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SHOOT APEX ORGANIZATION IN TAMARICACEAE

A.K. GUPTA, SHALU CHAUDHARY AND MEENU SINGH

Department Of Botany, Meerut College, Meerut-250001 (U.P.) India

shaluchaudhary57@gmail.com

Eighty six freshwater algal spThe shoot apex organization has been studied in three species of Tamarix and in one species of Myricaria. The shoot apices in all the species are dome shaped. On the basis of the plane of division, differences in cell size and shape, the shoot apex shows four zones which do not show much variation cytohistologically in different phases of plastochrons. These zones are - one layer of tunica, central zone of corpus mother cells, radiating zone on either side of the central zone (Flank zone) and zone at the subjacent level (Rib zone). In all the species the pattern of leaf development is same. The initiation of leaf is marked by the periclinal divisions in the first layer of corpus. The apical growth takes place by the differentiation of sub apical initials, which are differentiated at an early stage in the leaf buttress. The lamina is initiated by the marginal and submarginal initials differentiated along the two margins. The marginal initials divide only anticlinally and form the protoderm. The submarginal initials, have two cutting faces, which cut off cells adaxially and abaxially.

Key words: *:* Shoot Apex - Tamaricaceae

Shoot apical meristems are generally believed to have evolved independently in lycophytes, ferns and seed plants in association with establishment of the stem and leaf (Kenrick and Crane 1997, Friedman *et. al.* 2004). Shoot apical meristem of vascular plants have a wide variety of structure (Buvat 1989, Gifford and Foster 1989, Steeves and Sussex 1989, Lyndon 1998). Recent gene expression analysis have provided insights into the cytohistological zonation of angiosperm shoot apical meristem (Nishimura *et. al.* 1999, Fletcher and Meyerowitz 2000). The shoot apices of vascular plants although differ in detailed structure have in common many functional activities and features of organization (Wardlaw 1965 a). The role of shoot apical meristem depends on its organization (Wardlaw 1965 a,b,) has been amply emphasized and therefore it has received considerable attention of both morphologists and physiologists. Organization of shoot apex has been studied in a number of dicotyledones (Gifford and Corson 1971) but the members of Tamaricaceae have not been worked out so far.

The present communication deals with the shoot apex organization, and leaf development in *Tamarix aphylla, T. ramosissima, T. troupii, and Myricaria germanica.*

MATERIALS AND METHODS

The shoot apices of *Tamarix aphylla, T. troupii* were collected from Mathura and Ghaziabad and *T. ramosissima* and *Myricaria germanica* were procured from Prof. T. Pullaiah collected from Moscow. The shoot apices of these species were fixed in formaline -acetic acid-alcohol for 24 hours. The apices were dehydrated and cleared through T. B. A. series of ethanol-xylene series and embedded in paraffin wax (58-60º C). Longitudinal sections of shoot apices were cut at 5-8 □ m thickness. The sections were stained with tannic acid-iron alum with haematoxylin and iron alum - haematoxylin with aniline blue, the latter proved satisfactory (Johansen 1940).

OBSERVATIONS

The shoot apices appear dome shaped in all the species at maximal plastochron stage. The

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Table 1: Measurements of shoot apices.

S. No.	Name of Species	Height of shoot apex in µm	Diameter of shoot apex in µm		
		at minimal area phase	at maximal area phase	at minimal area phase	at maximal area phase
1.	*Tamarix aphylla*	20-32	45-75	38-47	60-76
2.	*T. ramosissima*	27-38	45-54	32-41	46-63
3.	*T. troupii*	18-35	60-75	54-75	66-106
4.	*Myricaria germanica*	18-33	39-51	36-54	45-72

apices of different species show variation in their height and diameter as shown in the table 1.

On the basis of plane of division, differences in cell size and shape, the shoot apex shows four zones which do not show much variation cytohistologically in different phases of the plastochrons. These zones are one layer of tunica, central zone of corpus mother cells, radiating zone on either side of the central zone (Flank zone) and zone at the subjacent level (Rib zone) (Fig. D, E, and F). The tunica is single layered with squarish cells which divide anticlinally. The cells at the summit show rare anticlinal divisions and are lightly stained, while the cells towards the flank meristems are comparatively deeply stained and the frequency of anticlinal divisions increases downwards along the flanks to proximal side. The cells of the corpus divide in all the directions and one or two stratifications can be seen during maximal area phase. These cells of corpus are comparatively larger in size than those of the tunica layer.

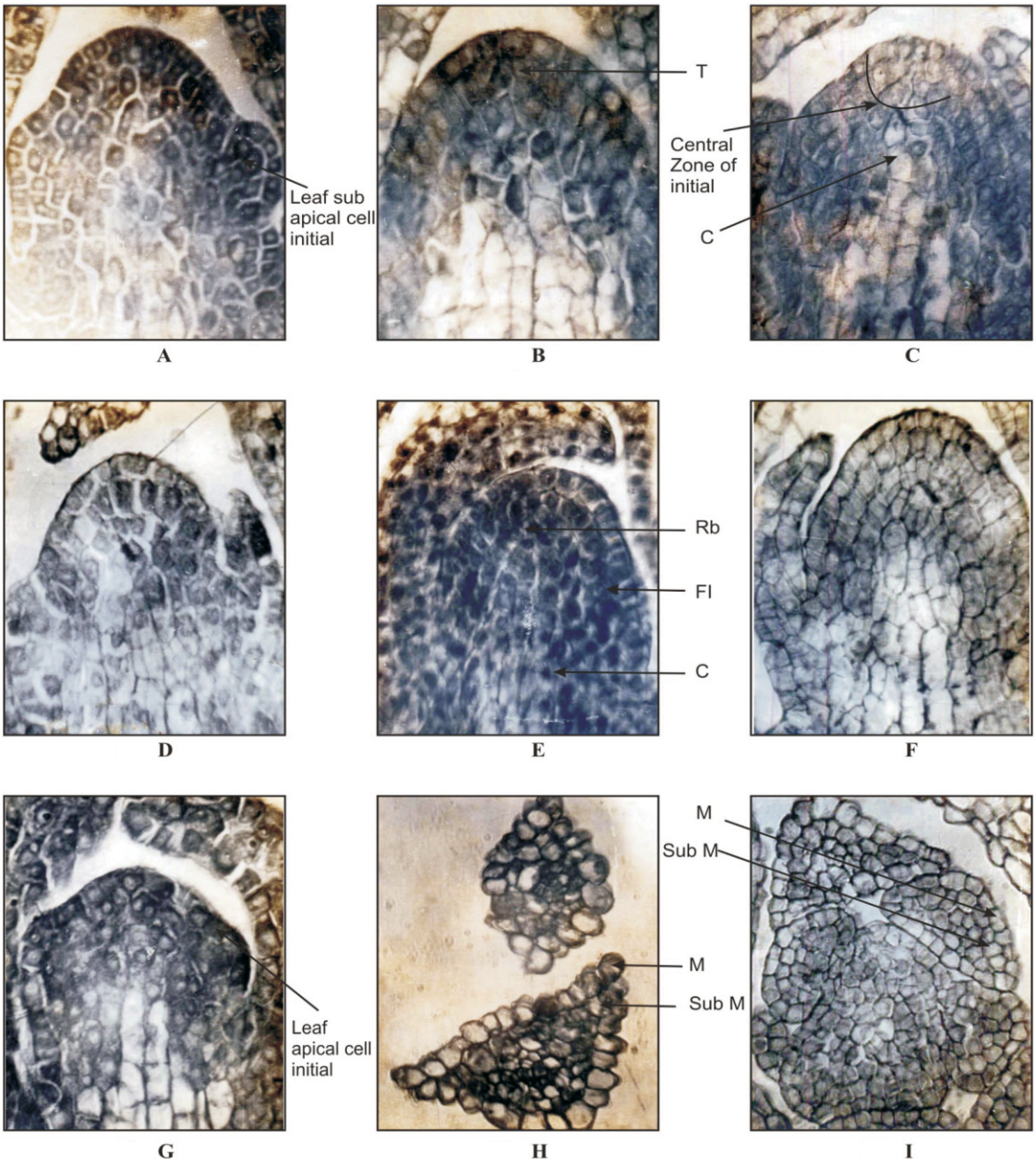
The flank zone is two to three layers of cells thick at the point of the insertion of leaf. It is made up of squarish cells in the distal and radially stretched cells in the proximal region. This zone surrounds the central rib zone which is two to four layers of cells in thickness. The cells of rib zone at the distal region are smaller, vacuolated and have smaller nuclei than those of the lower region. These cells form a clear cell lineage pattern and differentiate centrally into pith (fig. A, B and C).

Marginal and Submarginal Growth Of Leaves

The leaf primordium before the formation of the lamina appears to be almost triangular in transverse section. The lamina is initiated by the marginal and submarginal initials differentiated along the two margins. The marginal initials divide only anticlinally and form the protoderm. The submarginal initials, have two cutting faces, which cut off cells adaxially and abaxially. The initials of adaxial side divide repeatedly by anticlinal divisions only to form a single layered of not so well developed palisade tissue. The cells on the abaxial side divide anticlinally and periclinally to form the mesophyll and procambial strands (Fig. H, I). As the leaves are very small and scaly in nature they show poor development of palisade and spongy parenchyma.

DISCUSSION

The corpus in all the species examined show some differentiation into different cytohistological zones. The flank meristem consists of two to three layers of cells in thickness, while the rib zone is two to four layers of cells thick, which appear to originate by divisions in central zone of corpus mother cells. Since the tunica is single layered in all the species examined, the corpus cells play a major role in the initiation and the development of the leaf (fig. G). The marginal initials in all the species form the epidermis while the submarginal initials give rise to adaxial and abaxial cells. The adaxial cells form the ill



Figures(A-I) : L.S. of Shoot Apices of different species of *Tamarix* and *Myricaria* and T.S. of Young Leaves of *Tamarix*

Fig. A: *T. troupii* at minimal area phase, **Fig. B:** *T. troupii* at maximal area phase, **Fig. C:** *T. troupii* at mid area phase, **Fig. D:** *T. aphylla* at minimal area phase, **Fig. E:** *T. aphylla* at maximal area phase, **Fig. F:** *T. ramosissiama* at maximal area phase, **Fig. G:** *Myricaria germanica* at minimal area phase, **Fig. H:** Young leaf of *T. troupii* showing marginal and submarginal initials, **Fig. I:** Young leaf of *T. ramosissima* showing marginal and submarginal initials.

T = Tunica, **C =** Corpus, **Rb =** Ribzone, **Fl =** Flank zone, **M =** Marginal Initial, **Sub M =** Submarginal Initial

defined palisade parenchyma and the abaxial cells give rise to spongy parenchyma and the vascular tissue.

Although these meristems produce different organs and are characterized by specific gene activities, they have a number of common structural characteristics (Traas and Doonan 2001). The analysis of the genetic regulatory network controlling shoot meristems started decades ago with a set of extensive genetic screens, which have identified a series of key regulators (Aida and Tasaka 2006, Rast and Simon 2008).

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