

**APRCET-2024**  
**48- SERICULTURE**

**1. BIOLOGY OF MULBERRY TAXONOMY AND ANATOMY**

Distribution, morphology and taxonomic status of the genus *Morus*.

Popular mulberry cultivars of tropical and temperate regions and their yield potentiality. Anatomy of mulberry leaf, stem and root

**2. MULBERRY PRODUCTION TECHNOLOGY**

1. Principles and practices of plant propagation techniques with special reference to mulberry. Seedlings: Collection of seeds, growing seedlings in field nurseries.

Techniques of propagation by cuttings and saplings: their merits and demerits.

Grafting: Selection of stock and scion materials. Stem root and bud grafting techniques. Ground, air and Trench layering methods.

Preparation of nursery bed. Layout, size, composition, maintenance and care.

2. Mulberry cultivation practices (Under irrigated and dry land conditions)

Package of practices of mulberry cultivation under rain-fed and irrigated conditions.

Selection and preparation of land, implements and machinery employed in mulberry cultivation. Selection of elite varieties for cultivation.

Planting materials (cuttings, saplings, grafts, layers) and their practical utility.

Planting systems: Row system, pit system and paired row system, leaf yield estimation and their importance in leaf productivity under different field conditions.

Inter-cultivation, weeds and weeding.

3. Organic manure ( FYM, compost, tank silt, night-soil, sewage sludge, oil cakes, vermicompost)

Green manure, Bio-fertilizers, Chemical fertilizers – Types, application

methods and schedules for irrigated and rain fed mulberry gardens.

Mulching, Intercropping and their uses.

Foliar nutrition, formulations – Mode of application merits and demerits.

BIOFERTILIZERS – Nitrogen fixation and Mass production of bio fertilizers - diazotrophic microorganisms blue green algae and Azolla - Micorhizae.

4. Irrigation: Water requirement of mulberry, water resources, water quality, and irrigation systems. Pruning types, objectives, methods, advantages and practical relevance.
5. Leaf harvesting methods in relation to cultivation and rearing practices. Storage, transportation and preservation methods.
6. Watershed area concept and water management practices in dry land and mulberry cultivation. Influence of agro-climatic factors on growth and development of mulberry.
7. Edaphic factors: Soil chemical characters, Soil reaction, Salinity, acidity and alkalinity. Soil amendments, soil and water conservation. Soils of mulberry.
8. Climatic factors : Role of light, temperature, wind velocity, attitude, rainfall and relative humidity in mulberry growth and development. Mineral deficiency, diagnostic techniques, correction measures and mineral toxicity.

### **3. DISEASES OF MULBERRY AND THEIR CONTROL**

1. Fungal diseases: Leaf spot, Powdery mildew, Rust disease, Root rot, and Twig blight
2. Bacterial disease: Bacterial blight
3. Mycoplasma diseases: Dwarf diseases
4. Viral diseases: Mosaic diseases
5. Nematode diseases: Root knot disease
6. Deficiency diseases: Mineral deficiency and its control.

### **PESTS OF MULBERRY AND THEIR CONTROL**

1. Lepidoptera: Behar hairy caterpillar, Cutworm, Moringa hairy caterpillar, Tussock hairy caterpillar, Leaf –roller
2. Hemiptera: Mulberry mealy bug, Jassid, Scale insects,
3. Coleoptera: Stem girdler beetle and Stem borer

4. Orthoptera : Grass hopper
5. Thysanoptera: Thrips
6. Isoptera: Termites
7. Acarina: Mites
8. Integrated Pest and Disease Management (IDPM) in Mulberry

#### **4. MULBERRY BREEDING**

1. Brief account of micro and mega sporogenesis - development of male and female gametophytes - pollen structure – pollination – fertilization – endosperm – embryo – polyembryony - parthenocarpy with reference to mulberry.
2. General introduction to plant breeding: History - scope and objectives - Method of evaluation of mulberry genotypes - Agro-botanical parameters (Sprouting, rooting survivability, yield) - Chemoassay and Bioassay.
3. Stress parameters: Plant exploration - collection and establishment of mulberry germplasm bank - Field maintenance - Significance of mulberry germplasm conservation - Mulberry germplasm systems.
4. Plant introduction and acclimatization – Scope, objectives and limitations – Plant quarantine – Plant introduction agencies - National and International agencies.
5. Selection: Mass Selection - pure-line selection and clonal selection – definition - methods procedures followed - Applications and significance in mulberry breeding – Achievements made.
6. Hybridization: History – definition - objectives and application - Hybridization strategies in mulberry breeding (single cross - double cross - back cross - three-way cross - reciprocal cross) - advantages and constraints - Bulk and pedigree methods of segregating population - Heterosis and crop improvement.
7. Polyploidy: Definition – types - induction on polyploidy - Polyploidy in mulberry species/varieties - Characters associated with polyploids - Significance of polyploidy in evolving popular mulberry varieties. Mutation breeding: Definition – types - Artificial induction of mutations – Mutagens -Mulberry mutants- Role of physical and chemical mutants in inducing beneficial mulberry genotypes.
8. Distribution morphology and cultivation strategies of non-mulberry

silkworm food plants. (Tropical temperate Tasar - Muga and Eri food plants).

9. TISSUE CULTURE – Tissue culture techniques in mulberry anther/ pollen culture - callus culture - somoclonal variants – somatic - hybrid in vitro screening - cryopreservation.

## **5. MULBERRY PHYSIOLOGY**

1. Photosynthesis, photosynthetic pigments their characteristic, carbon fixation mechanism (C3, C4 and CAM) photorespiration and productivity.
2. Evapo-transpiration, stomatal frequency and dynamics, anti-transparentents.

Water stress and its effect on the growth and development of mulberry:

- (a) Biochemical and physiological adaptations, drought resistance
  - (b) Response of mulberry to salt stress and waterlogging
3. Symptoms of waterlogging injury in plants, physiological and biochemical responses of plants to waterlogging.
  4. Photoperiodism, Mulberry growth regulators, flowering and fruit development, senescence and abscission.
  5. Biological nitrogen fixation: Symbiotic and A symbiotic biological nitrogen fixation mechanism.

## **6. Silkworm Biology and Physiology**

1. Systematic position of mulberry silkworm-Life cycle of silkworm, *Bombyxmori* L. External morphology of silkworm-Egg, Larva, Pupa and Adult- Embryology-Structure of Egg-Fertilization-Cleavage-Blastoderm-Germ band formation-Blastokinesis-Involution of the embryo
2. Digestive system-Nutritional requirements of silkworm - Excretory system-Morphology and ultrastructure of Malpighian tubules-Respiratory system-Spiracles-Trachea-Types of respiration-Respiratory pigments-Silk gland-Structure and functions.
3. Circulatory system-Types of circulatory system-Dorsal blood vessel-Aorta-Heart-Heart beat-Alary muscles-Haemolymph - Nervous system-Central nervous system-Visceral or sympathetic nervous system-

peripheral nervous system-Muscular system-Structure of muscles-Types of muscles-Flight muscles - Reproductive system-Male and Female reproductive system of silk moth.

4. Physiology of silkworm: Digestive system – Food ingestion and digestion, assimilation and faecal elimination. Respiratory system-Micro structure of trachea, Mechanism of the respiration- gaseous diffusion, Tracheal ventilation. Excretory system, Circulatory system, Silk gland, -glandular system Muscular system and Reproductive system.
5. Endocrine system-Neuro secretory cells-Corpora cardiaca-Corpora allata-prothoracic gland-suboesophageal ganglion. Pheromones-Types of pheromones-Advantages and disadvantages of pheromones.

## **7. Silkworm Seed and cocoon production Technology**

1. Terminology in seed technology, Seed organization set up in India, Seed farms –P3, P2 and P1 – Cultivation practices of mulberry for seed crop rearing. Seed farms –P3, P2 and P1-Rearing technology of seed crop rearing. Seed act-seed areas and seed farmers. Seed cocoon markets-Marketing of seed cocoons and price fixing.
2. Grainage building and equipments- Disinfection - Steps involved in silkworm egg Production: Cocoon arrangements, Sorting of Cocoons, Arrangement of Cocoons, Sex separation, Emergence of moths, Pairing, Fertilization, Moth Examination, Sample testing, Individual and Mass moth examination, Washing of Eggs, Preparation of Sheet eggs and loose eggs and disposal of Dfls
3. Moth examination methods. Egg handling – Multivoltine,Bivoltine and hybrid eggs. Loose eggs and handling – Preparation and packing. Incubation and black boxing, Cocoon Production Technology
4. Preservation and handling of eggs: Embryology and hibernation of Silkworm eggs, Preservation of multivoltine eggs, Preservation of Bivoltine eggs, Acid treatment of Bivoltine eggs, Hot acid and Room

temperature acid treatment of silkworm eggs, Acid treatment after a long duration of chilling – Chilling for a shorter duration and acid treatment and cold storage of Acid-treated eggs.

## **8. Silkworm rearing technology**

1. Silkworm rearing technology – Importance – Types of rearing – Seed cocoon rearing and commercial rearing – Preparation for rearing silkworms – programming of mulberry garden.  
Model rearing house – Different types of rearing houses – Modifications to control Uzi fly infestation – Rearing appliances.
2. Sanitation – Importance and types and methods of disinfection – disinfectants – Bed disinfectants. Methods and importance of incubation-Black boxing-Brushing of silkworms – Young age silkworm rearing, methods– importance of Chawki rearing. Late age silkworm rearing, methods, their advantages and disadvantages. Cleaning and spacing – Principles and methods of cleaning – bed cleaning schedule - Objectives of spacing – Optimum spacing for different ages – Care during moulting.
3. Environmental factors for rearing – effect of temperature, humidity, air and light on growth and development of silkworm larvae – Optimum conditions – Devices to control temperature and humidity. Selection of mulberry for different ages of silkworm larvae – Feeding behaviour – Preparation of feed – frequency and quantity of mulberry leaf.
4. Mounting and spinning – methods of mounting – types of mountages – Population Density – Care during mounting spinning process – harvesting of Cocoons – Time of Harvest – Cocoon sorting – Assessment – Transportation and Marketing.

## **9. DISEASES OF SILKWORM AND THEIR CONTROL**

1. Viral diseases: Nuclear polyhedrosis, Cytoplasmic polyhedrosis, Infectious flacherie and Densonucleosis
2. Bacterial diseases: Septicemia, Bacterial disease of the digestive tract and Sotro ( Bacterial Toxicosis)
3. Fungal diseases: Muscarding and Aspergillosis
4. Protozoan disease: Pebrine

## **10. PESTS OF SILKWORM AND THEIR CONTROL**

1. Major pest : Uzi fly
2. Minor pests : Dermestid beetles and other pests of silkworm
3. Forms and formulations and applications of pesticides.
4. Integrated Disease and Pest Management (IDPM) in Silkworm.

## **11. SILK TECHNOLOGY**

1. Physical and commercial characteristics of multivoltine and bivoltine cocoons: Cocoon markets – organization and functions - cocoon sorting – objectives and procedure - defective cocoons.
2. Cocoon assessment – Cocoon shape, colour, size -wrinkles or grain - Defective cocoons – Types Types defective cocoons and percentage - estimated renditta - cocoon weight- shell weight- shell percentage – silk filament length- Denier.
3. Cocoon stifling: Objectives and methods – sun drying, steam stifling, hot air drying, - advantages and disadvantages - Preservation of cocoons.
4. Cocoon boiling / cooking – objectives – different methods – open pan, three pan, pressurized cocoon boiling systems – Floating and sunken systems – Merits and Demerits of each method – Appropriate cocoon cooking systems to be followed according to cocoon variety and reeling devices.
5. Reeling water: Sources and quality, importance in cocoon cooking and raw silk quality; factors influencing water quality; corrective measures.
6. Silk reeling : System of reeling – Direct and indirect type – Floating and sunken type. Reeling method on country Charkha – Improved Charkha – Cottage basin – Multiend and automatic reeling machines.
7. Re-reeling and packing: Objectives - grant reeling - hank preparation – lacing – skeining – booking - bale making and bundling.
8. Raw silk properties – physical - chemical and microscopic - Factors influencing the properties of raw silk- Silk exchanges – structure and function.
9. Raw silk testing and grading – objectives: Raw silk testing – conditioned weight - visual and mechanical tests - Raw silk grading - international standards (ISA) and Bureau of Indian Standards (BIS).

10. Byproduct Utilization: Byproducts of Mulberry cultivation – Silkworm seed and cocoon Production- silk reeling industry and their utilization.

## **12. VANYA SERICULTURE**

1. Insect and non-insect fauna producing silk and their distribution in world and India - Status of vanya silks in India – characteristic features, advantages, income and employment, production and demand. Host plants of vanya silkworms: State-wise distribution in India, area and economic importance.

## **13. BIOCHEMISTRY**

1. Carbohydrates – Structure, properties and classification. Glycolysis, Tricarboxylic acid cycle and Oxidative Phosphorylation.
2. Proteins –structure, Classification, properties and synthesis.
3. Amino acids –, structures and Classification, Amino acids of mulberry leaf and silk proteins (Fibroin and Sericin) Role of amino acids and proteins in silkworm nutrition
4. Phytochemical constituents of mulberry with special reference to silkworm nutrition.
5. Lipids: Structure, classification and functions. Properties of fatty acids –Tri acylglycerols, Phospholipids, Sterols, glycolipids, lipoproteins, cholesterol, Amphipathic lipids.
6. Enzymes – History, classification, nomenclature and properties Factors affecting enzyme activity – Cofactors, coenzymes, isoenzymes – Michael's Menten equations – Significance of  $K_m$  and  $V_{max}$ . Mechanism of enzyme action – Lock and key hypothesis, Induced fit theory and substrate strain theory.
7. Enzyme inhibition – Reversible(Competitive and non-competitive), Irreversible and Allosteric inhibitions –Thermodynamics of enzymatic reactions- Role of inhibitors in enzyme regulation – Feedback inhibition.

## **14. CELL BIOLOGY, MOLECULAR BIOLOGY AND IMMUNOLOGY**

1. Techniques in Cell Biology – Various types of microscopy – Light microscopy and electron microscopy – Fixation and staining – Cytochemical methods – detection of aldehydes, lipids and enzymes, cell culture – autoradiography – micro manipulation techniques, cell



fractionation, cell centrifugation and sedimentation – ultracentrifugation. Structure, organization and functions of plasma membrane models.

2. Ultra structure organization of the following organelles –

Golgi complex, Endoplasmic reticulum, Nucleus and nuclear envelop, Mitochondria, Chloroplast, Lysosomes and Ribosomes Structure and functions of cytoskeleton – microfilaments, microtubules – Intermediate filaments – organization of cytoskeleton.

Eukaryotic chromosomes – Types of chromosomes – Structures and organization of chromatin – Synaptemal complex – Polythene and lampbrush chromosomes.

3. **MOLECULAR BIOLOGY AND IMMUNOLOGY**

Introduction to nucleic acids – Chemistry and Physics of DNA and RNA – Watson and Crick model of DNA. Structure of RNA - Different types of RNA – tRNA, mRNA and rRNA – DNA organization in chromosomes. Mechanism of DNA replication – semiconservative synthesis of DNA – DNA replication in prokaryotes and eukaryotes – DNA polymerase – Inhibitors of DNA synthesis.

Transcription : Biosynthesis of RNA and DNA – RNA Polymerase – Initiation, elongation and termination of transcription – RNA.

Translation : Factors and enzymes involved in protein synthesis – initiation, elongation and termination of translation. Wobble hypothesis – a special note on amino acylation of t-RNA – inhibitors of protein synthesis.

4. **IMMUNITY** – Passive, active and acquired immunological action.

Cellular basis of immunity – Immune system, Mechanism of antigen – antibody reactions – defense mechanisms. Cell mediated immunity in silkworms – phagocytosis - Anti bacterial – anti viral factors and induced resistance.

5. **SEROLOGICAL TECHNIQUES** : Principles and application of

serological tests used in identification of Pathogenic agents - Precipitation tests – Ring test – Single and double diffusion test – Agglutination tests- Immuno fluorescence test - Enzyme linked Immunosorbent Assay (ELISA) – Western blotting method - Bio-insecticides – Engineered Baculaviruses – Molecular tools of

lepidopteron development biology and physiology - Potential agents for insect control - *Bacillus thurengiensis* gene.

## **15. BIOTECHNOLOGY**

1. Scope – Importance – Different branches of Biotechnology.
2. GENETIC ENGINEERING :Molecular vectors – Cloning – shuttle – expression - binary vectors – plasmids – virus - Enzymes – Restriction endonucleases - types and utility in gene cloning and mapping.
3. MOLECULAR CLONNING TECHNIQUES : cDNA synthesis - Joining of DNA fragments to vectors - Introducing of recombinant molecules into selected host cells (transformation) - Screening techniques – Western – Northern - Southern Blotting - Genomic and c DNA Libraries.
4. RECOMBINANT DNA TECHNOLOGY: Polymer chain reaction technology - PCR techniques in biotechnology and genetic engineering – Gene tagging and DNA finger printing.
5. RESTRICTION ENZYMES ANALYSIS – RFLP and RAPD profiles for identification of DNA genetic material.