

with best wishes,
Warren

Contributions to the Flora of Hawai'i I. Acanthaceae—Asteraceae

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ABSTRACT

This paper, covering the families Acanthaceae, Amaranthaceae, Apiaceae, Apocynaceae, Asclepiadaceae, and Asteraceae, is the first of a series providing new records and other information pertinent to species naturalized in the Hawaiian Islands. Also presented are new species or combinations of native plants to make them available prior to the publication of the *Manual of the Flowering Plants of Hawai'i*. Discussion or comments on both native and naturalized species are provided where pertinent. The following new records of naturalized species are reported: *Alternanthera caracasana*, *Amaranthus lividus*, *Baltimora recta*, *Bidens gardneri*, *Blumea sessiliflora*, *Erigeron bellioides*, *Palafoxia callosa*, and *Zinnia palmeri*. Previously misidentified species, those that have had nomenclatural changes, or those that have been difficult to identify in Hawai'i are found in the following genera: *Hemigraphis*, *Ruellia*, *Alternanthera*, *Amaranthus*, *Hydrocotyle*, *Torilis*, *Asclepias*, *Ambrosia*, *Anthemis*, *Calyptocarpus*, *Conyza*, *Crassocephalum*, *Crepis*, and *Gnaphalium*. *Wedelia trilobata* is reported as becoming a sexually reproducing naturalized species. The new combination and new status *Gnaphalium sandwicense* var. *hawaiiense* is made for the plants previously known as *G. hawaiiense*. Additional commentary is provided for the following native genera: *Rauwolfia*, *Gnaphalium*, *Lipochaeta*, and *Remya*. We conclude that *Alternanthera menziesii* and *Senecio sandwicensis*, previously considered to be endemic to the Hawaiian Is, actually represent *A. echinocephala* and *S. hydrophilus*, and that their previous inclusion in the Hawaiian flora is the result of faulty label information.

INTRODUCTION

It has been nearly a century since the last complete flora of Hawai'i was published (Hillebrand 1888). This has left the Hawaiian flora, doubtless one of the most interesting in the United States, without any significant modern inventory of its plants. A project initiated in 1982 by S.H. Sohmer and funded by the Irwin Charity Foundation of San Francisco is now underway at the Bishop Museum to produce the *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst & Sohmer, in prep.). The intent of the *Manual* is to bring together, with a uniform taxonomic treatment, the existing knowledge of the native and naturalized flowering plants pertinent to their identification, classification, distribution, and status. The project has invited knowledgeable specialists to contribute treatments of specific groups to the book and has encouraged scientists to initiate more detailed research programs on difficult Hawaiian genera. The completion of this project will be a significant step towards an overall evaluation of the native and naturalized flowering plants of the

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Hawaiian Archipelago; however, it should be followed by more detailed studies, especially in systematics, pollination ecology, autecology, genetics, and population biology.

The present series of notes is intended to bring out, prior to the publication of the *Manual*, new records of naturalized species, incorrectly identified naturalized species, and notes or comments on native and naturalized species. For some genera, new combinations or new species will be published in this series, since no new combinations or species will be published in the *Manual*.

Under each species discussed, a single collection is cited for each island on which it occurs. Also, the earliest known collection for naturalized taxa is given after the discussion of its presently known distribution in Hawai'i. References to original publications of names of naturalized species are not given, since they are available elsewhere, and the discussions of them here are more informal. However, references to original publications are given for all native Hawaiian taxa, since sources for infraspecific names are not given in standard references such as the Kew Index or St. John's checklist (1973).

ACANTHACEAE

Hemigraphis

The 2 species of *Hemigraphis* naturalized in Hawai'i have long been confused. We thank Dieter Wasshausen, Smithsonian Institution, for verification of the determinations. The following key distinguishes them.

Key to the Species of *Hemigraphis* in Hawai'i

1. Leaves cordate; floral bracts ovate, on stalks 1–2 mm long; plants sterile, no capsules produced
..... **H. alternata**
- Leaves oblong-elliptic to narrowly ovate, the base truncate or rounded; floral bracts spatulate,
on stalks 6–7 mm long; plants fertile, capsules narrowly ellipsoid, 6–7 mm long . . . **H. reptans**

***Hemigraphis alternata* (N.L. Burm.) T. Anderson**

Ruellia alternata N.L. Burm.; *R. colorata* Blume; *Hemigraphis colorata* (Blume) H. Hall.

The native range of this species, known as red ivy or red-flame, is unknown, but it probably is originally from the Malay Archipelago. In Hawai'i the species is cultivated as a ground cover; it is propagated vegetatively and sometimes spreads in Honolulu lawns. A label on *Wilder s.n.* collected in 1930 (BISH) states that it was brought to Hawai'i by him from Fiji in 1927.

***Hemigraphis reptans* (G. Forster) T. Anderson**

Ruellia reptans G. Forster.

The native range of this species also is unknown, but it was originally described from Aru I off the coast of New Guinea; in Hawai'i it is a lawn weed in Honolulu, O'ahu. First collected on O'ahu in 1957 (*Potter & Miyashiro s.n.*; BISH).

Ruellia

Three species of *Ruellia* are naturalized in Hawai'i: *R. brittoniana* Leonard, *R. graecizans* Backer, and *R. prostrata* Poir. The last species was previously misidentified in Hawai'i as *Ruellia repens* L., which differs from *R. prostrata* in its narrowly lanceolate to linear-lanceolate leaves and capsules only 1.2–1.5 cm long. *Ruellia repens* does not appear to be naturalized in Hawai'i.

Ruellia prostrata Poir.*Dipteracanthus prostrata* (Poir.) Nees.

Prostrate perennial herbs; stems often rooting at the nodes. Leaves green, conspicuously paler on the lower surface, ovate, 2–10 cm long, (0.9–)1.5–4.5 cm wide, sparsely strigose, especially on the upper surface, petioles 5–30 mm long. Flowers solitary in the leaf axils, subtended by oblanceolate to ovate bracts, 15–23 mm long; calyx 5-lobed, the lobes linear, 6–10 mm long; corolla violet blue to occasionally nearly white, 2.4–3.2 cm long, the lobes slightly spreading. Capsule clavate, 1.5–2.0 cm long, densely puberulent. Native of Java; in Hawai'i it is a weed of urban areas in Honolulu, O'ahu. First collected on O'ahu in 1944 (Neal *s.n.*; BISH).

AMARANTHACEAE

Alternanthera

Alternanthera menziesii St. John was described from a single Menzies collection presumed to be from the Hawaiian Is (St. John 1957). According to Fosberg (1966) and Mears (1977), the type collection actually was made in the Galapagos Is, where Menzies did visit. The type is *A. echinocephala* (J.D. Hook.) Christopherson, which is endemic to the Galapagos Is. We have seen no evidence of *A. echinocephala* in the Hawaiian Is and agree with Fosberg and Mears that the type of *A. menziesii* was collected in the Galapagos Is. St. John (1973) included *A. menziesii* as a synonym of *A. echinocephala* and suggested that perhaps it is naturalized in Hawai'i. Subsequently, St. John (1977) resurrected *A. menziesii* and maintained that the type was indeed collected in Hawai'i and that it represents an endemic species distinct from *A. echinocephala*.

In the past there has been some confusion regarding the number of naturalized species of *Alternanthera* in Hawai'i and their correct names. There are 4 species of *Alternanthera* naturalized in Hawai'i; the following key can be used to separate them. Nomenclature and interpretation of native ranges follows Mears (1977). We are grateful to U. Eliasson for confirming our determinations of the *Alternanthera* species and providing the analysis for *A. brasiliiana*.

Key to the Species of *Alternanthera* in Hawai'i

1. Scandent shrubs 1.5–4.0 m tall; inflorescences long-pedunculate, each flower on a short pedicel **A. brasiliiana**
- Perennial herbs; inflorescences sessile in the leaf axils, each flower sessile 2
- 2(1). Outer sepals and bracts spine-tipped; hairs multicellular and appearing barbed 3
- Outer sepals and bracts not spine-tipped; hairs smooth or multicellular and appearing barbed 4
- 3(2). Inflorescences sparsely pubescent; bracts and outer sepals with spines usually > 2 mm long; outer sepals 4–5 mm long **A. pungens**
- Inflorescences densely pubescent; bracts and outer sepals with small spines < 1 mm long; outer sepals 3.5–4.2 mm long **A. caracasana**
- 4(2). Leaves spatulate to oblong; outer sepals 3-nerved, brown at base; hairs barbed **A. tenella**
- Leaves linear-lanceolate to obovate; outer sepals 1-nerved or indistinctly 3-nerved toward base, white throughout; hairs smooth **A. sessilis**

Alternanthera brasiliiana* (L.) KuntzeGomphrena brasiliiana* L.

Native from Mexico to Brazil and the West Indies; in Hawai'i known from a single collection from 300 m, ridge between Hälawa Iki and Lamaloea gulches, north side of Hälawa Valley, Moloka'i, in 1973 (Pekelo *s.n.*; BISH) where it appears to be naturalized.

According to Eliasson (pers. comm.) the detailed distribution of *Alternanthera brasiliana* in the Americas is not presently known due to a frequent confusion with *A. flavescens* H.B.K., a species with proportionally shorter bracts and bracteoles and without a dorsal crest on the bracteoles. The exact identity of the nominate variety of *A. brasiliana* is doubtful (Mears 1977); no attempt to assign the Hawaiian specimen to a variety is made. The frequently cited name *Alternanthera ramosissima* (Mart.) Chod. is a synonym of *A. brasiliana* var. *villosa* (Moq.) Kuntze. The latter variety is especially common in eastern South America (Mears 1977); the Hawaiian collection is definitely not this variety.

***Alternanthera caracasana* H.B.K.**

A. peploides (Willd. ex Roem. & Schult.) Urban.

Alternanthera caracasana has been a weed in Hawai'i since at least the early 1920s; it has been consistently confused with *A. pungens* [*A. repens* sensu Degener (1938)]. Native to Africa, the Canary Is, and the Western Hemisphere; in Hawai'i it is a weed of dry areas such as roadsides, lawns, and beach parks on Kaua'i, O'ahu, Moloka'i, Lāna'i, and Maui. It was first collected on O'ahu in 1925 (Honolulu, Degener 8670; BISH).

Representative specimens examined. HAWAIIAN IS: KAUA'I: Lihu'e airport, 1938, Lyons s.n. (BISH); Moloka'i, Maunaloa Post Office, 1944, Collins s.n. (BISH); LĀNA'I: Lāna'i City, Degener & Degener 28544 (BISH); MAUI: Pu'unēnē, 1940, Judd s.n. (BISH).

***Alternanthera pungens* H.B.K.**

Achyranthes repens L.; *Alternanthera repens* (L.) Link (this combination often attributed to Kuntze), non J.F. Gmelin.

Alternanthera pungens has long been confused with *A. caracasana* in Hawai'i. Known as khaki weed, it is native to the Neotropics and is now widely naturalized in many parts of the world (Mears 1977). In Hawai'i it is a common weed of beach parks and other low-elevation, dry, disturbed sites; it is probably on all of the main islands, but we have seen specimens only from O'ahu, Moloka'i, and Hawai'i. It frequently grows with *A. caracasana*. First collected on O'ahu in 1959 (Punchbowl, Uehara s.n.; BISH).

Representative specimens examined. HAWAIIAN IS: MOLOKA'I: Kaunakakai, Pau Hana Inn, Hobby 2306 (BISH); HAWAII: Honaunau, Higashino et al. 10254 (BISH).

***Alternanthera sessilis* (L.) DC.**

Gomphrena sessilis L.; *Alternanthera ficoides* P. Beauv., non (L.) Sm.; *A. repens* J.F. Gmelin, non (L.) Link nec (L.) Kuntze.

Widespread in tropical and subtropical areas; in Hawai'i it is a common weed on O'ahu and probably on at least some of the other islands, although we have not seen any collections from the latter. First collected on O'ahu in 1935 (Kailua, Fosberg 10928; BISH).

***Alternanthera tenella* Colla**

A. amoena (Lem.) Voss; *A. bettzichiana* (Regel) Voss; *A. bettzichiana* Nicholson, nom. subnud.; *A. ficoides* (L.) Sm. var. *bettzichiana* (Regel) Backer; *Telanthera bettzichiana* Regel.

Widespread in the Neotropics; in Hawai'i it is commonly cultivated and often found persisting, presumably vegetatively, around old homesites. Our plants are the cultivar of *A. tenella*, previously referred to as *A. bettzichiana*.

Amaranthus

This is a taxonomically difficult genus of about 50 species chiefly of warm temperate and subtropical regions of the world; a number of species are cosmopolitan weeds. The naturalized species in Hawai'i are greatly in need of further collection, and the distributions stated below most likely do not reflect the full geographical ranges of the species. Most BISH material was lost while on loan, and thus the dates of first collection, as well as distributions, probably are inaccurate. We thank C.C. Townsend, Royal Botanic Gardens, Kew, for determinations on BISH material and for comments on the manuscript. Nomenclature follows Townsend (pers. comm.).

Key to the Species of *Amaranthus* in Hawai'i

1. Leaf axils with paired spines **A. spinosus**
 Leaf axils without paired spines 2
- 2(1). Fruit dehiscent, with circumscissile lid 3
 Fruit indehiscent or rupturing irregularly at maturity 4
- 3(2). Staminate flowers usually only at apex of spikes, rarely scattered among pistillate flowers;
 capsule lid wrinkled near line of dehiscence **A. dubius**
 Staminate flowers intermingled with pistillate flowers along length of spikes; capsule lid
 smooth **A. hybridus**
- 4(2). Leaves linear; fruit 0.8–1.0 mm long **A. brownii**
 Leaves deltoid-ovate, ovate, or rhombic-ovate; fruit 1.2–2.5 mm long 5
- 5(4). Flowers primarily in terminal, paniculate spikes with some small axillary clusters; fruit
 strongly rugose, slightly compressed to globose; seeds conspicuously reticulate under
 high magnification **A. viridis**
 Flowers primarily in axillary and terminal spikes, rarely paniculate; fruit smooth to some-
 times wrinkled when drying, distinctly compressed; seeds inconspicuously reticulate
 under high magnification **A. lividus**

Amaranthus brownii Christophersen & Caum

Amaranthus brownii (Christophersen & Caum 1931) is endemic to Nihoa, occurring at 120–215 m. This rare species is not presently common anywhere on the island. It was collected most recently in 1980 (*Herbst & Takeuchi 6545*; BISH); however, roughly a dozen plants were observed by W. Gagné, Bishop Museum (pers. comm.), on a field trip to Nihoa in 1983.

Amaranthus dubius Mart. ex Thell.

Native to tropical areas of the Old World; in Hawai'i naturalized in low-elevation, disturbed sites on O'ahu, Lāna'i, and Hawai'i. The earliest collection we have seen was made on O'ahu in 1972 (Kahana Val, *Herat & Wirawan 212*; BISH), although Fosberg (pers. comm.) states that he was aware of its presence in Hawai'i as early as the 1930s.

Representative specimens examined. HAWAIIAN IS: LĀNA'I: Keōmuku, *Herbst & Spence 4022* (BISH); HAWAI'I: Pōhakuloa State Pk, state bird propagating facility, *Herbst 5946* (BISH).

Amaranthus hybridus L.

Apparently native to the New World; in Hawai'i the green amaranth is very sparingly naturalized at low elevations on O'ahu and Maui. It was first collected on O'ahu in 1930 (Kāne'ohe, *Wilder s.n.*; BISH). Our plants can be referred to subsp. *hybridus*, which is distinct in that the bracteoles of the pistillate flowers are usually 1.5–2.0× longer than the perianth and the fruit has a distinct inflated neck.

Representative specimens examined. HAWAIIAN IS: MAUI: Kahakuloa, *Handy 34.15* (BISH).

Amaranthus lividus L.*A. blitum* L.

A native of warm temperate and tropical regions throughout the world; in Hawai'i it apparently is sparingly naturalized in disturbed areas on O'ahu and Hawai'i. Not previously reported for the state. The earliest collection we have seen was made on O'ahu in 1971 (Mānoa Val, *Nagata* 910; BISH, HLA). Our plants can be referred to subsp. *polygonoides* (Moq.) Probst, which is distinct in having smaller leaves (rarely more than 4 cm long), usually prostrate to decumbent stems, and fruit 1.2–1.8 mm long.

Representative specimens examined. HAWAIIAN IS: HAWAII: Ka'ū Dist, Ka'ū Sugar Mill, *Herbst & Ishikawa* 5517 (BISH).

Amaranthus spinosus L.

Cosmopolitan in the warmer regions of the world, perhaps of American origin; in Hawai'i the spiny pigweed is naturalized and often common in low-elevation, disturbed sites on Kure Atoll, Kaua'i, O'ahu, Moloka'i, Maui, Kaho'olawe, and Hawai'i, perhaps also on Ni'ihau and Lāna'i. Naturalized prior to 1928 (Neal & Metzger 1928).

Representative specimens examined. HAWAIIAN IS: KURE ATOLL: Green I, *Lamoureux* 2804 (BISH); KAUA'I: Lāwa'i Val, *Herbst* 2024 (BISH); O'AHU: Queen's Beach, *Wagner et al.* 4813 (BISH); MOLOKA'I: Hālawā Val, *Ishikawa* 136 (BISH); MAUI: SE of Lāhainā, *Ishikawa* 155 (BISH); KAHO'OLAWE: Smuggler's Cove, *Char* 78.077 (BISH); HAWAII: Hawai'i Volcanoes Natl Pk, Halapē Beach, *Herat et al.* 861 (BISH).

Amaranthus viridis L.*A. gracilis* Desf. ex Poir.; *A. lineatus* sensu Hillebr.; *Euxolus lineatus* sensu Hillebr.

Cosmopolitan in tropical and subtropical regions; in Hawai'i it is the most common naturalized species of *Amaranthus*, occurring in low-elevation, disturbed habitats on Ka'ula, Kaua'i, O'ahu, Lāna'i, Maui, Kaho'olawe, and Hawai'i. Naturalized prior to 1871 (Hillebrand 1888).

Representative specimens examined. HAWAIIAN IS: KA'ULA, *Herbst* 6215 (BISH); KAUA'I: Lāwa'i Val, *Wagner et al.* 5141 (BISH); O'AHU: Queen's Beach, *Wagner et al.* 4808 (BISH); LĀNA'I: W Lāna'i, nr pineapple station, *Spence* 167 (BISH); MAUI: Paeahu, *Herbst & Ishikawa* 5400 (BISH); KAHO'OLAWE: Moa'ula, *Char* 78.026 (BISH); HAWAII: Hawai'i Volcanoes Natl Pk, Hilina Pali, *Herat & Higashino* 903 (BISH).

Charpentiera

In the revision of *Charpentiera* (Sohmer 1972) a neotype was selected for *C. elliptica* (Hillebr.) A. Heller; however, it has come to our attention that syntype material is available and thus a lectotype must be selected. Hillebrand cited 2 collections, one from Kaua'i and another from Maui, as well as the illustration in *Indigenous Flowers of the Hawaiian Islands* (Sinclair 1885). Hillebrand's original material was destroyed in Berlin during WW II, but a duplicate of the Maui collection and the illustration are both available for lectotypification; therefore, the neotype is not necessary. The Maui collection is *C. obovata* and thus has no relevance to the Kaua'i endemic long known as *C. elliptica*. Thus, to retain the epithet "*elliptica*" for the Kaua'i species we designate the Sinclair illustration (pl. 44) as lectotype of *C. elliptica* [based on *C. obovata* Gaud. var. *elliptica* Hillebr., Fl. Hawaiian Isl. 375. 1888. TYPE: Pl. 44 in Sinclair, 1885, *Indigenous Flowers of the Hawaiian Islands*, lectotype, here designated].

APIACEAE

Hydrocotyle

Plants described by Degener & Greenwell (1956a) as *Hydrocotyle sibthorpioides* Lam. var. *oedipoda* Degener & Greenw. from Kilauea, Hawai'i, were thought to represent a naturalized taxon probably from Asia. L. Constance & J.M. Affolter, as part of their treatment of Apiaceae for the *Manual* (submitted), have determined this to be *H. bowlesioides* Math. & Const., a species native to Costa Rica.

Hydrocotyle bowlesioides Math. & Const.

H. sibthorpioides Lam. var. *oedipoda* Degener & Greenw.

Stems slender, creeping, hirsute. Leaves not peltate, roundish-reniform with a sinus at the base, excluding the petioles 10–20 mm long, 15–30 mm wide, shallowly 5-lobed, the lobes obtusely triangular, crenate, subequal, both surfaces hirsute, petioles slender, 1–12 cm long, reflexed-hirsute especially above. Umbels not proliferous, 2–10-flowered, globose, peduncles much shorter than leaves, axillary, slender, 2–12 mm long. Fruit ellipsoid, ca. 1 mm long, 1.5 mm wide, sessile, finely hispidulous in the intervals, ribs conspicuous, acute, subequal. Native to Costa Rica; in Hawai'i naturalized in open, sunny sites on O'ahu and Hawai'i. First collected on Hawai'i in 1943 (*Degener & Wiebke 3002*; UC).

Representative specimens examined. HAWAIIAN IS: O'AHU: Honolulu, *Herbst 8550* (BISH).

Torilis

Torilis japonica (Houtt.) DC. was recorded as naturalized in Hawai'i by St. John (1973); however, we have seen no evidence of this. The single collection known to us of *Torilis* made in Hawai'i in 1911, near Kanahāhā, Kona, Hawai'i (*Forbes 272.H*; UC), represents *T. nodosa*. There are no known recent collections of this species, and it may not be part of the naturalized flora. Determination and description of the following species as well as comments on the situation are based on Constance & Affolter (submitted).

Torilis nodosa (L.) Gaertn.

Tordylium nodosum L.

Plants slender, decumbent, 1–6 dm tall, hispid throughout, the branches spreading. Leaves oblong in general outline, 1–2-pinnately compound, the ultimate divisions linear to filiform, 1–2 mm wide, entire or lobed, acute. Peduncles 0–2.5 cm long, shorter than the leaves, involucre usually absent, involucl of 6–8 linear-lanceolate, acute bractlets longer than the pedicels, rays 2–3, short to absent. Fruit ovoid, 3–5 mm long, 1–2 mm wide, the outer mericarps bristly, the inner ones warty or bristly externally. Native to Europe; in Hawai'i apparently sparingly naturalized and known from a single collection near Kanahāhā, Kona, Hawai'i.

APOCYNACEAE

Rauwolfia**Rauwolfia sandwicensis** A. DC.

Ochrosia sandwicensis A. DC.; *Rauwolfia degeneri* Sherff; *R. forbesii* Sherff; *R. helleri* Sherff; *R. mauiensis* Sherff; *R. molokaiensis* Sherff; *R. m.* var. *parvifolia* Degener & Sherff; *R. m.* var. *typica* Sherff; *R. remotiflora* Degener & Sherff; *R. sandwicensis* var. *subacuminata* Sherff; *R. s.* var. *typica* Sherff.

Rauvolfia sandwicensis is the only member of the endemic sect. *Ochrosioides*. Rao (1956) states that *Rauvolfia sandwicensis* is related to members of the New World sect. *Macrovolfia*; however, in the smooth backs of the anthers, *R. sandwicensis* resembles the African sect. *Afrovolfia*.

As treated here, *Rauvolfia sandwicensis* is a widespread, variable species found on all of the main islands except Kaho'olawe, primarily on ridges, slopes, and gulches in mixed mesophytic forest, but also scattered in relatively low-elevation, open, dryland sclerophyll forest remnants, *Lantana* thickets, and, rarely, in open margins of low-elevation rain forest. It is also found on lava flows on Maui and Hawai'i, 100–500(–800) m.

Sherff (1947) and St. John (1980) recognized 7 species in Hawai'i. Our study of over 150 collections of this genus suggests that there is but 1 variable species in Hawai'i. The 7 species described by Sherff are based largely on leaf variation and, to some extent, calyx size and relative congestion of the inflorescence. When carefully compared these features seem to vary in a rather continuous fashion; however, 2 modally distinct groupings can be identified as follows:

Group 1 (*R. degeneri*) is distinctive because of its large calyx (4–)6–8(–10) mm long.

Representative specimens examined. HAWAIIAN IS: O'AHU: Wai'anae Mts, Pu'uku'ua, Takeuchi et al. *Waianae-134a* (BISH).

Group 2 (*R. forbesii*, *R. helleri*, *R. mauiensis*, *R. molokaiensis*, *R. remotiflora*, and *R. sandwicensis*) is characterized by the calyx 1–5 mm long. It is widespread, occurring on Kaua'i, O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i. This group is highly variable in calyx length, leaf size, peduncle length, and to some degree, fruit length and width. This variation correlates somewhat with geography; e.g., plants from Maui tend to have small leaves, but they grow in dryer habitats than most populations from the other islands, suggesting that the difference is largely ecological. The 2 groups intergrade to some degree on O'ahu.

Representative specimens examined. HAWAIIAN IS: KAUA'I: Kōke'e State Pk, Nonou Trail, *Herbst 1084* (BISH); O'AHU: Mānoa Cliff Trail, *Stone 3116-A* (BISH); MOLOKA'I: Wailau Val, *Degener & Nitta 9795* (BISH); LĀNA'I: head of trail Maunalei, *Munro 71* (BISH); MAUI: Auwahi, *K. Nagata 1935* (BISH); HAWAII: Kealakomo, Puna, *Stone 3016* (BISH).

At present we do not want to formally treat these entities as subspecies without detailed study.

ASCLEPIADACEAE

Asclepias

One of the 2 naturalized species here placed in *Asclepias* was previously known in Hawai'i as *Gomphocarpus physocarpus* E. Mey. The African species of *Asclepias*, which usually lack the internal horn in the hood, have been segregated in the past as the genus *Gomphocarpus*. According to Brown (1904) this genus should be included in *Asclepias*. *Asclepias physocarpa* (E. Mey.) Schlechter is native to South Africa; in Hawai'i it is naturalized in low-elevation, dry habitats occasionally up to 800 m on Kaua'i, O'ahu, Lāna'i, Maui, Kaho'olawe, and Hawai'i. According to Degener & Greenwell (1956b) it was originally introduced as a fiber crop on O'ahu, where it was first collected in 1919 (Halawa Val, *Gouveia s.n.*; BISH).

Representative specimens examined. HAWAIIAN IS: KAUA'I: Lāwa'i Val, *Herbst 2014* (BISH); MAUI: W of Maunawainui, *Wagner et al. 4771* (BISH); LĀNA'I: Lāna'i City, *Degener & Degener 28621* (BISH); KAHO'OLAWA: Moa'ula, *Clarke 415* (BISH); HAWAII: Hawai'i Volcanoes Natl Pk, *Herat et al. 822* (BISH).

ASTERACEAE

Ambrosia***Ambrosia artemisiifolia* L.**

A native of the United States and southern Canada; in Hawai'i it is naturalized in low-elevation, dry, disturbed habitats, especially along roadsides and in pastures, 0–900 m, on O'ahu, Moloka'i, Maui, and Hawai'i. It has been naturalized at least since 1854 (Hillebrand 1888).

Representative specimens examined. HAWAIIAN IS: O'AHU: Waialua, Hale'iwa Pt, *Fosberg 27129* (BISH); MOLOKA'I: 'Ualapu'e, *Degener 5594* (BISH); MAUI: Waipi'o, Kipapa Gulch, *Hosaka 1277* (BISH); HAWAI'I: junction of Māmalahoa Hwy and Saddle Rd, *Herbst & Spence 5313* (BISH).

Franseria strigulosa Rydb. (= *Ambrosia confertiflora* DC.) does not occur in Hawai'i as has long been assumed (Degener 1937; St. John 1973). The BISH specimens labeled as "*Franseria strigulosa*" are fruiting specimens of *A. artemisiifolia*, while those labeled as *A. artemisiifolia* are all immature specimens.

Anthemis***Anthemis cotula* L.**

A native of Europe; in Hawai'i it is sparingly naturalized in scattered localities on Kaua'i, Lāna'i, and Hawai'i. First collected on Hawai'i in 1909 (Parker Ranch, *Rock 3372–3374*; BISH).

Representative specimens examined. HAWAIIAN IS: KAUA'I: Waimea drainage basin, *Forbes 1056.K* (BISH); LĀNA'I: Kō'ele, *Munro 174* (BISH).

Some plants of this species from the island of Hawai'i have been misidentified previously as *Matricaria chamomilla* L., which differs from *Anthemis* in that the receptacle is naked. *Matricaria* is not known to be naturalized in Hawai'i.

Baltimora

We thank W. Arthur Whistler, Pacific Tropical Botanical Garden, for pointing out this recently naturalized species.

***Baltimora recta* L.**

Erect annual herbs up to 1(–3) m tall; stems many-branched, strigose throughout. Leaves simple, opposite, ovate, 2.5–18.0 cm long, 1.5–12.0 cm wide, both surfaces strigose and scabrous, margins crenate-serrate, apex long-acuminate, base truncate to broadly cuneate, petioles 1–7 cm long. Heads usually in large panicles, rarely racemes, peduncles 8–33 mm long; involucre bracts 3–6, in 3 series, base ± scarious, tips herbaceous, 3.5–6.0 mm long, weakly strigose and ciliate at the apex; receptacle chaffy throughout, the bracts conduplicate, membranous, lanceolate, 3.5–4.2 mm long; ray florets 3–8 per head in a single series, pistillate and fertile, rays yellow, 3.8–5.5 mm long; disk florets 16 or sometimes more per head, functionally staminate, corollas 5-lobed, yellow, ca. 1.5 mm long, style undivided; pappus appearing to be absent, but present as a very small crown of minute scales. Achenes developing only from ray florets, thick, 3-angled, 2.4–3.2 mm long, apex truncate, angled, ± winged, puberulent. Native from Chiapas and Yucatan, Mexico, southward throughout Central America; in Hawai'i very sparingly naturalized at Makapu'u, O'ahu. First collected in 1984 (*Whistler s.n.*; BISH).

Bidens

Bidens alba (L.) DC., *B. cynapiifolia* H.B.K., and *B. pilosa* L. have been the only species of *Bidens* known to be naturalized in Hawai'i. Here we report a 4th naturalized species. We thank F.R. Ganders, University of British Columbia, for providing the determination and description of the species.

Bidens gardneri Baker

Erect annual herbs (0.5–)0.6–1.6 m tall. Leaves simple or trifoliolate below, pinnatifid or bipinnatifid above, usually 3–8 cm long including petiole. Heads 3–12 in compound cymes terminating main stem as well as lateral branches, 2–3 cm in diameter including ray florets, peduncles (5–)10–25 cm long; outer involucre bracts linear or spatulate-tipped, (2.0–)3.0–4.5 mm long; ray florets 6–8 per head, sterile, rays orange, 12–16 mm long; disk florets 20–30 per head, perfect, corollas yellow or brownish; pappus of (3)4 awns 1–2 mm long, with pectinate retrorse barbs. Achenes grayish black, straight, wingless, 7–12 mm long, 1.0–1.5 mm wide, subglabrous. Native from Paraguay to central Brazil; in Hawai'i apparently recently naturalized on Moloka'i. First collected in 1983 on dry, open ridge, Honouli Wai (*Hobby 1833*; BISH).

Blumea

Previously only *Blumea laciniata* was reported as naturalized in Hawai'i (Degener 1934; St. John 1973). Here we report 1 additional naturalized species.

Blumea sessiliflora Decne.

Similar to *B. laciniata* except its stems are up to 1 m tall, unbranched or branched, erect, leaves 4–16 cm long, 1.4–6.0 cm wide, sessile, heads in clusters of 3–5 in an interrupted spike, sessile, involucre bracts spreading, 1.5–6.5 mm long, receptacle glabrous. A native of Indonesia, Indochina, southern China, Burma, and Peninsular India; in Hawai'i it is known from 1 specimen collected in 1920 (*Forbes s.n.*; BISH) on the island of Maui without further locality data. It is not presently known if this species has persisted. *Blumea laciniata* is known in Hawai'i generally in low-elevation, disturbed sites on O'ahu and Hawai'i. It was first collected on O'ahu in 1923 (*Degener 5286*; BISH).

Calyptocarpus

In Hawai'i *Calyptocarpus vialis* has been confused with *Synedrellopsis grisebachii* Hieron. & Kuntze, which was reported by St. John (1973). We thank F.R. Fosberg, Smithsonian Institution, for information on the earliest collection of this species.

Calyptocarpus vialis Less.

Synedrella vialis (Less.) A. Gray.

Perennial herbs; stems sprawling to prostrate, (1–)2–6 dm long, often rooting at the nodes. Leaves simple, opposite, deltoid, 1–3(–6) cm long, 1–2(–4) cm wide, margins serrate, petioles 0.5–1.5 cm long. Heads radiate, solitary, rarely 2 or more, in the leaf axils; involucre bracts 3–5, herbaceous, partially overlapping, 5–10 mm long, the inner bracts shorter and narrower; receptacle chaffy; ray florets pistillate and fertile, rays yellow, 1.5–3.0 mm long; disk florets perfect and fertile, 4-merous, corollas ca. 2.5 mm long; pappus consisting of a pair of stout, spreading marginal awns 1–2(–4) mm long. Achenes of 2 slightly different types, the inner ones somewhat flattened, the margins rounded, the peripheral ones some-

times with lacerate thickenings on the margins toward the apex, tuberculate. A native of Texas south to Guatemala, Costa Rica, and Cuba; in Hawai'i it is now a common weed of disturbed habitats, especially lawns; it is probably on all of the main islands, but we have seen collections only from Kaua'i, O'ahu, Lāna'i, and Maui. First collected on O'ahu in 1963 (Kalihi, Fosberg 44449; US).

Representative specimens examined. HAWAIIAN IS: KAUA'I: Lihu'e, *Herbst* 5247 (BISH); LĀNA'I: Lāna'i City, *Herbst & Spence* 5797 (BISH); MAUI: Kahului, *Hobdy* 1873 (BISH).

Conyza

Plants of this genus in Hawai'i usually have been included in the genus *Erigeron*; however, *Conyza* is generally accepted by botanists worldwide. In Hawai'i there are 2 widely naturalized species.

Key to the Species of *Conyza* in Hawai'i

1. Involucre 4–6 mm high, densely pubescent; pistillate florets 50–200 or more per head; plants usually canescent ***C. bonariensis***
- Involucre 3–4 mm high, glabrous or nearly so; pistillate florets 25–40 per head; plants glabrous to hirsute, green ***C. canadensis***

***Conyza bonariensis* (L.) Cronq.**

Erigeron bonariense L.; *Conyza albida* Willd. ex Spreng.; *C. floribunda* H.B.K.; *Erigeron albidus* (Willd. ex Spreng.) A. Gray.

Perhaps native to South America but nearly cosmopolitan; it is a common weed in both urban and nonurban areas, generally in relatively dry habitats, on all of the main Hawaiian Is and Kure Atoll, Midway Atoll, Laysan, and French Frigate Shoals of the Northwest Hawaiian Is. Naturalized in Hawai'i prior to 1871 (Hillebrand 1888).

This species commonly has been confused with the next one but can be separated by the characters in the key.

***Conyza canadensis* (L.) Cronq.**

Erigeron canadense L.; *Conyza parva* Cronq.; *Erigeron pusillus* Nutt.

A native of southern Canada south to tropical America, widely naturalized; in Hawai'i it is naturalized in relatively dry, disturbed areas on Ni'ihau, Kaua'i, O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i.

There are 2 varieties of *Conyza canadensis* in Hawai'i resulting from independent introductions. *Conyza canadensis* var. *pusilla* (Nutt.) Cronq. (incl. *Conyza parva* and *Erigeron pusillus*) is a small, subglabrous plant generally less than 5 dm tall with some or all of the involucre bracts purple-tipped. Its distribution in Hawai'i is the same as that listed above for the species. Naturalized in Hawai'i prior to 1871 (Hillebrand 1888).

Representative specimens examined. HAWAIIAN IS: NI'HAU: Ka'aliwai, *St. John* 23568 (BISH); KAUA'I: Kaholuamanu, *Heller* 2820 (BISH); O'AHU: Mānoa Val, *Caum s.n.* (BISH); MOLOKA'I: below Pu'ukolekole, *Nagata* 2709 (BISH); LĀNA'I: Kamoku, *Munro* 235 (BISH); MAUI: Pu'u'ōuli, *Forbes* 2144.M (BISH); HAWAI'I: Volcano, *Herbst* 5539 (BISH).

Conyza canadensis var. *canadensis* has not been previously recorded in Hawai'i; it is taller than var. *pusilla* (generally over 1 m), the lower stem is coarsely hirsute, and the involucre bracts usually lack purple tips. Until 1984 it was known only from the lower slopes of Mauna Kea and the Pōhakuloa Training Area in the saddle between Mauna Loa and Mauna

Kea, Hawai'i; it was collected in 1984 on Maui. The earliest collection in Hawai'i is from Waiki'i, Hawai'i, in 1911 (Mauna Kea, *Forbes 467.H*; BISH).

Representative specimens examined. HAWAIIAN IS: MAUI: Kahului industrial area, *Hobby 2085* (BISH).

Crassocephalum

Locally the following species has been confused with *Erechtites hieracifolia* (L.) Raf. ex DC.

Crassocephalum crepidioides (Benth.) S. Moore

Gynura crepidioides Benth.

Annual herbs 3–5(–15) dm tall, unbranched or branched above, upper stem and inflorescence strigillose, often densely so. Leaves simple, alternate, elliptic to oblanceolate or ovate, lyrate-pinnatifid to toothed, 5–18 cm long, 1–6 cm wide, margins coarsely and irregularly dentate. Heads in terminal corymbs, nodding during anthesis, becoming erect, discoid, homogamous; involucre in a single series, the bracts coherent, 8–10 mm long, subtended by a series of smaller, distinct, often purple bracts; receptacle naked; florets numerous, red to reddish orange; pappus consisting of numerous white capillary bristles ca. 12 mm long. Achenes reddish brown, cylindrical, ca. 2 mm long, with 8–10 weakly developed ribs, sparsely puberulent between the ribs.

According to Belcher (1955) this species is a native of tropical Africa, widely naturalized throughout the Old World; in Hawai'i it is naturalized in habitats ranging from relatively dry areas to wet forest on Kaua'i, O'ahu, Maui, and Hawai'i, and it apparently is spreading rapidly. First collected on O'ahu in 1929 (Hau'ula, *Bryan 702*; BISH).

Representative specimens examined. HAWAIIAN IS: KAUA'I: Limahuli, *Wagner et al. 5155* (BISH); MAUI: Ke'anae Arboretum access rd, *Hobby 1921* (BISH); HAWAII: Hilo, *Herbst 8552* (BISH).

Crepis

The only species of *Crepis* that is naturalized in Hawai'i has been consistently misidentified as *C. pulchra* L. (e.g., Neal 1965; St. John 1973).

Crepis capillaris (L.) Wallr.

Lapsana capillaris L.; *Crepis pulchra* sensu Hawaiian botanists, non L.

Annual or biennial herbs 2–9 dm tall, often branched; stems hirsute, at least near the base. Leaves lanceolate or oblanceolate, 3–30 cm long, 0.5–4.5 cm wide, glabrous or hirsute, quickly reduced upward, denticulate to pinnatifid, lower leaves on short petioles, upper ones sessile and even clasping. Heads with 20–60 florets; involucre 5–8 mm high, often with long black glandular hairs along the midrib of the bracts. Achenes tawny to pale brown, fusiform, ca. 10-ribbed, 1.5–2.5 mm long. A native of central and southern Europe; in Hawai'i it is naturalized on the island of Hawai'i. First collected in 1934 (Parker Ranch, *Ewart 342*; BISH).

Erigeron

Previously the only *Erigeron* naturalized in Hawai'i was *E. karvinskianus* DC. A 2nd species is now naturalized on O'ahu.

Erigeron bellioides DC.

Delicate herbs, spreading by slender stolons; stems 6–15 cm long, the flowering stems erect, \pm with very reduced leaves, the stolons 10–15 cm long, \pm with reduced leaves. Leaves primarily basal, spatulate, 1.0–3.5 cm long, 0.3–1.0 cm wide, abruptly constricted to winged petioles 1.0–2.5 cm long. Heads 1.5–3.0(–5) mm in diameter; involucre bracts in 2 series, the inner one ca. 2 mm long, the outer similar but shorter; rays white, ca. 0.3 mm long. Achenes pale straw-colored, ca. 1 mm long. Native to the Greater Antilles; in Hawai'i relatively recently naturalized only in Honolulu and Kāne'ohe, O'ahu. First observed on the University of Hawai'i Manoa campus by Herbst in 1977 and collected in 1984 (*Wagner 5392*; BISH).

One collection of *Erigeron annuus* (L.) Pers. (*Hosaka 1563*; BISH) identified by A. Jones, University of Illinois, was made in 1936 at Hāmākua, Hawai'i, but this species has not been collected since that time.

Gnaphalium

There are 2 naturalized and 1 widespread, variable endemic species of *Gnaphalium* in Hawai'i. The genus was studied by Sherff (1948, 1949) and reviewed by Degener & Degener (1960a, 1960b, 1960c, 1960d, 1962) and by Degener et al. (1970). Below we reassess the native taxa, reducing *G. hawaiiense* to a variety of the common *G. sandwicensium*. Among the naturalized species, *G. purpureum* and *G. peregrinum* have long been recognized in the Hawaiian literature, but they actually represent a single species.

Key to the Species of *Gnaphalium* in Hawai'i

1. Heads in dense, globose clusters, these subtended by linear, leaflike bracts ... **G. japonicum**
Heads in spikelike, corymbose, or rarely nearly globose clusters, these never subtended by linear, leaflike bracts 2
- 2(1). Pappus bristles connate at base, falling away in a ring; heads in spikelike arrangements; annual or biennial herbs **G. purpureum**
Pappus bristles distinct or sometimes slightly connate at base; heads in corymbose or sometimes in nearly globose arrangements; perennial herbs **G. sandwicensium**

***Gnaphalium japonicum* Thunb.**

Erect annual herbs usually 2–4 dm tall, often densely white tomentose. Leaves oblong-spatulate to linear, usually 1–7 cm long, 0.1–0.7 cm wide, the margins usually rolled under, glabrate above and densely white tomentose below. Heads small, in dense terminal, globose clusters, these subtended by linear, leaflike bracts; involucre bracts brown or straw-colored, woolly at the base; pappus bristles distinct, scarcely coherent at the base. Native of Australia; in Hawai'i relatively common in dry to wet, disturbed habitats, along roadsides or in pastures, 600–2,800 m, on Moloka'i, Lāna'i, Maui, and Hawai'i. First collected on Maui in 1909 (Haleakalā, *Faurie 928*; BISH).

Representative specimens examined. HAWAIIAN IS: MOLOKA'I: cliffs above Kalaupapa, *Swezey s.n.* (BISH); LĀNA'I: Mahana Ridge, *Rock 8079* (BISH); MAUI: Haleakalā, Ko'olau Gap, *Degener 18451* (BISH); HAWAI'I: Humu'ula, *Neal & Hartt 663* (BISH).

***Gnaphalium purpureum* L.**

G. peregrinum Fernald.

Erect annual or biennial herbs 1–4(–10) dm tall, sparsely to moderately woolly. Lower leaves spatulate to oblanceolate, 2–5(–9) cm long, 0.3–2.0 cm wide, gradually becoming reduced up the stem, the uppermost leaves oblanceolate to oblong or even linear, densely

white tomentose below, more sparsely so or glabrate above. Heads in terminal, spikelike, sometimes interrupted clusters, sometimes with a few small, leafy bracts; involucre bracts light brown or purple, woolly below; pappus bristles connate, forming a ring at the base, deciduous as a unit. Native to North America; in Hawai'i naturalized and relatively common from dry to wet, disturbed habitats, especially roadsides, pastures, and open lava, from near sea level to 2,100 m, on all of the main islands except Ni'ihau. Naturalized in Hawai'i prior to 1871 (Hillebrand 1888).

Representative specimens examined. HAWAIIAN IS: KAUA'I: Limahuli Garden, *Wagner et al.* 5157 (BISH); O'AHU: Honolulu, *Herbst & Ishikawa* 5269 (BISH); MOLOKA'I: peninsula E of Wailau Val, *Fosberg* 9647 (BISH); LĀNA'I: Lāna'i City, *Degener & Degener* 28408 (BISH); MAUI: 'Ulupalakua, *Hosaka* 1797 (BISH); KAHO'OLAWA: Luakeālia Lalo, *Cuddihy & Char* 355 (BISH); HAWAI'I: upper Waiākea Forest Res, *Wagner et al.* 4842 (BISH).

***Gnaphalium sandwicensium* Gaud.**

Gnaphalium hawaiiense Degener & Sherff; *G. luteo-album* sensu Hillebr., non L.; *G. sandwicensium* var. *flagellare* Sherff; *G. s.* var. *hawaiiense* (Degener & Sherff) W.L. Wagner, Herbst & Sohmer, comb. et stat. nov.; *G. s.* var. *kilaueanum* Degener & Sherff; *G. s.* var. *lineatum* Sherff; *G. s.* var. *molokaiense* Degener & Sherff; *G. s.* var. *typicum* Sherff; *G. s.* var. *t. f. canum* Sherff; *G. s.* var. *t. f. olivaceum* Degener & Sherff.

Perennial herbs 1.0–6.5 dm tall, moderately to densely woolly; stems olive green to white or gray, erect to prostrate, unbranched to many-branched. Leaves linear-spatulate to spatulate, 1.0–6.5 cm long, 0.1–2.0 cm wide, the uppermost ones usually reduced, both surfaces densely woolly, upper surface sometimes less dense or the hairs deciduous in age, sessile and sometimes somewhat clasping. Heads 1.5–7.0 mm in diameter, arranged in terminal, corymbose or sometimes nearly globose, leafless or nearly leafless clusters; involucre bracts whitish to pale yellow, ± shiny, sometimes obscured by dense woolly hairs; pappus bristles free or cohering at the base, individually deciduous or in clusters. Scattered to common in relatively dry sites from near sea level on clay or consolidated dunes, and at higher elevations on dry sites, especially lava or cinders, 0–3,000 m, on all of the main islands except Kaua'i and Kaho'olawe and apparently also native to Kure and Midway atolls.

All of the native populations of *Gnaphalium* have been treated here as constituting 1 highly variable species. There are, however, 4 modally distinctive entities that can be recognized.

a) var. *hawaiiense* (Degener & Sherff) W.L. Wagner, Herbst & Sohmer, **comb. et stat. nov.** [Based on *Gnaphalium hawaiiense* Degener & Sherff, *Am. J. Bot.* 36: 507. 1949. TYPE: HAWAIIAN IS: HAWAI'I: Kilauea, 9.IV.1930, O. *Degener* 18462b (NY, holotype, photo F). Part of this collection also serves as the type of *G. sandwicensium* var. *kilaueanum*]. Differs principally in that it is very fragrant, has leaves 1–2(–3) mm wide and the heads loosely disposed within the clusters, each one easily distinguishable individually. It has a similar distribution as var. *kilaueanum* except it also occurs at Waimea and South Kohala, Hawai'i, and Auwahi, Maui.

Specimens examined. HAWAIIAN IS: MAUI: S slope of Haleakalā, Kamana, *Forbes* 2125.M (BISH); Auwahi, K. *Nagata* 1934 (BISH); Maui Zoological and Botanical Gardens (from Auwahi), *Davis & Sylva* 12 (BISH); HAWAI'I: Mauna Kea, 0.5 km W of Pōhakuloa Gulch, *Warshawer & McEldowney* 3144 (BISH); nr 1907 lava flow, *Degener & Wiebke* 2124 (BISH); Kipapala Ranch, *Greenwell s.n.* (*Degener's* no. 20707) (BISH); Pu'uke'eke'e, *Degener et al.* 19818 (BISH); Hawai'i Volcanoes Natl Pk, Halapē Trail, *Herat et al.* 833 (BISH); Humu'ula Sheep Sta, *Hosaka* 2321 (BISH); Waimea, range paddock, *Hosaka* 2057 (BISH); Hualālai, back of Hu'ehu'e, *Rock* 3637 (BISH); slopes of Hualālai, *Rock* 3636 (BISH); summit of Hualālai, *Forbes* 167.H (BISH); 1853 lava flow nr Pu'uwa'awa'a, *Forbes* 63.H (BISH); Volcano Kilauea, *Forbes & Brigham s.n.* (BISH).

b) var. *kilaueanum* differs from var. *sandwicensium* in that the stems are up to 6.5 dm long, leaves 1.5–5.0 mm wide, and the exterior involucre bracts are shiny, white to yellowish. It is restricted to the island of Hawai'i on the high plains between Mauna Loa and Mauna Kea, extending down into North and South Kona, and the Ka'u Desert, Kilauea, 1,200–3,000 m.

Representative specimens examined. HAWAIIAN IS: HAWAI'I: Pu'uuhuluhulu, *Wagner et al.* 5239B (BISH).

c) var. *molokaiense* is very densely white woolly over the entire plant, the stems prostrate to sometimes erect, 1–3 dm long, the leaves spatulate to narrowly obovate, the lower ones usually 0.7–2.0 cm wide, and only the tips of the involucre bracts exposed, the remainder densely woolly. It is endemic to the strand and consolidated dunes of western Moloka'i and vulnerable because of potential development of coastal areas.

Representative specimens examined. HAWAIIAN IS: MOLOKA'I I: Mo'omomi, *Herbst & Spence* 5103 (BISH).

d) var. *sandwicensium* (vars. *flagellare* and *lineatum*) has stems unbranched to branched, usually erect, usually 2–4 dm long, \pm woolly, whitish to distinctly olive green, leaves linear to sometimes spatulate, 1.5–8.0(–15.0) mm wide, densely woolly, the upper surface usually less pubescent, heads 1.5–3.0 mm wide, the involucre bracts tan to whitish, glabrate except at the very base. This variety occurs on Kure Atoll, Midway Atoll, Ni'ihau, O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i.

Representative specimens examined. HAWAIIAN IS: KURE ATOLL: Green I, *Lamoureux* 2776 (BISH); MIDWAY ATOLL: Eastern I, *Herbst & Takeuchi* 6426 (BISH); Sand I, *Herbst & Takeuchi* 6361 (BISH); NI'IIHAU: 'Ō'iamoi, sand dunes, *St. John* 23651 (BISH); O'AHU: Kolekole Pass, *Forbes* 2032.O (BISH); MOLOKA'I: Makakupa'ia Ridge, *Char et al.* 82.019 (BISH); LĀNA'I: N of Lāna'i City, *Degener* 21993 (BISH); MAUI: 'Ili o kukuipuka, *Degener & Clay* 19367b (BISH); Hawai'i, Mauna Kea, Kaluamakani, *Rock* 3261 (BISH).

Intermediates between var. *molokaiense* and var. *sandwicensium* are known from dry, bare, or coastal habitats from Waimānalo and Diamond Head on O'ahu, Hālawā Val on Moloka'i, Lāna'i, and between Waiehu and Wailuku on Maui.

Representative specimens examined. HAWAIIAN IS: O'AHU: Waimānalo, *Lyon s.n.* (BISH); MOLOKA'I: Hālawā Val, *St. John et al.* 12787 (BISH); LĀNA'I, Munro Trail near Pu'ukilea, *Degener et al.* 26852 (BISH); MAUI: Waiehu Sandhills, *Hobby s.n.* (BISH).

Variety *sandwicensium* intergrades with var. *hawaiiense* in the vicinity of Mauna Kea and intergrades with var. *kilaueanum* in various parts of its range. This complex is in need of careful study, especially since 3 of the 4 distinctive entities have overlapping distributions yet apparently maintain themselves without any visible ecological differences.

Lipochaeta

When *Lipochaeta venosa* was listed as an endangered species (*Herbst & Fay* 1979), populations from 2 areas in the Pōhakuloa Training Area [Kīpuka Kalawamauna, 1,550 m, *Stemmermann* 1463 (BISH), *Davis* 299 (BISH), and the 1859 lava flow, 2,290 m, *Degener et al.* 19810 (BISH)] were included in *L. venosa*. Recent reevaluation of the relationship between *L. venosa* and the closely related *L. subcordata* for the *Manual* has shown that these higher-elevation populations from Pōhakuloa represent rather small-leaved plants of *L. subcordata*. These collections represent one end point in the variation of *L. subcordata*. When all of the material is considered, the high elevation populations intergrade smoothly into the low elevation populations and therefore are recognized here as one variable species.

With these rearrangements *L. venosa* is a very narrow endemic species restricted to the low-elevation cinder cones mentioned below. The ranges of these 2 closely related species do not overlap. *Lipochaeta venosa* has leaves 2.1–2.8(–5) cm long, stems low, arcuate-spreading, and heads solitary or sometimes in clusters of 2(3), whereas *L. subcordata* has leaves (2.4–)3.4–10.0(–16.0) cm long, stems erect to ascending, and heads in compound cymes, rarely in clusters of 2–3.

***Lipochaeta subcordata* A. Gray**

Lipochaeta deltoidea St. John; *L. flexuosa* Drake; *L. intermedia* Degener & Sherff; *L. populifolia* (Sherff) Gardner; *L. subcordata* var. *populifolia* Sherff; *L. s.* var. *typica* Sherff.

Suffruticose perennial herbs; stems erect to ascending, 3–30 dm long. Leaves narrowly deltate to deltate, occasionally with 2 basal lobes, (2.4–)3.4–10.0(–16.0) cm long, (2.4–)3–6(–10) cm wide, strigillose, lower surface often densely so, margins irregularly serrate, petioles 1–3 cm long. Heads in compound cymes or sometimes in clusters of 2–3; outer involucre bracts often purple along midrib, lanceolate to ovate, (3–)4–6 mm long, 1.5–2.3 mm wide, sparsely to moderately strigillose, apex attenuate to obtuse; chaffy bracts often purple near apex or tan throughout; ray florets 5–8 per head, rays oblong, (3.0–)4.0–9.3 mm long, 2–4 mm wide; disk florets 5-merous, 11–45 per head, corollas 2.5–3.4 mm long; anthers 1.1–1.5 mm long; pappus of scales forming an uneven corona tipped with short, deciduous awns or solely of short, deciduous awns. Achenes tuberculate, often spotted with purple, with a fringe of scales on upper outer rim, those of ray florets 1.9–2.8 mm long, 1.5–2.5 mm wide, with wings ca. 0.4 mm long, those of disk florets 2.1–2.8 mm long, 1.1–2.2 mm wide, \pm winged, the wing ca. 0.2 mm long. Scattered in dryland sclerophyll woodland or grassland, (100–)550–1,800 m, Hikimoe Val, Kaua'i, North Kona Dist, Hawai'i, and formerly Maunalei Val, Lāna'i.

Gardner (1979) presented a narrower concept of *Lipochaeta subcordata* than we have here. *Lipochaeta flexuosa*, and *L. intermedia* also described from the island of Hawai'i clearly fall within the range of variation in *L. subcordata*. Gardner also included the latter 2 names here.

Several collections from other islands also fit well within the range of variation of *Lipochaeta subcordata* and appear to represent relicts of a previously wider distribution. Two collections from Lāna'i and Kaua'i described as *Lipochaeta populifolia* [Maunalei Val, Munro 670 (F, holotype, not seen; BISH 3 sheets, isotypes)] and *L. deltoidea* [lower Hikimoe Val, Hobby 102 (BISH-468055, lectotype; Gardner, Rhodora 81: 323. 1979; BISH, isolectotype)], respectively, are scarcely distinct from *L. subcordata* and therefore are included here. *Lipochaeta subcordata* populations on the island of Hawai'i are variable, especially in leaf size and to some extent shape. In distinguishing features the single collection from Lāna'i described as *L. populifolia* falls well within the range of *L. subcordata* except that the leaves are more broadly deltate than other specimens of *L. subcordata*. The report by Gardner (1979) that the type of *L. populifolia* had rays 9.3 mm long seems to be an error. Measurements made on the 3 isotype sheets at BISH range from 6.3 to 7.0 mm long, which is in agreement with the measurements given by Sherff (1935), and thus are very similar to the length range found in plants of *L. subcordata* on Hawai'i. Likewise, a collection from Kaua'i described as *L. deltoidea* by St. John (1972) is within the range of *L. subcordata* except that the heads are solitary or in clusters of 2–3. Therefore, these entities seem to be best treated as 1 variable species. *Lipochaeta subcordata* A. Gray var. *membranacea* Sherff (Sherff 1933) was described from 1 collection (Bishop 14; B, presumably destroyed) from behind Lahaina; there is no way of determining what species it represents.

Lipochaeta venosa Sherff

Lipochaeta pinnatifida St. John; *L. setosa* St. John.

Suffruticose perennial herbs; stems arcuate-spreading. Leaves deltate, usually dimorphic, pinnately dissected throughout or very coarsely serrate, 2.1–2.8(–5) cm long, 0.8–2.2 cm wide, often with 2 basal lobes, upper surface sparsely strigillose, lower surface more densely so, petioles 0.8–1.5 cm long. Heads solitary or in clusters of 2(3); outer involucre bracts ovate, 5.0–5.5 mm long, 2.5–3.5 mm wide, strigillose, obtuse; chaffy bracts often purple near apex; ray florets 4–6(–8) per head, rays ovate-elliptic, 3–6(–12) mm long, 2.0–2.8 mm wide; disk florets 5-merous, 20–30 per head, corollas 3.0–3.3 mm long; anthers 1.4–1.5 mm long; pappus of short, deciduous awns. Achenes tuberculate, often spotted with purple, those of ray florets 2.0–2.4 mm long, 1.5–1.8 mm wide, with wings ca. 0.2 mm long, those of disk florets 2.0–2.4 mm long, 1.4–1.5 mm wide, wingless. Scattered in dryland sclerophyll woodland, ca. 730–915 m, known only from South Kohala Dist, Nohonaohae, Holoholokū, Pu'upāpapa, and Heihei cinder cones, Hawai'i.

Specimens examined. HAWAIIAN IS: HAWAI'I: South Kohala Dist, Nohonaohae cinder cone, J.F. Rock 8349 (F, holotype; BISH 2 sheets, GH, UC, isotypes), S. Anderson 499 (BISH), Nagata et al. 2026 (BISH), Nagata et al. 2028 (BISH), Davis 243 (BISH); Heihei cinder cone, S. Anderson 500 (BISH); Holoholokū cinder cone, S. Anderson 502 (BISH), Hosaka 2114 (BISH); cinder cone NE of Nohonaohae, S. Anderson 503 (BISH), Davis 713 (BISH), S. Anderson 505 (BISH); Pu'upa'a, nr tank rd, Warshauer 3160 (BISH, holotypes of *L. pinnatifida* and *L. setosa*).

Lipochaeta venosa is closely related to the polymorphic *L. subcordata* and differs principally in the combination of characters presented in the key. It is a rare species and is listed as endangered under the Endangered Species Act of 1973. The principal threats to populations of *L. venosa* include invasion of fountain grass and other alien species, fire, and browsing by cattle and feral goats and sheep (Herbst & Fay 1979; Wagner et al. 1985).

St. John (1984) described both *Lipochaeta pinnatifida* and *L. setosa* from a single population sample, Warshauer 3160, dividing the specimens based on leaf lobing and assigning the relatively unlobed sheet, Warshauer 3160A, as the holotype of *L. setosa*, and the pinnately dissected sheet, Warshauer 3160, as the holotype of *L. pinnatifida*. Both sheets fit well within the morphological range of *L. venosa*. On the label Warshauer stated that the specimens represented the range of variability within the population.

Hybridization in *Lipochaeta*

Natural intersectional hybrids between species of *Lipochaeta* have been reported (Sherff 1935), and the crossing relationships among *Lipochaeta* species and between *Lipochaeta* and closely allied genera have been explored (Rabakonandrianina & Carr 1981). Here we report on a series of plants that appear to represent hybrids between *L. integrifolia* and *L. succulenta*.

A few plants of a *Lipochaeta* similar to *L. integrifolia* (Nutt.) A. Gray growing at Kilauea Point, Kaua'i, were recently brought to our attention by Dan Moriarty. These plants can be characterized by the following description [based on examination of Flynn 809 (BISH) and Bottomley s.n. in 1983 (BISH)]:

Decumbent, mat-forming perennial herbs; stems branched. Leaves oblanceolate to oblong-elliptic, 1.3–3.5 cm long, 0.4–0.7 cm wide, sparsely strigillose to glabrate. Heads solitary in the leaf axils; involucre bracts ovate, 3.0–3.5 mm long, 2.5–3.0 mm wide, glabrate, apex acute; ray florets 9–13 per head, rays 2–3 mm long; disk florets both 4- and 5-merous. Achenes not developing.

These plants appear to represent sporadic hybrids in this locality on Kaua'i between *Lipochaeta integrifolia* and *L. succulenta* (Hook. & Arnott) DC. The evidence for this is basically

that although the habit and leaf shape of the putative hybrids are similar to *L. integrifolia*, the very sparse pubescence is that of *L. succulenta*. Also, the involucre bracts are within the shape and size range of *L. succulenta*. Moreover, the heads contain mixtures of 4- and 5-merous disk corollas, of which ca. 80% are 4-merous. This further suggests hybridization, since *L. integrifolia*, which these plants most closely resemble, has 5-merous disk corollas, whereas those of *L. succulenta* are 4-merous. Most importantly, however, the 1 plant tested had sterile pollen based on a test with Alexander's Stain (Alexander 1965), and no mature achenes could be found in any heads of the several plants examined.

We appreciate the assistance of Tim Flynn and Dan Moriarty in obtaining material of the plants studied.

Palafoxia

Palafoxia callosa, a native of the western and central United States, is here reported to be naturalized in Hawai'i.

Palafoxia callosa (Nutt.) Torr. & A. Gray

Polypteris callosa Nutt.

Slender, branching annual herbs 1–6 dm tall, coarsely strigose, the inflorescence pubescent with dark, tack-shaped, stipitate glands. Leaves narrowly lanceolate to linear, 3–6 cm long, 0.2–0.6 cm wide. Heads discoid, peduncles 5–30 mm long; involucre turbinate or campanulate, ca. 4–6 mm high, the bracts equal, herbaceous, tinged pinkish purple; disk florets ca. 5–15 per head, corollas pink, ca. 3 mm long; pappus scales with conspicuous membranous margins ca. 1 mm long. Achenes 4–7 mm long. Native from new Mexico to Arkansas, Oklahoma, and Missouri; in Hawai'i naturalized in dry, disturbed areas in the southwestern part of Moloka'i. First collected in 1971 (Kamāka'ipō, *Pekelo s.n.*; BISH).

Remya

Two species of this endemic genus of obscure affinity have long been known (Hillebrand 1888); however, *Remya kauaiensis* was until recently thought to be extinct. The following key summarizes the principal differences between the species.

Key to the Species of *Remya*

1. Leaves lanceolate to elliptic-lanceolate or broadly ovate, blades usually ca. 2.5× longer than wide, 4.5–13.0 cm long, 2.2–7.0 cm wide, base cuneate, petioles 1.2–2.2 cm long ***R. kauaiensis***
- Leaves narrowly elliptic, blades 5–12× longer than wide, 9–18 cm long, 0.8–2.6 cm wide, base long-attenuate, petioles 0–1 cm long ***R. mauiensis***

Remya kauaiensis Hillebr.

Remya kauaiensis var. *magnifolia* Sherff.

Erect, canescent shrubs ca. 1 m tall; stems densely leafy near the ends. Leaves lanceolate to elliptic-lanceolate or broadly ovate, blades 4.5–13.0 cm long, 2.2–7.0 cm wide, lower surface densely tomentose, margins sharply serrate-dentate, base cuneate, petioles 1.2–2.2 cm long. Heads in open panicles; involucre globose, ca. 3 mm high, 2.5–3.0 mm wide; ray florets ca. 20 per head, rays ca. 0.5 mm long; disk florets 30–40 per head, corollas ca. 2 mm long; pappus of 4–8 bristles, 2 of them as long as the achene, the others much shorter. Achenes ca. 1.5 mm long, puberulent. Known from a few collections in mixed mesophytic forest in the Kōke'e area of Kaua'i, ca. 1,050 m.

This species was thought to be extinct, but 4 populations recently (1982 and 1985) were rediscovered by T. Flynn (Pacific Tropical Botanical Garden), each consisting of about 3 or 4 plants. *Remya kauaiensis* var. *magnifolia* described by Sherff (1954) represents a plant with somewhat larger leaves than previously observed for this rare species and does not warrant formal recognition.

Representative specimens examined. HAWAIIAN IS: KAUA'I: Ka'ula'ula Val, Lapa Loop Rd, below Lapa tree planting site, *Flynn & Kawakami 448* (BISH); Kauhao Ridge, on a steep slope below the Boy Scout Camp, *Hobby 1825* (BISH); 2.4 km down Makaha Ridge Rd from Jct. Hwy 550, NW facing slope, *Wagner et al. 5620* (BISH).

Senecio

Senecio sandvicensis Less.

Erect perennial herbs 3.4 dm tall; stems unbranched, glabrous. Leaves mostly basal, oblong-ob lanceolate to elliptic, blades 7.5–10.0 cm long, 1.9–3.2 cm wide, becoming reduced above, margins entire, petioles 4.0–5.4 cm long. Heads in terminal cymes, discoid; involucre bracts 7 mm long; disk corollas yellow, ca. 6 mm long. Achenes unknown.

This species is based on 1 specimen collected by J.F. von Eschscholtz on the voyage of the Russian ship *Rurick*. The label of the specimen in Leningrad Herbarium (LE) states the locality as "Sandwich Islands, O Wahu" (St. John 1979); however, this specimen differs in no essential way from *S. hydrophilus* Nutt. from the western United States. It seems likely that there was an error in the original label data and that the collection actually was made at a stop on the California coast during the voyage. *Senecio hydrophilus* grows in the San Francisco Bay area of California where Eschscholtz did in fact collect, and this specimen probably came from there. Alternatively, it may represent an early introduction of *S. hydrophilus* in Hawai'i that persisted for only a short period.

St. John (1979) contends that *Senecio sandvicensis* is indeed from Hawai'i and represents a species distinct from *S. hydrophilus*; however, we see no essential differences when the full range of variation in *S. hydrophilus* is considered.

Wedelia

Wedelia trilobata (L.) Hitchc.

Silphium trilobatum L.

Creeping and mat-forming perennial herbs; stems rounded, rooting at the nodes, 1–3 (–4) dm long, the flowering portions ascending, coarsely strigose to spreading hirsute, sometimes subglabrous. Leaves fleshy, usually 4–9 cm long, (1.5–)2–5 cm wide, irregularly toothed or serrate, usually with a pair of lateral lobes. Heads on peduncles 3–10 cm long; involucre campanulate-hemispherical, ca. 1 cm high; ray florets often 8–13 per head, rays 6–15 mm long; disk corollas 4–5 mm long; pappus a crown of short fimbriate scales. Achenes tuberculate, 4–5 mm long, few achenes maturing in the cultivated plants in Hawai'i. Native to New World tropical regions; in Hawai'i cultivated as a ground cover. Owing to its vigorous vegetative reproduction, it has commonly escaped, probably on all of the main islands.

Plants cultivated in Hawai'i generally have heads that develop few mature achenes. Seedlings occasionally have been observed. If a fertile strain develops, this species could become a serious weed. It has been experimentally hybridized with *Lipochaeta* species (Rabakonandrianina & Carr 1981).

Zinnia

In Hawai'i *Zinnia peruviana* (L.) L., previously known as *Z. pauciflora* L., is naturalized and common in low-elevation, dry areas on Lāna'i, Maui, and Kaho'olawe. Here we report a species naturalized only on Koko Crater, O'ahu. We thank J.L. Strother, University of California, Berkeley, for his assistance. The delimitation of this species follows Strother (1979).

Zinnia palmeri A. Gray

Zinnia maritima sensu Torres, pro parte.

Annual herbs 2–4 dm tall. Leaves narrowly deltate to linear-triangular, 2–5 cm long, 0.4–1.2(–2) cm wide, margins often obscurely serrate, base truncate to subcordate-clasping, subsessile. Rays yellow to sometimes orange, suborbicular to oblong, 5–11 mm long; disk corollas purple to blackish at the apex, 3–4 mm long; pappus of 2 awns. Achenes 1.8–2.8 mm long. Native to central Mexico; in Hawai'i naturalized only on Koko Crater, O'ahu. First collected in 1980 (*St. John 26944*; BISH).

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LITERATURE CITED

- Alexander, M.P.** 1965. Differential staining of aborted and nonaborted pollen. *Stain Technol.* 41: 117–22.
- Belcher, R.O.** 1955. The typification of *Crassocephalum* Moench and *Gynura* Cass. *Kew Bull.* 1955: 455–65.
- Brown, N.E.** 1904. Asclepiadaceae. p. 231–503. In: W.T. Thiselton-Dyer, ed., *Flora of tropical Africa*. Lovell Reeve & Co., Ltd., London.
- Christophersen, E. & E.L. Caum.** 1931. Vascular plants of the leeward islands, Hawaii. *Bernice P. Bishop Mus. Bull.* 81. 41 p.
- Degener, O.** 1934. *Fl. Hawaiiensis*, fam. 344. *Blumea laciniata*. Publ. priv., 2 p. Rep., 1946.
- . 1937. *Fl. Hawaiiensis*, fam. 344. *Franseria strigulosa*. Publ. priv., 2 p. Rep., 1946, with change.
- . 1938. *Fl. Hawaiiensis*, fam. 112. *Alternanthera repens*. Publ. priv., 2 p. Rep., 1946.
- Degener, O. & I. Degener.** 1960a. *Fl. Hawaiiensis*, fam. 344. *Gnaphalium*. Publ. priv., 1 p.
- . 1960b. *Fl. Hawaiiensis*, fam. 344. *Gnaphalium hawaiiense*. Publ. priv., 2 p.
- . 1960c. *Fl. Hawaiiensis*, fam. 344. *Gnaphalium purpureum*. Publ. priv., 2 p.
- . 1960d. *Fl. Hawaiiensis*, fam. 344. *Gnaphalium sandwicensium*, part 1. Publ. priv., 2 p.
- . 1962. *Fl. Hawaiiensis*, fam. 344. *Gnaphalium sandwicensium*, part 2. Publ. priv., 2 p.
- Degener, O., I. Degener & Y. Makinen.** 1970. *Fl. Hawaiiensis*, fam. 344. *Gnaphalium peregrinum*. Publ. priv., 2 p.
- Degener, O. & A.B. Greenwell.** 1956a. *Fl. Hawaiiensis*, fam. 282. *Hydrocotyle sibthorpioides*. Publ. priv., 2 p.
- . 1956b. *Fl. Hawaiiensis*, fam. 306. *Gomphocarpus*; *Gomphocarpus physocarpus*. Publ. priv., 2 p.
- Fosberg, F.R.** 1966. Critical notes on Pacific island plants. 1. *Micronesica* 2: 143–52.
- Gardner, R.C.** 1979. Revision of *Lipochaeta* (Compositae: Heliantheae) of the Hawaiian Islands. *Rhodora* 81: 291–343.
- Herbst, D.R. & J. Fay.** 1979. Endangered and threatened wildlife and plants; determination that three Hawaiian plants are endangered species. *Fed. Reg.* 44(211): 62468–69.

- Hillebrand, W.** 1888. Flora of the Hawaiian Islands. Lubrecht & Cramer, Monticello, N.Y. 673 p. (Facsimile edition, 1981.)
- Mears, J.A.** 1977. The nomenclature and type collections of the widespread taxa of *Alternanthera* (Amaranthaceae). Proc. Acad. Nat. Sci. Phila. 129: 1-21.
- Neal, M.C.** 1965. In gardens of Hawaii. 2nd ed. Spec. Publ. Bernice P. Bishop Mus. 50. 924 p.
- Neal, M.C. & B. Metzger.** 1928. In Honolulu gardens. Spec. Publ. Bernice P. Bishop Mus. 13. 336 p.
- Rabakonandrianina, E. & G.D. Carr.** 1981. Intergeneric hybridization, induced polyploidy, and the origin of the Hawaiian endemic *Lipochaeta* from *Wedelia* (Compositae). Am. J. Bot. 68: 206-15.
- Rao, A.S.** 1956. A revision of *Rauwolfia* with particular reference to the American species. Ann. Mo. Bot. Gard. 43: 253-354.
- St. John, H.** 1957. Discovery of *Alternanthera* (Amaranthaceae) in the native Hawaiian flora. Hawaiian plant studies 27. Bull. Jard. Bot. Etat 27: 49-54.
- . 1972. Plantae Hobdyanae Kauaienses. Hawaiian plant studies 31. Pac. Sci. 26: 275-95.
- . 1973. List and summary of the flowering plants in the Hawaiian Islands. Pac. Trop. Bot. Gard. Mem. 1. 519 p.
- . 1977. The native Hawaiian *Alternanthera* (Amaranthaceae). Hawaiian plant studies 63. Phytologia 37: 476-78.
- . 1979 [1980]. The native species of *Senecio* (Compositae) in Hawaii. Hawaiian plant studies 53. Pac. Sci. 33: 329-32.
- . 1980. Key to Hawaiian species of *Rauwolfia* (Apocynaceae). Hawaiian plant studies 99. Phytologia 45: 354-55.
- . 1984. Novelties in *Lipochaeta* (Compositae). Hawaiian plant studies 119. Pac. Sci. 38: 253-82.
- Sherff, E.E.** 1933. New or noteworthy Compositae. IX. Bot. Gaz. (Crawfordsville) 95: 78-103.
- . 1935. Revision of *Tetramolopium*, *Lipochaeta*, *Dubautia* and *Railliardia*. Bernice P. Bishop Mus. Bull. 135. 136 p.
- . 1947. A preliminary study of the Hawaiian species of the genus *Rauwolfia* (Plum.) L. (family Apocynaceae). Field Mus. Nat. Hist. Bot. Ser. 23: 321-31.
- . 1948. A new variety of *Gnaphalium sandwicense* Gaud. in the Hawaiian Islands. Lloydia 11: 309.
- . 1949. Miscellaneous notes on dicotyledonous plants. Am. J. Bot. 36: 499-511.
- . 1954. Further notes upon the flora of the Hawaiian Islands. Bot. Leaflet. 9: 2-10.
- Sinclair, I.** 1885. *Indigenous flowers of the Hawaiian Islands*. Sampson, Low, Marston, Searle, & Rivington, London.
- Sohmer, S.H.** 1972. Revision of the genus *Charpentiera* (Amaranthaceae). Brittonia 24: 283-312.
- Strother, J.L.** 1979. Extradition of *Sanvitalia tenuis* to *Zinnia* (Compositae-Heliantheae). Madroño 26: 173-79.
- Wagner, W.L., D.R. Herbst & R.S.N. Yee.** 1985. Status of the flowering plants of the Hawaiian Islands. p. 23-74. In: C.P. Stone & J.M. Scott, eds., *Hawai'i's terrestrial ecosystems: Preservation and management*. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu.