



# ***B o t a n i c a l N o t e s***

A newsletter dedicated to dispersing taxonomic and ecological information useful for plant identification and conservation in Maine

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## ***JUNCUS ANTHELATUS* AND ITS IDENTIFICATION IN MAINE**

*Juncus tenuis* Willd. is a common and wide-ranging rush in Maine (Figure 1) that occurs in a number of natural and human-disturbed communities. Differing taxonomic treatments have caused rare species in the northeast to be reduced in rank or lost altogether in nomenclatural revisions. Fernald (1950) treated *J. tenuis* as containing three varieties. Those varieties were identified primarily on the basis of inflorescence stature. Gleason and Cronquist (1991) also recognized three varieties, though they were very different than the taxa recognized by Fernald (1950). Those entities were recognized primarily on leaf cross-section and auricle morphology. Clements (1990) considered *J. tenuis* as containing two varieties, reducing one of Fernald's varieties to synonymy. These discrepant treatments illustrate a need for taxonomic clarification of *J. tenuis* and its allied species. This note summarizes the taxonomy of the northeastern representatives of the *J. tenuis* complex with focus on *J. anthelatus* R. Brooks, a very rare species in Maine.



Figure 1. *Juncus tenuis*.

*Juncus tenuis* belongs to the section *Poiophylli*, a group of rushes recognized by possession of pedicellate and bracteolate flowers borne in a terminal inflorescence and leaves that lack transverse septae. *Juncus tenuis* is further characterized by flat or involute leaves that are mostly confined to the basal third of the stem, a leafy involucre with bracts conspicuously exceeding the inflorescence, and pseudo 3-locular capsules that are shorter than the persistent tepals.

*Juncus tenuis* is morphologically similar to *J. dichotomus* Wieg. and *J. dudleyi* Wieg. These two species have been included in *J. tenuis* by various authors but differ in regard to key morphological features. *Juncus tenuis* is best identified by examining the auricles, a pair of small appendages at the junction

of the leaf sheath and blade. The auricles of this species are elongate (2.0–6.0 mm long), translucent and scarious in texture, and acute at the apex. Both *J. dichotomus* and *J. dudleyi* have short (0.2–0.6 mm) auricles that are rounded at the apex. Those of the *J. dichotomus* range in texture from scarious to coriaceous. Those of the *J. dudleyi* are yellow-brown and cartilaginous. Figure 2 provides graphical comparison of the auricles of these three species.

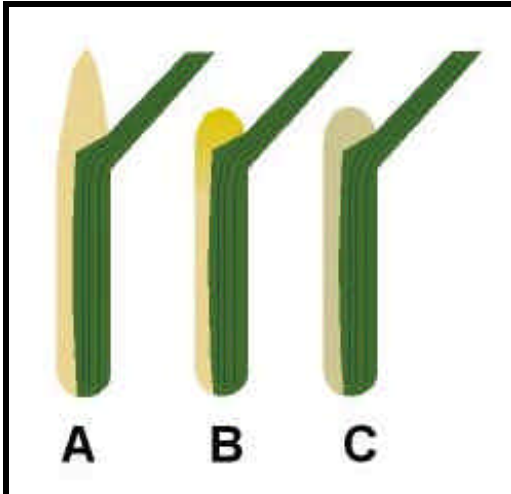


Figure 2. Comparison of the auricle morphology of *Juncus tenuis* and allied species. Upper leaf sheath and blade origin of A *J. tenuis*, B *J. dudleyi*, and C *J. dichotomus*.

Additional characters that allow separation of these three species include seed length, anther length, leaf morphology, and habitat. *Juncus tenuis* has seeds 0.5–0.7 mm long, anthers 0.1–0.2(–0.4) mm long, flat to involute leaves, and is widely distributed in upland and wetland habitats. *Juncus dichotomus* differs in that it has smaller seeds 0.3–0.4 mm long, larger anthers 0.4–0.8(–1.0) mm long, and leaves that are commonly terete in cross-section (varying to flat in the “*J. platyphyllus*” form). *Juncus dudleyi* differs in that it has larger anthers 0.6–1.0 mm long and, in Maine, a restricted habitat—it is usually found on river shores with circumneutral substrate. These morphological differences illustrate well that *J. dichotomus* and *J. dudleyi* are not conspecific with *J. tenuis*, as suggested by Gleason and Cronquist (1991).

*Juncus tenuis sensu* Fernald (*i.e.*, excluding *J. dichotomus* and *J. dudleyi*) was a variable taxon that was primarily subdivided on the basis on inflorescence size. At one extreme was *J. tenuis* var. *williamsii* Fern., a form identified by short, mostly spreading branches with secund and closely crowded flowers. Typical *J. tenuis* had a larger, but variably shaped inflorescence. At the other extreme was *J. tenuis* var. *anthelatus* Wieg., a form identified by elongate, ascending branches with remotely spaced flowers. The former two taxa had similar floral morphology and did not

form discrete entities (*i.e.*, they overlapped extensively in characters reported to distinguish them). The latter entity, however, had several characteristics not shared by the others. This prompted Brooks to elevate it to specific status as *J. anthelatus* (Wieg.) R. Brooks (Brooks and Whittemore 1999).

*Juncus anthelatus* can be identified through use of several morphological characters. It has a large and diffuse inflorescence with widely spaced flowers (Figure 3). The internodes of each branch generally exceed 6.0 mm (Figure 4). Though *J. tenuis sensu stricto* sometimes has a tall inflorescence, the flowers are then usually crowded at the ends of the branches with shorter internodes (Figure 5). *Juncus anthelatus* has short tepals mostly 2.5–3.5 mm long that are more than 1.3 times as long as the capsule. The tepals of *J. tenuis* average longer at mostly 3.5–4.5 mm long and are less than 1.3 times as long as the capsule. Figures 6 and 7 provide a comparison of tepal length to capsule length for these two species.



Figure 3. *Juncus anthelatus*. Note the large inflorescence and elongate internodes.

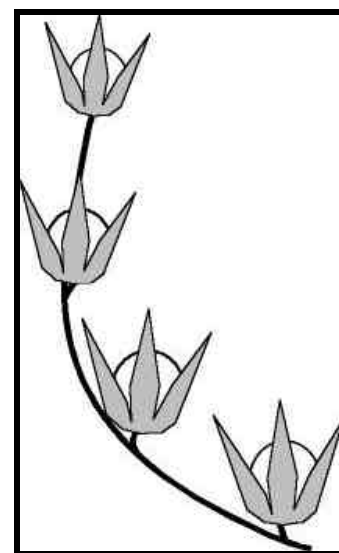


Figure 4. Typical branch of *Juncus anthelatus* with long internodes.

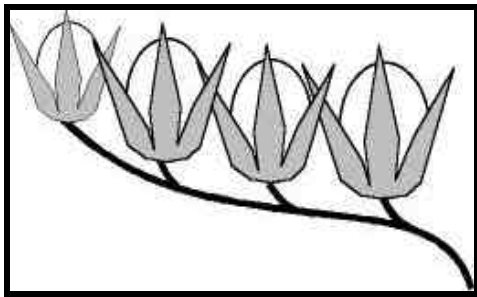
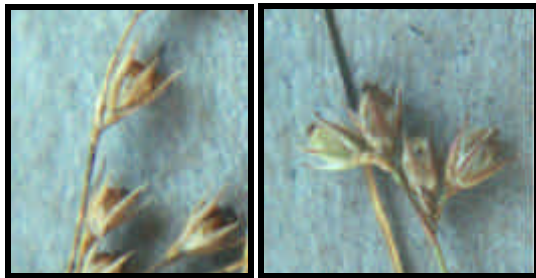


Figure 5. Typical crowded branch of *Juncus tenuis* with short internodes.



Figures 6 (left) and 7 (right). Comparison of capsule length to tepal length of *J. anthelatus* and *J. tenuis*. 6. The capsules of *Juncus anthelatus* are conspicuously shorter than the persistent tepals. 7. The capsules of *J. tenuis* are only somewhat shorter than the persistent tepals.

*Juncus anthelatus* can be further separated from *J. tenuis* on the basis of plant stature, ecology, and phenology. *Juncus anthelatus* is a relatively robust plant mostly 6.0–9.0 dm that is normally taller than *J. tenuis* (mostly 1.0–6.0 dm). *Juncus tenuis* is found in numerous natural and human-disturbed communities, including upland and wetland habitats. *Juncus anthelatus*, however, is restricted to hydric communities such as swamps and wet fields. When the two taxa are present at the same site, *J. anthelatus* flowers 7–14 days earlier than *J. tenuis* (Brooks and Clements 2000). Brooks (1989) has also identified unique allozyme markers that identify *J. anthelatus*. Though possessing many subtle differences, *J. anthelatus* and *J. tenuis* are closely related as evidenced by the shared morphology of elongate and scarious auricles. The following key serves to distinguish these two species.

- 1a.** Inflorescence with widely scattered flowers, the internodes usually exceeding 6.0 mm, with erect to ascending, often inwardly curved branches; ultimate branches of the cyme mostly 3.0–5.0 cm long; tepals 2.5–3.5(–4.0) mm long; capsules less than 0.75 times as long as the tepals; plants 6.0–9.0 dm tall ***J. anthelatus***
- 1b.** Inflorescence with crowded to remote flowers, the internodes less than 6.0 mm, with divergent to erect branches; ultimate branches of the cyme mostly 1.0–2.0 cm long; tepals (2.8–)3.5–4.5 mm long; capsules greater than 0.75 times as long as the tepals; plants 1.0–6.0 dm tall..... ***J. tenuis***

*Juncus anthelatus* is a very rare plant in Maine. Though it has been previously collected eight times in the state, no extant populations were known in recent years. Historic collections in chronological order include:

1. South Poland, Poland, Androscoggin County, 1895, K. Furbish (NEBC);
2. Low banks, North Berwick, York County, 1897, J. Parlin 1897 (NEBC);
3. Wells, York County, 1898, K. Furbish (NEBC);
4. Brackish marsh, Old Orchard Beach, York County, 1902, E. Chamberlain and C. Knowlton (NEBC);
5. Wildwood Farm, Mount Desert, Hancock County, 1905, M. Fernald (MASS);
6. Swampy woods, Alfred, York County, 1916, M. Fernald and B. Long (NEBC);
7. Damp edge of mill pond, Waterford, Oxford County, 1923, A. Pease (NEBC);
8. Penobscot County, 1932, E. Ogden (MAINE).

On 28 November 2000, I was traveling along an open power line corridor in Brunswick, Cumberland County. In a low, wet depression were approximately eight plants of *Juncus anthelatus* in a 12 m<sup>2</sup> area. Associated species included *Spiraea alba* var. *latifolia*, *Agrostis capillaris*, *Juncus effusus*, *Solidago canadensis*, and *Solidago rugosa* subsp. *rugosa*. Also present at the site were hybrids of *J. anthelatus* and *J. tenuis*. The hybrid plants were distinctive in that they possessed the tall inflorescence and widely spaced flowers of *J. anthelatus* combined with the relatively tall capsules (more than 0.75 times as long as the tepals) and straight branches of *J. tenuis* (Figure 8). This is the first report of *J. anthelatus* × *J. tenuis* from Maine.



Figure 8. Comparison of collected rushes from Brunswick, bar = 1.0 cm. A. *Juncus anthelatus* × *J. tenuis*. B. *Juncus anthelatus*.



Specimens of both *Juncus antheratus* and *J. antheratus* × *J. tenuis* have been deposited in the University of Maine Herbarium (MAINE). Given that *J. antheratus* has been previously found in both pristine and managed communities, it is likely additional occurrences of this species will be found in the southern and south-central portions of the state.

### Acknowledgments

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**Text, photographs, and computer graphics contributed by Arthur Haines**

## TAXONOMY OF THE *CYPRIPEDIUM PARVIFLORUM* COMPLEX IN MAINE

The genus *Cypripedium* is a familiar and well-marked group of orchids in the northeast. The large lower petal (called the labellum) has inrolled margins, creating a saccate structure that gives some species of this group their common name—lady slipper. The North American yellow-flowered lady slippers (Figure 1) have undergone numerous nomenclatural changes in the last century. Researchers agree that more than one recognizable form exists, but differ in what names they apply to forms. Some workers, such as Fernald (1950), considered the yellow-flowered *Cypripedium* to be part of a wide-ranging, circumboreal taxon. Other authors believed these orchids were endemic species of North America. In the latter case, either a single species was recognized with infraspecific taxa (Gleason and Cronquist 1991) or multiple species without infraspecific taxa (Magee and Ahles 1999). Research by Sheviak (1994) has helped answer many of the nomenclatural questions and has identified a new taxon for the northeastern flora. This note summarizes the taxonomy and morphology of the *Cypripedium parviflorum* Salisb. complex in Maine.



Figure 1. *Cypripedium parviflorum*.

North American yellow-flowered lady slippers were considered to be part of the Eurasian *Cypripedium calceolus* L. by Correll (1938). New England plants were referred to as *C. calceolus* var. *pubescens* (Willd.) Correll. Fernald recognized that this name was not adequate to deal with the forms present on the landscape. He proposed that relatively small-flowered plants from fens and river shores be called *C. calceolus* var. *parviflorum* (Salisb.) Fern. (Fernald 1946). Fernald's combination under the name *C. calceolus* was evidence he agreed with Correll's interpretation of the yellow-flowered lady slippers (*i.e.*, North American and Eurasian plants were members of the same species).

Atwood (1984) abandoned a circumboreal species concept for the yellow-flowered lady slippers. He considered North American species to be endemic to the continent and separate from Eurasian species. Sheviak (1992, 1994) also followed this concept and has provided morphological evidence to support this stance. North American yellow-flowered *Cypripedium* has conduplicate (*i.e.*, folded) staminodia that are yellow and broadest near the middle or base. European yellow-flowered *Cypripedium* has caniculate (*i.e.*, trough-shaped) staminodia that are white and broadest near the apex.

Once the circumboreal species concept was abandoned, researchers were left with two names to apply to the forms they observed in the field—*parviflorum* for the small-flowered forms and *pubescens* for the large-flowered forms. This simplistic treatment has been shown by Sheviak (1994) not to be adequate to deal with the variation encountered on the landscape. One of the main problems was that there appeared to be two small-flowered forms—a northern form of high pH wetlands and shores and a southern form of somewhat acidic, dry-mesic to mesic, deciduous forests. As Salisbury (1791) did not designate a type specimen, it was unclear which plant (the northern or southern small-flowered yellow lady slipper) the epithet *parviflorum* belonged to. Through careful review of Salisbury's original description, Sheviak (1994) determined that this epithet belonged to the southern form and, therefore could not be applied to our plants in Maine. Sheviak (1993) proposed the name *Cypripedium parviflorum* var. *makasin* (Farwell) Sheviak for the northern form.

Reviewing the morphology and ecology of eastern North American yellow-flowered lady slippers is important for understanding Sheviak's reasons for subdividing the small-flowered forms. The large-flowered form, *C. parviflorum* var. *pubescens* (Willd.) Knight, one of two forms found in Maine, is relatively straightforward to separate from the small-flowered forms. It has larger flowers with longer petals (see identification key), though small-flowered forms are known to the north and west of New England. Its lateral petals are entirely yellow-green or provided with sparse and minute flecks of red-purple (Figure 2). Its floral scent is rose-like or musty (similar to *C. parviflorum* var. *parviflorum*). It typically inhabits rich, mesic forests.



Figure 2. *Cypripedium parviflorum* var. *pubescens*. Note that the lateral petals are yellow-green with sparse, red-purple flecks.

*Cypripedium parviflorum* var. *makasin*, the other form known to occur in Maine, differs from the preceding variety in several ways. It has smaller flowers (see identification key) and its lateral petals are suffused with red-purple, except at the very base where the red-purple color breaks down into spots and streaks on a yellow-green background (Figure 3). *Cypripedium parviflorum* var. *makasin* occurs in high pH wetlands (*e.g.*, northern white cedar swamps, river shore seeps), communities not inhabited by the other two infraspecific taxa. Sheviak (1994) also reports this species to have an intensely sweet odor during anthesis, compared to a rose or musty scent of the other two forms.

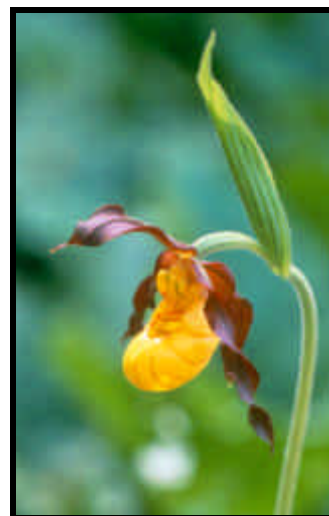


Figure 3. *Cypripedium parviflorum* var. *makasin*. Note that the lateral petals are suffused with red-purple.

*Cypripedium parviflorum* var. *parviflorum* is not known to occur in Maine, reaching its northern limit in southern New England. It is a species of deciduous-leaved forests, often occurring in more acidic locations than *C. parviflorum* var. *pubescens*. It is similar to *C. parviflorum* var. *makasin* in its smaller flowers and red-purple lateral petals. The coloration of the lateral

petals, however, is usually created by numerous and closely spaced, dots and streaks (Figure 4), rather than even suffusion of color (as in var. *makasin*). The two small-flowered forms also differ in the indument of the uppermost sheathing bract, located at the base of the stem below the expanded leaves. *Cypripedium parviflorum* var. *parviflorum* is closely pubescent with white hairs on the abaxial (i.e., outer) surface, at least when young (similar to var. *pubescens*; Figure 5). *Cypripedium parviflorum* var. *makasin*, on the other hand, is glabrous or obscurely pubescent on the abaxial surface of the uppermost sheathing bract (Figure 6).



Figure 4. *Cypripedium parviflorum* var. *parviflorum*. Note the lateral petals are largely red-purple, but the color is comprised of closely spaced dots and streaks.



Figures 5 (left) and 6 (right). Uppermost sheathing bracts of *Cypripedium parviflorum*. 5 Pubescent bract of *Cypripedium parviflorum* var. *parviflorum* and *C. parviflorum* var. *pubescens*. 6 Glabrous bract of *C. parviflorum* var. *makasin*.

The following key will distinguish material in the northeastern United States.

- 1a.** Labellum usually 3.0–5.4 cm long; lateral petals mostly 5.0–8.0 cm long, entirely yellow-green or provided with sparse streaks or flecks of red-purple; stems commonly with 4–6 leaves; plants of rich, mesic forests ..... *C. parviflorum* var. *pubescens*
- 1b.** Labellum usually 1.5–3.5 cm long; lateral petals mostly 3.0–5.0 cm long, either densely spotted or evenly suffused with red-purple; stems commonly with 3 or 4(5) leaves; plants of forests, wetlands, and shores

- 2a.** Uppermost sheathing bract conspicuously pubescent with white hairs; red-purple color of lateral petals comprised of numerous, densely spaced dots; plants of deciduous-leaved forests; floral scent rose-like or musty *C. parviflorum* var. *parviflorum*
- 2b.** Uppermost sheathing bract glabrous or inconspicuously pubescent; red-purple color of lateral petals provided by even suffusion of pigment; plants of high pH wetlands and shores; floral scent sweet ..... *C. parviflorum* var. *makasin*

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