

Anatomical features of the roots and leaves of *Hibiscus rosa sinensis* and *Abelmoschus esculenta*

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Abstract

Roots and leaves anatomical features of *Hibiscus rosa sinensis* and *Abelmoschus esculenta* found in different parts of Imo State Nigeria were studied with the aid of a light microscope. The aim is to ascertain the taxonomic importance of roots and leaf anatomical features in establishing intraspecific relationship among these taxa. Result obtained showed presence of long chain and numerous epidermal calls in *Hibiscus rosa seninsis* while they are short chains small and numerous in *Abelmoschus esculenta*. Similarly the xylem vessels are numerous and circular in *Hibiscus rosa seninsis* while they are few and cuboidal in *Abelmoschus esculenta*. Furthermore in the leaf anatomy of *Hibiscus rosa seninsis* the central cells are large with dark stained calcium oxalate crystal while in *Abelmoschus esculenta* the mesophyll layer is made up of 3 – 4 layers of regular shaped cells. An analysis of the root and leave anatomical features studied showed that these taxa possessed vital characteristic that could be attached to other taxonomic information and used in their description hence the biosystematic implication of this finding have been discussed in the light of the current literature. [Life Science Journal. 2008; 5(1): 68 – 71] (ISSN: 1097 – 8135).

Keywords: anatomy; *Hibiscus rosa sinensis*; *Abelmoschus esculenta*; malvaceae

1 Introduction

The plants *Hibiscus rosa sinensis* and *Abelmoschus esculenta* belong to the Subkingdom *Tracheobionta* (vascular plants), division magnoliopsida and family malvaceae (Tindale, 1979; Greensill, 1976; Stern, 2001).

The family malvaceae is one of the most important families consisting of 82 genera and 1,500 species with *Hibiscus* over 200 species, *sida* 200 species, *ablition* 190 species and *malva* 40 species. The family is world wide in distribution but is mostly represented in the tropical and subtropical region. Members may be herbs, shrubs or trees with mucilage.

Leaves of the family may be simple, alternate, stipulate, petiolate, palmatifid (as in cotton) or multifoliate as in silk cotton. Inflorescence is solitary as in cymes though occasional they are in panicle raceme, regular polypetalous, bisexual, hypogynous, conspicuously mycilaginous,

with a whorl of bracteoles known as epicalyx except in *ablition* and *sida*. The pollen grains are large and spiny; placentation is axile with the style passing through the staminal tube.

The fruit could be capsule in the cotton plant or a schizocarp as in *Abutilon* and *Althaea rosea*, the seed is endospermic (Vidyad and Tripathi, 2002).

Hibiscus rosa sinensis is an evergreen shrub growing up to 2.5 inches high. It is a tender perennial plant and it prefers light (sandy) medium (loamy) and heavy (clay) soils. The plant prefers neutral and basic soils and cannot grow in shade (Burkill, 1995). Similarly *Abelmoschus esculenta* grows best in warm climates with a minimum temperature of 18 °C. The plant is known and called different names in Nigeria such as Okra (Igbo name) Etighi in Efik, Kabewa in Hausa and Ila in Yoruba land (Harpert, 1977). It can grow up to 1.8 m in height depending on the variety as long as the soil is not water logged. The stem is erect and hairy and leaves are also hairy with long leaf stalk (Azah, 1968). *Hibiscus rosa sinensis* and *Abelmoschus esculenta* have been found to possess wide range

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of uses to mankind ranging from economic, medicinal and agronomic. The young leaves *Hibiscus rosa sinensis* are most times used as substitute for spinach in most parts of eastern Nigeria. The fibre is used for coarse fabrics, nets and paper making (Akroroda, 1985). The essential oil in the seed has a strong antispasmodic effect and has been successfully used to ease the pains for intestine pile or kidney colic. The flower extract is used internally in the treatment of excessive and painful menstruation, venereal diseases and to promote hair growth (Burkill, 1995). *Abelmoschus esculenta* on the other hand is also used for variety of purposes, e.g. the stem is used as paper manufacturing, the unripe fruits are used as vegetable while the sauces or soup used in active cooking known as palaver in Sireerleone is got from the leaves and fruits of *Abelmoschus esculenta* (Greenisill, 1976).

Despite the numerous economic, medicinal and agronomic importance of *Hibiscus rosa sinensis* and *Abelmoschus esculenta*, there is absence of a clear taxonomic criteria especially in root and leaf anatomy to delineate these two taxa. The probable lack of anatomical (roots and leaf). Information on these two taxa does not make them irrelevant considering the various roles anatomy has played in taxonomic delieanation of species (Schewell-Copper, 1957). Contributions on the anatomy of plants of various areas includes the works of Nwachukwu and Mbagwu (2006) in eight *Indigofera* species, Mbagwu and Edeoga (2000) in *Vigna* and Okoli (1987) in *Telfairia*. Further contributions of anatomical features in systematics are the works of *Curcubitacaea* and Metcalfe and Chalk (1950) in selected *Dicotyledons*.

This investigation therefore reports the root and leaf anatomical characters in *Hibiscus rosa sinensis* and *Abelmoschus esculenta* as observed with a light microscope. This investigation further assesses the relevance of these anatomical features (root and leaf) in deducing similarities and differences among the taxa studied as well as utilizing the anatomical characters obtained from these two taxa for the systematic grouping and characterization of the two taxa.

2 Materials and Methods

Section of mature and fresh roots and leaves of *Hibiscus rosa sinensis* not longer than 1 × 0.5 cm each of the two taxa collected from the cultural garden of IMSU and Songhi farms Nekede Owerri-West Local Government in Imo State were put into labeled vials and fixed in FAA (1 : 1 : 18). 40% formaldehyde, 70% ethanol (v/v) for at least 72 hours. These were then rinsed in several changes of distilled water and passed through different

alcohol series (30%, 50%, 95% and 100%). The dehydrated materials were infiltrated with wax by passing through different proportions of alcohol and chloroform gradually replaced the alcohol; pure chloroform and wax were added in the bottles. The idea was to gradually infiltrate the tissues with wax which would be hard enough to microtomy. The metal mould, were later removed and the specimens within the wax cube were trimmed and section on Reichert rotary microtome at 20 – 24 cm. The ribbons were placed on clean slides smeared with a film Haupt's albumen and allowed to dry and drops of water added prior to mounting.

Drops of alcian blue were put on the specimen for five minutes, washed off with water and counter stained with safranin for two minutes, then dehydrated in a series of alcohol 50%, 70%, 80%, 90%, xylene/absolute alcohol solution (i.e. 1 : 3 and 1 : 1 v/v) and pure xylene at intervals of a few seconds and mounted in Canada Balsam. Photomicrographs were taken from the slides using a Leitz Wetzlar artholus microscope fitted with a vivitar v-335 camera.

3 Results

The anatomical features of the root and leaf of *Hibiscus rosa sinensis* and *Abelmoschus esculenta* investigated are summarized in Tables 1 and 2 and illustrated in Figures 1a, 1b and 2a, 2b.

The root epidermal layer of the two taxa studied shows that the epidermal cells are in form of short chains (kioned) small and numerous in *Hibiscus rosa sinensis* while they are of long chains big and numerous in *Abel-*

Table 1. Anatomical characters of the roots of the two taxa studied

Characters	<i>Hibiscus rosa sinensis</i>	<i>Abelmoschus esculenta</i>
Epidermal cells	Short chains, small	Long chains, big
Parenchyma cells	Small in size	Big in size
Number of crystals	3	2
Xylem vessels	Numerous, circular in shape	Few, cuboidal in shape
Collenchyma cells	Angular	Present angular
Xylem fibres	Present	Absent
Meta xylem	Many	Few
Pith	Present	Present
Phloem	Present	Present
Stains of oxalate	No stain of oxalate	Dark stain of oxalate

Table 2. Anatomical characters of the leaves of the two taxa studied

Characters	<i>Hibiscus rosa sinensis</i>	<i>Abelmoschus esculenta</i>
Nature of central cells	Large with dark stained contents of Calcium Oxalate	Large without stains of Calcium Oxalate
Mesophyll	4 – 6 layers with irregular shape	3 – 4 layers with regular shapes
Xylem vessels	Very big and numerous	Very small and few
Sclerenchymatous and Parenchymatous	Well developed	Well developed
Crystals	Present	Present
Phloem	Present	Present

moschus esculenta (Figures 1a and 1b). Similarly the cortex tissue show the presence of small sized parenchyma cells in *Hibiscus rosa sinensis* while in *Abelmoschus esculenta* the parenchyma cells are bigger in size. Both taxa show presence of angular collenchyma. The xylem vessels are numerous circular in shape and are radially grouped in *Hibiscus rosa sinensis* while they are few and cuboidal in shape in *Abelmoschus esculenta*. The root anatomy of both taxa studied shows presence of calcium oxalate crystal in the cortex region of the two taxa though the crystal are not stained in *Hibiscus rosa sinensis* while they are dark stained in *Abelmoschus esculenta* (Figures 1a and 1b).

Furthermore the leaf anatomy (Figures 2a and 2b) of both taxa studied show variations in *Hibiscus rosa sinensis*, the mesophyll which is confined to the center of the

lamina is composed of 4 – 6 epidermal layers of cells and are irregular in shape while in *Abelmoschus esculenta* the mesophyll layer though confined to the centre of the lamina is composed of 3 – 4 epidermal layers of cells and are regular in shape (Figures 2a and 2b). There are also well developed sclerenchymatous and parenchymatous cells and calcium oxalate crystal in the leaves of the two taxa studied.

4 Discussion

The *Hibiscus rosa sinensis* and *Abelmoschus* taxa investigated possesses features in their root and leaf anatomy that could be vital in their description and in their taxonomy. The variation in the epidermal cells: short chains, small and numerous in *Hibiscus rosa esculentus* and long chains, big and numerous in *Abelmoschus* could be used to separate these two taxa. The mesophyll layer which is irregular comprised of 4 – 6 layers in *Hibiscus rosa sinensis* and regular with 3 – 4 layer in *Abelmoschus esculenta* could further strengthen the difference among the two taxa (Figures 1a, 1b, 2a and 2b) This observation is in line with the work of Okoli (1987), Edeoga and Okoli (1997; 2001) who used both the root and leaf anatomical features in the family *Cucurbitaceae* and *Dioscoraceae* in establishing relationship among taxa. The reported small sized parenchyma cells of root anatomy in *Hibiscus rosa sinensis* and bigger sized cell in *Abelmoschus esculenta* is not strange since Nwachukwu (2005) had reported that cells of parenchyma vary greatly in size, shape and could also be elongated or lobed. The parenchyma cells are metabolically active and are modified for photosynthetic

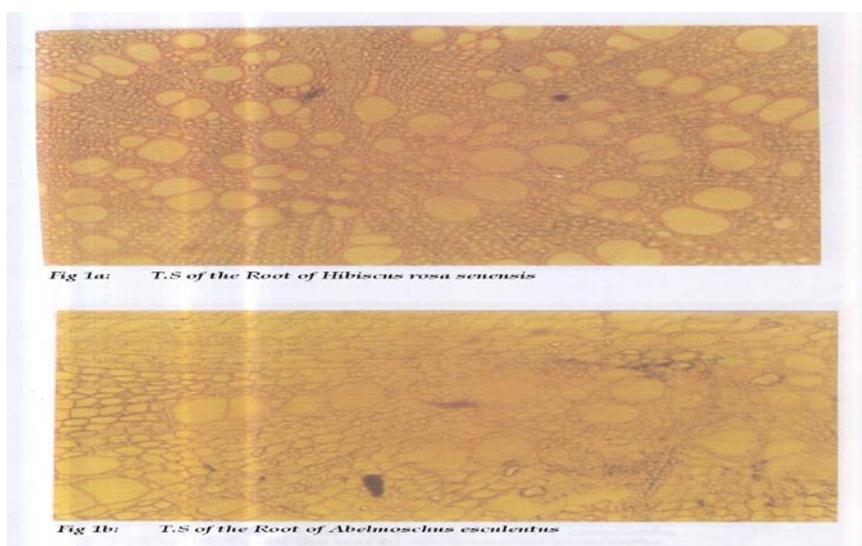


Figure 1. a: The root of *Hibiscus rosa sinensis*; b: The root of *Abelmoschus esculenta*.

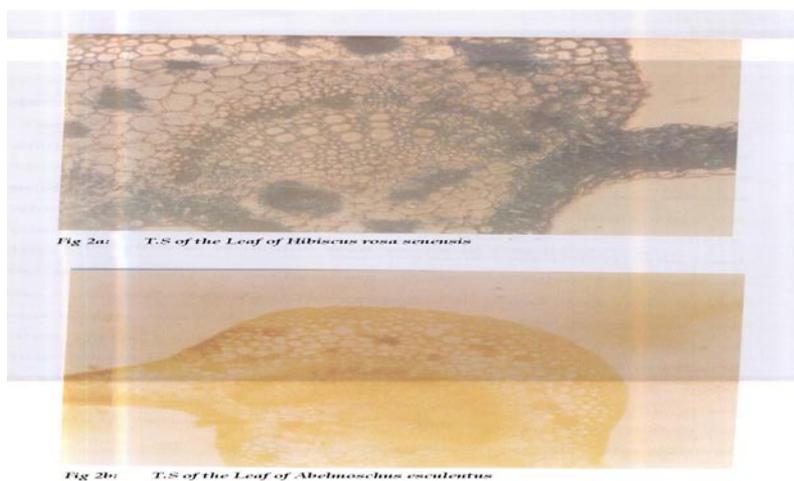


Figure 2. a: The leaf of *Hibiscus rosa sinensis*; b: The leaf of *Abelmoschus esculenta*.

and secretory function. The nature of xylem vessels in both taxa, are very big, numerous and circular in shape in *Hibiscus rosa sinensis* further separates it from the very small few and ovoid in shape xylem cells in *Abelmoschus esculenta*. This observation is equally significant since no previous work has been reported on the root and leaf of the two taxa studied. Hence this variation in vascular bundle types among the taxa could be used to distinguish them (Figures 1a and 1b) similarly variations in other features of the roots and leaves of the plants studied. Table 1 and 2 could further be used to separate this taxa, while the presence of protoxylem, metaxylem, crystals, angular collenchyma cells in both taxa studied are typical of most dicot plants. This study is therefore based on the principles that root and leaf anatomy has played a major role in the identification, characterization and delimitation of plants. Hence the need to incorporate information from root and leaf anatomy with data derived from other botanical disciplines remains vital when formulating conclusions on the systematic of the taxa investigated.

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