Role of Embryology in plant taxonomy

Micro- and mega-sporogenesis, gametophyte development, fertilization, and development of endosperm, embryo, and seed coats. ... where embryology has either supported earlier classifications or has proposed a new systematic position for the taxon concerned.

Embryology in Taxonomy:

Embryology is the study of the process of formation of embryo in a fertilised ovule, i.e., the study of the changes taking place in an ovule before and after the fertilisation.

In other words, it is the study of:

(a) Micro- and macro-sporogenesis in the diploid generation,

(b) Micro- and mega-gametophytes in the haploid generation and

(c) The embryo and endosperm in the new sporophyte.

As a result of such study different types of embryosac development have been noticed among the angiospermic groups, e.g., Asterad, Onagrad, Chenopodiad, Solanad, Caryophyllad and Piperad types. Some consider that such a grouping has great taxonomical significance while others are of opinion that the phylogenetic relationship apparent from the embryological studies are, however, not convincing.

Palynology in Taxonomy:

Study of the pollen morphology has proved of great value in the field of taxonomy. The discovery of Electron scanning and transmission microscopy, besides light microscopy, help in revealing ultra-structure of the pollen grains and spores.

Pollen grains may be simple (eumonad) or composite, e.g. dyad, tetrad, polyad, etc. They may be symmetrical, i.e., bilateral or radial, or asymmetric.

The shape varies from spheroidal to oval, rhomboidal, rectangular in meridional view and circular to semi-angular, angular or lobate in polar view. They may further be distinguished as apolar, polar or heteropolar. The size of pollen grains varies from 8-10 µm to 350 µm in angiosperms.

Palynological studies are based on the detailed and critical study of

(a) Aperture- and

(b) Sporoderm-morphology.

Pollen grains may be without aperture, i.e., omniaperturate, or they may be mono-, di-, tri-, tetra- or panto-(poly) aperturate. Aperture serves as weak region for pollen tube emergence or harmomegatic function.

Aperture may be simple-colpate or porate, or composite-colporate or pororate. They may be proximal (as in spores of Cryptogams), distal (as in pollens of Gymnosperms and Monocotyledons) or equatorial and global which are also called ana, cata, zono or

panto.

Simple apertures are present on the outer layer of sxine, viz., sexine or ektexine. Composite apertures are present both on external layer of exine, i.e., sexine or ektexine and also internal layer, i.e., nexine or endexine. The apertures may be long furrows or colpa or circular pores or ora.

Pollen grains are classified and named variously on the number, position and character of apertures, e.g. trizono colpate, i.e., number of apertures three, position equatorial (zono) and character colpa-like, similarly pantocolpate, pantoporate, tetracolporate, and so on.

Sporoderm provides another important character for consideration. Sporoderm or pollen wall is made up of a very resistant substance called sporopollinin. It comprises of two layers, the outer is the ektexine (or sexine) and the inner is endexine (or nexine). The sporoderm encloses the intine and protoplasm.

The spores of Pteridophytes have another external layer called penine. Both ektexine and endexine comprise more than one layer which are detectable under microscope and more so by their staining behaviour

Ektexine presents various structural and sculptural elements which help in identification, classification, etc. Endexine does not present such structure and sculpture as the ektexine but its thickness or other irregularity help in various ways.

Thus pollen morphology helps in solving many taxonomical problems at family, tribe, genus and even up to species level. It

provides valuable information and together with other information gathered from other disciplines of botany brings a reasonable solution to many disputed questions in taxonomy.

Preparation of Pollen-Slide:

For a morphological study of the pollen it is necessary to prepare pollen-slides. The process is briefly described here. A small amount of pollen is placed on a slide. A drop of alcohol is added and allowed to evaporate partly. The oily substance exuded from the pollen is wiped out with cotton moistened in alcohol

Before the pollens dry completely a drop of methyl-green glycerine jelly is placed over it and the pollen- mass is stirred with a clean needle. It is dried by passing over a flame or on hot plate.

It is then covered with a cover slip. The methyl-green stains the exine. If staining of the cell content is desired a weak eosine solution is added before applying alcohol. Character of the pollens are then studied under a microscope.

The most accepted method for preparing pollen slides is that by Erdtman known as acetolysis method. In this method a mixture of acetic anhydride and concentrated sulphuric acid is put over polliniferous material in a tube which is put in water and the water gradually heated to boiling point.

The material is then transferred to an electric centrifuge and after centrifuging a few drops of water added to the sediment. The tube is thoroughly shaken until the mixture foams.
The sediment is then put in a mixture of equal parts of glycerine and water. It is then centrifuged again and glycerine and water

added. The process is repeated several times and the liquid allowed to run off. A small quantity of the sediment is put on a slide and sealed.