PLANT ARCHITECTURE-INNOVATIONS THROUGH TIME AND SPACE

Bot.Sp-20 **Credit Hours: 3(2+1)**

THEORY:

Introduction to the course:

The course gives the students an introduction to the plant architecture, their evolution, biology, and morphology. The primary goal is to explain the science of palynology, to outline the main features of pollen and to show how these properties are used in various branches of science.

Course Objectives:

The aim of the course is:

1. To understand the structure pollen and spores.
2. To raise a level of identification for pollen analysis
3. To provide students with the practical skills to analyze pollen/spores and plant remains with microscopic techniques.

Course Detail:

1. **Plant Architecture**; meaning and Interpretation. Evolution, forces of evolution; geological, environmental, biological extinction and subsequent birth of new species. Concept of species in plants.
2. **Early Silurian:** Amphibious plants, the Silurian Climate, Stresses and Strains, Vegetative and Reproductive instability verses short life span and water dependency, Rootless, branchless and leaveless bodies, problems of geometrical symmetry and overcoming gravitational forces and desiccation, Only sporophytic generation known e.g. *Cooksonia.*
3. **Late Silurian to Early Devonian:** Archetectureal triumph, Erect upright very small (17-20cm) sporophytic body divided into three zones i.e.; Photosynthetic, Conductive and Absorptive Zones, branching dichotomous, epidermis cutinized and stomatiferous, spore smooth thin walled, both gametophyte and sporophyte short lived and amphibious. Hydroid and leptoids for conduction, xylem and phloem also emerged later, rounded geometrical symmetry firmly established, homospory e.g., *Aglaophyton, Taenocardia, Hicklingia, Horneophyton*.
4. **Late Devonian – Early Carboniferous:** Birth of roots, leafy appendages, dichotomy cum trichotomy, abaxial sporangia, heterospory, Corm containing reserved food developed, Aquatic habit emerged, sporangia terminal and lateral, spores thich walled, e.g., *Zosterophyllum, Trimerophyta, Drepanophycus, Asteroxylon*.
5. **Mid to late Carboniferous:** witnessed another important breakthrough further strengthening the Plant architecture i.e., Arborescent habit, root or root like structures, Heterospory and seed Habit, Pseudo-Bitegmic Seed, Twiner stems, bifacial true leaves, e.g., *Protolepidodendron, Lepidodendron, Spbenophyllum*, Ferns, Seed Ferns.
6. **Early Permian to Early Triassic**:- Arborescent and Seed Habits more refined and well established, Hetrospory more pronounced, true Bitegmic Seeds evolved, Seed Ferns, Progymmnosperms and Gymnosperms dominated the terrestrial Ecosystems. End Permian great Mass Extinction Episode, 90% Land Flora diminished. Some plants recovered during early Triassic. Permian Glossopteris Flora replaced by Dicoridium Flora, e.g., *Verteberaria, Glossopteriss, Gangamopteris, Squamalia, Dicoridium*.
7. **Mid Triassic to Late Triassic**; Gymnosperms with Arborescent Habit dominated the terrestrial Ecosystem further strengthening the Arborescent Habit with pronounced secondary growth and deep tap root system along with Dicoridium Flora.

8. **Early Cretaceous to Palaeocene**: Emergence of Angiosperms with same fundamental archetectural layout as exhibited by all tracheophytes till late Jurassic, but with two important Evolutionary innovations apart from many others, i.e.; reduction of male gametophyte to one cell, not requiring water for its transportation to female gametophyte and development of flower with bitegmic ovule.

Practicals:

1. Study of Architectural layout model of the major plant groups mentioned in the theory section through clay moulds.
2. Study through prepared slides the relevant anatomical and structural details of representative plants groups mentioned in the text.
3. Mandatory Field Study tour to the lesser Himalayas to collect rock samples from various formation (Permian to Palaeocene) to extract palynomorphs representing plants in the theory section through standard maceration techniques. Students shall be required to prepare a field study tour report in addition to the Practical copy and produce it at the time of Practical Examination. Both practical copy and Field report shall carry separate marks. Any student not attending the field study tour shall lose those marks (Field report).

Teaching-learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Field visits/ Workshop

Learning Outcome:

Students will be able to learn:

1. How plants evolved as shown from the fossil record.
2. How to identify and classify palynomorphs.
3. How to use palynofacies to reconstruct sedimentary environments.
4. How to use plant fossils in palaeoclimate reconstructions.
5. How sedimentary transport and post-depositional processes control the plant fossil record.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Recommended Readings:

1. Paleobotany, Paleoecology and Evolution. Kjniklas.Praeger Press, New York.
2. Jeryme, A.C., T.A. Ciabbe and B.A. Thomas. The phylogeny and classification of Ferns, Academic Press, London
3. Alfered Traverse 2007. Paleopalynology. Unwin Hyman Ltd.
4. Eames, A.J. Morphology of Vascular Plants (Lower Groups). McGraw Hill and Co.
5. Andrews, H.W. Studies in Paleobotany. John Wiley and Sons.
6. Sporne, K.R. The morphology of Pteridophytes. Hutchinson University Library.
7. Taylor and Taylor. Biology and Evolution of Fossil plants. Princeten Hall, New York.
8. Foster and Gifford. Comparative Morphology of Vascular Plants, W.H. Freeman, New York.
9. Lithostratigraphic Units of the Kohat, - Potwar Province, Indus Basin Pakistan, 1980. Memoir Volume No.10. Geological Survey of Pakistan.
10. Bierhorst, D.W. Morphology of Vascular plants. Macmillan, Inc. Insurance, New York.

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