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Morphoanatomical Variations of Specimens *Ocimum basilicum* Linnaeus

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Abstract

Specimens of Ocimum basilicum L. from the medicinal garden of the Universidade Federal Rural da Amazônia - Campus Belém, show variations in the pigmentation of their flowers, with some specimens presenting a white color, while others present a purple color. The white-flowered O. basilicum was named WFO, while the purple-flowered O. basilicum was named PFO. The objective of this work was to evaluate the morphoanatomical variations among these specimens and to characterize them in these aspects. From fertile material with the same level of development, morphological records were made with drawings, following the usual techniques in the composition of plates for taxonomic purposes. Photonic microscopy was obtained from histological slides of the vegetative organs following the usual techniques of plant anatomy. The flowers of this species are bilabial, which is the identifying characteristic of the Lamiaceae family, with five petals and sepals, but one of the sepals is different from the others with an obicular shape, due to these characteristics of the protection whorl its symmetry is zygomorphic. It was observed that the secretory structures of PFO on the abaxial surface of the leaf in natura reveal conspicuous differences, which has smaller and more numerous secretory cavities, while WFO has larger and more sparse secretory cavities. Both present aromas when macerated, but WFO presented a more lasting aroma. Thus, the morphoanatomical variations are perceptible, but they are not diagnostic enough to state that they are different species, but there are still strong indications that they constitute different histochemistry.

Keywords: Plant morphology. Plant anatomy. Secretory structure.

1. INTRODUCTION

The anatomical study of plants is intrinsically linked to plant morphology. Where according to Aguiar *et al* (2007) anatomy is based on studying plant cells, tissues and organs, while morphology is based on visual characters, such as the arrangement of leaves at the stem node. Botany has the function of studying both the morphology and anatomy of the plant, being of extreme relevance because it is able to help in the identification of plants in their respective families.

For this, the role of planning a living being is of great importance, because even with the loss of material reality that occurs with this projection, there is a representation that can be kept as a conceptual entity. Furthermore, even with a lot of effort, it is impossible to project all the characters of a flower, but it can be shown as the main characteristic, highlighting it in the morphological board (SILVA *et al*, 2007).

The species *Ocimum basilicum* belongs to the family Lamiaceae, of the order Lamiales, of the sub-clade of the Lamiids, clade of the Asterids and of the super-clade of the Superasterids, of the group of the Eudicots, of the great group of the Angiosperms that belongs to Kingdom Plantae, as predicted in the Angiosperm Phylogeny Group (APG) IV (BYNG, 2016).

According to studies by Reis *et al* (2006), *O. basilicum* has economic importance in Brazil for its oil, mainly, widely used in cooking and cosmetics due to its pleasant aroma, through the extraction of its essential oil, besides, it can also be used medicinally to treat coughs and stomach problems, as it has long been used in medicine by the empirical and scientific communities.

Specimens of *Ocimum basilicum* from the medicinal garden of the Federal Rural University of the Amazon - Campus Belém, presented pigmentation with colors that varied between green and purple in their flowers. Thus, the present study aims to differentiate and characterize the morphoanatomical variations in different specimens of *O. basilicum*, analyzing the external morphology of the vegetative and reproductive parts, and the anatomy of the vegetative part.

2. MATERIALS AND METHODS

Specimens of *O. basilicum* with green and purple leaf coloration were collected from the medicinal plant garden of the Universidade Federal Rural da Amazônia - Campus Belém (figure 1), for anatomical studies of the vegetative organs of the plant (stem and leaf) and morphological studies of the organs reproductive and vegetative.

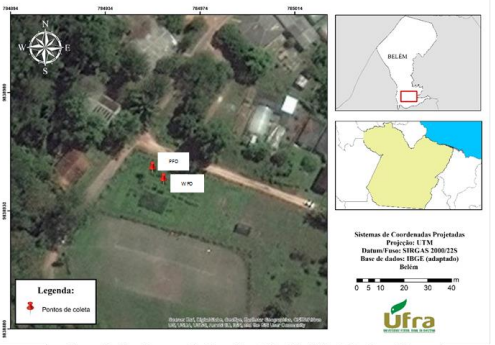

Figure 1 - Specimen collection site at the Medicinal Garden of the Universidade Federal Rural da Amazônia.

For standardization and facilitation of understanding in the present study, the studied specimens were treated in the text with the following abbreviations: White-flowered *O. basilicum* = WFO; Purple-flowered *O. basilicum* = PFO.

The botanical illustrations were made with the aim of visualizing the morphological aspects of the stem, leaves and flowers of the collected specimens, to represent details in their structures that may indicate the morphological limit between individuals. For this, the general reference photographs of the plant were obtained with the Nikon camera still at the collection site, the analyses directed to the stem, leaf and flower structures were carried out with the aid of the stereomicroscope at different focuses. The drawings were executed using two methods: ink pen on plain paper and digital drawing. For nankin drawings, a 0.05 nankin pen and 180 g/m² c'à grain paper were needed; the digital drawings were made using the Autodesk Sketchbook program, version 2011.

For leaf visualization, leaves were collected from the 5th node, sectioned in the central region for studies of the mesophyll and freehand cut of the adaxial and abaxial faces. For the stem, segments of the 5th internode of plants in the reproductive stage were selected. The semi-permanent slides were prepared with cross-sectional histological sections, made with the aid of steel blades, sectioned freehand in the different organs (stem and leaf), according to the usual methods of plant anatomy. Bleaching was performed with 30% aqueous sodium hypochlorite and washed in distilled water. The material was first stained with astra blue and then with safranin. Mounting was performed with 30% aqueous glycerin for better preservation of the botanical material fixed between the slide and the coverslip.

3. RESULTS AND DISCUSSION

In general, in the morphological character, the specimens of *Ocimum basilicum* did not show morphological difference. Both had leaves with phyllotaxy are opposite crossed with stem formation at nodes (Figure 2-G) with superior and tetralocular ovary. The flowers of this species are bilabial (figure 2B and 2F), which is the identifying characteristic of the family Lamiaceae according to Basílio *et al* (2006), with five petals and sepals (figure 2C), but one of the sepals is different from the others with the shape of a obicular, due to these characteristics of the protective whorl its symmetry is zygomorphic. The seams of the petals are classified as metachlamydial (gamopetalous) with the inflorescence in racimosis. The reproduction whorls showed no morphological difference, both have a superior ovary (gynoecium) with a bifid and terminal style, while the stamens (androecium) are oligostemonous and didynamosic, with the inferior ones being differentiated.

The secretory structures of PFO on the abaxial surface of the leaf in natura reveal conspicuous differences, which has smaller and more numerous secretory cavities, while WFO has larger and more sparse secretory cavities, as seen in figures 3A and 3B. Both present aromas when macerated, but WFO presented a more lasting aroma, and essential oils can occur in these secretory structures located below the leaves (OLIVEIRA *et al*, 2018; OLIVEIRA *et al*, 2022).

In Figure 3C, it is possible to observe the stem anatomy, which presented 4 poles of the sap conduction system located at the vertices of the stem angles, the cortical region is divided into 2 areas, composed of collenchyma (predominantly lacunar) and fundamental parenchyma, with the collenchyma corresponds to 4 layers of cortical

parenchyma cells. The other layers are filled by the fundamental parenchyma, constituted by cells larger in their transverse diameter.

Figure 2 - Morphological board made from nankin of *Ocimum basilicum* PFO (on the left): A – Floral branch; B – Side view; C – Aerial view; D – Longitudinal view;

Morphological board made by digital drawing of *O. basilicum* WFO (right): A – Floral branch; B –

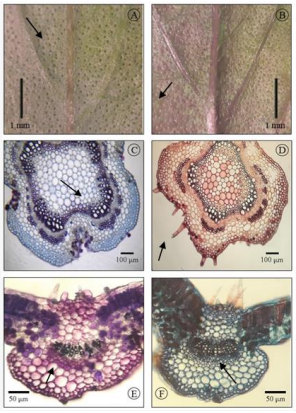

Figure 3 - Anatomical plate of *Ocimum basilicum*: A – WFO abaxial surface; B – PFO abaxial surface; C – WFO stem; D – PFO stem; E – Mesophyll WFO; F – Mesophyll PFO.

In figure 3D, although the stem is primary, the formation of the continuous vascular cambium can already be seen. According to Rocha *et al* (2015), it was possible to observe that below the epidermis of *O. basilicum* there are 2 to 3 layers of annular collenchyma, and in the cortical region the fundamental parenchyma presents approximately isodiametric cells with few intercellular spaces, the vascular system is similar to an open arc with the xylem positioned centrally and phloem cords are external to the xylem. Analyzing figure 3E, the leaf anatomy of the mesophyll was observed, where it was verified that in the central adaxial part there are the presence of tector trichomes and angular collenchyma in the innermost portion of the sample, this collenchyma having 4 layers of cells.

In Figure 3F, tector trichomes were found in the abaxial layers, and secretory trichomes adjacent to the lateral cells. This result can be compared to the study by Rocha *et al* (2015), where the mesophyll presented unistratified epidermis with sinuous

walls, just below a layer of chlorophyllous palisade parenchyma, with 3 to 4 layers of spongy parenchyma.

4. CONCLUSION

Characterization at the morphological and anatomical level ratifies other publications within the genus Ocimum, with many similarities between both. The anatomical variations are perceptible, but they are not diagnostic enough to state that they are different species, but there are still strong indications that they constitute different histochemistry.

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