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Microscopic Anatomy and Histochemistry of the Stem and Root of Some *Mimosa* species (Leguminosae-Mimosoideae)

H.O. Edeoga, G. Omosun, G.G.E. Osuagwu and O.O. Emezue
Department of Biological Sciences, Michael Okpara University of Agriculture,
Umudike, P.M.B. 7267 Umuahia, Abia State, Nigeria

Abstract: Microanatomical and histochemical investigations were carried out on three species of *Mimosa*: *M. pudica*, *M. invisa* and *M. pigra*. These studies were carried out using a Leitz Wetzler Ortholux contrast microscope fitted with Vivitar-V335 camera. The results obtained from the studies of stem and roots showed variation in shape of cells. Presence of raphides were observed only in *M. pigra*. The usefulness of these observations in understanding the biology of these taxa is not in doubt. Similarly, the utilization of the results in the characterization and differentiation of the different species were highlighted and discussed to the interest of the field biologist and others who are interested in pharmaceuticals and traditional medicine.

Key words: Anatomy, histochemistry, *Mimosa*, roots, stem

INTRODUCTION

Mimosa L. species are members of the family Leguminosae-Mimosoideae. This family is subdivided into Mimosoideae (Burkill, 1995). The Leguminosae is also referred to as the pod family or legume family and it is believed to be the largest family of the angiosperms. (Whistler, 1983).

The genus *Mimosa* include *Mimosa pudica* L., *M. pigra* L., *M. invisa* Mart. ex Colla and others but these three were those studied. This is because they are the common species that are often found in different parts of Southern and Eastern Nigeria.

The *Mimosa* species are characterized by their nyctinastic movement. It is seen most especially and rapidly in *Mimosa pudica* (Arbonnier, 2004). The nyctinastic movement (opening and closing) of the leaves is a circadian phenomenon and persist even when plants are kept continuously in light or darkness. The well-known movement of leaves of *M. pudica* is mediated by the activity of pulvini, joint like thickening of the base petioles and in base of petiolules in compound leaves (Vidyarathi *et al.*, 2002).

In diagnostic key to taxa, anatomical characters are frequently used and could be used at all taxonomic levels. Some anatomical works on the taxonomy of different plants have been done by different authors including Arroyo (1986), Okoli (1988), Edeoga and Ogbebor (1999), Edeoga and Okoli (2001) and Edeoga and Okoli (1997).

The histochemical features of plant especially the presence of crystals have been found in various forms in most plant cells (Metcalf and Chalk, 1983). The use of histochemistry in taxonomic conclusions are recently becoming frequent (Edeoga and Ugbo, 1997). The presence of calcium oxalates have been found in the leaves of *Dioscorea*. (Edeoga and Okoli, 1995) and in starch grains of yam (Okoli and Green, 1988). Osuji and Ndukwu (2005) investigated the presence and distribution of calcium crystals for taxonomic purposes. The taxonomic significance of crystals of calcium oxalate have also been indicated in diverse plant families especially in angiosperms such as Cucurbitaceae (Okoli 1988), Nyctagnaceae (Edeoga and Ikem, 2002). None of such studies have been done in *Mimosa species*. The purpose of this research is to examine the significance of microscopic anatomy and histochemistry in the recognition and systematic biology of these *Mimosa* spp.

MATERIALS AND METHODS

This study was carried out between January and July, 2005 at the Biological science Laboratory of Michael Okpara University of Agriculture, Umudike, Nigeria. The stems and roots of the plants studied were collected from uncultivated surrounding of the University, Campus of Michael Okpara University of Agriculture, Umudike, Umuahia and also along the river bank of Ivo River in Ivo L.G.A. Ishiagu, Ebonyi State all in Eastern Nigeria. Only

healthy and succulent parts of the plants were collected. All the plant samples were identified in the University Herbarium and Voucher specimens deposited there.

The anatomical studies were carried out by fixing some mature and fresh parts of the leaves, stems and roots of these *Mimosa* species in F.A.A (1:1:18) for 24-48 h. They were later washed in distilled water, then used for anatomical studies following the method of Peacock (1973). Photomicrographs were taken using Leitz Wetzler Ortholux constant microscope fitted with a Vivitar-V335 camera. Histochemical staining was done following the method described by Edeoga and Ikem (2002).

RESULTS AND DISCUSSION

The stems of the *Mimosa* species differ. *M. pudica* has reddish brown sub-woody and angular and *M. pigra* has strongly prickled woody stem. The transverse section of the stem of all the *Mimosa* species studied were externally bounded by epidermal cells. A cylindrical region of cortex lies below the epidermis. The collenchyma cells in all the species studied consist of 2-5 layer of collenchymatous cells (Fig. 1).

The parenchyma of the species are thin-walled, circular to oval-shaped and have 1-2 cell layers. The endodermis is one layer and delimits the cortex from the vascular bundles. The vascular bundles consist of a continuous or split cylinder arranged in a ring which encloses the pith. The vascular bundles are oval in transverse section, concentric with phloem in the centre and surrounded by xylem.

Table 1 summaries the anatomical characters of the *Mimosa* sp. investigated. In Fig. 2a-c, the cortex occurred immediately after the epidermis consisting of mostly parenchyma cells of 4-5 layers in all the species. The parenchyma cells are oval-shaped with a lot of intercellular spaces. The vascular bundles occupy the central portion of the root. They consist of xylem and phloem, with the xylem being more prominent as the protoxylem are smaller and in the outer layer of the pericycle. The metaxylem are larger and inside. The pith is well-developed, thick-walled and lignified. It is largely composed of parenchymatous cells containing a large portion of the central cylinder.

Trichomes were absent in the species of *Mimosa* studied but there is presence of corticellular hairs in *M. pigra*. Reports on trichomes have been documented by Metcalfe and Chalk (1983).

The root hairs were not conspicuous in the species investigated. The epidermis is barrel-shaped with a thick outer cuticle. It is the outer layer of the root which is one layer thick in the three species studied.

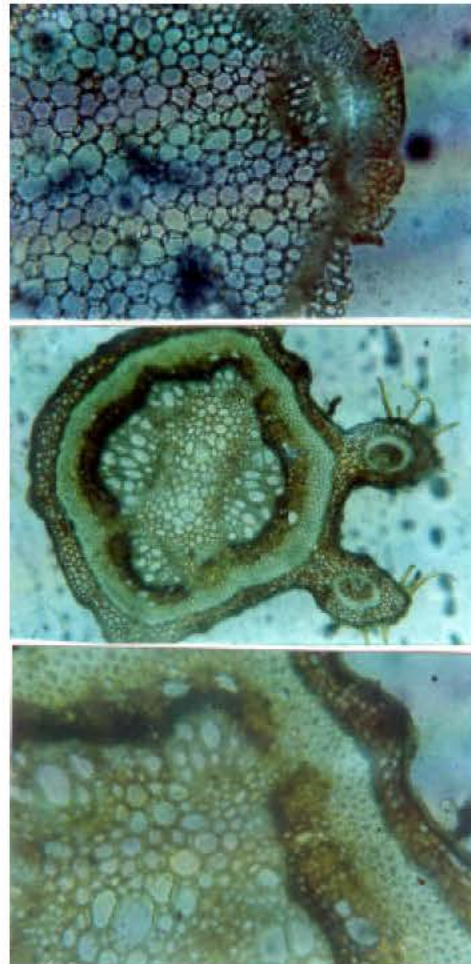


Fig. 1: Transverse sections of the stems of: (a) *M. pudica* (x100) (b) *M. pigra* (x100) (c) *M. invisa* (x250) Note the diagnostic features of the stems

The site of localization of calcium crystals have been found in the stem, root and epidermal cells. In the investigated plants, calcium oxalates occur in form of raphides and their distribution is significant for taxonomic purposes (Osuji and Ndukwu, 2005).

The rectangular shape of the stem in *M. invisa* clearly separates it from other species studied. Similarly the 2-3 layered collenchyma in *M. pudica* separates it from other taxa investigated. Earlier proofs on other plant groups have suggested that difference in the anatomical systems of stems and roots are vital sources of taxonomic inferences in different groups of flowering plants (Edeoga and Okoli, 1997, 2001).

The occurrence of calcium oxalate crystals mostly around cortex is significant since previous works on other plants have associated crystals with cortex. The probable role of this difference in localization of

Table 1: Anatomical characters of *Mimosa* sp investigated in this study

Characteristics	<i>M. pudica</i>	<i>M. invisa</i>	<i>M. pigra</i>
Stem			
Endodermis	1 layer thick	1 layer thick	1 layer thick
Hypodermis (Collenchyma cell layer)	2-3	4-5	4-5
Shape of parenchyma cell	Circular with thin walls	Circular with thin walls	Circular with thin walls
Types of trichomes	Absent	Absent	Absent
Shape of stem	Circular	Rectangular	Oval with protruding extra stem.
Roots			
Collenchyma cell layers	1-2	1-2	1-2
Parenchyma cell layer	4-5	4-5	4-5
Epidermis	Barrel-shaped with outer cuticle	Barrel-shaped with thick outer cuticle	Barrel-shaped with outer cuticle.
Forms of calcium oxalate crystals in stem and root	Circular and raphides	Raphides mostly	Both raphides and oval.
Location of calcium oxalate crystals in stem and root	Cortex and Vascular bundles	Mostly around cortex	Cortex, Endodermis and Vascular bundles.

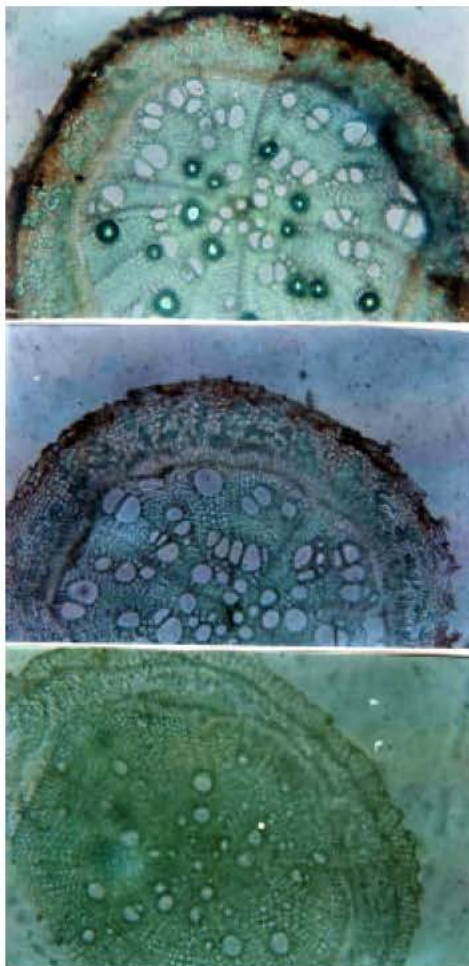


Fig. 2: Transverse sections of the roots of: (a) *M. pudica* (x100) (b) *M. invisa* (x100) (c) *M. pigra* (x100) Note the nature of the vascular bundles

crystals have been discussed by other authors (Edeoga and Okoli 1999; Edeoga and Ugbo, 1997; Edeoga and Ikem 2002; Okoli 1988; Okoli and Green 1988; Osuji and Ndukwu, 2005).

The future area of research thrown up from the microscopic anatomy and histochemistry of the plants is the relationship between the various characters recorded in this study and the nyctinastic movement of *Mimosa* species.

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