Seven New Species and One New Combination in *Carex* (Cyperaceae) from North America

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ABSTRACT. Seven species in four sections of *Carex* are described as new from North America: *C. acidicola* Naczi, *C. calcifugens* Naczi, *C. paeninsulae* Naczi, E. L. Bridges & Orzell, and *C. thornei* Naczi (all sect. *Griseae*); *C. kraliana* Naczi & Bryson (sect. *Laxiflorae*); *C. gholsonii* Naczi & Cochrane (sect. *Granulares*); and *C. infirminervia* Naczi (sect. *Deweyanae*). *Carex acidicola, C. calcifugens, C. paeninsulae,* and *C. thornei,* all members of the *C. oligocarpa* complex, have distichous perigynia and purple-red shoot bases. *Carex acidicola,* from a few sites in Alabama and Georgia, is distinctive in having the bases of the proximal bract blades whitish. *Carex calcifugens* occurs in a few populations in Florida, Georgia, North Carolina, and South Carolina. It is characterized by having the purple-red coloration at the plant base less extensive than in other members of the *C. oligocarpa* complex, the vegetative shoots exceeding the reproductive ones, and by bearing the proximal-most spikes at the bases of the shoots. *Carex paeninsulae* is restricted to a few sites in Florida. It is unique in the *C. oligocarpa* complex in having relatively long rhizomes. *Carex thornei* occurs in a few sites in Alabama, Florida, and Georgia. It has short bract blades and terminal spikes with long peduncles. *Carex kraliana* is widespread and frequent throughout most of the southeastern United States. It is distinctive in its lanceolate or narrowly lanceolate, wide bract blades. *Carex gholsonii* occurs in Alabama, Florida, Georgia, North Carolina, and South Carolina. It is rare in all portions of its range except for parts of Florida. It is distinctive in being loosely caespitose, having short ligules, short bract blades, long and wide terminal spikes, and long perigynia. The chromosome number of *C. gholsonii,* determined from two populations in Florida, is 16 II + 1 IV. *Carex infirminervia* is widespread but infrequent throughout much of the western United States and western Canada. It is unique in its combination of papillose culms, long ligules, perigynium beaks occupying a high percentage of the perigynium length, and toothless or short-toothed perigynium apices. The new combination *C. digitalis* var. *floridana* (L. H. Bailey) Naczi & Bryson (*Carex* sect. *Careyanae*) is proposed to replace *C. digitalis* var. *asymmetrica* Fernald because of the priority of Bailey's epithet.

Key words: *Carex, Carex* sect. *Careyanae, Carex* sect. *Deweyanae, Carex* sect. *Granulares, Carex* sect. *Griseae, Carex* sect. *Laxiflorae,* Cyperaceae, North America.

Recent studies of North American sedges have resulted in the description of many new species, particularly for the southeastern United States and western North America. The southeastern U.S. hosts a great diversity of *Carex* (Cyperaceae) in a wide range of habitats. Tucker (1987) estimated 165 species of *Carex* for the region. Western North America also possesses a diverse array of *Carex* species. In this paper, we increase the number of known species of North American *Carex* by describing seven new species, six from the Southeast and one from the West. Four of these new species belong to *Carex* sect. *Griseae* (L. H. Bailey) Kükenthal, one belongs to *Carex* sect. *Laxiflorae* Kunth, one is a member of *Carex* sect. *Granulares* (O. Lang) Mackenzie, and one belongs to *Carex* sect. *Deweyanae* (Tuckerman ex Mackenzie) Mackenzie.

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We also propose one new combination in *Carex* sect. *Careyanae*.

Four New Species of *Carex* sect. *Griseae*

Carex sect. *Griseae* is a group of 21 species endemic to eastern North America. The center of diversity for the section is the southeastern United States, where 20 species occur. Most of them inhabit mesic deciduous forests.

Apomorphies diagnosing *Carex* sect. *Griseae* are the large number (usually 40 or more) of nerves (sclerenchyma traces) that are impressed in the surface of living and dried perigynia. Additional distinctive characters of the section, but not necessarily autapomorphic, are long-sheathing proximal bracts, usually unisexual spikes with only the terminal one staminate, and glabrous perigynia that are obtusely triangular or suborbicular in cross section and have entire orifices.

Carex oligocarpa Willdenow, *C. bulbostylis* Mackenzie, *C. edwardsiana* E. L. Bridges & Orzell, and *C. planispicata* Naczi constitute a morphologically distinctive lineage within *Carex* sect. *Griseae*. As identified by Naczi (1999a), members of this *C. oligocarpa* complex have distichously imbricate perigynia and purple-red coloration on the proximal (2.7–)3.0–12 cm of the shoot bases. Other members of *Carex* sect. *Griseae* have spirally imbricate perigynia and brown shoot bases or, if purple-red, the coloration is usually less than 3.7 cm high. Recent herbarium, field, and laboratory work by Naczi has resulted in the discovery of four new species within the *C. oligocarpa* complex, which are described below as *C. acidicola*, *C. calcifugens*, *C. paeninsulae*, and *C. thornei*. With these new species, the *C. oligocarpa* complex now contains eight species and becomes the largest species complex within *Carex* sect. *Griseae*. Members of this complex are also the most difficult to identify in *Carex* sect. *Griseae*. Most previous determinations of specimens of these new species were as *C. oligocarpa*. Each of these new species appears to be rare and quite limited in geographic distribution. The new species are distinguished from other members of the *C. oligocarpa* complex in the following key.

Key to Members of the *Carex oligocarpa* Complex (Members of *Carex* sect. *Griseae* with Distichous Perigynia and Purple-red Shoot Bases)

This key is designed for identification of complete and ample specimens bearing mature perigynia. Because collectors often fail to gather rhizomes of *C. paeninsulae*, this species is keyed twice to permit identification of incomplete specimens of it.

1a. Perigynia much inflated, orbicular or suborbicular in cross section, (1.8–)2.0–2.5(–2.8) mm wide, 1.6–2.0(–2.1) times as long as wide . . . . . *C. bulbostylis*
1b. Perigynia tightly enveloping achene or slightly inflated, obtusely triangular in cross section, 1.4–1.9(–2.3) mm wide, (1.8–)2.1–3.3 times as long as wide.
  2a. Loosely caespitose, longer rhizomes 10–58 mm long between shoots or branches of the rhizomes . . . . . *C. paeninsulae* sp. nov.
  2b. Densely caespitose, longer rhizomes 0.2–6(–8) mm long between shoots or branches of the rhizomes.
    3a. Proximal bracts with bases of blades white between veins (most easily seen on abaxial surfaces of blades) . . . . . *C. acidicola* sp. nov.
    3b. Proximal bracts with bases of blades uniformly green.
      4a. Perigynia (1.8–)2.1–2.6 times as long as wide, with bodies usually abruptly contracted near apices to beaks (0.4–)0.5–1.0 mm long; longest lateral spike with 4 to 8(10) perigynia (including undeveloped or aborted ones).
        5a. Proximal-most spike usually considerably above base of shoot, inflorescence 46–94(–99)% of culm height; vegetative shoots exceeded by culms or slightly exceeding culms, tallest vegetative shoot 0.88–1.4 times as tall as tallest culm; hyaline band of sheaths of proximal bracts apically convex and elongated (0.8–)1.1–4.0 mm beyond sheath apex . . . *C. oligocarpa*
        5b. Proximal-most spike usually at base of shoot, inflorescence (88–)94–99% of culm height; vegetative shoots usually greatly exceeding culms, tallest vegetative shoot (0.80–)1.4–4.4 times as tall as tallest culm; hyaline band of sheaths of proximal bracts apically concave or truncate.
          6a. Purple-red coloration at shoot base 2.7–5.2(–5.6) cm high; bodies of pistillate scales (2.2–)2.5–3.0 mm long; achene beaks (0.10–)0.20–0.30 mm long *C. calcifugens* sp. nov.
          6b. Purple-red coloration at shoot base (3.7–)4.7–11.7 cm high; bodies of pistillate scales 1.5–2.1(–2.5) mm long; achene beaks 0.05–0.10(–0.15) mm long . . . . . *C. edwardsiana*
      4b. Perigynia (2.4–)2.5–3.3 times as long as wide, with bodies gradually tapering to apices and thus beakless or with beaks 0.1–0.4 mm long; longest lateral spike with (5)7 to 14 perigynia (including undeveloped or aborted ones).
        7a. Perigynia (1.9–)2.0–2.3 times as long as achene bodies; achene beaks (0.3–)0.4–0.7 mm long . . . . . *C. planispicata*
        7b. Perigynia 1.7–2.0 times as long as achene bodies; achene beaks 0.1–0.3(–0.4) mm long.

8a. Longest (per plant) peduncle of terminal spike (2.2–)5.1–8.9(–10.4) cm long (for this measurement, include the portion of the peduncle enclosed in the sheath of the distal-most lateral spike); 2 distal-most lateral spikes usually widely separate, longest (per plant) internode between distal lateral spikes (5.3–)8.8–15.2 cm; vegetative shoots exceeded by culms or slightly exceeding culms, tallest vegetative shoot 0.5–1.3 times as tall as tallest culm . . . . . *C. thornei* sp. nov.

8b. Longest (per plant) peduncle of terminal spike 0.9–3.2(–6.8) cm long (for this measurement, include the portion of the peduncle enclosed in the sheath of the distal-most lateral spike); 2 distal-most lateral spikes usually approximate, longest (per plant) internode between distal lateral spikes 0.9–7.4(–9.8) cm; vegetative shoots greatly exceeding culms, tallest vegetative shoot 1.4–2.2 times as tall as tallest culm . . . . . *C. paeninsulae* sp. nov.

Carex acidicola Naczi, sp. nov. TYPE: U.S.A. Georgia: Clarke Co., ca. 5 air mi. SSE of center of Athens, ca. 0.5 mi. S of end of Rock and Shoals Rd., 20 May 1995, *R. F. C. Naczi 4741* (holotype, DOV; isotypes, GA, MICH, NCU, NY, US, VDB, herb. Bryson). Figure 1.

A ceteris speciebus *Carici oligocarpae* affinibus interveniis albis ad bases laminarum bractearum proximalium differt.

Perennial, densely caespitose. Rhizomes 0.2–6 mm long between shoots or branches of the rhizomes. Shoot bases purple-red to (3.2–)4.1–7.4 cm high. Culms 11–41 cm tall. Leaves of reproductive shoots with widest blade per plant (3.7–)4.3–5.5 mm wide, deep green except proximal ones proximally whitish. Vegetative shoots 26–42 cm tall, 0.72–1.3 times as tall as culms. Infructescences 8.8–36 cm long, 68–95% of culm height, with the spikes widely separate or the distal-most 2 spikes overlapping, the internode between the distal lateral spikes 1.4–13 cm long, the longest (per plant) internode between the distal lateral spikes 3.1–13 cm long; proximal bract blades proximally white between veins, hyaline band of adaxial face of sheath with apex truncate or concave or slightly convex and elongated to 1.3 mm beyond sheath apex; bract blade of distal-most lateral spike usually exceeding terminal spike but occasionally shorter than terminal spike, longest (per plant) bract blade of distal-most lateral spike 4.9–12 cm long. Spikes 2 to 5; terminal spike 12–49 mm long, (1.3–)2.1–4.0 mm wide, the longest per plant (21–)26–49 mm long, usually much exceeding distal-most lateral spike, on peduncle 14–98(–141) mm long, the longest peduncle per plant 18–98 (–141) mm long; lateral spikes 6–21 × 3.2–5.7 mm, entirely pistillate, (2)4- to 7(11)-flowered, the longest per plant 5- to 7(11)-flowered, the perigynia distichously imbricate, the internode between the proximal-most scales in the proximal-most spike 2.4–3.0 mm long, perigynia overlapping, with ratio of length of longest lateral spike per plant (in mm): number of perigynia = 2.0–2.4. Staminate scales 4.2–6.5 × 1.6–2.4 mm, obtuse or acute, awnless. Pistillate scales 2.8–4.8 × 1.6–2.1 mm; body (2.0–)2.3–2.9 mm long, with midrib prolonged as awn 0.6–2.8 mm long. Perigynia (3.7–)4.2–4.9 mm long, 1.6–1.9 mm wide, 2.3–2.7(–2.9) times as long as wide, 1.6–1.8(–1.9) times as long as achene bodies, ascending, obtusely triangular in cross section, nerves deeply impressed and 49 to 64, narrowly obovate or obovate or narrowly elliptic or elliptic in outline, gradually tapered from widest point to base, gradually tapered or somewhat abruptly tapered from widest point to apex, beakless or with straight beak; beaks 0–0.7(–0.9) mm long, 0–17% of perigynium length, vertical. Achenes 3.1–3.3 × 1.5–1.8 mm, faces tightly enveloped by perigynia, proximally abruptly contracted to stipe, distally abruptly contracted to minute beak; stipe 0.3–0.6 mm long, usually vertical; body 2.4–2.7 mm long; beak 0.20–0.30 mm long, vertical.

Carex acidicola is unique in the *C. oligocarpa* complex in having the proximal bracts with the bases of the blades white between the veins. This feature is seen most easily on the abaxial surface of the blades. All other members of the complex have bract blades that are uniformly green. The region of the blades that is whitish is limited to a small area at the very base of the bract blade (immediately distal to the sheath summit). In this region, the veins and tissues immediately flanking veins are green, whereas the intervenal spaces are contrastingly white. This whitish region occurs quite consistently on the proximal bracts of all specimens seen of *C. acidicola*, though it may be difficult to discern the contrast of white and green on older, faded specimens. Because the whitish region is limited in extent and consistent in appearance, it does not appear to be teratologic. Rather, it appears to be a regular, predictable character state of *C. acidicola*.

Carex acidicola is also distinctive in its relatively wide leaves (widest leaf blade per plant [3.7–]4.3–5.5 mm wide). All other members of the *C. oligocarpa* complex have the widest leaf blade 1.8–4.0

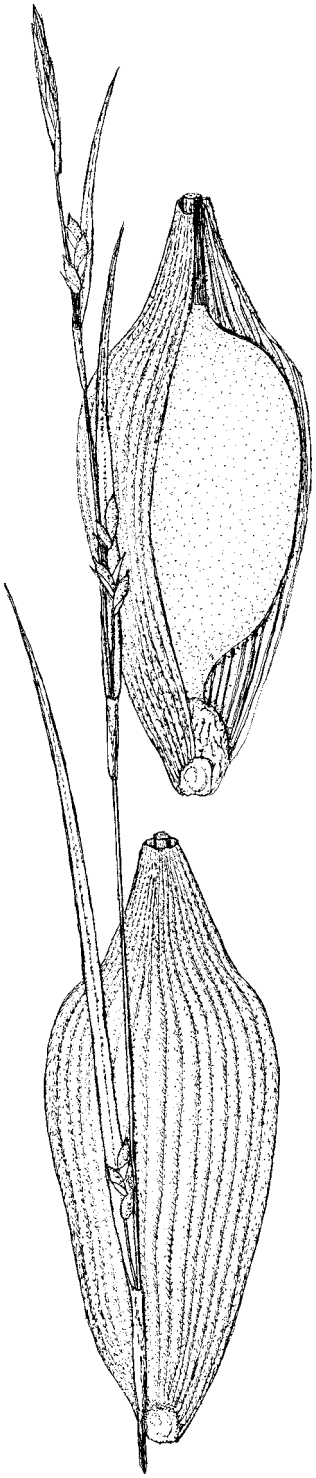

Figure 1. *Carex acidicola* Naczi. Distal portion of culm (× 0.9); abaxial view of perigynium in long section to reveal achene (upper), and abaxial view of whole perigynium (lower) (both × 17.5).

mm wide, except for *C. oligocarpa* (widest leaf blade 1.8–3.9[–4.6] mm wide), *C. paeninsulae* (3.0–4.6 mm wide), and *C. planispicata* ([3.0–]3.5–6.5 mm wide). Several features distinguish *C. acidicola* and *C. oligocarpa.* Besides different proximal bract blade coloration, *C. acidicola* has a shorter hyaline band of the adaxial face of the sheaths of the proximal-most bracts. In *C. acidicola,* the apex of the hyaline band is usually truncate or concave, but rarely elongated as much as 1.3 mm beyond the sheath apex. In *C. oligocarpa,* the apex of the hyaline band is convex and elongated (0.8–)1.1–4.0 mm beyond the sheath apex. Also, *C. acidicola* has perigynia with a higher length : width ratio (perigynia 2.3–2.9 times as long as wide in *C. acidicola* vs. 2.0–2.6 times as long as wide in *C. oligocarpa*). Differences between *C. acidicola* and *C. paeninsulae* include habit and rhizome length (densely caespitose, with rhizomes 0.2–6 mm long in *C. acidicola* vs. loosely caespitose and rhizomes 7–58 mm long in *C. paeninsulae*), and length of vegetative shoots relative to culms (vegetative shoots 0.72–1.3 times as tall as culms in *C. acidicola* vs. 1.4–2.2 times as tall as culms in *C. paeninsulae*). *Carex acidicola* differs from *C. planispicata* in three ways. First, *C. acidicola* has longer terminal spikes. The longest terminal spike per plant is (2.1–)2.6–4.9 cm long in *C. acidicola*, whereas it is 1.3–2.6(–3.0) cm long in *C. planispicata*. Second, perigynia of *C. acidicola* are 1.6–1.8(–1.9) times as long as the achene bodies versus (1.9–)2.0–2.3 in *C. planispicata.* Third, *C. acidicola* has the achene beaks 0.2–0.3 mm long versus (0.3–)0.4–0.7 mm long in *C. planispicata.*

Carex acidicola occurs disjunctly in three areas: central Alabama, central Georgia, and near the Chattahoochee River in easternmost Alabama and southwestern Georgia. It occurs in the Piedmont, Appalachian Plateaus, Ridge and Valley, and Coastal Plain. *Carex acidicola* is a very rare and local species, collected from only ten populations. The type and paratypes are all the specimens seen of *C. acidicola.* Few individuals occur at six of the seven populations studied by Naczi. Only at the type locality are plants relatively common.

Carex acidicola inhabits lightly shaded, acidic, humic, sandy loams in mesic forests. Vascular plants frequently associated with *C. acidicola* are *Aesculus sylvatica* Bartram, *C. superata* Naczi, Reznicek & B. A. Ford, *Carya* spp., *Cercis canadensis* L., *Hexastylis arifolia* (Michaux) Small, *Juniperus virginiana* L., and *Ostrya virginiana* (Miller) K. Koch. Unlike most of the other members of the *Carex oligocarpa* complex, notably the widespread and frequent *C. oligocarpa, C. acidicola* grows in acidic

soils rather than circumneutral ones. Whereas analyzed soils of eight populations of *C. oligocarpa* have pH values of 6.3–7.6, those of four populations of *C. acidicola* have pH values of 5.2–5.8. This apparent requirement for acidic substrates makes "*acidicola*" (literally, "acid-dweller") an appropriate epithet for this ecologically distinctive species.

Paratypes. U.S.A. **Alabama:** Bibb Co., 3.7 mi. NW of town of Sixmile, N of Little Cahaba River, 31 May 1997, *Naczi 6346 & MacDonald* (DOV); Lee Co., ca. 1.5 mi. N of Smiths Station, 24 Apr. 2002, *Naczi 9136* (DOV, MICH, MO, NY, VDB, herb. Bryson); Tuscaloosa Co., valley of Rocky Branch, 19 Apr. 1936, *Harper 3487* (GH, MO, NY, US); N side of Croton bluff on Warrior River, 16 Apr. 1959, *Harper 4437* (GA, UNA); NE from Tuscaloosa, along Black Warrior River, 10 Apr. 1992, *McKinney 4925 & Pittman* (DOV); ca. 1.5 mi. NW of Peterson, at Black Warrior River, 15 May 1995, *Naczi 4624* (DOV, MICH); ca. 9.5 mi. NE of center of Tuscaloosa, Rocky Branch Public Use Area, 29 Apr. 1996, *Naczi 5075* (DOV), 22 May 1996, *Naczi 5437 & Bryson* (DOV), 22 Apr. 1999, *Bryson 17073 & MacDonald* (DOV, MICH, VDB, WIN, herb. Bryson); ca. 6.5 mi. NE of center of Tuscaloosa, near Hurricane Creek, 1 June 1997, *Naczi 6368* (DOV). **Georgia:** Clarke Co., type locality, 29 Apr. 1981, *Manhart 234* (DOV, herb. Bryson), 10 May 1986, *Naczi 1065 & Manhart* (DOV, MICH), 24 May 1988, *Naczi 1968* (FLAS, FSU, GA, DOV, MICH, UNA, herb. Bryson); Decatur Co., above Lake Seminole, 27 May 1984, *Saucier s.n.* (herb. Bryson); DeKalb Co., Stone Mountain, 27 Apr. 1929, *Miller 275 & Maguire* (BH, CU); Early Co., W of Hilton, bluff along Chattahoochee River, 14 May 1947, *Thorne 3886* (CU); opposite Columbia, Alabama, bluffs of Chattahoochee, 11 Apr. 1977, *Kral 59607* (DOV, VDB); Walton Co., ca. 1 mi. E of Walnut Grove, 24 May 1988, *Naczi 1967* (MICH), 20 May 1995, *Naczi 4745* (DOV, MICH).

Carex calcifugens Naczi, sp. nov. TYPE: U.S.A. Georgia: Screven Co., Blue Springs, Blue Springs Landing on Savannah River, 2 May 1991, *R. F. C. Naczi 2840* (holotype, DOV; isotypes, FLAS, FSU, GA, GH, MICH, MO, NCU, NY, PH, TENN, UNA, US, USCH, VDB, VPI, VSC, WIN, herb. Bryson). Figure 2.

A *Carice oligocarpa* spica infima plerumque e basi culmi portata, foliis surculorum vegetativorum culmos plerumque superantibus, vitta hyalina adaxiali vaginae bracteae infimae ad apicem truncata vel concava differt; a *Carice edwardsiana* basibus surculorum atrovinosis usque 2.7–5.2(–5.6) cm tantum altis, corporibus squamarum pistillatarum longioribus, rostris acheniorum longioribus differt.

Perennial, densely caespitose. Rhizomes 0.2–7 mm long between shoots or branches of the rhizomes. Shoot bases sparingly purple-red to 2.7–5.2(–5.6) cm high. Culms 14–37 cm tall. Leaves of reproductive shoots with widest blade per plant 2.6–4.0 mm wide, green. Vegetative shoots 23–45 cm tall, (0.8–)1.4–1.6 times as tall as culms. In-

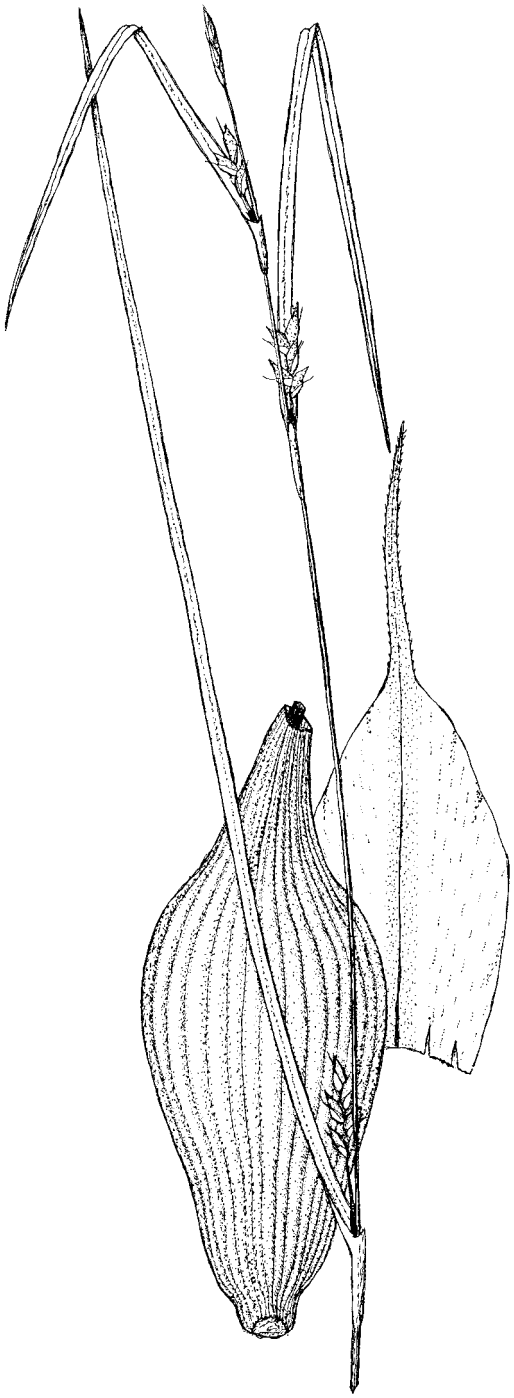

Figure 2. *Carex calcifugens* Naczi. Distal portion of culm (× 0.9); lateral view of perigynium and pistillate scale (both × 17.5).

fructescences 19–34 cm long, (88–)94–99% of culm height, with the spikes separate or the distal-most 2 to 3 spikes overlapping, the internode between the distal lateral spikes (1.0–)2.6–12 cm long, the longest (per plant) internode between the distal lateral spikes 5.2–12 cm long; proximal bract blades uniformly green, hyaline band of adaxial face of sheath with apex truncate or concave; bract blade of distal-most lateral spike exceeding terminal spike, longest (per plant) bract blade of distal-most lateral spike 6.1–15 cm long. Spikes 4 to 5; terminal spike 8–35 × 1.4–2.5 mm, the longest per plant 14–35 mm long, exceeding distal-most lateral spike, on peduncle 3.1–54(–73) mm long, the longest peduncle per plant 17–54(–73) mm long; lateral spikes 11–17 × 4.5–8.5 mm, entirely pistillate, 2- to 8-flowered, the longest per plant 5- to 8-flowered, the perigynia distichously imbricate, the internode between the proximal-most scales in the proximal-most spike 3.0–4.3 mm long, perigynia overlapping, with ratio of length of longest lateral spike per plant (in mm): number of perigynia = 2.2–2.4. Staminate scales 4.3–5.8 × 1.4–1.9 mm, usually acute but occasionally obtuse, awnless. Pistillate scales 3.6–5.7 mm long, 1.8–2.1(–2.4) mm wide; body (2.2–)2.5–3.0 mm long, with midrib prolonged as awn 1.0–3.2 mm long. Perigynia (3.7–)3.9–5.0 mm long, 1.6–2.0(–2.1) mm wide, 2.1–2.5(–2.7) times as long as wide, 1.5–2.0 times as long as achene bodies, ascending, obtusely triangular in cross section, nerves deeply impressed and 48 to 63, obovate or narrowly obovate in outline, gradually tapered from widest point to base, abruptly tapered from widest point to straight or slightly excurved beak; beaks (0.4–)0.6–1.0 mm long, 8.3–21% of perigynium length, vertical or bent 10–30° from vertical. Achenes 2.6–3.4 × 1.4–1.9 mm, faces tightly enveloped by perigynia, proximally abruptly contracted to stipe, distally abruptly contracted to minute beak; stipe 0.2–0.5(–0.7) mm long, vertical; body 2.0–2.6 mm long; beak (0.10–)0.20–0.30 mm long, vertical.

Carex calcifugens is morphologically most similar to *C. edwardsiana* and *C. oligocarpa.* All three of these species have a densely caespitose habit, the widest leaf blade per plant 1.8–4.0 mm wide, the longest pistillate spike 4- to 8(10)-flowered, perigynia usually 2.1–2.6 times as long as wide, perigynium bodies abruptly contracted to beaks (0.4–)0.5–1.0 mm long, and perigynia 1.5–2.0 times as long as the achene bodies. As indicated in the key, *C. calcifugens* shares several features with *C. edwardsiana* that distinguish both of these species from *C. oligocarpa*: the infructescence with the proximal-most spike usually at the base of the plant, vegetative shoots usually greatly exceeding culms, and hyaline bands of sheaths of proximal-most bracts apically truncate or concave. *Carex calcifugens* differs from *C. edwardsiana* in having the purple-red coloration of the shoot bases less extensive, longer bodies of the pistillate scales, and longer achene beaks.

Carex calcifugens ranges from eastern North Carolina south to northern Florida, strictly on the Coastal Plain. It is rare and very local. The type and paratypes are all the specimens examined of *C. calcifugens.* The total number of documented populations is about 18. Most populations seen consisted of fewer than 20 individuals. At the type locality, however, the plants were relatively numerous. The plants usually occur on slopes above streams in mesic deciduous forests with diverse herbaceous and woody angiosperm communities. Specimen labels indicate *C. oligocarpa* also occurs in maritime woodlands. Frequent vascular plant associates of *C. calcifugens* are *Aesculus pavia* L., *Carex abscondita* Mackenzie, *C. striatula* Michaux, *Cercis canadensis, Cornus florida* L., *Fagus grandifolia* Ehrhart, *Hexastylis arifolia, Polystichum acrostichoides* (Michaux) Schott, and *Sanguinaria canadensis* L. The substrates for four studied populations are well-drained sandy loams, loamy sands, and sands. Analyses of the soils in the immediate vicinity of the roots of *C. calcifugens* at these sites reveal low levels of calcium (calcium concentration at four sites = 473–920 ppm). Since several of the populations occur over shell mounds and deposits of fossil shells, it is likely the paucity of calcium is due to leaching. The epithet "*calcifugens*" ("calcium-fleeing") is fitting for this new species because of its affinity for calcium-poor soils, in contrast to its close relatives *C. oligocarpa* and *C. edwardsiana,* which are calciphiles (calcium concentration at eight sites of *C. oligocarpa* = 840–5937 ppm, calcium concentration at four sites of *C. edwardsiana* = 5937–6190 ppm, Naczi, unpublished data).

Paratypes. U.S.A. **Florida:** Leon Co., near Tallahassee, 8 Apr. 1910, *Harper 65* (GH, MIN, NY); ca. 2 mi. ESE of Tallahassee, 26 Apr. 1925, *Harper 30* (BH, GH, ILL, NY, PH, US); Liberty Co., Allen [Alum] Bluff of Apalachicola River, 11 Apr. 1931, *Palmer 38537* (GH, MO, NY); ca. 6 mi. NE of Bristol, 11 May 1989, *Orzell & Bridges 9716* (DOV, MICH), 1 Apr. 1990, *Orzell & Bridges 13061* (DOV, MICH), 14 Apr. 1990, *Orzell & Bridges 13155* (DOV, MICH). **Georgia:** Baker Co., E side of Ichauwaynochaway Creek, Ichauway Plantation, 11 Apr. 1986, *Gholson 11599* (FLAS, herb. Bryson); Burke Co., E of McBean, Shell Bluff Landing, 10 Apr. 1938, *Clausen & Trapido 3389* (BH, CU, OKL), 10 Apr. 1938, *Pyron & McVaugh 2502* (FSU, GA); 7 mi. NE of Shell Bluff, near

Savannah River, 18 May 1989, *Naczi 2191* (DOV, GA, MICH, MO, NY, VDB, herb. Bryson), 5 June 1990, *Naczi 2532* (MICH), 25 May 1999, *Morris 4525 & Patrick* (DOV, herb. Bryson); ca. 3 mi. E of Waynesboro, along Brier Creek, 18 May 1989, *Naczi 2195* (DOV); Early Co., N of Blakely, Colomokee Mounds State Park, 4 Apr. 1948, *Thorne 7971 & Muenscher* (CU, GA, GEO, GH); Effingham Co., N of Clyo, along the Savannah River, 21 Apr. 1962, *Ahles 56549 et al.* (NCU), 2 May 1991, *Naczi 2833* (DOV). **North Carolina:** Brunswick Co., Smith Island, May 1894, *Ashe s.n.* (NCU); Carteret Co., near Lenoxville, 11 Apr. 1898, *Ashe s.n.* (FSU, MICH, NCU); near Shackleford Pt., 11 Apr. 1898, *Ashe s.n.* (NCU); 1.2 km from the W end of Shackleford Island, 20 May 1990, *Peet 6794 & Larke* (NCU); Dare Co., near Cape Hatteras, 16 June 1898, *Ashe s.n.* (NCU); Buxton Woods, 23 May 1954, *Radford 8116* (NCU). **South Carolina:** Aiken Co., Savannah River Site, Compartment 48, Stand 37, 13 May 1993, *Stanford 152* (USCH); Savannah River Site, slope of Upper Three Runs Creek, 10 June 1994, *Hyatt 6085* (DOV, MICH); Savannah River Plant, compartment 31, near Tyler Rd., along Tinker Creek, 28 Apr. 2000, *Pittman 04280007 & Darr 313* (DOV, MO, USCH, herb. Bryson); Allendale Co., Savannah River Operations Area of the Atomic Energy Commission, 6 Apr. 1953, *Batson & Kelley s.n.* (USCH); Barnwell Co., Savannah River Plant, along Lower Three Runs Creek, 28 Apr. 2000, *Pittman 04280031 & Darr 337* (DOV, USCH); Charleston Co., Edisto State Park, 9 Apr. 1994, *Pittman 04099405* (MICH, USCH); Dorchester Co., SW of Summerville, near Ashley River, 27 May 1957, *Ahles 26411 & Haesloop* (NCU), 19 Apr. 1962, *Radford 44505* (FSU, GA, GH, NCU, NY, VDB), 25 May 1988, *Naczi 1970* (DOV, FLAS, MICH, MO, NY, USCH, VDB, WIN, herb. Bryson), 6 June 1990, *Naczi 2534* (MICH); Orangeburg Co., S end of Santee State Park, 19 May 1997, *Pittman 05199703* (DOV, MICH, USCH).

Carex paeninsulae Naczi, E. L. Bridges & Orzell, sp. nov. TYPE: U.S.A. Florida: Clay Co., ca. 1 mi. N of Green Cove Springs, Magnolia Springs, 0.4 mi. N of rte. 17, W of Haven Avenue and S of stream, 20 Apr. 1991, *R. F. C. Naczi 2770* (holotype, DOV; isotypes, FLAS, FSU, GA, GH, MICH, MO, NY, VDB, WIN, herb. Bryson). Figure 3.

Carex grisea var. *angustifolia* Boott, Illustr. Genus *Carex* 34. 1858. TYPE: U.S.A. Florida: [no additional locality data], [no date], *Chapman s.n.* (lectotype, designated here, K; isolectotype, K).

A ceteris speciebus *Carici oligocarpa*e affinibus rhizomatibus longioribus differt.

Perennial, loosely caespitose. Rhizomes 7–58 mm long between shoots or branches of the rhizomes. Shoot bases purple-red to 4.8–11.4 cm high. Culms 8.9–39 cm tall. Leaves of reproductive shoots with widest blade per plant 3.0–4.6 mm wide, green. Vegetative shoots 33–59 cm tall, 1.4–2.2 times as tall as culms. Infructescences 8.1–29 cm long, 73–95% of culm height, with the distalmost 2 to 3 spikes overlapping or rarely all spikes separate, the internode between the distal lateral spikes 0.4–7.4(–9.8) cm long, the longest (per plant) internode between the distal lateral spikes 0.9–7.4(–9.8) cm long; proximal bract blades uniformly green, hyaline band of adaxial face of sheath with apex truncate or concave; bract blade of distalmost lateral spike exceeding terminal spike, longest (per plant) bract blade of distal-most lateral spike 3.2–9.5 cm long. Spikes 4 to 6; terminal spike 14–38 × 1.2–2.1 mm, the longest per plant 17–38 mm long, exceeding distal-most lateral spike, on peduncle 3.0–32(–68) mm long, the longest peduncle per plant 8.7–32(–68) mm long; lateral spikes 7–20 × 3.5–4.8 mm, entirely pistillate, 2- to 12-flowered, the longest per plant (5)7- to 12-flowered, the perigynia distichously imbricate, the internode between the proximal-most scales in the proximalmost spike 2.4–3.5 mm long, perigynia overlapping, with ratio of length of longest lateral spike per plant (in mm) : number of perigynia = 1.8–2.5. Staminate scales 3.9–4.8 × 1.2–1.8 mm, acute, awnless or awned with awn up to 2.2 mm long. Pistillate scales 2.5–4.2 × 1.4–2.2 mm; body 1.5–2.4 mm long, with midrib prolonged as awn 0.4–2.4 mm long. Perigynia 4.1–4.7 × 1.4–1.6 mm, 2.7–3.1 times as long as wide, 1.8–1.9 times as long as achene bodies, ascending, obtusely triangular in cross section, nerves deeply impressed and 49 to 66, narrowly obovate in outline, gradually tapered from widest point to base, gradually tapered from widest point to apex, beakless or with straight beak; beaks 0–0.4 mm long, 0–10% of perigynium length, vertical. Achenes 2.9–3.4 × 1.3–1.4 mm, faces tightly enveloped by perigynia, proximally abruptly contracted to stipe, distally abruptly contracted to minute beak; stipe 0.5–0.6 mm long, vertical; body 2.2–2.6 mm long; beak 0.10–0.30 mm long, vertical.

Carex paeninsulae is unique in the *C. oligocarpa* complex in its loosely caespitose habit as a result of relatively long rhizomes (longer rhizomes 10–58 mm long between shoots or branches of the rhizome in *C. paeninsulae*). Other members of the complex are densely caespitose, with rhizomes short (0.2–8 mm long between shoots or branches of the rhizome). *Carex paeninsulae* differs from *C. oligocarpa* in having vegetative shoots greatly exceeding the culms (vegetative shoots 1.4–2.2 times as tall as culms in *C. paeninsulae* vs. 0.88–1.4 times as tall as culms in *C. oligocarpa*), hyaline bands of adaxial faces of sheaths of proximal-most bracts truncate or concave at their apices (convex and elongated 0.8–4.0 mm beyond the sheath apex in *C. oligocarpa*), and perigynia with a higher length : width ratio

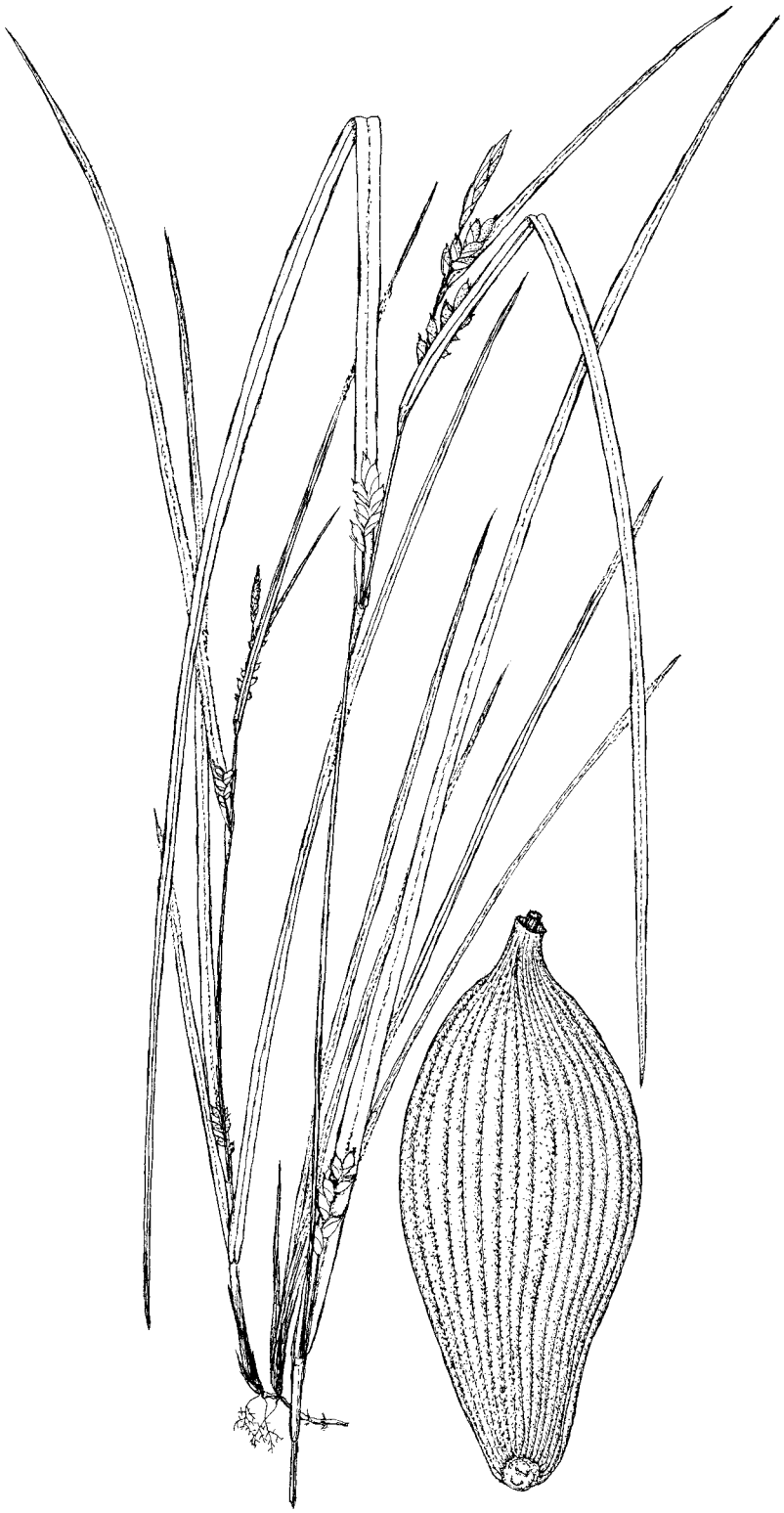

Figure 3. *Carex paeninsulae* Naczi, E. L. Bridges & Orzell. Habit (left; × 0.45); distal portion of culm (middle; × 0.9); and perigynium, lateral view (right; × 17.5).

(perigynia 2.7–3.1 times as long as wide in *C. paeninsulae* vs. 2.0–2.6 times as long as wide in *C. oligocarpa*). *Carex paeninsulae* is similar to *C. calcifugens* and *C. edwardsiana* in having the vegetative shoots exceeding the culms, but differs from those species in perigynia with a higher length : width ratio (perigynia 2.7–3.1 times as long as wide in *C. paeninsulae* versus 1.9–2.5[–2.7] times as long as wide in *C. calcifugens* and *C. edwardsiana*). In addition, *C. paeninsulae* has the purple-red coloration extending higher on the bases of the plants than in *C. calcifugens*: to 4.8–11.4 cm high in *C. paeninsulae* versus to 2.7–5.2(–5.6) cm high in *C. calcifugens*. Furthermore, *C. paeninsulae* has shorter bodies of the pistillate scales than *C. calcifugens*: 1.5–2.4 mm long in *C. paeninsulae* versus (2.2–) 2.5–3.0 mm long in *C. calcifugens*. Relative to *C. edwardsiana*, *C. paeninsulae* has longer achene beaks. In *C. paeninsulae*, these beaks are 0.10–0.30 mm long versus 0.05–0.10(–0.15) mm long in *C. edwardsiana*.

Carex paeninsulae occurs in the northern half of peninsular Florida, strictly on the Coastal Plain. It is rare and local, collected from only about 16 populations. The type and paratypes represent all the collections we have examined of this species. Plants grow in sandy loams in mesic deciduous forests in hardwood hammocks. Frequent vascular plant associates of *C. paeninsulae* include *Arisaema dracontium* (L.) Schott, *Carpinus caroliniana* Walter, *Liquidambar styraciflua* L., *Magnolia grandiflora* L., *Quercus virginiana* Miller, *Ruellia caroliniensis* (J. F. Gmelin) Steudel, *Sabal minor* (Jacquin) Persoon, and *S. palmetto* Schultes & Schultes. Because of its apparent restriction to the peninsula of Florida, "*paeninsulae*" is an appropriate epithet for this new species.

Edwin Bridges and Steve Orzell supplied numerous specimens and habitat notes to Robert Naczi for his description of *Carex paeninsulae*. In return, Naczi has complied with their request to be included as authors of the description.

Carex grisea var. *angustifolia*, as lectotypified here, is a synonym of *C. paeninsulae*. Though fragmentary, the lectotype possesses several features that are diagnostic of *C. paeninsulae*: a relatively long portion of a rhizome, a vegetative shoot that exceeds its associated culm, the longest peduncle of the terminal spike 24 mm long, the longest lateral spike with 8 perigynia, and perigynia with a length : width ratio of 2.8. Boott's syntypes of *Carex grisea* var. *angustifolia* are a mixture of *C. paeninsulae*, *C. bulbostylis*, and *C. corrugata* Fernald. For the lectotype, Naczi has chosen the specimen that best matches Boott's description (Boott, 1858: 35), especially ". . . perigyniis minus turgidis, apice saepe subrostellatis . . . ," which are more characteristic of *C. paeninsulae* than *C. bulbostylis* or *C. corrugata*. The lectotype is also the syntype that Boott illustrated for *C. grisea* var. *angustifolia* (Boott, 1858, pl. 87).

Paratypes. U.S.A. **Florida:** [county unknown], "Florida" [no additional data], 1859, *Chapman s.n.* (GH); [Bradford] Co., Mount Vernon, 1838, *Chapman 8* (NY); Clay Co., type locality, 5 May 1990, *Naczi 2373* (DOV, MICH); [Duval] Co., Island of Fort George, 1817, *Baldwin s.n.* (NY); St. Johns, [no date, but most likely 1817—see Darlington, 1843], *Baldwin s.n.* (PH); Gilchrist ["Levy" on label] Co., 1 mi. N of Trenton, 31 Mar. 1957, *Kral 4385* (FLAS, FSU, GH, MSC, VDB); Hernando Co., near Pineola, fern grottoes, 12 Apr. 1923, *Small 10835 & Mosier* (NY); Annutteliga Hammock, 26 Mar. 1958, *Cooley 5807 & Eaton* (FSU, GH, USF); Pineola Grotto, N of Brooksville near Istachatta, 8 Mar. 1977, *Wunderlin 5751* (USF); ca. 5 mi. N of Brooksville on rte. 41, 14 Apr. 1994, *Libby, Mears & Abbott s.n.* (DOV, MICH); ca. 6 air mi. NE of Brooksville, W side US 41, 12 Apr. 1994, *Orzell & Bridges 22634* (FTG, DOV, USF); Levy Co., Waccasassa Bay State Preserve, along boundary N of Turtle Creek, 12 Apr. 1996, *Abbott 8382* (DOV, FLAS); Marion Co., 4 mi. W of Anthony, 2 Apr. 1950, *Blake s.n. & Lewis* (FLAS); E side of Silver Springs, 13 Mar. 1976, *Kral 57220* (DOV, VDB); N side of US 27, ca. 1.6 mi. SE of junction with rte. 326 at Blichton, 28 Mar. 1993, *Orzell & Bridges 21348* (DOV), 8 May 1993, *Orzell & Bridges 21691* (FTG, DOV, MICH, US, USF); N side of US 27, ca. 1.8 mi. SE of junction with rte. 326 at Blichton, 28 Mar. 1993, *Orzell & Bridges 21352* (DOV, FTG, MICH, NY, US, USF, herb. Bryson); ca. 3.1 air mi. N of Flemington, 17 Apr. 1993, *Orzell & Bridges 21603* (US, FTG, DOV, MICH, USF); ca. 0.8 air mi. NNW of junction of rte. 318 and US 301 in Citra, 17 Apr. 1993, *Orzell & Bridges 21624* (FTG, DOV); 3.2 air mi. SW of Belleview, 18 Apr. 1993, *Orzell & Bridges 21626* (FLAS, FSU, FTG, DOV, MICH, NY, US, herb. Bryson); Seminole Co., near Oviedo, Black Hammock, 12 Apr. 1975, *Wunderlin 5456 & Poppleton* (USF); Sumter Co., ca. 2.2 mi. ENE of Linden, 15 Mar. 1992, *Orzell & Bridges 19167* (DOV, FLAS, FSU, FTG, GA, MICH, MO, NCU, NY, US, herb. Bryson); Suwannee Co., ca. 10.3 air mi. NW of Live Oak, on Suwannee River across from mouth of Alapaha River, 21 Mar. 1991, *Orzell & Bridges 16145* (FTG, MICH).

Carex thornei Naczi, sp. nov. TYPE: U.S.A. Alabama: Russell Co., 2.0 road mi. SW of Holy Trinity, along E side of rte. 165, along S side of Bluff Creek, 3 May 1996, *R. F. C. Naczi 5214* (holotype, DOV; isotypes, MICH, MO, NY, US, WIN, herb. Bryson). Figure 4.

A ceteris speciebus *Carici oligocarpa*e affinibus laminis bractearum brevibus, pedunculo spicae terminalis longo, perigyniis (2.4–)2.5–3.1plo longioribus quam latioribus differt.

Perennial, densely caespitose. Rhizomes 0.8–6.4 mm long between shoots or branches of the rhi-

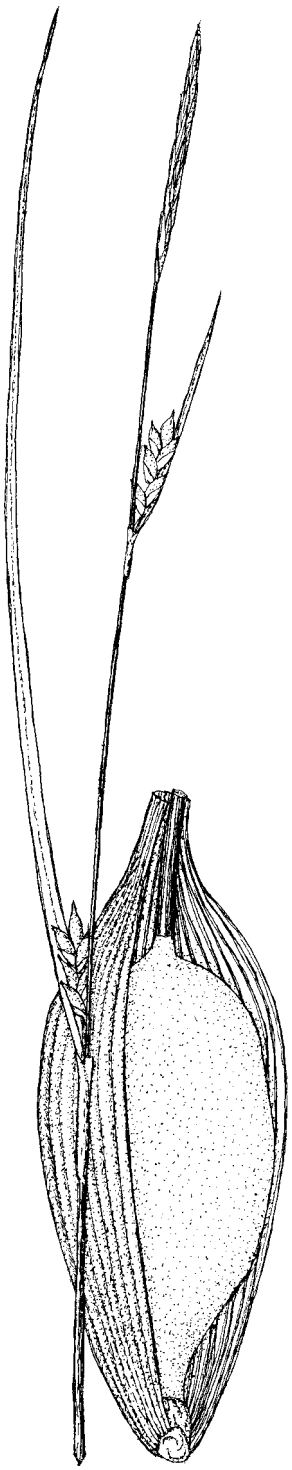

Figure 4. *Carex thornei* Naczi. Distal portion of culm (× 0.9); lateral view of perigynium in long section to reveal achene (× 17.5).

zomes. Shoot bases purple-red to 4.8–8.1 cm high. Culms 24–53 cm tall. Leaves of reproductive shoots with widest blade per plant 2.1–4.0 mm wide, green. Vegetative shoots 28–49 cm tall, 0.54–1.3 times as tall as culms. Infructescences 13–38 cm long, 77–96% of culm height, with the spikes usually separate or occasionally the distal-most 2(–3) spikes overlapping, the internode between the distal lateral spikes (1.6–)3.4–15.2 cm long, the longest (per plant) internode between the distal lateral spikes (5.3–)8.8–15.2 cm long; proximal bract blades uniformly green, hyaline band of adaxial face of sheath with apex usually truncate or concave but occasionally convex and elongated to 2.2(–5.0) mm from sheath apex; bract blade of distal-most lateral spike slightly exceeding terminal spike or exceeded by terminal spike, longest (per plant) bract blade of distal-most lateral spike 3.9–11 cm long. Spikes 4 to 5; terminal spike 16–36 × 1.9–2.5 mm, the longest per plant 17–36 mm long, exceeding distal-most lateral spike, on peduncle 3.4–89(–104) mm long, the longest peduncle per plant (22–)51–89(–104) mm long; lateral spikes 5–21 × 3.2–4.1 mm, entirely pistillate, 3- to 12-flowered, the longest per plant 6- to 12-flowered, the perigynia distichously imbricate, the internode between the proximal-most scales in the proximal-most spike 1.7–2.9 mm long, perigynia overlapping, with ratio of length of longest lateral spike per plant (in mm) : number of perigynia = 1.8–2.1. Staminate scales 4.3–5.0 × 1.4–1.8 mm, usually acute but occasionally obtuse, awnless. Pistillate scales 3.0–4.6 × 1.6–2.0 mm; body 1.6–2.6 mm long, with midrib prolonged as awn 1.1–2.5 mm long. Perigynia 3.8–4.9 × 1.4–1.7 mm, (2.4–)2.5–3.1 times as long as wide, 1.7–2.0 times as long as achene bodies, ascending, obtusely triangular in cross section, nerves deeply impressed and 53 to 64, narrowly obovate or narrowly oblong in outline, gradually tapered from widest point to base, gradually tapered from widest point to apex, beakless or with straight beak; beaks 0–0.4 mm long, 0–11% of perigynium length, vertical. Achenes 2.6–3.5 × 1.3–1.6 mm, faces tightly enveloped by perigynia, proximally abruptly contracted to stipe, distally abruptly contracted to minute beak; stipe 0.2–0.6 mm long, vertical; body 2.1–2.7 mm long; beak 0.1–0.4(–0.5) mm long, vertical.

Carex thornei is unique in the *C. oligocarpa* complex in its combination of short bract blades (longest distal-most bract blade per plant 3.9–11 cm long), long peduncles of the terminal spikes (longest peduncle of terminal spike per plant [22–]51–89[–104] mm long), and high length : width ratio of

perigynia (perigynia [2.4–]2.5–3.1 times as long as wide). Morphologically, it is most similar to *C. oligocarpa* and *C. planispicata*. *Carex thornei* differs from *C. oligocarpa* in having shorter bract blades (longest distal-most bract blade per plant [4.9–]9.2–14 cm long in *C. oligocarpa*), longer peduncles of the terminal spikes (9.8–49[–104] mm long in *C. oligocarpa*), perigynia with a higher length:width ratio (perigynia 2.0–2.6 times as long as wide in *C. oligocarpa*), and perigynia beakless or indistinctly beaked with beaks to 0.4 mm long (*C. oligocarpa* has distinctly beaked perigynia with beaks [0.4–]0.5–1.0 mm long). From *C. planispicata*, *C. thornei* differs by having longer peduncles of the terminal spikes (longest peduncle of terminal spike per plant 2.4–49 mm long in *C. planispicata*), the perigynia shorter relative to the achene bodies (perigynia 1.7–2.0 times as long as achene bodies in *C. thornei* vs. [1.9–]2.0–2.3 times as long as the achene bodies in *C. planispicata*), and shorter achene beaks (0.1–0.4[–0.5] mm long in *C. thornei* vs. [0.3–]0.4–0.7 mm long in *C. planispicata*).

Carex thornei is a narrow endemic of the lower Chattahoochee River–lower Flint River–upper Apalachicola River drainage in the region near the junction of the borders of Alabama, Florida, and Georgia. It occurs on the Coastal Plain, from the Fall Line south to Liberty County, Florida, a distance of only about 225 km (140 mi.). Within this region, it is sometimes frequent, but local. The paratypes cited below represent most of the known populations of the species. *Carex thornei* occurs in mesic deciduous forests, usually on the upper portions of floodplains and adjacent slopes, in sandy loams. Frequent associates include *Carex abscondita*, *C. basiantha* Steudel, *Cercis canadensis*, *Fagus grandifolia*, and *Hexastylis arifolia*.

Carex thornei has an unusual pattern of endemism, but not unique. Other species of flowering plants that are endemic to the region of the lower Chattahoochee, lower Flint, and upper Apalachicola rivers include *Rhododendron prunifolium* (Small) Millais, *Torreya taxifolia* Arnott, and *Taxus floridana* Chapman.

Carex thornei is named for Robert F. Thorne. Long ago (Thorne, 1951), he suggested what was being called *C. oligocarpa* from southwestern Georgia likely represented a new taxon. Actually, each of the three vouchers he cited as "*C. oligocarpa*" is a different new species, *C. thornei* (*Thorne 3100 et al.*), *C. acidicola* (*Thorne 3866*), and *C. calcifugens* (*Thorne 7971 & Muenscher*). It is fitting to recognize the taxonomic acumen of one of the earliest collectors of this species by naming it for him.

Paratypes. U.S.A. **Alabama:** Henry Co., vicinity of Shorterville, along Chattahoochee River S from Farmers Landing, 16 Apr. 2000, *MacDonald 13815* (DOV); Lee Co., 1.5 mi. N of Smith's Station, 7 Apr. 1949, *Duncan 9205 & Smith* (GA); Russell Co., ca. 2.5 mi. NW of Cottonton, along Sand Branch, 3 May 1996, *Naczi 5201* (DOV, MICH); type locality, 24 May 1997, *Naczi 6170* (DOV, herb. Bryson). **Florida:** Gadsden Co., Chattahoochee, between Main Street & Morgan Avenue, 27 Apr. 1974, *Gholson 809* (FLAS); Apalachicola River, Flat Creek Boat Landing, 13 Apr. 1982, *Gholson 9533 & Manhart* (FLAS), 13 Apr. 1982, *Manhart 407 & Gholson* (DOV, MICH); Chattahoochee, along Apalachicola River on River Landing Rd., 8 May 1995, *MacDonald 8645* (DOV, MICH, VDB, herb. Bryson); W of Chattahoochee, overlooking Apalachicola River, S of hwy. 90, 6 Apr. 2000, *Bryson 17850 & Usnick* (DOV, MICH, MO, USCH, VDB, VPI, WIN, herb. Bryson); Liberty Co., Torreya State Park, along Apalachicola River, 8 Apr. 1972, *Godfrey 71328* (FSU). **Georgia:** Baker Co., W bank of Flint River, Ichauway Plantation, 4 Apr. 1986, *Gholson 11593* (FLAS); Chattahoochee Co., ca. 9 mi. W of Cusseta, along Oswichee Creek, 23 May 1997, *Naczi 6135* (DOV); ca. 10.5 mi. NW of Cusseta, along Upatoi Creek, 24 May 1997, *Naczi 6148* (DOV); Decatur Co., 1 mi. N of Chattahoochee (Florida), bluff along Flint River, 14 Apr. 1947, *Thorne 3100 et al.* (CU, GA, GEO, GH), 22 Mar. 1949, *Thorne 9080 & Muenscher* (GEO, MICH, MO, PENN, US); Lake Seminole, East Bank Public Use Area, 13 Apr. 1982, *Manhart 401* (DOV, GA, GH, MICH, MO, NCU, NY, TENN, USCH, VDB, WIN, herb. Bryson), 20 Apr. 1985, *Gholson 11283* (FLAS), 12 May 1986, *Naczi 1072 & Gholson* (DOV, MICH), 18 May 1995, *Naczi 4710* (DOV, MICH); Early Co., W of Saffold railroad station, 26 Mar. 1949, *Thorne 9207 & Muenscher* (F); ca. 1.5 air mi. NW of Hilton, along Chattahoochee River, 18 May 1995, *Naczi 4715* (DOV, MICH).

Carex kraliana, a New Species of *Carex* sect. *Laxiflorae*

Carex sect. *Laxiflorae* is a group of about 25 species endemic to eastern North America, western North America, Central America, and Eurasia (Naczi, 1992). All but 2 of the 16 species that occur in the Western Hemisphere inhabit mesic deciduous forests of the southeastern United States, the center of diversity for the section.

Morphologic apomorphies that diagnose *Carex* sect. *Laxiflorae* are culms with acute angles and culms with epidermal cells conspicuously larger than underlying cells (Naczi, 1992). Additional morphologic features that characterize the species, but are probably not apomorphic of section *Laxiflorae*, include long-sheathing proximal bracts, usually unisexual spikes with only the terminal one staminate, glabrous perigynia that are obtusely triangular in cross section and have more or less entire orifices, and perigynia usually with 25 to 39 nerves (sclerenchyma traces) that are raised above the surface in living and dried material.

Past authors frequently placed members of *Carex*

sect. *Laxiflorae* in the same section as members of *Carex* sect. *Careyanae* Tuckerman ex Kükenthal (e.g., Kükenthal, 1909; Mackenzie, 1935; Fernald, 1950; Bryson, 1980; Manhart, 1986; Gleason & Cronquist, 1991). Bryson (1980) and Manhart (1986), based on morphologic and biochemical evidence, respectively, found section *Laxiflorae* s.l. to consist of two subgroups that correspond to section *Careyanae* and section *Laxiflorae* s. str. Phylogenetic analysis of morphologic data reveals that *Carex* sect. *Laxiflorae* s. str. and section *Careyanae* are not each other's sister groups, however, and uniting them would create a biphyletic group (Naczi, 1992). Analyses of DNA sequences also support treating *Carex* sect. *Laxiflorae* and section *Careyanae* as separate sections (Starr et al., 1999). For these reasons, we circumscribe *Carex* sect. *Laxiflorae* in the strict sense to exclude members of section *Careyanae*.

In the course of their ongoing research on the systematics of *Carex* sect. *Laxiflorae*, Naczi and Bryson have detected a previously undescribed species in the section. This new species, here named *Carex kraliana*, is widespread and frequent throughout much of the southeastern United States. In the following key, *Carex kraliana* is distinguished from all other members of section *Laxiflorae* that occur in the Western Hemisphere.

KEY TO SPECIES OF *CAREX* SECT. *LAXIFLORAE* NATIVE TO THE WESTERN HEMISPHERE

Complete, ample specimens bearing mature perigynia are necessary for identification. Magnification of 10× and bright illumination should be used when examining shoot bases for presence or absence of purplish coloration, since the coloration is often limited to small areas at the very bases of the plants. When measuring perigynium width, care should be taken to measure a perigynium at its widest point, since one face of a perigynium is usually slightly wider than the other two. When measuring length of the peduncles of lateral spikes, include the portion of the peduncle enclosed in the bract sheath.

1a. Bract blades of distal lateral spikes lanceolate or narrowly lanceolate, wider than spikes and concealing them when viewed from abaxial surface, widest bract blade (per plant) of distal-most lateral spike (3.0–)3.2–8.3 mm wide.
  2a. Widest leaf or bract blade 1.3–3.8(–5.0) cm wide; pistillate scales from proximal portions of spikes awnless (sometimes mucronate), with truncate bodies; perigynia (1.6–)1.7–1.9 mm wide . . . *C. albursina*
  2b. Widest leaf or bract blade 0.5–1.1 cm wide; pistillate scales from proximal portions of spikes awned, with acute bodies; perigynia 1.3–1.7(–1.8) mm wide . . . . . *C. kraliana* sp. nov.
1b. Bract blades of distal lateral spikes linear, narrower than spikes and not concealing them when viewed from abaxial surface, widest bract blade (per plant) of distal-most lateral spike 0.5–3.4 mm wide.
  3a. Perigynia 8- to 18-nerved . . . . . *C. leptonervia*
  3b. Perigynia (22)25- to 32-nerved.
    4a. Shoot bases purplish, with purplish coloration ranging from slight tingeing of brown background in basal 5 mm of shoots to strong staining that obscures brown background and extends 14 cm high.
      5a. Perigynia 2.4–3.3 mm long.
        6a. Perigynia closely overlapping, 1.8–2.7 times as long as wide, with beaks 0.2–0.8 mm long; internode between proximal-most scales in proximal-most spike 1.1–3.2(–4.8) mm long; longest lateral spike 11–21 mm long; angles of bract sheaths denticulate . . . . . *C. gracilescens*
        6b. Perigynia loosely overlapping or separate, 1.7–2.1 times as long as wide, with beaks 0.1–0.3 mm long; internode between proximal-most scales in proximal-most spike 3.3–14 mm long; longest lateral spike (15–)19–33 mm long; angles of bract sheaths entire or minutely papillate . . . . . *C. ormostachya*
      5b. Perigynia 3.4–4.5 mm long.
        7a. Terminal spike exceeding bract blade of distal-most lateral spike, longest peduncle (per plant) of terminal spike (31–)46–157 mm long; vegetative shoots with widest leaf blade 1.9–2.8 times as wide as widest leaf or bract blade of reproductive shoots; blades of overwintered leaves (often dying or dead at time of collection and thus partially or completely brown) with abaxial surfaces densely and minutely papillate . . *C. purpurifera*
        7b. Terminal spike usually exceeded by bract blade of distal-most lateral spike, longest peduncle (per plant) of terminal spike 12–32(–53) mm long; vegetative shoots with widest leaf blade 1.1–1.8(–2.4) times as wide as widest leaf or bract blade of reproductive shoots; blades of overwintered leaves (often dying or dead at time of collection and thus partially or completely brown) with abaxial surfaces smooth . . . . *C. manhartii*
    4b. Shoot bases brownish or whitish, with purplish coloration completely absent.
      8a. Perigynia closely overlapping, ratio of length of longest lateral spike (in mm):number of perigynia = 0.8–1.7.
        9a. Perigynia 2.5–3.8(–4.1) mm long, 1.5–1.9(–2.2) times as long as achene bodies; perigynium beaks 0.2–0.6 mm long.
          10a. Most culms with 2 distal lateral spikes overlapping (occasionally most culms

with distal lateral spikes separate, and only rarely with 3 to 4 distal lateral spikes overlapping) . . . . . *C. blanda*
10b. Most culms with 3 to 4 distal lateral spikes overlapping . . . . . *C. congestiflora*
9b. Perigynia (3.3–)3.9–5.4 mm long, 1.9–2.3 times as long as achene bodies; perigynium beaks 0.5–1.7 mm long.
11a. Distal lateral spikes overlapping; terminal spike exceeded by distal-most lateral spike or the 2 spikes subequal in height; perigynia ascending; most culms with peduncle of proximal-most spike arising in distal half of culm . . . . . *C. crebriflora*
11b. Distal lateral spikes separate; terminal spike clearly exceeding distal-most lateral spike; perigynia spreading; most culms with peduncle of proximal-most spike arising in proximal third of culm.
12a. Densely caespitose, with short rhizomes . . . . . *C. styloflexa*
12b. Loosely caespitose, with long rhizomes . . . . . *C. chapmanii*
8b. Perigynia loosely overlapping or separate, ratio of length of longest lateral spike (in mm): number of perigynia = 1.8–3.4.
13a. Pistillate scales 1.9–2.3 mm wide . . . . . *C. hendersonii*
13b. Pistillate scales 1.1–1.8 mm wide.
14a. Longer peduncles of proximal lateral spikes 4.6–14 times as long as spikes they subtend; perigynia spreading.
15a. Densely caespitose, with short rhizomes . . . . . *C. styloflexa*
15b. Loosely caespitose, with long rhizomes . . . . . *C. chapmanii*
14b. Longer peduncles of proximal lateral spikes 1.4–3.3(–5.3) times as long as spikes they subtend; perigynia ascending.
16a. Longest bract blade 5.0–6.7(–8.0) cm long; blades of overwintered leaves (often dying or dead at time of collection and thus partially or completely brown) with abaxial surfaces densely and minutely papillate . . . *C. radfordii*
16b. Longest bract blade (4.5–)6.5–15 cm long; blades of overwintered leaves (often dying or dead at time of collection and thus partially or completely brown) with abaxial surfaces smooth or rarely sparsely and minutely papillate.
17a. Achene body 1.8–2.2 mm long; perigynia (2.6–)3.2–4.1(–4.6) mm long; longest terminal spike 12–24(–34) mm long . . . . . *C. laxiflora*
17b. Achene body 2.2–2.8 mm long; perigynia (3.4–)3.9–5.1 mm long; longest terminal spike 20–32(–36) mm long . . . . . *C. striatula*

Carex kraliana Naczi & Bryson, sp. nov. TYPE: U.S.A. Mississippi: Winston Co., ca. 5 mi. NW of Louisville, W of Noxubee Crest Natural Area, T16N, R12E, NW1/4 of sect. 31, 11 Apr. 2000, *R. F. C. Naczi 8339, Bryson, Case, Smith, MacDonald & Goodlett* (holotype, DOV; isotypes, MICH, MO, NY, WIN, herb. Bryson). Figure 5.

A *Carice albursina* laminis foliorum angustioribus, squamis pistillatis acutis vel aristatis, perigyniis angustioribus differt; a ceteris speciebus sectionis *Laxiflorarum* laminis bractearum lanceolatis vel anguste lanceolatis, laminis bractearum latioribus differt.

Perennial, densely caespitose. Rhizomes 0.1–0.8 cm long between shoots or branches of the rhizomes. Shoot bases dark brown to light brown. Reproductive shoots erect to spreading; culms 9.2–56 cm tall. Leaves of reproductive shoots 2 to 4; blades 1.2–21 cm × 2.6–11 mm, the widest per plant 5.3–11 mm wide, dark green. Vegetative shoots 26–34 cm tall; leaves 4 to 6, similar to those of reproductive shoots except blades 0.9–32 cm long; pseudoculms 2.8–6.9 cm tall. Infructescences (1.6–)2.6–18(–27) cm long, 9.3–47(–77)% of culm height, with the distal-most 2 to 3 spikes overlapping, the internode between the distal lateral spikes 0.7–19 cm long, the internode between the proximal spike 2.8–19 cm long; proximal-most bract with blade 6.2–17 cm long and 19–61% of culm height; bract blade of distal-most lateral spike lanceolate or narrowly lanceolate, (1.9–)3.4–8.3 cm long, the widest per plant (3.0–)3.2–7.1 mm wide, wider than and concealing lateral spike when viewed from abaxial surface, much exceeding terminal spike. Spikes 2 to 4, erect; terminal spike 5.8–13(–18) mm long, the longest per plant 7.6–13(–18) mm long, 0.9–2.1 mm wide, the widest per plant 1.1–2.1 mm wide, entirely staminate, on peduncle 0.8–7.3(–27) mm long, usually exceeded by distal-most lateral spike but sometimes subequal to it; lateral spikes 5.3–18(–23) mm long, the longest per plant 12–18(–23) mm long, 3.7–4.6 mm wide, entirely pistillate, (4)6- to 16-flowered, the perigynia spirally imbricate, the internode between the proximal-most scales in proximal-most spike 1.1–3.2(–3.8) mm long, perigynia closely overlapping, with ratio of length of longest lateral spike per plant (in mm): number of perigynia = 0.97–1.6(–1.9). Staminate scales 1.9–3.8 × 0.8–1.5 mm, obtuse or acute, awnless. Pistillate scales 1.1–4.2 × 1.4–1.8

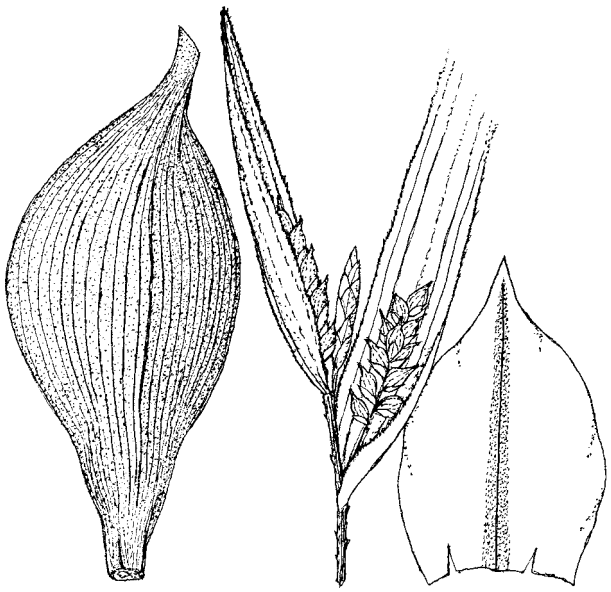

Figure 5. *Carex kraliana* Naczi & Bryson. Perigynium, lateral view (left; × 20); distal portion of culm (middle; × 2); and pistillate scale (right; × 20).

mm; body 1.1–2.2(–2.4) mm long, ovate, acute, usually awned when in proximal portions of spikes, usually awnless when in distal portions of spikes, margins usually whitish; awn 0–2.2 mm long. Perigynia 2.7–4.2(–5.0) mm long, 1.3–1.7(–1.8) mm wide, 1.8–2.4(–2.9) times as long as wide, 1.4–2.0 times as long as achene bodies, ascending, obtusely triangular in cross section, faces convex, nerves raised and 29 to 34, glabrous, yellow-green or pale green or yellow-brown, obovate in outline, apex excurved to beak, gradually tapered from widest point to narrow base, abruptly or gradually tapered from widest point to beak; beaks 0.2–0.6(–1.0) mm long, 9.0–21% of perigynium length, smooth, entire, deflected 30–45° from long axis of perigynium. Achenes 1.9–2.5(–2.9) mm long, 1.2–1.6(–1.7) mm wide, faces tightly enveloped by perigynia, obovoid or oblong, obtusely trigonous, faces flat or slightly convex, brown, basally abruptly contracted to stipe, apically abruptly contracted to minute beak; stipe 0.1–0.2 mm long, bent 10–30° from long axis of achene or vertical; body 1.8–2.2(–2.4) mm long; beak 0.1–0.2 mm long, bent (10–)45–60° from long axis of achene.

The most distinctive morphologic feature of *Carex kraliana* is its lanceolate or narrowly lanceolate, relatively wide bract blades. The width of the blades is greater than the width of the lateral spikes. The bract blades are quite spathe-like, since they obscure the lateral spikes when viewed from the abaxial surface of the bracts, and much exceed the spikes. Nearly all other members of *Carex* sect. *Laxiflorae* have linear bract blades that are narrower than or as wide as the lateral spikes. Only *C. albursina* Sheldon has wide and spathe-like bract blades similar to those of *C. kraliana.*

Carex kraliana differs from *C. albursina* in several ways. First, *C. kraliana* has narrower leaves than *C. albursina* (widest leaf blade per plant 5.3–11 mm wide for *C. kraliana* vs. 13–50 mm wide for *C. albursina*). Second, the pistillate scales of *C. kraliana* are acute to awned, but truncate and awnless in *C. albursina.* Third, the perigynia of *C. kraliana* are narrower than those of *C. albursina. Carex kraliana* has perigynia 1.3–1.7(–1.8) mm wide, while those of *C. albursina* are (1.6–)1.7–1.9 mm wide.

Carex kraliana is somewhat similar to several other species of section *Laxiflorae,* particularly *C. blanda* Dewey, *C. congestiflora* Reznicek & S. González, *C. crebriflora* Wiegand, *C. laxiflora* Lamarck, and *C. leptonervia* (Fernald) Fernald. These species share the following features with *C. kraliana*: brown shoot bases, the distal-most lateral spike often overlapping the terminal spike, and ascending, relatively short perigynia (perigynia often less than 4.3 mm long). Unlike *C. kraliana,* however, all these other species have linear and narrow bract blades. In *C. blanda, C. congestiflora, C. crebriflora, C. laxiflora,* and *C. leptonervia,* the widest (per plant) bract blade of the distal-most lateral spike is 0.9–3.2 mm wide (rarely up to 4.2 mm wide in *C. lax-*

iflora), whereas it is (3.0–)3.2–7.1 mm wide in *C. kraliana*.

Additional features distinguish *C. kraliana* from *C. blanda, C. congestiflora, C. crebriflora, C. laxiflora,* and *C. leptonervia*. *Carex kraliana* has the terminal spike exceeded by or subequal to the distal-most lateral spike, unlike *C. blanda,* which has the terminal spike usually clearly exceeding the distal-most lateral spike. *Carex kraliana* has the distal-most lateral spikes separate or no more than 2 of them overlapping, whereas *C. congestiflora* usually has the 3 or 4 distal-most lateral spikes overlapping. Also, *C. kraliana* has 1 to 3 lateral spikes versus 2 to 5 for *C. congestiflora*. Relative to *C. crebriflora, C. kraliana* has shorter pistillate scale bodies: 1.1–2.2(–2.4) mm long for *C. kraliana* versus (2.2–)2.5–3.5 mm long for *C. crebriflora*. Also, *C. kraliana* has narrower perigynia than *C. crebriflora*: 1.3–1.7(–1.8) mm wide for *C. kraliana* versus (1.6–)1.7–2.2 mm wide for *C. crebriflora*. *Carex kraliana* differs from *C. laxiflora* by its shorter terminal spikes: longest terminal spike per plant 7.6–13(–18) mm long in *C. kraliana* versus (12–)19–28(–34) mm long in *C. laxiflora*. In addition, *C. kraliana* has denser lateral spikes than *C. laxiflora*: internode between proximal-most scales of proximal-most spike 1.1–3.2(–3.8) mm long in *C. kraliana* versus 3.3–8.2 mm long in *C. laxiflora*. *Carex leptonervia* has 8- to 18-nerved perigynia (29- to 34-nerved in *C. kraliana*) and relatively loosely overlapping perigynia: internode between proximal-most scales of proximal-most spike 3.0–6.9 mm long in *C. leptonervia* versus 1.1–3.2 (–3.8) mm long in *C. kraliana*.

Probably because of its similarity to so many other species, *Carex kraliana* remained undescribed for so long. Older specimens of *C. kraliana* bear identifications most often of *C. blanda, C. crebriflora,* and *C. laxiflora* var. *serrulata* F. J. Hermann. Naczi and Bryson, too, had thought the name *C. laxiflora* var. *serrulata* applied to *C. kraliana* and annotated many specimens with this misidentification. Recent examination of the type of *C. laxiflora* var. *serrulata* (U.S.A. Indiana: Clark Co., ca. 1.5 mi. NW of Henryville, 25 May 1910, *Deam 6458,* holotype, GH; isotype, NY) reveals it is *C. laxiflora,* however, and not *C. kraliana*. Because of confusion of *C. laxiflora* var. *serrulata* with *C. kraliana,* reports of the former, particularly from the southeastern U.S. (e.g., Deam, 1940; Hermann, 1954, 1974; Braun, 1967; Hyatt, 1998; Reznicek & González-Elizondo, 1999), should be regarded as possibly *C. kraliana* and should be re-evaluated.

Plants of *C. kraliana* grow in mesic deciduous forests, usually in loams, sandy loams, and silt loams. Frequent associates of *C. kraliana* include *C. amphibola* Steudel, *C. basiantha, C. planispicata, C. rosea* Willdenow, *Hexastylis arifolia,* and *Podophyllum peltatum* L. *Carex kraliana* is frequent and widespread in the southeastern United States, ranging in several physiographic provinces from southern Maryland south to northern Florida and west to eastern Arkansas and eastern Texas. The paratypes are only a small fraction of the collections we have studied of *C. kraliana*.

Naczi and Bryson name this species for our friend and fellow student of Cyperaceae, Robert Kral, in recognition of his contributions to the knowledge of the flora of the southeastern United States, particularly its great diversity of sedges.

Paratypes. U.S.A. **Alabama:** Bibb Co., 6 mi. SE of Centreville, 1 May 1987, *Bryson 5606 & Kral* (herb. Bryson); Cleburne Co., ca. 10 mi. S of Borden Springs, 23 Apr. 1990, *Kral 77368* (VDB); Conecuh Co., ca. 1 mi. E of Jay Villa, 2 May 1996, *Naczi 5164* (DOV, MICH, MO, NY, WIN, herb. Bryson); Coosa Co., ca. 3.5 mi. SW of Unity, 14 Apr. 2000, *Naczi 8374 & Case* (DOV); Crenshaw Co., ca. 2 mi. S of Luverne, 17 Mar. 1993, *Naczi 2974 & Welpton* (DOV); DeKalb Co., ca. 0.5 mi. N of Portersville, 2 June 1997, *Naczi 6422* (DOV); Elmore Co., ca. 1.8 mi. SE of Titus, 23 Apr. 2002, *Naczi 9115* (DOV, MICH, VDB, WIN, herb. Bryson); Jackson Co., ca. 2.7 mi. N of center of Skyline, 22 Apr. 2002, *Naczi 9049* (DOV, VDB); Lawrence Co., ca. 8 mi. S of Mt. Hope, 21 May 1996, *Naczi 5403 & Bryson* (DOV, MICH, herb. Bryson); Lee Co., ca. 1.5 mi. N of Smiths Station, 24 Apr. 2002, *Naczi 9138* (DOV, VDB); Lowndes Co., 4.5 mi. E of Braggs, 6 Apr. 1993, *Kral 81989* (herb. Bryson); Madison Co., Huntsville, Monte Sano State Park, 6 May 1991, *Naczi 2878* (DOV, MICH); Marion Co., N side of Hamilton, 17 May 1973, *Kral 50065* (herb. Bryson); Russell Co., ca. 2.5 mi. NW of Cottonton, 3 May 1996, *Naczi 5189* (DOV, MICH, MO, NY, USCH, WIN, herb. Bryson); Tuscaloosa Co., near mouth of Hurricane Creek, 28 Mar. 1911, *Harper 141* (F, ILL); Winston Co., 5.5 mi. NE of Double Springs, 15 May 1992, *Bryson 11652* (DOV, herb. Bryson). **Arkansas:** Cross Co., W of Birdeye, along S side of rte. 42, 20 May 1990, *Naczi 2442* (DOV, herb. Bryson). **Florida:** Gadsden Co., S side of Chattahoochee, bluffs of Apalachicola River, 18 Mar. 1976, *Kral 57351* (DOV, MICH). **Georgia:** Early Co., W of Saffold railroad station, SW corner of county, 26 Mar. 1949, *Thorne 9208 & Muenscher* (MICH); Harris Co., ca. 6 mi. W of Mulberry Grove, along Mulberry Creek, 24 May 1997, *Naczi 6152* (DOV); Jasper Co., ca. 14 mi. SW of Monticello, ca. 0.8 mi. NE of Ocmulgee River crossing by rte. 83, 19 May 1997, *Naczi 6057* (DOV); Monroe Co., ca. 2.5 mi. SW of Russellville, 25 Apr. 2000, *Naczi 8397 & Ford* (DOV, herb. Bryson); Stephens Co., ca. 3 mi. N of Toccoa, 3 May 1991, *Naczi 2854* (DOV, herb. Bryson); Upson Co., ca. 1.4 mi. SSW of Roland, 25 Apr. 2002, *Naczi 9178* (DOV, VDB, herb. Bryson). **Indiana:** Crawford Co., 1.7 mi. E of Birdseye, 27 May 1990, *Naczi 2498* (DOV, herb. Bryson). **Kentucky:** Barren Co., ca. 3 mi. SSW of Haywood, Brigadoon State Nature Preserve, 14 June 1997, *Naczi 6459 & Heeg* (DOV); Clinton Co., ca. 3.3 mi. WNW of Albany, 23 May 1998, *Naczi 7187 & Ford* (DOV, MICH, herb. Bryson); Fulton Co., ca. 5 mi. SSW of Hickman, 27 June 1995,

Naczi 4853 & Reznicek (DOV, MICH); Robertson Co., ca. 4 mi. SE of Piqua, 28 May 1998, *Naczi 7356 & Ford* (DOV); Rowan Co., ca. 7 mi. S of center of Morehead, 1 June 1996, *Naczi 5597 & Trauth* (DOV, KNK, MICH, herb. Bryson). **Louisiana:** Morehouse Parish, W of Jones, 30 Apr. 1992, *Thomas 128379, Bryson & Newton* (VDB). **Maryland:** Charles Co., Thomas Stone National Historic Site (W of Rose Hill Rd., 2 mi. S of Marshalls Corner), 31 May 2001, *Lea 2569* (DOV). **Mississippi:** Forrest Co., Ragland Hills, 11 Apr. 1991, *Bryson 10640 & Rosso* (DOV, herb. Bryson); Grenada Co., Camp McCain, 5 May 1995, *MacDonald 8593* (DOV, herb. Bryson); Holmes Co., 6.2 mi. E of Thornton, 14 Apr. 1992, *Bryson 11223 & Newton* (DOV, herb. Bryson); Marion Co., 17.5–18 mi. SSE of Columbia, 26 Apr. 1991, *Bryson 10725 et al.* (DOV, herb. Bryson); Panola Co., 1.0 mi. W of Pleasant Grove, 19 May 1990, *Naczi 2437* (DOV); Tishomingo Co., ca. 1.3 mi. S of Mingo, 17 May 1992, *Bryson 11704 & Warren* (DOV, herb. Bryson). **North Carolina:** Montgomery Co., NW of Uwharrie, along West Branch of McLeans Creek, 7 June 1990, *Naczi 2540* (DOV); Rockingham Co., ca. 7 km W of Price, along South Mayo River, 2 May 1994, *Wieboldt 8873* (DOV, VPI). **Ohio:** Lawrence Co., N side of Sharp's Creek Rd. (C-19), 2 mi. W of Symmes Creek, 22 May 1997, *McCormac 5796* (MICH). **South Carolina:** Edgefield Co., ca. 8 mi. SW of Edgefield, 2 Apr. 1997, *Nelson 18040* (DOV, USCH); Lancaster Co., ca. 2 mi. E of Taxahaw, 17 May 1996, *Naczi 5319* (DOV); York Co., ca. 4 mi. NW of Bethany, 17 May 1996, *Naczi 5304* (DOV). **Tennessee:** Dyer Co., ca. 6 mi. NW of Dyersburg, 27 June 1995, *Naczi 4844 & Reznicek* (DOV); Grundy Co., ca. 10 mi. SW of Altamont, 29 May 1990, *Naczi 2517, Kral & Raveill* (DOV); Henderson Co., ca. 11 mi. W of center of Lexington, Blue Goose, 26 June 1995, *Naczi 4798 & Reznicek* (DOV); Jefferson Co., Jefferson City, Apr. 1844, *Rugel s.n.* (MICH); Perry Co., by Blue Creek Rd., 4 mi. S of I-40, 14 May 1996, *Kral 85847* (DOV, MICH); Scott Co., ca. 1 mi. W of Fairview, 22 June 1993, *Naczi 3195 & Reznicek* (DOV, MICH). **Texas:** Marion Co., E of N arm of Caddo Lake, 29 Mar. 1987, *Orzell & Bridges 4940* (MICH); Sabine Co., ca. 4.5 mi. N of Milam, along upper reaches of Mason Creek, 12 Apr. 1988, *Orzell & Bridges 6180* (MICH); Tyler Co., above B. A. Steinhagen Lake, 4 Apr. 1989, *Orzell & Bridges 8991* (MICH). **Virginia:** Prince William Co., just NE of Prince William Forest Park, 21 May 1995, *Lea 959* (GMUF); Scott Co., ca. 6 mi. NE of Gate City, W of rte. 669 crossing of Copper Creek, 21 June 1993, *Naczi 3172, Reznicek & Wieboldt* (DOV, VPI); Southampton Co., NW of Courtland, near Davis School, along Nottoway River, 8 May 1940, *Fernald & Long 11784* (US); Sussex Co., 1.3 mi. NW of Fields Crossroads, 2 May 1997, *Fleming 12821* (GMUF); Westmoreland Co., Littlefields farm, end of SR 672, 22 June 1999, *Dodge 1483* (GMUF).

Carex gholsonii, a New Species of *Carex* sect. *Granulares*

Carex sect. *Granulares* is a group of six species of North America and Central America (Naczi, 1992): *C. atractodes* F. J. Hermann, *C. crawei* Dewey, *C. granularis* Willdenow, *C. microdonta* Torrey & Hooker, *C. quichensis* F. J. Hermann, and *C. gholsonii,* described here. Four of these species (*C. crawei, C. gholsonii, C. granularis,* and *C. microdonta*) occur in the southeastern United States, the center of diversity of the section. *Carex atractodes* occurs in Mexico, and *C. quichensis* ranges in Guatemala. Members of this section inhabit mesic forests, moist meadows, moist prairies, and moist lake shores.

Three apomorphies diagnose *Carex* sect. *Granulares*: red-brown cells scattered in the epidermis of perigynia, 25 or more perigynia per well-developed lateral spike, and perigynia loosely enveloping the achenes (Naczi, 1992, 1997). Additional distinctive morphologic features that characterize the species, but are probably not apomorphic of *Carex* sect. *Granulares,* include long-sheathing proximal bracts, usually unisexual spikes with only the terminal one staminate, glabrous perigynia that are suborbicular or obtusely triangular in cross section and have more or less entire orifices, and perigynia usually with 25 to 39 nerves (sclerenchyma traces) that are raised above the surface in living and dried material.

Through their independent research on the systematics of *Carex* sect. *Granulares,* Naczi and Cochrane have discovered a previously undescribed species of the southeastern U.S. This new species, here named *C. gholsonii,* is infrequent to rare in its relatively small geographic range. In the following key, *C. gholsonii* is distinguished from other members of *Carex* sect. *Granulares.*

Key to *Carex* sect. *Granulares*

1a. Shoots scattered along long-creeping rhizomes; terminal spike and distal-most lateral spike (unless staminate) usually separate, longest (per plant) peduncle of terminal spike 2.2–15 cm long; proximal-most spike usually arising from proximal 30% of culm; perigynia with beaks 0.1–0.9 mm long.
  2a. Staminate scale bodies obtuse, awnless; widest leaf 1.8–2.8(–4.4) mm wide; perigynia 2.2–3.2 mm long, with beaks 0.1–0.3 mm long . . . . . *C. crawei*
  2b. Staminate scale bodies acute, often awned; widest leaf 2.8–8.3 mm wide; perigynia 2.8–4.2 mm long, with beaks 0.3–0.9 mm long . . . . . *C. microdonta*

1b. Shoots clumped on very short rhizomes; terminal spike and distal-most lateral spike usually imbricate, longest (per plant) peduncle of terminal spike 0.2–1.6(–14) cm long; proximal-most spike usually arising from distal 70% of culm; perigynia with beaks 0.1–0.3(–0.5) mm long.
  3a. Foliage usually glaucous; longest (per plant) bract blade of distal-most lateral spike 4.1–15.8 cm long; ligule of proximal-most bract (3.6–)4.0–26 mm long; perigynia 2.0–3.5(–3.9) mm long, 1.4–2.2(–2.4) times as long as wide; densely caespitose . . . . . *C. granularis*
  3b. Foliage usually green; longest (per plant)

bract blade of distal-most lateral spike 1.6–4.6(–7.1) cm long; ligule of proximal-most bract 0.6–5.9(–6.5) mm long; perigynia 2.7–4.0 mm long, (1.6–)1.9–3.0 times as long as wide; loosely caespitose.

4a. Longest (per plant) terminal spike 8–19 mm long; longest (per plant) peduncle of terminal spike 0.4–3.0 mm long . . . . . *C. atractodes*

4b. Longest (per plant) terminal spike (17–)19–38(–41) mm long; longest (per plant) peduncle of terminal spike 3.5–16(–140) mm long.

5a. Widest leaf blade (5.7–)6.4–11.3 mm wide; widest (per plant) terminal spike (2.4–)2.6–3.4(–4.0) mm wide; perigynia 2.9–4.0 mm long . . . . . *C. gholsonii* sp. nov.

5b. Widest leaf blade 5.7–6.2 mm wide; widest (per plant) terminal spike 2.2–2.6 mm wide; perigynia 2.7–3.1 mm long . . . . . *C. quichensis*

Carex gholsonii Naczi & Cochrane, sp. nov. TYPE: U.S.A. Florida: Citrus Co., ca. 3 mi. S of city of Crystal River, along S side of rte. 494, 1.4 mi. W of rte. 98, 24 Apr. 1991, *R. F. C. Naczi 2787* (holotype, DOV; isotypes, FLAS, MICH, MO, NY, WIS, herb. Bryson). Figure 6.

A *Carice granulari* habitu laxe caespitoso, foliis viridibus, ligulis brevioribus, laminis bractearum brevioribus, perigyniis longioribus, perigyniis (1.6–)1.9–3.0plo longioribus quam latioribus differt; a *Carice atractode* spica terminali longiore, pedunculo longiori insidente differt; a *Carice quichensi* laminis foliorum latioribus, spica terminali latiore, perigyniis longioribus differt.

Perennial, loosely caespitose. Rhizomes 0.1–4 cm long between shoots or branches of the rhizomes. Shoot bases light brown to dark brown. Reproductive shoots erect to spreading; culms 20–75 cm tall. Leaves of reproductive shoots 1 to 5; blades 2.3–26 cm × 2.2–11.3 mm, the widest per plant (5.7–)6.4–11.3 mm wide, green. Vegetative shoots 18–51 cm tall; leaves 3 to 6, similar to those of reproductive shoots except blades 0.6–43 cm long; pseudoculms 3.1–9.0 cm tall. Infructescences 24–60 cm long, 51–93% of culm height, with the distal-most 2 to 3 spikes overlapping or rarely all spikes separate, the internode between the distal lateral spikes 0.9–17 cm long, the internode between the proximal spikes 5.9–31 cm long; proximal-most bract with blade 5.0–27 cm long and 17–89% of culm height, ligule 0.6–5.9(–6.5) mm long; bract blade of distal-most lateral spike linear, 0.9–4.6(–7.1) cm long, the longest per plant 1.6–4.6 (–7.1) cm long, the widest per plant 1.2–2.4 mm wide, not concealing lateral spike when viewed from abaxial surface, greatly exceeded by terminal spike to slightly exceeding terminal spike. Spikes 4 to 6, erect; terminal spike 8.8–34(–41) mm long, the longest per plant (17–)19–34(–41) mm long, 1.7–4.0 mm wide, the widest per plant (2.4–)2.6–3.4(–4.0) mm wide, entirely staminate, overlapping and exceeding distal-most lateral spike or rarely separate from distal-most lateral spike; peduncle of terminal spike 1.4–16(–140) mm long, the longest per plant 3.5–16(–140) mm long; lateral spikes 5.3–25 × 4.2–6.6 mm, the longest per plant 14–25 mm long, entirely pistillate, 4- to 39-flowered, the perigynia spirally imbricate, the internode between the proximal-most scales in proximal-most spike 0.9–2.4 mm long, perigynia closely overlapping, with ratio of length of longest lateral spike per plant (in mm): number of perigynia = 0.58–1.1. Staminate scales 3.7–5.6 × 1.0–1.7 mm, usually acute but occasionally obtuse, awnless. Pistillate scales (2.0–)2.2–2.5(–3.1) mm long, 1.0–1.4 mm wide; body 1.4–2.2 mm long, ovate, acute and awnless or short-awned, margins whitish to ferruginous and often reddish-streaked and speckled; awn 0–1.0 mm long. Perigynia 2.9–4.0 mm long, 1.3–1.8(–2.1) mm wide, (1.6–)1.9–3.0 times as long as wide, 1.8–2.0 times as long as achene bodies, ascending, suborbicular to obtusely triangular in cross section (often flattened during specimen preparation), faces convex, nerves raised and 26 to 32, glabrous, olive to brownish green, narrowly ovate to ovate in outline, gradually tapered from widest point to broad base, abruptly tapered from widest point to excurved or straight beak; beaks 0.1–0.3 (–0.5) mm long, 3.0–17% of perigynium length, smooth, entire, bent 0–30° from long axis of perigynium. Achenes (1.9–)2.2–2.7 mm long, 1.2–1.6 mm wide, faces loosely enveloped by perigynia, obovoid, obtusely trigonous, faces slightly concave or flat, brown, basally abruptly contracted to stipe, apically abruptly contracted to minute beak; stipe 0.2–0.4 mm long, bent about 30° from long axis of achene; body 1.7–2.0 mm long; beak 0.1–0.5 mm long, bent (10–)30–90° from long axis of achene or rarely vertical.

With its caespitose habit, distal-most lateral spike usually overlapping the terminal spike, terminal spikes on relatively short peduncles, and relatively short-beaked perigynia, *Carex gholsonii* is most similar to *C. atractodes, C. granularis,* and *C. quichensis.* In fact, most specimens of *C. gholsonii* were originally identified as *C. granularis.* As indicated in the key, *C. gholsonii* differs from *C. granularis* by having a loosely caespitose habit, green foliage, shorter ligules, shorter bract blades, longer perigynia, and perigynia with a higher

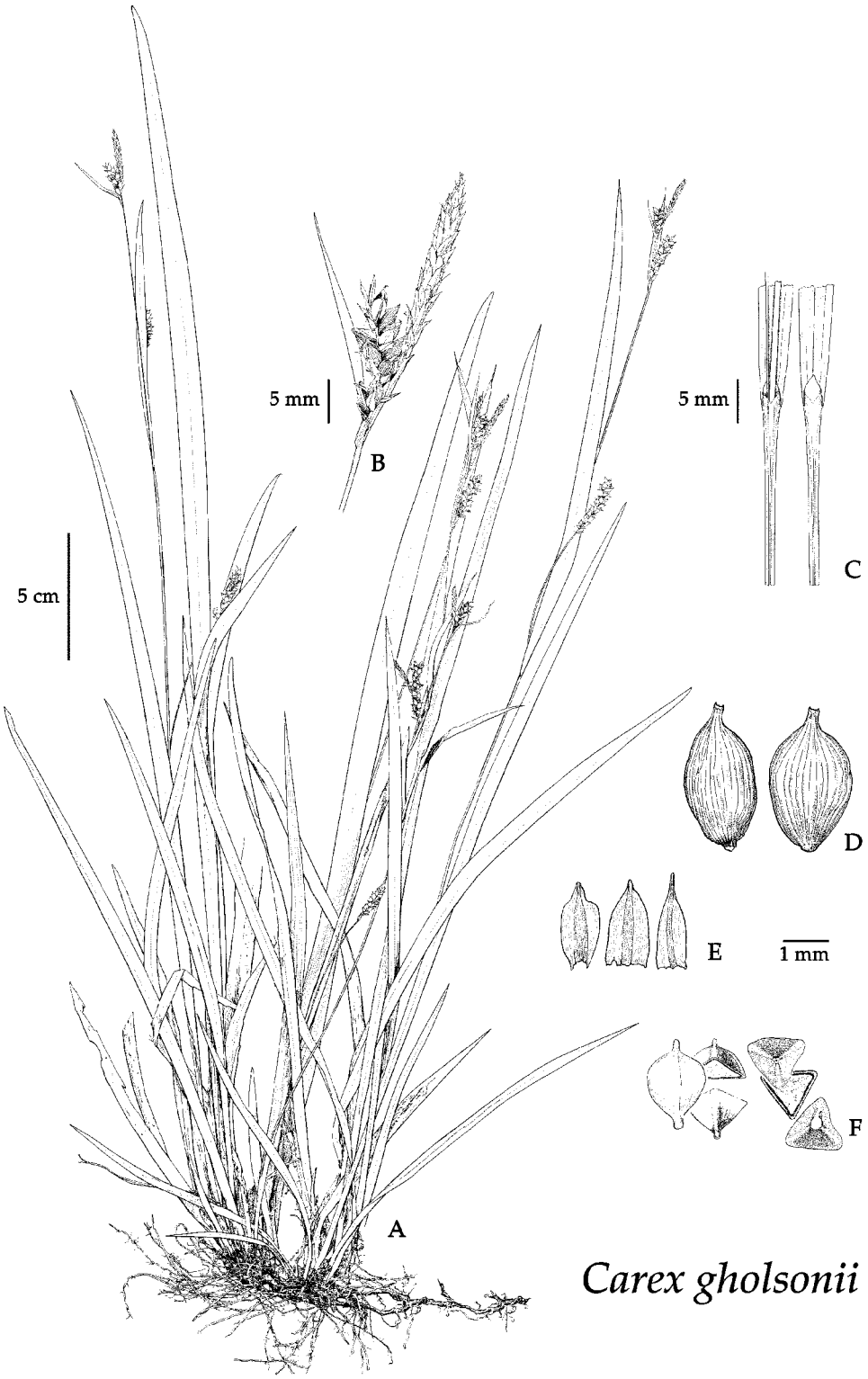

Figure 6. *Carex gholsonii* Naczi & Cochrane. —A. Habit. —B. Distal portion of culm. —C. Ligule of proximal-most bract, with (left) and without (right) included culm and peduncle of lateral spike. —D. Perigynium, lateral view (left) and adaxial view (right). —E. Pistillate scales. —F. Achene, whole (left), cross sectioned (middle), and showing apex, section, and base (right).

length : width ratio. Relative to *C. atractodes*, *C. gholsonii* has longer terminal spikes and longer peduncles of the terminal spikes. *Carex gholsonii* differs from *C. quichensis* by having wider leaf blades, wider terminal spikes, and longer perigynia.

The number and arrangement of chromosomes in two plants of *Carex gholsonii* at metaphase I are 16 II + 1 IV (methods as in Naczi, 1999b). One plant was from Nassau County, Florida (*Naczi 2742*, DOV, MICH; greenhouse-grown voucher originally from same population as *Naczi 2369*, cited below), and the second was from Wakulla County, Florida (*Naczi 2741*, DOV, MICH; greenhouse-grown voucher originally from same population as *Naczi 2383*, cited below). The chromosome number of *C. gholsonii* overlaps that of *C. granularis* (Naczi, 1999b). In addition, *C. granularis* frequently has 1 to 3 quadrivalents per cell at metaphase I, like *C. gholsonii*. The chromosome numbers of *C. atractodes* and *C. quichensis* are unknown.

Carex gholsonii ranges from southeastern North Carolina south to central peninsular Florida and west to southeasternmost Alabama. It occurs only on the Coastal Plain. It is quite rare in North Carolina, South Carolina, Georgia, and Alabama. Only in Florida is it relatively frequent, but even there it is local. The paratypes cited below are most of the specimens examined of *C. gholsonii*. No doubt its low frequency is due to its requirement for a specialized habitat, calcareous mucks and sandy loams. In these substrates, it grows along streams, in swampy forests, in hammocks, on floodplains, and in open, grassy areas such as roadsides. Frequent associates of *C. gholsonii* include *C. bromoides* Willdenow, *C. chapmanii* Steudel, *C. godfreyi* Naczi, *C. leptalea* Wahlenberg, *Rhynchospora miliacea* (Lamarck) A. Gray, *Ruellia caroliniensis*, *Sabal minor*, and *S. palmetto*.

Although *Carex granularis* is present in the southeastern United States, it is rare within the geographic range of *C. gholsonii*. No syntopic occurrences of these two species are known. *Carex gholsonii* is allopatric with the Central American *C. atractodes* and *C. quichensis*.

Naczi and Cochrane name this species for Angus K. Gholson, Jr., in gratitude for his assistance with fieldwork (including showing Naczi the first plants he saw of *C. gholsonii*), loans of specimens, and avid documentation of the flora of the southeastern United States. It is particularly appropriate that this species be named for Gholson since in the field it so often accompanies *C. godfreyi*, the namesake of Mr. Gholson's longtime friend and field companion.

Paratypes. U.S.A. **Alabama:** Houston Co., ca. 2 mi. S of Columbia, near George Andrews Lock & Dam, 3 May 1997, *MacDonald 10309* (DOV, FSU, MICH, UNA, VDB, WIS, herb. Bryson). **Florida:** [no locality beyond state], 1842–1849, *Rugel 289* (US); [Alachua] Co., Gainesville, 12 Apr. 1897, *Crawford s.n.* (PH); Brevard Co., Merritt Island National Wildlife Refuge, ca. 3 mi. N of Vehicle Assembly Bldg., 16 Apr. 1994, *Hyatt 5862* (DOV, MICH); Citrus Co., Chassahowitzka, along Chassahowitzka River just W of county park, 24 Apr. 1991, *Naczi 2792* (DOV, MICH); Columbia Co., 3 mi. W of Lula, 2 May 1965, *McDaniel 6085* (FLAS, FSU, MO, NY); Dixie Co., ca. 2.5 mi. NE of Jena, 24 Apr. 1991, *Naczi 2794* (DOV, FLAS, GA, GH, MICH, MO, NCU, NY, USCH, VDB, VPI, WIN, WIS, herb. Bryson); Gadsden Co., Chattahoochee, Lincoln Drive, 18 Apr. 1974, *Gholson 1030* (FLAS); Hillsborough Co., along Hillsborough River, next to Morris Bridge Rd., 19 Apr. 1978, *Arcuri 754 & Wunderlin* (USF); Jefferson Co., W of Aucilla River, along S side of rte. 98, 13 May 1986, *Naczi 1106 & Godfrey* (DOV); Lake Co., Astor Park, 0.2 mi. E of rtes. 40 & 445A junction, 22 Apr. 1991, *Naczi 2782* (DOV, FLAS, FSU, GH, MICH, MO, NY, TENN, UNA, USCH, VDB, herb. Bryson); Leon Co., W of Tallahassee, near Ocklockonee River, 5 Apr. 1925, *Small 11669 & Wherry* (NY); ca. 0.5 mi. S of Ocklockonee, 12 Apr. 1925, *Harper 16* (GH, NY, PH, US); ca. 6 mi. W of Tallahassee, 5 May 1960, *Godfrey 59510* (FLAS, FSU, NCU, NY, SMU, US, USF); Levy Co., ca. 1.2 mi. W of Otter Creek, along rte. 24, 9 Apr. 1977, *Gholson 6081 & Godfrey* (FLAS); Waccasassa Bay State Preserve, near Jack's Creek, 4 Mar. 1997, *Abbott 10029* (FLAS, DOV); Nassau Co., 1.8 mi. N of Callahan, along E side of rte. 1, 4 May 1990, *Naczi 2369* (DOV, MICH); Polk Co., E of rte. 60 crossing of Alafia River, 26 Mar. 1961, *Lakela 23960* (FLAS, GH, MIN, US, USF); St. Johns Co., N edge of St. Augustine, between rte. 1 and railroad, 15 Apr. 1982, *Correll 53634 & Popenoe* (NY); Taylor Co., ca. 2 mi. W of Hampton Springs, near Fenholloway River, low hammock, 29 Mar. 1910, *Harper 62* (CM, GH, NY); vicinity of Aucilla River, along rte. 98, 21 Apr. 1979, *Gholson 7661 & Godfrey* (FLAS); Volusia Co., Daytona, 14 Mar. 1904, *Deam 1805* (MICH); High Trail fish camp, 11 Apr. 1978, *Thorne s.n.* (USF); Wakulla Co., St. Marks Wildlife Refuge, 24 Apr. 1971, *Godfrey 70197* (FSU, GH, KNK, MSC, NY, PH, USF); ca. 0.7 mi. N of Newport, just S of Newport Spring, 6 May 1990, *Naczi 2383* (DOV, MICH). **Georgia:** Early Co., along Kirkland Creek, near Howard's Mill, 11 Apr. 1938, *Harper 3632* (F, GH, MICH, MO, NY, PH, US); Jefferson Co., ca. 10 mi. SE of Louisville, 8 Apr. 1904, *Harper 2104* (F, GH, MO, NY, US); Lee Co., Fowlton Creek near Armena, 20 Mar. 1949, *Thorne 9026 & Muenscher* (GA). **North Carolina:** Jones Co., 6.5 mi. E of Pollocksville, Island Creek, 20 Apr. 1952, *Godfrey 52245 & Radford* (NY, TENN); New Hanover Co., Wilmington, Delgado, 21 Apr. 1923, *Churchill 132* (GH); Pender Co., 7–13 June 1899, *Ashe s.n.* (NCU); ca. 11.5 mi. NNW of Holly Ridge, ca. 0.3 mi. W of Onslow Co. line, 20 May 1992, *Reznicek 8943 & Reznicek* (DOV, MICH); ca. 1 mi. W of Onslow Co. line, 20 May 1992, *Reznicek 8952 & Reznicek* (MICH). **South Carolina:** Aiken Co., Savannah River Site, along Tinker Creek above confluence with Upper Three Runs, 17 May 1993, *Antieau 185* (USCH); Allendale Co., Watchcall Creek, W side of SC 3, 13 Apr. 1996, *Nelson 17099 & Pittman* (DOV, MICH, USCH, VDB); Horry Co., 3 mi. N of Conway, 21 Apr. 1932, *Weatherby 16431 & Griscom* (NY); Orangeburg Co., Santee State Park, near Chapel Hill Baptist Church NE of rte. 6, 14 June 1988, *Hill 19574* (CLEMS, MICH).

Carex infirminervia, a New Species of *Carex* sect. *Deweyanae*

Carex sect. *Deweyanae* is a group of six to eight species of North America and eastern Asia. Most of the species occur in western North America, where as many as five species are sympatric in portions of British Columbia, Montana, and Washington. Members of *Carex* sect. *Deweyanae* usually inhabit mesic to wet-mesic woodlands.

Plants belonging to *Carex* sect. *Deweyanae* are lax sedges with setaceous proximal bracts, spikes that are usually gynecandrous or pistillate, distigmatic pistillate flowers, and spongy-based, beaked, thick-margined, non-puncticulate perigynia. The section contains *C. bolanderi* Olney, *C. bromoides* Willdenow subsp. *bromoides, C. bromoides* subsp. *montana* Naczi, *C. deweyana* Schweinitz var. *deweyana, C. deweyana* var. *collectanea* Fernald, *C. leptopoda* Mackenzie, *C. senanensis* Ohwi, and *C. infirminervia,* described here. Reznicek and Ball (1980) referred *C. laeviculmis* Meinshausen to section *Deweyanae.* It and the very similar (possibly conspecific) *C. kreczetoviczii* T. V. Egorova may belong to another section since they have shorter spikes, perigynia with lower length : width ratios, shorter perigynium beaks, and perigynia that are more spreading than is typical for section *Deweyanae.* All of the members of *Carex* sect. *Deweyanae* are native to North America, except *C. kreczetoviczii* (northeastern Russia) and *C. senanensis* (Japan).

Taxonomy within *Carex* sect. *Deweyanae* is controversial, particularly for *C. deweyana* and its western North American allies. In this group, some authors recognize as many as three species, *C. bolanderi, C. deweyana,* and *C. leptopoda* (Mackenzie, 1931; Hermann, 1970; Scoggan, 1978). Most recent authors, however, lump the three species, recognizing only *C. deweyana* with no infraspecific taxa (e.g., Hitchcock et al., 1969; Cronquist et al., 1977; Taylor, 1983; Klinka et al., 1989; Hurd et al., 1998). A few authors follow an intermediate course, treating *C. leptopoda* as *C. deweyana* subsp. *leptopoda* (Mackenzie) Calder & R. L. Taylor (Calder & Taylor, 1965, 1968; Mastrogiuseppe, 1993).

Detection of a new species of *Carex* sect. *Deweyanae* from western North America results from ongoing revisionary studies of the section by Naczi. Past failure to recognize this new species probably contributed to confusion among the species in the section. The new species, here named *C. infirminervia,* is distinguished from other members of the section in the following key.

Key to *Carex* sect. *Deweyanae*

This key works best with complete and ample specimens bearing mature perigynia; immature or incomplete specimens are difficult or impossible to identify. Since perigynia from the midregion of the spikes are most characteristic of the taxa, these perigynia should be studied in preference to perigynia from the proximal or distal portions of spikes.

1a. Longest (per plant) proximal spike 5.5–9.8 mm long; perigynium beaks 0.4–1.1(–1.3) mm long (beaks measured from achene apex to perigynium apex); widest leaf blade 1.3–2.0(–2.3) mm wide.
  2a. Infructescences (16–)28–58(–87) mm long . . . . . *C. laeviculmis*
  2b. Infructescences 15–25 mm long . . . . . *C. kreczetoviczii*

1b. Longest (per plant) proximal spike 8.7–27 mm long; perigynium beaks 0.9–2.8 mm long (beaks measured from achene apex to perigynium apex); widest leaf blade 1.3–5.9 mm wide.
  3a. Perigynia (3.3–)4.1–6.7 times as long as wide, abaxially with (3)4 to 8 complete nerves (those that extend unbroken from perigynium base to base of perigynium beak); achenes 1.9–2.9 times as long as wide; widest leaf blade 1.3–4.4 mm wide.
    4a. Culms 0.5–1.1 mm wide at mid-height; widest leaf blade 1.3–2.9(–3.1) mm wide; perigynium beaks 30–42% of perigynium length . . . . . *C. bromoides* subsp. *bromoides*
    4b. Culms 1.0–1.6 mm wide at mid-height; widest leaf blade (2.3–)2.8–4.4 mm wide; perigynium beaks 36–48% of perigynium length . . . . . *C. bromoides* subsp. *montana*
  3b. Perigynia 2.3–3.9(–4.2) times as long as wide, abaxially with 0 to 7 complete nerves (those that extend unbroken from perigynium base to base of perigynium beak); achenes 1.2–1.8 times as long as wide; widest leaf blade (2.2–)2.4–5.9 mm wide.
    5a. Ligule of distal leaf on culm 0.9–2.2 mm long; pistillate scale bodies 2.8–4.2 mm long; achenes (1.8–)1.9–2.2 mm long; longest infructescence with 2 to 5 spikes; longest proximal spike with 5–12 perigynia (including undeveloped or aborted ones).
      6a. Longest infructescence 35–56 mm long, longest internode between proximal spikes (11–)13–34 mm; longest proximal bract 15–49 mm long . . . . . *C. deweyana* var. *deweyana*
      6b. Longest infructescence 12–32 mm long, longest internode between proximal spikes 6–10 mm; longest proximal bract 9–12(–18) mm long . . . . . *C. deweyana* var. *collectanea*
    5b. Ligule of distal leaf on culm (2.1–)3.1–8.1 mm long; pistillate scale bodies 2.1–3.3(–3.8) mm long; achenes 1.4–1.9(–2.2) mm long; longest infructescence with (4)5 to 9 spikes; longest proximal spike with (9)12 to 37 perigynia (including undeveloped or aborted ones).
      7a. Perigynium beaks 0.9–1.5(–1.7) mm long, 28–38% of perigynium length; pistillate scale bodies 2.1–2.9(–3.1) mm long . . . . . *C. leptopoda*

7b. Perigynium beaks (1.4–)1.6–2.7 mm long, 38–50% of perigynium length; pistillate scale bodies (2.3–)2.7–3.8 mm long.
  8a. Perigynium apices with teeth 0–0.2(–0.4) mm long, teeth 0–8% of perigynium length (avoid perigynia with teeth lengthened by tearing of sinus between teeth); longest infructescence with (4)5 to 6(7) spikes; culm at mid-height papillose (best seen with 20× magnification on young culms) . . . . . *C. infirminervia* sp. nov.
  8b. Perigynium apices with teeth (0.2–)0.3–0.6(–1.0) mm long, teeth (6–)9–20% of perigynium length (avoid perigynia with teeth lengthened by tearing of sinus between teeth); longest infructescence with (5)6 to 9 spikes; culm at mid-height smooth, serrulate, or scabridulous (check with 20× magnification).
    9a. Perigynia abaxially with (2)3 to 7 complete nerves; perigynium margins denticulate for 34–51% of perigynium length . . . . . *C. bolanderi*
    9b. Perigynia abaxially with 0 to 2(3) complete nerves; perigynium margins denticulate for 49–64% of perigynium length . . . . . *C. senanensis*

Carex infirminervia Naczi, sp. nov. TYPE: [Canada. British Columbia]: Nelson, Silver King Mine Rd., roadside at about 5000 ft., 31 July 1943, *J. W. Eastham 10949* (holotype, UBC; isotype, DAO). Figure 7.

A *Carice bolandero* et *Carice senanensi* culmis papillosis, infructescentiis spicis paucioribus instructis, apicibus perigyniorum edentatis vel brevidentatis differt.

Perennial, densely caespitose. Culms 10–83 cm tall, 0.8–1.3 mm wide at mid-height, covered with minute papillae at mid-height. Leaves with blades 1.4–3.8 mm wide, the widest blades 2.3–3.8 mm wide; ligules of distal leaves on culm (2.1–)2.6–6.8 mm long. Infructescences 27–68 mm long, with the proximal-most 2 spikes overlapping or separate, internode between proximal-most spikes 7.3–28 mm long; proximal-most bract 11–61 mm long. Spikes (4)5 to 6(7), usually gynecandrous but also sometimes pistillate or staminate; terminal spike 9.6–16 × 3.4–6.2 mm, usually with 1 to 3 staminate and 14 to 21 pistillate flowers, sessile or on peduncle up to 1.8 mm long; proximal-most spike 9.7–18 × 3.7–6.6 mm, the longest per plant 12–18 mm long, usually with 1 to 3 staminate and 11 to 22 pistillate flowers, the longest per plant with 12 to 22 pistillate flowers. Pistillate scales 2.9–4.4 mm long, acuminate to short-awned with awn up to 1.1 mm long; bodies 2.9–3.8 × 1.4–1.8 mm, whitish to castaneous except for green midrib. Staminate scales 3.1–4.3 × 1.0–1.5 mm, acute to short-awned, margins whitish to castaneous. Perigynia 3.7–5.3 mm long, 1.1–1.3(–1.4) mm wide, erect to appressed-erect, narrowly lanceolate in outline, 3.2–3.9(–4.2) times as long as wide, green to brown, unnerved adaxially, unnerved or weakly 1- to 3(4)-nerved abaxially, gradually narrowed to a beak; beaks 1.5–2.2 mm long, 39–49% of total perigynium length, denticulate on margins for distal 49–60% of length of perigynium, the apex toothless or bidentulate with teeth 0.1–0.2(–0.4) mm long, teeth 0–8% of perigynium length. Achenes 1.6–2.2 × 1.1–1.3 mm, 1.5–1.8 times as long as wide. Stigmas 1.8–2.5 mm long. Anthers 1.3–1.8 mm long.

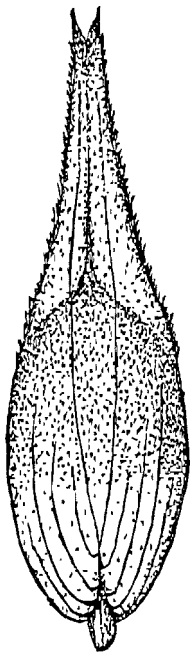

Figure 7. *Carex infirminervia* Naczi. Perigynium, abaxial view (× 20).

Carex infirminervia most closely resembles *C. bolanderi* and *C. senanensis*. *Carex infirminervia* possesses relatively long ligules (≥ 2.1 mm long), relatively long bodies of the pistillate scales (≥ 2.9 mm long), perigynia 3.2–3.9(–4.2) times as long as wide, and perigynium beaks occupying a relatively high percentage of the perigynium length (≥ 39%). Only *C. bolanderi* and *C. senanensis* also have this combination of features; other species in section *Deweyanae* have shorter ligules (*C. deweyana*), shorter pistillate scale bodies (*C. leptopoda*), perigynia with either a lower (*C. leptopoda*) or a higher (*C. bromoides*) length : width ratio, and perigynium

beaks occupying a lower percentage of the perigynium length (*C. deweyana, C. leptopoda*).

Carex infirminervia differs from both *C. bolanderi* and *C. senanensis* in at least three ways. First, at mid-height, the culms of *C. infirminervia* are covered with minute papillae (best seen with 20× magnification), whereas those of *C. bolanderi* and *C. senanensis* are smooth, serrulate, or scabridulous. The papillae on culms of *C. infirminervia* have their long axes perpendicular to the culm surface, unlike the serrulations and minute, antrorse teeth that are sometimes present in the mid-region of the culms of *C. bolanderi* and *C. senanensis.* The papillae are delicate, and many wear off the culms with age. By the time most perigynia have shed from a culm of *C. infirminervia,* the papillae may be patchily distributed or nearly absent. Thus, when studying the morphology of culms of *C. bolanderi, C. infirminervia,* and *C. senanensis,* one should examine more than one culm per specimen and include young culms in this examination. Within *Carex* sect. *Deweyanae,* papillose culms are not unique to *C. infirminervia.* Regularly, *C. leptopoda* has papillose culms, and *C. deweyana* occasionally has them. However, within the group of *C. bolanderi, C. infirminervia,* and *C. senanensis,* papillose culms are restricted to *C. infirminervia.*

A second feature that distinguishes *C. infirminervia* from *C. bolanderi* and *C. senanensis* is its fewer spikes per infructescence. The longest infructescence per plant in *C. infirminervia* bears (4)5 to 6(7) spikes, whereas *C. bolanderi* has (5)6 to 9 spikes and *C. senanensis* has 7 to 9 spikes. A third diagnostic feature of *C. infirminervia* is the toothless or relatively short-toothed perigynium apex. Whereas apices of perigynia of *C. infirminervia* have teeth 0–0.2(–0.4) mm long, those of *C. bolanderi* and *C. senanensis* bear teeth (0.2–)0.3–0.6(–1.0) mm long.

Additional features distinguish *C. infirminervia* and *C. bolanderi.* The perigynium margins of *C. infirminervia* are denticulate for the distal 49–60% of the perigynium length, whereas in *C. bolanderi,* the margins are denticulate for 34–51% of the perigynium length. Also, abaxial surfaces of perigynia of *C. infirminervia* usually have fewer and fainter nerves than those of *C. bolanderi.* In *C. infirminervia,* 0 to 3(4) fine nerves extend unbroken from the perigynium base to the base of the perigynium beak, whereas perigynia of *C. bolanderi* have (2)3 to 7 nerves, which are usually relatively thick. The epithet "infirminervia" ("weak-nerved") is appropriate for the new species since its relatively few and faint perigynium nerves distinguish it from *C. bolanderi,* the species to which it is morphologically and geographically most similar.

Carex infirminervia ranges from southwestern Alberta and central British Columbia south to northern Colorado and west to central California. Portions of the geographic range of *Carex infirminervia* overlap parts of the ranges of *C. deweyana* and *C. leptopoda. Carex infirminervia* is allopatric with the eastern North American *C. bromoides* and the Japanese *C. senanensis. Carex infirminervia* is sympatric with *C. bolanderi* over much of the ranges of the two species. Herbarium specimens document at least two locations for syntopy of *C. infirminervia* and *C. bolanderi*: one in British Columbia (Nelson, Six Mile Lakes, common on plateau, 4500 ft., 27 June 1940, *Eastham 7578* [UBC]—*C. infirminervia,* and *Eastham 7577* [UBC]—*C. bolanderi*) and the other in California (El Dorado Co., Strawberry Creek, 5900 ft., 20 July 1897, *Brainerd 179* [VT]—*C. infirminervia,* and *Brainerd 180* [VT]—*C. bolanderi*). In both cases, the collectors apparently noticed a difference between the two species, since they assigned different collection numbers to the specimens of each. Co-occurrence of *C. infirminervia* and *C. bolanderi,* with both apparently maintaining their distinctions, is further evidence in support of their status as two species.

Though widespread, *C. infirminervia* is infrequent and its populations are scattered. Judging from herbarium labels, it usually occurs in woodlands and their edges, often on slopes above streams. A few collectors have indicated *C. infirminervia* also grows in more open habitats, such as grassy slopes and roadsides. Perhaps these open habitats are near woodlands.

Most collections of *C. infirminervia* bear original identifications of *C. bolanderi, C. leptopoda,* or *C. deweyana. Carex infirminervia* shares some features with *C. bolanderi* (discussed above), *C. deweyana* (e.g., relatively long pistillate scale bodies, perigynium apex toothless or short-toothed, few and faint perigynium nerves), and *C. leptopoda* (e.g., relatively long ligules, perigynium apex toothless or short-toothed, few and faint perigynium nerves). Such shared characteristics probably account for much of the conflicting classification within the section. Recognition of the diagnostic features of *C. infirminervia* permits precise circumscription of it and similar species, with resultant clarification of the taxonomy of section *Deweyanae.*

Paratypes. CANADA. **Alberta:** Lake Louise, 22 July 1904, *Macoun 64142* (GH, NY); Carbondale River, 16 July 1944, *Cormack 328* (ALTA, US); Waterton Lakes National Park, above Waterton Lake, 13 July 1953, *Breitung 15880* (NY, US); Waterton Lakes National Park, E shore

of Cameron Lake, 1 Aug. 1956, *Hermann 13049* (ALTA, US). **British Columbia:** Selkirk Mountains, Glacier, 4300 ft., 10 Aug. 1897, *Brainerd s.n.* (VT); Selkirk Mountains, Glacier–Avalanche Mountain, 23 July 1908, *Butters 398 & Holway* (GH, RM); Nelson, Six Mile Lakes, 27 June 1940, *Eastham 7578* (UBC); ca. 11 mi. W of Revelstoke, near Victor Lake, 3 July 1941, *Hitchcock 7547 & Martin* (WTU); Rossland, Little Sheep Creek Trail, 5 July 1942, *Eastham 9978* (UBC); Fernie, Fairy Creek, 5 July 1947, *Eastham 15652* (DAO, UBC); ca. 9 mi. NE of Nelson, Sitcum Creek Delta, 19 June 1953, *Calder 9385 & Savile* (DAO, UBC, UC); NNE of Naramata, 1.5 road mi. SW of Chute Lake, 8 July 1953, *Calder 10242 & Savile* (DAO, DS); Manning Park, 12 mi. NW of ranger station, along Hope–Princeton Hwy., 3100 ft., 16 July 1953, *Calder 10606 & Savile* (DAO); just NW of Azouzetta Lake, Pine Pass, along Hart Hwy., 2900 ft., 13 July 1960, *Calder 26902 & Kukkonen* (DAO); Galena, at Hill Creek, 21 June 1962, *Taylor & Szczawinski 513* (UBC); Azouzetta Lake, Hart Hwy., 650 m, 5 July 1963, *Taylor & Szczawinski 636* (UBC); 20 km NE of Vernon, Silver Star Mountain, 5 July 1982, *Botham 2948* (DAO, MICH), *Botham 2962* (DAO, MICH); ca. 8 km E of Yahk, provincial rest area on N side of hwy. 3, 27 June 2000, *Ford 00125 & Saarela* (WIN); Manning Provincial Park, trail between Strike and Flash Lake, 29 June 2000, *Ford 00139 & Saarela* (DOV, WIN). U.S.A. **California:** El Dorado Co., Strawberry Creek, 5900 ft., 20 July 1897, *Brainerd 179* (VT); Lake Tahoe, Emerald Bay, 21 July 1941, *Rose 41334* (CAS); Fresno Co., 2 mi. N of General Grant, National Park Headquarters, 29 June 1940, *Rose 40686* (CAS); Glenn Co., Canyon of Snow Basin Creek, 5 Aug. 1943, *Howell 19106* (CAS, US); Humboldt Co., Trinity Summit, lower end of Brett Hole, 23 July 1935, *Tracy 14162* (CAS, DS, NCU, UC); Mariposa Co., Lake Tenaya Trail, 14 Aug. 1894, *Congdon s.n.* (DS); Nevada Co., between Donner Pass and West Lake, 23 July 1943, *Howell 18721* (CAS); Placer Co., Lake Tahoe, Chambers Lodge, 25 July 1944, *Rose 44245* (CAS); Plumas Co., 8 mi. SW of Johnsville, McRae Meadows, 28 June 1951, *Rose 51029* (COLO); Lassen Volcanic National Park, Boiling Springs Lake, 20 July 1960, *Howell 35759* (CAS); Siskiyou Co., Spirit Lake, Marble Mountains, 3 Aug. 1939, *Howell 14989* (CAS, UC); SE end of Long Gulch Lake, Klamath National Forest, T39N, R9W, SE1/4 sect. 32, 12 Aug. 1987, *Tallent 901* (MICH); Trinity Co., N Fork Coffee Creek, Trinity River, 19 Aug. 1916, *Goldsmith 19a* (JEPS); [Tuolumne] Co. [originally labeled as El Dorado Co.], Jones Hill, 1879, *Shockley 605* (JEPS). **Colorado:** Boulder Co., Marysville, E of Eldora, N-facing slope Tennessee Mountain, Shickley property, 23 July 1971, *Colson 71-23* (COLO); Gunnison Co., Gunnison National Forest, West Elk Wilderness, along Cascade Creek, 0.25 mi. upstream from Coal Creek confluence, 7200 ft., 19 July 1994, *Rondeau 94-203 & DeCoursey* (COLO); Routt Co., Routt National Forest, lower Silver Creek, ca. 8100 ft., 13 Aug. 1993, *Duff 435 & Kettler* (COLO). **Idaho:** Bonner Co., 20 mi. N of Sandpoint, 3.5 mi. NE of Jeru Peak, Homstead Creek Watershed, Selkirk Mts., 14 Aug. 1969, *Stickney 1954* (RM); Elmore Co., ca. 6 mi. from Atlanta on road to Featherville, 22 July 1944, *Hitchcock 10203 & Muhlick* (CAS, GH, NY, RM, UC, US, WTU); Latah Co., NE of Moscow, Thatuna Hills, 12 July 1939, *Baker 1428* (WTU); Valley Co., 3 mi. NW of Payette Lake, 25 June 1946, *Hitchcock 13949 & Muhlick* (CAS, MO, NY, RM, UC, UTC, WTU); 12 mi. N of McCall, Brush Creek Rd., Payette National Forest, 13 Aug. 1971, *Lewis 2144* (UTC); upper six mile creek, Middle Fork Payette, Boise National Forest, 14 July 1972, *Lewis 2451* (UTC). **Montana:** [Flathead] Co., Nyack, 5 Aug. 1894, *Williams 466* (US); Flathead Co., Upper Whitefish Lake, above campground, Whitefish Range, 2 July 1972, *Lackschewitz 3718* (RM); Glacier Co., Glacier National Park, along trail from Many Glacier Hotel to Swiftcurrent Pass, 19 July 1919, *Standley 16011* (US); Ravalli Co., 10 mi. S of Alta, head of Beaver Creek, 2 July 1946, *Hitchcock 14362 & Muhlick* (CAS, NY, WTU). **Nevada:** Washoe Co., Carson Range, Little Valley, 26 July 1975, *Tiehm 1640* (NY, RENO). **Oregon:** Baker Co., 18 mi. above Richland, Eagle Creek, 28 June 1938, *Peck 19969* (CAS, WILLU); [Hood River] Co., Mount Hood, near White River, 23 July 1928, *Thompson 5006* (MO, WTU); Klamath Co., Crater Lake National Park, Vidae Ridge, 15 Aug. 1950, *Baker 7244* (CAS); N end of Lake of Woods, *Peck 16589* (WILLU); Lane Co., Lookout Ridge, along Lookout Ridge Rd., Andrews Exp. Area, 25 July 1968, *Franklin 772* (OSC, RM); Morrow Co., Umatilla National Forest, Alder Creek, along FS Road 21, 10 July 1993, *Wilson 6153 et al.* (MICH); [Umatilla] Co., Laka, Blue Mountains, 12 June 1886, *Henderson 1784* (GH); Wallowa Co., Eagle Cap Wilderness, S of S end of road in Lostine Canyon, 8 Aug. 1994, *Wilson 7392 et al.* (MICH). **Utah:** [Salt Lake] Co., Alta, Wasatch Mountains, 8 Aug. 1879, *Jones 1218* (MICH, NY, UTC); Salt Lake Co., Little Cottonwood Canyon, White Pine Fork Trail, 13 Aug. 1983, *Arnow 6149* (NY). **Washington:** Asotin Co., SW of Anatone, head of Cottonwood Creek, T7N, R44E, sect. 6, 9 July 1949, *Cronquist 5944 & Jones* (COLO, GH, MICH, NY, UC, US, UTC, WTU); [Chelan] Co., Stehekin, June 1902, *Griffiths 198 & Cotton* (GH); Cascade Tunnel, 14 July 1911, *Jones s.n.* (DS); Stevens Pass, June 1928, *Grant s.n.* (RM); Chelan Co., Stehekin River, below Cottonwood Camp, 31 Aug. 1956, *Raven 10300* (CAS); Columbia Co., Blue Mountains, 11 Aug. 1897, *Horner R485B524* (GH); Pierce Co., Mount Rainier National Park, trail to Glacier Basin, White River Campground, 2 Aug. 1977, *Colson 77-60* (COLO); Whatcom Co., S of Colonial Campground, Thunder Creek Trail, 14 June 1991, *Castaner 10723* (DOV). **Wyoming:** Lincoln Co., Skull Creek at junction of Little Greys River, 28 June 1980, *Tuhy 66* (NY); Park Co., ca. 1.5 mi. N of rtes. 14, 16, and 20, along Grinnell Creek Trail, 9 Aug. 1980, *Evert 2343* (COLO, NY, RM); along Mormon Creek, ca. 2–3 mi. N of Hwy. 14, 19 July 1985, *Evert 8535* (NY); Teton Co., 13 mi. E of Driggs, Idaho, 2 mi. E of Treasure Mountain Scout Camp, Teton Forest Camp, 16 July 1956, *Anderson 507* (NY, UTC).

A New Combination for a Variety of *Carex digitalis* (*Carex* sect. *Careyanae*)

Carex digitalis Willdenow is widespread in forests of eastern North America and common throughout most of its range. Fernald (1950) recognized two non-autonymic varieties for this species, *C. digitalis* var. *asymmetrica* Fernald and *C. digitalis* var. *macropoda* Fernald. In the forthcoming treatment of *Carex* sect. *Careyanae* for the *Flora of North America*, Bryson and Naczi (in press) recognize three varieties for *C. digitalis*, using the same circumscriptions as Fernald. However, the nomenclature of one of these varieties must change. Over half a century prior to Fernald, Bailey (1889)

described *C. laxiculmis* var. *floridana,* which is the same taxon as *C. digitalis* var. *asymmetrica.* In order to use Bailey's prior epithet and align it with *C. digitalis,* it must be transferred, as follows.

Carex digitalis var. **floridana** (L. H. Bailey) Naczi & Bryson, comb. nov. Basionym: *Carex laxiculmis* var. *floridana* L. H. Bailey, Mem. Torrey Bot. Club 1: 47. 1889. TYPE: U.S.A. Florida: [no additional locality information, no date], *Chapman s.n.* (lectotype, designated here, BH).

Carex digitalis var. *asymmetrica* Fernald, Rhodora 43: 544. 1941. Syn. nov. TYPE: U.S.A. Virginia: Southampton Co., NW of Applewhite Church, near Three Creek, 8 May 1940, *Fernald & Long 11791* (holotype, GH; isotypes, GH, PH).

Carex digitalis var. *floridana* is diagnosed by relatively long perigynia (3.2–4.2 mm long) with conspicuously excurved apices. Specimens of the two other varieties, *C. digitalis* var. *digitalis* and *C. digitalis* var. *macropoda,* have perigynia 2.4–3.4 mm long with barely excurved apices. Examination of the types of *C. digitalis* var. *asymmetrica* and *C. laxiculmis* var. *floridana* reveal that both have long perigynia with excurved apices. In addition, Naczi and Bryson discern no taxonomic differences between these type specimens. Hence, we conclude they are the same taxon.

Bailey cited two syntypes for his *C. laxiculmis* var. *floridana, Chapman s.n.* and *Curtiss s.n.,* both from Florida. We choose the Chapman specimen as the lectotype because it more closely matches the description, and it bears mature and ample perigynia, whereas the other specimen (*Curtiss s.n.*) has immature and few perigynia.

Plants of *C. digitalis* var. *floridana* inhabit mesic, well-drained (usually sandy) soils of deciduous and deciduous-pine forests from southern Maryland south and west to eastern Texas, mostly on the Coastal Plain.

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