# NODAL ORGANIZATION IN POLYGONACEAE*

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The nodal structure ranges from trilacunar to 12-lacunar. The number of traces usually corresponds to the number of lacunae. Wherever the number of traces is more than the number of lacunae, the increase in the number of traces is always adjacent to the median. Such traces are given out from the main vascular cylinder without leaving a gap. Variation in nodal organization has been observed even within the same species. The vascular cylinder may have sclerenchymatous sheath on the outer and/or inner side of the ring or each bundle may be completely surrounded by the sheath. It may be altogether absent in a few cases. The climbing species generally have a tri-or pentalacunar node whereas the robust herbs and shrubs show multilacunar condition. The trilacunar 3-trace node has been regarded as the simplest. With the advent of specialization, amplification in the number of lacunae and traces seems to have given rise to multilacunar and multitrace condition.

The nodal organization of various families has been a subject of interest since long and various phylogenetic conclusions are attached to its organization. Sinnott (1914) regarded trilacunar condition in Polygonaceae as primitive and other organizations being derived from it. Mazumdar (1955) studied the node of *Polygonum* and correlated it with the organization of leaf base. The present authors (Agrwal and Saxena, 1975) also described the organization of node in some taxa of the family. The present communication deals with the study of nodal organization of some 23 taxa of the family.

**Key Words:** lacunae, trace

## MATERIAL AND METHOD

The plant material examined during the course of present study is enumerated hereunder along with place of collection:–

| | | |
|---|---|---|
| *1.* | *P. aviculare* Linn. | Switzerland |
| *2.* | *P. glabrum* Willd. | Meerut |
| *3.* | *Polygonum recumbans* Rolye ex Bab. | Shimla |
| *4.* | *P. sp.* 2469 B | Manali |
| *5.* | *P. serrulatum* Lagasca | Meerut |
| *6.* | *P. pterocarpum* Wall. ex Meissn. | Manali |
| *7.* | *P. alatum* Buch.-Ham. ex Spreng. | Shimla |
| *8.* | *P. bistorta* (L.) Sampai | Switzerland |
| *9.* | *Persicaria maculata* (Ref.) Love & Love | Switzerland |
| *10.* | *P. hydropiper* (L.) Opiz. | Meerut |
| *11.* | *P. polystachya* (Wall.) H. Gross | Manali |
| *12.* | *P. amplexicaulis* (D. Don.) Ronse Decraene | Mussoorie |
| *13.* | *Bilderdykia baldschuanica* D.A. Webb. | Switzerland |
| *14.* | *Fagopyrum cymosum* (Trev.) Meissn. | Shimla |
| *15.* | *Antigonon leptopus* Hook. & Arn. | Meerut |
| *16.* | *Rumex arifolius* All. | Switzerland |
| *17.* | *R. nepalensis* Spreng. | Mussoorie, Manali |
| *18.* | *R. scutatus* Linn. | Switzerland |
| *19.* | *R. hastatus* D.Don | Badrinath, Shimla |
| *20.* | *R. acetosa* Linn. | Switzerland |
| *21.* | *R. dentatus* Linn. | Meerut |
| *22.* | *Rheum undulatum* Linn. | Switzerland |
| *23.* | *Oxyria elatior* R.Br. | Switzerland |

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The FAA fixed nodes were processed following the customary method of dehydration and clearing through ethanol - xylene series and then embedded in paraffin wax (Johnson 1940). The paraffin embedded plant material was sectioned at 12-14 microns. The slides were stained with crystal violet-erythosin combination.

## OBSERVATIONS

In the present communication nodal structure of sinc 23 species of Polygonaceae has been studied (Plate I - Figs. 1-35). The sub-nodal vasculature comprises a ring of collateral bundles or a complete vascular cylinder. These bundles are generally provided with well developed sclerenchymatous outer bundle sheath and a poorly developed inner bundle sheath. The inner bundle sheath is in patches in plants like *Polygonum glabrum* and *Persicaria polystachya* but it is altogether absent in *Polygonum recumbans, P. pp. 2469B, P. pterocarpum, Persicaria hydropiper, P. bistorta, P. amplexicaulis, Fagopyrum cymosum* & *Rumex arifolius*. In *Oxyria elatior* the outer sheath is absent and in *Rheum undulatum* no bundle sheath is observed. The hypodermis may be aerenchymatous in *Polygonum aviculare* and *Persicaria hydropiper.* In *Polygonum serrulatum, P. pterocarpum, Persicaria polystachya* & *Rumex acetosa* it is collenchymatous. The leaf traces given out can be sharply differentiated as median and lateral (MLT & LLT). The table

**TABLE–1**

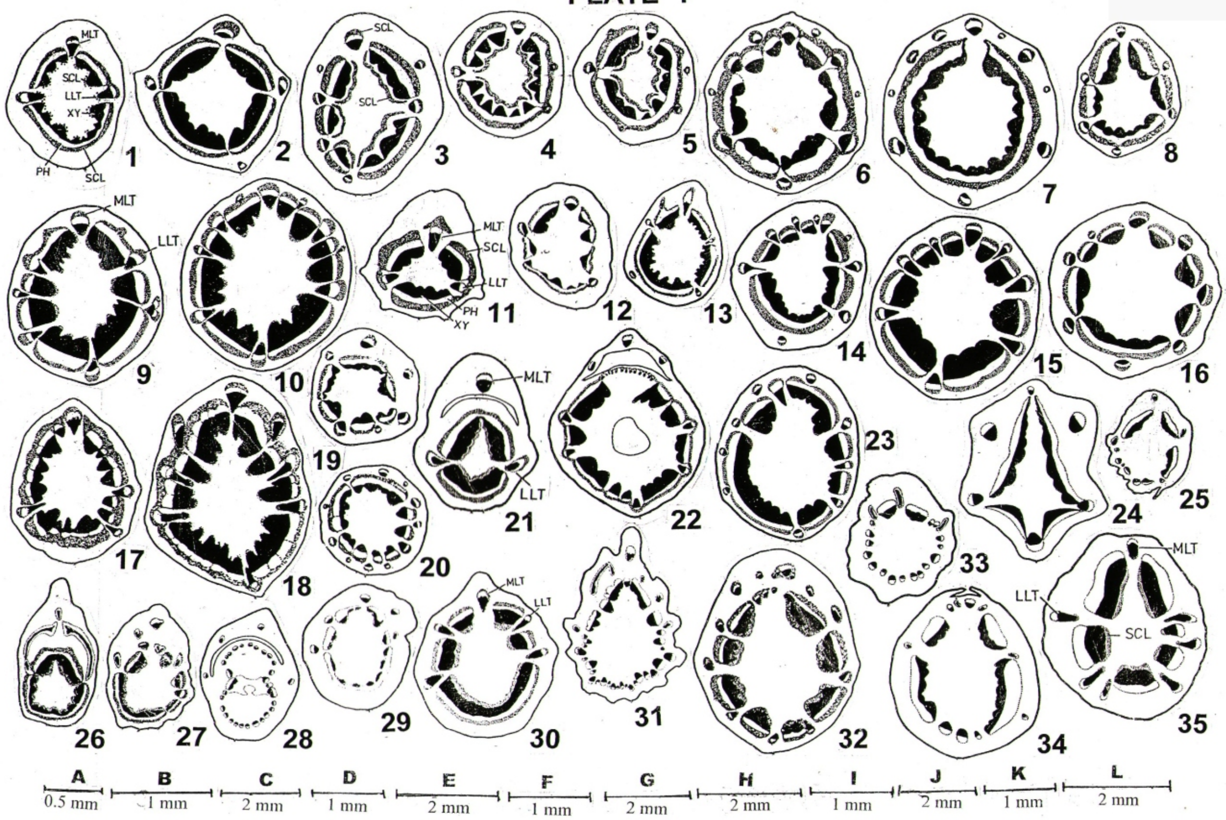
| S.No. | Taxa | Nodal Organization |
|---|---|---|
| 1. | *Polygonum aviculare* | Trilacunar 3-trace; Five lacunar 6-trace; Six lacunar 6-trace. |
| 2. | *P. recumbans* | Four lacunar 4-trace. |
| 3. | *P. glabrum* | Trilacunar 7-trace; Seven lacunar 7-trace. Four lacunar 4-trace. |
| 4. | *P. sp. 2469B* | Six lacunar 6-trace; Ten lacunar 10-trace. |
| 5. | *P. serrulatum* | Seven lacunar 9-trace; Ten lacunar 10-trace. |
| 6. | *P. pterocarpum* | Trilacunar 3-trace. |
| 7. | *P. alatum* | Four lacunar 4-trace. |
| 8. | *Persicaria maculata* | Six lacunar 7-trace. |
| 9. | *P. hydropiper* | Seven lacunar 8-trace; Eight lacunar 8-trace. |
| 10. | *P. bistorta* | Eight lacunar 8-trace. |
| 11. | *P. polystachya* | Four lacunar 4-trace; Eight lacunar 8- trace. |
| 12. | *P. amplexicaulis* | Six lacunar 6-trace; Eight lacunar 8- trace. |
| 13. | *Bilderdykia baldschuanica* | Trilacunar 3-trace. |
| 14. | *Fagopyrum cymosum* | Eight lacunar 8-trace; Nine lacunar 9-trace. |
| 15. | *Antigonon leptopus* | Five lacunar 5-trace. |
| 16. | *Rumex arifolius* | Trilacunar 3-trace. |
| 17. | *R. nepalensis* | Trilacunar 3-trace; Four lacunar 5-trace. |
| 18. | *R. scutatus* | Four lacunar 4-trace; Five lacunar 5-trace. |
| 19. | *R. hastatus* | Five lacunar 5-trace. |
| 20. | *R. dentatus* | Ten lacunar 11-trace. |
| 21. | *R. acetosa* | Twelve lacunar 12-trace. |
| 22. | *Rheum undulatum* | Trilacunar 3-trace; Five lacunar 5-trace. |
| 23. | *Oxyria elatior* | Five lacunar 6-trace; Six lacunar 6-trace; Seven lacunar 7-trace; Eight lacunar 9-trace. |

given hereunder summarises various types of nodal organizations recorded in the taxa studied for the present:–

## DISCUSSION

Sinnott (1914) in his classical review on nodal organization in angiosperms remarks that the Polygonaceae is a "typically multilacunar family". He observed trilacunar nodes in young plants of the dioecious species of *Rumex*. He, therefore, concluded that trilacunar condition is primitive in the family and the multilacunar condition has been derived due to amplification of the former one. Ozenda (1947), on the other

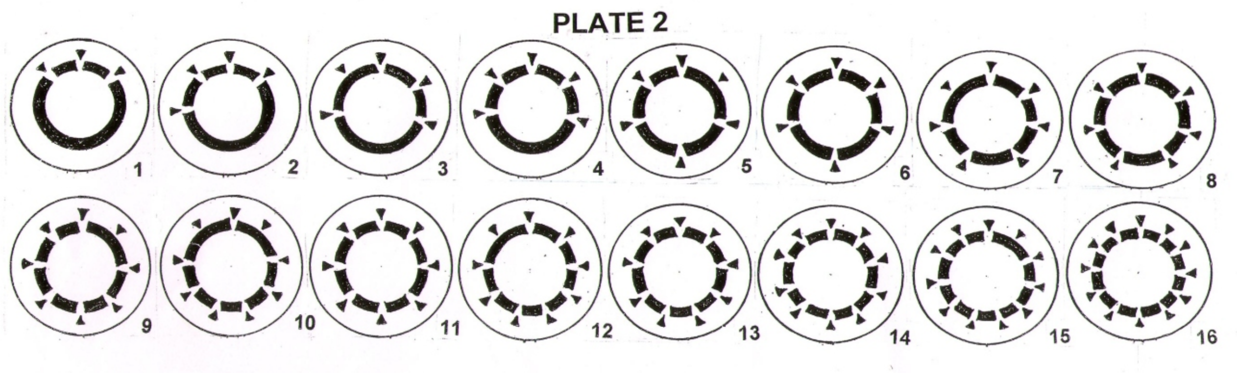
PLATE 1




**Figures. 1-35.** Transverse sections of node, 1. *Polygonum aviculare*, 2. *P. recumbans,* 3-5. *P. glabrum,* 6-8 *P. sp. 2469B,* 9-10. *P. serrulatum,* 11. *P. pterocarpum,* 12. *P. alatum,* 13. *Persicaria maculata,* 14-15. *P. hydropiper,* 16. *P. bistorta,* 17-18. *P. polystachya*, 19-20. *P. amplexicaulis,* 21. *Bilderdykia baldschuanica,* 22-23. *Fagopyrum cymosum,* 24. *Antigonon leptopus,* 25. *Rumex arifolius,* 26-27. *R. nepalensis,* 28-29. *R. scutatus,* 30 *R. hastatus,* 31. *R. acetosa,* 32. *R. dentatus,* 33-34. *Rheum undulatum,* 35. *Oxyria elatior.*

**Scales–**A for figures. 1-2; B for figures. 3-5; C for figures. 6; D for figures. 7-8, 13; E for figures. 9-10, 14-16; F for figures. 11, 17; G for figures. 12, 18-20; H for figures. 21-23; I for figures. 24; J for figures. 25-29 & 31-32; K for figures. 30; L for figures. 33-35.

LLT-lateral leaf trace; MLT-Median leaf trace; PH-phloem; SCL-Sclerenchyma; XY-xylem.




**Figures 1-16.** Diagrammatic representation of different types of nodal organizations in Polygonaceae:
1. Trilacunar and 3-trace. 2. Four lacunar and 3-trace. 3. Four lacunar and 5-trace. 4. Five lacunar and 5-trace. 5. Five lacunar and 6-trace. 6. Six lacunar and 6-trace. 7. Six lacunar and 7-trace. 8. Seven lacunar and 7-trace. 9. Seven lacunar and 8-trace. 10. Seven lacunar and 9-trace. 11. Eight lacunar and 8-trace. 12. Eight lacunar and 9-trace. 13. Nine lacunar and 9-trace. 14. Ten lacunar and 10-trace. 15. Ten lacunar and 11-trace. 16. Twelve lacunar and 12-trace.

hand, derived a trilacunar node from a multilacunar one. However, this primitive condition is found even in advanced groups like Umbelliferae, Asterales, Polygonales etc. Marsden and Bailey (1955) and Canright (1955) considered unilacunar, 2-trace condition to be most primitive. They derived multilacunar condition from trilacunar. This view was supported by many workers like Bilasputra (1962), Conde and Stone (1970), Stone (1970), etc. Takhtajan (1969), however, considered trilacunar or multilacunar node with two traces diverging from the median gap as most primitive. Dickson (1975) also regarded trilacunar, 3-trace condition as most primitive thus supporting Sinnott.

In the present study variations in nodal organization have been observed not only in different species but even within the same species. Various conditions observed are summarised in Table-1. The organization ranges from trilacunar, 3-trace condition (*Polygonum aviculare, P. pterocarpum, Bilderdykia baldschuanica, Rumex arifolius, R. nepalensis* and *Rheum undulatum*) to twleve lacunar, 12-trace condition (*Rumex acetosa*). (Plate 2, Figs. 1-16).

In most of the cases the number of traces correspond to the number of lacunae, but in certain members the number of lacunae is less than the number of traces. This situation may occur even within the same species such as *Polygonum aviculare, P. serrulatum, Rumex nepalensis* and *Oxyria elatior.* The nodal organization as such can not be used as a taxonomic criteria in the family Polygonaceae as there are variations in the number of lacunae and traces within the same species. However, it is interesting to note that the climbing species have a trilacunar or pentalacunar nodes. On the other hand, robust herbs and shurbs show a multilacunar condition.

The trilacunar, 3-trace node perhaps represents the simplest condition within the family. With the advent of specialization, amplification in the number of traces followed by the increase in the number of lacunae thus giving rise to a multilacunar condition with as many as 12 lacunae and 12-traces through various intermediate stages (Plate-2; Figs. 1-16).

Majumdar (1955) reported that in *Polygonum* and *Centella* the leaf near shoot apex has only one median bundle. He considered that as the foliar foundation gradually extends tangentially, more bundles (as laterals) enter into the extending wings and thus forming the sheathing base. Increase in the number of traces to many has been described for families with sheathing base. However, during the course of present study the sheathing base of the leaf is associated from trilacunar condition to multilacunar throughout the family.

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