

ANATOMICAL ASPECTS OF *CYPERUS ALTERNIFOLIUS* ROTTB.

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ABSTRACT

The paper presents histo-anatomical aspects of the vegetative organs (adventitious root, rhizome, scape and leaf) of a perennial herb, native to the swampy regions of Japan and Taiwan namely *Cyperus alternifolius* Rottb. It belongs to Cyperaceae family. In our country the plant is known as an ornamental plant. The material fixation and processing was done according to the usual protocol of the vegetal morphology and anatomy Laboratory belonging to the Natural Sciences Department of the our faculty. The adventitious root has a primary monocot structure with a developed aerenchyma created by lyses of cell walls. The rhizome vascular system consists of amphivasal collateral bundles to the center and peripheral few bundles. The scape is well-developed with epidermis, hypodermis and a number of air chambers. The leaf mesophyll is homogenous, represented spongy tissue. In the mesophyll are embedded few poorly developed vascular bundles. The aim of this study is to bring some new characteristics to complete the anatomical structure of adventitious root, rhizome, scape and leaf of this species.

Key words: anatomy, aquatic plant, vegetative organs, *Cyperus alternifolius*

INTRODUCTION

Cyperus alternifolius Rottb., known as umbrella sedge, is an aquatic annual or perennial rhizomatous species, originating from the swampy regions of Japan and Taiwan (Shimizu, 2003).

Elegant in its simplicity, with its composed leaves with long foliar's that are arranged on long and straight stems, in the shape of an emboliform crown. The flowers, insignificant, grouped in multiflora blossoms, develop in the middle of rosette (Fig. 1). It is multiplied by rhizomes or leaves (Shih et al., 2008). Recently was discovered a population of umbrella sedge in Baliwan



Fig. 1. Natural view of *Cyperus alternifolius* (Bercu and Gavati 2018) (orig.)

Community of Fengbin Township, Hualian County of Taiwan, which is almost indistinguishable from *C. alternifolius* L. subsp. *flabelliformis* (Rottb.) Kunt. After comparison with the study of Bajnath(1975), it was determined to be *C. alternifolius* L. Both subspecies of *C. alternifolius* are similar in appearance. However, *C. alternifolius* subsp. *flabelliformis* is different by achene morphology and the shape of

MATERIAL AND METHODS

The plant belongs to the Vegetal and Morphological Laboratory of the Faculty of Natural and Agricultural Science. Small pieces of adventitious roots, rhizome, scape and leaf were fixed in FAA (formalin: glacial acetic acid: alcohol 5:5:90). Cross sections of the species vegetative organs were performed by free hand made technique (Bercu and Jianu, 2003). The samples were stained with alum-carmin and iodine green and mounted in glycerinated gelatin. Anatomical observations and micrographs were performed with a BIOROM-T bright field microscope, equipped with a Topica 6001A video camera.

spikelet. Some studies refer to stem and leaf anatomy of *Cyperus* species, other than *C. alternifolius* belong to Batanouny (1992) and Amini Rad and Sonboli (2008). In Romanian *Cyperus alternifolius* such as other monocot plants is known as an ornamental plant and there are few data on the anatomy of this species (Fig. 1) (Bercu and Gavut, 2018; Niculescu, 2009).

RESULTS AND DISCUSSIONS

The adventitious mature monocot root epidermis appears almost entirely exfoliated. It is followed by some layers of cells showing lyse of the cell walls with air chambers value (Fig. 1, A) such as Martines and Scatena (2013) reported for other *Cyperus* species (*C. laxus* and *Fimbristylis dichotoma*). Remarkable are the thick-walled cells layers around the stele. Centrally located is the lignified endodermis and the pericycle with thick-walled cells. The vascular system is represented by 8-9 xylem vessels alternating with few developed floem bundles (Fig. 1, B).

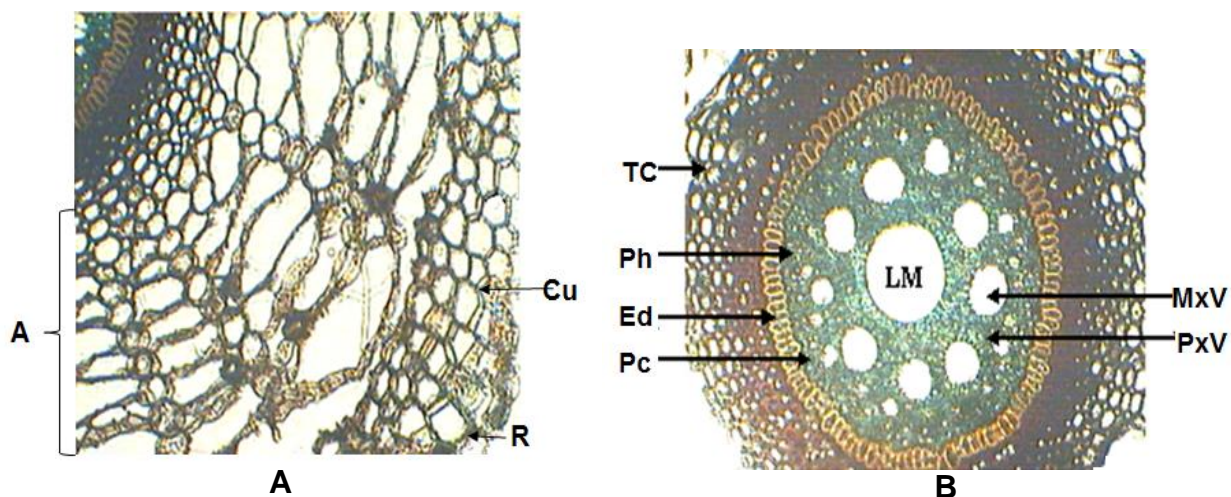


Fig. 1. Cross section on the adventitious root of *Cyperus alternifolius*. Portion with epidermis and aerenchyma (A, x 240). The stele (B, x 155): A- aerenchyma; Cu- cutis, Ed- endodermis, R- rhizoderma, MxV- metaxylem vessel; Pc- pericycle, PxV- protoxylem vessel, R- rhizodermis, TC- thick walled cells.

The cross section of the rhizome exhibits the outer layer of rectangular cells – epidermis – followed by the hypodermis containing two layers of parenchyma thick-walled small cells. It is

followed by a number of parenchyma layers of cells. Remarkable is the abundance of starch grains in the rhizome, often screening the vascular bundles (Fig. 2, A, B).

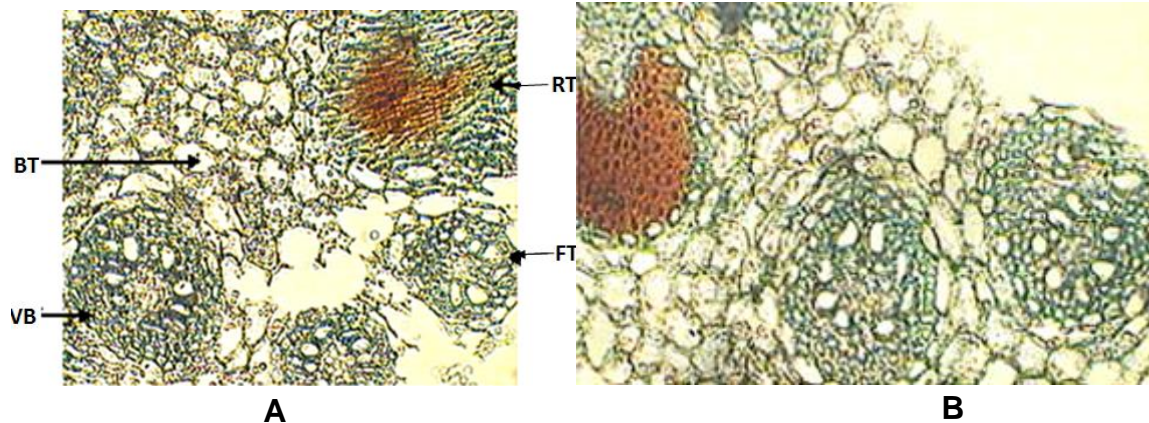


Fig. 2. Cross sections of the rhizome with amphivasal vascular bundles, and small collateral bundle (A, x 175; B, x 200): BT- basic tissue, FT – foliar trace, RT- root trace, VB- vascular bundle,

In the basic parenchymal tissue, there are numerous amphivasal vascular bundles, one larger than the other and several small collateral bundles (to the periphery of the rhizome) are present. The amphivasal vascular bundles have inside a well-developed phloem (sieve tubes and companion cells), surrounded by a number of xylem vessels. From the rhizome the root system of the adventitious roots and foliar tracts is detached (Fig. 2, A, B).

Cross section of the scape discloses a sinuous contour. Below the one-layered epidermis with cutinized cells, covered by the cuticle, there is a multilayered hypodermis. The hypodermis presents sclerenchyma strands alternating with chlorenchyma cells. In the basic parenchyma tissue, vascular bundles are present. The vascular bundles are poorly developed and consist of some xylem

and phloem elements. A large medullary lacuna is present in the central zone (Fig. 3). A transversal section through the blade exhibits a more or less triangular shape and the usual succession of tissues (Fig. 4, B). The blade mesophyll is homogeneous with cells containing numerous chloroplasts. The upper epidermis, such as the lower one, is formed by a single layer of thin-walled cells, covered by a thick cuticle with silica bodies. Such as in other amphibious plants (Bercu, 2008, 2009, 2015), the lower epidermis continuity is interrupted by stomata with small sub-stomatal cavities (lower epidermis). The lower epidermal cells are smaller than the upper one (Fig. 4, A).

However in the midrib area the epidermal cells of the upper epidermis are larger, radially elongated and in front of the secondary ribs they are visible small. The lower epidermis is abaxially slightly prominent.

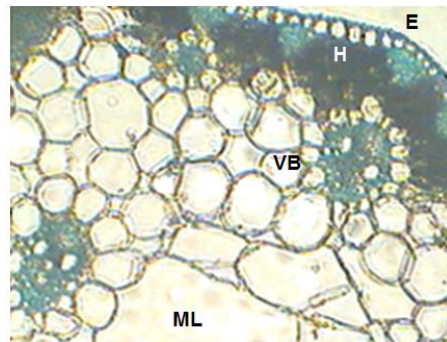


Fig. 3. Cross section of the scape with epidermis, hypodermis, vascular bundle and medullar lacuna(x 180): E- epidermis; H- hypodermis, ML- medullar lacuna, VB- vascular bundle.

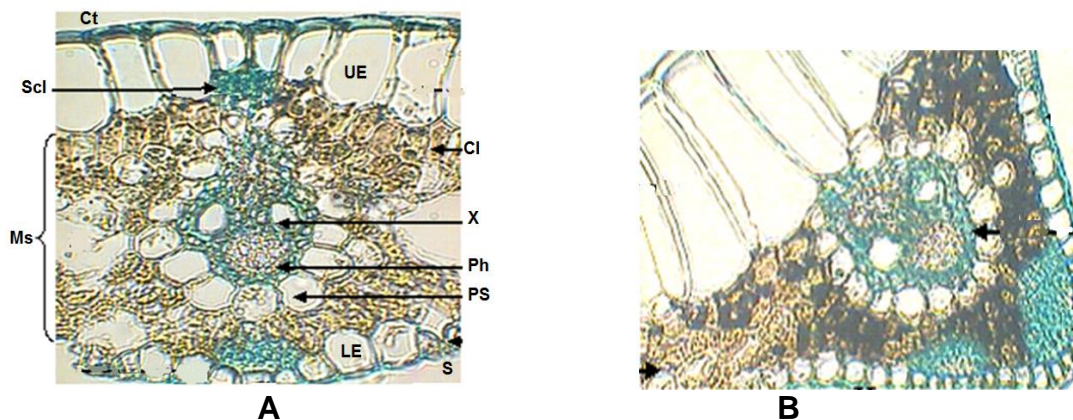


Fig. 4. Cross section of the blade. Portions of the blade(A, x 150; B, x 360): Cl- chloroplasts, Ct- cuticle, Ph- phloem, Ps- parenchyma sheath, LE- lower epidermis, Ms- mesophyll, S- stomata, Scl- sclerenchyma, UE- upper epidermis, x- xylem.

Between the midrib zone and both epidermises (upper and lower) there are small groups of sclerenchyma cells with a mechanical role (Fig. 4, A, B).

The vascular bundles are poor developed with few xylem (two metaxilem vessels, two of the protoxilem) and phloem elements (Fig. 4, A, B).

CONCLUSIONS

The adventitious root is by monocot type, with air chambers and centrally located is the lignified endodermis and the pericycle with thick-walled cells. The vascular system is represented by 8-9 xylem vessels alternating with few developed floem bundles.

The rhizome exhibits the outer layer of rectangular cells – epidermis – followed by the hypodermis containing two layers of parenchyma thick-walled small cells. It is followed by a number of parenchyma layers of cells. Numerous amphivasal vascular bundles, one larger than the other and several small collateral bundles (to the periphery of the rhizome) are present in the basic tissue. The scape discloses a one-layered epidermis with cutinized cells, covered by cuticle, there is a multilayered hypodermis with chlorenchyma strands, alternating with sclerenchyma strands. In the basic parenchyma tissue vascular poor

developed bundles are present. A large medullar lacuna is present in the central zone. The blade exhibits a homogenous mesophyll. Both one-layered epidemic cells are covered by a thick cuticle with silica bodies (upper epidermis). Stomata are present to the lower epidermis. The vascular bundles of the blade are poor developed with few xylem and phloem elements. Between the midrib zone and both epidermises (upper and lower) there are small groups of sclerenchyma cells with a mechanical role.

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