

**THE STATUS OF TWO NEW ENGLAND "ENDEMIC" CARICES:  
*CAREX ELACHYCARPA* AND *C. JOSSELYNII* (CYPERACEAE)**

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*Summary*

Two similar species of the *Stellulatae* group of *Carex*, *Carex elachycarpa* and *C. josselynii* were considered to be endemic to the state of Maine in northern New England. Their collection history, nomenclature and unusual morphology are reviewed. *Carex elachycarpa* was formerly placed in the genus *Kobresia* due to its possession of a split perigynium. This placement is shown to be untenable on morphological grounds. Close examination showed that both these taxa are aberrant forms of other species. *Carex elachycarpa* was found to be more or less dioecious with long anthers and is referred to the synonymy of *C. sterilis* with which it shares these features. *Carex josselynii* was placed with the synonymy of *C. echinata* because of its long beak and narrow perigynia. The wider occurrence in *Carex* of abnormalities found in these taxa such as split perigynia is noted.

*Introduction*

With interest increasing in the conservation of rare and endangered species it is important to verify the taxonomic status of species which may be eligible for conservation. The *Stellulatae* group of *Carex* is unusual in that many authors, e.g. Mackenzie (1931), Fernald (1950) and Seymour (1969), consider that it contains two species endemic to the state of Maine. These two species, *C. elachycarpa* Fernald and *C. josselynii* (Fernald) Mack. ex Pease, are very puzzling sedges.

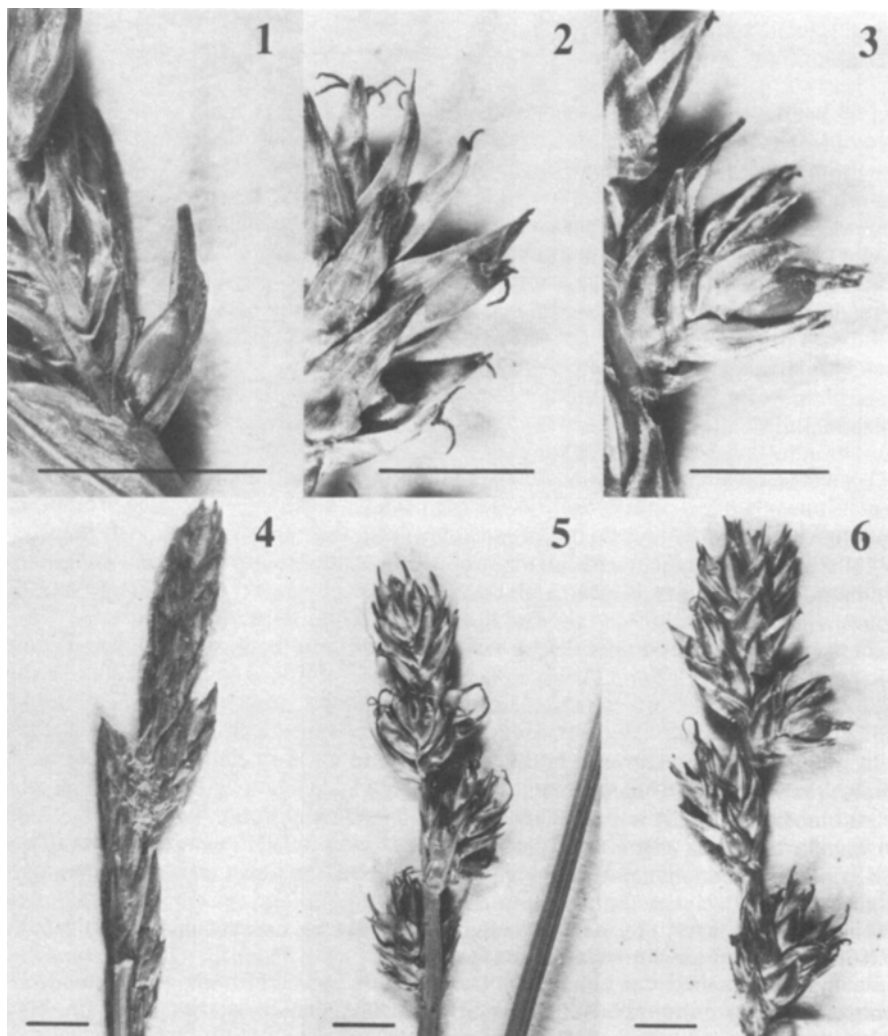
Both were discovered near the turn of this century on the banks of large rivers in northern Maine. *Carex elachycarpa* was described from a weeping spring along the Aroostook River at Fort Fairfield (Fernald, 1902) and *C. josselynii* (sub *C. interior* L. H. Bailey var. *josselynii* Fernald) from the banks of the St. John River at Fort Kent, about 80 km northwest (Fernald, 1906). Neither has been reported with conviction from anywhere but the vicinity of their type localities. *Carex elachycarpa* was first collected at Fort Fairfield in 1899 and again in 1902. Subsequent specimens so named have been collected along the Aroostook River; in 1935 at Presque Isle, 40 km upstream; and in 1946 at Washburn, 57 km upstream. *Carex josselynii* was first collected in 1898 and again in 1904 and 1908. One collection was made in 1961. All collections were made along the St. John River between Fort Kent and St. Francis, Maine. Few sheets of either taxon exist.

In addition to their close geographical proximity and their occurrence in similar habitats, the two taxa show a number of morphological similarities. They are both small, caespitose, multiple spiked sedges of similar aspect with ascending, narrow perigynia. Both also have perigynia which show a tendency to rupture along the abaxial false suture, exposing the achene (Fig. 1, 2). In the case of *Carex elachycarpa*, most perigynia are split with the achenes prominently exposed. The occurrence of a split perigynium is a particularly interesting feature of these taxa. It

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was not reported in *C. josselyni* until this investigation. Fernald (1950) even stated "perigynia . . . not rupturing" though most sheets examined had a few rupturing perigynia. However, when this feature was observed earlier in *C. elachycarpa*, it formed the basis for the transfer of the species to the genus *Kobresia* (Fernald, 1903), which is in part characterized by a split perigynium. This transfer has not been upheld by subsequent workers (Mackenzie, 1931; Gleason, 1952 and even Fernald,



Figs. 1-6.—Inflorescences in *Carex*. 1. Rupturing perigynium of *Carex elachycarpa*, from Cook, Shaw, Fernald in 1899. GH (isotype). 2. Rupturing perigynium of *Carex josselyni*, from Eaton, M81, GH. 3. Rupturing perigynium of *Carex sterilis*, enlargement of portion of inflorescence shown in Fig. 6. 4. Staminate inflorescence of *Carex elachycarpa*, from Williams, Collins, Fernald in 1902 (*Plantae Exsiccatae Grayanae*). UC. 5. Pistillate inflorescence of *Carex elachycarpa*, from Cook, Shaw, Fernald in 1899. GH (isotype). 6. Inflorescence of *Carex sterilis* with rupturing perigynium, from Québec, Ile d'Anticosti, Rivière Vaureal; F. F. Marie-Victorin et Rolland-Germain, P. Louis-Marie 20109; 27 Juillet, 1925 (NY). The bar equals 2 mm in all figures.

1950), for, although a split perigynium is entirely anomalous in *Carex* and would appear transitional to *Kobresia*, other features of habit, inflorescence and perigynium ally the plants with the *Stellulatae* group of *Carex*. Authors are in unusual agreement about this placement (Mackenzie, 1931; Fernald, 1950; Gleason, 1952; Seymour, 1969). Also, in spite of their anomalous perigynia and being known from only a few gatherings from the vicinity of the type localities, they are recognized at specific level by most recent authors. Gleason (1952) did not mention *C. josselynii*. Mackenzie (1931) and Gleason (1952), while recognizing *C. elachycarpa* at specific level, tentatively suggested that it might be a hybrid between *C. angustior* Mack. and *C. interior* or some other species.

In gathering together materials for a revision of the *Stellulatae* (Reznicek, 1978), a high proportion of the extant sheets of these two taxa were examined and new light shed on the nature of these interesting and unusual plants.

### *The identity of Carex elachycarpa*

Because of the former placement of *Carex elachycarpa* in *Kobresia* and its possession of apparently *Kobresia*-like perigynia it is important to briefly discuss the critical differences between these two closely related genera. In *Carex* the perigynium is closed except for an apical orifice and the inflorescences are exceedingly varied but with branching always accompanied by strict differentiation into spikes with long segments of nodes of one type and their unit one flowered spikelets (Smith and Faulkner, 1976). Most species have no rachilla in the perigynium and in those species in which it occurs it is vestigial. *Kobresia*, as well as usually having an open spathe-like perigynium, often has the rachilla prolonged and bearing further flowers. Thus, when branching occurs in a *Kobresia* inflorescence it is in part due to growth of the rachilla and the inflorescence is not as strictly organized as in *Carex*. Reduced *Kobresia* species without further development of the rachilla may resemble unispicate *Carex*. Since some *Kobresia* species do not have a fully split perigynium, a fundamental blurring of generic limits occurs with a few unispicate *Carex* such as *C. nardina* Fries which possess a vestigial rachilla. These species have been placed both in *Kobresia* and *Carex* in the past and may well be more closely related to *Kobresia* than *Carex* (Nelmes, 1952). A further important difference between *Carex* subgenus *Vignea* to which the *Stellulatae* belong and *Kobresia* is the lack of a prophyll in the former.

*Carex elachycarpa* possesses neither a rachilla nor a prophyll and has an inflorescence of several spikes bearing perigynia or staminate flowers in the typical fashion of *Carex* with strict differentiation between spikes and spikelets in the compound inflorescence (Fig. 4, 5). Also, the split perigynium of *Kobresia* is spathe-like and envelopes the achene. That of *C. elachycarpa* (and *C. josselynii*) is fundamentally different in structure with a bidentate apical beak and the achene extruded from the abaxial side (Fig. 1, 2). *Carex elachycarpa* certainly cannot be placed in *Kobresia* on morphological evidence. Fernald's (1903) placement was clearly in error.

In spite of the anomalous perigynium, *Carex elachycarpa* is correctly placed in *Carex* and evidently in the *Stellulatae* as suggested by previous authors. However, the position of the taxon in the *Stellulatae* is still in doubt. Examination of specimens showed that the terminal spikes were almost exclusively unisexual. No long clavate base of staminate flowers beneath perigynia which is characteristic of most *Stellulatae* was observed. Most culms were in fact unisexual. A staminate and pistillate inflorescence shown in Fig. 4 and 5 clearly demonstrate this. This sex distribution was also noted by Fernald (1903). These observations point to only one species, *C. sterilis* Willd. It is the only species in the *Stellulatae* that shows this particular sex distribution and one of the few in *Carex* (Reznicek, 1978). Further evidence is found in anther lengths which ranged in *C. elachycarpa* from 1.1 to 2.1 mm. This is too long for any similar species of *Stellulatae* but *C. sterilis*. Table 1 compares anther lengths of similar species of *Stellulatae* found in the region of the type localities of *C.*

Table 1. Anther lengths of *Carex elachycarpa* and *C. josselynii* and similar species of *Stellulatae* occurring in the vicinity of northern Maine.

| Species               | Anther length<br>mm range | Anther length<br>mm mean | Sample<br>size | Number of specimens<br>measured |
|-----------------------|---------------------------|--------------------------|----------------|---------------------------------|
| <i>C. elachycarpa</i> | 1.1–2.1                   | 1.51                     | 21             | 8                               |
| <i>C. sterilis</i>    | 1.2–2.35                  | 1.64                     | 50             | 50                              |
| <i>C. josselynii</i>  | 0.75–1.05                 | 0.91                     | 13             | 3                               |
| <i>C. echinata</i> *  | 0.8–1.6                   | 1.13                     | 50             | 50                              |
| <i>C. interior</i>    | 0.7–1.4                   | 1.0                      | 50             | 50                              |

\*In Reznicek (1978) it is shown that the eastern North American representatives of the *Carex echinata* complex, *C. cephalantha* (L. H. Bailey) Bickn., *C. angustior*, and *C. laricina* Bright, are best placed with the synonymy of *C. echinata* Murray. The anther data given include all these taxa.

*elachycarpa* and *C. josselynii*. It should be noted that Fernald (1903) described *Kobresia elachycarpa* as having two anthers but in all inflorescences examined, three anthers, typical of *Carex* were observed. Mackenzie's (1931) suggestion that *C. elachycarpa* might represent a hybrid between *C. angustior* and *C. interior* is highly improbable as both these taxa have smaller anthers, clavate bases to the terminal spike and a regular sex distribution in their inflorescences.

Examination of collections of *Carex sterilis* and other *Stellulatae* from throughout their ranges disclosed the occurrence of a split perigynium as an occasional abnormality. *Carex sterilis* seemed especially susceptible. Perigynia split by the developing achene in the same manner as in *C. elachycarpa* were observed on scattered collections from Newfoundland, Quebec, Ontario and Minnesota (Fig. 3). These collections were also interesting because *C. sterilis* normally has spreading or reflexed perigynia but specimens with rupturing perigynia often had more ascending perigynia (Fig. 6) similar to those found in *C. elachycarpa*. The similarity of the pistillate inflorescence in Fig. 6 to that of *C. elachycarpa* (Fig. 5) is indisputable. Split perigynia were apparently first noted in *Carex* by Duval-Jouve (1864) in *Carex flava* L. Attention is here drawn to their more widespread occurrence.

In this particular example ecological evidence is very consistent with the idea that *Carex elachycarpa* is an abnormal variant of *C. sterilis*. Brief habitat descriptions by Fernald (1903) and Fernald and Wiegand (1910) of the riverbank where it was collected included a host of calciphiles such as *Triglochin palustre* L., *Lobelia kalmii* L., *Potentilla fruticosa* L., *Carex crawei* Dewey, *C. interior* and *Parnassia glauca* Raf. *Carex sterilis* is well known to be a calciphile (Mackenzie, 1931; Fernald, 1950; Voss, 1972) and the plants listed above are common associates of it over large parts of its range. It is also known to occur on calcareous riverbanks in Quebec, not far from northern Maine (Scoggan, 1950; Marie-Victorin and Rolland-Germain, 1969). Further evidence is that the only known collections of *C. sterilis* from Maine are from along the Aroostook River about 40 and 57 km upstream from Fort Fairfield (Presque Isle, Aroostook Co., Maine, G. D. Chamberlain and R. E. Delano 819, 16 June, 1935, (NEBC!); Washburn, Aroostook Co., Maine, F. H. Steinmetz 812, 13 July, 1939 (TEX!).

It is clear from ample evidence that *Carex elachycarpa* is a minor variant of *C. sterilis*. The specimens are abnormal in the prevalence of split perigynia but their ecology, anther lengths, spike morphology and sex distribution leave no doubt as to their identity. In fact, the collections from Presque Isle and Washburn, Maine named *C. elachycarpa* appear very much like abnormal plants selected from populations of *C. sterilis* and they do not have split perigynia. *Carex elachycarpa* is not a "critical species" (Mackenzie, 1913) or a phylogenetically interesting taxon transitional to

*Kobresia* and is here placed with the synonymy of *C. sterilis*.

Although not as exciting as an endemic species, the occurrence of *Carex sterilis* in northern Maine is of considerable interest as it is a rare plant in the eastern portion of its range (Reznicek, 1978). In fact, it is likely that Fernald would not have described a new species had he been more familiar with *C. sterilis* at the time. The type locality at Fort Fairfield was visited in 1975 and 1978 but, unfortunately, the habitat has been seriously disrupted. A dam constructed downstream has raised water levels and various urban projects of Fort Fairfield have destroyed all trace of the weeping springs. It is unfortunate that this historically and taxonomically interesting colony is apparently extinct. Searches at other previously known sites of *C. sterilis* along the Aroostook River have also proved fruitless thus far.

#### *The identity of Carex josselynii*

As noted before, *Carex josselynii* is similar to *C. elachycarpa* in many respects, even in having some split perigynia. However, on close examination, the two plants are quite different. *Carex josselynii* has a distinct clavate base to the terminal spike, a sex distribution that is typical of the *Stellulatae* and anthers 0.75-1.05 mm long (Table 1).

The taxon was first described as *Carex interior* var *josselynii* (Fernald, 1906). Presumably, the small spikes of the plant led him to believe it to be a variant of *C. interior* as that species was poorly understood at the time. However, certain features do not indicate *C. interior*. The perigynia range up to 3.1 mm in length [3.25 mm according to Mackenzie (1931)] with a beak up to 1.1 mm long. Both these dimensions and especially the beak length are large for *C. interior* (Reznicek, 1978). The perigynia of most sheets of *C. josselynii* are strongly nerved on the adaxial surface, a feature rarely seen in *C. interior* and they are narrow, with perigynia up to 3 times as long as wide. The perigynia of *C. interior* do not exceed 2.2 times as long as wide (Reznicek, 1978). Ascending and occasional rupturing perigynia aside, the plants most closely resemble *C. echinata*. The major similarity to *C. interior* is that the specimens have more or less obtuse pistillate scales but this feature may also occur in *C. echinata*. Also, sporadic collections of plants closely resembling *C. josselynii* are known from a wide area. In some cases e.g. Menominee, Michigan, J. H. Shuette (NY!); these have been determined as *C. josselynii* by K. K. Mackenzie. However, Mackenzie (1931) never ascribed a range other than northern Maine to *C. josselynii*. Although very few sheets of *C. josselynii* exist upon which to base firm conclusions, *C. josselynii* appears to be a minor variant of *C. echinata* and is here placed with the synonymy of that species.

A visit in 1975 to the type locality disclosed a few plants of *Carex echinata* but none of *C. interior* nor any fitting the description of *C. josselynii*. A visit in 1978 found the riverbank habitat destroyed and replaced with beds of coarse gravel and stone. Searches elsewhere along the river have failed yet to disclose any specimens matching the description of *C. josselynii*.

#### *Conclusion*

*Carex josselynii* and *C. elachycarpa* are both referred to the synonymy of more widespread species. Their placement clears up a mystery that has prevailed since their descriptions. The plant's morphological aberrations are of some interest since the split perigynium has been rarely reported in *Carex*. *Carex* species however, are known for the frequent occurrence of a number of teratological forms as has been amply demonstrated by Duval-Jouve (1864), Svenson (1972) and Smith and Faulkner (1976). Some of these aberrations, as these authors point out, may simulate structures of other related genera such as *Kobresia* or *Schoenoxiphium*. *Carex elachycarpa* and *C. josselynii* were unusual in that they were widely recognized taxa based on aberrant collections.

It is possible that the abnormal perigynium morphology of these plants may have been induced by ice push in winter or flood damage in spring. Teratological forms in *Carex* have been related to disturbed sites (Duval-Jouve, 1864) and disturbances such as trampling by cattle during development (Smith and Faulkner, 1976). In view of the fact that ruptured perigynia occurred sporadically in *Carex sterilis* and other species of *Stellulatae* it is also possible that the anomalies may have become fixed in small, local populations.

All specimens examined of *Carex elachycarpa* and *C. josselynii* are cited below including types.

*Carex elachycarpa* Fernald, Proc. Am. Acad. Sci. 37: 492. 1902.

Holotype: Fort Fairfield, Valley of Aroostook River, Aroostook Co., Maine; Mabel P. Cook, Elsie L. Shaw, M. L. Fernald; June 29, 1899. GH(!). Isotypes GH(!), NEBC(!).

*Kobresia elachycarpa* (Fernald) Fernald, Rhodora 5: 251. 1903. Based on *Carex elachycarpa* Fernald.

Additional specimens examined (all from Aroostook Co., Maine): Gravelly river-Beach, Fort Fairfield; E. F. Williams, J. F. Collins, M. L. Fernald; July 15, 1902. GH (2 sheets!), NY (!). Same data as above but issued as *Plantae Exsiccatae Grayanae* UC (3 sheets!), F(!), GH(!), NY(!), TRT(!), MICH(!), NEBC(!). Gravel shore of river, Presque Isle; G. D. Chamberlain and R. E. Delano 821, June 16, 1935. NEBC (!). Beach of Aroostook River, Washburn; G. D. Chamberlain, R. C. Bean, A. S. P.[ease] 32,169, E. C. Ogden; 22 July, 1946 (NEBC!).

*Carex josselynii* (Fernald) Mackenzie ex Pease, Proc. Boston Soc. Nat. Hist. 37: 188. 1924.

Based on *C. interior* L. H. Bailey var. *josselynii* Fernald, Rhodora 8: 115. 1906.

Holotype: Wet sandy riverbank, Fort Kent, Valley of the St. John River, Aroostook Co., Maine; M. L. Fernald, July 6, 1904, GH(!). Isotype (NY!).

Additional specimens examined (all from Aroostook Co., Maine): Wet gravelly shore, Fort Kent; M. L. Fernald, June 16, 1898. (NEBC!). In meadow, St. Francis; O. W. Knight 64, July 7, 1904. (GH!), (NEBC!). Fort Kent, A. A. Eaton M81, July 10, 1904. (GH!). Wet banks of St. John River, Fort Kent; Kenneth K. Mackenzie 3429, July 11, 1908. (NY!). Bank of St. John River, St. John; Ralph C. Bean, Stuart K. Harris 22876; 29 June, 1961 (NEBC!).

#### Acknowledgements

We wish to thank Dr. W. R. Anderson and Dr. E. G. Voss for their comments on the manuscript. This work was supported by the Canadian National Research Council Grant A to P. W. Ball and Canadian National Research Council Postgraduate Scholarships and Ontario Graduate Scholarships to A. A. Reznicek.

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