, adult 14 Oct 2021, D. Rubinoff / HOST: *Bidens torta* (Asteraceae), leaf-tier (UHIM). 1♀, LCC Pearl City Garden, reared ex. *Flu*[*e*]*ggea neo*[*wawraea*], coll. 17 Nov 2015, pup. 30 Nov 2015, emerged 6 Dec 2015 (UHIM). 1♀, Schofield Barracks, Army Natural Resource Program (ANRP) greenhouse, reared ex. *Nototrichium humile*, feeding on leaves, coll. 8 Nov 2015, emerged 7 Dec 2015, K. Magnacca (UHIM). 1♀, Pia Valley Restoration area, 21.2973, -157.7420, 100 m, pupa coll. 23 Oct 2021, adult ecl. 31 Oct 2021, K.A. Austin, K. Faccenda / HOST: pupa on *Senna pendula* (Fabaceae), no feeding damage noticed (UHIM). 1 pupa, Honouliuli For[est] Res[erve], Pu‘u Hāpapa, near snail jail, 21.4670, 158.1030, 810 m, larva coll. 5 Oct, pupa 12 Oct [2021], killed by fungus, C. Doorenweerd, K.A. Austin / HOST: *Myrsine lessertiana* (Primulaceae), leaf-roller (UHIM).

Xyloryctidae

"*Eumenodora*" *tetrachorda* Meyrick **New state record**

Larvae of this species were found mining the needles of ironwood (*Casuarina equisetifolia* L., Casuarinaceae) on Kauaʻi and Oʻahu. The identification was provided by Mark Metz (USDA-SEL), but he noted that the higher taxonomy of this species is unresolved. He suggests that this species does not belong in Xyloryctidae, which Kaila (2013) transferred the type species of *Eumenodora* to without commenting on *E. tetrachorda* Meyrick. Metz (pers. comm., Aug 2022) suggested that *E. tetrachorda* belongs to Parametriotinae (Elachistidae). He also noted that a similar species known to mine needles of *Casuarina* in India, *Labdia xylinaula* Meyrick (Cosmopterigidae), may be conspecific. The types for both species (possibly in Calcutta) need to be carefully examined in order to resolve this. In addition to the pinned specimens listed below, numerous larvae are present in HDOA in three vials of 95% ethanol with same the data as the Kauaʻi specimens. This species is known from India.

Material examined. **Kauaʻi:** 2♂♂, Kapaʻa, Hotel Coral Reef, 22.07794, -159.31467, 16 Aug 2018 / ex. boring into *Casuarina equisetifolia* needles, coll. A. Tateno *et al.* (HDOA). **Oʻahu:** 3 sex undetermined, Honolulu, Keʻehi Lagoon Beach Park, 21.331244, -157.895321 / 30 Oct 2016, ex. boring into *Casuarina equisetifolia* needles, coll. M. Ramadan (HDOA).

Additional corrections to Nishida (2002) and Matsunaga *et al.* (2019) overlooked by Austin & Rubinoff (2022)

Erebidae

Simplicia caeneusalis (Walker) in Nishida (2002) should be *Simplicia cornicalis* (Fabricius) per Holloway (2008). This synonymy was overlooked by Austin & Rubinoff (2022).

Pyralidae

Paramyelois transitella (Walker) in Nishida (2002) should be *Amyelois transitella* (Walker) per Neunzig (1990). This current combination was overlooked by Austin & Rubinoff (2022).

Noctuidae

Heliothis virescens (Fabricius) in Nishida (2002) should be *Chloridea virescens* (Fabricius) per Pogue (2013). This current combination was overlooked by Austin & Rubinoff (2022).

Athetis in Matsunaga *et al.* (2019) was listed as having been transferred to Erebidae by Zahiri *et al.* (2011). This is incorrect; *Athetis* belongs to Noctuidae and was never transferred to Erebidae. All other genera listed as Erebidae in Matsunaga *et al.* (2019) are correct.

Corrections to Austin & Rubinoff (2022)

Crambidae

Hellula undalis (Fabricius) was misspelled as *Hellula undulalis* (Fabricius) in the text of Austin & Rubinoff (2022).

Pyralidae

Aphomia cephalonica was mistakenly listed as *Corcyra cephalonica* in the text of Austin & Rubinoff (2022). The correct combination was used in their table 1.

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A note on the snail host of *Ascocotyle felippei* Travassos, 1928 (Digenea: Heterophyidae), a parasite of Hawaiian stream fishes[1]

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The digenetic trematode *Ascocotyle felippei* Travassos, 1928 (formerly *A. tenuicollis* Price, 1935; see Santos *et al.* 2007 for synonymy) has been found to parasitize several species of native and alien stream fishes in the Hawaiian Islands (Font 1997a, 1997b, 1998, 2003, 2007). Contrary to earlier accounts, the identity of its first intermediate host in Hawai'i is unknown, but we may assume that one or more species of aquatic gastropods serve this purpose; its second intermediate hosts are numerous species of fresh- and brackish-water fish, and its definitive hosts are fish-eating birds and mammals (Scholz *et al.* 1997a, 2001). Chai (2019) listed several species of *Ascocotyle* (but not *A. felippei*) as known or potential intestinal parasites of humans.

Ostrowski de Núñez (1976) reported that in Argentina the first intermediate host of *A. felippei* (as *A. tenuicollis*) is the cochliopid snail *Littoridinia piscium,* now *Heleobia piscium* (d'Orbigny, 1835) (MolluscaBase eds. 2022). Like *A. felippei*, other species of *Ascocotyle* are also reported to parasitize aquatic snails of the family Cochliopidae: *Littoridinops tenuipes* (Couper, 1844) and *Onobops jacksoni* (Bartsch, 1953) (Schroeder & Leigh 1965; O'Hara *in* Heard 1970), *L. monroensis* (Frauenfeld, 1863) (Leigh 1974; Font *et al.* 1984), various species of *Heleobia*, some formerly placed in *Littoridina* or *Lyrodes* (review in Santos & Borges 2020), and *Pyrgophorus coronatus* (Pfeiffer, 1840) (Scholz *et al.* 1997a, 1997b). Font (1997a, 1997b), on the other hand, stated that the first intermediate hosts of *Ascocotyle felippei* (as *A. tenuicollis*) in Hawai'i are thiarid or "melanid" snails, and he later (2003) identified the host specifically as the thiarid snail *Melanoides tuberculata* (O.F. Müller, 1774). Font (2007) repeated that assertion, citing Martin (1958) as authority for that statement. Martin's work makes no mention of *Ascocotyle*, however, and the list by Pinto & De Melo (2011) of trematodes known to parasitize *M. tuberculata* does not include any species of *Ascocotyle*. Accordingly, Font's statement as to *M. tuberculata* lacks any basis and is erroneous.

If *Melanoides tuberculata* is *not* the first intermediate host of *A. felippei* in Hawai'i, alternative candidates would most likely be found among the Cochliopidae. Two species of cochliopids occur in the Hawaiian Islands: the alien *Pyrgophorus coronatus* (Pfeiffer, 1840) (Cowie 1999; Englund 2002) and the native *Tryonia porrecta* (Mighels, 1845) (Hershler 2001; Christensen *et al.* 2021). For neither species have Hawaiian populations been examined for trematodes, but the fact that *P. coronatus* is a known host of another species of *Ascocotyle* (Scholz *et al.* 1997a) suggests it to be a likely host of Hawaiian *A. felippei*. The matter is not so simple, however; in Hawai'i, *A. felippei* has only been found to occur on the island of Hawai'i (Font 1997a, 1998, 2007), whereas *P. coronatus* was first found to be present in the Hawaiian Islands in 1998 and has as yet been found to occur

1. Contribution No. 2023-003 to the Hawaii Biological Survey.

only on the island of O‘ahu, not on Hawai‘i (Cowie 1999; Englund 2002). Furthermore, *T. porrecta* has been found to occur at Waiakea on the island of Hawai‘i (Hershler 2001), the same location where Font (2007) reported *A. felippei* to occur. Accordingly, either or both are potential hosts, but the question remains unresolved.

Five species of native gobioid fishes inhabit our streams (Kinzie 1990). Concerns have been voiced regarding the impact on them of parasitic helminths that have become established here as a result of the introduction of various alien freshwater fish species (Devick 1991), and *A. felippei* has been reported to infect three of the native gobioids, including the endemic *Eleotris sandwicensis* Vaillant & Sauvage, 1875 (Font 1997b, 1998, 2003, 2007); the other two native species infected were not identified by name, but as *Lentipes concolor* (Gill, 1860) and *Sicyopterus stimpsoni* were said not to have been present in sites where *A. felippei* was found (Font 2007) we can infer that they were *Awous guamensis* (Valenciennes, 1837) and *Stenogobius hawaiiensis* Watson, 1991. The presence in Hawai‘i of *A. felippei* may also be relevant to the conservation of our native water birds, as another species of *Ascocotyle* has been found to parasitize a congener of the endangered Hawaiian stilt *Himantopus mexicanus knudseni* Stejneger, 1887 (Alda *et al.* 2011).

The distribution of the parasite will necessarily be constrained by that of its host. *M. tuberculata* is abundant in coastal wetlands and slow-moving streams throughout the main Hawaiian Islands, (Hayes *et al.* in prep.), whereas both *T. porrecta* and *P. coronatus* are much more restricted in range. *Tryonia porrecta*, though once as widespread as *M. tuberculata*, is now much reduced in range; in the Hawaiian Islands living specimens have only been observed three times in the last 50 years, in two coastal ponds on the island of Hawai‘i (one of them the Waiakea site where *A. felippei* is present) and in an O‘ahu nursery (Christensen *et al.* 2021). *Pyrgophorus coronatus* has as yet been found only in the Pearl Harbor region of O‘ahu (Cowie 1999; Englund 2002). Accordingly, improved knowledge of the true identity and range of its snail hosts would assist efforts to manage and conserve the native fishes which are among its second intermediate hosts as well as the endangered birds likely to serve as definitive hosts. Little is known of the biology of either of the two cochliopid snails now present in the Hawaiian Islands, but future studies of them should consider their potential role as hosts of *Ascocotyle*.

In a study of parasites of cats and dogs in Hawai‘i, Ash (1962) found *Phagicola longa* [now *Ascocotyle longa* Ransom, 1920, or *A. (Phagicola) longa*)] to be present in dogs, and thus two species of *Ascocotyle* are thought to occur in the Hawaiian Islands. The cochliopid snail *Heleobia australis* (d’Orbigny, 1835) is known to be a first intermediate host of *A. longa* in Brazil (Simões *et al.* 2010). As Alicata (1964) noted, the snail host of *A. longa* in Hawaii has not been identified, so either of the two cochliopids present in the Hawaiian Islands would be possible candidates for that function, even though *P. coronatus* is not thought to have been present in Hawai‘i at the time of Ash’s study. As with *A. felippei*, the definitive hosts of *A. longa* are fish-eating birds and mammals, but unlike the former species, *A. longa* has been found to be a rare cause of human infections (Chai 2019).

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