Babasaheb Bhimrao Ambedkar
Bihar University, Muzaffarpur
Directorate of Distance Education

BOTANY

Syllabus for M.Phil (Botany) 1st and 2nd Semester Session 2014-2015

Semester I	Title of the Course	Marks			Credits
		IA	UE	Total	
Paper I	Research methodology in Botany	20	80	100	4
Paper II	Advances in plant sciences	20	80	100	4
Paper III	Analytical methods of research	20	80	100	4

Semester II	Title of the Course	Marks			Credits
Paper IV	**Special Papers (Choose Any One)** 1.Plant Cytogenetics 2. Molecular Biology And Plant Biotechnology 3.Environment And Conservation Biology 4. Bioprospecting of Medicinal Of Aroma TIC Plants 5. Microbiology And Plant Pathology	20	80	100	4
Paper V	**Special Papers (Choose Any One)** 1. Algology 2. Physiological Embryology And Tissue Culture 3. Seed Technology 4. Medico – Botany 5. Floristics Taxonomy And Ethnobotany	20	80	100	4
Paper VI	Dissertation and VivaVoce Viva Voce 50 marks Dissertation 150 marks			200	8

Paper I Research methodology in Botany

Unit I

Theory of Scientific and Research methods in Natural Sciences (Botany), Deduction, Induction and generalization. Design, execution, analysis and evaluation of experiments.

Unit II

Centrifugation: Principle and Types of centrifuges. Ultracentrifugation, density gradient centrifugation and continuous centrifugation.

Microscopy - Differential interference contrast (DIC), polarization, fluorescent Microscopy, dark field and phase contrast microscopy. Electron microscope- SEM and TEM. Atomic Force Microscopy.

Unit III

Spectrometry, Electrophoresis and Separation techniques: Spectrometry- Principle – Beer Lambert's Law. UV, IR, FTIR, Atomic Absorption Spectroscopy, CD, Stop Flow, Mass, MALDI-TOF and NMR.

Electrophoresis: Principle of Gel electrophoresis, Polyacrylamide gel electrophoresis (PAGE & SDS PAGE) and Agarose gel electrophoresis, comet assay and capillary electrophoresis. Two dimensional electrophoresis and isoelectrofocussing.

Chromatography: Principle, Procedures and Application of TLC, PC, Gel Filtration and Ion exchange, Affinity Chromatography, GC, GLC, HPLC/FPLC and HPTLC.

Unit IV

Molecular biological techniques: Molecular biological techniques: Isolation and amplification of nucleic acid- Genome DNA (E.coli), Plasmid DNA, total RNA, Polymerase chain reaction – Types and its application. Gene cloning techniques: Phosphatase treatment of cloning vectors, use of adapters and linkers in cloning-screening of recombinants-labelling of nucleic acids by radioactive methods plaque and colony hybridization-southern blotting and western blot-Northern blot-DNA finger printing and Microarray.

Paper II Advances in plant sciences

Unit I

Molecular Taxonomy: Scope; Methods in Molecular taxonomy and Systematics; Processing molecular data and Phylogenetic inference using different Methods (Parsimony, Maximum Likelihood, Bayesian); Use of Chloroplast, Nuclear and Mitochondrial DNA sequences in Plant systematics; Phylogenetic trees and concepts; Applications of molecular Phylogenetics.

Unit II

Biotechnology and Advanced cell biology: Algal Biotechnology. Role of Fungi in industry. Gymnosperm biotechnology. Genetic engineering in plants, transgenic plants. Plant Cell Compartments, Membrane Structure and Membranous Organelles, Membrane transport mechanisms, Protein Sorting and Vesicle Traffic. Cell division regulation -Recent developments in cell cycle research. Mechanism of cell cycle regulation. Cell cycle regulation in multi-cellular organisms; Cell cycle regulation and plant cell growth.

Unit III

Plant Biotechnology: In-vitro culture techniques; Plasticity and totipotency, Culture types – callus, cell suspension culture, Protoplast, Root culture, Shoot tip and Meristemculture, Embryo culture, Microspore culture. Plant regeneration – Somatic embryogenesis, Organogenesis; Applications of tissue culture in plant breeding, Horticultre and Forestry; Industrial Applications of Tissue culture for secondary metabolite production; *Agrobacterium*-mediated plant transformations. Edible plant Vaccine (EPV) technology; Molecular Farming/pharming-metabolic engineering of plants.

Unit IV

Medicinal Plants and Phyto-chemistry: Floristic diversity and medicinal plant research scenario in India; Diagnostic features, bioactive molecules and therapeutic value of some common medicinal plants; Standardization of herbal drugs; Commercial cultivation of medicinal plants; Neutraceuticals and medicinal food; Bio-prospecting, bio-piracy and protection of traditional medicinal knowledge (IPR). Methods of Plant Analysis; Phenolic compounds; The terpenoids; Organic acids, lipids and related compounds; Nitrogen Compounds; Sugars and their derivatives; Macromolecules.

Unit V

Ecology and Conservation Biology: Scope of ecology; Community organizationconcept of habitat, functional role and niche, key stone species, dominant species, ecotone, edge effect. Natural Resources, Global warming and catastrophic threat to global biological diversity; Degradation and Restoration of Natural Ecosystems; Remote Sensing and its applications; Resource Policies, Conflict Management, Environmental Planning, International Environmental Policies and organizations and conventions.

Paper III Analytical methods of research

Unit I

Biostatistics: Collection and Presentation of Experimental data – Measures of Central Tendency: Arithmetic Mean, Median, Mode, Position of averages, Geometric Mean.

Unit II

Harmonic mean and percentile – Measures of Dispersion: Range, Inter quartile range, variance, standard deviation and standard error. Correlation and Regression: Correlation coefficient – Types of correlation – Regression- Simple and Linear regression – Biological significance of correlation and regression – Tests of significance: Basis of statistical inference – Student's 't' test for mean, difference of means and test for correlation and regression coefficients – Chi-square test – Analysis of variance and DMRT.

Unit III

Preparation of abstracts, manuscripts, dissertation, thesis and reports: Typing or printing, paper, margins, spacing, title and heading , keywords and running title, page numbers, tables and illustration corrections

and insertion. Writing research grant proposal and reports. Preparation of review article and book reviews. Presentation of Research work: Paper presentation in Seminar/ Symposia etc.

Unit IV

Data collection, and Research publications Data collection and Web browsing and searching- Electronic biological data bases – NCBI, PubMed, Sequence and Structure data bases. Research publications, Preparation of manuscripts-full paper, short communications and LCD preparations. Review paper, Thesis writing, Bibliography, Index card and Proof reading.

PAPER IV: 1. PLANT CYTOGENETICS

UNIT I:

Architecture of the chromosome – prokaryotic and eukaryotic chromosomes – plasmids, episomes , transposomes; Genomes of mitochondria and plastids – Euchromatin and heterochromatin – Chromatin and nucleosome – B-chro
mosomes and special types of chromosomes

UNIT II:

Structural changes in chromosomes – Duplications, Deficiencies, Inversions and Translocations – classification, identification, meiotic pairing, breeding behaviour and role in evolution of structural changes.

UNIT III:

Numerical changes in chromosomes : Haploidy – classification, methods of production, identification and utility. Polyploidy – Auto and Allopolyploidy, their classification, meiotic pairing, production, utility and role in evolution;
Aneuploidy – trisomy, tetrasomy, monosomy, and nullisomy.

UNIT IV:

Chromosome banding techniques – Different types and their application. In-situ hybridization. Induced mutation in plants and their application.

UNIT V:

Alien gene transfer through chromosome manipulation – whole genome, individual
chromosome, individual gene. Molecular markers and their utility – PCR, RAPD, RFLP, AFLP, VNTR, SSR.

References:

Gupta, P.K. 1995. Cytogenetics. Rastogi and Company. Meerut. Swanson, C.P. 1972. Cytology and Cytogenetics. Macmillan India Ltd. New Delhi.

PAPER IV. 2. MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

UNIT I:

Gene Concept DNA as genetic material. DNA structure, organization and replication. Organization of Pro and Eukaryotic genome . Gene expression – Genes in development – gene regulation. Control of gene expression. Terminator gene technology

UNIT II:

Plant Tissue Culture Types of cultures – Callus, organ, embryo, cell and protoplast. Micropropagation, Germplasm storage and conservation in-vitro, somaclonal variation, haploid production with reference to Rice, wheat, Sugarcane, and Cotton

UNIT III:

Gene Transfer Techniques Characterization of specific genes, Gene isolation

methods - Direct gene transfer methods – electroporation – microinjection – biolistics – PEG mediated – liposome mediated and plastid transformation. Indirect gene transfer methods – Agrobacterium mediated gene transfer

UNIT IV:
Transgenic in Crop Improvement Production of transgenic for resistance to abiotic
(low and high temperature, salt, herbicide) and biotic (pests and diseases). Quality improvement – protein enrichment, improvement in shelf life, male sterility, antisense messenger RNA, Bioreactors.

UNIT V : Markers and IPR Marker assisted selection for crop improvement – PCR, RAPD, RFLP, AFLP, SSR, EST Genome mapping. Intellectual property Rights – Forms of protection – copy right, trade mark, patent. Plant Breeders rights

References:
1. Chawla, H.S. 2002. Introduction to Plant Biotechnology. 2ndEd. Oxford University Press and IBH.
2. Gupta, P.K. Elements of Biotechnology, Rastogi, Meerut.
3. Lindsey, K. 1997. Transgenic Plant Research, Harwood Acad. Pub.
4. Primrose, S.B. Molecular Biotechnology, Blackwell Sc. Publications.
5. Chahal, G.s. and Gosal, S.S. 2002. Principles and Procedures of Plant Breeding. Narosa Publ Hos. New Delhi.

PAPER IV. 3. ENVIRONMENT AND CONSERVATION BIOLOGY

UNIT I:
Scope of Environmental Biology, Ecosystem, Energy Flow. Pollution – Air, Water and Soil – Its impact on plant, control measures.

UNIT II:
Global warming, Ozone depletion and Green house effect. Energy – sources – Fossil fuels, natural gas, wind energy, Bio energy and energy conservation.

UNIT III:
Historical account of conservation of fauna and flora in India: Phytogeographical regions. Biodiversity –Types, values, threats and "Hotspots".

UNIT IV:
Plant genetic resources: Conservation strategies for plant genetic resources (in situ and ex situ). IUCN classification – Red data book. Role of NBPGR,WWF, UNDP, IPGRI, FAO in conservation programmes in India.

UNIT V:

Human dimension in ecosystem management – Predominant ethnic communities of India – with special reference to Tamil Nadu and their role in conservation of plants. Tribal development programmes in Indian society and environment. Tribal bill.

References:
1. Sharma, P.D. Environmental Biology.
2. Patel, A.H. Industrial Microbiology.
3. Krishnan Kannan. Fundamentals of Environmentalpollution.
4. Whittakar, R.H. Ecosystem.
5. R.G.Bondand and C.P Straub. Environmental Control
6. Khan, T.I. and Shishoda, Y.S. (1998). Biodiversity conservation and sustainable
development., Pointer Publ., Jaipur
7. Trivedi, P.R. and Gurudeep Raj. 1992. Environmental Wildlife and Plant conservation. Akashdeep Publ. Hojuse, New Delhi.
8. Agarwal, K.C. 1996. Biodiversity. AgrobotanicalPublishers, India.

9. Jain, S.K. 1995. A manual of Ethnobotany, 2ndEd..
10.Mukherjee, B. 1997. Environmental Biology, Tata McGrew Hill Publ. Co. Ltd. New Delhi.

PAPER – IV - 4. BIOPROSPECTING OF MEDICINAL AND AROMA TIC PLANTS

UNIT-I

Plant genetic resources and their conservation: Medicinal and Aromatic Plants – Scope and importance. Approaches and strategies for ex-situconservation: botanical garden, arboreta, herbal garden and field gene bank.

UNIT-II

General principles of chromatography. Principle, instrumentation and application of HPLC, GC, GC-MS,. Extraction methods: distillation, steam and solvent.

UNIT-III

Classification, chemical nature and tests for carbohydrates, proteins, alkaloids and terpenoids. Antifungal and antiviral drugs. Stress physiology: Drought and freezing resistance, Heat shock and salinity stress.

UNIT- IV

Pharmacology: Routes of drug administration, absorption and distribution. Pharmacological activity of morphine, atropine, ephedrine and camphor. Chemotaxonomy of higher and lower plants and distribution of certain chemotaxonomical group of constituents in plant kingdom like alkaloids, glycosides and terpenoids.

UNIT-V

Post harvest technology in medicinal crops: scope and importance. Adulteration with reference to plant drugs, type of adulterants and method of adulteration. Importance of herbal marketing. Biodiversity act and Intellectual Property Right in the area of medicinal plants.

References:

1.Goodman Gillman's The Pharmacological basis of therapeutics. (2001) Ed. Hardman JG, Limbird LE (Tenth Edition) McGraw Hill press New York.
2.Wilson K and John Walker, 1999. Principles and techniques of practical biochemistry, Cambridge University Press.
3.Drug Discovery and Evaluation –Pharmacological assays. (1997) Ed.Vogel HG & Vogel WH. Springer-New York.
4.Aktal C K and B M Kapur, 1982. Cultivation and utilization of medicinal plants. RRL, CSIR, Jammu-Tawi.
5.Mukherjee P. K. (2002).Quality Control of Herbal Drugs, Business Horizons
Pharmaceutical Publisher, Delhi, Ist edn.
6.Harborne J.B. 1998.Phytochemical Methods - A guide to modern technique
of plant analysis, 3rd edn, Champan & Hall, UK.
7.Ali, M. 1997. Textbook of Pharmacognosy, CBS Publishers and Distributors, New Delhi.
8.Chaudhary R. D 1996. Herbal Drug Industry, 1st edn, Eastern Publication, New Delhi.
9.Trease, G. E. and Evans, W. C. 1985. Pharmacognosy, Bailliere Tindall. London. 12th edn. 10.Wijeskera, R. O. B. 1991. The medicinal Plant Industry, CRC Press, Boston, London.
11.Finar, I. L. 1975. Organic Chemistry, Stereochemistry and the Chemistry of Natural
Products, ELBS, Longman Singapore Publication (P) Ltd., Singapore, 5th edn.
12.Swain T. 1963. Chemical Plant Taxonomy, Academic Press London.
13.Anonymous. 1993. Standardization of Single Unani Drugs, CCRUM, New Delhi.

PAPER IV – 5. MICROBIOLOGY AND PLANT PATHOLOGY

Mycology

UNIT I

Fungal cell and its structure; Reproduction, Factors affecting asexual spore formation, maturation, spore dispersal mechanisms, dormancy and germination. Fungal nutrition, use of fungi in immobilized cell technology (outline only).

UNIT II

Ectomycorrhiza – Structure and development, Growth and carbon economy, Nitrogen and phosphorous nutrition, Ectendomycorrhizas. Endomycorrhiza – Arbuscular mycorrhiza: fungi involved, Root colonization and anatomy, Genetic, Cellular and molecular interactions, Growth and carbon economy of AM plants, Mineral nutrition, heavy metal accumulation and water relations of AM plants. Role of mycorrhizas in ecosystems - AM in agriculture and horticulture - Mycorrhizas in managed environment: forest production, interactions with other microorganisms and pollutants.

Plant pathology:

UNIT III

Effects of pathogens on host physiology, Genetic basis of host – Pathogen interaction – pathogenesis – Toxins – Definition, Classification, Chemistry, production and mode of action of bacterial toxins with special reference to wildfire toxin – Chemistry production and synthesis of fungal toxins with reference to Helminthosporium to xin – Host defense mechanisms – Epidemiology, assessment and forecasting of plant diseases.

Applied microbiology

UNIT IV

Microbes and soil fertility: Nitrogen fixing organisms (Symbiotic, nonsymbiotic and associative)- phosphate solubilizers (bacteria and fungi) – Inoculum production
Microbes in plant protection: Biological control ofplant pathogens – Mechanism – bio-insecticides, bio-herbicides, biofungicides.

UNIT V

Application of microbes in sewage and wastewater treatment, degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents, composting, Microbial biosensors. Microorganisms as source of food – single cell protein, Cultivation of mushrooms

Reference books :

1.The filamentous fungi – Vol. IV – fungal technology.
2.Physiology of fungi – V.W. Cochrane.
3.Fundamentals of Mycology – Burnett.
4.An Introduction to Mycology – R.S. Mehrotra & K.R. Aneja
5.The fungal spore – formation & function - D.J. Weber & W.H. Hess.
6.Plant Pathology – G.W. Agrios.
7.Plant Pathogenesis – H. Wheeler.

8.Microbiology – Michael J. Pelezar Jr., E.C.S. Chacor. Noel R. Krieg.
9.Microbiology – Fundamentals & applications – S.S. Purohit.
10.General Microbiology – Vol. II – Powar & Daginawala.
11.Mycorrhizal Symbiosis – Smith, S. E. & Read, D.J.
12.Plant Pathology – Sharma, P.D.
13.Applied Microbiology – Ahmed, M. & Basumatary, S. K.

PAPER V – 1. ALGOLOGY

UNIT I : TAXONOMY
Modern criteria (biochemical, cytological, physiological, ultra structural) in taxonomy and phylogeny of algae current taxonomic treatment of algal phyla. Fossil algae.

UNIT II : CULTURE
Isolation and culture and pure culturing of algae. Synchronous cultures, mass cultures, variations of algae in culture.

UNIT III : PHYSIOLOGY
Nutrition, photosynthesis and respiration, N2-fixation in blue greens. Cyaenophyages. Morphogenesis in algae.

UNIT IV : ECOLOGY
Occurance and seasonal distribution of fresh water and marine algae. Fresh water and marine phytoplankton and phytobenthos. Thermophilic algae; soil algae; algae in relation to pollution.

UNIT V : GENETICS AND BIOTECHNOLOGY
Mutation, recombination, molecular biology and biotechnology of cyanobacteria with special reference to Spirulina. Agricultural and industrial uses of algae.

PAPER V: 2. PHYSIOLOGICAL EMBRYOLOGY AND TISSUE CULTURE

UNIT I :
Anther development: Physiological and cytological studies, androgenesis and haploids. Ovary, ovule and nucellus culture.

UNIT II :
Biochemical embryogenesis. Embryo culture techniques and application. Somatic embryogeny physiology of the development ofsomatic embryos; strategies for large scale manipulations of somatic embryos. Synthetic seeds – production and application.

UNIT III :
Endosperm culture and application, somaclonal and gametoclonal variation.
Impact on plant biology and breeding strategies. Storage of germplasm and germplasm exchange. Production of secondary metabolities in vitro.

UNIT IV :
Protoplast isolation, culture, fusion and establishment of culture. Uptake of organelles and organisms. Somatic hybridization byprotoplast fusion. Implication for agriculture. Genetic engineering through (vector/vectorless) protoplast culture.

UNIT V :
Trends and prospects of tissue culture technology;Improvement of food and

energy crops (a general trends); Application in Forestry; Disease elimination – Meristem culture. Tissue culture in India – Potentials and progress.

PAPER V – 3. SEED TECHNOLOGY

UNIT I :

Germplasm resources of food grains – pulses, cereals and oil seeds – collection and ex situand in situconservation – Role of IPGRI (International Plant Genetic Research Institute) (Rome), NBPGR (New Delhi) and ICRISAT (Patancheru, Andhra Pradesh) in germplasm collection and conservation of most common cereal and pulse crops.

UNIT II :

Biochemical composition of legume and cereal seeds/grains. Seed proteins – albumins, globulins, glutelins and prolamines their structure, function and composition. Seed carbohydrates – starches and soluble carbohydrates including flatulence factors, structure and composition. Seed oils and lipids – structure and composition.

UNIT III :

Physiology of seed/grain development-growth patterns – sigmoid and double sigmoid growth curves – phases of growth – role of pericarp (hull), seed coats and flag leaf in seed/grain development. Biosynthesis of proteins, carbohydrates, lipids during seed grain development.

UNIT IV :

Physiology of seed germination – primary/early biochemical events of germination. Appearance and role of proteases, amylases and lipases in hydrolyzing stored food materials in storage organs. Mobilization of hydrolysed products to the growing embryonal axis/seeding.

UNIT V :

Antinutritional factors – Heat labile and heat stable antinutritional factors in food grains – their structure and role in human nutrition – Different processing methods to eliminate (post harvest technology) decrease antinutritional factors.

References :

1.(Eds) Bewley, J.D. and M. Black, 1985. Seeds : Physiology of development and germination, Plenum Press : New York.
2.(Ed) Murray, D.R. 1984. Seed Physiology Vol. I & II. Academic Press. Sydney – New York – London.
3.(Eds) Mehta S.L., Lodha, M.L. and Sane, P.V. 1993.Recent Advances in Plant Biochemistry. Publication and Information Division ICAR, New Delhi.
4.(Ed) Weil J.H. 1990, General Biochemistry, Wiley Eastern Limited, New Delhi.
5.(Eds) D.K. Salunkhe, Kadam S.S. and Chavsan J.K. 1985. Post harvest Biotechnology of food legumes. CRC Press, Boca Raton, Florida, USA.
6.(Eds) Salunke D.K., Chavan J.K., and Kadam S.S. (1985) CRC Press, Boca Raton, Florida, Post harvest Biotechnology of Cereals. USA.
7.(Eds) Arora S.K. (1982) Chemistry and Biochemistry of food leguemes, Oxford and IBH Publication, New Delhi.
8.(Eds) Daussant, J., Mosse.J and Vaughan, J. (1983). Seed Proteins, Academic Press, New York, USA.

9.(Eds) Summerfield R.J. and Bunting A.H. (1980). Advances in legume Science, Kew, Richmond, Surrey, U.K: Royal Botanic Gardens.
10.Murray, D.R. 1987, Nutritive role of seed coats in developing legume seeds.
Amer. J. Bot 74 :1122 – 1137.
11.Higgins T.J.V. 1984. Synthesis and regulation of major proteins in seeds.
Ann Rev. Plant Physiol. 35:191-221

PAPER V – 4. MEDICO - BOTANY

UNIT I :
Ethonobotany in human welfare – food, health-care conservation, bio-chemistry.
Regional studies, recent trends and socio-economic aspects.

UNIT II :

Pharmacognosy – Introduction, the oldest modern science classification of vegetable drugs, identification of drugs (taxonomical, anatomical, fluorescence, chemicals, organoleptic, microscopic only).

UNIT III :

Sources of vegetable drugs – Biological, geographical and culturals. Production of vegetable drugs – role of growth regulators. Deterioration of drugs and their control measures.

UNIT IV :

Chemistry of vegetable drugs – acid, alcohol, ester, carbohydrate, phenolic compounds, volatile oils, resin, saponin and carbioactivies.

UNIT V :

Importance and significance of flavonoids, alkaloids tumor inhibitors, vitamins, hormones, pesticides and antibiotics of plant origin.

References :

1.Anna de Pasguale 1984 – Pharmacognosy: The oldes modern Science,
J. Ethnobiology, 11:1-16.
2.Anonymous 1970 – The Pharmocopoea of India – Govt. of India, New Delhi.
3.Chase, P.R. and Pratt 1949 – Fluorescence of powdered vegetable drugs with particular reference to development of a system of identificat
ion J.Am. Pharm. Assoc. 38:324-331.
4.Jain S.K. (Ed.) 1996 – Ethnobiology in human welfare. Deep. Pub. A/3/27A DDA Flats Pashim Vihar, New Delhi.
5.Nadkarni K.M. 1954 – Indian Materia Medica, Karnataka Printing Press, Bombay.
6.Trease G.E. and Evans W.C. 1978 – Pharmacognosy Bailliere Tindal, Londan.
7.Wallis T.E. 1985 – Text Book of Pharmacognosy (5thEd) CBS Pub. Distributors. Bhola North Nagar, Delhi – 110 032.
8.Harborne J.B. – Phytochemical Methods (2ndEd.) Chapman and Hall. London.

PAPER V – 5. FLORISTICS, TAXONOMY & ETHNOBOTANY

UNIT I :

History of classification (pre and post – Darwinian). Aims of taxonomy. Units of classification, taxonomic hierarchy, concepts of families, genera, species and infraspecific taxa. Importance of characters, including anatomical, cytological, embryological and palynological, in taxonomy.

UNIT II :

Herbarium and its functions. Major herbaria in India. Floras, revisions and monographs. Botanical nomenclature. History of floristic studies in peninsular India.

UNIT III :

Ethnobotany (particularly) of south Indian tribals. Ethnobotanical aspects of conservation and management of plant resources. Importance of wild relatives of cultivated plants.

UNIT IV :

Floristic regions of India. Flora of peninsular India and their affinities and endemism with particular reference to angiosperms. Vegetation/forest types in peninsular India.

UNIT V :

Floristic diversity (flowering plants) in peninsular India. Services rendered and goods supplied by tropical forests. Causal factors of degradation and depletion of tropical forests. Rare and endangered species of flowering plants and their in situ (including National parks, Wildlife sanctuaries andbiosphere reserves in peninsular India) and ex situ conservation.