Course B.Sc. Bot. Hons.(part II)

E-content - Online class held on 17/7/20 &18/7/20

Modern Trends in Plant taxonomy

Taxonomy has long history beginning from the age of Theophrastus (370-285BC), when plants were classified on their habit. Many developments and changes came time to time with the proposition of artificial, natural and Phylogenetic classifications by great many taxonomists. Classification of angiosperms has long been a puzzle. The fragmentary fossil record of plants unfolded the mystery of evolution but still there are many shortcomings in the classical classifications. There were recommendations to introduce characters other than floral i.e. anatomical, cytological, palynological, physiological, biochemical and cytogenetically evidences in addition to the palaeobotanical evidences for assessment of the status of any taxon. New approach in this field began to include other disciplines of botany which might be helpful in establishment of phyletic relationships among taxa. This new trend came in the last century and has been successful to some extent to achieve its goal. Recent works have shown that contributions to systematic can come from any branch of botany such as *anatomy,embryology,cytology* .The taxonomic contributions to cytogenetics have been enormous and this gave the new discipline *cytotaxonomy*.Presence of specific chemical compound/s has proved to be another criterion to support taxonomy .This comes under the discipline *chemotaxonomy* .

Following branches have been included as supporting disciplines for taxonomic study:-

Anatomy

Anatomical characters of the vegetative parts have been employed with great success in solving many taxonomic puzzles. Such studies include epidermal cell characters, thickness, presence or absence of trichomes, papillae, surface sculpturing are some important parameters.

For example papillate and silicified epidermal cells have been emphasised in the systematic of *Gramineae,* and details of silica bodies distribution on the epidermal surface also provide important taxonomic criteria in *Cyperaceae.*

Stomatal characteristics such as their morphology and spatial relationship to the neighbouring cells, number and arrangement of subsidiary cells, and their ontogenetic al pattern may helpful in systematic and Phylogenetic considerations.

Leaf venation and leaf anatomy are also important parameters. It is established that venation and leaf anatomy in Dicots and Monocots differ from each other in tissue arrangements. Two distinct types of arrangements of internal tissues in leaf *panicoid and festucoid* have been found in grasses. Data obtained from venation have been used in the systematic of *Berberidaceae* and *Rutaceae.*

Petiole and nodal anatomy are also useful evidences in characterisation of families. Distribution of perivascular and vascular fibres and vascular tissues are useful in classification of certain *Leguminosae* plants.

Sclereids and distribution patterns of starch, proteins, tannins, crystals and other depository bodies in plant tissues are also diagnostic importance.

Wood anatomy of plants which include structure and nature of vessel elements, vascular rays, distribution of axial parenchyma and plane of cambial initials, are important characteristics of wood which provide taxonomic evidences. Establishment of *Magnoliaceae* as primitive family, as considered by J. Hutchinson, has got supportive evidence from wood anatomical data and refutes *Englerian* concept of *Amentifers* being primitive.

Embryology

Very significant role of embryology has been evidenced in solving taxonomic controversies. Earlier workers like Hofmeister and Strasburger had indicated that embryological data could serve the purpose of taxonomy. The embryological studies (*Maheshwari,*1964) stated that embryological techniques are more complicated than anatomy or cytology. Credit goes to the German embryologist *Schnarf* (1931) brought it to prominence.
It was found that various parts such as ovules, embryosac, endosperm, sporogenous tissue, embryo, anther, pollen grain greatly vary in different taxa and they can be used in taxonomy. Following variations are met with different parts in embryological studies-

Ovule- Tenuinucellate/crassinucellate, vascular supply presence or absence of obturator and nature of micropyle.

Embryo sac-The mode of development i.e. monosporic,bisporic and tetrasporic, structure and number of cells and arrangement of nuclei in embryo sac, persistence of antipodal cells, presence of embryo sac haustoria in some plants.

Endosperm-Presence or absence, types of endosperms i.e. nuclear, cellular or helobial.

Embryo- Presence or absence of suspensor, haustoria, nature and organisation of embryo and differentiation of proembryonal cells further into various plant parts.

Seed coat- structure is the distinguishing feature of taxonomic significance.

Anther- Number of loculi, nature of anther wall, character of tapetum i.e. glandular or amoeboid.

Pollen grains- Size, shape, nature of pore(porate or colpate),number and arrangement of openings, the exine pattern, behaviour of nucleus in pollen and number of cells present in it at the time of dehiscence of anther.

There are some families, which are marked out by their specialised embryological characteristics. For example *Podostemonaceae* are marked by the presence of Pseudoembryo sac, occurrence of pollen grains in pair, tenuinucellate bitegmic ovule, and bisporic type of embryo sac. The family *Onagraceae* is characterized by the universal occurrence of the *Oenothera* type of embryo sac which is not found in any of the family except some anomaly. In *Cyperaceae*, only one functional microspore is formed in each pollen mother cell instead of all the four functional microspores, as found usually. This single feature in Cyperaceae is unique for identification of taxa. Similarly *Orchidaceae* is characterised by the absence of endosperm in seeds. Systematic determination of the genus *Paeonia* has been made possible by obtaining embryological data and its inclusion in *Ranunculaceae* was revised by creating a separate family *Paeoniaceae.*

Palynology in relation to taxonomy-

The application of palynological data has found uses in exclusive texts of Zimmermann and Cronquist.Erdtman (1963) has listed 105 families of interest to support correlation of palynology with taxonomy.

Palynology (study of pollen grains) has also been found helpful in taxonomy. Some important features in pollens such as their shapes, size, number and position of furrows, sculpturing pattern on the exine, are considered for the characterisation of taxa.

These characters have been helpful in differentiation and establishing Phylogenetic relationships of taxa. For example the genera *Salix* and *Populus* (*Salicaceae*) can be distinguished on the basis of pollen characters. *Salix* has long and narrowed three furrowed pollen as compared to spherical pollen without distinct apertures in *Populus.* Similarly thickening of exine is a distinguishing feature in different genera of family *Betulaceae*. Pollen characters have also been extensively utilised in classifying the genera of the *Acanthaceae* and the *Primulaceae.*

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