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Kyllinga, a Genus of Neglected Weeds in the Continental United States[1]

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INTRODUCTION

The sedge genus *Kyllinga* consists of 40 to 45 species distributed in tropical, subtropical, and warm temperate regions around the world (Kükenthal 1936; Tucker 1987). This genus of low rhizomatous perennials or cespitose annuals is classified in the large cosmopolitan family Cyperaceae. Many *Kyllinga* species are considered weedy (Holm et al. 1979; Tucker 1987), while *Kyllinga nervosa* Steudel is considered an important forage plant in Africa (McNaughton 1985). The maximum diversity of *Kyllinga* occurs in tropical East Africa and Madagascar, where there are 30 to 35 species (Haines and Lye 1983; Kükenthal 1936). An additional 11 to 12 *Kyllinga* species occur in Asia, two in Australia; none is native to Europe. Currently, there are six *Kyllinga* species known in the United States (Table 1). Green kyllinga (*Kyllinga brevifolia* Rottb. #[3] KYLBR), *K. gracillima* Miq., *K. odorata* Vahl, *K. pumila* Michaux, and *K. squamulata* Thonn. ex Vahl are known from the continental United States (Kartesz 1994). Green kyllinga and *Kyllinga nemoralis* (J. R. & G. Forst.) Dandy ex Hutchinson & Danziel (= *Cyperus kyllingia* Endl. and cited as *K. monocephala* Rottb. in Holm et al. [1979]), commonly known as white kyllinga, are introduced weeds in Hawaii (Delahoussaye and Thieret 1967; Holm et al. 1979; Tucker 1987) (Figure 1).

Kyllinga pumila, initially described in the first North American flora by Michaux (1803), is evidently the only species native to the continental United States. Green kyllinga was established in the United States before 1821 (Elliott 1821) and *Kyllinga odorata* before 1836 (Torrey 1836). Both have become widespread in the eastern United States, especially in the southern Atlantic and Gulf Coastal plains. Their distributions and recent range expansions indicate later introductions for *K. gracillima* and *K. squamulata* (Bryson and Carter 1992, 1994; Bryson et al. 1996; Delahoussaye and Thieret 1967; Ferren and Schuyler 1980; Kral 1981; Mears and Libby 1995; Naczi 1984; Naczi et al. 1986; Sipple 1978; Snyder 1983, 1984; Sundell and Thomas 1988; Webb et al. 1981; Webb and Dennis 1981; Wunderlin 1982). Green kyllinga and *K. odorata* apparently have continued to spread northward and westward, especially as weeds of turf, pastures, and roadways (Bryson and Carter 1992, 1994; Bryson et al. 1996; Jones et al. 1993).

DESCRIPTION

The taxonomic history of *Kyllinga* is complex. It was treated as a subgenus of *Cyperus* by Kükenthal (1936). However, more recently it was recognized as a separate genus closely allied with *Cyperus* in the tribe Cypereae (Bruhl 1995; Goetghebeur 1986; Koyama 1985; Tucker 1984, 1987). The following combination of characteristics distinguishes *Kyllinga* from *Cyperus* (including *Pycreus, Mariscus, Juncellus*, and *Torulinum*): bicarpellate gynoecium with bifid style; bilaterally flattened achene with achene angle adjacent to rachilla axis; and spikelet basally articulated (entire spikelet separating as a unit at maturity).

The following is a general description of the genus *Kyllinga* based on Kükenthal (1936), Delahoussaye and Thieret (1967), and Tucker (1987). Culms are smooth, sharply or bluntly triangular in cross-section. There are one to five grasslike basal leaves with close-fitting sheathing bases, usually shorter than the culm. Leaf blades are flat or V-shaped in cross-section, with prominent midribs and finely toothed (especially distally) margins and keels. There are two to four leaflike inflorescence bracts, of varying length. Bracts are erect, spreading, or reflexed. Inflorescences are terminal, consisting of one to four sessile, densely ovoid, cylindrical, spherical, or dome-shaped spikes (heads). There are 15 to 150 spikelets per spike, ovate to lanceolate, flattened. The spikelet is subtended by a tiny scalelike bracteole and a prophyll. There are two true spikelet scales, the basal one fertile and the distal one usually sterile. The

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[3] Letters following this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available from WSSA, 810 East 10th Street, Lawrence, KS 66044-8897.

fertile scale is ovate, with two to four lateral nerves; a smooth, denticulate, or lacerate keeled midrib; and a mucronate or aristate apex. Sterile scale is reduced. Flowers are highly reduced, inconspicuous, and perfect. Perianth is lacking. There are one to three stamens, with linear ribbonlike filaments and linear to oblong-elliptic anthers. The style is threadlike. There are two stigmas about the same length as the style. Achene is lenticular, laterally compressed, narrowly ovoid to oblong or ellipsoid, usually about half as long as subtending scale, stipitate, the surface finely punctate.

Illustrations and a comparison of morphological features of *Kyllinga* species found in the continental United States are presented in Figure 1 and Table 2. A dichotomous key to the *Kyllinga* species of the continental United States follows.

1 Plants with rhizomes 2
  2 Scale keel toothed; spikes 3 to 7 mm diam, oval to oblong, one to three per inflorescence; stamen 1 ..... *K. brevifolia*
  2 Scale keel smooth; spikes 8 to 10 mm diam, spherical, one per inflorescence; stamens two to three ..... *K. gracillima*
1 Plants without rhizomes, cespitose 3
  3 Bracts strongly reflexed; spikes whitish; mature achene black; central spike cylindrical; keel of scale smooth to rarely denticulate ..... *K. odorata*
  3 Bracts spreading; spikes green; mature achene tan to brown; spikes ovoid to subglobose; keel of scale denticulate to lacerate 4
    4 Keel of scale denticulate; spikes 1 to 3, ovoid, 3 to 6 mm diam ..... *K. pumila*
    4 Keel of scale lacerate; spikes usually one (rarely to three), subglobose, 6 to 10 mm diam ..... *K. squamulata*

DISTRIBUTION, ECOLOGY, AND BIOLOGY

Green kyllinga, *K. gracillima, K. odorata,* and *K. squamulata* are pantropical species (Holm et al. 1979; Koyama 1985; Reed 1977; Tucker 1987) and were apparently all introduced into the continental United States from Asia. The time of introductions is unknown. Because of the small seed size, these species could have arrived by a variety of dispersal methods. Following introduction, these *Kyllinga* species were likely established along sandbars and disturbed areas along streams or in open ruderal sites with adequate moisture. Highly maintained, frequently irrigated turf in urban areas and on golf courses provides an excellent habitat for continued dispersal, range expansion, and localized proliferation of populations. Distribution maps for five species are shown in Figure 2. These maps are undoubtedly incomplete since certain species are expanding their ranges; e.g., *K. gracillima* has been reported new to nine states within the past two decades (Bryson and Carter 1994; Bryson et al. 1996; Ferren and Schuyler 1980; Kral 1981; Mears and Libby 1995; Naczi 1984; Naczi et al. 1986; Sipple 1978; Snyder 1983, 1984; Sundell and Thomas 1988; Webb et al. 1981; Webb and Dennis 1981).

Table 1. Nomenclature of *Kyllinga* species of the United States.

Kyllinga brevifolia Rottb., Green Kyllinga
Cyperus brevifolius (Rottb.) Endl.
Kyllinga gracillima Miq., False Green Kyllinga
Cyperus brevifolius (Rottb.) Hasskarl
Cyperus brevifolius (Rottb.) Endl. ex Hassk. var. *leiolepis* (Franch & Savigy) T. Koyama
Cyperus brevifolioides Delahoussaye & Thieret
K. brevifolioides (Delahoussaye & Thieret) Tucker, *nom. illeg.*
Kyllinga nemoralis (J. R. & G. Forst.) Dandy ex Hutchinson & Danziel, White Kyllinga
Cyperus kyllingia Endl.
Kyllinga odorata Vahl, Fragrant Kyllinga
Cyperus sesquiflorus (Torrey) Mattf. & Kükenth. ex Kükenth.
Kyllinga pumila Michaux, Tufted Kyllinga
Cyperus tenuifolius (Steudel) Dandy
Cyperus densicaespitosus Mattf. & Kükenth. ex Kükenth.
Cyperus densicaespitosus Mattf. & Kükenth. ex Kükenth. var. *major* (Nees) Kükenth.
Kyllinga tenuifolia Steudel
Kyllinga squamulata Thonn, ex Vahl, Cocks-comb Kyllinga
Cyperus metzii (Hochst. & Steudel) Mattf. & Kükenth. ex Kükenth.

Green kyllinga and *K. gracillima* are rhizomatous perennials, while *K. odorata, K. pumila,* and *K. squamulata* are annuals or short-lived perennials in warmer climates. Either whole plants, fragments, or seeds may be dispersed. All of these *Kyllinga* species produce many readily dispersed seeds. Whole plants or fragments, especially of green kyllinga and *K. gracillima,* are spread as contaminants in transported turfgrass sod and sprigs. A combination of frequent (often daily) irrigation and mowing frequency (three to six times per week) without removal of clippings, especially around golf course greens, enhances vegetative reproduction of perennial *Kyllinga* species (Yelverton 1996).

Our field observations indicate green kyllinga and *K. gracillima* produce culms that fruit below most turfgrass mowing heights (< 1.25 cm), resulting in a reproductive advantage over many other weeds. In addition, green kyllinga and *K. gracillima* spread rapidly in turf via rhizome growth. Several factors contribute to the increasing importance of *Kyllinga* species as weeds in the southeastern United States: (1) increased irrigation of turf; (2)

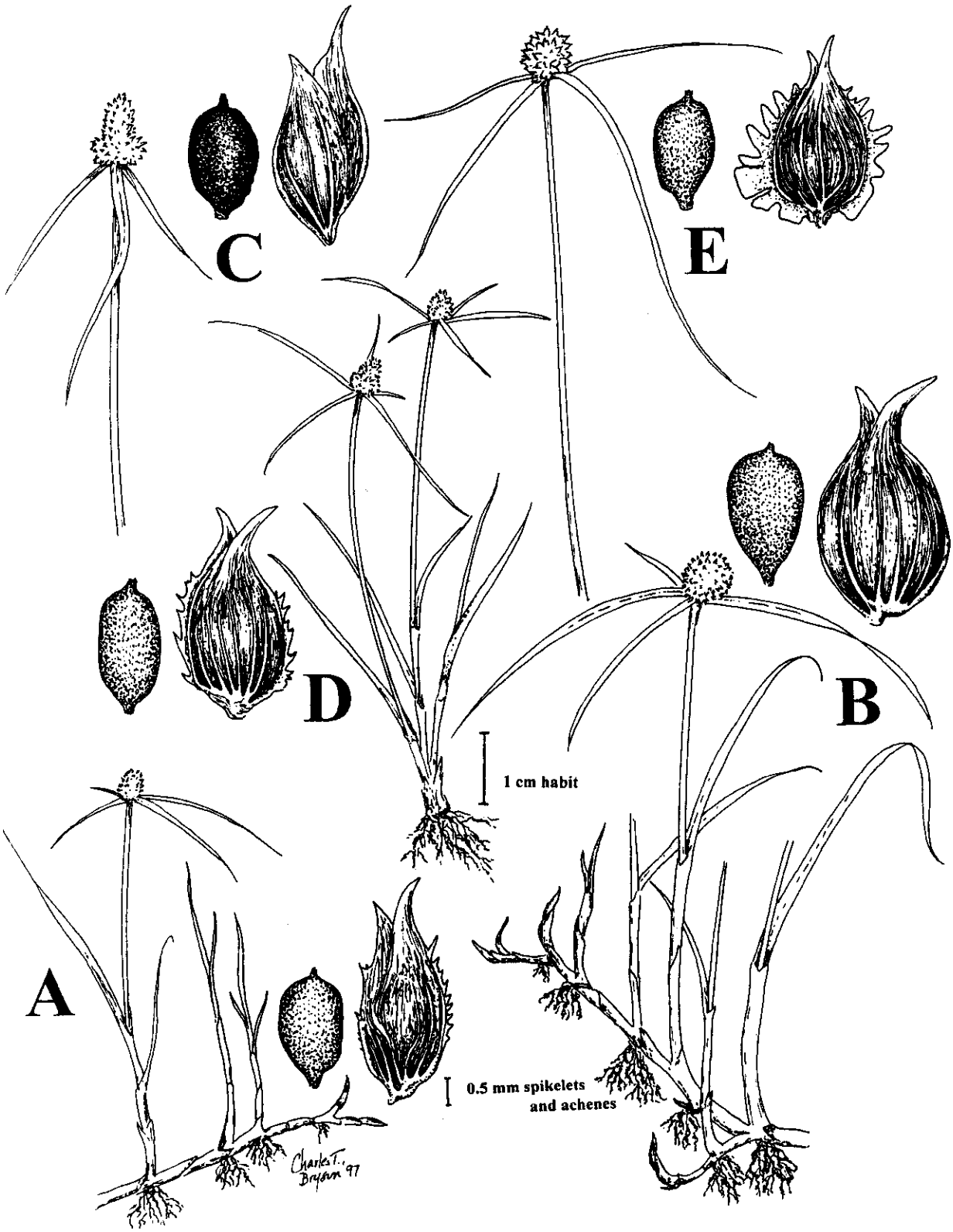

Figure 1. Achene, scale, and habit illustrations of *Kyllinga* species found in the continental United States: *K. brevifolia*—**A**; *K. gracillima*—**B**; *K. odorata*—**C**; *K. pumila*—**D**; and *K. squamulata*—**E**.

Table 2. Morphological comparison of *Kyllinga* species in the continental United States.

Character	*K. brevifolia*	*K. gracillima*	*K. odorata*	*K. pumila*	*K. squamulata*
Rhizomes	Present	Present	Absent	Absent	Absent
Culms[a]	15 to 40 cm tall	12 to 48 cm tall	5 to 30 cm tall	4 to 30 cm tall	6 to 36 cm tall
Inflorescences	1 to 3 heads, ovate to oblong, 3 to 8 mm long, 3 to 7 mm wide	Single head, round, 8 to 10 mm diam	1 to 3 heads, cylindrical or ovoid, 7 to 14 mm long, 5 to 7 mm wide	1 to 3 heads, ovoid, 3 to 7 mm long, 3 to 6 mm wide	1 (rarely to 3), subglobose, 6 to 10 mm diam
Bracts	Spreading	Spreading	Strongly reflexed	Spreading	Spreading
Spikelets	Green 2.1 to 3.2 mm long, 0.8 to 1.2 mm wide	Green, 3.5 to 4.6 mm long, 1.2 to 1.3 mm wide	Whitish, 2.4 to 3.2 mm long, 1.1 to 1.5 mm wide	Green, 1.8 to 3.3 mm long, 0.5 to 1.1 mm wide	Green, 2.5 to 4.5 mm long, 0.8 to 1.6 m wide
Scale keels	Denticulate	Smooth	Smooth or rarely denticulate	Denticulate	Lacerat, like a cocks comb
Achenes	Tan to deep reddish brown, broadly ovate to oblong (variable)	Tan to brown obovate	Purplish black, long ovate	Tan, oblong to oblong truncate	Brown, oblong to ovate, asymetrical
Stamens	1	2 to 3	2	1 or 2	2, rarely 1

[a] Culm height may vary greatly depending on mowing or competition with other plant species.

a change in timing of herbicide application; (3) use of different or new herbicides (i.e., reduced use of arsonate herbicides and increased use of preemergence herbicides that do not control sedges) (Yelverton 1996); (4) increased use of fertilizer; and (5) expansion in the turfgrass sod industry to meet the increasing demand for "instant," well-manicured lawns and golf courses.

Green kyllinga and *K. gracillima* are rhizomatous perennials, similar in appearance and difficult, if not impossible, to distinguish vegetatively (Yelverton 1996). Collections of fruiting specimens of *K. gracillima* are primarily from late August until frost, indicating this taxon's flowering is dependent upon photoperiod. The distribution of *K. gracillima* in the United States (Figure 2) suggests it can withstand cooler winter temperatures. Green kyllinga, *K. odorata, K. pumila,* and *K. squamulata* flower and produce fruits during the warm months throughout their ranges in the continental United States.

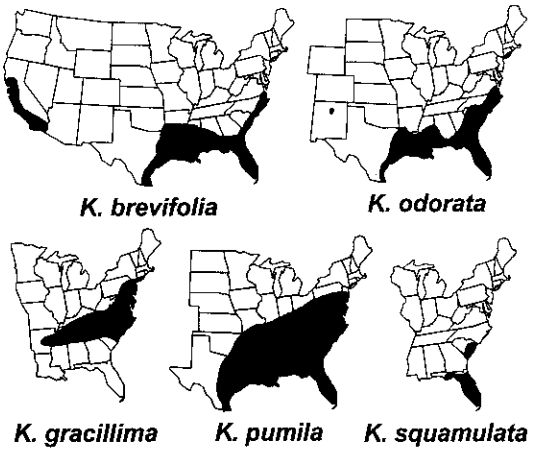

Figure 2. Distribution of *Kyllinga* species found in the continental United States.

Although *Kyllinga* species are not reported in agronomic field crops in the United States, Whitwell and Smith (1997) reported them as weeds of containerized nursery plants. *Kyllinga* species are also frequently found in lawns and highly mulched, frequently irrigated flower beds.

Of the *Kyllinga* species occurring in the continental United States, only green kyllinga has been assigned a computer code and common name in the *Composite List of Weeds.*[3] The common names false green kyllinga for *K. gracillima,* fragrant kyllinga for *K. odorata,* tufted kyllinga for *K. pumila,* and cocks-comb kyllinga for *K. squamulata* will be proposed to the WSSA Standardized Plant Names Subcommittee for consideration as WSSA-approved common names. These names are derived from habitat, biology, morphology, and other significant diagnostic characteristics.

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