Quadrant II - Transcript and Related Materials

Programme: Bachelor of Science (First Year) Subject: Botany Course Code: BOC 102 Course Title: Biodiversity II (Vascular Plants) Unit: Pteridophytes Module Name: Anatomy of *Equisetum* Name of the Presenter: Jyoti D. Vaingankar

Notes

Anatomy of root:

A transverse section of the root shows an epidermis, cortex and stele. Epidermis is an outermost layer made up of thin-walled cells also called as the piliferous layer. It bears root hairs in the root hair zone. Cortex is present below the epidermis and consists of many layers of parenchymatous cells and has two zones. The outer sclerenchymatous zone and the inner zone made up of thin-walled parenchyma with air spaces. In some species the cortical cells below the epidermis are thick walled and lignified constituting the tissue referred to as exodermis.

Internal to the cortex is a well-defined endodermis followed by a pericycle which is one cell thick. The cells of the pericycle fit accurately to those of endodermis thus the endodermis appears two layered thick. Since the casparian thickenings are absent in the inner layer it cannot be regarded as the second layer of endodermis. Casparian thickenings are clearly visible in endodermis. The stele is a protostele with triarch or tetrarch. In smaller roots, in the centre there is a large metaxylem element. The three or four protoxylem groups meet and surround a central metaxylem vessel. In larger roots there will be more than one metaxylem element. Pith is absent.

Anatomy of rhizome:

Anatomy of rhizome differs from that of aerial stem. Stomata are absent in the epidermis. The sclerenchyma is not very well developed as compared with the aerial shoot and forms a continuous layer. Chlorenchyma is absent in the cortex. The development of the mechanical tissue is less when compared with the aerial shoot. The solid pith is present in *E. arvense* but is absent in others.

Anatomy of stem internode:

<u>Epidermis:</u> Outermost layer is the epidermis which is single layered forming the strong outer covering. Epidermal cells are thick, cuticularised and have a deposition of silica in their outer and lateral walls. Due to the presence of silica, the stem appears hard and rough to touch. The continuity of epidermis is interrupted by sunken stomata distributed only in the furrows between the ridges. In each sunken stoma, the guard cells are covered completely by subsidiary cells, giving an appearance of two sets of guard cells. A hypodermal sclerenchymatous zone is present below each ridge which may extend up to stele in *E. giganteum*. Below the epidermis a well-developed cortex is present.

<u>Cortex</u>: The cortex is differentiated into outer and inner regions. The outer cortex is differentiated into two types of cells:

- Sclerenchymatous cells which are thick walled cells and give mechanical support to the stem and are subepidermal in position. Below the ridges, they are present in large and heavy groups. There is an equal number of smaller groups of sclerenchyma below the epidermis of grooves or furrows. But they are absent below the stomata.

- Chlorenchymatous cells which are present lateral to and below the sclerenchyma contains large number of chloroplasts in their cells and it is the assimilatory region of the stem.

<u>Inner cortex</u>: It is made up few layers of large, thin-walled parenchymatous cells. There is a large air cavity in the inner cortex corresponding to each furrow and alternating with the ridges, known as vallecular canals. These are schizolysigenous canals extending the entire length of internodes forming a distinct aerating system.

<u>Endodermis:</u> Innermost layer of cortex is the endodermis, the cells of which contains casparian strips. A variety of conditions is found with respect to the position of endodermis in various species. The most common condition is observed in *E. arvense* where a common endodermal ring is present around the whole ring of vascular bundles In *E. litorale*, each vascular bundle contains its individual endodermis. In some species like *E. debile* a common ring of endodermis is present both outside as well as inside the vascular bundles.

<u>Stele:</u> The stele consists of a well-defined ring of small vascular bundles surrounding a large pith cavity. They are present below the ridges, alternate in position with the vallecular canals of the cortex. The individual bundles in a ring are separated from one another by a large zone of parenchyma. Internal to the vascular bundles, below the ridges a small water containing cavity is present which is known as carinal cavity. The number of vascular bundles and vallecular canals is equal to the number of ridges and grooves, respectively.

Each vascular bundle is conjoint, collateral, closed and consists of xylem and phloem. Xylem is poorly developed, 'V'- shaped and endarch. The metaxylem consists of scalariform tracheids and forms the two limbs of the 'V'. Protoxylem is present opposite to carinal cavity. It consists of annular and spiral tracheids. Phloem is present in between two strands of metaxylem and made up of phloem parenchyma and sieve tubes.

<u>Pith:</u> Pith is present in the form of pith cavity in young stem, located in the centre of the aerial shoot.

Anatomy of stem node:

It is similar to the internode except for some differences. Vallecular canals are absent but may be present in some species like *E. debile*. In the central region a parenchymatous pith is present at nodes and forms a diaphragm separating the internodes above and below. The vascular bundles are connected by a continuous cylinder of xylem at nodal region. Carinal canals are absent in the nodal region.

Anatomy of leaf:

The leaf has a single vein, means each leaf contains a single vascular bundle which is collateral and is surrounded by an endodermis. The carinal canals are not found. Xylem is poorly developed. Surrounding the vein are found bands of sclerenchyma alternating with parenchymatous bands. Encircling this are thin-walled parenchyma cells. Stomata are found in the lower epidermis.