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SUBSIDIARY PART - II

GROUP C - PLANT PHYSIOLOGY

ASCENT OF SAP - I

The water absorbed by the roots together with absorbed salts and solutes (collectively known as sap) is to be ultimately conducted upwards from the xylem of the root to the leaves.

This upward journey of water containing dissolved salts and solutes against the downward pull of gravitation is known as ascent of sap.

In herbaceous species as well as shurby plants, the distance through which sap moves in passing from the root tip to the leaves is usually not more than a few feet. But in much taller trees like siquoia gigantia of California and the blue gums (eucalyptus) of Australia, this distance exceeds 300 feet and range nearly to 400 feet above the level of absorption.

Thus the problems pertaining to the mystery of ascent of sap is to be discussed under following two sub-heads :

1.Path of sap movement.

2. Mechanism of sap movement.

Path of sap movement :

i. The Girdling experiment (Ringing experiments) of Malpighi 1671, have amply confirmed that the lumen (and not the walls) of tracheids and vessels of the xylem (which are continuous from the root to the leaves) are the principal channels of sap conduction.

ii. In gymnosperms, since vessels are absent, the tracheids are the sole pathway for this job.

iii. Of all the xylem elements, the tracheids and vessels have been selected for the upward journey of sap because both of these are dead tissues. As such, the sap escapes any resistance of the protoplasm. Moreover, the walls of tracheids and vessels are perforated and interconnected thereby forming a continuous water tube.

iv. Apoplast and Symplast concept - Munch 1930, explained the pathway of ascent of sap in terms of apoplast and symplast. He coined the term apoplast to denote the dead parts of the plant including the

interconnecting walls and the water filled tracheids and vessels of xylem which constitute a single continuous system. The rest of the plant i.e. the living part, Munch called symplast which includes the whole protoplasm of the plant (excluding vacuoles) interconnected by Plasmodesmata and forming another continuous system. Munch said that ascent of sap is the job of the xylem part of the apoplast.

Mechanism of sap movement : Following three theories have been proposed :

a. Vital theories

b. Root Pressure theory

c. Physical theories