

Hello students, My self miss Shubhra Bhende, from Government College of arts science and commerce Kepem Goa. I'm working as an assistant professor in this college.

So today we are going to study the chapter adaptive and protector system.

From

this chapter we will focus on the module stomatal types

The outline includes structure of stomata, Types of stomata

The learning outcomes include

Defines the structure of stomata.

Understanding regulatory mechanism of opening and closing of stomata.

Listing out the different types of stomata with examples.

Firstly before beginning with the actual topic that is stomatal types. First we will see what is stomata.

These are the epidermal appendages or minute apertures which are present on the whole entire plant body. Now what is the role of this minute apertures?

These cannot be seen by the naked eye.

They require microscopic observations. The minute apertures or the epidermal appendages these are known as a stoma.

In this image, you can see that middle portion that is known as stomatal pore or stoma.

They are surrounded by two cells which are known as guard cells, which are in turn surrounded by other accessory cells. Now the accessory cells can be subsidiary cells or the epidermal cells, and when the stoma is enclosed by these guard cells and the subsidiary cells it is known as stomatal apparatus or stomatal complex.

It completes the whole stomata consisting of stoma together with subsidiary cells in the guard cells.

Next is the occurrence where this is found. As I mentioned you were before it is present on the entire plant body, but higher percentage or density of the stomata are found on the leaf surface.

Now how they are present on the leaf, They may be raised above or sunken below the surface of the epidermal layer. The sunken stomata we can observe in *Nerium* plant that is seen in the transverse section of *Nerium oleander*.

There are small depressions which you can see which are marked with the arrow. Those depressions are known as stomatal crypts. These depression consists of the sunken stomata.

Now the structure part of the stomata.

As I mentioned you all on the 1st slide that, the stoma or the minute aperture is surrounded by two cells which are known as the guard cells. As you can see in this particular image, the guard cell is kidney shaped, having very important function.

Now what is the function of guard cells? Guard cells help in opening and closing of stomata whenever the stomata opens and closes, it is all with regard to the movement of guard cells. Next is the Subsidiary cells how can you differentiate between subsidiary cells and epidermal cells?

Depending upon the shape, we can differentiate between subsidiary cells and epidermal cells. Now we come to the opening and closing of stomata. How does this occur during the daytime? As you all know,

That stomata open, this is because during the daytime, water from the surrounding cells, that is from the subsidiary cells or an epidermal cells enters into the guard cell making the guard become turgid and this leads to increase in the turgor pressure of guard cell.

So because of this increase in the turgor pressure stomata opens; whereas during the night time it is exactly opposite the water from the guard cell enters into the surrounding accessory cells that is epidermal cells, and

subsidiary cells because of these the turgor pressure is going to decrease in the guard cell there by leading to closing of the stomata so this particular mechanism goes on during the day and night.

Now the types of stomata

There are many criteria's for the classification of stomata that is, first criteria is based on the location,

Whether they are present on the upper surface, lower surface or on the both.

Depending on the surface the first one is known as Amphistomatous stomata.

This particular condition we can observe in grass species and rice. Now, what is this particular condition? In these the stomata is present on both, that is the upper surface and lower surface as well.

The second condition is Hypostomatous. That is, we can find it in *Nymphaea* species, and *Marsilea* species. In this particular situation, the stomata is confined to the lower region, lower surface of the epidermis. Third one is the Epistomatous stomata. We find this in *Ficus* sp, *Nerium* sp. that is it is present on upper portion of the leaf. Now these particular criteria was based on location.

Now we go to the second criteria for classifying the types of stomata that is based on the development of the guard cell and accessory cell. Accessory cell maybe the subsidiary cell or epidermal cell which surrounds the guard cell.

Now, in this particular criteria, first condition is Mesogynous. It is here both the guard cells, and accessory cells have been developed from identical and similar mother cells, and these particular condition we find in Brassicaceae family members.

And the second situation is Perigynous. Here both cells develop from non-identical or different mother cell and this condition we find in Cucurbitaceae family members.

Third one is derived from both first and second. It is Mesoperigynous. It takes into consideration both 1st and 2nd type of stomata, so that it is the guard cell

and one accessory cell develops from single mother cell where the 2nd accessory cell may develop from other neighboring cell.

This one is also found in Brassicaceae family members.

3rd very important criteria is structure. Depending upon the structure there are more than eight or nine types of stomata. We can broadly classify them in monocots and dicots.

In dicots, the first type of stomata is Anomocytic stomata in this the guard cells are surrounded by the accessory cells. They are not distinguishable into whether they are subsidiary cells or epidermal cells.

Their subsidiary cells in these particular stomata are absent or lacking.

We find this type of stomata in Ranunculaceae, Malvaceae members.

The image shows you all the different structures of the epidermal cells. There are no specific structure of subsidiary cells and therefore subsidiary cells are the major which are lacking in this particular type of stomata.

The second type is an *Anisocytic* stomata. This is very prominent and easily distinguishable from the other types of stomata that is the guard cells are surrounded by three subsidiary cells, one amongst the two is distinctly smaller than the others. We find this particular stomata in Arabidopsis plant and Brassicaceae family members.

The third type is Paracytic stomata. Here the stoma is surrounded by the guard cells, which are in turn surrounded by two subsidiary cells which are exactly parallel to the long axis of the guard cells, which means that the guard cells under subsidiary cells, they are exactly parallel to each other.

We find this particular stomata in Cruciferaeae, *Solanum sp*, *Nicotiana sp*.

Fourth type of stomata is Diacytic. In this is stomata, the guard cells are enclosed by two subsidiary cells whose connecting axis is at right angles to the guard cells. They are easily characterized.

We find this in Acanthaceae, Caryophyllaceae family members.

The 5th type is Actinocytic stomata

Now these the stoma is surrounded by a circle of radiating cells whose long axes are perpendicular to the outline of the guard cells. The accessory cells are present in a circle which surrounds the guard cell.

Example is Araceae, Musaceae, Commelinaceae family members.

Next one is Cyclocytic (encyclocytic). This is a same type as the previous one. It is derived from that of the Actinocytic stomata. Here the stomata is surrounded by one or more narrow rings of subsidy cells, numbering four or more

Note this particular stomata is also present in monocots. That is, in Palmae, Cyclanthaceae, Pandanus and in dicots *Laguncularia* and in monocots there are just two types of stomata

First one is Tetracytic. In Tetracytic the stoma is enclosed enclosed by four subsidiary cells, two lateral and two polar (terminal).

Now this has got exception that it is also found in dicots that is in *Tilia*, some members of Asclepiadaceae

The second type over here is Graminaceous type. This is very common because we find this in most of the grass species that is in poaceae and Cyperaceae family members.

Here the guard cell itself has got a different shape, that is dumbbell shape. Usually the guard cells are kidney shaped but here they are dumbbell shape and the subsidiary cells lie parallel to the dumbbell shaped guard cells which is very important.

These are the references. Thank you.