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

Robert F. C. Nacz
Claude E. Phillips Herbarium, Department of Agriculture & Natural Resources, Delaware State University, Dover, Delaware 19901-2277, U.S.A. rriaczi@dsc.edu

Charles T. Bryson
USDA-ARS, Southern Weed Science Research Unit, P.O. Box 350, Stoneville, Mississippi 38776, U.S.A. cbryson@ars.usda.gov

Theodore S. Cochrane
Herbarium, Department of Botany, University of Wisconsin—Madison, Madison, Wisconsin 53706-1381, U.S.A. tscochra@farstaff.wisc.edu

ABSTRACT. Seven species in four sections of Carex are described as new from North America: C. acidicola Nacz, C. calcifugens Nacz, C. paeninsulae Nacz, F. L. Bridges & Orzell, and C. thornei Nacz (all sect. Griseae); C. kraliana Nacz & Bryson (sect. Laxiflorae); C. gholsonii Nacz & Cochrane (sect. Granulares); and C. infirmiersa Nacz (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 infirmiersa 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) Nacz & Bryson (Carex sect. Careyanae) is proposed to replace C. digitalis var. asymmetrica Fernald because of the priority of Bailey's epithet.


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 Kunkenthal, one is a member of Carex sect. Granulares (O. Lang) Mackenzie, and one belongs to Carex sect. Deweyanae (Tuckerman ex Mackenzie) Mackenzie.

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.

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 impressed in the surface and dry perigynia. 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. edwardiana 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. calcigynus, C. paeninsulam, and C. thorioti. 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 PERIGYNYA 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. paeninsulam, 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, 1.0–2.0(–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 (most easily seen on abaxial surfaces of blades) ................................................................. C. paeninsulam 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 exceeding 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 convoluted (0.6–1.1–4.0 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. calcigynus 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(–0.13) mm long. C. edwardiana

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 exceed by culms or slightly exceeding culms, tallest vegetative shoot 0.5-1.3 times as tall as tallest culm .................................................. Carex hornii 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 .................................................. Carex paeninsulatae 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, MICII, NCU, NY, US, VDB, herb. Bryson). Figure 1.

A ceteris speciebus Carex oligocarpa affinis inter venis 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. Inflorescences 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, (24-) 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, beadless 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 contrasting 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
mm wide, except for C. oligocarpa (widest leaf blade 1.8—3.9—4.6 mm wide), C. pueninsulane (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. pueninsulane 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. pueninsulane), 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. pueninsulane).

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

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


*A Carex oligocarpa* spica infima pleurequae e basi culmi portata, foliis succulorum vegetatiorum culmos pleureaquae superantibus, vitta hyalina adaxialis vaginae bracteae infimae ad apicem truncata vel concava differt: a *Carex edwardsiana* basibus succulorum atrovinosis iasque 2.7–5.2(–5.6) cm tantum altis, corporibus squamamin pistillarum longioribus,ostiros 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-
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 distinctly 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–)1.0–6.1 mm long, 8.3–21% of perigynium length, vertical or bent 10–30° from vertical. Achene 2.6–3.4 × 1.4–1.9 mm, face tly 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 calci/ugens 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. calcis/ugens 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 calci/ugens 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 calci/ugens 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. calcis/ugens. 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. calcis/ugens are Aesculus pavia L., Carex abscondita Mackenzie, C. strictula Michaux, Carex 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. calcis/ugens 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 "calcis/ugens" ("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).


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

A species of Carex oligocarpa affinis Carex oligocarpa longissimus different.

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. Inflorescences 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 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 distalmost 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)7-12-flowered, the perigynia distichously imbricate, the internode between the proximal-most scales in the proximal-most 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 achenes 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 pentinsulata is unique in the Carex 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 Carex pentinsulata). Other members of the complex are densely caespitose, with rhizomes short (0.2-8 mm long between shoots or branches of the rhizome). Carex pentinsulata differs from Carex oligocarpa in having vegetative shoots greatly exceeding the culms (vegetative shoots 1.4-2.2 times as tall as culms in Carex pentinsulata vs. 0.88-1.4 times as tall as culms in Carex 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 Carex oligocarpa), and perigynia with a higher length:width ratio.
Figure 3. *Carex paeninsularae* 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. oligocarpae). 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. Vascular plant associates of C. paeninsulae include Arisema dracocontum (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 Stevë Orzell supplied numerous specimens and habitat notes to Robert Nacci for his description of Carex paeninsulae. In return, Nacci 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. Booth’s syntypes of Carex grisea var. angustifolia are a mixture of C. paeninsulae, C. bulbosylis, and C. corrugata-Fernald. For the lectotype, Nacci has chosen the specimen that best matches Booth’s description (Boott, 1858: 35), especially “…perigynia minus turbident, apice suepe subrostellatis . . .” which are more characteristic of C. paeninsulae than C. bulbosylis or C. corrugata. The lectotype is also the syntype that Booth illustrated for Carex grisea var. angustifolia (Boott, 1858, pl. 87).

Paratypes. U.S.A. Florida: [county unknown], “Florida” [no additional data], 1839, Chapman s.n. (GH); [Bradford Co.], Mount Vernon, 1838, Chapman 8 (NY); Clay Co., type locality, 5 May 1990, Nazzi 2373 (DOV, MICH); [Duval Co.], Island of Fort George, 1817, Balchius s.n. (NY); St. Johns, [no date, but most likely 1817—see Darlington, 1843], Baldwin s.n. (PH); Gilchrist [“Levy” on label], 1 mi. N of Trenton, 31 May 1957, Koral 4385 (FLAS, FSL, GH, MSC, VDB); Hernando Co., near Pinneola, fern grottos, 12 Apr. 1923, Small 10835 & Moser (NY); Annuitella Hammock, 26 Mar. 1958, Coodey 5807 & Eaton (FSU, GH, USF); Pinneola Grotto, N of Brooksville near Inuchenna, 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, Orzel & 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, 1 May 1976, Koral 57220 (DOV, VDB); N side of US 27, ca. 1.6 mi. SE of junction with rte. 355 at Bilchton, 28 Mar. 1993, Orozz & Bridges 21348 (DOV), 8 May 1993, Orozz & Bridges 21691 (FTG, DOV, MICH, US, USF); N side of US 27, ca. 1.8 mi. SE of junction with rte. 326 at Bilchton, 28 Mar. 1993, Orozz & Bridges 21352 (DOV, FTG, MICH, NY, US, USF, herb. Bryson); ca. 3.1 air mi. N of Flemington, 17 Apr. 1993, Orozz & 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, Orozz & Bridges 21624 (DOV, FTG); 3.2 air mi. SW of Belleview, 18 Apr. 1993, Orozz & Bridges 21626 (FLAS, FSU, FTG, DOV, MICH, NY, US, herb. Bryson); Seminole Co., near Oviedo, Black Hammock, 12 Apr. 1975, Wunderlin 5456 (USF); Sumter Co., ca. 2.2 mi. ENE of Linden, 15 Mar. 1992, Orozz & 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, Orozz & Bridges 16145 (FTG, MICH).


A ceteris speciebus Carice oligocarpa|ae affinitibus lanimis bractearum brevibus, pedunculo spicarum terminalis longi, perigynis (2.4–2.5–3.4) plo longioribus quam latiores differt.

Perennial, densely cespitose. Rhizomes 0.8–6.4 mm long between shoots or branches of the rhi-
Carex thornet Naczi 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 222–51–89(-104) mm long), and high length : width ratio of 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. Inflorescences 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, 3–12-flowered, the longest per plant 6–12-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 3.3–4.9 × 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 33 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 thornet 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

Figure 4. Carex thornet Naczi. Distal portion of culm (× 0.9); lateral view of perigynium in long section to reveal achene (× 17.5).
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 achenes bodies (perigynia 1.7–2.0 times as long as achenes bodies in C. thornei vs. [1.9–2.0–2.3 times as long as the achenes bodies in C. planispicata), and shorter achenes 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 prinophyllum (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. calirugiens (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.


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* Tucker 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 biphylectic 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 kraiiiana*, is widespread and frequent throughout much of the southeastern United States. In the following key, *Carex kraiiiana* is distinguished from all other members of section *Laxiflorae* that occur in the Western Hemisphere.

### KEY TO SPECIES OF CAREX SECT. LAXIFLORE NATIVE TO THE WESTERN HEMISPHERE

Complete, ample specimens bearing mature perigynia are necessary for identification. Magnification of 10X 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 the 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 (3.0-3.2-3.3 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 inodors; perigynia (1.6-)1.7-1.9 mm wide... *C. albatrscina*

2b. Widest leaf or bract blade 0.5-1.1 cm wide; pistillate scales from proximal portions of spikes awned, with acute inordors; perigynia 1.3-1.7(-1.8) mm wide... *C. Kraiiiana* 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. leptonerria*

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 3.1-3.2(-4.4) mm long; longest lateral spike 11-21 mm long; angles of bract sheaths denticulate... *C. gracillens*

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 3.3-4.5 cm 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-)40-157 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(-35) mm long; vegetative shoots with widest leaf blade 1.3-1.7(-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. manualttii*

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 large as achene bodies; perigynium beaks 0.2-0.6 mm long.

10a. Most culms with 2 distal lateral spikes overlapping (occasionally most culms...

A Carex albarina laminis foliorum angustioribus, squamos pistillatis acutis vel aristatis, perigynis angustioribus differt; a ceteris speciebus sectionis Laxifloraeum laminis bractearum lanceolatis vel angusti lanceolatis, laminis bractearum laticibus 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 stamine, 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).

Stamine scales 1.9–3.8 × 0.8–1.5 mm, obtuse or acute, awnless. Pistillate scales 1.1–4.2 × 1.4–1.8
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, obvoid 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 kraziiana* 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. alburnsina* Sheldon has wide and spathe-like bract blades similar to those of *C. kraziiana*.

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

*Carex kraziiana* 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. leptonerva* (Fernald) Fernald. These species share the following features with *C. kraziiana*: 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. kraziiana*, however, all these other species have linear and narrow bract blades. In *C. blanda*, *C. congestiflora*, *C. crebriflora*, *C. laxiflora*, and *C. leptonerva*, 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. laxi-
iflora). whereas it is (3.0-)3.2-7.1 mm wide in C. Kraiiana.

Additional features distinguish C. kraiiana from C. blandia, C. congestiflora, C. crebiflora, C. laxiflora, and C. leptonemia. Carex kraiiana has the terminal spike exceeded by or subequal to the distal-most lateral spike, unlike C. blandia, which has the terminal spike usually clearly exceeding the distal-most lateral spike. Carex kraiiana 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. kraiiana has 1 to 3 lateral spikes versus 2 to 5 for C. congestiflora. Relative to C. crebiflora, C. kraiiana has shorter pistillate scale bodies: 1.1-2.2(-2.4) mm long for C. kraiiana versus (2.2-2.5-3.5 mm long for C. crebiflora. Also, C. kraiiana has narrower perigynia than C. crebiflora: 1.3-1.7(-1.8) mm wide for C. kraiiana versus (1.6-1.7-2.2 mm wide for C. crebiflora. Carex kraiiana differs from C. laxiflora by its shorter terminal spikes: longest terminal spike per plant 7.6-13(-18) mm long in C. kraiiana versus (12-)19-28(-34) mm long in C. laxiflora. In addition, C. kraiiana 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. kraiiana versus 3.3-8.2 mm long in C. laxiflora. Carex leptonemia has 8- to 18-nerved perigynia (29- to 34-nerved in C. kraiiana) and relatively loosely overlapping perigynia: internode between proximal-most scales of proximal-most spike 3.0-6.9 mm long in C. leptonemia versus 1.1-3.2 (-3.8) mm long in C. kraiiana.

Probably because of its similarity to so many other species, Carex kraiiana remained undescribed for so long. Older specimens of C. kraiiana bear identifications most often of C. blandia, C. crebiflora, and C. laxiflora var. serrulata F. J. Hermann. Naczi and Bryson, too, had thought the name C. laxiflora var. serrulata applied to C. kraiiana 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. kraiiana. Because of confusion of C. laxiflora var. serrulata with C. kraiiana, reports of the former, particularly from the southeastern U.S. (e.g., Deam, 1940; Hermann, 1954, 1974; Braun, 1967; Hyatt, 1998; Renzieck & Gonzalez-Elizondo, 1999), should be regarded as possibly C. kraiiana and should be re-evaluated.

Plants of C. kraiiana grow in mesic deciduous forests, usually in loams, sandy loams, and silt loams. Frequent associates of C. kraiiana include C. amphibola Steudel, C. basiantha, C. planispicata, C. rascen Willdenow, Hexastylis arifolia, and Podophyllum peltatum L. Carex kraiiana 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. kraiiana.

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.


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, Weibold 8873 (DOV, VPI); Ohio: Lawrence Co., N side of Sharp's Creek Rd. (C-19), 2 mi. W of Swannes Creek, 22 May 1997, McCormar 5796 (MICH).

South Carolina: Edgefield Co., ca. 8 mi. SW of Edgefield, 2 Apr. 1997, Nelson 18840 (DOV, VPI); Lancaster Co., ca. 2 mi. E of Taxahaw, 17 May 1996, Naczi 3319 (DOV); York Co., ca. 4 mi. NW of Bethany, 17 May 1996, Naczi 5304 (DOV).

Tennessee: Deer Co., ca. 6 mi. NW of Dyer, 27 June 1995, Naczi 4844 & Reznicek (DOV); Grundy Co., ca. 10 mi. SW of Altamont, 29 May 1990, Naczi 2517, Kral & Raveell (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, Ozell & Bridges 4540 (MICH); Sabine Co., ca. 4.5 mi. N of Milam, along upper reaches of Mason Creek, 12 Apr. 1988, Ozell & Bridges 6189 (MICH); Tyler Co., above B. A. Steothagen Lake, 4 Apr. 1989, Ozell & Bridges 8991 (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 & Weibold (DOV, VPI); Southampton Co., NW of Courtland, near Davis School, along Notoway 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 SH 672, 22 June 1993, Dodge 1465 (GMUF).

Carex cholosonii, a New Species of Carex Sect. Grunulaires


donta) occur in the southeastern United States, the center of diversity of the section. Carex atraculodes 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. Grunulaires: 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. Grunulaires, include long-sheathing proximal bracts, usually unisexual spikes with only the terminal one staminate, glabrous perigynia that are suborbicular or obusely 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. Grunulaires, Naczi and Cochran have discovered a previously undescribed species of the southeastern U.S. This new species, here named C. cholosonii, is infrequent to rare in its relatively small geographic range. In the following key, C. cholosonii is distinguished from other members of Carex sect. Grunulaires.

Key to Carex Sect. Grunulaires

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. Stamine 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. cralei

2b. Stamine scale bodies acute, often awned; widest leaf 2.3-3.8 mm wide; perigynia 2.8-4.2 mm long, with beaks 0.3-0.9 mm long; C. microdonata

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 (4.5) mm long; pedigynia 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

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; pedigynia 2.9–4.0 mm long

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

C. atractodes

Carex gholsonii Naczi & Cochrane, sp. nov.


Figure 6.

A Carex granulata habitu laxa caespitosa, foliis viridibus, ligulis brevioribus, laminis bractearm brevioribus, perigynis longioribus, perigynis (1.6–)1.9–3.0 plo longioribus quam lariothibus differt; a Carex atractodei spica terminali longiore, pedunculo longiori insidente differt; a Carex quenesis laminis foliorum lariothibus, spica terminali latiore, perigynis 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. Inflorescences 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 8.5–34 (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; peduncle of terminal spike 1.4–16 (140) mm long, the longest per plant 3.3–16 (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 excursive 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 achene or perpendicular to broad base, abruptly contracted from widest point to minute beak; stipule 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. granulata, and C. quenesis. In fact, most specimens of C. gholsonii were originally identified as C. granulata. As indicated in the key, C. gholsonii differs from C. granulata by having a loosely caespitose habit, green foliage, shorter ligules, shorter bract blades, longer perigynia, and perigynia with a higher
Carex gholsonii

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 2396, 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. broomides Willdenow, C. chapmanii Steudel, C. godfreyi Naczi, C. leptalea Wahlenberg, Rhynchospora milacea (Lamarck) A. Gray, Ruellia carolinensis, Su-bal 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 Cochran 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 aid in 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.

**Carex infirmiervia**, 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 satevous proximal bracts, spikes that are usually gynecandrous or pistillate, distigmatic pistillate flowers, and spongy-based, beaked, thick-margined, non-punctate 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. infirmiervia*, 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; Scoggin, 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. infirmiervia*, 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* 1b. Infructescences 15–25 mm long ........................................ *C. kreczetoviczii*

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 mm 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 1.3–2.0 (–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*

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 undevolved 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 undevolved 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*
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 Carex bolanderi et Carex senanensis culmis papillosis, infructescetis spiciis paucioiaribus 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-)2.6-3.8 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 gynoecandrous 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 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. Stamina 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.

Carex infirminervia 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. bronnioides) length:width ratio, and perigynium

Figure 7. Carex infirminervia Naczi. Perigynium, abaxial view (X 20).
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, a. 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 infrutescence. The longest infrutescence 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 40–60% 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 northeastern 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, Brainard 179 [VT]—C. infirminervia, and Brainard 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 sect. Deweyanae.

Paratypes. CANADA. Alberta: Lake Louise, 22 July 1904, Macoun 64142 (GH, NY); Carbondale River, 16 July 1944, Carrick 529 (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, Brainened s.n. (VT); Selkirk Mountains, Glacier–Avachin Peak, 23 July 1908, Batters 398 & Holway (GH, IM); 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, Sitsum Creek Delta, 19 June 1953, Calder 9385 & Saville (DAO, UBC, UC); NNE of Naramata, 1.5 road mi. SW of Chute Lake, 8 July 1953, Calder 10242 & Saville (DAO, DS); Manning Park, 12 mi. NW of ranger station, along Hope–Princeton Hwy., 3100 ft., 16 July 1953, Calder 10666 & Saville (DAO); just NW of Assinook Lake, Pine Pass, along Hart Hwy., 2900 ft., 13 July 1960, Calder 25902 & Kukkonen (DAO); Galena, at Hill Creek, 21 June 1962, Taylor & Szczawinski 513 (UBC); Assinook Lake, Hart Hwy., 650 m, 5 July 1963, Taylor & Szczawinski 636 (UBC); 20 km NE of Vernon, Silver Star Mountain, 5 July 1962, Botham 2948 (DAO, MICH); Botham 2962 (DAO, MICH); ca. 8 km E of Yakil, provincial rest area on N side of hwy., 3 Jul 2000, ca. 00 km NE of Invermere, 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 1967, Brainened 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 Lake, 23 July 1935, Tracy 14162 (CAS, DS, NCU, UC); Mariposa Co., Lake Tenaya Trail, 14 Aug. 1894, Congdon s.n. (US); Nevada Co., between Durner 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 Meadowgs, 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 14899 (CAS, UC); SF. end of Long Gulch Lake, Klamath National Forest, T39N, R9W, SE1/4 sect. 32, 12 Aug. 1987, Tallent 901 (MICH); Trinity County, N Fork Coffee Creek, Trinity River, 19 Aug. 1916, Goldsmith 196a (JEPS); [Tiulumne Co. [originally labeled as El Dorado Co.], Jones Hill, 1879, Shockey 605 (JEPS).

**Colorado:** Boulder Co., Marvsyville, E of Eldora, N-facing slope Tennessee Mountain, Shickleay 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, Rondel 94-203 & DeCoursey (COLO); Routt Co., Routt National Forest, lower Silver Creek, ca. 8100 ft., 13 Aug. 1993, Duff 435 & Kettler (COLO).


**Montana:** [Flathead Co.], Nyack, 5 Aug. 1894, Williams 466 (US); Flathead Co., Upper Whitefish Lake, above campground, Whitefish Range, 2 July 1972, Lockschwidget 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 1966, Hitchcock 14362 & Mahlck (CAS, NY, WTU).

**Nevada:** Washoe Co., Carson Range, Little Valley, 26 July 1975, Te同类 1640 (NY, RENO).

**Oregon:** Baker Co., 18 mi. above Richland, Eagle Creek, 28 June 1933, Peck 19969 (CAS, WILLU); [Hood River Co.], Mount Hood, near White River, 23 July 1928, Thompson 5006 (MO, WTL); 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 1866, Henderson 1784 (GH); Wallowa Co., Eagle-Cap Wilderness, S of 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, Arrow 6149 (NY).

**Washington:** Asotin Co., SW of Anthony, head of Cottonwood Creek, T7N, R44E, sect. 6, 9 July 1949, Cronquist 5044 & 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, Norton R485B324 (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 1993, Castaier 10723 (DOV).


A NEW COMBINATION FOR A VARIETY OF CAREX DIGITALIS (CAREX SECT. CAREYANA)

*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. asymetrica Fernald and *C. digitalis* var. macrocoda 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. asymetrica*. In order to use Bailey’s prior epithet and align it with *C. digitalis*, it must be transferred, as follows.


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

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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