

STRUCTURAL ANATOMICAL ASPECTS OF TWO *EUPHORBIA* (EUPHORBIACEAE JUSS.) SPECIES LEAVES

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Abstract.

The paper presents a study concerning the leaf structure (petiole, as the case) and blade of two *Euphorbia* species belonging to Euphorbiaceae family: *Euphorbia trigona* Mill., and *E. tirucalli* L. In literature is little information concerning the leaf petiole or blade anatomy of species of *Euphorbia* genus in general and concerning these two species in particular.

The petiole of *Euphorbia trigona* possesses one epidermis cells which are more or less rounded in shape, covered by a thin cuticle. The vascular system of the petiole is represented by three closed–collateral vascular bundles. Anatomically, the leaves blade of the studied species are heterogenous and amphistomatic with laticifers especially presented to the midrib zone, more abundant in *Euphorbia tirucalli*. The midrib vascular system is more developed in *Euphorbia tirucalli* than *E. trigona*.

Keywords: anatomy, leaf, mesophyll, laticifers, *Euphorbia*

INTRODUCTION

The studied species belong to Euphorbiaceae family, one of the largest in the plant world, sometimes known as spurges. It includes around 300 genera and 7,700 species, mainly non-succulent herbs, shrubs and trees found in temperate, sub-tropical and tropical climates. The spurge family takes its name from the genus *Euphorbia*. *Euphorbia tirucalli* L. (pencil plant, milky shrub, pencil cake) is a perennial plant native from Africa where it was very widespread. Currently, it can also be found spontaneously, in restricted areas, in the center, southern and northeast of the African continent. It is a plant included in the IUCN Red List of Species since 2006 and has been threatened with extinction since 2004 (Haevermans, 2004). It is a plant with

a bushy harvested part, with the appearance of green rods and thick branches as a pencil (hence the popular name of the plant). Leaves are rare and small (Fig. 1, A). It develops well in hydroculture's (Burger and Huft, 1995). It is a very toxic euphoric species, currently used more as an ornamental plant (Miaulane, 2004).

Euphorbia trigona Mill. is a perennial plant, originating from Central Africa, with more popular names as the African milk tree, cactus cathedral (Broschat and Meerow, 1991; Fuller and McClintock, 1986) or cactus -candle (Miaulane, 2004),

The plant has a straight, thick stem, 3-4 lined, slightly branched, dark green with lighter green and V-shaped pattern.

On the stem crest the thorns are tall, twisted, about 5 mm in length.

Among stems and spines are rare, oblong-lanceolate leaves, with the whole margin, which appear in the spring, placed especially in the top of the stems (Fig. 1, B). In our country it is known as an ornamental plant.

In literature is little information concerning the leaf anatomy of species of *Euphorbia* genus in general and concerning these two species in particular.

Mostly researches followed the origin, development and structure of the laticifers. The most ample paper which analyzes the structure of the stem and leaf of spontaneous species and not only, from the *Euphorbiaceae* family is that of Gaucher (1902). Succinct references on the structure of the leaf as vegetative organ of some *Euphorbia* species are found in some

general studies concerning the angiosperms anatomy (G. Bonnier and Leclerc du Sablon, 1905; Dilcher, 1974; Esau, 1965; Metcalfe and Chalk, 1950; Napp-Zinn, 1973, 1974).

The Romanian literature there are only a few data on the structure of some vegetative organs (Ivanescu and Toma, 2003) of *Euphorbia* species; or general mentions in some lectures articles and manuals of Anatomy and Morphology of Plants (Bavaru and Bercu, 2002; Galeș and Toma, 2007; Grințescu, 1985, Niculescu, 2009; Șerbănescu-Jitariu and Toma, 1980; Toma and Gostin, 2000;).

The purpose of this paper is to highlight the anatomical characteristics of those two species. This paper could bring more information about this genus and this large family.



A



B

Fig. 1. *Euphorbia tirucalli* L. (A). *Euphorbia trigona* Mill. (B) (original).

MATERIAL AND METHODS

The mature leaves, of *Euphorbia tirucalli* and *E. trigona* were collected from S.C. IRIS S.R.L. Greenhouse and from the Vegetal Morphology laboratory of the faculty.

Small pieces of mature leaves were fixed in FAA (formalin: glacier acetic acid: alcohol 5:5:90). Cross sections of the vegetative organs were performed by manual technique used in vegetal histology (Bercu and Jianu

2003). The samples were stained with alum-carmin and iodine green. Anatomical observations and micrographs were performed with a BIOROM–T bright field microscope, equipped with a TOPICA 6001A video camera.

RESULTS AND DISCUSSION

The petiole is present only at *Euphorbia trigona* leaf. In cross-section, the petiole has a triangular contour shaped determinate by the presence of two developed lateral wings (Fig. 2).

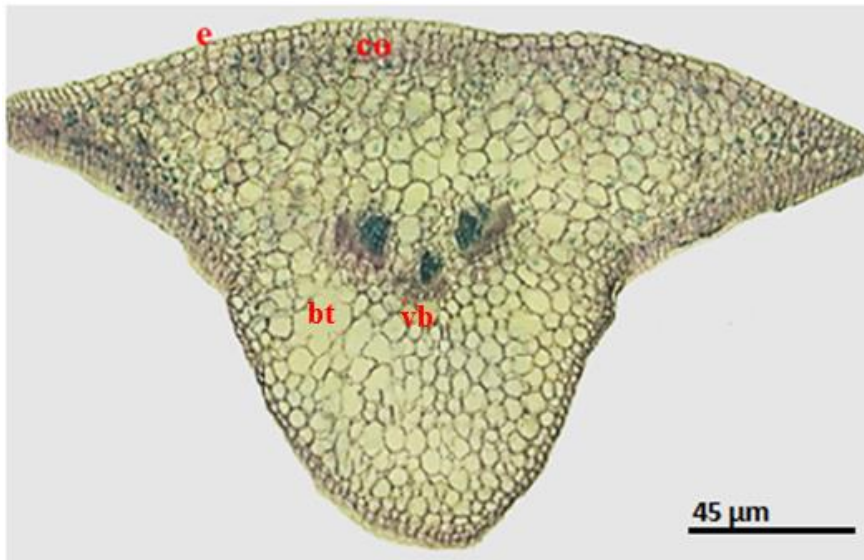


Fig. 2. Cross section of *Euphorbia trigona* petiole: bs- basic tissue, co- collenchyma, e- epidermis vb- vascular bundles.

The epidermis cells are more or less rounded in shape, especially in the vascular bundles area, slightly cutinized and covered by a thin cuticle.

Beneath the epidermis is a hypoderm, represented by a collenchyma tissue with chloroplasts (3-4 layers of cells) with mechanical role (Fig. 2).

Centrally located, in a basic parenchyma, is the vascular system of the petiole, represented by 3 closed – collateral type vascular bundles

The blade. The blade epidermis of *Euphorbia tirucalli* is one-layered celled and exhibits to upper and lower epidermis slightly rounded contour, covered with a thin cuticle. The lower epidermis forms a slightly vault. At this species, notable are the lateral parts of the blade that have a sinuous outline, with the margins slightly curved towards the adaxial face (Fig. 3). Among the lower and upper epidermis cells, rare stomata are present (Fig. 4, A).

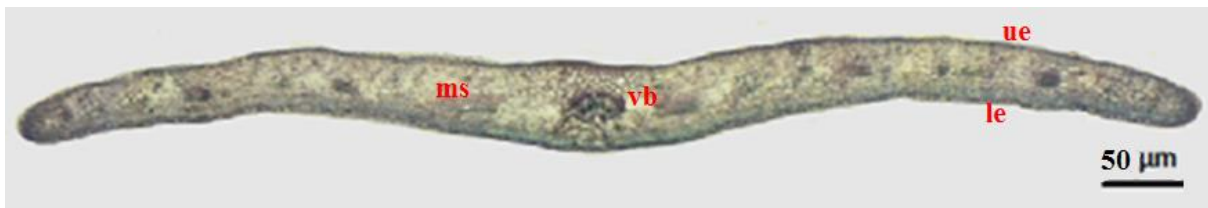


Fig. 3. Cross section of the mesophyll of *Euphorbia tirucalli* – ensemble: le- lower epidermis, ms- mesophyll, ue- upper epidermis, vb- vascular bundle of the midrib zone.

Cross sections of the blade exhibits an upper and lower epidermises, both one-layered and the mesophyll with vascular bundles embedded. The mesophyll is

heterogeneous and amphistomatic with laticifers (Fig. 4, A).

The main vein is represented by a collateral bundle (Raven et al., 1992) formed by xylem and phloem elements. Laticifers are present as well (Fig. 4, B).

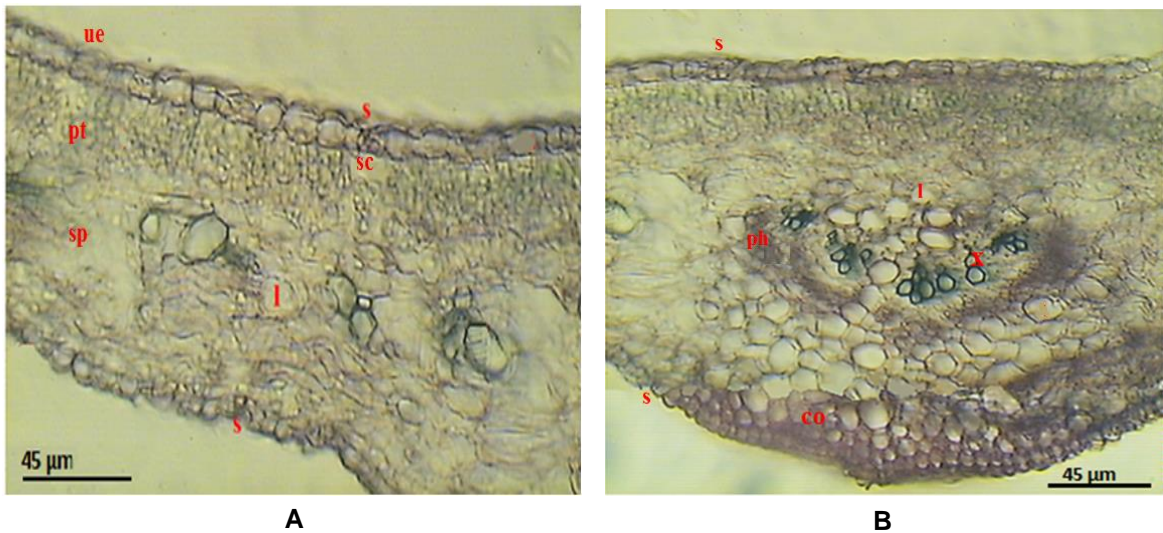


Fig. 4. Cross sections of *Euphorbia tirucalli* blade. Portion with mesophyll (A) Portion with midrib zone (B): co- collenchyma, l –lactiferous tube, ph- phloem, pt- palisade tissue, s- stomata, sc- sub-stomata cavity, sp- spongy tissue, ue- upper epidermis, x- xylem.

The sessile leaf of *Euphorbia trigona* has one layered upper and lower epidermis, covered by a thin cuticle, followed by a heterogeneous mesophyll with 2 layers of palisade tissue just below the upper epidermis and a number of spongy tissue

between the palisade tissue layers and lower epidermis. The mesophyll is amphistomatic with laticifers especially presented to the midrib zone (Fig. 5, 6, A). The main vein is represented of a collateral bundle with xylem and phloem elements.

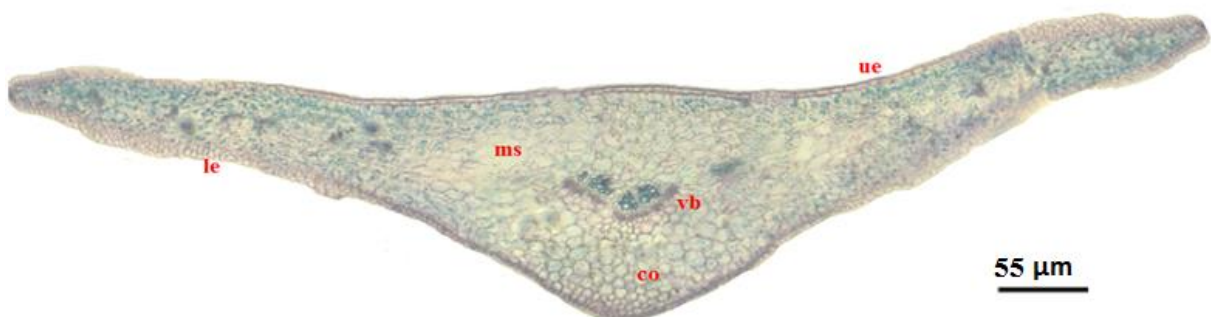


Fig. 5. Cross section of *Euphorbia trigona* blade - ensemble: co- collenchyma, le- lower epidermis, ms- mesophyll, ue- upper epidermis, vb- vascular bundle.

As Batanouny (1992) reported for other *Euphorbia* species, our

findings are the same for *Euphorbia trigona* concerning xylem conductive

elements which are placed towards the upper epidermis and exhibits a more or less radial arrangement. Phloem

elements, placed towards the lower epidermis, are poor developed than xylem ones (Fig. 6, B).

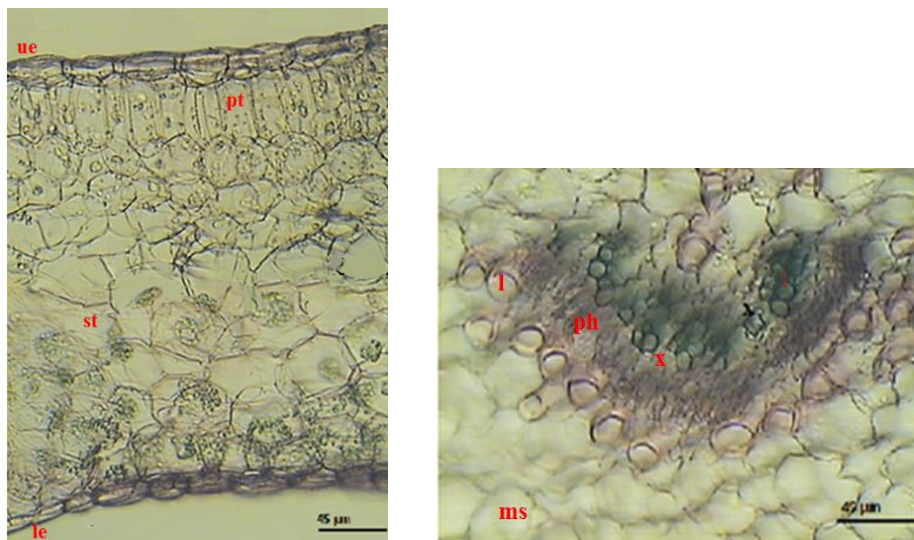


Fig. 6. Cross sections of *Euphorbia trigona* blade. Portion with mesophyll (A). Portion with midrib zone (B): l- laticifer tube, le- lower epidermis, ms- mesophyll, ph- phloem, pt- palisade tissue, sp- spongy tissue, x- xylem.

Just like in other studied *Euphorbia* sp. (Galeş and Toma, 2007) in the mesophyll of these two species, especially in the spongy tissue, the no articulated laticifers are present around the phloem tissue and have cellulosic thin walls, round or polygonal shape. In all studied species laticifers are also present mainly in the phloem area of the vascular bundles (Fig. 4, A, B: 6, B).

CONCLUSIONS

The petiole of *Euphorbia trigona* possesses epidermis cells which are more or less rounded in shape, slightly cutinized and covered by a thin cuticle. The vascular system of the petiole, represented by three closed –collateral type vascular bundles. Cross sections of the leaf blade of the two studied species (*Euphorbia trigona* și *E. tirucalli*) exhibits a single layered upper and lower epidermis which differ in shape and size, covered by a more or

less thin cuticle. The continuity of both epidermises is broken by the presence of stomata, more abundant in the lower epidermis. The mesophyll of both species is heterogeneous and amphistomatic with laticifers especially presented to the midrib zone. The midrib vascular bundle of both species possesses xylem elements to the upper epidermis and phloem elements, placed towards the lower epidermis which are poor developed than xylem one. The secretory elements – laticifers - are placed mainly in the main vein area, but also in the mesophyll, in all studied species. The mechanical tissue is not very well represented. It occurs such as collenchyma tissue in *Euphorbia trigona* petiole and to the lower epidermis for the blade of this species. It is poor developed for *Euphorbia tirucalli* leaf blade.

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