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STEM-NODE-LEAF CONTINUUM IN *CASSIA GLAUCA* LAM.

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Vasculature of the axis, node and petiole was studied in *Cassia glauca*. The distal middle and proximal foliar nodes showed a trilacunar three-trace condition. The basal stipules are vascularized from the lateral traces. Extrafloral nectaries occur between the insertion of Ist and sometime 2nd and 3rd pair of leaflets. Nectaries are vescularized from the adaxial part of the rachis vasculature. The spinule terminating the rachis is also vascularized which may be suggestive of considering this structure as a rudimentary terminal leaflet.

Keywords : *Cassia glauca* Lam; Stem-node-leaf continuum.

Introduction

The stem-node-leaf is a continuum of cells and tissues. In order to understand the nodal anatomy, information from all the three parts is essential. Howard[1] and Sharma and Pillai[2] suggested the importance of studies on these lines in morphotaxonomical considerations. Vascularizations of the internode, foliar node and petiole in *Cassia glauca* Lam. are described here.

Materials and Methods

Samples each of internode, node, petiole were collected from basal, middle and distal parts of branches of *Cassia glauca* and fixed in FAA followed by processing through TBA series and embedding in paraffin. Serial transvrse sections cut at 10µm were stained with normal morphological stains. The nodal beginning of structure has been conisdered to be from the level the first lateral trace starts leaving the axis stele. All the measurements are taken in relation to this reference point.

Results and Discussion

Cassia glauca is a medium sized cultivated ornamental tree bearing alternate unipinnately compound leaves. The rachis bears 2 to 4 pairs of opposite leaflets and terminates in spinule. There are two basal stipules (SP) per node. A green, stalked and cylinderical foliar nectary measuring about 3 mm in length and 0.60 mm in diameter is located adaxially between the insertion of the first pair of leaflets. Glandular hairs with multiseriate stalks and elliptical and multicellular heads occur around the foliar nectaries and in the node-petiole junction (Figs. 7, 11, 29). Uniseriate multicellular epidermal hairs (EH), with a long pointed apical cell and small basal cell are present on the internode, node & petiole (Figs. 1, 9, 13, 19, 24).

Internodes : The internode has five ridges alternating with as many furrows. A cylinder of conjoint, collateral and open vasculature is present in the internode. Xylem (X) is more below the ridges as campared to furrow portions (Figs. 1, 13) whereas phloem (PH) is almost uniformly distributed all round the axis vasculature. The internode shows an epidermis (E), single layered hyodermis (H), cortex, single layered endodermis and patches of phloem fibres and pericycle (P) (Figs. 1, 19) present between the endodermis and the secondary phloem.

Node : Distal, middle and proximal nodes do not show any difference in vascular pattern, The node is trilacunar three-trace. Of the five bundles inner to the ridges, three adjacent ones form the three traces to the leaf (Figs. 1, 2, 19). The lateral traces depart at different levels, i.e. LT_1 departs earlier than LT_2 (at 0.24 mm level from the LT_1) followed by the median trace (at 0.26 mm level) (Figs. 2, 3, 14, 15, 19). Differentiation of fresh procambium closes the lateral and median gaps. Both the lateral traces move towards the median trace and during this time the median trace divides laterally. Two bundles separate from the lateral sides of the median trace (at 0.74 mm and 0.84 mm levels) forming one MMT bundle and two MT bundles on its either sides (Figs. 4, 5, 16). The lateral traces (LT_1 & LT_2) also divide

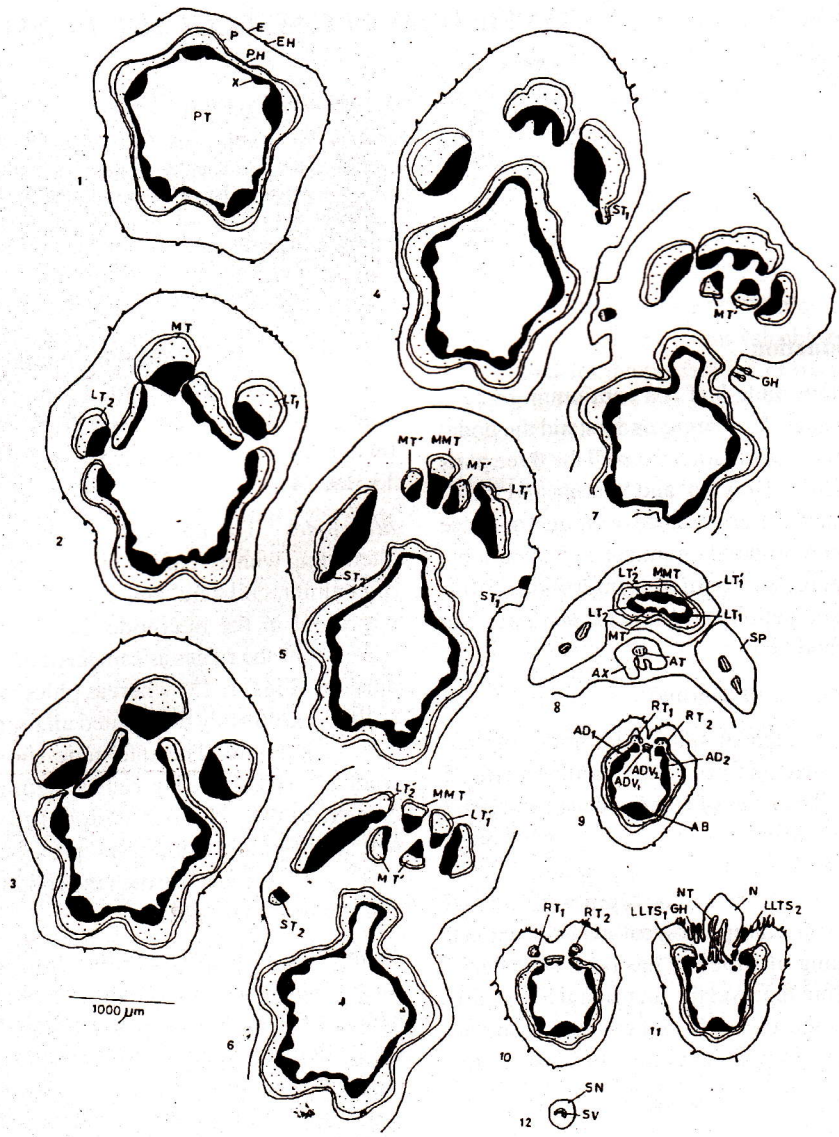

Fig. 1-12. Transverse sections of the internode node and petiole etc. of *Cassia glauca* 1. Internode; 2-4. Nodal region showing departure of traces; 5-6. Vasculature to the stipules and division of the median trace; 7. Movement of the lateral branches (MT') of median trace towards adaxial side while the lateral traces approaching the median bundle (MMT); 8. Ring of collateral vasculature at the base of petiole; 9-10. Formation of ridge bundles and adaxial vasculature; 11. vasculature to the nectary; 12. Vasculature to the spinule.

AB-abaxial bundle; AD_1, AD_2-adaxio-lateral bundle; ADV_1, ADV_2-adaxial bundles; E-epidermis; EH-epidermal hair; T- axillary bud trace; AX-axillary bud. GH-glandular hair; $LLTS_1$, $LLTS_2$-supply to the leaflet; LT_1, LT_2-lateral trace; MMT-middle bundle of the median trace; MT-median trace; MT'-lateral branches of median trace; N-nectary; NT-nectary supply; P-pericycle; PH-phloem; PT-pith; SN-spinule; SP-stipule; ST_1, ST_2-stipule traces; SV-spinule vasculature; X-xylem.

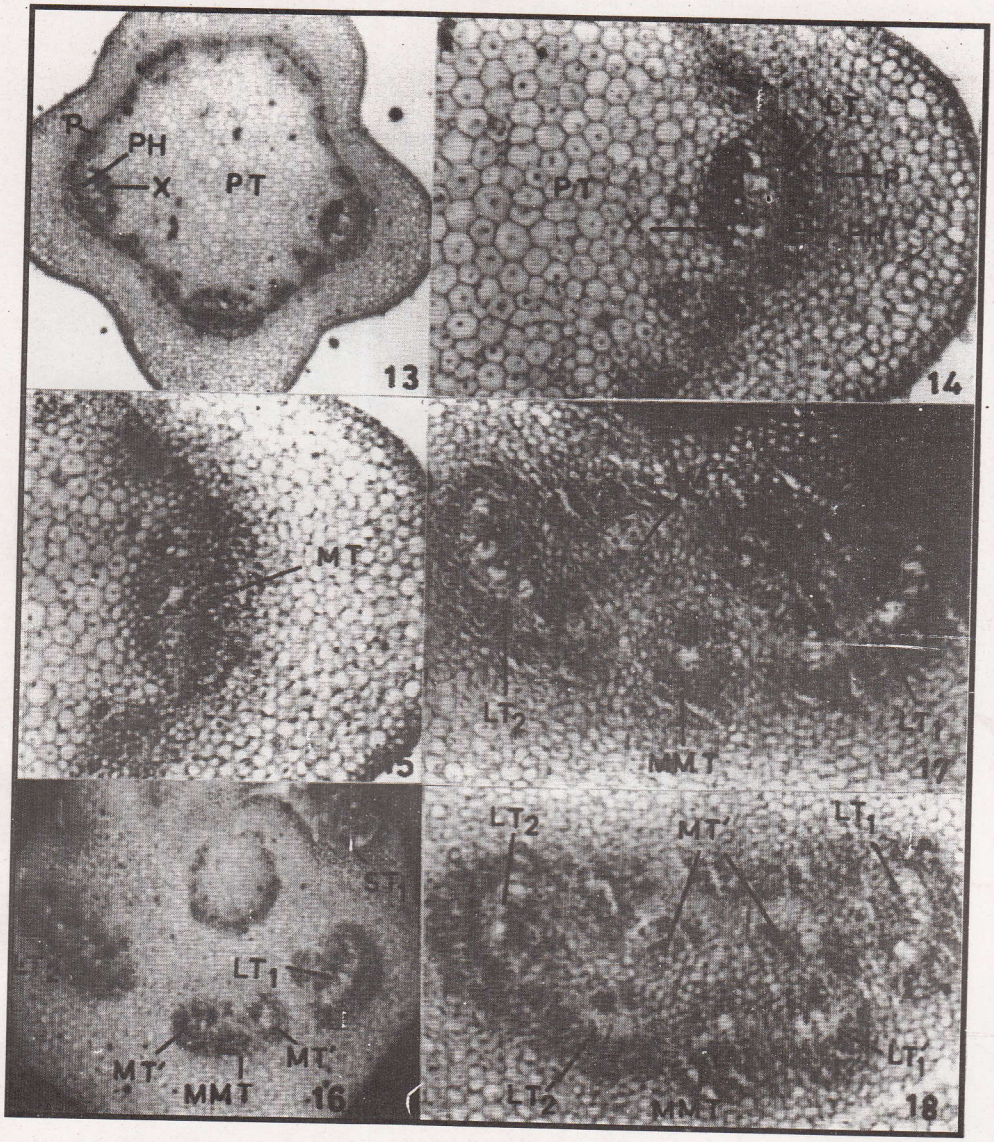

Fig. 13-18. Microphotographs of the T.S. of internode node, petiole etc. at different levels. 13. Internode; 14-15. Magnified view of a part of Fig. 13 showing preparation of the lateral and median traces respectively and their cellular details (X 200); 16. Course of the three traces and division of the median trace, also supply of the stipules; 17-18. Movement of the MT' bundles of the adaxial side and banching of the lateral traces (X 200).

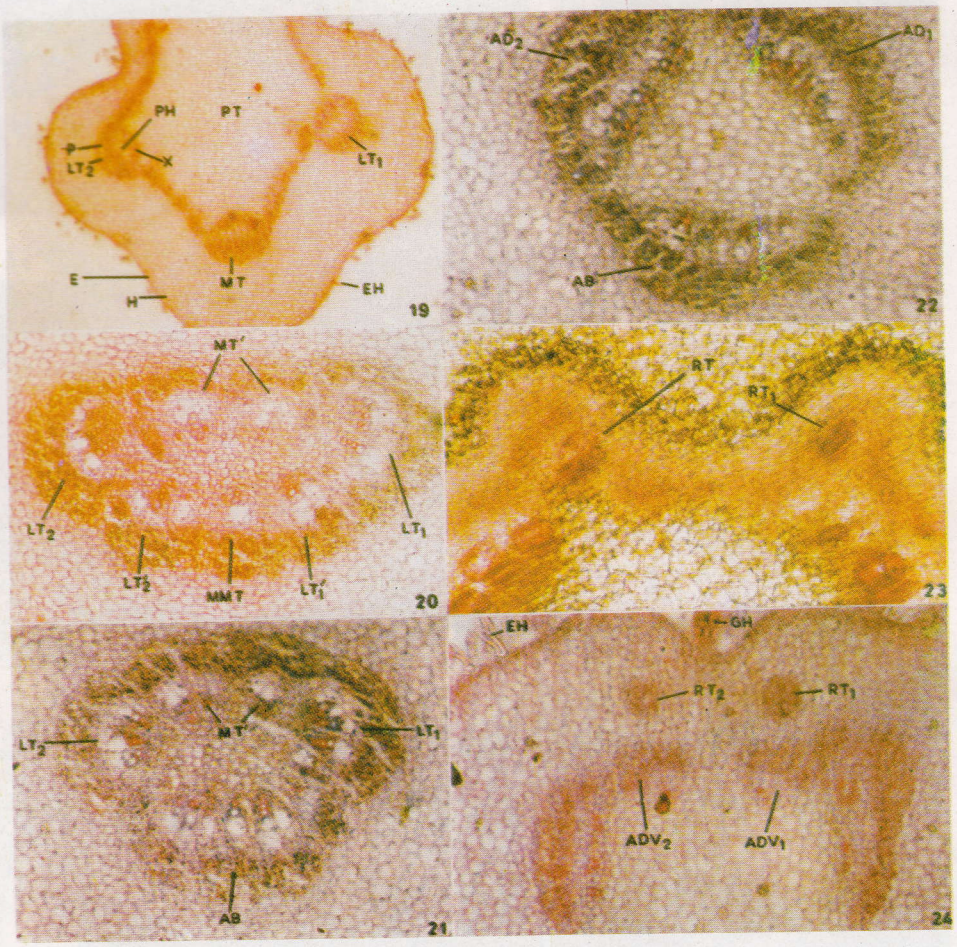

Fig. 19-24. Microphotographs of the node and petiole at different levels. 19. Departure of lateral traces (x 75); 20-21. Branches of the median and lateral traces approach each other and form a collateral vascular ring (X 200); 22. Organisation of the petiole vasculature into abaxial and two adaxio-lateral bundles (X 200); 23-24. Ridge traces move towards ADV and AD bundles for leaflet supply (X 200).

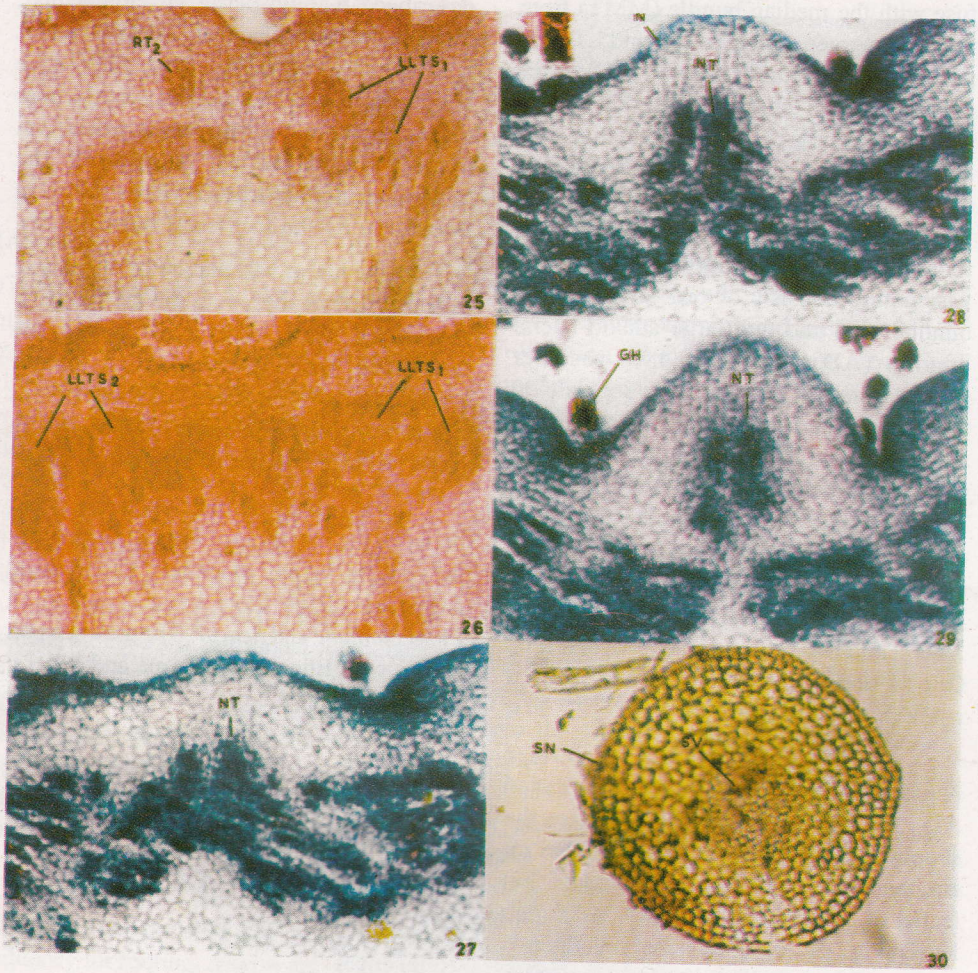

Fig. 25-30. Microphotographs of the T. S. of rachis and spinule (X 200); 25-26. Vascular supply to the two leaflets of the first pair; 27-29. Organisation and departure of the nectary vasculature; 30. T. section of the spinule showing vasculature.

laterally to give rise to stipular supply (ST_1 & ST_2). ST_1 departs earlier (at 0.46 mm level) than ST_2 (at 0.84 mm level) (Fig. 5-8, 16).

Petiole : The lateral traces LT_1 and LT_2 divide once again laterally (towards median trace) and give off two traces LT'_1 (at 0.98 mm and LT_2' (at 1.10 mm). Both LT_1' and LT_2' fuse with the median bundle (MMT) from the median trace. Later the LT_1 and LT_2 also fuse with the lateral branches (MT') of the median trace on their respective sides. This way all the branches of the median and lateral traces fuse and form a complete ring of collateral vasculature of the petiole (Fig. 7, 8, 17, 18, 20, 21). This vasculature is reorganised at 1.82 mm and the petiole vasculature consists of one large abaxial bundle (AB) and two large adaxio-lateral bundles (AD_1 and AD_2). Two vascular groups from the AD_1 and AD_2 separate on the adaxial side at 1.93 aqnd 1.99 mm levels and get housed in the two adaxial ridges as ridge bundles (RT_1 and RT_2) (Figs. 9, 10, 23, 24). At this level the petiole vasculature consists of one large abaxial bundle (AB), two large adaxio-lateral bundles (AD_1 and AD_2) two small adaxial bundles (ADV_1 and ADV_2) and two ridge bundles RT_1 and RT_2. Out of these the AB, AD_1, AD_2 have a common pericycle (Figs 9, 10, 22, 23, 27).

At 7.46 mm distance the first ridge bundle (RT_1) moves towards the ADV_1 and AD_1 and fuse with them to give rise the supply to the leaflets on one side. Later on similar pattern of vascular supply to the 2nd leaflet of the first pair follows (at 7.5 mm level) (Fig. 25, 26). After supplying the two leaflets of the pair, the vasculature complex formed by RT, ADV and AD bundles on either sides fuses adaxially forming an adaxial arch of vasculature which supplies the nectary (at 7.56 mm level). After sending vasculature to the nectary the arch is reorganised into its parent bundles *viz.*, the RT, ADV and AD bundles on either sides (at 7.7 mm level). The other leaflet pairs receive vascular supply in the similar manner as the first pair receives. After supplying the last pair of leaflets the remaining vary small amount of vasculature (which is in 'U' shape) enters into the spinule (at 14.6 mm level) (Fig. 12, 30).

Three types of nodes have been described[3] in angiosperms *viz.*, unilacunar, trilacunar and multilacunar. The foliar nodes reported here show a trilacunar three-trace condition. Sinnott[3] considered the trilacunar three-trace node as the most primitive. Marsden and Bailey[4] suggested the unilacunar double-trace node as the most primitive and Fahn and Bailey[5] supported this.

The major vasculature of the petiole is consumed in supplying the leaflet pairs. A small vasculature supplies the spinule. The suggestion[1] that the vascularised spinules terminating the rachis may represent rudiments of aborted leaflet of an originally imparipinnate condition, is supported.

Vascularised foliar nectaries occur between the insertion of 1st and sometimes the 2nd and 3rd pair of leaflets. Vascularised foliar nectaries have been reported in *Pithecolobium*[2] and *Acacia*[6]. The present report agrees with Elias[7] and Sharma and Pillai's[2] suggestion that the presence or absence of foliar nectaries or glands in the three subfamilies of Leguminosae may be useful in considerations of taxonomy.

Acknowledgements

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