Telome theory

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A number of theories on evolution of land-plant exist, and the telome theory of Walter Zimmermann is the most comprehensive. This theory is based on fossil record and synthesises the major steps in the evolution of vascular plants.

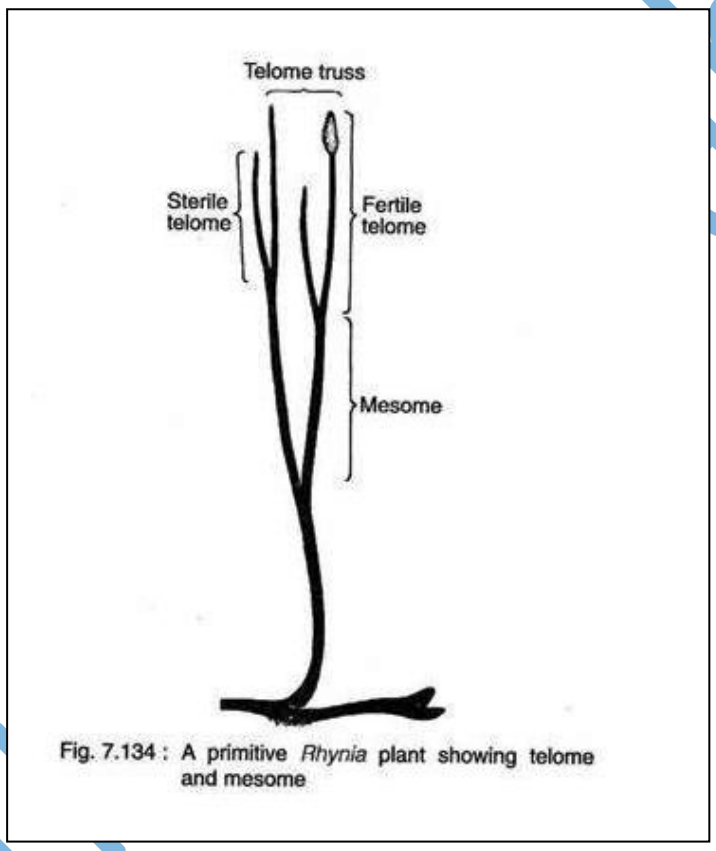

Fig. 7.134 : A primitive *Rhynia* plant showing telome and mesome

A "telome" is defined as ultimate terminal portion of a dichotomising axis i.e., it is the point of the most distal dichotomy to the tip of a branch. The connecting axes between dichotomies are called mesomes. Functionally, telomes are of two types; i) Fertile telome and, ii) sterile telome. If the ultimate branch is terminated by a sporangium then it is a fertile telome, whereas those terminal branches without sporangia are called sterile telomes. Several telomes, either fertile or sterile, becomes grouped together by connecting mesomes to form a more complex structure, called syntelome or telome truss.

Process of Telome theory:

According to Zimmermann, these telomes or telome trusses of primitive Rhynia type of vascular plants have been subjected to certain evolutionary processes in varying degrees among the various taxonomic groups. These processes are grouped in to 5 types

(i) Overtopping

(ii) Reduction,

(iii) Planation,

(iv) Syngenesis or webbing, and

(v) Curvation.

a) Overtopping:

In this process, one of the two dichotomising branches of the primitive axis produced by the apical meristem outgrows or overgrows the other. The larger axis thus produced becomes the stem, while the shorter or overtopped branches represent the beginnings of lateral branches or leaves. Now the earlier dichotomy will be transformed to pseudomonopodial branch.

b) Reduction

In this process, the activity of terminal meristem of each telome of the truss becomes suppressed resulting into much shorter branches by decreasing the length of telomes and mesome. This process is responsible for the formation of microphyllous leaves of the Lycopsida and Sphenopsida as well as the needle-like leaves of conifers.

c) Planation

The process of planation caused the telomes and mesomes of the truss to shift from a three-dimensional pattern (cruciate dichotomy) to a single plane (fan-shaped dichotomy). The process of infilling with photosynthetic and other tissues between the planated branches is called webbing which have led to the evolution of flattened leaf-like structure with a dichotomously veined lamina.

d) Syngenesis

This is an evolutionary process where tangential fusion of mesomes and telomes takes place. The lateral fusion of sterile vegetative telomes and mesomes resulted into complex anastomosing vascular systems in stem (e.g., polystelic condition in Selaginella).

The fusion of fertile trusses with their terminal sporangia resulted in the formation of synangia of Psilotum. The closed or reticulate venation pattern of some ferns, gymnosperm and many flowering plants are the result of syngenesis of the dichotomising veins of the primitive leaf.

e) Curvation

This evolutionary process is caused due to the unequal growth of the tissues on two opposite flanks of the telome. It has two types-

i) Recurvation

In this sub-process the telome bends inward toward an axis. The inward-projecting sporangia on a sporangiophore of Equisetum (Sphenopsida) is the result of this sub-process.

ii) Incurvation

In this sub-process, the fertile telome bends downward resulting in the downward shifting of the sporangia from terminal to the ventral surface of the leaf. This sub-process is responsible for the formation of ventral position of the sporangia in fern (Pteropsida) leaf.

Significance of Telome theory

a) Major significance

(i) The telome theory portrays the origin and evolution of the sporophytes in the earliest known land plants.

(ii) The theory is based mostly on account of the comparative study of the fossil as well as living genera of the vascular plants. It actually explains the phylogenetic relationship between the fossil and the living plants.

(iii) The five elementary processes like overtopping, reduction, planation, recurvation and syngenesis give a unified concept of the manner in which evolution might have proceeded in the land plants. These processes explain in a simple and lucid way as to how the primitive land plants led to the evolution of both the simple and the complex land plants of today.

b) Minor significance

This theory provides a basis of interpretation in solving the morphological controversies of different organs in the vascular plants such as:

(a) The nature of the aerial portion of the plant body of the Ophioglossaceae,

(b) Anatomy of some species of the Medullosaceae,

(c) Nature of the plant body un the Coenopterid forms,

(d) Evolution of the vegetative and reproductive structure of Cordaitales and early conifers,

(e) Phyllogeny and origin of stamens and carpels.

Conclusion:

The theory explains in a satisfactory manner that the entire sporophyte is an axis that has an underground portion called the root and an aerial part called the shoot. The appendages of the shoot that is the sporophylls, sporangia and sterile leaves are nothing but modified parts of the shoot.

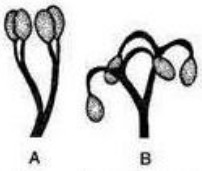

Fig. 7.138 : Telome concept : A–B. Evolutionary process of recurvation

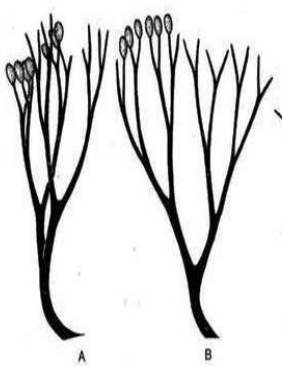

Fig. 7.136 : Telome concept : A–B. Evolutionary process of planation

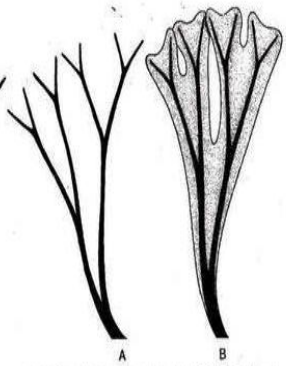

Fig. 7.137 : Telome concept : A–B. Evolutionary process of webbing

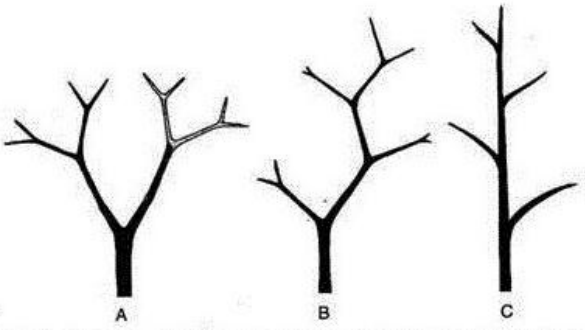

Fig. 7.135 : Telome concept : A–C. Evolutionary process of overtopping and reduction