

**THEORY:****Introduction of the Course:**

The course is organized to provide an adequate knowledge about different fungal groups with their representatives along with taxonomy and nomenclature of various fungal groups placed in higher fungi and their importance especially with reference to plants.

**Course Objectives:**

The course is designed:

1. To provide an adequate knowledge about basic concepts of different fungal groups and their characteristics.
2. To give an insight into structure of Higher fungi with an emphasis on their morphology, taxonomy and life cycle patterns.

**Contents:**

1. **Ascomycota:** Morphology, reproduction, life cycle patterns, sexual compatibility and parasexuality; Types of asci, centra and ascocarps; Ascosporeogenesis and conidiogenesis; Principles and systems of classification of Ascomycota and mitosporic fungi; classification; Concept of anamorphs and telomorphs
  - 1.1. Classes of conidial fungi: Hemiascomycetes; general characters of orders: Endomycetales (yeasts), Taphrinales etc.
  - 1.2. Plectomycetes, Pyrenomycetes; general characters of orders Erysiphales (powdery mildew), Xylariales. Clavicipitales (ergots)
  - 1.3. Discomycetes: general characters of orders Pezizales and Helotiales
  - 1.4. Loculoascomycetes; general characters of orders Pleosporales, Myriangiales and Hysteriales
  - 1.5. Ascolichens, general characters, anatomy and distribution in Pakistan.
2. **Basidiomycota:** Introduction to Basidiomycetes: Somatic structure, reproduction, basidiocarp developmental patterns, types of basidia and basidiospores; Principles and systems of classification; Life cycle.
  - 2.1. Class Homobasidiomycetes
  - 2.2. Heterobasidiomycetes
  - 2.3. Urediniomycetes
  - 2.4. Ustilaginomycetes
  - 2.5. Cladistic classification of Homobasidiomycetes.
  - 2.6. Gasteromycetes; their placement in different clades, general characteristics and spore dispersal
  - 2.7. Basidiolichens and their taxonomy.
3. **Mycorrhizae:** Ectotrophic mycorrhizae
4. **Fungi as re-cyclers**
5. **Poisonous fungi**
6. **Anamorphic fungi** (nematophagy and aquatic fungi).

**Practicals:**

1. Field study of Ascomycetous macrofungi, mushrooms, toadstools, rusts, smuts and other pathogenic fungi.
2. Isolation of pathogenic fungi from diseased tissues.
3. Anatomical and microscopic study of lichens. Anatomical study and hyphal systems of Polypores and Agarics.

4. Identification of various types of Ectomycorrhizae.
5. Study of interaction of fungi in culture, macroscopic and microscopic examination of common locally available types representing various taxonomic groups.
6. Collection, preservation, culturing and identification of mycological specimens with special reference to taxa of agricultural importance; use of keys for their identification.

**Teaching-learning Strategies**

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

**Learning Outcome:**

1. Students are expected to get familiarized with the morphological and systematic knowledge about different fungal groups.
2. They will be able to describe the concepts of what constitutes disease in plants and identify major principles of fungal plant pathology.
3. This will enable them to employ methods to diagnose and manage a wide range of plant diseases caused by fungi.

**Assessment Strategies:**

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

**Recommended Readings:**

1. Ahmad, S. (1978). *Ascomycetes of Pakistan*, Vol.1 and II. Biological Society of Pakistan, Lahore, Pakistan.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). *Introductory Mycology*. 4th edition, John Wiley and Sons. Inc., New York, USA.
3. Barnett, H. L. and Hunter, B.B. (1996). *Illustrated Genera of Imperfect Fungi*, 4<sup>th</sup> edition, American Phytopathological Society Press, St. Paul, Minnesota, USA.
4. Cole, G.T. and Kendrick, B. (1981). *Biology of Conidial Fungi*, Vol-II. Academic Press, New York, USA.
5. Cummins, E.A. (1971). *The Rust Fungi of Cereals, Grasses and Bamboo*. Springer-Verlag. Berlin, Germany.
6. Cummins, G.B. and Hiratsuka, Y. (2003). *Illustrated Genera of Rust Fungi*, 3<sup>rd</sup> Ed. APS Press, St. Paul Minnesota. 240 pp.
7. Hanlin, R.T. (1990). *Illustrated Genera of Ascomycetes*. Vol. 1. APS Press, St. Paul. Minnesota. 263 pp.
8. Hanlin, R.T. (1998). *Illustrated Genera of Ascomycetes*. Vol. 2. APS Press, St. Paul Minnesota. 258 pp.
9. Kendrick, B. (2000). *The Fifth Kingdom*. (3rd ed.). Focus Publishing/R. Pullins Company, Incorporated. 373 pp.
10. Kirk, P.M., Stalpers, J. A., Minter, D.W. and Cannon, P. F. (2008). *Dictionary of Fungi*. 10<sup>th</sup> ed. CABI, UK.
11. Lemke, P.A. and Esser, K. (2001). *The Mycota*. Volume VII. Systematics and Evolution. Part A. Springer.

12. Petrini-Klieber, L.E. and Petrini, O. (2013). *Identifying Moulds: A Practical Guide*. Gebruder Borntraeger Verlagsbuchhandlung, Science Publishers.
13. Vánky, K. (2012). *Smut Fungi of the World*. APS Press, St. Paul Minnesota. 1480 pp.
14. Vánky, K. (2002). *Illustrated Genera of Smut Fungi*. 3<sup>rd</sup> Ed. APS Press, St. Paul Minnesota. 280 pp.
15. Webster, J. and Weber, R. (2007). *Introduction to Fungi*. Cambridge University Press.
16. White J.F. (2003). Clavicipitalean fungi, Evolution, Biology, Chemistry, Bio and Cultural Control.

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