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Histological Study of the Leaf, Bark and Fruit of *Vismia cayennensis*

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Abstract: This research presents morphological features of leaf, bark and fruit of *Vismia cayennensis* (Jacq.) Pers. and shows the presence of structures that accumulate phenolics, main isolated chemical compounds of this genus. *Vismia* belongs to the Clusiaceae family, which, notwithstanding its large folk medicinal use in the Amazon region, has a few records about histological studies on this genus.

Key words: Clusiaceae, *Vismia cayennensis*, anatomy, phenolics

INTRODUCTION

The botanic family Clusiaceae occurs mainly in tropical regions and comprises 26 genera and 400 species (Ribeiro *et al.*, 1999). The family occurs such as trees or shrubs (some epiphytic), lianas, perennial or annual herbs, nearly always evergreen, usually with white, yellow, or other brightly colored latex. Leaves opposite, whorled or alternate, simple, entire; stipules absent, but small gland-like structures sometimes present at base of petiole. The inflorescences are terminal or axillary, cymose or flowers solitary. Flowers bisexual or unisexual (plants either hermaphroditic, dioecious, or polygamous), actinomorphic, most often white, yellow, or pink; bracteoles nearly always present. Stamens usually numerous, often grouped in 2-5 bundles opposite the petals, some stamens or fascicles often replaced by staminodia, or stamens free and numerous (sometimes reduced to 3 or 5). Ovary compound, superior, of united carpels; locules as many as carpels or ovary unilocular; placentation axile, less often parietal, basal, or apical; styles 1 or as many as the carpels; stigmas expanded, smooth and sticky (rarely hairy), or punctate and papillate,

or minutely porate. The fruit is usually a capsule, sometimes a berry or drupe; seeds arillate or not (Kearns *et al.*, 1998; Ribeiro *et al.*, 1999). The genus *Vismia* is used in popular medicine to treat many skin diseases, such as dermatitis, leprosy, syphilis, herpes, scabies, eczemas and wounds (Kuetze *et al.*, 2004; Lopez *et al.*, 2001; Mbwambo *et al.*, 2007; Nguemeving *et al.*, 2006). Cytotoxic, antifeedant (Mélan *et al.*, 2006; Seo *et al.*, 2000; Suffredini *et al.*, 2006), antiprotozoal (Estevez *et al.*, 2007; Francois *et al.*, 1999; Mbwambo *et al.*, 2004; Mélan *et al.*, 2006; Nougoué *et al.*, 2007), anticancer activity (Hussein *et al.*, 2003; Suffredini *et al.*, 2007), HIV-inhibitory (Fuller *et al.*, 1999) and antimicrobial activities (Kuetze *et al.*, 2007; Nguemeving *et al.*, 2006; Salas *et al.*, 2007; Tala *et al.*, 2007) were attributed to isolated substances of the *Vismia* species. This genus consists of small trees inhabiting the tropical and subtropical regions of South and Central America (Nagem and Oliveira, 1997). *Vismia cayennensis* (Jacq.) Pers. belongs to the Clusiaceae family, subfamily Hypericoideae, tribe Vismieae. This species popularly known as *lacre*, *lacre blanco*, *palo de gallineta*, *árvore-da-febre*, *goma-lacre*, *pau-de-lacre* and *pichirina* is a

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shrub or tree 2-15(-25) m tall; branches soon glabrous; petiole 4-10 mm long; blade 5-11.5 cm long, broadly to narrowly elliptic or oblong-elliptic to lanceolate or ovate or oblanceolate; petals 8-9 mm long and fruits 10-15 mm long. This species is found in the forest edges, savannas, semideciduous and evergreen lowland to lower montane forests in the Amazon region (Bittrich, 2007). The present research describes the histological study of the leaf, bark and fruit of *Vismia cayennensis* collected in the Ducke Natural Reserve (Manaus-Amazon).

MATERIALS AND METHODS

The leaf, bark and fruit of *Vismia cayennensis* were collected in the Ducke Natural Reserve in Manaus, Brazil. The voucher was deposited in the INPA Herbarium under number 218448. All botanic material was fixed in ethanol: water: glycerol (5:5:1) and stored in the laboratory of the UFAM, 2007, where the studies were conducted. Sections were cut on a Ranvier microtome and stained with Alcian/Safranin or Astrablue/Fucine. The cuts were clarified by spraying with aqueous 1% hypochlorite solution and mounted in glycerol (Kraus and Arduin, 1997). The stained sections were analyzed by two optic microscopes connected to a system of microphotography at 150 and 300X magnifications: an Olympus BX-40 Photomicroscope coupled to a PM -20 exposure control unity and a Carl Zeiss Axioskop Model with MC-80 camera.

RESULTS AND DISCUSSION

The leaf is anphistomatic with paracitic stomata, a family characteristic mentioned by Metcalfe and Chalk (1950). The epidermic tissue has polygonal contour cells with straight walls and shows numerous trichomes bases. The epidermis of the leaf lamina is unistratified on the adaxial and abaxial surfaces with thick cuticle, showing simple, unicellular (Fig. 1a), bicellular (Fig. 1b) or stellate tector trichomes (Fig. 1c) and rarely glandular trichomes while the sub-epidermis region is mainly composed of two cellular layers with thick walls. Although not common in the Clusiaceae family (Cronquist, 1981; Metcalfe and Chalk, 1950), trichomes presence was already described in other *Vismia* species (Almeida-Cortez and Melo-De-Pinna, 2006), according to observations made from this research. The dorsiventral mesophyll is composed of one layer of palisade cell and compact spongy parenchyma (Fig. 1d). The mesophyll contains calcium oxalate druses and a sclerenchymate sheath surrounds the vascular bundles. *V. cayennensis* dorsiventral profile is in accordance with the one found in the family (Metcalfe and Chalk, 1950),

also considering the description made for the pattern found in the vascular bundles (Fig. 1e).

The transversal section of the midvein, plan on the upper side and convex on the lower side, shows unistratified epidermis, on both sides, with angular collenchyma composed of even four layers of cells. The fundamental parenchyma shows numerous druses and some prismatic crystals of calcium oxalate (Fig. 1e and f) and phenolic cavities (Fig. 1g). The collateral vascular bundles are surrounded by a fibrous pericycle. The presence of calcium oxalate crystals was described by Metcalfe and Chalk (1950) and Cronquist (1981) for the family as well as the phenolic idioblasts, which are likely to be associated to the protection of the plant against herbivore and pathogenic microorganisms attack (Bonello *et al.*, 2006).

The bark has a suber with tabular cells and well-developed cortical parenchyma containing phenolic and calcium oxalate prismatic crystals idioblasts. The parenchymatic rays, with one to three layered cells, are arranged in all bark thickness reaching the phloem region without widening. The region of the phloem contains parenchyma, sieve tube elements and companion cells (Fig. 2a and b).

The fruits of *Vismia cayennensis* are constituted by a brownish berry with succulent and reddish pulp that, when compressed, presents an orange-yellow latex. The pericarp in transversal section shows glabrous epicarp with roundish cells. The parenchymatous mesocarp shows cells tangentially elongate, with thick walls, constituting together with the epicarp the rind of the mature fruit, as described by Mourão and Beltrati (2001) for the fruit of *V. guianensis*. In the innermost, the cells are roundish, with thick walls. The mesocarp is composed of starch, a number of secretory ducts and vascular bundles. The endocarp is morphologically similar to the previously described tissue, presenting, however, cells of smaller dimensions (Fig. 3).

This is the first report on the anatomic study of the leaves, barks and fruits of *V. cayennensis* used in popular medicine of the Amazon region. Based on the little existing information, the histological characteristics of this species show similarities with the ones already described for the leaf and fruit of *V. guianensis* (Almeida-Cortez and Melo-de-Pinna, 2006; Mourão and Beltrati, 2001). In this study, calcium oxalate crystals were found only in the leaves and bark. A larger quantity of phenolic cavities were found in the barks and fruits of *V. cayennensis* when compared to the leaves, which corroborates with the isolated phenolic compounds of this genus (Bilia *et al.*, 2000; Dos Santos *et al.*, 2000; Fuller *et al.*, 1999; Nguemeving *et al.*, 2006).

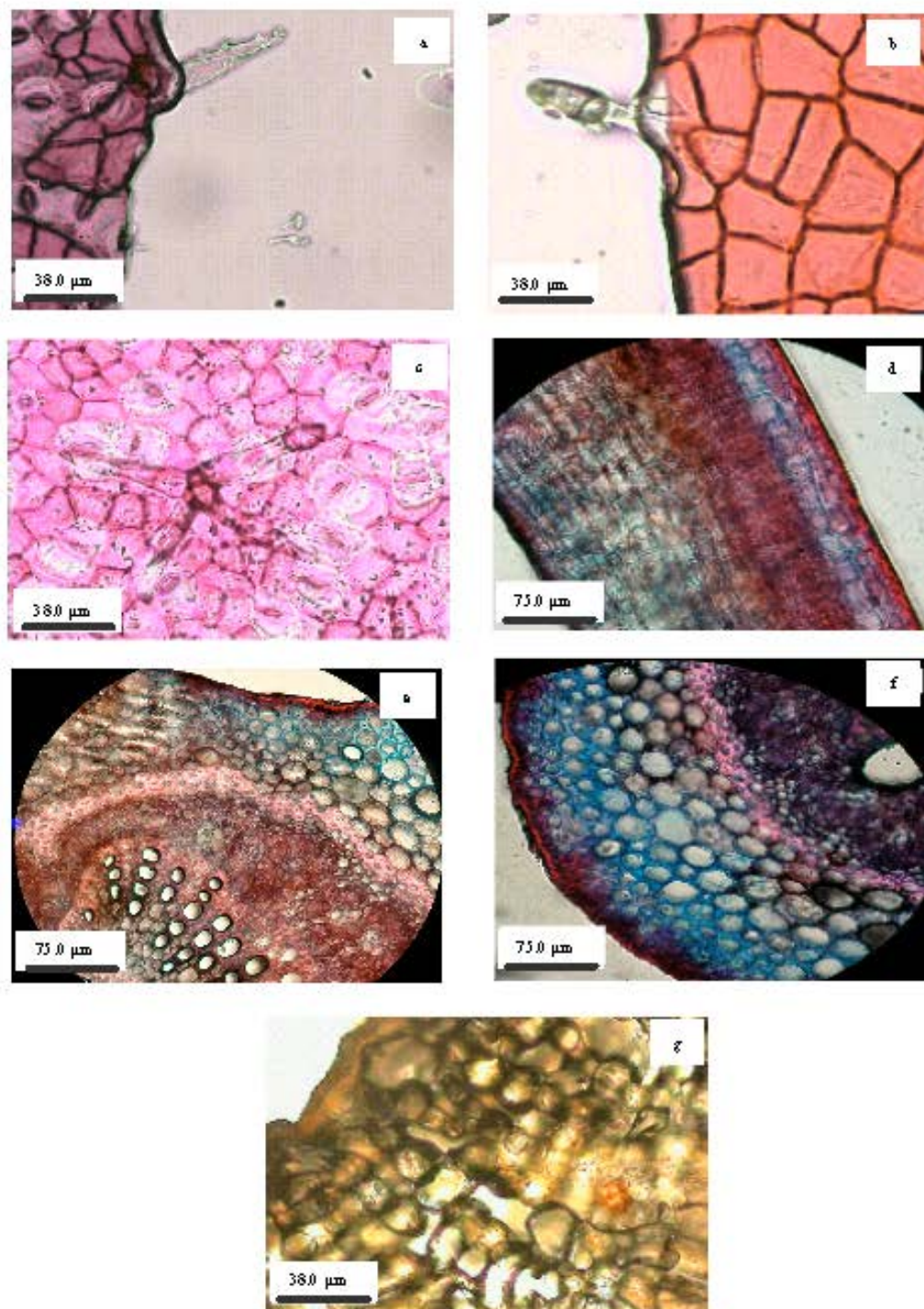


Fig. 1a-g: Anatomical characters of leaf. (a, b) uniccular and biccular tector trichomes. (c) stellate trichome. (d) transversal section of dorsiventral mesophyll. (e) transversal section of vascular region of midvein. (f) transversal section of the midvein with druses of calcium oxalate and (g) fundamental pascenchemyma with phenolic cavity

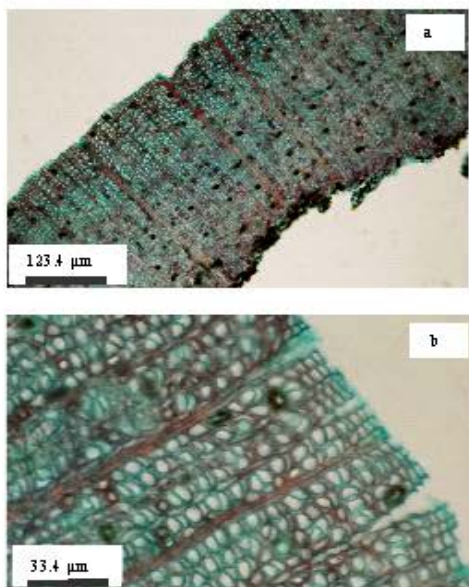


Fig. 2: Anatomical characters of bark. (a) transversal section and (b) parenchyma containing phenolic and calcium oxalate prismatic crystals idioblasts

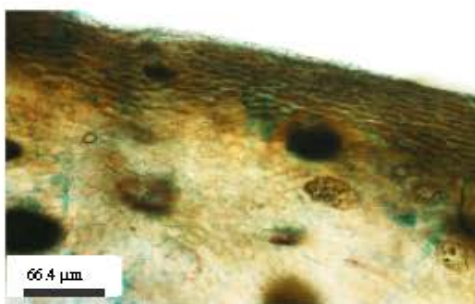


Fig. 3: Mesocarp and endocarp of fruit

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