VIVEKANANDA COLLEGE

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NAAC ACCREDITED 'A' GRADE

Topic:	PALEOBOTANY AND PALYNOLOGY
Course Title:	PLANT DIVERSITY II
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Application of palynology

Application of palynology in different fields or branches are given below. The branches are:

1. Palynotaxonomy

2. Aeropalynology

3. Melissopalynology (= melittopalynology)

4. Forensic Palynology

5. Paleopalynology

6. Copro Palynology (Greek ‘kopros’ means dung)

7. Entomopalynology

8. Palynodebris

9. Latropalynology.

1. Palynotaxonomy:

Palynotaxonomy is the study of spore morphology of embryophytes and pollen morphology of seed plants.

The contributions of Professor Erdtman on pollen morphology marked the beginning of a new phase on plant taxonomy. Erdtman and many palynologists all over the world made available pollen descriptions of all angiosperm families including most of the genera and species to taxonomists. Taxonomists employ pollen morphological attributes in systematic works, i.e. in solving controversial taxonomical and phylogenetical problems, identification and determining affinity etc.

On the basis of pollen morphological data plant families are divided into two groups —**stenopalynous and eurypalynous.** Stenopalynous families do not exhibit marked variations of pollen types with regard to apertures and sporoderm stratification etc. ex. Capparidaceae, Chenopodiaceae, Casuarinaceae and Gramineae etc. Eurypalynous families exhibit marked variation of pollen types with regard to apertures and sporoderm stratification etc. ex. Bignoniaceae, Boraginaceae, Cucurbitaceae and Euphorbiaceae etc.

Based on stenopalyny or eurypalyny the inter or intra family affinity of taxa, to some extent, can be determined, e.g. the pollen grains of

grasses are all monoporate and phylogenetically the Gramineae seem to be closely related to Restionaceae, Centrolepidaceae and Flagellariaceae group.

Morphological characters of pollen have been used to substantiate many taxonomical revisions. For example segregation of Trapaceae from Onagraceae, Bombacaceae from Malvaceae, the union of Zingiberaceae, Cannaceae and Musaceae into Scitamineae, and Moraceae and Cannabinaceae into Urticaceae.

2. Aeropalynology:

Aeropalynology is the study of palynomorphs found in. the atmosphere. The term palynomorph encompasses pollen, spores and other bioparticles that are acid resistant:

Pollen grains have an impact on human systems. They cause allergies in sensitive individuals. Hay fever or allergic rhinitis is the best known allergy of all. Hay fever is caused by pollen grains of *Betula, Populus, Salix* and *Chrysanthemum* etc. Allergy is also caused by the pollen grains of *Cynodon dactylon, Amaranthus spinosa, Chenopodium album, Cannabis sativa* and *Cassia occidentalis* etc.

The symptoms of hay fever are sneezing, clogged nose, itching nose, throat and eye, conjunctivitis and watering eyes. Aeropalynology

comes under the purview of aerobiology that includes the study of bioparticles present in the atmosphere in addition to pollen and spore. In aerobiological research palynologists in collaboration with clinicians search the causative agents present in the atmosphere that have impact on human health.

3. Melissopalynology (= melittopalynology):

Melissopalynology is the study of pollen and spore present in honey.

Pollen analysis of honey samples reveals the followings:

a. It provides the plant species foraged by honeybees.

b. The identified plants provide the fingerprint of the environment and pollen spectrum from where the honey comes.

c. It provides the botanical and geographical origin of honey.

d. It is an indispensable tool to authenticate honey-unifloral honey or multifloral honey. If unifloral whether the honey sample contains pollen grains of the same plant as is declared. As for example – *Brassica*-honey, *Acacia*-honey and Citrus-honey etc.

e. It detects whether the honey sample contains allergenic pollen grains.

f. It detects whether the honey sample contains poisonous pollen, e.g. Datura and Rhododendron etc.

g. It identifies pollen that are toxic to bees and cause bee poisoning, e.g. *Kalmia, Cuscuta, Tilia and Solanum* etc

4. Forensic Palynology:

Forensic palynology is the study of palynomorphs that are used as evidence in criminal cases and resolve other legal problems. Forensic palynology also includes identifying and linking the suspect to the scene of the crime.

The following attributes of pollen and spore form the basis of forensic palynology

a. Pollen grains are abundant in the atmosphere.

b. Pollen and spores are microscopic and may be unknowingly taken away or left at a crime scene. Such pollen and spores can be used as evidence.

c. Pollen and spores cannot be removed from a crime scene.

d. Sporopollenin is the major component of the pollen wall and it forms ‘species- specific-pattern’ that persists for thousands of years without any change in shape, aperture and sculpturing etc.

e. A pollen grain can be identified to a specific plant type, site, region or country.

The study of palynomorphs collected from crime scenes and the belongings of suspects enables forensic palynologists to decide whether the pollen analyses will be of any probative value. Forensic palynology has been utilized effectively in many cases, e.g. assault, rape, forgery, drug dealing, fraud and murder etc.

In many cases mud, dust or dirt are collected from shoes, vehicles etc. for pollen and spore analyses. There are several court cases where pollen evidence becomes important clues that helped to obtain conviction.

Sometimes ‘the pollen grains themselves can be the villains’. There are reports of several cases of death after consuming poisonous honey in the state of Sao Paulo in Brazil. The honey contained poisonous pollen grains of sapindaceous Serjania lethalis. Pollen analysis of the stomach content of a deceased boy revealed the presence of the lethal pollen.

5. Paleopalynology:

Palaeopalynology ‘deals with the study of fossil microorganisms such as pollen grains, spores, marine and freshwater algae, foraminifera and other planktonic forms’. The study of chitinozoans (animal remains), fungal spores, dinoflagellates, acritarchs and other organisms (except diatoms) is also included in paleopalynology.

Paleopalynology depends on the following attributes of a pollen grain

a. Pollen wall is tough and it survives better and longer than other biological materials.

b. Sporopollenin composes exine and it forms a ‘species-specific-pattern’ of ornamentation/sculpturing on a pollen wall. A pollen grain and its characteristic pattern fossilize well.

c. Due to presence of sporopollenin the shape, size, aperture(s) and sculpturing etc. remain unchanged after long term sedimentation underground. These properties of a pollen grain provide means of identifying an unknown sporomorph up to the respective family or genera or even species. Correct identification of a pollen grain and spore is an essential prerequisite to study any discipline of palynology.

d. A little quantity of peat or sediment sample contains a huge number of pollen grains and thus the vegetation that provided pollen can be studied.

Paleopalynology is an applicative discipline of palynology. It is of immense value in a wide range of scientific studies. With palaeo palynological data stratigraphic correlation and dating of ages etc. can be established. The presence of fossil fuels—coal and oil can be predicted through fossil pollen morphological studies. Pollen grains present in Quaternary deposits can be referred to extant genera and species.

Thus the past vegetation can be ascertained. From the identified plants the climate and ecology etc. can be determined. By studying the vegetation chronologically of the different strata the past history of vegetation, plant evolution, climatic and ecological change, geographical distribution, affinity between groups of plants, appearance and decline of some plants etc. can be interpreted.

6. Copropalynology (Greek 'kopros' means dung):

Copropalynology is the study of palynomorphs present in coprolite (= fossilized excrement) of animals. Human coprolite is preserved in dry caves. Pollen and spore analyses of human coprolite provide information about the diet of prehistoric humans. Pollen analysis of

herbivore coprolite provides data to reconstruct the composition of pastures of that time.

The term copropalynology also includes the pollen analysis of recent excreta. Forensic palynologists determine the last diet of a murdered person by pollen analyses of stomach, gut and feces.

7. Entomopalynology:

Entomopalynology is the study of pollen grains that are associated with insects. This study encompasses melissopalynology, researches on honeybees, foraging distances of insects and pollination biology etc.

The purpose of studying entomopalynology is to find the relation of pollinators and crop yield. It is observed that in apples, melons and almonds etc. the yield increases with the increase of pollinators. Some pollinators are pests on crops. By studying pollinators and pests efficient management practices can be developed to increase crop yield.

The studies include determining habit, habitat and life cycle of pollinators, the frequency of visits of pollinators; whether the pollinators are after nectar, pollen, or both, whether genetically modified plants affect pollinators, the future of plant species in

absence of pollinators and to save pollinators from being endangered etc.

8. Palynodebris:

"Palynodebris is the organic 'junk' = organic matter ("OM") found in palynological preparations along with palynomorphs"—Traverse. It has the size of a palynomorph and does not contain sporopollenin and chitin. It consists of charcoal or cellulosic tissue fragments like wood fragments that escape acetolysis.

Palynodebris is studied for its 'relevance to palynofacies/ environment relationship'. The analysis of charcoal reveals much about the environment at the time of deposition.

Palynofacies—this term refers to the total assemblage consisting of palynodebris and palynomorph present in sediment. The assemblage characterizes the sediment and reveals the environment at the time of deposition. Palynodebris is now studied along with paleopalynology.

9. Latropalynology:

It is the 'study of spores and pollen as applied to human health problems'—Traverse. It is known that pollen and spore have medicinal properties. As for example Arabian physicians use *Lycopodium* spores— commercially called 'vegetable sulphur' for the treatment of

stomach disorders. The spores of *Adiantum philippense* are used to cure coughs. The pollen grains of *Cycas circinalis* have narcotic properties.