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# *Eleocharis aestuum* (Cyperaceae), a New Tidal River Shore Spikesedge of the Eastern United States

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**ABSTRACT.** *Eleocharis diandra* is an annual spikesedge of northeastern U.S. river and lake shores. This species has a complicated taxonomic history and has been included in the synonymy of other members of the *Eleocharis ovata* complex by various researchers. Its differing applications are due, in part, to the existence of a previously undescribed taxon. The new species *Eleocharis aestuum* is described from the eastern United States and is restricted to freshwater tidal river communities. This species is similar to *E. diandra* in its marked absence or reduction of perianth bristles, but it differs in floral scale and tubercle morphology. Despite limited regional variation in morphology, *E. aestuum* is morphologically separable from other spikesedges throughout its range. Recognition of this new species reveals that *E. diandra* is geographically restricted and globally imperiled. Conservation action is needed for both species.

**Key words:** Cyperaceae, *Eleocharis*, North America, United States.

The *Eleocharis ovata* (Roth) Roemer & Schultes complex in North America is comprised of a small group of short-statured annuals that occur in a wide variety of open wetland communities. These caespitose species possess white to brown, smooth, biconvex achenes, dark brown and compressed tubercles, and a base chromosome number of  $n = 5$  (Hines, 1975). Species of this group do not display obvious vegetative differences between one another. Identification is based primarily on style and stamen number and achene, floral scale, and spikelet morphology. In need of clarification, spikesedges of Atlantic tidal river shores have suffered from taxonomic confusion.

Careful review of herbarium material reveals a new species with reduced or obsolete perianth bristles, similar to *Eleocharis diandra* C. Wright, but with larger tubercles (mostly  $0.2\text{--}0.3 \times 0.35\text{--}0.46$  mm), white-brown to nearly colorless floral scales that are rounded and not keeled at the apex, and commonly ellipsoid spikes (Fig. 1). This plant is restricted to fresh tidal river shores of the eastern

United States. In contrast, the related and wide-ranging *E. obtusa* (Willdenow) Schultes occurs in a wide variety of habitats including river and lake shores, wet depressions, and ditches. Publication of this new spikesedge is needed for the upcoming Cyperaceae treatment in the *Flora of North America*.

***Eleocharis aestuum*** D. M. Hines ex A. Haines, sp. nov. TYPE: U.S.A. New York: Columbia County, Livingston, intertidal mud, north shore, inlet, Roeliff Jansen Kill, 7 Aug. 1968, Hines 6826A (holotype, MICH).

Culmi 3.0–30.0 cm longi, 0.5–1.0 mm lati; spicae 3.0–10.0 mm longae, 2.0–4.0 mm latae, pallidae, ellipsoideae vel ovoideae; squamae florales apice rotundato, pallidae, costa viridi; flos perianthii setis nullis vel presentibus, 2–4, acheniis brevioribus; stamina 2(3); antherae 0.25–0.5 mm longae; styli bifidi (trifidi); achenia 0.75–1.00 mm longa, 0.58–0.78 mm lata; tubercula 0.20–0.30 mm longa, 0.35–0.46(–0.55) mm lata.

Stems 3.0–30.0 × 0.05–0.1 cm; leaf sheath 5.0–35.0 mm long, the apex truncate to oblique, usually darkened, and somewhat thickened, also sometimes provided with a small point; spikelets 3.0–10.0 × 2.0–4.0 mm, pale, ellipsoid to ovoid; floral scales covering the achenes, usually thin and scarious, rounded at the apex, white, sometimes tinged with brown, usually with a green midrib; perianth bristles absent or present, when present numbering 2–4, 0.1–0.6 mm long, lacking minute, retrorse barbules, and up to 0.4 times as long as the body of the achene; stamens 2(3); anthers 0.25–0.5 mm long; styles bifid (trifid); achenes white to light brown, the body 0.75–1.00 × 0.58–0.78 mm, biconvex in cross section; tubercles triangular, compressed, dark brown, 0.2–0.3 × 0.35–0.46(–0.55) mm, 0.50–0.68(–0.80) times as wide as the achene.

*Eleocharis diandra* occurs on wet sand shores of lakes and rivers of the northeastern United States subject to inundation in early season and other high water events. Though *E. diandra* sometimes occurs on shores of fresh tidal rivers, it is found in areas with minimal tidal fluctuation. It was described by

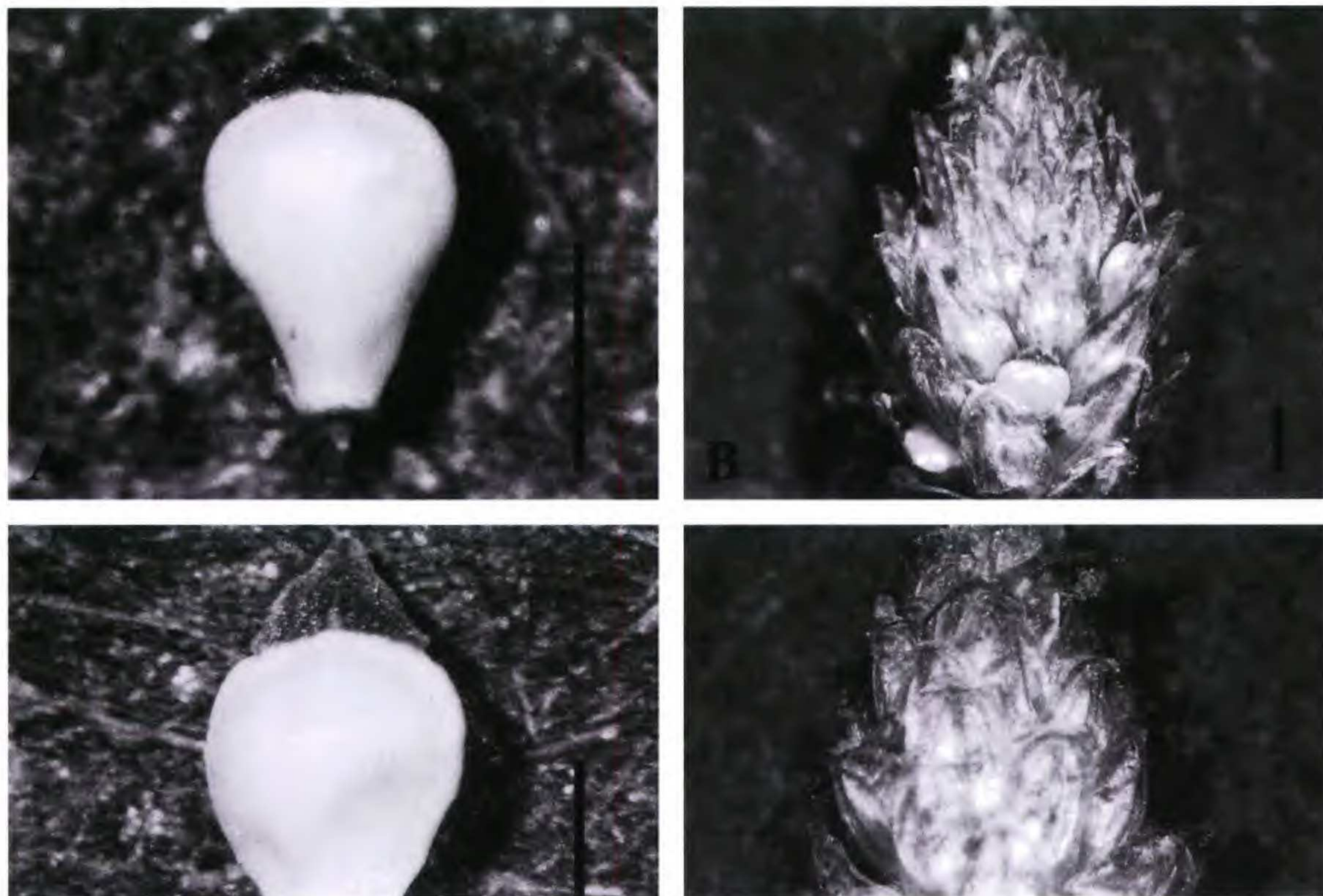


Figure 1. Achenes and spikelets of *Eleocharis diandra* and *E. aestuum*, bar = 0.5 mm. —A. *E. diandra* (Wright 1880, GH). —B. *E. diandra* (Wright 1881, GH). —C. *E. pallidostachys* (Fernald & Long 12786, GH). —D. *E. aestuum* (Fernald & Long 12786, GH).

Wright (1883) from the Connecticut River in Connecticut. This species has been included in the synonymy of *E. ovata* (Svenson, 1939, 1953; Gleason & Cronquist, 1991) and *E. obtusa* (Svenson, 1957; Kartesz, 1994). *Eleocharis diandra* is, however, one of the most distinctive species of this complex (Fig. 1). It has purple-brown floral scales that are acute and somewhat keeled at the apex (particularly in drying), similar to the southeastern *E. lanceolata* Fernald. The achenes lack perianth bristles and are crowned by diminutive tubercles (0.10–0.20 × 0.24–0.46 mm). The fruits are borne in plump, ovoid spikes. Fernald's (1950) description of *E. diandra*, however, depicts a different plant. Though tubercle and perianth bristle character states conform to the type, the floral scales are described as pale and rounded at the apex. Confusion of its identity is, in part, due to the existence of the previously undescribed *E. aestuum*.

*Eleocharis aestuum* was first identified as a distinct taxon by David Hines (1975), who considered it closely related to *E. diandra*. It most closely resembles *E. ovata*, however, and is consistently separated from this species only on the basis of its diminutive perianth bristles and pale floral scale color. *Eleocharis aestuum* appears to be similar to tidal species of *Bolboschoenus* and *Schoenoplectus* in that reduction or complete absence of perianth

bristles is correlated with existence in tidal communities (Schuyler, 1972; Strong, 1994).

Hines (1975) applied the name *Eleocharis pallidostachys* to *E. aestuum* in his dissertation and on sheet determinations. This name was not validly published according to the *Saint Louis Code* (Greuter et al., 2000), Article 29 and Recommendation 30A. The epithet *pallidostachys* is further disallowed by its mixture of Latin and Greek roots (Rec. 23A.3c). I have instead chosen the specific epithet *aestuum*, which means tidal, reflecting the associated habitat of the new species.

Many researchers failed to identify the distinctiveness of *Eleocharis aestuum* from *E. diandra*, despite the fact that these two species share only the similarity of reduced or obsolete perianth bristles. Svenson (1939) considered *E. aestuum* (under the name *E. diandra*) as conspecific with *E. ovata* after observing plants from the Hudson River with perianth bristles. However, the perianth bristles of these *E. aestuum* plants are reduced in length (shorter than the body of the achene) and smooth. In comparison, the perianth bristles of *E. ovata* exceed the combined length of the achene body and tubercle and are minutely retrose-barbulate.

Svenson (1953) later discussed specific collections from the Hudson River where he described a gradation between *E. aestuum* (as *E. diandra*) and

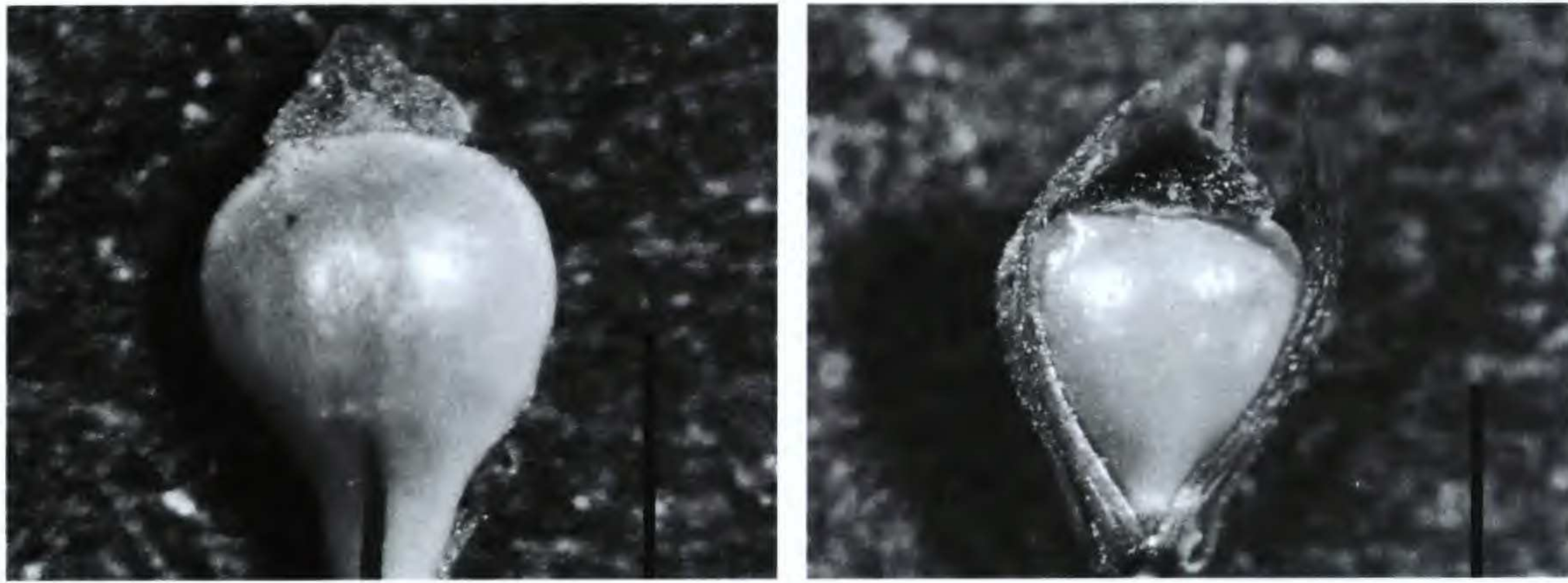


Figure 2. Achenes of *Eleocharis aestuum* and *E. obtusa*, bar = 0.5 mm. —A. *E. aestuum* (Svenson 13050b, MICH). —B. *E. obtusa* (Merrill 1898, MAINE).

*E. obtusa*. Later examination of those specimens (Svenson 13050a, b, and c, MICH) by Hines (1975) and myself do not reveal morphological intermediates. *Eleocharis aestuum* can be reliably separated from *E. obtusa* in the Hudson River valley on the basis of reduced perianth bristles, pale floral scales, narrower tubercles, and two styles and stamens per flower (Fig. 2).

Hines (1975) considered *Eleocharis aestuum* to be a species that could, in rare instances, possess well-developed perianth bristles. This interpretation is based on a set of extremely rare plants that are known only from the Delaware River (e.g., Ferren 796 (PH), Ferren 712 (PH), Ferren 1096 (PH), Benner 3747 (PH)). These specimens are a mixture of *E. obtusa* and *E. ovata* collections taken from fresh tidal communities. Similar to *E. aestuum*, they have relatively pale floral scales. However, these plants all possess long perianth bristles with retrorse barbules. Furthermore, close examination of many of the spikes reveals a sharp, but limited region of red-purple coloration on the floral scales. Therefore, these plants are excluded from the concept of *E. aestuum*.

Through examination of specimens from east coast tidal rivers, including four populations known to occur with or in close vicinity to other members of the *Eleocharis ovata* complex, and common garden experiments performed by Hines (1975), it is clear that *E. aestuum* is a distinct species that maintains its identity rangewide. Additionally, *E. aestuum* possesses a chromosome number of  $2n = 10$ , similar to all other species of the *E. ovata* complex in North America (Hines, 1975). With the proposed taxonomic innovations, *Eleocharis aestuum* and *E. diandra* are species of conservation concern (G3 and G2, respectively). Most occurrences of these two species are historic (collected prior to 1975). Furthermore, many collections are from riv-

ers that are now influenced by shoreline development, pollution, and river flow alteration (e.g., Delaware River, Connecticut River, Merrimack River). The only recent observations of *E. aestuum* are from the Androscoggin and the Kennebec Rivers (Maine) and the Hudson River (New York), and these populations consist of eight plants or fewer (A. Haines, unpublished). For *E. diandra*, the only recent observations are from the Connecticut River (Massachusetts) and Oneida Lake (New York), and these populations consist of five plants or less (A. Haines, unpublished).

*Eleocharis aestuum* usually occurs on wet sand, silt, or mud of fresh tidal rivers near or below the high tide limit. Where *E. aestuum* and *E. diandra* occur on the same river (e.g., Connecticut River), *E. aestuum* occurs further downstream where tidal fluctuation has a relatively greater effect on the plant communities. *Eleocharis aestuum* occurs with other fresh tidal species such as *Eriocaulon parkeri* B. L. Robinson, *Lindernia dubia* (L.) Pennell, *Persicaria punctata* (Elliott) Small, *Schoenoplectus smithii* (A. Gray) Soják, and *Schoenoplectus pungens* (Vahl) Palla.

**Paratypes.** U.S.A. **Connecticut:** Lyme, shore at Silden's Cove, 6 Sep. 1911, Harger 6107 (GH). **Delaware:** Wilmington, bank of Christiana River opposite mouth of White Clay Creek, 28 Sep. 1972, Ferren & Schuyler 1153 (PH). **Maine:** mud flats, Androscoggin River, 26 Aug. 1911, Bissell s.n. (MAINE); Bowdoinham, tidal mud flats, 16 Aug. 1968, Hines 6835k (MO). **New Jersey:** Kinkora, muddy tidal shore, Delaware River, 10 Aug. 1914, Long 10757 (PH). **Pennsylvania:** Tullytown, tidal shore, Delaware River, 6 Sep. 1927, Long 33775 (PH).

**Other representative specimens examined.** **Eleocharis aestuum.** U.S.A. **Connecticut:** Lyme, shore at Silden's Cove, 6 Sep. 1911, Harger 6107 (GH). **Delaware:** Hollyoak, upper tidal zone of *Scirpus americanus*, Delaware River, 15 Sep. 1972, Ferren 1115 (PH), 0.1 mi. NW of buoy light, 15 Sep. 1972, Ferren 1109 (PH). **Maine:** Brunswick, 1 Aug. 1894, Davis s.n. (GH); Brunswick, W

shore of Kennebec River, 24 Aug. 1921, *Fassett 117* (GH); Gardiner, 17 Sep. 1923, *Fassett 1030* (GH); Bowdoinham, tidal mud flats, 16 Aug. 1968, *Hines 6835, l, m, n, o, p, q, r, s, t, u, v, w, x, and y* (MICH); Cathance River at Merrymeeting Bay, 3 Sep. 1964, *Rosbach 6229* (MAINE); Abagadassett River, 17 Aug. 1983, *Vickery s.n.* (MAINE); tidal mud flats, Cathance River, 14 and 19 Sep. 1916, *Fernald & Long 12786* (GH); Topsham, Pleasant Point, Merrymeeting Bay, 10 Oct. 1993, *Hall s.n.* (MAINE), 14 Sep. 1991, *Hall s.n.* (MAINE), 15 Sep. 1991, *Hall s.n.* (MAINE); mud flats, Androscoggin River, 26 Aug. 1911, *Bissell s.n.* (GH); Woolwich, Coffin Sanctuary, intertidal mudflats, *Vickery s.n.* (MAINE). **New Jersey:** Kinkora, muddy tidal shore, Delaware River, 10 Aug. 1914, *Long 10765* (PH), 13 Oct. 1914, *Long 10943, 10996* (PH); Palmyra, tidal shore of Delaware River, 24 Sep. 1971, *Ferren 796* (PH); S end Burlington Island, Delaware River, 25 July 1972, *Ferren & Lloyd 985* (PH); Delair, Delaware River shore, 24 July 1905, *Brown, Crawford & Van Pelt s.n.* (PH), 30 Sep. 1907, *Van Pelt & Long s.n.* (PH); National Park, tidal shore of tributary to Woodbury Creek, 16 July 1971, *Ferren 712* (PH); Delaware River, Raccoon Island, 1 Oct. 1971, *Ferren 814, 815* (PH); Duck Island, Delaware River below Trenton, 10 Sep. 1972, *Schuyler 4353* (PH); tidal flats, Raritan River, Oct. 1918, *Mackenzie s.n.* (PH). **New York:** Livingston, tidal estuary of Hudson River, Roelliff Jansen Kill, 14 Sep. 1950, *Svenson 13050b and c* (MICH), 7 Aug. 1968, *Hines 6826a and b* (MICH); Hudson, Hudson River, 30 Sep. 1923, *Svenson s.n.* (GH); Catskill, mouth of Catskill Creek, 4 Sep. 1936, *Muencher & Curtis 5651* (GH); Saugerties, tidal mud flats, Hudson River, 2 Sep. 1936, *Muenschler & Curtis 5649* (GH). **Pennsylvania:** Eddington, border of dredged sand over tidal marsh, Delaware River, 24 Sep. 1932, *Long 38557* (PH); tidal shores, Delaware River, 24 Sep. 1932, *Long 38535* (PH); Bristol, mouth of tidal stream, Delaware River, 6 Oct. 1971, *Ferren & Givens 821, 822* (PH); Croydon, Delaware River, 0.6 mi. NE of mouth of Neshaminy Creek, 12 Aug. 1971, *Ferren & Givens 727* (PH); Andalusia, muddy, tidal shore, mouth of Poquessing Creek, 23 Oct. 1917, *Long 18252* (PH), 9 Aug. 1923, *Long 28399* (PH); tidal marsh at the mouth of Mill Creek, Delaware River, 12 July 1972, *Ferren & Braxton 945* (PH); tidal marsh on Mud Island, Delaware River, 24 July 1972, *Ferren & Lloyd 979* (PH); tidal marsh, N side Chester Island, Delaware River, 11 Aug. 1972, *Ferren & Lloyd 1015* (PH); Tinicum Island, Delaware River, 1 July 1971, *Givens & Ferren 1575, 1578* (PH), 10 Aug. 1972, *Ferren & Lloyd 1006, 1007* (PH).

**Eleocharis diandra.** U.S.A. **Connecticut:** East Windsor, Connecticut River, 17 Sep. 1899, *Bissell 889* (GH), 3 Sep. 1900, *Bissell 1* (GH), 13 Sep. 1903, *Bissell s.n.* (GH); Hartford, Connecticut River, 15 Sep. 1881, *Wright s.n.* (GH), 9 Aug. 1882, *Wright s.n.* (GH), 25 Sep. 1908, *Woodward s.n.* (GH); Weathersfield, sand bars of Connecticut River, 21 Aug. 1880, *Wright s.n.* type of *E. diandra* (GH). **Massachusetts:** Northfield, sandy beach of Connecticut River, 19 Sep. 1984, *Sorrie 2772* (GH). **New York:** Verona, sandy shores, Oneida Lake, 6 Sep. 1901, *Harberer 1356* (MAINE), 27 Aug. 1968 *Hines 6846* (MICH). **Vermont:** Newbury, Connecticut River, 23 Sep. 2000, *H. Gilman 2K219* (MAINE).

KEY TO THE *ELEOCHARIS OVATA* COMPLEX OF THE EASTERN UNITED STATES

1a. Perianth bristles numbering 5–7 per achene, re-

trorsely barbellate, and equaling or exceeding the length of the achene and tubercle (absent in extremely rare individuals).

2a. Tubercles 0.5–0.9 mm wide, 0.65–0.97 times as wide as the achene; flowers with 2 or 3 stamens.

3a. Floral scales acute and keeled at the apex, providing a sharp-pointed aspect to the apex of the spikelet; flowers usually with 2 stamens; plants of the southeastern United States . . . . .  
. . . . . *E. lanceolata* Fernald

3b. Floral scales rounded or obtuse at the apex, often providing a blunt aspect to the apex of the spikelet; flowers usually with 3 stamens; plants of widespread distribution.

4a. Styles usually trifid; tubercles 0.2–0.4 mm tall, 0.29–0.67 times as tall as wide; perianth bristles usually exceeding tubercle in length; spikes usually ovoid . . . . .  
. . . . . *E. obtusa* (Willdenow) Schultes

4b. Styles bifid or sometimes trifid; tubercles 0.12–0.23 mm tall, 0.1–0.38 times as tall as wide; perianth bristles commonly not exceeding the tubercle; spikes ellipsoid to ellipsoid-cylindric . . . . .  
. . . . . *E. engelmannii* (Steudel) House

2b. Tubercles 0.35–0.5 mm wide, 0.46–0.72 times as wide as the achene; flowers usually with two stamens . . . . .  
. . . . . *E. ovata* (Roth) Roemer & Schultes

1b. Perianth bristles lacking or, if present, numbering 2–4, smooth, and shorter than the length of the achene.

5a. Tubercles 0.68–0.83 mm wide, 0.78–0.97 times the width of achene; anthers usually 0.48–0.71 mm long; plants occurring on lake borders and in pools and seepages . . . . .  
. . . . . *E. engelmannii* (Steudel) House

5b. Tubercles 0.24–0.55 mm wide, 0.46–0.8 times the width of the achene; anthers 0.25–0.5 mm long; plants usually found on river shores.

6a. Floral scales purple-brown, acute and somewhat keeled at the apex; tubercle 0.1–0.2 mm tall; plants occurring on sand shores, not or only minimally tidal . . . . .  
. . . . . *E. diandra* C. Wright

6b. Floral scales white or tinged with brown (except for the green midrib), rounded and not keeled at the apex; tubercle 0.2–0.3 mm tall; plants occurring on sand, silt, or mud shores, always tidal . . . . .  
. . . . . *E. aestuum*  
D. M. Hines ex A. Haines

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#### Literature Cited

- Fernald, M. L. 1950. Gray's Manual of Botany, 8th ed. Von Nostrand Reinhold, New York.
- Gleason, H. A. & A. C. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, 2nd ed. New York Botanical Garden, the Bronx.
- Hines, D. M. 1975. A Monograph of the *Eleocharis ovata* Complex (Cyperaceae) in North America. Ph.D. Dissertation, University of Michigan.
- Greuter, W., J. McNeill, F. R. Barrie, H. M. Burdet, V. Demoulin, T. S. Filgueiras, D. H. Nicolson, P. C. Silva, J. E. Skog, P. Trehane, N. J. Turland & D. L. Hawksworth (editors). 2000. International Code of Botanical Nomenclature (Saint Louis Code). Regnum Veg. 138.
- Kartesz, J. T. 1994. A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland, 2nd ed. Timber Press, Oregon.
- Schuyler, A. E. 1972. Chromosome numbers of *Scirpus purshianus* and *Scirpus smithii*. Rhodora 74: 398–406.
- Sorrie, B. A. 1987. Notes on the rare flora of Massachusetts. Rhodora 89: 113–196.
- Strong, M. T. 1994. Taxonomy of *Scirpus*, *Trichophorum*, and *Schoenoplectus* (Cyperaceae) in Virginia. Bartonia 58: 29–68.
- Svenson, H. K. 1939. Monographic studies in the genus *Eleocharis*. Introduction. Rhodora 31: 121–127.
- . 1953. The *Eleocharis obtusa-ovata* complex. Rhodora 55: 1–6.
- . 1957. Cyperaceae: Scirpeae. N. Amer. Flora 18(9): 505–556.
- Wright, C. W. 1883. A new *Eleocharis*. Bull. Torrey Bot. Club 10: 101.