

M. Sc. Botany (Semester-III)
Paper-I: Evolutionary and Economic Botany
BOT301

UNIT-I

Evolutionary Biology: Origin of life (including aspects of prebiotic environment and molecular evolution); Concept of evolution; Theories of organic evolution; Mechanisms of speciation.

Hardyweineberg genetic equilibrium, genetic polymorphism and selection; origin and evolution of economically important microbes and plants.

UNIT-II

Origin of agriculture: World centers of primary diversity of domesticated plants; Plant introduction; Secondary centers of origin. Plant as a source of renewable energy; Innovations for meeting world food demands.

UNIT-III

Botany, cultivation and uses of –

- a. Food, forage and fodder crops (cereals, pulses, vegetables and fruits)
- b. Fiber yielding plants

UNIT-IV

Botany, cultivation and uses of-
Medicinal plants

- a. Aromatic plants
- b. Oil yielding plants

UNIT-V

Important fire-wood, timber-yielding plants and Non-wood forest products (NWFPs) such as- Bamboos, rattans, raw materials for paper-making, gums, tannins, dyes and resins. Plants used as avenue trees for shade, pollution control and aesthetics.

Suggested Laboratory Exercises (LAB-1)

The practical course is divided into three units:

- i) Laboratory Work
 - ii) Field Survey
 - iii) Scientific visits
- i) Laboratory Work

Food Crops: Wheat, Rice, Maize, Potato, Chickpea(Bengal gram), Sugarcane. Morphology, anatomy, microchemical tests for stored food materials.

Fodder Crops:Sorghum, Bajra, Berseem, Guar, Oat.

Plant Fibres: Cotton, Jute, Sun hemp, Coir.

Medicinal and Aromatic Plants: Study of live or herbarium specimens or other visual materials to become familiar with following plants:

Papaver somniferum, Atropa belladonna, Catharanthus roseus, Adhatoda zeylanica, Allium sativum, Rauwolfia serpentina, Withania somnifera, Phyllanthus niruri, Andrographis paniculata, Aloe barbadensis, Mentha arvensis, Ricinus communis, Abutilon indicum, Datura sp., Artemisia sp., Pedalium murex, Ocimum sanctum, Vetiveria zizanioides, Cymbopogon maritimi.

Gums, Resins, Tannins, Dyes: Acacia, Terminalia, Tea, Turmeric, Bixa orellana, Indigo, Butea monosperma, Lawsonia inermis.

ii) Field Survey

Prepare a list of important sources of firewood and timber in your locality. Give their local names, scientific names and families to which they belong.

iii) Scientific visits Students should be taken to any protected area, a recognized botanical garden or

museum (such as FRI, BSI, NBRI), to a CSIR laboratory doing research on plants and their utilization and an ICAR research institute or a field station dealing with crops.

Suggested readings:

1. Swaminathan, M.N. & Jain, R.S. Biodiversity: Implications for global security, Macmillan, 1982.
2. CSIR 1986. The Useful Plants in India.
3. Kothari, 1987. Understanding biodiversity, life sustainability and equity, Orient Longman.
4. Sharma, O.P. 1996. Hills Economic Botany.
5. Thakur, R.S. *et al.*, Major Medicinal Plants.
6. Kocchar, S.L. 1998. Economic Botany of Tropics..
7. Richard B. Primack. 1993. Essentials of Conservation Biology.
8. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment.
9. Peter B. Kaufman *et al.*, 1999. Natural Products from Plants.
10. Negi, S.S. 1993. Biodiversity and its Conservation in India.

M. Sc. Botany (Semester-III)
PAPER-II: PLANT REPRODUCTION
BOT302

UNIT-I

Male gametophyte: Structure of anther; microsporogenesis; role of tapetum; pollen development and gene expression; male sterility, sperm dimorphism; pollen germination; pollen tube growth and guidance, pollen storage; pollen allergy.

UNIT-II

Female gametophyte: Ovule development; megasporogenesis; organization of embryo sac; structure and functions of embryo sac cells. Pollination: Floral characteristics, mechanisms and vectors.

UNIT-III

Pollen-pistil interaction and fertilization: structure of the pistil; pollen stigma interactions, Self incompatibility- SSI and GSI (cytological, biochemical and molecular aspects); Double fertilization; in-vitro fertilization.

UNIT-IV

Seed Development: Endosperm development during early maturation and desiccation stages; embryogenesis- ultrastructure and nuclear cytology. Storage proteins of endosperms and embryo; Polyembryony; Apomixis; Embryo culture.

UNIT-V

Fruit Growth: Dynamics of fruit growth; Biochemistry and molecular biology of fruit maturation. Dormancy: Importance and types of dormancy; seed dormancy; methods of overcoming seed dormancy.

LABORATORY PRACTICAL-I

Suggested Laboratory -1 Exercises

1. Study of microsporogenesis and gametogenesis in sections of anthers.
2. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (maize, grasses, *Cannabis sativa*, *Tradescantia*, *Crotalaria*, *Brassica*, *Petunia*, *Solanum melongena*, etc.).
3. Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface cultures.
4. Estimating percentage and average pollen tube length *in vitro*.
5. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.
6. Pollen storage, pollen –pistil interaction, self incompatibility, *in vitro* pollination.
7. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporic type of embryosac development through examination of permanent, stained serial sections.
8. Field study of several types of flowers with different pollination mechanisms (wind

pollination, thrips pollination, bee/butterfly pollination, bird pollination).

9. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate out crossing systems.study of cleistogamous flowers and their adaptations.

10. Study of nuclear and cellular endosperm through permanent slides.

11. Isolation of zygotic globular, heart shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun, etc.by dissections.

12. Study of seed dormancy and methods to break dormancy.

Suggested readings

1. Bhojwani, S.S. and Bhatnagar, S.P. 2000The embryology of Angiosperms. (4th revised and enlarged edition), Vikas publishing house, New Delhi.

2. Maheswari, P. An Introduction to Embryology of Angiosperms, 1950.

3. Shivanna, K.R. and Johri, B.M. The Angiosperm Pollen: structure and Function, Wiley Eastern Ltd., Publications, 1989.

4. Johri, B.M., Ambegaokar, K.B. and Srivastava, P.S. Comparative Embryology of Angiosperms, Vol. I & II, SpringerVerlag publication.

5. Bhojwani, S.S.and Bhatnagar,S.P.1999.The Embryology of Angiosperms.Vikas. publishing House, New Delhi.

6. Raghwan,V.1997.Developmental biology of flowering plants. Springeverlag,New York.

7 Salisbury, F.B.and Ross,C.w.1992.Plant physiology(4th edn.).Wadsworth publishing, Belmont, Callifornia.

8. Shivanna, K.R.and Sawhney,V.K.1997.Pollen biotechnology for crop production and improvement. Cambridge University press, Cambridge.

M. Sc. Botany (Semester-III)
Paper-III: Ethnobotany
BOT303

Unit-I

Ethnobotany: Introduction, concept, scope And objectives. Ethnobotany as an interdisciplinary science; relevance of ethnobotany in the present context.

History of plant - human interactions and centers of ethnobotanical studies in the world .Ethnic groups and Ethnobotany: Major and minor ethnic groups or Tribals of India, and their life styles.

Unit-II

Methodology of Ethnobotanical studies: a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places f) Protocols Plants vs. Traditional Life: a) Food plants b) Intoxicants and Beverages c) Resins and oils d) Ropes and Bindings materials Plants in traditional life with reference to magico-religious rituals and social customs;

Unit-III

Medicinal plants used in traditional system of medicine with examples from local plants. A brief account ethnoveterinary medicine and its significance in Indian contest. Contribution of ethnobotany in modern medicine with special examples and ethnobotany directed drug Discovery

Unit-IV

Role of ethnobotany in the conservation of native plant genetic resources; sacred groves and sacred plants of Haryana and India Ethnobotany and legal aspects; ethnobotany as a tool to protect interests of ethnic groups;

UNIT-V

National and international initiatives for benefit sharing and intellectual property rights and conservation of traditional knowledge The ethnobotanical data documentation with special reference to Traditional Knowledge Digital Library

LABORATORY PRACTICAL-2

Practicals

1. Collection of ethnobotanical data: From a local forest area and from a local people ethnobotanical data are to be collected. The details of resource persons are documented (Photography, video, tape recording, etc.)
2. Analysis of ethnobotanical data disease-wise, plant part wise, habit-wise, region-wise and pictorial presentation of these data.
3. Calculation of total importance value (TIV) index of a species based on ethnobotanical uses; demonstrate the evaluation of two ethnobotanical sites for prioritization or disposal.
4. Submission of Ethnomedicinal herbarium /Museum specimens like leaves, barks, tubers, nuts, etc. of economic/medicinal use.

Spotters:

1. Ethnic food plants:
2. Ethnomedicinal plants:
3. Ethnoveterary plants:
4. Magio- religion/ ornamental plants:
5. A visit to a Tribal area to collect data
6. Listing of Crude drugs in pansari shops (local crude drugs shops) and their identification (little known drugs only)

Suggested Readings

- Faulks, P.J. 1958. An introduction to Ethnobotany, Moredale pub. Ltd. London
- Jain, S.K. (ed.) 1981. Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi
- Jain, S.K. (ed.) 1989. Methods and approaches in ethnobotany Society of ethnobotanists, Lucknow, India.
- Jain, S.K. 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur
- Jain, S.K. 1995. Manual of Ethnobotany, Scientific Publishers, Jodhpur,
- Sinha, R. K. 1996 Ethnobotany: The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur
- Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley

M. Sc. Botany (Semester-III)
Paper-IV: Pollution And Biodiversity Conservation
BOT304

UNIT-I

CLIMATE, SOIL AND VEGETATION PATTERNS OF THE WORLD :

Life zones, major biomes, major vegetation types and soil types of the world, barren land.

UNIT-II

POLLUTION, CLIMATE CHANGE AND ECOSYSTEMS :

Air, water and soil pollution:- kinds, sources, quality parameters, effects on plants and ecosystem. Green house gases (Carbon dioxide, methane, nitrous oxide, Chloro fluorocarbons: sources, trends and role), ozone layer, ozone hole, consequences of climate change) Carbon dioxide fertilization, global warming, sea level rise, UV radiation).

UNIT-III

BIOLOGICAL DIVERSITY :- Concepts and levels, status in India, Utilization and concerns, role of biodiversity in ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns, terrestrial biodiversity hot spots, inventory. World centers of primary diversity of domesticated plants; The Indo Burmese center, plant introductions and secondary centers.

UNIT-IV

CONSERVATION STRATEGIES

Principles of conservation, extinctions, environmental status of plants based on International union for conservation of Nature. In situ conservation, International efforts and Indian initiatives, protected areas in India sanctuaries, national parks, biosphere reserves, Wetlands, Mangroves and coral reefs for conservation of wild biodiversity.

UNIT-V

Ex situ conservation : Principles and practices, botanical gardens, field gene bank, seed banks, in vitro repositories, cryo banks, general account of the activities of Botanical survey of India (BSI), National Bureau of plant genetic resources (NBPGR), Indian council of Agriculture research (ICAR), Council of scientific and Industrial research (CSIR), and the department of Biotechnology (DBT) for conservation and non formal conservation efforts.

REFERENCE BOOKS :

Threshow, M1985. Air pollution and plant life, Wiley interscience. Mason C.F. 1991. Biology of fresh water pollution, Longman.

Hill, M.K. 1997. Understanding Environmental pollution, Cambridge University press.

Anonymous, 1987. National gene bank, Indian heritage on plant genetic resources, National