Volume , Number

ISSN 1115 2923

Transactions of The Nigerian Society for Biological Conservation.

(Special Edition)

The Status of Conservation of Renewable Natural Resources in the Niger Delta Area of Nigeria

A Journal of The Nigerian Society for Biological Conservation

Trans. Nig. Soc. Biol. Conserv. (Special Edition) 101- 107 (2002)

EPIDERMAL MORPHOLOGY AND STOMATAL ONTOGENY IN TWO VARIETIES OF *LASIANTHERA ARICANA* P. BEAUV. (ICACINACEAE)

M. E. Bassey and R. A. Sunday
Dept. Of Botany/Microbiology
University Of Uyo - Nigeria

ABSTRACT

Two etnobotanical varieties of Lasianthera africana P. Beauv. (Icacinaceae) have been investigated. The mature stomatal complex was predominantly anisocytic but some anomocytic types were observed. The leaves were hypostomatic. The anisocytic stomata followed the aniso – mesoperigenous pathway. While the anomocytic stomata followed the aperigenous pathway.

Abaxial epidermal cell walls were undulating in the forest variety but straight to wavy in the riverine variety. Length of trichomes, stomata, and epidermal cells also helped delimit the two varieties.

Keywords: Epidermal, Morphology, *L. africana*

INTRODUCTION

The leaf epidermals functions in development, gas exchange, wear retention and defense against pathogens (Becraft, Stinard and McCarty, 1996). The morphology of the epidermis is therefore adapted to suit these functions. The structure of the mature leaf epidermis and stomata have been described by many workers such as Olatunji, (1980); Wilkinson, (1970); Oladele, (1990); Adegbite, (1995) and Bassey and Ekanem (1999).

Examination of the mature stomata complex alone without developmental studies can be misleading as the same stomatal complex may have differing pathway of development. Developmental pathways of stomatal complexes have been investigated in some plant groups like the Zingiberales (Olatunji, 1980), Nigerian ferns (Karatela and Gill, 1984), the genus Crotalaria L. (Shah and Gopal, 1969), the species Dioscorea wattii Pr. & Burk. (Upadhyay, 1987).

The genus Lasianthera_belongs to the family Icacinaceae which consists of 58 genera and 400 species (Trease and Evans, 1989). Lasianthera africana_P. Beauv. is the only species reported for the genus in West Tropical Africa by Keay (1eay (1958). Among the Ibibios of Akwa Ibom State, the plant is called "editan". The leaves of the plant are commonly consumed as a vegetable while the twigs are used as a chewing stick. Lasianthera africana_P.Beauv. is a glabrous shrub with white flowers in headlike clusters. The leaves are oblong – elliptic, caudate – acuminate and cuneate at base (Keay, 1958). It grows wild in the forest and at river banks. It has been brought into cultivation by the Ibibios around family homesteads mainly as fencing posts. Among them four ehnobotanical varieties are known. They include "editan akai" (or the forest variety) "editan idim" (or the riverine variety); "These names are based on the natural habitats of the said varieties. The third and fourth varieties are "Obubit editan" (or black variety) and "afia editan" (or the white variety). The last two names refer to the leaf coloration.

The purpose of the present investigation was to add to our knowledge of structure and development of stomata in plants and to use the findings to attempt to delimit the two ethnobotanical varieties being investigated in this work.

MATERIALS AND METHOD

Materials were obtained fresh from different locations in Ibesikpo, Akwa Ibom State. The forest and riverine varieties were located and fresh twigs of each sample brought to the botany laboratory of the University of Uyo for identification and preservation.

For the observation of the leaf morphology, leaf portions were obtained from the standard median level (Olatunji, 1980). These portions were placed on a glass slide irrigated with distilled water and scraped with a sharp razor blade to obtain a transparent epidermis beneath. This was done to obtain both the abaxial and adaxial surfaces.

For ontogenetic studies, young leaves at the tip of the twigs were used. Epidermal peels were also obtained as above. Where the peels were to be left for sometime, they were stored in 70% alcohol. Before observations, each peel was washed in water, bleached in domestice parazone, washed again in water and stained in satranin for 2 - 5 minutes. Therefore, it was washed again to remove excess stain before mounting in 5% glycerol. Measurements of stomatal and epidermal length and breadth were made with a caliberated eyepiece micrometer.

The stomatal index (S.I) was estimated using the formular; $S / E + S \times 100$

Where S = Number of stomatal per unit area

E = Number of epidermal cells per unit area

Terminology used for ontogeny is after Fryns- Claessens and Van Cotthem (1973).

RESULTS AND OBSERVATIONS

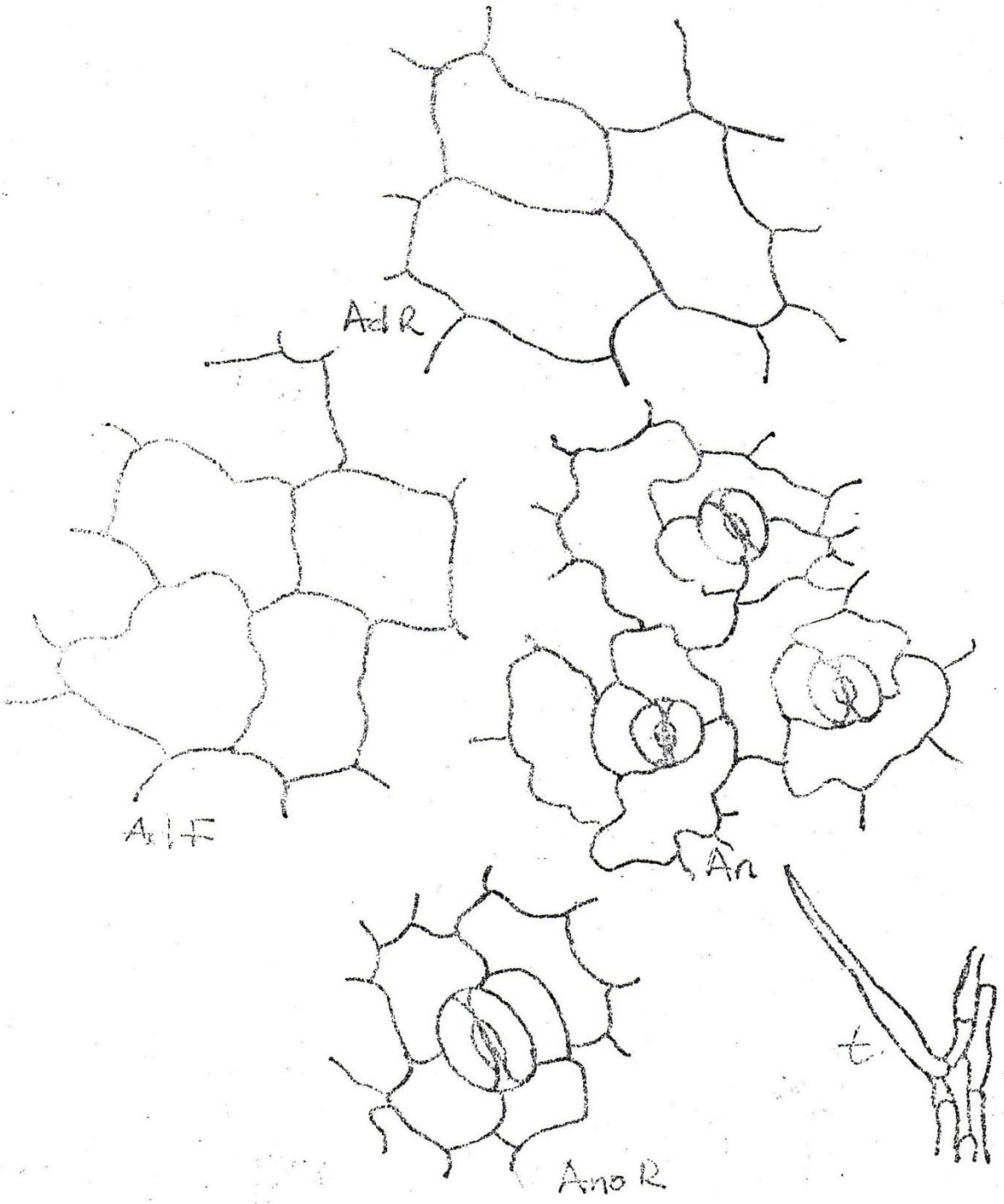
Epidermal cells were more (19) and longer 37.00 um in the forest (akai) variety than in the riverine variety. (Table 1). The length to breadth ratio of the epidermal cells was the same (ie 1:1) Epidermal cell walls on the adaxial surface were straight in both samples. However on the abaxial surface, the wall patterns were straight to wavy in the riverine variety but undulating in the forest variety.

In both samples the adaxial surface lacked stomata. Stomata were more (23) in the riverine (idim) variety than in the forest (akai) variety (8). Stomatal index in the former was 59 against 30 in the later. Stomata were longer (25.90 um) in the forest variety than in the riverine (20.35 um). However the ratio of length to breadth of the stomata was also the same (1:1). The mature stomatal type was predominantly anisocytic in both varieties. Anomocytic types were also observed in the riverine variety. Fig 1 Anomocytic stomata followed the aperigenous developmental pathway. (Fig. 2) In this case, the meristemoid develops into the guard cell mother cell (gcmc) producing the guard cells surrounded by perigenous cells.

The anicocytic stomata followed two kinds of the same pathway. In one case, (Fig.3) the meristemoid divides into two; the larger cell forms the mesogene cell (m^1) and two perigene cells (p^1 & p^2). In the other case, (Fig.4) the meristemoid develops and divides into two giving rise to the first mesogene cell (m^1) and a smaller cell. The later divides again to give the second mesogene cell (m^2) and a smaller cell that becomes the guard cell mother cell (gcmc). This produces the guard cells and becomes surrounded by three subsidiary cells one of which is a perigene cell (p^1) and the other two are mesogenous in origin (m^1 and m^2).

Varieties	Epidermal cell number	Epidermal cell measurement (um)		L/B	Stomatal Number	Stomatal Index	Stomatal Measurement (um)		L/B	Trichome Length in um	Cell Wall Pattern
		L	B				L	B			
Riverine (Idim) Variety	16	25.90 ±6.75	22.20 ± 5.24	1.1	23	59	25.35 ±4.27	16.65 ±3.59	1.1	730um ± 2.00	Less sinuous straight
Forest (akai) Variety	19	37.00 ±1.21	27.75± 8.08	1.1	8	30	25.90 ±3.39	22.20 ±3.65	1.1	55ums ±4.45	Sinuous

Table 1: Information on epidermal cells, stomata and trichomes



Ad R - Adaxial surface of riverine variety
Ad F - Adaxial surface of forest variety
An F - Anisocytic stumata in forest
Ano R - Anomocytic stomata in riverine variety
t - Unicellulaar trichome

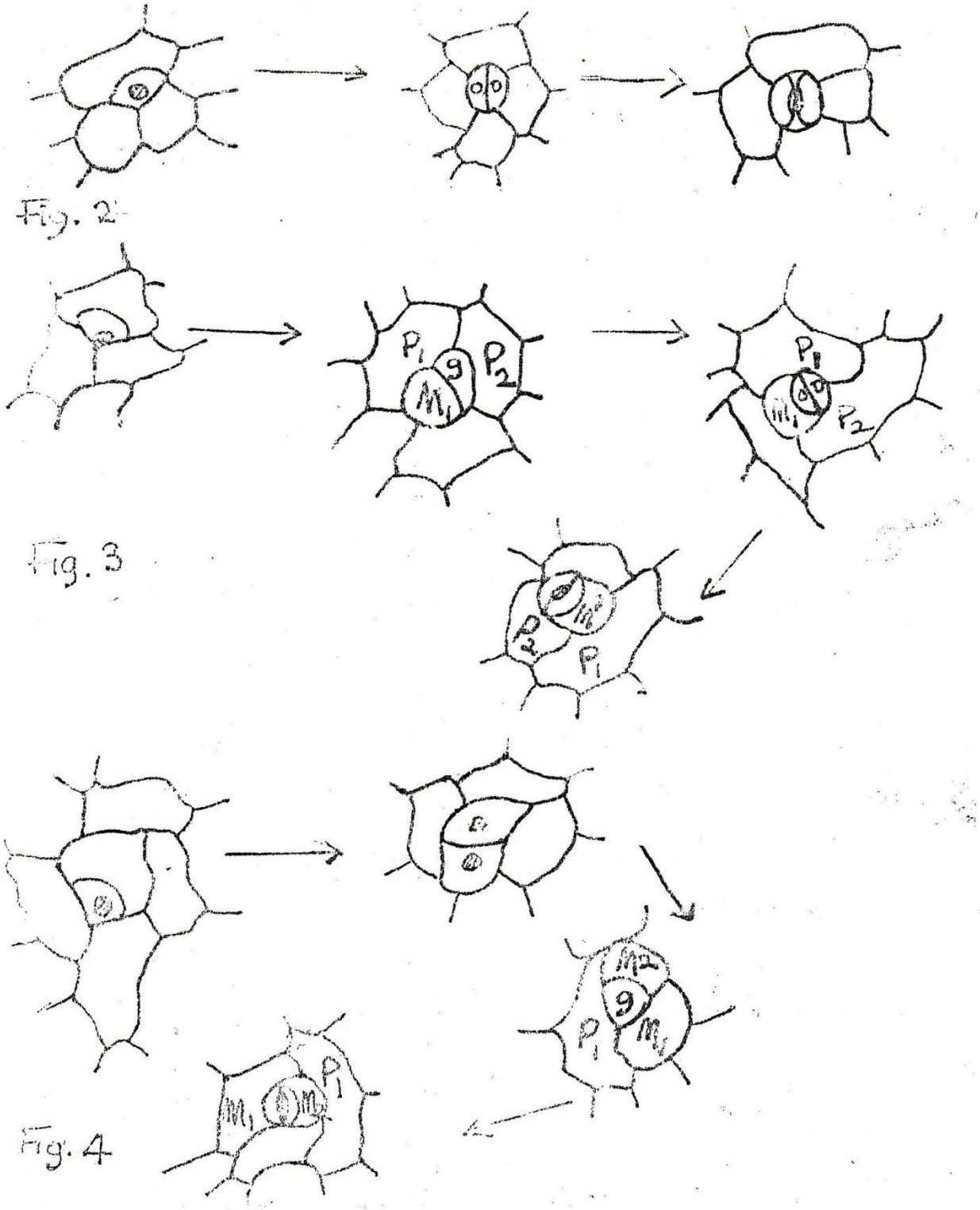


Fig. 2 Aperigenous pathway in developmet of Anomacyt

Fig. 3 The mesoperigenous pathway resulting in 2 pengenous and one mesogenous subsidiary cells

Fig. 4 The mesoperigenous pathway with 2 mwsogenous and 1 perigenous ubsidiary cells

Trichomes were absent from the adaxial surface of both samples. They occurred more on the veins abaxially. They were unicellular and longer (up to 7.30 um) in the riverine variety.

DISCUSSION

That there was no difference in the adaxial epidermal cell wall pattern and the length to breadth ratio of the epidermal cell walls is indicative of the genetic closeness of the plant samples. Bassey and Nyananyo (1995) also observed undulating epidermal walls but on both adaxial and abaxial surfaces of Acrostichum aureum a fern. Bassey and Ekanem (1999) working on Gnetum africanum welw, and G.buccholzianum Engl. also observed undulate epidermal walls. Both sets of plants are forest plants occurring in shade. Wilkinson (1989) noted that shade plants tend to have more undulate walls since epidermal cell wall undulation is known to be affected by light. This agrees with the undulate walls observed in the forest variety of the plants under investigation. Adegbite (1995) observed that in Aspilia the epidermal cells on the adaxial surface had less sinuous walls than those of the abaxial surface.

When stomata are restricted to the abaxial surface of a leaf, it is said to be hypostomatic (Metcalfe and Chalk, 1979).

There is a correlation between the stomatal number and stomatal index values. The later is independent of environmental influence, size or portion of the lead or size of the intervening epidermal cells (Metcalfe and Chalk, 1979).

That the anomocytic stomatal type were not observed in the forest variety does not rule out the fact it might be present. Stomatal diversity on the same surface of a leaf has been confirmed by may authors; Stace; 1980, Metacalfe and Chalk, (1979). Fryns-Claesens and Van Cotthem (1973) have described the ontogeny of the anisocytic stomata as described here as aniso-mesoperigenous and that of anomocytic stomata as aperigenous. Adegbite (1995), observed that stomatal types could be reached through different ontogenetic pathways so did Stace, (1980).

Adegbite (1995) referred to hairs that were over 700 mm long as long hairs those that were intermediate as ranging from 301mm to 70mm. He also commented that in *Aspila* unicellular hair serve to reduce rate of transpiration in the plants.

That, however does not apply in our plants which occur in forest environment and in riverine locations.

In conclusion, delimitations between the two varieties were observed in the stomatal size and cell, wall pattern length of trichomes and epidermal cells. However, the ratio of length to breadth of the epidermal cells and stomata, similarity of trichome type (unicellular) and ontogeny of the mature stomatal complex confirm the genetic closeness of the plants.

REFERENCES

Adegbite, A. E. (1995) Leaf epidermal studies in three Nigerian species of Aspilia (Heliantheae – Asteraceae) and two hybrids.

Bassey, M. E. and B. L. Nyanayo (1995) Taxaonomic studies of the macrophyte genus Acrostichum (Adiantaceae). Trans. Nig. Soc. Biol. Conserv. 3:4-9.

Bassey, M. E. and S. E. Ekanem (1999). Foliar epidermal characteristics of Gnetum africanum Welw. and G. bucholzianum Engl. Trans. Nig. Soc. Bio. Conserv. 8:170-174.

Fryns-Claeseens E. and W. Van Cotthem (1973). A. classification of the ontogenetic types of Stomata. Botanical Review 39:71-138.

Karatela, Y. and L. S. Gill (1984). Structure and Ontogeny of Stomata in Nigerian Ferns. Nova hedwigia, Band 40.

Keay, R. W. J. (1958) Flora of West Topical Africa 2nd Edition. Crown Agents for Oversea Governments and Administrations Millbank, London S. W. I. P.638.

Oladele, F. A. (1990) Leaf epidermal features in evrnonia amygdalina and V. cinerea Nig. Jour. of Bot. 3:71-77.

Olatunji, O. A. (1980) The structure and development o Stomata in some Zingiberales. Notes R. B. G. Edinb. 38(3):492-515.

Metcalfe, C. R. and L. Chalk (1979). Anatomy of the Dicotyledons Vol. 1. Claredon Press, Oxford pp 96 – 117.

Shah, G. L. and B. V. Gospel (1969). Development of stomata in some papilionaceae. Can. Jour. of Bot. 47:387 – 393.

Stace, C. A. (1979). Plant Taxonomy and Biosystematics. Contemporary Biology. The Pitman Press, Great Britian. pp. 279 – 288.

Trease, A. and W. C. Evans (1989). A textbook of Pharmacognosy. 13th ed. Bailliere, Tindall Ltd. London p.171. Upadhyay, N. (1987). Epidermal Structure and Onotogeny of Stomata of Diocorea Pr. & Burk. J. Indian Bot. Soc. 66: 448 – 450.

Wilkinson, H. P. (1979). The plant surface. In. Metcalfe C. R. and L.Chalk (edtrs) Anatomy of dicotyledons Vol. 1 Claredon Press, Oxford. pp. 96 – 165.

Wilkinson, H. P. (1989). Leaf anatomy of the Merispermaceae, tribe Triliacoreae Miers. Bot. Jour. of the Linn. Soc. 99:125 – 174.