



**Euphorbia (Euphorbiaceae) Section Tithymalus  
Subsection Inundatae in the Southeastern United States**

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# *EUPHORBIA* (EUPHORBIACEAE) SECTION *TITHYMALUS* SUBSECTION *INUNDATAE* IN THE SOUTHEASTERN UNITED STATES

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**Abstract:** Five taxa in *Euphorbia* section *Tithymalus* subsection *Inundatae* are recognized, two representing undescribed taxa here named *Euphorbia inundata* var. *garrettii* and *Euphorbia roscens*. All are endemic to portions of the outer coastal plain, ranging from southern Georgia to southern Florida and extending west to southern Mississippi, in pyrogenic-evolved pinelands or Florida scrub. Taxonomy of *Euphorbia floridana* and *Euphorbia telephioides* is unchanged, with lectotype designation for all Chapman-named species. *Euphorbia floridana*, an outer East Gulf Coastal Plain endemic, is found on yellowish sands of longleaf pine-turkey oak-wiregrass xeric sandhills. *Euphorbia telephioides*, an Apalachicola Lowlands narrow endemic, is confined to coastal Bay, Franklin, and Gulf counties of the east-central Florida panhandle in xeric, scrubby pinelands. *Euphorbia inundata* var. *garrettii* is allopatric with var. *inundata*, occurring in wet pinelands of southwestern and south-central Florida. *Euphorbia roscens*, a southern Lake Wales Ridge narrow endemic, is known only from Highlands County in peninsular Florida. It is a gap specialist found in Florida scrub types exclusively on xeric, white sand entisols. Morphological, geographical, and ecological factors are shown to distinguish members of the subsection *Inundatae*, of which all are recognizable by vegetative characters.

**Keywords:** *Euphorbia*, Euphorbiaceae, Florida, endemic, Lake Wales Ridge.

*Euphorbia*, a large and complex genus of worldwide distribution, has been subject to various circumscriptions. These have recognized various segregate genera, or conversely, numerous subgenera, sections, and subsections within *Euphorbia* s.l. The infrageneric concepts followed within this paper are those of Webster (1967), who within the southeastern United States recognized *Chamaesyce* as a distinct genus and referred all other generic taxa in the subtribe Euphorbiinae to the genus *Euphorbia*.

As defined by Webster (1967), *Euphorbia* within the southeastern United States is composed of the subgenera *Esula* Pers., *Agaloma* (Raf.) House, *Poinsettia* (J. Graham) House, and *Euphorbia*. Within subgenus *Esula*, the southeastern United States species are referred to three sections, *Lathyris* Godr., *Esula*, and *Tithymalus* Roep. Section *Tithymalus* is further divided into three subsections for southeastern United States species, *Tithymalus* (= *Galarrhaea*

Boiss.), *Purpuratae* Prokh., and *Inundatae* G. L. Webster. Webster (1967) characterized subsection *Inundatae* as being somewhat transitional between subgenus *Esula* and subgenus *Agaloma*. The section appears closest to *E. ipecacuanhae* L. of subgenus *Agaloma* but differs in lacking stipules and appendages on the cyathial glands (Webster, 1967). The question of whether subsection *Inundatae* also includes the South American species referred to it by Boissier (1862) or is an endemic subsection of the southeastern United States apparently remains unresolved and is not within the scope of this publication.

Naturalness of subsection *Inundatae* in the southeastern United States was recognized by Norton (1899), although he retained the subsection name *Ipecacuanhae* Boiss., even while transferring its type species, *E. ipecacuanhae*, to subgenus *Agaloma*. The species concepts within the subsection have remained essentially unchanged since

the publication of the *Flora of the Southern United States* (Chapman, 1860), in which all three of the currently recognized species of the subsection were first described. Upon first encountering these rather unusual *Euphorbia* species in Florida, Chapman believed they represented varieties of a single species (based on notations on Chapman specimens at NY). By the time of his 1860 *Flora*, Chapman had seen each of these enough times to describe all three at the species level. The species concepts of Chapman were followed unchanged by Boissier (1862) and Norton (1899). Small (1903, 1913) recognized the same species, but within the genus *Tithymalus*. Small (1933) later transferred these species to the genus *Galarhoeus* but in both cases added no new taxa to the subsection. There has been no comprehensive revision of this subsection since that of Norton (1899). In the 20th century, the geographical region of *Inundatae* has been subject to much more intensive botanical exploration and specimen collecting than before. As a result, much more is known of the variation, distribution, and ecology of these taxa.

Our interest in this subsection was prompted by field experience and collections made by us of all taxa within the known range of the subsection *Inundatae* from Florida west to southern Mississippi. Our collections of *Euphorbia* "inundata" in south-central Florida indicated to us that infraspecific variation warranted taxonomic study. Habitats of the *E. inundata* complex in the Florida peninsula were strikingly different from those with disjunct ranges north in the East Gulf Coastal Plain. In this paper, we present a full taxonomic revision of all taxa in the subsection within North America.

Morphological, ecological, and geographical factors are shown to distinguish members of the *Inundatae* complex and support our taxonomic revisions. Herbarium specimens were examined from ARCH, FLAS, FSU, FTG, SMU, TEX, and USF. Herbarium abbreviations follow Holmgren

et al. (1990). To our knowledge, there has been no definitive previous designation of type specimens of any taxa in *Euphorbia* section *Inundatae*. To determine which specimens should be designated as types, the senior author examined all specimens of this group on a visit to NY, with particular attention to the Chapman specimens representing potential type material. In addition, all archival correspondence between Chapman and Torrey during the period when Chapman was discovering and naming the species in the group was examined at NY. Based on Chapman's and Torrey's label data, annotations on herbarium sheets, and dated references in archival letters, a lectotype was designated for each Chapman-named species. Nomenclature follows Wunderlin (1998) with few exceptions.

#### TAXONOMIC TREATMENT

***Euphorbia* section *Tithymalus* subsection *Inundatae*** G. L. Webster, J. Arnold Arbor. 48:400. 1967. TYPE SPECIES: *Euphorbia inundata* Torr.

Perennial herbs, with one to few stems produced annually from the apex of a long, vertical rootstock. Lowermost stem leaves triangular, bract-like, the main stem leaves sessile, alternate, entire, estipulate. Inflorescence an umbellate cyme, the primary rays 2 to 3, few to many branched, the branching dichotomous, subtended by 2 to 3 whorled bracts (the pleiochasial leaves). Plants tending to be functionally dioecious, occasionally a few bisexual flowers produced, the abortive flowers of the opposite sex present in the functionally monoecious cyathia. Pistillate plants generally with 1 to 3 levels of inflorescence branching, the staminate plants with 3 to many levels of branching. Bracteal leaves subtending each inflorescence branch opposite, much smaller than the stem leaves. Cyathia solitary at the end of each inflorescence branch, campanulate, 1.5–4 mm long and wide. Glands

of the cyathium five, lunate and unappendaged. Staminate flowers many in each cyathium, each consisting of a single stamen. Pistillate flower central in the cyathium, solitary. Capsules 6–10 mm broad, strongly 3-lobed, 3-carpellate, borne on a stout, erect pedicel. Seeds ovoid to subglobose, 2–4 mm in diameter, ecarunculate.

*Euphorbia* section *Tithymalus* subsection *Inundatae* within the southeastern United States comprises five taxa; *E. floridana*, *E. telephioides*, *E. inundata* var. *inundata*, *E. inundata* var. *garrettii* var. nov., and *E. roscens* sp. nov. All taxa within the subsection are endemic to portions of the outer coastal plain of the southeastern United States from southern Georgia to southern Florida with some extending west to southern Mississippi. Although there is divergence in habitat preference, all are found on sandy outer coastal plain terraces or ridges of Pleistocene, Pliocene, or Miocene age. Each occurs in either pyrogenic pinelands or scrub vegetation types that are uniquely Floridian and are characterized by wide fluctuations in available soil moisture due to edaphic factors and cyclic climatic fluctuations. Geographic isolation and adaptation to both recurrent natural fires and restricted vegetation types is apparently a pattern of evolutionary history in the subsection *Inundatae*.

KEY TO THE TAXA OF *EUPHORBIA*  
SECTION *TITHYMALUS* SUBSECTION  
*INUNDATAE* IN THE SOUTHEASTERN  
UNITED STATES

1. Stem leaves obovate-spatulate, 1.5–3 cm wide; bracteal leaves numerous, abruptly smaller than the stem leaves, present on upper stems and on inflorescence branches as well as at the base of inflorescence branches; glands, lobes, and outer surface of the cyathia dark purple; cyathia up to 2 mm wide and high . . . . . 1. *E. telephioides*
1. Stem leaves linear, lanceolate, oblanceolate, narrowly elliptic, or obovate-spatulate, 0.1–2.1 cm wide; bracteal leaves less numerous, a pair generally present at the base of each branch of the inflorescence, inflorescence branches otherwise na-

ked; glands, lobes, and outer surface of the cyathia variously green or suffused with pinkish-purple, but never uniformly dark purple; cyathia generally more than 2 mm wide and high . . . . . 2

2. Lobes of cyathium as long or longer than the glands, truncate and erose to lacerate at the apex, where ciliate with mixed reddish and white hairs; glands entire to undulate, margins of glands and particularly the lobes of the cyathium suffused with deep pinkish-purple; seed ovoid, 2–3 mm wide . . . . . 3
2. Lobes of cyathium shorter than glands, acute to rounded at the apex, margins entire but densely ciliate with white hairs; glands undulate to lobed or crisped; reddish pigment, when present, concentrated on the outer surface of the cyathium, base of lobes, and base of glands, the margins of the glands and lobes generally yellowish-green; seed broadly ovoid to spherical, ca. 3–4 mm wide . . . . . 4
3. Stem leaves linear, narrowly elliptic, narrowly lanceolate, or rarely oblanceolate, (3–) 4–14 (–15) mm wide, the length:width ratio usually 5:1 to 10:1 (rarely to 25:1); leaf apex obtuse to short-acute . . . . .  
. . . . . 2 a. *E. inundata* var. *inundata*
3. Stem leaves narrowly linear, linear, or narrowly linear-lanceolate, 1.5–3.5 (–4.5) mm wide, the length:width ratio (12:1–) 15:1 to 20:1 (–50:1), leaf apex shortly acute to acuminate . . . . 2 b. *E. inundata* var. *garrettii*
4. Stem leaves narrowly linear, less than 7 mm wide, often reflexed, abruptly contrasting with the lance-ovate, acuminate bracteal leaves, long tapering to tip; all leaves uniformly green to margin; involucre generally 2–3 mm wide and high . . . . . 3. *E. floridana*
4. Stem leaves narrowly elliptic to obovate-spatulate, 5–21 mm wide, ascending to spreading, grading into the broadly ovate, triangular bracteal leaves, short tapering to tip; all leaves with a distinct, ca. 0.1 mm wide pinkish purple marginal zone; involucre generally 4–6 mm wide and 3–5 mm high . . . . 4. *E. roscens*

1. *EUPHORBIA TELEPHIOIDES* Chapm. Fl. South. U.S. 402. 1860. *Tithymalus telephioides* (Chapm.) Small, Fl. S.E. U.S. 719. 1903. *Galarhoeus telephioides* (Chapm.) Small, Fl. S.E. U.S. 801. 1933. TYPE: "Apalachicola", n.d., A. W. Chapman s.n. (LECTOTYPE, here designated, NY).

Perennial milky-juiced herb; rootstock vertical, light brown, 3–10 mm wide. Stems (20–)23–25 cm tall, lower stems ca. 2–3 mm wide, green to greenish-purple, firm, striate. Leaves oblanceolate to obovate or spatulate, 4–6 cm long, (1–) 1.5–3.0 cm wide, leaf length:width ratio typically 2:1 to 3:1, ranging from 1.5:1 to 4:1, leaves ascending, base strongly cuneate, apex obtuse to rounded or slightly acute, the margins usually maroon; pleiochasial leaves lanceolate, 1.0–2.2 cm long, 8–10 mm wide, length:width ratio about 2:1 (occasionally 3:1), spreading to ascending, base truncate to cordate, apex acute; bracteal leaves numerous, highly reduced, ovate to ovate-lanceolate, 3–15 mm long, 3–8 mm wide. Inflorescence a diffusely branched terminal cyme; involucre broadly campanulate, ca. 1–2 mm long, very dark purple; lobes of the cyathium suborbicular, erect, dark reddish-purple, ciliate-fimbriate, about as long as the glands; glands of the involucre five, maroon-purple, short-stalked, hemispherical, the margins entire to undulate. Capsules 7–8 mm broad, granular. Seeds subglobose, gray or gray-brown, ca. 3 mm in diameter.

*Euphorbia telephioides* is restricted to scrubby pine flatwoods on low sand ridges (Kral, 1983) near the coast in Franklin, Gulf, and Bay counties of the east-central Florida panhandle. All known locations are within 6.4 km of the Gulf of Mexico and its embayments within the Apalachicola Embayment (see Schmidt, 1984) of the Gulf Coastal Lowlands physiographic region (see Brooks, 1981; Puri & Vernon, 1964). *Euphorbia telephioides* is narrowly endemic to the floristically rich Apalachicola Lowlands (see Orzell & Bridges, 1993). *Euphorbia telephioides* can be locally abundant along disturbed sandy road embankments through scrubby flatwoods, as well as of more sporadic occurrence in the dense grass cover of unburned scrubby flatwoods. Its scrubby flatwoods habitat occurs where a relatively deep sandy surface soil overlies an impervious “spodic horizon,” i.e., a subsurface layer formed from organic matter in

combination with aluminum and/or iron from downward leaching. Spodic layers in scrubby flatwoods create alternating conditions of subsurface saturation and drought, thereby resulting in juxtaposition of xerophytic and hydric floristic elements. In the panhandle of Florida, scrubby flatwoods typically have a scattered pine canopy (most often of *Pinus palustris* Mill), with a low shrub layer (1–2m) of semi-evergreen xeromorphic scrub oaks and ericaceous shrubs, as well as palmetto [*Serenoa repens* (W. Bartr.) Small] that historically was maintained by periodic lightning season fires. Closely associated plants include *Xyris brevifolia* Michx., *X. elliotii* Chapm., and *Lachnocaulon anceps* (Walt.) Morong. Other typical associates recorded at a scrubby flatwoods in coastal Bay County include *Asclepias cinerea* Walt., *Carphephorus odoratissimus* (J. F. Gmel.) Hebert, *Conradina canescens* (Torr. & A. Gray) A. Gray, *Cyrilla racemiflora* L., *Gratiola subulata* Baldw., *Hypericum tetrapetalum* Lam., *Ilex glabra* (L.) A. Gray, *Kalmia hirsuta* Walt., *Liatris tenuifolia* Nutt., *Lyonia ferruginea* (Walt.) Nutt., *L. lucida* (Lam.) K. Koch, *Polygonella gracilis* (Nutt.) Meisn., *Quercus minima* (Sarg.) Small, *Rhynchospora plumosa* Ell., *Smilax auriculata* Walt., and *Xyris isoetifolia* Kral.

This clearly marked species is apparently derived from *E. inundata* and differs primarily in its much wider obovate to oblanceolate stem leaves and smaller, more purplish or dark reddish involucre. It is not known to be sympatric with *E. inundata*, although its range is well within the potential range of *E. inundata* and known populations of the two species are separated by less than 30 km. *Euphorbia telephioides* was listed as Federally Threatened in 1992 (USFWS, 1992). There are three Chapman sheets at NY which represent probable type material, all of which are labeled as from “Herb. Chapman Southern Flora”. The one sheet which also gives a location of the collection as “Apalachicola” is here designated as the lectotype.

REPRESENTATIVE SPECIMENS EXAMINED: **UNITED STATES. FLORIDA. Bay County:** Dry scrubby flatwoods on low sand ridge, on N side of US 98, 1.9 mi W of int Alt US 98, 0.2 mi W of Catholic Church, ca. 2.0 air mi ENE of Panama City Beach, SEQ, SEQ, Sec. 25, T3S, R16W, 30°11'34" N, 85°47'54" W, elev. 5 m, 8 Jul 1990, *Orzell & Bridges 14219* (FLAS, GA, NCU, SMU, TEX). **Gulf County:** Dry sandy ridges in wetland longleaf pine savanna, on S side of Airport Rd., ca. 0.4 mi E of FL 30 at a point 1.3 mi S of jct US 98, ca. 3.5 air mi S of US 98/FL 382 jct in Port St. Joe, NEQ, NEQ, NWQ, Sec. 25, T8S, R11W, 29°45'42" N, 85°17'49" W, elev. 3 m, 15 Sep 1990, *Orzell & Bridges 15368* (FTG, USF); Slightly elevated places in pine flatwoods, 3.8 mi E of Port St. Joe, by U.S. Rt. 98, dioecious, 31 Jul 1981, *Godfrey 79065* (FTG, FSU).

2. *EUPHORBIA INUNDATA* Torr. ex Chapm. Fl. South. U.S. 402. 1860. *Tithymalus inundatus* (Torr.) Small, Fl. S.E. U.S. 719. 1903. *Galarhoeus inundatus* (Torr.) Small, Fl. S.E. U.S. 801. 1933. TYPE: Apalachicola (also has "Tennessee Bluff" label on sheet), 1836, A. W. Chapman s.n. (LECTOTYPE, here designated, NY).

Perennial milky-juiced herb; rootstock vertical, gnarled, ca. 3–8 mm thick, dark gray to brown; stems (10–) 25–35 (–40) cm tall, ca. (1–) 2–3 mm wide at base, green to greenish-purple, firm, striate. Leaves of the lowest 2–4 nodes bractlike, the main stem leaves alternate, sessile, narrowly linear, linear, narrowly elliptic, narrowly lanceolate, or rarely oblanceolate, (3–) 4–6 (–10) cm long, (1.5–) 2–8 (–14) mm wide, the length:width ratio varying from 5:1 to 50:1, ascending to somewhat spreading, the base cuneate, the apex obtuse, shortly acute, to acuminate; pleiochasial leaves linear-lanceolate, narrowly lanceolate, to lance-ovate, (1.5–) 3–4 (–4.5) cm long, 4–8 mm wide at base, the length:width ratio 3:1 to 6:1 (occasionally to 12:1), ascending to spreading,

the apex acute, acuminate, or long-attenuate, the base rounded to truncate; bracteal leaves lanceolate, lance-ovate, to broadly ovate, acute to acuminate, rarely apiculate, gradually reduced upwards in the inflorescence. Inflorescence a diffusely dichotomously branched terminal umbelliform cyme; peduncles of the cyathia 5–10 mm long, stoutish; involucre campanulate, 2–3 mm long, green or more commonly suffused with reddish purple; lobes of the cyathium ovate, green basally, deep reddish purple distally, equalling or longer than the glands, truncate at tip, erose to irregularly lacerate, ciliate with a mixture of reddish and hyaline trichomes, the midrib of the lobe sometimes shortly excurrent as a mucro; glands of the involucre five, wedge-shaped, somewhat fleshy, spreading, green to maroon, 1.5 mm long and somewhat broader than long distally; stalk of the mature capsule stout, exerted ca. 4 mm from the cyathium. Capsules 6–10 mm broad, broader than long, granular, markedly 3-lobed, the faces of the lobes nearly flat or moderately convex, style branches 3, these bifid near the tip. Seeds grayish, ovoid, 2–3 mm wide at base, 2–3 mm long, smooth.

*Euphorbia inundata* consists of two allopatric varieties.

## 2 a. *EUPHORBIA INUNDATA* var. *INUNDATA*

Stem leaves linear, narrowly elliptic, narrowly lanceolate, or rarely oblanceolate, (3–) 4–6 (–11.5) cm long, (3–) 4–14 (–15) mm wide, the length:width ratio typically 5:1 to 10:1 (rarely to 25:1), the apex obtuse to shortly acute.

Common in mesic and wet longleaf pine savannas, mesic pine flatwoods, and low hillside seepage-bogs, both above and below the zone of seasonal inundation, from the Florida panhandle (Wakulla Co.) west to southeastern Mississippi (Jackson Co.), and from extreme southeastern Georgia south through northeastern Florida to Putnam County (Fig. 1). Bridges (1989) in-

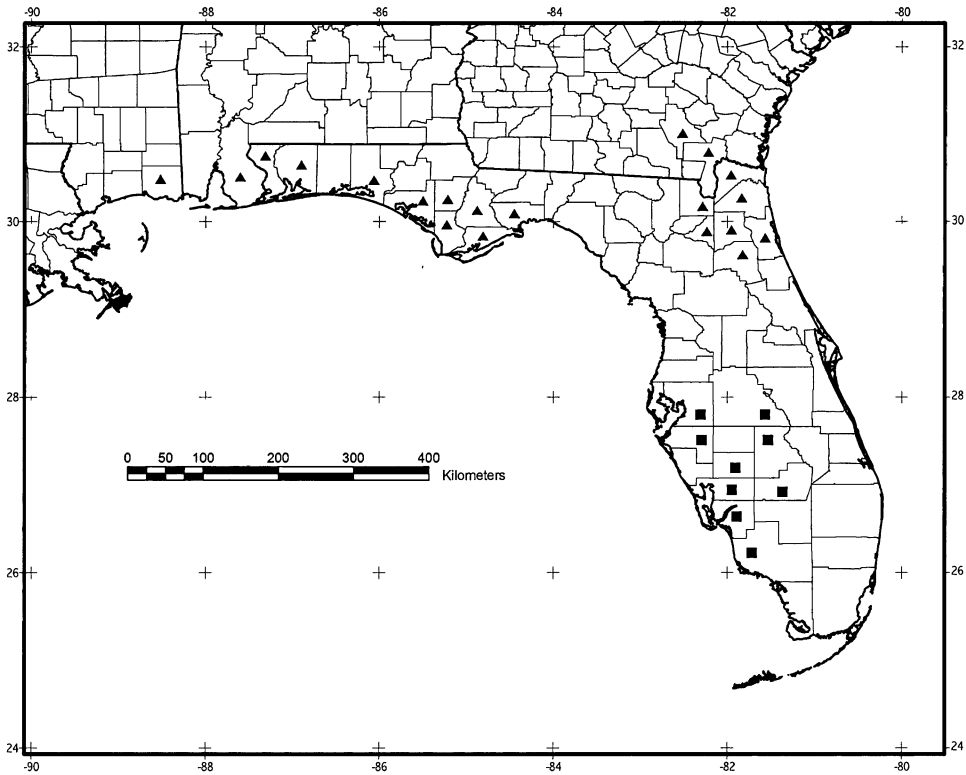


FIG. 1. Range map for *Euphorbia inundata* var. *inundata* (triangles) and *E. inundata* var. *garrettii* (squares).

cludes habitat descriptions of this variety at its western range limit.

All of the type material of *Euphorbia inundata*, as well as all other sheets collected by Chapman at NY, are var. *inundata*. There are additional sheets of *E. inundata* collected by Chapman labeled as from "Apalachicola" at NY and US. The single sheet with the additional label of "Tennessee Bluff" is here designated as the lectotype, since Chapman refers to this location in correspondence with Torrey and on other labels as being a specific location for *E. inundata*, and because this location was used to contrast *E. inundata* with *E. floridana*. With its restriction to central and southern peninsular Florida, at the time essentially unknown territory botanically, it is unlikely that Chapman ever saw specimens of var. *garrettii*.

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES. ALABAMA. **Baldwin County:** Frequent in meadow dominated by *Aristida stricta*, 8 mi S of Foley, 23 Jul 1950, *Webster & Wilbur* 3534 (NY, SMU, TEX). FLORIDA. **Calhoun County:** Cutover wetland pine savanna, N of Scotts Ferry Rd., just E of Bay Co. line, ca. 3 air mi SE of Youngstown, SWQ, SWQ, Sec. 31, T1S, R11W, 30°21'00" N, 85°23'13" W, 15 Aug 1991, *Orzell & Bridges* 17507 (FTG); Savanna, 4.5 mi S of Blountstown, 4 Jul 1963, *Godfrey & Clewell* 62910 (FSU, SMU). **Clay County:** Burned mesic pine flatwoods, ca. 0.2 air mi S of Duval Co. line, ca. 2.3 air mi S of jct FL 217 and FL 228 (in Duval Co.), ca. 9.2 air mi NW of Middleburg, NEQ, NWQ, Sec. 6, T4S, R24E, 30°11'05" N, 81°56'30" W, elev. 26 m, 6 Jun 1990, *Orzell & Bridges* 13875

(TEX); Pine flatwoods, 2 mi E of Middleburg on FL 21, 21 Jun 1981, *Sauleda & Ragan 5630* (FTG); Longleaf pine scrub oak ridge, 6.7 mi W of Green Cove Springs, 21 May 1964, *Godfrey 63935* (FSU). **Escambia County:** Dry oak woods on sandy soil, 11 mi W of Pensacola, 25 Jul 1950, *Webster & Wilbur 3573* (SMU). **Franklin County:** Wetland longleaf pine savanna, on S side of FS Rd. 143, 0.4 mi E of int FS Rd. 143-B and 0.9 mi E of FL 65, ca. 7 mi S of Sumatra, Apalachicola National Forest, NWQ, Sec. 32, T6S, R7W, 29°54'50" N, 84°57'47" W, elev. 6 m, 9 May 1989, *Orzell & Bridges 9614* (USF); Frequent, longleaf pine flatwoods, Apalachicola National Forest, by FL 65, 2.5 mi S of its jct with road to Ft. Gadsden SRA, 21 Apr 1984, *Godfrey 81228* (FSU, FTG). **Gulf County:** Low prairie, 10 mi N of Port St. Joe on Rte. 71, 24 Jun 1950, *Sargent, s.n.* (SMU). **Liberty County:** Wetland longleaf pine savanna, on S side of FS Rd. 105, 0.6–0.8 mi W of int FL 65 at Liberty, ca. 5 mi S of Telogia and 12 mi NE of Wilma, Apalachicola National Forest, SEQ, NEQ, NWQ, Sec. 29, T2S, R6W, 30°16'55" N, 84°51'23" W, elev. 30 m, 9 May 1989, *Orzell & Bridges 9562* (FTG); Wetland longleaf pine savanna, on E side of FL 379, from 0–0.3 mi N of int FS Rd. 172, ca. 9 mi NW of Sumatra and 4.2 air mi W of Kern, Apalachicola National Forest, NEQ, Sec. 17, T4S, R8W, 30°07'55" N, 85°03'20" W, elev. 11 m, 9 May 1989, *Orzell & Bridges 9602* (FLAS, FTG, NCU, USF); In *Pinus palustris* flatwoods along CR 379, 5 mi N of Sumatra, Apalachicola National Forest, 13 May 1989, *Herndon 2535* (FTG); In a *Pinus palustris* flatwoods that burned ca. 2 months ago, CR 379, 5.2 mi N of SR 65 (at Sumatra), Apalachicola National Forest, 5 Jul 1990, *Herndon 2846* (FTG – 2 sheets, one of staminate plant and one of pistillate plants); Savanna, Apalachicola National Forest, by FS Rd. 23, 0.6 mi NW of FL 379, generally NW of Sumatra, 1 Sep 1988, *Godfrey, Gholson, & Carter 82848* (FTG); On moist sandy bank along FL 65, about 10 mi N of Wilma, 24 Apr 1981, *D.S. & H.B. Cor-*

*rell 51617* (FTG, NY). **St. Johns County:** Slash pine flatwoods, 11 mi NE of St. Augustine along FL 16, 14 May 1971, *Godfrey 70205* (FSU); Pine flatwoods, 3 mi SE of Orangedale, 22 May 1964, *Godfrey 64028* (FSU). **Wakulla County:** Mesic longleaf pine / wiregrass–saw palmetto savanna, on SW side of FS Rd. 314-I at int of FS Rd. 314-H, ca. 0.4 mi NW of int FH 13 at a point ca. 2.4 mi NE of int FL 375, ca. 1.6 air mi NE of Smith Creek School, Apalachicola National Forest, SEQ, SEQ, NWQ, SEQ, Sec. 21, T3S, R4W, 30°12'02" N, 84°38'02" W, elev. 21 m, 24 Jun 1990, *Orzell & Bridges 13986* (FSU, TEX); Wet wiregrass longleaf pine flatwoods, St. Marks National Wildlife Refuge, along Lighthouse Rd, 25 May 1963, *Godfrey 62832* (FSU (4 sheets), SMU). **Walton County:** Longleaf pine savanna, 20 mi E of Fort Walton, 8 Oct 1950, *Whitehouse 23975* (SMU). **GEORGIA. Ware County:** Savanna, near Waycross, 7 Jun 1950, *Godfrey 50405* (NY). **MISSISSIPPI. Jackson County:** Wetland longleaf pine savanna on W side of Martin Bluff Rd., 0.1–0.2 mi S of I-10 bridge, ca. 3 mi N of Gautier and 1.5 mi E of Gautier-Vancleve Rd. jct with I-10, NEQ, NEQ, SEQ, Sec. 13, T7S, R7W, 30°26'07" N, 88°37'55" W, 16 May 1989, *Orzell & Bridges 10101* (MISSA, TEX); Acid low pine woods, ca. 3 mi E of Ocean Springs, coastal flatwoods, 29 Apr 1967, *Jones 11879* (FSU, VDB); 2 mi N of Fontainebleau, occasional on longleaf pine savanna, 26 May 1962, *McDaniel 3188* (NY).

2 b. *Euphorbia inundata* var. *garrettii* E. L. Bridges & S. L. Orzell, var. nov. (Fig. 2)

TYPE: UNITED STATES. FLORIDA. Highlands County: Mesic to wet longleaf pine savanna, recently burned, ca. 1.0 air mi NE of jct Morgan Hole Rd. and Van Eeghen Rd. in Avon Park Air Force Range, ca. 1.1 air mi W of Submarine Lake, ca. 13 mi ENE of Sebring, NWQ, SEQ, Sec. 13, T33S, R30E, 27°36'31" N, 81°16'35" W, elev. 22 m, 14 Aug 1993, *S. L. Orzell & E. L. Bridges*



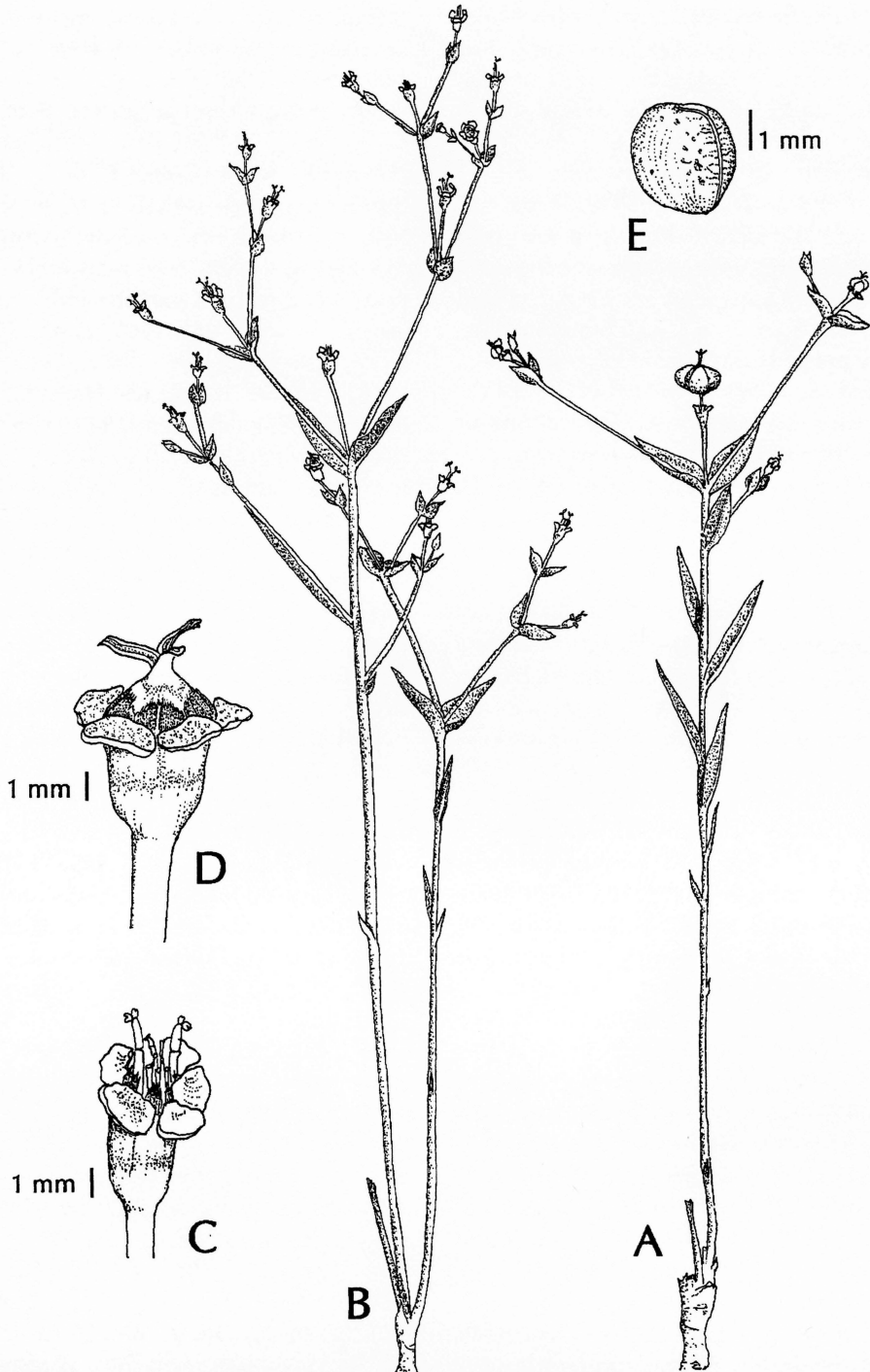


FIG. 2. *Euphorbia inundata* var. *garrettii* (Orzell & Bridges 22211 and live material). A. Habit of pistillate plant. B. Habit of staminate plant. C. Staminate cyathium. D. Pistillate cyathium. E. Seed.

22211 (HOLOTYPE: USF; ISOTYPES: F, FLAS, FTG, MO, NY, TEX, US, USF).

*Euphorbiae inundatae* var. *inundatae* similis sed foliis caulinis angustioribus acutis vel acuminatis.

Stem leaves narrowly linear, linear, or narrowly linear-lanceolate, (2.5–) 3–6 (–10) cm long, 1.5–3.5 (–4.5) mm wide, the length:width ratio (12:1–) 15:1–20:1 (–50:1), leaf apex shortly acute to acuminate.

The name honors the Highlands County, Florida, amateur botanist Ray Garrett (b. 1921), who made extensive collections of this variety and of *E. rosescens* in 1948 and understood that two taxa of the subsection *Inundatae* inhabited Highlands County.

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES. FLORIDA. **Charlotte County:** Scrubby flatwoods on low sand ridge, on E side of Co. Rd. 765 (Burnt Store Rd.), 0.5 mi NE of jct with Zemel Rd., N of drainage canal, just NE of Pirate Harbor, SH, NEQ, SWQ, Sec. 20, T42S, R23E, 26°48'15" N, 82°01'52" W, 28 Apr 1992, *Orzell and Bridges 19436* (USF); Outer edges of shallow marsh within hydric slash pine savanna, E of Oil Well Rd., 0.3 mi N of jct with Tuckers Grade Rd., in Cecil M. Webb Wildlife Management Area, ca. 2 air mi E of jct I-75 and Tuckers Grade Rd., ca. 17 air mi N of Ft. Myers, SWQ, SWQ, Sec. 32, T41S, R24E, 26°51'40" N, 81°56'15" W, 29 Apr 1992, *Orzell, Bridges, & Beever 19461* (NY, TEX, USF); Recently burned hydric pine savanna, on N side of Tuckers Grade Rd., 0.4 mi E of powerline, ca. 3.9 mi E of jct Oil Well Rd., ca. 11 air mi ESE of Punta Gorda, SEQ, SEQ, Sec. 35, T41S, R24E, 26°51'30" N, 81°52'40" W, 14 Jun 1992, *Orzell, Bridges, & Beever 19630* (NY, USF); "Pine slough—man made", 27 Mar 1946, *Frye & Arnold s.n.* (FLAS); Along FL 74, 7 mi E of jct FL 31, 5 mi W of Glades Co. line, low flatwoods, 16 Jun 1968, *Beckner 2265* (FLAS); Occasional in dried up flatwoods pond, with *Panicum tenerum* and *Hypericum fasciculatum*, Caloosa Experi-

mental Range, U.S. Forest and Range Station, SE part of county, 10 Jun 1956, *Adams 178* (FSU). **Collier County:** Northeast of Naples, 6 Jul 1951, *Garrett s.n.* (FLAS). **DeSoto County:** "Arcadia", 5 Apr 1935, *McFarlin 10171* (NY). **Glades County:** Grassy edge of seasonal pond in pine flatwoods, Tasmania, 31 Mar 1963, *Brass 32972* (ARCH). **Highlands County:** Route 18, ca. 5 mi W of Childs, moist sandy edge of a prairie pond, 7 Jul 1945, *Brass 15,366-A* (USF); Damp grassy soil along south Tiger Branch Drive, Highlands Hammock State Park, Sebring, 14 Sep 1948, *Garrett s.n.* (FLAS); Damp sandy pinelands W of Sebring, 27 Jul 1948, *Garrett s.n.* (FLAS); Sandy damp pineland, 4.5 mi W of Sebring, 27 Jul 1948, *Garrett s.n.* (FLAS); Road shoulders, Highlands Hammock State Park, Sebring, n.d., *Garrett 214* (FLAS); Burned wet-mesic longleaf pine savanna, ca. 1.1 air mi ENE of jct Morgan Hole Rd. & Van Eeghen Rd., Avon Park Air Force Range, ca. 0.8 air mi W of Submarine Lake, ca. 12.5 air mi ENE of Sebring, SEQ, SEQ, Sec. 13, T33S, R30E, 27°36'13" N, 81°16'21" W, Elev. 22 m, 17 Aug 1993, *Orzell & Bridges 22304* (FLAS, TEX, US, USF). **Hillsborough County:** Dry sandy roadside, U.S. 41, ca. 2.2 mi N of Little Manatee River, 7 Apr 1950, *Dress & Hansen 952* (FLAS, SMU). **Lee County:** N. Ft. Myers, N-S power line, N of club house, Tamiami Village, 24 Jun 1985, *Brown s.n.* (USF); Infrequent, burned over flatwoods along FL 767, just S of rd. to Pineland, Pine Island, 22 Apr 1967, *Beckner 1740* (FLAS); On ground fill, Middle Captiva Island, 7 Apr 1973, *Brumbach 8297* (FLAS); Moist mucky sand margin of flatwoods pond, ca. 2.2 air mi SW of US 41 crossing of Charlotte-Lee Co. line, ca. 8.5 air mi NW of downtown Ft. Myers, Sec. 1 & 12, T43S, R23E, 26°45'20" N, 81°57'47" W, 1 May 1992, *Orzell & Bridges 19477* (FLAS, NY, USF). **Manatee County:** Disturbed area, sand, irrigation drainage, FL 64, 25 mi E of Bradenton, 13 Apr 1975, *Genelle & Fleming 2028* (USF); Ditch along sideroad, deep sandy soil, FL 64, 20 mi E of

Bradenton, 27 Apr 1975, *Genelle & Fleming* 2036 (USF); Outer edge of small, herb dominated, flatwoods marsh located in the SW part of Sec. 2, T33S, R22E, ca. 0.8 mi W of FL 37 and 0.5 mi S of the Hillsborough Co. line (NE of Duette), 18 Apr 1978, *Shuey* 2109 (USF), 12 Jul 1978, *Shuey* 2118 (FLAS); From outer edge of a small, herb-dominated flatwoods marsh located in the NE part of Sec. 9, T33S, R22E, ca. 0.5 mi E of Gill Rd. and 2.75 mi N of Duette and FL 62, 3 Jul 1980, *Shuey* 2405 (USF). **Polk County:** Wet-mesic longleaf pine savanna, recently burned, ca. 0.6 air mi SW of jct Smith Rd. & Old Bravo Rd., Avon Park Air Force Range, ca. 1.9 air mi NW of Old Bravo Rd. crossing of Polk-Highlands Co. line, ca. 16 air mi ESE of Frostproof, SWQ, NEQ, Sec. 26, T32S, R30E, 27°40'08" N, 81°17'20" W, elev. 27 m, 10 Sep 1993, *Orzell & Bridges* 22337 (TEX, USF).

*Euphorbia inundata* var. *garrettii* is endemic to south-central Florida, from southern Hillsborough County south to northern Collier County and inland to Highlands and Polk counties. It is allopatric with var. *inundata* and is disjunct over 200 km from its nearest stations in northeast Florida (Fig. 1). The pyrogenic, wet pinelands of south-central and southwestern Florida are the habitat of var. *garrettii*, where it is adapted to alternating soil saturation, inundation, and seasonal drought. Here it is occasional in seasonally inundated wet to hydric pineland savannas and outer edges of seasonal herbaceous-dominated shallow ponds within pinelands. Less commonly it occurs in mesic to scrubby pinelands.

Within south-central Florida in Polk and Highlands counties, var. *garrettii* occurs sporadically in mesic to wet pinelands. Here it occurs on poorly drained soils that are saturated to the surface from a few weeks to about two months during the wet season but are rarely inundated more than a few inches for short periods and are periodically droughty in the winter dry season. In the subtropical wet-dry climate of southwestern

Florida (Charlotte, Collier, & Lee counties), it is common in shallow herbaceous-dominated depressions within the hydric pine flatwoods (see Long, 1974; Wharton, 1977; see hydric slash pine flatwoods of Beaver & Dryden, 1992a, 1992b; Beaver & Dryden, 1999) savanna landscape. These ponds have a deep, sandy soil surface layer with a less permeable layer in the subsoil that restricts drainage. Pineland ponds are often dry for six months or more during the winter and spring but are covered with 30 to 50 cm of water for several continuous months during the summer wet season. Based on our observations, var. *garrettii* is adapted to this seasonal cycle with rapid growth and fruit set during the few months at the beginning of the wet season, when sufficient soil moisture is present but inundation has not yet occurred, during April through June. A few Charlotte County sites are savanna-like, hydric pinelands dominated by South Florida slash pine (*Pinus elliottii* Engelm. var. *densa* Little & Dorman), where there is similar seasonal variation in soil saturation but with shorter periods of shallower inundation. Rarely it occurs in distinctly drier, sandy mesic pine savanna on Immokalee soils (Arenic Haplaquods), which are not seasonally inundated but are still poorly drained (see Henderson, 1984).

Inflorescence and floral characters are essentially the same as var. *inundata*; however, the leaves of var. *garrettii* are distinctly narrower and the leaf apex is more acute to acuminate, in contrast to the obtuse to acute leaf apices of var. *inundata*. If not for the disjunct geographical range of this variety, one might attribute these differences to intraspecific variation. However, var. *garrettii* maintains its vegetative differences from the type variety throughout its geographic range and variety of ecological habitats, indicating taxonomic recognition at the varietal level.

3. EUPHORBIA FLORIDANA A. W. Chapm. Fl. South. U.S. 401. 1860. TYPE: "Dry sandhills near Aspalaga, Chapm.", A. W. Chap-

*man* s.n. (LECTOTYPE, here designated, NY). *Galarhoeus floridanus* (Chapman) Small, Fl. S.E. U.S. 801. 1933.

*Euphorbia sphaerosperma* Shuttlew. in Rugel ex Boiss. in DC. Prodr. 15(2): 102. 1862.  
*Tithymalus sphaospermus* (Shuttlew. ex Boiss.) Small, Fl. S.E. U.S. 719. 1903.

TYPE: In arenosis apricis collium, prope Aspalaga, Florida, May-Jul 1843, *Rugel s.n.* (ISOTYPE: NY)

Perennial milky-juiced herb; rootstock vertical, slender, straight, light brown, ca. 2–5 mm wide. Stems (20–) 35–45 (–65) cm high, lower stems ca. 1–3 mm wide, green, greenish purple, or purple, firm, striate; stem leaves linear to very narrowly elliptic, (4–) 5–7 (–10) cm long, (1–) 2–3 (–7) mm wide, leaf length:width ratio typically 20:1 (ranging from 10:1 to 40:1). Leaves typically strongly recurved, rarely spreading or slightly ascending, often deciduous by the time of fruit maturation; pleiochasial leaves narrowly lanceolate to narrowly ovate (typically lanceolate), (1–) 2–4 (–6) cm long, (6–) 8–10 (–13) mm wide at base, length:width ratio typically 3:1 to 4:1 (ranging from 2.5:1 to 6:1), strongly reflexed to spreading, truncate to cordate at base, apex acuminate to long-acuminate, rarely acute; bracteal leaves progressively reduced upwards, lanceolate to ovate, (0.5–) 1–2.5 (–4) cm long, 5–13 mm wide at base, length:width ratio typically 1.5:1 to 3:1 (ranging from 1:1 to 4:1), base truncate to cordate, apex acute, long-acuminate, or abruptly short-acuminate. Inflorescence usually with three primary branches, these typically dichotomously branched, rarely with additional axillary branches; involucre 2–3 mm high and broad; lobes of the cyathium ovate, erose, the margins minutely ciliate; glands of the involucre flabellate, the edges erose-crumpled, with short, fleshy lobes, longer than the lobes of the cyathium. Capsules 8–10 mm broad, markedly 3-lobed, the faces of the lobes rotundly bulging, the

surface smooth to very slightly wrinkled. Seeds subglobose to spheroidal, grayish to brown, ca. 4 mm wide, smooth.

*Euphorbia floridana* is most frequently encountered on xeric, typically yellowish sands of longleaf pine-turkey oak-wiregrass sandhills (*Pinus palustris*—*Quercus laevis* Walter—*Aristida beyrichiana* Trin. & Rupr.) of the outer East Gulf Coastal Plain. These sandhill woodlands or savannas can also be dominated by bluejack oak (*Quercus incana* W. Bartr.), or sand live oak (*Quercus geminata* Small). *Euphorbia floridana* occasionally occurs in sand pine [*Pinus clausa* (Chapm. ex Engelm.) Vasey ex Sarg.] scrub near the coast in the western Florida Panhandle. It ranges from the Florida panhandle and adjacent southwest Georgia west to southern Alabama and perhaps into southern Mississippi (Fig. 3).

*Euphorbia floridana* can be readily distinguished in vegetative condition from members of the subsection by its reflexed, narrowly linear stem leaves, which abruptly contrast with the shorter and broader, spreading bracteal leaves. The pleiochasial leaves are usually intermediate between these forms, being broadened at the base like the bracteal leaves but usually somewhat reflexed.

Apparently, no type material was designated for *Euphorbia floridana*. A lectotype is herein designated, being the only sheet of this species deposited at NY collected by Chapman. A note by Chapman on this sheet states, “seems to be very near *E. inundata* and perhaps not distinct. The latter sp. grows abundantly in the Damp pine barrens near ‘Tennessee Bluff’ alias ‘Iola’”. This annotation makes it likely that this is the first collection made by Chapman of this species, probably collected in 1836 or 1837, based on references (and lack thereof) in letters from Chapman to Torrey between 1835 and 1838 (NY archives). Chapman had originally labeled this sheet as “*Euphorbia* sp.? heterophyl. Chap”, but it is clear that this is among the specimens upon which he later based *E. floridana*.

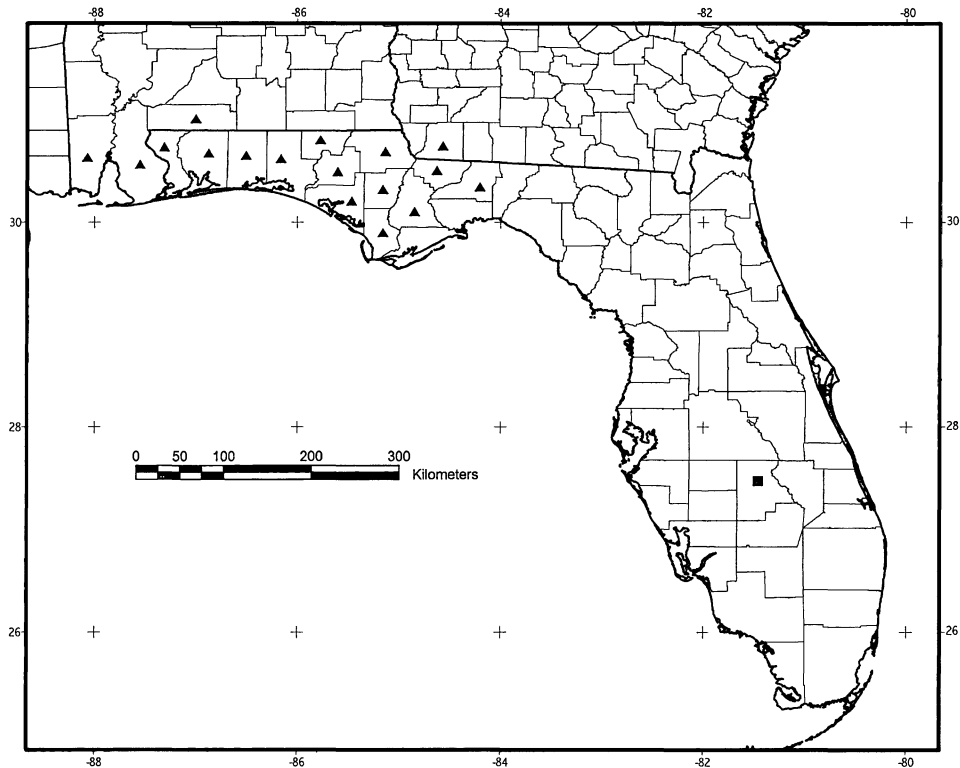


FIG. 3. Range map for *Euphorbia floridana* (triangles) and *E. rosescens* (square).

REPRESENTATIVE SPECIMENS EXAMINED: **UNITED STATES. ALABAMA. Escambia County:** Dry sandhill woodland, on S side of Co. Rd., 0.6 mi W of int Escambia Co. Rd. 11 at Parker Springs, ca. 3 mi N of Florida state line, at headwaters of Sweetwater Creek, Conecuh National Forest, SH, SEQ, Sec. 14, T1N, R12E,  $31^{\circ}02'32''$  N,  $86^{\circ}44'15''$  W, elev. 79 m, 12 May 1989, *Orzell & Bridges 9872* (FTG, TEX). **Mobile County:** Sands of longleaf pine hills by US 45, 3.8 mi SE of Chunchula, 3 Jun 1970, *Kral 39609* (NY). **FLORIDA. Bay County:** Xeric sandhills, in valley E of sand road, ca. 1.2 air mi W of US 231 at Fountain, in headwaters of Bear Creek, ca. 2 air mi N of FL 20, EH, NWQ, NEQ, Sec. 28, T1N, R12W,  $30^{\circ}27'48''$  N,  $85^{\circ}26'35''$  W, elev. 49 m, 11 May 1989, *Orzell & Bridges 9758* (FTG); Dry turkey oak woods, jct of FL 390 & 389, 0.3 mi E of Lynn Haven, N of Panama City, T3S, R14W, Sec. 15, 1 May 1982,

*Wunderlin & Beckner 9307* (FTG). **Calhoun County:** Cutover dry, sandy pineland, on S side of FL 20, 0.6 mi W of gravel rd, 1.1 mi W of int Co. Rd. 287 at Rollins Corner, 3.2 mi W of int FL 73 S and 3.4 mi W of FL 73, NEQ, NWQ, NEQ, Sec. 4, T1S, R10W,  $30^{\circ}26'00''$  N,  $85^{\circ}14'24''$  W, elev. 46 m, 12 Sep 1989, *Orzell & Bridges 11862* (TEX). **Holmes County:** Cleared sandhill in powerline at tributary headwaters NW of Hog Creek, ca. 0.2 air mi E of FL 10A, ca. 1.2 air mi NE of jct FL 10A and US 90 near Argyle, ca. 7.2 air mi NW of Ponce de Leon; SWQ, SEQ Sec. 22, T3N, R18W;  $30^{\circ}44'07''$  N;  $86^{\circ}01'42''$  W, 28 Aug 1994, *Orzell & Bridges 23014* (FLAS, USF); **Jackson County:** Disturbed, overgrown, wet seepy flatwoods swale, just N of I-10 near milepost 145, ca. 6.6 mi W of int FL 69, ca. 3.0 mi E of int FL 71 near Oakdale, SEQ, NWQ, Sec. 33, T4N, R9W,  $30^{\circ}42'15''$  N,  $85^{\circ}08'25''$  W, elev. 33 m, 7 Jul 1990, *Orzell & Bridges*

14065 (FLAS, TEX). **Leon County:** Low moist sandhill swales, on N side of FS Rd. 320, just E of int FL 375, ca. 3 mi S of Bloxham, Apalachicola National Forest, SWQ, NEQ, Sec. 32, T1S, R4W, 30°21'10" N, 84°39'13" W, elev. 115–120 ft., 9 May 1989, *Orzell & Bridges 9645* (FTG, TEX); Frequent, longleaf pine-scrub oak ridge, by FS Rd. 325, ca. 0.3 mi W of FL 20, Apalachicola National Forest, 26 Apr 1991, *Godfrey 84126* (FTG); Disturbed pine-oak woodland, Silver Lake Rec. Area, Apalachicola National Forest, 29 May 1986, *Hernndon 1555* (FTG, 2 sheets). **Okaloosa County:** Open sandy soil between FL 90 and railroad, 1 mi W of Deerland, 27 Jul 1981, *Correll & Correll 52233* (FTG, NY); In dry open woods, along FL 90, ca. 1 mi W of Milligan, 20 Apr 1982, *Correll & Correll 53782* (FTG, NY); Dry sandy pineland, S of US 90, 0.3 mi W of bridge over Shoal River, in valley of Shoal River, ca. 3.4 air mi E of downtown Crestview, NEQ, SWQ, SEQ, Sec. 14, T3N, R23W, 30°45'11" N, 86°30'54" W, elev. 27 m, 10 Jul 1990, *Orzell & Bridges 14256* (BRIT, FLAS, USF); **Santa Rosa County:** Dry longleaf pine savannah, ca. 3 air mi S of FL 4 at a point ca. 3.4 mi E of Munson, at head of S-draining tributary of Middle Creek, Blackwater River State Forest, NEQ, SWQ, NWQ, Sec. 35, T4N, R26W, 30°48'40" N, 86°49'12" W, elev. 49 m, 20 Sep 1989, *Orzell & Bridges 12454* (NCU, TEX); **Walton County:** Powerline right-of-way through sandhills, 0.3 mi N of int US 90 at a point 1.1 mi W of Holmes Co. line and ca. 1.1 mi E of Koerber, ca. 3.5 mi E of De Funiak Springs, SEQ, NEQ, Sec. 29, T3N, R18W, 30°43'45" N, 86°03'20" W, elev. 67 m, 18 Aug 1990, *Orzell & Bridges 14767* (FTG, USF); **Washington County:** Dry, sandy clearcut, on N side of Greenhead Rd., ca. 0.7 mi E of FL 77 at Riverside, ca. 0.7 mi N of Long Lake Slough, NEQ, NWQ, Sec. 16, T1N, R14W, 30°29'40" N, 85°38'56" W, elev. 20 m, 12 Sep 1989, *Orzell & Bridges 11889* (TEX). **GEORGIA. Decatur County:** Sandhills SW of Recovery, 14 Aug 1903, *Harper 1931*

(NY); Dry oakland on sand hills ca. 3 mi WSW of Faceville, 31 Aug 1955, *Thorne & Davidson 16721* (NY).

4. ***Euphorbia roscens*** E. L. Bridges and S. L. Orzell, sp. nov. (Fig. 4). TYPE: UNITED STATES. FLORIDA. Highlands County: Locally abundant in white sand (Archbold sand; Typic Quartzipsamments) openings in ancient sand pine–oak scrub, on NE side of main road through mostly undeveloped northern part of Highland Park Estates, near substation, ca. 1 air mi SE of Lake Apthorpe, NEQ, NWQ, SEQ, NWQ, Sec. 20, T36S, R30E, 27°20'08" N, 81°20'45" W, elev. 26 m, 25 May 1991, S. L. Orzell and E. L. Bridges 16950 (HOLOTYPE: USF; ISOTYPES: DUKE, F, FLAS, FTG, GA, GH, MO, NCU, NY, TEX, US, USF).

*Euphorbiae floridanae* similis sed foliis caulinis latioribus patentibus, foliis bracteatis late ovatis, et involucris majoribus differt. Differt a *Euphorbia inundata* lobis cyathii glandibus brevioribus marginibus integris albo-ciliatis.

Perennial milky-juiced herb; rootstock vertical, light brown, slightly gnarled, ca. 3–10 mm wide, 5–15 cm or more long, becoming larger on older plants. Stems erect, (15–) 25–35 (–45) cm tall, (2–) 3–4 (–5) mm wide at base, greenish-purple, soft, striate; the lowest 2–4 nodes with purplish bract-like leaves. The largest leaves borne at midstem, these narrowly elliptic, oblanceolate, or obovate-spatulate, (3–) 4–5 (–6) cm long, (5–) 8–10 (–21) mm wide, the average length:width ratio about 5:1 (3:1–6:1), strongly ascending to somewhat spreading; pleiochasial leaves usually 3, sometimes 2, narrowly to broadly ovate, (1–) 1.5–2.5 cm long, (0.9–) 1.3–1.5 (–2.0) cm wide at base, the average length:width ratio about 1.5:1 (1.1:1–3:1), spreading, the base truncate to cordate, the apex shortly acute; bracteal leaves progressively reduced upwards, broadly ovate to very broadly ovate, 0.5–1.6 cm long, 0.5–1.5 cm wide, generally as broad as long (with a length:width ratio typically 1:1 (ranging from 0.6:1 to 2:1),

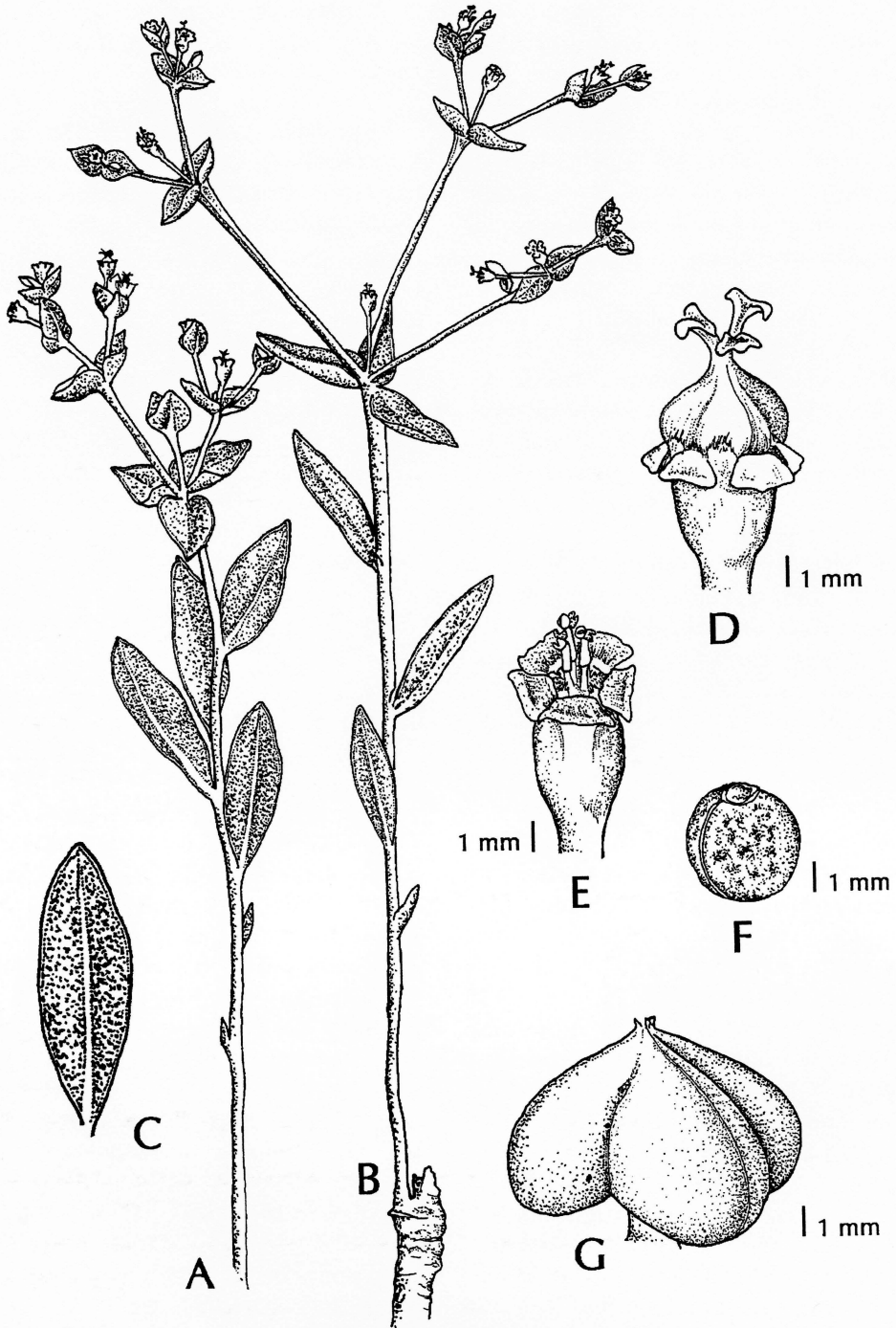


FIG. 4. *Euphorbia rosescens* (Orzell & Bridges 16950 and live material). A. Habit of pistillate plant. B. Habit of staminate plant. C. Stem leaf. D. Pistillate cyathium. E. Staminate cyathium. F. Seed. G. Capsule.

truncate to cordate at base, apex obtuse, shortly acute, or abruptly short acuminate, and typically mucronulate, deep green with a distinct pinkish-purple midrib and ca. 0.1 mm wide marginal zone, occasionally with a narrow hyaline zone at extreme margin. Inflorescence a terminal umbellate cyme, the primary rays usually 3, sometimes 2, these typically dichotomously branched from the axils of the bracteal leaves, often only one branch developing or represented only by a single cyathium, smaller lateral inflorescences often developing from the axils of the upper stem leaves; peduncles of the cyathia 2–3 mm long, often hidden by the bracteal leaves; involucre broadly campanulate, ca. 3–5 mm high and 4–6 mm broad, strongly suffused with a bright rose-pink color, sometimes mixed with green; lobes of the cyathium shorter than the glands, deltoid, ca. 0.6–0.8 mm long, marginally and distally ciliate with white hairs, tending to be rose-pink or purplish towards the base and green towards the apex; glands of the cyathium five, undulate to lobed, shallowly obtriangular or broadly wedge-shaped, tapering from 1.0–2.0 mm wide at apex to 0.6–0.8 mm wide at base, ca. 1 mm long, suffused with rose-pink at the base, but becoming yellowish-brown to olive green at the apex; styles 3, fused into a column for about half their length, the branches bifid towards the apex, the bifid branches recurved. Capsules 8–10 mm broad, markedly 3-lobed, 3-celled, the faces of the lobes convex, the outer surface of the capsule essentially smooth. Seeds broadly ovoid to spherical, ca. 3.5 mm wide at base, ca. 3.5 mm long, brownish-gray to silver-gray.

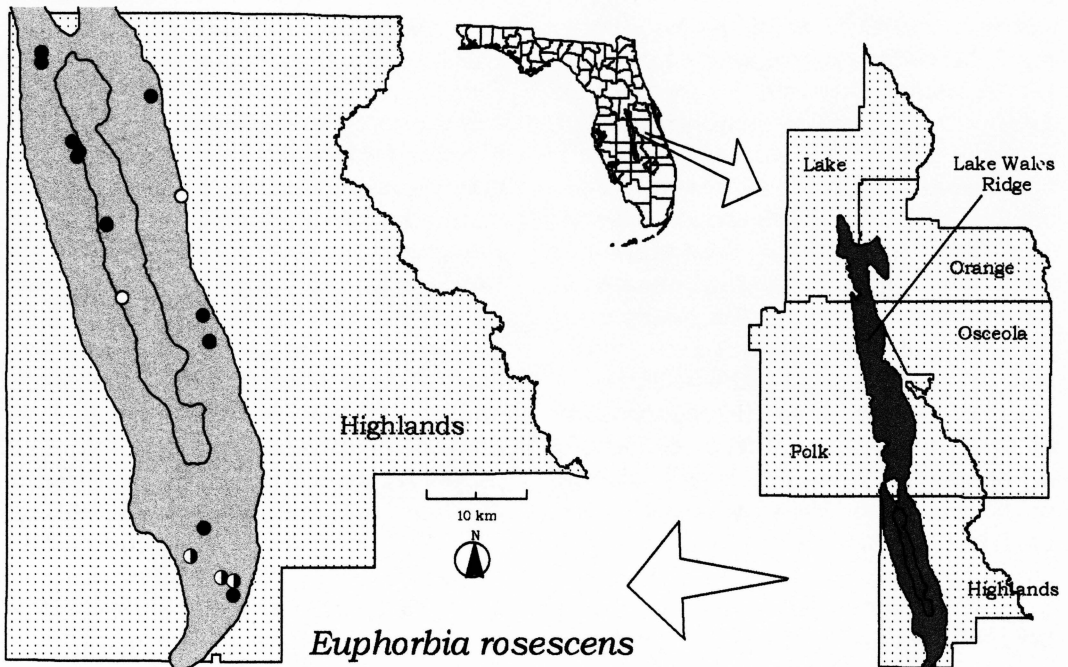
Restricted to sclerophyllous low oak scrub with scattered *Pinus clausa* (sand pine) or *Ceratiola ericoides* Michx. (Florida rosemary) dominated scrub (rosemary phase of scrub in Abrahamson et al., 1984; rosemary scrub in Johnson & Abrahamson, 1990; Menges, 1999; Menges & Kohfeldt, 1995; Hawkes & Menges, 1996; Menges & Kimmich, 1996; Dolan et al., 1999; rose-

mary balds in Christman, 1988; Stout, 2001), a naturally fragmented subtype of Florida scrub vegetation. Florida scrub is a seasonally dry plant community dominated by xeromorphic shrubs that are periodically burned, on well to excessively-drained, nutrient poor, sandy entisols with low seasonal water availability (Menges & Kohfeldt, 1995; Menges & Kimmich, 1996; see Menges, 1999 for overview on scrub).

*Euphorbia roscens* is found in low areas where seasonal moisture is available on otherwise excessively-drained white sands (see for discussion on sand color preferences, Christman & Judd, 1990) of the Archbold soil series (Hyperthermic, uncoated, Typic Quartzipsammets; see Carter, 1989) primarily in areas of bare sand or gaps (see open space and gaps in Hawkes & Menges, 1996; gaps in Stout, 2001; Menges, 2001) in scrub vegetation. *Euphorbia roscens* has been observed along sandy roads, firebreaks, and on other soil disturbances in scrub. It is narrowly endemic to the southern end of the Lake Wales Ridge (Christman, 1988) of south-central Florida, known only from Highlands County (Fig. 3 and 5). The distance from the southernmost sites near Venus to the northernmost sites near Avon Park for *E. roscens* is about 50 km, and in no place is the range more than 10 km wide, not all of which includes suitable habitat (Fig. 5).

Flowering occurs from late April to July, and occasionally to September, but usually peaks in late May, and is strongly dependent upon ample moisture at the culmination of the dry season and prior to onset of the wet season in south-central Florida. The fleshy nature of *E. roscens* and its rather large rootstock allow for atypical vegetative growth in late winter and early spring during unusual prolonged periods of abundant rainfall and mild temperatures, such as in the El Niño weather event of 1998. During February and early March of 1998, *E. roscens* was noted in vegetative condition, when plants would otherwise be dormant at the peak of the normal dry sea-





### Legend

- Extant
- ◐ Historic collection, not verified
- Herbarium specimen, not relocated

FIG. 5. Populations of *Euphorbia rosescens*, showing Lake Wales Ridge (shaded area), recently extant occurrences (solid circles), historic occurrences (half shaded circles), and unverified occurrences (open circles). The authors have verified 6 of the 11 extant sites shown; others were previously verified by Christman (1988) but may no longer be extant.

son in south-central Florida. Rarely plants continue to flower and fruit into September given ample rainfall, but plants tend to lose their lower cauline leaves.

REPRESENTATIVE SPECIMENS EXAMINED: **UNITED STATES. FLORIDA. Highlands County:** Same as type locality, 7 May 1992, *Orzell & Bridges* 19514 (FLAS, GA, NCU, NY, USF); Low oak scrub, ca. 0.4 mi E of Grassy Pond, ca. 3 air mi NE of Lakemont, ca. 6 air mi ESE of Avon Park, SEQ, NWQ, Sec. 34, T33S, R29E, 27°33'55" N, 81°24'33" W, elev. 33 m, 26 May 1991, *Orzell & Bridges* 16978 (FTG, NY, USF), 7 May 1992, *Orzell & Bridges* 19515 (FLAS, USF); Sand pine scrub, and transition zones to scrubby flatwoods, just E of Ponce de

Leon Blvd. at jct of Savona Dr., 0.9 mi SW of jct with US 27, ca. 3.4 air mi S of jct FL 64 in Avon Park, SWQ, SWQ, Sec. 3, T34S, R28E, 27°32'44" N, 81°30'49" W, elev. 47 m, 6 May 1992, *Orzell & Bridges* 19508 (FLAS, USF); Vacant lots of cleared former sand pine scrub, between middle and southern roads of Pine & Lake Estates, off Pinewood Blvd., ca. 0.3 mi W of Jackson Dr. (FL 634), ca. 2.5 mi WNW of Sebring, SWQ, SWQ, NEQ, Sec. 23, T34S, R28E, 27°30'32" N, 81°29'17" W, elev. 43 m, 6 May 1992, *Orzell & Bridges* 19502 (FLAS, NCU, NY, USF); Road embankment through low oak scrub, on E side of US 27, ca. 1.9 mi N of jct FL 731 near Venus, ca. 4.2 mi N of Glades Co. line, ca. 8 mi S of jct FL 70, NEQ, SEQ, SEQ, Sec. 8, T39S,

R30E, 27°05'40" N, 81°20'01" W, elev. 41 m, 7 May 1992, Orzell & Bridges 19512 (FLAS, USF); White sand dune scrub, Lake Sebring Subdivision, Sebring, 15 Jul 1948, Garrett s.n. (FLAS); White sand scrub, Lake Sebring Subdivision, N of Sebring, 19 Sep 1948, Garrett s.n. (FLAS); Scrub, Lake Sebring Subdivision, N of Sebring, 6 Aug 1948, Garrett s.n. (FLAS); Sand dune ridge, NE of Sebring, 28 Jul 1948, Garrett s.n. (FLAS); White sand scrub, N end of Huckleberry Lake, S of Lake Jackson, Sebring, 1 Oct 1948, R. Garrett s.n. (FLAS); Scrub W of Avon Park, 28 Apr 1948, R. Garrett 213 (FLAS); North fence line Maxey's Ranch, white sand scrub, 3 mi SW of Avon Park, 24 Jun 1948, Garrett s.n. (FLAS); Dunescrub, along Box M ranch fence line, N of Sebring, 24 Jun 1948, Garrett s.n. (FLAS); Locally common in dry sand road on W border of Archbold Biological Station near rosemary bald R-26, west-central portion of Sec. 30, T38S, R30E, 13 Jul 1989, Johnson 8360 (FSU, FTG); Growing in open white sand of fire lane where Primitive Rd. 40 cuts through scrub, Tract 30, Archbold Biological Station, near Lake Placid, 25 May 1985, Herndon 1218 (FLAS, FTG); Sand pine scrub E of Grassy Pond, ca. 4 mi SE of Avon Park, T33S, R29E, Sec. 34, S 1/2, white sand, 25 Apr 1988, DeLaney 1683 (USF); Scrub on white sand ca. 4 mi NE of Lake Placid (town), 11 Sep 1987, Skean, Judd, Alcorn, & Christman 2159 (FLAS); Hendrie Ranch Middle, Sec. 9 & 10, T39S, R30E, Venus Quad., white sand rosemary bald and oak scrubs dominated by *Ceratiola ericoides*, *Quercus inopina*, *Q. geminata*, *Q. chapmanii*, *Sabal etonia*, *Serenoa repens*, with scattered *Pinus clausa* and *P. elliottii*, 1 Jul 1986, Huck 4253 (FLAS).

*Euphorbia roscens* was first collected by Avon Park botanist Ray Garrett in 1948. In that year, Garrett made extensive collections in Highlands County. Based on his label data, it is obvious that Garrett recognized that it was a distinct taxon. His collections from xeric white sands on the Lake Wales Ridge are herein referred to *E. roscens*.

Garrett also first collected three other recently described southern Lake Wales Ridge xeric upland endemics, *Ziziphus celata* Judd & D. W. Hall (Judd & Hall, 1984), *Crotalaria avonensis* DeLaney & Wunderlin (DeLaney & Wunderlin, 1989) and *Dicerandra christmanii* Huck & Judd (Huck et al., 1989). However, Garrett's collections had largely remained unstudied by other Florida botanists until recent years. His collections, as well as almost all other collections of *E. roscens*, had been determined and sometimes annotated as either *E. inundata* or *E. floridana*.

After Garrett's flurry of plant collecting in 1948, *Euphorbia roscens* remained a botanical enigma and was not re-collected until the mid-1980's resurgence of interest in Lake Wales Ridge scrub. Christman (1988) noted what he termed "*Euphorbia* c.f. *floridana*" at 12 sites, all in Highlands County, in his Central Florida Ridges scrub inventory. Actually, since *E. roscens* most closely resembles *E. floridana* in cyathial characters, it imperfectly keys to *E. floridana*. Christman correctly noted its affinities to *E. floridana* but more importantly highlighted the need for taxonomic study. Christman (1988) was aware that it potentially represented an undescribed species. It is an endemic that shares a recent common ancestor or was derived from one of the other members in subsection *Inundatae*, perhaps *E. floridana*.

In our study of *Euphorbia* specimens at FLAS, we found that other Florida botanists had recognized that specimens we herein name as *E. roscens* were not typical *E. inundata*. Daniel Ward had annotated several FLAS specimens as "*E. inundata* var. 'A'", and Alan Herndon had determined and distributed his specimens of *E. roscens* as *E. floridana*.

We have been able to verify only six of eleven recently extant populations of this very narrow endemic, all from the southern Lake Wales Ridge (Fig. 5). These include five sites reported for *E. cf. floridana* by Christman (1988). Three additional Christ-

man sites were searched for the species in May 1992, but no *Euphorbia* could be located. The remaining four Christman sites were not visited by us due to access problems. Based on our floristic field surveys, a total of 54 species were determined to be closely associated with *E. roscens*, including numerous Central Florida Ridge endemics. The most frequent of these associates are *Chapmannia floridana* Torr. & A. Gray, *Hypericum cumulicola* (Small) W. P. Adams, *Lyonia fruticosa* (Michx.) G. S. Torr., *Opuntia humifusa* (Raf.) Raf., *Paronychia chartacea* Fern., *Pinus clausa*, *Polanisia tenuifolia* Torr. & A. Gray, *Polygonella myriophylla* (Small) Horton, *P. robusta* (Small) G. L. Nesom & V. M. Bates, *Quercus chapmanii* Sarg., *Q. geminata* Small, *Q. inopina* Ashe, *Q. myrtifolia* Willd., *Sabal etonia* Swingle ex Nash, *Smilax auriculata*, and *Stillingia sylvatica* L.

*Euphorbia roscens* adds to the list of xeric central Florida ridge endemics. Central Florida ridge endemism has been summarized by Christman (1988), Christman & Judd (1990), and Huck et al. (1989) and represents one of the highest concentrations of plant endemism in the United States (Dobson et al., 1997; Estill & Cruzan, 2001). *Euphorbia roscens* is one of nearly thirty vascular plants endemic to xeric habitats found on some eight ridges or fewer in central Florida (see figure 1 in Menges et al., 2001) and one of twelve which are modal to rosemary scrubs (Hawkes & Menges, 1996; Christman & Judd, 1990). *E. roscens* is one of seventeen Lake Wales Ridge near-endemics and one of three (*Dicerandra christmanii*, *Eryngium cuneifolium* Small, *E. roscens*) found only in Highlands County. Other southern Lake Wales Ridge narrow endemics (some more restricted than *E. roscens*, others overlapping its range and extending slightly northward) include *Dicerandra frutescens* Shinnery, *D. christmanii*, *E. cuneifolium*, and *Crotalaria avonensis*. *Euphorbia roscens*, *Eryngium cuneifolium*, and *Hypericum cumulicola* are all narrowly endemic scrub forbs that share many eco-

logical traits. Of the Lake Wales Ridge endemics only *E. cuneifolium* (Menges & Kimmich, 1996) and *H. cumulicola* (Menges, 2001) share restriction to xeric white sand scrubs and have a narrow ecological amplitude like *E. roscens*.

Historical clearing of upland xeric vegetation for citrus agriculture, and more recently for commercial and residential development (Christman & Judd, 1990; Dolan et al., 1999; Stout, 2001), has reduced the Lake Wales Ridge xeric upland landscape to less than 15% of its estimated 292,645 ha of presettlement xeric vegetation (Weekley et al., 2001). Furthermore, an increase in woody competition as a result of fire suppression has altered species composition in scrub communities (Menges & Kohfeldt, 1995; Abrahamson & Abrahamson, 1996; Dolan et al., 1999) causing degradation of *E. roscens* habitat. *Euphorbia roscens* should be considered globally imperiled with 6–12 extant sites, only two of which are within managed conservation lands (Archbold Biological Station, and the Lake Apthorpe Scrub owned by The Nature Conservancy). A combination of narrow geographic range, patchy habitat and distribution, habitat specificity, and limited localized populations should qualify it as a potential candidate for listing as a federally protected plant.

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#### LITERATURE CITED

- Abrahamson, W. G., A. F. Johnson, J. N. Layne, and P. A. Peroni. 1984. Vegetation of the Archbold Biological Station, Florida: an example of the southern Lake Wales Ridge. *Florida Sci.* 47:209–250.
- Abrahamson, W. G. and J. R. Abrahamson. 1996. Effects of low-intensity winter fire on long-unburned Florida sand pine scrub. *Nat. Areas J.* 16: 171–183.
- Beever, J. W. and K. A. Dryden. 1992a. Red-cockaded woodpeckers and hydric slash pine flatwoods. *Trans. 57<sup>th</sup> North American Wildlife & Natural Resources Conf.*: 693–700.
- . 1992b. The Hydric Pine Flatwoods of Southwest Florida: A Community Profile. *Abstr. of Florida Sci. 1992 Annual Meeting.* 55:27–28.
- . 1999. Hydric Pine Flatwoods. Pp. 231–278 in *South Florida Multi-Species Recovery Plan, A Species Plan, An Ecosystem Approach.* eds. U. S. Wildlife Service. Southeastern Region of U. S. Fish and Wildlife Service. Atlanta, Georgia.
- Boissier, E. 1862. Subordo I. Euphorbieae, in DC. *Prodr.* 15: 3–188.
- Bridges, E. L. 1989. *Carex walteriana* (Cyperaceae) and *Euphorbia inundata* (Euphorbiaceae) new to Mississippi. *Phytologia* 67:217–219.
- Brooks, H. K. 1981. *Physiographic divisions of Florida.* Cooperative Extension Service, Institute of Food and Agricultural Sciences. University of Florida. Gainesville, Florida.
- Carter, L. J. 1989. *Soil Survey of Highlands County, Florida.* USDA, Soil Conservation Service.
- Chapman, A. W. 1860. *Flora of the Southern United States.* Ivison, Blakeman, Taylor, and Company. New York, New York.
- Christman, S. P. 1988. Endemism and Florida's Interior Sand Pine Scrub. Final Proj. Rep. GFC-84-101, Florida Game and Fresh Water Fish Commission. Tallahassee, Florida.
- Christman, S. P. and W. S. Judd. 1990. Notes on plants endemic to Florida scrub. *Florida Sci.* 53: 52–73.
- DeLaney, K. R. and R. P. Wunderlin. 1989. A new species of *Crotalaria* (Fabaceae) from the Florida Central Ridge. *Sida* 13:315–324.
- Dobson, A. P., J. P. Rodriguez, W. M. Roberts, and D. S. Wilcove. 1997. Geographic distribution of endangered species in the United States. *Science* 275:550–553.
- Dolan, R. W., R. Yahr, E. S. Menges, and M. Halfhill. 1999. Conservation implications of genetic variation in three rare species endemic to Florida rosemary scrub. *Amer. J. Bot.* 86:1556–1562.
- Estill, J. C. and M. B. Cruzan. 2001. Phytogeography of rare plant species endemic to the southeastern United States. *Castanea* 66:3–23.
- Hawkes, C. V. and E. S. Menges. 1996. The relationship between open space and fire for species in xeric Florida shrubland. *Bull. Torrey Bot. Club* 123:81–92.
- Henderson, W. G. 1984. *Soil Survey of Charlotte County, Florida.* USDA, Soil Conservation Service.
- Holmgren, P. K., N. H. Holmgren, and L. C. Barnett. 1990. *Index Herbariorum. Part I: The Herbaria of the World.* New York Botanical Garden. Bronx, New York.
- Huck, R. B., W. S. Judd, W. M. Whitten, J. D. Skean, R. P. Wunderlin, and K. R. DeLaney. 1989. A new *Dicerandra* (Labiatae) from the Lake Wales Ridge of Florida, with a cladistic analysis and discussion of endemism. *Syst. Bot.* 14:197–213.
- Johnson, A. F. and W. G. Abrahamson. 1990. A note on the fire responses of species in rosemary scrubs on the southern Lake Wales Ridge. *Florida Sci.* 2:138–143.
- Judd, W. S. and D. W. Hall. 1984. A new species of *Ziziphus* (Rhamnaceae) from Florida. *Rhodora* 86:381–387.
- Kral, R. 1983. A report on some rare, threatened, or endangered forest-related vascular plants of the south. Volume I: Isoetaceae through Euphorbiaceae. USDA Forest Service Technical Report R8-TP 2, Atlanta, Georgia

- Long, R. W.** 1974. The vegetation of southern Florida. *Florida Sci.* 37:33–45.
- Menges, E. S.** 1999. Ecology and conservation of Florida Scrub. Pp. 7–22 in *Savannas, Barrens, and Rock Outcrops of North America*, eds. R. C. Anderson, J. S. Fralish and J. M. Baskin. Cambridge University Press, Cambridge.
- Menges, E. S.** 2001. Comparative ecology of Florida scrub plants. Pp. 30–32. in *Proceedings of the Florida Scrub Symposium, July, 2001*. ed. D. P. Zattau, U. S. Fish and Wildlife Service. Jacksonville, Florida.
- Menges, E. S. and N. Kohfeldt.** 1995. Life history strategies of Florida scrub plants in relation to fire. *Bull. Torrey Bot. Club* 122:282–297.
- Menges, E. S. and J. Kimmich.** 1996. Microhabitat and time-since fire: effects on demography of *Eryngium cuneifolium* (Apiaceae), a Florida scrub endemic. *Amer. J. Bot.* 83:185–191.
- Menges, E. S., R. W. Dolan, R. Yahr, and D. R. Gordon.** 2001. Comparative genetics of seven plants endemic to Florida's Lake Wales Ridge. *Castanea* 66:98–114.
- Norton, J. B. S.** 1899. A revision of the American species of *Euphorbia* of the section *Tithymalus* occurring north of Mexico. *Ann. Missouri Bot. Gard.* 11:85–114. pls. 11–52.
- Orzell, S. L. and E. L. Bridges.** 1993. *Eriocaulon nigrobacteatum* (Eriocaulaceae), a new species from the Florida panhandle, with a characterization of its poor fen habitat. *Phytologia* 74:104–124.
- Puri, H. S. & R. O. Vernon.** 1964. *Summary of the geology of Florida and a guidebook to the classic exposures*. Florida Geol. Surv. Spec. Publ. No. 5. 312 pp.
- Schmidt, W.** 1984. *Neogene stratigraphy and geologic history of the Apalachicola Embayment, Florida*. Florida. Geol. Surv. Bull. No. 58.
- Small, J. K.** 1903. *Flora of the Southeastern Flora*. Published by the author. New York, New York.
- Small, J. K.** 1913. *Flora of the Southeastern Flora*. Second edition. Published by the author. New York, New York.
- Small, J. K.** 1933. *Manual of the Southeastern Flora*. Univ. of North Carolina Press. Chapel Hill, North Carolina.
- Stout, J. I.** 2001. Rare plants of the Florida Scrub, USA. *Nat. Areas J.* 21:50–60.
- U. S. Fish and Wildlife Service.** 1992. Endangered and threatened wildlife and plants; threatened status for three Florida plants [*Euphorbia telephioides*, *Macbridea alba*, *Scutellaria floridana*]. *Fed. Reg.* 57:19813–19819.
- Webster, G. L.** 1967. The genera of Euphorbiaceae in the southeastern United States. *J. Arnold Arbor.* 48: 303–361, 363–430.
- Weekley, C. W., E. S. Menges, and A. L. Wally** 2001. Integrating sandhill restoration with an experimental introduction of Florida *Ziziphus* (*Ziziphus celata*). Pp. 38–40. in *Proceedings of the Florida Scrub Symposium, July, 2001*. ed. D. P. Zattau, U. S. Fish and Wildlife Service. Jacksonville, Florida.
- Wharton, C. H.** 1977. Forested wetlands of Florida—their management and use. Final Report to Division of State Planning. Center for Wetlands. University of Florida. Gainesville, Florida. DSP-B-1977. 412pp.
- Wunderlin, R. P.** 1998. *Guide to the Vascular Plants of Florida*. University Press of Florida. Gainesville, Florida.