# ANATOMICAL ASPECTS OF *BEGONIAHYDROCOTYLIFOLIA*OTTO EX HOOK. (BEGONIACEAE) LEAF

***RODICA BERCU***
*Faculty of Natural and Agricultural Sciences,"Ovidius" University, Constantza*
*University Alley, No. 1, B, 900470, Constantza*
E-mail: *prof.rodicabercu@gmail.com*

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## *ABSTRACT*

*The paper presents anatomical aspects concerning the leaf structure of Begonia hydrocotylifolia Otto ex Hook. belonging to Begoniaceae family. Anatomically, the petiole has a unistratous epidermis and a differentiated mesophyll. The vascular system is fascicular type with a large number of collateral bundles placed into a basic tissue. The blade consits of an upper epidermis with a many-layerd hypodermis, a lower epidermis and the mesophyll. The mesophyll is differentiated into palisade and spongy tissue with the same vascular bundle structure such as those of the petiole but with foliar arrangement of the conductive tissues. Stomata are present to the lower epidermis. Remarkable are the cytological elements represented by prismatic oxalate crystals, druses, crystalline sand and tannin cells. The mechanical tissue is represented by collencyma cellls, presented in the petiole and blade structure.*

## INTRODUCTION

The family Begoniaceae consists of two genera: *Begonia* Linnaeus, with approximately 1.500 species and pantropical distribution (spread in Central and Southern America, Asia, Africa, the Pacific Isles) and the monospecific *Hillebrandia* Oliver, from the Hawaiian Islands (Jacques and Mamede, 2005). Begoniaceaefamily comprises perennial herbaceous plants, suffrutescent or frutescent plants, alternateleafed plants, sometimes asymmetrical, stipellated, whole or with a lobed side, lobed or divided, variously colored (Cruceru, 2011). The family is characterized by threewinged capsular fruits, bifid styluli and peculiar seed micromorphology (Forrest et al., 2005).

Most Begoniaceae are monoecious perennials with very few dioecious exceptions. Begonias are widely spread in the rainforest in the humid mountain areas, inside the woods, on the edge of water courses, on rock walls, where water drops. They most likely originated in the mid-Eocene to late Oligocene and reached their current distribution by multiple intercontinental dispersal events (Goodall-Copestake et al., 2009). Over 10000 begonias hybrids and cultivars have been introduced by commercial growers. Many begonias are popular ornamentals (Awal et al, 2008).

The large size of the genus *Begonia* and its variation makes it ideal for studies of speciation (Ali, 2013). At the mega-diverse genus level *Begonia* is divided into 66 sections. *Begonia* is now considered to be one of the five largest genera of vascular plants (Hoover et al, 2004). These plants display a big variety of shapes, colours, patterns and textures in their leaves rarely seen in other groups of plants. Sheue et al. (2012) concluded that the variegation is structural, like the intracellular space, where the light areas were created by internal reflection between the intercellular spaces. The intracellular space may occur below the superior epidermis or below the tissue that store water, both forms may have a common origin, where the dermal tissues it is loosely connected to mesophyll. Some investigation evaluates the antimicrobial and in vitro antioxidant potential of extracts of *Begonia* (Indrakumar et al., 2014), histoanatomical and physiological aspects (Lee, 1974;

Stratu et al, 2011), chromosome cytology (Zeilinga, 1962; Peng et al, 2014), phylogenetic relationships (Tebbitt et al., 2006), somatic embryogenesis and plant regeneration (Rosilah et al, 2014), the effect of potassium silicate on the growth and leaf epidermal characteristics (Lim et al., 2012).
Many species are observed to have a hypoderm and abnormal stomatal patterning ("stomatal cluster") (Dehnel, 1961; Tang et al., 2002). Medullary and cortical vascular bundles in the petiole and stem represent an anatomical pattern more like monocotyledons than dicots. The stem has superficial cork-cambium. Correlations between leaf shape and the numbers and size of trichomes were examined (Mclellan, 2005). Physiologically, *Begonia* is distinct for the presence of oxalic acid in cytoliths, another characteristic limited in the angiosperms (Pireyre, 1961). Calcium oxalate crystals are most widespread storage material in plant (druses and prismatic types) (Ianovici, 2010: Niculescu, 2009). *Begonia* species are examples of plants with paedomorphic secondary xylem containing thin walled, wide libriform fibers (Dulin, 2008).
*Begoniahydrocotylifolia* Otto ex Hook. is originating from Mexico where it can be found spontaneously in nature. In our country is known as a decorative species especially by it leaves. It is a plant both inside and outside, being used in decorating gardens. If is cultivated as ornamental plant in pots, the plant prefers an indirect action of the sun's rays and a constant humidity as Cruceru (2011) reported for *Begonia* species. This species blade has a slightly asymmetrical shape, with cordate base and full red hair to the margins. The blade is discolored, the upper face is dark green, very glossy and glabrous, with slightly wrinkled and discolored ribs (Fig, 2, A, B). The lower face is reddish brick, with red hairs. The consistency of the blade is fleshy. The cylindrical petiole is long, fleshy and yellowish (Fig. 1, A). It possess all over the surface fine red hairs. The hairs of this species are different by the numerous brownish hairs at the junction of the petiole with the blade described for other species of *Begonia* by Foster (1958). The flowers are mostly pink, arranged in 4-5 in dichasium inflorescence (Fig. 1, B).


A B

***Fig. 1. Begonia hydrocotylifolia Otto ex Hook.: leaves (A) and inflorescence (B) (A-Web 1; B-Web 2).***

The aim of this paper is to analyze the some amatomical aspects of the petiole and blade of *Begonia hydrocotylifolia.* In literature are few data about this plant leaf anatomy and in our country almost lack. This is the way we believe that the present paper brings added knowledge about this group of plants (genus *Begonia*) in general and in particular for *Begoniahydrocotylifolia*.


***Fig. 2. Frunză de Begonia hydrocotylifolia Otto ex Hook. (original).***

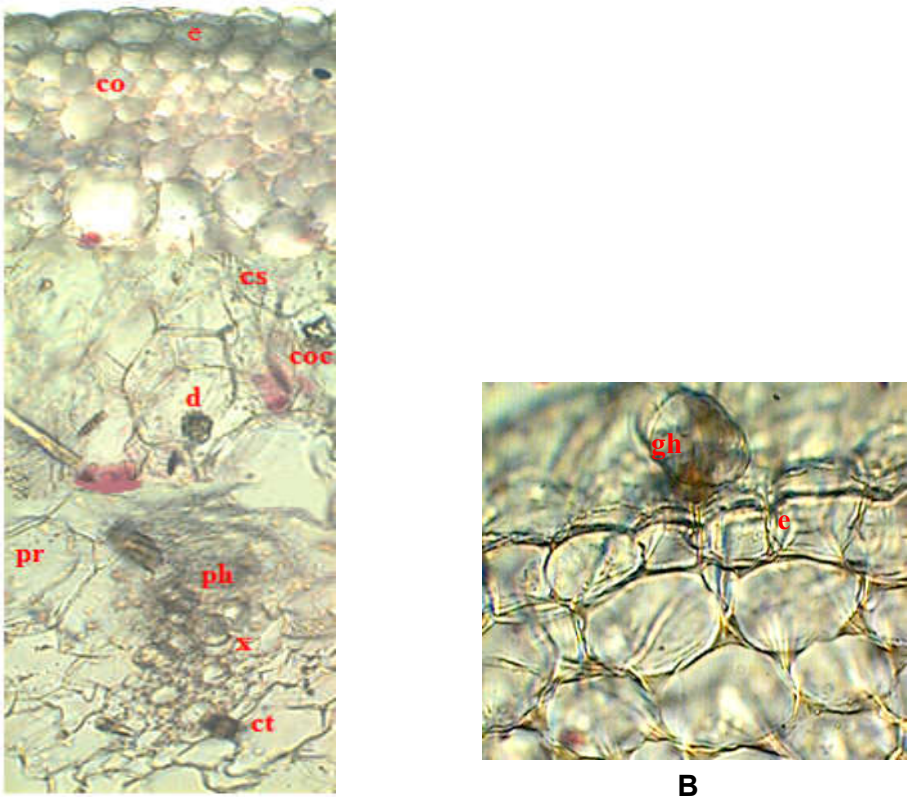
## MATERIAL AND METHODS

The plant mature leaves of *Begonia hydrocotylifolia* were collectd from S.C. Iris International S.R.L in august, 2016. Small pieces of leaves (petiole and blade) were fixed in FAA (formalin: glacial acetic acid: alcohol 5:5:90). Cross sections of the leaf were performed by free hand made technique (Bercu and Jianu, 2003). The samples were stained with alum-carmine 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 DISCUSSIONS

The petiole, in cross section, is circular in shape. The outer epidermis has a single layer of cells covered by a thick cuticle. Its continuity is interrupted by the presence of glandular hairs and stomata.The glandular hairs of the petiole are two-celled, formed by a short basal cell and a capitate glandular cell (Fig. 3, B). It is followed by the cortex, differentiated into an external region and an inner region. The external area is represented by an angular collenchyma tissue (5 layers of cells) and an internal one, represented by a number of parenchyma layers of cells. The vascular system is fascicular, represented by numerous closed collateral vascular bundles (25), with culinary arrangement, placed on two circles, with poor developed xylem and phloem vascular elements, separate by medullary rays (Fig. 3, A). Such as other *Begonia* species leaves (Bercu, 2005;Li Jing Xiu,2007), the petiole vascular system is embadded into a basic tissue of parenchyma nature with rare tannin cells, calcium oxalate crystals (isolated prismatic crystals, crystalline sand and druses) are present (Fig. 3, A).

Cross section of the blade shows the usual tissue sequence: upper epidermis, lower epidermis, and mesophyll. The upper epidermis consists of a layer of isodiametric cells tightly joined together, covered with a thick cuticle, supplemented with vegetable wax (Fig. 3, 4). Below the epidermis is a many-layered hypodermis (Fig. 4; 5). The mesophyll consists of palisade and a spongy tissue. The palisade tissue is poor developed, consisting of 2-3 layers of rounded assimilation cells, containing numerous chloroplasts. Small rare tannin cells and crystalline sand are present as well (Fig. 4; 5).The lacunar tissue consists of a 5-6 layer of large cells, with small intercellular spaces between them, and they are rounded in front of the mid rib. It is remarkable the presence of rare crystals isolated calcium oxalate (druse) (Fig. 6).




A B

**Fig. 3. Portion of a cross section of the petiole with a epidermis, cortex and a vascular bundle (A, x 156). Epidermis with glandular hair and stomata (B, x 230): co – collenchyma, coc- calcium oxalate crystal, cs- crystalline sand, ct- tannin cell, e- epidermis, d- druse, gh- glandular hair, ph- phloem, x- xylem.**

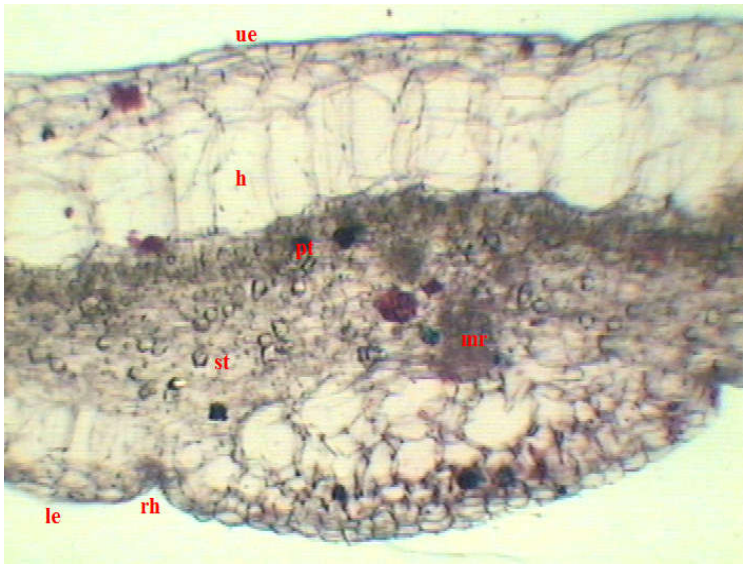



**Fig. 4. Cross section of the blade – ensamble (x 80): h- hypodermis, le- lower epidermis, mr- mid rib, rh- root hair, pt- pallisade tissue, sp- pongy tissue, ue- upper epidermis.**

The vascular bundle of the mid rib is poorly developed, consisting of few elements of xylem, to the upper epidermis and some phloem vessels to the lower epidermis. In front of the primary mid rib, beneath the lower epidermis, there are two cell layers with slightly collenchyma cells (Fig. 5, 6).

The lower one-layered epidermis, with cells smaller cells than those of the upper epidermis, including bi-cellular glandular hairs the same with those of the petiole. To their place of formation, the lower epidermis forms an obvious recess (Fig. 6).

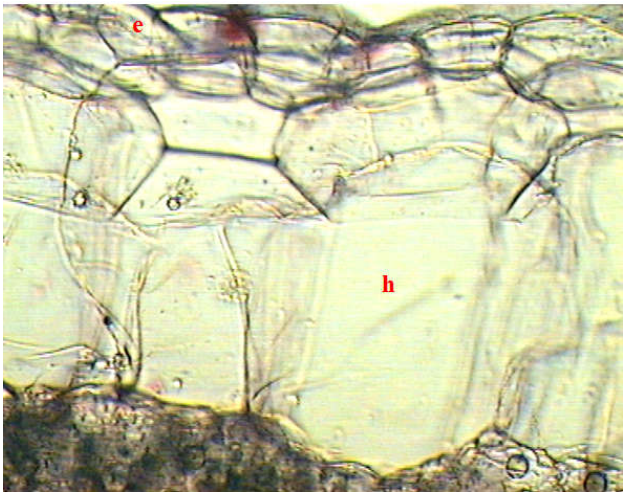



**Fig. 5. Cross section of the blade with epidermis and hypodermis –detail (x 235): e- epidermis, h- hypodremis.**

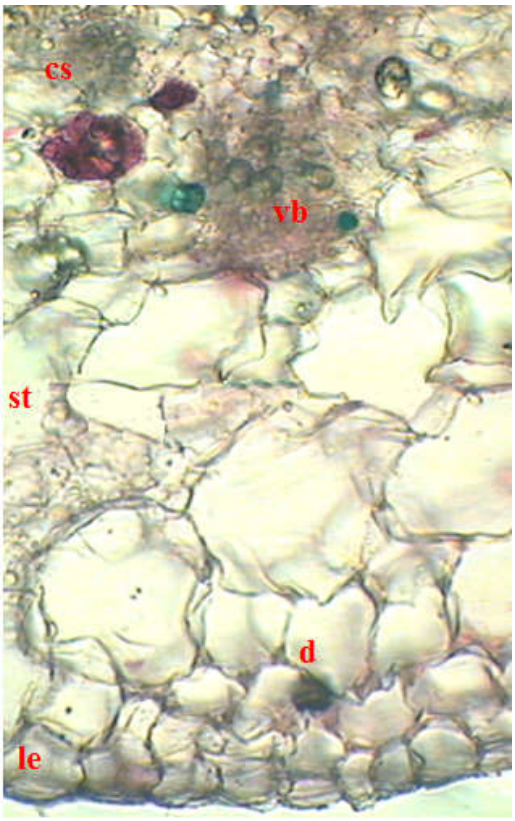



**Fig. 6. Cross section of the blade (x 235): cs- crystalline sand, d-druse, le- lowe epidermis, st- spongy tissue, vb- vascular bundle.**

## CONCLUSION

The petiole has a single layered epidermis and a differentiated cortex (collenchyma and parenchyma of the outer respectively inner cortex). The vascular system is of fascicular type, composed by a large number of collateral vascular bundles. The lamina has a unistratous upper and lower epidermis and a many-layered hypodermis. Remarkable is the presence of tanin cells, prismatic oxalate crystals and crystalline sand in the petiole and blade structure.

The mesophyll is heterogenous and hipostomatic. The vascular system is represented by a number of vascular bundles withthe ussualyfoliar arrangement of the conductive tissues. The strength of the petiole and blade is, due to the collenchyma tissue, placed bellow the lower petiole epidermis.

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