parts of the plant brings down their temperature to protect them from ***excessive*** heating.

But, recently it is confirmed that plants lose the heat by thermal emission (loss of heat by emitting heat waves) but not exactly by transpiration.

4. Gain of Carbon dioxide

In plants, there is a correlation between loss of water by transpiration and carbon dioxide assimilated by the plant. This is called ***transpiration ratio***. Generally, in C_3 plants about 500 molecules of water are lost for every molecule of CO_2 fixed by photosynthesis. So, the transpiration ratio is 500. Water use efficiency of such plants is 1/500 or 0.002%. This is because -

- The concentration gradient driving water loss is about 50 times larger than that driving the influx of CO_2. This is due to the low concentration of CO_2 in air (about 0.03%) and high concentration of water vapor within the leaf.
- CO_2 diffuses 1.6 times more slowly through air than water molecules diffusing through air. This is because the CO_2 molecule is larger than H_2O.
- CO_2 has to pass through diffusion barriers in the plasma membrane, cytoplasm and chloroplast envelope before it is assimilated in the chloroplast.

The C_4 plants generally transpire less water per molecule of CO_2 assimilated during photosynthesis. The transpiration ratio for C_4 plants is about 250.

In desert plants which are adapted for CAM photosynthesis, the transpiration rate is very low and carbon assimilation rate is high. So, the transpiration ratio of CAM plants is about 50.

Transpiration As a Necessary Evil

The loss of water vapour from the surface of aerial parts of the plant is termed as ***transpiration***.

Although transpiration assists many physiological activities of plants, it harms the plants also. Hence, transpiration is considered as a ***necessary evil***.

Transpiration as a Necessary Process

Transpiration is of a vital importance for plant life. It is necessary for -

- the ***absorption of water*** by plant roots,
- ***absorption*** and ***translocation of mineral ions***,
- ***cooling*** of plant surfaces
- ***CO_2 assimilation*** by leaves.

As the rate of transpiration ceases, the rate of these processes also declines to an extent that cannot support the growth and survival of the plants. So, transpiration is a necessary process for plants. (See Significance of Transpiration)

Transpiration as an Evil Process

- Transpiration leads to ***unnecessary wastage of water*** from plants.
- It sends out 95% of the water absorbed by plants. Some amount of ***metabolic energy*** is also wasted for opening and closing the stomata.
- Rapid transpiration removes plenty of water from the soil, which leads to ***scarcity of water*** in the soil.
- As a consequence, ***internal water deficit*** is created in the plants, leading to ***wilting*** and ***death*** of the plants.
- In order to tolerate this adverse condition, plants have to develop ***extra adaptation*** for reducing the transpiration rate.
- For this purpose alone deciduous trees have to ***shed their leaves*** during autumn. Therefore, transpiration in plants is an ***evil process.***

Conclusion

Although transpiration imposes many disadvantages, the plants cannot avoid transpiration to escape from water loss because of the unique anatomical features of leaves. These anatomical features meant for gas exchange during respiration and photosynthesis are also favourable for transpiration. Plants cannot prevent water loss via transpiration. Hence, ***Curtis*** (1926) and others called transpiration as a ***necessary evil***.

Factors Affecting Transpiration

The rate of transpiration varies from plant to plant and from day to day. Both the external factors (environmental conditions)