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Research paper

Comparative morph-anatomical studies on selected Sudanese medicinal plants: part iv. abutilon figarianum and abutilon pannosum leaves

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Abstract

In this study, macro and micro morphology of the leaves of Abutilon figarianum and Abutilon pannosum(Malvaceae) were compared to assist as a relevant source of information and contribute towards the standards to dispose the quality and identity of these plants to avoid adulterations. Laminar size, shape, marginal type, leaf length, width, petiole length, leaf base angle and leaf apex angle were observed and measured. The relationships were illustrated by differences of radar shape. Transverse sections of the leaves were done using wax method. Three regions from each leaf were sectioned apex, middle and base. The epidermises formed of one layer of small polygonal cells covered by mucilage, large numbers of epidermal hairs appeared. The two leaves are dorsiventral. The vascular bundles arch shaped surrounded by collenchymas and ground parenchyma. Xylem consists of radial rows of cells. The phloem is found beneath. The structures at the apex, middle and bases of the leaves are similar, trichomes are denser in the middle region followed by the upper and lastly the lower region. Calcium oxalate druses are appeared in some parenchyma cells of the mid rib region, and these are of large numbers in the basal region.

Keywords: *Abutilon Figarianum; Abutilon Pannosum; Malvaceae; Macromorphology; Micromorphology.*

1. Introduction

1.1. Morphological and anatomical characters of leaf

Leaves are important organs for photosynthesis and play an important role in survival and growth of a plant. Many previous studies have revealed that variations in leaf traits are the result of adaptations to growth habitats [1]. Quantification and visualization of morphological variations of leaves and other structures are essential for an overview of evolutionary and ecological processes of phenotypic diversification and are the fundamental basis from which to develop more complex studies to achieve new perspectives on the interaction of phenotype, genotype and environment [2].

Leaf traits are globally repeated despite large variations in the values of the traits across individual species with very diverse phylogenetic, biogeographical and environmental affinities. As well, leaf traits can thus provide a link between various environmental factors and leaf functions, and they have been widely used in functional-structural plant models [3].

Morphological and anatomic characters of leaf are used as taxonomic markers to assist in the correct identification of the plant species. Some particular groups of plants or taxa seem to be characterized by specific type of cross-sectional anatomy, epidermal features, which are the epidermis, stomata, gland and trichomes [4]. Several methods of describing the leaf shape have been proposed in several species to establish a typology of leaves and to study leaf traits ([5], [6], [7].and [8]).Abutilon Abutilon species are medicinal plants widely used in herbal medicine, but they are subjected to rare morphological and anatomical studies. In the literature, there are no anatomical studies for A.figarianum or A.pannosum. from the genus Abutilon indicumwas studied bySikat (2016)[8] and the mostly important anatomical characters were compared with selected species from the family Malvaceae.

1.2. The main objectives of the present investigation are

1) To identify the morphological and anatomical characters of the leaves of Abutilon figarianum and Abutilon pannosum (Malvaceae) for the purpose of the proper identification of the leaves and to avoid adulterations. The literature survey revealed that no anatomical studies were done for them before.
2) To interpret the numerical data of biometric measurements of some leaf traits (such as leaf length, leaf width, petiole length, leaf apex angle and leaf base angle).

1.3. Abutilon figarianum Webb. (= A. graveolens Br .& Mass., non Wight & Arn.)

Shrubs, 1-2 m high, with a zigzag-branched stem. Leaves up to 16 cm long and 8 cm broad, with the petiole as long as the blade, ovate-cordate, acute at the apex, stellate hairy, crenate-margined. Flowers axillary, solitary or paired. Carpels of the fruit 3-seeded. bark, root, leaves, flowers and seeds are all used to treat pile complaints[10].

1.4. Abutilon pannosum (Forst. F.) Schlecht. (=A. glaucum Br.& Mass., non Sweet, A. muticum (del.)

Herbs or shrub, yellow-green, dense velvety-canescent. Leaves ovate – cordate, acute, dentate. Flowers large, usually in pairs, axillary on long pedicels, yellow with purple centre. Carpels 25-30, each 2-3 ovuled, rounded at the apex ; epicalyx absent. Fruit schizocarpic at maturity.The leaves are used for pile complaints [10]. Used by Bedouins in folk medicine for the treatment of dysentery and gonorrhea [11].

2. Materials and methods

2.1. Plant materials

The plant materials used for the present study, Abutilon figarianumand A. pannosum(Malvaceae) were collected from Khartoum State (Omdurman Islamic University) in October 2014, they were taxonomically identified and herbarium specimens were deposited in Herbarium of Botany Department Omdurman Islamic University.

2.2. Methods

2.2.1. Macromorphological study

The studied plant leaves characters: laminar size, laminar shape, marginal type, leaf length, leaf width, petiole length, leaf base angle and leaf apex angle were observed and measured. Ten read were taken for each parameter, and the mean value was calculated.

2.2.2. Micromorphological study

Transverse Sections of the leaves:
Three regions from each leaf (upper, middle and base) were transversely sectioned using wax method technique [12], the prepared slides were dried, and they were examined under the microscope and photographed. Photomicrographs of the transverse sections were taken from the slide using camera fitted with a microscope.

3. Results and discussion

3.1. Macromorphology

Abutilon figarianum leaf has cordate shape, acute apex and lobate base measuring about 6.95cm long and 6.98cm width and 65^0 base angle, 53.9^0 apex angle. The margin crenate and petiole base is swollen, vein category actinodromous and laminar symmetrical(Plate1).Abutilon Abutilon pannosum leaf has cordate shape, acuminate apex and lobate base, measuring about 8.34cm long,7.38cm width and 68^0base angle, 67^0 apex angle. The margin crenate and petiole base is swollen, Vein category actin odromous, laminar symmetrical. (Plate 2).

Plate 1: Abutilon figarianum.

Plate 2: Abutilon pannosum.

The relationship between five leaf traits: leaf length, leaf width, petiole length, leaf base angle and leaf apex angle were illustrated by differences of radar shape (Figures 1).The radar shape showed that the leaves of the two species are similar in the general structure but differ in their size.

Table 1: Leaf Macro Morphological Characters of A. figarianumand A. pannosum

Character	Abutilon figarianum	Abutilon pannosum
leaf shape	Cordate	Cordate
Leaf apex	Acute	Acuminate
Leaf base	Lobate	lobate
margin	Crenate	crenate
Leaf length (cm)	6.95	8.34
Leaf width (cm)	6.98	7.38
Petiole length (cm)	3.7	4.91
Leaf base angle	65	68.2
Leaf apex angle	35.9	67.9

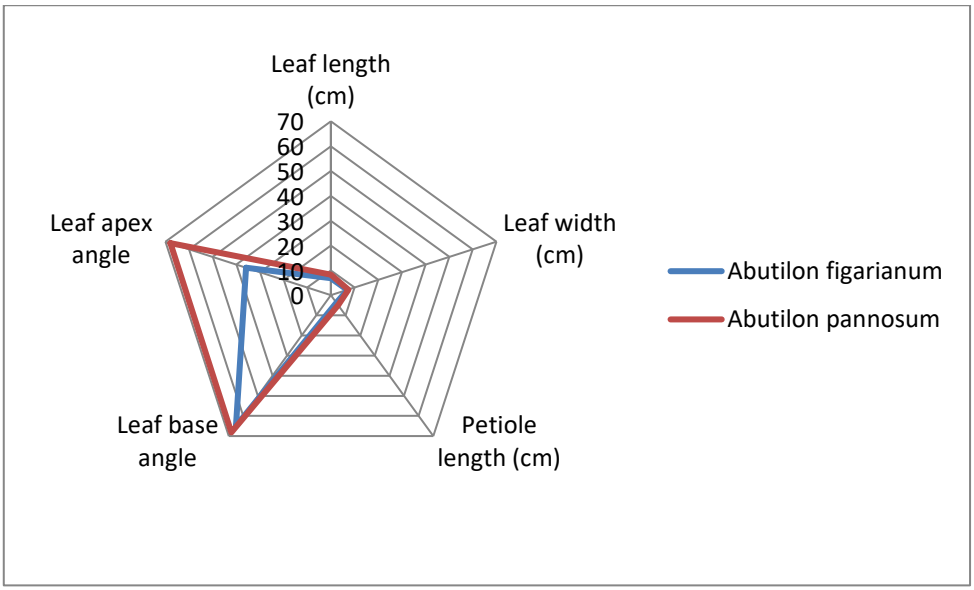

Fig. 1: Radar Shape of Two Leaf Characters in Abutilon Species.

3.2. Micromorphology

The epidermal layers are thin with small squares or rectangular cells. Some of the epidermal cells are dilated and contain dense mucilage. There are many stellate trichromes project from the epidermal cells, Saikat, 2016 studied A.indicum and reported the types of trichromes as stellate, unicellular with a pointed tips. The number of trichomes are more on the lower epidermis. The mesophyll tissue is differentiated into adaxial palisade zone and abaxial spongy mesophyll tissue (dorsiventral leaves). The palisade mesophyll consists of narrow, cylindrical cells, which are in two rows. The spongy parenchyma consists of about 5 layers of loosely arranged cells. The lamina becomes slightly thicker in the region of the lateral vein. The vascular bundles of the lateral veins consist of phloem, xylem and parenchymatous bundle sheath.

The midrib region is very prominent projecting on both the adaxial and abaxial sides. Dense trichromes are seen on all sides of the midrib. The ground tissue consists of an outer zone of 4 - 5 layers of collenchyma's cells of abaxial midrib. The remaining part of the ground tissue is formed of ground parenchymatous cells. The vascular bundle, large and arch shaped. Xylem consists of several radial rows of cells. The phloem is found in the xylem, and it occupies large area compared to the phloem of many dicotyledonous leaves. It was observed that the structures of the leaves in the apex, middle and the bases of the leaf are similar. The trichromes are much denser in the section of the middle region (fig 3 and 4) followed by the upper and lastly the lower region. In the lower region two mid regions appear in Abutilon figarianum (fig. 3c) because of the palmately venation of the leaf in the base of the leaf (fig. 1). Many calcium oxalate druses are appeared in some parenchyma cells of the mid rib region, and these are many large numbers in the section of the basal region (fig. 3 and 4 c).

4. Conclusion

Macro- and micromorphological studies of Abutilon figarianum and A. pannosum(Malvaceae) showed that the two species are structurally similar. However, slight differences exist between the two species with respect to leaf size, types and abundance of trichomes. Further morphological and anatomical studies for the all species of the genus Abutilon should conducted to avoid adulteration because they are important medicinal herbs and there are rare studies done for them.

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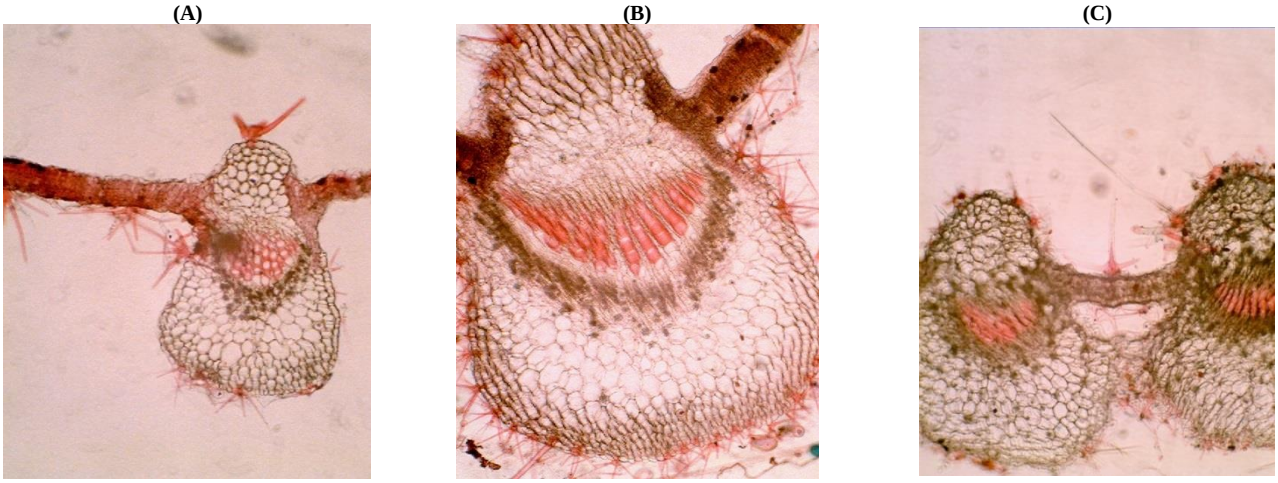

Plate. 3: S of Abutilon figarianumleaf, (A) Tip (X40), (B) Middle (X40), (C) Base.(X100).

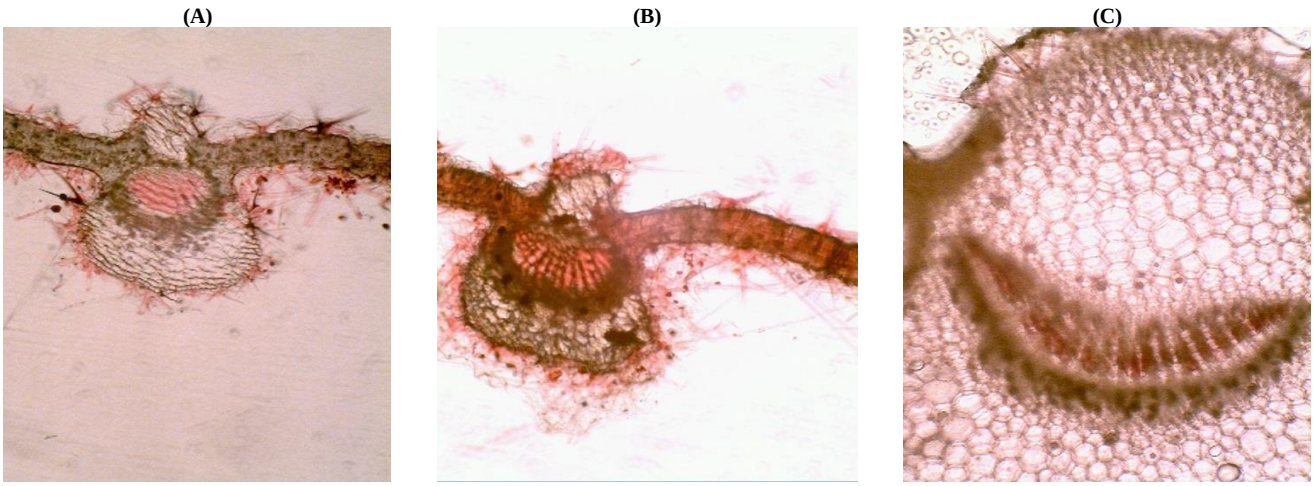

Plate. 4: T.S of Abutilon pannosum Leaf, (A) Tip (X40), (B) Middle (X40), (C) Base. (X100).

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