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## Scirpus validus and S. acutus: A Question of Distinctness

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## BOTANY

# Scirpus validus and S. acutus— A Question of Distinctness

MARLYN MILLER\*, E. O. BEAL\*\*

**ABSTRACT**—An analysis of 32 populations of bulrushes in the *Scirpus validus-acutus* complex growing in Itasca State Park and prairie ponds to the west indicates that most of the populations are referable to neither *S. validus* nor *S. acutus* but, rather, are intermediate in morphology. Further, the supposedly characteristic features by which the two nomenclatural species have been identified are erratically correlated.

Two widely distributed nomenclatural species of bulrushes, *S. validus* Vahl and *S. acutus* Muhl. are generally recognized. These emergent aquatics not only seem to share similar, if not identical, habitats but also share similar morphological characteristics the ranges of which are barely distinct and in several instances are overlapping. Consequently, although several manuals (e.g., Fassett, 1957; Fernald, 1950; Gleason, 1952; Gleason & Cronquist, 1967; Muenscher, 1944) list *S. validus* and

*S. acutus* as distinct, we have been unable to observe the described discontinuity among 32 populations in Lake Itasca and surrounding areas. On the contrary, the populations sampled present a picture of phenotypic intermediacy with key characters, when compared on a paired basis, presenting a very erratic pattern of correlation. The degree of phenotypic intermediacy and erratic nature of correlation between key characters cast serious doubt on the validity of maintaining *S. validus* and *S. acutus* as distinct species even though samples for this study are from a geographical area of relatively restrictive size. A similar conclusion was drawn by Beal & Monson (1954) from a sampling of plants throughout the state of Iowa.

As a means of determining the phenotypic affinity of the bulrushes in Lake Itasca and surrounding areas to *S. validus* & *S. acutus*, 32 populations were sampled. Fourteen of these populations are in Lake Itasca, three in Elk Lake — which drains into Lake Itasca, two in the Mis-

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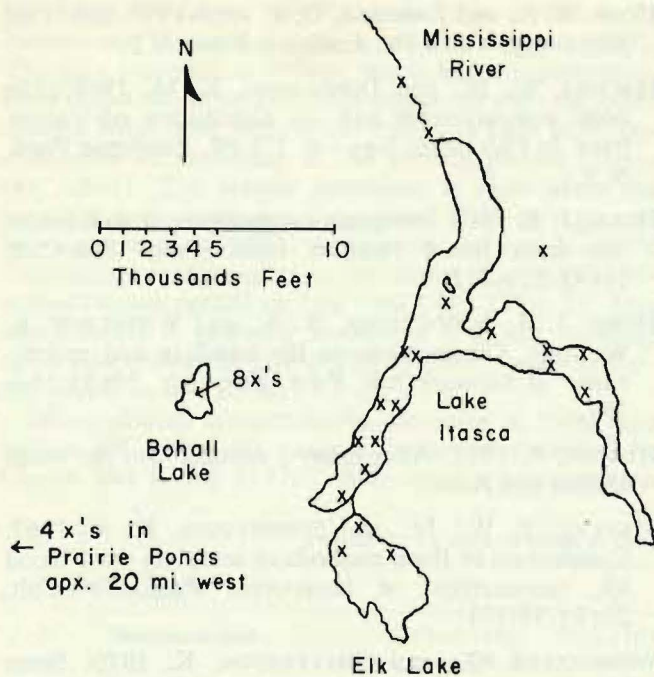


FIGURE 1. Location of populations of *Scirpus* sampled in Lake Itasca and surrounding areas.

Mississippi River within three miles of the headwaters, at Lake Itasca, one in a small swale adjacent to Lake Itasca, eight in Bohall Lake 1.2 miles west of Lake Itasca, and four in prairie ponds approximately 20 miles west of Lake Itasca. (Fig. 1). Flowering and fruiting specimens were collected from each population and, while in the fresh condition, were analyzed according to the double index technique of Klekowski & Beal (1965) for each of twelve features commonly recognized as key charac-

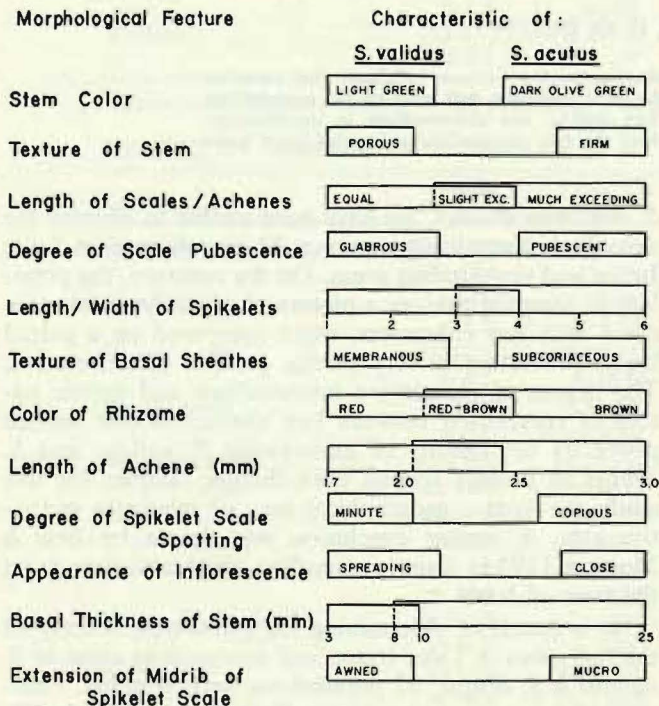


FIGURE 2. Published ranges for twelve morphological features of two species of *Scirpus*.

ters in discriminating between *S. validus* & *S. acutus*. (Fig. 2).

As is evident in Fig. 2, some of the characters analyzed present an area of quantitative or subjective overlap between *S. validus* and *S. acutus*. The populations sampled also provided numerous specimens which are referable only to an overlapping category with regard to five of the characters. The seven remaining characters were gradable on a "yes" or "no" basis for either *S. validus* or *S. acutus* but not for both. Thus, in analyzing the phenotypic affinity of each population to *S. validus* and *S. acutus*, according to the double index technique, populations presenting features falling within an overlapping category were graded "yes" for both species whereas those features falling within a category limited to a single species were graded "yes" for that species only.

When plotted on a two-way graph, with the *S. validus* phenotypic rating as one axis and the *S. acutus* rating as the other (Fig. 3), it is evident that the majority of populations studied are clearly neither "good" *S. validus* nor *S. acutus* but, rather, intermediate forms. On the other hand, a few populations (three from the prairie ponds, two from the Mississippi River, and one from Floating Bog Bay of Lake Itasca) exhibit strong affinity for *S. validus* with a correspondingly low affinity for *S. acutus*.

Since each population was examined in reference to each of the twelve morphological features, it was possible to determine the extent to which paired features correlate in discriminating between *S. validus* and *S. acutus*. For example, as indicated in Fig. 4, stem color correlates with the length of midrib extension of spikelet scales, in the pattern described for either *S. validus* or

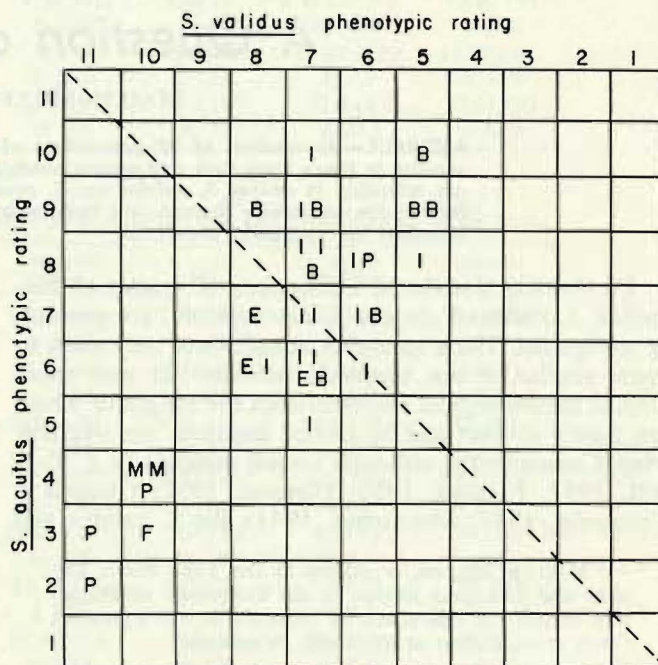


FIGURE 3. Populations of *Scirpus* from Lake Itasca and surrounding areas plotted by means of their "validus-acutus" phenotypic ratings. Each sample population plotting at a given point is indicated by a letter - B = Bohall Lake, E = Elk Lake, F = Floating Bog Bay, I = Lake Itasca, M = Mississippi River, P = Prairie Pond.

Stem Color :	Length of Midrib Extension :		
	mucro	awned	
dark olive green	0	14	<u>S. acutus</u>
light green	4	16	<u>S. validus</u>
	<u>S. acutus</u>	<u>S. validus</u>	Characteristic of :

FIGURE 4. An example of correlation between *S. acutus* and *S. validus* on the basis of the paired features of stem color and length of midrib extension. Correlation of the species with the expected combination of morphological characteristics is 47%. Numbers, which refer to the actual number of sampled populations, do not total 32 since two were actually intermediate and counted for both species.

*S. acutus*, in only 47 per cent of the samples. Conversely, in 53 percent of the samples one feature was characteristic of *S. validus* while the other was characteristic of *S. acutus*. Correlation percentages for all paired combinations are presented in Fig. 5, in which the descending order of listing is indicative of decreasing consistency of a morphological feature in correlation with other features. That is, stem color is most consistently correlated with other features while the length of midrib extension of spikelet scales is very inconsistently correlated with other features. It should be noted, however, that the highest correlation, 91 percent, was between rhizome color and length of midrib extension. On the other hand, it should also be noted that the lowest correlation, zero percent, was between the degree of spikelet scale spotting and length of midrib extension.

Further examination of Fig. 5 shows that the supposedly characteristic features by which the two nomenclatural species are recognized are very erratically correlated. Such an erratic pattern would not be unexpected if we assume the morphological features to be genetically controlled and the various populations to be no more than the various recombinations within one gene pool which have been selected by the local habitat. Whether the assumption of a genetic basis is valid in the first place and whether the individual populations actually represent genetic recombinants cannot be determined by such a field study as herein presented but must await experimental determination. It is evident, however, that *S.*

*validus* and *S. acutus* are not sufficiently differentiated to warrant recognition as separate species. Thus we concur with the decision of Beal & Monson (1954) in reducing *S. acutus* to synonymy within *S. validus*.

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	2	3	4	5	6	7	8	9	10	11	12
1. Stem Color	61	73	73	65	56	55	48	56	51	56	47
2. Stem Texture		46	66	62	59	50	44	60	67	65	40
3. Scale / Achene			80	55	72	50	65	63	59	20	31
4. Scale Pub.				68	78	27	41	80	44	27	20
5. Length/Wid. of Spikelet					64	70	37	68	43	37	32
6. Text. Basal Sheathes						25	48	85	76	23	13
7. Rhizome Color							77	9	35	83	91
8. Length of Achene								32	34	69	68
9. Scale Spotting									86	12	0
10. Appear. of Infl.										33	14
11. Stem Thickness											88
12. Midrib Extension											

FIGURE 5. Correlation of *S. validus* and *S. acutus* in reference to twelve morphological features in all paired combinations. Numbers across the top refer to the morphological features listed by number. All numbers within the table are percentages.