Chapter 2

Plant tissues

You have already learnt about different cell organelles and their functions in the chapter ***"Cell its structure and functions".*** In unicellular organisms, a single cell performs all the functions. But in multi-cellular organisms there are numerous cells, performing various functions.

Plants that we observe around us are usually multi-cellular. They perform several life processes such as growth, respiration, excretion, etc, similar to those performed by animals. In addition to these they can perform photosynthesis and prepare food not only for themselves but also for all the other living organisms dependent on them, either directly or indirectly.

Let us recall the information about different parts of the plants and the functions they are associated with.

Activity-1

Parts of the plants and their functions.

We have studied about the functions of plant parts in earlier classes. Read the functions given below and write the name of the parts involved in performing the respective function.

S.No	Function	Name of the parts
1	Absorption of water from soil	
2	Exchange of gases (air)	
3	Photosynthesis	
4	Transpiration	
5	Reproduction	

- How can the plants perform all the life processes?
- Is there any specific arrangement of the cells in plants that help in carrying out these processes?

Let us try to find out more about arrangements of cells in plants and their functions by the following activities.

Do the following activities with the help of your teacher.

Activity-2

Cells in onion peel

- Take a piece of an onion peel.
- Now place it on the slide.
- Put a drop of water and then a drop of glycerin on it.

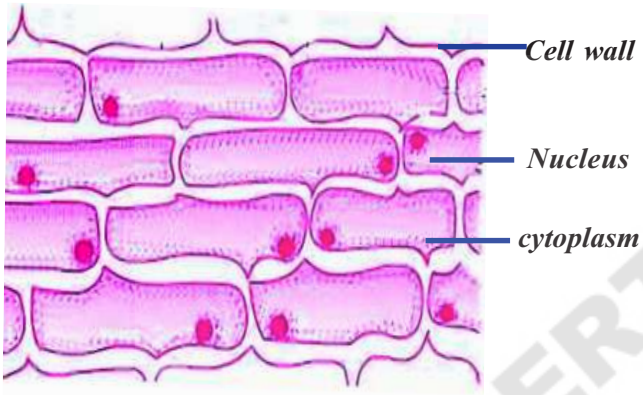


Fig-1 Onion peel

- Gently cover it with a cover -slip.
- Observe it under the microscope.
- Draw and label the diagram, what you have observed under the microscope.

Compare your drawing with the figure-1 to find out labeled parts.

- Are all the cells similar?
- How are the cells arranged?

Activity-3

Cells in a leaf peel.

- Take a betel leaf or a Tradescantia leaf.
- Tear it with a single stroke. So that a thin edge be seen at torn end.
- Observe the thin edge where the leaf

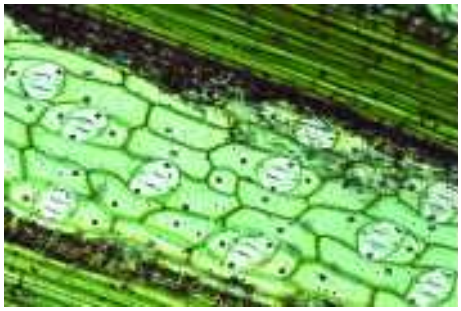


Fig-2 Betel leaf peel

has been torn under the microscope in the same manner as you had observed the onion peel.

Draw a diagram of what you observed and compare with the following.

- Are all the cells similar?
- Is there any difference in their arrangement?
- What can we infer from the above activities?
- Do you find cells in groups in both the activities?
- Compare and write a note on the arrangements of the cells as you see in both the activities.

You may have observed that the cells are present in groups with certain arrangement. With the help of following activities we shall try to find out whether these arrangements have special roles to play in the plant body.

Activity-4

(a) Cells in root tip

- Are the cells in the root similar to that in a leaf. Let us find out how the cells are arranged in the root. For this we need onion root tips.

- Take a transparent (plastic/glass) bottle fill with water. Take an onion bulb slightly larger than the mouth of the bottle.
- Put the onion bulb on the mouth of the bottle as shown in the fig-3.

Fig-3 Onion root

- Observe the growth of roots for a few days till they grow to nearly an inch.
- Take the onion out and cut some of the root tips.
- Take an onion root tip.
- Place it on the slide.
- Put a drop of water and then a drop of glycerin on it.
- Cover with cover-slip.
- Put the 2-3 layer of filter paper on the cover slip,
- Tap the cover-slip gently press with the blunt end of the needle or brush to spread the material.
- Observe the structure and arrangement of the cells.
- Draw diagram that you observed under microscope.

· Are all the cells similar?

· What is the arrangement of cells?

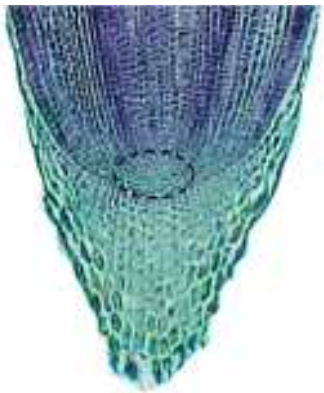


Fig-4 Onion Root Tip

Activity-5

(b) Growing roots

- Take the onion used in the previous activity and mark the cut end of the roots with a permanent marker.
- Put it in the same set up as used in the previous activity.
- Leave the set up aside for at least four to five days. Take care that there is enough water in the glass so that the roots are submerged.

- Did all the roots grow in a same manner?
- What happened to the roots which had been cut off?
- Write down your findings, regarding the cut roots and those that were not?

We observe that by removing the tip of the onion root, having a particular arrangement of cells, the growth of the root in length is stopped.

You have observed that cells are present in groups. Cells in groups which are nearly similar in structure perform similar functions. Such groups of cells are called tissues.

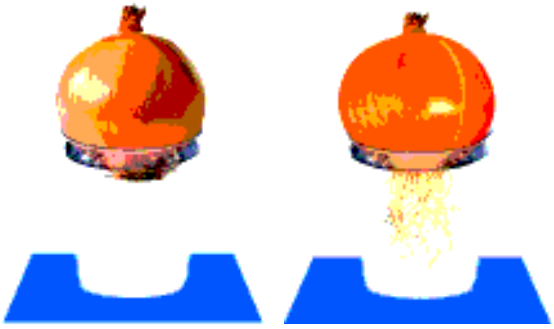


Fig-5 Growth of roots in onion bulb

One day Haritha went to a park with Latha. There she saw a gardener had been cutting the tips of the plants with cutter. She had a doubt and asked the gardener.

Let us read the conversation

"How do the plants grow if the tips have been cut off?"

He said "Branches will grow from the sides".

Later she saw another gardener, watering a stump. She went there and asked.

"Why are you watering the stump?"

"The stump will soon bear leaves" He said

Haritha had a question in her mind, "How will the leaves come?" Do you know the answer?

Now we will study about those tissues that bring about growth, repair and other functions in a plant body.

There are four basic types of tissues in the plants. They are

- Tissues that bring about overall growth and repair are called **Meristematic tissues**.
- Tissues that form outer coverings are called as **Dermal tissues.**
- Tissues that form the bulk of the plant body, helping in packing other tissues are called as **Ground tissue**s.
- Tissues that help in transport of materials are called as **Vascular tissues**.

You have already observed some types of tissues. To observe the various types of plant tissues we need to know some techniques for preparing slides and cutting sections. See annexure-1 for the same.

Meristematic tissues

Observe the given figure of a stained section of a shoot tip.

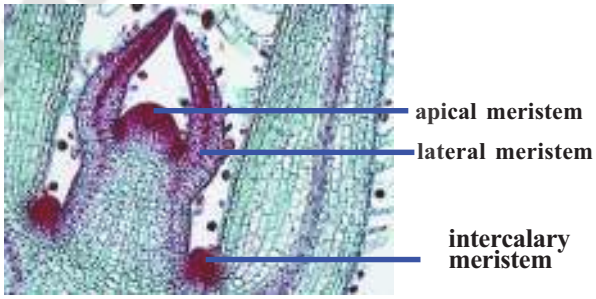


Fig-6 L.S. of a Shoot tip

From the above figure you can infer that meristematic tissues are present on the tip, sides and in between layers of other tissues. Meristematic tissues at the growing tip that bring about growth in length are called as **apical meristematic** tissues.

Tissues present around the edges in a lateral manner and giving rise to growth in girth of the stem are called **lateral meristematic** tissues.

Areas from which branching takes place or a leaf or a flower stalk grows, we find a kind of meristematic tissue called as **intercalary meristematic (also called as Cambium)** tissue.

Activity-5

We had already observed the tissues present in the root tip in earlier activities.

Table -2

Arrangement of the cells (Tissues)	Shoot tip	Root tip
At the tip At the lateral side At the point of branching		

From all this we can conclude that different types of meristematic tissues are present both in the root tip and shoot tip.

Cells in the meristematic tissues are

- Small and having thin cell wall.
- Living with prominent nucleus and abundant cytoplasm.
- Compactly arranged without intercellular spaces.
- Continuously dividing cells.

Let us learn about the other types of tissues.

Activity-7

Dicot Stem tissues

- Prepare a temporary mount of the TS of a dicot stem.

Can we find the above tissues in the root tip as well?

Activity-6

Comparing the shoot tip and the root tip – Meristamatic tissue

Carefully observe the figures of root tip and shoot tip. Do you find any similarities or differences between the two? Note down your observations in the following table-2

- Observe it under the microscope.
- Draw and label the diagram.
- Compare it with figure given below

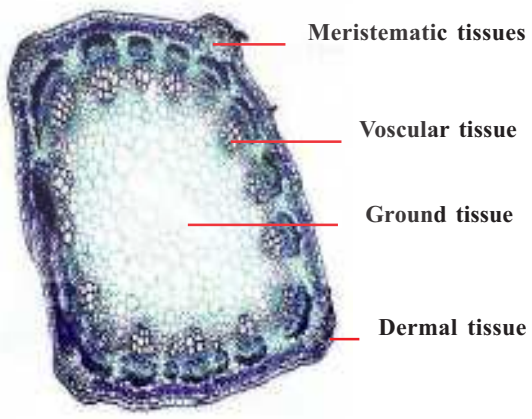


Fig-7 Dicot stem (TS) - Tissues

- What are the similarities between the shoot tip tissues and the tissues as shown in the above figure?
- Are all the cells similar in shape and structure?

- How many different types of arrangement of cells (in the form of tissues) could you see in the given figure?

You have already studied about the meristematic tissues. The other major groups that we shall study now are dermal tissue, ground tissue and vascular tissue. These develop from the cells of the meristematic tissues during the growth and repair of the plants parts.

Dermal Tissue

- What kind of arrangements do you observe in the outer layer of the TS of stem?

We can find the dermal tissue over the entire surface of the plant body.

We will do the following activity to observe the dermal tissue more closely.

Activity-8

Rheo leaf - Dermal tissue.

- Take a fresh leaf of Rheo or Betel plant
- Tear it with a single stroke, so that a thin whitish edge can be seen at torn end.
- Slowly remove it and observe that peel under the microscope (by preparing a temporary mount).

See the arrangement of cells .Are all cells similar? Are there any spaces between the cells?

This activity shows a part of the dermal tissue of plants.

Dermal tissue (Dermis) usually consists of a single layer of tissues showing variations in the types of cells. On the basis of their functions and location. This tissue is studied as three different types- epidermis (outer most layer), mesodermis (The middle layer) and endodermis (the innermost layer).

The walls of the cells of dermal tissue are thicker as compared to the cells of meristematic tissues. In desert plants it may be even more thick and waxy. Small pores are seen in the epidermis of the leaf, called stomata. They are enclosed by two kidney shaped cells, called guard cells. Cells of the roots have long-hair like parts, called root hairs.

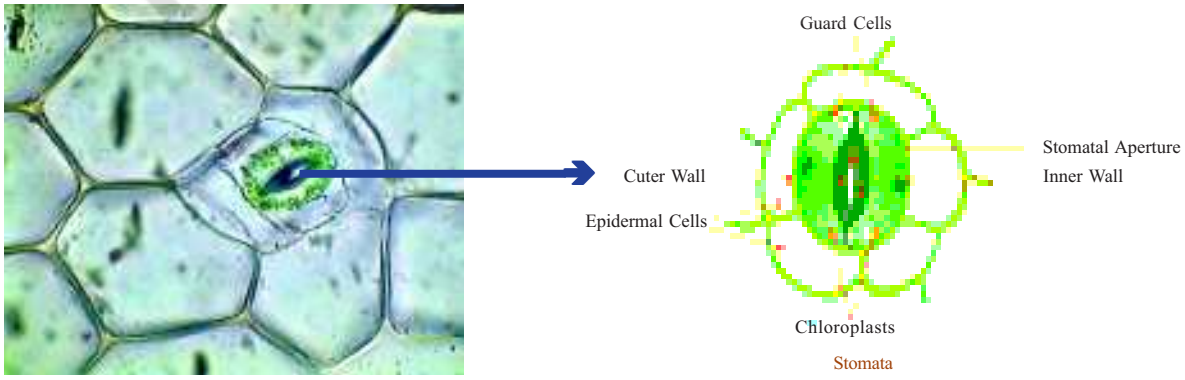


Fig-8 Peel of Rheo leaf – Dermal tissue

Do you ever saw sticky substance on the trunk or branches of tree like Acacia, Neem, etc,. What is it? Where is the gum secreted from?

Do you know?

Plants have the ability to store certain substances that are either their excretory products or accumulated food or some secretary substances in different ways. Gum is secreted from the dermal layer of gum tree.

The dermal layer protects the plants from loss of water, mechanical damage and invasion by parasitic and disease causing organisms. In big trees the dermal tissue forms several layers above the epidermis. It is called bark.

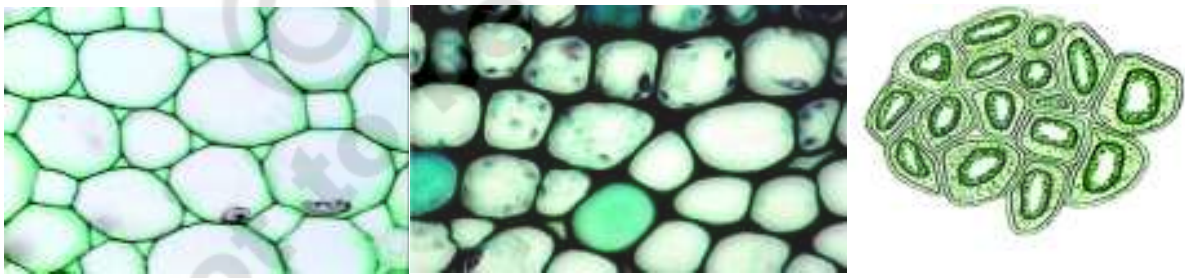
Stomata and root hair are also dermal tissues that are essential for gaseous exchange and transpiration as well as absorption of water and minerals respectively. Photosynthesis is also carried out by certain cells of this tissue.

Ground Tissue

You have seen the ground tissue in the T.S. of stem (Figure 7). Make a sketch of the arrangement of cells you had seen.

You can see that cells appear larger with prominent walls.

These cells form the ground tissue. It forms the bulk of the plant body. The ground tissue is useful for storing food and providing physical support to the plant body. There are mainly three types of ground tissues. They are parenchyma, collenchyma and sclerenchyma.



Parenchyma *Collenchyma* *Sclerenchyma*

Fig -9 Ground tissue- Types

The cells of the parenchyma are soft, thin walled and loosely packed. The Parenchyma which contains chloroplasts is called “Chlorenchyma”. The Parenchyma which contains large air cavities or spaces is called “Aerenchyma”. The Parenchyma which stores water or food or waste products is called “Storage Tissue”.

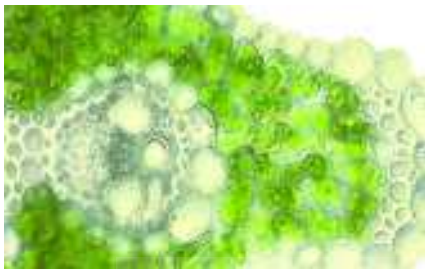
Collenchyma tissues have thicker walled, longer cells compared to parenchyma.

In the sclerenchyma the cells are thick walled and compactly arranged with nearly no spaces between them.

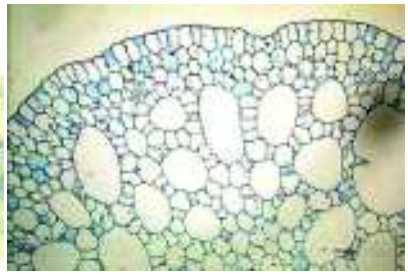
Let us observe the ground tissue of some other stems

Activity-9

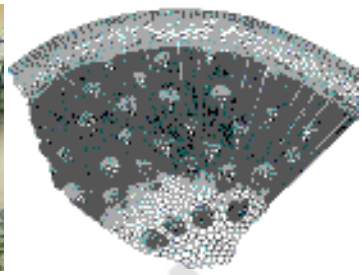
Take permanent slides of Chlorenchyma, Arenchyma, Storage Tissue in your laboratory observe under microscope find out the characters and differences write in your notebook.



Chlorenchyma



Arenchyma



Storage Tissue

Fig -10

Do you know?

Nehemiah Grew (1641-1712) was practicing physician and worked as the secretary of the Royal Society, London. He began his work on the study of internal structure of the plants in the year 1664.

Grew's fundamental inference was "Every plant organ consists of two types of organical parts. One is pithy and other is ligneous part".

Grew gave the term **"parenchyma"** for the pithy part. Grew initiated the study of tissues (Histology) in plant bodies and published his work as the book 'Anatomy of Plants' in the year 1682.

Nehemiah Grew
(1641-1712)

Vascular Tissue

We know that roots can absorb water from the soil and send it to other parts of the plant. The leaves and other green parts prepare food and supply it to all the parts of the plant.

Let us study the tissues involved in transportation.

We had performed an experiment on transportation in class VII, in the chapter on plant nutrition. We had seen that if the plant is kept in red coloured water. Some of the parts of the plant turned red. Do the same experiment again by keeping a small plant (with roots) in red coloured water? Leave it for two hours. Now cut a T.S. of the stem and observe it under the microscope.

- Which portion of the plant is responsible for this transport?
- Draw a rough sketch of the portion and mark the portion that appeared red.

- What do you conclude from your observation?

The tissues involved in transportation are vascular tissues. They are composed of different types of cells and their specific arrangements.

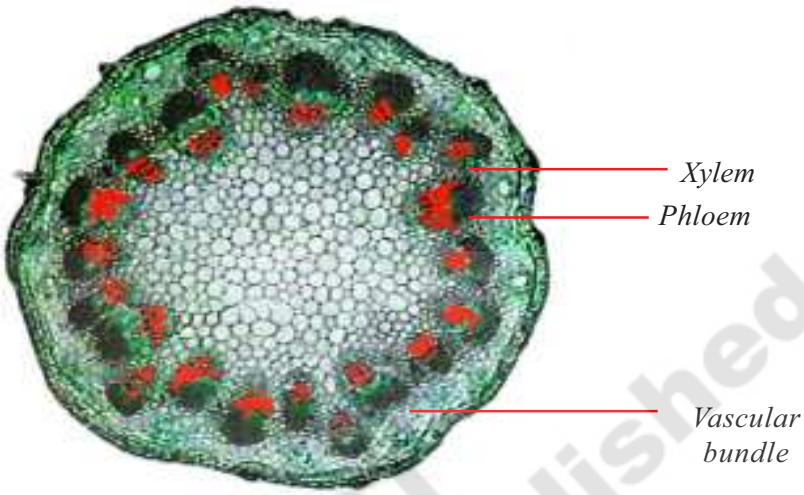


Fig-11 TS of stem

The part that appeared red is Xylem tissues, while the cells adjacent to these (As shown in the figure 12) are of phloem tissues. Xylem is responsible for transport of materials away from the root. Phloem helps in the transportation of the material away from the photosynthetic parts of the plants. Hence they are known as conducting or vascular tissues. xylem and phloem together form the vascular bundles.

The vascular tissue gives mechanical support to the plant as well.

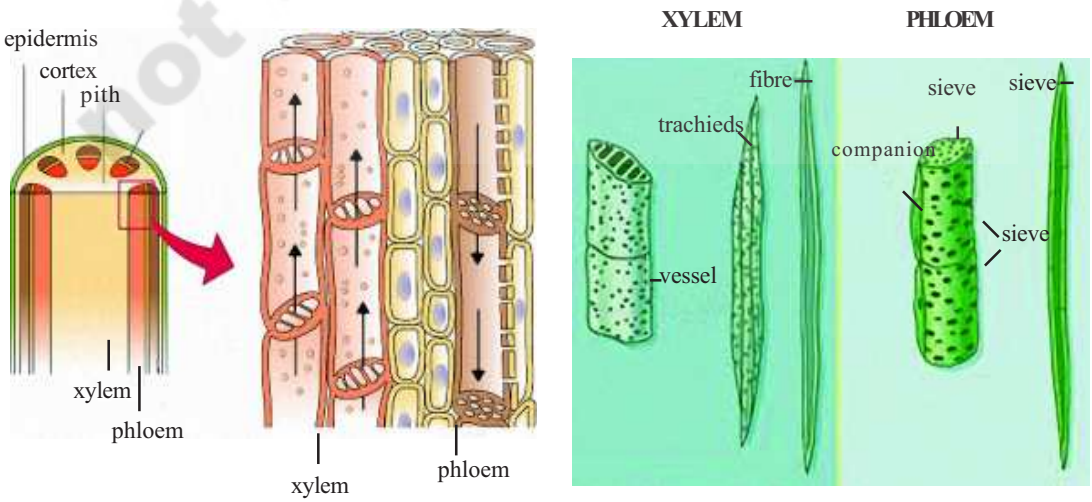


Fig-12 Different Cells of Xylem and Phloem

Xylem contains elongated tracheid cells, tubular vessels, fibres and parenchyma Phloem contains long sieve cells and sieve tubes, companion cells, fibres and parenchyma.

Do you know the vascular tissues carry water to great heights in the plant body. It is up to nearly 200 ft in Eucalyptus plants and up to nearly 330 ft in the red wood trees.

We have seen in this lesson that plants have different types of tissues which are arranged in specific manner to carry out different functions in the plant body.

Key words

Tissue, Meristematic tissue, Apical meristem. Later meristem, Inter calary meristem. Dermal tissue, Epidermis, Bark, Ground tissue, Parenchyma, Collenchyma, Sclerenchyma, Vascular tissue, Xylem, Phloem, Vacular bundles, Trachieds, Vessels, Fibres, Sieve cells, Sieve tubes, Companion cells.

What we have learnt?

- Tissue is a group of cells similar in structure, and performing similar functions.
- Meristematic tissue is the dividing tissue, present in the growing regions.
- Meristematic tissue is mainly of three types. They are Apical meistem, Lateral meristem and Intercalary meristem.
- Dermal tissue covers the plant body and gives protection.
- Ground tissue is bulk in all the parts of the plant and gives support and stores food. It is of three types. They are Parenchyma. Collenchyma and Sclerenchyma.
- Vascular tissue conducts transportation. It is mainly of two types. They are xylem and phloem.

Improve your learning

1. Define the terms (AS 1)
   - Tissue
   - Meristematic tissue
   - Dermal tissue

2. Differenciate in between the following (AS 1)
   - Meristematic tissue and Ground tissue
   - Apical meristem and lateral meristem
   - Parenchyma and collenchyma
   - Sclerenchyma and parenchyma
   - Xylem and phloem
   - Epidermis and bark
3. Name the following (AS 1)
   - Growing tissue, which cause growth in the length of the plant.
   - Growing tissue, which cause growth in the girth of the plant.
   - Large air cavities in the aquatic plants.
   - Food material in pharenchyma.
   - Pores essential for gaseous exchange and transpiration.
4. Compare and contrast the following (AS 1)
   - Xylem and phloem
   - Meristematic tissue and Dermal tissue.
5. Give reasons to the following (AS 1)
   - Xylem is a conductive tissue
   - Epidermis gives protection
6. "Bark cells are impervious to gases and water". What experiment you will perform to prove this? (AS 3)
7. Chlorenchyma, Arenchyma and storage tissue – Even though these three are parenchyma. Why do they have special names? (AS 1)
8. Draw and label the diagram of the T.S. of stem (AS 5)
9. Describe the functions of - Meristem, Xylem and phloem (AS 1)
10. While observing internal parts of plants, how do you feel about its structure and functions? (AS 6)
11. If you want to know more about tissues in plants what questions you are going to ask? (AS 2)
12. Collect information about dermal tissues of plants in what way they help to them. (AS 4)

ANEXURE

In this technique fine sections of the material are cut. Figures in next page will help you to understand this technique.

- To get section cuttings pith material is taken as the support. A slit is made in the pith material longitudinally.
- The specimen (root or stem or leaf or bud) is inserted in the slit for section cutting.
- To get longitudinal section (LS) the specimen should be inserted in the pith material transversely.
- To get transverse section (TS) the specimen should be inserted in the pith material longitudinally.
- Thin sections should be cut, using the blade as a tool.
- Collect the cuttings in a watch glass with water.
- Select one thin section and put it on a glass slide with the help of a small brush.
- Put a drop of glycerin on it.
- Stain with a drop of safranin.
- Gently cover with the cover-slip using needle.
- Use blotting paper to remove the excess water or glycerin or stain.
- Then observe under the microscope.

(a) Material

(b) Making the pith material

(c) Making slit in the pith material

(d) Cutting specimen to get TS

(e)Inserting the Specimen to get TS

(f) Section cutting with blade

(g) Taking the thin section with brush

(h) Keeping the section on the slide

(i) Putting a drop of water, Glycerin

(j) Staining with safranin

(k) Covering with cover-slip

(l) Obsere under Microscope