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Anatomical Study of Some Monocot Leaves

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Abstract:

In the present investigation of leaves of *Musa paradisiaca* L., and *Carica papaya* L., we found a clear pronouncement between them instead they are monocots. In leaves epidermis present both side upper and below adaxial epidermis (upper) and abaxial epidermis (below). Only spongy mesophyll cell are present in the leaves. A parenchymatous bundle sheath is present around the vascular bundle. These anatomical differences helps us to understand the structural adaptations of the monocot plant leaves with respect to diverse environmental conditions. We hope this study will be a key player for further investigations on these plants for medicinal and nutraceutical properties.

Keywords: vascular bundle (xylem and phloem), epidermis, aerenchymatous, *Carica papaya*, *Musa paradisiaca*.

Introduction

Carica papaya L.: *Carica papaya* is generally known for its fruit and medicinal value. They're substantially grown in tropical and tropical tableland region. Among the developing countries India, Mexico, Nigeria, and Indonesia are the largest papaya growing countries. Enormous, simple, lobed leaves combine with a single box and succulent fruit to make this a desirable factory for numerous geographies [figure 1 & 2]. Flowers are produced along the box from the splint axil. Flowers on manly shops are more conspicuous and grabby; womanish flowers are borne close to the stem and generally go unnoticed. Fruit are produced in the splint axil close to the box. The box becomes thickened, sometimes growing to 12 elevation in periphery. Although aged plants can reach 20 bases altitudinous or more, utmost reach only 15 bases before dying. Plants are short lived but grow snappily [6].

Taxonomic positon of *Carica papaya* L.

Kingdom	-	Plantae
Division	-	Angiosperms
Class	-	Monocotyledon.
Order	-	Brassicales
Family	-	Caricaceae
Genus	-	<i>Carica</i>
Species	-	<i>papaya</i>



Figure 1. Mature *C. papaya*.



Figure 2. Fruits of *C. papaya*.

Musa paradisiaca L.: It is one of the most popular and commonly Indian plant with multiple pharmacological potential. *Musa paradisiaca* (Banana) is perennial tree like herb cultivated in many region around the world. Banana eaten as fruit or a vegetable is one of the most important crop in several countries due to medicinal and traditional value. Banana leaf is used for serve food which is traditional method of serving like rice and dishes mainly in south India and several other places [1]. Banana is one of the world's most imperative fruit crops [1], reaching in the year of 2015 a global annual production of circa 118 million tons. Parts of banana plant are commonly used in traditional medicine in many countries [2]. Many investigations have been conducted to explore the biological effects of *Musa* spp., including antimicrobial [3], antiulcerogenic, galactagogue, anti-inflammatory, anti-hyperglycemic and antidiabetic effects [4], α -glucosidase and α -amylase inhibitory effects and antioxidant effect. Moreover, some compounds that are known to have biological effects already been identified, including anthocyanins, phenolic acids, flavanones, and terpenoids [5].

Taxonomic positon of *Musa paradisiaca* L.:

Kingdom	-	Plantae
Division	-	Angiosperms
Class	-	Monocotyledon
Order	-	Zingiberales
Family	-	Musaceae
Genus	-	<i>Musa</i>
Species	-	<i>paradisiaca</i>



Figure 3. *M. paradisiaca* with fruits and flowers.

Medicinal and Nutraceutical Properties

Carica papaya L.:

Carica papaya is commonly known for its nutritional and medicinal value worldwide. It is a rich source of minerals and vitamins like vitamin C and vitamin B etc. Its mineral composition contain of potassium (k) and magnesium (mg) with calcium, iron, manganese, phosphate, zinc etc. It possess digestive enzymes papain [6] that helps to overcome allergies and sport injuries. The leaf of *C. papaya* is beneficial for dengue patient as it is believed to boost platelets counts.

Musa paradisiaca L.:

Musa paradisiaca leaf play a great role in medical industry. It contains vital substance such as proteins, polyphenol and hemicellulose. Polyphenol oxidase which is an enzyme to treat Parkinson disease. It is a disorder of nervous system. Banana leaf has also peculiar anti-bacterial property that help in protecting the food from being ruined by germs or bacteria [3, 4]. Banana possess a protein, lectin. Lectin help to increase the count of T cell in the body. T-cell are the part of immune cell that help to identify and mark the pathogen in the body. Leaf are also useful to treat several diseases like ulcers as leaf contain flavonoid and many organic and inorganic compound that may provide protective effect against gastric mucosal injury.

Materials and Methods

The specimens of *M. paradisiaca* and *C. papaya* collected from George Town, District Prayagraj, Uttar Pradesh India in October 2022 [7]. All specimens are identified and compared with voucher specimen. They were properly cleaned and cut the transverse sections of specimen using dissection blade and stained using safranin and fast green then add some drop of glycerol. Finally, prepare a slide and set down cover slip over

the stained sample without bubbles between cover slip and slide. By adjusting all these set up we absorbed under compound microscope.

Result and Discussion

C. papaya:

Epidermis is outermost layer cover both side upper and below covered with cuticle. The spongy mesophyll are compactly packed with each other [Figure 4B]. In papaya leaf the aerenchymatous space are present in center [Figure 4C] of the given structure where as in banana many aerenchyma cells are present vascular bundle (xylem and phloem) [Figure 4A] distributed in mesophyll cell. Phloem are widely distributed around the xylem in papaya leaf.

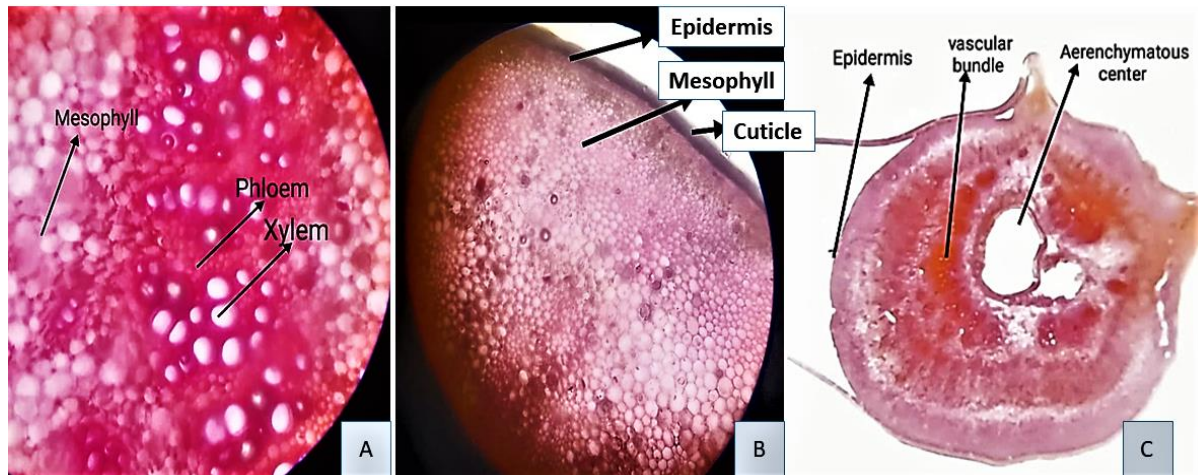


Figure 4. *C. papaya*. (A) Vascular Bundle under Compound Microscope. (B) Mesophyll, Epidermis and Cuticle under compound microscope. (C) Whole section under simple microscope.

Histologically, a leaf is composed of three types of tissue systems: epidermis, mesophyll and vascular tissue [9]. Leaf development, structure and cell number may be modified by many plant and environmental factors. The main factors include: plant water status which affects CO_2 solubility in the liquid phase; turgidity of cells and leaf expansion [6] photosynthetic photon flux density (PPFD) which influences the size of the mesophyll layers, which in turn affect chlorophyll content [6]; and leaf temperature which affects cell division and enlargement.

***M. paradisiaca*:** In the epidermal tissue system epidermis is outermost layer which cover with waxy thick layer known as cuticle [Figure 5A] epidermis cover form both side below (abaxial epidermis) and above (adaxial epidermis) side. Ground tissue system contain spongy mesophyll [Figure 4A] cell. Mesophyll cells contain chloroplast which play a great role in the photosynthesis. In *M. paradisiaca* large aerenchymatous space are present which are modification of parenchyma. Aerenchyma are spongy tissue create space and provide air channels to exchange of gas between one region to another. Vascular bundle (xylem and phloem) [Figure 5B & C] disperse in mesophyll with bundle sheath which are made from one or more parenchymatous cell. *Musa paradisiaca* presents amphistomatic bracts and tetracytic stomata. From the surface view, the bracts show straight and thin anticlinal walls on both adaxial and abaxial epidermises [Figure 5a]. The presence of tetracytic stomata on both faces is characteristic in several cultivars of *Musa* spp. [9]. The mesophyll is homogeneous, formed by smaller cells near the epidermal layers and larger cells in the middle region, where aeration chambers with branched parenchyma can be seen [Figure 5 A, B & C]. Small collateral vascular bundles are immersed in the mesophyll [Figure 5B]. These features were reported for *M. acuminata* [10]. Fibers are found not only adjoined to the phloem but also spread in the mesophyll.

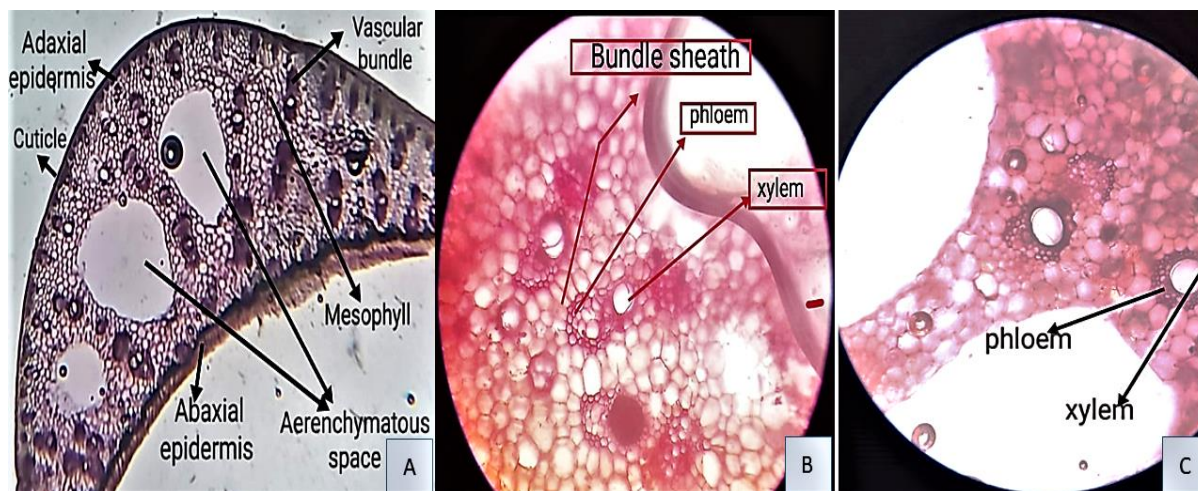


Figure 5. *M. paradisiaca* (A) Whole section under simple microscope. (B) Vascular bundle under compound microscope (10X x 10X). (C) Xylem, Phloem and Aerenchyma under compound microscope.

Conclusion:

In this comparative anatomical study we found that internal organisation of leaves of aforementioned plants have variability. With these structure we can easily identify their evolutionary relationship. These structures helps us to figure out that they are adopted according the need and different environmental conditions. Both plants are monocots still shows difference like arrangement of vascular bundle. In *C. papaya* they present densely and closer to each other but in *M. paradisiaca* they are distributed distantly. In papaya only central aerenchymatous space is present but in banana many aerenchymatous space are seen. *C. papaya* has great medical values as it is used in local remedies and in Ayurvedic system whereas *M. paradisiaca* has traditional as well as medicinal purposes. Future studies are also required in order to understand these structure and their relationship with special reference to medicinal and nutraceutical purposes.

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