



Department of Agricultural Entomology
Uday Pratap College, Varanasi

Syllabus

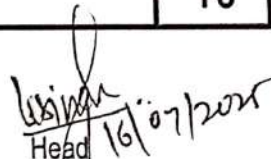
Revised- 2025

B. Sc. (Hons.) Ag.

(According to the recommendations of ICAR's 6th Dean's Committee)

Course Details

Sl. No.	Semester	Course Code	Course Title	Credit
1.	II	ENT-121	Fundamentals of Entomology	3 (2+1)
2.	III	ENT-211	Fundamentals of Nematology	2 (1+1)
3.	IV	ENT-221	SEC-VI (Beneficial insect farming)	2 (0+2)
4.	V	ENT-311	Pest Management in Crops and Stored Grains	3 (2+1)
5.	VII	ENT-411	Bioformulation and Nano formulation (Elective Course)	4 (3+1)
6.	VIII	ENT-421	RAWE	2
Total				16


Head 16/07/2025
Department of Ag. Entomology
Uday Pratap College
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1. Fundamentals of Entomology (ENT- 121)

Credit hours: 3 (2+1)

Objectives

1. To know the history of entomology, classification of insects and their relationship with other arthropods
2. To study the various morphological characters of class insect and their importance for classification of insects
3. To get an idea about the different physiological systems of insects and their roles in growth and development and communications of insects
4. To study the characteristics of commonly observed insect orders and their economical important families

Theory

History of Entomology in India. Major points related to dominance of Insects in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insects 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.

Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs. Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors and biotic factors. Categories of pests. Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, 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.

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); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

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Suggested readings

1. Fundamentals of Ecology - Eugene. P. Odum and Gray W. Barrett
2. Imm's General Text book of Entomology- O.W. Rechards and R.G. Davies
3. Introduction to the study of Insects- D. J. Borror and DeLong's

2. Fundamentals of Nematology (ENT- 211)

Credit hours: 2 (1+1)

Objectives

1. To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes.
1. To impart knowledge on nematode pests of different crops of national and local importance and their management.

Theory

Introduction: History of phytonematology, habitat and diversity, economic importance of nematodes. General characteristics of plant parasitic nematodes. Nematode: definition, general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of feeding/ parasitic habit. Symptomatology, role of nematodes in disease development, Interaction between plant parasitic nematodes and disease-causing fungi, bacteria and viruses. Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fibre crops, citrus and banana, tea, coffee and coconut. Different methods of nematode management: Cultural methods, physical; methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM.

Practical

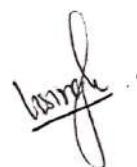
Sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following Cobb's sieving and decanting technique, Baermann funnel technique, Picking and counting of plant parasitic nematode. Identification of economically important plant nematodes up to generic level with the help of keys and description: Meloidogyne, Pratylenchus; Heterodera, Tylenchulus, Xiphinema, and Helicotylenchus etc. Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, plantation crops etc. Methods of application of nematicides and organic amendments.

Suggested readings

1. Economic Nematology-Edited by J.M. Webster
2. Plant Parasitic Nematodes (Vol-1) by Zukerman, Mai, Rohde
3. Plant Parasitic Nematodes of India: Problems and Progress by - Gopal Swarup, D. R. Dasgupta, P. K. Koshy.
4. Text book on Introductory Plant Nematology -R.K. Walia and H.K. Bajaj.







3. Beneficial Insect Farming (ENT- 321)

Credit hours: 2 (0+2)

Practical

Bee Keeping:

Importance of Honeybees, 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. Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Visit to research and training institutions devoted to beekeeping.

OR

Sericulture

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. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Visit to research and training institutions devoted to sericulture.

OR

Lac Culture

Species of lac insect, morphology, biology, host plant, lac production, seed lac, button lac, shellac, lac products. Species of lac insect, host plant identification. Visit to research and training institutions devoted to lac culture.

OR

Biological Control Agents

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. Identification of other important pollinators, weed killers and scavengers. Identification and techniques for mass multiplication of natural enemies. Visit to research and training institutions devoted to natural enemies.

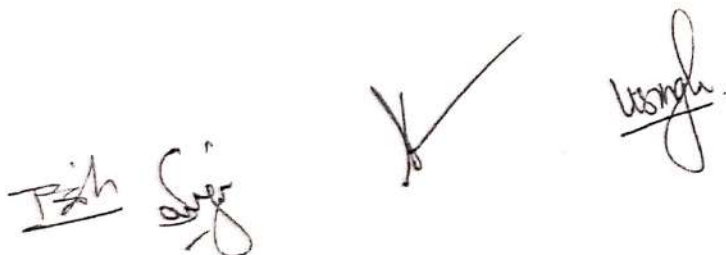
4. Pest Management in Crops and Stored Grains (ENT 311)

Credit hours 3 (2+1)

Objectives

Diagnosis and management of major insect and non- insect pests of crops in field and storage

Theory

The image shows four handwritten signatures or initials in black ink. From left to right: the first is 'Pah' with a horizontal line underneath; the second is 'Sug' with a flourish underneath; the third is a large, stylized 'K' with a long diagonal stroke; the fourth is 'K Singh' with a flourish underneath.

- Section I:** General description on nature and type of damage by different arthropod pests; Scientific name, order, family, host range, distribution, biology and bionomics.
- Section II:** Nature of damage and management of major insect pests of various field crops, vegetable crops, fruit crops.
- Section III:** Structural entomology and important household pests, their nature of damage and management.
- Section IV:** Factors affecting loss of stored grains. Insect pests, mites, rodents, birds and microorganisms associated with stored grains and their management. Storage structures and methods of grain storage and fundamental principles of stored grains management.
- Section V:** Management of non-insect pest of mites, snails and slugs, Concept of IPM, Practices, scope and limitations of IPM.
- Section VI:** Classification of insecticides, toxicity of insecticides and formulations of insecticides, Biorational pesticides including insect repellents, antifeedants.
- Section VII:** Use of drones and AI in pest management.

Practical

1. Field visit, identification of major insect pests and their damage symptoms.
2. Collection and preservation of major insect pests; collection of damage samples, their identification and herbarium preparation.
3. Methods of monitoring of pest incidence *in situ*.
4. Management strategies of insect pests of different crops.
5. Study on structural entomology and household pests.
6. Storage structures and methods of grain storage.
7. Vertebrate pest management, Mass multiplication of NPV and entomopathogenic nematodes.
8. Insecticides and their formulations.
9. Pesticide appliances and their maintenance.
10. Spraying techniques for selected field and horticultural crops.
11. Sampling techniques for estimation of insect population and damage.


Suggested readings

1. A Textbook of Insect Pest and Disease Management, 2021. Somnath Sen, and Mohd. Sameer, S. Kataria & Sons publish.
2. Agricultural Pests of India and South east Asia, A.S. Athwal, Kalyani Publishers.
3. A Textbook of Applied Entomology, K.P. Srivastava and G. S. Dhaliwal, Kalyani Publish.
1. Essentials of Pest Management: Key Information on Pest Identification and its Management, 2022. Prakash Rambhat Thalya and Ravi Chandra
4. Integrated pest Management Concept and Approaches- G.S. Dhaliwal and Ramesh Arora
5. Pest Management: Methods, Applications and Challenges, Tarique Hassan Askary, Nova, Pest Control, Science and Technology, 2022









5. Bioformulation and Nanoformulation (ENT 411)

Credit hours: 4 (3+1)

Objectives

1. To enable students to acquire expertise and skill to develop bioformulation and Nanoformulation
2. To know the importance of biopesticides and biofertilizers
3. To make the students know about various techniques involved in biofertilizers and biopesticides production
4. To get knowledge on essential oils, botanicals, predators, parasitoids, pheromones, and parapheromone and their application in insect pest management
5. To get concepts on agrochemical formulations with nanoparticles and acquaint them with nanotechnology.

Theory

Introduction and history of biological control of pests and diseases; Microbial biopesticides: the global and Indian market scenario; biopesticides for organic agriculture; Different phytopathogenic biocontrol agents: Mode of action; Different entomopathogenic biocontrol agents: Mode of action; Microbial inoculants as biofertilizer candidates, Production, quality assessment and methods of application of biopesticides and biofertilizers; Regulatory system of biopesticides in India; Formulations of plant essential oils, botanicals, pheromone, and parapheromone and their application in insect pest management; Use of predators and parasitoids for insect pest management; Nanotechnology: its applications in pest and disease diagnosis and management; Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides; Nano Fertilizers: Concept and importance, Types of nano fertilizers; Different techniques of producing nano fertilizers; Green synthesis of nano fertilizers; green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles.

Practical

Introduction and acquaintance with biopesticide laboratory; Preparation of culture media; Isolation and purification of bioagent from soil and infected insects; Microscopic study of different microbial bioagents; In vitro assay of microbial bioagents against plant pathogens. In vitro compatibility study among different microbial bioagents; Mass multiplication of biopesticides; Population enumeration of biocontrol agents in different biopesticides; Preparation of plant extracts and their efficacy test against insect pests; Use of pheromone parapheromone for monitoring and management of insect pests; Bioassay of Entomopathogenic biocontrol agents on insect pests; Preparation of microbial inoculants of biofertilizer microbes; Compatibility of biofertilizer microbes; Preparation of solid and liquid consortia of biofertilizer microbes

Suggested readings

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society.



2. Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology.
3. Boland, G.J. and David, L.1998. Plant microbe interactions and Biological Control. Kuykendall Marel Dekker, INC.
4. Ciancia, A. and Mukerji, K.J. 2007. General Concepts of Integrated Pest and Disease Management. Edited Published by Springer.
5. Cincholkar, S.B. and Mukherji, K.G. 2007. Biological Control of Plant Diseases. Hawarth Food and Agricultural products.
6. Gnanamanickam, S.S. 2002. Biological Control of Crop Disease. Kuykendall Marel Dekker, INC.
7. Ramanujam, B. and Rabindra, R.J. 2006. Current Status of Biological Control of Plant Disease using Antagonistic Organisms in India. Precision Fototype Services, Bengaluru.
8. Singh, S.P. and Hussanini, S.S. 1998. Biological Suppression of Plant Disease, Phytoparasitic Nematodes and Weeds. Precision Fototype Services, Bengaluru.
9. Allhoff, Fritz and Lin, Patrick (Eds). 2009. Nanotechnology and Society. ISBN: 978-1-4020 6208-7 Springer Publications, UK.
10. Prasad, Ram, Vivek Kumar, Manoj Kumar and Devendra Choudhary Eds, 2019. Nanobiotechnology in Bioformulations, Kindle Edition
11. Koul, Opendar Ed, 2019. Nano-biopesticides Today and Future Perspectives. Academic Press.
12. Shah, M. A. and Tokeer Ahmad. Nano Science and T+echnology, Wiley India.

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DEPARTMENT OF AGRICULTURAL ENTOMOLOGY

U.P College, Varanasi

Pre-Ph.D. Course

Paper I 4(3+1)

Unit I: Insect Morphology

Principles, utility and relevance: insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation. **Head**- Origin, structure and modification; types of mouthparts and antennae, tentorium and neck sclerites. **Thorax**- Areas and sutures of tergum, sternum and pleuron, pterothorax; 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; Types of metamorphosis. Insect sense organs (mechano, photo, and chemoreceptors).

Practicals

1. Study of Insect Body Tagmata, Segmentation, and Mouthparts
2. Dissection and Examination of Insect Thorax: Wings, Legs, and Modifications
3. Study of Insect Antennae, Sense Organs, and Genitalia

Unit II: Anatomy

Structure, modification and physiology of different systems; digestive, circulatory, respiratory, nervous, reproductive & musculature.

Practicals

1. Study of Digestive and Circulatory Systems in Insects
2. Examination of Respiratory and Nervous Systems in Insects
3. Dissection and Study of Insect Reproductive and Muscular System

Unit III: Insect Physiology and Nutrition

Physiology and biochemistry of insect cuticle and moulting process. Biosynthesis of chitin, chitin-protein interactions in various cuticles, hardening of cuticle. Digestive enzymes, digestive physiology in phytophagous, wood boring and wool feeding insects, efficiency of digestion and absorption, role of endosymbionts in insect nutrition, nutritional effects on growth and development; physiology of excretion and osmoregulation, water conservation mechanisms. Detailed physiology of nervous system, transmission of nerve impulses, neurotransmitters and modulators. Production of receptor potentials in different types of sensilla, pheromones and other semiochemicals in insect life, toxins and defense mechanisms. Endocrine system and insect hormones, physiology of insect growth and development metamorphosis, polymorphism and diapause. Insect behaviour in IPM-concept of super-normal stimuli and behavioural manipulation as potential tool in pest management, use of semio-chemicals auditory stimuli and visual signals in pest management.

Practicals

1. Study of Insect Cuticle Structure and Moulting Process

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2. Analysis of Digestive Physiology and Role of Endosymbionts in Insect Nutrition
3. Study of Insect Nervous and Endocrine Systems with Emphasis on Neurotransmitters and Hormones
4. Study of Insect Behaviour and Its Application in Integrated Pest Management (IPM)

Unit-IV: Recent Trends in Biological Control

Scope of classical biological control and augmentative bio-control; introduction and handling of natural enemies; nutrition of entomophagous insects and their hosts, dynamics of bio-agents *vis-à-vis* target pest populations. Bio-inputs: mass production of bio-pesticides, mass culturing techniques of bioagents, insectary facilities and equipments, basic standards of insectary, viable mass-production unit, designs, precautions, good insectary practices. Colonization, techniques of release of natural enemies, recovery evaluation, conservation and augmentation of natural enemies, survivorship analysis and ecological manipulations, large-scale production of bio-control agents, bankable project preparation. Scope of genetically engineered microbes and parasitoids in biological control, genetics of ideal traits in bio-control agents for introgressing and for progeny selections, breeding techniques of bio-control agents.

Practicals

1. Introduction, Rearing, and Handling of Natural Enemies for Biological Control
2. Mass Production Techniques of Bioagents
3. Study of Insectary Facilities, Equipment, and Good Insectary Practices
4. Techniques of Release, Recovery, and Evaluation of Natural Enemies

Unit V: Advanced Integrated Pest Management

Principles of sampling and surveillance; database management and computer programming, simulation techniques and system analysis and modeling. Case histories of national and international programmes, their implementation, adoption and criticisms, global trade and risk of invasive pests. Genetic engineering and new technologies-their progress and limitations in IPM programmes, development of benevolent alien genes for pest management-case studies; scope and limitations of bio-intensive and ecological based IPM programmes. Application of IPM to farmers' realtime situation. Challenges, needs and future outlook; dynamism of IPM under changing cropping systems and climate; insect pest management under protected cultivation; strategies for pesticide resistance management.

Practicals

1. Study of Sampling Methods, Pest Surveillance Techniques, and Data Management in IPM
2. Application of Simulation Models and System Analysis in Insect Pest Management
3. Case Study Analysis of IPM Programmes and Strategies for Pesticide Resistance Management

Unit VI: Insecticide Toxicology

Penetration and distribution of insecticides in insect system; insecticides selectivity: factor affecting toxicity of insecticides. Problem associated with pesticides use in agriculture: pesticide resistance mechanism and resistant management strategies. Pest resurgence and out breaks. Pesticide pollution health hazards & their management.

Practicals

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1. Study of Insecticide Penetration, Distribution, and Selectivity in Insects
 2. Assessment of Pesticide Resistance Mechanisms and Management Strategies
 3. Evaluation of Pesticide Pollution, Health Hazards, and Their Mitigation in Agriculture

Suggested Readings:

1. Chapman RF. 1998. *The Insects: Structure and Function*. Cambridge Univ. Press, Cambridge.
2. David BV & Ananthkrishnan TN. 2004. *General and Applied Entomology*. Tata-McGraw Hill, New Delhi.
3. Duntson PA. 2004. *The Insects: Structure, Function and Biodiversity*. Kalyani Publ., New Delhi.
4. Saxena RC & Srivastava RC. 2007. *Entomology: At a Glance*. Agrotech Publ. Academy, Jodhpur.
5. Snodgrass RE. 1993. *Principals of Insect Morphology*. Cornell Univ. Press, Ithaca.
6. Kerkut GA & Gilbert LI. 1985. *Comprehensive Insect Physiology, Biochemistry and Pharmacology*. Vols. I-XIII. Pergamon Press, New York.
7. Patnaik BD. 2002. *Physiology of Insects*. Dominant, New Delhi.
8. Richards OW & Davies RG. 1977. *Imm's General Text Book of Entomology*, 10th Ed. Vol. 1. *Structure, Physiology and Development*. Chapman & Hall, New York.
9. Wigglesworth VB. 1984. *Insect Physiology*. 8th Ed. Chapman & Hall, New York.
10. Burges HD & Hussey NW. (Eds.). 1971. *Microbial Control of Insects and Mites*. Academic Press, London.
11. Coppel HC & James WM. 1977. *Biological Insect Pest Suppression*. Springer Verlag, Berlin.
12. De Bach P. 1964. *Biological Control of Insect Pests and Weeds*. Chapman & Hall, London.
13. Dhaliwal, GS & Koul O. 2007. *Biopesticides and Pest Management*. Kalyani Publ., New Delhi.
14. Hayes WJ & Laws ER. 1991. *Handbook of Pesticide Toxicology*. Academic Press, New York.
15. Matsumura F. 1985. *Toxicology of Insecticides*. Plenum Press, New York.
16. Dhaliwal GS & Arora R. 2003. *Integrated Pest Management- Concepts and Approaches*. Kalyani Publ., New Delhi.
17. Dhaliwal GS, Singh R & Chhillar BS. 2006. *Essentials of Agricultural Entomology*. Kalyani Publ., New Delhi.
18. Flint MC & Bosch RV. 1981. *Introduction to Integrated Pest Management*. Springer, Berlin.
19. Koul O, Dhaliwal GS & Curperus GW. 2004. *Integrated Pest Management-Potential, Constraints and Challenges*. CABI, London.
20. Maredia KM, Dakou D & Mota-Sanchez D. 2003. *Integrated Pest Management in the Global Arena*. CABI, London.
21. Metcalf RL & Luckman WH. 1982. *Introduction of Insect Pest Management*. John Wiley & Sons, New York.
22. Pedigo RL. 1996. *Entomology and Pest Management*. Prentice Hall, New Delhi.

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