*Records of the Hawaii Biological Survey for 1996. Bishop Museum Occasional Papers* 48: 51-65. (1997)



# Contributions to the Flora of the Hawai‘i. VI[1]

WARREN L. WAGNER [2], ROBYNN K. SHANNON (Department of Botany, MRC 166, National Museum of Natural History, Smithsonian Institution, Washington DC 20560, USA), and DERRAL R. HERBST[3] (U.S. Army Corps of Engineers, CEPOD-ED-ES, Fort Shafter, HI 96858, USA)

As discussed in previous papers published in the *Records of the Hawaii Biological Survey* (Wagner & Herbst, 1995; Lorence *et al.*, 1995; Herbst & Wagner, 1996; Shannon & Wagner, 1996), recent collecting efforts, continued curation of collections at Bishop Museum and the National Museum of Natural History (including processing of backlogs), and review of relevant literature all continue to add to our knowledge about the Hawaiian flora. When published, this information supplements and updates the treatments in the *Manual of the flowering plants of Hawai‘i* (Wagner *et al.*, 1990). In just the last 2 years, in the *Records of the Hawaii Biological Survey* alone, new records for 265 taxa of flowering plants have been reported from the Hawaiian Islands. In this paper we report an additional 13 new state records (from Kaua‘i, O‘ahu, Moloka‘i, and Hawai‘i), 14 new island records (from Midway Atoll, Kaua‘i, O‘ahu, Maui, Lana‘i, Kaho‘olawe, and Hawai‘i), 8 taxonomic changes, and 2 corrections of identification. All specimens are determined by the authors except as indicated.

**Amaranthaceae**

***Amaranthus retroflexus*** L. **New state record**

This coarse, villous, monoecious herb 5–30 dm tall apparently was naturalized in the Hawaiian Islands 20 years ago, but its current status is not known. The following diagnostic characters are adapted from Webb *et al.* (1988) and Reed (1970). *Amaranthus retroflexus* is distinguished from other species of *Amaranthus* in the Hawaiian Islands by leaf blades 2–10 cm long, 1–4.5 cm wide, narrowly ovate, the petioles up to 5 cm long; flowers in dense spike-like clusters in stout paniculate inflorescences 5–20 cm long, the staminate tepals 4–5, 2–3 mm long, the pistillate ones similar in number and size, but the apex rounded to truncate, the bracteoles 4–5 mm long, lanceolate, awn-tipped; and fruit ca. 1.5 mm long, circumscissile near the middle, the lid smooth or rugulose near the line of dehiscence.

*Amaranthus retroflexus* is native from southern Canada through much of the United States and northern Mexico; it is widely naturalized around the world.

*Material examined.* HAWAI‘I: Ka‘ohe, Pohakuloa State Park, 6500 ft., 7 July 1977, *Herbst 5907* (US). Specimen det. by F. R. Fosberg and S. Mosyakin.

**Apocynaceae**

***Alstonia macrophylla*** Wall. ex G. Don **New state record**

This species was cultivated in the Hawaiian Islands prior to 1949. There are collections at BISH from Lawa‘i Kai, Kaua‘i; the Waimea Arboretum and Botanical Gardens, O‘ahu; and the Shipman estate, Kea‘au, Hawai‘i (the label on this specimen, collected by

1. Contribution No. 1997-005 to the Hawaii Biological Survey.
2. Research Associate in Botany, Department of Natural Sciences, Bishop Museum, Honolulu, Hawaii.
3. Honorary Associate in Botany, Department of Natural Sciences, Bishop Museum, Honolulu, Hawaii.

L.W. Bryan, 2 Aug. 1949, states that, "this tree came from nursery at Foster Gardens many years ago"). It has recently become naturalized on Hawai'i. Specimens det. by A.J.M. Leeuwenberg.

*Material examined.* HAWAI'I: Pepe'ekeo, mauka of Highway 19, directly across from Hilo Processing Co. quarry site, near entrance to D. Carlsmith estate, in pasture with exotics such as guava and rose apple, ca. 550 ft., 25 Feb. 1991, *Takiue s.n.* (BISH); Hilo, invasive weed tree on various substrates, 76 m, March 1993, *Paul s.n.* (BISH); South Hilo Dist., Waiakea, Keaukaha Military Reservation, along jeep road through mixed native/alien forest, occasional, 60 ft., 5 July 1996, *Herbst & Hopper 9783a* (BISH).

**Asteraceae**

***Cyanthillium cinereum*** (L.) H. Rob. **Taxonomic change**

The species treated as *Vernonia cinerea* (L.) Less. in Wagner *et al.* (1990: 373) has recently been recognized as belonging to the segregate genus *Cyanthillium*. Robinson (1990) provided the new combination. Though no recent monograph exists, *Cyanthillium* is thought to be a genus of about 25 species, and, except for the pantropical *C. cinereum* which occurs in the Hawaiian Islands, is restricted to Africa, Madagascar, and Asia (Bremer, 1994).

***Emilia sonchifolia*** (L.) DC. var. ***javanica*** **New island record**
(N. Burm.) Mattfeld

Reported by Wagner *et al.* (1990: 312) as occurring only on Kaua'i and O'ahu, *E. sonchifolia* var. *javanica* is now known to be naturalized on East Maui as well, along with *E. sonchifolia* var. *sonchifolia* and *E. fosbergii* Nicolson.

*Material examined.* MAUI: East Maui, Maliko Bay off Hwy. 36, beach front, 5 August 1993, *McKinnon et al. 510* (US).

Gnaphalieae

Delimiting the large and heterogeneous taxa *Helichrysum* and *Gnaphalium* and the numerous related genera has been a significant problem in generic classification in the Asteraceae. Recently the tribe Inuleae has been revised at the generic level (for summary see Anderberg, 1994). In that revision the Inuleae was split into 3 tribes. One of them, comprising the everlastings and cudweeds (represented in the Hawaiian Islands by *Gnaphalium, Filago,* and *Helichrysum*; Wagner *et al.*, 1990) were removed to the tribe Gnaphalieae and generic circumscriptions were revised (Anderberg, 1991). The revision of the Gnaphalieae included the description of a number of new genera and resurrection of several others. Considerable progress in delimiting more natural groupings in this difficult tribe has been made through these studies, but some difficult problems remain, especially in and surrounding the large genus *Helichrysum*.

Many of the revisions suggested or supported by Anderberg are being widely adopted. When they are adopted for the taxa in the Hawaiian flora, a number of changes are necessary. In the revised scheme *Gnaphalium* in the Hawaiian Islands has been replaced

by the 3 genera *Euchiton*, *Gamochaeta*, and *Psuedognaphalium*, and each of the 3 *Gnaphalium* species treated by Wagner *et al.* (1986, 1990: 320) is placed in a different genus. The species key provided in Wagner *et al.* summarizes some of the diagnostic characters of the these genera, but a more detailed key to these genera, adapted from Drury (1971) and Anderberg (1991), is presented below.

We also report that the species long known in the Hawaiian islands as *Gnaphalium japonicum* Thunb. has been misidentified and is actually *Euchiton sphaericus* (Willd.) A. Anderb. (syn. *G. sphaericum* Willd.). We conclude by reporting the true *E. japonicus* (Thunb.) A. Anderb. (syn. *G. japonicum* Thunb.) as a new state naturalized record.

Several papers by Drury on the New Zealand Gnaphalieae (1970, 1971, 1972) are helpful, although he treats the taxa considered genera by Anderberg (1991, 1994) at the sectional level in the genus *Gnaphalium*. It now appears to be generally accepted that the old broad circumscription of *Gnaphalium* is polyphyletic. In fact the species included in *Pseudognaphalium* are considered to be more closely related to and perhaps congeneric with *Helichrysum* (Hilliard & Burtt, 1981; Anderberg, 1991). The following key separates the 3 genera occurring in the Hawaiian Islands formerly treated as *Gnaphalium*.

1. Leaves usually weakly clasping the stem and sometimes slightly decurrent; capitulescences in corymbose or subglobose clusters; involucral bracts opaque-white or -yellowish white, conspicuously shiny; corollas pale yellow; pappus hairs deciduous individually or held together in small clusters by basal cilia; achene epidermis with often overlapping papillae; achene sparsely covered with short, clavate myxogenic hairs, the hairs producing exudate in water ..... ***Pseudognaphalium***

1. Leaves not clasping the stem, not decurrent; capitulescences usually crowded into terminal clusters enveloped by leafy involucral bracts or into terminal and axillary clusters coalescing into spiciform inflorescences; corollas purple at least toward the lobes; pappus hairs deciduous in small groups held together by basal cilia or connate and deciduous as a unit; achene epidermis smooth or with paired papillae; achene with globose or short clavate myxogenic hairs, the hairs producing exudate or not (**2**).

2. Leaves flat and straight; achene epidermis microscopically papillose, the papillae paired; achenial hairs clavate, usually 4 × as long as wide, not readily emitting mucilage in water; capitula usually crowded into terminal clusters enveloped by a leafy involucre or with a smaller bracteate cluster immediately below; pappus hairs usually deciduous in small groups held together by basal cilia, not connate basally ..... ***Euchiton***

2. Leaves often folded or sickle-shaped; achene epidermis smooth, without microscopic papillae; achenial hairs globose, producing exudate in water; capitula crowded into terminal and axillary clusters, the clusters usually coalescing into spiciform inflorescences; pappus hairs connate basally into a ring, deciduous as a unit ..... ***Gamochaeta***

In the following synopsis of *Pseudognaphalium* only the necessary nomenclature and types needed to validate new combinations are provided. A full listing of the taxonomic synonyms for these taxa is given by Wagner *et al.* (1986).

***Euchiton***

There are 2 species of *Euchiton* in the Hawaiian Islands. *Euchiton sphaericus* has been consistently misidentified (as *Gnaphalium japonicum*), and *E. japonicus* is reported here for the first time.

***Euchiton japonicus*** (Thunb.) A. Anderb. **New state record**

The following collection was originally identified by Wagner as *Gnaphalium purpureum* L., but a specialist on this group, M. Dillon, provided the correct identification in 1994. It is easily distinguished from *Euchiton sphaericus*, which is an annual herb, by its stoloniferous perennial habit, and from *Gamochaeta* by the characters given in the key.

*Material examined.* HAWAI'I: Upper Waiakea Forest Reserve, along Disappointment Trail (Pu'u Maka'ala access rd.) of Stainback Hwy., in *Metrosideros* rainforest, ca. 1100 m, 26 July 1983, *Wagner et al. 4842* (BISH, US).

***Euchiton sphaericus*** (Willd.) A. Anderb. **Corrected identification**

This species has been consistently misidentified in the Hawaiian Islands as *Gnaphalium japonicum* since its introduction in the early part of this century.

***Gamochaeta purpurea*** (L.) Cabr. **Taxonomic change**

The plant treated by Wagner *et al.* (1990: 321) as *Gnaphalium purpureum* is transferred to *Gamochaeta* in the classification of Anderberg (1991).

***Logfia gallica*** (L.) Coss. & Germ. **Taxonomic change**

In the classification of Anderberg (1991) this is the correct name for the naturalized species referred to *Filago gallica* L. by Wagner *et al.* (1990: 315).

***Pseudognaphalium sandwicensium*** (Gaudich.) A. Anderb. **Taxonomic changes**

*Pseudognaphalium sandwicensium* var. *sandwicensium*

*Pseudognaphalium sandwicensium* var. *hawaiiense* (O. Degener & Sherff) W.L. Wagner, comb. et stat. nov. [based on *Gnaphalium hawaiiense* O. Degener & Sherff *in* Sherff, *Am. J. Bot*. 36: 507. 1949. TYPE: Hawaiian Islands: Hawai'i: Kilauea, 9 April 1930, *O. Degener 18462b* (NY, holotype, photo F)].

*Pseudognaphalium sandwicensium* var. *kilaueanum* (O. Degener & Sherff) W.L. Wagner, comb. nov. [based on *Gnaphalium sandwicensium* var. *kilaueanum* O. Degener & Sherff *in* Sherff, *Am. J. Bot*. 36: 505. 1949. TYPE: Hawaiian Islands: Hawai'i: Kilauea, dryish barren roadside, 9 April 1930, *O. Degener 18462a* (NY, holotype, photo F)].

*Pseudognaphalium sandwicensium* var. *molokaiense* (O. Degener & Sherff) W.L. Wagner, comb. nov. [based on *Gnaphalium sandwicensium* var. *molokaiense* O. Degener & Sherff *in* Sherff, *Lloydia* 11: 309. 1948. TYPE: Hawaiian Islands: Moloka'i: west

Moloka‘i, near Waiahewahewa Gulch, rather localized on arid hot coastal dunes, 19 April 1928, *O. Degener 18302* (NY, holotype; BISH, NY[3], US!, isotypes)].

The plants referred to as intermediates between *P. sandwicensium* var. *sandwicensium* and *P. sandwicensium* var. *molokaiense* by Wagner *et al.* (1986, 1990: 322) from coastal strand and dune habitats are here considered better referred to *P. sandwicensium* var. *molokaiense*. They are a close match morphologically, and probably represent past direct connections among the islands of the Maui complex (Maui Nui) and the thin land connection between O‘ahu and Moloka‘i discussed by Carson & Clague (1995).

***Sphagneticola trilobata*** (L.) Pruski **Taxonomic change**

In his monograph of Ecliptinae, Strother (1991) transferred the species treated as *Wedelia trilobata* (L.) Hitchc. by Wagner *et al.* (1990) to the new genus *Complaya*. Robinson and Cuatrecasas (1992) pointed out that the group had already been named *Thelechitonia* Cuat. Now Pruski (1996) has found that *Sphagneticola* is an even earlier name for this group of 4 species, and has made the new combination. For a detailed discussion of the nomenclature of this species the reader is referred to Pruski (1996); publication of the combination was effected in Funk & Pruski (1996).

**Chenopodiaceae**

***Atriplex maximowicziana*** Makino **New state record**

This species has been known to be naturalized in the Hawaiian Islands for over 20 years but was not treated by Wagner *et al.* (1990) because it remained unidentified until recently when S.L. Welsh examined several of the specimens cited here. The following description is modified from the *Flora of Taiwan* (Liu, 1996).

Monoecious, suffrutescent, perennial herbs; stems up to 10 dm tall, procumbent to erect, densely farinose. Leaves alternate or the lowermost subopposite, ovate to trullate, 1–4 cm long, 0.7–1.8 cm wide, margin entire, apex obtuse to muncronulate, base cuneate. Staminate flowers in terminal, dense spikes, ca. 1 cm long; pistillate flowers in small paniculate clusters of spikes. Fruiting bracts compressed, trullate-rhombic, 6–9 mm long, coarsely toothed in the lower half, connate at base. *Atriplex maximowicziana* is native to southeastern China, Taiwan, and Japan (Ryukyu Islands).

*Material examined.* HAWAI‘I: Hawaii Volcanoes National Park, Puukohola Heiau historic site, April 1975, *J. D. MacNeil s.n.* (US [2 sheets]); South Kohala Dist., Kawaihae Ahupua‘a, Kawaihae Harbor, on dredged coral substrate, 21 June 1987, *Stemmermann & Luce 7151* (US); South Kohala Dist., Kawaihae Ahupua‘a, Kawaihae Harbor, on limestone, 6 September 1987, *Stemmermann & Luce 7195* (US); South Kohala Dist., Kawaihae Ahupua‘a, Kawaihae Harbor, open, dry, exposed areas, 2 Aug. 1996, *Herbst 9796* (BISH); South Kohala Dist., Kawaihae Ahupua‘a, Kawaihae Harbor, in disturbed area by harbor, 27 April 1975, *Herbst 9714* (BISH). Specimens det. by S.L. Welsh.

***Salsola tragus*** L. **Taxonomic change**

The genus *Salsola* has long been taxonomically difficult with a number of different interpretations adopted at various times, especially for the widely naturalized species

often treated as *S. kali* L. The correct name for the single species naturalized in the Hawaiian Islands (a widely naturalized species worldwide, treated as *S. kali* by Wagner *et al.*, 1990: 540) is *S. tragus* (S. Mosyakin, pers. comm.; Wilken, 1993). *Salsola tragus* is native to Eurasia. Other names that have been associated with this widely naturalized species of *Salsola* have been misapplied.

**Cyperaceae**

***Rhyncospora caduca*** Elliott **New island record**

Previously reported from the islands of Maui and Hawai‘i by Koyama (1990: 1428), this species now occurs on O‘ahu as well.

*Material examined.* O‘AHU: Kahana Valley, 200 ft., Sept. 1992, *Takeuchi 8516* (BISH).

**Euphorbiaceae**

***Chamaesyce serpens*** (Kunth) Small **New state record**

*Chamaesyce serpens*, a New World native, was formerly confused with *C. albomarginata* (Torr. & A. Gray) Small by experts on Hawaiian botany (Koutnik & Huft, 1990: 604). In the Hawaiian Islands it is known only from Kaua‘i, whereas *C. albomarginata* is known only from O‘ahu. These 2 species can be separated by the following key adopted from the descriptions in the *Flora of Texas* (Correll & Johnston, 1970).

1. Plants perennial; staminate flowers 15–30 per cyathia; leaves 3–8 mm long, orbicular to oblong, apex rounded, occasionally emarginate or apiculate; base strongly inequilateral; stipules united into a membranous scale 1–2 mm long, white; involucre ca. 1 mm long; capsules 1.3–2 mm long ..... ***C. albomarginata***
1. Plants annual; staminate flowers 3–8(–10) per cyathia; leaves 2.5–2.8 mm long, oblong to orbicular, apex rounded; base weakly inequilateral; stipules united into a membranous scale 0.2–1.2 mm long, white to pink; involucre ca. 0.7 mm long; capsules 1–1.2 mm long ..... ***C. serpens***

*Material examined.* KAUA‘I: Hanama‘ulu Bay, naturalized around abandoned wharf, 17 March 1961, *Degener & Degener 27481* (US); Maha‘ulepu, between Ha‘ula and Po‘ipu, lithified dunes, 27 May 1984, *Wagner et al. 5373* (BISH); near Waita Reservoir, below Koloa and Poipu, along dirt road in sugar cane fields, 8 April 1988, *Wagner et al. 6024* (BISH, US); Koloa Dist., Maha‘ulepu, littoral vegetation in sand pockets over lithified dunes, 15 ft., 28 September 1990, *Flynn et al. 4253* (BISH, US).

**Fabaceae**

***Crotalaria juncea*** L. **New state record**

This species has not previously been reported as naturalized in the Hawaiian Islands, but it has been cultivated (Neal, 1965). It can be distinguished from the other naturalized Hawaiian species of the genus by the following characters adopted from the treatment by Rudd (1991). It is an annual herb up to 2.5 m tall; stems erect, ribbed, subappressed pubescent; leaves simple, oblong to oblanceolate, apex acute to obtuse, stipules filiform, ca. 2 mm long; flowers 15–20 mm long, in terminal inflorescences 10–25 cm long, bracts nar-

rowly lanceolate, 3–5 mm long, calyx 15–20 mm long, weakly bilabiate, the lobes 3–4 times as long as the tube, velutinous; petals 15–25 mm long, bright yellow, with dark red or brown streaks, the standard to 25 mm long, the keel to 20 mm long, with a twisted beak, the wings shorter than the keel; pods cylindrical, 2.5–3.5(–5.5) cm long, velutinous, sessile; seeds 6–15 per pod, cordiform, 4–6 mm long, light brown to black. *Crotalaria juncea* is native to India, but is widely cultivated as a cover crop and for fiber. In the Hawaiian Islands it was cultivated by the Hawaiian Sugar Planters' Association as early as 1918 (*Rock s.n.*, BISH) and is apparently known as sunhemp and grown for its nitrogen fixation properties (L. Stemmermann, pers. comm.). It has become widely naturalized and now has a pantropical distribution.

*Material examined.* O'AHU: Honolulu, Kalakaua Ave., 9 Sept. 1962, *Sasakawa s.n.* (BISH); det. by R. Barneby. HAWAI'I: Ka'u Dist., along Ka'alu'alu-Wai'ohinu rd., cleared field in subdivision, 230 m, 19 June 1990, *Wagner et al. 6392* (US); det. by D. Windler.

***Medicago sativa*** L. **New island record**

Formerly known to occur on Midway Atoll, Kaua'i, O'ahu, Lana'i, and Hawai'i (Geesink *et al.*, 1990: 686), *Medicago sativa* is now known to occur on Maui as well.

*Material examined.* MAUI: [East Maui?], roadside *hale*, 2160 m, 30 Oct. 1982, *Medeiros 295* (BISH); East Maui, Baldwin Ave. near Hali'i Maile Rd. jct, weed on road shoulder, 17 June 1991, *Hobdy et al. 3381* (BISH).

***Senna gaudichaudii*** (Hook. & Arn.) H. Irwin & Barneby **New island record**

At the time of publication of the *Manual of the Flowering Plants of Hawai'i*, *Senna gaudichaudii* had been documented from all of the main islands except Ni'ihau and Kaho'olawe (Geesink *et al.*, 1990: 699). Its occurrence on Kaho'olawe has now been documented as well.

*Material examined.* KAHO'OLAWE: Makawao Dist., 'Ale'ale stack, near Pu'u Koa'e, 10–90 m, 18 March 1992, *Wood et al. 1729* (BISH).

**Lauraceae**

***Cinnamomum burmani*** (Nees) Blume **New island record**

This species has been cultivated on O'ahu for most of this century and is naturalized there (Werff, 1990: 846). It was recently reported as naturalized on East Maui (Wagner & Herbst, 1995), and is here reported as naturalized on Hawai'i.

*Material examined.* HAWAI'I: Hamakua Dist., Nienie Ahupua'a, in patch of exotic trees near irrigation reservoir, trees of various sizes and many seedlings observed, ca. 1000 ft, 12 July 1996, *Herbst 9787* (BISH).

**Lemnaceae**

In the *Manual of the flowering plants of Hawai'i*, Wagner *et al.* (1990) treated only 2 species of Lemnaceae. There are now known to be 5 species of Lemnaceae in the Hawaiian Islands. In addition to reporting 3 new state records (*Lemna obscura* (Austin)

Daubs, *Spirodela punctata* (G. Mey.) C.H. Thomps., and *Wolffia globosa* (Roxb.) Hartog & Plas), we also report one taxonomic change (*Lemna aequinoctialis* Welw.) and 3 new island records (for *Lemna aequinoctialis* and *Spirodela polyrhiza* (L.) Schleid.).

For keys, descriptions, and distribution records for all taxa in the Lemnaceae, the reader is referred to Landolt (1980, 1986) and Landolt & Urbanska-Worytkiewicz (1980); a key to genera occurring in the Hawaiian Islands and key characters for the *Lemna* and *Spirodela* species occurring in the Hawaiian Islands are given below (from Landolt, 1980, 1986). Determinations were kindly provided by E. Landolt (excluding US sheet of *S. punctata*).

The 2 species of Lemnaceae treated by Wagner *et al.* (1990) were considered by them to be possibly naturalized, but they may represent natural introductions by migrating waterfowl. The colonization sources of the others reported here are similarly ambiguous.

Key to genera of Lemnaceae in the Hawaiian Islands:

1. Fronds with 1–20 roots (2).
1. Fronds rootless ..... ***Wolffia***
2. Fronds with 1 root and 1–5 (–7) nerves ..... ***Lemna***
2. Fronds with (1–)2–20 roots and (3–)5–16 nerves ..... ***Spirodela***

Key to *Lemna* in the Hawaiian Islands:

1. Root sheath winged at base; root tip sharply pointed; roots not longer than 3 cm; no red color present on fronds ..... ***L. aequinoctialis***
1. Root sheath not winged; root tip mostly rounded; roots often longer than 3 cm; fronds often red colored on lower surface or with red spots on either surface ..... ***L. obscura***

***Lemna aequinoctialis*** Welw. **Taxonomic change and new island record**

Wagner *et al.* (1990) reported the *Lemna* occurring in the Hawaiian Islands as *L. perpusilla* Torr. According to Landolt (1980, 1986; see also Landolt & Urbanska-Worytkiewicz, 1980), *L. perpusilla* is restricted in distribution to eastern North America, and the plants in the Hawaiian Islands previously referred to *L. perpusilla* actually represent *L. aequinoctialis* Welw., a pantropical species which is very similar to *L. perpusilla*. The observation of this species on the island of Hawai‘i reported in Wagner *et al*. (1990) is documented by the following collection.

*Material examined.* HAWAI‘I: Hilo, Wailoa Estuary, floating, 25 July 1987, *Stemmermann & Luce 7184* (mixed collection with *Spirodela polyrhiza*) (BISH).

***Lemna obscura*** (Austin) Daubs **New state record**

Aside from the 3 documented collections from the Hawaiian Islands, *L. obscura* occurs only in southeastern North America.

Reported by Landolt (1986) from O‘ahu, Pearl City, 2 collections by D. Herbst, ETH culture numbers 7325 and 7471 (vouchers at ZT).

*Material examined*. HAWAI'I: Hilo, Lokaka Pond, floating, 20 Aug. 1987, *Stemmermann & Warshauer* 7188 (BISH).

Key to *Spirodela* in the Hawaiian Islands:

1. Fronds 1–1 1/2 times as long as wide, with 7–16 (–21) nerves; roots 7–21, up to 4 cm long ..... ***S. polyrhiza***
1. Fronds 1 1/2–2 times as long as wide, with (3–) 5–7 nerves; roots (1–) 2–7 (–12), up to 7 cm long ..... ***S. punctata***

***Spirodela polyrhiza*** (L.) Schleid. **New island records**

Previously known only from O'ahu (Wagner *et al.*, 1990: 1458), the following collections document the occurrence of *Spirodela polyrhiza* on Maui and Hawai'i.

*Material examined.* MAUI: *s.l.*, 5 Aug. 1927, *Degener 8934* (collected by D.L. Topping; mixed collection with *Lemna aequinoctialis*) (US). HAWAI'I: Hilo, Wailoa Estuary, floating, 25 July 1987, *Stemmermann & Luce 7184* (mixed collection with *Lemna aequinoctialis*) (BISH).

***Spirodela punctata*** (G. Mey.) C.H. Thomps. **New state record**

*Material examined.* O'AHU: near Kailua levee, floating in standing water in *Scirpus* stands, 30 July 1976, *Smith 150* (BISH, US [2 sheets]); US sheets det. by F.R. Fosberg. HAWAI'I: Punalu'u, Ninole Pond, floating, 4 Sept. 1987, *Stemmermann 7194* (BISH); Hilo, Waioloa Estuary, 25 July 1987, *Stemmermann & Luce* 7182 (BISH).

***Wolffia globosa*** (Roxb.) Hartog & Plas **New state record**

Other than the 2 collections cited here from the Hawaiian Islands, *W. globosa* is known to occur in California, eastern and southern Asia, and southern and eastern Africa (Landolt, 1986). Reported by Landolt (1986) from O'ahu, Pearl City, D. Herbst, ETH culture number 7470 (voucher at ZT).

*Material examined.* MOLOKA'I: Puko'o, along shore, 11 Oct. 1916, *Hitchcock 15116* (US).

**Malvaceae**

***Sida ciliaris*** L. **New state record**

There are 4 conspicuous differences (2 of them vegetative) between *Sida ciliaris* and the 7 naturalized or indigenous species of *Sida* reported for the Hawaiian Islands by Bates (1990). *Sida ciliaris* is the only species in the Hawaiian Islands that is a procumbent herb; it has much smaller leaf blades than any of the other species, with a length of only 1–2 cm; the petals are often rose colored, although they are sometimes red-orange or yellowish; and the schizocarps are muricate (Fryxell, 1988). Other characters described by Fryxell include leaf blades narrowly elliptic, few-toothed apically, and glabrous above; stipules linear to oblanceolate; flowers subsessile in dense terminal clusters; calyx lobes divided in apical half; schizocarp conical; and mericarps 5–8. A plant of disturbed, often arid habitats, *S. ciliaris* was previously known from southern North America, South America, and the West Indies (Fryxell, 1988) and is now also known from several localities on O'ahu.

*Material examined.* O‘AHU: Ke‘ehi Lagoon Park, in lawns, 5 May 1987, *Whistler s.n.* (BISH); Makakilo, lowland dry grassland and forest W of Makakilo town and below paved road leading toward Camp Timberline access road, growing along road with other alien species, uncommon, 22 Oct. 1990, *Imada & Char s.n.* (BISH); Pearl Harbor, Pearl City Peninsula, near Surtass Bldg., 13 Aug. 1991, *E. Funk s.n.* (BISH); Honolulu Dist., Camp Catlin area, at edge of parking lot, locally common, ca. 10 ft., 15 March 1991, *Herbst 9373* (BISH); ‘Ewa Dist., Barbers Point Naval Air Station, naturalized in lawn in front of terminal, ca. 1.5 m, 7 Sept. 1992, *Nagata 4250* (BISH). *Whistler s.n.* and *E. Funk s.n.* det. by D. Bates.

**Passifloraceae**

***Passiflora suberosa*** L. **New island record**

*Passiflora suberosa* was previously known only from the islands of O‘ahu, Maui, and Hawai‘i (Escobar, 1990: 1014). Its occurrence on Lana‘i is reported here.

*Material examined.* LANA‘I: Kanepu‘u dry forest, opening in the Olopua forest of Lapaiki Road, inside the *Gardenia brighamii* exclosure, 518 m, 11 May 1991, *Hobdy 3293* (BISH).

**Poaceae**

***Dactyloctenium aegyptium*** (L.) Willd. **New island record**

This record from Midway Atoll represents the first known collection of *Dactyloctenium aegyptium* from the Northwestern Hawaiian Islands. It had previously been documented on O‘ahu, Moloka‘i, Maui, Kaho‘olawe, and Hawai‘i (O’Connor, 1990: 1522).

*Material examined.* MIDWAY ATOLL: W end of Sand Island, Frigate Point, in sand, 16 Dec. 1991, *Flint s.n.* (BISH).

***Festuca***

Two species of *Festuca*, both previously known to be naturalized on Hawai‘i, one *(F. rubra*) of which is also reported from Maui (O’Connor, 1990: 1547, 1548), are here reported as naturalized on Kaua‘i. Specimens det. by D. Clayton.

***Festuca arundinacea*** Schreb. **New island record**

*Material examined.* KAUA‘I: Makaha roadside, tall clump grass to nearly 1.3 m tall, 23 March 1993, *Hobdy 3586* (BISH); Waimea Dist., Pu‘u Ka Pele Forest Reserve, Makaha Ridge Road, 0.8 miles W of jct. with Hwy. 550, ca. 3000 ft., 31 May 1992, *Flynn et al. 3976* (BISH).

***Festuca rubra*** L. **New island record**

*Material examined.* KAUA‘I: Hanalei Dist., Kalalau Rim, Kalahu side below and W of first Kalalau Lookout, 790 m, 13 March 1992, *Wood & Perlman 1701* (US), *Wood & Perlman 1704* (BISH); Pohakuao, hanging valley between Kalalau and Hanakoa, 400–600 m, 1 April 1992, *Wood et al. 1761* (BISH, US); Waimea Dist., Awa‘awapuhi Valley, N facing slopes above stream, 0.5 miles in along trail, 3300–3500 ft., 18 May 1994, *Wood et al. 3193* (BISH).

**Polygonaceae**

***Rumex conglomeratus*** Murr. **New state record**

This species has been naturalized in the Hawaiian Islands on the island of Kaua‘i

since at least the 1980s. The collections listed below were misidentified as *R. crispus* or not identified. Characters that separate *R. conglomeratus* from other Hawaiian species of *Rumex* are adopted from several regional treatments (S. Mosyakin, unpubl.; Webb *et al*. 1988; Hickman, 1993). *Rumex conglomeratus* can be distinguished from other species of *Rumex* in the Hawaiian Islands by its distinctly interrupted inflorescence, the whorls of flowers widely spaced; fruiting inner tepals oblong and each with a tubercle, these subequal or equal, 1/2–3/4 the tepal width, and tepal margins entire. The most useful characters for distinguishing *R. conglomeratus* from *R. crispus* are the whorls of flowers widely spaced vs. nearly continuous and the tubercles > 1/2 the tepal width vs. < 1/2 the tepal width. *Rumex conglomeratus* is native to Europe, western and southwestern Asia, and northern Africa; widely naturalized in other parts of the Pacific basin and North America. Specimens det. by S. Mosyakin.

*Material examined.* KAUA‘I: Hanalei Dist., Koke‘e State Park, Mohihi Rd., near Camp Sloggett, disturbed roadside, 1100 m, 26 May 1984, *Wagner et al. 5370* (BISH, US); upper slopes of Kalalau Valley between Kalalau and Pu‘u O Kila lookouts, diverse forest, 3660 ft., 23 September 1986, *Flynn & Koob 1902* (US).

**Rubiaceae**

***Serissa japonica*** (Thunb.) Thunb. **New state record**

This species is a cultivated ornamental that now appears to have become naturalized on Hawai‘i.

*Material examined.* HAWAI‘I: Hamakua Dist., Nienie Ahupua‘a, sparingly naturalized at the edge of a macadamia nut orchard, ca. 1000 ft., 2 July 1996, *Herbst 9788* (BISH).

***Spermacoce capitata*** Ruiz & Pav. **New state record**

The sole specimen known to document the occurrence of this species in the Hawaiian Islands was found at US recently while curating the entire Hawaiian collection. The large capitate inflorescences are the most striking feature of *Spermacoce capitata*, as indicated by the specific epithet. The habit and size of this coarse, erect, perennial herb are also unique among *Spermacoce* species occurring in the Hawaiian Islands; *Spermacoce capitata* reaches a height of 1 m, and has sessile leaves that are 3–10 cm long. Other diagnostic characters (from MacBride, 1936; Steyermark, 1974) include inflorescences terminal or axillary, subhemispherical, 8–16 mm in diameter; calyx lobes 4–5; corolla tube 2–4 mm long; seeds 1.2–1.6 mm long, the surface foveolate and transversely deeply grooved.

*Material examined.* HAWAI‘I: Honounau, Kona, in field, 1000 ft., 18 August 1979, *Kami s.n.* (US). Specimen det. by F.R. Fosberg.

***Spermacoce ovalifolia*** (M. Martens & Galeotti) Hemsl. **New island record**

Lorence *et al.* (1995) reported *Spermacoce ovalifolia* from Hawai‘i, the first documented occurrence of this species in the Hawaiian Islands. It is now known to occur on O‘ahu also.

*Material examined.* O‘AHU: N Halawa Valley, wet soil in grass-covered hill, 2 February 1994, *Imada et al. 94-5* (BISH, US).

**Sapotaceae**

***Chrysophyllum oliviforme*** L. **New island record**

A common ornamental tree in the Hawaiian Islands, *C. oliviforme* was reported as naturalized on Kaua‘i by Lorence *et al.* (1995). It is now clearly naturalized on 2 other islands as well, O‘ahu and Hawai‘i.

*Material examined.* O‘AHU: ‘Ewa Dist., along Panakauahi Gulch, at the edge of an old pineapple field, very common along gulch sides with *Eucalyptus, Albizzia*, and silk oak, 600 ft., 8 Feb. 1996, *E. Funk s.n.* (BISH). HAWAI‘I: Hamakua Dist., Kapulena Ahupua‘a, Kapulena Gulch, sparingly naturalized along sides of gulch forested with alien species of trees, ca. 1000 ft., 2 Aug. 1996, *Herbst 9797* (BISH).

**Solanaceae**

Two changes to the treatment of *Lycopersicon* by Symon (1990) in the *Manual of the Flowering Plants of Hawai‘i* are reported here. The first involves placement of the genus *Lycopersicon.* Spooner *et al.* (1993) present data from morphological and cpDNA phylogenetic analyses that strongly support the sister relationship of potatoes and tomatoes, and treat *Lycopersicon* as a subsection within *Solanum* sect. *Potatoe*; based on their analyses, *Lycopersicon* species are now treated as species of *Solanum*. Readers are referred to their paper for details of this long-contentious situation.

Symon (1990) treated 2 species of naturalized *Lycopersicon*, *L. esculentum* Mill. and *L. pimpinellifolium* (Jusl.) Mill. The second change concerns the identification of the naturalized plants referred by Symon (1990: 1259) to *L. pimpinellifolium* (= *Solanum pimpinellifolium* Jusl.). These actually represent feral forms of *L. esculentum* Mill. (= *Solanum lycopersicum* L.), as *S. pimpinellifolium* does not occur in the Hawaiian Islands. Apparently the incorrect identification traces to Neal (1965 or earlier editions). A.A. Heller was the first to collect the wild-growing plants in the Hawaiian Islands in 1895, and he correctly identified them in his report (Heller, 1897). Muller (1940) likewise cited Hawaiian collections (including Heller’s) under *L. esculentum* in his monograph of the genus. O. Degener *et al.* (1967) treated the naturalized plants as *L. galenii* Mill., a name that has been considered by others (including Muller) to be a taxonomic synonym of *L. esculentum* Mill. The description given by Symon (1990) does reflect characteristics of *S. pimpinellifolium*; however, close study of plants naturalized in the Hawaiian Islands shows them to have the less deeply divided corollas, shorter inflorescences, coarser habit, and slightly larger fruits of the wild-reverted forms of the cultivated tomato. In summary, the 2 taxa of *Lycopersicon* reported by Symon (1990) are both *S. lycopersicum*, one a long-naturalized wild-reverted form and the other primarily represented by repeatedly escaped cultivated tomatoes.

***Solanum lycopersicum*** L. var. ***cerasiforme*** **Taxonomic change and**
(Dunal) Spooner, Anderson & Jansen **corrected identification**

**Acknowledgments**

The authors wish to express their thanks to the many specialists mentioned in the text who provided determinations of specimens; to M. Dillon for discussion of taxonomy of the Gnaphalieae; to S. Mosyakin for allowing access to his unpublished manuscript on *Rumex* for the *Flora of North America* treatment; and to S. Rehm, whose editorial comments greatly improved the manuscript. Specimens of several groups were sent on loan for determination by the Bishop Museum herbarium staff, primarily for the *In gardens of Hawaii II* project; we appreciate their support and help.

**Literature Cited**

**Anderberg**, **A**.**A**. 1991. Taxonomy and phylogeny of the tribe Gnaphalieae (Asteraceae). *Opera Bot.* **104**: 1–195.

———. 1994. Tribe Gnaphalieae, p. 304–64. *In*: Bremer, K., *Asteraceae: cladistics and classification*. Timber Press, Portland, Oregon.

**Bates**, **D**.**M**. 1990. Malvaceae, p. 868–903. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai'i*. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Bremer**, **K**. 1994. *Asteraceae: cladistics and classification*. Timber Press, Portland, Oregon.

**Carson**, **H**.**L**. **& D**.**A**. **Clague**. 1995. Geology and biogeography of the Hawaiian Islands, p. 14–29. *In*: Wagner, W.L. & V.A. Funk, eds., *Hawaiian biogeography: evolution on a hot spot archipelago*. Smithsonian Institution Press, Washington, DC.

**Correll**, **D**.**S**. **& M**.**C**. **Johnston**. 1970. *Manual of the vascular plants of Texas*. Texas Research Foundation, Renner, Texas.

**Degener**, **O**., **I**. **Degener & A**.**B**. **Greenwell**. 1967. *Fl. Hawaiiensis, fam. 318. Lycopersicon galenii*. Privately published. 2 p.

**Drury**, **D**.**G**. 1970. A fresh approach to the classification of the genus *Gnaphalium* with particular reference to the species present in New Zealand (Inuleae-Compositae). *N.Z. J. Bot.* **8**: 222–48.

———. 1971. The American spicate cudweeds adventive to New Zealand: (*Gnaphalium* section *Gamochaeta*–Compositae). *N.Z. J. Bot.* **9**: 157–85.

———. 1972. The cluster and solitary-headed cudweeds native to New Zealand: (*Gnaphalium* section *Euchiton*-Compositae). *N.Z. J. Bot.* **10**: 112–79.

**Escobar**, **L**.**K**. 1990. Passifloraceae, p. 1007–1014. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai'i*. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Fryxell**, **P**.**A**. 1988. Malvaceae of Mexico. *Syst. Bot. Monogr.* **25**: 1–522.

**Funk**, **V**.**A**. **& J**.**F**. **Pruski**. 1996 [17 December 1996]. Asteraceae. *In:* Acevedo-Rodríguez, P. & collaborators, Flora of St. John, U.S. Virgin Islands. *Mem. N.Y. Bot. Gard.* **78**: 85–122.

**Geesink**, **R**., **W**.**L**. **Wagner & D**.**R**. **Herbst**. 1990. Fabaceae, p. 629–721. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai'i*.

University of Hawaii Press & Bishop Museum Press, Honolulu.

**Heller**, **A**.**A**. 1897. Observations on the ferns and flowering plants of the Hawaiian Islands. *Minn. Bot. Stud.* **1**: 760–922.

**Herbst**, **D**.**R**. **& W**.**L**. **Wagner**. 1996. Contributions to the flora of Hawai'i. V. *Bishop Mus. Occas. Pap.* **46**: 8–12.

**Hickman**, **J**.**C**. 1993. Polygonaceae, p. 854–95. *In*: Hickman, J.C., ed., *The Jepson manual: higher plants of California*. University of California Press, Berkeley.

**Hilliard**, **O**.**M**. **& B**.**L**. **Burtt**. 1981. Some generic concepts in Compositae–Gnaphalinae. *Bot. Linn. Soc.* **82**: 233–65.

**Koyama**, **T**. 1990. Cyperaceae, p. 1381–1436. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai'i*. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Koutnik**, **D**.**L**. **& M**.**J**. **Huft**. 1990. Chamaesyce, p. 602-17. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai'i*. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Landolt**, **E**. 1980. Key to the determination of taxa within the family of Lemnaceae. *In*: E. Landolt, ed., Biosystematic investigations in the family of duckweeds (Lemnaceae). Vol. 1. *Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich* **70**: 13–21.

———. 1986. Biosystematic investigations in the family of duckweeds (Lemnaceae) (Vol. 2): The family of Lemnaceae–a monographic study. Vol. 1. *Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich* **71**: 1–566.

———. **& K**. **Urbanska-Worytkiewicz**. 1980. List of the studied Lemnaceae samples: origin and chromosome numbers. *In*: Landolt, E., ed., *Biosystematic investigations in the family of duckweeds (Lemnaceae).* Vol. 1. *Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich* **70**: 205–47.

**Liu**, **H**.-**Y**. 1996. Chenopodiaceae. *In*: *Flora of Taiwan*, 2nd ed. **2**: 382–77.

**Lorence**, **D**.**H**., **T**.**W**. **Flynn & W**.**L**. **Wagner**. 1995. Contributions to the flora of Hawai'i. III. New additions, range extensions, and rediscoveries of flowering plants. *Bishop Mus. Occas. Pap.* **41**: 19–58.

**MacBride**, **J**.**F**. 1936. Flora of Peru. *Field. Mus. Nat. Hist., Bot. Ser.* **13** (6)(1): 1–261.

**Muller**, **C**.**H**. 1940. A revision of the genus *Lycopersicon*. *Misc. Publ. U.S. Dep. Agric.* **382**: 1–29.

**Neal**, **M**.**C**. 1965. *In gardens of Hawaii.* 2nd ed. Bishop Museum Press, Honolulu. xix + 924 p.

**O'Connor**, **P**.**J**. 1990. Poaceae, p. 1481–1604. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai'i*. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Pruski**, **J**.**F**. 1996 [27 December 1996]. Compositae of the Guayana highland–IX. *Tuberculocarpus* gen. nov. and some other Ecliptinae (Heliantheae). *Novon* **6**: 404–18.

**Reed**, **C**.**F**. 1970. Amaranthaceae, p. 551–74. *In*: Correll, D.S. & M.C. Johnston. *Manual of the vascular plants of Texas*. Texas Research Foundation, Renner, Texas.

**Robinson**, **H**. 1990. Six new combinations in *Baccharoides* Moench and *Cyanthillium* Blume (Vernonieae: Asteraceae). *Proc. Biol. Soc. Wash.* **103**: 248–53.

———. **& J**. **Cuatrecasas**. 1992. *Thelechitonia* Cuatrecasas, an older name for *Complaya* Strother (Ecliptinae–Heliantheae–Asteraceae). *Phytologia* **72**: 141–43.

**Rudd**, **V**.**E**. 1991. Fabaceae (Leguminosae), Subfamily Faboideae (Papilionoideae). *In*: Dassanayake, M.D. & F.R. Fosberg, eds., *A revised handbook to the flora of Ceylon* 7: 108–236. Smithsonian Institution and National Science Foundation, Washington.

**Shannon**, **R**.**K**. **& W**.**L**. **Wagner**. 1996. New records of Hawaiian flowering plants primarily from the United States National Herbarium. *Bishop Mus. Occas. Pap.* **46**: 13–15.

**Spooner**, **D**.**M**, **G**.**J**. **Anderson & R**.**K**. **Jansen**. 1993. Chloroplast DNA evidence for the interrelationships of tomatoes, potatoes, and pepinos (Solanaceae). *Am. J. Bot.* **80**: 676–88.

**Steyermark**, **J**.**A**. 1974. Rubiaceae. *In*: Lasser, T., ed., *Flora Venez.***10**(3): 1111–2070.

**Strother**, **J**.**L**. 1991. Taxonomy of *Complaya*, *Elaphandra*, *Iogeton*, *Jefea*, *Wamalchitamia*, *Wedelia*, *Zexmenia*, and *Zyzyxia* (Compositae—Heliantheae—Ecliptinae). *Syst. Bot. Monogr.* **33**: 1–111.

**Symon**, **D**.**E**. 1990. Solanaceae, p. 1251–1278. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai‘i*. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Wagner**, **W**.**L**. **& D**.**R**. **Herbst**. 1995. Contributions to the flora of Hawai‘i. IV. New records and name changes. *Bishop Mus. Occas. Pap.* **42**: 13–27.

———., **D**.**R**. **Herbst & S**.**H**. **Sohmer**. 1986. Contributions to the flora of Hawai‘i. I. Acanthaceae—Asteraceae. *Bishop Mus. Occas. Pap.* **26**: 102–22.

———., **D**.**R**. **Herbst & S**.**H**. **Sohmer.** 1990. *Manual of the flowering plants of Hawai‘i*. 2 vols. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Webb**, **C**.**J**., **W**.**R**. **Sykes & P**.**J**. **Garnock-Jones**. 1988. *Flora of New Zealand*. Vol. IV: Naturalised pteridophytes, gymnosperms, dicotyledons. Botany Division, D.S.I.R., Christchurch.

**Werff**, **H**. **van der**. 1990. Lauraceae, p. 843–48. *In*: Wagner, W.L., D.R. Herbst & S.H. Sohmer, *Manual of the flowering plants of Hawai‘i*. University of Hawaii Press & Bishop Museum Press, Honolulu.

**Wilken**, **D**.**H**. 1993. Chenopodiaceae, p. 500–15. *In*: Hickman, J.C., ed., *The Jepson manual: higher plants of California*. University of California Press, Berkeley.