ANOMALOUS SECONDARY GROWTH IN BOERHAAVIA

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INTRODUCTION

Secondary growth :

Meristematic activity of the cambial ring in the stellar region is uniform throughout. This results in the uniform increase in girth or diameter of dicot stem(and also in dicot roots)

Anomalous secondary growth :

In some plants the cambium is normal at the beginning but thereafter, it becomes unevenly active at different parts, producing different proportion of secondary xylem and secondary phloem with an unusual arrangement. When the cambium in some parts produces a large amount of xylem than phloem, and in reverse order in some other parts, the vascular cylinder produced, thus, becomes lobed instead of being cylindrical.

T.S. of Boerhaavia – Stem

T.S. reveals the following tissues from outside within:

Epidermis:

- Single layered consists of small, radially elongated cells with cuticle and some stomata.
- . Multicellular epidermal hairs arise from some cells.

Cortex:

- It is well differentiated and consists of few layered collenchymatous hypodermis followed by chlorenchyma.
- Collenchyma is 3 to 4 cells deep, but generally near stomata it is only one layered.
- Chlorenchyma is present inner to collenchyma in the form of 3 to 7 layers.
- Chlorenchymatous cells are thin walled, oval, full of chloroplasts and enclose many intercellular spaces.
- Endodermis is clearly developed and made up of many, tubular, thick-walled cells.

Pericycle:

- Inner to the endodermis is present parenchymatous pericycle but at some places it is represented by isolated patches of sclerenchyma

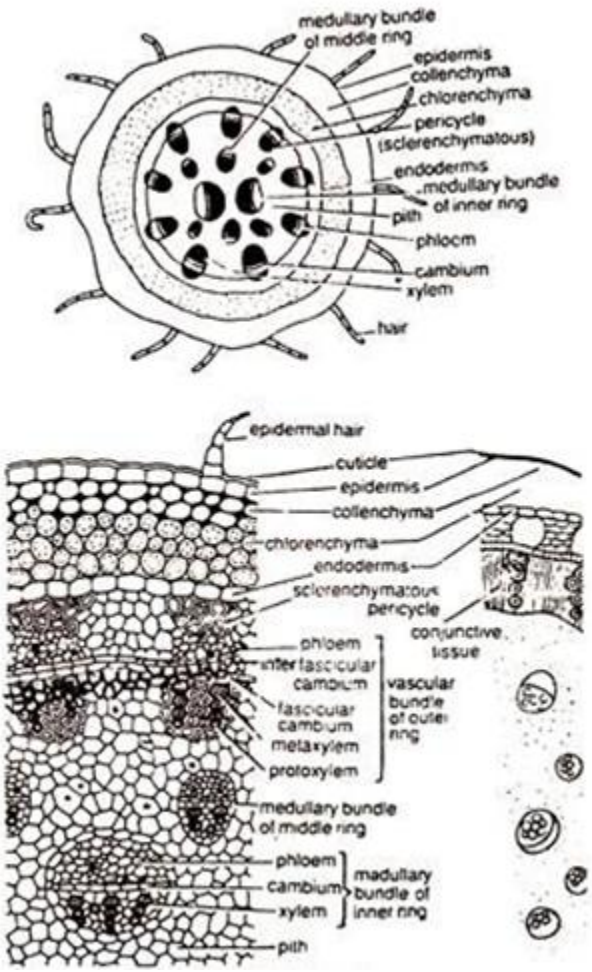

Fig. Boerhaavia. T.S. of stem

Vascular System:

- Vascular bundles are present in three rings. In the *innermost ring* are present **two large bundles**; in the *middle ring* the number ranges from **6 to 14** while the *outermost ring* consists of **15 to 20 vascular bundles.**
- Vascular bundles of innermost and middle rings are medullary bundles.
- Vascular bundles are conjoint, collateral and endarch.
- Two vascular bundles of the innermost ring arc large, oval and lie opposite to each other with their xylem facing towards centre and phloem outwards.
- Middle ring consists of 6-14 small vascular bundles.
- Vascular bundles of inner and middle rings may show a little secondary growth.

- Phloem consists of sieve tubes, companion cells and phloem parenchyma while the xylem consists of vessels, tracheids and xylem parenchyma.
- Outermost ring of the vascular bundles contain inter-fascicular cambium which is absent in other two rings.
- Cambium develops secondarily from the pericycle and becomes active. It cuts secondary phloem towards outer side and secondary xylem towards inner side. Due to these changes the primary phloem becomes crushed and present next to pericycle. Primary xylem is situated near the pith.
- Interfascicular cambium also soon becomes active and cuts internally the row of cells which become thick walled and lignified and are known as conjunctive tissue.

Pith:

It is well developed, parenchymatous and present in the centre.

Anomalous Secondary growth in Boerhaavia :

Primary anomaly :Two biggest central bundles are followed by a ring of 5-10 medullary bundles.

Secondary anomaly :Thter is no formation of interfascicular cambium either in the central or medullary bundles .Hence, the fascicular cambium itself acts slowly to produce secondary vascular tissue. These bundles get slightly increased in bulk.

- Secondary growth begins with the appearance of a cambium ring outside the primary bundles. It cuts off a third peripheral ring of several collateral bundles, each with secondary xylem and phloem in normal positions and a fascicular cambium in between.
- The activity of cambial ring decline soon The stripes of secondary cambium out side the secondary phloem unite with the perfect cambial ring. This cambial ring repeats the meristematic activity in a way similar to that of primary cambial ring.
- During the process , several such stripes or cambial ring may be produced successively. And as such, owing to their meritematic activity, secondary bundles produced remain embedded in in the thick walled lignified conjunctive tissue.
- Cork and lenticels develop a little later in the external region outside the hypodermis.