Welcome students to this module of e-learning. I'm Dr. Maria A. D'souza Assistant Professor, St. Xavier's College, Mapusa Goa will present to you this module to the first year students of Botany semester two course code BOC 102 and the Paper titled Biodiversity II - Vascular plants. The module name - Taxonomic evidence from Palynology which belongs to Unit 5 taxonomic evidences from palynology cytology, phytochemistry and molecular data.

The outline of the module will be definition of palynology, basic evidentiary characters of pollen grain. Examples of taxonomic evidences from palynology. Once the student completes this module, the student will be able to explain the terms like taxonomic characters and palynology. Describe the evidentiary characters of pollen grains and the taxonomic evidences based on palynology.

Dear students, what does taxonomic character mean. The other attributes that can be used to provide evidences from which relationships between taxa can be inferred.

Now if you see the word palynology. It is dealing with the study of pollen grains and it comes from the Greek word Palyein means to scatter. Now the pollen grains are disseminated by different agents of pollination, and they are found in every nook and corner. Palynological evidences appear very effective students in plant taxonomy and phylogeny. Since Pollen grains possess distinctly unique characters which are genetically controlled. Pollen grain morphology plays an important role in classification. Study of pollen grains has been proved to be very useful in solving taxonomic disputes.

Now, there are several pollen features useful in taxonomic delimitation like pollen unit type, Pollen grain polarity, exine structure, exine sculpture, aperture, shape, type, position. There are a number of them to list.

If you see the pollen aggregation or pollen unit type, we see monads, which are seen in majority of the angiosperms. Dyads which are seen in the rare cases like Magnoliidae, Trinucleate are seen in Caryophyllidae, tetrad also are seen a number of number of plants which we'll see in the next slide. Polyads are seen in Calliandra and Massulae they form irregular groups in Orchidaceae whereas pollinia they are seen very much in Asclepidiaceae.

Now the tetrad also are seen in particular families like tetrahedral tetrad in Ericaceae, linear tetrad in Typha, rhomboidal Tetrad in one plane with two separated from one another by close

contact of the other two. This is the one students. Tetragonal tetrad in one plane seen in Philydrum and decussate that means in two pairs. That means they arrange at right angles to one another seen in Lachnanthes.

We also see a lot of variation in Pollen wall sculpturing students. We see Baculate, Clavate, Fovulate reticulate, Fossulate, Verruculate, Gemmate, Psilate, Striate. Specifically in the genus Taraxaccum sp. we see echinate type of pollen grains and they are having spines greater than one microns, whereas in Quercus species we have scabrate pollen grains with spine like elements which are less than one micron.

There are a number of variations with regard to the pollen apertures. We have two types initially inaperturate - that means there is no aperture and aperturate- that means there's a presence of an aperture. The aperture can be porate, colpate, sulcate whether it is a pore, it’s a furrow or sac like structure. It can be mono tri porate, colpate or sulcate. .

Now depending upon the palynogical evidences, two distinct phylogenetic stalks have been seen in the dicots have been suggested, one is Magnoliaceae and Ranunculaceae where in Magnoliaceae shows monocolpate pollen grains that means a single colpi, whereas tricoplate means - it's having 3 colpi.

Now, if we see the angiosperms, the monocolpate conditions is widely distributed in primitive dicots and a majority of the monocots and the monocots are considered to be closely related to the Magnolian stock on the basis of monocolpate pollen grains. The pollen grains of anemophilous plants, the one which are being disseminated by wind- They are usually small, round, smooth, thin walled, dry, seen in the families Poaceae, Cyperaceae. They can be easily disseminated students because of their structure like this whereas the ones which are disseminated by insects, birds on the other hand, they are large sculptured, often coated with adhesive, waxy or oily substance.

Now let's see step-by-step at the family, genus and species level how palynology has helped in solving taxonomic disputes.

On the basis of Palynological character with regard to family level, Fumariaceae is separated from Papavaraceae and Nelumbonaceae from Nymphaeceae. See now if we see Nelumbo. Nelumbo is a genus which shows consistently tricolpate pollen grains. Now it was originally

placed in the family Nymphaeaceae. The family Nymphaeaceae shows Monosulcate pollen grains. Now because Nelumbo shows tricoplate pollen grains, it is shifted from Nymphaeceae and place into Nelumbonaceae as a separate family students which is Nelumbonaceae. So this is at the family level. There are some families also students which are recognized on the basis of pollen sculpture. Malvaceae and Bombacaceae are separated on the basis of exine characters wherein Malavaceae shows spinous exine, whereas Bombacaceae shows reticulate exine in pollen green. In addition, Malvaceae and Asteraceae have both spinolose exine. Plumbaginaceae has verrucate exine. Poaceae has smooth, sulcate exine. Nepenthaceae and Droseraceae except Drosophyllum has spinuliferous pollen tetrad. Such type of pollen tetrads are not found in any other plants. Relationship between Polygalaceae and Ephedraceae are based on similarity between their pollen grains.

Now we'll see the family Berberidaceae. The Family Berberidaceae consists of 12 genera. Modern taxonomists What they did is they removed the genus Podophyllum from this family Berberidaceae and placed in a separate family Podophyllaceae because on the basis of pollen aggregation because Podophylum the pollen grains in Podophylum remain united, but they are free in other genera. This shows the role of palynology in taxonomic delimitation at the family level at the genetic level,

At the generic level, the role of palynology is delimitation or genius level is evident from the family Salicaceae. Now Salicaceae family has two genera Salix and Populous and these are distinguished based on the pollen grain characteristics. The genus Populus has spherical pollen grains without distinct aperture whereas Salix is long narrowed and three furrowed pollen. There are seven genera of Polygonaceae that is *Koenigia, Persicaria, Polygonum, Pleuropteropyrum, Bistoria, Tiniaria* and *Fagopyrum* are different in all their pollen morphology. In Phytolaccaceae the pollen of *Phytolacca* is 3-zonocolpate, whereas that of *Rivinia* is Pantocolpate. The pollen characteristics helps in differentiating species within a single genus.

Now, last at the specific level, we have the genus *Anemone* buttercup belonging to Ranunculaceae the different species of can be distinguished. Now this genus there are four species in this genus, *alchemillaefoliath, rivularis, fulgen*. Now these four are distinguished based on their pollen grains. *Obtusifolia* shows *3*-zonocolpate, the second species *A. alchemillaefoliath shows pantoporate,* third one *A. rivularis* showed *Pantocolpate* and *A. fulgen* showed *S*piraperturate.

So at the specific level based on the exine pattern different species of *Bauhinia* (Fabaceae) can be differentiated. Now see students pollen size played a vital role in demarcating different species of *Malva* belonging to (Malvaceae).

So you see how palynological evidence have helped at the family level, Generic level and the species level. So students, these are the references. These are the online references.
And thank you students for a patient hearing.