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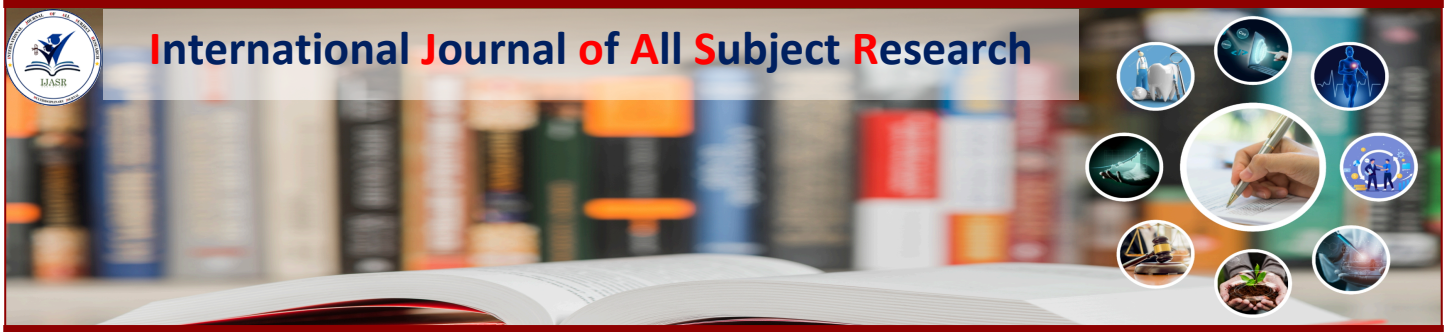

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Nodal Vasculature in Some Anacardiaceae

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Abstract

The vascular organization in the node of 14 genera from the family Anacardiaceae has been investigated. The leaves were simple in *Mangifera*, *Anacardium*, *Bouea*, *Gluta*, *Buchanania*, *Semecarpus* and *Holigarna*, 3-foliate in *Rhus* while pinnately compound in other taxa. These were alternate (opposite in *Bouea*) and exstipulate. The foliar nodes were trilacunar, three-traced in the majority of the plants. In *Buchanania cochinchinensis* and *Semecarpus heterophylla* in addition to trilacunar three-traced nodes, pentalocular five-traced nodes were also observed whereas only multilacunar multi-traced noted in *Semecarpus anacardium.* The results are discussed with respect to the evolutionary conception of node.

Keywords: Anacardiaceae, node, nodal evolution

Introduction

The Anacardiaceae is a moderate-sized family includes 60-80 genera and some 700 species of trees and shrubs from temperate North America, Asia, and Europe to temperate South America, Africa and Australia (Cronquist, 1981) [1]. In India, the family is represented by 20 genera and 60 species of trees and 3 genera and 8 species of shrubs (Singh *et al.* 2000). Sinnott (1914) [8] have reported the trilacunar nodal structure in Anacardiaceae. Since the nodal vasculature in the family has received little attention, it warrants a detailed study. Present study deals with nodal organization of 20 species distributed in 14 genera of family Anacardiaceae.

Material and Methods

The plant materials of *Pistacia chinensis* Bunge ssp. *integerrima* (Stewart) Reichb. f., *Schinus molle* L. and *Pleiogynium timoriense (*DC.) Leenh. were collected from Lalbag Botanical Garden, Bengaluru whereas *Anacardium occidentale* L., *Buchanania axillaris* (Desr.) Ramamoorthy, *Toxicodendron vernicifluum* (Stokes) F.A. Berkley, *Holigarna arnottiana* Wall. ex Hook. f. and *Gluta travancorica* Beddome were collected from Nilambur, Kerala. *Bouea oppositifolia* (Roxb.) Meisn., *Semecarpus heterophylla* Blume, *Pistacia vera* L. and *Mangifera sylvatica* Roxb. Were collected from Dooars forest, West Bengal. *Rhus sinuate* Thumb, *Rhus parviflora* Roxb. and *Rhus paniculata* Wallich ex Don obtained from the Panchmarhi. *Buchanania cochinchinensis* (Lour.) M.R. Almeida, *Lannea coromandelica* (Houtt.) Merr, *Mangifera indica* L., *Semecarpus anacardium* L. and *Spondias pinnata* (L.f.) Kurz were collected from the Nagarjuna medicinal garden, Akola. The plant materials fixed in F.A.A. were preserved in 70% alcohol. Free hand serial sections of the young nodal regions as well as microtome sections were prepared following usual method of dehydration, clearing and embedding in paraffin wax. These were stained either in safranin-light green combination or crystal violet and erythrosine and examined under compound microscope.

Observations

The leaves are simple, trifoliate or pinnately compound. These are nearly always alternate and exstipulate. In all the species examined, the internodal region shows a complete vascular cylinder. In the nodal region, variable numbers of leaf traces diverge from the main vascular cylinder leaving behind prominent gaps.

Trilacunar Three-Trace Node

In *Rhus paniculata*, *R. parviflora*, *R. sinuate*, *Toxicodendron vernicifluum*, *Pistacia chinensis* ssp. *integerrima*, *Pistacia vera*, *Mangifera indica*, *M. sylvatica*, *Anacardium occidentale*, *Bouea oppositifolia, Buchanania axillaris*, *B. cochinchinensis*, *Schinus molle*, *Semecarpus heterophylla* and *Pleiogynium timoriense* all the three traces are given out simultaneously from the main stele (Figs. 1-11), whereas the median trace emerges out first and the two lateral traces diverge out at the higher level in *Gluta travancorica*, *Lannea coromandelica*, *Holigarna arnottiana* and *Spondias pinnata* (Figs. 12-17).

The median bundle is broad in *Rhus parviflora*, *R. paniculata*, *Rhus sinuate*, *Toxicodendron vernicifluum*, *Mangifera indica*, *M. sylvatica*, *Anacardium occidentale*, *Bouea oppositifolia,*

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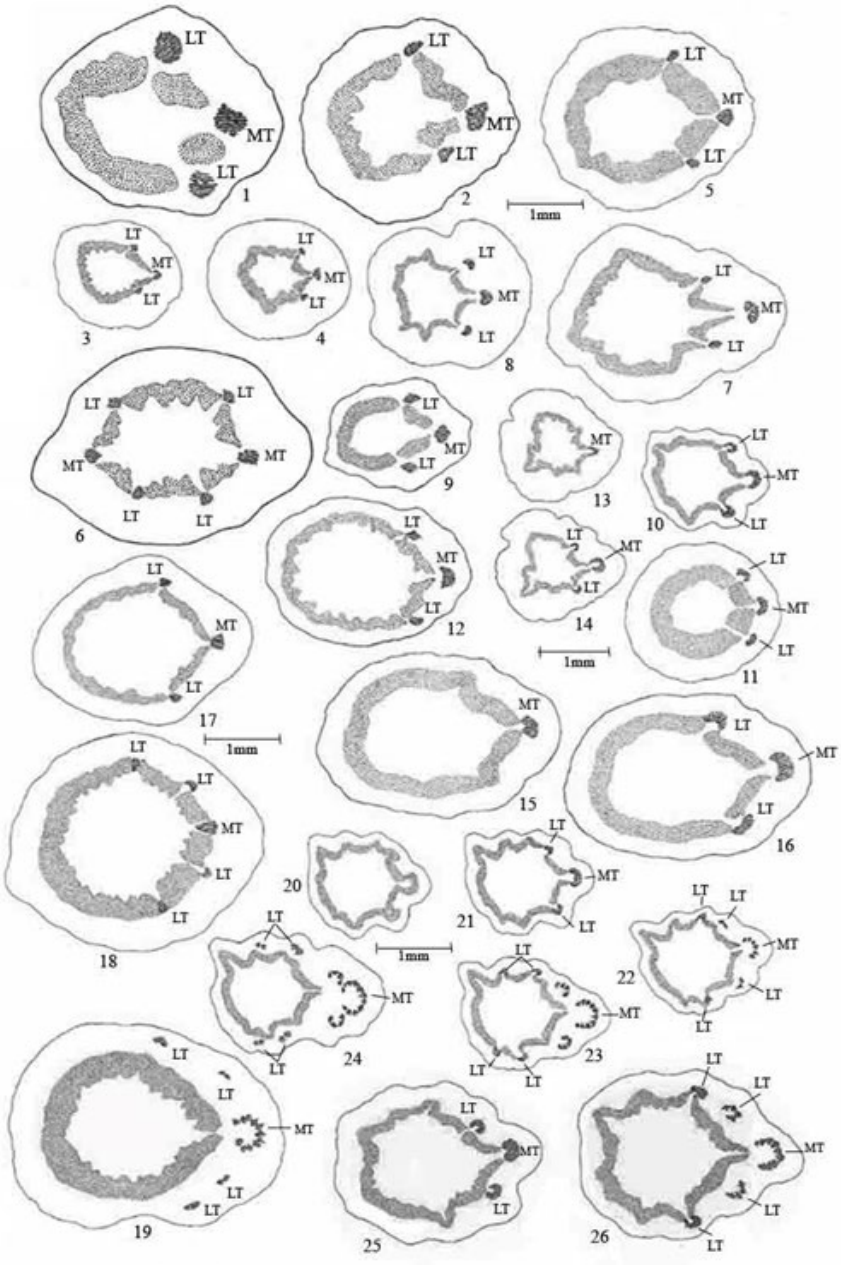
Gluta travancorica, *Schinus molle, Holigarna arnottiana*, and *Spondias pinnata* and more prominent and arc-like in the remaining taxa wherein it breaks up into 6, 10 or more traces. The lateral bundles divide, may not divide during their upward course and extend along with the daughter strands of median bundle, into the petiole/rachis.

Pentalocular Five-Trace Node

In *Semecarpus heterophylla* and a few nodes of *Buchanania cochinchinensis* pentalocular five-trace condition has been observed. The axial vascular cylinder first sends off a broad median trace leaving behind a gap. The first pair of lateral traces is derived next, while the second pair of laterals diverges out later (Figs. 18, 25). The median trace undergoes divisions into 8-10 daughter strands while each of lateral traces splits into two (Figs.19, 26). All the traces develop a ring and enter into the petiole.

Multilacunar Multi-Trace Node

In *Semecarpus anacardium*, a broad and prominent median trace is the first to emerge out from the main stele (Fig.21). The first pair of laterals is the next to emerge (Fig.22). The second and third pairs of laterals are derived in the end (Fig.23). All the lateral traces now traverse towards the median. The median bundle undergoes divisions into twelve to many daughter traces. The first pair of laterals splits into four strands, while the remaining laterals divide into two strands (Fig. 24). All these traces unite to form a ring like structure and enter into the petiole.



Figs. 1-26: Transections showing structure of foliar nodes, Fig. 1. *Rhus sinuate*; Fig. 2. *Toxicodendron vernicifluum*; Fig. 3. *Pistacia vera*; Fig. 4. *Mangifera indica*; Fig. 5. *Anacardium occidentale*; Fig. 6. *Bouea oppositifolia*; Fig. 7. *Buchanania axillaris*; Fig. 8. *Buchanania cochinchinensis*; Fig. 9. *Schinus molle*; Fig. 10. *Semecarpus heterophylla*; Fig. 11. *Pleiogynium timoriense*; Fig. 12. *Gluta travancorica*; Figs. 13, 14. *Lannea coromandelica*; Figs. 15, 16. *Holigarna arnottiana;* Fig. 17. *Spondias pinnata*; Figs. 18, 19. *Buchanania cochinchinensis*; Figs. 20-24. *Semecarpus anacardium*; Figs. 25, 26. *Semecarpus heterophylla*
Abbreviations used: MT- Median trace; LT- Lateral trace

Figure Plate

Discussion

This study brings out interesting variations in the nodal structure; the most common nodal condition is the trilacunar three-trace. In *Buchanania cochinchinensis* and *Semecarpus heterophylla* both have trilacunar as well as pentalocular five-trace structure of node. In *Semecarpus anacardium* multilacunar multi-trace structure of node is seen. Generally the median trace and lateral traces emerge simultaneously. It is interesting to note that the median trace emerges prior to the laterals in *Gluta*, *Lannea*, *Holigarna* and *Spondias.* The median bundle is broad or more prominent, arc-like in the majority of the plants and shows a number of divisions in its upward course. The lateral bundles also show divisions. These variations in the division of the medians and laterals may be looked upon from the points of view of mechanical strength and size of leaf.

While reviewing the nodal structure in angiosperms, Sinnott (1914) [8] writes that the trilacunar nodal structure occurs in the Anacardiaceae. The present study indicates that the trilacunar three-trace nodes occur in the majority of the taxa studied, while the pentalocular structure is noted in *Buchanania cochinchinensis* and *Semecarpus heterophylla.* In addition a third nodal type, the multilacunar multi-traced condition also exists in *Semecarpus anacardium*.

Sinnott (1914) [9] has emphasized the significance of the leaf trace and leaf gap in the systematics. Conflicting views have been expressed by various workers regarding the evolutionary conception of vegetative node in angiosperms, suggesting both reduction and/or amplification of vascular traces during the course of specialization (see Sinnott, 1914; Ozenda, 1949; Marsden and Bailey, 1955; Meeuse, 1966; Dickson, 1969; Stebbins, 1974; Sivaramakrishana, D. and H. Ramappa, 1988) [9, 6, 4, 5, 2, 11, 10]. Later, Takhtajan (1969, 1980) [12, 13] postulated tri-or multilacunar type of nodal structure with double trace in median gap as the most primitive one, which has given rise to all the nodal types known presently.

Conclusion

The present study demonstrates that the node is trilacunar three-trace in the majority of the taxa and considered to be basic for this family. *Buchanania cochinchinensis* and *Semecarpus heterophylla* has trilacunar as well as pentalocular nodal structure. *Semecarpus anacardium* has multilacunar nodal condition. This leads the present authors to infer that pentalocular condition in *Buchanania cochinchinensis* and *Semecarpus heterophylla* and then multilacunar in *Semecarpus anacardium* is a subsequent development through an elaboration of the lateral in the course of evolution. Eames (1961) [3] also arrives at similar conclusion of the nodal structure in this family.

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