Comparing *Rhynchospora indianolensis* (Small) and *Rhynchospora scutellata* (Griseb.) achene dimensions using scanning electron microscopy measurements to consider them one single species

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Abstract

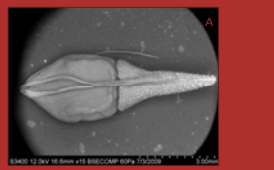
A current taxonomical debate exists over the species *Rhynchospora scutellata* of the sedge (Cyperaceae) family. Past studies suggest a variety of ways to taxonomically group *R. scutellata*, with some researchers treating as many as four species as conspecific. Achene morphology has been used in several past studies to differentiate between two species. This preliminary study utilized scanning electron microscopy to examine sedge achenes of two of the controversial species, *Rhynchospora indianolensis* and *Rhynchospora scutellata,* in order to determine whether they are actually the same species. Several dimensions of the achenes were photographed, measured, and compared. The measurement data concluded that the two species demonstrate distinct patterns of separate species. However, due to only slight variation in measurements an expanded study with a greater number of specimens is necessary to better understand the correlation between *R. indianolensis* and *R. scutellata*.

Introduction

The lack of research over the sedge family (*Cyperaceae*) can be attributed to the challenge faced when categorizing sedges into taxa due to reduced fruit and flower structure (1). Results of several past studies found sedge achenes (single seeded indehiscent fruits) to be useful indicators for identifying the taxa. A sedge achene structurally consists of the plant ovary (the achene body itself) and the tubercle (the base of the plant's style in this morphologically reduced plant) attached to the apex of the achene. Vertically stretching from the center of the tubercle base to the tubercle apex is a depressed groove called the sulcus. Within the genus *Rhynchospora* a debate persists over the taxonomic position of *Rhynchospora scutellata* Griseb. Past researchers have grouped the species in various ways, with some treating as many as four species as conspecific (Figure 3) (2). One study established the scanning electron microscope (SEM) to be a sufficient tool for observing achene surfaces because they remain stable (some for over fifty years) upon drying (3). The SEM has become an important asset in previous taxonomic studies for separation of closely related species, enabling the examination of rigid sedge achene structures where a transmission or light microscope would fail (4). The purpose of this preliminary research was to focus on *R. indianolensis* Small and *R. scutellata,* two of the controversial groupings, to determine if they may actually be the same species using scanning electron microscopy.

Methods

Specimens of sedge achenes for this experiment were obtained from the Texas A&M University S.M. Tracy Herbarium (TAES). Ten achenes from specimens of *R. indianolensis* (Figure 1) and ten of *R. scutellata* (Figure 2) were randomly selected from the collection. The dried achenes were removed from herbarium sheet fragment packets and placed in paper packets. Each specimen was placed on a stub and held in place with folded masking tape in order to avoid damaging brittle parts of the dried achene. The specimens were examined under the Hitachi S3400-N SEM at 12kV. Dimensions were photographed with the SEM, then measured and recorded using Quartz PCI Version 8 software. Achene body height (AH), achene width at its widest point (AW), achene height to width ratio (AH-WR), tubercle height (TH), tubercle base width at its widest point (TBW), tubercle height to base ratio (TH-BR), sulcus width at base of tubercle (SBW), sulcus width at tubercle midsection (SMW), and sulcus base width to sulcus midsection width ratio (SB-MR) were measured.



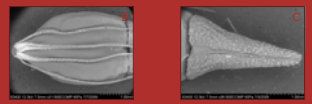
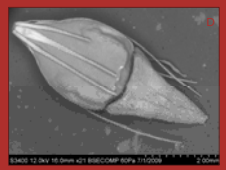


Figure 1: *Rhynchospora indianolensis* specimens as photographed with the Hitachi S3400-N SEM; A: achene, B: achene body, C: tubercle



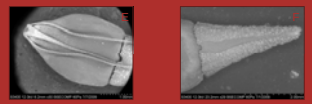


Figure 2: *Rhynchospora scutellata* specimens as photographed with the Hitachi S3400-N SEM; D: achene, E: achene body, F: tubercle

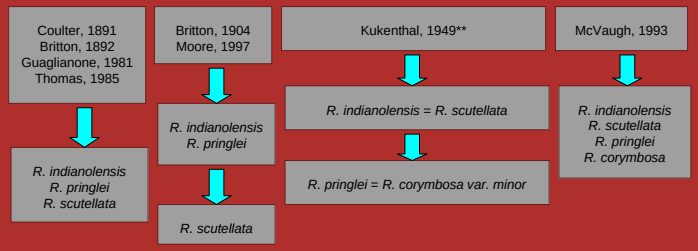


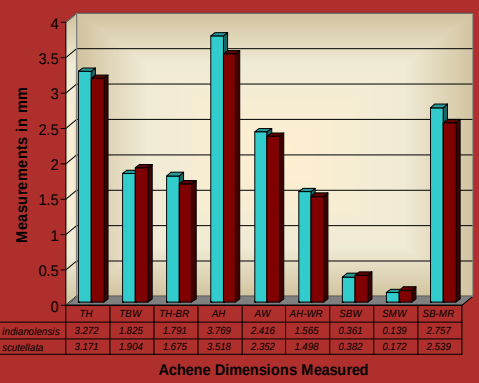
Figure 3: Researchers and their breakdown of *Rhynchospora scutellata*: each box treated as conspecific*
*Chart divisions based on research by Moore (2)
**Kukenthal regarded the first group as synonymous and the second group as synonymous

Results

After examining all twenty achene specimens, the measurements were averaged for each species, compared, and analyzed (Figure 4). *R. indianolensis* had consistently higher measurement averages for all three achene measurements recorded. The achene of *R. indianolensis* was taller by .251mm, wider by .064mm, and had a larger achene height to achene width ratio, but *R. scutellata* had a wider measurement range for all three. Data indicates that on average *R. indianolensis* had a taller tubercle and a wider range of tubercle height. *R. scutellata* had a wider tubercle base and a wider range of tubercle base width measurements on average. *R. scutellata* had an overall wider sulcus on average correlating with its wider tubercle base.

Discussion

Initially, this study was designed to determine if *R. indianolensis* and *R. scutellata* are actually one single species that may have migrated along the coast, considering one is endemic to the Texas coast and the other to South American countries along the coastline. The results did not support the hypothesis that the two species may be conspecific. No significant difference in achene appearance surfaced. It was difficult to locate definitive boundary lines of the sulcus on some specimens. The sulcus may still provide some assistance with determining taxa, but in this study the significance of the sulcus was inconclusive. With the results from this preliminary study, it is evident that further research is necessary for explaining the relationship of the two species. *R. indianolensis* and *R. scutellata* may have originated from a common ancestor and divergently evolved into separate species as they migrated farther apart from each other and adapted to their new surroundings. The results concluded that the two should be treated as separate species taxonomically. An expanded study with a greater number of specimens is necessary to better understand the correlation between *R. indianolensis* and *R. scutellata*. Past achene studies have relied on observations of the internal structure for differentiating taxa, which may be obligatory for these two species.



	TH	TBW	TH-BR	AH	AW	AH-WR	SBW	SMW	SB-MR
R. indianolensis	3.272	1.825	1.791	3.769	2.416	1.565	0.361	0.139	2.757
R. scutellata	3.171	1.904	1.675	3.518	2.352	1.498	0.382	0.172	2.539

Figure 4: Graph of the achene dimensions of *R. indianolensis* and *R. scutellata*

Literature Cited

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Acknowledgments

A thanks to Dale Kruse of Texas A&M University for all of his assistance and expertise of the sedge family; the Texas A&M University S.M. Tracy Herbarium (TAES) for allowing access to their achene specimens; Dr. Carl Knight and Jessica Silva of Eastfield College for their assistance throughout the entirety of the project; Michael Black, photographer. Eastfield College Project Pathways Summer Institute is supported by the National Science Foundation Science Talent Expansion Program Grant # DUE-0525536, the Dallas County Community College District, the National Park Service, and the Big Thicket Association.

Photos courtesy of Michael Black