

TRANSLOCATION OF MANUFACTURED SUBSTANCES

- The movement of substances manufactured in the leaves during photosynthesis to other parts of the plant is known as **translocation**
- The manufactured substances are sugars, mainly sucrose
- The sucrose is transported by the phloem tissue from the leaves to the stems and roots
- Translocation is an **active process** that requires energy

TRANSPIRATION

ADVANTAGES OF TRANSPIRATION:

1. Transpiration leads to **transpiration pull**, which in turn is **responsible for the upward movement of water through the plant**.
2. Transpiration helps in the **cooling** of the **plant** through the **loss of water vapour**.

TRANSPIRATION

RELATIONSHIP BETWEEN WATER LOSS AND LEAF STRUCTURE:

- ⦿ We must remember that leaves are all not the same.
- ⦿ They **differ** in the following ways::
 1. Their **shape and size**.
 2. The **arrangement** of the **leaves** themselves.
 3. **Hairs**: are present or not.
 4. The **cuticle**: thickness.
 5. The **stomata**: number and position

TRANSPIRATION

- ⊙ These **differences** effect the **rate at which water is lost form the plant** , through **transpiration**.
- ⊙ The **rate at which water is lost** through transpiration is called the **rate of transpiration**.
- ⊙ The **rate of transpiration** refers to how **quickly or slowly water vapour is lost from the plant**.

TRANSPIRATION

They can change the rate of transpiration in the following ways:

1. The **shape and size of leaves** are **changed** to **reduce** the **surface area** and this leads to a **reduction** in the **rate of transpiration**. Example the leaves of the pine tree which are needle-shaped.
2. **Leaves** may **overlap** each other to **reduce** **surface area exposed to the sun** and therefore **reduces the rate of transpiration**.

TRANSPIRATION

3. **Hairs** maybe present on some leaves, these hairs **reflect sunlight** and **reduces air movement**, therefore **reducing the rate of transpiration**.
4. **Waterproof cuticle** maybe **thickened** to further **reduce the rate of transpiration**.
5. The **arrangement and number of stomata** may be **altered to reduce the rate of transpiration**. For example **more stomata** are found on the **undersurface of the leaf, away from the direct sunlight**. Some of the **stomata are sunken to trap moisture** reducing the rate of transpiration.

TRANSPIRATION

Effect of Environmental factors on the rate of Transpiration:

- ⦿ Earlier we discussed how the **structure of the leaf affected the rate of transpiration**. We call these **internal structures**.
- ⦿ The **environment may also affect the rate of transpiration**. These are called **external factors**.
- ⦿ We shall now discuss how these external factors affect the rate of transpiration.

TRANSPIRATION

1. Wind:

- ⊙ Usually there is a **pocket of humid air** around the **leaf**.
- ⊙ The **wind blows away the pocket of humid air**.
- ⊙ Therefore there is a **higher concentration of water vapour molecules inside the leaf** than **outside**.
- ⊙ Remember that **water always moves from a region of high concentration to a region of lower concentration**. (In other words from where there is a lot to where there is a little.)

TRANSPIRATION

- Therefore **water would move out of the leaf into the surrounding atmosphere.**
- Therefore **wind increases the rate of transpiration.**
- However **very strong winds** causes the **stomata to close, reducing the rate of transpiration.**

TRANSPIRATION

2. Temperature:

- ⊙ When the **temperature increases the kinetic energy of the water molecules also increases.**
- ⊙ This **increased energy causes the water molecules to move faster.** In other words **they move at a faster rate.**
- ⊙ Therefore **more water molecules will diffuse out of the leaf on a hot.**
- ⊙ In other words the **rate of diffusion of water molecules out of the leaf is higher on a hot day than a cold one.**
- ⊙ This means that...

TRANSPIRATION

high temperatures **increases** the rate of transpiration.

TRANSPIRATION

3. Humidity:

- ⊙ **Humidity** refers to the **amount of moisture** in the **atmosphere**.
- ⊙ On a **humid day** there is a **high concentration of water vapour around the leaves**.
- ⊙ Therefore **water will remain within the leaf** because there is a **higher concentration of water vapour molecules outside the leaves**.
- ⊙ **Remember** that **water moves from a region of high concentration to a region of low concentration**.
- ⊙ This means that...

TRANSPIRATION

increased humidity **decreases** the rate of transpiration.

TRANSPIRATION

4. Light Intensity:

- ⦿ The **stomata open** in the **presence of light**.
- ⦿ Therefore as **light intensity increases** the **rate of transpiration...**

increases.

- ⦿ However if the **light intensity is too high** the **stomata closes to prevent excessive loss of water.**

GUTTATION:

- ⊙ **Guttation** is the **loss of water** in the form of **droplets** from special pores in the leaves called **hydathodes**.
- ⊙ The **hydathodes** are **found** on the **margins of the leaves**.
- ⊙ It occurs in the following way...



Guttation

GUTTATION:

- ⊙ If the **air is very humid** transpiration may slow down or can even stop because there is more moisture outside the leaf than in.
- ⊙ The **concentration gradient has been reversed**.
- ⊙ If there is **enough moisture in the soil** and the **plant has absorbed more water than necessary** then it **loses the excess water** in the form of **droplets through the hydathodes**.

WILTING

- ⦿ Sometimes the **environmental factors** causes an **increase in transpiration**, causing the plant to lose a large amount of water.
- ⦿ The **plant** must be able to **absorb more water from the soil to replace the water lost through transpiration**.
- ⦿ If the **soil does not have enough water** or the **roots do not have a large enough surface area to absorb enough water to replace the lost water** then..
- ⦿ The **xylem absorbs the water from the surrounding cells** for example the parenchyma.

WILTING

- ⦿ The loss of water causes...
 - a. the **vacuoles to shrink in size** and
 - b. Sometimes even the **volume of the cytoplasm to decrease due to the water loss.**
- ⦿ These cells lose the **tugour or turgidity.**
- ⦿ This **loss of turgidity** can sometimes result in the **leaves and even stems becoming limp.**
- ⦿ They then droop.
- ⦿ When this happens then the plant is **wilting.**

WILTING

- ⦿ However wilting **does not** have to be **permanent**, it can be **reversed if the plant is placed in water or water is added to the soil**, provided that it did not suffer a **water loss for too long**.

CLASS ACTIVITY - WATER ABSORPTION

1. The force necessary for the upward movement of water is called ...
2. The natural tendency for liquids to move up tubes with fine bores is called
3. The upward force that is caused by the continual entry of water into the roots is called..
4. Water enters the epidermis of the root because
5. The endodermis is able to direct the flow of water because of its..
6. Mineral salts are absorbed by active transport because...
7. The process during which the plant loses water in the form of water vapour through the aerial parts of the plant is called..