DARWINIANA ISSN 0011-6793

35(1-4) 169-173 1998

NOTE ON *ELEOCHARIS TUCUMANENSIS* (CYPERACEAE)

ENCARNACIÓN R. GUAGLIANONE [1,4], OSAMU UENO [2] & BARBARA RUTHSATZ [3]

[1] *Instituto de Botánica Darwinion, Casilla de Correo 22, 1642 San Isidro, Buenos Aires, Argentina*
[2] *National Institute of Agrobiological Resources, Kannondai 2-1-2, Tsukuba, Ibaraki 305, Japan*
[3] *Universitat Trier-FB VI Geobotanik, D 54286, Trier, Germany*

ABSTRACT: Guaglianone, E R, Ueno, O. & Ruthsatz, B. Note on *Eleocharis tucumanensis* (Cyperaceae) *Darwiniana* 35: 169-173

Eleocharis tucumanensis Barros grows in the high mountains of Argentina, Bolivia and Chile The anatomical structure of culms was studied and showed it is a C_3 species. A complete description, illustrations, and SEM micrographs of the achenes are given.

Keywords C_3 species, Achenes, Micromorphology, *Eleocharis tucumanensis,* Cyperaceae.
Palabras clave: especie C_3, Aquenios, Micromorfología, *Eleocharis tucumanensis*, Cyperaceae.

Eleocharis tucumanensis Barros is a poorly known species present in subtropical-semiarid high mountains of Bolivia, Chile and northwestern Argentina, including the northwestern mountains in Tucumán (Ruthsatz, 1995; Guaglianone, 1996) This species was not included in the study of distribution and evolution of C_4 syndrome in *Eleocharis* (Ueno et al., 1989). On the basis of new collections, the anatomical structure of culms was examined in order to determine the photosynthetic pathway type. A complete description of this species is presented and new illustrations are given, together with SEM micrographs of achenes.

MATERIALS AND METHODS

The culms were hand-sectioned transversely The sections were observed for the presence of Kranz cells or vascular parenchyma cells with green contents under a light microscope. Afterwards, they were immersed in commercial bleach for 10 minutes to remove the cell contents and then stained with safranin and fast green after washing. These sections were examined for the size of the vascular parenchyma cells and the arrangement of mesophyll cells (Ueno et al., 1989).

[4] Miembro de la Carrera del Investigador, CONICET

The achenes were submerged in xylene and placed in ultrasonic cleaner for 30 minutes, in order to eliminate the cuticle and outer periclinal cell walls. Afterwards, they were air-dried and coated with gold-palladium and observed with SEM, ZEISS-DSM, 940 A. Micrographs were taken of the central portion of the achene (Menapace, 1990).

Eleocharis tucumanensis Barros, Lilloa 12: 7. 1946 TYPE: Argentina. Tucumán. Dpto. Tafí· río de la Puerta, 4.000 m s.m., XII-1931, *Schreiter 7071* (holotype: LIL!). Figs. 1-2.

Plants 1-1,5 cm high. Horizontal slender rhizomes, with fascicles of vertical culms. Culms filiform, obscurely 3-angled or circular in outline. Uppermost sheath scarious at apex, sub-inflated, mouth oblique. Spikelets asymmetric, in outline more or less deltoid, 2-3 mm long x 1,5 mm wide, 1(-2) flowered. Scales 3(-4), sub-distichous, broadly ovate, obtuse, striate, with reddish-black sides and a scarious margin; lowest scale sterile, 1 mm long, with a broad greenish midrib; second scale 1,6 mm long; third scale 2,2 mm long. Stamens 3; anthers 1 mm long, shortly apiculate. Style trigonous, trifid. Achenes trigonous, sub-obovoid, 0,8-1 mm long x 0,5-0,7 mm wide, yellowish or pale brown; surface finely trabeculate, with horizontally rectangular

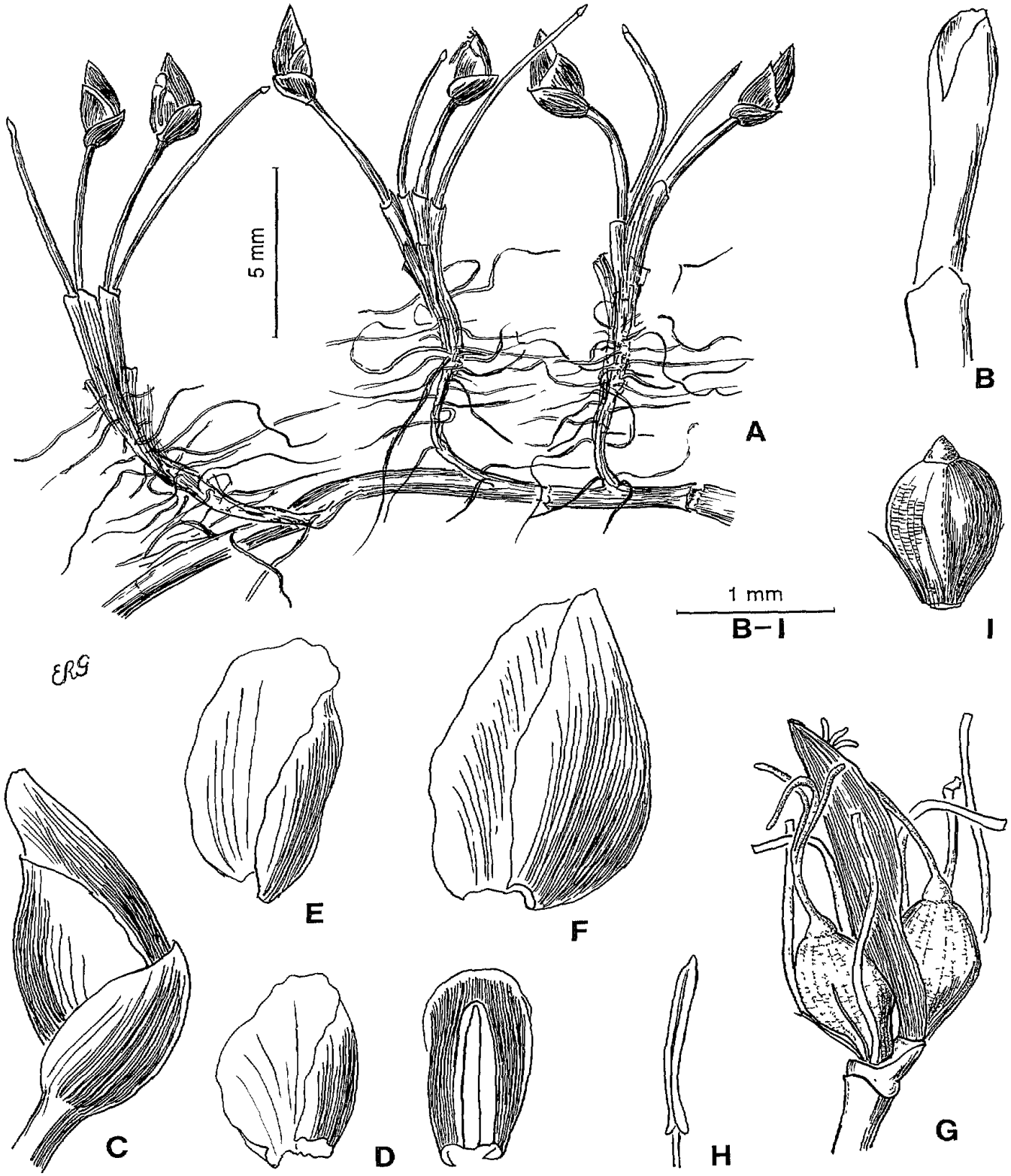

Fig 1.- *Eleocharis tucumanensis*. A: aspect. B: view of the lower and upper sheath. C: spikelet D· lower scale, ventral and dorsal view. E· second scale. F: third scale G: spikelet, without scales, with 2 achenes. H. anther I. achene From *Menhofer 1613*.

cells between the longitudinal ribs; cells with crenate anticlinal walls and pitted lumen; style base small, pyramidal, 0,3 mm long, not confluent but separated from the achene by a constriction; bristles 2-4, white to brownish, slender, shorter than the achene, somewhat denticulate.

Distribution and habitat: Andean ranges of central Bolivia, northern Chile and northwestern Argentina, growing in mountain meadows (vegas), between 3900 and 4600 m altitude.

Specimens examined

ARGENTINA. **Jujuy**. *Dpto Humahuaca*· Mina Aguilar, 3900 m s m., 17-X-1949, *Hueck 308* (LIL). **San Juan**. *Dpto. Iglesias*: Valle del Cura, río Blanco, 4300 m s.m., 24-I-1995 (fr) *Kiesling & Ruthsatz 8691* (SI)

BOLIVIA. **La Paz**· Prov F.Tamayo, Ulla-Ulla, Cañuma, orillas de la laguna, 4450 m s.m , 4-XI-1982 (fr) *Menhofer 1613* (SI).

CHILE. **Región I**. *Tarapacá*. Putre, Lag. Chungara, 4600 m s m., orilla de la laguna, 18°18'S, 69°08'W, 1-XI-1991 (fr) *Ruthsatz 7989* (SI); Idem, Iquique, Collaguasi (Ujima), en vega, 4450 m s.m 20°59'S, 68°39'W, 24-III-1992 (fr) *Ruthsatz 8423* (SI). **Región II**. *Antofagasta*. El Loa, Qda Linzor, vega, 4000 m s.m., 22°13'S, 68°01'W, 21-III-1992 (fr) *Ruthsatz 8374* (SI).

Anatomical structure of culms (Fig. 3)

In transverse sections, the culms have a somewhat triangular to circular outline, three vascular bundles are present in the former and four in the latter The outer cell wall of epidermal cells is very thick. Small air cavities occur in the center. Two or three layers of mesophyll cells are present below the epidermis. Two bundle sheaths surround the vascular bundles. The outer sheath is translucent and parenchymatous, and the inner one is a mestome sheath consisting of colorless cells with thick inner tangential wall Metaxylem vessels are small and make direct contact with the mestome sheath. Vascular parenchyma cells are small, with yellow contents.

DISCUSSION AND CONCLUSIONS

Eleocharis tucumanensis grows in Andean tropical vegas, together with *Distichia muscoides* Nees & Meyen ex Wedd., *Poa perligulata* Pilg., *Werneria heteroloba* Wedd., *W. solivaefolia* Sch. Bip., *W. spathulata* Wedd., *Plantago tubulosa* Decne., *Lachemilla diplophylla* (Diels) Rothmaler, *Aa paludosa* (Rchb. f.) Schltr., *Hypochoeris taraxacoides* (Walp.) Benth. & Hook., *Cuatrecasasiella argentina* (Cabrera) H. Robinson, etc. In these areas the mean minimum annual temperature is 3.1° to 5° C (Cabrera, 1957; Ruthsatz & Hofmann, 1984). C_4 species, are generally restricted to warm and semiarid environments, and the percentage of C_4 species diminishes with altitude until they constitute only 1% of the flora in the subandean belt between 4100- 4500 m (Ruthsatz & Hofmann, 1984).

The vascular parenchyma cells of *E. tucumanensis* have yellow contents, which are probably chloroplasts. The size of these cells is clearly smaller than those of C_3-C_4 intermediate species and the Kranz cells of C_4 species in *Eleocharis*, indicating that *E. tucumanensis* is a C_3 species, as most species belonging to that genus (Ueno et al., 1989). The mesophyll cells also are non typical of C_4 species.

Eleocharis tucumanensis belongs to subgenus *Scirpidium* (Nees) Kukkonen (Kukkonen, 1990; González-E. & Peterson, 1997), section *Scirpidium* (Nees) Benth. & Hook. f., formerly series *Aciculares* (C.B.Clarke) Svenson (Svenson, 1929), the latter based on subgenus *Eleocharis*, section *Aciculares* C. B. Clarke (Clarke, 1908; Egorova, 1981). The rest of species considered in sect. *Scirpidium* differ from *E tucumanensis* by having multiflowered spikelets, with the lowest scale fertile, except in *E. ayacuchensis* S. González & Reznicek, and achenes terete or obscurely trigonous.

ACKNOWLEDGMENTS

The authors wish to thank Prof. E. A Ulibarri, Dr. M. M. Ponce and anonymous reviewers, for their valuable help.

LITERATURE CITED

Cabrera, A. L. 1957. La vegetación de la Puna argentina. *Revista Invest. Agric.* 11: 317-412.

Clarke, C. B. 1908. New genera and species of Cyperaceae. *Bull. Misc. Inform. Kew. Addit. ser.* 8: 1-196.

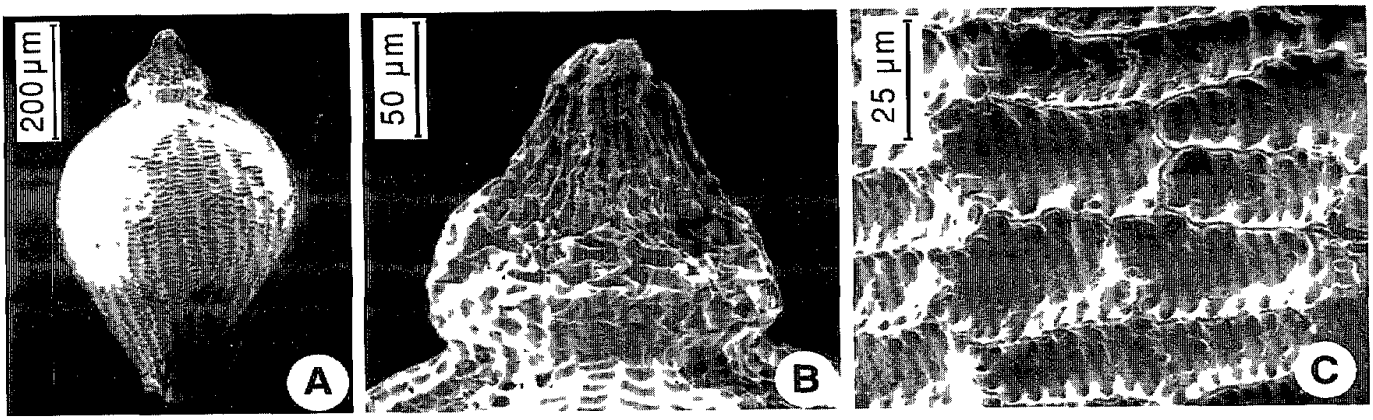

Fig. 2.- *Eleocharis tucumanensis*· SEM micrographs of the achene. A· achene B: style base C. surface of the achene, without the outer periclinal wall. From *Menhofer 1613*.

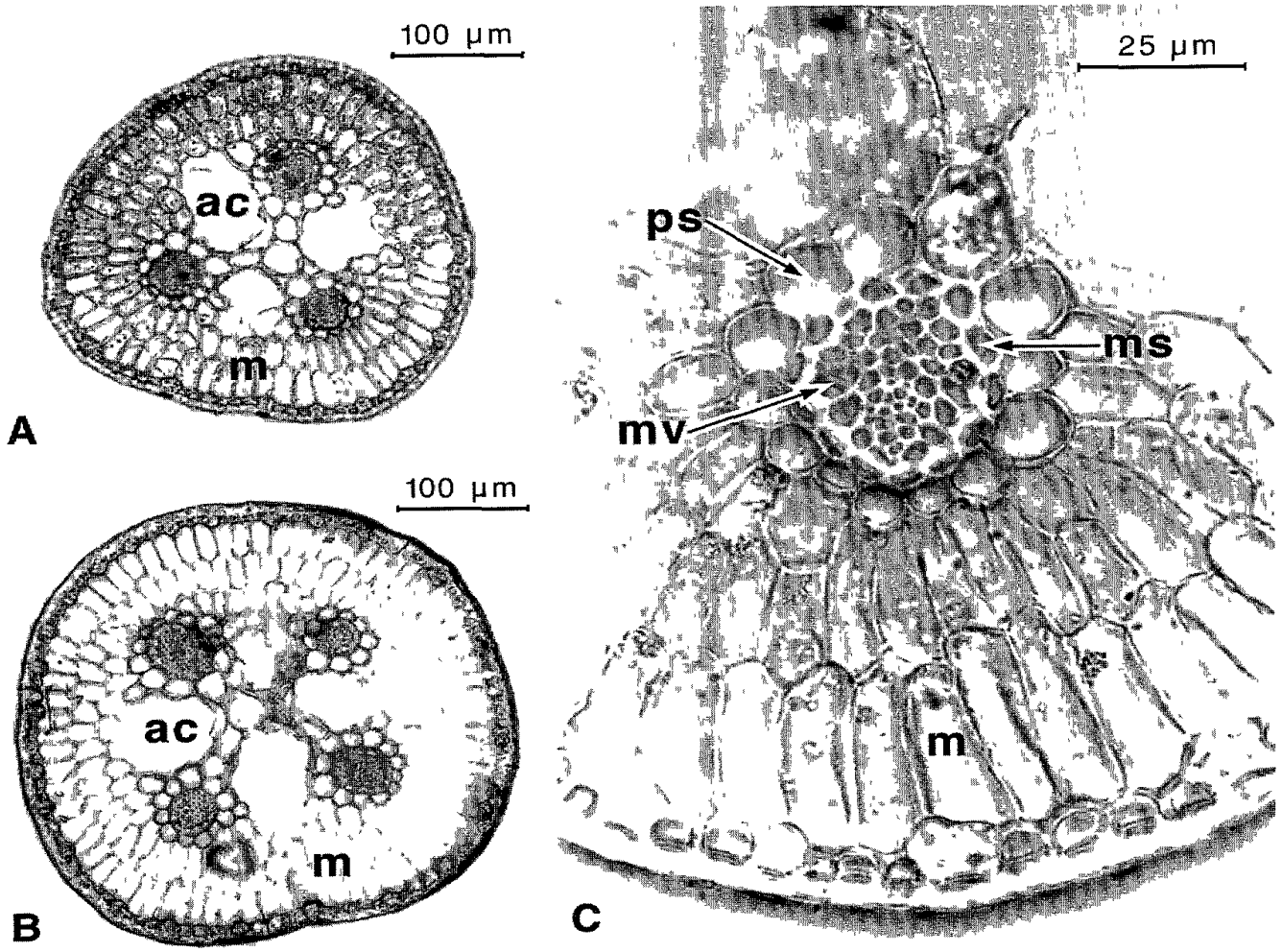

Fig 3 - *Eleocharis tucumanensis* A: transverse section of a culm with three vascular bundles B: transverse section of a culm with four bundles. C transverse section of a vascular bundle, which is surrounded by two bundle sheaths ac, air cavity, m, mesophyll cells; ps, parenchyma sheath; ms, mestome sheath; mv, metaxylem vessel. From *Ruthsatz 8423*.

Egorova, T. 1981 Generis *Eleocharis* R Br. (Cyperaceae) Florae URSS Systema et Conspectus *Novit. Syst. Plant. Vasc.* 18: 95-123.

González-Elizondo, M. S. & Peterson, P M. 1997 A classification of and key to the supraspecific taxa in *Eleocharis* (Cyperaceae). *Taxon* 46. 433-449

Guaglianone, E. R. 1996. Cyperaceae p p., en Zuloaga, F O. & O. Morrone (eds.) Catálogo de las Plantas Vasculares de la República Argentina. I. *Monogr. Syst. Bot Missouri Bot. Gard.* 60· 128-197

Kukkonen, I. 1990. On the genus *Eleocharis* (Cyperaceae) in the Flora Iranica area, with revised infrageneric classification and nomenclature. *Ann. Bot. Fennici* 27: 109-117.

Menapace, F. J. 1990. A preliminary micromorphological analysis of *Eleocharis* (Cyperaceae) achenes for systematic potential. *Canad. J. Bot.* 69: 1533-1541.

Ruthsatz, B. & Hofmann, U. 1984. Die Verbreitung von C4-Pflanzen in den semiariden Anden NW-Argentiniens mit einem Beitrag zur Blattanatomie ausgewählter Beispiele. *Phytocoenologia* 12: 219-249.

——. 1995 Vegetation und Okologie tropischer Hochgebirgsmoore in den Anden Nord-Chiles. *Phytocoenologia* 25· 185-234.

Svenson, H. K. 1929. Monographic studies in the genus *Eleocharis*. *Rhodora* 31. 121-163.

Ueno, O., Samejima, M. & Koyama, T. 1989. Distribution and evolution of C4 syndrome in *Eleocharis*, a sedge group inhabiting wet and aquatic environments, based on culm anatomy and carbon isotope ratios. *Ann. Bot.* 64: 425-438.

Original recibido el 7 de marzo de 1998; aceptado el 4 de junio de 1998.