ANATOMICAL PECULIARITIES OF STEM AND LEAF IN *EUPHORBIA SPLENDENS*

PARTICULARITĂŢI ANATOMICE ALE TULPINII ŞI FRUNZEI LA *EUPHORBIA SPLENDENS*

SOARE Liliana Cristina, DOBRESCU Codruţa Mihaela
University of Pitesti, Romania

Abstract. *Also know as the crown of thorns, Christ's thorn, Euphorbia splendens is an Euphorbiaceae native of Madagascar, mostly spread on desert. In Romania it is grown in greenhouses and apartments. The latex produced by plant gives medicinal, molluscicidal properties and some researches indicate its potential to cause cancer. From all the anatomical peculiarities of the stem and leaf that emphasize the xerophytic origin of the species, we mention: chlorophyllous and water-storing stem cortex, poorly developed vascular and mechanical tissues, epicuticular wax.*

Key words: *Euphorbia splendens,* anatomical peculiarities**,** xerophilous plants

Rezumat. *Cunoscută sub numele de coroana de spini sau coroana lui Hristos, Euphorbia splendens este o Euphorbiaceae originară din Madagascar, cu răspândire în zonele deşertice, în România fiind cultivată în sere şi apartamente. Latexul produs îi conferă plantei proprietăţi medicinale, moluscicide, iar unele cercetări indică un potenţial cancerigen al acestuia. Dintre particularităţile anatomice ale tulpinii şi frunzei, particularităţi ce relevă originea xerofitică a speciei, menţionăm: scoarţa caulinară cloroplastică şi acviferă, ţesuturile conducătoare şi mecanice reduse, ceara epicuticulară pe frunze.*

Cuvinte cheie: *Euphorbia splendens,* partcularităţi anatomice, plante xerofile

INTRODUCTION

Euphorbia is a cosmopolitan genus that includes aproximately 2,000 herbaceous and shrub species, spread all over the Earth. The species of *Euphorbia* have been studied from an anatomical point of view especially due to the presence of the non-articulated laticifers (Galeş & Toma, 2006).

Known by the name of “crown of thorns“, or “Christ's thorn“, *Euphorbia splendens* is an *Euphorbiaceae* whose origins can be traced back to Madagascar, and is spread in desert areas, while in Romania it is grown in greenhouses and apartments.

Numerous researches have demonstrated the fact that the milky latex produced by the laticifers in the body of the plant have a moluscicidal action, and it can be used to fight the species which are intermediate hosts for *Schistosoma* (Zamith et al., 1996) and *Fasciola hepatica* (Vasconcelos & Amorim, 2003).

Similarly, the latex has anti-inflamatory properties (Bani et al., 1999) and some researches suggest that it contains substances that induce the formation of tumours (Cruz et al., 1996).

MATERIAL AND METHOD

The vegetable material represented by fragments of young stems and leaves of *Euphorbia splendens* was cross-sectioned, javelized and coloured with Geneva reagent.

The pictures were taken with an Optika microscope with a digital Canon camera. Part of the pictures were devoted to the unprocessed sections.

RESULTS AND DISCUSSIONS

Anatomy of the stem. The fleshy stems are covered with epidermis in the young parts, localized towards the apex. At a small distance from the apex it can be noted that the protection role of the stem is taken over by the suber (fig. 1).

The latter is formed from phellogen wich is localised in hypodermic position. The multi-layered cortex is differentiated into outer, middle and inner cortex. The outer cortical strata are collenchymatized and chloroplastic.

The middle cortex is made up of bigger cells than those in the outer cortex, having small intercellular spaces, and fewer chloroplasts (fig. 1).

That area represents an aquiferous parenchyma, characteristic of xerophilous plants. In the inner part of the aquiferous middle cortex collateral bundles can be seen (fig. 2), a situation that can be also found in many genera of cactaceae (Mauseth, 2006).

The inner cortex, placed round the central cylinder, is made of small cells. In the middle cortex and in the inner cortex can be noticed the presence of the non-articulated laticifers (fig. 2), characteristic of the genus *Euphorbia* (Esau 1965; Metcalfe & Chalk, 1983; Galeş & Toma, 2006).

In the cross-section it can be noticed that the laticifers' shape is round or oval, with a cell wall thicker than that of the neighbouring cells, of a cellulose nature. In the latex were revealed halter-shaped starch grains; in fact, these starch grains of various shapes are often found in the latex of the genus *Euphorbia* (Fahn, 1982; Toma & Gostin, 2000).

The central cylinder of the stem exhibits collateral vascular bundles, less developed, as a result of the adaptation to the xerophytic environment (fig. 2) (Fahn, 1982; Şerbănescu-Jitariu & Toma, 1980).

The primary medulla rays situated between the vascular bundles, are narrow, and made up of 1-2 rows of parenchymatous cells, elongated radially.

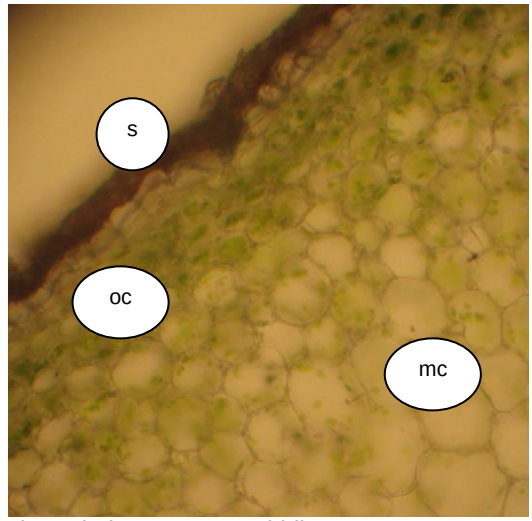

Fig. 1. Cross-section through the stem: mc-middle cortex, oc-outer cortex, s-suber (x 200, orig.).

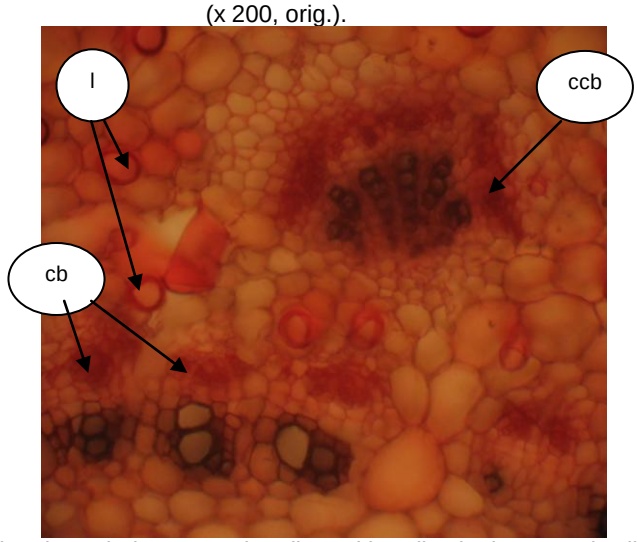

Fig. 2. Cross-section through the stem: cb-collateral bundles in the central cylinder, ccb-cortical collateral bundles, l-laticifers (x 200, orig.).

The pith is made by parenchymatous cells, with small intercellular spaces. In the old areas, in the central cylinder is formed the cambium, which generates secondary xylem and phloem.

Anatomy of the leaf

The petiole has, in the cross-section, a flat-convex, and its upper side is flat. It is protected on the outside by a one-layered epidermis, coverred with a cuticle. The first cell layers of the fundamental parenchyma are collenchymatous, and the remainder of the parenchyma is made up large cells with thin walls and small intercellular spaces. The vascular tissues are organized in collateral bundles

lying in the shape of an arch, and encompassed by a parenchyma made up of small parenchymatous cells (fig. 3). Towards the upper side of the petiole there are a few reduced bundles, which have a reverse orientation of the vascular tissues. In the inner part of the fundamental parenchyma, as well as inside the arch made by the vascular bundles, non-articulated laticifers can be observed.

The lamina of the leaf is delimited by upper and lower one-layer epidermis, the latter also exhibiting stomata. Macroscopically, on the surface of both epidermes can be observed the epicuticular wax in the shape of a very thin layer, which appears, when seen through the microscope, as spherical little grains (fig. 6). The wax that can be found on the surface of the cuticle drastically reduces permeability, limiting the material exchanges between the plant and its environment, and increasng its resistance to drought (Burzo et al., 2004). The mesophyll is differentiated into palisade parenchyma and spongy parenchyma; the leaf has a bifacial-heterofacial structure. The palisade parenchyma is localized under the upper epidermis; it is one-layered, being made of chloroplastic prosenchymatic cells (fig. 5). Under it there is a layer of collecting, isodiametric cells. The spongy parenchyma is multi-layered, made up of heteromorphous cells between which there are lacunae; the cells of the spongy parenchyma contain fewer chloroplasts. In the mesophyll are encompassed the veins: middle and lateral, and the non-articulated laticifers are localized mainly round the veins, very much as with other species of *Euphorbia* (Galeş & Toma, 2006). The middle vein, encased in a hyaline parenchyma, is made up of a large collateral bundle, which has the xylem strand towards the upper face, and the phloem strand towards the lower face, and a smaller collateral bundle situated above the large one, having a reverse orientation of the vascular tissues (fig. 4). Very much as in the petiole, in the stem the vascular tissues (the veins) are encased in a parenchyma made of small cells.

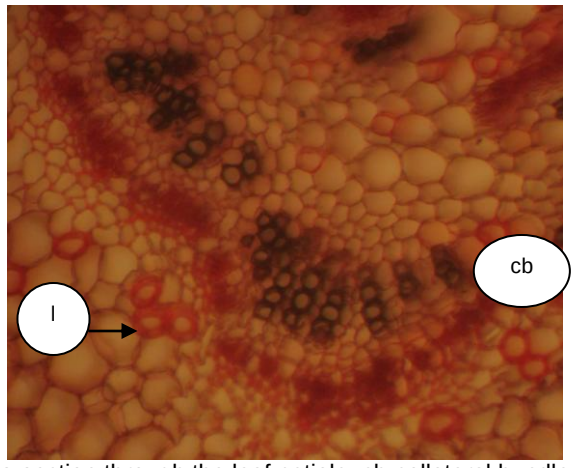

Fig. 3. Cross-section through the leaf petiole: cb-collateral bundles, l-laticifers (x 400, orig.).

Fig. 4. Cross-section through the leaf lamina – middle vein (x 200, orig.).

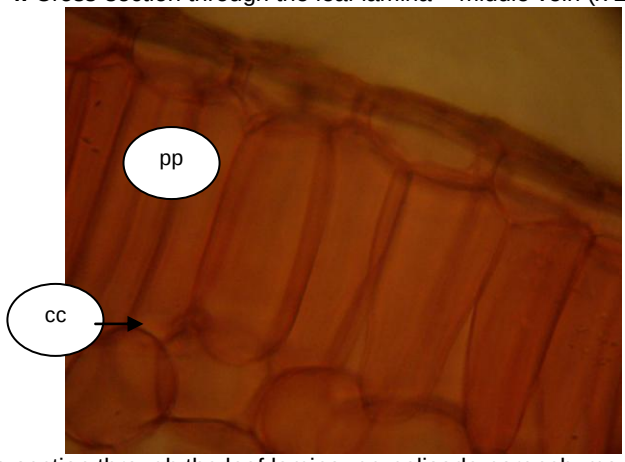

Fig. 5. Cross-section through the leaf lamina: pp-palisade parenchyma, cc-collecting cells (x 600, orig.).

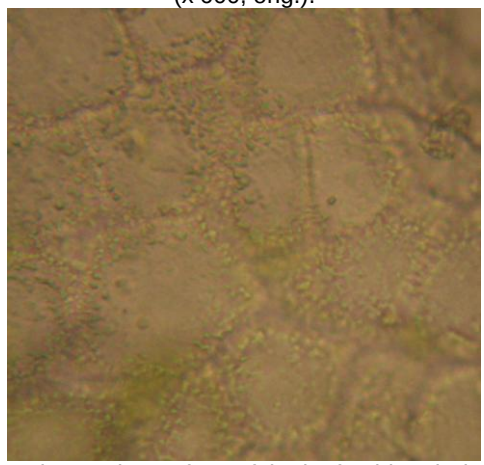

Fig. 6. Wax grains on the surface of the leaf epidermis (x 1600, orig.).

CONCLUSIONS

The anatomical peculiarities of the stem and leaf of the species *Euphorbia splendens* bear witness of its xerophytic origin. Thus, the fleshy stems of the plant have a well-developed cortex, whose outer area is photosynthetic, because in conditions of drought the leaves fall, and only a small number of leaves are maintained in the top of the stems. The middle area of the cortex is the best developed part, representing an aquiferous parenchyma, characteristic of xerophilous plants. In that area the presence can be noted of a number of cortical vascular bundles; these are considered to have had a special importance in the evolution of the well-developed cortex characteristic of cactaceae (in special in *Cactoideae*), plants of a similar xerophytic origin. The vascular tissues in the stem are reduced, and the mechanic ones are represented by the subepidermic collenchyma. The leaves are covered by epicuticulary wax in the form of little grains.

REFERENCES

1. **Bani S., Singh S., Singh G. B., Banerjee S. K., 1999** - *Antiinflammatory actions of Euphorbia splendens extract.* Phytotherapy Research 11(1): 76–78.
2. **Burzo I., Delian E., Dobrescu A., Voican V., Badulescu L., 2004** - *Fiziologia plantelor de cultură* (Vol. I) – *Procesele fiziologice din plantele de cultură*. Editura Ceres, Bucureşti.
3. **Cruz C.M., Kasper P., Cataldo A., Zamith H.P.S., Paumgartten F.J.R., 1996** - *Tumor promoter-like activity of the molluscicidal latex of Crown-of-Thorns (Euphorbia milii var. hilsopii) in the V79 metabolic cooperation assay*. Braz.J.Med.Biol.Res. 29(11): 1519-1523.
4. **Esau K., 1965 -** *Plant Anatomy (ed. 2)*. John Wiley and Sons, New York, London, Sydney, 318-337.
5. **Fahn A, 1982** - *Plant anatomy*, 3rd ed., Pergamon Press, Oxford.
6. **Galeş R.C., Toma C., 2006** - *Morfologia şi distribuţia laticiferelor în organele vegetative ale unor specii de Euphorbia din flora României*. 21-26 Lucrările Ştiinţifice USAMV Iaşi, Seria Horticultură, anul XLIX(49): 21-26.
7. **Mauseth J.D., 2006** - *Structure–Function Relationships in Highly Modified Shoots of Cactaceae*. Annals of Botany 98: 901–926.
8. **Metcalfe C.R., Chalk L., 1983** - *Wood structure and conclusion of general introduction*, 2. Clarendon Press, Oxford, 75-77.
9. **Şerbănescu-Jitariu G., Toma C., 1980** - *Morfologia şi anatomia plantelor*. Editura Didactică şi Pedagogică, Bucureşti.
10. **Toma C., Gostin I., 2000** - *Histologie vegetală*. Editura Junimea, Iaşi, 214.
11. **Vasconcellos M.C, Amorim A., 2003** - *Molluscicidal Action of the Latex of Euphorbia splendens var. hislopii N.E.B. ("Christ's Crown") (Euphorbiaceae) against Lymnaea columella (Say, 1817) (Pulmonata: Lymnaeidae), Intermediate Host of Fasciola hepatica Linnaeus, 1758 (Trematode: Fasciolidae).* 1-Test in Laboratory. Mem Inst Oswaldo Cruz, Rio de Janeiro, Vol. 98(4): 557-563.
12. **Zamith H.P.S., Paumgartten F.J.R., Speit G., 1996** - *Evaluation of the mutagenicity of the moluscicidal latex of Christ's Crown (Euphorbia milii var hislopii) in mammalian cells in vitro and in vivo*. Mutagenic Res 368: 15-20**.**