

# ENTOMOLOGY

## **Insect Biodiversity and Biosystematics**

Evolution of insects, introduction to class Insecta and its position in phylum Arthropoda; history of insect classification; phylogeny, evolution and nomenclature; diversity of insect and mite fauna in various ecosystem; importance of insect biodiversity in relation to forest and environment.

Classification, distinguishing characters, general biology, habits and habitats of insect orders (Collembola, Protura, Diplura, Thysanura, Odonata, Ephemeroptera, Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Embioptera, Zoraptera, Psocoptera, Phthiraptera, Thysanoptera, Hemiptera, Strepsiptera, Megaloptera, Raphidioptera, Neuroptera, Coleoptera, Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera and Hymenoptera). Distinguishing characters, general biology, habits and habitats of important families of forest and agricultural importance.

History of Entomology in India. Principles and application of zoological nomenclature; palaeontology and phylogeny; species concept and speciation; taxonomic publications; identification keys; description of new taxa; taxonomic characters; numerical taxonomy; cladistics and phenetics; molecular systematic. Current trends in insect classification; institutions of importance in biosystematics; status of biosystematics in India.

## **Insect Morphology**

Insect body structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation. Head and their appendages - origin, structure and modification; types of mouthparts and antennae, tentorium and neck sclerites. Thorax structure, thoracic appendages and their modification. Wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; Legs: structure and modifications. Abdomen-segmentation and appendages; genitalia and their modifications; embryonic and post-embryonic development; insect sense organs.

## **Insect Physiology and Anatomy**

Scope and importance of insect anatomy and physiology; anatomy and physiology of digestive, excretory, respiratory, circulatory, nervous, endocrine and reproductive systems of important insect groups. Process of insect body development and role of hormones in body

development, metamorphosis and different physiological process. Physiology of various systems. Adaptation of insects to various ecosystems. Chemistry of cuticle- pre and post metamorphic changes; ultrastructure of nerve and glial cells, cuticle, trachea, muscle fibres, epidermis and midgut cells; sensory physiology; chemical communication in insects; pheromones in insect behaviour; exocrine and accessory glands; acoustic communication; photoperiodism; diapause; immunity; insect clocks; insect venoms; migration and dispersal, polymorphism in insects and its endocrine regulation.

Nutrition of phytophagous insects, entomophagous insects; role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals in insect nutrition; growth factors; extra and intra cellular micro organisms and their transmission, location and physiology.

### **Insect Ecology**

Concept of ecology, Environment and its components-biotic and abiotic factors and their effects on growth, development, population dynamics, distribution and dispersal. Principle of biogeography and insects biodiversity. Biotic potential and environmental resistance. Ecosystems, agroecosystems analysis, their characteristics and functioning. Intra and inter specific relationship; competition, predator-prey and host-parasite interactions, ecological niche. Life table studies, population models. Food chain and food web. Arthropod population monitoring, pest forecasting. Diapause and causes of pest out breaks.

### **Integrated Pest Management (IPM)**

History, principles and concepts of IPM; ecological and socioeconomic aspects; concept of injury level. Sampling and measuring for economic levels of damage, analysis and modeling. Methods of integrated pest management:- all aspects of biological, microbial control, behavioral control, Hormonal control, chemical control, legal control, cultural control, genetic control and other management tactics, their integration in IPM, and their advantages and limitations. Laws of quarantine.

### **Host Plant Resistance**

Chemical ecology: mechano and chemo receptors. Insect plant interactions, mechanism of host plant selection by insects. Defense mechanism of plants against phytophagous insect. Mechanism of biotypes development and its remedial measures. Tritrophic interactions, induced resistance. Concept, basis and mechanism of resistance development and evaluation

techniques. Genetics and types of resistance. Biotechnological approaches and development of transgenic insect resistant plants, its advantages and limitations. Case histories. Insect resistance to transgenic plants and its management.

### **Biological Control of Insect Pests**

Importance, scope, components and concepts of biological control, history of biological control: Important entomophagous insect Orders and Families. Principles and procedures of using exotic biocontrol agents. Mass multiplication techniques important bio-agents. Effective evaluation techniques, Biocontrol organizations in world and India. Successful cases of biological control of pests.

### **Chemical Control and Toxicology**

History, scope and principles of chemical control. Classification of insecticides, formulations, metabolism and mode of action of different groups of insecticides. Problems of pesticide hazards and environmental pollution, safety, precautions and first aid treatments. Insecticides Act, registration and quality control. Pesticides residues in the environment and their dynamics of movements, methods of residue analysis. Selectivity of insecticidal actions, insecticide resistance and management of insecticide resistance. Insecticide application appliances. Types of nozzles in sprayers their uses and maintenance of appliances.

### **Insect Pests and their Management**

Distribution, host range, biology and bionomics, nature of damage and management of insect pests of important forestry species, forest nursery, field crops, horticulture crops, stored grains/ seeds, converted wood and polyphagous insect pests.

Insect vectors of plant diseases: Common and important insects as vectors and their relationship with the plant diseases. Mechanism of pathogen transmission. Management of insect vector and its effect on diseases control.

### **Industrial Entomology and other beneficial insects**

**Apiculture, Lac culture, Sericulture.** Pollinators, biocontrol agents of weeds, soil fertility improving agents, scavengers. Use of insects in medicines, scientific investigations, insects as food, etc.

## **Recent Trends in Entomology**

Molecular insect systematic and taxonomy, Genetic improvement and insect gene transformation of natural enemies, and plants for resistance. Genetic engineering in baculoviruses, *Bt* and entomopathogenic fungi, Genes of interest in entomological research. Transgenic plants for insect pest resistance. Biotechnology in relation to silkworms and honey bees. Computer aided decision making and modeling; system approach in agro-ecosystem; remote sensing; perception of sound and light by insect – their applications.