

Basic evolutionary trends in Angiosperms

There is a controversy regarding the habit of the most primitive Angiosperms being woody or herbaceous, otherwise a consensus exists about the general primitive features of Angiosperms. The primitive features are:

- Simple alternate exstipulate leaves
- Leaves are entire, petiolate, with poorly organized reticulate venation
- Unilacunar , two trace nodes,
- Vessels are absent or tracheid-like,
- Flowers are bisexual, radially symmetrical, floral parts are spirally arranged.
- Stamens are broad, undifferentiated with marginal microsporangia.
- Carpels are broad with large number of ovules,
- Stigma along the margin and not completely sealed,
- Ovules bitegmic, crassinucellate
- Fruit are follicular.

From such primitive condition evolution within Angiosperms has proceeded along different lines in different groups. Numerous trends in the evolution of angiosperms have been recognized from comparative studies of extant and fossil plants. The evolutionary trends in angiosperms are thus often complicated and frequent reversal of trends may be encountered, as for example the secondary loss of vessels in some members. The general processes involved in attaining diversity are:

Fusion

During the course of evolution in angiosperms, fusion of different parts has led to floral complexity. Fusion of like parts has led to the development of gamosepaly, gamopetaly, synandry and syncarpy in various families of angiosperms. Stamens have shown fusion to different degrees: fusion of filaments only (monadelphous condition in Malvaceae), fusion of anthers only (syngenesious condition found in Asteraceae) or complete fusion (synandry as in *Cucurbita*). Carpels may similarly be fused only by ovaries (Synovarious:

Caryophyllaceae), only by styles (synstylous: Apocynaceae) or complete fusion of both ovaries and styles (Synstylovarious: Solanaceae, Primulaceae). Fusion of unlike parts has resulted in an epipetalous condition (fusion of petals and stamens), formation of gynostegium (the fusion of stamens and gynoecium: Asclepiadaceae) and formation of an inferior ovary (fusion of calyx with ovary: Apiaceae, Myrtaceae, etc.).

Reduction

Relatively simple flowers of many families have primarily been the result of reduction. The loss of either stamens or carpels has resulted in unisexual flowers. The loss of one perianth whorl has resulted in monochlamydeous forms, and their total absence in achlamydeous forms. There has also been individual reduction in the number of perianth parts, number of stamens and carpels. Within the ovary different genera have shown reduction in the number of ovules to ultimately one, as seen in the transformation of follicle into achene within the family Ranunculaceae. There has also been reduction in the size of flowers, manifested in diverse families such as Asteraceae and Poaceae. Reduction in the size of seeds has been extreme in Orchidaceae. Male flower of *Euphorbia* presents a single stamen, there being no perianth or any trace of a pistillode, only a joint indicates the position of thalamus and the demarcation between the pedicel and the filament.

Change in Symmetry

From simple radially symmetrical actinomorphic flowers in primitive flowers developed zygomorphic flowers in various families to suit insect pollination. The size of corolla tube and orientation of corolla lobes changed according to the mouthparts of the pollinating insects, with striking specialization achieved in the turn-pipe mechanism of *Salvia* flowers, and female wasp like flowers of orchid *Ophrys*.

Elaboration

This compensating mechanism has been found in several families. In Asteraceae and Poaceae, the reduction in the size of flowers has been compensated by an increase in the number of flowers in the inflorescence. Similarly, reduction in the number of ovules has been accompanied by an increase in the size of ovule and ultimately seed, as seen in *Juglans* and *Aesculus*.

Remoration

The term was suggested by Melville (1983) to refer to evolutionary retrogression found in angiosperms and their fossil relatives. The fertile shoots of angiosperms, according to him, show venation pattern changes progressively from vegetative leaves through successive older evolutionary stages in bracts and sepals, and the most ancient in petals. The innermost parts in a bud as such represent the most primitive evolutionary condition, and the outermost the most recent condition.

References

Singh, (2012). *Plant Systematics: Theory and Practice* Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.