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NODAL ANATOMY OF SEEDLINGS IN SOME RUBIACEAE

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Anatomy of the juvenile nodes in the seedlings of eight genera of the Rubiaceae is described. The cotyledonary nodes in the family show a two-trace, unilacunar, and one-trace, unilacunar conditions. At the second and third node level, the one-trace Unilacunar; and three-trace; trilacunar conditions are witnessed. The present study suggest that the three-trace, trilacunar condition is a later attainment.

Keywords : Nodal anatomy; Rubiaceae; Seedlings.

Introduction

A delve into the literature shows that the nodal anatomical investigations in the Rubiaceae[1-9] are restricted to the mature nodes exclusively. The present attempt is aimed at to find out the phylogenetic significance of seedling nodes not studied hitherto in the family.

Materials and Methods

Seedlings were raised from the seeds collected at various localities in Dhule and Nasik District of Maharashtra. Portions of the axis obtained by cutting a little below and above the first, second and third nodes of the seedlings raised, were fixed in FAA. The usual paraffin infiltrated material were cut on a microtome at a thickness of 10-15 microns. They were stained with safranin using light green as counter stain and mounted in Canada balsam.

Observations

1) *Kohautia aspera (Heyne ex Roth) Brem.*

The hypocotyledonary axis contains a ring of vascular tissue (Fig.1) upwards, it sends out two traces on each side(Fig.2). The bases of the cotyledonary leaves are connate and separate as such in the form of the ring (Fig.3). The cotyledonary node is unilacunar, one traced. The second and third nodes are also unilacunar, one traced. The single trace, however, bears branches on either side which extend into the stipular collar a little higher (Figs. 4-6). The stipules are interpetiolar (Fig.6).

2) Spermacoce hispida L.

As usual, the hypocotycledonary axil contains a ring of vascular tissue. On either side, it bears two traces (Fig.7). These extend into the petiole without fusion or branching (Fig.8).An axillary bud is present in the axial of the cotyledons (Fig.8).

The petiole bases separate from the axis in the form of a ring (Fig. 8). The cotyledonary node has a two-trace, unilacunar pattern. The leaves of the second and third node have a one trace, unilacunar supply. The solitary trace sends branches laterally on both side which extend into the stipular collar (Figs.9-10). The stipules are interpetiolar (Fig.10).

3) *Hedyotis corymbosa (L) Lam.*

A ring of vascular tissue extends into the hypocotyledonary axis (Fig.11).Two traces emerge from either side leaving one gap (Fig.12).These traces retain their separate entity upwards (Figs.13-14). The cotyledonary node is unilacunar, two-traced. The second and third nodes show similar pattern. A solitary trace departs from the axial vascular tissues on either side (Fig.15). These send lateral branches to the interpetiolar stipules. (Fig.16).

4) Mitragyna parvifolia (Roxb) Korth.

The hypocotyledonary axis has a vascular cylinder (Fig.17).A little upwards, two traces on either side emerge from one gap each (Fig.18). The leaves at the second and third node have a three-trace, unilacunar supply. Three juxtaposed - one larger median and two smaller lateral traces depart from the axial vascular tissues (Fig.19).The laterals bear a branch which continues into the stipules (Fig.20). The principal lateral trace however extends into the petiole. These nodes thus exhibit trilacunar, three-trace condition.

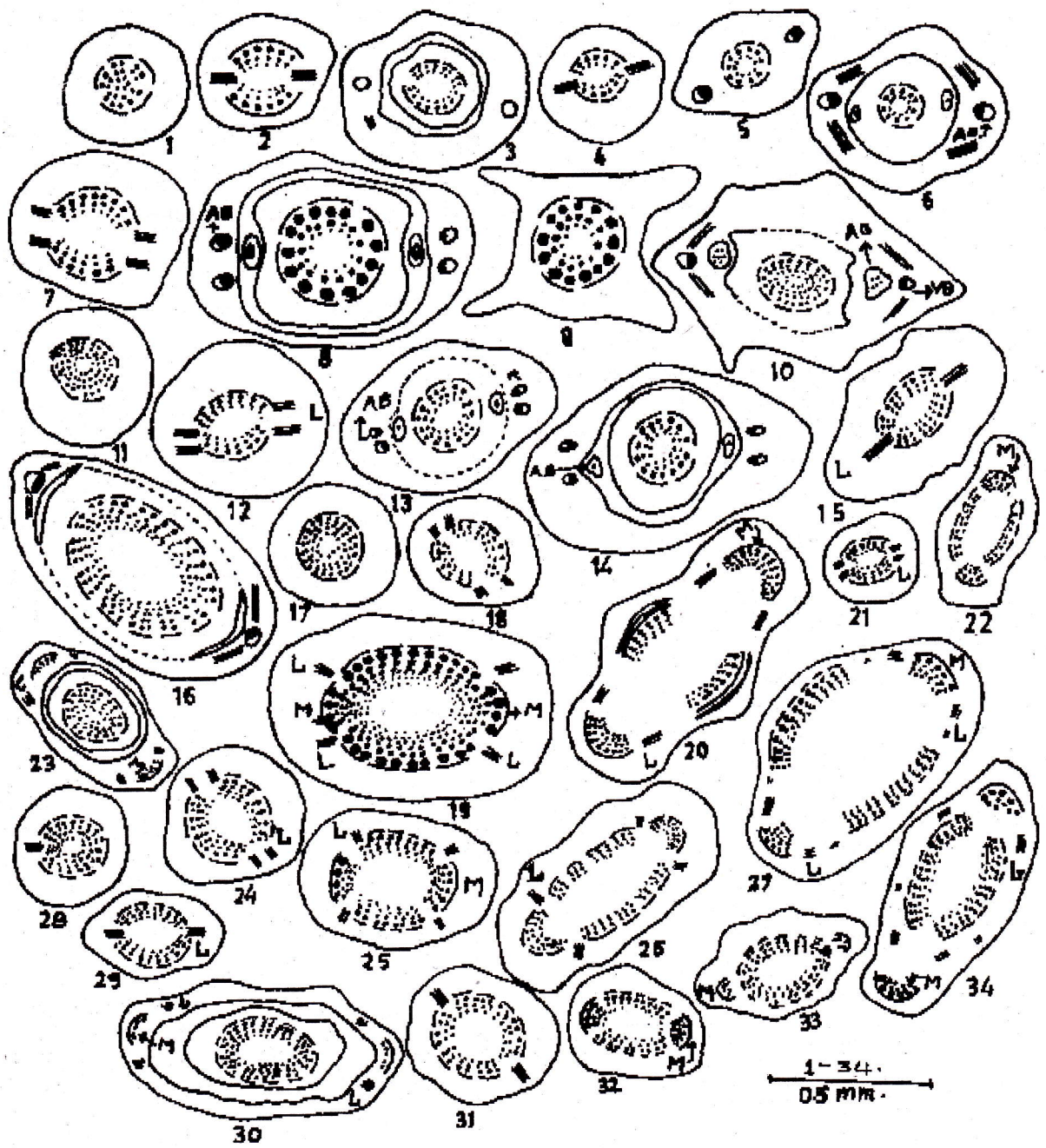
5) Canthium parviflorum Lam.

The cotyledonary node shows a two-trace, unilacunar pattern (Fig.21). In case of second and third nodes, a single trace separates from the vascular tissue on either side (Fig.22). This bears branches to form vascular supply to stipules (Fig.23).

Thus they are unilacunar, one - traced.

6) Catunaregam spinosa (Thumb) Tirvengadum

The cotyledonary node has a unilacunar, two-trace supply (Fig.24). In case of second node, three traces-one median and two lateral traces depart from a single gap in the vascular cylinder (Fig.25). The former extends into the petiole, whereas the latter while shifting towards the stipular collar divide once or twice (Fig.26-27). The second node is thus unilacunar, three-traced. The third node likewise shows similar structure.



Kohautia aspera : First Node - Figs. 1-3. Second & Third Nodes - Figs. 4-6.
Spermacoce hispida : First Node - Figs. 7-8. Second & Third Nodes - Figs-9-10.
Hedyotis corymbosa : First Node - Figs. 11-14. Second & Third Nodes - Figs. 15-16.
Mitragyna parvifolia : First Node - Figs. 17-18. Second & Third Nodes - Figs. 19-20.
Canthium parviflorum : First Node - Fig. 21. Second & Third Nodes - Figs. 22-23.
Catunaregam spinoza : First Node - Fig. 24. Second & Third Nodes - Figs. 25-27.
Neanotis montholoni : First Node - Fig. 28. Second & Third Nodes - Figs. 29-30.
Ixora coccinea : First Node - Fig. 31. Second & Third Nodes - Figs 32-34.
(AB - Axillary bundle; L - Lateral trace; M - Median trace; VB - Vascular bundle)

7) Neanotis montholoni (Hook-f.) Lewis

The cotyledonary node shows unilacunar, one-trace structure (Fig.28). At the second node the vascular tissues sends a solitary trace which divides into three thus forming a median and two lateral traces (Fig.29-30). The laterals extend into the collar of the stipules (Fig.30).The second as well as third node exhibit a unilacunar, one-trace supply.

8) Ixora coccinea L.

The cotyledonary node has a unilacunar, one trace supply (Fig.31).The nodes at second and third leaf levels are trilacunar, three-traced. At first, the median trace on either side departs from the vascular ring, whereas the lateral traces with their own gaps do so a little upwards (Figs.32-33). The lateral traces shift into the collar of the stipules (Fig.34) and the median trace alone extends into the base of the petiole (Fig.34).

Discussion

Previous works on nodal anatomy have widely acknowledged the different patterns of nodal structure and phylogenetic status [2, 10-14]. Depending upon the number of leaf gaps, the nodes of angiosperms are described as either unilacunar, trilacunar and multilacunar. A fourth type , viz., unilacunar with two traces , was considered basic later by various authors[11,12,15]. This view gained a wider support from a number of anatomists. For the sake of precision, a discussion on these nodal patterns is avoided here.

During the present investigation, two-trace, unilacunar type is witnessed in the cotyledonary nodes of *Spermacoce hispida, Canthium parviflorum, Mitragyna parvifolia* and *Gatunaregam spinosa,* whereas it is unilacunar one-traced in others. At the second node level the unilacunar one-trace condition is met with in *Neanotis montholoni, Spermacoce hispida, Canthium parviflorum, Kohautia aspera* and *Hedyotis corymbosa.* The unilacunar, one traces condition is maintained in these plants at the third level as well.

The condition in *I.coccinea* is significant. The cotyledonary node is unilacunar, one- traced, whereas the second and third nodes are trilacunar, three-traced. It may be also noted that, in general, there is ontogenetic transition, if any, from the one-trace, unilacunar condition of the earlier nodes to the unilacunar, three-trace, or trilacunar, three-trace condition of the later developed more mature nodes. The unilacunar, single-traced supply appears basic and the three-trace, trilacunar more specialized. The three trace supply, associated with a three gaps is found at the more mature second and third nodes. The cotyledonary node with one or two-trace condition occurs at the cotyledonary nodes. Mars den and Bailey[11] considered the one-trace, unilacunar pattern derived by the close approximation of the two traces arising from one lacuna. However, present authors did not observe such a behavior of the two traces in the plants examined. The contention of these authors may get support if more taxa of the family are studied.

Sinnott[1] in a critical review of the nodes in Angiosperms states ..." that the Rubiaceae are overwhelmingly unilacunar, the only exception being the genus *Sarcoephalus,* where the presumably ancient trilacunar condition persists." Majumdar & Pal[3-5]. similarly, Rao *et al*[8] add some taxa to the list with trilacunar nodes. *Ixora* of the present account forms one more example. However, present study doesn't lend support to Sinnott's[1] (*loc.cit*) viewpoint. Instead, if divulged a contradictory condition. During the course of evolution, the unilacunar node with a single trace might have resulted on account of fusion of two traces, and the trilacunar and multilacunar types by the addition of lateral traces arising from new gaps in the vascular cylinder (cf.Marsden and Bailey[11], *loc.cit.*).The present and past studies in the family may be taken as evidence in support of the above standpoint.

Sinnott and Bailey[1] opined that in majority of plants. In general with unilacunar nodes, the stipulates are absent. This was supported later on by Dickinson[16]. The present study on unilacunar nodes in the Rubiaceae is not in favour of such a viewpoint as the family itself is characterized especially by the presence of stipule. The pattern of vascular supply to them is also varied. Sometimes, the single trace gives rise to two lateral traces. In case of trilacunar, three-traced nodes, the laterals continue into the stipules, rarely, they bear a branch to the latter.

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