## **3.3. ASCENT OF SAP**

## **SYNOPSIS**

- The water absorbed by root hairs passes through cortex, passage cells of the endodermis, pericycle and finally enters the xylem. Through xylem it reaches to all parts of the shoot system.
- The upward movement of water against gravitational force, from, the root to the shoot is called 'ascent of sap' or 'upward movement of water'
- The most accepted theory which explains the ascent of sap is Cohesion Tension theory.
- This theory was first introduced by **Dixon** (1914), which is based on
  - i. Cohesion and adhesion of water molecules ii. continuity of water column and
  - iii. transpiration pull
- water potential decreases in the mesophyll cells due to transpiration pull
- The cohesive forces between water molecules and the tension created in vessels due to the transpiration pull result in the upward movement of the water from the roots to the mesophyll cells of the leaves in accordance with water potential gradient.
- A difference of water potential of about 1.3 MPa • is needed to raise water to a height of about 400 feet with an optimum velocity of water movement.
- It was calculated that a water potential difference of more than **4.0 MPa** existed in the tall trees.
- Cavitation in the xylem i.e. formation of gas bubbles in xylem and obstruction to the continuity of water column. It is called 'embolism'.
- According to the cohesion-tension theory, the tracheids are to be deemed as more efficient water conducting channels than vessels.
- The gradual elimination of tracheids by vessels in the course of evolution does not support this contention.

## ASCENT OF SAP

## LEVEL-I

- 51. Cohesion and Tension theory was proposed by 1) Dixon and Web 2) Dixon
  - 3) Hoagland and knops 4) Bowling
- 52. Driving force for Ascent of Sap 1) Water potential gradient
  - 2) Proton motive force
  - 3) Transpiration pull 4) Turgor pressure

	UNIT - III :: ASCENT OF SAP	
53.	Pseudostugor menziesi	i is a
	1) Tallest Angiosperm	2) Tallest Pteridophyte
	3) Tallest Dicot	4) Tallest Gymnosperm
54.	The term denoting the formation of air bubble	
	in xylem is	
	1) Ascent of Sap	2) Embolism
	3) Cavitation	4) Plasmolysis
LEV	'EL - II	
55.	Assertion(A) : Water potential decreases in the	
	mesophyll cell as a result of transpiration	
	Reason (R): During tr	anspiration water is lost
	from the surface of the mesophyll	
56.	Identify the correct order in passage of water to	
	xylem elements	
	1. Cortex $\rightarrow$ Root hairs $\rightarrow$ Pericycle $\rightarrow$ Passage	
	cells $\rightarrow$ xylem	
	2. Root hairs $\rightarrow$ Passage cells $\rightarrow$ Cortex $\rightarrow$	
	Pericycle $\rightarrow$ xylem	
	3. Root hairs $\rightarrow$ Passagecells $\rightarrow$ Cortex $\rightarrow$	
	epidermis → xylem	
	4. Koot hairs $\rightarrow$ Cortex $\rightarrow$ Passagecells $\rightarrow$	
	Pericycle $\rightarrow$ xylem	
57.	Upward movement of water through xylem is	
	1) Dinging experiments 2) Dellier experiment	
	2) Thirds funnel experiment	
	4) Cobalt chloride experiment	
58	Tallest Gymnosperms are	
	1. Eucalyptus regnans and Eucalyptus amyodalina	
	2. Sequoia sempervirens and Pseudotsuga	
	menziesii	
	3. Eucalyptus regnans and sequoia sempervirens	
	4. Pseudotsuga menz	ziesii and Eucalyptus
	amygdalina.	
59.	Cohesive forces between	n water molecules is
	1) 1.3 MPa 2) 30 b	Dars
	3) 300 bars 4) 300 Mpa	
60.	Eucalyptus amygdalina is	sa
	1) Tallest Gymnosperm 2) Tallest angiosperm	
	3) Fossil Gymnosperm	
	4) Gymnosperm with vessels	
61.	Arrange the following ascendingly based upon their	
	water potential values	
	A) Root B) Atm	nosphere
	C) Leat D) Soil	
$(\mathbf{a})$	1) BCAD 2) DACB	3) BACD 4) DCAB
62.	In a tall coniter tree the	$\psi$ of root 1s - 2.6 Mpa.

During ascent of sap, the  $\psi$  of leaf should be

4) - 2.9 Mpa

1) < -3.9 Mpa 2) > -3.9 Mpa

3) - 1.3 Mpa

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