

NOMENCLATURAL NOTES ON *CYPERUS ODORATUS* AND RELATED SPECIES (CYPERACEAE)

GORDON C. TUCKER^{1,2} AND KANCHI N. GANDHI³

Abstract. We discuss nomenclatural and taxonomic matters pertaining to three species of *Cyperus* subg. *Diclidium* (Schrad. ex Nees) C. B. Clarke, viz., *C. acicularis* (Schrad. ex Nees) Steud., *C. flexuosus* Vahl, and *C. macrocephalus* Liebm. We examined the relevant available type materials of the three species and their associated synonyms. Our study shows that based on priority, the names *C. ferax* Rich. and *C. conglobatus* Link replace *C. flexuosus* and *C. macrocephalus*, respectively. For *C. acicularis*, a later homonym (non (L.) With.), *C. strongii* G.C. Tucker & Gandhi is proposed as the replacement name. A key is provided for identification of all the *Cyperus* subg. *Diclidium* species occurring in the New World.

Keywords: Neotropical, *Cyperus*, Sedge, nomenclature

The genus *Cyperus* L. includes about 900 species, occurring worldwide in warm temperate and tropical regions (Larridon et al., 2011a, 2011b). The distribution of the individual species ranges from nearly cosmopolitan, e.g., *C. squarrosus* L. and *C. flavescens* L., to regional and narrow endemics found in most tropical and temperate regions (Alves et al., 2007; Kükenthal, 1935–1936; Tucker, 1994, 2013; Tucker et al., 2002). In the New World, areas of high diversity and endemism include the southeastern United States, Mexico, the Greater Antilles, the Guiana Shield, and eastern Brazil (Ribeiro et al., 2015; Tucker, 2007, 2013). Recent molecular studies (Larridon et al., 2011a; 2011b; 2013) demonstrated that the “*Cyperus* Clade” comprises 13 or more genera traditionally segregated from *Cyperus* (e.g., *Kyllinga* Rottb., *Lipocarpa* R. Br., *inter alia*), as well as confirming the majority of subgenera and sections proposed by Kükenthal (1935–1936).

Within *Cyperus* (*sensu stricto*), a small but well-marked

group of species is characterized by the disarticulation of the rachilla of mature spikelets into one-seeded segments. This group has been treated as either *C.* subg. *Diclidium* (Schrad. ex Nees) C. B. Clarke (Kükenthal, 1936) or given generic status as *Torulinium* Desv. ex Ham. or *Diclidium* Schrad. ex Nees (Koyama, 1978). In a DNA-based phylogeny of the genus, Reid et al. (2017) included three species of subgenus *Diclidium*: *C. odoratus* L., *C. macrocephalus* Liebm., and *C. filiformis* Sw. We have examined images of their vouchers and agree with the identifications. In the phylogeny, however, *C. odoratus* and *C. macrocephalus* were sister species, whereas *C. filiformis* was placed in sect. *Laxiglumi* (C.B. Clarke) Kük. It is emphasized here that the three species have never been the focus of a taxonomic revision, although several nomenclatural changes were made by Jones et al. (1996). In this paper, we discuss issues pertaining to the application of three species of *Cyperus* subg. *Diclidium*. We also provide a key to all species of the subgenus.

AN EARLIER NAME FOR *CYPERUS FLEXUOSUS*

Cyperus flexuosus has been considered to be a regional endemic species of the West Indies and northern South America (Kükenthal, 1935–1936; McLaughlin, 1944; Acevedo and Strong, 2005). This species can readily be distinguished from *C. odoratus* by the outline of its spikes, broadly ovoid or egg-shaped, with the lower spikelets reflexed (*C. odoratus* has broadly cylindrical spikes with all the spikelets spreading). *Cyperus ferax* was generally included in the synonymy of *C. odoratus*. However, examination of the type of *C. ferax* (Fig. 1) shows that it is indistinguishable from the type of *C. flexuosus* (Fig. 2) Therefore, *C. flexuosus* should be removed from the synonymy of *C. odoratus*, and instead be treated as a taxonomic synonym of *C. ferax*, the oldest name for this species, as given below.

Cyperus ferax Rich., Act. Soc. Hist. Nat. Paris 1: 106. 1792. TYPE: “Cayenna Missarum A Domino Le Blond.” French Guiana: Cayenne, 1792, *J. B. Le Blond s.n.* (Lectotype, here designated: P; Isolectotypes: G, P).

Homotypic synonyms: *Diclidium ferax* (Rich.) Schrad. ex Nees in C.F.P. Martius, Fl. Bras. 2(1): 54. 1842 (as *ferox*).

Mariscus ferax (Rich.) C.B. Clarke in J.D. Hooker, Fl. Brit. India 6: 624. 1894. *Torulinium ferax* (Rich.) Ham., Prodr. Pl. Ind. Occid. 15. 1825 (as *Feroci*); Urb., Symb. Antill. 2: 165. 1900 (isonym).

Except for mentioning the locality (as Cayenne) and the collector’s name (as Le Blond), Richard did not cite or indicate the holotype, and the name *Cyperus ferax* needs

We thank the curators of herbaria (F, M, P) for access to digital images of specimens and permission to reproduce these, as well as the curators of the following herbaria for access to specimens: AAU, ARIZ, CORD, F, FTG, GH, HAL, ILL, ILLS, JE, K, LCA, MICH, MO, NY, SP, U, and US. We thank Randy Mears for calling to our attention about the information on the distinctness of *Cyperus engelmannii* from *C. odoratus*. We also thank Dr. Anthony R. Brach (A, GH) for providing useful comments on the original version of the manuscript.

¹Department of Biological Sciences, Eastern Illinois University, Charleston, Illinois 61920, U.S.A.

²Corresponding author: gctucker@eiu.edu

³Harvard University Herbaria, 22 Divinity Avenue, Cambridge, Massachusetts 02138, U.S.A.



FIGURE 1. *Cyperus ferax* Rich. Type specimen, conserved at the Museum Nationale d'Histoire Naturelle, Paris.



FIGURE 2. *Cyperus flexuosus* Vahl. Type, conserved at Copenhagen Herbarium. Image courtesy Field Museum of Natural History.

to be typified. Acevedo-Rodríguez and Strong (Contr. U.S. Natl. Herb. 52: 280. 2005) cited: "Type: French Guiana; Cayenne. *Leblond s.n.* (Holotype: P; Isotypes: G, P)" (sic). Since they did not use the phrase "designated here" or an equivalent, their usage of the type term "holotype" cannot be corrected to lectotype (ICN Arts. 7.10, 9.9).

Heterotypic synonyms: *Cyperus flexuosus* Vahl, Enum. Pl. 2: 359. 1805. TYPE: "Habitat in America meridionali v. *Rohr [s.n., s.d.]*" Virgin Islands, [*J.P.B. Rohr 173* (Lectotype: C; photograph: F# 22395)]

Diclidium vahlii Schrad. ex Nees in C.F.P. Martius, Fl. Brasil. 2(1): 53. 1842. *Cyperus vahlii* (Schrad. ex Nees) Steud., Syn. Pl. Glumac. 2(7): 48. 1854. *Torulinium vahlii* (Schrad. ex Nees) C.B. Clarke in Urban, Symb. Antill. 2(1): 56. 1900. TYPE: "Habitat in America meridionali: *J. P. B. Rohr s.n., s.d.* An quoque in Brasilia?" (sic; not located).

Cyperus ehrenbergii Kunth, Enum. Pl. 2: 89. 1837. TYPE: "C. strigosus (sensu) Schlechtend. in Ehrenb. herb. Ins. St. Thomae. (nec Linn.) - Insulae St. Thomae (*Ehrenb.*) et Cubae (*Poeppig.*)" Virgin Islands. St. Thomas, [*C.A. Ehrenberg 77* (Lectotype (vide P. Acevedo-Rodríguez and M.T. Strong, Contr. U.S. Natl. Herb. 52: 269. 2005): HAL; isolectotype: B!).

Cyperus insignis Kunth, Enum. pl. 2: 92. 1837; *C. flexuosus* f. *insignis* (Kunth) Kuk., Pflanzenreich IV. 20 (Heft 101, 4): 622. 1936. TYPE: Trinidad: *F. W. Sieber 7* (not located).

Diclidium fuscatum Schrad. ex Nees in C.F. P. Martius, Fl. Brasil. 2(1): 52. 1842. TYPE: Brazil: Minas Gerais, Serro Frio, *C.F.P. Martius s.n., s.d.* (Lectotype: M; photo F # 18870).

Herbs, perennial, cespitose, 20–40 cm tall. Rhizome 0.5–2.0 cm long, 0.5–1.5 cm in diameter, indurate, horizontal to slightly oblique. Culms 2–3 mm in diameter, trigonous, smooth (base tuberos-thickened). Leaves 2–5, 10–50 cm long, 5–10 mm wide, flanged v-shaped or inversely w-shaped, the margins scabrellate especially distally; sheaths stramineous to light brown. *Inflorescence bracts* (4–) 6 or 7, (3–) 10–28 cm long, 3–9 mm wide, the margins and keel

scabrellate, horizontal to ascendant at 30–60°. Rays 8–10, 1–6 cm long; prophyll 5–10 mm long, with two apical teeth up to 3 mm long; secondary rays up to 1 cm long. *Spikes* 1–3, 10–20 (–40) mm long, (8–) 10–30 (–35) mm wide, loosely spherical (spikelets radiate, the lower reflexed); bractlets 1–2 cm long, 0.5–1.5 mm wide; prophyll 3–4 mm long, tubular, sheathing. *Spikelets* 20–40, 5–8 mm long, 0.8–1.1 mm wide, linear, subulate; rachilla articulate at the bases of the scales at maturity, ca. 0.5 mm wide, 0.1–0.4 mm thick, straight to slightly flexuous, becoming corky or spongy thickened with achene maturation, stramineous, wings 0.2–0.5 mm wide, membranous to corky, yellow to brown (clasping the mature achene), successive scales 1–1.5 mm apart. *Scales* persistent, appressed to slightly spreading, partly covering the next scale above, 6–12, 2–2.5 mm long, 2 mm wide, obovate, obtuse, slightly mucronulate (semicircular in cross-section), laterally faintly 1 (–3) nerved, reddish to stramineous to shiny brown or beige, medially 3–5 nerved, green. *Stamens* 3; filaments ca. 2 mm long; anthers ca. 0.5 mm long, ellipsoid, the connective apex minute, less than 0.1 mm long, reddish. Styles 0.5–1.2 mm long; stigmas 3, ca. 1 mm long. *Achenes* 1–1.5 mm long, ca. 0.5 mm wide, trigonous (dorsiventrally flattened or equilateral in cross-section), oblong-obovoid, slightly falcate, acute to barely obtuse, apiculate, the stipitate base 0.1–0.2 mm long, the faces flat to convex, the surface finely papillose, light brown to grayish brown.

Additional Specimens Examined: CUBA: Matanzas: near Guamá, *W.W. Thomas et al. 14767* (NY). Oriente: Sierra Maestra, Bayamo, Mina Christina, *H. Lippold 16039* (JE). DOMINICAN REPUBLIC. *L. Ekman 14454* (NY, US). HAITI. *L. Ekman 8279* (US), *Leonard & Leonard 15716* (NY, US). JAMAICA. Kingston, *Fuller 144* (ILL). MARTINIQUE. *Duss 709, 765* (NY). VIRGIN ISLANDS. St. John: Lamosure, *N.L. Britton & Shafer 623* (MO, NY, US); St. Thomas: *N.L. Britton & Marble 1224* (NY, US). TRINIDAD. *Broadway 4312* (US). MEXICO. Quintana Roo: sur de Cozumel, rumbo al Cedral, *J.J. Ortiz 937* (MO). GUYANA. Mazaruni Station, *Forestry Dept. M394* (U). SURINAME. Toekoemoetoe-Kreek, fluv. Saramacca sup. bank 1 km S of Base Camp, *A.G.H. Daniels & F.P. Jonker 1307* (U).

AN EARLIER NAME FOR *CYPERUS MACROCEPHALUS*

Cyperus macrocephalus is a regional endemic species of the Caribbean and northern South America (Kükenthal 1935–1936; O'Neill, 1940; Benedict Ayers, 1946). This species can be distinguished readily from *C. odoratus* (and the other members of the subgenus) by the outline of its inflorescence, lacking rays, and having the spikelets congested into a dense mass. *Cyperus oxycarioides* has sometimes been treated as a synonym of *C. eggersii* Boeck. However, the type of *C. oxycarioides* has dense inflorescences, not the pyramidal spikes composed of ascending appressed spikelets, characteristic of *C. eggersii*. *Cyperus macrocephalus* was sometimes included in the synonymy of *C. odoratus* (Tucker, 1994; Tucker et al., 2002). Examination of the type of *C. conglobatus* (Fig. 3), however, shows that its taxonomy is the same as that of *C. macrocephalus*. Thus, the oldest name for this species is *C. conglobatus*, as shown below.

Cyperus conglobatus Humb. ex Link, Jahrb. Gewächsk. 1(3): 87. 1820.

TYPE: VENEZUELA. [Bolívar]: "[Venezuela] von Humboldt am Orinoko," in arenosis Carichane, *F.N.H.A. Humboldt 845* (Lectotype, here designated: B) [Kükenthal gives A.J.A. Bonpland as collector].

Homotypic synonyms: *Cyperus ferax* var. *conglobatus* (Humb. ex Link) Kük., Pflanzenreich IV. 20 (Heft 101, 4): 617. 1936.

C. cephalophorus J. Presl & C. Presl, Reliq. Haenk. 1(3): 170. 1828, *nom. superfl. & illegit.* [the protologue includes *C. conglobatus* Willd. Herb. in synonymy].

Diclidium conglobatum Nees in C.F.P. Martius, Fl. Bras. 2(1): 51. 1842, *nom. invalid* [Nees assigned *C. conglobatus* to *Diclidium*, but did not make the new combination].



FIGURE 3. *Cyperus conglobatus* Humb. ex Link. Type specimen from Berlin Herbarium.

Heterotypic synonyms: *Cyperus ignoratus* Boeck., Linnaea 36: 395. 1870. TYPE: not located [“(Ex herb. F. Ottonis) Patria?” (sic)]. Application of name follows Kükenthal (1935–1936).

Cyperus macrocephalus Liebm., Mexic. halvgr. 33. 1850. TYPE: Mexico. Veracruz, Denne udmærkede Art voxer i den østlige Kystregion paa Bredderne af Río Nautla ved Pital (faa Mil fra dens Udloeb i mex. Bugt), og blomstrer i April og Mai.” Lectotype (here designated): *F.M. Liebmann 14367* (C; Isolectotypes: GH, HAL, K, LL, MICH; photograph: F).

Torulinium macrocephalum (Liebm.) Koyama, Phytologia 29: 74. 1974.

Cyperus oxycarioides Britton, Bull. Torrey Bot. Club 11: 86. 1884.—TYPE: U.S.A. Texas, valley of the lower Rio Grande, 1878–83, *S. B. Buckley s.n.* (Holotype: NY).

Herbs, perennial, cespitose, 15–65 cm tall. Rhizome 0.5–2.0 cm long, 0.5–1.5 cm in diameter, indurate, horizontal to slightly oblique. Culms 12 mm in diameter, trigonous, smooth. Leaves 2 or 3, 15–40 cm long, 2–7 mm wide, sub-coriaceous, flat, revolute, the margins and keel scabrellate and upper surface distally; sheaths reddish brown. *Inflorescence bracts* 4–7, 4–10 (–15+) cm long, 1–8 mm wide, the margins and keel scabrellate, spreading to reflexed. Rays absent. *Spikes* aggregated into a globose head. *Spikelets* 50–100+, 5–12 (–15) mm long, 0.9–1.1 mm wide, oblong to linear-lanceolate, subcylindrical;

rachilla 0.3–0.4 mm wide, 0.1–0.4 mm thick, straight to slightly flexuous, becoming corky or spongy thickened with achene maturation, stramineous, wings 0.2–0.5 mm wide, membranous to corky, stramineous to bronze or carmine, rhomboidal (clasping the lower half of the mature achene), rachilla articulate at the bases of the scales at maturity. *Scales* persistent, 5–12, ca. 2 mm long, 1.5 mm wide, ovate, obtuse, sometimes mucronulate (semicircular in cross-section), laterally faintly 1 (–3) nerved, light brown or beige, medially faintly to rather conspicuously 5-nerved, green. *Stamens* 3; filaments 2–3 mm long; anthers ca. 0.5 mm long, ellipsoid, the connective apex minute, less than 0.1 mm long, reddish. *Styles* 0.6 mm long; stigmas 3, 1.0–1.3 mm long. *Achenes* ca. 1.2 mm long, ca. 0.5 mm wide, compressed trigonous (dorsiventrally flattened in cross-section), ellipsoid, obtuse, the stipitate base ca. 0.1 mm long, the faces flat to convex, the surface finely papillose, dull brown.

Additional Specimens Examined: CUBA. Matanzas: Mun. Ciénaga de Zapata: near Guamá, *Thomas et al. 14767* (NY). MEXICO. Campeche: Tuxpena, *C. Lundell 1042* (GH, LCA, MO, US). Quintana Roo, sur de Cozumel, 29 Aug 1985, *Ortiz 937* (MO). Sinaloa: Meseta de Cacaxtla, *Ruiz G. et al. 2006-151* (ARIZ, EIU). Veracruz: Antigua, *Purpus 6252* (GH, MO, NY); 89 km ESE of Ébano on hwy. 70, *M. Nee & Hansen 18343* (AAU). Yucatán: Uxmal, *J. Swallen 2587* (US). BELIZE. Corozal Dis., Corozal-Consejo road, *Lundell 4974* (LL). Cayo Dis., Grano de Oro, *T. Croat 23370* (AAU, MO). GUATEMALA. Petén: Uaxactun, *H. Bartlett 12769*; Remate, *C. Lundell 2091*.

A NEW NAME FOR *CYPERUS ACICULARIS*

The name *C. acicularis* (Nees) Steud. (based on *Diclidium aciculare* Schrad. ex Nees), used in some floras (e.g. O’Neill, 1940), is illegitimate because of the existence of the earlier homonym *C. acicularis* (L.) With., dated 1796. Therefore, we provide a new name for this species. As in the case of *C. macrocephalus*, *C. acicularis* (Nees) Steud. and its relative *C. engelmannii* Steud. together have sometimes been treated as either varieties or synonyms of *C. odoratus*. The lapse may be explained by the fact that earlier treatments (e.g., Tucker, 1994) relied heavily on the work of Benedict Ayers (1946) who noted the difficulty in distinguishing *C. engelmannii* from *C. odoratus*, especially in South America. However, in contrast, in the earlier work by his doctoral supervisor, O’Neill (1940) provided a somewhat better account of *C. engelmannii* and *C. acicularis*. The two species can be distinguished from *C. odoratus*, provided mature spikelets are compared. Both *C. engelmannii* and *C. acicularis* can be distinguished from other species of the *C. odoratus* group by the internode of the spikelet rachilla being always longer than the corresponding floral scale. [In contrast, younger spikelets can have more closely spaced, even slightly overlapping scales (cf. Mears, 1995)] Worldwide, very few species of *Cyperus* have spikelets with such widely spaced scales. These differences are summarized in the key below.

Cyperus strongii G.C. Tucker & Gandhi, *nom. nov.*

Replaced synonym: *Diclidium aciculare* Schrad. ex Nees in C.F.P. Martius, Fl. Bras. 2(1): 55. 1842. TYPE: Brazil. “Habitat in ad Engenho da Ponta Praedium

et Caxoeira oppidum prov. Bahiensis, C.F.P. Martius [s.n. s.d.]; “*Cyperus variabilis* Herb. Lindl.”; “*Cyperus lomentaceus* Nees ... quoad locum natalem Bahiam et syn. Lindl., excl. syn. *Cyp. ferocis* Link” (Lectotype here designated: M-0243949). Fig. 4.

C. acicularis (Schrad. ex Nees) Steud., Syn. Glum. 2(7): 45. 1854, not *Cyperus acicularis* (L.) With. (1796; based on *Scirpus acicularis* L.); *C. ferax* var. *acicularis* (Schrad. ex Nees) Kük. in A. Engler, Pflanzenreich IV. 20 (Heft 101, 4): 619. 1936.

Herb, perennial, cespitose, 30–90 cm tall. Rhizome 0.5–1.0 cm long, 1–2 cm in diameter, indurate, slightly oblique. Culms 2–5 mm in diameter, trigonous, smooth. Leaves 3–5, 15–80 cm long, 5–20 mm wide, flanged v-shaped, coriaceous, the margins and keel scabrellate; sheaths stramineous to reddish-brown. *Inflorescence bracts* 6–8, 10–60 cm long, 5–20 mm wide, the margins and keel spinulose-scabrellate, ascendant at 30–60°. Rays 4–12, 2–30 cm long; secondary rays 1–9 cm long. *Spikes* 1–5, 20–50 mm long, 20–35 mm wide, loosely ovoid. *Spikelets* (10–) 20–30, 5–25 mm long, 0.55–0.8 mm wide, linear, cylindrical; rachilla articulate at the bases of the scales at maturity, 0.3–0.4 mm wide, 0.1–0.4 mm thick, straight to slightly flexuous, becoming corky or spongy thickened with achene maturation, stramineous, wings 0.2–0.5 mm wide, membranous to corky, stramineous to bronze or carmine (clasping the mature achene and barely reaching its apex), successive scales 2.7–2.8 mm apart. *Scales* persistent, appressed, not reaching the next scale



FIGURE 4. *Diclidium aciculare* Schrad. ex Nees. Lectotype at Munich Herbarium. Photo from negative courtesy Field Museum of Natural History.

above, (4–) 8–12, 2.0–2.3 mm long, ca. 1.6 mm wide, ovate, obtuse, sometimes slightly mucronulate (semicircular to C-shaped in cross-section), chartaceous, laterally faintly to conspicuously 1 (–3) nerved, reddish to stramineous to shiny brown or beige, medially 2–5 nerved, green to brownish. *Stamens* 3; filaments 2.0–2.5 mm long; anthers 0.3–0.35 mm long, linear, the connective apex minute, less than 0.1 mm long, reddish. Styles 0.7–1 mm long; stigmas 3, 0.7–1.0 mm long. *Achenes* 1.6–1.7 mm long, 0.3–0.45 mm wide, trigonous (dorsiventrally flattened or equilateral in cross-section), linear to linear-oblong, slightly falcate, acute to barely obtuse, scarcely apiculate, the stipitate base 0.1(–0.2) mm long, the faces flat to convex, the surface finely papillose, dull brown.

Additional Specimens Examined: CUBA. *N.L. Britton et al.* 525 (NY); *H.S. Wright* 704 (US). HAITI. *Nash* 330 (NY). PUERTO RICO. Mpio. Yauco, Cordillera Central, 1.6–2 km S of hwy 365 along hwy 3365, *R.D. Worthington* 37549 (ILLS, UTEP). TRINIDAD AND TOBAGO. Trinidad, *N.L. Britton et al.* 1142 (GH). BELIZE. El Cayo Dis., *H. Bartlett* 12047, 12872 (MICH). GUATEMALA. Izabal: Lago Izabal, El Estor, *Morales & Pérez* 2978 (MO).

COSTA RICA. Puntarenas: Isla del Coco, *J.L. Trusty & Kesler* 468 (FTG). ARGENTINA. Jujuy: Dep. Santa Bárbara: entre El Palmar y Laguna de la Brea, *A. Cabrera et al.* 29831 (AAU, SI). BOLIVIA. Chuquisaca: Hernando Siles: Saucos: Azero Norte, *Peñarenda et al.* 1311 (MO). BRAZIL. Mato Grosso, Corumbá, *Silva* 44 (ILL, SP). Paraíba: São Joco do Cariri, *J. Mattos* 9378 (SP). Paraná: between Uraí and Cornélio Procópio, *T. Koyama et al.* 13738 (NY, SP). Rio Grande do Sul: Porto Alegre, *W.D. Clayton* 4453 (K, SP). São Paulo: São Bernardo do Campo, *J. Mattos* 15428 (SP). COLOMBIA. Antioquia: alrededores del río Ampurrumiado, *Gutiérrez & Barkley* 17C188 (COLO, CORD). ECUADOR. Guayas: km 5.5 Balao–Naranjal, *Laegaard* 70431 (AAU). Sucumbios: Reserva Faunística de Cuyabeno, *H. Balslev et al.* 84896 (AAU). PERU. Loreto: Lower Uyucali River, 3 km W of Jenaro Herrera, *Kvist* 1244 (AAU).

Eponymy: The new name honors Mark T. Strong (b. 1954), botanist at the U.S. National Herbarium, for his contributions to the botany of the Caribbean and northern South America, especially his publications on Cyperaceae.

KEY TO SPECIES OF *CYPERUS* SUBG. *DICLIDIUM*

- 1a. Spikelets few, ± erect or spreading; inflorescence unbranched; longest inflorescence bract erect 2
- 1b. Spikelets numerous; inflorescence branched (if unbranched, spikelets numerous and congested in head); inflorescence bract not erect. 3
- 2a. Culms single or clustered; creeping rhizome absent; Caribbean, Florida, N. South America *Cyperus filiformis* (*C. floridanus*)
- 2b. Culms borne singly, 2–5 mm apart, from creeping rhizome; Jamaica endemic *Cyperus harrisii*
- 3a. Achene linear to linear-oblong; scales not overlapping on the same side of the rachilla (separated by 0.3–0.8 mm); wings of rachilla about 0.2 mm wide, usually reaching the apex of the achene. 4
- 3b. Achene oblong to obovoid; scales overlapping on the same side of the rachilla (by 0.4–0.9 mm); wings of rachilla 0.4–0.5 mm wide, not usually extending beyond the middle of the achene. 5
- 4a. Leaves and bracts membranous, 1–4(–6) mm wide; culms 1–2 mm wide below bracts; anthers ca. 0.4 mm long; secondary rays absent; plants annual, rhizome absent; primarily in eastern and central United States. *C. engelmannii*
- 4b. Leaves and bracts coriaceous, 8–16 mm wide; culms 3–5 mm wide below bracts; anthers 1.5–1.8 mm long; secondary rays usually present, up to 15 cm long; plants perennial (sometimes flowering the first year), rhizome present; primarily in tropical America (Cuba to southern Mexico, southern to northern Argentina) *C. strongii* (*C. acicularis*)
- 5a. Inflorescence congested into a single ± globose, compact head, 2–3 cm in diameter; bracts reflexed; achene ellipsoid; culms sharply trigonous; leaves 4–6 mm wide. *C. conglobatus* (*C. macrocephalus*)
- 5b. Inflorescence with some rays; bracts spreading or ascendant; achenes obovoidoblong to linearoblong 6
- 6a. Spikelets suberect, penicillate, very densely fascicled at the ends of the rays, into head-like or pyramidal clusters. *C. eggersii*
- 6b. Spikelets divaricate, subdense, scattered along the rachis 7
- 7a. Achenes with transverse notch on the abaxial surface; Pacific coast of Central America (also Venezuela). *C. hayesii*
- 7b. Achenes without notch 8
- 8a. Plants diminutive, 2–6 cm tall, culms spreading to prostrate; endemic to Chile *C. poeppigii*
- 8b. Plants taller, stems erect; widespread (but not occurring in Chile).
- 9a. Scales orbiculate, conduplicate; Bahamas endemic *C. correllii*
- 9b. Scales elliptic, involute in cross-section (especially at or before anthesis); widespread species 10
- 10a. Spikes elliptic to egg-shaped in outline; lower spikelets reflexed, the medial spreading, the upper ascending *C. ferax* (*C. flexuosus*)
- 10b. Spikes broadly ovoid to shortly cylindric in outline; spikelets all spreading.
- 11a. Scales 1.8–2.6 mm long, laterally reddish to reddish-brown; achenes 0.8–1.1 mm long, (0.3–) 0.4–0.5 mm wide; each ray bearing 1(–3) spikes, secondary bracts usually absent or minute *C. odoratus* var. *squarrosus* (*C. ferruginescens*)
- 11b. Scales 1.8–3.0 mm long, laterally light to medium brownish; achenes (1.2–) 1.3–1.5 mm long, (0.5–) 0.6–0.7 mm wide; rays each bearing 3–4 spikes, subtended by secondary bracts up to 6 cm long. *C. odoratus* var. *odoratus*

LITERATURE CITED

- ACEVEDO-RODRÍGUEZ, P. AND M.T. STRONG. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1–415.
- ALVES, M., A. C. ARAÚJO, A. P. PRATA, F. A. VITTA, S. M. HEFLER, R. TREVISAN, A. BRAGANÇA GIL, S. MARTINS, AND W. W. THOMAS. 2007. Diversidade de Cyperaceae no Brasil. Pages 286–290 in L. M. BARBOSA AND N. A. DOS SANTOS, JR., EDS., *A Botânica no Brasil: pesquisa, ensino e políticas públicas ambientes*. Sociedade Botânica do Brasil, São Paulo.
- BENEDICT AYERS, BRO. 1946. The genus *Cyperus* in Mexico. Catholic Univ. Amer. Biol. Stud. 1: 1–104.
- JONES, S.D., J.K. WIPFF, AND R. CARTER. 1996. Nomenclatural combinations in *Cyperus* (Cyperaceae). Phytologia 84(4): 288–290.
- KÜKENTHAL, G. (1935–1936). Cyperaceae-Scirpoideae-Cypereae. *Das Pflanzenreich* IV. 20 (Heft 101, 1–4): 1–671.
- KOYAMA, T. 1978. Cyperaceae. In R. A. HOWARD, ED., Flora of the Lesser Antilles 3: 220–320.
- LARRIDON, I., K. BAUTERS, M. REYNDERS, W. HUYGH, A.M. MUASYA, D.A. SIMPSON, AND P. GOETGHEBEUR. 2013. Towards a new classification of the giant paraphyletic genus *Cyperus*. Bot. Jour. Linn. Soc. 172: 106–126.
- LARRIDON, I., M. REYNDERS, W. HUYGH, K. BAUTERS, K. VAN DE PUTTE, A.M. MUASYA, P. BOECKX, D.A. SIMPSON, A. VRIJDAGHS, AND P. GOETGHEBEUR. 2011a. Affinities in C_3 *Cyperus* lineages (Cyperaceae) revealed using molecular phylogenetic data and carbon isotope analysis. Bot. Jour. Linn. Soc. 167: 19–46.
- LARRIDON, I., M. REYNDERS, W. HUYGH, K. BAUTERS, A. VRIJDAGHS, O. LEROUX, A.M. MUASYA, AND P. GOETGHEBEUR. 2011b. Taxonomic changes in C_3 *Cyperus* (Cyperaceae) supported by molecular phylogenetic data, morphology, embryography, ontogeny and anatomy. Pl. Ecol. Evol. 144: 327–356.
- McLAUGHLIN, A. D. 1944. The genus *Cyperus* in the West Indies. Catholic Univ. Amer. Biol. Stud. 5: 1–108.
- MEARS, R.L. 1995. New Records of *Cyperus* (Cyperaceae) from Kentucky. *Castanea* 60: 79–82.
- O'NEILL, H. T. 1940. The sedges of the Yucatan Peninsula. Publ. Carnegie Inst. Wash. 19.
- REID, C.S., V.P. DOYLE, J.R. CARTER, Y. VARGAS-RODRÍGUEZ, AND L.E. URBATSCH. 2017. Molecular systematics of targeted flat sedges (*Cyperus*, Cyperaceae) of the Americas. Pl. Ecol. Evol. 150: 343–357.
- RIBEIRO, A.R. DE OLIVEIRA, M. ALVES, A.P. PRATA, O.F. OLIVEIRA, L. DE O. F. SOUSA, AND R.C. DE OLIVEIRA. 2015. The genus *Cyperus* (Cyperaceae) in Rio Grande do Norte State, Brazil. *Rodriguésia* 66(2): 571–597. <https://dx.doi.org/10.1590/2175-7860201566221>
- TUCKER, G. C. 1994. Revision of the Mexican Species of *Cyperus* L. (Cyperaceae). Syst. Bot. Monogr. 43.
- . 2007. Systematics of *Cyperus* L. section *Diffusi* Kunth (Cyperaceae) in the Neotropics. Pages 311–314 in L. M. BARBOSA AND N. A. DOS SANTOS, JR., EDS., *A Botânica no Brasil: pesquisa, ensino e políticas públicas ambientes*. Sociedade Botânica do Brasil, São Paulo.
- . 2013. Two new Neotropical species of *Cyperus* (Cyperaceae). Kew Bulletin 68: 850–855.
- , J. R. CARTER, AND B.G. MARCKS. 2002. *Cyperus* (Cyperaceae – Sedge Family) Pages in FLORA OF NORTH AMERICA EDITORIAL COMMITTEE, EDS., Flora of North America 23: 141–190. Oxford University Press, New York and Oxford.