

# Comparative Leaf Anatomy of Sensitive Plants found in Akola District

SP. Rothe and AU. Bathe

P. G. Department of Botany, Shri Shivaji College of Arts, Commerce and Science, Akola, 444005, Maharashtra, India.

## ABSTRACT

Plant anatomy explains some of the facts which the structure of the plant part has and that can be co-related to survival in the kinds of environment in which the plants lives. Now it is known fact that a plant is a product of its genes and those differences in plant structure can ultimately be traced to the genes present and how they are regulated. If we consider that all the plants products of nature selection and that interpretation of plant anatomy can only make sense in light of evolution of an organism and evolutionary line. The plants selected for this study are *Biophytum sensitivum*, *Mimosa pudica* and *Neptunia Triquetra*. All these plants characterized by Seismonastic movement also known as Sensitive plants. Internally leaf is characterized by epidermis, mesophyll cells and vascular bundle, a typical dorsiventral type of leaf and also petiole characters of these plants.

**Keywords:** Anatomy, sensitive plants.

## INTRODUCTION

For the comparative anatomy of sensitive plants like *Biophytum sensitivum*, *Mimosa pudica* and *Neptunia Triquetra* are selected Seismonastic movement define as touching the leaves or shaking the plant or slight warming of the leaves or chemical or electrical stimuli or subjecting the plant to a lack of water, will cause the leaflet to fold together and the whole leaf to drop down words temporarily. The mechanism of upward movement of pinnules and downward bending of the entire leaf at the base is now considered as due to the activity of the motor cells found in pulvinous.

The member *Biophytum* includes in the family Oxaliaceae, *Mimosa* and *Neptunia* to family Mimosaceae. The primary objective of this anatomical study is to gain understanding of the internal structure of Seismonastic plants. Understanding the hierarchy of plant structure by learning the basic features of plant cells, tissues and organs and to relate the structure of particular types of cells and tissues to their function, Comparing structural differences among different taxa of vascular plants and to interpret the basic pattern of plant growth from different kinds of meristem in the given plants, Plant anatomy contribute significantly, Not only this, it also helps to understand the relationships between primary growth and secondary growth which enables to protect the eco-climatic features of the native of the plant.

Plant anatomy describes some of the facts which the structure of plant part has and that can be co-related to survival in the kind of environment in which the plant lives. The plants selected for this study are *Biophytum*, *Mimosa* and *Neptunia*. All these plants characterized by Seismonastic movement also known as sensitive plants.

## Traditional uses

### 1) *Biophytum sensitivum* (L.) DC

The *biophytum sensitivum* is used as traditional folk medicine to treat numerous diseases. *Biophytum* is used as a tonic and stimulant. It is use for chest complaints, convulsions, cramps and inflammatory tumors. Its ash is mixed with lime juice and given for stomach ache. Its leaves are styptic; decoction of leaves is given for diabetes, asthma and phthisis. Brushed leaves applied to contusions. Plant decoction used for diabetes. Infusion of leaves use as expectorant. It is used as antiasthmatic also used for scorpion bites. It is used for tuberculosis. It is used for asthma and phthisis. Folk medicine used as diabetes.

### 2) *Mimosa pudica* Linn

The *Mimosa pudica* used in treatment of leprosy, dysentery, vaginal and uterine complaints, inflammation, burning sensation, asthma, leucoderma and fatigue and blood disease. It is mainly use in herbal preparation

for gynecological disorders. Brushed leaves applied to contusions. Plant decoction used for diabetes. Infusion of leaves used as expectorant. As *chhuimui* leave used for increasing the sexual potency in men in Kurukshetra District (Haryana), India. As a *Laajavanti*, its leaves are used for gravel and other kidney diseases also for piles and pistula In the Sugar District Madhya Pradesh, India. As *Punyo-sisa*, leaves are used in Pillows to induce, sleep in children and the elderly in Ecuder. The warm leaf paste is applied around furuncle, abscess and boils to burst and release of pus. The leaf paste is applied on the burst boils and itches for quick healing. The leaf paste is applied on forehead to get relief from headache and migraine. The leaf paste with honey is prescribed twice a day in empty stomach for 3-4 days for stomach and intestinal worms. Whole plant useful in treatment of diabetes, mixture of leaf powder with *gymnema Sylvestre* reduces blood glucose.

### 3) *Neptunia triquetra* Benth

Fresh leaf juice is taken as refrigerant. Culinary: - This plant is cultivated as a vegetable in Southeast Asia (leaves and shoot have cabbage-like flavor). They young leaves shoot tips and young pods usually eaten raw or in stir fries and curries such as *Kaengsom*. *Neptunia* stem is use as a stimulant young stem is cut and chewed. Astringent stem juice is poured into ear to get a relief from earache (*Bhoomannarar et al., 2004*). Young ends of stem are edible and usually eaten row as a vegetable in Thailand and Cambodia and cultivated much like rice. Juice of the stem is used for medicinal purposes. To cure earache and *syphilis* shoot used in stir fry also eaten *mimosa*. The whole plant is very good tonic particularly for those who are suffering from *Jaundice*.

### MATERIAL AND METHODS

For the study three sensitive plants were selected *Biophytum sensitivum* (L.) DC, family *oxalidaceae* and *Mimosa pudica* L, *Neptunia triquetra* (Willd) Benth. Family *mimosaceae*. The plants were collected from *Medshi*, Dist. *Washim* and *Akola* city.

The anatomical studies were carried out by fixing some mature and fresh part of the sensitive plant in F.A.A. (1:1:18) for 24-48hr. They were latter wash in distilled water, and then used for anatomical studies following the method of *Peacock* (1973). Photomicrograph was taken using *Leitz Wetzler Ortholux* constant microscope fitting with a *Vivitar V335* camera. Histochemical staining was done

following the method of described by *Edeoga and Ikenm* (2002).

### OBSERVATION AND RESULTS

Anatomical study of leaflets in all three selected plant reveals that each leaflet is characterized by the presence of epidermis on both sides i.e. on upper and lower side. In *Biophytum* upper epidermis breaks at certain points where it shows the presence of stomata.

### Anatomy of Leaflet of *Biophytum sensitivum* (L.) DC

**1) Epidermis:** It is a single outermost layer consists of parenchymatous cells present on both side i.e. upper and lower epidermis. Upper epidermis breaks at certain point, where the presence of stomata is rubiacious with at least one and sometime two subsidiary cells parallel to the pore. Glandular hairs are found on the epidermal cells. **2) Mesophyll cell:** It is differentiated into dipper palisade and lower spongy parenchyma cell. The palisade parenchyma cell contains the chloroplast while the spongy cells are smaller in size and loosely arranged. **3) Vascular bundle:** Conjoint collateral and closed. It consists of xylem towards the centre and surrounded by phloem restricted to only main vein. Each vascular bundle is surrounded by bundle sheath

### Anatomy of Leaflet of *Mimosa pudica* L

#### 1) Epidermis

There are two epidermal layer i.e. upper epidermis and lower epidermis, both epidermal layer are consist of compactly arranged oval or tetragonal shape thick walled cells and posses distinct cuticle paracytic stomata were present on both the sides of epidermis. Hair like appendages is observed in between the stomata.

#### 2) Mesophyll Cells

Mesophyll tissues are differentiated in to palisade and spongy parenchyma. The chlorophyll containing cells are prominent while the spongy cells are smaller in size and loosely arranged forming intercellular spaces.

#### 3) Vascular bundle

Vascular bundles are in different sizes. They are collateral and closed phloem lies towards the lower epidermis and xylem towards the upper side each vascular bundle are surrounded by bundle sheath.

### **Anatomy of Leaflet of *Neptunia triquetra* (Willd.) Benth**

#### **1) Epidermis**

Leaflet is covered by both surfaces by epidermis. The cells are compactly arranged and show the presence of cuticle and stomata on the epidermis. Stomata are found between the epidermal cells. Each stomata surrounded by two guard cell, with specialize shape and structure. They are paracytic type containing chloroplast. Their inner walls are thick and regulate opening and closing of stomata. The guard cell surrounded by two subsidiary cells. Stomata are found only on lower epidermis. The function of transpiration and gaseous exchange between the plant and atmosphere is performing by the stomata.

#### **2) Mesophyll Cells**

The tissue of the leaf that lies between the upper and lower epidermis excepting the veins is known as mesophyll. It usually undergoes differentiation to form photosynthetic tissues these are consist of two types of cell Palisade parenchyma and spongy parenchyma. Palisade parenchyma consist of an elongated more or less cylindrical cells found below the upper epidermis and are arranged compactly in one layer palisade cells are arranged near to the upper surface of the leaf where they receive more sun light and perform the function of photosynthesis. The spongy parenchyma usually consists of loosely and irregularly arranged small thin walled cells having large intercellular spaces among them. These cells contain less amount of chloroplast palisade cell. Due to the presence of large air spaces the spongy tissue is more adapted to the exchange of gases between the cells and atmosphere. Leaves with palisade parenchyma on one side and spongy parenchyma on the other are known as dorsiventral or bifacial.

#### **3) Vascular bundle**

The veins of the leaf are continuous through the petiole with the vascular of the stem. The conducting tissues are situated near or at the centre of the mid rib this system may be in the form of crescent shape ring and scattered patches. In the ring shape conducting system parenchyma cells are usually in centre of the ring.

The vascular bundles are conjoint, collateral and closed. It consists of xylem towards the upper surface and phloem toward the lower surface. Xylem differentiated in to vessels, trachids and xylem parenchyma. It conducts water and row material to the leaf. The phloem consists of sieve tubes, companion cells and

phloem parenchyma. The translocates the prepared food material from leaf to other parts of the plant. The small vascular bundles covered by parenchymatous cells forming bundle sheath.

### **Anatomy of petiole of *Biophytum sensitivum* (L.) DC**

T.S. of petiole is circular in outline.

**1) Epidermis:** It is outermost single layer consist of parenchyma cell. **2) Cortex:** It is differentiated into following layer. **Collenchyma:** It consists of several layers of cell. These are thick walled circular to oval in shape. **Sclerenchyma:** Below the colleenchyma layer presence of sclerenchyma that give mechanical strength to petiole and protection to vascular bundle. **3) Pericycle:** Pericycle is bounded by composite and more or less **4) Vascular Bundle:** The vascular bundles are conjoint, collateral found in a circle. These are composed of xylem and phloem. As the name of family implies oxalic acid is very common in tissue where it is believed to occurs in the form of dissolved potassium oxalate crystals as well as being secreted as calcium oxalate, usually in the form of small solitary, cubical and crystal cells. These cells accompany and form sheath to the vascular bundle of the vein in *Biophytum sensitivum* (L.) DC leaflets are usually dorsiventral having glandular hair, stalk of varying length and unicellular heads. Vascular bundles of the vein are provided with enlarged terminal tracheids. **5) Pith:** The central pith is parenchymatous. It is well developed.

### **Anatomy of petiole of *Mimosa pudica* L**

T.S. of petiole is circular in outline

**1. Epidermis:** It is outermost single layer and made up of barrel shape cell **2) Cortex:** It is differentiated into following layer. **Parenchyma:** It consists of 2 to 3 layers, present below the epidermis. **Sclerenchyma:** It consists of 3 to 4 layers, the cylinder of sclerenchyma for mechanical strength and protection. **3) Pericycle:** Single layer pericycle consists of thin walled sclerenchyma cell. **4) Vascular Bundle:** The vascular bundles are four in number. These are collateral found. These are composed of xylem and phloem. **5) Pith:** The central pith is parenchymatous.

### **Anatomy of petiole of *Neptunia triquetra* (Willd.) Benth**

T.S. of petiole is Semi-circular in outline

**1) Epidermis:** It is outermost single layer and made up of barrel shape cell. **2) Cortex:** It is differentiated into following layer. **Parenchyma:** It consists of 4 to 5 layer,

present below the epidermis. **Sclerenchyma:** It consists of 2 to 3 layer, thick walled cells. **3) Pericycle:** Single layer pericycle present below sclerenchymatus layer. **4) Vascular Bundle:** The vascular bundles are conjoint, collateral found. These are composed of xylem and phloem. **5) Pith:** Parenchymatus pith is present in the centre.

## DISCUSSION

The family Oxidaceae and Mimosaceae is generally distinguished by the solitary (rarely) or aggregated in inflorescence cymose head, ovary unilocular, placentation marginal or axile. Although so the family received varied treatment in the Englerian and prantle system of classification. Its taxonomy explains that the subclass is dicotyledonae super order is leguminales.

The result of present day investigation indicates that the member of mimosaceae and oxalidaceae under studied showed that many of anatomical character are common in them.

All three plants show Seismonastic movement. These plants are very sensitive to touch, rather shock generated by the touch. Touching the leaves is believed to cause the seismic shock to the leaves and this stimulus is transmitted along with the rachis downward and reaches the basal pulvinous of the leaf. The irritability caused, due to touch is actually transmitted through sieve tube, because there are the only structure which are capable of transmitting the stimulus as fast as 1.5 to 20 cm/sec. The material basis for the transpiration stimulus has been found to be ABA and ABA mediated ions. As the ABA ion diffuse along the rachis, it also transdiffuses into pulvinous of the leaflets.

Comparative anatomical characteristics of leaf in *Biophytum*, *Mimosa* and *Neptunia* shows that internally leaf is characterized by epidermis, mesophyll cell and vascular bundle, a typical dorsiventral type of leaf. In *Biophytum* epidermis is characterized by the presence of glandular hairs and rubiaceous type of stomata. While in *Mimosa* and *Neptunia* glandular hairs are not seen and stomata are paracytic type. Epidermis appears on both surfaces. Lower epidermis is characterized by stomata. In *Biophytum* Mesophyll cells differentiated in to upper palisade parenchyma and lower spongy parenchyma cells. Palisade parenchyma appears in to 1-2 layers. While in *Neptunia* the leaflets are narrower palisade tissues appear in a single layer, a slight variation in mimosa is that palisade appears 1-2 layers.

In all three plants spongy parenchyma are small, irregularly arranged, forming intercellular spaces.

In *Biophytum* presence of oxalic acid in a dissolve form as the name of family is implies. These are appears in the form of potassium oxalate crystals and calcium oxalate crystals. Vascular bundle in *Biophytum* appears in crescent ring found only in the midrib part, also same feature are found in *Neptunia*. While in *Mimosa* vascular bundle are having with different sizes and in these xylem found towards the upper side and phloem towards the lower side. Internally petiole of *Biophytum* is characterized by the presence of epidermis, cortex, pericycle and vascular bundle in which cortex appears with collenchymas and sclerenchyma cells. While in the petiole in *Neptunia* and *Mimosa* cortex consist of parenchyma and sclerenchyma cells. Vascular bundle in *Biophytum* are arranged in a circle while in *Neptunia* these are restricted to only main veins and in *Mimosa* the Vascular bundle are found four in number.

In cell above mentioned plants the pericycle consists of sclerenchymatous cells, which are found in a ring. They give protection to the conducting tissue.

In *Mimosa pudica* L the experimental result of a crucial character are given which shows that the theory of the transpiration current, as the agent of conduction of excitation in *Mimosa* is entirely oppose to facts. The theory assumes that conduction is brought about by the transpiration current in the xylem, carrying some stimulating substances excreted in consequences of the stimulation. But it has been shown that conduction take place even when the wood remains entirely unstimulated. Again, transpiration current in intact specimen is normally upwards, but it has been shown that conduction of excitation takes place in both upward and downwards at the same time. The petiole contains four main conducting strands, which meet and form an almost continuous ring at the central pulvinous end. These four conducting strands terminate separately in the four sub petioles carrying the sensitive leaflets. The nervous connection between the centre and periphery has been traced both anatomically and physiologically. Peripheral stimulation of each of the four subpetiole gives rise to characteristics responsive movement of the leaf. Up or down, a left handed or a right handed torsion. It is by the particular innervations of the motor organ that the leaf undergoes the purposeful movements by which it places itself a right angle to the incident light. So as to absorb the largest amount of radiant energy. The nervous

connection between the centre and periphery is independent demonstrated by observation the effect of the centrifugal impulse producer by successive and separate stimulation of the different nerve ends in the pulvinus which cause the responsive falls of the sensitive leaflets of the sub petiole in connection with each stimulated nerve end.

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