

LATICIFERS

Latex is one of the most important secretory products of the plants. It is found in representatives of about 20 families, including 12,500 species in 900 genera of dicotyledons and monocotyledons. Latex is secreted by specialized cells or groups of cells known as **laticifers**.

Laticifers have unique structures and interesting growth patterns.

Classification of laticifers- they are grouped in two major groups on the basis of their structure.

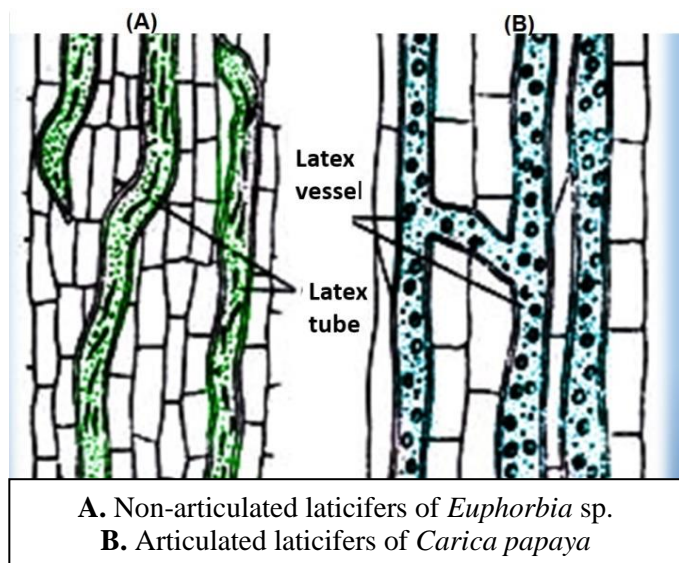
1. Articulated (jointed) and 2. Non-articulated.

1. Articulated-

They are compound in origin (originated from the no. of cells), consisting of longitudinal files of cells, the end walls of which break down wholly or in part. Such perforation of end walls gives rise to laticifers that are tube-like in form and resemble xylem vessels in origin. This type of laticifer has been formerly called laticiferous vessels.

Now these articulated laticifers are grouped into two groups:-

- (i) Articulated anastomosing
- (ii) Articulated non-anastomosing



- (i) **Articulated anastomosing**-These laticifers consist of long cell chains or compound tubes connected with each other laterally, all combined into a net-like structure or reticulum.
- (ii) **Articulated non-anastomosing**-These consist of long cell chains or compound tubes not connected with each other laterally.

2. Non-articulated-

These are originated from single cell, (simple in origin), which through continued growth develop into tube-like structure. Often much branched, but typically they undergo no fusion with other similar cells. These types of laticifers are called laticiferous cells.

It is also two kinds- (a) branched and (b) unbranched

Examples:-

- (i) **Articulated anastomosing-** In Compositae (*Lactuca*, *Taraxcum*, *Sonchm* etc.); Compamilaceae; Caricaceae (*Carica papyra*); Papaveraceae (*Papaver*, *Argemone*); Euphorbiaceae (*Hevea*, *Manihof*).
- (ii) **Articulated non-anastomosing-** In Convolvulaceae (*Convolvulus*, *Ipomoca*); Papaveraceae; Sapotaceae (*Achra sapota*); Liliaceae (*Allium*), Musaceae (*Musa*).
- (iii) **Non-articulated branched-** In Euphorbiaceae (*Euphorbia*); Asclepiadaceae (*Asclepias*, *Cryptostegia*); Apocynaceae (*Nerium olcauder*), Moraceae (*Ficus*, *Macura*) etc.
- (iv) **non-articulated unbranched-** In Apocynaceae (*Vinca*), Urticaceae (*Urtica*), Moraceae (*Cannabis*).

The list given above shows that the type of laticiferous element is not constant in a given family. In Euphorbiaceae, for example, *Euphorbia* has non-articulated laticifer, but *Hevea* contain articulated laticifers. Such type of instances is very frequent in many families of laticiferous groups. So, by comparative study of laticifer, it is not possible to draw a systematic phylogeny among the groups of laticiferous plants.

Cytology of laticifers:-

According to the common concept, the laticifers maintain a living protoplast, the nuclei remain in this protoplast upon maturation of the elements, and the cytoplasm occurs as a parietal layer enclosing the vacuolar sap, or latex. In non-articulated laticifers of many plants the nuclei are known to undergo division resulting in a multinucleate coenocytic condition. Articulated laticifers, in which communication is established between the individual cells, are also multinucleate but apparently only because the protoplasts fuse and not because of a subsequent multiplication of nuclei. In young laticifers the nuclei are readily distinguished; but later the dense latex obscures their visibility. It was also reported that the nucleus degenerates in mature laticifers after an exudation of nucleoli (Milanez- 1946, 1949).

Structure of the cell wall:-

The walls of the laticifers are non-liquefied and apparently plastic. They may be no thicker than the walls of the adjacent cells, or they may be noticeably thicker. The walls often increase in thickness with the age of the element. The thick walls are highly hydrated, and contain cellulose and high proportion of pectic substances and hemicelluloses. The thickness may be uneven, but primary pit fields are rarely observed. Plasmodesmata are present in between the laticifers and adjacent parenchyma cells. The callose has been recorded in laticifers.

Development of laticifers:-

(i) Non-articulated-

The branched non-articulated laticifers of Euphorbiaceae, Apocynaceae and Asclepiadaceae arise during the development of embryo in the form of relatively few primordial, then grow concomitantly with the plant into branched systems permeating the whole plant body.

In *Nerium oleander*, and *Euphorbia marginata* where the primordia of laticifers appear in embryo when cotyledons are initiated. They are located at the cotyledonary node. In *Nerium* embryo 28 primordia and *Euphorbia* 12 primordia are present (Mahlberg, 1961). The primordial cells grow more rapidly than neighbouring cells, and their nuclei also enlarge and subsequently divided without accompanying the wall formation.

Thus developing non-articulated laticifers become multinucleate cell; it also characterized by extensive growth. Then they branched in various directions by forming protrusion in different direction and spines of these protrusions push their way among the surrounding cells by intrusive growth.

It is found in *Nerium*, where the laticifers young cell branched repeatedly and the laticifers become continuous with branches formed in the cotyledonary node of the embryo. These cells thus ramify through the tissues, by means of rapid and predominant apical growth. Laticifers grow intrusively and occupying the intercellular spaces.

In case of non-articulated unbranched laticifers, where the pattern of growth is very simpler than the branched ones. The primordial have been recognized here, not in embryo, but in growing shoot (*Vinca rosea*) or in shoot and root (*Eucommia*) new primordial arise beneath the apical meristems repeatedly and each elongates into a unbranched tube, apparently by a combination of intrusive and symplastic growth.

It has recently been shown that the enzyme *Pectinase* is present in abundance in the latex of milkweed, *Asclepias syriaca*. It is thought that the intrusive growth of the ramifying laticifers of this species is facilitated by secretion of pectinase by the growing tip of laticifers, resulting in pectolytic dissolution of middle lamella of the adjacent cells.

(ii) Articulated laticifer:-

As these are compound in origin, so they are not developed from the single cell. They develop into extensive tube like stc. by constant addition of new primordial to existing ones. Thus they differentiate acropetally in various directions. The direction of differentiation is similar to that of non-articulated branched laticifers, but it occurs by successive conversion of cells into laticiferous elements instead of by apical intrusive growth.

Now when these tubes become anastomosed

- (i) by dissolving the common wall of the tubes lie side by side, or

- (ii) by transforming the intervening cells into laticifers with resorption of the common wall when the vessels are apart from each other, or
- (iii) the existing vessels may send out lateral protuberances that fuse with those from another vessel.

In *Hevea* sp., the vessels associated with the vascular bundles of the embryo in late development. Perforation of lateral walls is apparently more advanced than that of end wall and a complex anastomosing system become established early in ontogeny.

In *Achras sapota*, disappearance of end walls is also gradual. The laticifers of *Nelumba nucifera* with the electron microscope conform the presence of single perforation in the end wall of the laticifers.

In many cases where the primordia of articulated laticifers are not found in embryonic stage. In *Papaver somniferum* the laticifers are absent in the embryo, but differentiated in the pericycle of the primary root of soon after germination.

Arrangement or distribution: -

Laticifers are frequently distributed rather generally through the plant but sometimes they are more or less restricted to certain tissues. Most commonly they are associated with the phloem.

Nor-articulated :- In the genus *Euphorbia*, the main tube of branched non-articulated laticifers commonly are located in the outer part of the vascular cylinder. From here the branches extend into the cortex and sometimes also into the pith.

In some Apocynaceae, Asclepiadaceae and Moraceae (Ficus) laticifers appears rather generally dispersed in various tissues, including the vascular tissue.

Branched non-articulated are found mainly in the leaves. Here they follow vascular bindles, and ramify in the mesophylls. The unbranched non-articulated laticifers of *Vinca*, *Cannabis* occurs in the primary phloem but are apparently absent in secondary tissues.

Articulated:-

Such types of laticifers also show various arrangements and a frequent association with the phloem. In Cichorieae, the peripheral portion of primary phloem contain it.

The secondary phloems of the root of *Taraxacum* contain articulated anastomosing laticifers. *Hevea*, have its main laticifers system in the secondary.