

CYPERUS FUSCUS (CYPERACEAE), NEW TO MISSOURI AND NEVADA, WITH COMMENTS ON ITS OCCURRENCE IN NORTH AMERICA

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ABSTRACT

Field and herbarium studies have documented *Cyperus fuscus* as new for Missouri and Nevada. Localities, habitat data, lists of associated species, description, illustrations, photo of habit, and discussion of weedy potential are presented.

RESUMEN

Los estudios de campo y de herbario han documentado *Cyperus fuscus* como nuevo para Missouri y Nevada. Se aportan localidades, datos del hábitat, listas de especies asociadas, descripción, ilustraciones, foto del hábito, y discusión de su potencial como mala hierba.

INTRODUCTION

Cyperus fuscus L. [section *Fusci* (Kunth) Clarke] is native to Eurasia and the Mediterranean Region of northern Africa, extending from Greenland and Iceland to China south to Spain, Iran, Egypt, Algeria, and northern India (Kükenthal 1936; Tutin et al. 1980). The common name for this species has been listed as "galingale," "brown galingale," or "black galingale" (Weedon & Stephens 1969). It apparently was first discovered in North America based on specimens collected by Herbert A. Young along Revere Beach in Essex County, Massachusetts in 1877 (Knowlton et al. 1911; McGivney 1938). *Cyperus fuscus* was subsequently documented in California (McGivney

1938; Tucker 1993), Connecticut (McGivney 1938; Dowhan 1979; Tucker 1995), Maryland, (Kükenthal 1936), Nebraska (Weedon & Stephens 1969; Kolstad 1986; Rolfsmeier 1995), New Jersey (Britton 1886; McGivney 1938), Pennsylvania (Rhoads & Klein 1993), South Dakota (Weedon & Stephens 1969), and Virginia (Hitchcock & Standley 1919; Kolstad 1986; Tucker 1987). Although the species has also been recorded for New York (e.g., Weedon & Stephens 1969; Kolstad 1986), no specimens have been located and the only ones so identified were actually *C. diandrus* Torr. (Mitchell & Tucker 1997). Although *C. fuscus* has been present on the North American Continent since at least 1877, its spread apparently has been slow, and outside of brief accounts related to its increase in distribution, there has been little attention given to it in the New World literature.

Given the great attention to new records of *Cyperus* in North America by Charles Bryson, Richard Carter, Stanley Jones, Barney Lipscomb, Gordon Tucker, and others in the last 20 years (e.g., Lipscomb 1978, 1980; Tyndall 1983; Carter et al. 1987; Carr 1988; Carter 1988; Sundell & Thomas 1988; Carter & Bryson 1991; Webb et al. 1991; Bryson & Carter 1992; Jones et al. 1993; Bryson & Carter 1994; Tucker 1994; Bryson et al. 1996; Carter et al. 1996), it is interesting and somewhat amazing that the species has not been discovered at more localities throughout the United States, especially as Weedon and Stephens (1969) noted that it was a weed of rice fields in the Old World. Outside the United States, the species has been discovered in Canada (Gillett 1970), but it has not been found in Mexico (Tucker 1994) or Central America (Tucker 1983).

DESCRIPTION

The following is a description of *C. fuscus* based on Kükenthal (1936), McGivney (1938), Fernald (1950), Kolstad (1986), and our observations. *Cyperus fuscus* (Figs. 1, 2): a caespitose annual with few to numerous culms and reddish-brown fibrous roots; culms upright, inclined, or decumbent, 2–30 (rarely 50) cm long, 1.3–3.0 mm thick, smooth, flaccid, and triangular in cross-section; 2–4 basal leaves per culm, 1–25 cm long, 1–4 mm wide, flat, flaccid, and minutely scabrous toward the acute apex; 2 or 3 leaf-like bracts subtend each inflorescence, varying in length, 2–25 cm long, 1–3(–5) mm wide, spreading, flat, flaccid, and minutely scabrous toward the acute apex; 6–24(–80) densely or loosely congested spikelets per spike; spikelets 8–18(–40) flowered, 3–8(–12) mm long, 1–1.5 mm wide, linear, and compressed; rachillas 0.3 mm wide, 0.2 mm thick, dark brown, straight or slightly curved, and wingless; scales (sometimes called “glumes”) subtending the flowers 0.8–1.2 mm long, 0.8–1.5 mm wide, broader than long, 3-nerved, tan or light brown at the center with narrowly hyaline margins, and the

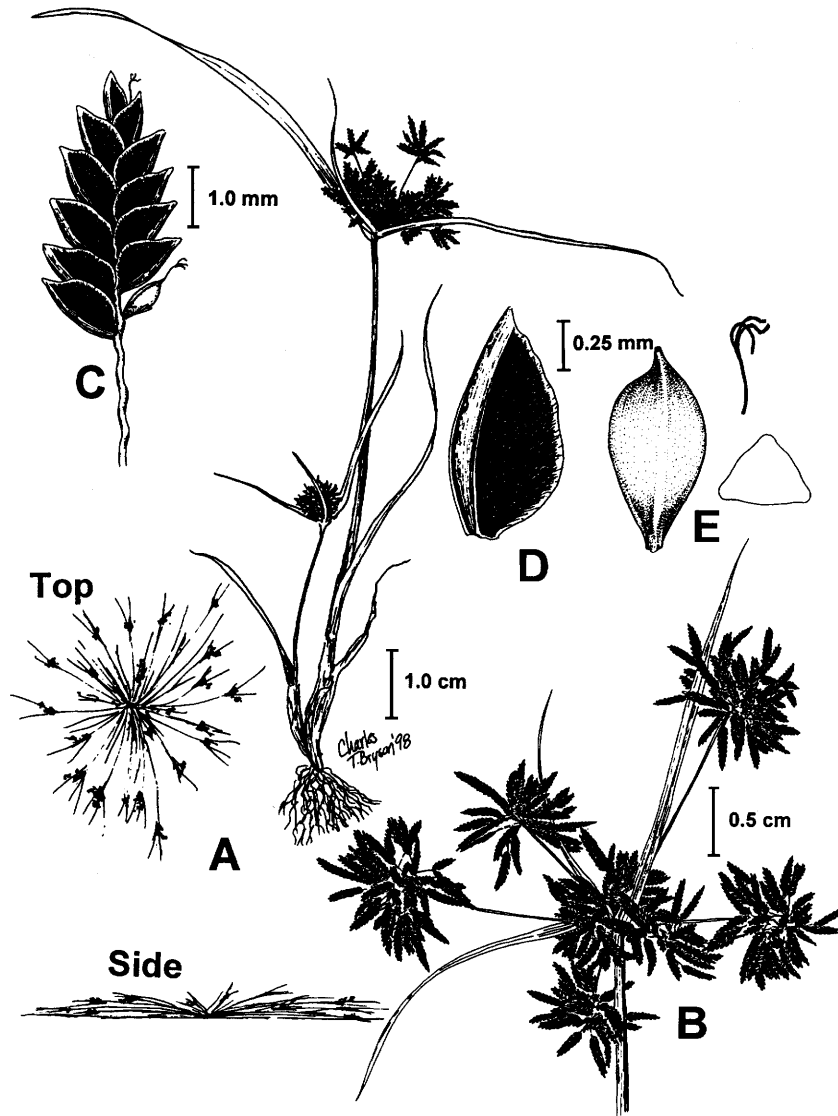


FIG. 1. *Cyperus fuscus*. A. Habit (top and side views of clump and side view of two erect plants). B. Inflorescence. C. Spikelet. D. Scale. E. Achene (including cross-sectional view and side view of 3-cleft style). (Based on McKenzie 1802 with Jacobs; McKenzie 1804; McKenzie 1807 with Jacobs and Johnson; illustrated by Charles T. Bryson).

surfaces primarily dark reddish-brown to purple; the tips minutely apiculate; achenes 0.9–1.1 mm long, 0.4–0.5 mm wide, gray to almost white, trigonous, and narrowly ovoid; styles 0.4–0.6 mm long, 3-cleft, and not persistent; stamens 2 per flower, 0.7–0.8 mm long; anthers 0.4–0.5 mm long, tan or yellowish, and linear oblong.

BIOLOGY, ECOLOGY, AND DISTRIBUTION

On 9 September 1997, while conducting a search for state-listed species of *Cyperus*, *Schoenoplectus*, and *Lipocarpus* along mudflats of the Missouri River in Cooper County, McKenzie and Jacobs discovered a population of *Cyperus* sp. unfamiliar to them. This *Cyperus* was semiprostrate with the culms radiating like spokes in a wheel and leaning mostly horizontal to the ground (Fig. 2). The most diagnostic features of the sedge were its dark purple to reddish-brown scales, its strongly triangular stems, its bright rusty red roots, its small spikelets, and its pale, trigonous achenes. Specimens were subsequently determined as *Cyperus fuscus*. McKenzie and Jacobs returned to the site on 28 September 1997 and counted 110 plants scattered along the silty mudflats and shoreline of the Missouri River, associated with the following species: *Ammania coccinea* Rottb., *Cyperus diandrus* Torrey, *C. erythrorhizos* Muhl., *C. odoratus* L., *C. squarrosus* L. (*C. aristatus* Rottb.; *C. inflexus* Muhlenb.), *Eclipta prostrata* (L.) L., *Eragrostis hypnoides* (Lam.) Britton, Sterns, & Pogg., *Fimbristylis vahlia* (Lam.) Link, *Leucospora multifida* (Michx.) Nutt., *Lipocarpus micrantha* (Vahl) G. Tucker, *Polygonum* spp. and *Ranunculus scleratus* L. Although the majority of plants were in full sunlight, some extended into the partial shade of the developing seedlings of *Salix* spp. and *Populus deltoides* Bartram ex Marshall.

Subsequent to this discovery, McKenzie and Jacobs were asked by Rhett Johnson of the Missouri Department of Conservation to identify an unknown specimen of *Cyperus* that had been collected from another site along the Missouri River in adjacent Howard County, approximately 32 km WNW of the original discovery site. McKenzie and Jacobs identified the specimen as *C. fuscus* and visited the site with Johnson on 11 October 1997, where they counted approximately 70 plants scattered along moist, sandy and silty flats adjacent to a chute that had been formed during the 1995 flood of the Missouri River.

Because the discovery of *C. fuscus* in two adjacent counties along the Missouri River suggested that the species could be widely distributed along the river, Jacobs searched locations downstream of the original discovery site and discovered it in Boone, Callaway, and Cole counties. A lack of time due to the season's first killing frosts prevented additional searches in other counties bordering the Missouri River. With the exception of *Fimbristylis vahlia*, associated plants at the second, third, fourth, and fifth sites were mostly identical to those previously mentioned for the original discovery site.



FIG 2. Photograph of *Cyperus fuscus* taken from Lisbon Bottoms, Big Muddy National Fish and Wildlife Refuge, Howard Co., Missouri, 11 Oct 1997 (photographed by Paul M. McKenzie).

Although the initial North American discovery of *C. fuscus* in Massachusetts was apparently along a sandy beach, many subsequent records along the Atlantic seaboard were associated with "ballast sand" (Britton 1886), or "waste ground, ballast, and wharf areas" (Rhoads & Klein 1993). The Connecticut record comes from a "sandy river shore" (Tucker 1995) and habitat for the species in California has been reported as "damp, disturbed soil, receding shorelines, and puddles" (Tucker 1993). In the Midwest, the initial discoveries of this sedge were made along "wet open sandy flats" of the South Platte River in Lincoln County, Nebraska and "wet sandy clay soil" along the banks of the Keya Paha River in Tripp County, South Dakota (Weedon & Stephens 1969). The accounts by Britton (1886) and Rhoads and Klein (1993) suggest that *C. fuscus* was initially introduced to the New England coast accidentally via achenes that were in ship ballast water that originated in Europe. Introductions into other areas of the country, however, are more difficult to assess. It is possible that waterfowl were responsible for the species' introduction into Nebraska, South Dakota, and elsewhere. Dunn and Knauer (1975) postulated that waterfowl were responsible for the introductions of *Cyperus flavicomus* Mich. [*C. albomarginatus* (C. Martius & Schrader ex Nees) Steudel], *Fimbristylis miliacea* (L.) Vahl, and *Aeschynomone indica* L. into the Mingo National Wildlife Refuge in southeastern Missouri.

While the source of introduction of *C. fuscus* into Missouri is unknown, the recent and apparent widespread distribution of this sedge along the Missouri River suggests that the species may have become established soon after the 1993 or 1995 floods. At the original discovery site in Cooper County, plants were located at the spot where a large levee break had occurred in 1995. Rolfsmeier (1995) reported that the two Nebraska records of *C. fuscus* were from separate locations along the Platte River. Because the Platte River empties into the Missouri River, and the Keya Paha eventually does the same, it is feasible that Nebraska or South Dakota may have been the seed source for the Missouri populations that became established along the Missouri River following the 1993 and/or 1995 floods. This introduction may be due to soil movement and sedimentation within the Missouri River floodplain.

Rice growers in the United States should be alerted to the potential of this sedge becoming a troublesome weed. Holm et al. (1979) listed *C. fuscus* as a principal weed in Portugal and as occurring in Afghanistan and Israel. Based on the rapid and aggressive spread of its relative *Cyperus difformis* L. in North American rice fields (Lipscomb 1980; Tyndall 1983; Bryson et al. 1996), and because *C. fuscus* is a rice weed in the Old World (Weedon & Stephens 1969; Mingyuan & Dehu 1970; Holm et al. 1979), this species should be looked for in rice producing areas of Arkansas, California, Louisiana, Mississippi, Missouri, Tennessee, and Texas.

Due to the combination of its semiprostrate habit with the culms radiating like spokes in a wheel (Fig. 2), its dark purple to reddish-brown scales, its strongly triangular stems, its bright rusty red roots, its small spikelets, and its pale (almost white), trigonous achenes, this *Cyperus* is unlikely to be confused with any other North American member of the genus. The conspicuous rusty red roots and small trigonous achenes are similar to *C. erythrorhizos*, but the dark purplish scales, strongly triangular stems, apiculate achenes, and stamen number (2 vs. 3 in *C. erythrorhizos*) easily distinguish it from that species. The purplish-tinged scales of *C. fuscus* are somewhat reminiscent of the scales of *C. diandrus*, *C. bipartitus* Torrey, or *C. flavicomus*. It can easily be separated from *C. diandrus* and *C. bipartitus* by its trigonous vs. lenticular achenes, and by its smaller (ca. 1.0 mm vs. 1.8 mm) scales. It differs from *C. flavicomus* by its flattened vs. erect habit, by the lack of white margins on the scales, and by its trigonous vs. lenticular achenes.

The authors noted that bruised fresh and herbarium material of *C. fuscus* possesses a fragrance similar to, but not as strong as, *C. squarrosus* or *C. setigerus* Torr. & Hook. Steyermark (1963) described this odor as that of slippery elm (*Ulmus rubra* Muhl.). Bruhl (1995) stated that "(i)n a few genera of Cyperaceae, a fenugreek (*Trigonella foenum-graecum*) odour is readily detectable in fresh and (especially) herbarium material."

There is apparently some disagreement in the literature regarding the

number of stamens of each floret of *C. fuscus*. In the *Flora of the Great Plains* (Kolstad 1986), two stamens are given in the key but three in the species account. One (McGivney 1938), rarely two (Kükenthal 1936), or two (Tutin et al. 1980) stamens are also cited elsewhere in the literature. George Yatskievych (Missouri Botanical Garden, pers. comm.) examined all voucher specimens from Missouri and noted that florets had only two stamens.

Given the apparent rapid spread of this species along the Missouri River in Missouri and the weedy nature of many *Cyperus* in the Old World, it is likely that this species will be discovered with sufficient effort at other Midwest locations and possibly elsewhere in North America. While studying *Cyperus* specimens at the Missouri Botanical Garden in 1988, Carter discovered a misidentified specimen of *C. fuscus* from western Nevada that originally was determined as *C. acuminatus* Torr. & Hook. The "exposed mudflat" habitat at the Nevada site is apparently similar to that in the San Joaquin Valley of adjacent California described by Tucker (1993). *Cyperus fuscus* was not listed by Cronquist et al. (1977) in the *Intermountain Flora*, nor in Kartesz's (1987) dissertation on the *Flora of Nevada*. As with California, Missouri, Nebraska, and South Dakota, waterfowl may have been responsible for the introduction of achenes of *C. fuscus* into Nevada. The following data provide documentation for *C. fuscus* in Missouri and Nevada with herbarium abbreviations following Holmgren et al. (1990), except ctb (pers. herb. of Charles T. Bryson).

Voucher specimens: U.S.A. Missouri. Cooper Co.: Big Muddy National Fish and Wildlife Refuge-Overton Bottoms, ca. 1.9 mi NW of Overton, T49NR15W Sect. 31SESENW1/4, Rocheport 7.5' Quad., 9 Sep 1997, *McKenzie 1802 with Brad Jacobs* (ctb, EIU, MO, SWSL, VSC); *Jacobs 97-67 with Paul McKenzie* (MO); 28 Sep 1997, *McKenzie 1804 with Brad Jacobs* (ctb, MICH, SWSL, UMO); Howard Co.: Big Muddy National Fish and Wildlife Refuge-Lisbon Bottoms, ca. 1.5 mi NW of Lisbon, T50NR18W Sect. 18, Arrow Rock 7.5' Quad., 11 Oct 1997, *McKenzie 1807 with Brad Jacobs and Rhett Johnson* (ctb, MICH, MO, SWSL, UMN, UMO, VDB, VSC); *Jacobs 97-40 with Paul McKenzie and Rhett Johnson* (ctb, MO, MICH, SWSL, UMN, UMO). Boone Co.: McBaine, W of Columbia waste water treatment lagoon # 3, T47NR13W Sect. 7SWSES1/4, Hunstdale 7.5' Quad., 13 Oct 1997, *Jacobs 97-37 with Tim Smith* (MO, UMN, UMO). Callaway Co.: North Jefferson City, along N side of the Missouri River, approximately 400-500 m downstream from the Jefferson City bridge over the Missouri River, T44N R11W Sect. 15SWSW1/4, Jefferson City 7.5' Quad., 14 Oct 1997, *Jacobs 97-38* (ctb, MO, UMO), *Jacobs 97-44 with Chris Dietrich* (MO). Cole Co.: Jefferson City, along the S edge of the Missouri River, approximately 400-500 m downstream from the Jefferson City Bridge over the Missouri River, just W of Wears Creek, T44NR11W Sect. 7NENE1/4, Jefferson City 7.5' Quad., 15 Oct 1997, *Jacobs 97-39* (MO, NEMO, UMO); *Jacobs 97-46* (MO). Nevada. Lyon Co.: Lahontan Reservoir, mudflats at the SE end of the reservoir, T17NR26E Sect. 8, 4150 ft, plants growing on exposed mudflats, 1 Sep 1981, *Tiehm 6769* (MO).

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REFERENCES

- BRITTON, N.L. 1886. A preliminary list of N.A. species of *Cyperus*, with descriptions of new forms. Bull. Torrey Bot. Club 13:205-216.
- BRUHL, J.J. 1995. Sedge genera of the world: relationships and a new classification of the Cyperaceae. Austral. Syst. Bot. 8:125-305.
- BRYSON, C.T. and R. CARTER. 1992. Notes on *Cyperus* and *Kyllinga* (Cyperaceae) in Mississippi with records of six species new to the state. Sida 15:119-124.
- BRYSON, C.T. and R. CARTER. 1994. Notes on *Carex*, *Cyperus*, and *Kyllinga* (Cyperaceae) in Mississippi with records of eight species previously unreported to the state. Sida 16:171-182.
- BRYSON, C.T., J.R. MACDONALD, R. CARTER, and S.D. JONES. 1996. Noteworthy *Carex*, *Cyperus*, *Eleocharis*, *Kyllinga*, and *Oxycaryum* (Cyperaceae) from Alabama, Arkansas, Georgia, Louisiana, Mississippi, North Carolina, Tennessee, and Texas. Sida 17:501-518.
- CARR, B. 1988. *Cyperus difformis* L. (Cyperaceae) new to Texas. Sida 13:255-256.
- CARTER, R. 1988. *Cyperus hystricinus* (Cyperaceae) new to Florida. Sida 13:118-119.
- CARTER, R. and C.T. BRYSON. 1991. A report of *Cyperus grayioides* and *Cyperus retroflexus* (Cyperaceae) new to Missouri and notes on other selected Missouri *Cyperus*. Sida 14:475-481.
- CARTER, R., C.T. BRYSON, and B.L. LIPSCOMB. 1987. *Cyperus uniflorus* (Cyperaceae) east of the Mississippi River. Sida 12:250.
- CARTER, R., R.L. MEARS, K.C. BURKS, and C.T. BRYSON. 1996. A report of four exotic *Cyperus* (Cyperaceae) species new to Florida, U.S.A. Sida 17:275-281.
- CRONQUIST, A., A.H. HOLMGREN, N.H. HOLMGREN, J.L. REVEAL, and P.K. HOLMGREN. 1997. Intermountain flora. Vol. 6. Columbia University Press. New York.
- DOWHAN, J.J. 1979. Preliminary checklist of the vascular flora of Connecticut. State geological and natural history survey of Connecticut. Dept. of Env. Protection-Nat. Resources Center Rept. of Investigations No. 8.
- DUNN, D.B. and D.F. KNAUER. 1975. Plant introductions by waterfowl to Mingo National Wildlife Refuge Missouri. Trans. Missouri Acad. of Sci. 9:27-28.
- FERNALD, M.L. 1950. Gray's manual of botany. 8th ed. D. Van Nostrand Co., New York.
- GILLET, J.M. 1970. *Cyperus fuscus* L.—new to Canada. Canad. Field Nat. 85:190.
- HITCHCOCK, A.S. and P.C. STANDLEY. 1919. Flora of the District of Columbia and vicinity. Contr. U.S. Natl. Herb. 21:1-329, pl. 1-42.
- HOLM, L., J.V. PANCHO, J.P. HERBERGER, and D.L. PLUCKNETT. 1979. A geographical atlas of world weeds. John Wiley and Sons, New York.
- HOLMGREN, P.K., N.H. HOLMGREN, and L.C. BARNETT, eds. 1990. Index Herbariorum. Part 1: The herbaria of the world, 8th ed. New York Botanical Garden, Bronx, New York.
- JONES, S.D., A.A. REZNICEK, and G.D. JONES. 1993. *Cyperus setigerus* (Cyperaceae), new for New Mexico. Sida 15:655.

- KARTZ, J.T. 1987. A flora of Nevada. Unpublished Ph.D. dissertation, University of Nevada, Reno.
- KNOWLTON, C.H., J.A. CUSHMAN, W. DEANE, and A.K. HARRISON. 1911. Reports on the flora of Boston District-VIII. *Rhodora* 13:27-29.
- KOLSTAD, K.O. 1986. Cyperaceae. In: R.L. McGregor, Coordinator; T.M. Barkley, R.E. Brooks, and E.K. Schofield, eds. *Flora of the Great Plains*. University Press of Kansas, Lawrence. Pp. 1059-1113.
- KÜKENTHAL, G. 1936. Cyperaceae-Scirpoideae-Cyperae. In: L. Diels, ed. *Pflanzenreich* IV. 20(Heft) 101:1-671.
- LIPSCOMB, B.L. 1978. *Cyperus surinamensis* (Cyperaceae): new to Arkansas, Kansas, and Oklahoma. *Sida* 7:307.
- LIPSCOMB, B.L. 1980. *Cyperus difformis* L. (Cyperaceae) in North America. *Sida* 8:320-327.
- MCGIVNEY, M.V. 1938. A revision of the subgenus *Eucyperus* found in the United States. *Cathol. Univ. Amer. Biol. Ser.* 26:1-74.
- MINGYUAN, X. and M. DEHU. 1970. Farmland weeds in China: a collection of coloured illustrated plates. Agricultural Publishing House. Beijing, China.
- MITCHELL, R.S. and G.C. TUCKER. 1997. Revised checklist of New York State plants. *New York State Museum Bulletin* 490.
- RHOADS, A.F. and W.M. KLEIN, JR. 1993. The vascular flora of Pennsylvania—annotated checklist and atlas. American Philosophical Society, Philadelphia.
- ROLSMEIER, S.B. 1995. Keys and distributional maps for Nebraska Cyperaceae, Part 1: *Bulbostylis*, *Cyperus*, *Dulichium*, *Eleocharis*, *Eriophorum*, *Fimbristylis*, *Fuirena*, *Lipocarpus*, and *Scirpus*. *Trans. Nebraska Acad. Sci.* 22:27-42.
- SUNDELL, E. and R.D. THOMAS. 1988. Four new records of *Cyperus* (Cyperaceae) in Arkansas. *Sida* 13:259-261.
- STEYERMARK, J.A. 1963. *Flora of Missouri*. Iowa State University Press, Ames, Iowa.
- TUCKER, G.C. 1983. The taxonomy of *Cyperus* (Cyperaceae) in Costa Rica and Panama. *Syst. Bot. Mongr.* 43:1-85.
- TUCKER, G.C. 1987. The genera of Cyperaceae in the southeastern United States. *J. Arnold Arbor.* 68:361-445.
- TUCKER, G.C. 1993. *Cyperus*. In: J.C. Hickman, ed. *The Jepson manual: Higher plants of California*. University of California Press, Berkeley. Pp. 1138-1141.
- TUCKER, G.C. 1994. Revision of the Mexican Species of *Cyperus* (Cyperaceae). *Syst. Bot. Mongr.* 43:1-213.
- TUCKER, G.C. 1995. The vascular flora of southeastern Connecticut. *Mem. Connecticut Bot. Soc.* 3:1-205.
- TUTIN, T.G., V.H. HEYWOOD, N.A. BURGESS, D.M. MOORE, D.H. VALENTINE, S.M. WALTERS, and D.A. WEBB, eds. 1980. *Flora Europaea*-Volume 5, Alismataceae to Orchidaceae (Monocotyledons). Cambridge University Press, Cambridge.
- TYNDALL, R.W. 1983. Distribution of *Cyperus difformis* L. (Cyperaceae) in the southeastern United States. *Castanea* 48:277-280.
- WEBB, D.H., W.M. DENNIS, and T.S. PATRICK. 1991. Distribution and naturalization of *Cyperus brevifolioides* (Cyperaceae) in eastern United States. *Sida* 9:188-190.
- WEEDON, R.R. and H.A. STEPHENS. 1969. *Cyperus fuscus* in Nebraska and South Dakota. *Rhodora* 71:433.

