



TRENDS OF SPECIALIZATION IN THE FLOWER OF POLYGONACEAE

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The floral plan of Polygonaceae flower is basically hexamerous in *Rheum* and *Rumex*. It probably gave rise to pentamerous and tetramerous conditions by reduction. There has been phylogenetic modification in the organization of the floral vasculature not only through reduction but also through amplification, cohesion and adnation.

Key words: Reduction, Amplification, Cohesion, Adnation.

In an earlier communication Agrwal & Saxena (2012) described the anatomy of flower of some 33 species of Polygonaceae wherein they noted some interesting trends of specialization in flower in terms of their vascular organization. The flowers may be tri- to pentamerous and tri- to pentacyclic. While the number of tepals range from four to six, arranged in one or two whorls, the stamens vary from five to nine, also arranged in one or two whorls. The number of carpels may be two or three.

DISCUSSION AND CONCLUSIONS

There has been considerable difference of opinion about the basic plan of the polygonaceous flower. Whether it is a trimerous plan with two whorls of perianth or only a single whorl of five or six perianth members representing the basic condition? Ontogenetic studies of Payer (1857), suggested that the trimerous plan is fundamental. Eichler (1878), considered the trimerous plan representing the most primitive condition. He visualized whorled arrangement in those taxa where there are six perianth members, and spiral arrangement where there are four or five perianth members. Thus, he concluded the presence of both cyclic and acyclic members within the family. Bentham (1837), on the basis of his study on *Rheum* also considered trimery as the basic condition and the other types being derived from it. Dammer (1889), Gross (1913), Lundbald (1922), Rendle (1925), Laubengayer

(1937) and Vautier (1949), on the basis of their studies on the floral anatomy of the family also concluded that trimerous whorled condition is the basic condition for the family. The other conditions with five or four tepals arrived as a result of fusion or suppression of the floral parts.

Pax (1890) and Celakovsky (1899) regarded the six tepaled perianth forming a single whorl as the fundamental condition and five or four tepaled condition to be derived. Bauer (1922) remarked that the nutritive conditions of the flower are responsible for increase or decrease of the number of tepals.

The present study indicates that the basic plan of polygonaceous flower is trimerous and pentacyclic as seen in *Rheum*. It has six tepals arranged in two trimerous whorls, only three alternating in the inner and a tricarpellary gynoecium. According to Puri (1952, 58, 62), the vascular ground plan of the flower undergone modification modified by reduction, amplification, cohesion and adnation. The following trends appear to have been responsible for specialization of the polygonaceous flower:

- (a) Reduction in the number whorls of tepals and stamens.
- (b) Reduction in the number of carpels.
- (c) Amplification in the perianth vasculature.

- (d) Cohesion and adnation in the floral vasculature.

As a result of these changes specialization leading to evolution of flower seems to have occurred along the following lines:

- (i) The condition of *Rumex nepalensis*, *R. hastatus* and *R. arifolius* can be derived from *Rheum undulatum* by complete disappearance of stamens belonging to inner whorl. The vasculature is modified due to adnation of the carpellary dorsals with the staminal bundles as in *Rumex acetosa*, *R. alpinus*, *R. dentatus* and *R. scutatus*.
- (ii) In another line of specialization, the reduction in the number of tepals from 3+3 to five appears to be the result of fusion of a postero-lateral tepal of outer whorl with an antero-lateral tepal of inner whorl, accompanied by the disappearance of an antero-lateral stamen of inner whorl. The alternate tepal is two trace in flowers of *Polygonum serrulatum*, *P. plebejum* and *Persicaria amplexicaulis*, suggesting its double nature i.e., formed by the fusion of two tepals. An outer stamen lying opposite to the inner edge of alternate tepal, though anatomically belongs to the outer whorl is pushed to the inner whorl. This resulted in 5+3 arrangement of stamens.
- (iii) During further specialization the two bundles in the alternate tepal fused and, as a result, each of the five tepals became one trace. The remaining floral organization did not undergo any change and remained the same as that of *Polygonum serrulatum* etc. The bifurcation in *Persicaria polystachya*, *Polygonum sphaerostachyum*, P.sp.2469 B is an intermediate step in the reduction series.

- (iv) Further specialization in the flower seems to have taken place by the reduction in the number of carpels from three to two by suppression of one carpel. This change appears to be accompanied by the disappearance of a postero-lateral stamen of outer whorl which came to lie in the inner whorl in other species of *Polygonum* and *Persicaria*. Thus the number of stamens in the inner whorl is reduced to two (*Polygonum lanigerum*). Further reduction in the number of stamen belonging to inner whorl perhaps led to the condition seen in *Polygonum aviculare* and *P. glabrum*. This trend seems to be culminating in complete disappearance of stamens of inner whorl as in *Persicaria maculata*.
- (v) By considering reduction in the number of tepals from 5 to 4 and disappearance of one stamen of the outer whorl, *Persicaria orientalis* can be linked to *Polygonum lanigerum*.
- (vi) Further, *Oxyria digyna* can be linked to *Persicaria orientalis* by shifting of two inner stamens to the outer whorl, thus all the six stamens come to lie in one whorl and by amplification of vasculature of the inner tepals.
- (vii) Another trend of specialization is seen in *Persicaria hydropiper*, *Polygonum sphaerostachyum* and P.sp. 2469 B where there is adnation of varying number of staminal traces with tepal traces. This condition seems to have arisen from *Fagopyrum cymosum*, *Persicaria bistorta* etc.
- (viii) To condition of *Polygonum alatum* can be correlated to *Fagopyrum cymosum* by considering fusion of two adjacent tepals as indicated by bi-trace condition of one inner tapel. Further, instead of two, four stamens were born in the inner

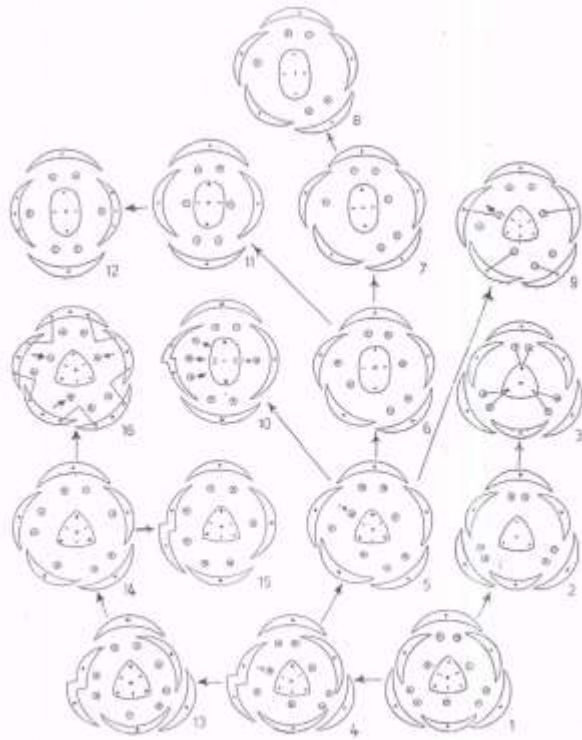


Figure-1 (1-16) Floral patterns in different members of Polygonaceae showing trends of specialization in the flower:

1. *Rheum undulatum*. 2. *Rumex nepalensis*, *R. hastatus*, *R. arifolius*. 3. *Rumex alpinus*, *R. acetosa*, *R. dentatus*, *R. scutatus*. 4. *Persicaria amplexicaulis*, *Polygonum plebejum*, *P. serrulatum*. 5. *Fagopyrum cymosum*, *Persicaria bistorta*, *P. capitata*, *Polygonum recumbans* etc. 6. *Polygonum lanigerum* 7. *Polygonum aviculare*, *P. glabrum*. 8. *Persicaria maculata*. 9. *Persicaria hydropiper*, *Polygonum sphaerostachyum*, *P.sp.2469B*. 10. *Persicaria orientalis*. 11. *Oxyria digyna*. 12. *Polygonum alatum*. 13. *Bilderdykia baldschuanica*. 14. *Muehlenbeckia platyclados*, *Polygonum pterocarpum*, *Bilderdykia baldschuanica* (in some flowers). 15. *Bilderdykia baldschuanica* (in a few flowers) 16. *Antigonon leptopus*.

whorl and four in the outer, but all the eight stamens came to lie in one whorl. This has been accompanied by reduction in the number of carpels from three or two in the same way as has been considered for *Polygonum lanigerum*.

(ix) In another line of specialization there

has been shifting of inner stamens to the outer whorl and thus all the eight stamens came to lie in one whorl. By considering this trend, *Bilderdykia* can be linked to *Polygonum serrulatum*, *P. plebejum* and *Persicaria amplexicaule*. These species resemble in having a bitrace alternate tepal.

(x) Further specialization has taken place by reduction in the number of traces in the fused tepal from two to one. The possibility of fusion of the two traces can not be ruled out. This is exemplified in *Muehlenbeckia* and a few flowers of *Bilderdykia* and *Polygonum pterocarpum*. In some flowers of *Polygonum pterocarpum* the second stamen lying opposite to alternate tepal has also disappeared.

(xi) *Muehlenbeckia* can be linked to *Bilderdykia* by reduction in the number of tepals from five to four, the fused tepal being two trace, and disappearance of one stamen lying opposite to fused tepal.

(xii) The condition of *Antigonon* can be linked to *Muehlenbeckia* by considering amplification in the tepal vasculature and cohesion of laterals of adjacent tepals. Cohesion upto various degrees has been observed between tepal laterals. The traces for all the eight stamens though arise simultaneously, the stamens get arranged in two whorls (5+3) and they are basally connate.

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