CYPERUS ENTRERIANUS (CYPERACEAE), AN OVERLOOKED SPECIES IN TEMPERATE NORTH AMERICA

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ABSTRACT

Cyperus entrerianus Böckeler, an apparently recent introduction from South America or Mexico, is reported in temperate North America. It is presently known from 20 sites in five states in southeastern United States. Its distribution and ecology are discussed, and differences between it and closely related *Cyperus luzulae* (L.) Retz. are detailed. A key is given to distinguish *Cyperus entrerianus* from other members of section *Luzuloidei*, which occur in North America.

RESUMEN

Cyperus entrerianus Böckeler es registrada para la zona templada de America del Norte; esta especie aparentemente es de reciente introduccion de Mexico o America del Sur. Esta expecie se conoce actualmente de 20 localidades en cinco estados en el sureste de los Estados Unidos. Se discute aqui su distribucion y ecologia y se detallan las diferencias entre esta y la especie mas afin *Cyperus luzulae* (L.) Retz. Se incluye una clave taxonomica para distinguir *Cyperus entrerianus* de los otros miembros de la seccion *Luzuloidei*, que ocurren en America del Norte.

INTRODUCTION

While conducting field work in southern Georgia during 1987, an unfamiliar species of *Cyperus* Section *Luzuloidei* was located in Ware County. I tentatively identified it as *Cyperus ochraceus* Vahl var. *excelsior* Kükenthal? and sent a duplicate to Robert Kral (VDB) who identified it as *C. surinamensis* Rottb. Intensive field work during 1988 and 1989 revealed 12 additional sites from southern Georgia and western Florida to southeastern Texas. Additional specimens from Florida, Louisiana, and Texas have been located at FSU, IBE, and VDB.

This sedge has now been identified as *Cyperus entrerianus* Böckeler, which is primarily a temperate South American species (Kükenthal 1936). The epithet "entrerianus" is derived from Entre Rios, the name of an historically disputed area presently in Argentina and the type locality of *C. entrerianus* (Böckeler 1878). Kükenthal (1936) and Pedersen (1968) recognized *C. entrerianus* as a distinct species, and Kükenthal (1936) placed it into section *Luzuloidei* of *Cyperus*. Also, this taxon was treated as a variety

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of *C. luzulae* by Barros (1938). Denton (1978), in a taxonomic treatment of the "Luzulae group" of *Cyperus*, placed the name into the synonymy of *Cyperus luzulae* (L.) Retz., but, in discussion, referred to " 'entrerianus' and 'luzulae' modes of variation". Furthermore, Denton (1978) cited specimens of *C. luzulae* from Florida, Missouri, Oklahoma, and Texas, which I have not seen; it is unclear whether these are *C. luzulae* or *C. entrerianus*. However, *C. luzulae* is primarily a tropical species, and it seems doubtful that it has or will become established in other than subtropical regions of the United States, such as extreme southern Texas or perhaps southern Florida.

TAXONOMY

Cyperus entrerianus is a stout rhizomatous perennial, which may be as much as 120 cm tall. It has bicarinate, dorsally grooved scales and florets characterized by a single stamen. It clearly belongs to section *Luzuloidei* as circumscribed by Kükenthal (1936) and is closely related to *Cyperus luzulae*. I have observed *Cyperus luzulae* in the field in Peru [*McDaniel 23640, Rimachi, Carter* (IBE, VDB)] and in Dominican Republic [*Carter 5201, 5220* (MO, VSC)], and I believe it and *Cyperus entrerianus* are specifically distinct.

There are a number of differences between these two taxa. *Cyperus entrerianus* is a larger plant than *C. luzulae*. The leaf bases of *C. entrerianus* are heavily black-pigmented, and their fibrous remains are persistent. Its base, unlike that of *C. luzulae*, is deeply set in the substrate and has thick rhizomes with short internodes. Spikes of *C. entrerianus* are conspicuously compound and composed of one to several globose units, while those of *C. luzulae* generally are dense and conical and appear simple. The spikelets of *C. entrerianus* are more loosely arranged and have 16 − 32 pale greenish scales, while those of *C. luzulae* are tighter and have 12 − 16 whitish to tawny scales.

Certain specimens (e.g., *Carter 6296, 7319, 7447, 8040, 8093, and 8102*) from southeastern United States exhibit sparsely scabrid culms and, thus, will key to *Cyperus surinamensis* with most conventional keys (e.g. Godfrey and Wooten 1979). The culm teeth are mostly retrorsely oriented as they are in *C. surinamensis*. This characteristic has not been previously noted in *C. entrerianus* in the literature. Also, the number of fertile scales per spikelet in *C. entrerianus* specimens from United States seems to be greater than in specimens from South America and falls within the range for *C. surinamensis* (see table 1). Furthermore, specimens of *C. entrerianus* from southeastern United States apparently are more robust than ones from South America, and in the United States *Cyperus entrerianus* appears to be an aggressive weed and is often locally abundant and dominates its disturbed

TABLE 1. Morphological comparison of *Cyperus entrerianus* with *C. luzulae* and *C. surinamensis*.

CHARACTERS	TAXA		
	C. entrerianus	*C. luzulae*	*C. surinamensis*
HEIGHT	>5 dm	<5 dm	1.0 – 7.5 dm
RHIZOME	stems more or less loosely loosely clustered, connected by thick rhizomes with short internodes	cespitose, rhizomes not at all evident	cespitose, rhizomes not at all evident
LEAF BASE	blackish purple; persistent & fibrous	brown to reddish brown; neither persistent nor fibrous	brown to reddish brown; neither persistent nor fibrous
SPIKE			
DENSITY	loose, thus individual spikelets distinct	tight, thus individual spikelet not distinct	loose, thus individual spikelets distinct
SHAPE	compound, units globose	appearing simple, conical	compound, somewhat flattened
SPIKELET			
FERTILE SCALES	16 – 32	12 – 16	18 – 48
WIDTH	1.8 – 2.1 mm	1.4 – 1.8 mm	1.6 – 2.3 mm
SCALE			
COLOR	pale green	whitish to tawny	golden yellow to stramineous
SCALE			
POSTURE	divergent ca 30°	divergent ca 30°	divergent ca 45°

habitat. The aggressive nature and robust size of plants of *C. entrerianus* from southeastern United States might well be due to heterosis. These characteristics suggest introgression between *C. entrerianus* and *C. surinamensis*, which frequently occur together in southeastern United States. A morphological comparison of *Cyperus entrerianus*, *C. luzulae*, and *C. surinamensis* is given in table 1. Following is a key by which the North American species of section *Luzuloidei* may be identified.

KEY TO *CYPERUS* SECTION *LUZULOIDEI* IN NORTH AMERICA

1. Culm triquetrous, angles sharp, usually flattening when pressed and dried.
   2. Achene about 1/2 – 2/3 as long as scale; inflorescence open; bracts exceeding inflorescence more than 4. ..... *C. virens* Michx.
   2. Achene at least 3/4 as long as scale; inflorescence compact; bracts exceeding inflorescence 4 or fewer ..... *C. drummondii* T. & H. [=*C. robustus* Kunth]

1. Culm obtusely trigonous to subterete, usually not flattening when pressed and dried.
    3. Culm smooth.
        4. Achene with conspicuous basal callosity . . . . . *C. distinctus* Steud.
        4. Achene without basal callosity.
            5. Achene linear, 4 – 5 times as long as wide; dorsal edge of scales weakly S-shaped. . . . . *C. pseudovegetus* Steud.
            5. Achene broadly ellipsoidal to oblong-ellipsoidal, 2 – 3 times as long as wide; dorsal edge of scales merely curved into a simple arc or angle, but not as above.
                6. Bracts less than 3 mm wide, 3 or fewer bracts present, the longest of these usually strict and appearing as a continuation of the culm; culms slender, 1 – 2 mm wide at midculm.
                    7. Achenes broadly ellipsoidal; scale tips conspicuously excurved; species common and wide-ranging in U.S. . . . . *C. acuminatus* T. & H.
                    7. Achenes narrowly ellipsoidal to oblong; scale tips more or less straight, not conspicuously excurved; species rare in U.S., restricted to Texas, Oklahoma, Louisiana, and western Florida. . . . . *C. reflexus* Vahl
                6. Widest bract usually more than 4 mm broad, 4 or more bracts exceeding the inflorescence, all bracts ascending to spreading; culms mostly (2-) 3 – 5 mm wide at midculm.
                    8. Spikelet at least 3.0 mm wide; scales with straight to excurved tips, thus spikelet with toothed outline; scales golden-yellow; in U.S., species restricted to California and Oregon. . . . . *C. eragrostis* Lam.
                    8. Spikelet less than 3.0 mm wide; spikelet with an entire outline; scales stramineous to brown, sometimes yellow or red tinted, or pale green or whitish; species of south-central and southeastern U. S.
                        9. Achene broadly ellipsoidal, 2 – 3 times as long as wide, 0.5 – 0.6 mm wide; scales ovate, 0.6 mm wide as seen laterally, stramineous to yellow-brown; in the U.S., species restricted to Texas and Louisiana. . . . . *C. ochraceous* Vahl
                        9. Achene narrowly ellipsoidal, 3 – 4 times as long as wide, 0.2 – 0.3 mm wide; scales lanceolate, 0.3 – 0.4 mm wide as seen laterally, pale green or whitish.
                            10. Plants robust, usually more than 5 dm high, base blackish purple, leaf bases persistent and becoming fibrous with age; spikes conspicuously compound (or rarely simple), units globose; spikelets loosely arranged, with 16 – 32 scales; mature scales pale green. . . . . *C. entrerianus* Böck.

10. Plants less than 5 (7) dm high, base purplish to brownish; leaf bases not persistent; spikes compact, conical, and appearing simple, thus individual spikelets difficult to distinguish; spikelets with 12 – 16 scales; mature scales whitish to tawny. . . . . *C. luzulae* (L.) Retz.

3. Culm scabrid.
   11. Scale tips conspicuously excurved. . . . . *C. acuminatus* T. & H.
   11. Scale tips straight to slightly incurved.
      12. Plants robust, mostly more than 5 dm high; leaf bases blackish purple; culms sparsely scabrid; scales pale green, divergent at about 30 degrees. . . . . *C. entrerianus* Böck.
      12. Plants mostly less than 5 (8) dm high; leaf bases straminеous to brownish; culms densely scabrid; scales yellowish, divergent at about 45 degrees. . . . . *C. surinamensis* Rottb.

DISTRIBUTION AND ECOLOGY

As shown in figure 1, *Cyperus entrerianus* is primarily distributed in temperate South America and rarely in Mexico. Thus, it is not surprising that it has persisted and increased its range upon introduction into temperate North America, and it probably will continue to spread.

Cyperus entrerianus is a copious producer of achenes and is often locally abundant in its disturbed habitat. It has been observed growing on mucky sands in southeastern Georgia and northwestern Florida and sticky clays in southern Louisiana and southeastern Texas. Thus, soil texture seems not to be a major factor determining its distribution. However, it does apparently require disturbed sites with high-hydroperiod soils, such as ditches, depressions in flatwoods, pond margins, stream bottoms, and edges of salt marsh. Table 2 contains a composite list of species associated with *C. entrerianus* in southeastern Georgia.

In addition to collections made by me from 1987 – 1989, other specimens of *C. entrerianus* have been located at FSU, IBE, and VDB, which had been identified variously as *Cyperus pseudovegetus* Steud., *C. robustus* Kunth, *C. virens* Michx., and *C. virens* var. *drummondii* (T. & H.) Kükenth. Distribution of *C. entrerianus* in the United States is shown in figure 2. Following is a complete list of *Cyperus entrerianus* specimens from United States, which I have seen.

Specimen citations. ALABAMA: **Baldwin Co.**: 1.1 mi E of Mobile, heavily disturbed fill area along and S of Battleship Parkway at edge of Mobile Bay, 8 Aug 1989, *Carter 8095* (MO, SMU, VDB, VSC). FLORIDA: **Calhoun Co.**: S of Blountstown, 23 Jul 1977, *Godfrey 75970* (FSU, IBE, VDB). **Escambia Co.**: Pensacola, on Scenic Highway, 24 Jul 1974, *Godfrey 73755* (FSU, VDB); S side of Ensley, wet ditch along hwy. US 29, 8 Aug 1989, *Carter 8093* (FSU, MO, VDB, VSC). **Gulf Co.**: 7.5 mi N of White City, by Fla. Rt. 71, 4 Aug 1981, *Godfrey 79070* (FSU, IBE); M & K Tract, generally 6.5 air mi NW of Apalachi-

TABLE 2. A composite list of species associated with *Cyperus entrerianus* in southeastern Georgia.

Carex festucacea Schk.	*Lipocarpha maculata* (Michx.) Torr.
Cuphea carthagensis (Jacq.) Macbr.	*Ludwigia microcarpa* Michx.
Cyperus croceus Vahl	*L. palustris* (L.) Ell.
C. haspan L.	*Lythrum alatum* Pursh var. *lanceolatum* (Ell.) T.&G.
C. odoratus L.	*Mitreola petiolata* (Gmel.) T. & G.
C. pseudovegetus Steud.	*Murdannia nudiflora* (L.) Brenau
C. strigosus L.	*Phyllanthus urinaria* L.
C. surinamensis Rottb.	*Polygonum hydropiperoides* Michx.
C. virens Michx.	*Rhynchospora cephalantha* Gray
Eleocharis tuberculosa (Michx.) R. & S	*R. corniculata* (Lam.) Gray.
Hypericum mutilum L.	*R. inexpansa* (Michx.) Vahl
Juncus marginatus Rostk.	*R. microcarpa* Baldw. ex Gray
J. repens Michx.	*Verbena brasiliensis* Vell.

cola, W of Sand Creek, T8S, R8W, S 1/2 Sec. 7, 8 Nov 1985, *Anderson 9018* (FSU); 2 mi W of Daniels Road, ca 4 air mi NE of Overstreet, Sec. 15, T5S, R11W, 1 Jun 1989, *Anderson 12034* (VSC), 20 Jul 1989, *Anderson 12172* (MO, VSC); western edge of Wewahitchka, ditch by hwy. FL 22, 5 Aug 1989, *Carter 8040* (FSU, MO, VDB, VSC). GEORGIA: **Brantley Co.**: 0.8 mile W of Nahunta, 4 Jul 1988, *Carter & Carter 6960* (FSU, GA, MO, SMU, VDB, VSC). **Camden Co.**: 2 mi NE of Waverly, along Hwy. US 17, 4 Jul 1988, *Carter & Carter 6935* (FSU, GA, MO, SMU, VDB, VSC). **Glynn Co.**: ca 1.5 mi S of Brunswick near intersection of Hwys. US 84 and GA 50, edge of saltmarsh, 26 Aug 1988, *Carter & McCormick 7435* (FSU, GA, MO, SMU, VDB, VSC). **Liberty Co.**: just SE of Flemington city limits along Hwy. US 82, 26 Aug 1988, *Carter & McCormick 7447* (FSU, GA, MO, SMU, VDB, VSC). **Ware Co.**: western part of Waycross, N of Hwy. US 84, near corner of New Mexico and Virginia Avenues, 2 Sep 1987, *Carter 6296* (FSU, GA, MO, SMU, VDB, VSC); Waycross, creek bottom at corner of Blackshear and Riverside Streets, 18 Aug 1988, *Carter 7319* (MO, SMU, VDB, VSC). LOUISIANA: **Calcasieu Parish**: 9.3 mi N of Hackberry, ditch along Hwy. LA 27, local in sticky clay, 10 Aug 1989, *Carter 8130* (MO, SMU, VDB, VSC). **Jefferson Davis Parish**: E of Hwy. US 165 and 0.25 mi S of Hwy. I-10, 1.4 mi E of Hwy. LA 383 Iowa exit, locally common along mowed ditch and adjacent road shoulder in vicinity of rice fields, 10 Aug 1989, *Carter 8127* (MO, SMU, VDB, VSC). **St. Landry Parish**: ca 3 mi W of Eunice along Hwy. 190, 25 Jul 1975, *Allen 6674* (VDB). TEXAS: **Chambers Co.**: 9.8 mi E of Wallisville exit and 11.9 mi E of Trinity River, sticky black clay at edge of rice field N of Hwy. I-10, common and locally abundant along an approximately 6 mile stretch of Hwy. I-10, 10 Aug 1989, *Carter 8142* (MO, SMU, VDB, VSC). **Fort Bend Co.**: roadside clearing on Hwy. 59, 0.1 mi S of Redding Road, sandy soil, 29 Jul 1981, *Kessler 4739* (VDB). **Harris Co.**: 0.5 mi E of Peek Road exit to Katy, ditch along Hwy. I-10 near rice fields, sticky black clay, 10 Aug 1989, *Carter 8144* (MO, SMU, VDB, VSC).

DISCUSSION

The earliest collection of *Cyperus entrerianus* that I have seen from the United States is *R. K. Godfrey 73755* (FSU) collected in 1974 in Escambia County, Florida. Thus, it would appear that *C. entrerianus* is a relatively recent introduction into southeastern United States. The largest popula-

FIG. 1. The distribution of *Cyperus entrerianus*. Closed circles based on specimens; open circles based on Kükenthal (1936) and Pedersen (1968).

tion (*Carter 8142*) was seen in Chambers County, Texas, where *C. entrerianus* is common and locally abundant, in places forming almost pure stands, along an approximately 6 mile stretch of highway I-10.

Cyperus entrerianus is often locally abundant, and in eastern Texas and

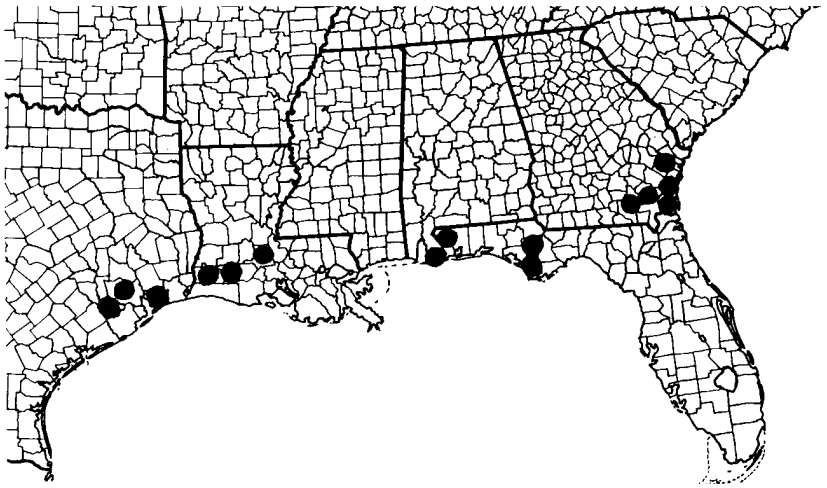

FIG. 2. The distribution by county of *Cyperus entrerianus* in the United States.

southern Louisiana it seems to be highly correlated with rice culture. Curiously, label data on a specimen (*E. Lurvey 440*, MO) of *Cyperus entrerianus* indicates that it was collected in a rice paddy in Paraguay. Additional information about sources of rice seed used in southeastern Texas and southern Louisiana might be helpful in determining the origin of *C. entrerianus* in the United States. If the introduction of *C. entrerianus* is not an artifact of human activity, then it seems reasonable to assume that it might have been introduced by migrating water fowl. Electrophoretic analysis and comparison of proteins from individuals of different populations might show whether multiple introductions of *C. entrerianus* have occurred along the Gulf and Atlantic Coasts of southeastern United States or whether it has spread out from a single colony.

All of the southern Georgia populations were located in ditches along highways and two particularly extensive populations (*Carter & Carter 6960* and *Carter & McCormick 7447*) were beside highways along which major construction had recently occurred. Thus, it is likely that *C. entrerianus* is being moved about along highways and perhaps in part by highway construction and maintenance equipment.

Cyperus entrerianus is to be expected in at least coastal regions of other southeastern states from North Carolina to Texas. Based upon its widespread occurrence in temperate South America far inland and at altitudes up to 410 m (*P. Goetghebeur 4791*, VSC), it is reasonable to expect that it

will continue to spread from the outer coastal plain into interior physiographic regions. Additional life history and ecological studies should be done to determine the extent that *C. entrerianus* might become a harmful weed in North America.

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