

## FACTORS AFFECTING TRANSPIRATION

**Transpiration ratio:** the amount of water transpired per unit of dry matter manufactured by a plant is called transpiration ratio (LOWES, 1850)

### Significance of transpiration

It helps in the movement of water and minerals upside in the xylem elements. It also helps in the removal of excess water. Transpiration provides a cooling effect to the plant. Xerophytic plants, in order to reduce transpiration rate, develop a lot of mechanical tissues. Transpiration helps in increasing the concentration of minerals and also their distribution. Transpiration also helps in the development of root system in plants.

### Factors affecting transpiration

#### External factors

1. **Relative humidity** with increase in relative humidity the rate of transpiration decreases and vice versa.
2. **Carbon dioxide concentration** for stomatal opening, the carbon dioxide concentration should be below 300 PPM. Higher CO<sub>2</sub> concentration results in closure of stomata.
3. **Temperature** although with the rise in temperature the rate of transpiration increases but if the temperature is too high, transpiration rate decreases. At 30-35°C, stomatal closure takes place.
4. **Light** the quality and intensity of light also affect the rate of transpiration. High light intensity results in increase in temperature which results in higher transpiration rate. Besides this, the quality of light also affects transpiration. No opening of stomata takes place in green, UV and far red Light.
5. **Wind velocity** a wind velocity of 20 to 30 km per hour is favourable for transpiration. When the wind velocity reaches 40 to 50 km per hour the transpiration rate decreases due to closure of stomata.
6. **Atmospheric pressure** increase in atmospheric pressure leads to decreased rate of transpiration.
7. **Water availability** water availability is directly proportional to the rate of transpiration. When the available water is more in soil, rate of transpiration increases and vice versa.

#### Internal factors

Besides these external factors internal factors also affect the rate of transpiration.

1. **Leaf area** with increase in leaf area the frequency of stomata per unit area also increases. This results in increased rate of transpiration. Xerophytic plants which are found in dry areas, face water stress and therefore in these plants, the leaf area gets reduced or the leaves fall off early or they are modified into spines.

2. **Leaf structure** the leaf structure also affects the rate of transpiration. In leaf structure:

**Thickness of cuticle** determines the rate of transpiration. Thicker cuticle reduces the rate of transpiration.

**Number and position of stomata** if the stomata are more in number, transpiration rate is high. Similarly, the position of stomata is also important. Presence of stomata only on the lower surface of the leaf, reduces the transpiration rate.

**Sunken stomata** In xerophytic plants for example *Pinus*, *Nerium* etc., stomata are not found on the surface rather they are present in small cavities under the surface. Such stomata are called sunken stomata. This small stomatal cavity contains a number of hairs which help in reducing the rate of transpiration.

3. **Leaf modifications** several types of modifications are found in plants in order to reduce the rate of transpiration. These are:

**Phylloclad** for example **Opuntia**. Here the leaves fall off early and the stem becomes flat and and photosynthetic.

**Cladode** It is a modification of the single internode. Eg. *Asparagus*.

**Phyllode** is the modification of petiole. The leaves are reduced are fall off early and therefore the petiole flattens and becomes leaf like for example *Acacia melanoxylon*.

4. **Quality of fruits** with increase in rate of transpiration the sugar content of fruit increases.

**Disadvantages of transpiration** transpiration has its inherent negative effect on the plant also.

Very high rate of transpiration leads to wilting in plants.

The growth of the plant is reduced along with reduced yield.

Plants facing water stress produce ABA (abscisic acid) in large amount. This helps in the closure of stomata. ABA is therefore called the stress hormone.

Most of the water, which is absorbed by plant is lost through the process of transpiration. This results in wastage of a lot of energy.