ORGANIZATION OF ROOT APEX

The root apex is constituted as the apical meristem or growing point or growing tip of root. The root apex is few milimeter to few centimeters in length. Longitudinal section of root apex observed under microscope shows three distinct regions such as

1. Dermatogen
2. Periblem
3. Plerome

Dermatogen:

It is outer most layer of the root apex. It is single layered. It is also known as peliferous layer. The cells of dermatogen just at the apex divide and redivide and give rise to a tissue of thin walled, narrow, rectangular cells called the calyptrogen. The calyptrogen later on gives rise to a protective covering called the root cap. The root cap gets crushed during the process of penetration of root into soil which is again reformed by the calyptrogen. In aquatic plants the root caps are totally absent, but analogous structures called the root pockets are present. The cells of the dermatogen here and there produce certain

prolongations generally towards the upper side called the root hairs.

Periblem:

It is the region lying just below the dermatogen. It is single layered at the apex and multilayered towards the upward side. The cells of this region divide and redivide and finally give rise to cortex of the root.

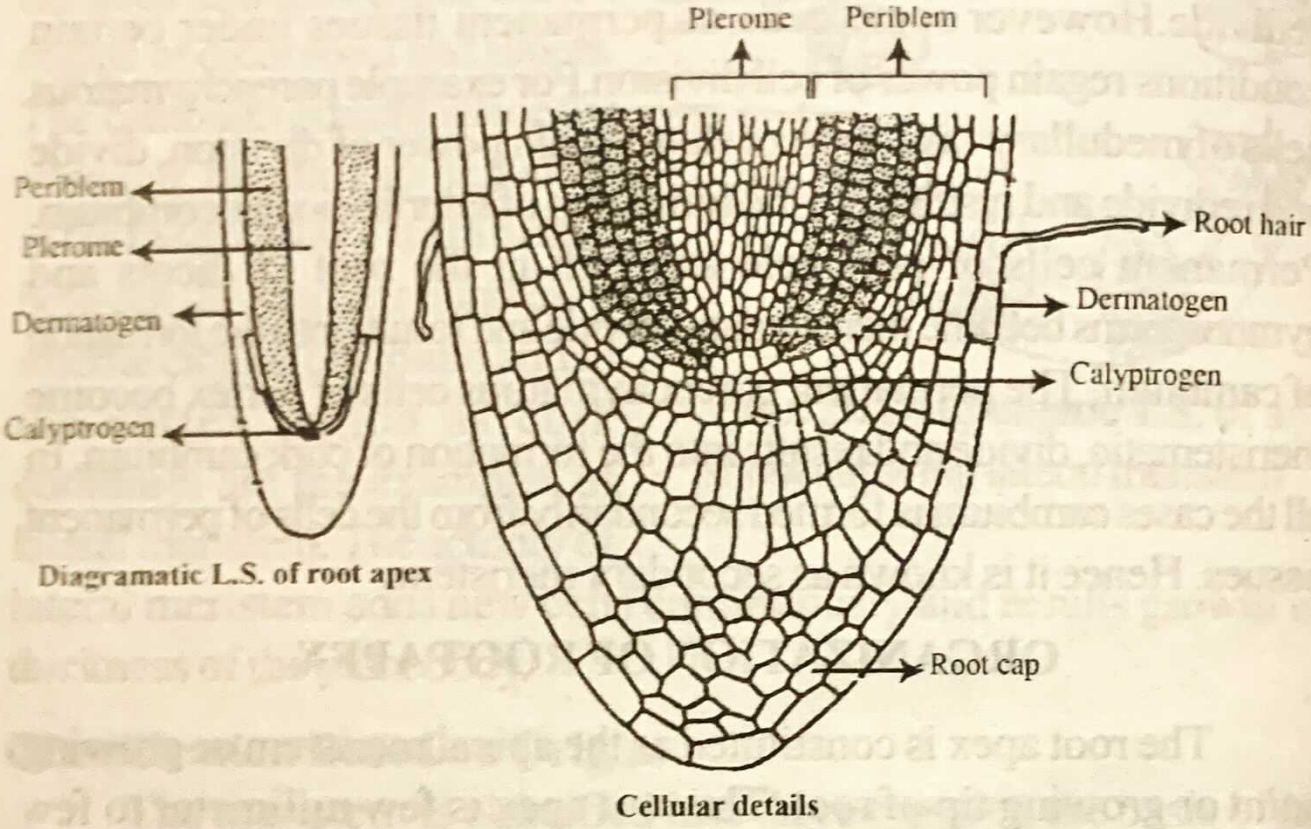

Fig.1.6(A-B). L.S.of root apex showing cellular organization

Plerome:

It is central region of the root apex. The cells of this region divide irregularly at a very little distance just behind the growing point and produce new cells. Some of the new cells become much elongated and finally give rise to the promeristem or procambium which later on gives rise to radial vascular bundles of the root. The remaining new cells give rise to pericycle and pith of the root.

ORGANIZATION OF SHOOT APEX

The shoot apex is constituted as the apical meristem or growing point or growing tip of shoot. The shoot apex is few milimeter in length. Longitudinal section of shoot apex observed under microscope shows three distinct regions such as

1. Dermatogen

2. Periblem

3. Plerome

Dermatogen:

It is outer most layer of the shoot apex. It is single layered. The cells of dermatogen divide anticlinally add new cells and finally give rise to epidermis of the stem. The dermatogen possesses many small prolongations called leaf premordia. The leaf premordia arch over the growing tip and protect the shoot apex.

Periblem :

It is the region lying just below the dermatogen. It is single layered at the apex and becomes multilayered towards downward side. The cells of periblem divide and redivide and finally get differentiated into cortex of the stem. In dicot stem the cortex is differentiated into hypodermis, general cortex and endodermis.

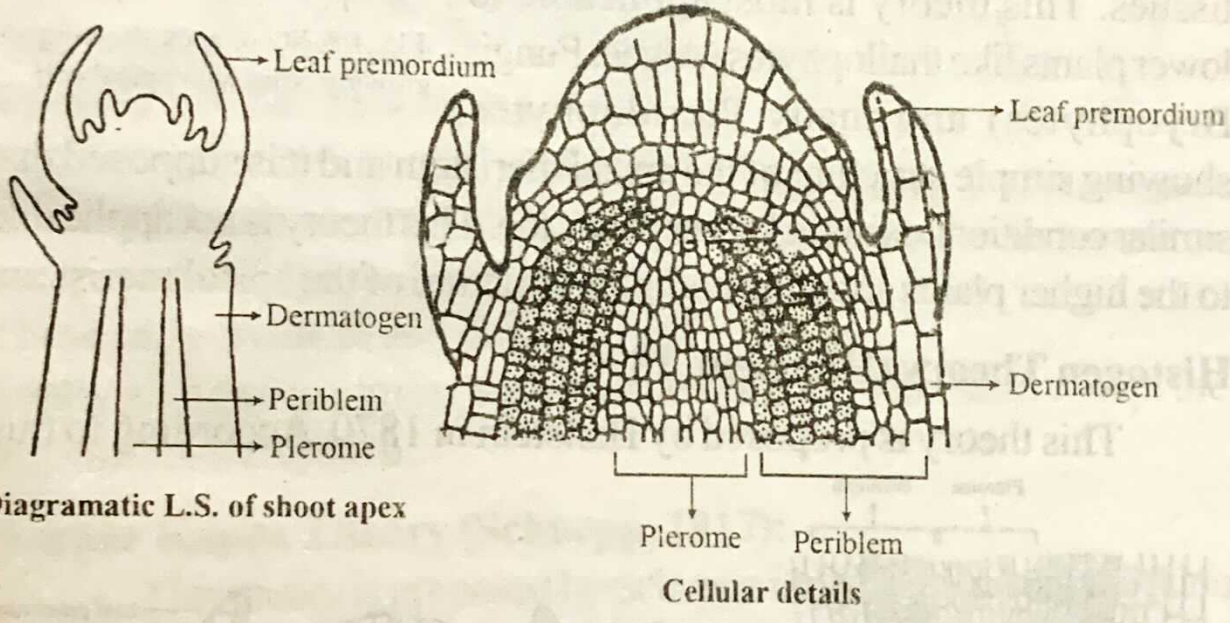

Fig.1.7 (A-B). L.S.of shoot apex showing cellular organization

Plerome:

It is central region of the shoot apex. The cells of plerome divide irregularly at a very little distance just near the growing point and add new cells. Some of the new cells become much elongated and finally give rise to procambium. The procambium later on gives rise to vascular tissues of the stem. The remaining new cells divide again and again and finally give rise to pericycle and pith region of the stem.

THEORIES OF APICAL MERISTEM ORGANIZATION

Many therories have been put forward from time to time to explain the earliest structure of the apical meristem. There are four important theories in connection with the organization of the apical meristem such as

1. Apical cell theory
2. Histogen theory
3. Tunica Corpus theory
4. Korper Kappe theory

Apical Cell Theory (Nageli, 1858):

This theory is proposed by Nageli in 1858. According to this theory the apical meristem or growing point is composed of single cell known as apical cell. The sequence of division of the apical cell results into the formation of different tissues. This theory is most applicable to lower plants like thallophytes (Algae, Fungi, Bryophytes) and many Pteridophytes showing simple structure of the apical meristem and it is supposed that similar conditions exists in higher plants too. This theory is not applicable to the higher plants showing complex structure of the apical meristem.

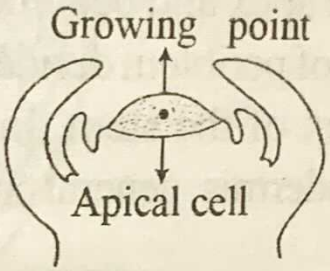

Fig. 1.8. Shoot apex showing growing point with apical cell

Histogen Theory (Hanstein, 1870):

This theory is proposed by Hanstein in 1870. According to this

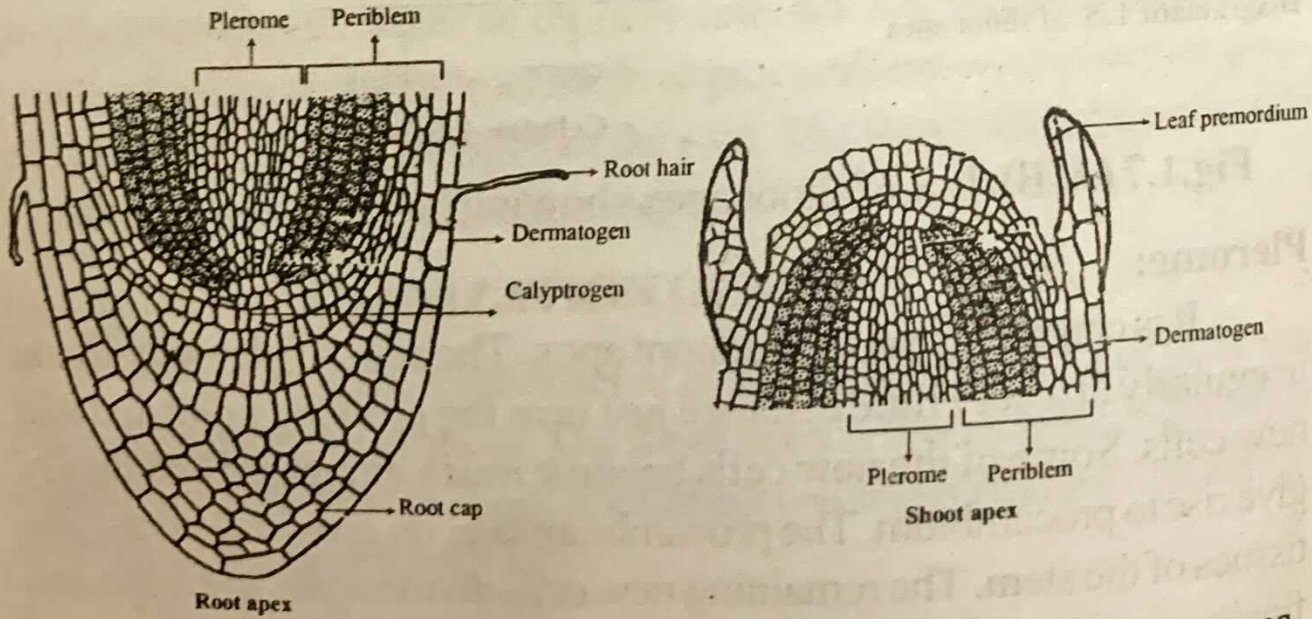

Fig. 1.9(A-B). L.S. of root apex and shoot apex showing Histogens

theory the apical meristem is composed of different zones. And each zone consists of a group of initial cells called **Histogen or a tissue builder.** The major histogens or groups of initial cells in root and shoot apices are the dermatogen, periblem and plerome.

The dermatogen gives rise to epidermis, periblem gives rise to cortex and plerome gives rise to stelar regions of the root and stem.

This theory is most applicable to the flowering plants. However it has been found that, there is no such clear cut demarcation of different zones of apical meristem. The zonation is not visible under microscope.

Tunica Corpus Theory (Schmidt, 1924):

This theory is proposed by Schmidt in 1924 for the organization of shoot apex.Apical meristem in higher plants is composed of only two zones. The outer zone is called as tunica and inner zone as corpus. The tunica is composed of variable layers of cells. This zone gives rise to epidermal tissue system of the shoot. The corpus zone is composed of large and irregular cells. These cells divide in any direction and finally give rise to almost all the tissue systems of the stem except the epidrmal tissue system.

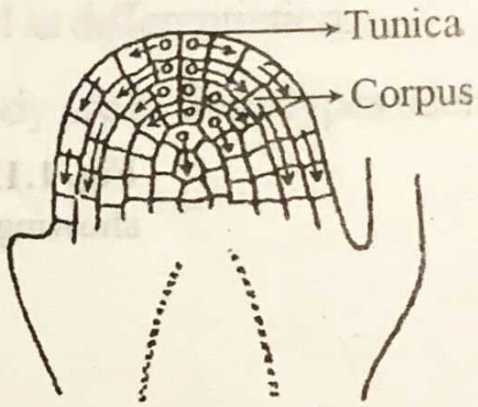

Fig. 1.10. L.S. of shoot apex showing tunica and corpus

Korper Kappe Theory (Schuepp, 1917):

This theory is proposed by Schuepp in 1917 for the organization of root apex. According to this theory the root during the process of growth in thickness shows various points. Each point has a group of longitudinally elongated cells. All the cells at each and every point divide and result into the formation of double the number of cell. During the process of cell division a single cell at each point divides transversely and results into the formation of two daughter cells. The transverse division is followed by longitudinal division of one of the daughter cells. This results into the formation of T-shaped cell walls. Hence it is known

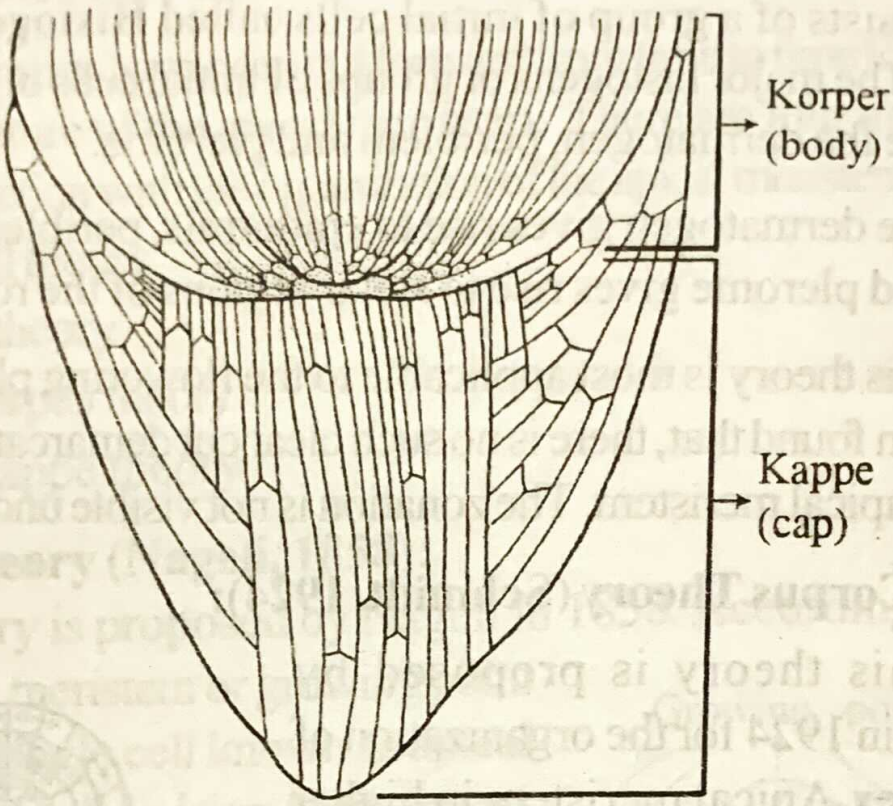

Fig. 1.11. L.S. of root apex of Maize showing karper and kappe

as T-division. In the central zone of the root apex the head of the T-faces towards the apex (T) and in other zones of the root apex head of T faces away from the root apex (⊥). These zones of the root delimited by the planes of cell division are called Korper (body) and Kappe (cap) respectively. This theory may be compared with the tunica-corpus theory in the shoot apex.