EXTENDED LECTURE OUTLINE

SCI6 312 **Silkworm Breeding** **(2+1)**

Theory

1. **History of silkworm breeding** in Japan, China and India, Origin and differentiation of silkworm breeds, Genealogy of silkworm races, CSR breeds and Hybrids: Characters and requirements for cocoon production, Analysis of accomplishment of silkworm breeding in India and causes for non exploitation of native silkworm breeds

2. Principles and objectives of silkworm breeding, Hardy Weinberg's Law of Equilibrium of gene and genotype frequencies, Factors disturbing the equilibrium in random populations: Migration, Mutation, Random drift, Selection and Inbreeding, Systems of mating: Random mating, Genetic assortative mating, Genetic dissortative mating, Phenotypic assortative mating and Phenotypic dissortative mating.

3. **Activities of silkworm Breeding Programme:** Creation of variation, Selection, Evaluation, Multiplication and Distribution.

4. **Maintenance of silkworm germplasm bank:** Definition of Germplasm, Importance of maintenance of silkworm germplasm bank/station, Objectives of germplasm station, Activities of germplasm stations, Collection: Definition, Criteria/Procedure for collection of germplasm, Proforma for collection of silkworm breeds, Maintenance of germplasm: Care taken during maintenance, Rearing schedule, Incubation and Black boxing, Pattern of Brushing, Method of rearing, Selection of cocoons, Egg Production, Passport Description of Germplasm: Name and Number of the Accession/Genotype, Donor, Place of Origin, Classification/Category of germplasm based on origin (Indegenous, Exotic) and need (Breeds in current use, Obsolete breeds, Breeding material, Other collection)

5. **Maintenance and multiplication of silkworm breeds/stocks,** Maintenance of silkworm breeds/ stocks – types and importance of genetic stocks, Procedure for Multivoltines and Bivoltines and Maintenance of Breeder's stock, Maintenance of Parental stocks, 3- tier multiplication of parental stocks of silkworms

6. **Genetic Basis of silkworm breeding programmes,** Hybridizarion: Meaning and Objectives, Types, Pre-requisites and Procedure/Steps in silkworm Hybridization Programme, Choice of parental material, Crossing and hybridization, Precautions during hybridization, Concept and handling of filial generations (F1), Handling of Second filial (F2) and subsequent generations: Pedigree method, Mass/bulk method, Comparison of Pedigree and Mass/Bulk Methods, Consequences and problems in hybridization. Preserving the variability, Minimizing Inbreeding depression.

7. **Heterosis breeding:** Heterosis, Meaning of Heterosis, definition of heterosis, Effects of Heterosis (Biological, Physiological), Classification of Heterosis, Causes of Heterosis, Biochemical basis. Breeding methods to exploit Heterosis, Measurement of Heterosis: Relative Heterosis, Heterobeltiosis, Standard Heterosis. Commercial exploitation of Heterosis and manifestation of Heterosis, commercial exploitation of heterosis.

8. **Silkworm Improvement through Selection Breeding**, Mass selection/Bulk Method: Definition, Procedure of mass selection, Merits and demerits. Pureline selection: Definition, Characters of pureline, Uses of the pureline, Procedure for pureline selection, Advantages and disadvantages of pureline selection. Back cross (BC) breeding: Definition of Backcross, Requirements for BC breeding program, Application of BC method, Genetic consequences of BC method, Procedure for BC method and Merits and demerits of BC and a few accomplishments. Line breeding: Definition of line breeding and inbreeding, Criteria for line breeding, Procedure for Line/inbreeding and Effects of line/inbreeding

9. **Parthenogenesis in silkworms:** Definition and history of parthenogenesis in silkworm, Classification of parthenogenesis, Characteristic features of parthenogenetic individuals, Methods of induction of parthenogenesis in silkworms (Heat shock, Cold treatment, Chemical treatment, Mechanical stimulation, Osmotic Treatment and Electric Shock Method), Significance of Parthenogenesis in Silkworms.

10. **Mutation breeding in silkworm improvement:** Definition and historical account of mutation breeding, classification of mutations, mutagens and their classification, effects of mutagens, molecular basis of mutations, mechanism of action of mutagens, procedure for mutation breeding to improve polygenic traits in silkworms, handling mutated population and methods of measurement of mutation frequency and application, limitations and achievements of mutation breeding.

11. **Polyploidy breeding in silkworm improvement:** Definition, occurrence and origin of polyploids, Types of polyploids (Autopolyploids and Allopolyploids) Production of polyploids in silkworms (Temperature Shock Method, Colchicine Treatment, Centrifugation Method and Hybridization and Chromosome Doubling), characteristics of polyploids in silkworm, Significance and limitations of Polyploids in Sericulture.

12. **Breeding for stress tolerance (Biotic:** Disease **and Abiotic:** Temperature) **in silkworms:** Definition of disease, Disease development, Concept of disease escape and disease resistance, Mechanism of disease resistance: Mechanical, Hyper sensitivity, Antibiosis, Nutritional, Genetic basis of disease resistance and Approaches for disease resistance breeding in silkworms, Breeding for Abiotic Stress Tolerance, Importance and limitations of Stress Tolerance Breeding.

13. **Sex limited breeding in silkworm, *Bombyx mori* L.** Objectives of Sex-Limited Breeding, Basis of Sex-Limited Breeding, Techniques for breeding of auto sexing races in silkworms. Methods Used in Sex-Limited Breeding, Concepts of breeding autosexing silkworm breeds, application of Sex limited breeding in sericulture, advantages and dis-advantages of Sex limited breeding in sericulture.

14. **Concepts of Breeding of non-mulberry silkworm:** Objectives, Species-Specific Breeding Concepts, Breeding Approaches (Selection, Hybridization, Pure Line Selection, Ecotype Improvement, Mutation Breeding), Tasar silkworm ecotypes, Muga Silkworm Biotypes, Muga Silkworm Races Developed Through Breeding Methods and Major Eri Silkworm Eco-Races.

15. **Authorization of silkworm breeds and their hybrids**: Definition, Objectives of Authorization, Need for Authorization, Organizations Involved, AISRCC (All India Sericulture Research Co-ordination committee) norms of authorization, JICA (Japanese International Co-operation for Agriculture) Race Authorization committee, Procedure for Authorization, Criteria for Authorization, Types of Authorized Silkworm Hybrids, Advantages and limitations of Authorization, Authorized commercial silkworm hybrids.