



# Asian Journal of Plant Sciences

ISSN 1682-3974

**science**  
alert

**ANSI***net*  
an open access publisher  
<http://ansinet.com>

## Micromorphology of the Leaf Cuticle in *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:** Leaf epidermal investigations were carried out on three species of *Mimosa*, *M. pudica*, *M. invisa* and *M. pigra* common in Nigeria. The results obtained revealed the nature of the irregularly shaped epidermal cell walls of *M. pigra* and *M. pudica*. The epidermal cell walls of *M. invisa* were however mostly rectangular to pentagonal in shape. Morphological type of stomata was the diacytic type in all the species. The average stomatal index of 13.43% on the upper epidermis of *M. invisa* and that of 40.91% on the lower epidermis was significantly different from the stomatal index of the other two species. The result of this investigation will help in the taxonomy and also contribute to more information on the biology of these three obnoxious species of *Mimosa*.

**Key words:** Cuticle, micromorphology, *Mimosa*, Mimosoideae

### INTRODUCTION

Fabaceae is regarded as the modern and accepted name of the family of which *Mimosa* belongs (Marshman, 2004). The subfamilies are Mimosoideae, Caesalpinoideae and Papilionoideae (which is now regarded as Faboideae). Vidyarthi and Tripathi (2002) reported that the subfamily has 56 genera and 2000 species, which are commonly found in tropical and subtropical countries.

The *Mimosa* species are characterized by their nyctinastic movement. It is seen most especially and rapidly in *M. pudica* (Arbonnier, 2004). The nyctinastic movement (opening and closing) of the leaves is a circadian phenomenon and persists even when plants are kept continuously in light or darkness. *M. pudica* is a widespread weed of native America but was introduced to West Africa in 1839 and 1840 (Burkill, 1995).

*Mimosa invisa* Mart. commonly called giant sensitive plant is a biennial or perennial legume. It starts as an erect plant and grows into a spiny climbing shrub with the capacity to smother competing plants in its domain. It has a variety known as *M. invisa* var *Inermis* Adelb. They are similar but can be distinguished by the absence of prickles on the stem, leaves and fruits of the variety *Inermis*. Burkill (1995) described *M. invisa* as one of the worst weeds due to its nasty thorns. According to Alabi *et al.* (2001), *M. invisa* limits the yield of cassava (*Manihot* sp.) in South Western Nigeria where more than 30% of total national production is generated.

*M. pigra* often found in riverbanks and fresh water swamps has been found common throughout the regions from Senegal to Nigeria and widespread over tropical Africa. It is also known as *M. asperata*

Linn. (Burkill, 1995). *M. pigra* is an invading woody, prickly, leguminous shrub and it is capable of a dramatic population explosion (Miller and Lonsdale, 1993). *M. pigra* is similar in appearance to *M. invisa*. It can be distinguished by its very sensitive leaves, very strong thorns and pale mauve flower balls which differ from the pinkish flower of *M. invisa*.

This study is carried out with a view to using available differences in the micromorphology of the leaf cuticle in characterizing these three common and economically important *Mimosa* species available in Nigeria.

### MATERIALS AND METHODS

This study was carried out between January and July, 2005 at Michael Okpara University of Agriculture, Umudike, Nigeria. The fresh leaves were collected from plants growing in natural conditions in different locations of Eastern Nigeria. The leaf samples were boiled in concentrated HNO<sub>3</sub> for 2 min. The samples were then carefully washed in water and the adaxial and abaxial epidermis teased from the mesophyll using fine forceps and dissecting needles. The peelings of the leaves were then mounted in glycerine on glass slides.

Photomicrographs were taken using a Leitz Wetzlar Ortholux microscope fitted with a Vivitar-V335 camera.

### RESULTS

The characteristic epidermal features of the three taxa are shown in Fig. 1-2 and Table 1. The morphological type of stomata found in the three *Mimosa* species is the

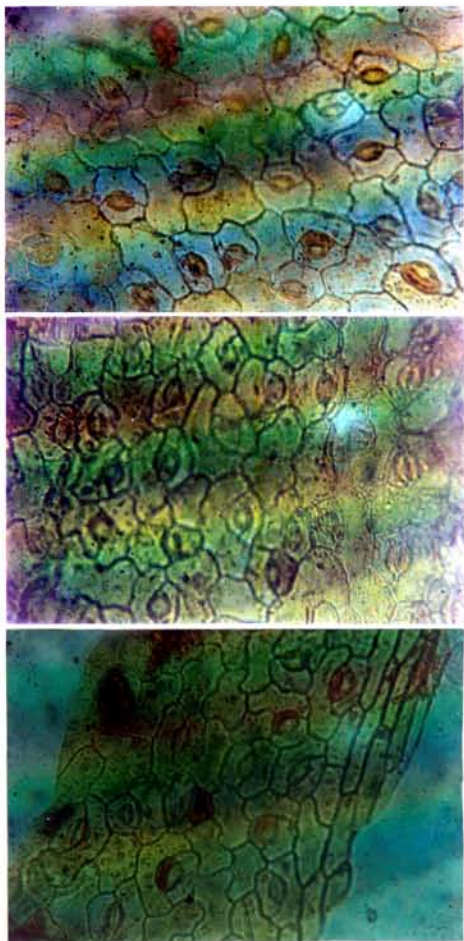


Fig 1: (a) Epidermal morphology showing diacytic stomatal arrangement in lower epidermis of *M. pudica*. (b) Upper epidermal cells of *M. pudica* with irregularly shaped epidermal cell walls. (c) Lower epidermis of *M. pigra* with irregularly shaped epidermal cell walls

Table 1: Epidermal characters of the *Mimosa* species studied

| Characteristics              | <i>M. pudica</i> | <i>M. invisa</i>       | <i>M. pigra</i> |
|------------------------------|------------------|------------------------|-----------------|
| Shape of epidermal cell wall | Irregular        | Rectangular-Pentagonal | Irregular       |
| Epidermal cell wall          | Straight         | Straight               | Straight        |
| Stomatal type                | Diacytic         | Diacytic               | Diacytic        |
| Stomatal index (%)           |                  |                        |                 |
| Upper epidermis              | 24.39            | 13.43                  | 19.23           |
| Lower epidermis              | 27.50            | 40.91                  | 22.95           |

diacytic stomata type. The epidermal cells were mostly irregularly shaped, but the epidermal cell walls of *M. invisa* were mostly rectangular to pentagonal in shape (Fig. 2a, b).

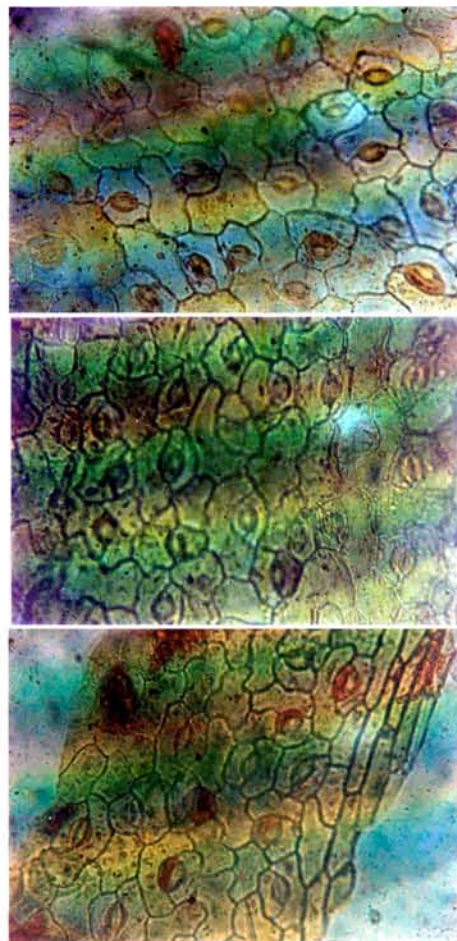


Fig. 2: (a) Lower Epidermis of *M. invisa* with polygonal shaped cells. (b) *M. invisa* showing less number of stomata on upper epidermis. (c) Irregularly shaped epidermal cell walls of upper epidermis of *M. pigra*

The anticlinal cell walls of the three taxa were straight in nature. Stomata was present on both the lower and upper epidermis of all the species investigated, i.e., they were amphistomatic. From data collected on the stomata index, stomata were more on the lower epidermis than on the upper epidermis. The stomatal index in the lower epidermis varied from 22.95% (*M. pigra* through 13.43 (*M. invisa*) to 24.39% in *M. pudica*.

## DISCUSSIONS

Leaves are probably the most varied organs of the angiosperms. Carlquist (1961) has reported the valuable role of leaf anatomy in taxonomy. Irvine (1961), Metcalfe

and Chalk (1983) have reported the use of epidermal characters such as leaf surface, epidermal cell wall pattern, nature of stomata as identifiable aids of some families and genera and sometimes for species. In the presently investigated *Mimosa* species, the epidermal cell walls varied from irregular in shape to rectangular or pentagonal in both the upper and lower epidermis.

The stomata type was diacytic in all species. Remarks have been made by some researchers in different plants on the use of epidermal characters in taxonomy (Edeoga and Ugbo, 1997; Edeoga and Ikem, 2002; Chandra *et al.*, 1969). Stomatal frequency is one of the most widely used characters in taxonomy and pharmacognosy. (Karishnamurthy and Sundaram, 1970). Many other researchers like Ahmad (1964) have established the significance of stomatal frequency as a taxonomic tool. In the *Mimosa* species studied, the stomatal frequency varied significantly. The very low occurrence of stomata on the upper epidermis of *M. invisa* and the relatively high stomatal index of the lower epidermis of *M. invisa* also can be conveniently used as a distinguishing character from other *Mimosa* species studied.

The results obtained from the study of the micromorphology of the three *Mimosa* species will help in separating these taxa from other similar species or related taxa. This study, apart from the general morphology of these plants will help in the recognition of the *Mimosa* species of economic and medicinal importance. It will also contribute to the biology of the obnoxious species of *Mimosa*.

From the shape of the epidermal cell wall, *M. invisa* could be separated from the three taxa due to its rectangular-pentagonal shaped epidermis. This is in line with earlier affirmation by other researchers (Chandra *et al.*, 1969). Similarly, *M. pigra* could be separated from *M. pudica* due its relatively lower value of stomatal index (22.95) as against the relatively high stomatal index of *M. pudica* (27.50). This is not strange as well since similar observations have been made by other researchers in other taxa (Edeoga and Jimoh, 2005; Chandra *et al.*, 1969).

An interesting area of further research is that of their exhibition of nyctinastic movement by these taxa. Differences in leaf epidermal micromorphology could be involved in the various degrees of response to the sense of touch by these *Mimosa* species, investigated. However, further research is required in this direction so as to understand clearly the probable role of leaf characters in nyctinastism.

## REFERENCES

- Ahmad, K.I., 1964. Cuticular studies with special reference to abnormal stomata cells in *Cestrum*. J. Ind. Bot. Soc., 43: 165-177.
- Alabi, B.S., A.O. Ayemi, A.A. Agboolu and B.A. Mayel, 2001. Giant sensitive plant interference in cassava. Weed Sci., 9: 171-176.
- Arbonnier, M., 2004. Trees, Shrubs and Lianas of West African Dry Zones. CIRAD-MARGRAF MNHN.
- Burkill, H.M., 1995. The Useful Plants of West Tropical Africa. Vol. 3, Families 5-L. Botanical Gardens, Kew.
- Carlquist, S., 1961. Comparative Plant Anatomy. In: Plant Anatomy, Mau Seth, J.D., 1988 (Ed.). The Benjamin/Cummings Publishing Co. San Hill. Road California. Holt Rinchart and Winston, New York.
- Chandra, V., S.L. Kapur, P.L. Sharma and D.L. Kapoor, 1969. Epidermal and venation studies in Apocyanaceae. Bull. Bot Surv. India, 11: 286-289.
- Edeoga, H.O. and H.N. Ugbo, 1997. Histochemical localization of calcium oxalate crystals in leaf epidermis of some *Commelina* L. (Commelinaceae) and its bearing on taxonomy. Acta Fatuities. Gabbed., 48: 23-30.
- Edeoga, H.O. and C.I. Ikem, 2002. Tamin, saponin and calcium oxalate crystals in some Nigerian species of *Boerhavia* L. (Nyctagniaceae). S. Afr. J. Bot., 68: 1-3.
- Edeoga, H.O. and M.A. Jimoh, 2005. Leaf epidermis of *Hyptis suaveolens* and *Ocimum gratissimum* complex. Environ. Ecol., 23: 831-837.
- Irvine, F.R., 1961. Woody Plant of Ghana. Oxford University Press Ltd., London.
- Karishnamurthy, K.H. and R. Sundaram, 1970. Histomorphology of foliar epidermis and Phamacognocny in Asdepiadaceae. J. Ind. Bot. Soc., 46: 160-168.
- Marshman, 2004. Legume taxonomy in *Vilitipedia*, the free encyclopedia. Taxon, 53: 853-856.
- Metcalf, C.R. and L. Chalk, 1983. Anatomy of Dicotyledons. 2nd Edn. Vol. 2, Clarendon Press, Oxford.
- Miller, I.L. and W.M. Lonsdale, 1993. Fire as a management tool for a tropical woody weed, *Mimosa pigra* in Northern Australia. J. Environ. Manage., 39: 77-87.
- Vidyarthi, R.D. and S.C. Tripathi, 2002. A Textbook of Botany. Chand and Company Ltd., New Delhi.