

Syllabus

B.Sc. (Hons.) Agriculture 1st Semester

AEN 104 Fundamentals of Agricultural Entomology I 3 (2+1)

Theory

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ, sense organs. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects.

Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

B.Sc. (Hons.) Horticulture 1st Semester

AEN (H) 104 Fundamentals of Agricultural Entomology I

3 (2+1)

Theory

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Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

B.Sc. (Hons.) Agriculture 2nd Semester

AEN 154 Fundamentals of Agricultural Entomology II

2 (1+1)

Theory

Introduction of ecology, definition and its biotic & abiotic components. Effect of abiotic factors- temperature, RH, rainfall, light, atmospheric pressure & air current. Effect of biotic factors- intra & inter specific relationship, food competition. Natural and environmental resistance. Concept and definition of Pests, its categorization. Insects and mite pests of crops. Survey and surveillance, sampling, and estimation of pest population. Concept & definition of IPM, importance, principles and tools of IPM. Clarification of tools and their application in IPM system. Bio-control agents including predators, parasitoids, mite predators, microbial and their application in IPM. Chemical control- definition, importance, hazards and limitations. Classification of insecticides, label and formulation of insecticides. Synthetic chemical insecticides in plant protection. Botanical insecticides- definition, scope and limitation of botanicals. Recent methods of pests control- repellents, antecedents, sex pheromones and IGRs. Insecticides act 1968- Important provisions. Application techniques of spray fluids- high, low and ultra low volume spray. Symptoms of poisoning- first aids and antidotes for important group of insecticides.

Practical

Study of distribution pattern of insects in crop ecosystem. Sampling techniques for the estimation of insect population and damage. Habit, habitat, distribution, sampling and identification of mite pests. Survey on pests and forecasting of pest incidence. Pest surveillance through light trap, pheromone traps and forecasting of pest incidence. Identification of pests and their estimation. Identification of bio-control agents and their qualitative and quantitative estimation. Label and toxicity of insecticides. Acquaintance of insecticides formulations. Calculation of doses/concentration of different insecticides. Plant protection equipments and spray droplet size Compatibility of pesticides with other agro-chemicals and phytotoxicity of insecticides. Study of insect pollinators, weed killers and scavengers. Commonly used acaricides, rodenticides and nematicides. Microbial insecticides and IGRs. Application of IPM techniques, integration and case studies.

B.Sc. (Hons.) Agriculture 3rd Semester

AEN 204 Pests of Crops and Storage and their Management

3 (2+1)

Theory

Stored grain pests, biology, NSD and their management. Insect pests of rice, biology, NSD and their management. Insect pests of wheat, maize, sorghum, ragi, sugarcane, jute, cotton, mesta, sunwomp. Pests of oilseed crops (Ground nut, mustard, castor, gingeshy, sunflower and safflower) NSD and their management. Pests of pulses, biology, NSD and their management. Pests solonaceous, cruciferous, cucurbitaceous, nhindi, colasazia, moringa and amaranths, NSD and their management. Pests of Mango and Banana, their biology, NSD and their management. Pests of citrus, cashew, coconut, coffee, tea, their biology and management. Pests of Grapevine, pomegranate, guava, sapota, ber, apple, tobaccoco, their biology, NSD and management. Pests of chilli, betelvine, onion, turmeric, coriander, garlic, curry, leaf, pepper, ginger, their biology, NSD and management. Pests of ornamental plants and their management.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

B.Sc. (Hons.) Horticulture 3rd Semester

AEN (H) 210 Non-Insect Pests of Horticultural Crops and their Management

2(1+1)

Theory

History, definition and economic importance of plant parasitic nematodes, phytophagous mites, rodents, horticulturally important birds, snails and slugs. General characters of aforementioned organisms, their morphology, taxonomy, classification, biology and behaviour symptomatology and management.

Practical

Morphological study and identification of horticulturally important mites, nematodes, rodents, birds, snails and slugs etc. Collection, cleaning and preservation as far as possible.

Studies of symptoms of damage and habitat study. Sampling and estimation of population

Suggested Reading:

Upadhyay, K.D and Dwivedi, K. 1997. A text book of plant nematology. Amman Publishing House Aman publishing house, Meerut

Vasanth Raju David, B. 2001. Elements of economic entomology. Popular book Depot, Chennai.

Gopal Swaroop and Das Gupta 1986. ICAR, New Delhi. Plant Parasitic Nematodes of India Problems and Progress.

Nair, M.R.G.K. 1975. Insects and Mites of Crop in India. ICAR, New Delhi

Metcalf, R.L. and Luckman, W.H. 1982. Introduction to Insect pest management Wiley Inter Science Publishing, New York.

Butani, D.K. 1984. Insects and Fruits. Periodical Expert Book Agency, New delhi

E.I.Jonathan, I Cannayane, K. Devrajan, S. Kumar, S. Ramakrishan, Agricultural Nematology. TNAU, Coimbatore.

B.Sc. (Hons.) Horticulture 4th Semester

AEN (H) 258 Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops

3(2+1)

Theory

General - economic classification of insect; Bio-ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops; pest surveillance. Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops like coconut, areca nut, oil palm, cashew, cacao, tea, coffee, cinchona, rubber, betel vine senna, neem, belladonna, pyrethrum, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and Storage insects - distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their maximum residue limits (MRLs).

Practical

Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect - pests affecting fruits, plantation, medicinal and aromatic crops in field and storage.

B.Sc. (Hons.) Agriculture 5th Semester

AEPP 306 Principles of Integrated Pest and Disease Management 3(2+1)

Theory

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Different aspects of plant bio-security, bio-safety and preventive measures. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma*, *Pseudomonas*, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases . Performance study of hot water treatments of fruits and vegetables.

Theory

Balance of nature-natural control. Biological control-definition, its advantages and disadvantages Biocontrol agents, arachnids, fungi, bacteria, viruses, protozoa, Vertebrates. Brief history of bio-control with examples of successful cases. Insects parasitoids and predators-types of parasitism. Methods of biological control- conservation, augmentation and importation. Predators and parasitoids of agricultural importance- Coleoptera (Coccinellids, Carabids, Staphylinids): Hemiptera (Mirids, Reduviids, Pentatomids): Diptera (Syrphids, Tachinids): Lepidoptera (Pyralid- *Epiricania melanolenca*): Hymenoptera (Trichogrammatids, Eulophids, Scelionids, Mymarids, Braconids, Ichneumonids): Spiders (Arachnida); Mites (Phytoseiids) and Weed feeding herbivores-*Zygogramma bicolorata*. Bio-pesticides – Entomopathogenic microbes, Bacteria – *Bacillus thuringiensis*, *B. papillae*; Fungi – (*Beauveria bassiana*, *Metarhizium anisopliae*, *Verticillium lecanii*, *Nomuraea rileyi*, Viruses (NPV and GV); Nematodes (Heterohabditidae idea, Steinernematidae and Protozoa. Mass production of bio agents).

Practical

Mass rearing of natural enemies- facilities required in general for mass production of natural enemies. Mass rearing of host insects of natural enemies on nature or artificial diets – a) *Corcyra cephalonica*, b) *Spodoptera litura*, c) *Plutella xylostella* d) *Helicoverpa armigera*, e) Mealy bugs, f) *Galleria mellonella*. Mass production of parasitoids and predators – a) *Trichogramma chilonis* / *T. japonicum*, b) *Bracon brevicornis* c) *Cotesia plutellae*, d) *Chrysoperla carnea* e) *Cryptolaemus montrouzieri*, f) *Scymnus coccivora*. Mass production of weed feeding herbivore-*Zygogramma bicolorata*. Quality control of natural enemies. Impact assessment of natural enemies.

B.Sc. (Hons.) Agriculture 6th Semester

AEN 354 Management of Beneficial Insects

2(1+1)

Theory

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

Theory

History, definition and economic importance of plant parasitic nematodes, phytophagous mites, rodents, agriculturally important birds, snails and slugs. General characters of aforementioned organisms, their morphology, taxonomy, classification, biology and behavior symptomatology and management.

Practical

Morphological study and identification of agriculturally important mites, nematodes, rodents, birds, snails and slugs etc.

Collection, cleaning and preservation as far as possible.

Studies of symptoms of damage and habitat study.

Sampling and estimation of population.

B.Sc. (Hons.) Horticulture 6th Semester

AEN (H) 354 Insect Pests of Vegetable, Ornamental and Spice Crops

3(2+1)

Theory

Economic importance of insects in vegetable, ornamental and spice crops -ecology and pest management with reference to these crops. Pest surveillance in important vegetable, ornamental and spice crops. Distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting vegetable, ornamental and spice crops. Important storage insect-pests of vegetable, ornamental and spice crops, their host range, bio-ecology, injury and integrated management. Insect –pests of processed vegetables and ornamental crops, their host range, bio-ecology, injury and integrated management. Insecticidal residue problems in vegetables and ornamental crops, tolerance limits etc.

Practical

Study of symptoms, damage, collection, identification, preservation, assessment of damage/population of important insect-pests affecting vegetable, ornamental and spice crops in field and during storage.

Suggested reading:

- Reddy, P. P., 2010, Plant Protection in Horticulture Vol. 1, 2 & 3, Scientific Publishers, Jodhpur
- Ranjit, P., 2012, Entomological Techniques in Horticultural Crops, New India Publishing Agency.
- Nair M R G K, 1995, Insect and Mites of Crops in India, ICAR, New Delhi.
- Ayyar, T.V.R. 1963. Hand book of entomology for south India. Govt. press Madras, 516p.
- David B V and Kumarswami, T, 1982. Elements of Economic Entomology. Popular Book Department, Madras, 536p.
- P. Srivastava, Dharmo K. Butani Pest management in vegetables – Part1. Researcho Book Centre, 1998
- K.P. Srivastava, Dharmo K. Butani Pest management in vegetables – Part-2. Researcho Book Centre, 1998
- Rachna and Benna kumari. Pest management and residual analysis in horticultural crop
- Ramnivas sharma. Identification and management of horticulture pest.
- T. V. Sathe. Pests of ornamental plants.
- A. S. Atwal. Agricultural pests of south Asia and their management
- Butani, D.K. 1984. Insects and Fruits. Periodical Expert Book Agency, New Delhi.
- Butani, D.K. 1984. Insects and Fruits. Periodical Expert Book Agency, New Delhi
- Metcalf, R.L and Luckman, W.H. 1982. Introduction to Insect pest management. Wiley Inter Science Publishing, New York
- Dhalinal, .G.S. and Ramesh Arora Integrated Pest Management Concept and Approaches. Kalyani Publishers, Ludhiana.
- K.P. Srivastava .A Text Book on Applied Entomology Vol. I&II. , Kalyani Publishers, Ludhiyana
- Emmanuel, N, A. Sujatha, T.S.K. K. Kiran Patro, MLN Reddy, B. Srinivasulu, TSSK Samuel Patro. Text
- Book on Integrated Pest Management of Horticultural Crops Astral International Publishers, New Delhi.

Theory

Introduction to beneficial insects. Importance and History of apiculture. Species of honey bees, Rock bee, Little bee, Indian bee, European bee, Italian bee and Dammar bee, lifecycle and caste determination. Bee colony maintenance, bee colony activities, starting of new colony, location site, transferring colony, replacement of queen, combining colonies, swarm prevention, colony management in different seasons, Equipment for apiary, types of bee hives and their description. Bee pasturage. Honey extraction, honey composition and value, bee wax and tissues.. Importance, History and development in India, silkworms kinds and their hosts, systematic position, distribution, lifecycles in brief, Silk glands. Mulberry silkworm-morphological features, races, rearing house and equipments, disinfection and hygiene. Grainage acid treatment, packing and transportation of eggs, Incubation, black boxing, hatching of eggs. Silkworm rearing young age /chawki rearing and old age rearing of silkworms. Feeding, spacing, environmental conditions and sanitation. Cocoon characters colour, shape, hardness and shell ratio. Defective cocoons and stifling of cocoons. Uses of silk and by-products. Economics of silk production. Moriculture-Mulberry varieties, package of practices, Pests and diseases and their management. Lac growing areas in India, Lac insects, biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac-insects.

Practical

Honey bee colony, different bee hives and apiculture equipment. Summer and Winter management of colony. Honey extraction and bottling. Study of pests and diseases of honeybees. Establishment of mulberry garden. Preparation of mulberry cuttings, planting methods under irrigated and rainfed conditions. Maintenance of mulberry garden-pruning, fertilization, irrigation and leaf harvest. Mulberry pests and diseases and their management and nutritional disorders. Study of different kinds of silkworms and mulberry silkworm morphology, silk glands. Sericulture equipments for silkworm rearing. Mulberry silkworm rearing room requirements. Rearing of silkworms-chalky rearing. Rearing of silkworms late age silkworm rearing and study of mountages. Study of silkworm pests and their management. Study of silkworm diseases and its management. Lac insects-biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac insects.

Suggested Reading:

- Singh, S., 1975. Bee keeping in India – ICAR, New Delhi., 214p.
- Sunita, N.D, Guled ,M.B, Mulla S.R and Jagginavar,2003, Beekeeping, UAS Dharwad
- Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur.
- Singh, D and Singh, D.P. 2006. A hand book of Beekeeping, Agrobios (India).
- Paul DeBach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University Press; 2 edition (27 June 1991)
- YA Shinde and BR Patel. Sericulture in India
- Tribhuwan Singh. Principles and Techniques of Silkworm Seed Production, Discovery publishing House Pvt. Ltd
- M.L. Narasaiah. Problems and Prospects of Sericulture. discovery publishing House Pvt. Ltd.
- Ganga,G. and Sulochana Chetty, J. 1997. An introduction to Sericulture (2nd Edn.). Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
- Krishnaswamy, S. (Ed). 1978. Sericulture Manual - Silkworm Rearing. FAO Agrl. Services bulletin, Rome.
- Singh, S. 1975. Bee keeping in India. ICAR, New Delhi.
- Glover, P.M. 1937. Lac cultivation in India. Indian Lac Research Institute, Ranchi.
- Jolly, M.S. 1987. “Appropriate sericulture techniques” International centre for training and Researchin Tropical Sericulture, Mysore,209.
- K. P. Srivastava .A Text Book on Applied Entomology Vol. I & II. , Kalyani Publishers, Ludhiyana
- B.r. David and V. V. Ramamurthy. Elements of Economic Entomology, 7th Edition. Namrutha Publications, Chennai

B.Sc. (Hons.) Agriculture 8th Semester

Experiential Learning Programme (ELP)

ELP 455 Commercial Beekeeping

(0 + 10) + (0 + 10) = 20

Theory

1. Introduction to apiculture, honey bee types and their importance
2. Organization of honey bee colony and biological behaviour of different bee species
3. Useful bee plants and foraging of bees
4. Essential equipment of bee keeping
5. Factors to be considered for establishing of apiary
6. Artificial rearing of queen
7. Seasonal management of bees
8. Products of bee hive
9. Nutritive values, uses and quality control of honey
10. Bee disease and their management
11. Insect and mite enemies of bees and their management
12. Crop pollination and bee keeping
13. Pesticidal poisoning to honey bees
14. Economic of bee keeping

Practical

1. Acquaintance with bee keeping equipments and handling of bees
2. Artificial queen rearing
3. Multiplication of bee colony
4. Management of bees during different seasons
5. Extraction of honey and bee wax
6. Ripening of honey and its quality control
7. Production of royal jelly
8. Management of insect and mites of bees
9. Management of insect and mites of bees