# ACHENE MICROMORPHOLOGY OF SOME INDIAN CYPERACEAE V. ACHENE MICROMORPHOLOGY AS A POSSIBLE SYSTEMATIC AID TO THE TAXONOMIC RECOGNITION OF *FIMBRISTYLIS* SECTIONS

FRANCIS J. MENAPACE, DANIEL E. WUJEK<sup>1</sup> AND B. H. M. NIJALINGAPPA<sup>2</sup>

Department of Biology, University of North Alabama, Florence, Alabama 35632 U.S.A. <sup>1</sup>Department of Biology, Central Michigan University, Mt. Pleasant, Michigan 488 59 U.S.A. <sup>2</sup>Department of Botany, University of Bangalore, Bangalore.

# ABSTRACT

Achenes of nine Indian Fimbristylis from sections Cymosae, Fuscae and Trichelostylis were treated with an acid solution to remove their cuticle and outer periclinal epidermal walls. Subsequent scanning electron micrographs revealed micromorphological characters of potential systematic merit. However, an attempt to correlate the achene micromorphology with the sectional ranks proposed by Kern, failed, with respect to the Cymosae and Trichelostylis. Such results suggest that either : (1) the sectional parameters recognized by Kern may be in need of revision or, (2) that the achene micromorphology is of little value in delimiting Fimbristylis sections.

## INTRODUCTION

Derived from the Latin *fimbria* and *stylus*, in reference to the typically ciliate style, *Fimbristylis* Vahl is principally a tropical genus comprised of approximately 300 species (Willis, 1973). Initially synonymous with *Scirpus*, Vahl (1806) segregated plants with a ciliate, deciduous style to, *Fimbristylis*.

Acknowledging the extreme degree of macromorphological vegetative uniformity within *Fimbristylis*, few cyperologists have attempted a subgeneric classification (Koyama, 1961). Utilizing essentially inflorescence characters, Ohwi (1938) recognized 14 sections for Japan, and Kern (1974) 18 sections for Malaysia. A published contemporary sectional classification

Received on 12th December, 2002; accepted on 23rd September, 2003.

of Indian *Fimbristylis*, apparently does not exist. Consequently, Kern (1974) is adopted here for comparative purposes.

Accepting the widely attributed concept that fruit characters are innately more conservative than vegetative characters, cyperologists have utilized achene macromorphological characters to establish generic and subgeneric taxonomic parameters. Naturally, with advances in scanning electron microscopy (SEM), sedge taxonomists have logically extended their research to micromorphological achene characters, to augment the macromorphology, with the expectation of resolving systematic questions. With the completion of numerous sedge SEM studies, it is now apparent that the achene micromorphology is particularly beneficial in clarifying systematic disputes below the generic level (*e.g.*, Menapace & al., 1986; Wujek and Menapace, 1986; Menapace and Wujek, 1987; Menapace, 1993).

Prior SEM studies of Indian *Fimbristylis* (Wujek & al., 1992; Wujek, & al., 1994) revealed sufficient micromorphological achene character differences to suggest their use systematically at the sectional rank. In this study nine Indian species from sections, *Cymosae* [*F. dura* (Zoll. & Mor.) Merr., *F. cymosa* R. Br., *F. sericea* R. Br.], *Fuscae* [*F. disticha* Boeck., *F. eragrostis* (Nees) Hance, *F. intonsa* S.T. Blake] and *Trichelostylis* [*F. complanata* (Retz.) Link, *F. thomsonii* Boeck., *F. woodrowii* C. B. Clarke] were examined in an attempt to correlate the achene micromorphology with the sectional classification proposed by Kern (1974).

### MATERIALS AND METHODS

Achene preparation and observations were conducted as previously described (Wujek & al., 1992) except that a JEOL 840A was used for some of the observations. A minimum of three achenes from each specimen were examined. Vouchers are listed in Table 1.

#### **RESULTS AND DISCUSSION**

Micrograph analysis revealed four different micromorphological achene characters. Characters and their associated character states are defined in Table 2. Employing these four characters, six achene-forms were recognized. Achene-forms and their



Plate I. (figs. 1-9) Fimbristylis achenes.

 F. dura, 2. F. complanata, 3. F. cymosa, 4. F. disticha, 5. F. intonsa, 6. F. eragrostis, 7. F. sericea, 8. F. thomsonii and 9. F. woodrowii. Scale bar = 10 μm.

micromorphological character distributions are summarized in Table 3. Table 4 is a comparative assessment of the achene-forms with the sectional parameters proposed by Kern (1974).

Achene-forms 1 and 3 were restricted to the Trichelostylis, achene-forms 2, 5 and 6,

Our intent to draw a parallel relationship between the achene micromorphology, and the macromorphological sectional limits established by Kern, failed, with respect to the sections *Cymosae* and *Trichelostylis*. In fact, within sections *Cymosae* and *Trichelostylis*, none of

*Table 1*. Voucher data of *Fimbristylis* specimens from which the material for the study by SEM were obtained<sup>1</sup>.

Section Cymosae Fimbristylis dura (Zoll. & Mor.) Merr. AJGH Kostermans 26089 K Fimbristylis cymosa R. Br. HEPM 5745 Κ J. S. Gamble 21525 Fimbristylis sericea R. Br. Κ Section Fuscae Fimbristylis disticha Boeckler R. Wright s. n. K S. Kurz 12042 Fimbristylis intonsa S. T. Blake Κ K Fimbristylis eragrostis (Nees & Mey.) Hance W. J. L. Wenger 262 Section Trichelostylis Fimbristylis complanata (Retz.) Link Fimbristylis thomsonii Boeckler C. B. Clarke, Herb. of Cash India Co., No.6336 Κ Fimbristylis woodrowii C. B. Clarke Nijalingappa 152 Bangalore

Sectional classification is according to Kern (1974).

Table 2. Achene micromorphological characters and character states.

Character #1 - anti	Character #1 - anticlinal wall configuration			
0 = entire	1 = crenate	2 = serrate		
Character #2 - lum	Character #2 - lumen configuration			
0 = level	1 = concave			
Character #3 - lumen pits				
0 = absent	1 = present			
Character #4 - lumen nodule : central large				
0 = absent	1 = present			

*Table 3*. Achene-forms. Micromorphological character and character state distribution. See Table 2 for description of character state.

Achene Form	Character # 1	Character # 2	Character # 3	Character # 4
No.1	0	0	0	0
No.2	0	0	0	1
No.3	0	1	0	0
No.4	1	0	0	0
No.5	2	0	1	0
No.6	2	1	0	0

Kern section	Indian species	Achene-form	Micrograph
Cymosae	F. cymosa	No. 6	Fig. 3
Cymosae	F. dura	No. 5	Fig. 1
Cymosae	F. sericea	No. 2	Fig. 7
Fuscae	F. disticha	No. 4	Fig. 4
Fuscae	F. eragrostis	No. 4	Fig. 6
Fuscae	F. intonsa	No. 4	Fig. 5
Trichelostylis	F. complanata	No. 1	Fig. 2
Trichelostylis	F. thomsonii	No. 4	Fig. 8
Trichelostylis	F. woodrowii	No. 3	Fig. 9

Table 4. C	Comparative assessmen	t of achene-forms	and Kern classification.
10000 11 0			

the con-sectional taxa were assigned to the same achene-form. Section *Fuscae* demonstrated a high level of conformity, with all three con-sectional taxa assigned to achene-form 4.

The data presented in this study indicates that the Kern (1974) sectional approach, may be, in need of revision or, that the achene micromorphology of *Fimbristylis* is of limited systematic significance in delimiting sectional ranks. A recent achene micromorphological study of Indian *Scleria* (Wujek & al., 2001) resulted in a similar conclusion.

### ACKNOWLEDGEMENTS

Thanks are due to the Curators of the herbaria of BM, K and MICH. We are indebted to D. Dworzecki and G. Williams for their photographic assistance. This study was partly supported by the CMU FRCE Committee and Department of Biology.

#### REFERENCES

KERN, J. H. Cyperaceae. In Flora Malesiana, Series I. 7: 435-753. 1974.

- Koyama, T. Classification of the Family Cyperaceae (1). J. Fac. Sci. Univ. Tokyo 3. 8: 37-148. 1961.
- MENAPACE, F. J. Achene micro-morphology as a systematic aid to the series placement of Sevenson's undesignated *Eleocharis* (Cyperaceae) Species. *Rhodora* 95 : 214-224. 1993.
- MENAPACE, F. J. AND D. E. WUJEK. The systematic significance of achene micromorphology in Carex retrorsa (Cyperaceae). Brittonia 39: 278-283. 1987.
- MENAPACE, F. J., D. E. WUJEK AND A. A. REZNICEK. A systematic revision of the genus *Carex* (Cyperaceae) with respect to the section *Lupulinae*. *Can. J. Bot.* 64:2785-2788. 1986.
- OHWI, J. J. Notes on Japanese Fimbristylis. J. Jap. Bot. 14: 564-579. 1938.
- VAHL, M. Enumeratio Plantarum 2 : 1-423. Copenhagen. 1806.
- WILLIS, J. C. A. A Dictionary of the Flowering Plants of Ferns. 7th ed., Cambridge University Press, London. 1966.
- WUJEK, D. E. Achene micromorphology of some Indian Cyperaceae II. Fimbristylis. Asian Journ. Pl. Sci. 6: 1-17. 1994.
- WUJEK, D. E. AND F. J. MENAPACE. Taxonomy of *Carex* section *Folliculatae* using achene morphology. *Rhodora* 88: 399-403. 1986.
- WUJEK, D.E., S. K. VERMA, AND R. A. RUHLMAN. Achene micromorphology of some Indian Cyperaceae (Cyperus, Fimbristylis, Pycreus, Scirpus and Scleria). Asian J. Pl. Sci. 4: 1-19. 1992.

WUJEK, D. E., F. J. MENAPACE, E. A. DUFFIELD AND B. H. M. NIJALINGAPPA. Achene micromorphology of some Indian Cyperaceae. IV. Achene micromorphology of selected *Scleria*. In: S.V.S. Chauhan and S.N. Chaturvedi, *eds.*, Botanical Essays : Tribute to Professor Bahadur Singh. Printwell Publishers, Jaipur, pp. 218-228. 2001.