U. P. Education Service Selection Commission, Prayagraj

Syllabus.

AGRICULTURAL ZOOLOGY/ENTOMOLOGY
(Subject Code-87)

Unit 1: Systematics

History and development of Entomology, Evolution of insects, position of insects in the animal kingdom, Principles of insect nomenclature, characteristics of phylum Arthropoda, structural features of important arthropod groups such as Trilobita, Chelicerata and Mandibulata, structural features of important classes of phylum Arthropoda viz. Arachnida, Crustacea, Chilopoda, Diplopoda and Hexapoda. Classification of class insects up to order level, habits, habitats and distinguishing features of different Order class and important Families.

Morphology

Body wall, its structure, outgrowths, endoskeleton, Body regions, segmentation, sclerites and sutures. Head and head appendages, types of mouth parts, antennae, their structure and types. Thorax structure, thoracic appendages and their modification. Wings, their modification and venation, Abdomen; structure, abdominal appendages both in Pterygota and Apterygota. External genitalia, general structure and modification in important insect orders.

Embryology, Internal Anatomy and Physiology

Embryonic and post embryonic development, types of metamorphosis. General features and types of larvae and pupae. Structure, function and physiology of Digestive, Endocrine Circulatory, Respiratory, Reproductive,Nervous and Excretory systems, Sense Organs; structure and types. Post embryonic developments, Insect food and nutrition; minerals, carbohydrates, proteins and amino acids, lipids, vitamins and their role in growth and development, artificial diets.

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, agro-ecosystems 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 and pest resurgence,categories of pest.

Unit 2: Biological Control

Importance and scope of biological control, history of biological control: Biocontrol agents-parasitoid, parasites and predators. Important entomophagous insect Orders and Families. Ecological, biological, taxonomic, legal and economic aspects of biological control, quantive land phenomena of multiple parasitism, hyperparasitism, superparasitism and their applied importance. Principles and procedures of using exotic biocontrol agents. Utilization of natural bio-control agents: conservation, habitat management and augmentation. Mass multiplication techniques and economics. Effective evaluation techniques, Bio-control organizations in world and India. Successful cases of biological control of pests. Entomophilic pathogens: bacterial, fungi, viruses, rickettsiae, Protozoan and nematodes, Modes of transmission, methods of uses, symptoms of infection. Microbial insecticides and their formulation. Merits and demerits of microbial control. Role of biocontrol agents and microbial insecticides in Integrated Pest Management.

Microbial Control

History, Definition, Traits desirable in pathogens, Principle group of Pathogens, Toxin produced by microbes, Host resistance to Pathogens, Natural dispersal of Pathogens, Modes of Pathogen Transmission, Formulation and additives of microbial insecticides , Methods of application, Mass production of Pathogen, Advantages and disadvantage.

Bio-technological approaches

Role of Bio-technological methods in pest management Tissue culture, Recombinant DNA Technology, Transgenic crop protection, Bt endotoxins, Resistance in pest to transgenic.

Hormonal control of Insect pests

Kinds of insect hormones, Functions of hormones, concept of hormonal control of insects, control of insects by IGRs, Insect hormones and the problem of resistance, Advantages and disadvantages.

Unit 3: Chemical Control and Toxicology

History, scope and principles of chemical control. Insecticides and their classification. Formulations of insecticides. Susceptibility of insects to the entry of insecticides. Physical, chemical and toxicological properties of different groups of insecticides: chlorinated hydrocarbons, organophosphates, carbamates,

synthetic pyrethroids, Neonicotionoids, Thioureaderivatives, Spinosyn, chlordimeform, chitin synthesis inhibitors, avermectins, nitroguandines, phenylpyrrozzoles, botanicals (natural pyrethroids, rotenone, neem products, nicotine, pongamia spp. etc). Combination insecticides. Problems of pesticide hazards and environmental pollution. Safe use of pesticides, precautions and first aid treatments. Insecticides Act 1968, registration and quality control of insecticides. Evaluation of toxicity, methods of toxicity testing, determination of LD 50, LT 50, RL 50 etc. Pesticides residues in the environment and their dynamics of movements, methods of residue. Pharmacology of insect poisons. Mode of action of different groups of insecticides; neuroactive (axonal and synaptic) poisons, respiratory poisons, chitin synthesis inhibitors. Metabolism of insecticides; activative and degradative metabolism, detoxification enzymes and their role in metabolism. Selectivity of insecticidal actions; insecticide resistance; mechanism, genetics and management of insecticide resistance.

Host Plant Resistance

Chemical ecology: mechano and chemo receptors. Host plant selection by phytophagous insects. Secondary plant substances and their defenses against phytophagous insect. Basis of resistance (Antixenosis, Antobiosis, Tolerance). Biotypes development and its remedial measures. Tritrophic interactions, induced resistance. Breeding for insect resistant plant varieties. Resistance development and evaluation techniques. Genetics of Resistance: vertical resistance, horizontal resistance, oligogenic resistance, polygenic resistance. Insect resistance to transgenic plants and its management.

Innovative Approaches in Pest Control

Behavioral control: pheromones-types and uses, advantages and limitations. chemosterilants, antifeedants, attractants, repellents; their types, method of applications, advantages and limitations. Genetic control: concepts and methods, case histories, advantages and limitations.

Integrated Pest Management

History, concept and principles of IPM. Components of IPM: Host plant resistance, agronomic manipulations, mechanical and physical methods, chemical methods, biocontrol agents utilization, genetic and behavioral control strategy etc. IPM strategies for field and horticultural crops. IPM case histories. Concept of damage levels- Economic threshold levels (ETL), Economic injury levels (EIL) and their determination. System approach, Constraints and Strategies of IPM implementation. Development and validation of IPM modules for inset pest and diseases.

Unit 4: Pesticide Application Equipments

Types of appliances: sprayers, dusters, fog generators, smoke generators, soil injecting guns, seed treating drums, flame throwers, etc. Power operated sprayers and dusters. Types of nozzles and their uses. Maintenance of appliances. Aerial application of pesticides, principles of aerial application, factors affecting the effectiveness of aerial application. Equipments for aerial applications. Advantages and disadvantages of aerial application.

Unit 5: Pests of Field Crops and their Management

Distribution, host range, biology and bionomics, nature of damage and management of arthropod pests of cereals, Oilseed, pulses and fibre crops, sugarcane and tobacco. Polyphagous pests: locusts, termites, hairy catepillars, cut worms and white grubs.

Unit 6: Pests of sub-tropical and Tropical Fruits

Citrus, mango, Grapevine, Guava, Ber, Banana, Jackfruit, Apple, Jamun, Litchi and Papaya.

Pest of Spices

Cardamom, large Cardamom, Chillies, Black Peppers, Turmeric, Ginger, Coriander, Cinnamon.

Pest of Vegetables

Winter Vegetables-cabbage, cauliflower, radish, potato, tomato, onion, pears, summer vegetables-brinjal, cucurbits, okra, sweet patato.

Unit 7 :Pests of Stored Products and their Management

Fundamentals of storage of grains and grain products. Storage losses, sources of infestation/infection, factors influencing losses, insect and non-insect pests, their nature of damage .Microflora in storage environment and their control. Storage structures, bulk storage and bag storage, their relative efficacy and demerits. Grain drying methods and aeration. Non-insect pests (rodents, birds, mites) of stored products and their control. Integrated management of storage pests.

Unit 8: Arthropod Vectors of Plant Diseases

Common arthropod vectors viz., aphids, leaf hoppers, plant hoppers, whiteflies, thrips, psylids, beetles, weevils, flies, bees and mites and their relationship with the plant pathogenic fungi, bacteria, viruses, mycoplasma. Mechanism of pathogen transmission : Active mechanical transmission, biological transmission. Toxicogenic insects, mites and phytotoxemia. Some important arthropod vector transmitted diseases and their epidemiology in India. Management of vector and its effect on control of diseases.

Unit 9: Honey Bees and Bee-keeping

Honey bees and their economic importance. Bee species, their behaviour, habit and habitats. Bee Keeping: bee pasturage, hives and equipments, seasonal management. Bee enemies including diseases and their management.

Silkworms and Sericulture

Silkworm species, their systematic position and salient features. Rearing techniques of mulberrymuga-eri and tassar silkworms. Nutritional requirements of silkworms. Sericulture: rearing house and appliances, silkworm breeds, principles of voltism and nioultism, seed production and its economics. Enemies and diseases of silkworms and their management. Sericulture organization in India.

Lac Insect

Lac insect, its biology, habit and habitats. Host Trees: pruning, inoculation, lac cropping techniques, and harvesting. Enemies of lac insect and their control.

Other Useful/beneficial Insects

Pollinators, biocontrol agents of weeds, soil fertility improving agents, scavengers. Use of insects and insect products in medicines. Usefulness of insects in scientific investigations.

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