

Short Communication

Anatomy of leaf epidermis and petiole of two selected species of *Hibiscus*

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The anatomy of leaf epidermis and petiole of two selected species of *Hibiscus* were considered in a laboratory experiment through staining of cut sections and microscope visualization. The experiment revealed morphological differences between the two species studied. The foliar anatomy of the species *Hibiscus sabdariffa* and *Abelmoschus esculentus* were observed as well as the variations in the shapes of petiole in the proximal region, the variation in the number and arrangement of distal end of the petiole. Consequently, the occurrence, distribution and quality of the crystals on the adaxial and abaxial epidermal surfaces of the two species gave an in-sight to the variation between *H. sabdariffa* and *A. esculentus*.

Keywords: Anatomy, *Hibiscus*, Malvaceae, Morphology, Akungba-Akoko.

INTRODUCTION

The genus *Hibiscus* belongs to the family Malvaceae. The genus is represented in Nigeria by twenty-three species and the family is cosmopolitan in its distribution worldwide.

The species of *Hibiscus* are very important economically. The outstanding economic importance of this genus is the fibers which they produce; hence some species are cultivated for their fibers (Schippers, 2000). The plants are erect, procumbent or decumbent. The distinguishing characters of taxonomic value include the variation in shapes of petiole in the proximal region, the variation in the number and arrangement of the vascular bundles, presences or absences of medullar bundles in the pith at the distal end of the petiole, types of trichomes on the lamina and petiole and presence or absence of cuticular striations on the epidermal surfaces. *Hibiscus* is widely used today, the red flowered, tangy taste it is a common constituent of herbal beverage teas. Medicinally, *hibiscus* has been taken internally for the treatments of various forms of and astringents effects when used typically.

Okra *Abelmoschus esculentus* L. [Moench], is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. This crop is suitable

for cultivation as garden crop as well as on large commercial farms. It is grown commercially in digestive upset, along with hibiscus shrub is widely cultivated ornamental and because of its pleasant scurvy, anxiety, and fevers. Okra provides an important source of vitamins, calcium, potassium, and other mineral matters which are often lacking in the diet of developing countries. The composition of edible portion of okra had earlier been published by Gopalan *et al.* (2007).

H. sabdariffa is an annual erect, bushy herbaceous sub shrub about 8ft [2.4m] tall with smooth or nearly smooth cylindrical, typically red stems. The leaves are alternate, 3-5 inch [7.5-12cm] long, green with reddish veins and long and short petioles. As a multiple-use species, Roselle is often mentioned as energy candidate, yielding fiber, beverage, edible foliage, and an oil seed. It is grown for fiber, much biomass remains as residue.

Druses of calcium oxalates crystals occur generally on the genus, however, occurrence, distribution and quantity of these crystals is quite diagnostic on the adaxial and abaxial epidermal surfaces. The taxonomic value of epidermal morphology of *Hibiscus* species is well documented in botanical literature (Jayeola *et al.*, 2001). Given the available information, the report on the

anatomy of the Hibiscus species in Nigeria is very scanty. The present study is therefore aimed at describing the anatomy of the leaf epidermis and petiole of two selected species of *Hibiscus*, viz *sabdariffa* and *Abelmoschus esculentus* occurring in Nigeria with the view to establishing characteristics of foliar structures with taxonomic value information useful in the identification of the species.

MATERIALS AND METHODS

The studies were carried out in the Department of Plant Science and Biotechnology, of Adekunle Ajasin University, Akungba Akoko, Ondo State. Fresh leaf materials collected from the screen house of the department were used for the research.

Technique for obtaining the epidermal peels

Epidermal observations were carried on fresh foliar materials. Samples were taken from identical regions of the adaxial and abaxial i.e. the lower and the upper surfaces of each leaf. Scissors was used to cut the leaf into pieces, placed in a Petri dish containing conc. nitric acid, covered and put in sun until it swell. After, spatula was used to pick the leaf and arranged properly in water and pointed forceps/brush was used to peel the leaf carefully. The peeled part was put on clean slides and mount with Safranin O for 3 minutes, allowed to dry. Covered with cover slip and viewed under the microscope.

For the venation pattern, cleared portions of the leaf were stained in 1% aqueous Safranin O and mounted in 25% glycerol.

Transverse sections of petioles were cut using Reichert sliding microtome at thickness between 10-15m. The specimens were stained in Alcian blue for 3-5 minutes, rinsed thoroughly in water to remove excess stain and Safranin O solution to mount for 3-5 minutes. The section were again washed with water and mounted in 25% glycerol.

Illustrations were made with camera. Measurements were made with the aid of ocular micrometer. Slides of all samples were examined under the research microscope.

RESULTS AND DISCUSSION

Epidermis: Uniseriate in all the three regions in *H. sabdariffa* and *A. esculentus* moderately thickened.

Cortex: composed of angular collenchyma cells to the outer part and polygonal parenchyma cells on the inner part. Considering the vasculature, in the proximal region, vascular bundle occurs in isolated collateral bundles of

different sizes. Medium region is 6-7 µm in *H. sabdariffa*; 4-5 µm in *A. esculentus* (Tables 1 and 2).

. Distal region-vascular system is generally amphicribal, perivascular fiber form a continuous layer round the phloem. In the pith, the three regions, proximal, medium and distal comprise of polygonal parenchyma cells. Medullar bundles present. The trichomes are similar to those present on the lamina. For the crystal, druses of calcium oxalate crystals are present, randomly distributed in the epidermises, cortex, vascular bundles and pith.

Lamina in surface view: *Hibiscus sabdariffa*

Epidermal cells often polygonal with straight anticlinal walls on both adaxial and abaxial surfaces. The stomata are amphistomatic, anisocytic, occasionally anomocytic. For the trichomes, only the stalked glandular trichomes type present on both adaxial and abaxial surfaces, sparse in distribution.

The trichomes base appeared circular to oval, occasionally polygonal. Cuticular striations are present on both surfaces and the mucilaginous cells present have sparse crystals. The druses of calcium oxalate crystals are occasionally present.

Lamina in surface view: *Abelmoschus esculentus*

Epidermal cells are polygonal to occasionally irregular with wavy anticline walls on the adaxial surfaces, irregular with anticline wall wavy to undulating on the abaxial surface. The stomata are anomocytic, amphistomatic and often anisocytic. Trichomes present are non-glandular and majorly simple unicellular with cuticular striations on both surfaces. Mucilaginous are present on both surfaces as large as irregular cells in between epidermal cells. The crystals are of druses of calcium oxalate crystals and occasionally prismatic crystals present on both surfaces. Stomata are more on the upper surface than the lower surface (Tables 1 and 2).

In the transverse section of the petiole, the differences observed in the vascular bundles, the outline of the adaxial surface and arrangement of the vascular bundle through the proximal region can be used to determine the limits of some species of the Hibiscus studied from the others. The vascular bundles are arranged in a ring arc form in *H. sabdariffa* and *A. esculentus*. The vascular bundle varies isolated bundles in the proximal regions and in the median region. In the distal region of the petiole, the xylem forms a closed ring round by phloem in *H. sabdariffa* and *A. esculentus*.

Soladoye (1999) and Bakare (2000) in their work on the species of *Baphia* and *Sida* respectively used the presence or absence of medullar bundles in the pith of the distal end of the petiole to determine the limit of some species they worked on. In the present study, the

Table 1. Abaxial properties.

Average	<i>Hibiscus sabdariffa</i>	<i>Abelmoschus esculentus</i>
Stomata length	1.48 µm	1.45 µm
Stomata width	1.24 µm	1.28 µm
Guard cell length	1.03 µm	1.19 µm
Guard cell width	0.43 µm	0.37 µm
Frequency of epidermal cell	19	14
No of stomata	6	6
Range of length of spongy cells	1.00-1.08 µm	1.30-1.52 µm

Table 2. Adaxial properties.

Average	<i>Hibiscus sabdariffa</i>	<i>Abelmoschus esculentus</i>
Stomata length	1.46 µm	1.16 µm
Stomata width	1.25 µm	1.05 µm
Guard cell length	0.94 µm	0.29 µm
Guard cell width	0.45 µm	1.29 µm
Number of epidermal cell	22	17
No of stomata	8	8
Range of length of spongy cells	0.98-1.02 µm	0.07 µm

presence and absence of medullar bundles can be used to determine the limit of species from the others.

The venation is palmate in *H. sabdariffa* and *A. esculentus*. The primary veins generally radiate from a single point at the base

On the adaxial surface, the epidermal cell is generally polygonal occasionally irregular in *H. sabdariffa* and *A. esculentus*, while the anticinal walls are straight in *H. sabdariffa*; wavy in *A. esculentus*. On the abaxial surface, epidermal cell is irregular and anticinal wall wavy to undulating in *A. esculentus*. Epidermal cell is polygonal and anticinal wall straight in *H. sabdariffa*.

The leaves are amphistomatic but, generally the stomata are more numerous on the adaxial surface than on the abaxial surface. Guard cell area, although quantitative, is of taxonomic interest.

Whilst stomata frequency varies considerably with the age of the leaf, stomata index is highly constant for any given species. Stomata index can therefore be used for both classification and definition purpose in the taxa.

Mucilaginous cells are generally found occurring among the epidermal cells of both adaxial and abaxial surface as distinct cells. They are usually large than the epidermal cells. Trichomes are found in *H. sabdariffa* and *A. esculentus*. The differences observed in the type, arms, occurrence and patterns of distribution of the trichomes could be used to separate the species. The trichomes types observed are the stalked glandular, found occurring in *A. esculentus*.

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