

Morphohistological Studies of Seedlings of *Annona squamosa* Lam.

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Abstract: *Annona squamosa* Lam. is also known as Sugar Apple or Sitaphal plant. It is a small, semi deciduous, which is rich in medicinally and industrially important. Bio-active components present all its parts it belongs to the family Annonaceae. This plant should only be used under professional guidance. The leaves as well as the bark and the fruit and the seeds are used in herbal preparations. This study includes the anatomy of various plants of sapling viz., root, epicotyl, hypocotyl, cotyledons, & leaves. The dermal tissues of leaves also included in the present work.

Keywords- Seed germination, Sapling, *Annona squamosa* Lam., Medicinal plant, Annonaceae



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INTRODUCTION

Seedling is a young plant produced from seed, different to the artificially propagated plant [1]. The anatomical studies of the seedlings appeared for the first time in 1870. The leading authors in this field of study were Arber, (1925), Boyd Lucy (1932), Compton (1912) and Gatin (1906) [2-5]. When the cotyledons are shed their function will be taken up by the organs which are not present in the embryo, but developed or formed at later stage. Stage after shedding of the cotyledons may not be called a seedling stage, it is better termed 'Juvenile stage' and their functions are taken up by the newly developed leaves. The leaves of a seedling may differ from the adult plant [6, 7]. Considerable work has been done on the seedlings of herbs, it helps in discriminating weeds from the cultivated plants. Differences in seedling morphology have sometimes been a basis for re-arrangement of classification. It has been assumed, sometimes tacitly, that in a natural genus consequently the seedlings must be similar [8].

In the second part of the nineteenth century, the morphological variation of seedlings was further investigated, by different workers dealing with the morphological description of one or a few seedlings [9-13]. The study of seedlings has a considerable scientific value. They provide a data about the little known stage in the life cycle of a plant. This offers many characters useful for taxonomic classification and for morphological and evolutionary considerations. Identification of seedlings is of great importance to plant breeders. The seedling knowledge is also significant in ecology. Although the organs and characters of seedlings are limited in number, their diversity is so great that specific combination of morphological characteristics may serve the purpose of identification of seedlings [14].

The present research deals with the anatomical characters of various part of sapling of *Annona viz.*, root, hypocotyl, epicotyl, leaves and cotyledons to determine their importance in taxonomic identification. *Annona squamosa* is much branched shrub or small tree 3 meters (9.8 ft) to 8 meters (26 ft.) tall [15]. Leaves are thin and 5-6 centimeters (2.4 in) wide, Pale green on both surfaces and mostly hairless with slight hairs on the underside when young. Leaves are rounded at the base and pointed at the tip. The Roots, leaves, fruits, seeds and bark of the plant has multiple uses and can be easily

grown in dry climates as well. The fruits are very high in calorific value and are a rich source of minerals and Vitamins. They are used by athletes for their high energy content. The seeds are powerful insecticides and powdered seeds are used for removing head lice. It is also used as an effective pesticide in agriculture and horticulture.

The leaves are shown to have anti-diabetic properties. They are also used as anti-depressants, in epilepsy and in spinal cord disorders. Fruits are sweet, haematinic (A medicine which increases the haemoglobin content of the red cells in the blood), cooling, act as a sedative, stimulant and function as expectorant and tonic. Seeds are abortifacient and insecticidal properties. Roots are powerful purgatives and are also used in dysentery. The Sitaphal pesticide is inexpensive, environment-friendly and highly effective in containing a variety of pests on a number of crops. Its fruit is used to make a hair tonic in some parts of India.

MATERIALS AND METHODS:

Seeds of *Annona squamosa* Lam. were obtained from the Dhanvantari Udhyan, Department of Biosciences, Veer Narmad South Gujrat University, Surat (Gujrat). Seeds were sown separately in four wooden boxes containing garden soil and organic manure, Seedlings were collected and preserved in F.A.A. (formalin, Acetic Acid and alcohol) for the anatomical studies. Sections were cut mostly from the fresh materials, but the preserved materials were also used frequently. Fresh materials were used for the stomatal and epidermal tissues. Sections of root, hypocotyls, epicotyls, cotyledon, lamina and peel of leaves were stained in safranin and mounted in glycerine [16].

RESULTS

Germination and Morphology of Seedling

Germination occurs in 8-10 weeks. Cotyledons are sessile or shortly petiolate, elliptic, acute. First leaves are opposite. At times, first two pairs are opposite and subsequent leaves are alternate. Germination type is Macaranga type. Hypocotyl and epicotyl are much elongated (Fig. I).

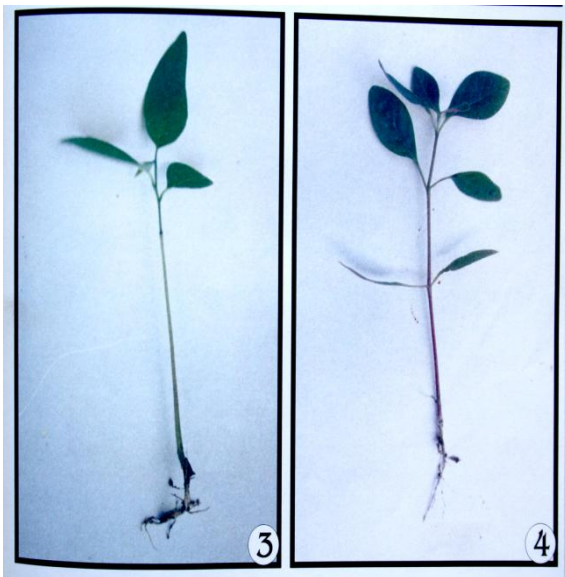


Fig I: Seedlings of *Annonasquamosa* Lam.

Anatomy of Seedling

Root: Circular in T.S. having brown periderm. Cortex is 12-13 layers. The size of the cortical cells increase towards the endodermis. The cortical cells are packed with bacterial colonies. The cambium ring is seen outside the xylem ring. Pith is large and circular. Bacterial colonies are extremely scarce in the pith region (Fig. II-1).

Hypocotyl: Circular in T.S, Epidermis single layered with thick cuticle. Cortex 12-17 layered. The hypodermal layers are chlorophyllous. Endodermis is composed a sclerenchymatous 3-8 layered patches of sclerenchyma arranged in a ring below the cortex. This layer is interrupted by the presence of 2-3 layers of parenchyma. The xylem cylinder is made up of 10-12 xylem patches, pith is large (Fig. II-2).

Epicotyl: Circular in T.S. (fig. II-3 and II-4.), exhibit the anatomy of young epicotyl. Epidermis single layered, cuticle inconspicuous, cortex 6-8 layered having distinctive 3-5 layered chlorophyllous cortex towards the periphery. Endodermis is composed of alternating patches of sclerenchyma and parenchyma. It is followed by patches of phloem situated under each patch of sclerenchyma (fig. B4). Cambium layer is light coloured seen in the form of interrupted ring between phloem and xylem cylinder. Xylem cylinder comprises 10-12 patches of xylem. Pith is large.

Figure II-4 shows the anatomical features of slightly older epicotyle. Secondary growth is set in. Periderm is of 3-5 layers of squarish or trapezoidal cells. Chlorenchyma are scattered in cortex. Cortex is reduced

to 4-6 layers with decreased inter cellular spaces. The bacterial colonies remain scattered in cortical cells. This sclerenchymatous endodermis exhibit isolation of sclerenchyma patches. The xylem cylinder of secondary xylem appears more or less complete with primary xylem patches towards the pith. Pith cells are also showing the presence of bacterial colonies.

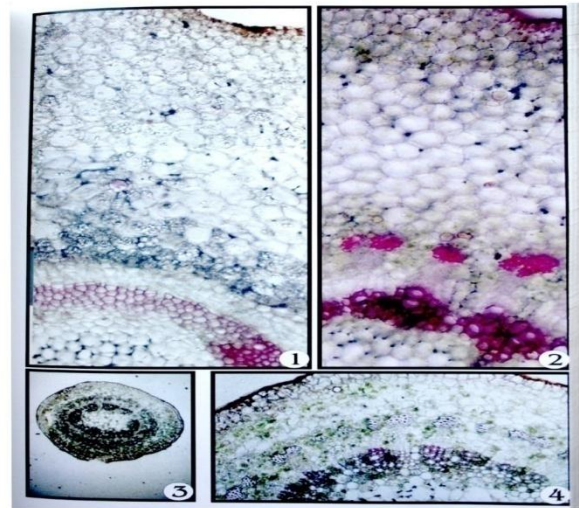


Fig.II:1 -T.S. of Root; 2 -T.S. of Hypocotyl; 3 & 4 -T. S, of Epicotyl.

Cotyledons: The internal structure exhibit isobilateral arrangement. The epidermis is unilayered made up of squarish cells with thin cuticle. Cells of lower epidermis are smaller as compared to upper epidermis. Midrib mesophyll is composed of a trapezoidal patch of xylem with phloem towards abaxial side. The bundle sheath is scanty, 2-3 layered on the adaxial side. Rest of the mesophyll is parenchymatous. Mesophyll of the lamina is made up of spongy chlorenchyma (Fig. III-1).

Leaf Lamina: Epidermis unilayered on both the sides, made up of slightly elongated squarish or oblong cells on adaxial side and pyramidal cells on the abaxial side. The midrib mesophyll is only two layered mildly chlorophyllous on both the sides. The midrib vascular bundle occupies most of the space. Vascular-bundles are arranged in c-shaped surrounded by 2-4 layered sclerenchyma. The laminar mesophyll is of 5-6 layered heavily chlorophyllous, spongy cells (Fig. III-2). Upper epidermis is having very scarce stomata. The stomata are paracytic with elongated guard-cells (Fig. III-4). Lower epidermis is composed of isodiametric cells with wavy cell walls. Very surprisingly, stomata is absent in lower epidermis (Fig. III-5).

Midrib: The midrib mesophyll is only two layered mildly chlorophyllous on both the sides. The midrib vascular bundle occupies most of the space. Vascular bundles are arranged in c-shaped surrounded by 2-4 layered sclerenchyma.

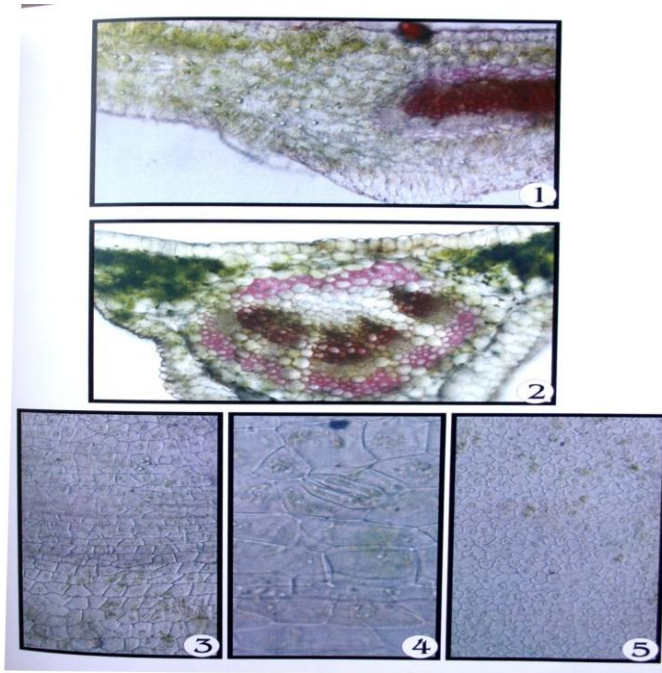


Fig.III: 1-T.S. of Cotyledon; 2-T.S. of Leaf; 3 & 4 -T.S. of Epidermal peel.

DISCUSSION:

Melville (1953) showed the importance of leaf spectrum. He showed that not only the morphology of mature plants but the full range of variations should be studied and recorded [17]. This should also include leaves of juvenile stage; the seedlings. This will provide added numbers of characters for deriving natural classification.

The mature plants, depending upon their natural geographical origin may show specific characters as xerophyte or halophyte. However almost all the seeds germinate in predominately mesophytic condition, later on the specific character may appear. The delayed expression of genes decide the adult characteristic of a taxon but the juvenile stage in the ontogeny exhibit the preceding ancestral character.

In root, Bacterial colonies are extremely scarce in the pith region. The xylem cylinder is made up of 10-12 xylem patches in hypocotyl. Epidermis single layered, cuticle inconspicuous, cortex 6-8 layered having distinctive 3-5 layered chlorophyllous cortex towards the periphery in epicotyl. Midrib mesophyll is composed of a trapezoidal

patch of xylem with phloem towards abaxial side. The bundle sheath is scanty, 2-3 layered on the adaxial side in cotyledons. The stomata are paracytic with elongated guard-cells (Fig. III-4). Lower epidermis is composed of isodiametric cells with wavy cell walls. Very surprisingly, stomata is absent in lower epidermis.

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