

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Transactions of the Nebraska Academy of
Sciences and Affiliated Societies

Nebraska Academy of Sciences

1977

A Taxonomic Investigation of Some Rhizomatous Species Of The Genus *Muhlenbergia* (Gramineae)

James Kurtz

University of Nebraska-Omaha

David M. Sutherland

University of Nebraska-Omaha

Follow this and additional works at: <https://digitalcommons.unl.edu/tnas>

Kurtz, James and Sutherland, David M., "A Taxonomic Investigation of Some Rhizomatous Species Of The Genus *Muhlenbergia* (Gramineae)" (1977). *Transactions of the Nebraska Academy of Sciences and Affiliated Societies*. 427.

<https://digitalcommons.unl.edu/tnas/427>

This Article is brought to you for free and open access by the Nebraska Academy of Sciences at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Transactions of the Nebraska Academy of Sciences and Affiliated Societies by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

A TAXONOMIC INVESTIGATION OF SOME RHIZOMATOUS SPECIES OF THE GENUS *MUHLENBERGIA* (GRAMINEAE)

JAMES KURTZ and DAVID M. SUTHERLAND

University of Nebraska-Omaha 68101

Seven species of the grass genus *Muhlenbergia* were studied using gross morphological and anatomical characters. The anatomical criteria proved to be of limited taxonomic value. A key to the species of the east-central plains was developed.

† † †

INTRODUCTION

The genus *Muhlenbergia* is a large, widely distributed group of grasses, encompassing numerous species and various growth forms. The subgenus *Muhlenbergia*, comprised of mesic, broad-leaved, usually rhizomatous species, can easily be separated from the rest of the genus on the basis of growth habit and habitat preferences (Pohl, 1969). Species of the subgenus are widely distributed in North America but are most abundant in the deciduous forests of the eastern part of the continent. All of the species included in this study are perennials and possess well-developed scaly rhizomes. Seven species were studied: *M. bushii* Pohl, *M. frondosa* (Poir.) Fern., *M. mexicana* (L.) Trin., *M. racemosa* (Michx.) B.S.P., *M. sobolifera* (Muhl.) Trin., *M. sylvatica* (Torr.) Torr. and *M. tenuiflora* (Willd.) B.S.P.

Morphological similarity among members of the subgenus makes them difficult to separate using conventional taxonomic characteristics. The intent of this study is to explore these taxonomic difficulties using both anatomical and gross morphological characters.

METHODS AND MATERIALS

The majority of the plants used in this study were collected from an area which included seven southeastern Nebraska counties and two southwestern Iowa counties; field collections were made from August through mid-October, 1975. Additional specimens used were borrowed from the University of Nebraska-Lincoln herbarium.

All measurements of 10 mm or less were made with a stereoscopic binocular microscope with an ocular micrometer calibrated to 0.1 mm intervals. Lemma, glume, and anther measurements were obtained from mature spikelets. The larger basal leaves were chosen for ligule measurements and for making transverse sections of the blade and sheath. Blade sections were taken at a point midway between the tip of the blade and ligule; sheath sections were taken from a point not

more than 1.0 cm below the ligule. Sections were made free-hand from both fresh material and herbarium specimens; dried leaves were soaked in a softening solution (Pohl, 1965). Hoyer's solution was used to clear the sections and also as a mounting medium (Humason, 1972). Cellulose acetate casts were made to study epidermal characteristics (Payne, 1968).

RESULTS AND DISCUSSION

Anatomical Characters

Epidermal leaf anatomy and transverse blade anatomy proved to be of limited taxonomic value. Only minor differences were noted among the species. Transverse sheath anatomy provides a reliable character to separate *M. mexicana* and *M. sylvatica* since it clearly shows the degree to which the sheath is keeled (Fig. 1). *M. mexicana* has prominently keeled sheaths in contrast to the rounded sheaths of *M. sylvatica*.

Species Differences and Key Characters

Comparisons between certain species pairs were made using ligule, anther, lemma, and glume measurements. The species pairs selected were chosen because of their similarity to each other or because they tend to be paired in the keys.

M. mexicana – *M. sylvatica* (Table I):

These species are difficult to separate and have often been confused, probably because two distinct forms of *M. mexicana* exist. The form with slender elongate inflorescences, not unlike those of *M. sylvatica*, is common in eastern Nebraska; while the typical form with dense lobulate inflorescences appears to be common in western Nebraska. Average ligule length of *M. sylvatica* is twice that of *M. mexicana*. The ligule of *M. sylvatica* also projects well above the summit of the sheath, in contrast to the ligule of *M. mexicana* which is barely visible from the side. Additional differences noted include: (1) mean anther length which is 50% greater in *M. sylvatica* than in *M. mexicana*; and (2) an abruptly keeled leaf sheath in *M. mexicana* in contrast to the rounded sheaths of *M. sylvatica*.

M. mexicana – *M. racemosa* (Table I):

Several characters are needed to separate these species.

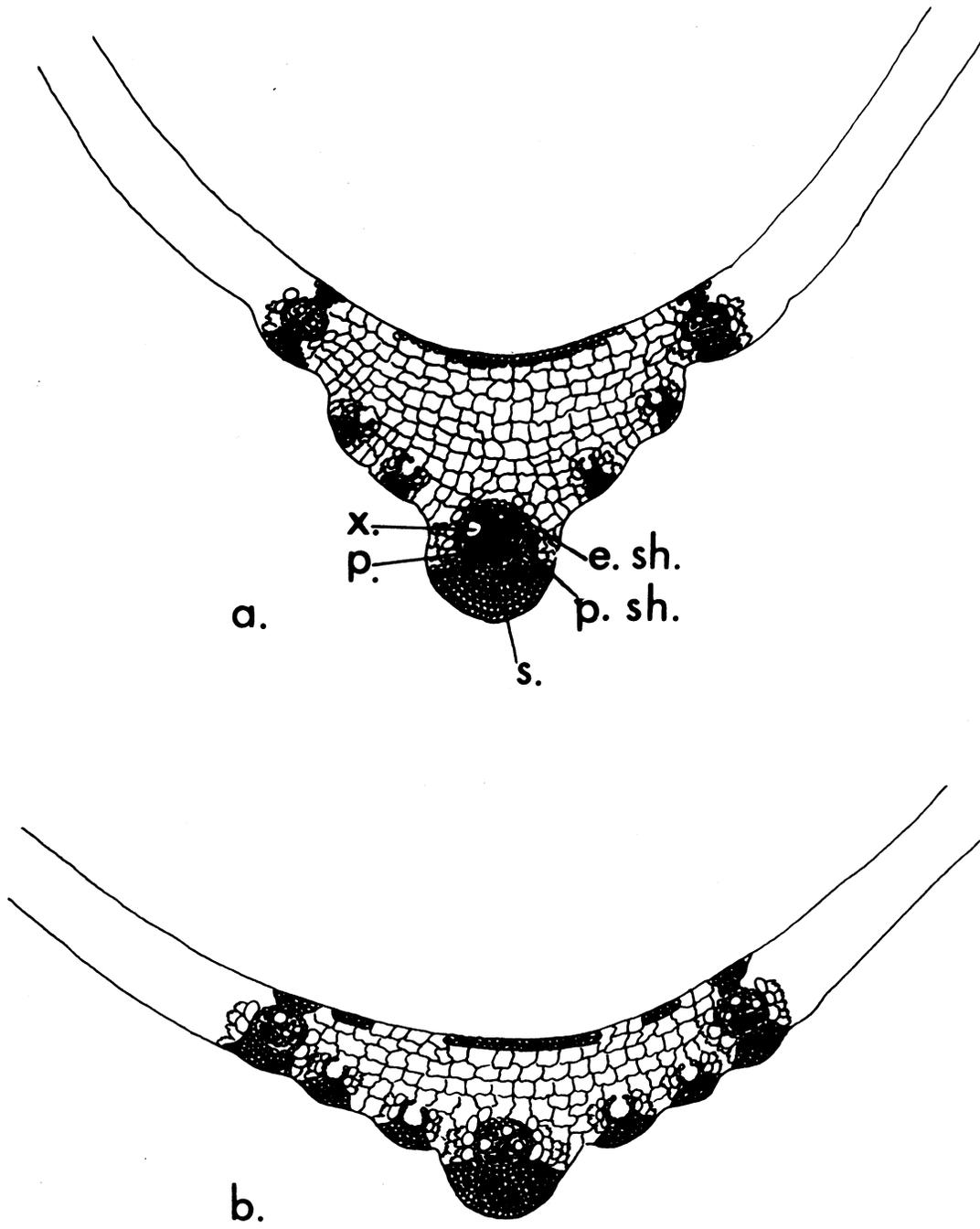


Figure 1. a) *M. mexicana* – cross section of sheath
 x. – xylem
 p. – phloem
 e. sh. – endodermal sheath
 p. sh. – parenchyma sheath
 s. – sclerenchyma
 b.) *M. sylvatica* – cross section of sheath

Table I:
Comparison of Species Using Six Key Characters
Lengths are Given in mm

	Ligule	Anther	Lemma	Glumes	Internodes	Panicles
<i>M. bushii</i>	0.2-0.8 $\bar{x} = 0.6$	0.3-0.6 $\bar{x} = 0.4$	2.4-3.3 $\bar{x} = 2.8$	1.5-2.4 $\bar{x} = 2.0$	smooth and shining	numerous included panicles
<i>M. frondosa</i>	0.8-1.5 $\bar{x} = 1.1$	0.3-0.6 $\bar{x} = 0.4$	2.8-3.5 $\bar{x} = 2.9$	1.9-3.2 $\bar{x} = 2.7$	smooth and shining	numerous included panicles
<i>M. tenuiflora</i>	0.4-0.9 $\bar{x} = 0.6$	1.1-2.2 $\bar{x} = 1.2$	2.9-3.4 $\bar{x} = 3.1$	1.5-3.0 $\bar{x} = 2.1$	puberulent	panicles long exserted
<i>M. sobolifera</i>	0.4-1.0 $\bar{x} = 0.6$	0.4-0.8 $\bar{x} = 0.7$	1.7-2.1 $\bar{x} = 1.9$	1.3-2.0 $\bar{x} = 1.6$	smooth and shining	panicles long exserted
<i>M. sylvatica</i>	1.3-2.5 $\bar{x} = 2.0$	0.5-0.8 $\bar{x} = 0.8$	2.2-3.5 $\bar{x} = 2.6$	1.6-3.0 $\bar{x} = 2.0$	puberulent or glabrous	panicles long exserted
<i>M. mexicana</i>	0.4-1.2 $\bar{x} = 0.8$	0.3-0.6 $\bar{x} = 0.5$	2.0-3.1 $\bar{x} = 2.3$	1.5-2.8* $\bar{x} = 2.1$	puberulent	panicles long exserted
<i>M. racemosa</i>	0.6-1.5 $\bar{x} = 1.2$	0.5-1.0 $\bar{x} = 0.6$	2.3-3.5 $\bar{x} = 3.1$	4.0-6.0 $\bar{x} = 4.7$	glabrous to puberulent roughened	panicles usually exserted

*occasionally over 3.0

Individuals were occasionally encountered which were intermediate between the two species with respect to internodal pubescence and glume length. Recent keys indicate that *M. racemosa* invariably has smooth, shining internodes, but many individuals of this species were found to have puberulent, roughened internodes similar to those of *M. mexicana*. Furthermore, individuals of *M. mexicana* were encountered with relatively long awn-tipped glumes similar to those of *M. racemosa*. The following are valuable when atypical plants are encountered: (1) glumes of *M. racemosa* are much longer than the lemmas on all spikelets of a given plant. In *M. mexicana* glume length is more variable, not exceeding the lemmas in all of the spikelets; (2) anthers and ligules of *M. racemosa* are longer than those of *M. mexicana* although some overlap occurs; (3) the lemmas of *M. racemosa* are never awned in contrast to the occasionally awned lemmas of *M. mexicana*;

(4) grains of *M. racemosa* are usually longer than 1.5 mm, while those of *M. mexicana* are less than 1.5 mm.

M. bushii – *M. frondosa* (Table I):

Glumes and ligules of *M. frondosa* are much longer than those of *M. bushii*, but individuals were occasionally encountered which were intermediate with respect to these characters. Three other characters are valuable with such individuals (Mitchell, 1962): (1) the terminal panicle of *M. bushii* tends to be more exserted than in *M. frondosa*; (2) the leaves of *M. bushii* tend to be positioned at right angles to the stem, unlike those of *M. frondosa*; (3) the leaves of the side branches in *M. bushii* are relatively shorter and narrower than are the leaves of the main culm; such an obvious difference does not exist in *M. frondosa*.

M. sobolifera – *M. tenuiflora* (Table I):

These two species are usually paired in keys because each has short, broadly ovate glumes. Lemma and anther length are sufficient to separate the two.

Key

The following key was constructed using observations made in the course of this study combined with some of those characteristics used by Pohl (1969), Gleason and Cronquist (1965), Fernald (1943), and Mitchell (1962).

1. Glumes with stiff awn-tips, both one-third longer than the awnless lemma in the majority of the spikelets; anther 0.5 mm or longer; grain usually longer than 1.5 mm; internodes often smooth and shining, occasionally puberulent-roughened *M. racemosa*
 Glumes awnless or awn-tipped, usually shorter than the lemma, occasionally longer; lemma awned or awnless; anthers, grain, and internodes variable. 2
2. Internodes of culm glabrous, sometimes slightly puberulent near the summit 3
 Internodes of culm puberulent, especially near the summit 6
3. Plants with numerous axillary inflorescences, many of these included in the leaf sheath 4
 Plants with few axillary inflorescences, but if present their peduncles long and exserted. 5
4. Glumes much shorter than the lemma, mostly under 2.2 mm; ligules 0.7 mm or less; leaves positioned at right angles to the stem, those of the secondary branches often shorter and narrower than the leaves of the main culm; terminal panicle often well exserted *M. bushii*
 Glumes nearly as long as the lemma, the second sometimes exceeding the lemma; ligule 0.8 mm or more; leaves not conspicuously positioned at right angles to the stem and with little difference in size between the leaves of the branches and the main culm; terminal panicle not usually long exserted *M. frondosa*
5. Ligules conspicuous, 1.4-2.5 mm, projecting above the summit of the sheath, lemma 2.4 mm or more *M. sylvatica*

Ligules not conspicuous, 1.0 mm or less; lemma 2.2 mm or less. *M. sobolifera*

6. Glumes much shorter than the lemma, broadly ovate and overlapping; anthers longer than 1.0 mm *M. tenuiflora*
 Glumes as long as the lemma (occasionally shorter), lanceolate, not overlapping; anthers 0.8 mm or less 7

7. Ligules conspicuous, 1.4-2.5 mm, projecting above summit of sheath; inflorescences slender; anthers 0.6-0.8 mm; leaf sheaths rounded *M. sylvatica*

Ligules not conspicuous, 1.2 mm or less; inflorescences from very dense and lobulate to very slender; anthers 0.5 mm or less; leaf sheaths abruptly keeled. *M. mexicana*

REFERENCES

Fernald, M.L. 1943. Five common rhizomatous species of *Muhlenbergia*. *Rhodora*. 45:221-239.

Gleason, H.A. and A. Cronquist. 1965. Manual of vascular plants of northeastern United States and adjacent Canada. New York, D. Van Nostrand Co. pp. 82-85.

Humason, G. 1972. Animal tissue techniques. San Francisco, Freeman.

Mitchell, W.W. 1962. Variation and relationships in some rhizomatous species of *Muhlenbergia*. Unpubl. Ph.D. thesis, Iowa State University Library.

Payne, W.W. 1968. The use of cellulose acetate film for the production of epidermal casts. *Ward's Bull.* (April) pp. 6-7.

Pohl, R.W. 1965. Dissecting equipment and materials for the study of minute plant structures. *Rhodora*. 67:95-96.

———. 1969. *Muhlenbergia*, subgenus *Muhlenbergia* (Gramineae) in North America. *Amer. Midl. Natur.* 82:512-542.