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Effects of different light conditions on leaf anatomy of *Ruellia furcata* (Ness) Lindau (Acanthaceae)

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Workshop Information

I Workshop of Plant Biology (I Workshop de Biologia Vegetal) was held in the Bioscience Institute – UNESP, campus of Rio Claro, Brazil, during August 20 and 21, 2012. Workshop was a scientific event organized by Post-graduate students from that Institute aiming to integrate Post-graduate and Graduate students from different areas related to Plant Biology (Anatomy, Ecology, Evolution, Morphology, Physiology, and transitional areas) from different Universities. Workshop Organization offered a large number of speaking activities, scientific discussions, and extra short-courses to improve the knowledge and formation of students in Plant Biology.

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INTRODUCTION

Among Acanthaceae's genera, *Ruellia* is one of the major of the family and its species occupy a wide variety of habitats (Wasshausen and Wood 2004). The studied species, *Ruellia furcata*, (Nees) Lindau is an herb, occurring at the sand of Restinga, usually found at shade environments as thicket areas, it has hairy stem and leaves, white corolla, and fruit with four retinacula (Monteiro and Aoyama 2012).

The external environmental factors have great influence at plants growth and development, such as edaphic conditions, water availability, temperature and light (Larcher 2000). The light factor acts at the plant development, qualitatively and quantitatively (Lima Jr. et al. 2006) and different light intensity may influence in significant changes at anatomical features (Castro et al. 2007). All these adaptations can allow the occupation in environments with heterogeneous light conditions (Boeger et al. 2009).

For this, this work proposed to acquire information about the interactions between leaf anatomy and light conditions and understand adaptive plasticity of *Ruellia furcata* at different light condition environment.

MATERIAL AND METHODS

Individuals of *Ruellia furcata* were collected at restinga of Liberdade (18°44'10.52"S and 39°48'37.72"W), São Mateus, ES. The collected individuals were transplant at plastic pots with soil from the restinga.

The experiment was carried out in two steps, the first one known as initial time, was the acclimation period, where the plants remained in a shady site by 78 days. In the second step, the plants were subjected to three treatments with different light conditions: 15 individuals exposed to high light level, 15 individuals exposed to 70% of light and 15 individuals exposed to 50% of light, for a period of 129 days and weekly irrigation.

Leaves between 3rd and 4th nodes were used and fixed in FAA (etanol 70ºGL, formaldehyde and acetic acid 18:1:1 v/v) (Johansen 1940) and preserved in alcohol 70°GL. Samples of petiole, the median leaf, midrib and edge of the leaf were used to obtain the anatomic sections, made freehand. Sections were stained with safranin and Astra Blue (1% aqueous solution) (Kraus and Arduin 1997) and mounted in 50% glycerin. For studies of surface and venation it was

used the diaphanization method (Arnott 1959). The slides were analyzed on digital images obtained by light microscopy coupled with digital camera. The description of the trichome was based on Ahmad (1978) of stomata in Inamdar et al. (1983) and of cystoliths in Patil and Patil (2011).

RESULTS AND DISCUSSION

In transverse section, adaxial epidermis of the initial time and all treatments were unistratified with quadrangular cells, being abaxial side cells smaller, and presence of smooth cuticle (Figure 1 A, B, C, D. The stomata occur on the abaxial epidermis and are the type diacytic (Figure 1 E). This pattern is found in many species of Acanthaceae, as well as most of the dicots (Smith and McClean 1989).

In frontal view, the epidermal cells of adaxial surface of the initial time and 50% light have more sinuous cell walls when compared with those exposed to full sunlight and 70% light (Figure 1 F, G, H, I). Other authors have reported this fact, where species that have evolved in environments with high light intensity had thicker walls, less or no sinuosity (Nascimento-Silva and Paiva 2007; Castro et al. 2007).

The cystoliths are present in the entire leaf of initial time and treatments, being observed in greater quantity in the epidermis of the adaxial surface, are

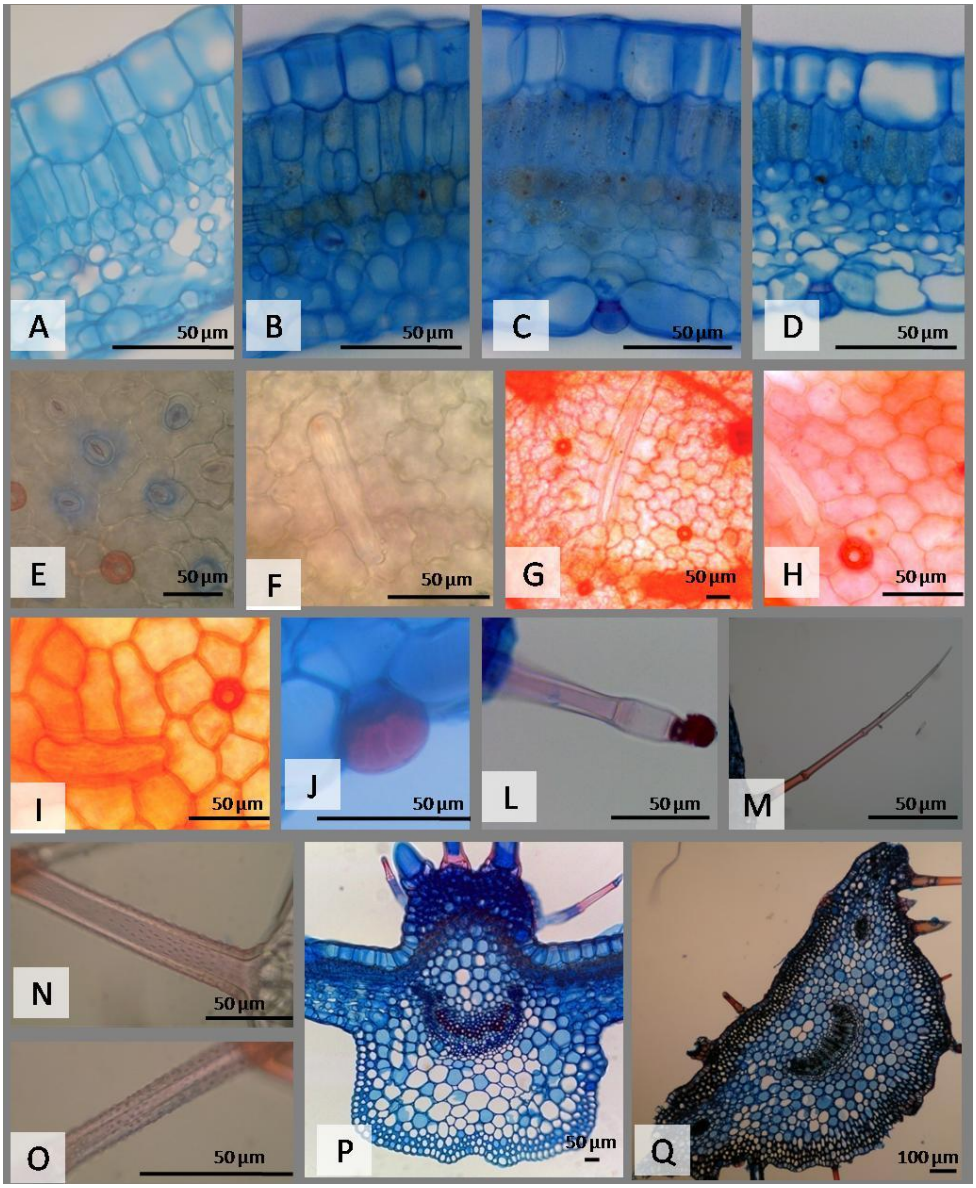

Figure 1. Transverse sections and front view of the adaxial and abaxial leaf of *Ruellia furcata* (Nees) Lindau. A. General appearance of plant mesophyll initial time. B. General appearance of the mesophyll of plants in full sun. C. General appearance of the mesophyll of plants at 70% light. D. General appearance of plant mesophyll at 50% light. E. Abaxial epidermis with details of diacytic stomata of initial time in plants. F. Details of the sinuosity of the epidermal cells of plants from the initial time. G. Details of the sinuosity of the epidermal cells of plants from 50% light. H. Details of the sinuosity of the epidermal cells of plants from 70% brightness. I. Details of the sinuosity of the epidermal cells of plants from full sun. J. Sessile glandular trichomes in plant from initial time. L. Detail of pedicellate glandular trichomes from 70% light. M. Details for tector trichomes on midrib plants from initial time. N / O. Details for cell wall ornamented tector trichomes of plants from the initial time. P. Plants of the midrib from 50% light. Q. Petiole from initial time.

cylindrical, elongated, with one end tapered more than the other (Figure 1 F, G, H, I). Cystoliths structures are restricted to a few families such as Moraceae, Urticaceae and Acanthaceae (Metcalfe and Chalk 1983), being one of the main features of Acanthaceae, being present in almost all species and can vary in type, size and frequency (Inamdar et al. 1990).

For the initial time and for all treatments were observed sessile and pedicellate glandular trichomes (Figure 1 J, L) as well as multicellular tector trichomes (Figure 1 M, N, O). According to Ahmad (1978) non-glandular trichomes are widely varied and play an important role in the identification of several species of Acanthaceae.

Mesophyll of the initial time and treatments is characterized as heterogeneous dorsiventral (Figure 1 A, B, C, D). In the midrib of the initial time and treatments can be observed angular collenchyma below the epidermal cells on both sides, the vascular bundles is collateral, and two lower cylindrical vascular bundle in a lateral position (Figure 1 P).

In transverse section, the petiole of the initial time and the treatments has rounded shape on the abaxial surface, with two lateral projections and the flat adaxial surface. The epidermis is uniseriate and internally to the same track is a continuous angular collenchyma. The vascular system is represented by a central beam side arc-shaped and collateral vascular bundles smaller diameter at the ends (Figure 1 Q). The petiole vascular bundles arc-shaped features are common in many species of the family (Metcalfe and Chalk 1983).

CONCLUSION

Anatomically, it can be seen mechanisms that can assist in the establishment and survival of the species in relation to different lighting conditions in the environment, as the presence of the cuticle, the lower sinuosity of the cell wall of epidermal cells, hypostomatic leaves, among others. According to data obtained, it can be seen *Ruellia furcata* is a species with a wide adaptive plasticity, which is essential in the environment of restinga, with great environmental variation and a high incidence of light, which may hinder the establishment, growth and survival.

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