

Chaudhary Mahadeo Prasad College

(A CONSTITUENT PG COLLEGE OF UNIVERSITY OF ALLAHABAD)

E-Learning Module

Subject: Botany

(Study material for Post Graduate Students)

M.Sc. II Sem

COURSE CODE: BOT 514

Plant Morphology and Anatomy

Unit: III

Topic: Origin of Lateral Roots

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Origin of Lateral Roots:

The lateral roots are endogenous in origin. They develop from mature cells, some distance away from the apical meristem usually behind the root hair zone. The apical meristem of the root does not lay down any appendage. It is a marked point of contrast with the shoot where the primordia of the leaves and branches develop in the apical meristem.

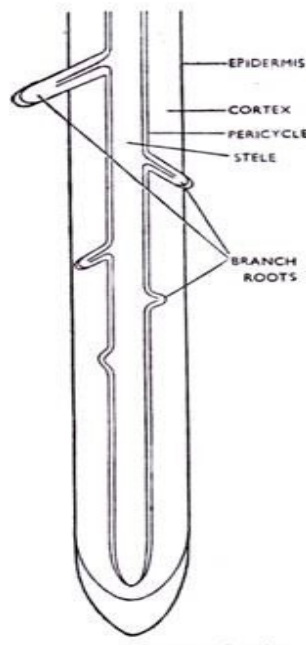


Fig. Diagram showing origin of branch roots

In higher plants, angiosperms and gymnosperms, the development of lateral root is commonly initiated in the pericycle – an intrastelar ground tissue of the parent root, and the lateral root ultimately makes its way by piercing the cortex and epidermis. In lower vascular plants the branch roots originate in the endodermis.

The method of formation of a lateral root in a higher plant is as follows. A few mature cells of pericycle, usually opposite a protoxylem group, become meristematic and go on dividing periclinally and anticlinally. Thus a number of cells are produced, which form something like a protrusion. This is really the primordium of the lateral root. It soon takes the shape of a growing point with its initial cells, the cap and other histogens.

With gradual development of the primordium other tissues surrounding it get stretched and ultimately ruptured. That is how it eventually comes out piercing all the tissues. As regards the mechanism of growth of the lateral root some workers have suggested that it partially digests the cortical tissue during its advance; whereas others are of opinion that it is entirely a matter of mechanical penetration.

It has been reported in some cases that the endodermis also undergoes anticlinal division and forms a layer surrounding the lateral root primordium; and by further periclinal division it may be even more than one layer in thickness. But at any rate those cells die and are shed when the lateral root comes out.

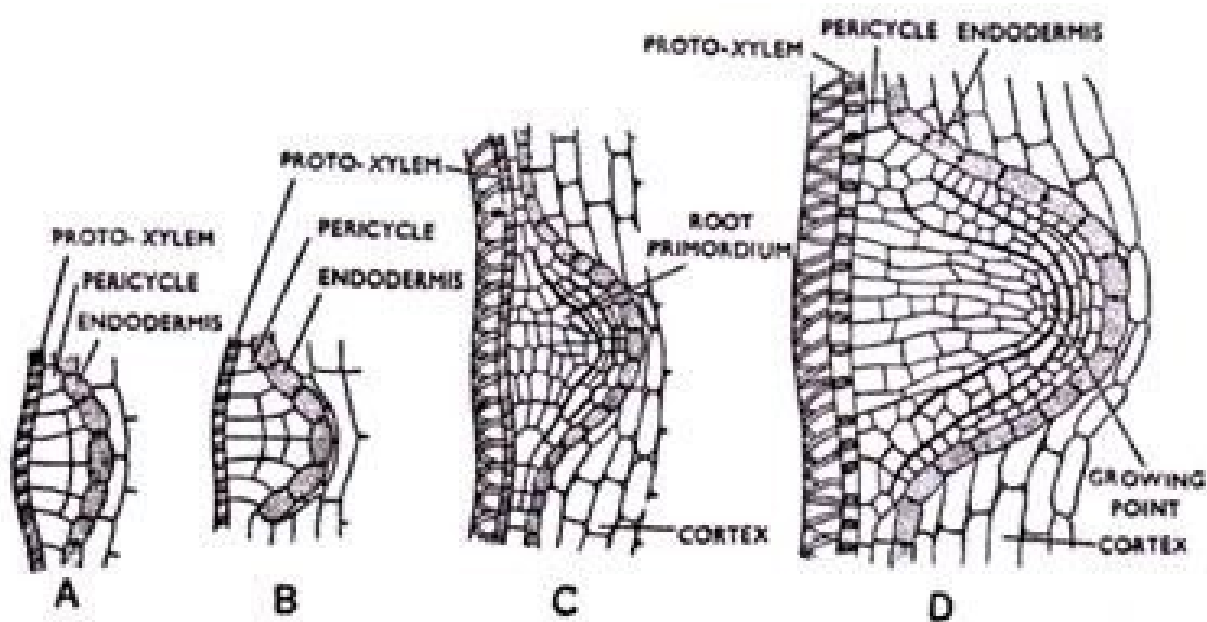


Fig. Formation of a lateral root: stages in longitudinal views.

The lateral roots develop from the mature tissues in acropetal order, though there is no regularity in the order of development with reference to each other. In roots having more than two xylem strands the lateral roots commonly originate against the protoxylem groups, or less commonly opposite the phloem groups.

Thus they come out in vertical rows, the number being equal to that of the xylem strands present. But in diarch roots having two xylem strands, the primordia develop at each side of the phloem group, so that the number of lateral roots formed is double that of xylem strands.

They exhibit all the characters of the primary root, having four distinct regions. Thus an extensive root system is formed which ramifies through the soil particles. All the lateral roots do not grow equally vigorously. In fact, many of them continue normal growth and form the root system, whereas some remain undeveloped, or may even be lost. In some fleshy roots like those of carrot additional lateral roots may arise at the bases of original ones when the latter perish.

Formation of Adventitious Roots:

Adventitious roots are of diverse types. They may arise either in association with buds or independently; either in the young organs or in the comparatively mature tissues which have retained the potentialities of cell division. They usually originate endogenously from the primordium already formed and lying in dormant condition, or they may form new primordium. Exogenous development cannot be ruled out. Primordia of adventitious roots may be formed from epidermis with cortical tissues, different internal regions, even from the tissues of leaf margins and petioles, e.g. Begonia, Kalanchoe.

Adventitious roots from the stems are the most common ones. It has been established that initiation of such roots takes place near about the differentiating vascular tissues of the organ by a group of cells forming the primordium near the periphery of vascular system in case of young stem, and near the vascular cambium in case of mature stem.

The cells forming the primordium are derived from inter-fascicular parenchyma, medullary rays, or from vascular rays. It is often stated that the pericycle is the seat of origin of adventitious roots, but the –stages. Very existence of pericycle in a stem has been rather doubtful.

Because of the origin of adventitious root from the tissues stated above, the developing root lies close to the xylem and phloem of the stem; and thus vascular connection

between the two organs is easily established. It is similar to a lateral root as regards the organisation of the growing point, formation of cortex, etc., and mechanism of growth.

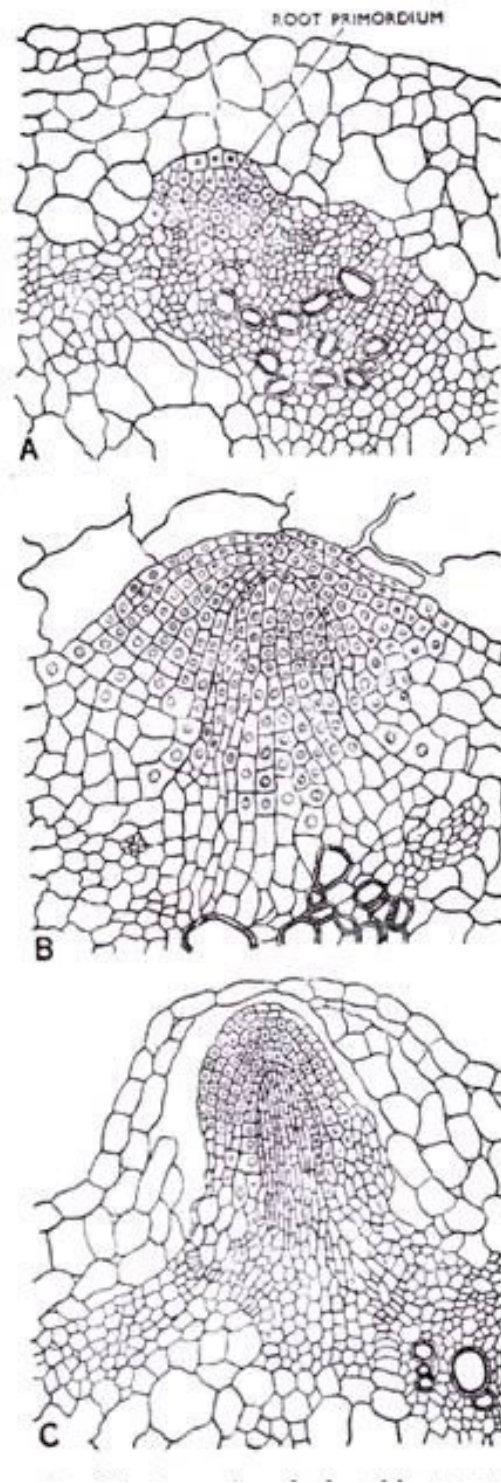


Fig. Formation of adventitious root from the stem of Tomato