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A comparative foliar anatomical and morphological study on *Anacardium occidentale* L. and *Spondias mombin* L.

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Abstract

A comparative Foliar Anatomy and Morphology study was carried out on *Anacardium occidentale* L. and *Spondias mombin* L. These are perennial trees, belonging to the family of flowering plants *Anacardiaceae*, which are cultivated throughout the world for their edible fruits and seeds, medicinal compounds, valuable timber and landscape appeal. The anatomical and morphological foliar features shows that *anomocytic* and *diacytic* stomata type occurred in both species and the number of stomata found in *S. mombin* was twice that of *A. occidentale* with about 47 and 45 stomata present on the abaxial and adaxial part of the leaves respectively. *A. occidentale* consist of no stoma on the adaxial, but has about 25 stomata on the abaxial surface. Other features which were present include the guard cells, elongated epidermal cells and subsidiary cells. In their anatomy, a rod-like-shaped structure occurred in *A. occidentale* whereas a bee cone-like-shaped structure occurred in *S. mombin* which revealed the character that help in their classification. More so, xylem, phloem, upper and lower epidermis, palisade and cuticle that covered the epidermis also occurred in both species. These features however, uphold their close taxonomic relationship in the family *Anacardiaceae*.

Keywords: Anatomical study, morphological study, *Anacardium occidentale* L., *Spondias mombin* L.

1. Introduction

Anacardium occidentale L. and *Spondias mombin* L. are perennial trees belonging to the family of *Anacardiaceae* which consists of about 800 species in 82 genera^[1]. *Anacardiaceae* (the cashew or sumac family) is a family of flowering plants, which are cultivated throughout the world for their edible fruits and seeds, medicinal compounds, valuable timber and landscape appeal^[2,3]. *Anacardium occidentale* L. is a well branched tree with ethno-botanical and economic uses. The common cashew tree is more widespread and much taller, with a height varying from 8 to 15m and a crown span that can reach 20m^[1]. The mature leaves of *A. occidentale* are evergreen, mainly thick and oval or elongated shaped, pointed or rounded tip, compound or simple, alternate or rarely opposite arranged and some have terminal leaflet. The flowers grow at the end of a branch or stem or at angle from where the leaves join the stem and have bracts. They often have bisexual and male flowers on same plants, bisexual and female flowers on others or flowers having both stamens and perfect pistils. The calyx with 3 to 7 cleft sepals and the same number of petals, occasionally no petals. The mature fruits are mainly oval in shape, yellowish or reddish or dark-red when ripe, rarely opening and mostly drupes. Seeds are mainly found inside the fruit, but in *A. occidentale* is located on the edge of the fruit with hard or leathery covering^[4].

S. mombin commonly known as Hog plum or yellow mombin or monkey plum is a tree growing to about 30m high in the same family. It is widespread in farmlands and growing easily from stakes used in making fences and enclosures. In Nigeria, it is known to Ibos as "Ichikara", in Hausa as "Tsardarmasar" and in Yoruba as "Akika". Other common names are "Iyeye" in Yoruba and "Uvuru" in Igbo^[5]. The matured tree measures about 9-15ft high and 1-4ft wide. The leaves are alternate, once pinnate with an odd terminal leaflet, leaflets 5-10 pairs, apex long acuminate, truncate, margins entire, glabrous with pointed tips. Fruit's an ovoid or ellipsoid drupe with 3-4 x 2-2.5cm in diameter. Dull light orange to yellow or brown, in clusters of 5-20 fruits, epicarp thin enclosing a juicy orange or yellow mesocarp 3-6mm thick, endocarp large with a soft fibrous grooved coat surrounding 2-4 small seeds. Flowering occurs during the dry season and some ripe fruit can be found on the tree most of the year^[6]. This study was carried out to justify that comparative foliar anatomy and morphology of *Anacardium occidentale* and *Spondias mombin* is relevant to their Classification and taxonomy.

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2. Materials and Methods

S. mombin and *A. occidentale* twigs were collected from Umueziukwu Igboeze-Onicha in Onicha LGA of Ebonyi State (NIG.), where *S. mombin* tree is used for live fence, land demarcation and yam ban while *A. occidentale* is used for shield and income earnings. The specimens were identified by Prof. M. O. Nwosu of Department of Plant Science and Biotechnology, University of Nigeria Nsukka.

Impression technique was used for the stomata studies; a leaflet was taken from the already identified leaves stalk. It was placed on the safety cabinet and colourless nail varnish was applied 3-4 coatings on the adaxial and abaxial parts,

using nail brush. It was allowed to coagulate for about 15 minutes, and then was placed under the fan to dry. The coated part was gently pilled off, using forceps. Then was placed on different slides, stained with 2-3 drops of alcian blue and safranin-o respectively; damping was done using cotton wool so as to remove excess stain and then covered properly using cover slides. It was properly viewed under the light microscope and photomicrograph of the specimens was taken using a Nikon digital camera.

3. Results

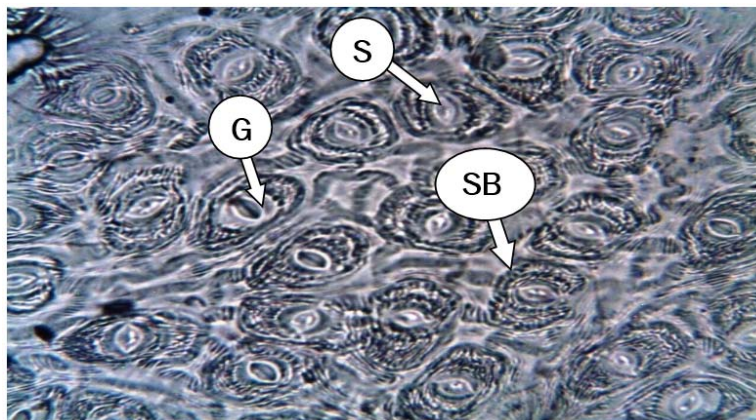


Fig 1: Abaxial view of *Anacardium occidentale* Leaf (x400) G: Guard cell; S: Stomata; SB: Subsidiary cell

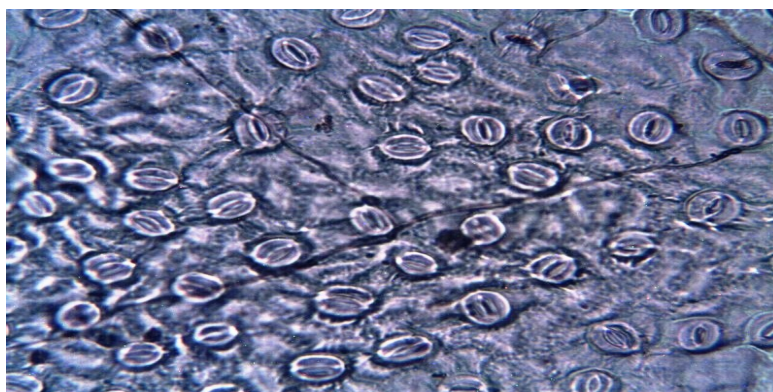


Fig 2: Abaxial view of *S. mombin* Leaf (x400)



Fig 3: Adaxial view of leaf of *S. mombin* (x400).

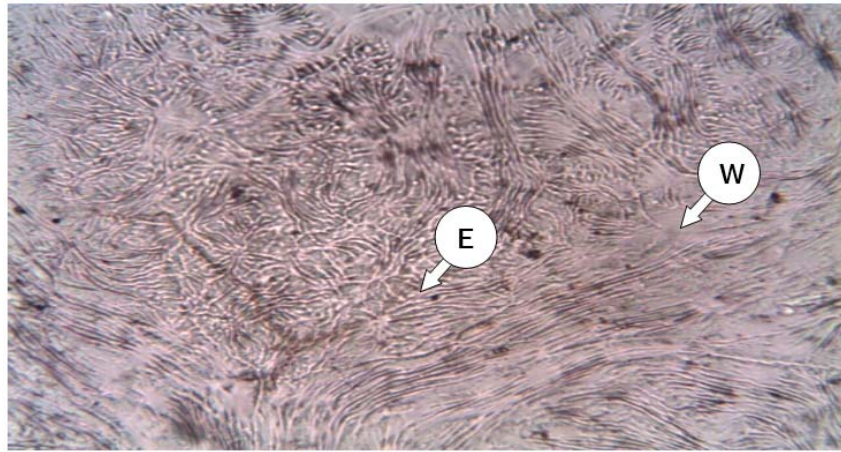


Fig 4: Adaxial view of leaf of *Anacardium occidentale* L. x100

Features present

E=Epidermal cell; W=Waxy material

Photomicrographs of Leaves anatomical structures of *Anacardium occidentale* L. and *Spondias mombin* L.

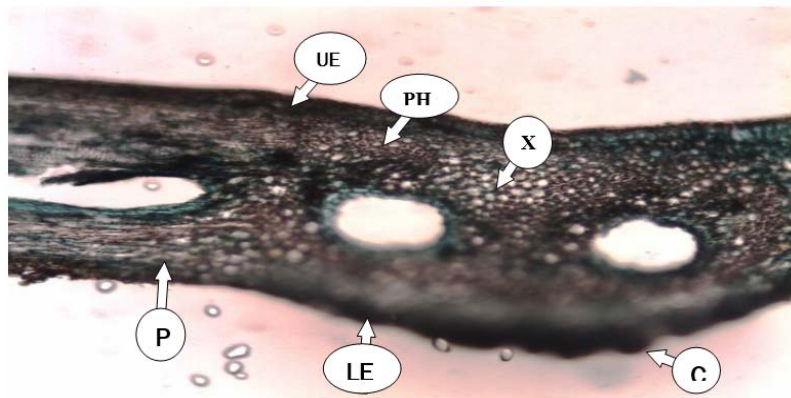


Fig 5: T/S of leaf of *Anacardium occidentale* L. (x100).

Features present

UE=Upper epidermis; LE=Lower Epidermis; C=Cuticle; Ph=Phloem; X=Xylem; P=Palisade cell

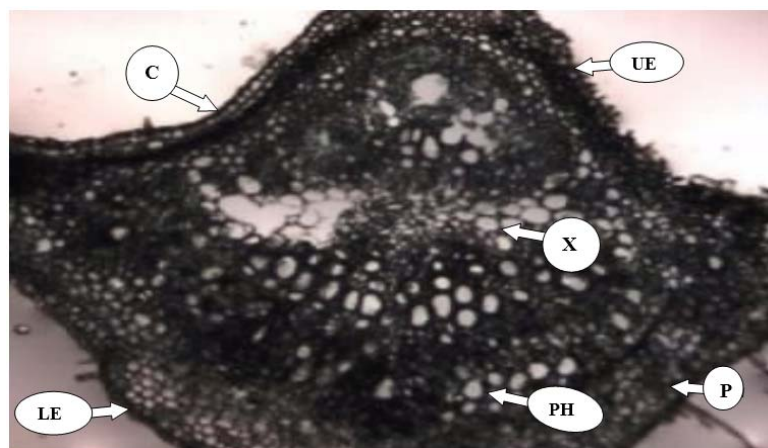


Fig 6: T/S View of leaf of *Spondias mombin* L. (x100).

Table 1: showing the number and type of stomata specie part stomatal type no of stomata

Specie	Part	Stomatal Type	No of stomata
A. occidentale	Adaxial	---	0
	Abaxial	Diacytic	25
S. mombin	Adaxial	Anomocytic	45
	Adaxial	Anomocytic	47

Table 2: showing the presence or absence of guard cell, subsidiary cell, waxy material and elongated epidermal cell.

Species	Part	Guard cell	Subsidiary cell	Waxy material	Elongated epidermal cell
<i>A. occidentale</i>	Adaxial	Absent	Absent	Present	Present
	Adaxial	Present	Present	Absent	Present
<i>S. mombin</i>	Adaxial	Present	Present	Absent	Present
	Adaxial	Present	Present	Absent	Present

Table 3: Showing the presence or absence of some Anatomical features of both species

Species	Shapes	Cuticle	Epidermis	Palisade	Xylem	Phloem
<i>A. occidentale</i>	Rod-like shaped	Present	Present	Present	Present	Present
<i>S. mombin</i>	Bee-cone like shape	Present	Present	Present	Present	Present

5. Discussion/ Conclusion

The foliar anatomy and morphological feature of *A. occidentale* and *S. mombin* has shown in details some significant phylogenetic and taxonomic character that identifies them within the *anacardiaceae* family. The number of stomata was 25 on the abaxial surface of *A. occidentale* and stomata were lacking on the adaxial surface, *S. mombin* had 45 stomata on the adaxial surface and 47 stomata on the abaxial surface. Stomata type, anomocytic and diacytic which exist among these species, unequal number of stomata distribution, epidermal cells and waxy materials found in adaxial part of *A. occidentale* are evidence for their convergent character which help them to survive in their habitat. Some land plants may have stomata on one or both leaf surfaces. Stomata are common on the abaxial surface, but are usually sparse or absent on the adaxial surface [1].

The guard cells are very different from other epidermal cells which may be quite distinctive. Some certain plant groups have additional cell arranged around their stomata cells. These additional specialize cells are referred to as subsidiary or accessory cells. They may act to assist, reinforce, or protect the stomata cells. The ontogeny of subsidiary cells is considered important in plant classification [7]. Given that plant cells have relatively rigid cellulose cell walls and that the stomata must expand and contract, subsidiary cells afford a cushioning effect for the adjoining cells from the stomata expansion and contractions. Subsidiary cells have been more prevalent in plants with larger leaf cells and less in ones with small to tiny leaf cells [8].

In anatomical features, the difference in shapes of their leaves, presence of vascular bundle (phloem and xylem), epidermis etc, are evidence of their classification and evolutionary history as it concerns their homology and convergent character. Therefore, the anatomical and morphological leaves study of this species in *Anacardiaceae* family reveals many features which described their resemblances and differences as shown in the tables above.

More so, the resin canals located in the pith is a characteristic feature of many of the cashew family. Several species have these located in the primary cortex or the irregular bark. Tannin sacs are also widespread among this family. Secretory canal in the leaves and stems of vascular plants is a relevant taxonomic character and important anatomical feature that has been utilized in distantly and closely related families [9]. The presence of foliar secretory cavities is the paramount anatomical feature and good taxonomic character that identified certain families, *S. mombin* and *A. occidentale* was observed to contain secretory cavities and studies on the significance of this structure in many selected genera of the angiosperm families such as *Rutaceae*, *Myrtaceae*,

Myoporaceae, *Fabaceae*, *Asteraceae*, *Bombacaceae*, *Scrophulariaceae*, and *Cactaceae* have shown the taxonomic values of secretory cavities [6].

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