

THE TAXONOMY OF *CYPERUS VIRENS* AND
CYPERUS DRUMMONDII (CYPERACEAE) IN THE
SOUTHEASTERN UNITED STATES

RICHARD CARTER and DAVID K. ALEXANDER

*Herbarium, Biology Department
Valdosta State University
Valdosta, GA 31698-0015, U.S.A.*

CHARLES T. BRYSON

*USDA, ARS
Southern Weed Science Research Unit
P.O. Box 350
Stoneville, MS 38776, U.S.A.*

ANDREAS LAZARI

*Mathematics and Computer Science Department
Valdosta State University
Valdosta, GA 31698, U.S.A.*

ABSTRACT

Data for 20 morphological characters taken from recent collections of the *Cyperus virens* group from the southeastern United States were statistically analyzed using principal components analysis and discriminant analysis. Based upon results of the analyses and recent field observations, it is concluded that *C. drummondii* and *C. virens* are distinct at the rank of species. The taxonomy is revised accordingly. A taxonomic key, technical descriptions, distributional, and ecological data on the two species are presented.

RESUMEN

Los datos de 20 caracteres morfológicos de colecciones recientes del grupo de *Cyperus virens* del sureste de los Estados Unidos fueron analizados estadísticamente usando el análisis de componentes principales y el análisis discriminante. En base a los resultados de los análisis y de recientes observaciones de campo, se concluye que *C. drummondii* y *C. virens* son distintas en el rango de especie. Se revisan de acuerdo con esto la taxonomía. Se presentan una clave taxonómica, descripciones técnicas, datos ecológicos y sobre la distribución de las dos especies.

INTRODUCTION

Cyperus virens and *C. drummondii* are closely related and belong to section *Luzuloidei* and are characterized by persistent rachillas; bicarinate, deciduous scales; and 1–2 stamens per floret (Kükenthal 1935–1936; Denton 1978).

Both taxa have sharply three-angled (triquetrous) culms, which, in combination with the characteristics listed above, easily separates them from all other *Cyperus* species in the southeastern United States. Carter (1990) provides a key separating *C. virens* and *C. drummondii* from other members of section *Luzuloidei*.

Cyperus virens Michx. has historically presented a taxonomic problem because of its complex pattern of variation and wide distribution. According to Denton (1978), *C. virens* consists of four varieties: *C. virens* var. *virens*, *C. virens* var. *drummondii* (Torr. & Hook.) Kükenthal, *C. virens* var. *minarum* (Boeck.) Denton, and *C. virens* var. *montanus* (Boeck.) Denton. Of these taxa, only *C. drummondii* and *C. virens* var. *virens* occur in the United States. *Cyperus drummondii* was first described in 1836 based upon a specimen collected in Texas by Thomas Drummond (Torrey 1836). *Cyperus drummondii* has been treated variously since.

Chapman (1889), like Torrey (1836), recognized *Cyperus drummondii*. Subsequently, several floristic manuals include only *C. virens* with no mention of *C. drummondii* as either a taxon or a synonym (Chapman 1897; Mohr 1901; Small 1933; Correll & Johnston 1970; Correll & Correll 1975; Godfrey 1979; Wunderlin 1982, 1998; Clewell 1985; Thomas & Allen 1993). Hatch et al. (1990) did not recognize *C. drummondii* at any rank, while Tucker (1994) treated it as a synonym of *C. virens*. *Cyperus drummondii* was first treated as a variety of *C. virens* by Kükenthal (1935–1936); this view was upheld by McGivney (1938), Denton (1978), and Adams (1994). Koyama (1970) treated *C. drummondii* as a subspecies of *C. virens*. Other recent authors (Bryson & Carter 1994; Jones et al. 1997) recognized *C. drummondii* at the rank of species.

Cyperus virens and *C. drummondii* are widely distributed in the New World and are sympatric in the coastal plain of the southeastern United States. Although *C. drummondii* has been known from Louisiana and Texas (Torrey 1836; McGivney 1938), it is infrequently collected elsewhere in the southeastern United States. Recently, it was reported new from Mississippi (Bryson & Carter 1994). Kükenthal (1935–1936) and Denton (1978) documented the distribution of *C. drummondii* outside the United States in Nicaragua, Jamaica, Surinam, Ecuador (Galapagos Islands), and Brazil.

MATERIALS AND METHODS

We examined 57 specimens of *C. virens* and 44 specimens of *C. drummondii*. Specimens were reproductively mature and from the southeastern United States. Initially, each specimen was identified by a unique number and after preliminary examination was assigned to *C. drummondii* or *C. virens*.

After a survey of the critical literature (Kükenthal 1935–1936; Denton 1978) and a preliminary study of our collections 20 characters were selected

TABLE 1. List of characters used in analysis.

PPEDN	number of primary peduncles
BRACNL	number of primary inflorescence bracts exceeding longest ray
CULML	culm length (cm)
BRAC TL	maximum primary inflorescence bract length (cm)
RAYL	maximum ray length (cm)
INFLW	maximum inflorescence width (cm)
SPKW	maximum spike width (cm)
CULMW	mid-culm width (mm)
BRAC TW	maximum mid-bract width (mm)
LEAFW	maximum mid-leaf width (mm)
SPKLTW	spikelet width (mm)
SCALL	scale length (mm)
ACHNL	achene length (mm)
ACHNLW	achene width (mm)
ANTHL	anther length (mm)
SCALN	scale number per spikelet
CIRAT	ratio of culm length to inflorescence width
ASRAT	ratio of achene length to scale length
ACHLW	ratio of achene length to width
BCRAT	ratio of longest primary inflorescence bract to culm length

for analysis. The characters are listed in Table 1, and all character states are continuous quantitative. These data were subjected to principal components analysis (PCA) and discriminant analysis (DA) using Minitab© release 11.21 (Sneath & Sokal 1973; Seber 1984; Anonymous 1996). Data points plotted using PCA were identified by specimen number and their *a priori* species categories, and eigenvectors generated from a PCA were used to determine which characters most accounted for the variance observed. All characters were analyzed using DA to determine order of reliability of characters and which minimal combination of characters would allow classification of our specimens into the taxonomic groups defined by PCA.

RESULTS

Results of PCA, shown in Table 2 and Figure 1, indicate the specimens form discrete clusters corresponding with our *a priori* classification and that no single character is outstanding in accounting for the variation in principle components one and two. Variation in principal component one is primarily due to SCALL, INFLW, BCRAT, BRAC TW, RAYL, BRACNL, CIRAT, ACHNL, ACHNLW, SPIKLTW, PPEDN, and ASRAT, and variation in principle component two is primarily accounted for by CULML and CULMW. The results of DA are used to rank individual characters (Table 3) in order of taxonomic reliability and to determine which combinations of characters (Table 4) best classify our specimens into their categories as determined by PCA.

TABLE 2. Eigenvectors and cumulative variance for first six principal components in principal components analysis.

Variable	Eigenvectors					
	PC1	PC2	PC3	PC4	PC5	PC6
PPEDN	-0.245	-0.165	-0.155	-0.061	-0.232	-0.070
BRACNL	-0.254	0.102	-0.065	0.001	0.140	0.147
CULML	0.167	-0.485	0.097	-0.039	0.275	0.007
BRAC TL	-0.226	-0.270	-0.134	-0.081	-0.014	0.049
RAYL	-0.255	-0.244	0.061	-0.042	-0.246	-0.077
INFLW	-0.269	-0.117	0.170	-0.017	-0.237	-0.060
SPKW	-0.192	-0.111	0.354	-0.293	-0.402	-0.100
CULMW	-0.197	-0.410	0.005	0.224	0.113	-0.029
BRAC TW	-0.258	-0.181	-0.077	0.158	0.082	-0.090
LEAFW	-0.196	-0.355	-0.060	0.230	0.254	-0.054
SPKLTW	-0.248	0.172	0.151	-0.017	0.296	0.168
SCALL	-0.274	0.182	0.149	0.041	0.150	0.147
ACHNL	-0.252	0.131	-0.029	0.212	0.091	0.342
ACHNW	0.075	0.026	0.415	0.700	-0.241	0.272
ANTHL	-0.137	0.256	0.054	0.316	0.161	-0.825
SCALN	0.007	-0.060	0.676	-0.297	0.245	-0.037
CIRAT	0.253	-0.190	0.033	0.006	0.318	0.016
ASRAT	0.242	-0.187	-0.212	0.110	-0.187	0.042
ACHLW	-0.249	0.087	-0.160	-0.181	0.278	0.102
BCRAT	-0.262	0.123	-0.165	-0.049	-0.110	0.071
Cumulative variance	0.544	0.654	0.728	0.785	0.831	0.867

DISCUSSION

Kükenthal (1935–1936) treated *Cyperus drummondii* as a variety of *C. virens* with no justification other than brief diagnoses of the taxa. Denton (1978), in a numerical taxonomic analysis of the *Luzulae* group of *Cyperus*, came to the same conclusion as Kükenthal (1935–1936). Denton (1978, p. 257) stated that *C. drummondii* and other varieties of *C. virens* could not be elevated in rank because of overlap in scale and achene dimensions in some collections. However, Denton's research involved little fieldwork and included few *C. drummondii* specimens from the southeastern United States.

Our analysis included numerous recent collections of *Cyperus drummondii* from the southeastern United States, not seen by Denton (1978). Discrete clusters obtained with PCA indicate our specimens can be readily identified as either *C. drummondii* or *C. virens* based upon our character set and that *C. drummondii* and *C. virens* are distinct species. Further, DA shows that six characters (SCALL, SPKLTW, ACHNL, ASRAT, CIRAT, BCRAT) are particularly effective in correctly classifying our specimens and that these six

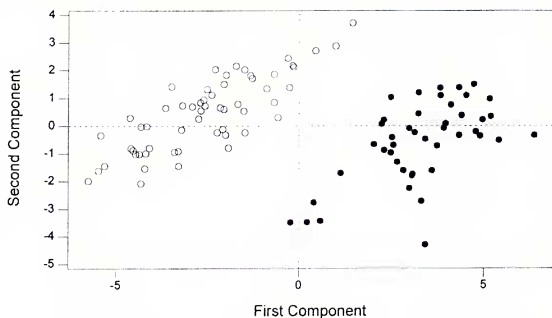


FIG. 1. Results of principle components analysis of *Cyperus virens* (open circles) and *C. drummondii* (closed circles).

TABLE 3. Proportion of specimens correctly classified in discriminant analysis by individual characters.

Individual Characters	Proportion Correctly Classified	Individual Characters	Proportion Correctly Classified
SCALL	0.986	BRACNL	0.832
SPKLTW	0.968	PPEDN	0.828
ACHNL	0.953	RAYL	0.780
ASRAT	0.946	BRACTL	0.752
BCRAT	0.915	ANTHL	0.726
CIRAT	0.905	SPKW	0.720
ACHLW	0.885	LEAFW	0.695
CULML	0.875	CULMW	0.649
BRACW	0.849	ACHNW	0.615
INFLW	0.833	SCALN	0.548

characters are the minimum combination required to classify all of our specimens into the two groups defined by PCA. Our specimens were classified with 99.3% accuracy using two combinations of four characters each (SCALL, SPKLTW, ACHNL, ASRAT and SPKLTW, CIRAT, ASRAT, BCRAT), two combinations of three characters (SCALL, SPKLTW, ACHNL and ASRAT, BCRAT, CIRAT), and three combinations of two characters (SCALL, ASRAT; SCALL, CIRAT; and SCALL, BCRAT). Moreover, DA showed the combination of key characters (SCALL, SPKLTW, PPEDN, RAYL, LEAFW, ASRAT) used by Denton (1978) correctly classifying 99.1% of our specimens. Ad-

TABLE 4. Proportion of specimens correctly classified in discriminant analysis by selected groups of characters.

Grouped Characters	Proportion Correctly Classified
SCALL, SPKLTW, ACHNL, ASRAT, BCRAT, CIRAT, ACHLW, BRACNW, INFLW, BRACNL, PPEDN, RAYL	1.000
SCALL, SPKLTW, ACHNL, ASRAT, CIRAT, BCRAT	1.000
SCALL, ACHNL, BCRAT, CIRAT, BRACNW, INFLW, BRACNL, RAYL	0.993
SCALL, SPKLTW, ACHNL, ASRAT	0.993
SPKLTW, CIRAT, ASRAT, BCRAT	0.993
SCALL, SPKLTW, ACHNL	0.993
ASRAT, BCRAT, CIRAT	0.993
SPKLTW, ASRAT	0.993
SCALL, ASRAT	0.993
SCALL, CIRAT	0.993
SCALL, BCRAT	0.993
SCALL, SPKLTW, ASRAT, CIRAT, BCRAT	0.986
SCALL, SPKLTW, ACHNL, BCRAT	0.986
SCALL, SPKLTW, ACHNL, CIRAT	0.986
BCRAT, CIRAT, BRACNW, INFLW, BRACNL, RAYL	0.981
SPKLTW, CIRAT	0.981
SPKLTW, BCRAT	0.980

ditionally, the qualitative character, scale shape, was observed to be markedly and consistently different between the two taxa and is included in the dichotomous key.

In summary, of the six key characters used by Denton (1978), we found three (SCALL, SPKLTW, ASRAT) to be highly reliable and concur with their relative placement in Denton's dichotomous key. Because of substantial overlap between the two taxa, Denton's remaining three key characters (PPEDN, RAYL, LEAFW) proved to be of limited use in our study. Additionally, we have identified four other taxonomically useful characters: ACHNL, BCRAT, CIRAT, and floral scale outline.

CONCLUSIONS

Results of PCA and DA show six characters are taxonomically useful in separating *Cyperus drummondii* and *C. virens*. These in ranked order as determined by PCA and DA are SCALL, SPKLTW, ACHNL, ASRAT, BCRAT, and CIRAT. Additionally, we have determined that the qualitative character, scale outline, is useful in separating the two taxa. Further, the discrete clusters obtained in PCA indicate *C. virens* and *C. drummondii* are distinct in the southeastern United States and support recognition of *C. drummondii* at the rank of species as follows.

TAXONOMIC TREATMENT

Key to *Cyperus virens* and *Cyperus drummondii*

1. Floral scales oblanceolate, at least 1.7 mm long; spikelets at least 2.25 mm wide; achenes less than 0.7 times as long as subtending floral scale; achenes 1.2–1.5 mm long; longest primary inflorescence bract length at least 0.45 times as long as culm; culm less than 8 times longer than inflorescence width; primary peduncles 5–10. 1. *C. virens*
1. Floral scales ovate, less than 1.7 mm long; spikelets less than 2.25 mm wide; achenes at least 0.7 times as long as subtending floral scale; achenes 1.1–1.2 mm long; longest primary inflorescence bract less than 0.45 times as long as culm; culm (8–)10–33 times longer than inflorescence width; primary peduncles 3–5. 2. *C. drummondii*
1. *Cyperus virens* Michx., Fl. Bor.-Amer. 1:28. 1803. (Fig. 2). TYPE: "Carolina," *Herb. A. Michaux* (HOLOTYPE: P, microfiche!).

Cespitose perennial herb. Roots fibrous, reddish brown. Culms 16–100 cm high, 3–13 times longer than inflorescence width, 2.4–6.9 mm wide, triquetrous, scabrid. Leaves basal, blades 3.5–13.2 mm wide. Primary inflorescence bracts 4–8, longest 17–75 cm long, up to 0.3–1.5 times as long as culm, 2.7–13.2 mm wide. Inflorescence usually diffuse, (4.2–)7–18.4 cm wide, rays 5–10, longest 2.4–12 cm long. Spikes globose, 1.2–7.3 cm wide. Spikelets flattened, 1.7–3.2 mm wide. Floral scales 12–38, distichous, spreading to ascending, bicarinate, oblanceolate, (1.35–)1.9–2.4 mm long, pale grayish-green, turning brown. Stamens 1–2, anthers 0.8–1.3 mm long. Style 3-branched, exserted, deciduous. Achene oblong-ellipsoidal, 2.7–4.1 times as long as wide, (0.9–)1.2–1.5 × 0.3–0.4 mm, trigonous, stipitate, brown.

Distribution and habitat.—Widely distributed in the New World: southeastern United States, Caribbean, Mexico, Central America, and South America (Denton 1978; Kükenthal 1935–1936). In the coastal plain of the southeastern United States, from Texas through Florida into North Carolina (Fig. 3). Common in a variety of disturbed, low, intermittently wet habitats, such as ditches, stream bottoms, edges of ponds and lakes.

Phenology.—Flowering and fruiting April through December.

Specimens examined. U.S.A. ALABAMA. Baldwin Co.: Point Clear, 22 May 1975, *Kral* 55724 (VSC); Battleship Parkway, 1.1 mi E Mobile city limit, 8 Aug 1989, *Carter* 8100 (erb, VSC). Butler Co.: SE Greenville, 12 Jul 1995, *Kral* 85208 (VSC). Clarke Co.: SW Jackson, 1 Jun 1972, *Kral* 47088 (VSC). Crenshaw Co.: N Rutledge, 23 Jul 1995, *Kral* 82944 (VSC). Dallas Co.: SE Selma, 4 Oct 1994, *Kral* 84302 (VSC). Houston Co.: ca. 2.5 mi SW Cottonwood, 26 Sep 1994, *MacDonald* 7812 (erb, VSC). Lee Co.: Uchee Creek, 4 Aug 1960, *Wills s.n.* (SWSL); Spring Villa, 25 Jul 1977, *H. McIntyre s.n.* (VSC). Mobile Co.: Bayou la Barre, 7 Jun 1971, *Kral* 53056 (VSC). Montgomery Co.: WSW Montgomery, 10 Oct 1970, *Kral* 41573 (VSC). Pike Co.: 5 mi SE Troy, 12 Aug 1973, *Kral* 51217 (VSC). FLORIDA. Alachua Co.: NW Gainesville, 29 Jul 1978, *Dunn* 43 (erb),

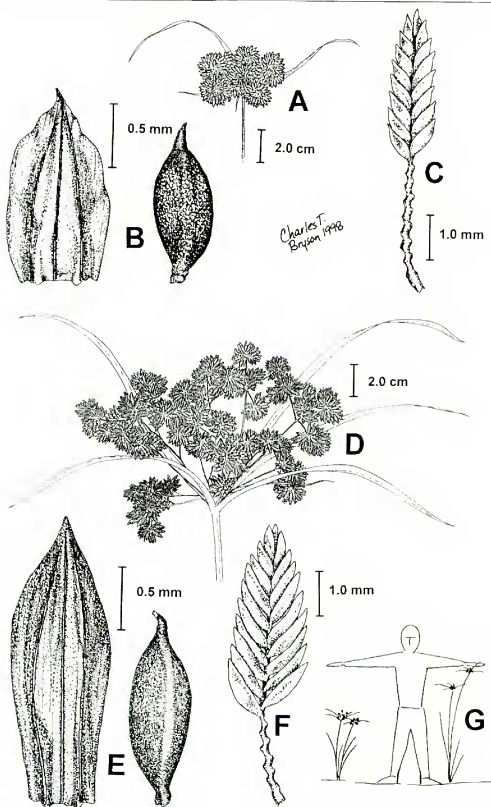


FIG. 2. *Cyperus drummondii*: A. Inflorescence. B. Floral scale and achene. C. Spikelet. Drawn from Carter 10738 (ctb). *Cyperus virens*: D. Inflorescence. E. Floral scale and achene. F. Spikelet. Drawn from Carter 6961 (ctb). G. Habit: *C. virens* (left) and *C. drummondii* (right).

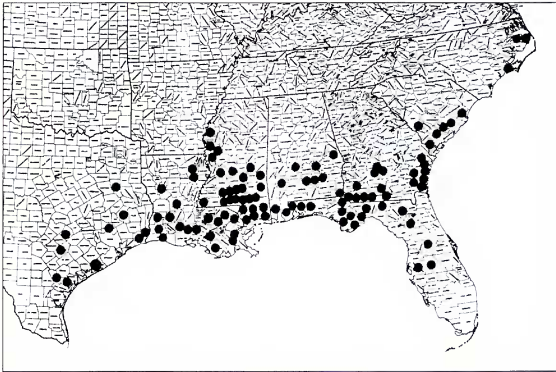


FIG. 3. Distribution of *Cyperus virens* in the United States.

6 May 1979, *Dunn* 595 (ctb); Paynes Prairie, 19 May 1979, *Smith* 15 (FSU). Calhoun Co.: E Bountstown, 6 Jun 1956, *Redfearn* 2197 (FSU). Columbia Co.: N Providence, 21 May 1964, *Godfrey* 63797 (FSU). Escambia Co.: Pensacola, 24 Jul 1974, *Godfrey* 73759 (FSU). Franklin Co.: NW Apalachicola, 29 Jun 1956, *Kral* 2737 (FSU); St. Vincent Island, 29 Jan 1987, *Anderson* 10290 (FSU). Gulf Co.: 6.5 mi NW Apalachicola, 12 May 1986, *Anderson* 9401 (FSU). Hillsborough Co.: ca. 1.5 mi NE of bridge, 18 May 1974, *Burch* 6825 (FSU). Jackson Co.: S Sneads, 23 Sep 1976, *Godfrey* 75663 (FSU). Lake Co.: E Bartow, 10 Apr 1962, *Godfrey* 61885a (FSU). Leon Co.: near Lake Bradford, 23 Jul 1957, *Godfrey* 55675 (FSU); Apalachicola National Forest, 25 Jun 1993, *Godfrey* 84612 (VSC); Tallahassee, 22 Jun 1989, *Godfrey* 83318 (VSC). Liberty Co.: N Bristol, 30 Sep 1964, *Godfrey* 64661 (FSU). Madison Co.: Greenville, 24 Jun 1956, *Godfrey & Kral* 54922 (FSU); 14 Jun 1991, *Godfrey* 84184 (VSC). Okaloosa Co.: Niceville, 12 Oct 1974, *Godfrey* 73974 (FSU). Polk Co.: N Lake Weohyakapka, Nalcrest, 7 May 1980, *E.M. Wheeler s.n.* (ctb, VSC). Santa Rosa Co.: Milton, 2 Sep 1976, *Godfrey* 75489 (FSU). Wakulla Co.: Newport, 23 Jul 1961, *Ward* 2737 (FSU). GEORGIA. Baker Co.: Newton, 28 Sep 1991, *Carter* 9379 (ctb, VSC). Ben Hill Co.: Red Bluff, 19 Aug 1967, *Faircloth* 4640 (VSC). Brantley Co.: 0.8 mi W Nahunta, 4 Jul 1988, *Carter* 6961 (ctb, VSC). Bryan Co.: Ft. Stewart Military Reservation, 24 Jun 1992, *Carter* 9930 (VSC). Camden Co.: Kinlaw, 7 Jul 1995, *Carter* 12523 (VSC). Cook Co.: 6 mi W Adel, 19 Jul 1965, *Faircloth* 2406 (VSC). Decatur Co.: 2.7 mi N state line, 20 May 1967, *Faircloth* 4466 (VSC). Glynn Co.: Sterling, Hwy. GA 99, 23 May 1997, *Carter* 14032 with *Alexander* (VSC); 7.72 mi SE Mt. Pleasant, Hwy. US 341, 23 May 1997, *Carter* 14037 with *Alexander* (VSC). Grady Co.: 4 mi N Cairo, 7 Aug 1987, *Carter* 6010 (ctb, VSC). Liberty Co.: Ft. Stewart Military Reservation, 16 Jul 1992, *Carter* 10177 (VSC). Lowndes Co.: N Valdosta, 20 Jul 1988, *Carter* 7092 (ctb, VSC); 11 Jun 1989, *Carter* 7892 (VSC). McIntosh Co.: Butler Island, 1.4 mi SW Darien, Hwy. US 17, 23 May 1997, *Carter*

14030 with *Alexander* (VSC). Seminole Co.: 0.4 mi E Iron City, 5 Aug 1989, *Carter* 8023 (ctb, VSC). Thomas Co.: 3.1 mi NE Metcalf, 2 Aug 1965, *Faircloth* 2628 (VSC). Turner Co.: 2.6 mi N Cravey, 28 Jun 1993, *Carter* 10843 with *Kral* (VSC). Wayne Co.: Gardi, 23 May 1977, *Carter* 14054 with *Alexander* (VSC). Wilcox Co.: 8.8 mi. N Abbeville, Hwy. US 129, 9 Aug 1987, *Carter* 6060 (ctb, VSC); 1.5 mi N jct. Hwys. US 280 and GA 215, 30 May 1998, *D. Alexander s.n.* (VSC). LOUISIANA. Acadia Parish: 0.5–1.0 mi E jct. Hwys. LA 124 and US 90 in Estherwood, 3 Sep 1992, *Carter* 10444 (VSC). Allen Parish: ca. 8 mi N Elton, *Thieret* 29557 (FSU). Assumption Parish: Platterville, ca. 1 mi. N jct. Hwys. LA 70 and 308, 19 Sep 1986, *Bryson* 5054 (ctb). Beauregard Parish: near DeQuincy, 13 Jul 1963, *Brown* 17793 (ctb). Calcasieu Parish: ca. 1.5 mi NNW Starks, 18 Jun 1968, *Thieret* 29424 (FSU); Chloe, 3 Sep 1992, *Carter* 10517 (VSC). Cameron Parish: ca. 10 mi W Holly Beach: 14 Dec 1957, *Reese & Harris* 1536 (FSU). East Baton Rouge Parish: E Baton Rouge, 17 Nov 1993, *McKenzie* 1333 (VSC); Burden Research Center, S Hwy. 1-10, 28 Sep 1994, *Bryson* 14487 (ctb). Franklin Parish: SW Holly Grove, 17 Sep 1981, *Thomas* 78546 (ctb). Jefferson Parish: 5 mi S Marrero, 5 Jun 1948, *Ewan* 17710K (FSU). Lafayette Parish: ca. 5 mi S Lafayette, 5 Oct 1957, *Reese* 1414 (FSU); 5 mi S Raynes, 15 May 1967, *Wooten* 1042 (FSU); Lafayette, 16 Jun 1993, *Carter* 10739 (ctb, VSC). Livingston Parish: 1.3 mi N Bayou Manchac, 11 Sep 1979, *Carter* 2084 (VSC). Natchitoches Parish: Chestnut, Hwy. LA 9, 19 Sep 1981, *Joye* 2224 & *Nielsen* (ctb). Orleans Parish: New Orleans, 15 Oct 1993, *Carter* 11537 (VSC). Rapides Parish: Pineville, 16 May 1994, *Bryson* 13452 (ctb, VSC). Richland Parish: W Rayville, Hwy. US 80, 21 Aug 1990, *Bryson* 10203 & *Newton* (ctb). St. Martin Parish: NW Duck Lake, 30 Oct 1963, *Thieret* 16611 (FSU); St. Martinville, 16 Jun 1993, *Carter* 10751 (VSC). St. Tammany Parish: 2.7 mi N Hwy. US 11 at Pearl River, 26 Aug 1991, *Carter* 8994 (ctb, VSC); W Slidell, 3.1 mi. W jct. Hwys. 1-12 and US 11, 17 May 1994, *Bryson* 13496 (ctb). Tangipahoa Parish: 4 mi SW Hammond, 2 May 1963, *Wilson* 160 (FSU); Lees Landing, 17 Sep 1993, *Carter* 11351 (VSC). Terrebonne Parish: Brule, 7 Jul 1977, *Webster* 800 (ctb); Cocodrie, S Houma, 12 Aug 1989, *Thomas* 112004 (VSC). MISSISSIPPI. Bolivar Co.: S Shaw, 25 Jul 1994, *Bryson* 13982 with *MacDonald* (ctb, VSC). Clarke Co.: Pachuta, 28 Aug 1991, *Carter* 9087 & *Bryson* (ctb, VSC). Covington Co.: Collins, 7 Dec 1994, *Bryson* 14705 (ctb, VSC). Forrest Co.: W Brooklyn, 4 Aug 1992, *Bryson* 11840 (ctb), *Bryson* 11852 (ctb, VSC); Camp Shelby, NE McLaurin, Hartfield Creek, 15 Oct 1994, *Bryson* 14506 et al. (ctb); Camp Shelby, NE McLaurin, S of Forrest Ave, 15 Oct 1994, *Bryson* 14522 et al. (ctb). George Co.: 7.5 mi. ESE Lucedale, 19 Jul 1988, *Morris* 3224 (ctb). Hancock Co.: Buccaneer State Park, 26 Aug 1991, *Carter* 8976 & *Bryson* (ctb, VSC); Hwy. MS 607, 1.4 mi ESE Hwy. US 90W, 26 Aug 1991, *Carter* 8979 (ctb, VSC); Mississippi Welcome Center, S Hwy. 1-10, W Hwy. MS 607, 26 Aug 1991, *Carter* 8988 (VSC), 17 May 1994, *Bryson* 13529 (ctb); W Mill Creek, 18 Oct 1993, *Bryson* 13264 & *Carter* (ctb, VSC). Harrison Co.: Gulfport, 6 Aug 1992, *Bryson* 11985 (VSC), *Bryson* 11991 (ctb, VSC), *Bryson* 11997 (ctb, VSC), *Bryson* 11998 (ctb); Orange Grove Community Center, 13 Oct 1993, *Lockley s.n.* (ctb), 16 Oct 1993, *Bryson* 13165 (ctb, VSC), 27 Jul 1994, *Bryson* 14004 (ctb); jct. Hwys. 1-10 and MS 67, 27 Aug 1991, *Carter* 9052 (ctb, VSC). Hinds Co.: Jackson, S of Lakeland Dr., 0.3 mi. W of Pearl River on Hwy. MS 25, 29 Oct 1993, *Bryson* 13300 (ctb); Lefluers Bluff State Park, 26 Aug 1995, *MacDonald* 9090 et al. (ctb). Humphreys Co.: 1.5 mi SW Isola, 23 Jun 1988, *Bryson* 8141 (ctb, VSC). Jackson Co.: 7 mi E Moss Point, 24 Jul 1989, *Bryson* 8666 (ctb, VSC); Pascagoula, 16 Sep 1991, *Bryson* 11043 (ctb, VSC); 4 Aug 1992, *Bryson* 11879 (VSC), 9 Aug 1993, *Bryson* 12597 (ctb, VSC); Moss Point, 1 Sep 1993, *Bryson* 12841 (ctb, VSC); Moss Point, 16 Sep 1993, *Carter* 11316 (VSC). Jefferson Davis Co.: S Prentiss, 12 Aug 1993, *Bryson* 12705 (ctb, VSC). Lamar Co.: 1 mi. N Lumberton, Hwy. US 11, 18 May 1994, *Bryson* 13568 (ctb).

Lawrence Co.: NE jct. Hwys. MS 27 and 44, 29 Jul 1994, *Bryson 14094* (ctb, VSC). Lincoln Co.: S Brookhaven, 29 Jul 1994, *Bryson 14103* (ctb, VSC). Marion Co.: 4.6 mi. S jct. Hwys. US 98 and MS 13, 0.3 mi. S Upper Little River, S Columbia, 29 Jul 1994, *Bryson 14059* (ctb). Newton Co.: 4 mi E Newton, 31 May 1985, *Bryson 3943* (ctb, VSC). Pearl River Co.: 3 mi W Picayune, 27 Jun 1967, *Sargent & Jones 13766* (FSU); Picayune, 18 Oct 1993, *Bryson 13248* (ctb, VSC); 2.5 mi N Carriere, 26 Aug 1991, *Carter 9005* (ctb, VSC). Perry Co.: New Augusta, 19 Oct 1994, *Bryson 14640* (ctb, VSC). Pike Co.: Percy Quinn State Park, 9 Jun 1967, *Jones 13229* (FSU), 28 Sep 1994, *Bryson 14462* (ctb, VSC). Rankin Co.: 0.5 mi S jct. Hwys. 49 and 1-20, 22 Oct 1976, *Barnes 790* (FSU); Flowood, 7 Sep 1993, *Bryson 12973* (ctb, VSC); Richland, W Hwy. US 49, 1.2 mi. S jct. Hwys. 1-20 and US 49, 27 Sep 1994, *Bryson 14429* (ctb). Sharkey Co.: ca. 9 mi ENE Anguilla, 14 Aug 1988, *Bryson 8348* (ctb, VSC); Delta National Forest, 3 Aug 1993, *Bryson 12544* (ctb, VSC). Smith Co.: SW Raleigh, 3.2 mi. W jct. Hwys. MS 35 and 540, 26 Jul 1995, *Bryson 14952* (ctb). Stone Co.: Flint Creek Water Park, 18 Oct 1993, *Bryson 13280* (ctb). Walthall Co.: NW Tylertown, 0.8 mi. W jct. Hwys. US 98 and MS 583, 29 Jul 1994, *Bryson 14089* (ctb). Washington Co.: Leroy Percy State Park, 2-6 May 1975, *Gunn 10637* (SWSL), 1 Jul 1977, *Barnes 964* (SWSL), 16 Jul 1993, *Bryson 12505* (ctb, VSC). Wayne Co.: Waynesboro, 1 Sep 1993, *Bryson 12934* (ctb, VSC). Wilkinson Co.: Little Buffalo Creek, N of Hiram McGraw Rd., 9 Jun 1991, *Rosso 91-271* (ctb), *Rosso 91-274* (ctb); ca. 8 mi N Woodville, 29 Sep 1994, *Bryson 15002* (ctb, VSC). NORTH CAROLINA. Carteret Co.: 3.6 mi NE Beaufort, Hwy. US 70, 30 Jul 1988, *Carter 7202* (VSC). Dare Co.: 2.6 mi W Alligator Point, Hwy. US 64, 29 Jul 1988, *Carter 7199* (ctb, VSC). Tyrell Co.: 10.2 mi E Columbia, Hwy. US 64, 29 Jul 1988, *Carter 7185* (ctb, VSC). SOUTH CAROLINA. Barnwell Co.: NW Barnwell, 12 Jun 1987, *Horn 1904* (VSC). Berkeley Co.: Rte. 41, 5 mi. N Rte. 17, 18 Jun 1983, *McNeilus 35* (ctb). Colleton Co.: ca. 1 mi. N Green Pond, Rte. 17, 20 Aug 1993, *McNeilus 93-1921* (ctb); vic. Green Pond, Rte. 303, 29 Aug 1994, *McNeilus 94-857* (ctb). Dorchester Co.: SW Summerville, 17 May 1957, *Ahles 26402* (FSU). Georgetown Co.: Cat Island, 26 Jul 1990, *Nelson 9392* (VSC). Jasper Co.: 4.6 mi NW Tillman, 9 Sep 1968, *Leonard 1928* (VSC). TEXAS. Aransas Co.: Lamar, 13 Sep 1992, *Carter 10620* (VSC). Bastrop Co.: 1.8 airmiles N 37° W of RR trestle at Sayersville, 13 Jun 1986, *Carr 7567* (VSC). Bee Co.: Naval Air Station Chase Field, 30 Sep 1991, *Carr 11539* (VSC). Cherokee Co.: 2.6 mi W Reklaw, 17 Aug 1989, *Carter 8240* (VSC). Gonzales Co.: N Hwy. US 1-10 and W Hwy. US 90, 11 Aug 1989, *Carter 8151* (ctb, VSC). Jefferson Co.: Port Arthur, 10 Aug 1989, *Carter 8140* (ctb, VSC). Matagorda Co.: NNE Palacios, Fm. Rd. 521, 13 Sep 1992, *Carter 10632* (ctb, VSC). Montgomery Co.: ca. 9 mi. S Conroe, 28 Jun 1988, *Hatch 5449* (ctb). Orange Co.: along Hwy. 1-10, milemarker 868, 19 Jun 1987, *Lievens 2616* (ctb). Polk Co.: 7.7 mi. S on Hwy. 59 from jct. with Hwy. 190 in Livingston, 11 May 1988, *Jones 1494 & Wipff* (ctb).

2. *Cyperus drummondii* Torr. & Hook. in Hook., Ann. Lyceum Nat. Hist. New York 3:437 (and errata). 1836. *Cyperus virens* subsp. *drummondii* (Torr. & Hook.) Koyama, Madroño 20:254. 1970. *Cyperus virens* var. *drummondii* (Torr. & Hook.) Kük., Pflanzenreich IV. 20 (Heft 101):181. 1936. TYPE: U.S.A. TEXAS: *Drummond 449* (LECTOTYPE, typified by Denton (1978): K; ISOLECTOTYPES: B, GH, NY-fragment!, OXF!).

Cyperus robustus Kunth, Enum. Pl. 2: 41. 1837. *Cyperus virens* Michx. var. *robustus* (Kunth) Kük., Pflanzenreich IV. 20 (Heft 101): 181. 1936. TYPE: BRAZIL: Brasilia, *Sello s.n.* (B, HOLOTYPE, *fide* Denton 1978).

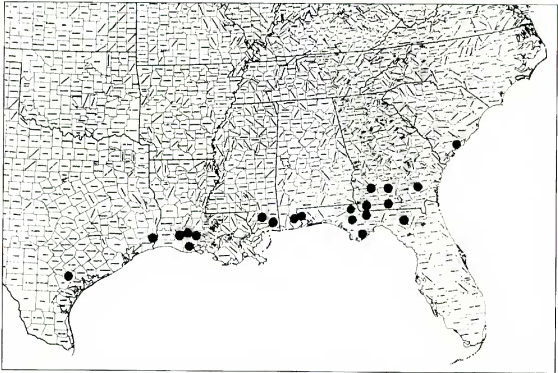


FIG. 4. Distribution of *Cyperus drummondii* in the United States.

Cespitose perennial herb. Roots fibrous, reddish brown. Culms 35–170 cm high, (8–)10–35 times longer than inflorescence width, 2–4.7 mm wide, triquetrous, scabrid. Leaves basal, blades 2.4–11.2 mm wide. Primary inflorescence bracts 3–5, longest 11.3–47.9 cm, up to 0.523 times as long as culm, 1.9–6.7 mm wide. Inflorescence usually tight, 2.1–8(–11.9) cm wide, rays 3–5, longest 0.9–7.7 cm long. Spikes globose, 1.1–7 cm wide. Spikelets flattened, 1.5–2.2 mm wide. Floral scales 18–42, distichous, spreading to ascending, bicarinate, ovate, 1.4–1.6 mm long, pale grayish-green, turning brown. Stamens 1–2, anthers 0.8–1.2 mm long. Style 3-branched, exserted, deciduous. Achene trigonous, oblong-ellipsoidal, 2.4–3.9 times as long as wide, 1.0–1.2 × 0.3–0.5 mm, stipitate, brown. Fig. 2.

Distribution and habitat.—Southern Georgia and northern Florida westward through southern Mississippi and southern Louisiana into southeastern Texas (Fig. 4). Also, known from Nicaragua, Jamaica, Surinam, Ecuador (Galapagos Islands), and Brazil (Kükenthal 1935–1936; Denton 1978). In the southeastern United States, found in the lower coastal plain along the margins of flatwoods ponds, seepage slopes, and coastal prairies.

Phenology.—Flowering and fruiting May through October.

Because of its greater height and tighter inflorescence *Cyperus drummondii* has a strikingly different habit from *C. virens*; this is best observed in the field. *Cyperus drummondii* does not appear to be as weedy as *C. virens*. *Cyperus*

virens is much more common and widely distributed in the southeastern United States, occurring in a variety of low wet disturbed habitats, especially ditches. In contrast, *C. drummondii* is less common and tends more to be restricted to less disturbed systems such as margins of flatwoods ponds, seepage slopes, and coastal prairies. Also, as summarized in the key, *C. drummondii* differs from *C. virens* in its narrower spikelets, greater achene length to scale length ratio, ovate scales, and fewer primary inflorescence bracts.

Specimens examined. U.S.A. ALABAMA. Baldwin Co.: Gulf Shores, S Intercoastal Waterway, 3 Aug 1996, *Kral* 86381 (VSC); Gulf Shores, N Intercoastal Waterway, 4 Aug 1996, *Kral* 86382 (VSC). FLORIDA. Calhoun Co.: ca. Ocheesee Landing, 10 Jul 1976, *Godfrey* 75220 (FSU). Escambia Co.: near Pensacola, Hwy. I-10, E of Hwy. FL 291, 8 Aug 1989, *Carter* 8085 (ctb, VSC). Franklin Co.: 3 airmiles N Apalachicola, 19 Jun 1986, *Anderson* 9577 (FSU). Gadsden Co.: between Quincy and Gretna, 3 Nov 1965, *Godfrey* 67556 (FSU). Jackson Co.: 4.9 mi N Sneads jct. Hwys. US 90 and FL 271, 19 Sep 1988, *Carter* 7627 (ctb, VSC); Lake Seminole, 6 Aug 1977, *H. McClutrye s.n.* (VSC). Suwannee Co.: E Live Oak, 19 Aug 1976, *Godfrey* 75398 (FSU). GEORGIA. Brooks Co.: W Dixie, old Hwy. US 84, 22 Jul 1995, *Carter* 12532 (ctb, VSC). Decatur Co.: Hwy. US 27, 4.3 mi S Ausmac, 5 Aug 1989, *Carter* 8019 (ctb, GA, MO, SWSL, VDB, VSC); E Bainbridge, Hwy. US 84, 13 Oct 1992, *Kral* 80044 (VSC). Dougherty Co.: 6 mi S Albany, Thorne 5002 (US); ca. 4 mi SE Putney, 18 Aug 1989, *Norris & Owsley* 5854 (personal herbarium R.A. Norris). Pierce Co.: 3.4 mi NE jct. Hwys. GA 15-121 and US 84 in Blackshear, 19 Jun 1992, *Carter* 9861 (ctb, VSC); Hwy. US 84, 1.4 mi N Blackshear jct. with Hwy. GA 15-121, 19 Jun 1992, *Carter* 9863 (ctb, VSC); SW Blackshear, 2.67 mi NE Hwy. US 84 Satilla River bridge, 17 May 1997, *Carter* 14024 (VSC); *Carter* 14055 with *Alexander* (VSC). Tift Co.: 1.6 mi W Tyty, Hwy. US 82, 26 Jun 1993, *Kral* 82744 with *Carter* (VSC); *Carter* 10863 with *Kral* (ctb, VSC). LOUISIANA. Acadia Parish: 0.5-1.0 mi E jct. Hwys. LA 1124 and US 90 in Estherwood, 3 Sep 1992, *Carter* 10455 (ctb, VSC); 0.95 mi W Midland, 17 Jun 1993, *Carter* 10761 (ctb, VSC); 5 mi. S Eunice and 5 mi. NE Iota near Frey, 16 May 1994, *Bryson* 13478, *Allen, Cascio & Geter* (ctb, VSC). Jefferson Davis Parish: 2.1 mi N jct. Hwys. US 165 and LA 101 in Woodlawn, 7 Sep 1992, *Carter* 10533 (VSC); E Jennings, 1.0 mi W jct. Hwys. US 90 and LA 1126, 8 Sep 1992, *Carter* 10542 (VSC). Lafayette Parish: between Duson and Scott, 0.5 mi E jct. Hwys. US 90 and LA 724, 6 Sep 1992, *Carter* 10508 (ctb, VSC); Lafayette, Moore Park, 16 Jun 1993, *Carter* 10738 (ctb, VSC). Vermilion Parish: Abbeville, *A.B. Langlois* 855c (US); ca. 7.5 mi SW Gueydan, 8 Sep 1992, *Carter* 10546 with *McInnis & Smith* (VSC). MISSISSIPPI. Jackson Co.: Moss Point, Hwy. MS 63 between Frederick St. and Martin Luther King Dr., 0.5 mi. S Escatawpa River bridge, 16 Sep 1993, *Carter* 11314 (VSC), 11315 (ctb, SWSL, VSC); 16 Oct 1994, *Bryson* 14544 & *MacDonald* (ctb, SWSL, VSC). Stone Co.: Hwy. 49 at 2.7 mi S jct. with Hwy. 26 in Wiggins, 20 Aug 1999, *MacDonald* 13422 with *Warren & Leonard* (VSC). SOUTH CAROLINA. Charleston Co.: N McClellanville, *Godfrey & Tryon* 724 (US). TEXAS. Goliad Co.: 8 mi S Coletto Creek, S Victoria, Hwy. 77, Jones 719 (US); Orange Co.: 5.5 mi W Orange, *Cory* 50890 (US).

ACKNOWLEDGMENTS

Portions of this article were submitted by D.K. Alexander in fulfillment of course requirements for Directed Study (BIO 495) at Valdosta State University

and were presented in poster format at the 1998 Symposium for Undergraduate Research sponsored by the Valdosta State University Council on Undergraduate Research. Appreciation is extended to Ken Ledford for assistance with data collection and Drs. S.D. Jones and G.C. Tucker for constructive reviews of the manuscript.

REFERENCES

- ADAMS, C.D. 1994. *Cyperus*. In: Davidse, G., M.S. Sousa and A.O. Chater, eds. Flora Mesoamericana, Vol. 6: Alismaceae a Cyperaceae. Universidad Nacional Autónoma de México. Ciudad Universitaria, Pp. 423–440.
- ANONYMOUS. 1996. Minitab reference manual: release 11 for Windows™. Minitab Inc., State College, PA.
- BRYSON, C.T. and R. CARTER. 1994. Notes on *Carex*, *Cyperus*, and *Kyllinga* (Cyperaceae) in Mississippi with records of eight species previously unreported from the state. *Sida* 16: 171–182.
- CARTER, R. 1990. *Cyperus entrerianus* (Cyperaceae), an overlooked species in temperate North America. *Sida* 14: 69–77.
- CHAPMAN, A.W. 1889. Flora of the southern United States, 2nd ed. Ivison, Blakeman, and Company, NY.
- CHAPMAN, A.W. 1897. Flora of the southern United States, 3rd ed. Cambridge Botanical Supply Company. Cambridge, MA.
- CLEWELL, A.F. 1985. Guide to the vascular plants of the Florida panhandle. University Presses of Florida, Tallahassee.
- CORRELL, D.S. and H.B. CORRELL. 1975. Aquatic and wetland plants of the southwestern United States. Stanford University Press, Stanford, CA.
- CORRELL, D.S. and M.C. JOHNSTON. 1970. Manual of the vascular plants of Texas. Texas Research Foundation, Renner, TX.
- DENTON, M.F. 1978. A taxonomic treatment of the *Luzulae* group of *Cyperus*. *Contr. Univ. Michigan Herb.* 11:197–271.
- GODFREY, R.K. and J.W. WOOLEN. 1979. Aquatic and wetland plants of southeastern United States: Monocotyledons. University of Georgia Press, Athens.
- HATCH, S.L., K.N. GANDHI, and L.E. BROWN. 1990. Checklist of the vascular plants of Texas. MP-1655. Texas Agricultural Research Station, College Station.
- JONES, S.D., J.K. WIPFF, and P.M. MONTGOMERY. 1997. Vascular plants of Texas: A comprehensive checklist including synonymy, bibliography, and index. University of Texas Press, Austin.
- KOYAMA, T. 1970. New combinations in the Cyperaceae of the Galapagos Islands. *Madroño* 20:254.
- KÜNKENTHAL, G. 1935–1936. *Cyperus*. In: A. Engler and L. Diel, eds. Das Pflanzenreich IV. 20 (Heft 101):1–674.
- MCGIVNEY, M.V. 1938. A revision of the subgenus *Encyperus* found in the United States. *Cath. Univ. Amer. Biol. Ser.* 26:1–74.
- MOHR, C. 1901. Plant life of Alabama. *Contr. U.S. Natl. Herb.* 6:1–921.
- SEBER, G.D.F. 1984. Multivariate observations. John Wiley & Sons. New York.
- SMALL, J.K. 1933. Manual of the southeastern flora. New York.
- SNEATH, P.H.A. and R.R. SOKAL. 1973. Numerical Taxonomy. W. H. Freeman and Company. San Francisco.

- THOMAS, R.D. and C.M. ALLEN. 1993. Atlas of the vascular flora of Louisiana, Vol. I: the ferns & fern allies, conifers, & monocotyledons. Moran Colorgraphic Printing, Baton Rouge, LA.
- TORREY, J. 1836. Monograph of North American Cyperaceae. Ann. Lyceum Nat. Hist. New York 3:1-448.
- TUCKER, G.C. 1994. Revision of the Mexican species of *Cyperus* (Cyperaceae). Syst. Bot. Monogr. 43:1-213.
- WUNDERLIN, R.P. 1982. Guide to the vascular plants of central Florida. University Presses of Florida, Tallahassee.
- WUNDERLIN, R.P. 1998. Guide to the vascular plants of Florida. University Press of Florida, Gainesville.