



**SNJB's KKHA Arts, SMGL Commerce  
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423101.**



**Course Title: S.Y.B.Sc Plant Physiology & Metabolism  
(NEP 2020)**

**Topic: Transpiration**

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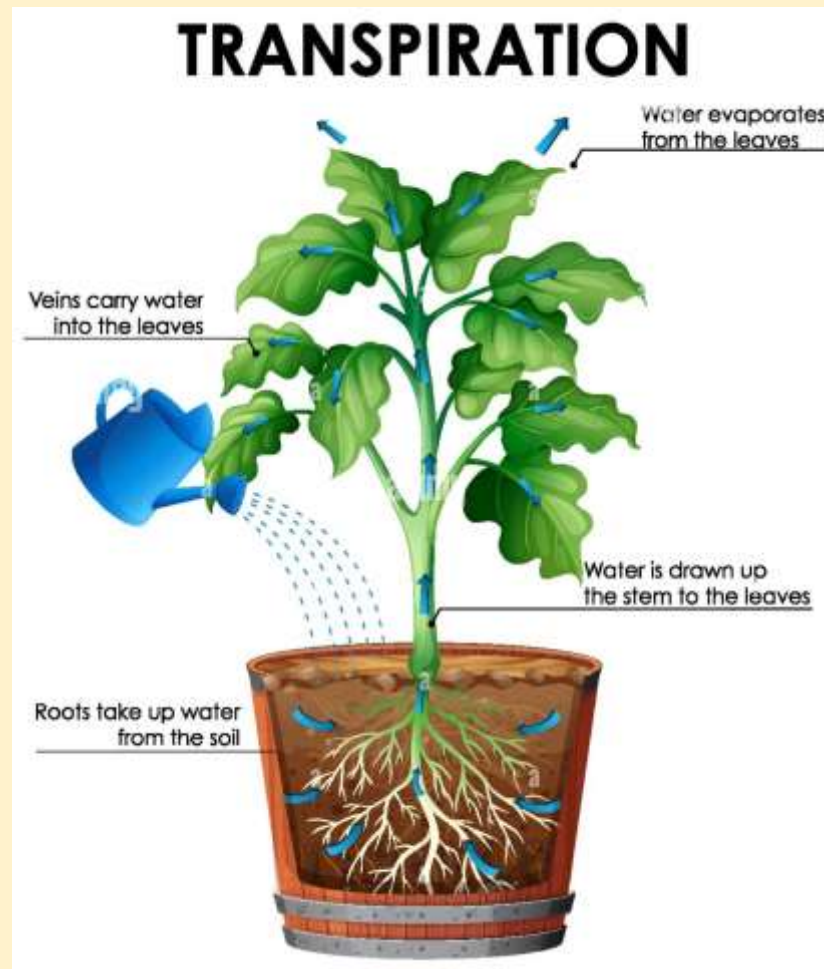
**(M.Sc. Ph.D., B.Ed., CSIR NET JRF, ICAR NET, SET, GATE)**

**(Department of Botany)**



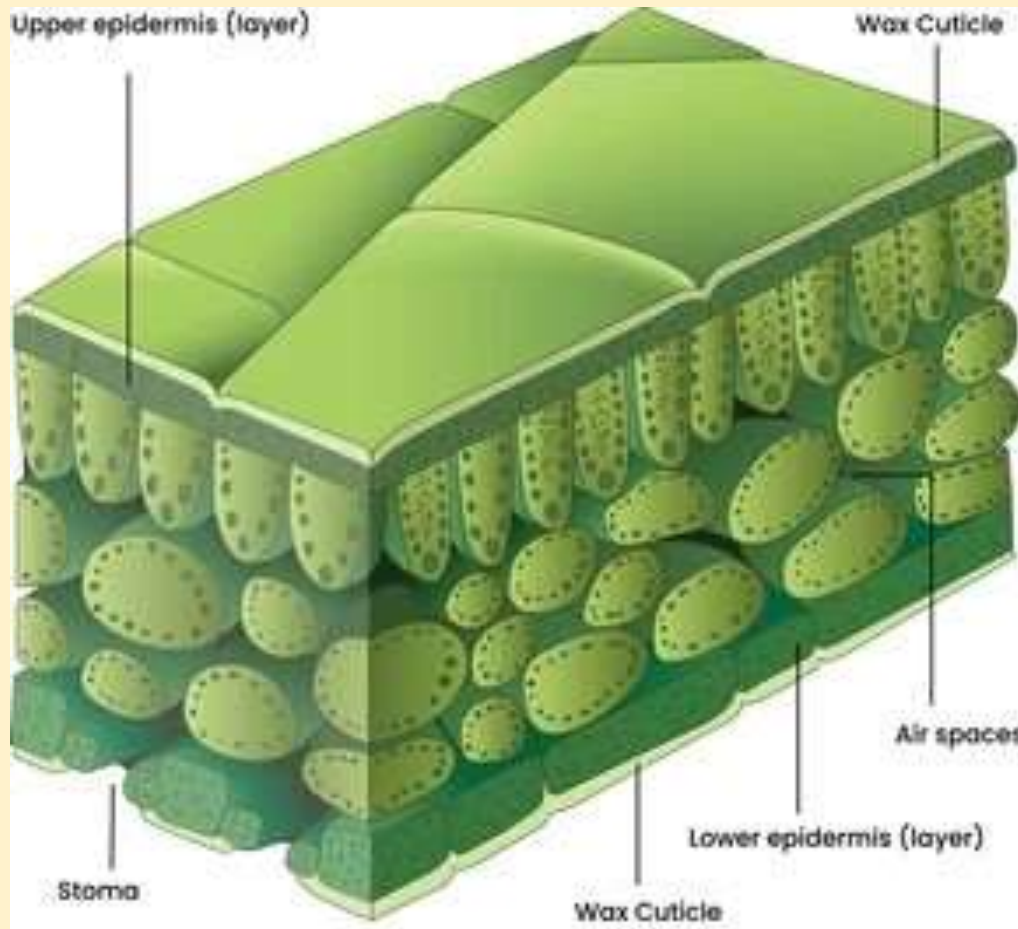
# INTRODUCTION

- **Definition:** The loss of water in vapour form (gaseous form) from the aerial parts of the plants is known as transpiration.
- Plant absorb large amount of water from the soil only 1 to 2% of water used by plants and 98-99% is lost in the form of water vapour
- E.g. *Helianthus annuus* ( Sunflower) loses about 56 kg of water in its life cycle of 4-5 months.



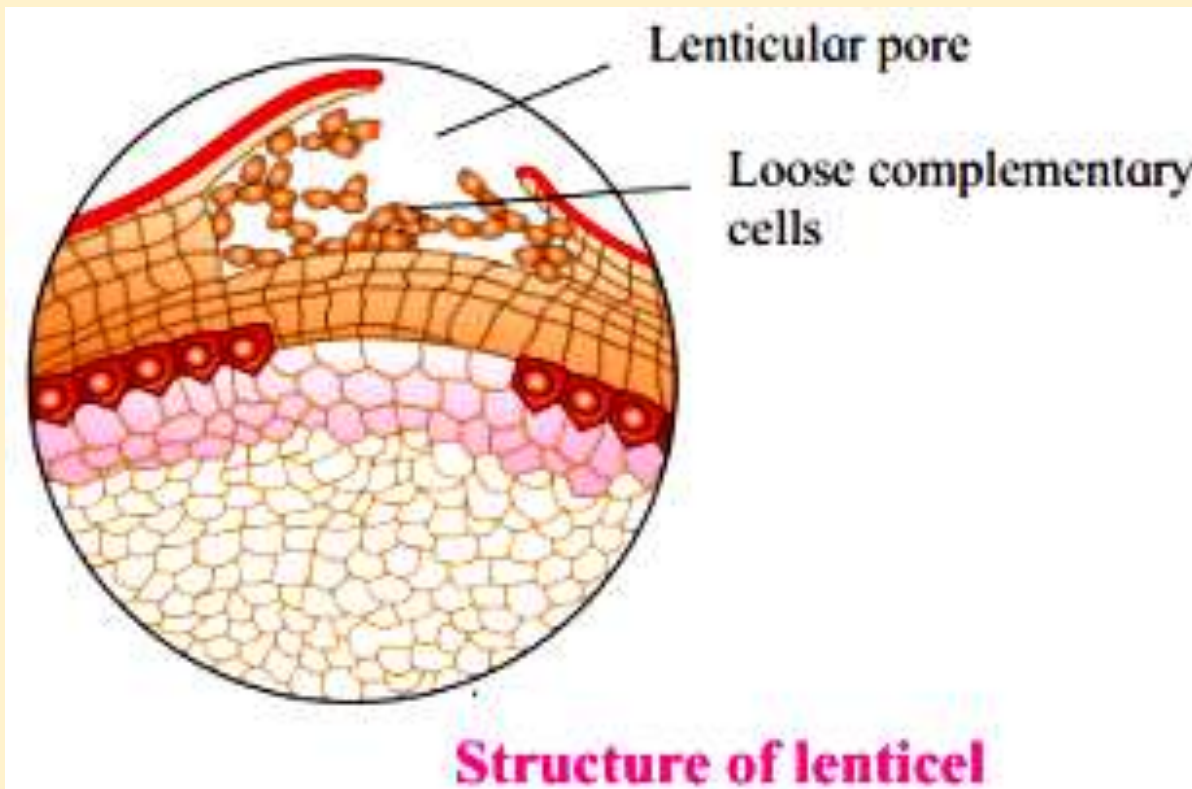
# TYPES OF TRANSPIRATION

- ❖ **Cuticular Transpiration:** Cuticle is the waxy, protective outer layer over the leaf epidermis where transpiration takes place.
- ❖ When water lost through cuticle, it is called as cuticular transpiration.
- ❖ Nearly 5% of water lost through cuticle.



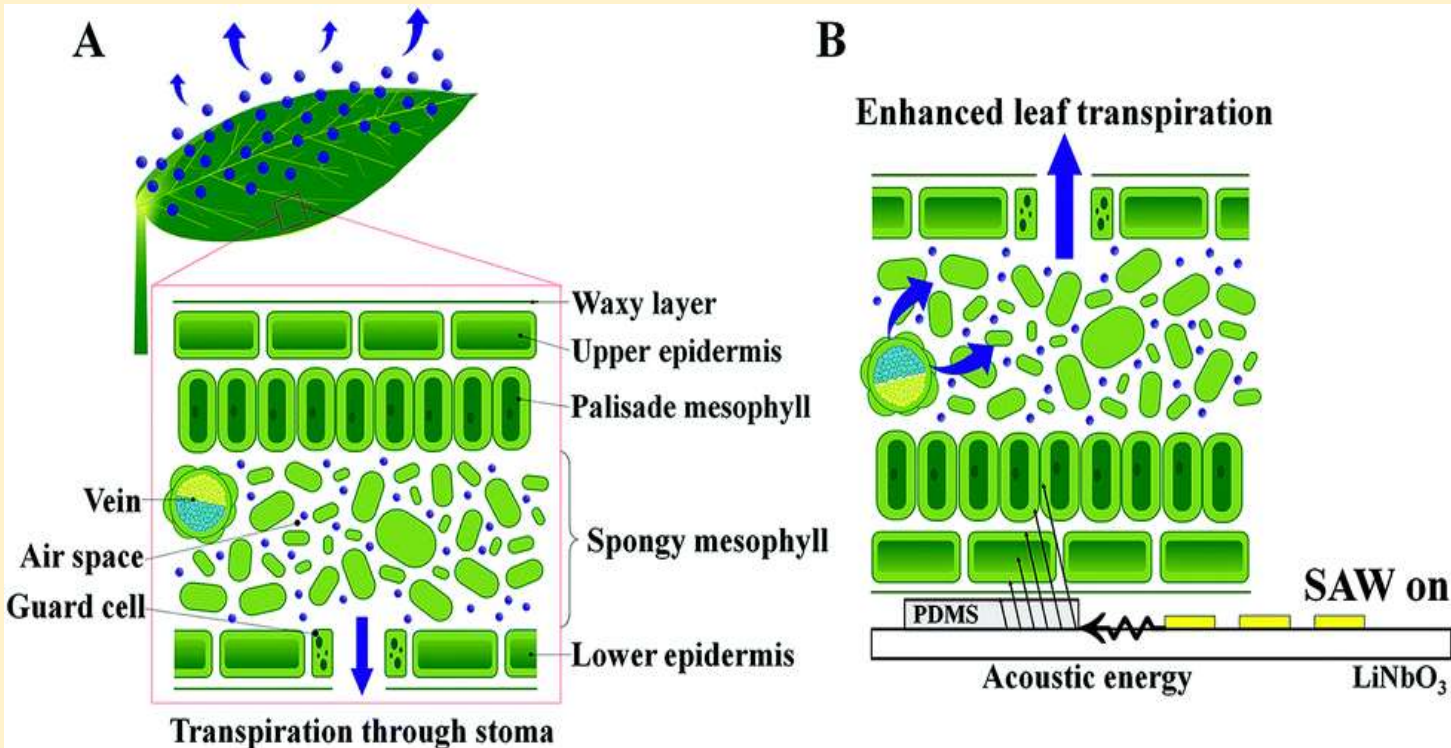
# TYPES OF TRANSPIRATION

- ❖ **Lenticular transpiration:** When transpiration takes place through lenticels (Small pores on Stem), it is called as lenticular transpiration.
- ❖ Only 0.1 to 0.2 percent water lost through lenticels



# TYPES OF TRANSPIRATION

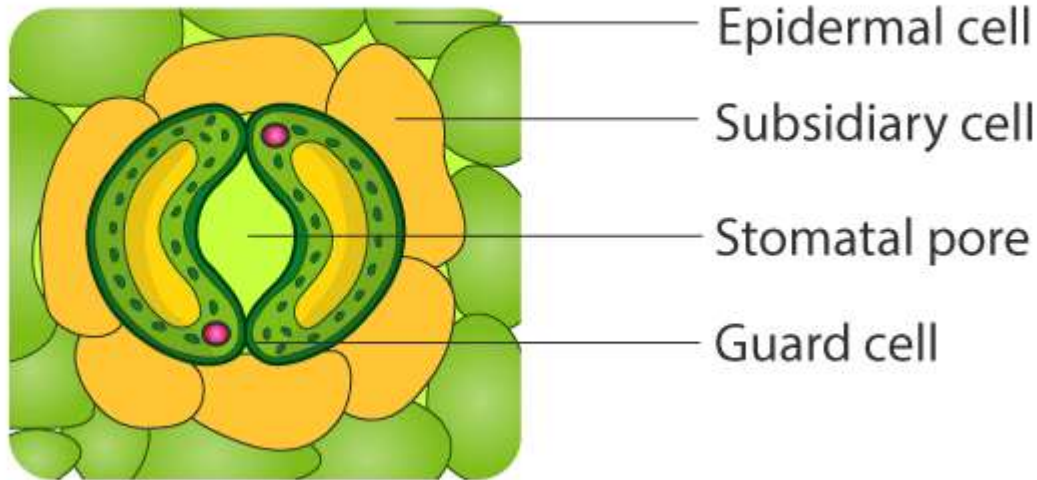
- ❖ **Stomatal transpiration:** Loss of water through stomata is called as stomatal transpiration.
- ❖ Stomata (singular stoma) are the small pores openings present in the epidermis of leaves.
- ❖ More number of stomata present of lower surface of leaves.
- ❖ In monocots like grasses equal number of stomata present on both the surfaces.
- ❖ In aquatic plants like Pistia & Eichhornia stomata only present on upper surface of leaves. About 80-90% water lost by stomatal transpiration.



# STRUCTURE OF STOMATA

- ❖ Stomata are the minute pores or openings, which are present in the epidermis of leaf.
- ❖ Each stoma consists of an elliptical (crescent shaped) pore, surrounded by two specialised cells called as guard cells.
- ❖ Each guard cell is kidney shaped as in dicots or dumb-bell shaped as in monocots
- ❖ Each guard cell contains a nucleus, chloroplasts and lining layer of cytoplasm & a central vacuole filled with cell sap. They contain a large amount of protoplasm than their neighbouring epidermal cells.

## STRUCTURE OF STOMATA

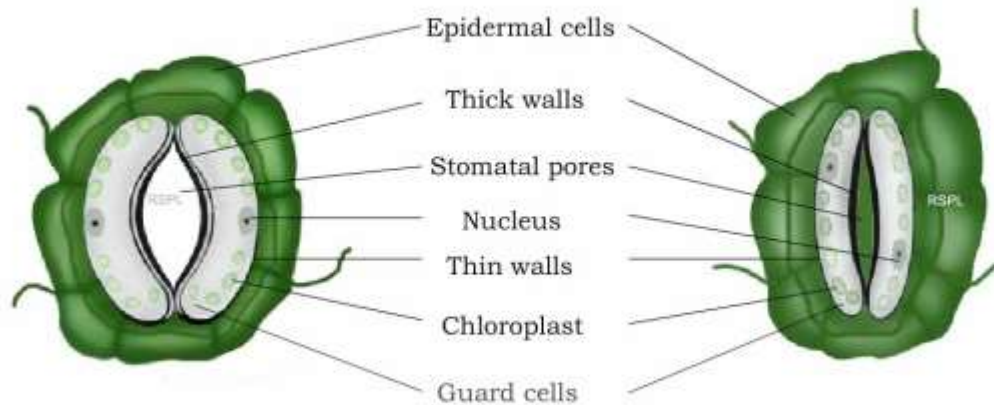


# TYPES OF STOMATA

## DICOT STOMATA

- ❖ **Guard Cells:** Kidney-shaped with a thick inner wall (towards pore) and thin outer wall.
- ❖ **Stomatal Pore:** Opening between guard cells for CO<sub>2</sub> intake and water vapour release.
- ❖ **Subsidiary Cells:** Epidermal cells surrounding guard cells; their number and arrangement vary.
- ❖ **Epidermal Cells:** Flattened outer layer cells of the leaf.
- ❖ **Chloroplasts in Guard Cells:** Enable photosynthesis and ATP production for movement of stomata.

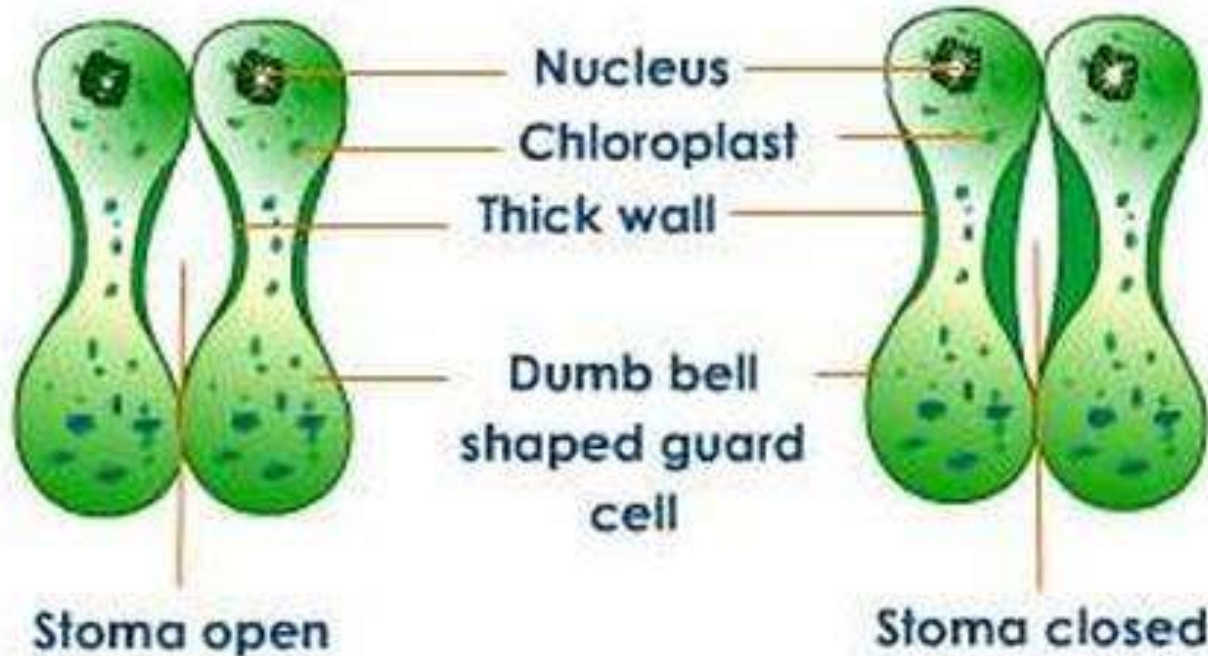
Opened and Closed Stomata : Dicots



# TYPES OF STOMATA

## MONOCOT STOMATA

- ❖ **Guard Cells:** Dumbbell-shaped, with swollen ends and a thin, narrow middle portion.
- ❖ **Stomatal Pore:** The gap between guard cells for exchange of gases and water vapour.
- ❖ **Subsidiary Cells:** Usually two, one on each side of guard cells, arranged parallel to the pore.
- ❖ **Epidermal Cells:** Large, elongated cells surrounding the stomatal complex.
- ❖ **Chloroplasts:** Present in guard cells for energy production to regulate opening and closing.



# GUTTATION

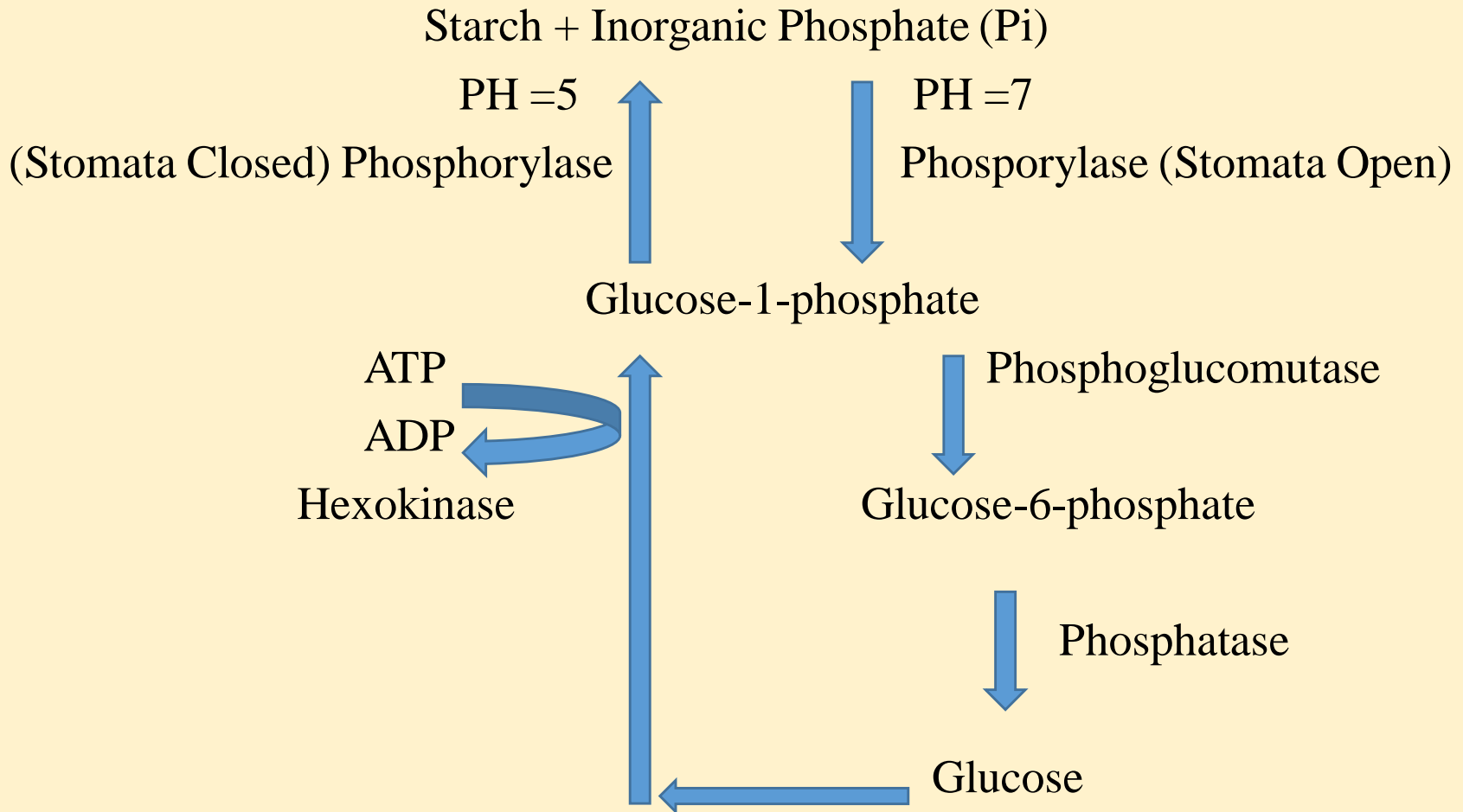
- **Definition:** Loss of water in liquid form from the uninjured tips or margins of the leaf is known as guttation
- Burgerstein reported guttation in 333 genera of plants belonging to 115 families. E.g. Tomato, Grasses etc.
- Generally guttation takes place when the conditions are such that absorption of water greatly exceeds transpiration.
- Therefore the excess of water escapes through the structures called Hydathodes.



# STOMATAL OPENING & CLOSING

## STEWARDS HYPOTHESIS

- Steward (1964) Proposed a hypothesis to explain the mechanism of opening & closing of stomata.



# **FACTORS AFFECTING THE RATE OF TRANSPIRATION**

## **1. External Factors (Environmental Factors)**

- I. Temperature**
- II. Light**
- III. Atmospheric Humidity**
- IV. Atmospheric Pressure**
- V. Water Content of Soil**
- VI. Air Currents**

## **2. Internal Factors**

- I. Size of Leaves**
- II. Coating of cuticle, wax & cutine**
- III. Number and of size of stomata per unit area**
- IV. Water content of mesophyll cell**
- V. Root shoot ratio**

# REFERENCE

- **Plant Physiology** by Taiz & Zeiger
- **Biochemistry and Molecular Biology** of Plants by Buchanan, Gruissem & Jones
- **Plant Physiology** by Mohr & Schopfer
- **A text book of Plant Physiology S.Y.B.Sc Botany NEP 2020.**

