**Ex. No. 2: Kranz Anatomy**

**Introduction:** Kranz means wreath in German (A wreath is an assortment of flowers, leaves, fruits, twigs, cells or various materials that is constructed to resemble a ring). Kranz anatomy refers to an arrangement of bundle sheath cells surrounded by mesophyll cells in $C_4$ plants. This arrangement ensures that mesophyll cells are no more than 2-4 cell layers away from the bundle sheath cells. Hence, the transport of $C_4$ cycle metabolites is facilitated via plasmodesmata through these two cell types.

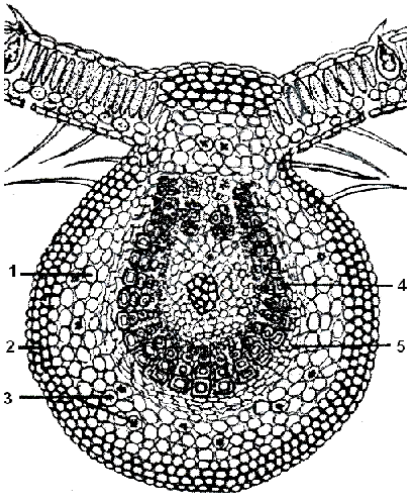
Plants are categorized as $C_3$ and $C_4$ plants based on the nature of carbon compounds formed during carbon dioxide fixation. Generally in plants like dicots *eg*., in mulberry a 3 carbon compound phosphoglyceric acid (PGA) is formed as a first stable compound during $CO_2$ fixation and therefore such plants are called as $C_3$ plants. However, in some monocots *eg.*, sugarcane, a 4 carbon compounds like oxaloacetate, malate and aspartate are formed during $CO_2$ fixation. Therefore, these plants are called as $C_4$ plants.

**Aim:** To study the Kranz anatomy.

**Procedure:** Prepare a thin transverse section of mulberry as well as sugar cane leaf and mount on a clean glass slide with a drop of glycerin and diluted safranin. Observe under a microscope and list out the differences.

**Differences between $C_3$ and $C_4$ plants**

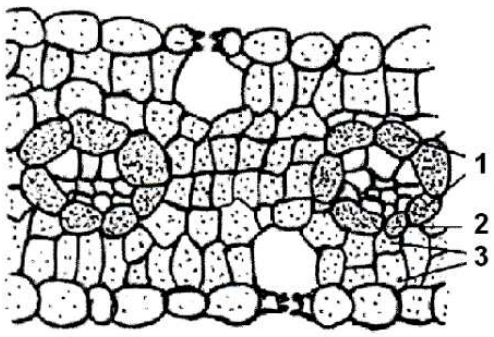
| Sl. No. | $C_3$ Plants | $C_4$ Plants |
|---|---|---|
| 1 | Non Kranz type anatomy. | Kranz type anatomy *i.e*., has a concentric arrangement of the bundle sheath and mesophyll layer, the bundle sheath is also thicker. |
| 2 | Bundle sheath cells are absent. Carbon fixation and Calvin cycle reactions occur in mesophyll cells only. | Bundle sheath cells are present and contain chloroplasts. Carbon is fixed in mesophyll cells and then transported to bundle sheath cells where Calvin cycle reactions occur. |
| 3 | A 3 carbon compound phosphoglyceric acid (PGA) is formed as a first stable compound. | Four carbon compounds like oxaloacetate, malate and aspartate are formed during $CO_2$ fixation as first stable compound |
| 4 | Ribulose 1,5 bisphosphate carboxylase (RuBisCo) is the $CO_2$ accepter. | Phosphoenolpyruvate (PEP) carboxylase is the $CO_2$ accepter, and is more efficient than RuBisCo. |
| 5 | Only $C_3$ pathway is present and involves in $CO_2$ fixation. | Both $C_3$ and $C_4$ pathways present and involves in $CO_2$ fixation. Hence they are called as "Efficient Plants" |




**Cross Section of $C_3$ Plant Leaf**

1. Parenchyma, 2. Collenchyma
2. Druses, 4. Xylem, 5. Phloem

Courtesy: Krishnaswamy *et al*. 1973. *Sericulture Manual 1*, FAO ASB, Rome.




**Cross Section of $C_4$ Plant Leaf**

1. Bundle Sheath
2. Bundle Sheath Cell
3. Mesophyll Cell

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