EVOLUTION OF LEAF

LEAF

Leaf is a green mostly flat structure borne at the node on the stem or on its branches in all the vascular plants. The primary function of the leaf is photosynthesis. It also helps in transpiration. Another activity of the leaf is respiration which involves the absorption of oxygen and liberation of carbondioxide.

EVOLUTION OF LEAF

The primitive vascular plants lacked leaves. The stem being green was photosynthetic. It is the evolution of leaf which resulted in efficient photosynthesis.

How did this important organ of the plant arise, when none was present in primitive vascular plants? Before we answer to this question, we must distinguish b.w two basic types of leaves occuring among vascular plants.

One kind is microphyllous leaf with a single vein and the other is megaphyllous leaf with many veins.

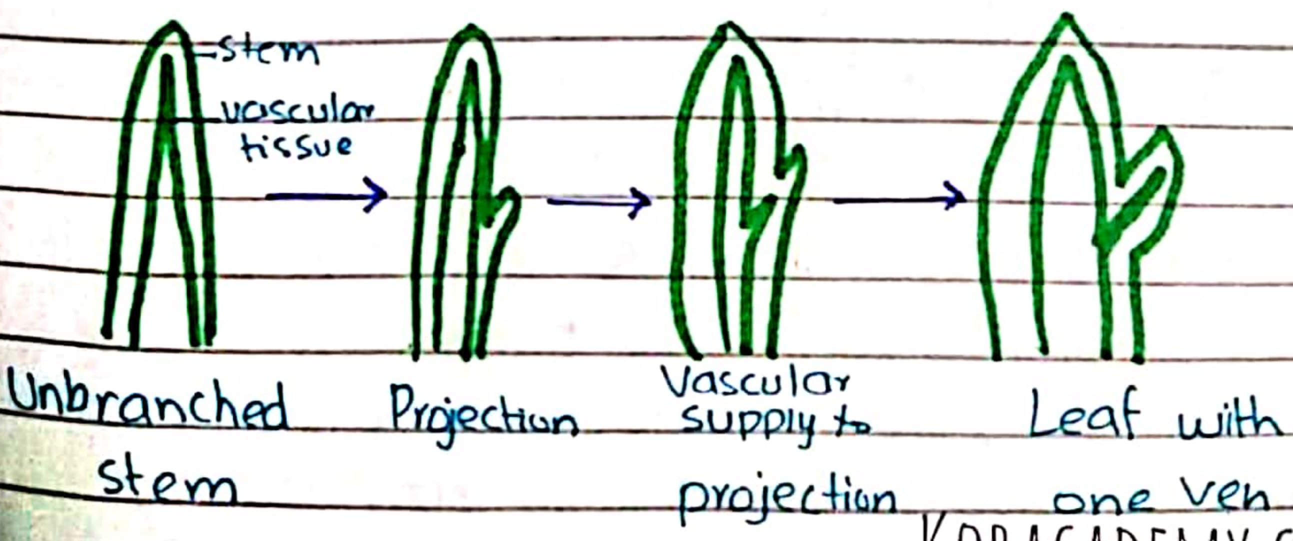
a. EVOLUTION OF MICROPHYLLOUS LEAF

Microphyllous leaf is present in club moss and horse tails. The interpretation of the fossil record doesnot permit a clear answer as to how the microphyllous leaf evolved. However, there are two possibilities about the origin of microphyllous leaf:

1. Out-growth hypothesis
2. Reduction hypothesis

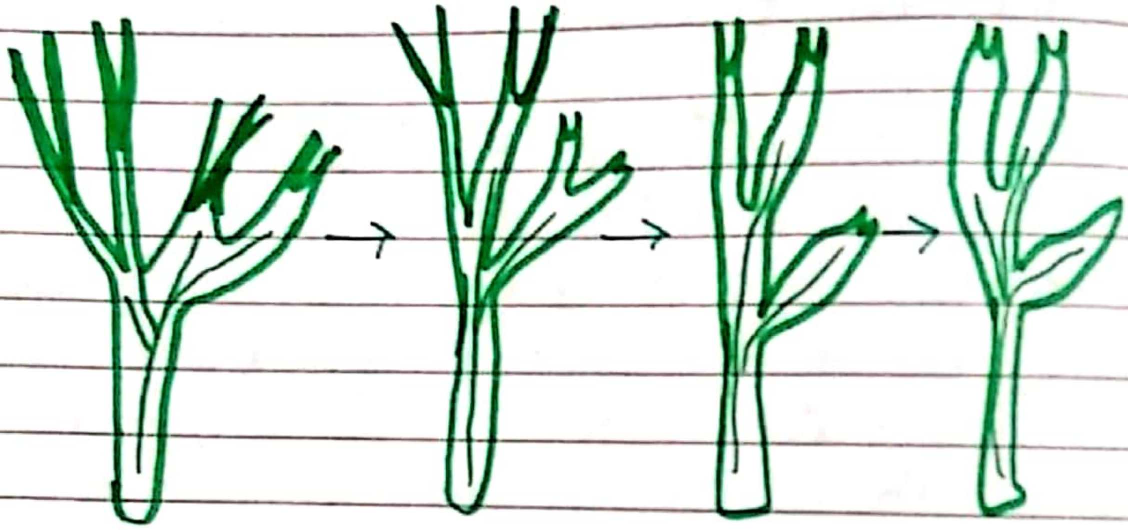
1. OUT-GROWTH HYPOTHESIS

According to out-growth hypothesis, a single veined leaf originated as an outgrowth, lacking vascular tissue, from the naked branches of the primitive plant. With increase in size, it needed support and transport so vascular tissue in the form of one vein appeared in it and in this way microphyllous leaf was formed.



2. REDUCTION HYPOTHESIS

The reduction hypothesis states that the early vascular plants had leafless branches. These branches were gradually reduced in size. Thus by simplification and flattening of the leafless branches the single veined leaves were evolved.



b) EVOLUTION OF MEGAPHYLLOUS LEAF

It is evident from fossil record that megaphellous leaves have evolved through modification of the forked branches found in early vascular plants e.g Rhynia. Megaphyllous leaf is found in many plants such as leaf of Ginkgo.

FORKED BRANCHING REDUCTION HYPOTHESIS

When we examine the leaves, we find that they are evolved by the evolutionary modification of the forked branching system. Therefore, this hypothesis of the evolution of megaphyllous leaf is called forked branching reduction hypothesis. The evolution of megaphyllous leaves occured in the following steps:

1. OVERTOPPING / UNEQUAL BRANCHING

The dichotomously branched aerial portion of the stem showed unequal branching. Some branches remained short while others grew and expanded at a much faster pace. All these branches grew in different planes. Such an unequal development of various branches is called overtopping

[Dichotomous: di-two chotomy-cutting
Branches are always divided into two]

2. PLANATION

Next important step was the arrangement of unequal dichotomies in one plane. This process is termed as planation.

3. FUSION / WEBBING

Next in evolution, the spaces between the bundles and branches of vascular tissue became filled by a sheet of parenchyma cells which connected these branches forming a flat lamina or leaf blade type of structure, having many dichotomously branched veins. This process is called webbing. The organ, now a leaf, looked superficially the webbed foot of a duck. The branches changed into veins which resulted in many veined leaf or megaphyllous leaf.