Proforma of information to be collected for the University departments/ADR/ Research satation/ for uploading on University website

1. **Name of the Department/Section :** Department of Agril. Entomology, College of Agriculture, Dapoli
2. **About Department:** This department was established in the year **1965** with the establishment of College of Agriculture, Dapoli with intake capacity of **64 students.** In the year 1996 ICAR modified UG syllabus of B.Sc.(Agri) and ICAR curriculum in the vogue. In the **year 2001**, the intake capacity of this college was increased to **128** and now Department is offering entomological courses to these students. In addition, this department is also offering the courses to B.Sc. (Hort) and B.Sc. (For.) students. M. Sc. (Agri) programme in Entomology has been started in the year **1977** with the earlier intake capacity of 2 students only. But, subsequently, the intake capacity was increased to 9 students. Presently, the PG courses are offered as per the recommendations of ICAR and those courses are being offered from the year 2004-05. **Ph.D programme** was started in the year **2002** with the intake capacity of 2 students.
3. **Academic** Programmers: Provide the details of each doctoral programme as
   a. **Name of the programme: Doctoral Programmes**

Semester No.	Term No.	Course No.	Credits	Title of the course offered by the department
I	I	ENT-601	1+2=3	Insect Phylogeny and Systematics
II	II	ENT-602	2+1=3	Insect Physiology and Nutrition
II	II	ENT-605	2+1=3	Bio-Inputs for Pest Management
I	I	ENT-606	2+1=3	Insect Toxicology and Residues
I	I	ENT-608	1+1=2	Acarology
III	I	ENT-609	1+1=2	Molecular Entomology
II	II	ENT-610	2+0=2	Integrated Pest Management
III	I	ENT-691	0+1=1	Doctoral Seminar-I
IV	II	ENT-692	0+1=1	Doctoral Seminar-II
-	-	ENT-699	0+75=75	Doctoral Research

Course Curricula and syllabi:

Course Contents
Ph.D. (Ag) in Plant Protection-Entomology

ENT 601 INSECT PHYLOGENY AND SYSTEMATICS 3 (1+2)

Objective

To familiarize the students with different schools of classification, phylogenetics, classical and molecular methods, evolution of different groups of insects. Detailed study about the International Code of Zoological Nomenclature; ethics and procedure for taxonomic publications.

Theory

UNIT I

Detailed study of three schools of classification- numerical, evolutionary and cladistic. Methodologies employed. Development of phenograms, cladograms, molecular approaches for the classification of organisms. Methods in identification of homology. Species concepts, speciation processes and evidences. Zoogeography.

UNIT II

Study of different views on the evolution of insects- alternative phylogenies of insects: Kukalova Peck and Kristensen. Fossil insects and evolution of insect diversity over geological times.

UNIT III

Detailed study of International Code of Zoological Nomenclature, including appendices to ICZN; scientific ethics. Nomenclature and documentation protocols and procedures; report preparation on new species; deposition of holotypes, paratypes, and insect specimens as a whole in national and international repositories – requirements and procedures.

UNIT IV

Concept of Phylocode and alternative naming systems for animals. A detailed study of selected representatives of taxonomic publications – small publications of species descriptions, works on revision of taxa, monographs, check lists, faunal volumes, etc. Websites related to insect taxonomy and databases. Molecular taxonomy, barcoding species and the progress made in molecular sytematics.

Practical

Collection, curation and study of one taxon of insects- literature search, compilation of a checklist, study of characters, development of character table, and construction of taxonomic keys for the selected group. Development of descriptions, photographing, writing diagrams, and preparation of specimens for "type like" preservation. Submission of the collections made of the group. Multivariate analysis techniques for clustering specimens into different taxa, and development of phenograms. Rooting and character polarization for developing cladograms and use of computer programmes to develop cladograms.

Learning outcomes

Scholars are expected to understand the concepts of taxonomic hierarchy, study taxonomic characters, variations, intra-specific phenotypic plasticity; prepare taxonomic keys for specific groups and write taxonomic papers and reviews.

Scholars should be able to identify insects of economic importance up to family/ generic levels and specialize in any one group of insects up to species level identification.

Suggested Readings

CSIRO 1990. *The Insects of Australia: A Text Book for Students and Researchers*. 2 nd Ed. Vols. I and II, CSIRO. Cornell Univ. Press, Ithaca.

Dakeshott J and Whitten MA. 1994. *Molecular Approaches to Fundamental and Applied Entomology*. SpringerVerlag, Berlin.

Freeman S and Herron JC. 1998. *Evolutionary Analysis*. Prentice Hall, New Delhi.

Hennig W. 1960. *Phylogenetic Systematics*. Urbana Univ. Illinois Press, USA.

Hoy MA. 2003. *Insect Molecular Genetics: An Introduction to Principles and Applications*. 2nd Ed. Academic Press, New York.

Mayr E and Ashlock PD. 1991. *Principles of Systematic Zoology*. 2 nd Ed. McGraw Hill, New York.

Mayr E.1969. *Principles of Systematic Zoology*. McGraw-Hill, New York.

Quicke DLJ. 1993. *Principles and Techniques of Contemporary Taxonomy*. Blackie Academic and Professional, London.

Ross HH. 1974. *Biological Systematics*. Addison Wesley Publ. Co., London.

Wiley EO. 1981. *Phylogenetics: The Theory and Practices of Phylogenetic Systematics for Biologists*. Columbia Univ. Press, USA.

ENT 602 INSECT PHYSIOLOGY AND NUTRITION 3 (2+1)

Objective

To impart knowledge to the students on detailed physiology of various secretory and excretory systems, moulting process, chitin synthesis, physiology of digestion, transmission of nerve impulses, nutrition of insects, pheromones etc.

Theory

UNIT I

Physiology and biochemistry of insect cuticle and moulting process. Biosynthesis of chitin, chitin-protein interactions in various cuticles, hardening of cuticle.

UNIT II

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.

UNIT III

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.

UNIT IV

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.

Practical

Preparation of synthetic diets for different groups of insects; rearing of insects on synthetic, semi-synthetic and natural diets; determination of co-efficient of utilization; qualitative and quantitative profile of bio-molecules: practicing analytical techniques for analysis of free amino acids of haemolymph; zymogram analyses of amylase; determination of chitin in insect cuticle; examination and count of insect haemocytes.

Learning outcomes

The scholars are expected to have thorough theoretical and practical knowledge of insect physiology that can be made use of in practical/ applied entomological aspects.

Understand how physiological systems in insects are integrated to maintain homeostasis.

Suggested Readings

Ananthkrishnan TN. (Ed.). 1994. *Functional Dynamics of Phytophagous Insects*. Oxford and IBH, New Delhi.

Bernays EA and Chapman RF. 1994. *Host-Plant Selection by Phytophagous Insects*. Chapman and Hall, London.

Kerkut GA and Gilbert LI. 1985. *Insect Physiology, Biochemistry and Pharmacology*. Vols. I-XIII. Pergamon Press, Oxford, New York.

Muraleedharan K. 1997. *Recent Advances in Insect Endocrinology*. Association for Advancement of Entomology, Trivandrum, Kerala.

Rockstein, M. 1978. *Biochemistry of Insects*, Academic Press.

Simpson, SJ. 2007. *Advances in Insect Physiology*, Vol. 33, Academic Press (Elsevier), London, UK.

ENT 605 BIO-INPUTS FOR PEST MANAGEMENT 3 (2+1)

Objective

To appraise the students with advanced techniques in handling of different bio-agents, modern methods of biological control and scope in cropping system-based pest management in agro-ecosystems.

Theory

UNIT I

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.

UNIT II

Bio-inputs: mass production of bio-pesticides, mass culturing techniques of bio-agents, insectary facilities and equipments, basic standards of insectary, viable mass-production unit, designs, precautions, good insectary practices.

UNIT III

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.

UNIT IV

Scope of genetically engineered microbes and parasitoids in biological control, genetics of ideal traits in biocontrol agents for introgressing and for progeny selections, breeding techniques of bio-control agents.

Practical

Mass rearing and release of some commonly occurring indigenous natural enemies; assessment of role of natural enemies in reducing pest populations; testing side effects of pesticides on natural enemies; effect of semio-chemicals on natural enemies, breeding of various bio-control agents, performance of efficiency analyses on target pests; project document preparation for establishing a viable mass-production unit /insectary; observation of feeding behavior acts of predatory bugs/ beetles.

Learning outcomes

Scholars are expected to learn the mass multiplication techniques of the more common and economically feasible natural enemies to be exploited under IPM programmes.

They should be able to guide entrepreneurs for establishing a viable mass-production unit /insectary.

Suggested Readings

Burges HD and Hussey NW. (Eds.). 1971. *Microbial Control of Insects and Mites*. Academic Press, London.

Coppel HC and James WM. 1977. *Biological Insect Pest Suppression*. Springer Verlag, Berlin.

De Bach P. 1964. *Biological Control of Insect Pests and Weeds*. Chapman and Hall, London.

Dhaliwal, GS and Koul O. 2007. *Biopesticides and Pest Management*. Kalyani Publ., New Delhi.

Gerson H and Smiley RL. 1990. *Acarine Biocontrol Agents – An Illustrated Key and Manual*. Chapman and Hall, New York.

Huffakar CB and Messenger PS. 1976. *Theory and Practices of Biological Control.*

Academic Press, London.

ENT 606 INSECTICIDE TOXICOLOGY AND RESIDUES 3 (2+1)

Objective

To acquaint the students with the latest advancements in the field of insecticide toxicology, biochemical and physiological target sites of insecticides, and pesticide resistance mechanisms in insects. Theory

UNIT I

Penetration and distribution of insecticides in insect systems; insecticide selectivity; factors affecting toxicity of insecticides. Modes of action of newer insecticide molecules; developments in bio-rational approaches; SPLAT; RNAi technology for pest management.

UNIT II

Biochemical and physiological target sites of insecticides in insects; developments in biorationals, biopesticides and newer molecules; their modes of action and structural – activity relationships; advances in metabolism of insecticides.

UNIT III

Joint action of insecticides; activation, synergism and potentiation.

UNIT IV

Problems associated with pesticide use in agriculture: pesticide resistance; resistance mechanisms and resistant management strategies; pest resurgence and outbreaks; persistence and pollution; health hazards and other side effects.

UNIT V

Pesticide residues and its significance and risk assessment; Estimation of insecticidal residues sampling, extraction, clean-up and estimation by various methods; maximum residue limits (MRLs) and their fixation; bound and conjugated residues, effect on soil fertility; insecticide laws and standards, and good agricultural practices.

Practical

Residue sampling, extraction, clean-up and estimation of insecticide residues by various methods; method validation, calculations and interpretation of data; biochemical and biological techniques for detection of insecticide resistance in insects; preparation of EC formulation using neem oil; Visit to residue laboratory.

Learning outcomes

Scholars are expected to be well versed with the latest technologies of bioassays, insecticide/ pesticide residue analysis and solving problems associated with insect resistance to insecticides.

Suggested Readings

Busvine JR. 1971. *A Critical Review on the Techniques for Testing Insecticides*. CABI, London.
Dhaliwal GS and Koul O. 2007. *Biopesticides and Pest Management*. Kalyani Publ., New Delhi.
Hayes WJ and Laws ER. 1991. *Handbook of Pesticide Toxicology*. Academic Press, New York.
Ishaaya I and Degheele (Eds.). 1998. *Insecticides with Novel Modes of Action*. Narosa Publ. House, New Delhi.
Matsumura F. 1985. *Toxicology of Insecticides*. Plenum Press, New York.
O' Brien RD. 1974. *Insecticides Action and Metabolism.* Academic Press, New York.
Perry AS, Yamamoto I, Ishaaya I and Perry R. 1998. *Insecticides in Agriculture and Environment*. Narosa Publ. House, New Delhi.
Prakash A and Rao J. 1997. *Botanical Pesticides in Agriculture*. Lewis Publ., New York.

ENT 608 ACAROLOGY 2 (1+1)

Objective

To acquire a good working knowledge of identification of economically important groups of mites up to the species level, a detailed understanding of the newer acaricide molecules and utilization of predators.

Theory

UNIT I

Comparative morphology of Acari, phylogeny of higher categories in mites, knowledge of commonly occurring orders and families of Acari in India. Diagnostic characteristics of commonly occurring species from families Tetranychidae, Tenuipalpidae, Eriophyidae, Tarsonemidae, Phytoseiidae, Bdellidae, Cunaxidae, Stigmaeidae, Pymotidae, Cheyletidae, Acaridae, Pyroglyphidae, Orthogalumnidae, Argasidae, Ixodidae, Sarcoptidae. Soil mites in India.

UNIT II

Management of economical important species of mites in agriculture, veterinary and public health; storage acarology.

UNIT III

Mites as vectors of plant pathogens; mode of action, structure-activity relationships of different groups of acaricides; problem of pesticide resistance in mites, resurgence of mites.

UNIT IV

Predatory mites, their mass production and utilization in managing mite pests, acaropathogenic fungi-identification, isolation and utilization.

Practical

Identification of commonly occurring mites up to species, preparation of keys for identification. Collection of specific groups of mites and preparing their identification keys. Rearing phytoseiid mites and studying their role in suppression of spider mites. Management of mite pests of crops using acaricides, phytoseiid predators, fungal pathogens etc.

Learning outcomes

Scholars should be able to identify major mite pests, their management and predatory mites that can be used in biological control.

They are also expected to learn the rearing techniques of predatory Phytoseiid mites.

Suggested Readings

Evans GO.1992. *Principles of Acarology*. CABI, London.

Gerson H and Smiley RL. 1990. *Acarine Bio-control Agents- An Illustrated Key and Manual*. Chapman and Hall, New York.

Gupta SK. 1985. *Handbook of Plant Mites of India*. Zoological Survey of India, Calcutta.

Krantz GW. 1970. *A Manual of Acarology*. Oregon State University Book Stores, Corvallis, Oregon.

Sadana GL. 1997. *False Spider Mites Infesting Crops in India*. Kalyani Publ. House, New Delhi.

ENT 609 MOLECULAR ENTOMOLOGY 2 (1+1)

Objective

To familiarize the students with DNA recombinant technology, marker genes, transgenic plants, and biotechnological advances in sericulture & apiculture.

Theory

UNIT I

Introduction to molecular biology; techniques used in molecular biology.

UNIT II

DNA and RNA analysis in insects- transcription and translocation mechanisms. DNA recombinant technology, identification of genes/nucleotide sequences for characters of interest. Genetic improvement of natural enemies. Cell lines, genetic engineering in baculoviruses, *Bt* and entomopathogenic fungi.

UNIT III

Genes of interest in entomological research- marker genes for sex identification, neuropeptides, JH esterase, St toxins and venoms, chitinase, CPTI; lectins and proteases. Transgenic plants for pest resistance and diseases.

UNIT IV

Insect gene transformation; biotechnology in relation to silkworms and honey bees; introduction of lectin genes for pest suppression; DNA finger printing for taxonomy and phylogeny. Genetic improvement of inebriate tolerance of natural enemies.

UNIT V

DNA-based diagnostics; insect immune systems in comparison to vertebrates; molecular basis of metamorphosis; Sf transgenic technology and implications; molecular biology of baculoviruses; insecticide resistance. Resistance management strategies in transgenic crops.

Practical

Isolation of DNA/RNA; purity determinations, purification of total DNA from animal tissues; base pair estimation; agarose gel electrophoresis; quantitative enzyme profile of alimentary canal; restriction mapping of DNA; demonstration of PCR, RFLP and RAPD techniques.

Learning outcomes

The scholars are expected to have mastered the molecular techniques applicable in entomological research like isolation of insect DNA, purification, DNA barcoding and utilizing these techniques in molecular systematics and biological control aspects.

Suggested Readings

Bhattacharya TK, Kumar P and Sharma A. 2007. *Animal Biotechnology*. 1st Ed., Kalyani Publication, New Delhi.

Hagedon HH, Hilderbrand JG, Kidwell MG and Law JH. 1990. *Molecular Insect Science*.

Plenum Press, New York.
Hoy MA. 2003. *Insect Molecular Genetics: An Introduction to Principles and Applications*. 2nd Ed. Academic Press, New York.
Oakeshott J and Whitten MA. 1994. *Molecular Approaches to Fundamental and Applied Entomology*. Springer Verlag.
Rechcigl JE and Rechcigl NA. 1998. *Biological and Biotechnological Control of Insect Pests.* Lewis Publ., North Carolina.
Roy U and Saxena V. 2007. *A Hand Book of Genetic Engineering*. 1st Ed., Kalyani Publ., New Delhi.
Singh BD. 2008. *Biotechnology (Expanding Horizons).* Kalyani Publ., New Delhi.
Singh P. 2007. *Introductory to Biotechnology*. 2nd Ed. Kalyani Publ., New Delhi.

ENT 610 INTEGRATED PEST MANAGEMENT 2 (2+0)

Objective

To acquaint the students with recent concepts of integrated pest management; surveillance and data base management; successful national and international case histories of integrated pest management, non-conventional tools in pest management.

Theory

UNIT I

Principles of sampling and surveillance, database management and computer programming; simulation techniques, system analysis and modeling.

UNIT II

Study of case histories of national and international programmes, their implementation, adoption and criticism; global trade and risk of invasive pests; updating knowledge on insect outbreaks and their management.

UNIT III

Genetic engineering and new technologies- their progress and limitations in IPM programmes, deployment 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' real time situation.

UNIT IV

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.

Learning outcomes

Having gained sufficient experience in advanced studies of IPM the scholars should be able to independently frame IPM schedules for major crops/ cropping ecosystems (cereal / pulse crop / oilseed crop based/ vegetable crop based agro-ecosystems).

Suggested Readings

Dhaliwal GS and Arora R. 2003. *Integrated Pest Management – Concepts and Approaches*. Kalyani Publ., New Delhi.
Dhaliwal GS, Singh R and Chhillar BS. 2006. *Essentials of Agricultural Entomology*. Kalyani Publ., New Delhi.
Flint MC and Bosch RV. 1981. *Introduction to Integrated Pest Management*. Springer, Berlin.
Koul O and Cuperus GW. 2007. *Ecologically Based Integrated Pest Management*. CABI, London.
Koul O, Dhaliwal GS and Curperus GW. 2004. *Integrated Pest Management –Potential, Constraints and Challenges*. CABI, London.
Maredia KM, Dakouo D and Mota-Sanchez D. 2003. *Integrated Pest Management in the Global Arena.* CABI, London.
Metcalf RL and Luckman WH. 1982. *Introduction to Insect Pest Management*. John Wiley and Sons, New York.
Norris RF, Caswell-Chen EP and Kogan M. 2002. *Concepts in Integrated Pest Management*. Prentice Hall, New Delhi.
Pedigo RL. 1996. *Entomology and Pest Management*. Prentice Hall, New Delhi.
Subramanyam B and Hagstrum DW. 1995. *Integrated Management of Insects in Stored Products*. Marcel Dekker, New York.

b. **Name of the programme: Masters Programmes**

Semester No.	Term No.	Course No.	Credits	Title of the course offered by the department
I	I	ENT-501	2+1=3	Insect Morphology
I	I	ENT-502	2+1=3	Insect Anatomy and Physiology
I	I	ENT-505	2+1=3	Biological Control of Insect Pests and Weeds
II	II	ENT-506	2+1=3	Toxicology of Insecticides
II	II	ENT-508	2+0=2	Concepts of Integrated Pest Management
II	II	ENT-510	2+1=3	Pests of Horticultural &Plantation Crops
I	I	ENT-511	1+1=2	Post Harvest Entomology
III	I	ENT-519	2+1=3	Molecular Approaches in Entomology
III	I	ENT-591	0+1=1	Master's Seminar
-	-	ENT-599	0+30=30	Master's Research

Course Curricula and syllabi:

Course Contents
M.Sc. (Ag) in Plant Protection-Entomology

ENT 501 INSECT MORPHOLOGY 3 (2+1)

Objective

To acquaint the students with the external morphology of the insect's body and the functioning of various body parts.

Theory

UNIT I

External Morphology: Definition, Principles, Scope and Importance of Insect Morphology. Insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation, general body organization of insects.

Head- Origin, structure and modification; mouthparts, antennae, their types and functioning; 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.

UNIT II

Insect sense organs (mechano-, photo- and chemo- receptors); organogenesis at pupal stage; insect defense; chaetotaxy; morphological traits in relation to forensic entomology.

UNIT III

Types of immature stages in insect orders, morphology of egg, nymph/larva and pupa, identification of different immature stages of crop pests and stored product insects. Comparative study of life history strategies in hemimetabola and holometabola, immature stages as ecological and evolutionary adaptations, significance of immature stages for pest management.

Practical

Dissection of mouth parts of different insects, preparation of permanent mounts of different body parts and their appendages of taxonomic importance including male and female genitalia; dissection of genitalia. Types of immature stages in insects; their collection, rearing and preservation. Identification of immature insects to orders and families, in endopterygote orders *viz.*, Diptera, Lepidoptera, Hymenoptera and Coleoptera using key.

Learning outcomes

Students are expected to have a complete understanding of the comparative morphology of the external features of insects that can be utilized in taxonomy, ecology and applied entomology.

Suggested Reading:

Chapman, RF. 1998. *The Insects: Structure and Function*. Cambridge Univ. Press, Cambridge.
Richards, OW and Davies, RG. 1977. *Imm's General Text Book of Entomology*. 10th Ed.
Chapman and Hall, London.
Snodgross, RE. 1993. *Principles of Insect Morphology*. Cornell Univ. Press, Ithaca.
Tembhore, D.B. 2000. *Modern Entomology*, Himalaya Publishing House, Mumbai.
Chu, HF. 1992. *How to Know Immature Insects*. William Brown Publication, Iowa.
Peterson, A. 1962. *Larvae of Insects*. Ohio University Press, Ohio.

Stehr, FW. 1998. *Immature Insects*. Vols. I, II. Kendall Hunt Publication, Iow

ENT 502 INSECT ANATOMY AND PHYSIOLOGY 3 (2+1)

Objective

To impart knowledge about the anatomy and physiology of insect body systems; nutritional physiology; and their applications in entomology.

Theory

UNIT I

Scope and importance of insect physiology; physiology of integument, moulting, chemistry of cuticle, biosysthesis of chitin; growth, hormonal control, metamorphosis and diapause; pheromone secretion, transmission, perception and reception.

UNIT II

Physiology and mechanism of digestion, circulation, respiration, excretion, reproduction, secretion (exocrine & endocrine glands) and nerve impulse transmission in insects.

UNIT III

Importance of insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular microorganisms and their role in physiology; artificial diets.

Practical

Latest analytical techniques for analysis of free amino acids of haemolymph; determination of chitin in insect cuticle; examination and count of insect haemocytes; preparation and evaluation of various diets; consumption, utilization and digestion of natural and artificial diets.

Learning outcomes

Students are expected to have a thorough understanding of insect growth and development, physiology of exoskeleton, endoskeleton and different organ systems; action and role of hormones, pheromones, physiology of nutrition and its application.

Suggested Reading

Chapman RF.1998. *Insects: Structure and Function*. ELBS Ed., London.
Duntson PA. 2004. *The Insects: Structure, Function and Biodiversity*. Kalyani Publ., New Delhi.
Kerkut GA and Gilbert LI. 1985. *Comprehensive Insect Physiology, Biochemistry and Pharmacology*. Vols. IXIII. Pergamon Press, New York.
Simpson, SJ. 2007. *Advances in Insect Physiology*, Vol. 33, Academic Press (Elsevier), London, UK.
Wigglesworth VB.1984. *Insect Physiology*. 8 th Ed. Chapman and Hall, New York.

ENT 505 BIOLOGICAL CONTROL OF INSECT PESTS AND WEEDS 3 (2+1)

Objective

To train the students with theory and practice of biological control, mass production techniques and field evaluation of various biological control agents like parasitoids, predators and various entomopathogenic microorganisms.

Theory

UNIT I

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation. History of insect pathology, infection of insects by bacteria, fungi, viruses, protozoa, rickettsiae, spiroplasma and nematodes.

UNIT II

Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action. Biological control of weeds using insects. Epizootiology, symptomatology and etiology of diseases caused by the above and the factors controlling these. Defense mechanisms in insects against pathogens.

UNIT III

Mass production of quality bio-control agents- techniques, formulations, economics, field release/application and evaluation.

UNIT IV

Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies and packing- Quarantine regulations, biotechnology in biological control. Semiochemicals in biological control.

Practical

Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers. Development of insectaries, their maintenance. Visits to bio-control laboratories to learn rearing

and mass production (techniques of available bioagent in area wise locations) of egg, egg-larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds. Packaging of bioagents. Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

Learning outcomes

Students are expected to have a good understanding of the role of natural enemies in managing pest populations below those causing economic damage.

Learn the techniques for mass production of quality bio-agents and their optimal use in IPM.

Suggested Readings

Burges HD and Hussey NW. (Eds). 1971. *Microbial Control of Insects and Mites*. Academic Press, London.

De Bach P. 1964. *Biological Control of Insect Pests and Weeds*. Chapman and Hall, New York.

Dhaliwal GS and Arora R. 2001. *Integrated Pest Management: Concepts and Approaches*. Kalyani Publ., New Delhi.

Gerson H and Smiley RL. 1990. *Acarine Biocontrol Agents – An Illustrated Key and Manual*. Chapman and Hall, New York.

Huffaker CB and Messenger PS. 1976. *Theory and Practices of Biological Control.* Academic Press, London.

Ignacimuthu SS and Jayaraj S. 2003. *Biological Control of Insect Pests*. Phoenix Publ., New Delhi.

Saxena AB. 2003. *Biological Control of Insect Pests.* Anmol Publ., New Delhi.

Van Driesche and Bellows TS. Jr. 1996. *Biological Control*. Chapman and Hall, New York.

ENT 506 TOXICOLOGY OF INSECTICIDES 3 (2+1)

Objective

To orient the students with structure and mode of action of important insecticides belonging to different groups, development of resistance to insecticides by insects, environmental pollution caused by toxic insecticides and their toxicological aspects.

Theory

UNIT I

Definition and scope of insecticide toxicology; history of chemical control; pesticide use and pesticide industry in India.

UNIT II

Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature; categorization of insecticides on the basis of toxicity – criteria for bees, beneficial insects and other insects in general; structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrozoles, insect growth regulators, microbials, botanicals, new promising compounds/ new insecticide molecules; nanopesticides; drawbacks of insecticide abuse.

UNIT III

Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides-synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity. bioassay definition, objectives, criteria, factors, problems and solutions.

UNIT IV

Insecticide metabolism; insect-pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence.

UNIT V

Insecticide residues, their significance and environmental implications; procedures of insecticide residue analysis. Status of Pesticide residue in India. Insecticide Act, registration procedures, label claim, and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.

Practical

Insecticide formulations and mixtures; laboratory and field evaluation of bio-efficacy of insecticides; bioassay techniques; probit analysis; evaluation of insecticide toxicity. Toxicity to beneficial insects. Pesticide appliances. Working out doses and concentrations of pesticides. Procedures of residue analysis.

Learning outcomes

Students are expected understand the concept of toxicity, bio-efficacy, insecticide formulations, modes of action of insecticides, estimation of insecticide residues and have significant know-how about the functioning of various types of spray equipments.

Suggested Readings

Chattopadhyay SB. 1985. *Principles and Procedures of Plant Protection*. Oxford and IBH, New Delhi.
Gupta HCL.1999. *Insecticides: Toxicology and Uses*. Agrotech Publ., Udaipur.
Ishaaya I and Degheele (Eds.). 1998. *Insecticides with Novel Modes of Action*. Narosa Publ. House, New Delhi.
Matsumura F. 1985. *Toxicology of Insecticides*. Plenum Press, New York.
Perry AS, Yamamoto I, Ishaaya I and Perry R. 1998. *Insecticides in Agriculture and Environment*. Narosa Publ. House, New Delhi.
Prakash A and Rao J. 1997. *Botanical Pesticides in Agriculture*. Lewis Publication, New York.
Pedigo, L.P. and Marlin, E. R. 2009. *Entomology and Pest Management*, 6th Edition, Pearson Education Inc., Upper Saddle River, New Jersey 07458, U.S.A.
Dovener, R.A. Mueninghoff, J.C. and Volgar, G.C. 2002. Pesticides formulation and delivery systems: meeting the challenges of the current crop protection industry. ASTM, USA
Dodia, D.A. Petel, I.S. and Petal, G.M. 2008. *Botanical Pesticides for Pest Management*. Scientific Publisher (India), Jodhpur.
Ishaaya, I. and Degheele, D. 1998. *Insecticides with Novel Modes of Action: Mechanism and Application*. Norosa Publishing House, New Delhi.
Mathews G.A. 2002. *Pesticide Application Methods*. 4th Ed. Intercept. UK.
Otto, D. and Weber, B. 1991. *Insecticides: Mechanism of Action and Resistance*. Intercept Ltd., U.K.
Prakash, A. David, B.V., J. Rao., Srivastava, S.K., Berliner, J. and Totan Adak. *Synthetic Pesticides*. AZRA Publications.
Roy, N.K. 2006. *Chemistry of Pesticides*. Asia Printograph Shahdara Delhi.

ENT 508 CONCEPTS OF INTEGRATED PEST MANAGEMENT 2 (2+0)

Objective

To familiarize the students with principles of insect pest management, including concept and philosophy of IPM. Train students in computation of ETL and implementing IPM programmes.

Theory

UNIT I

History, origin, definition and evolution of various terminologies. Importance of resistance, principles, classification, components, types and mechanisms of resistance. National and international level crop protection organizations; insecticide regulatory bodies; synthetic insecticide, bio-pesticide and pheromone registration procedures; label claim of pesticides – the pros and cons.

UNIT II

Concept and philosophy, ecological principles, economic threshold concept and economic consideration. Insect host plant relationships; theories and basis of host plant selection in phytophagous insects.

UNIT III

Tools of pest management and their integration- legislative, quarantine regulations, cultural, physical and mechanical methods; semiochemicals, biotechnological and bio-rational approaches in IPM. Pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost-benefit ratios and partial budgeting; case studies of successful IPM programmes. ITK-s in IPM, area-wide IPM and IPM for organic farming; components of ecological engineering with successful examples.

UNIT IV

Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses; global and Indian scenario of crop losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world.

Learning outcomes

Students are expected to have significant knowledge of IPM concepts, estimation of losses due to insect pests, computation of ETL, EIL and should be able take management decisions.

Suggested Readings

Dhaliwal GS and Arora R. 2003. *Integrated Pest Management – Concepts and Approaches*. Kalyani Publ., New Delhi.
Horowitz AR and Ishaaya I. 2004. *Insect Pest Management: Field and Protected Crops*. Springer, New Delhi.
Ignacimuthu SS and Jayaraj S. 2007. *Biotechnology and Insect Pest Management*. Elite Publ., New Delhi.

Pedigo RL. 2002. *Entomology and Pest Management*. 4th Ed. Prentice Hall, New Delhi.
Norris RF, Caswell-Chen EP and Kogan M. 2002. *Concepts in Integrated Pest Management*. Prentice Hall, NewDelhi.
Subramanyam B and Hagstrum DW. 1995. *Integrated Management of Insects in Stored Products.* Marcel Dekker, New York.

ENT 510 PESTS OF HORTICULTURAL AND PLANTATION CROPS 3 (2+1)

Objective

To impart knowledge on major pests of horticultural and plantation crops regarding the extent and nature of loss, seasonal history, their integrated management.

Theory

Systematic position, identification, distribution, host range, bionomics and seasonal abundance, nature and extent of damage and management of insect pests of various crops.

UNIT I

Fruit Crops- mango, guava, banana, jackfruit, papaya, pomegranate, litchi, grapes, ber, fig, citrus, sapota, aonla, jamun, avocado, dragon fruit, custard apple, tamarind, pineapple, apple, peach and other temperate fruits.

UNIT I

Vegetable crops- tomato, potato, sweet potato, radish, carrot, beetroot, cole crops (cabbage, cauliflower, knolkhol), French beans, chow-chow, brinjal, okra, all gourds (pumpkin, bottle gourd, bitter gourd, ridge gourd, sponge gourd, cucumber etc.), drumstick, leafy vegetables (amaranthus, spinach, fenugreek) etc.

UNIT III

Plantation crop- coffee, tea, rubber, coconut, oil palm, arecanut, cashew, cocoa, betelvine etc.; Spices and Condiments- pepper, cinnamon, cardamom, clove, nutmeg, chillies, turmeric, ginger, onion, garlic, curry leaf, cumin, coriander etc.

UNIT IV

Ornamental (croton, rose, gerbera, chrysanthemum, carnation, tuberose, aster, jasmine), medicinal (*aloe vera*, shatavari, ashwagandha, sarpagandha) and aromatic plants and pests in polyhouses/protected cultivation.

Practical

Collection and identification of important pests and their natural enemies on different crops; study of life history of important insect pests and non-insect pests.

Learning outcomes

Students are expected to acquire knowledge of insect pests of horticultural, medicinal and plantation crops, their nature of damage, life history traits and effective management.

Suggested Readings

Atwal AS and Dhaliwal GS. 2002. *Agricultural Pests of South Asia and their Management*. Kalyani Publ., New Delhi.
Butani DK and Jotwani MG. 1984. *Insects and Vegetables*. Periodical Expert Book Agency, New Delhi.
Dhaliwal GS, Singh R and Chhillar BS. 2006. *Essential of Agricultural Entomology*. Kalyani Publ., New Delhi.
Srivastava RP.1997. *Mango Insect Pest Management*. International Book Distr., Dehra Dun.
Verma LR, Verma AK and Goutham DC. 2004. *Pest Management in Horticulture Crops: Principles and Practices*. Asiatech Publ., New Delhi.

ENT 511 POST HARVEST ENTOMOLOGY 2 (1+1)

Objective

To focus on requirement and importance of grain and grain storage, to understand the role of stored grain pests and to acquaint with various stored grain pest management techniques for avoiding losses in storage.

Theory

UNIT I

Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses in toto vis-à-vis total production of food grains in India. Scientific and socio-economic factors responsible for grain losses. Concept of seed vault.

UNIT II

Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology,

nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes.

UNIT III

Ecology of insect pests of stored commodities/grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage- types of storage structures i.e., traditional, improved and modern storage structures in current usage. Ideal seeds and commodities' storage conditions.

UNIT IV

Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Role of bird pests and their management. Control of infestation by insect pests, mites and microorganisms. Preventive measures-Hygiene/sanitation, disinfestations of stores/receptacles, legal methods. Curative measures-Non-chemical control measures- ecological, mechanical, physical, cultural, biological and

engineering. Chemical control- prophylactic and curative- Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Insecticide resistance in stored product pests and its management; recent advances (MAS, PPP, HS) in storage pest management; integrated approaches to stored grain pest management.

Practical

Collection, identification and familiarization with the stored grains/seed insect pests and nature of damage caused by them; detection of hidden insect infestation in stored food grains; estimation of uric acid content in infested produce; estimation of losses in stored food grains; determination of moisture content in stored food grains; familiarization of storage structures, demonstration of preventive and curative measures including fumigation techniques; treatment of packing materials and their effect on seed quality. Field visits to save grain campaign, central warehouse and FCI warehouses and institutions engaged in research or practice of grain storage like CFTRI, IGSMRI, Hapur etc. (only where logistically feasible).

Learning outcomes

Students are expected to acquire knowledge of pestiferous insects, mites, rats and birds affecting stored produce, their nature of damage, life history traits and effective management.

Detection of insect infestation and familiarization with different storage structures.

Learning preventive and curative measures to manage infestation in storage houses.

Suggesting Readings

Hall DW. 1970. *Handling and Storage of Food Grains in Tropical and Subtropical Areas*. FAO. Agricultural Development Paper No. 90 and FAO, Plant Production and Protection Series No. 19, FAO, Rome.

Jayas DV, White NDG and Muir WE. 1995. *Stored Grain Ecosystem.* Marcel Dekker, New York.

Khader V. 2004. *Textbook on Food Storage and Preservation*. Kalyani Publ., New Delhi.

Khare BP. 1994. *Stored Grain Pests and Their Management*. Kalyani Publ., New Delhi.

Subramanyam B and Hagstrum DW. 1995. *Interrelated Management of Insects in Stored Products.* Marcel Dekker, New York.

ENT 519 MOLECULAR APPROACHES IN ENTOMOLOGY 3 (2+1)

Objective

To acquaint students the latest techniques used in molecular biology.

Theory

UNIT I:

Introduction to molecular biology, techniques used in molecular biology.

UNIT II:

DNA recombinant technology, identification of genes/nucleotide sequences for traits of interest, techniques of interest in plants and microbes.

UNIT III:

Genes of interest in entomological research- marker genes for sex identification, peptides and neuropeptides, JH esterase, St toxins and venoms, chitinase, Plant-derived enzyme inhibitors, protease inhibitors, trypsin inhibitors, α-amylase inhibitors, lectins, terepenes and terpenoids; genes of non-plant origin, *Bacillus thuringiensis* endotoxins, mode of action of cry genes, classification and properties, synthetic *Bt* toxin genes, Other toxin genes, genes derived from entomophagous viruses, transgenic plants for pest resistance.

UNIT IV:

Genetically engineered microbes and parasitoids in biological control-Genetic engineering in baculoviruses and fungal biocontrol agents for greater efficacy against insect pests. Effects of transgenic plants on pest biology and development, resistance management strategies in transgenic crops, molecular mechanism of insecticide resistance.

UNIT V:

Genetic-based methods for agricultural insect pest management-insect pest management through sterile insect technique and release of insects carrying a dominant lethal gene. Methods and application of insect transgenesis, transgenics in silkworm and honeybees. Molecular tools for taxonomy and phylogeny of insect-pests, DNA-based diagnostics. Nano technology and its application.

Practical

Isolation of DNA/RNA; agarose gel electrophoresis of DNA, quantification of DNA by spectrophotometric and agarose gel analysis, PCR amplification of mitochondrial cytochrome oxidase subunit I gene (cox1) and 16S rRNA gene, cloning of PCR amplicons in standard plasmid vectors for sequencing, confirmation of the insert, miniprep of recombinant plasmid DNA, BLAST analysis and multiple sequence alignment of the sequence with sequences already available in GenBank; isolation of host plant proteins, SDS-PAGE of the isolated proteins.

Learning outcomes

The students are expected to be well versed with the basic techniques used in molecular biology.

Suggested Readings

Bhattacharya TK, Kumar P and Sharma A. 2007. *Animal Biotechnology*. 1st Ed., Kalyani Publication, New Delhi.

Hagedon HH, Hilderbrand JG, Kidwell MG and Law JH. 1990. *Molecular Insect Science*. Plenum Press, New York.

Hoy M.A. 2003. *Insect Molecular Genetics: An Introduction to Principles and Applications*. 2nd Ed. Academic Press, New York.

Oakeshott J and Whitten MA. 1994. *Molecular Approaches to Fundamental and Applied Entomology*. Springer Verlag.

Rechcigl JE and Rechcigl NA. 1998. *Biological and Biotechnological Control of Insect Pests*. Lewis Publ., North Carolina.

Roy U and Saxena V. 2007. *A Hand Book of Genetic Engineering*. 1st Ed., Kalyani Publ., New Delhi.

Singh B.D. 2008. *Biotechnology (Expanding Horizons).* Kalyani Publ., New Delhi.

Singh P. 2007. *Introductory to Biotechnology*. 2nd Ed. Kalyani Publ., New Delhi

c. **Name of the Programme: Bachelor Programmes**

Semester No.	Term No.	Course No.	Credits	Title of the course offered by the department
II		ENTO- 121(New)	1+1=2	Fundamentals of Entomology
III		ENTO 232 (New)	1+1=2	Insect Ecology & Integrated pest Management
IV		ENTO 243(New)	1+1=2	Pests of Horticultural Crops and their Management
V		ENTO 354(New)	1+1=2	Pests of crops and stored grain pests and their management
VI		ENTO 365(New)	1+1=2	Management of Beneficial Insects
VII		SR/ENTO 476	0+1=1	RAWE & AIA Rural Agricultural work experience and Argro-industrial attachment
VIII		ELM ENTO 486	0+10=10	Mass production of bio-agents and bio-pesticides
B.Sc. (Hons.) Hort.				
II		H/ENTO- 121(New)	2+1=3	Fundamentals of Entomology
III		H/ENTO 232 New	2+1=3	Insect pests of Vegetable, ornamental and spices crops
IV		H/ENTO 243 (New)	2+1=3	Insect Pest of Fruit, Plantation, Medicinal and Aromatic Crops
V		H/ENTO 354 (New)	1+1=2	Apiculture, Sericulture and Lac culture
VI		H/NTO 365 (New)	1+1=2	Nematode Pests of Horticultural Crops and their Management
		RHWE ENT-471 & IND (H) 475	0+2=2	Integrated pest and disease management
B.Sc. (Hons.) Forestry				
V		F/ENTO 351	1+1=2	Forest Entomology

Course Curricula and syllabi of each subject:

Course :	ENTO 121		**Credit:**	2(1+1)	**Semester-II**
Course title:	Fundamentals of Entomology				

Syllabus

Theory Part-I

Introduction and History of Entomology in India.Definitions: Insect, Entomology, Agricultural Entomology. Classification of phylum Arthropoda up to classes.Relationship of class Insecta with other classes of Arthropoda.Insect Dominance. Economic importance of insects: Harmful, Beneficial and productive insects. Premier institutes concerned with Entomology. **Morphology:-**Insect integument: structure and functions. Cuticular appendages and processes.Moulting: Definition and steps in moulting. Body segmentation: Structure of head, thorax and abdomen. Insect head capsule: Important sclerites and sutures. Positions of head.Structure and modifications of insect antennae, mouth parts, legs and wings (wing venation, wing coupling apparatus). Structure of thorax and abdomen: segmentation, appendages and processes, pregenital and post genital appendages and structure of male and female genital organ. Metamorphosis: Definition and types of metamorphosis with examples and its significance. Insect Diapause: Definition and example, Seasonal adaptations in insects: aestivation, hibernation and quiescence: Definitions; Insect egg: General structure, types of egg with examples (at least one). Types of larva and pupa with examples.Structure and functions of digestive, nervous, circulatory, respiratory, excretory, secretary and reproductive systems in insects.Types of reproduction in insects.Sensory organs sound producing organs in insects

Part-II

Systematics: Definitions: Taxonomy, Systematics, Binomial nomenclature, Order, Family, Genus, Species, Subspecies, Biotype. Binomial nomenclature: Definition and Rules. Classification of Class Insectaupto Orders. Important orders: Important distinguishing / taxonomic characters of orders with families of agricultural importance with examples.Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae;

Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae,

Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Lophopidae, Lacciferidae; Neuroptera:Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae,Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera:Coccinellidae,Chrysomelidae,Cerambycidae,Curculionidae,Bruchid ae,Scarabaeidae;Hymenoptera:Tenthridinidae,Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae,Muscidae, Tephritidae.

Practical:

Methods of collection and preservation of insects.External features of Cockroach.Types of insect antennae, mouthparts (dissection) and legs.Wing venation, types of wings and wing coupling apparatus.Types of insect larvae and pupae.Dissection of digestive system, Central nervous system, male and female reproductive systems in insects (Cockroach/Grasshopper). Distinguishing/taxonomic characters of orders: Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance with examples.

Suggested Readings:

1) Chapman, R. F. – The Insects : Structure and Functions
2) David, B. V. and T. Kumarswami – Elements of Economic Entomology
3) Marc J. Klowden- Physiological Systems in Insects
4) Pant N.C. and SwarajGhai – Insect Physiology and Anatomy
5) Nayar, K. K.; Anathkrishanan T.N. and B.V.David – General and Applied Entomology
6) Richards O.W. and R.G. Davies – Imms' General Text Book of Entomology –Vol.I&II
7) Patton R.L.- Introductory Insects Physiology
8) Wigglesworth – Principles of Insects Physiology
9) Metcalf and Flint – Destructive and Useful Insects; their habits and control.

Course :	ENTO 232		**Credit:**	2(1+1)	**Semester-III**
Course title:	Insect Ecology and Integrated Pest Management				

Syllabus

Theory

Part I: Insect Ecology: Definition, scope, environment and its components. Effect of abiotic factors – temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents.Effect of biotic factors – food competition, natural and environmental resistance.Concepts of balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem.

Part II: Pest surveillance,it's types and pest forecasting. Categories of pests.Natural and applied pest control.IPM – Introduction, Importance, Scope, Concepts, Principles, Tools and Limitations of IPM.Host plant resistance, cultural, mechanical, physical and legislative methods of pest control.Biological- parasitoids, predators and transgenic plant pathogens such as bacterial, fungi and viruses.Chemical control– importance, hazards and limitations.Classification of insecticides, toxicity of insecticides and formulations of insecticides.Examples of important insecticide groups - botanical insecticides – Neem based products.Cyclodienes, Organophosphates, Carbamates, Synthetic pyrethroids, Novel insecticides, Pheromones, Nicotinyl insecticides, Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic lactones, Oxadiazines, Thioureaderivaties, Pyridine azomethines, Pyrrolesetc, Nematicides, Rodenticides, Acaricides and Fumigants. Insecticides Act 1968- important provisions. Application techniques of spray fluids.Phytotoxicity of insecticides.Symptoms of poisoning, first aid and antidotes. Recent methods of pest control. Repellants, antifeedants, hormones, attractants, gamma radiation and genetic control.

Practical:

Visit to meteorological observatory / automatic weather reporting station. Terrestrial and pond ecosystems of insects.Behaviour of insects and orientation (repellency, stimulation, deterancy). Distribution patterns of insects, sampling techniques for the estimation of insect population and damage. Pest surveillance through light traps, pheromone traps and field incidence. Practicable IPM practices- Mechanical and physical methods, Cultural and biological

methods. Chemical control – Insecticides and their formulations.Pesticide appliances, insecticide application techniques, calibration of plant protection appliances, Calculation of doses/concentrations of insecticides.Compatibility of pesticides and Phytotoxicity of insecticides IPM case studies–Cotton, Sugarcane, Mango/ Citrus/Pomegranate.Identification of common phytophagous mites and their morphological characters Identification of rodents, bird pests, their damage and management.Vermiculture – visit to vermiculture unit,Biopesticides used in IPM with mass multiplication of NPV and Entomopathogenic fungi.

Suggested Readings:

1) Metcalf, R.L. and Luckman W.H. 1982. Introduction to Insect Pest Management.Wiley Inter Science publishing, New York.
2) G.S. Dhaliwaland RameshArora 2001. Integrated Pest Manageemnt. Concepts and Approaches. Kalyani publishers, New Delhi.
3) Larry P. Pedigo. 1991. Entomology and Pest Management. Larry P. Pedigo. 1991.Mac Millan publishing company, New York.
4) Yazdani G. S. and Agarwal M.L. 1979. Elements of Insect Ecology. Naroji publishing house, New Delhi.
5) Hufakar C.V. Ecological Entomology
6) Clark L.R., Gier P.W., Rughas R.D. and Marris R.F. The Ecology and Insect Population.
7) Odum E.P. Fundamentals of Insect Ecology
8) Gupta S. K. Plant Mites of India, 1995

Course :	ENTO 243		**Credit:**	2(1+1)	**Semester-IV**
Course title:	Pest of Horticultural Crops and their Management				

Syllabus

Theory

General – economic classification of insects. Ecology and insect-pest management with reference to fruit, plantation crops. Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, vegetable, ornamental, spices and condiments crops like citrus, mango, grapevine, pomegranate, guava, fig, banana, papaya, custard apple, ber, sapota, aonla, coconut, arecanut, cashew, apple, tea, coffee, brinjal, okra, tomato, chilli, potato, sweet potato, cruciferous, cucurbitaceous, colocassia and moringa, turmeric, ginger, onion, garlic, coriander, curry leaf, black pepper, rose, gerbera and carnation.

Definition of Nematode and Nematology, Characteristics of plant parasitic nematodes. Important symptoms caused by nematodes with examples. Integrated Nematode 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: Fruit Crops, Vegetable Crops, Plantation, Spices and Condiments.

Suggested Readings:

1) A.S. Atwal and G.S. Dhaliwal: Agricultural Pests of South Asia and their Management
2) B.V. David and V.V. Rammurthy: Elements of Economic Entomology
3) Pedigo L.P.: Entomology and Pest Management.
4) VenuGopalRao: Insect Pest Management
5) S. Pradhan: Insect pests of crops
6) V.B. Awasthi: Introduction of General and Applied Entomology.
8) Dr. K.D.Upadhyay, Dr. KusumDwived : A text book of Plant Nematology
9) P. Parvatha Reddy: Plant Nematology
10) Swarup G. Deogupta D.R. and Gill J.S: Nematode pest management

Course :	ENTO 354		**Credit:**	2(1+1)	**Semester-V**
Course title:	Pests of Crops and Stored Grain and their Management				

Syllabus

Theory

General account on nature and type of damage by different arthropods pests: Scientific name, order, family, host range, distribution, biology, nature of damage and management of insect pests of **Cereals-Rice -** Paddy stem borer, Green leaf hopper, Brown plant hopper, White backed plant hopper, Gall midge, Paddy grasshopper, Blue beetle, Caseworm, Armyworm, Gundhi bug, Hispa, Leaf folder. **Sorghum –** Shoot fly, Stem borer, Aphids, Delphacids, Grasshopper, Earhead midge, Earhead caterpillars. **Maize –** Shoot fly, Stem borer, Armyworm, Cob earworm. **Bajra –** Shoot fly, Blister beetle. **Wheat –** Stem borer, Aphids, Termites. **Minor millets. Pulses – Pigeon pea**, **chickpea, mungbean, urdbean, cowpea, pea. Pigeon pea** – Pod borer, Plume moth, Pod fly, Spotted pod borer, Leaf webber, Mites. **Chickpea –** Gram pod borer, Aphids, Cutworm. **Mung and Urdbean** – Aphids, Leaf eating caterpillar, Semilooper, Pod borer.**Cowpea and Pea** – Aphids, Blue butterfly, Pod borer. **Oilseeds -Groundnut** – Leaf miner, Hairy caterpillar, Tobacco leaf eating caterpillar, Aphids, Thrips, White grub, Pod sucking bug. **Castor** – Semilooper, Capsule borer, Jassids, Tobacco leaf eating caterpillar. **Sunflower** – Capitulum borer, Hairy caterpillar, Jassids, Thrips, Whitefly, Stem borer. **Safflower-** aphids, Capitulum borer, Guzia weevil.**Mustard –** Aphids, Sawfly, Leaf webber. **Linseed –** Gall fly. **Soybean –** Stem fly, Girdle beetle, Leaf miner, Tobacco leaf eating caterpillar, Whitefly, Semilooper, Gram pod borer. **Sesamum –**Til hawk moth, Gall fly, leaf eating caterpillar.**Niger –**Semilooper, Gram pod borer. **Fiber crops –Cotton –** Aphids, Jassids, Thrips, Whitefly, Mealy bugs, Spotted bollworm, American bollworm, Pink bollworm, Tobacco leaf eating caterpillar, Leaf folder, Semilooper, Red cotton bug, Dusky cotton bug, Grey weevil. **Sunhemp and Mesta** – Sunhemp hairy caterpillar. **Sugarcane crops** - Early shoot borer, Internode borer, Top shoot borer, Whitefly, Pyrilla, Woolly aphids, Mealy bug, Scale insect, Termites, White grub. **Non-insect pests of above crops –** Crabs, Snails and Slugs, millepedes, Mites, Rats and squirrels.**Stored grain pests -** Biology and damage of Primary and Secondary pests. Primary store grain pests- Internal feeders - Rice weevil, lesser grain borer, pulse beetle and Angoumois grain moth. External feeders - khapra beetle, Indian meal moth. Secondary store grain pests – Rust red flour beetle, Saw toothed grain beetle, Long headed beetle. Primary and Secondary store grain pests - Rice moth. Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management.Preventive and curative methods of stored grain pests. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different type of damage.Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce. **Field crops: Cereals-** Rice, Sorghum, Maize, Bajra, Wheat and Miner millets. **Pulses-** Pigeon pea, Chickpea, Mung bean, Urd bean, Cowpea and Pea.**Oilseeds:** Groundnut, Castor, Sunflower,Safflower, Mustard, Linseed, Soybean, Sesamum and Niger. **Fibre:** Cotton, Sunhemp and Mesta. **Sugar crop:** sugarcane. Non insect pests of field crops.Store grain pests. Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management.Preventive and curative methods of stored grain pests. Storage structure and methods of grain storage and fundamental principles of grain store management.

Suggested Readings:

1) A.S. Atwal and G.S. Dhaliwal :Agricultural Pests of South Asia and their Management
2) B.V. David and V.V. Rammurthy: Elements of Economic Entomology
3) Manishekharan and Sudarrajan : Pest Management in Field Crops.
4) Pedigo L.P. : Entomology and Pest Management.
5) VenuGopalRao: Insect Pest Management.
6) B.P. Khare : Storage Entomology

Course :	ENTO 365		**Credit:**	2(1+1)	**Semester-VI**
Course title:	Management of Beneficial Insects				

Syllabus

Theory

Importance of beneficial insects.

Bee keeping, pollinating plants and their cycle, 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.
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. Pests and diseases of silkworm, their 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 pollinators, weed killer and scavengers with their importance.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemiesand disease.Bee pasturage, bee foraging and communication.
Types of silkworm, voltinism and biology of silkworm, mulberry cultivation, mulberryvarieties 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 researchand training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.

Suggested Readings:

1) Singh, S., 1975.Bee keeping in India – ICAR, New Delhi., 214p.
2) Sunita, N.D, Guled, M.B, Mulla, S.R and Jagginavar, 2003, Beekeeping, UAS Dharwad
3) Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur.
4) Singh, D. and Singh, D.P. 2006. A Hand Book of Beekeeping, Agrobios (India).
5) Paul DeBach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University Press; 2 edition (27 June 1991)
6) Y.A. Shinde and BR Patel. Sericulture in India
7) Tribhuwan Singh. Principles and Techniques of Silkworm Seed Production, Discovery publishing House Pvt. Ltd
8) M.L. Narasaiah. Problems and Prospects of Sericulture.discovery publishing House Pvt. Ltd.
9) Ganga, G. and SulochanaChetty, J. 1997. An Introduction to Sericulture (2nd Edn.). Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
10) Krishnaswamy, S. (Ed). 1978. Sericulture Manual - Silkworm Rearing. FAO Agril. Services bulletin, Rome.
11) Glover, P.M. 1937. Lac Cultivation in India. Indian Lac Research Institute, Ranchi.
12) Jolly, M.S. 1987. Appropriate Sericulture Techniques. International Centre for Training and Research inTropical Sericulture, Mysore, 209.
13) K.P. Srivastava. A Text Book on Applied Entomology. Vol. I & II, Kalyani Publishers, Ludhiana
14) B.R. David and V.V. Ramamurthy. Elements of Economic Entomology, 7thEdn. Namrutha Publications, Chennai Horticulture B. SC. Courses :

Course No.: H/ ENTO-121 **Title: Fundamentals of Entomology**

Credits: (2+1) 3 **Semester: II**

Theory:

Introduction and History of Entomology in India including contribution of scientists in brief. Definitions: Insect, Entomology, Horticultural Entomology. Classification of phylum Arthropoda up to classes. Relationship of class Insecta with other classes of Arthropoda. Insect Dominance. Economic importance of insects: Harmful, Beneficial and productive insects. Premier institutes concerned with Entomology. Insect Integument: Structure and Functions. Cuticular appendages

and processes. Moulting: Definition and steps in moulting. Body segmentation: Structure of head, thorax and abdomen. Insect Head Capsule: Important sclerites and sutures. Positions of head. Structure and modifications (with examples) of insect antennae, mouth parts, legs and wings (wing venation, wing coupling apparatus with examples). Structure of thorax and abdomen: segmentation, appendages and processes, pregenital and post genital appendages and structure of male and female genital organ.Metamorphosis: Definition and Types of metamorphosis with examples. Post embryonic development: Eclosion. Insect egg: General structure, Types of egg with examples (at least one). Types of larva and pupa with examples.Structure and functions of digestive, nervous, circulatory, respiratory, excretory, secretary and reproductive system in insects.Types of reproduction in insects.Sensory and Sound producing organs.

Systematics: Definitions: Taxonomy, Systematics, Binomial nomenclature, Order, Family, Genus, Species, Subspecies, Biotype. Binomial nomenclature: Definition and Rules. Classification of Class Insecta upto Orders. Important orders: Important distinguishing/taxonomic characters of orders. Families of horticultural importance with examples. Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Lophopidae, Lacciferidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae.
Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Plant mites: Morphological/general features of phytophagous mites, important families with examples (Tetranychidae, Tarsonomidae, Tenuipalpidae and Eriophyidae).

Practical:

Methods of collection and preservation of insects including immature stages. Identification of important insect. External features of Cockroach/Grasshopper. Study of Types of insect antennae, mouthparts (dissection) and legs.Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae. Study and Dissection of digestive system in insects (Cockroach (caterpillar
) /Grasshopper). Study and Dissection of Central nervous system in insects (Cockroach/Grasshopper). Study and Dissection of male and female reproductive systems in insects (Cockroach/Grasshopper). Study of distinguishing/taxonomic characters of orders: Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera. Families of horticultural importance with examples.

Textbooks:

- Richards O.W. and R.G. Davies – Imms' General Text Book of Entomology –Vol. I and II

Reference Books:

- Chapman, R. F. – The Insects : Structure and Functions
- David, B. V. and T. Kumarswami – Elements of Economic Entomology
- Marc J. Klowden- Physiological systems in Insects
- Pant N.C. amd Swaraj Ghai – Insect Physiology and Anatomy
- Nayar, K. K.; Anathkrishanan T.N. and B.V.David – General and Applied Entomology
- Patton R.L.- Introductory Insects Physiology
- Wigglesworth – Principles of Insects Physiology
- Metcalf and Flint – Destructive and Useful Insects; their habits and control.
- Evan G.O -Principles of Acarology.
- Krantz G.W – A manual of Acarology.

e-reading: **http://ecourses.iasri.res.in/**

Course NO. H/ENTO-365 **Course title : Nematode Pests of Horticultural Crops and their management**

Credits : 1 + 1 = 2 **Semester : VI**

Theory:

History of development of Nematology-Definition, economic importance. General characteristics of plant parasitic nematodes. Nematode general morphology, taxonomy and biology. Classification of nematodes. Symptomatology. Control of important plant parasitic nematodes of Fruit crops: Pomegranate, Grapes, Fig, Citrus, Strawberry, Cashewnut, Vegetable crops: Tomato, Brinjal, Okra, Chilli and Cucurbits etc. Tuber and bulb crops: Potato, Sweet potato, Carrot, Radish and onion; Ornamental crops: Chrysanthemum, Rose, Tuberose, Gladiolus, Carnation and Gerbera; Spices: Turmeric, Ginger, Cardamom and Clove; Plantation Crops: Banana, Area nut and Coconut.

Practical:

Methods of sampling.Extraction of nematodes from soil and plant parts.Counting and estimation of plant parasitic nematodes. Nematode killing, fixing and preparation of temporary and permanent mounts. Nematicides and their use. Collection and preservation of 20 plant species/parts damaged by plant parasitic nematodes.

No.	Name of book	Name of the author and publication
Text books:		
1.	A Textbook of Plant Nematology	Upadhyay K.D. and Dwivedi K. 1997, Amman Publishing House, Meerut.
References books:		
1.	Plant nematode control	Whitehead A.G., CAB International Wallingford U.K.
2.	Nematode pest management	Swarup G. Deogupta D.R. and Gill J.S.

3.	An appraisal of Eco-FriendlyApproaches	Nematological Society of India IARI,New Delhi

4.	A Treatise on phytonematology	P. Parvatha Reddy Agri. Cole Publishing Academy New Delhi
5.	Plant Nematology	P. Parvatha Reddy

Course No.: H/ENTO-243 Course Title: Insect Pests of Fruit, Plantation,

Medicinal and Aromatic Crops

Credits: (2+1) 3 Semester: IV Syllabus (Theory):

General – economic classification of insects. Ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops. Pest survey, surveillance & forecasting. 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 citrus, mango, grapevine, pomegranate, guava, fig, banana, papaya, custard apple, ber, sapota, jamun, aonla, jackfruit, coconut, areca nut, oil palm, cashew, cacao, tea, coffee, rubber, betelvine, apple, pear, peach, plum, almond, cinchona, senna, neem, hemp, belladonna, pyrethrum, isabgol,dhatura,wildbrinjal, sweetflag, safedmusli, shatavari, ashwangandha,sarpgandha, opium, tephrosia, mint, dioscoria, comphor, costus, crotalaria, jasmine, patchouli, vetiver, davana, kevara, citronella, geranium, lemongrass, palmarose, eucalyptus and sandalwood . 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 residual limits (MRLs).

Syllabus (Practical):

Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect – pests affecting citrus, mango, grapevine pomegranate, guava, fig, banana, papaya, custard apple, ber, sapota, jamun, aonla, jackfruit, coconut, areca nut, oil palm, cashew, cacao, tea, coffee, rubber, betel vine, apple, pear, peach, plum, almond, cinchona, senna, neem, hemp, belladonna, pyrethrum, isabgol, dhatura, wild brinjal, sweet flag, safedmusli, shatavari, ashwangandha, sarpgandha, opium, tephrosia, mint, dioscoria, comphor, costus, crotalaria, jasmine, patchouli, vetiver, davana, kevara, citronella, geranium, lemongrass, palmarose, eucalyptus and sandalwood. Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of pests of stored fruits, plantation, medicinal and aromatic plants.

Textbooks:

- David B V and Kumarswami, T, 1982. Elements of Economic Entomology. Popular Book Department, Madras, 536p.
- Ramnivas Sharma : Identification and management of horticulture pest.

Reference Books:

- 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. V. Alford. Pest of fruit crops. A. M. Ranjith. Identification and management of Horticulturalpest.
- Rachna and Bennakumari. Pest management and residual analysis in horticultural crop
- K. P. Srivastav and Y. S. Ahawat. Pest management in citrus.
- Fryer : Insect pest of fruit crops
- S. Atwal. Agricultural pests of south Asia and their management.
- Mark Vernon Slinger land and C. R. Crosby. Manual of fruit insects.
- Metcalf, R.Land Luckman,W.H.1982. Introduction to Insect pest management.WileyInterSciencePublishing,NewYork
- Butani, D.K.1984. Insects and Fruits. Periodical Expert Book Agency, NewDelhi
- ***e-reading:*** **http://ecourses.iasri.res.in/**

Course No: H/ENTO- 354 Course Title: Apiculture, Sericulture and Lac Culture

Credits: (1+1) 2 **Semester: V**

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 theirhosts, 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, hardiness and shell ratio. Defective cocoons and stifling of cocoons.Uses of silkand 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 rain fed 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:

Text books:

- K.P.Srivastava .A Text Book on Applied Entomology Vol.I&II. , Kalyani Publishers,Ludhiyana

Reference books:

- 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. CambridgeUniversity Press; 2 edition (27 June 1991)
- Y.A. Shinde and B.R. 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 SulochanaChetty, 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. Servicesbulletin, 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 andResearchinTropicalSericulture,Mysore,209.
- B.R. David and V.V.Ramamurthy. Elements of Economic Entomology, 7th Edition. Namrutha Publications, Chennai

e-reading: **http://ecourses.iasri.res.in/**

Course No. : H/ENTO 232 *Title: Insect Pests of Vegetable, Ornamental and* **Spice Crops**

Credits : (2+1) 3 *Semester-III*

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.

Reference books

- Ayyar, T.V.R. 1963, Hand Book of Economics Entomology for South India. Govt. PressMadras.
- David, B.V. 2006. Elements of Economic Entomology. Popular Book Depot, Chennai.
- Butani, D.K. and M.G.Jotwani, 1984. Insects of Vegetables. Periodical Expert Book Agency,New Delhi.
- Srivastava, K.P. and D.K.Butani, 1998. Pest Management in Vegetables (Part I & II) ResearchPeriodicals and Book Publishing House, India.

e-reading: **http://ecourses.iasri.res.in/**

Course No. : F/ENTO 351 Title : Forest Entomology
Credits : 2 (1+1) Semester : V

Theory

Definitions, importance and scope of Entomology. Division of Entomology. Defination of Insects and position in animal kingdom. Import characters of phylum Arthopoda and class insecta and classification of class insecta. Insect relation to man, External morphology of generalized insect. Immature stages of Insect (Egg, Larvae/Nymph and Pupae), Metamorphosis in Insect, History and importance of Forest Entomology in India. Methods and principles of pest control; mechanical, physical, silvicultural, legal, biological and chemical. Principles and techniques of Integrated pest management in forest. Classification of forest pests: types of damages and symptoms; factors for outbreak of pests. Nature of damage and management: Insect pests of forest seeds, forest nursery and standing trees of timber yielding species of natural forest (Tectona, Dalbergia spp., Sal, Sandal Wood, Ain, Gmelina, Pines), Plantation forest species (Eucalyptus, Bamboo, Casuriana). Insect pests of freshly felled trees, finished timbers and their management.

Practical

Study of distinguishing characters of phylum Arthropoda. Study of morphology. Mouth parts and appendages of coackroach. Study of different types of insects. Study of immature stages of insects. Study of Anatomy of Cockroach. Study of insect collection, pinning, labeling and preservation. Study of representatives of insect orders and families pertaining to forest trees. Study of insecticides and their formulations. Study of plant protection appliances

Suggested readingText book

Forest Entomology (1984) Coulson, R.N. and Witter, J.H. John Wily Pub. N.York
Principles of Forest Entomolgy (1952) -Grahm S.A.
Forest and Shade tree Entomology-Anderson, R.E.
Timber Pest and Diseases, Monograph No.5-Jack Kepe
Pest and Diseases of Forest Plantation Trees-Brown, F.G. and Laurie, M.U.
Text Book Entomolgy-A.D.Imms.

Reference book :

Destructive and Useful insects-Metcalf R.L. and Flint W.P.
General and Applied Entomology- Nayar K.K.
Anatomy and Physiology- Pant N.C. and Swaraj Ghai
Tree Protection (1988) Edited Gupta V.K. and Sharma N.K. Published by Society of Tree Scientist, Solan

4. Infrastructure

a. **Laboratories : 02 UG Lab and 01 PG Lab, Biocontrol Lab, Insect museum**

b. **Name of the important instruments/facilities**: Laminar airflow, Autoclave, Microscopes, Refrigerator

c. **Activities:** Provide the details such as the different educational and research activities that can be performed in the laboratory

1. ELP on mass production of bioagents and biofertilizers is run in the biocontrol laboratory.
2. Detection of insect and study of different morphological and anatomical systems in UG and PG laboratories.
3. Insect collection and display of different insects.

a. **Photographs:** Photographs of the important instruments preferably with students using theses instruments/equipments or being demonstrated.

5. Faculty

a. **Academic staff:** Assistant Professor and above with the details of the staff as given below

Name of the Faculty	Dr. V. N. Jalgaonkar (Agril. Entomology)
Post Held	Head
Date of Birth	04/02/1976
Qualification	Ph.D. (Ag.) Entomology
Area of Specialization	IPM, Climate Change, A-Z
Experience (Years)	19 Years
Research Projects guided Ph.D. M.Sc.	 01 04
Present area of research	IPM, Climate Change
Contact details Land line No. Mobile Fax Email	 9422487393,8233487393 - vinayakjalgaonkar@gmail.com vnjalgaonkar@dbskkv.ac.in/hodento@dbskkv.ac.in

Name of the Faculty	Dr. (Mrs.) K. V. Naik (Agril. Entomology)
Post Held	Professor (CAS)
Date of Birth	26th October, 1964
Qualification	Ph.D. (Ag.) Entomology
Area of Specialization	Pest Management
Experience (Years)	27 Years 01 Month 18 Days
Research Projects guided Ph.D. M.Sc.	 01 18
Present area of research	Pest Management
Contact details Land line No. Mobile Fax Email	- - 9421229878/7875637787 - kumudvaik@yahoo.in/kvnaik@dbskkv.ac.in

Name of the Faculty	Dr. M.S. Karmarkar (Agril. Entomology)
Post Held	Associate Professor (CAS)
Date of Birth	10th February, 1973
Qualification	Ph.D. (Ag.) Entomology
Area of Specialization	Economic Entomology
Experience (Years)	19 Years
Research Projects guided Ph.D. M.Sc.	 01 09
Present area of research	Integrated Pest Management
Contact details Land line No. Mobile Fax Email	- - 9422447994 - Makarnadkarmarkar73/mskarmarkar@dbskkv.ac.in

Name of the Faculty	Dr. B. D. Shinde (Agril. Entomology)
Post Held	Associate Professor (CAS)
Date of Birth	01st June 1974
Qualification	Ph.D. (Ag.) Entomology
Area of Specialization	Economic Entomology
Experience (Years)	19 Years
Research Projects guided Ph.D. M.Sc.	1.CROPSAP-Rice & HORTSAP-Mango 2.Organic Farming Research & Training Centre 3.Improvement of red banana through mutation breeding and biotechnological intervention 01 06
Present area of research	Organic and Natural Farming
Contact details Land line No. Mobile Fax Email	- - 8806340855/8007823060 - bdshinde4@gmail.com bdshinde@dbskkv.ac.in

Name of the Faculty	Dr. S. N. Kale (Agril. Entomology)
Post Held	Assistant Professor
Date of Birth	08/07/1978
Qualification	Ph.D. (Ag.) Entomology
Area of Specialization	Biological control
Experience (Years)	18 years
Research Projects M.Sc. students guided	Isolation, identification and mass multiplication of entomopathogenic fungi 04
Present area of research	Biological control
Contact details Land line No. Mobile Fax Email	- - 7378833010 - sameerakl@yahoo.com snkale@dbskkv.ac.in

Name of the Faculty	Dr. R. S. Mule (Agril. Entomology)
Post Held	Assistant Professor
Date of Birth	25th July, 1974
Qualification	Ph.D. (Ag.) Entomology
Area of Specialization	Insect Pest Management
Experience (Years)	13 Years, 5 Months, 11 Days
Research Projects guided Ph.D. M.Sc.	- 02
Present area of research	IPM, Applied Entomology
Contact details Land line No. Mobile Fax Email	- - 7378833010 - sameerakl@yahoo.com/ snkale@dbskkv.ac.in

6. Instructional Farm : Nil

a. **Location:**

b. **Infrastructure:** such as irrigation facilities (source: well, farm pond, canal, irrigation system: drip, sprinkler etc), water measurement, polyhouse, shednet house, farm equipments, fertigation unit, rain out shelters etc.

c. **Activities:** Provide the details such as the different educational, research and demonstration activities that can be performed on the farm

d. **Photographs:** Photographs of the important facilities preferably with students using those or being demonstrated.

7. Research Activities and Achievements (including projects)

Variety/Implements released: Provide the details of the Variety/Implements released in Joint Agresco or at State or National level along with relevant photographs

a. Variety/Implements released: Provide the details of the Variety/Implements released in Joint Agresco or at State or National level along with relevant photographs

b. **Research Recommendations:** Provide the details of the research recommendations approved in Joint Agresco along with relevant photographs

१) नारळावरील काळया डोक्याच्या अळीच्या एकात्मिक कीड नियंत्रणासाठी खालील उपाययोजना अंतर्भूत करावी. (२००४)

- किडीचा प्रादूर्भाव जास्त असेल तर खालची २—३ जास्त पाने कापून उपद्रवग्रस्त पाने कापून जाळून टाकावीत.
- काळया डोक्याच्या अळीच्या जैविक किड नियंत्रणासाठी *गोनियोझस निफॅटिडस* हे परोपजिवी किटक ३५०० प्रती हेक्टर या प्रमाणात बागेत सोडावेत.

- काळया डोक्याच्या अळीचा प्रादुर्भाव जास्त असेल तर गरजेनुसार कार्बारिल ०.१ टक्के किंवा एन्डोसल्फान ०.०४ टक्के किंवा डायक्लारोव्हॉस ०.०५ टक्के या पैकी कोणत्याही एका किटकनाशकाची फवारणी झाडावर करावी. फवारणी करताना पानाच्या खालच्या बाजूस होईल याची दक्षता घ्यावी. फवारणी केल्यानंतर १५ दिवसांनी परोपजीवी कीटक बागेत सोडावेत.
- वरील उपाय योजना करण्यापूर्वी माडावरील सर्व तयार नारळ काढून घ्यावेत आणि ४५ दिवसांपर्यंत नारळ किंवा शहाळी काढू नयेत.

२) नारळावरील गेंडया भुंग्याच्या एकात्मिक किड नियंत्रणासाठी खालील उपाय योजना अंतर्भूत करावी. (२००४)
- बागेतील मेलेल्या माडांची खोडे, कुजलेला पालापाचोळा इत्यादी जाळून नष्ट करावा किंवा त्यांची व्यवस्थित विल्हेवाट लावावी कारण अशाच ठिकाणी गेंडया भुंग्यांची पिढी तयार होते.
- भुंग्याचा उपद्रव जास्त असतांना म्हणजे जून ते सप्टेंबरमध्ये माडाच्या सुऱ्यास उपद्रव झाला असतांना किंवा त्यातून ताजा भूसा बाहेर येतांना दिसत असल्यास त्यामध्ये तारेचा हूक घालावा व भुंगे बाहेर काढावेत.
- नारळ बागेत ०.६ X ०.६ X ०.६ मिटर आकाराचे एकूण १० खडड्े प्रती हेक्टरी खोदावेत. त्यामध्ये शेणखत भरुन ठेवावे. अशा खडड्यांमधून सापडणाऱ्या अळया दर दोन महिन्याने एकत्र करुन माराव्यात किंवा खडड्यांवर कार्बारिल ०.१ टक्के या प्रमाणात फवारणी करावी.
- गेंडया भुंग्याच्या नियंत्रणासाठी बॅक्युलो विषाणूग्रस्त भुंगे ३०—३७ प्रती हेक्टरी या प्रमाणात सोडावेत.

३) फोरेट १० जी २५ ग्रॅम, एन्डोसल्फान ४ टक्के पावडर ४० ग्रॅम, मिथील पॅराथिऑन पावडर २ टक्के ४० ग्रॅम, लिंडेन १.ण टक्के पावडर ४० ग्रॅम या मात्रा वाळूमध्ये मिश्रण करुन माडाच्या सुऱ्यात मार्च, जून, सप्टेंबर व डिसेंबर महिन्यात क्रमश: टाकल्या असत्या गेंडा भुंग्याचा प्रादुर्भाव कमी होतो असे आढळले. (२००४)

४) आंब्यावरील तुडतुडयांच्या नियंत्रणासाठी थायोमेथॉक्झाम २५ डब्लु.जी. १ ग्रॅम प्रति लिटर या प्रमाणे गरजेनुसार फवारणी करावी. (२००६)

५) काजूवरील खोडकिडीच्या प्रभावी नियंत्रणासाठी लागण झालेल्या झाडातील अळी १५ मि.मि. पटाशीच्या सहाय्याने काढून क्लोरपायरीफॉस २० टक्के प्रवाही १० मि.ली. प्रती लिटर पाण्यात मिसळून या द्रावणाची किडग्रस्त झाडाच्या भागावर भिजवण करावी व उर्वरीत द्रावण झाडाच्या खोडालगत मुळात ओतावे. या करीता प्रती झाडास ५ लिटर दावण वापरावे. (२००६)

६) काजुवरील ढेकण्या आणि फुलकीडीच्या नियंत्रणासाठी ०.००३ टक्के लॅम्डा सायहॅलोथ्रीन या कीटकनाशकाची नवीन पालवी आल्यानंतर व फळधारणा झाल्यानंतरच्या फवारणीकरिता पर्यायी कीटकनाशक म्हणून शिफारस करण्यात येत आहे. (२००७)

७) चिकुवरील बी पोखरणाऱ्या अळीच्या नियंत्रणासाठी प्रोफेनोफॉस ४० टक्के १ मिली/लिटर पाणी किंवा लॅम्डासायहॅलोथ्रिन १ मिली/लिटर पाणी किंवा डेल्टामेथ्रिन २.८ टक्के १ मिली प्रती लिटर पाणी या किटकनाशकांच्या फवारण्या कराव्यात. पहिली फवारणी पावसाळा संपताच करावी व त्यानंतर एक महिन्याच्या अंतराने तीन फवारण्या कराव्यात. वरील पैकी किटकपाशकांच्या दोन वेळा फवारणी करु नये. (२००८)

८) हवामानावरुन काजुवरील ढेकण्या कीडीच्या प्रादुर्भावाचे पूर्वानुमान काढण्याचे समिकरण (२००८)

वाय १ = ०.०१५२७१ क्ष १ — ०.०९३ क्ष २ + ०.०३०३२१ क्ष ३ + ०.०३००१९ क्ष ४ — ०.१६४७८ क्ष ५ — ०.२१६३४ क्ष ६ — ०.०९३७३ क्ष ७ + १०.३१७१३	**आर स्क्वेअर = ०. ८९१**

वाय १ = काजुवरील वेंगुर्ला ४ या जातीवरील अपेक्षित फुलकीडींची संख्या
क्ष १ = पाऊस (मि.मी.)
क्ष २ = सकाळची आद्रता (%)
क्ष ३ = दुपारची आद्रता (%)
क्ष ४ = किमान तापमान अंश सेल्सिअस
क्ष ५ = कमाल तापमान अंश सेल्सिअस
क्ष ६ = वाऱ्याचा वेग (ताशी किलोमीटर)
क्ष ७ = सूर्यप्रकाशाचे तास

९) हवामानावरुन काजुवरील फुलकीडीच्या प्रादुर्भावाचे पूर्वानुमान काढण्याचे समिकरण (२००८)

वाय १ = ०.०९००९५ क्ष १ — ०.००३५९ क्ष २ + ०.७०१३७ क्ष ३ + ०. ०८४६७२ क्ष ४ — २.६८७१६ क्ष ५ — २.८७४०१ क्ष ६ — ०.४११२१ क्ष ७ + १७३.२१८५	**आर स्क्वेअर = ०.८३०**

वाय १ = काजुवरील वेंगुर्ला ४ या जातीवरील अपेक्षित फुलकीडींची संख्या
क्ष १ = पाऊस (मि.मी.)
क्ष २ = सकाळची आद्रता (%)

क्ष ३ = दुपारची आद्रता (%)
क्ष ४ = किमान तापमान अंश सेल्सिअस
क्ष ५ = कमाल तापमान अंश सेल्सिअस
क्ष ६ = वाऱ्याचा वेग (ताशी किलोमीटर)
क्ष ७ = सूर्यप्रकाशाचे तास

१०) काजुवरील खोडकिडीच्या नियंत्रणासाठी प्रादुर्भित भागामधील छिद्रातून भुसा काढून १० मिली क्लोरपासरीफॉस + ५० मिली रॉकेल किंवा १० मिली डी.डी.व्ही.पी. + ५० मिली रॉकेल प्लॅस्टीक पाईपच्या सहाय्याने ओतावे व सदर छिद्र ओल्या मातीच्या सहाय्याने बुजवावे.(२००८)

११) नारळाच्या सोंडया भुंग्याच्या नियंत्रणासाठी बागेच्या पूर्वेस आणि पश्चिमेस याप्रमाणे प्रत्येकी एक रक्षक—२ सापळे प्रती हेक्टरी लावावेत त्यातील अमिष (पी.डी.बी.सी.) दर तीन महिन्यांनी बदलावे आणि भुंग्यांनरा अधिक प्रभावीपणे आकर्षित करण्यासाठी प्रत्येक सापळयात ५ मिली अननसाचा कृत्रिम गंध वापरावा. (२००८)

१२) सुरणाचे गोगलगाईपासून संरक्षण करण्यासाठी पंधरा दिवस अगोदर मुख्य पिकाभोवती मिश्रीकंदाची संरक्षक ओळ म्हणून लागवड करावी आणि खबरदारीची उपाय म्हणून मिश्रीकंद बियाणाची भुकटी अधिक रिठा बियांचा अर्क प्रती लीटर पाण्यात ५० ग्रॅम घेवून त्याच्या द्रावणाची फवारणी मुख्य पिकावर करावी. (२००८)

१३) आंब्यावरील तुडतुडयांच्या नियंत्रणासाठी क्लोथियानिडीन ५० टक्के पाण्यात मिसळणारे दाणेदार किटकनाशक १.२ ग्रॅम प्रति १० लिटर पाण्यात मिसळून मोहोर येण्यापूर्वी फक्त एकदाच फवारण्याची शिफारस करण्यात येत आहे.(२००९)

१४) चिकुवरील कळी पोखरणाऱ्या अळीच्या नियंत्रणासाठी इमामेक्टीन बेन्झोएट ५ एस.जी. ०.४५ ग्रॅम प्रति लिटर पाण्यात मिसळून पिकावर ५० टक्के फुले आल्यानंतर फवारणी करण्याची शिफारस करण्यात येत आहे. गरज भासल्यास दुसरी फवारणी एक महिन्याच्या अंतराने करावी.(२००९)

१५) आंब्यावरील फुलकिडीच्या व्यवस्थापनासाठी फुलकिडीचा प्रादुर्भाव दिसून येताच ०.०११३ टक्के तीव्रतेचे स्पिनोसॅड (२.५ मिली प्रति १० लिटर पाणी) किटकनाशकाची पहिली फवारणी व गरज भासल्यास ०.०५ टक्के तीव्रतेचे थायमिथोक्झॅम २५ डब्ल्युडीजी (२ ग्रॅम प्रति १० लिटर पाणी) या किटकनाशकाची दुसरी फवारणी करावी.

१६) नारळावरील कोळीच्या व्यवस्थापनासाठी ॲझाडिरॅक्टीन ०.०३ टक्के + सूक्ष्म अन्नद्रवे मिश्रण हे मिश्र किटकनाशक २५० मिली २० लिटर पाण्यात मिसळून दर तीन महिन्यांच्या अंतराने माडाच्या अळयामध्ये ओतावे.

१७) नारळावरील सोंडया भुंग्याच्या व्यवस्थापनासाठी फेरोमोन गंध सापळयांचा वापर करावा.

१८) मिरची पिकावरील फुलकिडीच्या नियंत्रणासाठी गोमुत्र १० टक्के आणि ॲझाडिरॅक्टीन १०००० पी.पी.एम. ३ मि.ली. प्रति लिटर पाण्यातून आलटून पालटून लागवडीनंतर सात दिवसांच्या अंतराने १५ दिवसापासून साडेतीन महिन्यापर्यंत फवारण्या कराव्यात.

१९) रताळयावरील सोंडया भुंग्याच्या व्यवस्थापनासाठी दोन ओळी रताळे व एक ओळ झेंडू याप्रमाणे लागवड करावी.

२०) आंब्यावरील तुडतुडयांच्या व्यवस्थापनासाठी ४ ई.सी. तिव्रतेचे लॅम्डा सायहॅलोथ्रीन ६ मि.ली. किंवा ४० ई.सी. ट्रायझोफॉस १० मि.ली. किंवा मिश्र किटकनाशक १ ई.सी. डेल्टामेथ्रीन + ३५ ई.सी. ट्रायझोफॉस १० मि.ली. किंवा ५० ई.सी. क्लोरपायरीफॉस + ५ ई.सी. सायपरमेथ्रीन १० मि.ली किंवा ४० ई.सी. प्रोफेनोफॉस + ४० ई.सी. सायपरमेथ्रीन या मिश्र कीटकनाशकांची फवारणीसाठी शिफारस करण्यात येत आहे.

२१) आंब्यावरील खोडकीडीच्या व्यवस्थापनासाठी आंब्याच्या खोडातून/फांदीतून बाहेर आलेल्या ताज्या भुशावरुन खोडकीडग्रस्त झाड ओळखावे व प्रादुर्भावग्रस्त ठिकाणी खोल छिद्र पाडून त्यामध्ये क्लोरपायरीफॉस (२० ई.सी.) १० मि.ली. किंवा डीडीव्हीपी (७६ ई.सी.) १० मि.ली + २० मि.ली. रॉकेलचे मिश्रण छोटया प्लॅस्टीकच्या नळीच्या सहाय्याने ओतावे व छिद्र ओल्या चिखलाने बंद करावे.

२२) रताळयावरील सोंडया भुंग्याच्या व्यवस्थापनासाठी पीक लागवडीनंतर एक महिन्याने *बिव्हेरीया बॅसिअॅना* १.५ पा. मि. ६.७५ कि.ग्रॅ. प्रति हेक्टर वाळूत मिसळून १:१ या प्रमाणात जमिनीमध्ये सरीतून वापरण्याची शिफारस करण्यात येते.

२३) भातावरील सुरळीतील अळीच्या व्यवस्थापनासाठी कार्बोफ्युरॉन ३ टक्के दाणेदार कीटकनाशक १६.५ कि.ग्रॅ. प्रती हेक्टर या प्रमाणात किडीचा प्रादुर्भाव, आर्थिक नुकसान पातळीपर्यंत आढळल्यास जमिनीत टाकावे व गरज भागल्यास दुसरा हप्त्यानंतर १५ दिवसांनी द्यावा अशी शिफारस करण्यात येते.

२४) चिकू बागेमध्ये चिकू कळी पोखरणाऱ्या पतंगाच्या सर्वेक्षणासाठी निळया रंगाच्या प्रकाश सापळयाची शिफारस करण्यात येते.

२५) काळया डोक्याच्या अळीच्या प्रभावी जैविक कीड नियंत्रणासाठी परोपजीवी कीटक गोनियोझसची निर्मिती करताना सदर कीटक काळया डोक्याच्या अळीने प्रादुर्भित केलेली पाने, विष्ठा व खाल्लेला भाग यासोबत तीन दिवस प्रयोगशाळेमध्ये वाढविण्याची शिफारस करण्यात येत आहे.

२६) कणगर कंदपिकावरील सुत्रकृमींच्या व्यवस्थापनासाठी कणगरांच्या दोन ओळींमध्ये झेंडू पिकाची लागवड करावी किंवा निंबोळी पेंड १०० ग्रॅम प्रती खडडा या प्रमाणात लागवडीच्यावेळी देण्याची शिफारस करण्यात येत आहे.

२७) नारळावरील इरिओफाईड कोळीच्या प्रभावी नियंत्रणासाठी नारळ बागेची स्वच्छता, बागेतील काडीकचऱ्यापासून गांडूळखत निर्मिती करुन ते माडांना घालणे, माडाच्या आळयात हिरवळीच्या खतांचा वापर, रासायनिक खतांची मात्रा (युरिया ३ किलो, सिंगल सुपर फॉस्फेट ३ किलो व म्युरेट ऑफ पोटश ३.५ किलो) वर्षातून तीन वेळा विभागून (जून, ऑक्टोबर आणि फेब्रुवारी) देणे, नारळाच्या आळयाध्ये ओलावा टिकविण्यासाठी नारळाच्या शेंडया पुरणे आणि झावळयांचे आच्छादन करणे, उन्हाळयामध्ये पाण्याचे योग्य व्यवस्थापन, याचबरोबर ॲझाडिरॅक्टीन ५ टक्के ७.५ मिली अधिक ७.५ मिली पाणी वर्षातून तीन वेळा (ऑक्टोबर—नोव्हेंबर, जानेवारी—फेब्रुवारी, मार्च—मे) मुळावाटे द्यावे.

२८) भातावरील खोडकिडीच्या व्यवस्थापनासाठी ॲसिफेट ७५ टक्के पाण्यात विरघळणारी भुकटी १२.५ ग्रॅम प्रती १० लिटर पाण्यामधून किडीचा प्रादुर्भाव आर्थिक नुकसान पातळीपर्यंत (५ टक्के मेलेले फुटवे किंवा १ मादी पतंग/चौ.मी.) आढळल्यास फवारणीची शिफारस करण्यात येते.

२९) नारळावरील इरिओफाईड कोळीच्या एकात्मिक व्यवस्थापनासाठी शिफारशीत नत्र, स्फुरद आणि पालाश, ॲझाडिरॅक्टीन, बोरॉन, मॅगनिज, मॉलिब्डेनम या सुक्ष्म अन्नद्रव्ययुक्त गोळया ४.५ किलो प्रति माड प्रति वर्ष याप्रमाणे वर्षातून तीन वेळा जून, ऑक्टोबर आणि फेब्रुवारीमध्ये विभागून देण्याची शिफारस करण्यात येत आहे.

३०) आंब्यावरील तुडतुडयांच्या नियंत्रणासाठी बुप्रोफेझीन २५ एस.सी. २० मिली प्रति १० लिटर पाण्यात मिसळून फवारण्याची शिफारस करण्यात येत आहे.

३१) काजूवरील बोंड व बी पोखरणाऱ्या अळीच्या नियंत्रणासाठी डायक्लोरोव्हॉस ७६ टक्के प्रवाही १० मिली प्रती १० लिटर पाण्यातून फवारणी करण्याची शिफारस करण्यात येत आहे.

३२) भात पिकावरील खोडकिडा व पाने गुंडाळणारी अळीच्या नियंत्रणासाठी कारटाप हायड्रोक्लोराईड ४ टक्के दाणेदार १८.७५ किलो किंवा क्लोरॅन्ट्रीनीलीपोल ०.४ टक्के दाणेदार १० किलो किंवा फिप्रोनिल ०.३ टक्के दाणेदार २०.८ किलो प्रती हेक्टर या प्रमाणात पहिला मात्रा रोपवाटीकेमध्ये २—३ दिवस पुर्नलागवडीपूर्वी आणि दुसरी मात्रा पुर्नलागवडीनंतर ३०—३५ दिवसांनी आवश्यकतेनुसार देण्याची शिफारस करण्यात येत आहे.

३३) नारळावरील इरिओफाईड कोळीचे प्रभावी व्यवस्थापन करुन उत्पादन व माडाच्या चांगल्या आरोग्यासाठी वर्षभरामध्ये प्रति माडास खालीलप्रमाणे एकात्मिक अन्नद्रव्य व्यवस्थापन आणि एकात्मिक किड व्यवस्थापन करण्याची शिफारस करण्यात येत आहे.

महिना	करावयाची उपाययोजना (प्रति माडास)
मे	शेणखत १० किलो + गांडुळखत १० किलो द्यावे.
जून	प्रति माडास शिफारशीप्रमाणे ७५० ग्रॅम युरिया, ३ किलो स्फुरद व ६५० ग्रॅम पोटॅश, निंबोळी पेंड ५ किलो, हिरवळीचे खत (चवळी) ५० ग्रॅम माडाभोवती पेरावे. नारळाच्या काथ्या/सोडण. १० किलो माडाच्या आळयात पुराव्यात तसेच सुक्ष्म अन्नद्रव्य ५०० ग्रॅम द्यावे.
सप्टेंबर	शेणखत १० किलो + गांडुळखत १० किलो द्यावे.
ऑक्टोबर	७५० ग्रॅम युरिया व ६५० ग्रॅम पोटॅश, सुक्ष्म अन्नद्रव्य ५०० ग्रॅम, केराप्रोबियो (बॅसिलस मेगाटेरियम) १०० ग्रॅम वाफसा स्थितीत द्यावे.
डिसेंबर	गंधक पावडर ८० टक्के पाण्यात विरघळणारी भुकटी ५ ग्रॅम + पामतेल २०० मिली आणि २.५ ग्रॅम कपडे धुण्याची पावडर ८०० मिली पाण्यात घेवून फवारणी करावी.
फेब्रुवारी	७५० ग्रॅम युरिया + ६५० ग्रॅम पोटॅश.
मार्च	फेनपायरोक्सिमेट ५ टक्के प्रवाही १० मिली + २० मिली पाणी मुळाव्दारे पध्दतीचा वापर करुन द्यावे.

३४) काजूवरील फुलकिड आणि ढेकण्या किडीच्या नियंत्रणाकरिता २० टक्के प्रवाही ॲसिटॅमिप्रीड ५ ग्रॅम प्रति १० लिटर पाण्यात मिसळून फवारणी करावी अशी संशोधनात्मक शिफारस करण्यात येत आहे.

३५) नारळावरील रुगोज चक्राकार पांढरी माशीच्या व्यवस्थापनासाठी बागेत पिवळे चिकट सापळे माडाच्या खोडाला जमिनीपासून ४ फूट उंचीवर (३० सें.मी. रुंदीचे) लावावेत. त्यानंतर पंधरा दिवसांच्या अंतराने तीन

वेळा निमतेल ०.५ टक्के प्रवाही (५० मि.ली.) + साबणाचा चुरा (२० ग्रॅम) प्रती १० लिटर पाण्यात मिसळून फवारावे. पहिली फवारणी ऑक्टोबरच्या दुसऱ्या पंधरवडयात करावी. निमतेलाच्या तीनही फवारण्या संपल्यानंतर पुन्हा पंधरा दिवसांच्या अंतराने एच.टी.पी. फवारणी पंपाने फक्त पाण्याच्या तीन फवारण्या कराव्यात अशी शिफारस करण्यात येते.

३६) मिरची पिकावरील पांढरी माशीच्या पर्यावरण पुरक व्यवस्थापनासाठी पिकाचे अवशेष गोळा करुन नष्ट करणे, पिकाच्या भोवती झेंडू व मका या सापळा पिकांच्या ओळी लावणे, पालाश खत १०० किलो व पिवळया रंगाचे २५ चिकट सापळे (२२.५ X १४ सेमी आकाराचे) प्रती हेक्टर वापरण्याची शिफारस करण्यात येत आहे.

३७) कारली पिकावरील पांढऱ्या माशीच्या पर्यावरण पुरक व्यवस्थापनासाठी पिवळया रंगाचे २५ चिकट सापळे (२२.५ X १४ सेमी आकाराचे) प्रती हेक्टरी, चंदेरी प्लॅस्टिक आच्छादनाचा वापर तसेच ५ टक्के निंबोळी अर्काची पहिली फवारणी पिकाच्या शाखीय वाढी दरम्यान आणि एक टक्का लसूण अर्काची दुसरी फवारणी पहिल्या फवारणीनंतर १५ दिवसांनी करण्याची शिफारस करण्यात येत आहे.

३८) भात पिकामधील खेकडयांच्या नियंत्रणासाठी १० तास पाण्यात भिजवलेले चिंचोके प्रती बीळ एक याप्रमाणात टाकून सदर बीळ चिखलाने बंद करण्याची शिफारस करण्यात येत आहे.

c. Research Outcome/Findings: Nil

d. Completed Research Projects/Programmes/Schemes : Nil

e. Ongoing Research Schemes: Combine CROPSAP-Rice /HORTSAP-Mango Project

8. Repository of abstracts of the theses: Provide here the years wise details of the abstract of the theses/projects approved by the Department/Section for Bachelor, Masters and Doctoral theses in following format

2018

Name of Candidate: Patil Dhaneshwar Bhagwan
Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology
Year of Submission: 2018
Name of Guide/ Co guide: Dr. M. S. Karmarkar
Abstract:

The present studies were undertaken at Quarantine laboratory of "Plant Pathology Department, and Agricultural Entomology Department. Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist: Ratnagiri (M.S.) during 2016-18. The present research was carried out to determine the compatability of green muscardine fungus, *M. anisoplice* with pesticides and its pathogenicity against *Aphis craccivora* (Koch) under laboratory conditions.

Studies on the compatability of *M. anisopliae* indicated that Azadirachtin, Buprofezin and Sulphar were the most suitable pesticides as it showed significantly superior growth on potato dextrose agar media over the untreated control. However, the Emamectin benzoate, Azadirachtin. Profenophos, Indoxacarb. Thiophanate. Paraquat Dichloride and Glyphosate showed significantly higher mean mycelial weight over the untreated control on potato broth medium. At the same time, amongst pesticides used in the experiment only insecticides (Emamectin benzoate, Azadirachtin and Deltamethrin) reported synergestic increase in conidial count with theuntreated control, while Fungicides and Herbicides reported drastic reduction in conidial count.

Results of the pathogenicity of the *M. anisopline* harvested from the chemical treatments against *A. craccivora* revealed that all the pesticides investigated had reduced its pathogenecity in comparison to untreated control. However Emamectin benzoate, Indoxacarb and Paraquat dichloride showed maximum per cent mortality and can be used in combination with *M. anisopleae*.

As far as the symptoms of infection by *M. anisopliae* on nymphs were concerned, the infected nymphs were found at the surface of soil and plant. Subsequent symptoms observed were inactiveness, development of coppery fungal growth on the body which, further developed to olive green fungus mat all over the body parts.

Name of Candidate: Shinde Priyesh Bhargav
Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology
Year of Submission: 2018
Name of Guide/ Co guide: Dr.(Mrs) K.V.Naik
Abstract:

The present investigation entitled “Screening of cultivars, seasonal incidence of pests infesting cucumber and management of fruit flies” was carried out during kharif season of 2017-18 at Central Experimental Station, Wakawali, Dist.-Ratnagiri. During present investigation, fifteen cucumber cultivars were screened against pests infesting cucumber. The infestation of red pumpkin beetle and flea beetle was started from seedling stage. Negligible infestation (0.08 to 0.17) of leaf miner was observed on cucumber in

seedling stage whereas, there was no infestation of fruit flies observed on all screened cultivars after germination of seeds up to fruit setting. The highest mean infestation of red pumpkin beetle was recorded in cultivar CHC-1 (4.40 ± 0.82 scrapped galleries/three leaves/plant) followed by DARL-103 (4.04), PCUCH-7 (3.96). Lowest mean infestation was recorded in cultivar VRC-19 (1.74 ± 0.82). 32 The highest mean infestation of flea beetle was recorded in cultivar DARL-103 (10.78 ± 2.02 shot holes/three leaves/plant) followed by PCUC-28 (9.22), Sheetal (8.81). Lowest mean infestation (3.51 ± 2.02) was recorded in cultivar VNRC-4. The highest (48.39 ± 10.67) mean per cent fruit flies infestation was recorded in cultivar Sheetal followed by AAUC-3 (47.03%), CHC-1 (44.58%), PCUCH-7 (44.05). The minimum (19.11± 10.67) mean per cent fruit flies infestation was observed in cultivar Pusa Sanyog.

The study on seasonal incidence of pests infesting cucumber revealed that there were marked differences in infestation of red pumpkin beetle, flea beetle and fruit flies while, negligible infestation (0.20 to 0.64 leaf mines/three leaves/plant) of leaf miner observed in only 26th, 27th and 28th SMWs. The initiation of red pumpkin beetle infestation (2.48) was observed in the 26th SMW (25 June-01 July). Minimum red pumpkin beetle infestation (0.48 ± 1.20) was recorded in 37th SMW (10-16 September), while maximum (3.64 ± 1.20) infestation was recorded during 32nd SMW (06-12 August). Whereas, flea beetle infestation (0.80) was started in the 26th SMW (25 June-01 July). Minimum flea beetle infestation (0.60 ± 2.26) was recorded in 37th SMW (10-16 September) while, maximum (7.96 ± 2.26) infestation was recorded during 33rd SMW (13-19 August). The initiation of fruit flies infestation was started after fruit setting in the last week of July (30th SMW). Minimum per centfruit flies infestation (35.71 ± 36.91) was recorded in 34th SMW (20-26 August), while maximum 33 (100.00 ± 36.91) per cent infestation was recorded during 30th SMW (23-29 July) and 31st SMW (30 July-05 August). The data on correlation between mean infestation of pests and different meteorological parameters revealed that the mean infestation of red pumpkin beetle exhibited significant correlation (r= -0.576) with maximum temperature and morning relative humidity (r= -0.675) while, other meteorological parameters viz., minimum temperature, evening relative humidity, Bright Sunshine Hours (BSS), and rainfall were found to be non-significant. The data on correlation between flea beetle and fruit flies with different meteorological parameters showed that the various meteorological parameters were found to be non-significant.

The results on efficacy of some insecticides against fruit flies infesting cucumber indicated that spinosad 45 SC @ 0.014 per cent was the best treatment which recorded minimum (15.38%) mean fruit infestation and was at par with emamectin benzoate 5 SG @ 0.002 per cent (20.49%). The next best treatments were azadirachtin (1%) @ 0.003 per cent (27.99%) and malathion 50 EC @ 0.05 per cent (32.89%) which were at par with each other. Similarly, malathion 50 EC @ 0.05 per cent (32.89%) which was at par with deltamethrin 2.8 EC @ 0.0024 per cent and dichlorvos 76 EC @ 0.05 per cent recorded 37.32 and 38.99 per cent fruit infestation, respectively. All the above treatments were found to be superior over untreated control which recorded highest fruit infestation (70.54%).

Name of Candidate: Dahivalkar Shraddha Sunil

Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology

Year of Submission: 2018

Name of Guide/ Co guide: Dr. V.S.Desai

Abstract:

The field experiment on „Effect of sowing dates and mulches on pests infesting okra" was conducted during rabi hot weather season of 2016-2017 at Agronomy farm, College of Agriculture, Dapoli. The data on effect of different sowing dates on mean aphid population per three leaves during 4th, 5th, 6th, 7th, 8th and 9th WAS, was minimum (6.61, 5.63, 8.06, 11.69, 7.45 and 4.80, respectively) in treatment S1 (46th SMW, 12th-18th Nov.) and the treatment was at par with S2.

The data on effect of different mulches on mean aphid population per three leaves during 4th, 5th, 6th, 7th, 8th and 9th WAS, was minimum (5.42, 5.45, 8.37, 12.27, 8.20, 5.43, respectively) in treatment M2 (Silver polythene mulch) and the treatment was at par with M3. The data on combination effect of different sowing dates and mulches on mean aphid population during 4th, 5th, 6th, 7th, 8th and 9th WAS, was minimum (4.46, 4.74, 6.23, 9.16, 6.02 and 3.29, respectively) in treatment combinations S1M2 [S1 (46th SMW, 12th-18th Nov.) + M2 (Silver polythene mulch)] and S2M2 [S2 (49th SMW, 3rd-9th Dec.) + M2 (Silver polythene mulch)]. The data on effect of different sowing dates on mean jassid population during 4th,5th, 6th, 7th, 8th and 9th WAS, was minimum (2.12, 3.44, 6.55, 4.22, 2.21 and 0.96, respectively) in treatment S1 (46th SMW, 12th-18th Nov.) and was at par with S2. The data on effect of different mulches on mean jassid population during 4th, 5th, 6th, 7th and 8th WAS, was minimum (0.02, 4.58, 7.29, 4.76 and 3.04, respectively) in treatment M2 (Silver polythene mulch) which was at par with M3. The data on combination effect of different sowing dates and mulches on mean jassid population during 4th, 5th, 6th, 7th, 8th and 9th WAS, was minimum (1.05) in treatment combinations S1M2 [S1 (46th SMW, 12th-18th Nov.) + M2 (Silver polythene mulch)] and S2M2 [S2 (49th SMW, 3rd-9th Dec.) + M2 (Silver polythene mulch)].

The incidence of shoot and fruit borer was not observed on okra shoots whereas, fruit infestation was started from 8th WAS. The data on effect of different sowing dates on per cent fruit infestation of okra shoot and fruit borer was recorded from 8th WAS to 12th WAS. During 8th, 9th, 10th, 11th and 12th WAS, the minimum (3.63%, 5.77%, 8.82%, 6.26% and 7.77, respectively) per cent fruit infestation was recorded in treatment S1 (46th SMW, 12th-18th Nov.) The maximum (10.13%) fruit infestation by shoot and fruit borer was recorded in treatment S6 (9th SMW, 26th-Feb.-4th Mar). The results on effect of different mulches on per cent fruit infestation of okra shoot and fruit borer during 8th, 9th ,10th, 11th and 12th WAS indicated that the minimum (3.87%, 6.27%, 9.20%, 6.43% and 4.89%, respectively) fruit infestation was recorded in treatment M2 (Silver polythene mulch). The maximum (11.62%, 15.28%, 17.09%, 15.59% and 12.49%, respectively) fruit infestation was recorded in treatment M1 (No mulch). The data on combination effect of different sowing dates and mulches on infestation of okra shoot and fruit borer was recorded from 8th WAS to 12th WAS. During 8th, 9th, 10th, 11th and 12th WAS, the minimum (1.23%, 3.17%, 6.20%, 3.33% and 2.33%, respectively) fruit infestation was recorded in treatment combinations S1M2 [S1 (46th SMW, 12th-18th Nov.) + M2 (Silver polythene mulch)] and S2M2 [S2 (49th SMW, 3rd-9th Dec.) + M2 (Silver polythene mulch)] and both these treatment combinations were significantly superior over other treatment combinations. The maximum (11.10%, 14.54%, 15.93%, 14.78 and 11.98%, respectively) fruit infestation was recorded in treatment combination S6M1 (S6 (9th SMW, 26th-Feb.-4th Mar) + M1 (No mulch)].

Name of Candidate: Mokal Aishwarya Jagannath

Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology
Year of Submission: 2018

Name of Guide/ Co guide: Dr. B.D. Shinde

Abstract:

The present investigation on "Screening of cultivars, seasonal incidence and management of sucking pests infesting chilli" was carried out during rabi season of 2016-17 at Central Experimental Station, Wakawali, Dist.-Ratnagiri. During present investigation, twenty three cultivars were screened against overall mean population of thrips, whiteflies and aphids per three leaves per plant. The thrips population ranges from 1.27 to 3.25. The highest mean population was recorded on the cultivar Jwala (3.25) and lowest mean population in the cultivar Parbhani tejas (1.27). The overall mean population of whiteflies was in the range of 1.00 to 1.17 per three leaves per plant. The highest mean population was recorded on the cultivar Arka supriya (1.17). The minimum population (1.00) recorded on cultivars Jayanti, LCA-283, LCA-334, Parbhani tejas, RHR-16-5, Pant C3, ACS-9818, KA-2, DPL-C2, BC-24, BC-28 and Jwala, respectively. The data on overall mean population of aphids showed that the population was in the range of 1.35 to 9.31. The maximum mean population (9.31) was recorded on the cultivar BC-24. The minimum population (1.35) was observed on cultivar Arka supriya.

The study on seasonal incidence of sucking pest infesting chilli revealed marked differences in mean pest infestation as regard to Standard Meteorological Weeks. The population of thrips reached to peak (5.25) in 11th SMW (12-18 March). The maximum (3.05) whitefly population recorded in 9th SMW (26 February-04 March) and aphid population in 8th SMW (19-25 February) which recorded 11.05 mean aphid population. The minimum temperature recorded significant correlation with mean thrips population (r= 0.770) and other parameters were non-significant. The maximum temperature (r= 0.225), morning relative humidity (r= 0.091), evening relative humidity (r= 0.505) and Bright Sunshine Hours (r= 0.238) were only showed positive correlation with mean thrips population. The mean whitefly population showed negative correlation maximum temperature (r=-0.090) and morning relative humidity (r= 0.391) while, minimum temperature (r= -0.008), evening relative humidity (r= 0.266) and Bright Sunshine Hours (r= 0.189) were positively correlated The mean aphid (A. gossypii) population exhibited negative significant correlation with maximum temperature (r= -0.753). The other parameters viz., minimum temperature (r= -0.186), morning relative humidity (r= -0.296) and evening relative humidity (r= -0.033) negative correlation with aphid population, while positive correlation with Bright Sunshine Hours (r= 0.239).

The overall efficacy of all three sprays revealed that spinosad 45 SC @ 0.014 per cent was the best treatment which recorded minimum (1.41) mean thrips population per three leaves per plant and was significantly superior over all other treatments followed by emamectin benzoate 5 SG @ 0.002 per cent recorded (1.92) and was at par with thiamethoxam 25 WG @ 0.01 per cent recorded (2.09). The mean whitefly population was reduced in treatment acetamiprid 20 SP @ 0.004per cent (0.11) and at par with thiamethoxam 25 WG @ 0.01 per cent (0.17) whereas Spinosad 45 SC @ 0.014 per cent recorded (0.36). The results regarding overall mean of three sprays against aphids revealed that treatment thiamethoxam 25 WG @ 0.01 per cent recorded (5.03) and was at par with treatment imidacloprid 17.8 SL @ 0.004 per cent (5.32). All the above treatments were found superior to untreated control. The data on effect of different treatments on the yield of green chilli revealed that, the maximum average green chilli yield (112.34 q/ha)

was recorded in the treatment Spinosad 45 SC @ 0.014 per cent which was significantly superior over rest of the treatment and followed by thiamethoxam 25 WG @ 0.01 per cent (111.43 q/ha).

Name of Candidate: Kelkar Ankush Prakash
Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology
Year of Submission: 2018
Name of Guide/ Co guide: Dr. A.J. Munj
Abstract:

The present studies were undertaken at Agronomy farm, College of Agriculture, Dapoli during kharif 2017-18 to evaluate the effect of various mulches, insecticidal dust, botanical and entomopathogenic fungi under field condition for the management of okra flea beetle, *Podagrica bowringi* Baly. The observations recorded at 1st week after first soil application indicated that the treatment (M3) black polythene mulch (7.17) was found to be effective treatment. At 2nd week, minimum numbers of shot holes were recorded in the treatment (M3) black polythene mulch (6.97 shot holes/three leaves/plant). At 3rd week the treatment (M3) black polythene mulch was found 84 to be the effective treatment which recorded 7.17 shot holes per three leaves per plant. The observations recorded at 1st week after second soil application indicated that the treatment black polythene mulch (M3) was found to be effective treatment (8.70 shot holes per three leaves per plant). At 2nd week, minimum numbers of shot holes were recorded in the treatment (M3) black polythene mulch (9.50 shot holes/3 leaves/plant). The data at 3rd week revealed that (M3) black polythene mulch, (M2) silver polythene mulch and (M1) transparent polythene mulch recorded 8.60, 9.77 and 10.11 shot holes per three leaves per plant, respectively and all these treatments were at par with each other. The observations recorded at 1st week after third soil application indicated that black polythene mulch (M3) was found to be the effective treatment (8.29 shot holes/3 leaves/plant). At 2nd week, minimum numbers of shot holes were recorded in the treatment (M3) black polythene mulch 7.62 shot holes/three leaves/plant. The data at 3rd week revealed that the treatment (M3) black polythene mulch, (M2) silver polythene mulch and (M1) transparent polythene mulch recorded 7.17, 8.19 and 8.34 shot holes per three leaves per plant, respectively and all these treatments were at par with each other.

The observations recorded at 1st week after first soil application of sub plot treatments indicated that *Beauveria bassiana* 10 g l-1 (T2) was found to be effective treatment which recorded 8.57 shot holes per three leaves per plant. At 2nd week minimum numbers of shot holes were recorded in *Beauveria bassiana* 10 g l-1 (T2) 7.99 shot holes/three leaves/plant. At 3rd week the treatment *Beauveria bassiana* 10 g l-1 (T2) was found to 85 be effective treatment which recorded 7.04 shot holes per three leaves per plant. The observations recorded at 1st week after second soil application indicated that the treatment *Beauveria bassiana* 10 g l-1 (T2) was found to be effective treatment which recorded 8.60 shot holes per three leaves per plant. At 2nd week minimum numbers of shot holes were recorded in *Beauveria bassiana* 10 g l-1 (T2) 9.87 shot holes/three leaves/plant. At 3rd week the treatment *Beauveria bassiana* 10 g l-1 (T2) was found to be effective treatment which recorded 9.22 shot holes per three leaves per plant. The observations recorded at 1st week after third soil application indicated that the treatment *Beauveria bassiana* 10 g l-1 (T2) was found effective by recording 8.74 shot holes per three leaves per plant. At 2nd week minimum numbers of shot holes were recorded in (T2) *Beauveria bassiana* 10 g l-1 8.01 shot holes/three leaves/plant. At 3rd week the treatment (T2) *Beauveria bassiana* 10 g l-1 was found to be effective treatment which recorded 7.68 shot holes per three leaves per plant. The observations recorded at 1st week after first soil application indicated that the treatment combination, black mulch + B*eauveria bassiana* 10 g l-1 recorded 4.06 shot holes per three leaves per plant. At 2nd week, minimum numbers of shot holes were recorded in the treatment combination black mulch + *Beauveria bassiana* 10 g l-1 (4.02 shot holes/three leaves/plant). At 3rd week, black mulch + *Beauveria bassiana* 10 g l-1 was found to be effective treatment combination which recorded 4.06 shot holes per three leaves per plant. 86 The observations recorded at 1st week after second soil application indicated that the treatment combination, black mulch + *Beauveria bassiana* 10 g l-1 recorded 6.09 shot holes per three leaves per plant and found to be the best treatment combination. At 2nd week, minimum numbers of shot holes were recorded in black mulch + *Beauveria bassiana* 10 g l-1 (7.06 shot holes/three leaves/plant). At 3rd week, the treatment combination black mulch + *Beauveria bassiana* 10 g l-1 recorded 6.38 shot holes per three leaves per plant. The observations recorded at 1st week after third soil application indicated that the treatment combination, black mulch + *Beauveria bassiana* 10 g l-1 was found to be effective treatment which recorded 6.35 shot holes per three leaves per plant. At 2nd week, minimum numbers of shot holes were recorded in the treatment combination black mulch + *Beauveria bassiana* 10 g l-1 (5.65 shot holes per three leaves per plant). At 3rd week, the treatment combination, black mulch + *Beauveria bassiana* 10 g l-1 was found to be effective treatment which recorded 5.33 shot holes per three leaves per plant.

Name of Candidate: Dubale Mayuresh Mahendra

Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology
Year of Submission: 2018
Name of Guide/ Co guide: Dr. V.N. Jalgaonkar
Abstract:

The present investigation entitled―Screening of cultivars, seasonal incidence of pests infesting ridge gourd and management of fruit flies was carried out during kharif season of 2017-18 at Central Experimental Station, Wakawali, Dist.-Ratnagiri. During present investigation, fifteen ridge gourd cultivars were screened against pests infesting ridge gourd. The infestation of red pumpkin beetle, flea beetle and leaf miner was started from seedling stage of ridge gourd whereas, there was no infestation of fruit flies on all screened cultivars after germination of seeds up to fruit setting. The highest mean infestation of red pumpkin beetle was recorded in the cultivar, Konkan Harita with 3.06 ± 0.46 scrapped galleries/three leaves/plant followed by KRG-5 (2.78), Satputiya (2.50) andBSS-405 (2.50). Lowest mean infestation was recorded in cultivar NRG-9 (1.47 ± 0.46). 60 The highest mean infestation of flea beetle was recorded in cultivar RG-2 with 9.69 ± 1.69 shot holes/three leaves/plant) followed byNRG-9 (7.75) and RGH-1 (7.72). Lowest mean infestation (2.91 ± 1.69) was recorded in cultivar JRGL-13. The highest mean infestation of leaf miner was recorded in cultivar RG-2 with 0.88 ± 0.46 leaf mines/three leaves/plant followed by Utkal Trupti (0.84), RG-1 (0.84) and RGH-3 (0.50). The minimum mean infestation (0.13 ± 0.46) was recorded in cultivar KRG-5. The highest (43.24 ± 10.78) mean per cent infestation fruit flies was recorded in cultivar Konkan Harita followed KRG-5 (31.76%) and Pusa Nasdar (31.48%). The minimum (0.79 ± 10.78) mean per cent infestation of fruit flies was observed in cultivarJRGL-13. The study on seasonal incidence of pests infesting ridge gourd revealed that there were marked differences observed in infestation of red pumpkin beetle, flea beetle, leaf miner and fruit flies. The infestation of red pumpkin beetle (0.84 ± 0.73) was found in the 26th SMW (25 June-01 July). The lowest (0.52 ± 0.73) infestation of red pumpkin beetle was recorded in 35th SMW (27 August-2September), while maximum (2.84 ± 0.73) infestation was recorded during 31st SMW (30 July-5 August). Whereas, the infestation of flea beetle (0.24 ± 6.67) was started in the 26th SMW (25 June-01 July).Minimum flea beetle infestation (0.24 ± 6.67)was recorded in 26th SMW (25 June-01 July), while maximum (27.56 ± 6.67)infestation was recorded during 40th SMW (01-07 October).

The infestation of leaf miner (0.04 ± 0.26) was started in the 28th SMW (09-15 July).Minimum leaf miner infestation(0.04 ± 0.26)was recorded in 28th SMW (09-15 July) and 29th SMW (16-22 July), 61 while maximum (0.84 ± 0.26) infestation was noticed during 33rd SMW (13-19 August).The infestation of fruit flies was started after fruit setting in the third week of August (33th SMW). Minimum (16.67 ± 18.25) per cent infestation of fruit flies was recorded in 36th SMW (03-09 September), while maximum (50.00 ± 18.25) per cent infestation was observed during 40th SMW (01-06 October). The data on correlation between mean infestation of pests and different meteorological parameters revealed that the mean infestation of red pumpkin beetle exhibited positive correlation with minimum temperature(r= 0.362), while negative correlation with remaining weather parameters viz.,maximum temperature, evening relative humidity, Bright Sun Shine Hours (BSS)and rainfall were found to be non-significant. The data on correlation between mean infestation of flea beetle and leaf miner with different meteorological parameters revealed that the various meteorological parameters like maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, Bright Sun Shine Hours (BSS) and rainfall were found to be non-significant. The data on correlation between mean per cent infestation of fruit flies exhibited significant negative correlation (r= -0.720) with morning relative humidity. While remaining meteorological parameters viz., maximum temperature, minimum temperature, evening relative humidity, Bright Sunshine Hours (BSS) and rainfall was found to be non-significant. The results on the efficacy of insecticides against fruit flies infesting ridge gourd indicated that spinosad 45 SC @ 0.014 per cent was the best treatment which recorded minimum (23.55%) mean fruit infestation and was at par with emamectin benzoate 5 SG @ 0.002 per cent (24.77%) and deltamethrin 2.8 EC @ 0.0024 62 per cent (25.93%).Similarly, treatment emamectin benzoate 5 SG @ 0.002 per cent (24.77%) was at par with deltamethrin 2.8 EC @ 0.0024 per cent and malathion 50 EC @ 0.05 per cent which recorded 25.93 and 28.92 per cent fruit infestation, respectively. Further treatment deltamethrin 2.8 EC @ 0.0024 per cent (25.93%) was at par with malathion 50 EC @ 0.05 per cent (28.92%) and azadirachtin (1%) @ 0.003 per cent (30.08%).While treatments viz.,malathion 50 EC @ 0.05 per cent (28.92%), azadirachtin (1%) @ 0.003 per cent (30.08%) and dichlorvos 76 EC @ 0.05 per cent (33.47%) were at par with each other. All the above treatments were found to be superior over untreated control which recorded highest (47.19%) fruit infestation.

Name of Candidate: Name of Candidate: Narvekar Prasad Fati
Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology
Year of Submission: 2018
Name of Guide/ Co guide: Dr. S. K. Mehendale
Abstract:

The present studies were undertaken at Department of Entomology, College of Agriculture, Dapoli (MS) during 2017-18 to know the biology of *S. litura* on different host plants, digestibility indices of *S. litura* on different host plants and effect of *Bt* on third instar larvae of *S. litura* through different host plants.

The data on comparative biology of *S. litura* on different hosts inferred that, the minimum larval development period of 11.67 days was noticed on castor, whereas, it was maximum (17.33 days) on tapioca. The minimum pre-pupal (2.00 days) and pupal period (7.33 days) were recorded on castor, while maximum (3.00 days pre-pupal and 11.67 days pupal period) on tapioca host. The pupal weight was maximum on castor i.e. 0.28 g and minimum on cowpea (0.19g). The maximum pupal success of 86.67 per cent was observed in larvae fed on castor, whereas, it was significantly lowest on tapioca leaves (46.67%). Highest adult weight was found on tapioca leaves (0.20g) followed by groundnut (0.18g) and the lowest adult weights recorded on Mulberry and cowpea (0.08g each). Among the eight hosts the adult longevity was recorded maximum on castor and sweet potato i.e. 7.67 days each and minimum on tapioca (5.33 days). The larvae fed on sweet potato leaves supported highest adult success Le. 73.81 per cent and lowest mean adult success was observed on tapioca (35.00%). The total development period was significantly highest on tapioca (37.00 days) and it was found to be minimum on castor (28.33 days). The maximum mean fecundity was 3074.00 eggs per female on castor host, whereas, minimum with 622.00 eggs per female on tapioca host. The sex ratio of female to male was observed as 1:0.7, 1:05, 1:0.6, 1:08, 1:06, 1:05 and 1:07 on castor, mulberry, okra, sweet potato, taro, groundnut and tapioca, respectively. The male biased ratio was only observed on cowpea (1:1.2).

The data on digestibility indices of *S. litura* on different hosts revealed that, Efficiency of Conversion of Ingested food (ECI), Efficiency of conversion of digested food (ECD), Consumption rate (CR) and Relative growth rate (RGR) were found to be maximum on the castor (21.82%, 23.14%, 0.92 and 3.51, respectively.). The ECI and ECD were found minimum on taro ie. 12.59 and 12.71 per cent, respectively. AD was highest on taro (98.82%) and lowest on castor (95.01%). The mean CI value was highest on taro (5.67) and lowest on groundnut (3.89). The best host of *S. litura* in laboratory was castor. Tapioca and cowpea were worst and other hosts were intermediate host.

Study on efficacy of *Bt* against 3rd instar larvae of *S. litura* on different host plants revealed that *Bt* on okra was most effective with cent per cent mortality followed by cowpea with 96.67 per cent mortality. While *Bt* on sweet potato was least effective and significantly inferior to the rest of the treatments.

Name of Candidate: Parab Amol Chandrakant

Degree for which the thesis: M.Sc. (Ag.) Agricultural Entomology
Year of Submission: 2018

Name of Guide/ Co guide: Dr. S.D. Desai

Abstract:

The research project entitled “Species Composition and Management of Fruit Flies (Diptera: Tephritidae) Infesting Mango (*Mangifera indica* L.).” was undertaken at Horticulture Nursery, Department of Horticulture, College of Agriculture, Dapoli during May to July 2017. The data on total number of fruit flies trapped during May to July 2017 per trap revealed that the fruit flies trapped per trap were in the range of 0.00 to 363.67. The maximum (363.67) number of fruit flies were trapped in the treatment T2 (Black Ocimum + Malathion) which was significantly superior over rest of the treatments except treatment T8 (Black Ocimum + Spinosad) which recorded 325.33 number of fruit flies and both the treatments were at par with each other. The next best treatments in order of efficacy were T1 (Green Ocimum + Malathion), T7 (Green Ocimum + Spinosad) and T3 (Black Jaggery + Malathion) which recorded 258.67, 222.67 and 211.33 number of fruit flies respectively. The minimum fruit flies were recorded in the treatment T10 (common Jaggery + Spinosad) which recorded 90 fruit flies per trap during the period of May to July 2017. Among the bait material used for attracting fruit flies all were more or less effective but the treatment T2 (black Ocimum (leaf extract) + Malathion) and treatment T8 (black Ocimum (leaf extract) + Spinosad) attracted maximum number of fruit flies. In the species composition study of fruit flies trapped in fruit fly traps, five different species of fruit flies viz., *Bactrocera dorsalis*, *Bactrocera zonata*, *Bactrocera cucurbitae*, *Bactrocera correcta* and *Bactrocera tau* were trapped in traps. Among these species, *Bactrocera dorsalis* almost accounted 3810 (52.31 %) fruit flies of the total population indicating dominant species of this region, which was followed by *Bactrocera zonata* with 2007 (27.56 %) of fruit flies population and *Bactrocera cucurbitae* with 939 (12.89 %) fruit flies population and occupied rank second and third in composition, respectively. *Bactrocera correcta* accounted 498 (6.84 %) fruit flies population and occupied position forth. Whereas *Bactrocera tau* accounted only 29 (0.40 %) fruit flies population. The study carried out to find out varietal screening of fruit flies on five mango varieties revealed that out of five varieties tested two varieties viz., Pairi and Sindhu were completely free from fruit fly infestation. The per cent infestation was maximum in Alphonso (30.00 %), followed by Keshar (20.00 %) and Ratna (15.00 %). The observations recorded

showed that the varieties Alphonso, Keshar, and Ratna were preferred by fruit flies. The results obtained are based on natural preference of fruit flies in the field.

Name of Candidate: Raut Pravin Pandurang

Degree for which the thesis: Ph.D. (Ag.) Agricultural Entomology

Year of Submission: 2018

Name of Guide/ Co guide: Dr. V. S. Desai

Abstract:

The experiment on the 'Species composition, population fluctuation and eco-friendly management of mango hoppers' was conducted during 2015-16 and 2016-17. During present investigation, eleven species of mango hoppers viz., *Amritodus atkinsoni* (Lethierry), *Idioscopus nitidulus* (Walker), *Idioscopus nagpurensis* (Pruthi), *Flata* sp., *Nephesa* sp., *Paragomeda* sp., *Tambila gravelyi* Distant, *Scolypopa* sp., *Eurybrachys* sp., *Kolla ceylonica* (Melichal) and *Krisna* sp., were recorded at different stages of mango. Out of which only six viz., *A. atkinsoni, I. nitidulus, I. nagpurensis, Flata* sp., *Nephesa* sp. and *Paragomeda* sp. were frequently observed while, rest of the species were rare in occurrence.

During both the years of study, I nitidulus was the most dominant species observed in almost all Dapoli locations followed by *A. atkinsoni* and *I. nagpurensis* at all the phenological stages of mango.

During year 2015-16, the overall mean hopper population at different phenological stages was in the range of 0.13 to 29.27 hoppers per panicle. The maximum (29.26) hopper population was recorded at flowering stage in PA (PHM orchard-Alphonso) and minimum (0.13) at egg stage in HK (Horticulture Nursery-Kesar). During the year 2016-17, the overall mean hopper population at different phenological stages was in the range of 0.07 to 17.05 hoppers per panicle. The maximum (17.05) hopper population was recorded at flowering stage in PaUSA (Pangari Bock-Unsprayed Alphonso) and minimum (0.07) was observed at egg stage in HK (Horticulture Nursery-Kesar).

The pooled efficacy of entomopathogenic fungi during both the years revealed that the hopper population was ranged from 2.00 to 8.57. The treatment Tio (Cypermethrin 25 EC @ 3 ml/ 10 lit.) showed minimum (2.00) hoppers and was significantly superior over rest of the treatments. The next best treatments were T3 (*Verticillium lecanii* @ 10 g/lit.), T6 (*Metarrhizium anisopliae* @ 10 g/lit.) and T2 (*Verticillium lecanii* @7.5 g/lit.) which recorded 3.89, 4.50 ad 4.69 hoppers per panicle respectively. The maximum (8.57) hoppers per panicle were recorded in T11 (Water spray).

The results the recovery of mango hoppers using on entomopathogenic fungi (EPF) indicated that after isolation, no any entomopathogenic fungi (EPF) was observed which was used for the spraying. A saprophytic fungi, *Fusarium* spp. was observed from all the dead mango hoppers collected from the experimental plot which were kept for isolation of the fungus.

The correlation between mango hopper population and different weather parameters during 2015-16 was found to be non-significant except evaporation which was negatively significant (r=0.576) only in IIA (Indo-Israel Project- Alphonso). The correlation between mango hopper population and different meteorological parameters during year 2016-17 was found to be non-significant except minimum temperature and wind speed. The correlation between minimum temperature and hopper population in IIA (Indo-Israel Project- Alphonso) and IIPA (Indo-Israel Project- Pruned Alphonso) indicated that as temperature decreases population of hopper decreases, whichshowed the values of -0.791 r=0.602and -0.744 r=0.602, respectively. In PaSA (Pangari Block-Sprayed Alphonso) and PaUSA (Pangari Block-Unsprayed Alphonso) results revealed that as wind speed increases the population of hopper decreases and showed values of 0.529 r=0.514and 0.595 r=0.514, respectively.

Name of Candidate: Mazagaonkar Anilkumar Rameshchandra

Degree for which the thesis: Ph.D. (Ag.) Agricultural Entomology

Year of Submission: 2018

Name of Guide/ Co guide: Dr. A. L. Narangalkar

Abstract:

The studies on the species diversity and management of termites in the Konkan were conducted from 2014 to 2017. Survey of the termite fauna of Konkan region revealed the presence of 25 species belonging to seven genera and six sub families under two families, Termitidae and Rhinotermidae. *Odontotermes annamallensis* and *Odontotermes obesus* were common to all the five districts, while, *Trinervitermes biformis* was found in all four districts except Palghar. Termitidae was the dominant family and Odontotermes was the most common genus. Except for six species belonging to the family Rhinotermitidae all the others were solely soil inhabiting species. The termite fauna identified from Konkan now stands at 25 species from the earlier figure of 15. The following 13 species are being reported for the first time. *Odontotermes anamallensis, O. bhagwati, O. boveni, O. parvidens, O. peshawarensis, O. redemanii, O. yadevi, Microtermes incertoides, Microcerotermes cameroni, M. heimi, Coptotermes ceylonicus, C. kishori* and *Heterotermes balwanti*.

The presence of termites was found to be necessary for the breakdown of organic mulches and their assimilation into the soil. Termites preferred the grass mulch over paddy straw and coconut husk. Termites when present in the grass mulch, raised the pH of the soil from 5.22 to 5.99 and reduced the bulk density of the soil by 35 per cent. The foraging by termites opened up many voids and made the soil porous and friable. Organic carbon levels in the grass mulched plots increased by 59 per cent to reach 3.32 per cent over a period of two years. The total nitrogen content increased from the initial 0.94 to 1.55 percent when termites were present in the grass mulch, which was a rise of65 per cent. The plots mulched with paddy straw recorded 1.33 percent nitrogen the plots with coconut husk had 1.03 percent nitrogen, while the bare plots where termites were absent showed a steady erosion in the total nitrogen content over two seasons from the initial 0.89 percent to 0.78 percent, which was a decline of 12.4 percent.

The elevation in the phosphorus content was 20.18 per cent in the coconut husk mulched plots. The use of different mulching material did not show much difference in the rise of phosphorus levels. All the mulched plots did show and increment in the potash levels ranging from 1.83 to 1.14 per cent in the presence of termites, with all the mulches performing at par. The maximum increase however, was noted in the paddy straw mulched plots which rose to 348.64 kg/ha from the initial level of 342.38 kg/ha.

The baiting devices set up around the selected termite mounds failed to attract termites for two seasons. The inability of corrugated sheets to act as bait for the dominant field termites species of the Konkan indicated that the nutritional requirements of *Odontotermes obesus* are different from those of the lower termites like *Coptotermes* spp. and *Reticultermes* spp. Development of a suitable bait matrix based on the nutritional requirements of *Odontotermes* spp. which is the dominant genera of the Konkan is required, if baiting is to be used as a termite management tool with a view to reduce the use the environmental load of Persistent Organic Pesticides for management of termites in the Konkan.

Evaluation of four IGRS Nuvaluron, Buprofezin, Diflubenzuron and Pyriproxifen at 500 ppm, 1000 ppm and 5000 ppm each alongwith Fipronil 0.5 per cent against *Odontotermes obesus* revealed that Nuvaluron 5000 ppm recorded the maximum mortality of nymphsafter 24 hours, while both Nuvaluron 5000 ppm and Fipronil 0.5 per cent were at par after 48 and 96 hours exposure. The least mortality was recorded in Nuvaluron 500 ppm. The *O. obesus* workers however recorded the highest morality in Fipronil 0.5% followed by all the four IGRS at 5000 ppm. The least mortality was seen in all four IGRS at 500 ppm and Nuvaluron and Buprofezin at 1000 ppm. Delayed mortality of the workers due to the lower doses of IGRSmakes them suitable candidates for use in baits for colony management of *Odontotermes*.

A novel method for quantification of termite activity was used. The time taken to repair and seal a 10 mm hole in the termite mound was noted to gauge the effect of various ecological factors on the termite activity. Observations were noted from the second fortnight of October 2015 to the second fort night of September 2017. The maximum time of 52.6 minutes required to repair the breach of 10 mm was recorded in the second fortnight of February 2017 indicating the slowest or least activity. The fastest reconstruction time of 9.2 minutes was noted in the first fortnight of September 2016. The minimum temperature showed a strong negative coefficient of correlation (-0.89939) indicating that the lower temperature resulted in longer time taken to repair the holes thus indicating lower termite activity. Similarly, minimum humidity was also found to bear a strong negative correlation (-0.714) with the time taken to repair a 10.00 mm diameter breach in the termite nest walls.

2019

Name of the Candidate : Bhojane Sugar Namdeo
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2019
Name of Guide/Co guide : Dr. V. S. Desai
Abstract :

The field experiment on Management of pests infesting rice (*Oryza sativa* L.) using botanicals and ITKs was conducted during *kharif* season of 2018 at Agronomy farm, College of Agriculture, Dapoli.

The results regarding overall mean of three sprays of botanicals against yellow rice stem borer infesting rice revealed that the treatment Ty Azadirachtin 10000 ppm (1%) 3 ml/liter was found to be the best treatment by recording 2.57 per cent dead hearts per hill and was at par with the treatment T, Nirgudi leaf extract 10% @ 100 g/liter (3.647%), treatment T Neem oil 1% @ 10 ml/liter (3.04%) and treatment T, Ritha powder extract 5% 250 g/liter (3.18%)

The results regarding overall mean of three sprays of botanicals against rice blue beetle infesting rice revealed that the treatment T, Nirgudi leaf extract 10% @ 100 g/liter was found to be most effective treatment which recorded 2.28 per cent infested leaves per hill and was at par with the treatment T, Azadirachtin 10000 ppm (1%) 3 ml/liter (2.46%), treatment T. Ritha powder extract 5% 50g/liter (2.70%) and treatment T, Custard apple leaf extract 10% @ 100 g/liter (2.84%).

The results regarding overall mean of three sprays of botanicals against nce leaf folder infesting rice revealed that the treatmem T, Azadirachtin 10000 ppm (1%)@3 ml/liter was found to be most effective treatment which recorded 5.35 per cent infested leaves per hill and was at par with the treatment T, Nirgudi leaf extract 10% 100 gliter (5.59%), treatment T Neem oil 1% 10 ml/liter (5.766) and treatment T, Karanj oil 1% @ 10 ml liter (6.35%)

The results regarding overall mean of three applications of TTK's against yellow rice stem borer infesting rice revealed that the treatment T placing of Orange peel 5 fruit peel/plot was found to be most effective treatment which recorded 0.75 per cent dead hearts per hill and was at par with the treatment T, placing of Nirgudi twigs (*Vitex negundo*) @ 5 twigs/plot (0.91)-

The results regarding overall mean of three applications of ITK's against rice blue beetle infesting rice revealed that the treatment T, placing of Nirgudi twigs (*Viler negundo*) 5 twigs/plot was found to be most effective treatment which recorded 2.56 per cent infested leaves per hill and was at par with the treatment T, application of raw cow dung @ 1:2 Kg/plot (2.67%), treatment T application of fresh goat excreta @ 12 Kg plot (3.00%), treatment 1, placing of neem twigs in rice field @ 5 twigs plot (3.05%), treatment T, placing of Orange peel @5 fruit peel plot (3.18%)

The results regarding overall mean of three applications of ITK's against rice leaf folder infesting rice revealed that the treatment T, placing of Nirgudi twigs (*Viter negundo*) @ 5 twigs plot was found to be most effective treatment which recorded 1.86 per cent infested leaves per hill and was at par with the treatment Ty placing of neem twigs in rice field @ 5 twigs/plet (2.15%) and treatment T, placing of Orange peel @ 5 fruit peel/plot (2.32%)

Name of the Candidate : Mr. Mane Ajit Dattatraya
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2019
Name of Guide/Co guide : Dr. M. S. Karmarkar
Abstract :

The present investigation was carried out on seasonal incidence, biology, efficacy of insecticides of rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin. on coconut at College of Agriculture, Dapoli, Dist. Ratnagiri, Maharashtra during 2018 to 2019.

Incidence of spiralling whitefly occurred throughout the year. However the peak period was noticed from first week of October to last week May which was in the range of 10.08 to 41.94 adults/leaves.

The correlation study with weather parameters showed significant positive correlation with maximum temperature and significant negative correlation with minimum temperature, relative humidity, (morning and afternoon) and rainfall.

The studies on biology revealed that female laid on an average 50.7 eggs. The average duration of first, second, third, fourth instars were 5, 5.5, 6.6 and 6.6 days, respectively. Male adults were bigger than female. The adults survived for on an average of 12.8 days. The total life cycle completed in 43.1 to 56.9 days with an average of 49.9 days.

For the management, the insecticide buprofezin 0.001 per cent was found most effective followed by imidacholrpid 0.003.

Name of the Candidate : Mr. Kinjale Rushikesh Shashikant
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2019
Name of Guide/Co guide : Dr. V. N. Jalgaonkar
Abstract :

The present investigation entitled "Screening of rice varieties, population dynamics and management of major pests infesting nce *Oryza sativa* L." was carried out during kharf season of 2018 at RARS, Karjat During present investigation, fifteen varieties were screened against pests infesting rice. During the course of studies it, was revealed that the insect pests of rice vie, yellow rice stem borer, leaf folder and rice case worm were attacked the different varieties used in study.

The per cent damage of rice stem barer varied from 0.76 to 5.06 and 1.06 to 4.54 as a dead hearts and white ear heads, respectively The minimum dead hearts (0.76 ± 1.14%) and white ear heads (1.06 10.87 9) were recorded in Sahyadri-4 and Karjat-4 variety, respectively. The maximum dead hearts (5.06 ± 1.14 %) and white ear heads (4.54 0.87 %) were recorded in Karjat-3 variety. The per cent infestation of rice leaf folder varied from 0.11 to 0.19 during the cropping season. Among all the varieties screened against rice leaf folder, Ratnagiri-3 variety showed higher per cent infestation (0.19 0.03) during cripping phase we Karjat-4 variety show lowest per cent infestation 10.11 0.04 The per cent infestation of rice case worm varied from 0.06 to 0.15 during the study period. Among all the varieties screened, Karjat-3 variety showed higher per cent infestation: 10.15 0.03% during cropping phase (damaged leavest. Minimum per cent infestation (0.06.2

0.03%) were recorded in the varieties Karjat-4 and Bahyadri-4.The study on seasonal incidence of pests infesting rice revealed that there were marked differences observed in infestation of yellow stem borer, leaf folder and case worm.
The study on population dynamics of yellow stem borer revealed that initiation of stem borer infestation (3.25% was observed in the 31 SMW (30 July-5 Aug. The maximum infestation (6.55 2.53%) and (7.03 ± 2.53%) of dead hearts and white ear beads were recorded in 30 SMW (first week of September) and 41 SMW 15 Oct-14 Oct), respectively. The minimum per cent infestation (DH- 1.02%) (WEH-1.09% were recorded in 39 SMW. The initiation of leaf folder infestation (0.38%) was observed in the 31 SMW (30 July 5 Aug. Minimum leaf folder infestation (0.07 0.26%) was recorded in 36 SMW (3-9 September) whereas maximum (0.89 ± 0.25% infestation of leaf folder was recorded during 32 BMW (6 August 12 August). The initiation of case worm infestation (0.40%) was observed in the 32 SMW 15 Aug -12 Aud Minimum case worm infestation (0.06 1.20) was recorded in 37 SMW (10-16 September), while maximum 10.87 1.20) infestation was = recorded during 34th SMW (20-26 August).

The data on correlation between mean infestation of stem borer infesting rice and different weather parameters revealed that all the meteorological parameters tz, maximum temperature, minimum temperature, morning relative humidity and evening relative humidity, wind speed, bright sunshine hours and rainfall were found to be non- significant with mean infestation of stem borer. The mean infestation of higher per cent infestation (0.19 0.03) during cripping phase we Karjat-4 variety show lowest per cent infestation 10.11 0.04 The per cent infestation of rice case worm varied from 0.06 to 0.15 during the study period. Among all the varieties screened, Karjat-3 variety showed higher per cent infestation: 10.15 0.03% during cropping phase (damaged leavest. Minimum per cent infestation (0.06.2 0.03%) were recorded in the varieties Karjat-4 and Bahyadri-4.The study on seasonal incidence of pests infesting rice revealed that there were marked differences observed in infestation of yellow stem borer, leaf folder and case worm.

The study on population dynamics of yellow stem borer revealed that initiation of stem borer infestation (3.25% was observed in the 31 SMW (30 July-5 Aug. The maximum infestation (6.55 2.53%) and (7.03 ± 2.53%) of dead hearts and white ear beads were recorded in 30 SMW (first week of September) and 41 SMW 15 Oct-14 Oct), respectively. The minimum per cent infestation (DH- 1.02%) (WEH-1.09% were recorded in 39 SMW. The initiation of leaf folder infestation (0.38%) was observed in the 31 SMW (30 July 5 Aug. Minimum leaf folder infestation (0.07 0.26%) was recorded in 36 SMW (3-9 September) whereas maximum (0.89 ± 0.25% infestation of leaf folder was recorded during 32 BMW (6 August 12 August). The initiation of case worm infestation (0.40%) was observed in the 32 SMW 15 Aug -12 Aud Minimum case worm infestation (0.06 1.20) was recorded in 37 SMW (10-16 September), while maximum 10.87 1.20) infestation was = recorded during 34th SMW (20-26 August).

The data on correlation between mean infestation of stem borer infesting rice and different weather parameters revealed that all the meteorological parameters tz, maximum temperature, minimum temperature, morning relative humidity and evening relative humidity, wind speed, bright sunshine hours and rainfall were found to be non- significant with mean infestation of stem borer. The mean infestation of leaf folder showed significant negative correlation with bright sunshine hours (-0.635) while evening relative humidity (r 0.616) and wind speed (r 0.562) showed significant positive correlation. The mean infestation of case worm showed significant negative correlation with maximum temperature (0,576) and bright sunshine hours (r- 0.619). Morning relative humidity (r 0.622), evening relative humidity Ir-0.616) and rainfall (r 0.795) showed significant positive correlation. while other parameters found to be non significant.
The results on the efficacy of insecticides against yellow stem borer indicated that overall mean yellow stem borer infestation (dead heart varied from 1.23-7.50 per cent. The Ts (Flubendiamide 20 WG 0.005 %) recorded minimum (1.23%) infestation of yellow stem borer and which was significantly superior over all remaining treatments. The Ts (Flubendiamide 20 WG 0.005% with 0.25 per cent infestation was also found effective against leaf folder which was at par with treatments vin, Tr (Chlorantraniliprole 18.5 SC @ 0.006 %) 0.26 per cent infestation, Ti (Cartap hydrochloride 75 80 0.090 % 0.27 per cent infestation, T (Emamectin benzoate 5 S0 @ 0.0015 %) 0.27 per cent infestation, T (Lambda cyhalothrin 5 EC0.003 %) 0.29 per cent infestation and T (Fipronil 5 SC 0.01 %) 0.29 per cent infestation In case of case worm, the Ti (Cartap hydrochloride 75 50 @ 0,090 %%) with 0.05 per cent infestation was found effective and was at par with all other treatments riz, Tr (Chlorantraniliprole 18.5 SC @ 0.006 0.05 per cent infestation, T. (Thiodicarb 75 WP 0.113 %) 0.05 per cent infestation, Ts (Emamectin benzoate 5 SG 0.0015 %) 0.06 per cent infestation, T (Flubendiamide 20 WG @ 0.005 %) 0.06 per cent infestation, Te (Fipronil 5 SC @ 0.01 %) 0.06 per cent infestation and T (Lambda cyhalothrin 5 EC0.003 %) 0.06 per cent infestation.
Name of the Candidate : Sontakke Aparna Sanjay
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology

Year of Submission : 2019
Name of Guide/Co guide : Dr. S. D. Desai
Abstract :
The field experiment on 'Screening of cultivars and effect of sowing windows, varieties and methods of transplanting on pests infesting finger millet, *Eleusine coracana* (L.) Gaertn.' in which, experiment on screening of varieties was undertaken at Department of Agril. Botany, College of Agriculture, Dapoli and the experiment of sowing windows, varieties and methods of transplanting was undertaken at Department of Agronomy, College of Agriculture, Dapoli, during the *Kharif* season of 2018.

During present investigation, fifty-eight cultivars/genotypes were screened against overall mean population of aphids, ear head caterpillar infesting panicle and percent leaf infestation by ear head caterpillar. The aphids population ranges from 4.77 to 13.78. The highest (13.78) mean population was recorded on the cultivars N27 and lowest (4.77) population was recorded on the cultivar N50.

The data on overall mean percent leaf infestation by ear head caterpillar per plant was in the range of 8.71 to 15.49. The highest (15.49) percent leaf infestation by ear head caterpillar was recorded on the cultivar N30 and lowest (8.71) percent leaf infestation by ear head caterpillar was recorded on the cultivar N10. The data on overall mean population of ear head caterpillar infesting panicle was in the range of 0.45 to 0.80. The highest (0.80) mean population of ear head caterpillar infesting panicle was recorded on the cultivars N35, N36, N52, N54, N59 and lowest (0.45) mean population of ear head caterpillar infesting panicle was recorded on the cultivars N4, N8 and N27.

The data on effect of different sowing windows on aphid population per plant during 38th SMW, was minimum (37.75) in treatment S2 (25th SMW, 18th -24th June) and the treatment was at par with S1 (23rd SMW, 4th-10th June) with 38.45 aphids per plant. data on effect of different varieties on aphid population during 39th SMW results revealed that the minimum (34.98) aphid population was observed in V4 (Sindhudurg local) and was at par with the V2 (Dapoli safed) and V3 (Dapoli-2) with 39.50 and 39.71 aphids per plant, respectively.

The data on combine effect of different sowing windows and varieties on ean population of aphid per plant during 33rd SMW and 34th SMW, were minimum (19.15, 20.71 respectively) in S1V4. During 35th SMW, 37th SMW, 38th SMW and 39th SMW, were minimum (16.23, 26.03, 30.30, 24.54, respectively) in treatment combination S3V4 [S3 (27th SMW, 2nd -8th July) + V4 (Sindhudurg local)], S2V3 [S2 (25th SMW, 18th -24th June) + V3 (Dapoli-2)], S1V1 [S1 (23rd SMW, 4th -10th June) + V1 (Dapoli-1)], S2V4 [S2 (25th SMW, 18th -24th June) + V4 (Sindhudurg local)], respectively.

The data on combine effect of different sowing windows and methods of transplanting on population of aphidsper plant during 33rd SMW, 35th SMW, 37th SMW, 38th SMW, 39th SMW, was minimum (20.14, 21.43, 35.84, 34.05, 34.32, respectively) in treatment combination S1M1 [S1 (23rd SMW, 4th -10th June) + M1 (Thomba)], S3M2 [S3 (27th SMW, 2nd -8th July) + M2 (Awatni)], S2M1, S1M2, S2M2, respectively.

The data on combine effect of different varieties and methods of transplanting on aphid population per plant during 31st SMW, 32nd SMW, 33rd SMW, 34th SMW, 37th SMW were minimum (12.57, 15.60, 18.17, 18.96, 43.41 respectively) in treatment combination V3M1 and during 38th SMW were minimum (34.07) in treatment combination V4M2. The data on combine effect of different sowing windows, varieties and methods of transplanting on population of aphid per plant during 31st SMW, 32nd SMW, 33rd SMW, 34th SMW, 35th SMW, 36th SMW, 37th SMW, 38th SMW, 39th SMW were minimum (9.45, 12.47, 14.21, 14.53, 12.66, 15.40, 21.36, 26.33, 23.85, respectively) in treatment combination S3V2M2, S1V3M1, S1V3M1, S1V3M1, S3V4M2, S2V1M2, S2V3M2, S1V1M2, S2V4M1, respectively.

The data on effect of different sowing windows on percent leaf infestation by ear head caterpillar per plant during 35th SMW were minimum (10.27) in treatment S1 and was at par with the S2. During 38th SMW were minimum (5.91) in treatment S2 and was at par with the S1. The data on effect of different varieties on percent leaf infestation by ear head caterpillar during 35th SMW were minimum (8.92) in treatment V4 and was at par with the V1 and V2.

The data on combine effect of different sowing windows and varieties on percent leaf infestation by ear head caterpillar during 35th SMW, 38th SMW were minimum (6.36 and 4.70) in treatment combination S1V3, S2V1, respectively. During 37th SMW, 41st SMW, 42nd SMW, 43rd SMW were minimum (8.87, 9.94, 13.05,13.58, respectively) in treatment combination S2V4.

The data on combine effect of different sowing windows and methods of transplanting on percent leaf infestation by ear head caterpillar during 35th SMW, 39th SMW, 41st SMW were minimum (9.11, 7.80, 11.15, respectively) in treatment combination S3M1, S3M1, S2M2, respectively.

The data on combine effect of different varieties and methods of transplanting on percent leaf infestation by ear head caterpillar during 35th SMW, 36th SMW, 39th SMW (7.26, 9.23, 7.38, respectively) in combination V4M1, V2M1, V3M1 respectively. During 40th, 41st SMW, 42nd SMW were minimum (13.31,10.89,15.60, respectively) in V4M2.

The data on effect of different sowing windows, varieties and methods of transplanting on percent leaf infestation by ear head caterpillar during 35th SMW, 36th SMW, 37th SMW, 38th SMW, 39th SMW, 40th SMW, 41st SMW, 42nd SMW, 43rd SMW were minimum (5.26, 6.69, 7.69, 4.50, 6.22, 12.59, 8.75, 12.33, 12.00, respectively) in S2V4M1, S3V3M2, S2V4M1, S2V1M2, S3V3M1, S2V4M2, S2V4M2, S2V4M1, S2V4M1 respectively.

The data on combine effect of different sowing windows and varieties on mean population of ear head caterpillars per panicle during 42nd SMW was minimum (0.57) in S2V2 and S2V3. The data on combine effect of different varieties and methods of transplanting on mean population of ear head caterpillars per panicle during 40th SMW, 43rd SMW were minimum (0.36 and 0.69) in V2M2, and V3M1.

The data on combine effect of different sowing windows, varieties and methods of transplanting on mean population of ear head caterpillars per panicle during 40th SMW, 41st SMW, 42nd SMW, 43rd SMW were minimum (0.20, 0.46, 0.53, 0.60, respectively) in S2V3M1, S1V1M2, S2V1M1, S1V4M2 respectively. The data on effect of different sowing windows on root aphids on root of per plant during 43rd SMW was minimum (4.78) in treatment S3 which was at par with the treatment S2. The data on combine effect of different sowing windows and varieties on root aphids on root of per plant during 43rd SMW was minimum (4.07) in S3V1.

The data on combine effect of sowing windows and methods of transplanting on root aphids on root of per plant during 42nd SMW, 43rd SMW were minimum (4.27 and 4.33) in S3M1. The data on combine effect of different varieties and methods of transplanting on root aphids on root of per plant during 42nd SMW was minimum (4.11) in V1M1.

The data on combine effect of sowing windows, varieties and methods of transplanting on root aphids on root of per plant during 42nd SMW, 43rd SMW were minimum (3.13 and 3.40) in S3V2M2, S3V1M1 respectively.

Name of the Candidate : Shigwan Priti Sunil
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2019
Name of Guide/Co guide : Dr. A. L. Narangalkar

Abstract :

The present investigation on "Screening of cultivars, seasonal incidence and management of pests infesting brinjal, *Solanum melongena* L." was carried out during *rabi* season of 2017-18 at Central Experimental Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

During present investigation, twenty three cultivars were screened against overall mean population of whitefly, jassid and aphid per three leaves and per cent infestation of shoot and fruit borer. The whitefly population varied from 4.33 to 5.35 per three leaves. The maximum mean population was recorded on the cultivars Arka nilkanth and DPLBR-17 and minimum mean population in the cultivar BB-64**.**

The overall mean population of jassid was in the range of 5.42 to 6.25 per three leaves. The maximum mean population was recorded on the cultivar BB-64. The minimum population recorded on cultivar Kali rawai.

The data on overall mean population of aphid showed that the population was varied from 3.97 to 5.08 per three leaves. The maximum mean population was recorded on the cultivar CHES-249. The minimum population was observed on DPLBR-13.

The mean infestation of brinjal shoot and fruit borer was in range of 7.26 to 34.36 per cent. The maximum infestation was noticed in the DPLBR-14. The minimum infestation was recorded in cultivar SM-6-6.

The study on seasonal incidence of pests infesting brinjal revealed marked differences in mean pest infestation as regard to Standard Meteorological Weeks. The population of whitefly and jassid reached to peak in 16^{th} SMW (16^{th}-22^{nd} April) that was recorded 9.06 and 8.76 per three leaves, respectively whereas aphid population peaked in 15^{th} SMW (9^{th}-15^{th} April) which was recorded 10.11 per three leaves. The shoot and fruit borer infestation ranged from 5.35 to 25.00 per cent. It reached to peak in 17^{th} SMW (23^{rd}- 29^{th} April) which was recorded 25.00 per cent.

The population of whitefly, jassid and aphid showed positive significant correlation with maximum and minimum temperature whereas infestation of shoot and fruit borer showed positive significant correlation with minimum temperature. The population of whitefly, jassid, aphid and infestation of shoot and fruit borer showed positive correlation with evening humidity and negative correlation with morning relative humidity.

The data on mean population of whitefly per three leaves after three sprays revealed that the treatment spinosad 45 SC @ 0.015 per cent was the best treatment which was recorded minimum (6.25 per three leaves) mean whitefly population and was at par with *Verticillium lecanii* 1.5 L @ 4ml/*l* (6.41),

emamectin benzoate 5 SG @ 0.002 per cent (6.43), buprofezin 70 DF @ 0.045 per cent (6.65) and *Metarhizium anisopliae* 1 WP @ 5g/*l* (6.74).

The data pertaining to the overall efficacy of different insecticides against jassids per three leaves infesting brinjal after three sprays revealed that the treatment spinosad 45 SC @ 0.015 per cent was the best treatment which was recorded minimum (8.36 per three leaves) mean population and was at par with *Verticillium lecanii* 1.5 L @ 4ml/*l* (8.45), emamectin benzoate 5 SG @ 0.002 per cent (8.70), buprofezin 70 DF @ 0.045 per cent (8.89), azadirachtin 1 EC @ 0.0025 per cent (9.17) and *Metarhizium anisopliae* 1 WP @ 5g/*l* (9.21).

The results regarding overall mean of three sprays against aphids infesting brinjal revealed that the treatment spinosad 45 SC @ 0.015 per cent was the best treatment which was recorded minimum (5.92 per three leaves) mean population and was at par with *Verticillium lecanii* 1.5 L @ 4ml/*l* (6.11), emamectin benzoate 5 SG @ 0.002 per cent (6.24), buprofezin 70 DF @ 0.045 per cent (6.42), *Metarhizium anisopliae* 1 WP @ 5g/*l* (6.63) and azadirachtin 1 EC @ 0.0025 per cent (6.67).

The data on mean per cent infestation of shoot and fruit borer after three sprays revealed that the treatment spinosad 45 SC @ 0.015 per cent was the best treatment which was recorded minimum (3.29) and was at par with emamectin benzoate 5 SG @ 0.002 per cent (4.12), azadirachtin 1 EC @ 0.0025 per cent (6.57), buprofezin 70 DF @ 0.045 per cent (7.70), *Metarhizium anisopliae* 1 WP @ 5g/*l* (8.07) and *Verticillium lecanii* 1.5 EC @ 4ml/*l* (8.57).

Name of the Candidate : Mr. Pawar Amol Vijay

Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology

Year of Submission : 2019

Name of Guide/Co guide : Dr. S. K. Mehendale

Abstract :

The present investigation entitled "Screening of cultivars, seasonal incidence and management of pests infesting green gram, *Vigna radiata* (L.) Wilczek was carried out during *rabi* season of 2018-2019 at Research and Educational Farm, Department of Agricultural Botany, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.).

During present investigation, sixteen genotypes of green gram were sown from which five genotypes were not germinated. The overall mean per cent plant damage of stem fly in different cultivars was in the range of 20.00 to 42.22 per cent. The highest mean per cent damage was recorded in the PUSA-1477(42.22%) and lowest in DPLM-26(20.00%). The overall mean aphid population was in the range of 0.41 to 6.86. The highest mean population was recorded on cultivar Vaibhav(6.86) and lowest population was on cultivar PKV-AKM-4(0.41). The overall mean population of whitefly per leaf was in the range of 0.19 to 0.47. The highest population was recorded on the cultivar DPLM-26(0.47) and minimum on the cultivar PUSA-1477(0.19).

Seasonal incidence study revealed that the mean per cent plant damage by stem fly was first observed from 51st SMW (17Dec-23Dec 2018). No stem fly infestation was recorded in 50th SMW (10Dec-16Dec) and onwards. As regards correlation with weather parameters, the mean per cent damage of stem fly exhibited significant positive correlation with minimum temperature (r=0.70), maximum temperature (r=0.734), Bright Sunshine Hours (B.S.S.) (r=0.797). While significant negative correlation with morning relative humidity (r= -0.71).

Similarly, no aphid population was recorded upto 50th SMW (10Dec-16Dec 2018) which slowly increased and reached to peak in 4th SMW (22Jan-28Jan) with 12.45 mean aphid population. After 2nd SMW the aphid population increased at a sudden. The correlation between mean population of aphids and different meteorological parameter revealed that maximum temperature (0.759) and wind speed (0.718) were significant and positively correlated whereas, morning relative humidity (-0.682), evening relative humidity (-0.883) were significant and negatively correlated.

The whitefly population initiated from 51st SMW (17Dec-23Dec). The mean population of white fly ranged from 0.00 to 0.80. No population was recorded upto 50th SMW (10Dec-16Dec). The minimum (0.08) incidence was recorded in 51st SMW (17Dec-23Dec). The maximum whitefly population (0.80) was recorded in 6th SMW (05Feb-11Feb).However whiteflies remained at very low level throughout the season. The correlation between mean whitefly population and the weather parameters showed negative significant correlation with morning relative humidity (r=-0.902), evening relative humidity(r=-0.773), while maximum temperature(r=0.716), minimum temperature (r=0.850), wind speed(r=0.926) were positively correlated with mean whitefly population.

The results regarding cumulative effect of two insecticide application in case of stem fly revealed that per cent plant damage in the treatment fipronil 0.3% GR @ 20kg/ha was found to be significantly less with 15.79 per cent. Untreated plot recorded highest (38.08%) plant damage. Similarly, the cumulative mean population of aphid after three sprays revealed that treatment monocrotophos 36% SL @ 4.37 ml/10L was

the best treatment recorded minimum mean population of aphids (4.41).Untreated control which recorded highest aphid population (9.29). Cumulative mean of two insecticide applications for whitefly revealed that treatment fipronil 0.3% GR @ 20kg/ha (0.06) was significantly the best treatment than other treatments. The maximum (0.67) whitefly population was recorded in untreated control.

The effect of different treatments on the yield of green gram revealed that, the maximum green gram yield (6.67 q/ha) was recorded in fipronil 0.3% GR @ 20 kg/ha which was significantly superior over rest of the treatment followed by monocrotophos 36% SL @ 4.37 ml/ha (5.46 q/ha).

Name of the Candidate : Ms. Lad Sonali Sanjay

Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology

Year of Submission : 2019

Name of Guide/Co guide : Dr. (Mrs.) Kumud V. Naik

Abstract :

The present investigation entitled Screening of cultivars, seasonal incidence and management of pests infesting bitter gourd. *Mamordica charantia* L. was carried out during *rabi*-summer season of 2017-18 at Centre of Excellence for Mango, College Of Agriculture, Dapoli Dist. Ratnagiri.

During present investigation, six bitter gourd cultivars were screened against pests infesting bitter gourd. The incidence of whiteflies, aphids, leaf miners, thrips was started from seedling stage of the crop whereas, there was no infestation of fruit flies on all screened cultivars after germination of seeds up to fruit setting. The maximum mean population of whiteflies was recorded in the cultivar Hirkani (3.51 0.29) whiteflies/three leaves/plant, while the minimum (2.76 0.29) mean population was recorded in cultivar BA 07. The maximum mean population of aphids was recorded in cultivar BA 07 (3.94 ± 0.50) aphids/three leaves/plant, while minimum mean population (2.71 ± 0.50) was recorded in cultivar Phule Green Gold. The maximum mean infestation of leaf miners was recorded in cultivar DPL BG 8 (1.47 ± 0.19) leaf mines/three leaves/plant and minimum mean infestation (0.97 0.19) was recorded in cultivar Kokan Tara. The maximum mean population of thrips was recorded in cultivar Kokan Tara with 4.00 ± 0.23 thrips/three leaves/plant, while minimum mean population (3,34 0.23) was recorded in cultivar Phule Green Gold. The maximum (64.56 12.93) per cent mean infestation of fruit fly was recorded in the cultivar DPL BG 8 followed by Kokan Tara (50.70), BA 07 (41.78), Preethi (35.97) and Hirkani (33.55). The least (29.86 ± 12.93) per cent mean infestation was recorded in the cultivar Phule Green Gold.

The study on seasonal incidence of pests infesting bitter gourd revealed that there were marked differences observed in infestation of whiteflies, aphids, leaf miner, thrips and fruit flies. The population of whiteflies (1.00 1.31) was found in the 13 SMW (26 March -01 April). The minimum population (0.33 1.31 per three leaves) was recorded in 23rd SMW (5th 11th June), while maximum (4.00 1.31) population observed in 14m SMW (204 - 8th April) and 150 SMW (9th-15th April), Whereas, the population of aphids (5.00 ± 1.44) was noticed in the 13th SMW (26 March-1 April). Minimum aphid population (2.50 1.44) was recorded in 19th SMW (7th-13th May), while maximum (7.10 ± 1.44) population was recorded during 15h SMW (9th-15th April). The mean infestation of leaf miners (0.32 0.22) was observed in the 13th SMW (26th March-1 April). Minimum leaf miner infestation (0.01 ± 0.22) was recorded in 23rd SMW (5th-11th June), while maximum (0.50 0.22) infestation was recorded during 15th SMW (9th-15th April) and 16th SMW (23 29th April). The mean population of thrips (4.60 ± 1.05) was noticed in the 13th SMW (26th March-1 April). Minimum thrips population (1.00 ± 1.05) was recorded in 23rd SMW (5th-11th June), while maximum (4.60 1.05) population was recorded during 13 SMW (26th March-1 April). The infestation of fruit flies was started after fruit setting in the third week of April (16th SMW). Minimum per cent fruit flies infestation (31.05 ± 27.08) was recorded in 16 SMW (16th-22nd April), while maximum (73.58 ± 27.58) per cent infestation was recorded during 20th SMW (14th. 20th May).

The data on correlation between mean population of pests infesting bitter gourd and different weather parameters revealed that all the meteorological parameters viz., maximum temperature, minimum temperature, morning relative humidity and evening relative humidity were found to be non-significant with mean population of aphids. The minimum temperature had significant correlation with mean population of whiteflies, thrips, leaf miner infestation and per cent infestation of fruit flies while, other meteorological parameters were found to be non-significant.

The studies on efficacy of some insecticides against pests infesting bitter gourd indicated that lambda cyhalothrin 5 EC @ 0.0025 per cent was found to be effective against whiteflies with minimum (1.73) mean whitefly population per three leaves per plant and was at par with azadirachtin 1 EC @ 0.003 per cent (1.97) and spinosad 45 SC @ 0.014 per cent (2.22). Lambda cyhalothrin 5 EC@ 0.0025 per cent was found again effective against aphids with 4.26 mean population per three leaves per plant. In case of leaf miners, lambda cyhalothrin 5 EC @ 0.0025 per cent was the best treatment which recorded minimum (1.97) mean infestation per three leaves per plant and was at par with azadirachtin 1 EC @ 0.003 per cent (2:21), spinosad 45 SC @ 0.014 per cent (2.31) and chlorantraniliprole 18.5 SC @ 0.005 per cent (2.41). The

treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was found effective against thrips which recorded minimum (2.41) population and was at par with spinosad 45 SC @ 0.014 per cent (3.05) and malathion 50 EC@0.05 per cent (2.84). While, spinosad 45 SC @ 0.014 per cent was found effective against fruit flies which recorded minimum (16.69%) mean fruit infestation and was at par with emamectin benzoate 5 SG @ 0.002 per cent (20.26%).

Name of the Candidate : Ajith Kumar Bugada
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2019
Name of Guide/Co guide : Dr. A. Y. Munj

Abstract :

The present studies were undertaken at Agronomy farm, College of Agriculture, Dapoli during *rabi* 2018-19 to evaluate the effect of different fertilizer levels and various mulches on the pests infesting okra in the *rabi*- summer okra.

During 4^{th} WAS the treatment F_2 (100% RDF through fertigation in 14 splits) recorded minimum aphid population (4.06 aphids/ three leaves/plant) which was at par with the treatments F_1 (120% RDF through fertigation in 14 splits) and F_4 (Soil application of 100% RDF at recommended time schedule) which recorded 4.57 and 4.64 aphids per three leaves per plant respectively. Data during 6^{th} WAS revealed that the mean aphid population (11.36) was lowest in the treatment F_3 (80% RDF through fertigation in 14 splits) which was at par with the treatments F_2 and F_4 which recorded 12.19 and 13.57 aphids respectively. During 7^{th} WAS treatment F_1 and during 8^{th} WAS treatment F_4 recorded minimum aphid population (22.27 and 10.61 aphids/3 leaves/plant).

During 5^{th} WAS minimum whitefly population was recorded on the treatments F_3 and F_4 which recorded 0.53 whiteflies /3 leaves /plant and these treatments were at par with the treatment F_1 which recorded 0.55 whiteflies /3 leaves / plant. During 7^{th} WAS whitefly population was found lowest (0.57) in the treatment F_2 which was at par with the treatment F_3 that recorded 0.60 whiteflies per three leaves per plant.

On 10^{th} and 13^{th} picking data on effect of different levels of fertigation on fruit and shoot borer infesting okra showed that the treatment F_1 was found to be the effective treatment by recording 7.53 and 7.19 per cent fruit borer infestation per plot.

During 4^{th} WAS the minimum aphid population (2.94) was recorded in treatment M_3 (Paddy straw mulch) which was at par with treatment M_4 (No mulch).During 5^{th} WAS the minimum aphid population (3.33 aphids/three leaves/plant) was recorded on the treatment M_4. During 7^{th} and 8^{th} WAS the treatment M_3 was effective in controlling aphids which recorded 17.77 and 8.79 aphids respectively. During 9^{th} WAS the minimum aphid population (0.53 aphids/three leaves/plant) was recorded in the treatment M_4 which was at par with the treatments M_3 and M_1 (Black polythene mulch) which recorded 0.56 and 0.58 aphids. During 10^{th} WAS the lowest aphid population (0.50) was recorded on M_3 which was at par with treatments M_2 and M_4.

The data on effect of different mulches on mean jassid population revealed that during 3^{rd},4^{th},5^{th} ,6^{th},7^{th},8^{th},9^{th} and 10^{th} WAS, the minimum (0.90, 0.87, 2.12,3.33,2.66, 3.58 , 2.78 and 2.77 respectively) jassids population was recorded in treatment M_3 which was at par with treatment M_4 (No mulch).

During 4^{th}, 6^{th} and 9^{th} WAS the minimum number of whiteflies were recorded in the treatment M_3 (0.54, 0.50 and 0.52 respectively) and was at par with M_4 no mulch (0.63 0.85 and 0.59 respectively).

Data on infestation of fruit borer showed that during 20^{th} picking the infestation (8.70%) was found in the treatment M_3 which was at par with treatment M_4 which recorded 10.29 percentage of fruits infested with fruit borer.

During 3^{rd} WAS the lowest aphid population(0.52 aphids/3 leaves/plant) was recorded in the treatment F_1M_2 (120% RDF through fertigation + Silver polythene mulch) which was at par with the treatments F_1M_1, F_1M_4, F_2M_2, F_2M_4, F_3M_2 F_3M_3, F_3M_4 and F_4M_2 that recorded 0.68 ,0.72, 0.56,0.61,0.67,0.63,0.67 and 0.69 aphid per three leaves per plant respectively. During 4^{th} WAS treatment combination F_2M_3 (100% RDF through fertigation + Paddy straw mulch) recorded minimum aphid population (2.54 aphids/three leaves/plant). During 5^{th} WAS minimum aphid population (2.40 aphids/3 leaves/plant) was recorded in the treatment F_2M_4 (100% RDF through fertigation + No mulch). During 7^{th} WAS the treatment combination F_4M_3 (Soil application of RDF+ Paddy straw mulch) recorded the lowest number of aphids (14.82 aphids/3 leaves/plant). During 8^{th} WAS the lowest population (6.15) was observed on the treatment combination F_3M_3 (80% RDF through fertigation + Paddy straw mulch) which was at par with F_4M_3 , F_2M_2, F_1M_2, F_1M_3, F_4M_2 , F_4M_4, F_3M_2, F_1M_4 , F_2M_3, F_1M_1, F_2M_1 which recorded 6.40, 9.80, 9.86, 10.41,11.43, 11.64, 13.05, 13.14, 13.37 and 13.79 aphid population respectively.

The observations recorded on interaction effect of fertigation and mulching on jassids during 3rd WAS showed that the treatment combination F_3M_3 recorded lowest jassid population (0.84 jassids/three leaves/plant). During 4th WAS minimum jassid population (0.83 jassid/3 leaves/plant) was recorded on the treatment combination F_1M_3. During 5th WAS, results revealed that the treatment combination F_2M_4 recorded minimum jassid population (1.89 jassids/3 leaves/plant) which was at par with the treatments F_1M_3 (mulch). During 6th WAS the treatment combination F_2M_3 recorded minimum jassid population (2.75 /3 leaves/ plant.) During 7th WAS and 8th WAS showed that the treatment combination F_1M_3 recorded minimum jassid population 2.33 and 2.85 jassids /3 leaves /plant. During 9th WAS the treatment combination F_4M_3 was found effective and recorded minimum jassid population of 0.98 jassid /3 leaves/plant. During 10th WAS the lowest jassid population (2.14) was recorded in the treatment combination F_3M_4.

The data on combination effect of different fertigation and mulches on infestation of whiteflies showed that during 6th WAS the treatment combinations F_1M_3, F_2M_3, F_3M_3 and F_4M_3 recorded minimum whitefly population (0.50 whiteflies/3 leaves/plant.

During 12th picking data on fruit borer infestation recorded on different treatment combinations was lowest (7.41%) in treatment F_3M_1 which was at par with the treatments F_1M_2, F_1M_3, F_2M_1, F_2M_2, F_2M_3, F_3M_2, F_3M_3, F_4M_1 and F_4M_2 which recorded 9.97 ,9.77 ,8.68, 8.19, 9.04, 8.50, 9.77,8.95 and 9.60 per cent fruit borer infestation respectively. During 15th picking the lowest percent infestation (6.69) was observed on the treatment combination F_3M_4 which was at par with F_4M_2 , F_1M_3 , F_2M_4, F_2M_2, F_3M_1, F_4M_1, F_4M_3, F_1M_2, F_4M_4, F_2M_1, F_3M_2 ,F_1M_4 and F_2M_3 which recorded 8.06, 8.83, 9.00, 9.35, 9.48, 9.64, 9.82, 10.90, 11.10, 11.26, 12.08, 12.27 and 13.28 borer per cent infestation respectively.

Name of the Candidate : Harshitha. M
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2019
Name of Guide/Co guide : Dr. B. D. Shinde
Abstract :

The present investigation on "Screening of cultivars, seasonal incidence and management of pests infesting tomato" was carried out during rabi season of 2017-18 at Central Experimental Station, Wakawali, Dist.- Ratnagiri.

During present investigation, twenty six cultivars were screened against overall mean population of thrips, whiteflies, aphids and fruit borer. The whiteflies population ranges from 3.38 to 4.60. The highest mean population was recorded on the cultivar LE-415 (4.60) and lowest mean population in the cultivar DPLTO-2 (3.38).The overall mean population of thrips was in the range of 2.17 to 3.41 per three leaves per plant. The highest mean population was recorded on the cultivar LE-66 (3.41). The minimum population was recorded on cultivar DPLTO-7 (2.17).

The data on overall mean population of aphids showed that the population was in the range of 2.02 to 3.11. The maximum mean population (3.11) was recorded on the cultivar LE-415. The minimum population (2.02) was observed on cultivar DPLTo-1.The data on overall mean population of borer showed that the population was in the range of 43.76% to 16.10%. The maximum mean population (43.76%) was recorded on the cultivar BT-317. The minimum population (16.10%) was observed on cultivar DPLTO-2.

The study on seasonal incidence of pests infesting tomato revealed marked differences in mean pest infestation as regard to Standard Meteorological Weeks. The maximum (8.80) whitefly population recorded in 17th SMW (23rd 29th April). The population of thrips reached to peak (7.56) in 11th SMW (4th-10th March). The maximum (4.69) aphid population recorded in 8th SMW (18th 24th February) and maximum (43.20%) fruit borer infestation was recorded during 14th SMW (1- 7th March).The maximum temperature (r=0.597) and minimum temperature (r-537) recorded positive significant correlation with mean population of whiteflies. The evening humidity (r=0.310) showed only positive correlation with mean population of whiteflies.The maximum temperature (-0.716) and minimum temperature (r-0.610) recorded positive significant correlation with mean population of thrips. The evening humidity (r=0.051) showed only positive correlation with mean population of thrips. The maximum temperature (r=-0.011), minimum temperature (r=-0.390), morning relative humidity (-0.153) and evening relative humidity (-0.368) recorded negative non- significant correlation with mean population of aphids.The maximum temperature (r-621) recorded positive significant correlation with per cent infestation of fruit borer. The minimum temperature (0.463) showed positive correlation with per cent infestation of fruit borer.The overall efficacy of different insecticides against whitefly per three leaves after three sprays revealed that the treatment Thiamethoxam 25 WG @ 0.01 per cent was the best treatment. which was recorded minimum (3.36) mean pest population per three leaves and was at par with Chlorantraniliprole 2 SC @ 0.004 per cent (3.36) and Lamda Cyhalothrin 5 EC@ 0.0025 per cent (3.39).The overall efficacy of different insecticides against thrips per three leaves infesting tomato after three sprays revealed that the treatment Thiamethoxam 25 WG @0.01 per cent was the

best treatment which was recorded minimum (3.00) mean population per three leaves and was at par with Lamda Cyhalothrin 5 EC @ 0.0025 per cent (3.13).

The results regarding overall mean of three sprays against aphids infesting tomato revealed that the treatment Dimethoate 30 EC @ 0.06 per cent was the best treatment which was recorded minimum (1.29) mean population per three leaves.The data on mean per cent infestation of fruit borer three sprays revealed that the treatment after Chlorantraniliprole 2 SC @ 0.004 per cent was the best treatment which was recorded minimum (13.23) and was at par with Flubendiamide 20 WG @ 0.01 per cent (13.32). The data on effect of different treatments on the yield of tomato revealed that, the maximum average tomato yield (38.50 t/ha) was recorded in the treatment Chlorantraniliprole 2 SC @ 0.004 per cent which was significantly superior over rest of the treatment. The next effective treatments Flubendiamide 20 WG @0.01 per cent (37.70 t/ha).

Name of the Candidate : Gujar Swapnil Vilasrao
Degree for which the thesis : Ph. D.(Ag.)
Year of Submission : 2019
Name of Guide/Co guide : Dr. A. L. Narangalkar
Abstract :

The present studies entitled "Fruit flies infesting Mango and their management' conducted during year 2014-15 and 2015-16. The observations on population fluctuation of fruit flies in Mango ecosystem revealed that the maximum fruit flies were noticed during first fortnight of July (460.10-126.06 flies/trap). From second fortnight of September onwards, population was declined gradually and reached its minimum (32.90±126.06 flies/trap) during second fortnight of December 2014. Further it gradually rose to (188.80126.06 flies/trap) during first fortnight of March 2015, and then declined till second fortnight of April and again rose to (216.70 126.06 flies/trap) during second fortnight of May 2015.

During first fortnight of June 2015 to second fortnight of May 2016, the maximum fruit flies were noticed during first fortnight of June (478.80+126.19 flies/trap). The peak activity was noticed from first fortnight of June 2015 to first fortnight of August 2015.From second fortnight of August 2015 onwards population was declined gradually and reached its minimum (21.90±126.19 flies/trap) during first fortnight of February 2016.

Further fruit fly population gradually rose from second fortnight of February 2016 second fortnight of May 2016. The data on correlation between fruit flies and different meteorological parameters during 2014-15 reveled that minimum temperature (0.650*) morning relative humidity (0.510), evening relative humidity (0.628), wind speed (0.674*) and rainfall (0.717) was found to be positively significant. While bright sunshine hours (-0.778°) was found to be negatively significant. During 2015-16, minimum temperature (0.539°), wind speed (0.773), and rainfall significant. While bright (0.580) were found to be positively sunshine hours (-0.613") was found to be negatively significant.

The data on species composition of fruit flies infesting Mango from Konkan region and also fruit fly species observed in Mango ecosystem in Methyl eugenol baited traps revealed that four species were trapped in fruit fly traps from different locations during both the years. They were *Bactrocera dorsalis* (Hendel) Oriental fruit fly, *Bactrocera correcta* (Bezzi) Guava fruit fly. *Bactrocera zonata* (Saunders) Peach fruit fly, *Bactrocera cucurbitae* (Coquillet)-Melon fly.

The data on fruit flies trapped in traps baited with methyl eugenol during fortnight of April up to second fortnight June 2015 and 2016 revealed that overall in Palghar, Roha, Pangari and Vengurla total of 14680 fruits flies were trapped in which B dorsalis was observed to be the most predominant species followed by *B. zonata*, *B. correcta* and *B. cucurbitae* which contributed 10648 (72.53%), 2652 (18.07%), 716 (4.88%) and 664 (4.52%) fruit flies, respectively.

The data on species composition of fruit flies emerged from mango fruits collected from various places in Konkan region during 2015 and 2016 revealed that overall in Palghar, Roha, Pangari and Vengurla, *B. dorsalis* was observed to be the most predominant species contributed 56.89 per cent followed by *B. zonata* 24.09 per cent and *B. correcta* 19.02 per cent.

The oveall pooled mean number of fruit flies trapped per trap June for both years revealed that the treatment T (3 ml Methyl Eugenol alone) was found to be the best treatment and recorded 168.41 mean number of fruit flies per trap. However, it was at par with Ty-(3 ml Methyl Eugenol+1 ml Cue Lure). T.-(3 ml Methyl Eugenol+1.5 ml Cue Lure). Ts -(3 ml Methyl Eugenol+2 ml Cue Lure), and T7- (2 ml Methyl Eugenol+1 ml Cue Lure) which recorded 162.06, 153.76, 148.06 and 142.89 mean number of fruit flies per trap, respectively.

The data pertaining to the pooled per cent infestation of fruit flies infesting Mango during 2015-2016 revealed that the per cent fruit infestation was lowest in the treatment Ts-(Deltamethrin @0.0025%) which recorded 9.33 per cent fruit infestation which was at par with the treatments T (DDVP @ 0.05%), T-(Emamectin Benzoate @ 0.0016). T6-(Azadirachtin @ 0.0025 %), T4 (Spinosad @ 0.016) and 12-

(Malathion 50EC @ 0.05) which recorded 12.67, 16.33, 19.67, 23.00, 25.00 per cent fruit infestation, respectively,

The overall per cent fruit damage by fruit fly was ranged from 4.00 (Konkan Ruchi) to 29.00 (Suvarna). The lowest fruit flies infestation was recorded in Konkan Ruchi (4.00%). While in varieties Sindhu and Ratna 13.00 and 20.00 per cent fruit damage The variety Suvarna had noticed highest fruits damage (29.00%).

The data pertaining to screening of exotic mango genotypes against Fruit flies revealed that the overall lowest fruit fly infestation was observed in Tomy Atkins (15.00%). The next genotypes viz., Keitt, Osteen, Maya and Lily recorded 24.00, 24.00, 30.00 per cent fruit damage, respectively.

The data pertaining to screening of and Indian mango genotypes/ cultivars against fruit indicated that the minimum (8.00%) fruit damage was observed in genotype Olur. Whereas, the genotypes viz., Pulihora, Baigampallai, Chiturbadami, Panchadharakalasa,Jahangir. Suvernarekha, Chota Jahangir. Himayuddin, Kondur Goa, Goa mankur, Badami, Vanraj, Pahutan, Fernandian, Neelum, Kesar, Totapuri, Pairi, Mankurad, NajukPasant, Pedharbum, Sabja, Saleem and Rumani recorded 11.00, 13.00, 13.00, 13.00, 14.00, 17.00, 18.00, 19.00, 19.00, 20.00, 21.00, 22.00, 23.00, 24.00, 24.00, 24.00, 24.00,27.00, 28.00, 29.00, 29.00, 33.00, 37.00 and 39.00 per cent fruit damage respectively.

Name of the Candidate : Chopade Bapurao Jaywant
Degree for which the thesis : Ph. D.(Ag.)
Year of Submission : 2019
Name of Guide/Co guide : Dr. S. K. Mehendale
Abstract :

The studies entitled „Seasonal incidence, screening and management of pod borer complex of pigeon pea (*Cajanus cajan* (L.) Millsp)‟ were conducted during 2017-2018 and 2018-2019. Seasonal incidence of pigeon pea against various pod borers revealed that the maximum per cent infestation of *Maruca vitrata* (Geyer) (15.12) was observed in 47th SMW (4th week of November), the maximum per cent infestation of *Exelastis atomosa* (Walsingham) (8.91) was observed in 45th SMW (1st week of November), the maximum per cent infestation of *Helicoverpa armigera* (Hubner) (18.78) was observed in 52nd SMW (5th week of December) and the peak per cent infestation of *Melanagromyza obtusa* (Malloch) (18.38) was observed in 1st SMW (1st week of January). Correlation of pest incidence and weather parameters revealed that the incidence of *M. vitrata* showed non-significant correlation with all the meteorological parameters, the incidence of *H. armigera* showed 46 negative significant correlation with minimum temperature, the incidence of *E. atomosa* showed negative correlation with morning relative humidity and evening relative humidity and the incidence of *M. obtusa* showed negative correlation with minimum temperature. Varietal screening of pigeon pea against various pod borers revealed that all the pod borers (*M. vitrata*, *E. atomosa*, *H. armigera*, and *M. obtusa*) infestation was observe less in cultivars/genotypes BDN-711 (4.25, 2.65, 5.89 and 8.61, respectively) and higher in Kt-1 (10.20, 6.65 and 12.07, respectively) and DPLP-10 (17.66) for *M. obtusa*. Biochemical components of different cultivars/genotypes revealed that the lowest total phenol was recorded in the cultivar Kt-1 while highest in BDN-711, the lowest total soluble sugar was recorded in the cultivar BDN-711 while highest in Kt-1, the lowest protein was recorded in the cultivar BDN 711 while highest in Kt-1. The correlation of biochemical components of different cultivars /genotypes with pod borer complex of pigeon pea revealed that the incidence of all pod borers *M. vitrata*, *H. armigera*, *E. atomosa* and *M. obtusa* had negative but highly significant correlation with total phenol content and positive significant correlation with total soluble sugar and protein. Effect of different sowing dates on pod borer complex revealed that 27th June sowing date was observed to be more congenial for *M. vitrata*, *E. atomosa* and *H. armigera* (11.69, 10.05 and 12.07, respectively) while 13th June sowing date was not congenial as it has revealed less damage by three pod borers (6.88, 5.70 and 7.20, respectively). However, pod fly infestation was highest in 30th May sowing date (19.92) and was less in 27th June sowing date (13.05). Efficacy of different insecticides in managing pod borers of pigeon pea revealed that for all the pod borers (M. vitrata, E. atomosa, *H. armigera*, and *M. obtusa*) the treatment T2 (emamectin benzoate 5 SG @ 0.0015%) was found to be the best treatment by recording minimum overall mean per cent infestation and highest per cent 47 reduction over untreated control (3.71 & 82.34 %, 4.13 & 77.96 %, 2.68 & 81.86 % and 3.23 & 80.67 %, respectively). This treatment was however at par with T1 (spinosad 45 SC @ 0.014%) and T6 (lamda-cyhalothrin 5 EC @ 0.0025%). Further the untreated control recorded highest overall mean per cent infestation (21.01, 18.74, 14.78 and 16.71, respectively). Effect of various treatments on grain yield of pigeon pea revealed that the maximum of 12.87q/ha yield was recorded in treatment T2 (emamectin benzoate 5 SG @ 0.0015%) and it was at par with treatments T1 (spinosad 45 SC @ 0.014%) and T6 (lamda-cyhalothrin 5 EC @ 0.0025%) which recorded 12.58 and 12.51 q/ha, respectively. The minimum pigeon pea yield (5.78 q/ha) was recorded in T8 (Untreated control). Economics of all the treatments against

pod borer complex revealed that the treatment T6 (lamda-cyhalothrin 5 EC @ 0.0025%) emerged as the most economic one recording highest ICBR 1:35.71. It was followed by T2 (emamectin benzoate 5 SG @ 0.0015%) and T5 (indoxacarb 15.8 EC @ 0.0079%) which recorded ICBR of 1:18.83 and 1:14.04, respectively.

Name of Candidate: Golvankar Gopal Maruti
Degree for which the thesis: Ph.D (Ag.)
Year of Submission: 2019
Name of Guide/ Co guide: Dr. V.L.Narangalkar

Abstract:

The present studies on the „Seasonal incidence, screening and management of pests infesting lablab bean (*Lablab purpureus* (L.) Sweet)‟ was conducted at Botany farm, College of Agriculture, Dapoli, Tal: Dapoli, Dist: Ratnagiri (M.S.) during Rabi season 2017-18 and 2018-19. The maximum population (2.50 and 12.38) of aphids three leaves-1 plant-1 was recorded in 12th Standard Meteorological Week i.e. SMW (19-25 March, 2018) and 11th SMW (12-18 March, 2019), respectively. The peak (0.45 and 1.00) of jassids three leaves-1 plant-1 was recorded in 11th SMW (12-18 March, 2018) and 11th SMW (12-18 March, 2019), respectively. The maximum population (0.31, 1.36 and 1.36) of whiteflies three leaves-1 plant-1 was recorded in 8th SMW (19-25 February, 2018), 6th SMW (5-11 February, 2019) and 8th SMW (19-25 February, 2019), respectively. The peak (0.33 and 0.36 thrips three leaves-1 plant-1) population was recorded in 9th SMW (26 February – 4 March, 2018) and 8th SMW (19-25 February, 2019), respectively. The peak activity of *Maruca vitrata* 14.97 and 27.28 per cent pod damage plant-1 was noticed in 12th SMW (19-25 March, 2018) and 11th SMW (12-18 March, 2019), respectively. The maximum population (0.45, 0.45 and 1.20 coccinellids plant-1) was observed in 13th SMW (26 March – 1 April, 2018), 14th SMW (2-8 April, 2018) and 11th SMW (12-18 March, 2019), respectively. The highest population (0.50 and 1.10 mirid bugs plant-1) of mirid bugs was recorded in 12th SMW (19-25 March, 2018) and 10th SMW (5-11 March, 2019), respectively. The peak activity 1.40 spiders plant-1 was noticed in 12th SMW (19-25 March, 2018), 13th SMW (26 March – 1 April, 2018), 10th SMW and 11th SMW (5-11 March, 2019 and 12-18 March, 2019), respectively. The data on correlation between aphids infesting lablab bean and different meteorological parameters revealed that, the meteorological parameters like minimum temperature (r = 0.620), wind speed (r = 0.763 and 0.779) and evaporation (r = 0.721 and 0.859) were found to be positively significant with aphid population. While, morning relative humidity (r = - 0.529) had found to be negatively significant with aphid population. The minimum temperature (r = 0.792), wind speed (r = 0.741 and 0.826) and evaporation (r = 0.802 and 0.952, respectively) were found to be positively significant with jassid population. While, morning relative humidity (r = - 0.528) had found to be negatively significant with jassid population. The wind speed and evaporation were found to be positively significant with whitefly population (r = 0.813, and 0.797, respectively). The maximum temperature (r = 0.586) and evaporation (r = 0.535) were found to be positively significant with thrips population. The minimum temperature (r = 0.702 and 0.518), wind speed (r = 0.814 and 0.657) and evaporation (r = 0.776 and 0.858) were positively significant with pod borer infestation whereas, the morning relative humidity (r = -0.543) was found to be negatively significant with pod borer infestation. The maximum mean population of aphids was recorded in culture Line 9 (4.46 aphids three leaves-1 plant-1) and lowest (2.19) mean population of aphids was recorded in culture Line 26. In resistance rating status, the 18 cultures viz., Line 4, Line 6, Line 8, Line 9, Line 10, Line 11, Line 14, Line 16, Line 22, Line 26, Line 29, Line 36, Line 38, Line 39, Line 40, Line 41, Line 42 and Line 44 i.e. Konkan Wal -2 were observed to be moderately resistance noticed with 1.1 to 2.0 mean infestation index of aphids. The highest mean population of jassids was recorded in the culture Line 44 i.e. Konkan Wal -2 (0.42 jassids three leaves-1 plant-1) whereas, the lowest mean population of jassids (0.28) was recorded in culture Line 4 and Line 11. The highest mean population of whiteflies (1.43) was recorded in genotype Line 8 and lowest (0.28 whiteflies three leaves-1 plant-1) was recorded in genotypes Line 10 and Line 26. The maximum mean population of thrips was recorded in cultures Line 14, Line 41 and Line 44 i.e. Konkan Wal -2 (0.12) while, the lowest (0.03) mean population of thrips was recorded in culture Line 16. The maximum pod damage (15.23%) was recorded in genotype Line 44 i.e. Konkan Wal -2 and the lowest pod damage (10.41%) was recorded in genotype Line 16. In resistance rating status, the all 18 cultures were observed to be highly resistance (0-20% pod damage) against pod borer. The maximum mean population of coccinellids was recorded in culture Line 40 (0.41 coccinellids plant-1) whereas, the lowest (0.22) mean population of coccinellids was recorded in culture Line 22 and Line 44 i.e. Konkan Wal -2. The highest mean population (0.43) was recorded in genotype Line 8 while, the lowest mean population (0.28 mirid bugs plant-1) was recorded in genotype Line 26. The maximum mean population of spiders was recorded in culture Line 41 (1.16 spiders plant-1) and the lowest (1.01) mean population of spiders was recorded in culture Line 4. In main crop two years pooled results indicated that the treatment lablab bean + marigold (3:1) (T4) was recorded 3.67 mean population of aphids and significantly superior over the rest of treatments. In main crop

two years pooled results indicated that the treatments viz., lablab bean + maize (3:1) (T1), lablab bean + sesamum (3:1) (T6), lablab bean + niger (3:1) (T3), lablab bean + mustard (3:1) (T2), lablab bean + marigold (3:1) (T4) and lablab bean + coriander (3:1) (T5) recorded 2.22, 2.31, 2.45, 2.67 and 2.67 jassids three leaves-1 plant-1, respectively and all the treatments were significantly superior over the treatment sole lablab bean (T7), but at par with each other. In main crop two years pooled results indicated that the rests of the treatments showed minimum thrips infestation, except lablab bean + coriander (3:1) (T5) and sole lablab bean (T7). The treatments viz., lablab bean + maize (3:1) (T1), lablab bean + mustard (3:1) (T2), lablab bean + niger (3:1) (T3), lablab bean + marigold (3:1) (T4) and lablab bean + sesamum (3:1) (T6) were significantly superior over the treatments lablab bean + coriander (3:1) (T5) and sole lablab bean (T7), but at par with each other and recorded 0.06, 0.11, 0.33, 0.36 and 0.39 thrips three leaves-1 plant-1, respectively. Whereas, the next best treatment was found to be lablab bean + coriander (3:1) (T5) observed 0.54 mean thrip population. In main crop two years pooled results indicated that the mean per cent pod damage five plants-1 of pod borer, M. vitrata observed in the treatments viz., lablab bean + marigold (3:1) (T4), lablab bean + maize (3:1) (T1) and lablab bean + niger (3:1) (T3) were at par with each other and significantly superior over rest of the all treatments with recorded (27.98%, 29.38% and 30.69%) pod damage five plants-1, respectively. In inter crops two years pooled results indicated that the mean aphid population on inter crops observations revealed that the treatment lablab bean + niger (3:1) (T3) was trapped maximum 29.77 mean population of aphids and significantly superior over the rest of all treatments. In inter crops two years pooled results indicated that the mean jassid population on inter crops observations revealed that the treatment sole lablab bean (T7) was significantly superior over rest of all treatments and recorded maximum 3.82 jassids three leaves-1 plant-1. In main crop two years pooled results indicated that the mean population of coccinellids and mirid bugs observations revealed that the treatment sole lablab bean (T7) was significantly superior over rest of treatments with recorded maximum 5.26 mean population of coccinellids and 5.30 mean population of mirid bugs. In inter crops two years pooled results indicated that the mean population of coccinellids and spiders observations revealed that the lablab bean + maize (3:1) (T1) was significantly superior over the rest of all treatments with recorded maximum (110.67) mean population of coccinellids and(17.00) spiders plant-1. The mean population of mirid bugs and honey bees of both years of all observations revealed that the maximum (11.20) mean population of mirid bugs as well as 10.67 mean population of honey bees were noticed in lablab bean + niger (3:1) (T3) and significantly superior over the rest of all treatments. In main crop two years pooled results indicated that the average grain yield of lablab bean revealed that the maximum average grain yield of lablab bean 7.07 q ha-1 was recorded in the treatment lablab bean + maize (3:1) (T1) which was significantly superior over rest of the treatments and at par with treatment lablab bean + marigold (3:1) (T4) recorded (6.49 q ha-1) grain yield. In inter crops two years pooled results indicated that the average yield of inter crops revealed that the maximum average yield of inter crops as marigold (9.52 q ha-1) was recorded in the treatment lablab bean + marigold (3:1) (T4) which was significantly superior over rest of all the treatments. The lablab bean + maize (3:1) (T1) were found to be next best treatment and recorded 4.72 q ha-1 grain yield of maize. The highest LEY (16.01 q ha-1) was observed in lablab bean + marigold (3:1) (T4). The highest gross return (128098.77 ` ha-1), gross margin (119473.77 ` ha-1) and benefit cost ratio (14.85) were observed in the same treatment (T4) lablab bean + marigold (3:1). The next best treatment lablab bean + sesamum (3:1) (T6) were noticed LEY (12.42 q ha-1), gross return (99335.80 ` ha-1), gross margin (91655.80 ` ha-1) and benefit cost ratio (12.93), respectively. In insecticidal application two years pooled data indicated that the mean aphid population observations revealed that the treatment T4 (Malathion 50 EC) was significantly superior over rest of the treatments by recording 2.30 aphids three leaves-1 plant-1. The treatment T4 (Malathion 50 EC) was at par with treatments T3 (Deltamethrin 2.8 EC), T1 (Spinosad 45 SC) and T8 (Emamectin benzoate 5 SG) which recorded 2.83, 3.94 and 4.10 mean population of aphids, respectively. In insecticidal application two years pooled data indicated that the per cent pod damage five plants-1 by pod borer, *M. vitrata* infesting lablab bean observations revealed that the treatment T1 (Spinosad 45 SC) was significantly superior over rest of the treatments by recording 4.20 per cent pod damage five plants-1. The treatment T1 (Spinosad 45 SC) was at par with T8 (Emamectin benzoate 5 SG) recorded 5.13 per cent pod damage five plants-1. In insecticidal application two years pooled data indicated that the mean population of coccinellids was the highest (13.37) coccinellids population plant-1 recorded in treatment T9 (Control water spray), which was significantly superior over rest of the treatments. The mean population of mirid bugs during both the years was revealed that the highest (11.33) mirid bug population plant-1 recorded in treatment T9 (Control water spray) which was significantly superior over the rest of the treatments and at par with treatment T2 (Azadirachtin 10,000 ppm) recorded 9.87 mirid bugs plant-1. The mean population of spiders and syrphids during both the years revealed that the highest (18.97) spider population plant-1 and (12.33) syrphids plant1 recorded in treatment T9 (Control water spray), which was significantly superior over rest of the treatments. The average grain yield of lablab bean of both the years revealed that the maximum average grain yield of lablab bean 7.35 q ha-1 was

recorded in the treatment T1 (Spinosad 45 SC) which was significantly superior over rest of the treatments and also found at par with treatment T8 (Emamectin benzoate 5 SG) with 6.87 q ha-1 grain yield. The maximum net monetary return (NMR) 26580.25 ha-1 was obtained from treatment T1 (Spinosad 45 SC). The maximum Incremental Cost Benefit ratio (ICBR) of 1:19.68 with was obtained from treatment T4 (Malathion 50 EC).

2020

Name of the Candidate : Chavan Aishwarya Anant
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2020
Name of Guide/Co guide : B. D. Shinde
Abstract :

The present investigation on "Screening of genotypes, seasonal incidence and biointensive management of pests infesting chilli (*Capsicum annum L.*)" was carried out during rabi season of 2018-19 at Central Experiment Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

During present investigation, nineteen genotypes were screened against the population of whitefly, thrips and aphids and the fruit borer.

The whitefly population varied from 1.26 to 2.06 per three leaves per plant. The highest mean population was recorded on the genotype WKLC-6 (2.06) and lowest mean population in the genotype DPLC-16 (1.26).

The data on overall mean population of thrips was in the range of 1.68 to 2.69 per three leaves per plant. The highest mean population was recorded on the genotype Jwala (2.69) and lowest population in the genotype WKLC-1 (1.68).

The data on overall mean population of aphids was in the range of 2.86 to 8.26 per three leaves per plant. The highest mean population was recorded on the genotype BC-24 (8.26) and lowest population in the genotype WKLC-15 (2.86).

The data on overall mean infestation of fruit borer was in the range of 11.29 to 32.22 per cent. The maximum (32.22 per cent) mean infestation was recorded in the genotype WKLC-11. The minimum (11.29 per cent) mean infestation was recorded in the genotype Suvarn Prafulla.

The study on seasonal incidence of pests infesting chilli revealed marked differences in mean pest infestation as regard to Standard Meteorological Weeks. The population of whitefly reached to peak in 3rd SMW (15th-21st January) which was recorded 3.20 mean whitefly population per three leaves per plant. The maximum (5.60) mean thrips population per three leaves per plant recorded in 7th SMW (12th-18th February), whereas aphid population peaked in 3rd SMW (15th -21 January) which was recorded 12.30 mean aphids population per three leaves per plant. The fruit borer infestation ranged from 12.73 to 25.33 per cent. It reached to peak in 8th SMW (19th-25th February) which was recorded 25.33 per cent.

The morning relative humidity recorded positive significant correlation with mean whitefly population (r=0.616) and other parameters viz., maximum temperature (r=-0.013), minimum temperature (r=0.205) and evening relative humidity (r=-0.332) showed negative non-significant correlation with population of whiteflies.

The mean thrips population showed positive non- significant correlation with maximum temperature r=0.409minimum temperature r-0.508and evening relative humidity r=0.173while, morning relative humidity r-0.255showed negative non-significant correlation with mean population of thrips.

The mean aphid population exhibited positive significant correlation with morning relative humidity 0.691while, minimum temperature r=-0.560showed negative significant correlation with mean aphid populationThe other parameters viz., maximum temperature r=-0.293and evening relative humidity (r= -0.465) recorded negative non-significant correlation with mean population of aphid.

The per cent mean infestation of fruit borer recorded positive significant correlation with maximum temperature r=0.515and minimum temperature r=0.630while, morning relative humidity r=-0.655recorded negative significant correlation with per cent infestation of fruit borer. The evening relative humidity r=0.372exhibited positive non-significant correlation with per cent infestation of fruit borer.

The data on mean population of per three leaves per plant after three sprays revealed that the treatment *Lecanicillium lecanii* 2×108 cfu/ml @4ml/lit was the best treatment which was recorded minimum (1.49) mean pest population per three leaves per plant and was at par with *Beauveria bassiana* 2x10 cfu/ml @5ml/lit (1.55).

The data pertaining to the overall efficacy of different biopesticides against thrips per three leaves per plant infesting chilli after three sprays revealed that the treatment *Beauveria bassiana* 2×10 cfu/ml @5ml/lit was the best treatment which was recorded minimum (1.87) mean population per three leaves per plant and was significantly superior over rest of the treatments. The next effective treatment was

Lecanicillium lecani 2-10 cfu/ml @4ml/lit which recorded (2.14) mean population of thrips per three leaves per plant.

The results regarding overall mean of three sprays against aphids infesting chilli revealed that the treatment *Lecanicillium lecani* 2×10 cfu/ml @4ml/lit was the best treatment which was recorded minimum (5.93) mean population of aphids per three leaves per plant and was at par with the treatment *Beauveria bassiana* 2×108 cfu/ml @5ml/lit (6.18).

The data on mean per cent infestation of fruit borer after three sprays revealed that the treatment *Bacillus thuringiensis* 3.5% ES @2ml/lit was the best treatment which was recorded minimum (9.54) per cent infestation of fruit borer which was significantly superior over rest of the treatments. The next effective treatment was *Nomurea rileyi* 2×108 cfu/g @ 1g/lit which recorded (9.69) per cent infestation of fruit borer.

The data on effect of different treatments on the yield of chilli revealed that, the maximum chilli yield (117.82 q/ha) was recorded *Bacillus thuringiensis* 3.5% ES @2ml/lit treated plot which was significantly superior over rest of the treatment. The next effective treatment was *Nomurea rileyi* 2×108 cfu/g @ 1g/lit (115.63 q/ha).

Name of the Candidate : Kengare Madhuri Namdev
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2020
Name of Guide/Co guide : (Mrs.) Kumud V. Naik
Abstract :

The present investigation "Seasonal incidence, effect of sowing dates and management of pests infesting dolichos bean, *Lablab purpureus* (L.) Sweet" was carried out during *rabi* season of 2018-19 at Central Experiment Station, Wakavali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Dist. Ratnagiri.

During present investigation, the study on seasonal incidence revealed that there was marked difference in aphid population as regard standard Meteorological weeks. Minimum aphid population (2.8176.81) was noticed in the 48th SMW (26th November-2nd December), while maximum (239.6±76.81) population was recorded during 8th SMW (19th. 25th February). The infestation of pod borers started in the 4th week of December (52th SMW). Minimum (3.9±10.35) per cent infestation of pod borers was recorded in 2nd SMW (8th-14th January). While, maximum (28.10±10.35) per cent infestation was recorded during 6th SMW (5th 11th February).

The data on correlation between mean population of pests infesting dolichos bean and different weather parameters revealed that maximum temperature recorded positive non-significant correlation while, minimum temperature, morning relative humidity and evening relative humidity showed negative non-significant correlation with mean population of aphids. The pod borers exhibited non-significant positive correlation with maximum temperature and minimum temperature while, morning relative humidity and evening relative humidity were found to be negatively non-significant.

The study on the effect of sowing dates against pests infesting dolichos bean revealed marked difference in the population of aphids and pod borers infestation. The minimum (6.36) aphid population was recorded in first date of sowing (2-11-2018) and maximum (38.24) aphid population was recorded in third date of sowing (12-12-2018). The minimum (33.41%) damage of pod borers was recorded in first date of sowing (2-11-2018) and maximum (55.67%) observed in third date of sowing (12-12-2018). It was evident from the results that in dolichos bean pest incidence increased gradually with the advancement of cropping season.

The studies on efficacy of insecticides against pests infesting dolichos bean indicated that treatment chlorpyriphos 20EC @ 0.06 per cent was most effective which recorded 16.5 mean aphid population and was at par with *Lecanicillium lecanii* which recorded 20.57 mean aphid population and Azadirachtin 1000 ppm @ 0.003 per cent recorded 22.53 mean aphid population per three leaves per plant. The treatment chlorpyriphos 20EC @ 0.06 per cent was the best treatment which recorded minimum (12.74%) mean pod infestation and was at par with *Bacillus thuringiensis* (14.03%).

Name of the Candidate : Shinde Pranjali Anil
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2020
Name of Guide/Co guide : S. N. Kale,
Abstract :

The present investigation “Developmental studies of pulse beetle *Callosobruchus maculatus* (Fab.) in different pulses.” with specific objectives was carried out at College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Dist. Ratnagiri (M.S.) during 2018-19. During present investigation, nine different pulses were screened under laboratory conditions to study development, ovipositional preference of

Callosobruchus maculatus. And losses caused due to its infestation. The overall results concluded that none of the pulses were totally resistant to the damage caused by *C. maculatus.* The susceptibility differed in different pulses. During developmental studies, different aspects were studied like, egg laying capacity of *C. maculatus*, incubation period, hatching percentage, adult longevity and total developmental period. The results showed that, average no.of eggs laid by *C.maculatus* on nine different pulses were 119.19 eggs/100 grains. Maximum no.of egg laying was recorded on Gram i.e.(290.67) whereas, minimum no.of egg laying was recorded on Horse gram (23.67). Incubation period was ranged between 2-5days in all the pulses. Maximum incubation period was observed in Black gram i.e.4.67 days whereas minimum incubation period was observed in Green gram and Cowpea i.e.2.67 days. Hatching percentage was found to be maximum i.e.100 per cent in Cowpea and Gram while minimum hatching percentage was recorded in Horse gram (50 per cent). During present investigation, mean developmental period (Days) of *C.maculatus* was recorded 27.96 days. It was maximum no. of days on Green pea i.e 35.33 days and minimum on Gram i.e. 21.33 days. Studies found that maximum number of adults were emerged from Gram (163.00) whereas, minimum no.of adults were emerged from Horse gram (4.33) per 100 grains. Adult longevity was ranged from 3-11days in different pulses. With mean 8.07 days. The maximum adult longevity was observed on Wal i.e. 10.00 days whereas minimum adult longevity was observed on Horse gram i.e. 4.00 days. Preference of female *C. maculatus* to nine different pulses was evaluated under free choice test in olfactometer. The data on average number of eggs laid by female *Callosobruchus maculates* per 100 grains placed in olfactometer showed significant variations. Highest oviposition was recorded on Gram i.e. 106 per 100 grains. The lowest oviposition was recorded on Horse gram i.e 11.00 per 100 grains. Data recorded on orientation of female beetle towards the pulses revealed that mated *C. maculatus* females were most attracted towards Gram as highest number of females were oriented at all the intervals of observation i.e. 8, 8 and 4 at 24, 48 and 72 hours after release, respectively. Horse gram was least attractive to mated *C. maculatus* females as only one female is oriented towards it only at 24 hours after release. Black gram and Wal were also less attractive after horse gram as both these pulses recorded only two female orientations only at 72 hours after release. In case of losses caused by *C. maculatus* to different pulses,both quantitative and qualitative losses were recorded. Per cent weight loss in different pulses showed significantly highest weight loss in Gram i.e. 61.87% and was at par with Mung bean which recorded 46.53% weight loss. Lowest weight loss was found in Horse gram i.e. 8.20% and was at par with Green pea 13.24 %, Wal 14.61%, Pigeon pea 14.61%, Black gram 21.11 % and moth bean 21.75 %. Cow pea recorded moderate weight loss i.e. 31.88%. Per cent grain infestation by *C. maculatus* showed significant variations amongst treatments. Gram recorded significantly highest per cent grain infestation i.e. 98.67% Whereas, lowest grain infestation 9.33 % was recorded in Horse gram. The data obtained from protein estimation, highest protein after infestation of *C. maculatus* was observed in Cow pea i.e. 24.33% and was at par with Green pea and Horse gram which recorded 23.49% and 20.79% protein respectively. Whereas, Mung bean recorded lowest per cent protein i.e. 13.29% and was at par with gram (14. 95%) and Wal (16.79%). From the data obtained from starch content in pulses, the highest starch after *C.maculatus* infestation was observed in Green pea i.e. 19.52% and was at par with Gram 18.37% and Pigeon pea 18.09%. Whereas, Wal recorded minimum starch i.e. 13.96 % and was at par with Green gram 14.21% and Horse gram 14.85%.

Name of the Candidate : Thantharate Sakshi Haresh

Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology

Year of Submission : 2020

Name of Guide/Co guide : Dr.S. D. Desai

Abstract :

Estimation of insecticidal residue was taken up with objectives to estimate the residue of recommended insecticides in Alphonso mango and insecticidalresi due from farmer sorchards. Data on residue of deltamethrin sprayed at recommended and double doses one day after spraying revealed that recommended dose of deltamethrin(9 ml/10 lit.) showed residue of 0.14 ppm which was reduced to 0.08 ppm on 5th day and thereafter was not detectable at 10, 15 and on 25th day. Deltamethrin sprayed at double than recommended dose (18ml/10 litre) showed residue of 0.20 ppm after one day which was reduced to 0.12 ppm on 5th day and thereafter was not detectable at 10, 15 and on 25th day. Per cent loss of deltamethrin residue at arecommended dose on 5th day was 57.14 which was totally lost at 10 days. The half-life of deltamethrin at a recommended dose was observed to be 4.35 days and waiting period was 6.52 days. Deltamethrin at a double dose dissipates 40 per cent on 5th day and it was totally lost on 10th day. The half-life of deltamethrin at a double dose was recorded to be 6.02 days and waiting period was 9.25 days. Data on residue of lambda cyhalothrin sprayed at recommended (6 ml/10 lit.) and double doses (12 ml/10 lit.) at 1,5,10,15 and 25 days after spraying revealed that recommended dose showed residue of 0.84 ppm which was reduced to 0.48, 0.21 and 0.04 ppm on 5, 10 and 15 days after spray respectively. On 25th day the residue of lambda cyhalothrin was below detectable level. The results of lambda cyhalothrin sprayed at

double than recommended dose (12ml/10 lit.) revealed that after one day, double recommended dose of lambda cyhalothrin (12 ml/10 lit.) recorded residue of 1.40 ppm which was reduced to 0.95, 0.53 and 0.10 ppm on 5,10 and 15 days after spraying. The residue of lambda cyhalothrin at 25 days after spraying was below detectable level. Per cent loss of lambda cyhalothrin residue at a dose of 6 ml/10 litre on 5th day was 42.83per cent which was reduced to 75.00 and 95.23 per cent at 10 and 15 days after spraying. The residue of lambda cyhalothrin was totally lost at 25 days after spraying. The half-life of lambda cyhalothrin at a dose of 6 ml per 10 litre was observed to be 8.12 days and waiting period was 18 days. The insecticide lambda cyhalothrin at a dose of 12 ml per 10 litre dissipated 32.14 per cent on 5th day then it was reduced to 62.14 and 92.85 per cent at 10 and 15 days after spraying and later on it was totally lost on 25th day. The half-life of lambda cyhalothrin at a dose of 12 ml per 10 litre was recorded to be 8.75 days and waiting period was 19 days. Imidacloprid residue of the dose 3 ml per 10 litrein HPLC on day one after spraying was 0.12 ppm which reduced to 0.06 ppm at 5 days after spraying. It was below detectable level on 10th day after spraying. The residue of imidacloprid at double than recommended dose of 6 ml per 10 litre at one day after spraying was 0.16 ppm which was reduced to the extent of 0.10 and 0.04 ppm at 5 and 10 days after spraying and later on it was not detectable. Per cent loss of imidacloprid residue at a dose of 3 ml/10 litre on 5th day was 50.00 which was reduced to 100 per cent on 10th day after spraying. The half-life of imidacloprid at a dose of 3 ml per 10 litre of water was found to be 5 days and waiting period was 10 days. The insecticide imidacloprid at a dose of 6 ml per 10 litre dissipated 37.50 per cent on 5th day then it was reduced to 75.0 per cent at 10th day after spraying and later on it was totally lost on 15th day. The half-life of imidacloprid at a dose of 6 ml per 10 litre was recorded to be 7.5 days and waiting period was 15 days. The residue of thiamethoxam at a recommended dose of 1 g per 10 litre of water at one day after spraying was 1.21 ppm which was reduced to 0.53, 0.25, 0.13 and 0.06 at 5,10,15 and 25 days respectively. The residue of thiamethoxam at double than recommended dose at 2 g per 10 litre of water at one day was 2.02 ppm which was reduced to the extent of 1.02, 0.42, 0.20 and 0.12 ppm at 5,10,15 and 25 days after spraying. The insecticide thiamethoxam at a dose of 1 g per 10 litre was dissipated to the extent of 56.19 per cent at five days after spraying and then it was reduced to 79.33, 89.25 and 95.04 per cent at 10, 15 and 25 days respectively. Whereas, double than recommended dose of thiamethoxam was reduced from 49.50, 79.20, 90.09 and 94.05 per cent at 5,10,15 and 25 days after spraying respectively. The half-life of thiamethoxam at a recommended dose was 4.80 days and waiting period was 20 days. The half-life and waiting period of double than recommended dose of thiamethoxam was reported to be 5.20 and 20 days respectively. The residue of dimethoate at a recommended dose of 10 ml per 10 litre of water at one day after spraying was 1.92 ppm which was reduced to 0.57 and 0.12 ppm on 5 and 10 days after spraying respectively. The residue of dimethoate was not detectable after 15 days. Whereas, the residue of dimethoate at double than recommended dose of 20 ml per 10 litre was 3.58 ppm at one day after spraying which was reduced to 1.04 and 0.19 ppm at 5 and 10 days respectively. The insecticide dimethoate was not detectable after 15 days after spraying in mango fruits. The insecticide dimethoate at a dose of 10 ml per 10 litre of water was lost to the extent of 70.31 per cent on 5th day which was then lost to 94.16 and 100 per cent at 10 and 15 days after spraying. Whereas, at double than recommended dose of 20 ml per 10 litre of water was lost from 70.94, 94.69 and 100 per cent at 5, 10 and 15 days after spraying. The half-life of dimethoate at single and double dose was 3.68 and 3.69 days whereas, waiting period was 11 and 12 days respectively. The mango fruits as per treatment were brought from farmers field for the estimation of insecticide residue. The residue of the insecticides deltamethrin, lambda cyhalothrin, imidacloprid, thiamethoxam and dimethoate was estimated by using HPLC at College of Forestry. The data on residue of the five insecticides under study in mango fruits of the farmers filed are presented in Table 12. Data revealed that the residue of deltamethrin was not detectable. The residue of lambda cyhalothrin was 0.24 ppm which uses University recommended schedule. The residue of the insecticide lambda cyhalothrin was 0.18, 0.44 and 0.48 ppm from the mango fruits of the farmersfield those who practice 5, 6-10 and more than 10 sprays respectively. The residue of imidacloprid from the mango fruits of the farmer's those use University recommended schedule was 0.02 ppm. The residue of imidacloprid was 0.38, 0.40 and 0.42 ppm those who use 5, 6-10 and more than 10 sprays respectively. The residue of thiamethoxam from the mango fruits of the farmers who use university schedule was 0.84 ppm. Whereas, the residue was 0.84, 0.18 and 1.24 ppm from the mango fruits of the farmers those practice up to 5 sprays, 6-10 sprays and more than 10 sprays. The residue of dimethoate from the mango fruits of the farmers field those practice University recommended schedule was 0.84 ppm.

Name of the Candidate : Nikhil Khemrajji Hatwar

Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2020

Name of Guide/Co guide : V. N. Jalgaonkar,

Abstract :

The present investigation entitled “Seasonal incidence, effect of different cultivation methods and botanicals on major pests infesting rice, *Oryza sativa* L.” was carried out during *Kharif* season of 2019 at RARS, Karjat. Study on seasonal incidence of major pests infesting rice revealed that the initiation of stem borer pest infestation (3.06%) was observed in the 31st SMW (30 July-5 Aug). The maximum infestation of yellow stem borer was (6.31± 2.57) and (6.81± 2.38) of dead hearts and white ear heads which were recorded in 37th SMW (10 Sept- 16 Sept) and 42th SMW (15 Oct – 21 Oct) respectively. Initiation of white ear heads was recorded from 40th SMW (1Oct-7 Oct). The minimum percent infestation [(DH- 1.01%) + (WEH-1.72%)] were recorded in 40th SMW (1Oct-7 Oct). The initiation of leaf folder infestation (0.44%) was observed in the 31st SMW (30 July - 5 Aug). Minimum leaf folder infestation (0.11 ± 0.38 %) was recorded in 40th SMW (1 October – 7October). While maximum (1.04 ± 0.38%) infestation was recorded during 34th SMW (20 August – 26 August). The initiation of case worm infestation (0.22%) was observed in the 31st SMW (30 July- 05 Aug). Minimum case worm infestation (0.09 ± 0.25) was recorded in 37th SMW (10-16 September), while maximum (0.69± 0.25) infestation was recorded during 34th SMW (20Aug-26Aug). The data on correlation between mean infestation of stem borer infesting rice and different weather parameters revealed that mean infestation of yellow stem borer showed non-significant negative correlation with (r= -0.059) maximum temperature, minimum temperature (r= -0.088) while, sunshine hours (r= 0.017) showed non-significant positive correlation. The mean infestation of leaf folder showed significant positive correlation with minimum temperature (r= 0.750) and non-significant positive correlation with Morning relative humidity (r= 0.023), evening relative humidity (r= 0.333) and wind speed (r= 0.450). The mean infestation of case worm showed significant positive correlation with minimum temperature(r= 0.718) and evening relative humidity (r= 0.153), wind speed (r= 0.399) showed non-significant positive correlation. During present investigation, effect of different cultivation methods on major pests (viz. Yellow stem borer (DH, WEH), leaf folder and case worm) infesting rice was studied and result was revealed that lowest per cent dead hearts infestation due to stem borer was found in Char sutri (2.75%) which was at par with RRC- Recommended rice cultivation (3.03%) followed by SRI- System of Rice intensification (3.17%), MT- Mechanical transplanting (3.25%). Among all cultivation methods lowest per cent white ear head infestation due to stem borer was found in char sutri (2.84%) which was at par with RRC- Recommended rice cultivation (3.18%) followed by SRI- System of Rice intensification (3.31%), MT- Mechanical transplanting (3.33%), FP- M- Farmers practice- Mulching (3.48%), DSDS- Drum seeding of sprouted seed (3.68%). Per cent infestation due to leaf folder was found minimum in SRI- System of Rice intensification (0.07%).The mean per cent infestation in RRC- Recommended rice cultivation (0.11%) was at par with SRT- Saguna rice technique (0.12%), char sutri (0.14%). Per cent case worm infestation was found lowest in SRI- System of Rice intensification (0.04%). The mean per cent infestation in FP-M- Farmers practice- Mulching (0.06%) was on par with SRT- Saguna rice technique (0.07%) and char sutri (0.07%). During present investigation, efficacy of different botanicals on major pests (viz. yellow stem borer, rice leaf folder, rice case worm) infesting rice was studied and result revealed that: Treatment T2 Vitex negundo (L.) 0.1% @10ml/litre (2.78%) infestation was found best treatment with minimum infestation of dead heart due to yellow stem borer, which was at par with Treatment T1 *Pongamia pinnata* (L.) Pierre 0.1% @10ml/litre (2.99) infestation, Treatment T7 Adhatoda Vasica (L.)Nees 0.1%@10ml/litre (3.10) infestation and the maximum infestation (7.04%) dead heart was recorded in Treatment T10 Untreated Control. In leaf folder, Treatment T2 Vitex negundo (L.) 0.1% @10ml/litre (0.27%) infestation was found effective with minimum leaf folder infestation and was at par with Treatment T7 Adhatoda Vasica (L.) Nees 0.1%@10ml/litre (0.30%), Treatment T3 *Andrographis paniculata* (Burm. fil.) Nees 0.1 % @10ml/litre (0.32%) infestation. The maximum (0.72%) infestation was recorded in Treatment T10 Untreated Control. In case worm, Treatment T9 Colocasia esculanta (L.) Schott 0.1%@10ml/litre with (0.15%) infestation was found best treatment which was at par with Treatment T8 *Calotropis gigantean* (L.) 0.1%@10ml/litre (0.17%), Treatment T2 Vitex negundo (L.) 0.1%@10ml/litre (0.21%), Treatment T5 Melia dubia Cav. 0.1%@10ml/litre (0.26%). The maximum infestation was recorded in Treatment T10 Untreated Control (0.57%). The present investigation entitled “Seasonal incidence, effect of different cultivation methods and botanicals on major pests infesting rice, *Oryza sativa* L.” was carried out during Kharif season of 2019 at RARS, Karjat. Study on seasonal incidence of major pests infesting rice revealed that the initiation of stem borer pest infestation (3.06%) was observed in the 31st SMW (30 July-5 Aug). The maximum infestation of yellow stem borer was (6.31± 2.57) and (6.81± 2.38) of dead hearts and white ear heads which were recorded in 37th SMW (10 Sept- 16 Sept) and 42th SMW (15 Oct – 21 Oct) respectively. Initiation of white ear heads was recorded from 40th SMW (1Oct-7 Oct). The minimum percent infestation [(DH- 1.01%) + (WEH-1.72%)] were recorded in 40th SMW (1Oct-7 Oct). The initiation of leaf folder infestation (0.44%) was observed in the 31st SMW (30 July - 5 Aug). Minimum leaf folder infestation (0.11 ± 0.38 %) was recorded in 40th SMW (1 October – 7October). While maximum (1.04 ± 0.38%) infestation was recorded during 34th SMW (20 August – 26 August). The initiation of case worm infestation (0.22%) was observed in the 31st SMW (30

July- 05 Aug). Minimum case worm infestation (0.09 ± 0.25) was recorded in 37th SMW (10-16 September), while maximum (0.69± 0.25) infestation was recorded during 34th SMW (20Aug-26Aug). The data on correlation between mean infestation of stem borer infesting rice and different weather parameters revealed that mean infestation of yellow stem borer showed non-significant negative correlation with (r= -0.059) maximum temperature, minimum temperature (r= -0.088) while, sunshine hours (r= 0.017) showed non-significant positive correlation. The mean infestation of leaf folder showed significant positive correlation with minimum temperature (r= 0.750) and non-significant positive correlation with Morning relative humidity (r= 0.023), evening relative humidity (r= 0.333) and wind speed (r= 0.450). The mean infestation of case worm showed significant positive correlation with minimum temperature(r= 0.718) and evening relative humidity (r= 0.153), wind speed (r= 0.399) showed non-significant positive correlation. During present investigation, effect of different cultivation methods on major pests (viz. Yellow stem borer (DH, WEH), leaf folder and case worm) infesting rice was studied and result was revealed that lowest per cent dead hearts infestation due to stem borer was found in Char sutri (2.75%) which was at par with RRC- Recommended rice cultivation (3.03%) followed by SRI- System of Rice intensification (3.17%), MT- Mechanical transplanting (3.25%). Among all cultivation methods lowest per cent white ear head infestation due to stem borer was found in char sutri (2.84%) which was at par with RRC- Recommended rice cultivation (3.18%) followed by SRI- System of Rice intensification (3.31%), MT- Mechanical transplanting (3.33%), FP- M- Farmers practice- Mulching (3.48%), DSDS- Drum seeding of sprouted seed (3.68%). Per cent infestation due to leaf folder was found minimum in SRI- System of Rice intensification (0.07%).The mean per cent infestation in RRC- Recommended rice cultivation (0.11%) was at par with SRT- Saguna rice technique (0.12%), char sutri (0.14%). Per cent case worm infestation was found lowest in SRI- System of Rice intensification (0.04%). The mean per cent infestation in FP-M- Farmers practice- Mulching (0.06%) was on par with SRT- Saguna rice technique (0.07%) and char sutri (0.07%). During present investigation, efficacy of different botanicals on major pests (viz. yellow stem borer, rice leaf folder, rice case worm) infesting rice was studied and result revealed that: Treatment T2 *Vitex negundo* (L.) 0.1% @10ml/litre (2.78%) infestation was found best treatment with minimum infestation of dead heart due to yellow stem borer, which was at par with Treatment T1 *Pongamia pinnata* (L.) Pierre 0.1% @10ml/litre (2.99) infestation, Treatment T7 *Adhatoda vasica* (L.)Nees 0.1%@10ml/litre (3.10) infestation and the maximum infestation (7.04%) dead heart was recorded in Treatment T10 Untreated Control. In leaf folder, Treatment T2 *Vitex negundo* (L.) 0.1% @10ml/litre (0.27%) infestation was found effective with minimum leaf folder infestation and was at par with Treatment T7 Adhatoda Vasica (L.) Nees 0.1%@10ml/litre (0.30%), Treatment T3 *Andrographis paniculata* (Burm. fil.) Nees 0.1 % @10ml/litre (0.32%) infestation. The maximum (0.72%) infestation was recorded in Treatment T10 Untreated Control. In case worm, Treatment T9 Colocasia esculanta (L.) Schott 0.1%@10ml/litre with (0.15%) infestation was found best treatment which was at par with Treatment T8 *Calotropis gigantean* (L.) 0.1%@10ml/litre (0.17%), Treatment T2 *Vitex negundo* (L.) 0.1%@10ml/litre (0.21%), Treatment T5 *Melia dubia* Cav. 0.1%@10ml/litre (0.26%). The maximum infestation was recorded in Treatment T10 Untreated Control (0.57%).

Name of the Candidate : Wade Pratyay Sunil
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2020
Name of Guide/Co guide : , S. M. Wankhede
Abstract :

The present investigation "Screening of genotypes, seasonal incidence and management of pests infesting tomato (*Solanum lycopersicumL*.) was carried out ,in which four different speciesof insect pests (Whitefly, aphid, leaf miner and fruit borer) were recorded on the tomato crop at Central Experiment Station, Wakawali, Dist. Ratnagiri during *rabi* season of2018-2019. During present investigation, fifteen genotypes were screened again stover all mean population of white flies and aphids per three leaves per plant, per cent mean infestation of leaf miner and fruit borer infestation (on number and weight basis). The data on overall mean population of whiteflies was in the range of 3.34 to 4.74. The highest mean population was recorded on the genotype Konkan Vijay (4.74 ± 0.42) per three leaves. The lowest population was recorded on the genotype N-2257(3.34±0.42) per three leaves. The data on overall mean population of aphid was in the range of 2.10 to 3.05 per three leaves. The highest mean population was recorded on the genotype SUN-7610(3.05±0.31) per three leaves. The lowest population was recorded on the genotype N- 2257(2.10 ± 0.31) per three leaves. The data on overall mean leaf miner per cent infestation was in the range of 30.24 to 34.32 per cent. The highest mean leaf miner per cent infestation was recorded on the genotype LE-66 (34.32% ± 1.07). The lowest mean leaf miner per cent infestation was recorded on the genotype BT-1 (30.24% ± 1.07). During present study the maximum fruit borer infestation recorded in genotype N-2257 which were found to be 44.71 and 41.28 percent to number and weight basis, respectively. The lowest 19.78 mean percent fruit

infestation on number basis was recorded in genotype BT-105, whereas 18.74 per cent fruit infestation on weight basis was recorded in same genotype. During present investigations, the study revealed that there were marked differences in whiteflies population as regard Standard Meteorological Weeks. The mean population ranges from0.07to7.83 per three leaves. The minimum population (0.07± 2.25) per three leaves was recorded in 2nd SMW (8th– 15thJanuary, 2019). It reached to peak (7.83 ± 2.25) per three leaves during 16thSMW (17thto 23thApril, 2019). In present study correlation of whitefly with maximum temperature (r=0.319) and evening relative humidity (r=0.394) recorded positive non- significant correlation. The minimum temperature (r=0.521) recorded positive significant correlation with mean population of whiteflies. The morning relative humidity (r=-0.429) recorded negative non-significant correlation with mean population of whiteflies. The study revealed that there were marked differences in aphids population as regard Standard Meteorological Weeks. The mean population of aphids (0.53±1.28)per three leaves was first observed from 2ndSMW (8th- 15thJanuary, 2019). It reached to peak in 7thSMW (13th-19thFebruary) which was recorded (4.53 ± 1.28) mean aphids population per three leaves. Aphid population was observed non-significant negative in correlation with maximum temperature (r=-0.472), minimum temperature (r=- 0.455), morning relative humidity (r=-0.209) and evening relative humidity(r=-0.308). The study revealed that there were marked differences in leaf miner per cent infestation as regard Standard Meteorological Weeks. First appearance of the pest was recorded during the 2ndSMW (14.04% ± 7.49) and continued till harvest. The leaf miner per cent infestation reached its peak infestation (40.02% ± 7.49) during 12ndSMW (20thto 26thMarch, 2019). Leaf miner per cent infestation was observed to be non-significant but positive with maximum temperature (r=0.468) and evening relative humidity (r=0.384). The correlation of leaf miner per cent infestation and morning relative humidity (r=-0.498) was found to be negatively non-significant. The leaf miner per cent infestation was positively significant in relation to minimum temperature (r=0.571). The study revealed that there were marked differences in fruit borer infestation as regard Standard Meteorological Weeks. The initiation of pest incidence was found in 5thSMW (30 th January - 5thFebruary, 2019). Maximum (43.13%) fruit bore infestation was recorded during 13thSMW (27thMarch- 2thApril, 2019).The association between maximum temperature (r=0.374), minimum temperature (r= 0.450) and evening relative humidity(r= 407) with percentage damaged fruit was found to be positive but not significant. Morning relative humidity (r= -0.484) was found negative but non-significant correlation with fruit per cent infestation. A field experiment was conducted during *rabi* season to study the efficacy of some insecticides against major pests infesting tomato. The data on mean population of whitefly per three leaves per plant of three sprays revealed that the treatment *Beauveria bassiana*@ 5ml lit-1 was the best treatment which was recorded minimum (3.28) mean whitefly population per three leaves and was at par with Azadirachtin 1% EC @ 0.002 per cent which recorded (3.32) and *Lecanicillium lecanii* @5mllit-1recorded (3.43) whiteflies per three leaves. The results regarding overall mean of three sprays against aphids infesting tomato revealed that the *Lecanicillium lecanii* @ 5ml lit-1 treatment was the best treatment which was recorded minimum(1.47) mean population per three leaves and was at par with treatment *Beauveria bassiana* @ 5ml lit-1 which recorded (1.67) and Azadirachtin 1 EC @ 0.002 per cent which recorded (1.76) aphids per three leaves. The results regarding overall mean of three sprays against per cent leaf miner infestation, showed that Emamectin benzoate 05 SG @ 0.002 per cent was found most effective treatment against serpentine leaf miner, *Liriomyza trifolii* Burgess, as it was recorded lowest per cent leaf miner infestation (11.71%) and was at par with Azadirachtin 1 EC @ 0.002 per cent which recorded (13.18%) infestation of leaf miner. Among the different treatments, effect on fruit borer infestation on number and weight basis were lowest in Emamectin benzoate 05 SG @ 0.002 per cent treated plot (13.10% in number and 11.81% in weight basis) which was at par with Azadirachtin 1EC @0.002 percent treated plot (15.40 %in number and13.86% in weight basis).

Name of the Candidate : Akshay Maruti Kekan
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2020
Name of Guide/Co guide : Dr.S.S Gurav

Abstract :

The present studies related to „Screening of genotypes, seasonal incidence and management of major sucking pests infesting okra, *Abelmoschus esculentus* (L.) Moench." were conducted at Central Experiment Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, (Dr.B.S.K.K.V), Dapoli (Ratnagiri) during *Kharif* season of 2019 to screen the okra genotypes to know their reaction to major sucking pests, Seasonal incidence of major sucking pests in relation to abiotic factors and effect of different biopesticides on major sucking pests infesting okra. Okra wasattacked by sucking pests like leafhopper, *Amrasca biguttula biguttula*(Ishida), aphids, *Aphis gossypii* (Glover), whitefly, *Bemisia tabaci* (Gennadius) in the early crop growth stages. Upon screening the genotype Kashi Pragati found least susceptible to all sucking pests viz., Leafhoppers, aphids and whiteflies followed by the genotypes Phule Utkarsha, Phule Vimukta, Varsha

Uphar which were moderately resistant to sucking pests. The lowest leaf hopper population per three leaves was observed on the genotype kashi Pragati (4.18 ± 0.84) while Pusa Sawani recorded highest leaf hopper population (8.08 ± 0.84). The maximum aphid population per three leaves was observed on the genotype Pusa Sawani (7.55 ± 0.25) while the genotype Kashi Pragati recorded least aphid population (4.90 ± 0.25). The maximum whitefly population per three leaves was recorded on the genotype parbhani kranti (4.97± 0.46) while the Kashi Pragati genotype found as least susceptible which recorded 2.95 ± 0.46 whitefly per three leaves. The mean leaf hopper population ranges from 0.00 to 13.77 per three leaves. It reached to peak (13.77 ± 4.65) per three leaves during 35th SMW (27 th August to 02 th September, 2019). The mean leafhopper population was negatively non- significant with maximum temperature (r=-0.178), minimum temperature (r= -0.363) and evening relative humidity (r=-0.0907) while morning relative humidity (r=0.175) was positively non-significant. The mean aphid's population ranges from 0.00 to 16.47 per three leaves. It reached to peak in 38th SMW (17th -23rd September, 2019) which was recorded (16.47 ± 5.18) mean aphids population per three leaves. After 38th SMW (17th-23rd September, 2019) there was a gradual decline in the aphids population and was available upto 41st SMW (08th-14th October, 2019). Aphid population was found non-significant negative in correlation with maximum temperature (r=-0.07), minimum temperature (r=-0.325) and evening relative humidity (r=-0.209), while the evening relative humidity (r=0.0841) positive non-significant. The mean whiteflies population ranges from 0.00 to 5.47 perthree leaves. It reached to peak in 35th SMW (27th August -02 nd September, 2019) which was recorded (5.47 ± 1.76) mean whiteflies population per three leaves and it fluctuates near peak population upto crop period. The mean whiteflies population found negatively non-significant with maximum temperature (r=-0.0437), minimum temperature (r=-0.327) and evening relative humidity (r=-0.254), while was positive non-significant correlation with morning relative humidity (r=0.160). The results regarding leafhoppers management the treatment Azadirachtin 1% EC @ 0.003 per cent was found best treatment which was recorded minimum (3.07) mean leafhopper population per three leaves and was at par with treatment *Lecanicillium lecanii*@ 5gm/lit recorded (3.48). Higher leafhopper population occurs in treatment Soapnut liquid extract @ 5 per cent recorded (5.64) leafhoppers population per three leaves, whereas highest mean leafhopper population occurs in untreated control (8.81) per three leaves. The treatment *Lecanicillium lecanii* @ 5gm/lit was the best treatment which was recorded minimum (6.28) mean aphid population per three leaves and was at par with treatment Azadirachtin 1% EC @ 0.003 per cent recorded (6.65). All the treatments were found to be superior over untreated control which recorded highest mean aphid population 11.83 per three leaves. The mean population of whitefly per three leaves was found minimum in the treatment *Lecanicillium lecanii* @ 5gm/lit was the best treatment which was recorded minimum (2.58) mean whitefly population per three leaves and was at par with Azadirachtin 1% EC @ 0.003 per cent (2.72) and *Beauveria bassiana* @ 5g/lit (3.17), Whereas the treatment Soapnut liquid extract @ 5% recorded highest population except untreated control. The effect of different treatments on the yield of okra revealed that, the maximum average okra yield (114.03 qt/ha) was recorded in the treatment Azadirachtin 1% EC @ 0.003 per cent which was significantly superior over rest of the treatment. The next effective treatments were *Lecanicillium lecanii* (113.45 qt/ha), *Pongamia pinnata* 1% EC @ 0.2 per cent (112.28qt/ha), Beauveria bassiana (110.55qt/ha), Chilli garlic extract @ 5 per cent (110.48qt/ha), *Metarhizium anisopliae* @ 0.6 per cent (110.40qt/ha) and Soapnut liquid extract @ 5 per cent (110.32qt/ha). The minimum okra yield (109.55qt/ha) was recorded in untreated control.

Name of the Candidate : Dalv Neha Sameer
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2020
Name of Guide/Co guide : V. S. Desai
Abstract :

The field experiment on 'Effect of sowing time and establishment methods on pest complex of rice varieties' was conducted during *Kharif* season of 2018-2019 and 2019-2020 at Agronomy farm, College of Agriculture, Dapoli. During 2018-2019 and 2019-2020, the lowest per cent infestation by yellow stem borer was recorded in S1 (23rd SMW, 4th to 10th June) 0.38 and 0.25, respectively. The overall mean data during both years revealed that per cent infestation of *S. incertulas* was lowest (0.32) in S1. During 2018-2019, the minimum per cent infestation 0.38 was recorded in Karjat-3 (V6) which was at par with Swarna (V7) 0.45 and Sahyadri-4 (V8) 0.52. During 2019-2020 the minimum (0.40) per cent infestation by yellow stem borer was recorded in V8 which was at par with V7 with 0.42 and V6 with 0.48. The overall mean data during both years revealed that the lowest per cent infestation (0.43) was recorded in V6 followed by V7 with 0.44 and V8 with 0.46 which was at par with each other. The data during 2018-2019 revealed that the per cent infestation by yellow stem borer was minimum (0.14) in S1V6 (23rd SMW X Karjat-3) which was at par with S1V7 (23rd SMW X Swarna), S1V8 (23rd SMW X Sahyadri-4) and S1V2 (23rd SMW X Karjat-7)

with 0.17, 0.24 and 0.35 per cent infestation by yellow stem borer, respectively. During 2019-2020 the per cent infestation by yellow stem borer was minimum (0.07) in S1V8 which was at par with S1V7, S1V6 with 0.11 and 0.19, respectively. The overall mean data on per cent infestation in different sowing date and varieties of *S. incertulas* during both years revealed that the lowest per cent infestation (0.07) was recorded in S1V8 which was at par with S1V7, S1V5 (23rd SMW X Palghar-1) and S1V6 with 0.11, 0.18 and 0.19, respectively. During 2018-2019 and 2019-2020, the lowest per cent infestation by leaf folder was recorded in S1 0.34 and 0.55, respectively.The overall mean data on per cent infestation of leaf folder during both years revealed that the lowest per cent infestation by leaf folder (0.44) was recorded in S1. During 2018-2019, the data revealed that the per cent infestation of *C. medinalis* in different varieties was minimum (0.60) in V6 which was at par with V8, V5 (Palghar-1), V4, V1, V7, V2 (Karjat-7) and V3 with 0.61, 0.66, 0.70, 0.72, 0.76, 0.84 and 0.86, respectively. During 2019-2020 the minimum (0.60) per cent infestation by leaf folder was recorded in V6 which was at par with V8, V4, V5, V1 and V3 0.70, 0.81, 0.91, 0.94 and 0.94, respectively. The mean data on per cent infestation of C. medinalis during 2018-2019 and 2019-2020 revealed that the lowest per cent infestation (0.60) was recorded in V6 which was at par with V8, V4, V5, V1, V3 and V2 0.66, 0.76, 0.80, 0.82, 0.90 and 0.92, respectively. During 2018-2019, the per cent infestation by leaf folder was recorded minimum (0.06) in S1V6 which was at par with S1V8, S1V1 (23rd SMW X Karjat-5), S1V5, S1V3 (23rd SMW X Ratnagiri-24) and S1V2 with 0.16, 0.40, 0.44, 0.48 and 0.53, respectively. During 2019-2020 the minimum (0.26) per cent infestation by leaf folder was recorded in S1V6 which was at par with S1V8 and S1V1 with 0.41 and 0.49, respectively. The data pertaining to overall mean per cent infestation of leaf folder during both years revealed that in different combinations of sowing time and varieties the lowest (0.16) was recorded in S1V6 which was at par with S1V1 (0.33). During 2018-2019 and 2019-2020, the per cent infestation of blue beetle in sowing time S3 recorded lowest in S1 5.47 and 5.07, respectively. The data on pooled mean per cent infestation of *L. pygmaea* in different sowing time during 2018-2019 and 2019-2020 revealed that the lowest (5.27) was recorded in S1. The data during 2018-2019 and 2019-2020, revealed that the per cent infestation of blue beetle in different varieties was minimum in (V6) 7.26 and 7.16, respectively which was at par with (V8) 8.43 and 8.07, respectively. The pooled data on per cent infestation of *L. pygmaea* during both years revealed that the lowest (7.21) was recorded in V6 (Karjat-3) which was at par with V8 with 8.25.During 2018-2019, the per cent infestation by blue beetle was recorded minimum (3.39) in S1V8 which was at par with S1V6 and S1V2 with 3.81 and 4.06, respectively. The data on mean per cent infestation by blue beetle during 2019-2020 was minimum (3.12) which was at par with S1V6 and S1V2 with 3.57 and 3.85, respectively. The pooled mean data on per cent infestation of *L. pygmaea* during both years revealed that in different sowing time and varieties the lowest (3.25) was recorded in S1V8 which was at par with S1V6 and S1V2 with 3.69 and 3.95, respectively. The average grain yield during *Kharif* 2018-2019 and 2019-2020 revealed that the rice crop sown on 23rd SMW recorded significantly higher grain yield (4597.00 kg ha-1) over delayed sowing 24th SMW (4220.41 kg ha-1) and 25th SMW (3695.35 kg ha-1), while rice crop sown on 24th SMW recorded significantly higher grain yield (4220.41 kg ha-1) over delayed 25th SMW (3695.35 kg ha-1). The data of grain yield of different varieties during Kharif 2018-2019 and 2019- 2020 revealed that the rice variety Sahyadri-4 recorded the significantly higher grain yield (4639.12 kg ha-1) and was at par with Karjat – 3 (4497.01 kg ha-1), Swarna (4338.33 kg ha-1), Palghar-1 (4300.66 kg ha-1) and Jaya (4268.7 kg ha-1). The data of interaction effect between sowing time and rice varieties during both years indicated that Karjat-3 sown on 23rd SMW recorded highest grain yield (5613.83 kg ha-1) which was at par with Sahyadri-4 (5026.01 kg ha-1) and Swarna (4908.09 kg ha-1) sown on 23rd SMW. The correlation between yellow stem borer infesting rice at different sowing time and different meteorological parameters during 2018-2019 revealed that, the weather parameter rainfall (r = 0.908) was found to be positively significant with yellow stem borer infestation in S1. Remaining all of the weather parameters were found to be non significant. During 2018-2019 the correlation between yellow stem borer infesting rice at different varieties and different meteorological parameters revealed that, the weather parameter rainfall was found to be positively significant in V1 (r=0.662), V2 (r=0.626), V3 (r=0.730), V4 (r=0.622), V5 (r=0.745), V6 (r=0.603) and V9 (r=0.662). While, maximum temperature had found to be negatively significant in V3 (r=-0.633) and V5 (r=-0.608). Remaining all of the weather parameters were found to be non-significant. The correlation between yellow stem borer infesting rice at combine effect of different sowing time and varieties with different meteorological parameters, rainfall in S1V1 (r=0.894), S1V2 (r=0.840), S1V3(r=0.889), S1V4 (r=0.926), S1V5 (r=0.898), S1V6 (r=0.867), S1V7 (r=0.888), S1V8(r=0.819),S1V9 (r=0.885) S2V5 (r=0.661) and morning relative humidity in S1V6 (r=0.629), S1V7 (r=0.621) and S1V8 (r=0.611) were found to be positively significant. While, maximum temperature was found to be negatively significant in S1V1 (r=-0.605), S1V3 (r=-0.604), S1V4 (r=-0.631), S1V9 (r=-0.631) and S2V5(r=-0.605). Remaining all of the weather parameters were found to be non significant. The data on correlation between yellow stem borer infesting rice at different sowing time, varieties, combine effect and different meteorological parameters during 2019-2020 revealed that, all the weather parameters were found

to be non-significant. The data during 2018-2019 and 2019-2020 on correlation between yellow stem borer infesting rice at combine effect of different sowing time and varieties with meteorological parameters, morning relative humidity in S1V1 (r=0.723), S1V2 (r=0.636), S1V3(r=0.880), S1V5 (r=0.674) and evening relative humidity in S1V3 (r=0.646), S1V5 (r=0.620) and S1V6 (r=0.626) was found to be positively significant. While, maximum temperature in S1V3 (r=-0.708), S1V4 (r=-0.704), S1V5 (r=-0.760), S1V6 (r=-0.786), S1V7 (r=-0.721), S1V8 (r=-0.721), S1V9 (r=-0.617) and bright sunshine hours S1V2 (r=-0.606) and S1V3 (r=-0.747) was found to be negatively significant. Remaining all of the weather parameters were found to be non-significant. The data on correlation between leaf folder infesting rice at different sowing time and different meteorological parameters during 2018-2019 revealed that, maximum temperature (r = -0.652) was found to be negatively significant in S3. Remaining all of the weather parameters were found to be non-significant. The data on correlation between leaf folder infesting rice at different varieties and different meteorological parameters revealed that, minimum temperature in V7 (r=0.636) and evening relative humidity (r=0.615) were found positively significant. While, maximum temperature and bright sunshine hours had found to be negatively significant in V7 (r=-0.591) and V7 (r=-0.613). Remaining all of the weather parameters were found to be non-significant. The correlation between leaf folder infesting rice at combine effect of different sowing time and varieties with different meteorological parameters, minimum temperature in S2V7 (r=0.577) was found to be positively significant. While, maximum temperature in S3V1 (r=-0.590), S3V5 (r=-0.622), S3V7 (r=-0.662) and bright sunshine hours in S2V3 (r=-0.580), S3V5 (r= -0.577) was found to be negatively significant. Remaining all of the weather parameters were found to be non-significant.The data on correlation between leaf folder infesting rice at different sowing time, varieties, combine effect of different sowing time and varieties and different meteorological parameters during 2019-2020 revealed that, all the weather parameters were found to be non-significant. The data on correlation between leaf folder infesting rice at different sowing time and different meteorological parameters during 2018-2019 and 2019-2020 revealed that, weather parameter, morning relative humidity in S2 (r=0.614) was found to be positively significant. While, maximum temperature in S2 (r=-0.719), S2 (r=-0.691) and bright sunshine hours S2 (r=-0.656) was found to be negatively significant. Remaining all of the weather parameters were found to be non-significant. During 2018-2019 and 2019-2020 the data on correlation between leaf folder infesting rice at different varieties and different meteorological parameters revealed that, morning relative humidity was found to be positively significant in V2 (r=0.607), V4 (r=0.635), V5 (r=0.606), V7 (r=0.613) and V9 (r=0.665). While, maximum temperature in V1 (r=-0.610), V2 (r=-0.599), V4 (r=-0.632), V5 (r=-0.622), V6 (r=-0.583), V7 (r=-0.633), V8 (r=-0.638) and V9 (r=-0.624) and bright sunshine hours V4 (r=-0.578) was found to be negatively significant. Remaining all of the weather parameters were found to be non-significant. The data during both years on correlation between leaf folder infesting rice at combine effect of different sowing time and varieties with different meteorological parameters, morning relative humidity in S1V2 (r=0.576), S1V4 (r=0.625), S1V5 (r=0.617), S1V7 (r=0.618), S1V9 (r=0.617), S2V1 (r=0.583), S2V3 (r=0.672), S2V5 (r=0.583), S2V9 (r=0.630), S3V2 (r=0.630), S3V5 (r=0.578), S3V9 (r=0.622), evening relative humidity in S2V1 (r=0.611) and rainfall in S2V1 (r=0.642) were found to be positively significant. While, maximum temperature in S1V5 (r=-0.599), S2V1 (r=-0.697), S2V5 (r=-0.634), S2V9 (r=-0.614), S3V1 (r=-0.614), S3V2 (r=-0.629), S3V5 (r=-0.599), S3V8 (r=-0.622), S3V9 (r=-0.647) and bright sunshine hours S2V1 (r=-0.714), S3V8 (r=-0.604) were found to be negatively significant. Remaining all of the weather parameters were found to be non significant. The data on correlation between blue beetle infesting rice at different sowing time and different meteorological parameters during 2018-2019 revealed that, maximum temperature (r= -0.618) was found to be negatively significant with blue beetle infestation in S1. Remaining all of the weather parameters were found to be non-significant. The data on correlation between blue beetle infesting rice at different varieties and different meteorological parameters revealed that, maximum temperature had found to be negatively significant in V3 (r=-0.586), V5 (r=-0.579) , V6 (r=-0.577) and V9 (r=-0.600). Remaining all of the weather parameters were found to be non-significant. The correlation between blue beetle infesting rice at combine effect of different sowing time and varieties with different meteorological parameters, rainfall in S1V4 (r=0.590), S1V6 (r=0.587) and S1V9 (r=0.580) was found to be positively significant. While, maximum temperature in S1V1 (r=-0.591), S1V2 (r=-0.645), S1V3 (r=-0.639), S1V5 (r=-0.628), S1V6 (r=-0.591), S1V7 (r=-0.620), S1V9 (r=-0.580), S2V3 (r=-0.601), S2V5 (r=-0.589), S2V6 (r=-0.616)and bright sunshine hours in S1V5 (r=-0.577), S1V7 (r=-0.618), S1V8 (r=-0.577) was found to be negatively significant. Remaining all of the weather parameters were found to be non-significant. During 2019-2020, data on correlation between blue beetle infesting rice at different sowing time, different varieties, interaction effect and different meteorological parameters revealed that, all the weather parameters were found to be non-significant. The data on correlation between blue beetle infesting rice at different sowing time and different meteorological parameters during 2018-2019 and 2019-2020 revealed that, morning relative humidity in S1 (r=0.625) was found to be positively significant. While, maximum temperature in S1 (r=-0.659) was found to be negatively

significant. Remaining all of the weather parameters were found to be non-significant. The correlation between blue beetle infesting rice at different varieties and different meteorological parameters revealed that, maximum temperature in V5 (r=-0.628), V6 (r=-0.595), V8 (r=-0.585) and V9 (r=-0.612) was found to be negatively significant. Remaining all of the weather parameters were found to be non-significant. The correlation between blue beetle infesting rice at combine effect of different sowing time and varieties with different meteorological parameters, morning relative humidity in S1V1 (r=0.702), S1V2 (r=0.661), S1V3 (r=0.739), S1V4 (r=0.684), S1V5 (r=0.746), S1V6 (r=0.762), S1V7 (r=0.705), evening relative humidity in S1V1 (r=0.597), S1V3 (r=0.638), S1V4 (r=0.572), S1V5 (r=0.612), S1V6 (r=0.638), S1V7 (r=0.605) were found to be positively significant. While, maximum temperature in S1V1 (r=-0.704), S1V2 (r=-0.622), S1V3 (r=-0.711), S1V4 (r=-0.650), S1V5 (r=-0.684), S1V6 (r=-0.708), S1V7 (r=-0.677), S1V8 (r=-0.579), S2V5 (r=-0.618), S2V6 (r=-0.616), S2V8 (r=-0.582) and bright sunshine hours S1V1 (r=-0.585), S1V2 (r=-0.591), S1V3 (r=-0.670), S1V4 (r=-0.601), S1V5 (r=-0.666), S1V6 (r=-0.687), S1V7 (r=-0.638)were found to be negatively significant. Remaining all of the weather parameters were found to be non-significant. The mean data of spider population per hill during 2018-2019 ranged from 0.06 to 0.31. The peak activity 0.31 spiders per hill was recorded in S3 which was at par with S2 (0.21) whereas the lowest population (0.04) spiders per hill was recorded in S1. The pooled of two years (*Kharif* 2018-2019 and 2019-2020) revealed that the peak activity 0.28 spiders per hill was recorded in S3 which was at par with S2 (0.21). The of spider population per hill during 2018-2019 revealed that the peak activity (0.23) was recorded in V7. All the varieties were at par with each other. The data pertaining to overall mean spider population per hill in different varieties during 2019- 2020 revealed peak activity 0.24 spiders per hill in V9 which was at par with V3 and V4 with 0.20 and 0.20, respectively. The pooled data for two years revealed that spider population per hill in different varieties ranged from 0.12 to 0.23. The peak activity 0.23 spiders per hill was recorded in V9. The data pertaining to overall mean spider population per hill in different sowing time and varieties during 2018-2019 and 2019-2020 was found to be non-significant and ranged from 0.00 to 0.44 and 0.01 to 0.33, respectively. The pooled data for two years (*Kharif* 2018-2019 and 2019-2020) revealed that spider population per hill in different sowing time and varieties ranged from 0.01 to 0.36 which was found to be non-significant. Data during 2018-2019, revealed the per cent infestation of yellow stem borer in different establishment methods was recorded highest (0.83) in M1 (Drilling) and lowest (0.28) in M2 (Early transplanting, 15 DAS). The data revealed that during 2019-2020, the per cent infestation of yellow stem borer was maximum (0.94) in M1 which was at par with M4 (Transplanting with Thomba method) with 0.89 and the lowest (0.51) was recorded in M2 which was at par with M3 (Transplanting as per recommendation) with 0.62. The pooled data on per cent infestation of yellow stem borer during both years revealed that the highest (0.89) per cent infestation was recorded in M1 and the lowest (0.40) was recorded in M2. The data pertaining to overall mean data during 2018-2019 revealed that the per cent infestation of *S. incertulas* in different varieties was minimum (0.28) in Sahyadri-2 (V4) which was at par with V5 (Karjat-3) 0.29. During *Kharif* 2019-2020, mean data indicated that the minimum (0.36) per cent infestation by yellow stem borer was recorded in (V3) which was at par with Palghar-1 (V2) with 0.44. The pooled data on per cent infestation of S. incertulas in different varieties during both years revealed that the lowest (0.46) was recorded in V5 which was at par with V2 and V3 0.46 and 0.50, respectively. The data on overall mean revealed that during 2018-2019 the per cent infestation by yellow stem borer was minimum (0.13) in M2V4 (Early Transplanting, 15 DAS X Sahyadri-2) which was at par with M2V5 (Early transplanting, 15 DAS X Karjat-3) and M2V2 (Early transplanting, 15 DAS X Palghar-1) 0.15 and 0.23, respectively. During 2019-2020 the mean data revealed that per cent infestation by yellow stem borer was minimum (0.17) in M2V2 which was at par with M2V3 (Early transplanting, 15 DAS X Karjat-2) and M3V3 (Transplanting as per recommendation X Karjat-2) 0.28 and 0.41, respectively. The pooled data on per cent infestation of S. incertulas during 2018-2019 and 2019-2020 revealed that the in different combinations of establishment methods and varieties the lowest per cent infestation (0.20) was recorded in M2V2 which was at par with M2V5 0.33. The overall mean data of the per cent infestation of leaf folder in different establishment methods during 2018-2019 revealed that the lowest (0.33) was recorded in M2 which was at par with M4 with 0.33. During Kharif 2019-2020 the overall mean data on per cent infestation of leaf folder in different establishment methods was lowest per cent infestation by leaf folder (0.09) was recorded in M2. The pooled mean data on per cent infestation of C. medinalis during 2018-2019 and 2019-2020 revealed in different establishment methods the lowest per cent infestation by leaf folder (0.21) was recorded in M2. The data pertaining overall mean during 2018-2019, revealed that the per cent infestation of C. medinalis in different varieties was maximum (0.62) in variety Karjat 184 (V1) which was at par with Karjat-7 (V6). The minimum per cent infestation by leaf folder 0.22 was recorded in Karjat -3 (V5) which was at par with V4 (Sahyadri-2) with 0.25. The mean data during 2019-2020 revealed that the minimum (0.12) per cent infestation by leaf folder was recorded in V4 which was at par with V6 with 0.13.The pooled data on per cent infestation of C. medinalis during 2018-2019 and 2019-2020 revealed that the lowest (0.18) was recorded in V4 which was at par with V5 with 0.22. The mean data revealed that

during 2018-2019 the per cent infestation by leaf folder was minimum (0.18) in M3V5 (Transplanting as per recommendation X Karjat-3), M2V4, M4V5 (Transplanting with Thomba method X Karjat-3), M1V5 (Drilling X Karjat 3), M3V4, M2V5 and M4V4 (Transplanting with Thomba method X Sahyadri-2) with 0.19, 0.22, 0.24, 0.25, 0.28 and 0.28, respectively. During 2019-2020 the per cent infestation by leaf folder revealed minimum (0.05) in M2V6 which was at par with M2V4 (0.07). The pooled data on per cent infestation of C. medinalis during both the years revealed that in different combinations of establishment methods and varieties the lowest per cent infestation (0.13) was recorded in M2V4 which was at par with M2V5, M3V4 and M2V6 0.19, 0.19 and 0.20, respectively. The data pertaining to overall mean revealed that during 2018-2019, the per cent infestation of blue beetle in different establishment methods lowest in M2 and M4 with 0.59 and 0.59 which was at par with each other. During Kharif 2019-2020, mean data indicated that the per cent infestation of blue beetle, in establishment method M1 (Drilling) recorded highest 0.92 and the lowest (0.40) was recorded in M2. The pooled data on per cent infestation of blue beetle during 2018-2019 and 2019-2020 revealed that highest (0.98) per cent infestation of L. pygmaea was recorded in M1 and the lowest (0.50) was recorded in M2. The data pertaining to overall mean during 2018-2019, revealed that the per cent infestation of L. pygmaea in different varieties was maximum (1.08) in V1 which was at par with V6 and the minimum 0.37 was recorded in V5. The overall mean data during 2019-2020 revealed that minimum (0.41) per cent infestation by blue beetle was recorded in V5 which was at par with V2, V3 and V4 0.44, 0.45 and 0.60, respectively. The pooled data on per cent infestation of L. pygmaea during 2018-2019 and 2019-2020 revealed that highest (1.07) was recorded in V1 which was at par with V6 (1.05) and the (0.39) was recorded in V5 which was at par with V2 (0.56). The data pertaining to overall mean revealed that during 2018-2019 the per cent infestation by blue beetle was minimum (0.25) in M4V5 (Transplanting with Thombamethod X Karjat-3) which was at par with, M3V5 and M2V5 0.32, 0.34 and 0.35, respectively. During 2019-2020, the overall mean data on per cent infestation by blue beetle was minimum (0.19) in M2V3 which was at par with M2V5 (0.28. The pooled data on per cent infestation of L. pygmaea during 2018-2019 and 2019-2020 revealed in different combinations of establishment methods and varieties the lowest (0.25) was recorded in M2V3 which was at par with M2V5 and M3V5 0.32 and 0.34, respectively. The pooled data of average grain yield and straw yield during 2018-2019 and 2019-2020 indicated that the M3 recorded higher grain yield (3917.82 kg ha-1) which was at par with M4 (3917.82 kg ha-1) followed by M2 (3772.22 kg ha-1) and lesser grain yield was obtained in M1(3660.30 kg ha-1). The pooled grain yield during 2018-2019 and 2019-2020 of different varieties revealed that the variety V5 recorded higher grain yield (4212.5 kg ha-1) which remained at par with V2 (4028.30 kg ha-1) and V3 (4007.12 kg ha 1). The pooled data of average yield of rice in interaction of different establishment methods and varieties during 2018-2019 and 2019-2020 revealed that, M3V3 recorded significantly higher grain yield (4845.10 kg ha-1) over rest of the treatment combinations except M2V5 and M4V5 and M2V2.

2021

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Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2021
Name of Guide/Co guide : Dr. S. M. Wankhede
Abstract :

Nearly 90 per cent of potential insect pests of agricultural crops are biologically controlled by their natural enemies. Therefore, conservation and augmentation of such naturally occurring enemies of insect pests and their utilization in biological control has been recently gaining momentum. This can reduce the use and dependence on synthetic insecticides for pest management. Likewise, reduviid bugs are significant predators of insect and their role in pest management had been revealed in past few decades. Predatory reduviid bug, *Rhynocoris marginatus* (Fab.) is a polyphagous and multivoltine assassin bug commonly found in India under various agro-ecosystem. Being an effective biological control agent, it is gaining increased attention to be used in Bio-Intensive Pest Management (BIPM) by conservation and augmentative release in field. Hence, the present study entitled "Biology and predatory potential of reduviid bug, *Rhynocoris marginatus* (Fab.) (Hemiptera: Reduviidae)" was carried out at Department of Agricultural Entomology, College of Agriculture, Dapoli.

The study of biology of *R. marginatus* on *Corcyra cephalonica* (Stainton) larvae revealed that, the incubation period for eggs was 8.07 ± 0.08 days with average 89 ± 9.94 per cent eggs hatching. The average length and breadth of eggs measured 2.65 ± 0.16 mm and 0.72 ± 0.06 mm, respectively. The average durations of first, second, third, fourth and fifth nymphal instars were 9.3 ± 0.64, 9.5 ± 1.07, 8.25 ± 1.18, 11.4 ± 1.93 and 19.45 ± 2.29 days, respectively. The average size of nymph increased with successive nymphal instars witnessing first instar nymph of 2.02 ± 0.09 mm in length whereas fifth instar nymph of 9.47 ± 0.46 mm in length. The average nymphal developmental period was 57.9 ± 2.59 days. Female adult was

easily distinguishable due to broader size measuring average length of 15.22 ± 1.20 mm and abdominal width of 5.92 ± 0.78 mm, while male adult measured 12.34 ± 0.89 mm in length and 4.23 ± 0.71 mm in abdominal width. The male to female sex ratio was female biased (0.89:1). The pre-oviposition, oviposition and post-oviposition period lasted for 12.9 ± 3.14, 44.6 ± 6.31 and 5.6 ± 2.12 days, respectively. The fecundity of female was 279 ± 48.20 with an average of 45.54 ± 11.56 eggs per batch. Female adult (63.1 ± 9.56 days) lived for more duration than male adult (42.1 ± 6.73 days). The generation time of *R. marginatus* from egg stage to the death of adult was found longer in females (129.3 ± 9.96 days) and shorter in males (108.8 ± 8.77 days).

A field experiment carried out during *Rabi* season of 2020-21 to study the predatory potential of reduviid bug against tomato fruit borer revealed that, three augmentative releases of reduviid predator (@5000 bugs ha^{-1}) at 30, 50 and 70 days after transplanting of crop resulted in reduction of mean number of *H. armigera* and *S. litura* larvae of per plant in T1-predator released plot than in T2-control plot throughout the experiment. The mean per cent fruit damage per plant was significantly lower at every picking in predator released plot than control plot. Thus, the study revealed that, release of predator had played a significant role in reducing larval population and ultimately reduced fruit damage in tomato.

Name of the Candidate : Patil Shubham Sharad
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
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Abstract :

The present investigation "Evaluation of different organic products against pulse beetle, *Callosobruchus maculatus* Fab. (Coleoptera: Chrysomelidae) under laboratory conditions" with specific objectives was carried out at College of Agriculture, Dapoli facilitated by Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Dist. Ratnagiri (M.S.) during 2019-20.

Eight different organic products like Agniastra, Jeevamrit, Ghanajeevamrit, Brahmastra, Neemastra, Mixed-leaf extract, Dashparni extract and Chilli-Garlic extract at 3% concentration were tested in the laboratory against pulse beetle, *Callosobruchus maculatus* Fab. on five different pulses.

During developmental studies, observations of efficacy on various parameters like fecundity, developmental period, adult emergence, adult longevity, weight loss, germination percentage etc. were recorded. The results under No Choice Test showed that, ovipositional period in different pulses like cowpea, green gram, pigeon pea, gram and black gram was 4 to 6.67 days, 5.33 to 8.67 days, 4.33 to 7.33 days, 6.33 to 9.67 days and 7 to 11.33 days respectively. The least oviposition period was observed in treatment T7 i.e. Dashparni extract and highest in untreated Control i.e. treatment T9 in all five different pulses.

The number of eggs laid per 100 gm pulses were 514.33 to 679.67 eggs in cowpea, 420.33 to 609.67 eggs in green gram, 357.67 to 503.33 in pigeon pea, 251.33 to 389.67 in gram and 164.67 to 270.33 eggs in black gram. Out of which, number of adults emerged were ranged between 403.67 - 611.33, 299.33 - 536.33, 199.67 - 433.33, 197.67 - 347.33 and 143.67 - 234.33 respectively.

Mean developmental period was more in Dashparni extract and found to be very effective in all pulses as compared to all other treatments. In Cowpea, highest and lowest developmental period was 27.00 days when treated with Dashparni extract and 22.67 days in untreated control. Similar results were obtain in green gram, pigeon pea, gram and black gram with highest and lowest developmental period of 37.67 and 34.00 days, 31.33 and 27.67 days, 43.67 and 39.67 days, 47.67 and 41.67 days respectively. The maximum male and female adult longevity was observed in treatment T9 i.e. Untreated control and minimum in treatment T7 i.e. Dashparni extract.

Mean per cent weight loss ranged from 8.79 - 9.98% in cowpea, 7.12 - 8.47% in green gram, 5.61 - 7.17% in pigeon pea, 3.96 - 5.79% in gram and 2.87 - 3.91% in black gram. Mean germination percentage amongst all different pulses was highest in treatment T2 i.e. Jeevamrit and treatment T3 Ghanajeevamrit. There was no adverse effect on germination percentage observed in rest other treatments too.

The preferential studies for adult pulse beetles were carried out under Free Choice Test using treated and untreated pulse grains. It was observed that the beetles preferred the untreated pulse grains over the treated grains.

Overall results showed that, efficacy of different organic products not only varied treatment wise but also pulse wise. Treatment T9, Dashparni extract was found to be very effective in controlling pulse beetle, *C. maculatus*. Along with Dashparni extract (T9), Brahmastra (T4), Agniastra (T1) and Neemastra (T5) were also found to be effective. Among the different pulses used, cowpea was found to be most susceptible to pulse beetle infestation followed by green gram, pigeon pea, gram and black gram.

Thus, the present laboratory studies clearly revealed that, organic products used here were found quite effective against pulse beetle, *C. maculatus* without causing any deleterious effects on quantitative parameters of pulses. Hence, it can be implemented in stored grain pest management practices as they are eco-friendly, cost effective and can be easily made available.

Name of the Candidate : Miss. Dandu Tejeswini
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2021
Name of Guide/Co guide : Dr. A.L. Narangalkar
Abstract :

The laboratory investigations on biology of fall armyworm were carried out in departmental laboratory, Department of Agricultural Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, during December 2020 to February 2021. Experiment revealed the mean pre oviposition, oviposition and post oviposition periods of fall armyworm was 3.2, 2.5, and 4.8 days, respectively. The fecundity and number of egg masses averaged 1017.8 and 2.8, respectively, in a gravid female. Per cent hatchability and incubation period of fall armyworm was 95.7 per cent and 3.3 days, respectively. Larval period in fall armyworm lifecycle was 16.25 days on average. There were six larval instars in larval development. In this, first instar, second instar, third instar, fourth instar, fifth instar and sixth instar lasted on an average of 2.5, 2.75, 2, 2, 2.45, 4.7 days, respectively. The head capsule is seen with white Y shaped line on frons which is characteristic to fall armyworm. Pre pupal and pupal duration were 1.2 days and 9.95 days in the total life cycle of fall armyworm. Adult longevity differed in both sexes. Female moths lasted long compared to male ones. Female moths recorded a mean longevity of 9.6 days whereas male moths recorded 8.1 days mean longevity. All over, total mean life cycle duration of fall armyworm tested during December to February of 2020-21 was recorded as 35.9 days in male and 38.6 in females. Study on morphometrics of different life stages of fall armyworm revealed that, diameter and height of eggs averaged 0.38mm and 0.3 mm, respectively. From the morphometrics data collected and analysed it is observed that, the length of sixth instar larvae is 22 times (2106.45% increase) compared to first instar larvae. The width and head width increased by 21.5 times (2048.15% increase) and 6.75 times (575.8% increase). Pupal morphometrics data collected showed that female pupae were smaller compared to that of male pupae. The length of male pupae averaged to 17.85mm whereas female pupae mean length was 15.22 mm. Similar trend was seen in adults of fall armyworm where mean wingspan of male moth is larger than the female moth. Average wingspan of male moth was 31.61mm and that of male moth was 29.12mm.

A laboratory experiment was set up to investigate persistence of different synthetic insecticides in maize plant system, and the effect of this persistence toxicity on fall armyworm *S.frugiperda* and predatory coccinellid beetle, *Menochilus sexmaculatus.* Among the tested synthetics, Spinetoram 11.7% SC suited best as toxicity persistence and LT50 of this insecticide was longer in case fall armyworm and less persistence in case of *Menochilus sexmaculatus.* Chlorantraniliprole 18.5 %SC, although persisted long and caused good immediate mortality in FAW, it was also quite toxic to *Menochilus sexmaculatus*. Thiamethoxam 25%WG caused very good immediate mortality and appreciable persistence in fall armyworm. But Thiamethoxam 25%WG was as harmful to *Menochilus sexmaculatus* as it is to fall armyworm. Novoluran 10% EC, on the other hand was less harmful to *Menochilus sexmaculatus* and produced appreciable immediate mortality in fall armyworm. This suggests that Novoluran 10%EC can be efficiently used to produce immediate, short term control over fall armyworm. Bifenthrin10 %EC (3.44) and Tolfenpyrad 15%EC (3.31), as per mortality data collected seemed to be not as effective in fall armyworm control compared to other synthetic insecticides, as they are not only harmful to *Menochilus sexmaculatus* but also seemed to have less persistence toxicity.

Field study to observe the effect of biorational insecticides on fall armyworm in maize (*Zea mays covar. Saccharata)* was conducted from November 2020 to February 2021. Data was collected on per cent whorl infestation, leaf damage score, and predator count, at 3, 7, and 9 days after spraying in two sprays. The experimental results showed that among the tested biorational insecticides, Emamectin benzoate 5SG produced good yield. But, in data collected on predator count, it was observed that predatory beetles population and spider populations were significantly decreased in Emamectin benzoate 5SG treated plots. These populations did not reestablish quickly marking loongterm effect of this pesticide over predators. Remaining tested insecticides *Metarhizium anisopliae* (CFU:1×10^{8}), Neem oil *(Azadirachta indica* seed extract), Undi oil (*Calophyllum inophyllum* plant seed extract), combination of neem oil and undi oil (1:3), Soap solution showed positive increase in yield when treated in the respective plots. Predator populations in these plots also seemed to be recuperated after initial decrease aiding to control of fall armyworm.

Name of the Candidate : Mansoor

Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2021
Name of Guide/Co guide : Dr. R. S. Mule
Abstract :

The present studies on "Efficacy of chitin synthesis inhibitors against *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae)" were carried out at laboratory of the Department of Agricultural Entomology, College of Agriculture, Dapoli, Dist. Ratnagiri-415 712 (Maharashtra).

The two chitin synthesis inhibitors *viz.,* chlorfluazuron (Atabron 5EC) and novaluron (Rimon 10EC) each at nine different concentrations i.e. 0.002, 0.004, 0.006, 0.008, 0.02, 0.04, 0.06, 0.08 and 0.1 per cent, respectively, were tested in the laboratory against freshly laid eggs and those prior to hatching, larval and pupal stages of *S. frugiperda*. The mean per cent unhatched eggs was ranged from 33.00 to 100.00 and 27.78 to 73.33 in various treatments applied at two stages of egg development, respectively for chlorfluazuron and for novaluron it was varied between 35.56 to 100.00 and 15.56 to 75.56, respectively, for these two stages. The treated eggs of *S. frugiperda* turned dark black, shriveled, dried and reduced in size. The freshly laid eggs of *S. frugiperda* were more susceptible to both the compounds.

The per cent larval mortality in various treatments of chlorfluazuron was ranged from 33.33 to 100.00 per cent, 23.33 to 100.00 per cent, 23.33 to 100.00 per cent, 23.33 to 100.00 per cent and 13.33 to 90.00 per cent, respectively and for novaluron it varied from 36.67 to 100.00 per cent, 20.00 to 100.00 per cent, 26.67 to 100.00 per cent, 20.00 to 100.00 per cent and 16.67 to 93.33 per cent, respectively in progressive instars. Most of the affected larvae failed to shed off their exuviae at the time of moulting, turned black and displayed morphological deformities.

Both the compounds adversely affected the larval growth of all the larval instars as indicated by reduced head width, body width, body length and body weight. However, the developmental period in all the instars was prolonged considerably as compared to that in control. The efficacy of both the compounds was found dependent on age of the larvae at the time of treatment.

The per cent adult emergence in various insecticidal treatments was ranged from 0.00 to 100.00 per cent in both the compounds as against 100.00 per cent adult emergence in control. The treatment with lower concentrations produced adults with crippled and wrinkled wings. The adults were unable to fly and died within couple of days.

Name of the Candidate : Mr. Wasnik Sumit Sadanand
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2021
Name of Guide/Co guide : Dr. S. K. Mehendale
Abstract :

The present studies on "management of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) infesting Maize, *Zea mays* L." was undertaken at Agronomy farm and Department of Entomology, College of agriculture, Dapoli (MS) during *Rabi* season 2019-20.

To evaluate the efficacy of different inert dusts for the management of *S. frugiperda* different insert dusts *viz.* wood ash (T_1), sawdust (T_2), paddy husk (T_3), paddy husk ash (T_4), powdered lime (T_5), lateritic rock grit (T_6), black rock grit (T_7), combination of sawdust, lime and ash at 2:1:1 ratio (T_8) were evaluated against untreated control (T_9). Data on overall efficacy of different inert dusts reveled that lowest fall armyworm infestation was recorded in treatment T_1 (wood ash) (7.41%) which was at par with T_4 (paddy husk ash) (8.33%). fall armyworm infestation was highest in untreated maize (T_9) (22.47%). Next best treatments at managing fall armyworm infestation were T_7 (Black rock Grit), T_6 (lateritic rock grit) and T_8 (Sawdust + lime + ash at 2:1:1 ratio) which recorded 10.91 per cent, 11.41 per cent and 13.99 per cent infestation, respectively. The maximum infestation (22.74%) was recorded in untreated control, which ultimately showed significant effect of dusting in fall armyworm management.

To study the effect of different intercrops for management of *S. frugipedra* in maize. The treatments were maize intercropped with sunflower (T_1), maize intercropped with mustard (T_2), maize intercropped with sorghum (T_3), maize intercropped with dhaincha (T_4), maize intercropped with bajra (T_5), maize intercropped with okra (T_6), maize intercropped with marigold (T_7) and sole maize (T_8). Pooled data on per cent infestation of fall armyworm revealed that T_7 (7.42%) was found to be more effective treatment in reducing fall armyworm infestation which was at par T_6 (11.04%). Per cent infestation of fall armyworm was highest in T_8 (23.23%).

Data on larval population of fall revealed that Lowest larval population was observed in T_7 (2.75). The other treatments T_2, T_1, T_3, T_5 and T_6 recorded 3.18, 3.47, 3.56, 3.61 and 3.61 larvae, respectively. This was followed by T_4 (4.09). Sole maize recorded maximum number of larva (5.61).

Maximum healthy cobs were obtained from T_7 (maize + marigold) (94.00%) and was found at par with T_6 (maize + okra) (92.66%) while minimum per cent healthy cobs were obtained from sole maize plot (84.66%).

Average population of lady bird beetles in maize plants ranged from 1.88 to 2.39. The maximum lady beetles 2.39 were recorded in the treatment maize intercropped with mustard, followed by maize intercropped with sorghum (2.16), sole maize (2.14), maize intercropped with bajra (2.10), maize intercropped with okra (2.03), maize intercropped with sunflower (2.02) and maize intercropped with marigold (2.01) while least population of lady beetles was observed in maize intercropped with dhaincha (1.88).

Average number of spiders observed in seven weeks was in the range of 0.32 to 0.68. The maximum number (0.68) of spiders were recorded from the treatment of Maize intercropped with okra, followed by maize intercropped with mustard (0.65), maize intercropped with sunflower (0.58), maize intercropped with sorghum (0.50), sole maize (0.50), maize intercropped with marigold (0.49), maize intercropped with bajra (0.48) and maize intercropped with dhanicha (0.32).

Name of the Candidate : Ms. Pisal Sneha Subhash
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2021
Name of Guide/Co guide : Dr. S. D. Desai
Abstract :

The laboratory investigations on biology of *Spodoptera litura* (Fabricius) was carried out during the year 2020-2021 at the Department of Agricultural Entomology, College of Agriculture, Dapoli, Dist. Ratnagiri. Similarly, field experiments were conducted to test the efficacy of insecticides against insect pests infesting dolichos bean at Agronomy farm of the College of Agriculture, Dapoli, Dist. Ratnagiri. The mean pre-oviposition, oviposition and post-oviposition period lasted for 3.1, 3.5 and 1.3 days, respectively. The female laid on an average 966.5 eggs. The eggs were spherical, pearl-white colored and were laid in batches on the surface of leaves. Average length of eggs measured as 0.46 mm with an average breadth of 0.39 mm. The incubation period lasted for 2.8 days.

The larva moulted four times and passed through five larval instars. Duration of each instar was found to be 3, 2.8, 3.3, 3.3 and3.4 days, respectively. The larval development completed with an average of 15.9 days. The first instar larva was tiny and seems like a pale green with an average width of head capsule 0.24 mm, body length and width of 1.47 mm and 0.23mm, respectively. The second instar larva was pale greenish in color, hairless and smooth skinned with an average width of head capsule 0.35 mm, body length and width of 4.47 mm and 0.52 mm, respectively. The third instar larva was dark green colour, with an average width of head capsule 0.49 mm, body length and width of 11.98 mm and 1.51 mm, respectively.

The fourth instar larva was green to brown colour with an average width of head capsule 0.69 mm, body length and width of 23.04 mm and 3.18 mm, respectively. The fifth instar larva was dark brown coloured with an average width of head capsule 1.10 mm, body length and width of 37.81 mm and 5.75 mm, respectively. The mean pre-pupal and pupal period lasted for 1.4 and 8.3 days respectively. Pupae seems as yellowish initially and later on it changed its colour into reddish brown with an average length of 15.26 mm and average breadth of 4.55 mm.

The forewing of adult moth was having its forewings with a grey to reddish brown colored and having a complex pattern of creamy streaks. The adult longevity of male and female was observed as 4.1 day and 5.8 day respectively. Body length and wing expanse of female and male moth was measured as 17.06 mm, 36.91 mm, 15.62 mm and 37.08 mm, respectively. The sex ratio for male to female was 1: 1.38. The total life cycle of male was found to be completed within 24.5 to 38.5 days with an average of 31.5 days and the total life cycle of female was completed in 32.5 to 50.5 day with an average of 41.5 days.

The studies on efficacy of insecticides against pests infesting dolichos bean indicated that treatment spinosad 45 SC @ 0.006 per cent was most effective which recorded 29.29 mean aphid population followed by emamectin benzoate 5 SG @ 0.0025 per cent recorded 30.40 mean aphid population. The treatment spinosad 45 SC @ 0.00675 per cent was found to be the best treatment which recorded minimum (6.40%) mean pod infestation and was at par with emamectin benzoate 5 SG @ 0.0025 per cent and lamda cyhalothrin 5 EC @ 0.025 per cent recorded 7.00 per cent and 7.55 per cent pod damage, respectively. The results of overall mean of all two sprays against *S. litura* infesting dolichos bean revealed that treatment emamectin benzoate 5 SG @ 0.0025 per cent was most effective which recorded 14.30 mean per cent leaf damage which was at par with spinosad 45 SC @ 0.00675 (15.02%).

Name of the Candidate : Kadu Vaibhav Vinodrao
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology

Year of Submission : 2021
Name of Guide/Co guide : Dr. S. N. Kale
Abstract :

The present investigation on "Effect of planting dates and management of sucking pests infesting brinjal, *Solanum melongena* L." was carried out during *rabi* season of 2019-20 at Rukhi block, Central Experimental Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

During present investigation, study the effect of planting dates against sucking pests infesting brinjal. Based on overall results of field experiment, it was revealed that lowest overall mean 3.49, 4.19 and 4.55 per three leaves per plant population of aphid, jassid and whitefly, respectively were recorded in early planted crop i.e. 22nd October, while the highest overall mean 4.55, 4.62 and 4.84 per three leaves per plant population of aphid, jassid and whitefly, respectively were recorded from late planted crop i.e. 21st November.

The data on correlation between mean aphid population and weather parameters revealed that aphid populations recorded at first and second dates of planting showed negative but non-significant correlation with maximum temperature but aphid population recorded at third date of planting showed positive correlation with maximum temperature but it was also non-significant. However, population of aphid recorded at all the three dates of planting showed negative significant and negative non-significant correlation with minimum temperature and morning relative humidity, respectively. Aphid population recorded at first and third planting dates showed significant negative correlation with evening relative humidity while aphid population at second date of planting showed negative but non-significant correlation with evening relative humidity.

The data on correlation between mean jassid and whitefly population and weather parameters revealed that at first and second dates of planting the jassid and whitefly population exhibited negative but non-significant correlation with maximum temperature, while at third date of planting positive non-significant correlation was recorded with mean population of jassid and whitefly. However, jassid and whitefly population recorded at all the three dates of planting showed significant negative correlation with minimum temperature. Thus, it can be concluded that increase in minimum temperature causes reduction in jassid and whitefly population. Jassid and whitefly population recorded at first and second planting dates showed non-significant positive correlation with morning relative humidity while jassid and whitefly population at third date of planting showed negative but non-significant correlation with morning relative humidity. However, jassid and whitefly population recorded at all the three planting dates showed negative non-significant correlation with evening relative humidity.

The data on mean population of aphids per three leaves after three sprays revealed that the treatment thiamethoxam 25 % WG @ 0.0063 per cent was the best treatment by recording minimum (2.62 per three leaves) aphids and was at par with *Lecanicillium lecanii* 1.15 % WP @ 5 g/*l* (2.75), azadirachtin 1 % EC @ 0.0030 per cent (3.00), *Metarhizium anisopliae* 1.15 % WP @ 5g/*l* (3.07).

The data pertaining to overall efficacy of different insecticides against jassids infesting brinjal after three sprays revealed that the treatment thiamethoxam 25 % WG @ 0.0063 per cent was found to be most effective treatment which recorded 3.28 jassids per three leaves and was at par with the treatment *Metarhizium anisopliae* 1.15 % WP @ 5g/*l* (3.72), *Lecanicillium lecanii* 1.15 % WP @ 5 g/*l* (3.83) and azadirachtin 1 % EC @ 0.0030 per cent (3.90).

The data on mean population of whitefly per three leaves after three sprays revealed that the treatment thiamethoxam 25 % WG @ 0.0063 per cent was the best treatment by recording minimum (3.17 per three leaves) whiteflies and was at par with *Lecanicillium lecanii* 1.15 % WP @ 5 g/*l* (3.64), azadirachtin 1 % EC @ 0.0030 per cent (3.94).

Name of the Candidate : Ms. Mhatre Swarali Pradip
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2021
Name of Guide/Co guide : Dr. M. S. Karmarkar
Abstract :

A laboratory experiment was conducted during 2019-2021 to study the "Comparative study of Mulberry silkworm *Bombyx mori* Linn. under different season of Konkan region of Maharashtra" at sericulture unit, Department of Agriculture Entomology, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri. In this particular experiment three different seasons were studied viz, October – November, March – April and January – February. In all this period observations like feeding duration, moulting duration, leaf consumption, survival percentage, cocoon yield, economic traits like cocoon weight, shell weight, shell ratio and effective rate of rearing by number and by weight were studied. Among three periods,

October – November showed better result in case of all observation followed by January – February. The negative impact on growth of mulberry silkworm was observed during March - April.

In this experiment, effect of folic acid administration on growth rate pattern of different mulberry silkworm instars were also studied. The six treatments were replicated four times randomly into three different instars viz, third instar, fourth instar and fifth instar. The treatments consisted different concentration of folic acid 0.2 %, 0.4 %, 0.6 %, 1.6 %, 2.4 % and control.

Among the various treatments, the maximum growth index, cocoon weight, shell weight and shell ratio was observed in fifth instar larvae (I_3) with 1.6 % folic acid treatment (T_4), so combined result was found maximum in I_3T_4 followed by I_3T_5 and I_3T_3. For third instar (I_1) treatment 0.6 % (T_3) i.e. I_1T_3 and fourth instar larvae (I_2) treatment 1.6 % (T_4) i.e. I_2T_4 showed maximum result in case of growth index, cocoon weight, shell weight and shell ratio compared to control and other treatments. However, effective rate of rearing by number found to be non-significant. While, effective rate of rearing by weight found significant with maximum in treatment combination of fifth instar larvae with 1.6 per cent folic acid treatment (I_3T_4).

The above results revealed that in Konkan region October- November and January – February are observed to be successful for rearing mulberry silkworm. However, folic acid administration to mulberry leaves gives better result in case of economic characters like cocoon weight, shell weight and shell ratio and subsequently quality of silk compared to control which is adaptable and less costly.

Name of the Candidate : Pachre Anand Mahadevrao

Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology

Year of Submission : 2021

Name of Guide/Co guide : Dr. S. S. Gurav

Abstract :

The present investigation "Seasonal incidence and management of pests infesting cowpea, *Vigna unguiculata* (Walp.)" was carried out during *rabi* season of 2020-21 at Agronomy Farm and in laboratory of Department of Agricultural Entomology, College of Agriculture, Dapoli, Dist. Ratnagiri.

During present investigation, the study on seasonal incidence revealed that the pest population showed marked difference with respect to Standard Meteorological Weeks. Aphids, *Aphis craccivora* Koch, leafhoppers, *Empoasca kerri* Pruthi and Pod borers, *Maruca vitrata* Fabricius and *Lampides boeticus* Linnaeus were found damaging the crop. Peak incidence of aphids (11.03 ± 4.34 aphids per 10 cm twig) was observed in 9th SMW (26th February – 4th March). Population of leafhoppers reached to peak (3.12 ± 1.24 leafhoppers per leaf) in 9th SMW (26th February – 4th March). Maximum population of pod borers (3.21 ± 1.14 larvae per plant) was found in 11th SMW (12th – 18th March), while highest per cent bud damage (34.86 ± 16.05) and pod damage (25.76 ± 11.64) was recorded in 10th SMW (5th – 11th March). Coccinellid beetles viz., *Chilomenes sexmaculata* (Fabricius) and *Coccinella transversalis* (Fabricius) were also observed on crop after the infestation by pests. Population of coccinellids reached to peak (3.23 ± 1.30 grubs and adults per plant) in 10th SMW (5th – 11th March).

The data on correlation between aphids infesting cowpea and different weather parameters revealed that minimum temperature exhibited significant negative correlation with aphid population. Maximum temperature, wind speed and bright sunshine hours showed non-significant positive correlation, whereas morning and evening relative humidity showed non-significant negative correlation with aphid population. The leafhoppers exhibited non-significant positive correlation with maximum temperature, wind speed and bright sunshine hours, while minimum temperature, morning and evening relative humidity were found to be negatively non-significant.

Data on correlation revealed the significant positive correlation between maximum temperature and population of pod borers larvae. Minimum temperature, wind speed and bright sunshine hours had positive influence while morning and evening relative humidity had negative influence on pod borers population. No any weather parameter showed significant correlation with mean per cent bud damage. Weather parameters viz., maximum temperature, wind speed and bright sunshine hours were positively correlated, whereas minimum temperature, morning and evening relative humidity were negatively correlated with mean per cent bud damage. Mean per cent pod damage exhibited significant positive correlation with maximum temperature and wind speed and significant negative correlation with morning relative humidity. Weather parameters viz., minimum temperature and bright sunshine hours had non-significant positive correlation while evening relative humidity had non-significant negative correlation with mean per cent pod damage. Coccinellids showed significant positive correlation with population of aphids, leafhoppers and pod borers.

During the laboratory studies on the biology of *Maruca vitrata* (Fabricius), it was recorded that mean pre-oviposition, oviposition and post-oviposition period lasted for 3.5, 3.4 and 1.7 days, respectively. An average 58.4 eggs were laid, singly or in groups by the female. The incubation period lasted for 3.3 days with 72 per cent hatching. The mean duration of larval, pre-pupal and pupal period was found to be 14, 2.3 and 8.4 days, respectively. Longevity of male and female moths was 4.4 and 8.6 days, respectively. The sex

ratio for male to female was 1:1.04. Total life cycle of male and female was completed within 32.4 and 36.6 days, respectively.

The investigations on efficacy of insecticides against pests infesting cowpea revealed that the treatment deltamethrin 2.8 EC @ 0.0028 per cent was the best treatment against aphids which recorded minimum (4.25 aphids per 10 cm twig) population of aphids. The treatment spinosad 45 SC @ 0.0072 per cent was most effective in reducing the leafhoppers population which recorded 1.70 leafhoppers per leaf and was at par with deltamethrin 2.8 EC @ 0.0028 per cent (1.77 leafhoppers per leaf). The treatment chlorantraniliprole 18.5 SC @ 0.0044 per cent was found to be superior against pod borers which recorded minimum (8.32%) overall mean per cent damage.

Name of the Candidate : Parkar Huzaifa Hanif
Degree for which the thesis : Agricultural Entomology
Year of Submission : 2021
Name of Guide/Co guide : Dr. M. S. Karmarkar
Abstract :

The research project entitled "*In- vivo* efficacy of insecticide combinations against *Spodoptera frugiperda*, J. E. Smith (Lepidoptera: Noctuidae)" was undertaken in a laboratory at Department of Agricultural Entomology, College of Agriculture, Dapoli in year 2020- 21.

Experiment were conducted in four different sets for both second and fourth instar larvae of *S. frugiperda*, for studying efficacy of insecticide combinations. The treatments in set one included recommended dose of insecticides under study while second set included full dose of synthetic pyrethroids + ½ dose of remaining insecticides under study. Similarly third and fourth sets had ½ dose of synthetic pyrethroids + full dose of other insecticides and ½ doses of both synthetic pyrethroids and other insecticides.

In case of recommended dose of insecticides alone, treatment with 0.00003 per cent fipronil gave cent per cent mortality of second instar larvae of *S. frugiperda* which was followed by 0.05 per cent thiamethoxam (93.33%) and 0.005 per cent fenpyroximate (85.10%). Similarly, fipronil 0.00003 per cent (100%) and thiamethoxam 0.05 per cent (96.67%) gave the best results with fourth instar larvae too but cypermethrin 0.01 per cent did not prove to be effective with only 13.33 per cent mortality.

The treatment of combinations of cypermethrin 0.01 per cent with thiamethoxam 0.05 per cent and fipronil 0.00003 per cent were the most effective in second set in case of second instar which gave 96.67 per cent mortality each while for fourth instar larvae while for fourth instar larvae cypermethrin 0.01 per cent when mixed with fipronil 0.00003 per cent or thiamethoxam 0.05 per cent and bifenthrin when mixed with 0.005 per cent fenpyroximate proved to be the best with 100, 96.67 and 96.67 per cent mortality, respectively.

In third set, fipronil 0.00003 per cent with cypermethrin 0.005 per cent and bifenthrin 0.004 per cent gave best results (100%) for second instar larvae while for fourth instar cypermethrin 0.005 per cent + thiamethoxam 0.05 per cent was best. While mixture of cypermethrin 0.005 per cent + fenpyroximate 0.005 per cent was least effective.

Fipronil 0.000015 per cent when mixed with bifenthrin 0.004 per cent gave best results in case of both second and fourth instar larvae for fourth set.

Overall results indicated that combination of synthetic pyrethroids with fipronil at any concentrations gave good results in most of the cases.

Name of the Candidate : S. D. Sapkal
Degree for which the thesis : Ph.D (Ag.)
Year of Submission : 2021
Name of Guide/Co guide : Dr. S. K. Mehendale
Abstract :

The investigations on 'Bio-intensive management of major pests infesting okra (*Abelmoschus esculentus* (L.) Moench.)' were carried out to study the seasonal activity of okra pests and their natural enemies, screening of different genotypes, effect of border crops and evaluation of bio-pesticides against okra pests and their natural enemies during two consecutive *Summer* seasons, *viz.,* 2019 and 2020 at the research farm of the Vegetable Improvement Scheme, Central Experiment Station, Wakawali, under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

The results revealed that the seasonal incidence of sucking pests *viz.,* jassid and aphid were started during 10th SMW while, whitefly during 11th SMW and reached its peak level in 16th (20.75), 15th (12.25) and 14th (5.80) SMW, respectively. Whereas, the per cent shoot damage was started during 9th SMW and reached its peak (11.11%) in 14th SMW, while per cent fruit damage was started during 13th SMW and reached its peak in 16th SMW (35.45% and 33.25%) in both number and weight basis, respectively. The weather parameters such as maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, bright sunshine, wind speed, evaporation play an important role in abundance of

above pests. The population of coccinellids and spiders started during 11th SMW and reached its peak in 16th SMW (3.15) and 17th SMW (2.15), respectively and were commonly observed throughout the season when there was more incidence of sucking pests. Screening of different genotypes of okra against major pests indicated that none of the tested genotypes were found free from the pest infestation. The population of sucking pest's *viz*., jassid and whitefly were recorded minimum in Arka anamika (3.77 and 2.39, respectively) while, maximum in Bantiware Local (12.69) and Okra Local (6.05), respectively. However, aphid population was minimum in Kashi Pragati (5.63) while, maximum in Pusa Sawani (10.91). The per cent shoot and fruit damage was lowest in HRB-108-4 and highest in Pusa Sawani. The trichomes and phenol content in leaves found significantly negative correlation with sucking pests while, phenol content in fruits found significantly negative and sugar content in fruits found significantly positive correlation with shoot and fruit borer. Effect of different border crops on major pests and their natural enemies of okra revealed that, the population of sucking pest's *viz*., jassid, aphid and whitefly were minimum in maize border with okra crop while, maximum in untreated control plot (without border crop). Whereas, the per cent shoot and fruit damage was lowest in sunflower border with okra crop while, highest in untreated control plot (without border crop). The population of coccinellids and spiders were maximum in maize border with okra crop while, minimum in untreated control plot (without border crop). However, the population of coccinellids and spiders were maximum in maize while, minimum in castor border crops. Evaluation of different bio-pesticides against major pests and their natural enemies of okra indicated that, all the treatments were found to be significantly superior in recording minimum number of sucking pests as well as shoot and fruit borer damage over untreated control. Among the all treatments, the treatment T_7 (thiamethoxam 25 WG) was found most effective against sucking pests followed by T_6 (emamectin benzoate 5 SG), T_5 (*Lecanicillium lecanii* 2 x 10^8), T_1 (azadirachtin 10000 ppm) and T_3 (*Beauveria bassiana* 2 x 10^8). Whereas, the treatment T_6 (emamectin benzoate 5 SG) was found most effective against *Earias spp*. followed by T_7 (thiamethoxam 25 WG), T_1 (azadirachtin 10000 ppm), T_2 (*Bacillus thuringiensis var. kurstaki* 3.5 ES) and T_4 (*Metarhizium anisopliae* 2 x 10^8). All the bio-pesticides were found to be safest to the natural enemies except chemical insecticides treatment T_6 (emamectin benzoate 5 SG) and T_7 (thiamethoxam 25 WG). Economics of all the treatments revealed that, the treatment T_7- thiamethoxam 25 WG @ 0.20g/lit emerged as the most economical one recording highest ICBR 1:20.21. It was followed by, T_6- emamectin benzoate 5 SG @ 0.32g/lit and T_2- *B. thuringiensis var. kurstaki* 3.5 ES @ 1.5ml/lit recording ICBR of 1:16.72 and 1:11.50, respectively.

Name of the Candidate : S. S. CHAVAN
Degree for which the thesis : Ph. D. (Agriculture)
Year of Submission : 2021
Name of Guide/Co guide : Dr. A. L. Narangalkar

Abstract :

The population of rugose spiralling whitefly was recorded throughout the year. The population of rugose spiralling whitefly was in the range of 4.24 to 102.87 adults per frond per palm, however the outbreak was noticed during 15th SMW (9/04/2019 to 15/04/2019) *i.e.***,** 102**.**87 adults per frond per palm while the minimum population was recorded at 40th SMW (01/10/19 to 07/10.19).

The rugose spiralling whitefly completed its life cycle in 58.15 ± 3.24 days on coconut with eggs, nymphal and adult period of 6.78 ± 1.17, 30.97 ± 2.32 and 20.4 ± 2.22 days, respectively. Longevity of female and male were found to be 20.4 ± 2.22 and 14.0 ± 1.24 days respectively. The pre-oviposotion and ovipostion period found to be 3.2 ± 0.58 and 4.4 ± 0.65 days respectively, while fecundity was 53.2 ± 6.14. The female to male sex ratio was 1:0.45.

A. rugioperculatus was found in all the districts of Konkan region with varying intensity ranging from 37.87 per cent to 76.86 per cent. Intensity of infestation was high in Palghar district (76.86%) which was found to be statistically at par with Raigad district (74.50%). It was followed by Ratnagiri and Sindhudurg district which recorded 52.14 and 41.51 per cent respectively. Low intensity of infestation was recorded in Thane district (37.87%)**.** Infestation index was medium in all the districts. The intensity of infestation was found to be high in coastal part of all the districts and decreases as move away from coastal area.

Rugose spiralling whitefly was recorded on 19 plant species *viz.,* Guava (*Psidium guajava*), Papaya (*Carica papaya*), Banana (*Musa paradisiaca*), Custard apple (*Annonas quamosa*), Oil palm (*Elaeis guineensis*), Nutmeg (*Myristica fragrans*), Coconut (*Cocus nusifera*), Bird of paradise (*Strelitzia reginae*), Rose apple (*Syzygium samarangense*), Ramphal (*Annona reticulate*), Mango (*Mangifera indica*), Chafa (*Plumeria alba*), Heloconia (*Heliconia rostrata*), Sapota (*Achras zapota*), Aonla (*Phyllanthus emblica*), Black pepper (*Piper nigrum*), Hibiscus (*Hibiscus rosasinensis*), Arecanut (*Areca catechu*) and Teak (*Tectona grandis*) in costal districts of Konkan region. Out of these 19 plants, only egg stage was recorded on 6 plants

viz., sapota, Aonla, Black pepper, Hibiscus, arecanut and teak which might be accidental egg laying. While the mango, Chafa and Heliconia plant recorded with eggs and nymph stage.

Total twelve species of natural enemies were recorded on RSW. Among twelve natural enemies ten were predators while two were parasitoids. Among ten predators recorded, two were from Chrysopids, one from Cybocephallids, four from Coccinelids, one each from Phytoseiid, Psocoptera and Dermaptera, while two parasitoid species from aphilinids were recorded. Although diverse natural enemies were found to be associated with RSW, the most dominant parasitoid species was *Encarsia guadeloupae*. While other *Encarsia* spp. was found to be rare on RSW on coconut.

The treatment with neem oil 0.2 per cent was found to be most effective with lower number of eggs survival at 3 and 7 DAS. The treatment with fish oil rosin soap 0.2 per cent was found to be most effective for the control of nymphs of RSW. The treatment with detergent powder 5 per cent was found to be most effective in controlling the adult population.

The treatment profenofos 50 EC was found to be most effective with ovicidal action in controlling eggs of RSW. The treatment imidacloprid 17.8 SL was recorded significantly lower number of nymphal population. The treatment with imidacloprid 17.8 SL was found to be most effective in supressing the population of adults of RSW.

2022

Name of the Candidate : Ms. Munj Sujal Suhas
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : Dr. S.S. GURAV

The present investigation entitled "Survey, biology and management of banana skipper, Erionota torus (Evans.)" was conducted during the year 2021-22. The survey was conducted in Sindhudurg district. While biology and efficacy of different insecticides against, Erionota torus (Evans.) were carried out in laboratory of Department of Entomology and at experimental Research farm, College of Horticulture, Mulde, respectively. According to survey data, Sindhudurg district had an average per cent incidence of 6.20, while the average per cent pest intensity was 2.55 of E. torus. Pre-oviposition, oviposition, and post-oviposition period were on average 2.5, 1.4, and 6.5 days, respectively. The female deposited an average of 21 eggs, either individually or in clusters. The incubation period was 7.30 days with 75.00 per cent of the eggs hatching. It was found that the mean duration of the larval, pre-pupal, and pupal stages were 24.5, 3.3, and 9.2 days, respectively. Male and female adults completed their life cycle within 52.0 and 54.4 days, respectively.

The most efficient insecticidal treatment against E. torus larvae was found to be chlorantraniliprole 18.5 SC @ 0.005 per cent. Quinalphos 25 EC @ 0.05% and cypermethrin 25 EC @ 0.07% were the next effective treatments.

Name of the Candidate : Ms. Radhika Bankapur
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : Dr. R.S. MULE
Abstract :

The present studies on "Biology and effect of grain protectants against rice moth, *Corcyra cephalonica* (Stainton) (Lepidoptera: Pyralidae) on rice varieties" were carried out at laboratory of the Department of Agricultural Entomology, College of Agriculture, Dapoli, Dist. Ratnagiri 415 712 (Maharashtra).

Two new rice varieties *viz.*, Ratnagiri-7 (red rice) and Ratnagiri-8, recently released for cultivation in Konkan region of Maharashtra were selected and used for studying various aspects of biology of pest and effect of different grain protectants on growth and developmental characters of *C. cephalonica* infesting rice grains. The average fecundity, oviposition and incubation periods, hatching percentage, larval and pupal periods were recorded as 300.08, 4.12 and 4.02 days, 91.76 per cent, 32.91 and 9.04 days, respectively. The mean developmental period was found to be 51.90 days. The mean adult longevity for male and female adult was 9.51 and 7.67 days, respectively, whereas, mean sex ratio, per cent adult emergence and growth index was observed to be 1.09, 87.49 per cent and 1.68, respectively. Among different oil treatments, coconut oil and sesame oil each at 3ml per 100g of grains were found to be most effective treatments against *C. cephalonica* followed by mustard oil. In case of plant products (as such) sweet flag rhizome and dry nutmeg each at 3g and 6g per 100g of grains were found to be most promising treatments against rice moth followed by turmeric rhizome.

Name of the Candidate : Waman Abhijit Gokul
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology

Year of Submission : 2022
Name of Guide/Co guide : Dr. A. Y. Munj
Abstract :
The laboratory experiment was carried out at laboratory of Department of Agricultural Entomology, College of Agricultural Dapoli, Ratnagiri Maharashtra during the year 2021-22 to study the 'Management of pulse beetle, *Callosobruchus maculatus* (fab.) (Coleoptera: Chrysomelidae) infesting cowpea, *Vigna unguiculata* (L.)'. Eight different genotypes of cowpea *viz.*, CP-06, CP-08, CP-13, SNJ-11, SNJ-22, SNJ-27, SNJ-32 and PP were examined for the orientation, oviposition and developmental period of *C. maculatus*. The cowpea variety Konkan safed was used for the management of *C. maculatus* and to work out the germination percentage using different ITK based plant products and the inert materials such as neem leaf powder, karanj leaf powder, vekhand powder, turmeric powder, wood ash, eucalyptus oil and fine sand. The overall study resulted that, the genotype SNJ-11 was observed to be the least preferred by *C. maculatus* for oviposition. Also, the minimum number of eggs (113.67 eggs) were laid on the same genotype with minimum hatching percentage (50%) and adult emergence (27.00 adults). For management, of *C. maculatus* the seed treatment of cowpea seeds with eucalyptus oil @10ml/kg was proved to be the most effective with cent per cent mortality of *C. maculatus* at 5 DAT. The seed treatment with vekhand powder was observed to be the next best treatment. The maximum germination percentage was observed in seeds treated with wood ash (88%); However, there was no any adverse effect on germination in the seeds treated with other ITKs.
Name of the Candidate : Ms. V. Amsavalli
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : Dr. B. D. SHINDE
Abstract :
The laboratory investigations on biology of black aphid, *Pentalonia nigronervosa* (Coquerel) was carried out during the year 2021-22 at the Department of Agricultural Entomology, College of Agriculture, Dapoli, Dist. Ratnagiri. Similarly, field experiment was conducted to test the efficacy of insecticides against black aphid, at Biological control laboratory, College of Agriculture, Dapoli, Dist. Ratnagiri. The mean duration of first, second, third and fourth instar on red banana lasted for 2.5, 2.4, 2.5 and 3.2 days, respectively and on taro it was observed as 3.5, 3.5, 3.3 and 3.4 days. The mean pre-reproduction, reproduction, post-reproduction period and adult longevity on red banana lasted for 4.1, 11.9, 3.6 and 19.6 days, whereas on taro it was observed as 5.5, 10.3, 6.1 and 21.1days, respectively. The life of aphid from first nymphal instar to the death of adult on red banana was completed within 26.50 to 33 days and on taro was 31.50 to 37 days.

The overall mean per cent mortality after two sprays revealed that the treatment T_6- imidacloprid 17.8 SL @ 0.053 per cent was most effective treatment which recorded (90.07%) mortality of aphids and it was followed by T_7- acetamiprid 20 SP @ 0.1 per cent with (83.17%) mortality. The least mortality (10.21%) was observed in T_8- untreated control.
Name of the Candidate : Mr. Sourav Rajendra Patil
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : Dr. S. D. Desai
Abstract :
The present investigation, entitled "Seasonal incidence and management of pests infesting sunflower, *Helianthus annuus* (L.)", was conducted at the Instructional Farm, Department of Agronomy, College of Agriculture, Dapoli, Dist. Ratnagiri, during the *Rabi* season of 2021-22. The pests attacking on the sunflower were capitulum borer, *Spilosma obliqua* Walker, *Spodoptera litura* Fabricius, aphids and whiteflies. The peak population of capitulum borer (*Helicoverpa armigera* Hubner) (3.70 /ten plants) was recorded in the fourth week of February (8^{th} SMW). The peak population of hairy caterpillar (*S. obliqua)* (4.20 /ten plants), *S. litura* (3.90 /ten plants) and aphids (4.10/three leaves) was recorded in the second week of February (6^{th} SMW) respectively. While the peak incidence of whitefly was noticed during the fourth week of January (4^{th} SMW).

The efficacy of Deltamethrin, Emamectin benzoate, Indoxacarb, Lambdacyhalothrin, Thiomethoxam, Imidacloprid, and Azadirachtin was evaluated against pest infesting sunflower. Deltamethrin found superior and most effective to control the defoliators *viz.*, capitulum borer, hairy caterpillar, *S. litura* while imidacloprid was observed to be superior and most effective for controlling the sucking pests such as aphid and whitefly. The least mean population of capitulum borer (2.20/five plants), hairy caterpillar (2.67/five plants), and *S. litura* (2.28/five plants) was observed in the plot treated with Deltamethrin 2.8 EC. The treatment Imidacloprid 17.8 SL was observed to be superior and most effective for controlling the aphid (6.30 aphids/three leaves) and whitefly (2.90 whiteflies/three leaves). The treatments Indoxacarb, Emamectin

benzoate, Lambdacyhalothrin, *Azadirachtin* were also found effective in controlling the defoliators while Thiomethoxam had shown significant reduction in the population of aphids and whitefly. All the treatments shown significant reduction in the population of pests as compared to the untreated control.

Name of the Candidate : Shigwan Priti Sunil
Degree for which the thesis : Ph.D.(Ag.)
Year of Submission : 2022
Name of Guide/Co guide : Dr. (Mrs.) Kumud V. Naik
Abstract :

The experiment was conducted on the topic entitled 'Management of pests infesting cabbage, *Brassica oleracea* var. *capitata* L.' to study the seasonal incidence of pests infesting cabbage, effect of dates of transplanting, effect of mulches and efficacy of insecticides on pests infesting cabbage during *rabi* season of 2020-21 and 2021-22 at Vegetable Improvement Scheme, Central Experiment Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

During the investigation, the cabbage crop was found to be infested mainly with sucking pest aphids and foliage feeding pest tobacco caterpillar, *Spodoptera litura* (Fabricius). The results on pooled data of both seasons revealed that the population of aphids and *S. litura* was in the range of 0.16 to 47.72 aphids per plant and 0.14 to 6.26 larvae per plant, respectively. The peak population of aphids and *S. litura* was observed during 7^{th} and 2^{nd} SMW, respectively. The population of aphids was found to be increased continuously till the harvesting of cabbage, whereas the population of *S. litura* was fluctuating. The incidence of both pests started from 52^{nd} SMW.

The pooled data of aphid population showed positive significant correlation with wind speed and bright sunshine hours while negative significant correlation with morning and evening relative humidity. Other weather parameters were non-significantly correlated with aphid population. The pooled data of *S. litura* population showed non-significant correlation with all studied weather parameters. The investigation revealed that the weather parameters contributed for 96.02 and 80.91 per cent of total variation in the population of aphids and *S. litura* on cabbage, respectively.

The population of aphids and *S. litura* was noticed minimum (5.75 aphids per plant and 0.64 larvae per plant) on cabbage trasplanted earlier *i.e.* (D_1) cabbage transplanted on 15 days before recommended date of transplanting as compare to (D_2) cabbage transplanted on recommonded date of transplanting (10.81 and 1.58) and (D_3) 15 days after recommended date of transplanting (14.57 and 2.89).

The pooled data of both seasons indicated that the population of aphids and *S. litura* was the least on M_4-paddy straw mulched crop (8.05 aphids per plant and 0.92 larvae per plant) and it was followed by M_5-glyricidia (10.99 and 1.19), M_3-transparent polythene (16.75 and 1.50), M_1-silver polythene (17.69 and 1.54), M_2-black polythene (20.23 and 1.84) and M_6-grass (20.94 and 1.98) mulched crop. The highest aphid and *S. litura* population (35.39 aphids per plant and 3.57 larvae per plant) was observed on M_7-un-mulched crop.

Among the all treatments, the treatment T_3-chlorantraniliprole 18.5 per cent SC was found to be most effective against aphids and it was followed by T_5-novaluron 10 per cent EC, T_6-spinosad 2.5 per cent SC, T_4-emamectin benzoate 5 per cent SG, T_1-azadirachtin 300 ppm and T_2-*Bacillus thuringiensis* var. *kurstaki* 0.5 per cent WP. In case of *S. litura*, the treatment T_3-chlorantraniliprole 18.5 per cent SC was found to be most effective and it was followed by T_4-emamectin benzoate 5 per cent SG, T_5-novaluron 10 per cent EC, T_6-spinosad 2.5 per cent SC, T_1-azadirachtin 300 ppm and T_2-*B. thuringiensis* var. *kurstaki* 0.5 per cent WP. All the treatments showed less population of both pests as compared to T_7-untreated control. According to ICBR, T_3- chlorantraniliprole 18.5 per cent SC @ 0.1 ml/L emerged as the most economic treatment recording highest ICBR 1:27.61. It was followed by T_4-emamectin benzoate 5 per cent SG @ 0.4 g/L (1:12.19), T_5-novaluron 10 per cent EC @ 0.75 ml/L (1:11.74), T_6-spinosad 2.5 per cent SC @ 1.4 ml/L (1:9.73), T_2-*B. thuringiensis* var. *kurstaki* 0.5 per cent WP @ 1 g/L (1:4.89) and T_1-azadirachtin 300 ppm @ 5 ml/L (1:3.53).

Name of the Candidate : Mr. Rushikesh Gorakh Kale
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : Dr. V. N. Jalgaonkar
Abstract :

The field experiments entitled "Seasonal incidence and management of pests infesting watermelon, *Citrullus lanatus* (Thunb.)" were carried out at Vegetable Improvement Scheme (VIS), Central experimental Station, Wakavali during summer 2021-22. From the investigation it was found that seasonal activity of pests attacking on the watermelon viz., aphid, whitefly leaf miner and pumpkin caterpillar was observed between 6 SMW to 16h SMW. The peak population of aphids and whitefly was recorded in the third week of March (11th SMW) maximum leaf infestation of leaf miner and pumpkin caterpillar was observed in the second

week of April (14th SMw) and fourth week of the March (12" SMW) respectively. All the weather parameters were non-significantly correlated with pests infesting watermelon. The efficacy of Chlorantraniliprole, Emamectin benzoate, Spirotetramat, Thiomethoxam, PVriproxyfen, Azadirachtin and *Beauveria bassiana* was evaluated. Spirotetramat was found superior and most effective in controlling sucking pests such as aphid and whitefly. The treatment Emamectin benzoate was found etfective to control leaf miner leaf infestation. The plot treated with Chlorantraniliprole noticed less infestation by pumpkin caterpillar leaf infestation. Spirotetramat was effective insecticide which gave highest (35.81 t ha) vield as compared to other treatments.

Name of the Candidate : Shaikh Arshad Kadar
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : : Dr. S. M. Wankhede

Abstract :

An experiment "Biology of stingless bee and its impact on pollination in radish, *Raphanus sativus* (L.)" was conducted near Biocontrol unit of Department of Agricultural Entomology and field experiment was conducted with 3 replication and 8 treatments in RBD at Central Experimental Station, Wakawali, Dr. BSKKV, Dapoli during *Rabi*, 2021-22. Submitted stingless bee sample was identified as *Tetragonula* nr. *pagdeni* by Dr. Viraktamath, NBAIR, Bengaluru. Results revealed that variation in antennal length, absence of corbicula, wing over the abdomen and shape of the abdomen are the primary identifiers within a caste. The queen is bigger in size (8.18 mm), followed by the drone (4.07 mm) and worker (3.74 mm). The biology of stingless bee consisting of egg, larval and pupal phases taking an average of 6.3, 15.1 and 18.7 days, respectively. Maximum number of stingless bees were recorded in T_1- jaggery solution @ 10 per cent (11.4 bees/5 min), *A. florea* visited towards T_2- sugar solution @ 10 per cent (2.7 bees/5 min) and *A. cerana indica* visits in T_4- sugarcane juice @ 10 per cent (1.9 bees/5 min). Stingless bee pollination can enhance the high per cent of pod setting and seed yield of radish.

Name of the Candidate : J. J. Dubale
Degree for which the thesis : Ph.D. (Ag.)
Year of Submission : 2022
Name of Guide/Co guide : Dr. B. D. Shinde
Abstract :

The investigations on 'Biology and biointensive management of fall armyworm *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera : Noctuidae) infesting maize in Konkan region' was carried out to study the biology on different host, seasonal incidence, survey, different biointensive management practices and their effect on natural enemies during two consecutive Rabi seasons, viz., 2019-20 and 2020-21 at the research farm of the Tetawali-B, Central Experiment Station, Wakawali, under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

The biological studies of fall armyworm revealed that, the average fecundity on maize, rice and fingermillet was 1125.4, 1082.4 and 480 eggs, respectively with average incubation period of 2.40, 2.35, and 2.95 days respectively. The mean larval period on maize and fingermillet was 16.07 and 16.38 days, respectively however, on rice it was 18.18 days. The pupal period on maize, rice and fingermillet was 9.13, 9.13 and 9.00 days, respectively. The total life cycle of male and female on maize was 34-38 and 37-39 days, on rice 36-38 and 38-41 days and on fingermillet it was 35-38 and 38-40 days, respectively. The incidence of fall armyworm population ranged from 0.03 to 0.45 larvae per plant. The incidence observed during 2nd SMW and the peak population was noticed during 8th & 9th SMW. The population of fall armyworm was observed in declining condition after peak incidence till maturity of maize crop. The weather parameters such as evening relative humidity and bright sunshine hours played an important role in population density of fall armyworm. The survey data of Konkan region indicated that, the incidence of S. frugiperda was found in all the districts with varying infestation, it ranged from 13.70 to 48.18 per cent. Fall armyworm per cent infestation was highest in Palghar district (48.18%) followed by Sindhudurg district (42.14%). The Raigadh and Ratnagiri district recorded 27.58 and 24.16 per cent infestation, respectively. Lowest infestation was recorded in Thane district (13.70%).

The effect of bioinsentive management practices against *S. frugiperda* infesting maize indicated that, all the treatments were found effective against fall armyworm as compare to untreated control in all three management practices applied at vegetative (whorl) as well as reproductive (cob) stage of maize. Among Indigenous Technology Knowledge (ITKs) treatments, wood ash was found most effective against fall armyworm followed by rock powder. Among the biopesticides, Spinosad 45 SC was found most effective against fall army worm followed by Nomuraea rileyi 2×108cfu/g. However, insecticides used against fall

armyworm revealed that, Chlorantraniliprole 18.5 SC was found most effective treatment followed by Lambdacyhalothrin 4.6 + Chlorantraniliprole 9.3 ZC, Emamectin benzoate 5 SG and Spinetoram 11.7 SC. The effect of different biointensive management practices on natural enemies had a significant difference among different treatments. Among Indigenous Technology Knowledge (ITKs) treatments, the Lime powder + Saw dust (1:1) was found safe for lady beetles as well as spiders population followed by saw dust, soap solution, lime powder and paddy husk. Among bio-pesticides treatments, Pongamia oil 1% was safe for lady beetles and spiders followed by *Bacillus thuringienesis* 0.5% WP, *Metarhizium anisopliae* 2×108 cfu/ml, *Beauveria bassiana* 2×108 cfu/ml, Azadirachtin 10000 ppm and *Nomuraea rileyi* 2×108cfu/g. The effect of insecticides revealed that, all the insecticides were unsafe to lady beetles and spiders. Economics of all three management practices revealed that, ITK wood ash was most economical one recording highest yield (114.62 q/ha) and ICBR 1:35.99 followed by T4- Rock powder recording yield (111.79 q/ha) and ICBR of 1:30.45. In bio-pesticides, Spinosad 45 SC @ 0.3 ml/l was the most economical one recording highest yield (130.63 q/ha) and ICBR 1:36.07. It was followed by *Nomuraea rileyi* @ 4 g/l, *Beauveria bassiana* @ 5 ml/l and *Metarhizium anisopliae* @ 3 ml/l recording ICBR of 1:12.72, 1:11.73 and 1:11.57 respectively. Among insecticides, Emamectin benzoate 5 SG @ 0.4g/l emerged as the most economical one recording highest ICBR 1:32.61. It was followed by Chlorantraniliprole 18.5 SC @ 0.4 ml/l and Lambdacyhalothrin 4.6 + Chlorantraniliprole 9.3 ZC @ 0.6 ml/l recording ICBR of 1:22.43 and 1:20.86 respectively. Next economic treatments were Thiamethoxam 12.6 + Lambdacyhalothrin 9.5 ZC @ 0.25 ml/l, Spinetoram 11.7 SC @ 0.5 ml/l, Lambdacyhalothrin 5 EC @ 0.6 ml/l and Deltamethrin 2.8 EC @ 0.9 ml/l, which recorded ICBR 1:18.99, 1:18.72, 1:17.95 and 1:17.89, respectively. The Chlorantraniliprole 18.5 SC @ 0.4 ml/l had highest yield (150.89 q/ha) and it was followed by treatment Lambdacyhalothrin 4.6 + Chlorantraniliprole 9.3 ZC @ 0.6 ml/l (134.48 q/ha), Spinetoram 11.7 SC @ 0.5 ml/l (132.63 q/ha) and Emamectin benzoate 5 SG @ 0.4g/l (121.15 q/ha). But due to low cost of Emamectin benzoate in market, it had high ICBR.

Name of the Candidate : Mr. Dethe Sominath Radhakisan
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : Dr. S. N. KALE

Abstract :

The laboratory experiment entitled "Effect of different layers of cereals on infestation and development of pulse beetle, *Callosobruchus maculatus* (Fab.) Coleoptera : Chrysomelidae" were carried out at experimental laboratory, Department of Agricultural Entomology, College of Agriculture, Dapoli during 2020-21. 4 cm and 6 cm layers of cereals *Viz,* red rice, nachani, wheat, bajara and maize were put above the kabuli gram and 5 pairs of adults *C. maculatus* were released in each treatment, different parameters of infestation and development were recorded. Data recorded on adult survival duration of *C. maculatus* varied significantly among the treatment. It was varied from minimum 3 days maximum 11 days. Treatments comprised of 6 cm layer of nachani recorded shortest adult survival duration *i.e* 4.2 days while it was longest in control *i.e* 10.2 days.

Data on probing movement of *C. maculatus* in different treatments showed no probing movement in the treatments comprised layer of red rice, nachani and bajara and highest probing movement was observed in control *i.e* 5, 6, 4.5, 6.5, 5 and 7 cm at 2, 4, 6, 8, 10 and 12 hours after release of beetle respectively.

Data on number of eggs laid by *C. maculatus* per 100 grains of kabuli gram also varied significantly among the treatments. Treatments comprised of layer of red rice, nachani, and bajara recorded no eggs on kabuli gram. Treatments comprised of either 6 cm or 4 cm layer of wheat or maize recorded average 16.77, 19.66 and 22.22 and 24.55 eggs respectively, where in control treatments recorded on an average 71.33 eggs per 100 grains of kabuli gram.

Data on numbers of eggs laid per 100 grains of cereals also showed no eggs on any cereals except on maize on an average 28.00 and 30.33 eggs were recorded in the treatment with 6 cm and 4 cm layer respectively.

There were significant difference between treatments regarding no damaged of kabuli gram grains at 30, 60 and 90 days after introduction highest number of average damaged kabuli gram grains were recorded in control (58.66) followed by treatment comprised of 6 cm layer of maize, 4 cm layer of maize, 6 cm layer of wheat and 4 cm layer of wheat *i.e* 24.44, 21.88, 19.33 and 16.55 grains respectively. Treatments comprised of layer of red rice, nachani, bajara recorded no damaged kabuli gram grains. Data regarding no of damaged grains of cereals grains showed no damage to any cereal grains at any storage period.

Data recording number of adult *C. maculatus* emerged in different treatment showed highest adult emergence in control (390.41) and were followed by treatment comprised at 4 cm layer of maize (76.60), 4 cm layer wheat (25.66). Treatment comprised layer of red rice, nachani and bajara recorded no adult emergence at any storage interval.

Data regarding per cent weight loss in different treatments also showed significant variation, treatments comprised layers of red rice, nachani, and bajara recorded no weight loss due to *C. maculatus* significantly highest weight loss was recorded in control (71.73%) followed by treatment comprised of 4 cm layer of maize (39.20%), 6 cm layer of maize (36.2%), 4 cm layer of weight (32.16%) and 6 cm layer of wheat (27.5%).

Data on biological parameters of *C. maculatus* on kabuli gram recorded average incubation period, larval-pupal period and total developmental period (from egg to adult emergence) of 4.15±0.87days, 26.30±3.06 days, 32.85±3.42 days respectively, adult longevity of male and female of *C. maculatus* on kabuli gram was 9.30±1.008 days and 10.15±0.98 days respectively, female *C. maculatus* laid on an average 79.15±8.44 eggs during average ovipositional period of 8.10±1.25 days.

Name of the Candidate : Gitte Madhav Eknath
Degree for which the thesis : M. Sc. (Ag.) Agricultural Entomology
Year of Submission : 2022
Name of Guide/Co guide : Dr.(Smt.) V. P. Sawant

The present investigation on "Effect of essential oils against pulse beetle, *Callosobruchus maculatus* (Fab.) (Coleoptera: Chrysomelidae) under laboratory conditions" with specific objectives was carried out at College of Agriculture, Dapoli Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Dist. Ratnagiri (M.S.) during 2021-22.

During developmental studies, effect of different essential oil on various parameters such as fecundity, developmental period, adult emergence, adult longevity, per cent weight loss, germination percentage etc. were taken. The results under No Choice Test showed that, essential oils affected significantly the egg laying behavior by female pulse beetle *C. maculatus* on chickpea treated with different essential oils at different level of concentrations. Least fecundity was observed in treatment T_6, Lemongrass oil @ 40µl/100g seeds and highest in untreated control treatment T_9. Mean developmental period was extended in all treatment with essential oils in treatment T_6, Lemongrass oil @ 40µl/100g mean developmental period was highest. The least adult emergence was recorded in treatment T_6, Lemongrass oil @ 40µl/100g seeds. The minimum male and female longevity were observed in treatment T_6, Lemongrass oil @ 40µl/100g seeds and maximum in treatment T_9, Untreated control. The average per cent weight loss in chickpea due to infestation of pulse beetle ranged from 1.46 to 11.28%. There was no adverse effect on germination percentage observed in all treatments with essential oils.

In orientation and ovipositional preference it was observed that the beetles preferred untreated seeds over the treated seeds with essential oils for oviposition and orientation. The least ovipositional preference observed in treatment T_6, Lemongrass oil @ 40µl/100g seeds.

At 12 hours of exposure period the mean of per cent mortality were ranged 0.00% to 83.33%. The cent per cent progressive mortality was recorded in all treatments except in untreated control after 72hrs of exposure period.

Thus, the present laboratory studies clearly confirmed that, essential oils used were found significantly effective against pulse beetle, *C. maculatus* without causing any harmful effects on qualitative as well as quantitative parameters of chickpea. Hence, it can be implemented in stored grain pest management practices as they are eco-friendly, cost effective and can be easily made available.

9. Extension Activities

a. Training programmes organised:- 02

1. Title: One day training on "Bee Keeping"
2. Sponsorer: ICAR under Sc-Sp plan
3. Date and duration: 04/02/2022 duration one day
4. Participants: Students from Sc-category
5. Schedule of training programme:
6. Special feature: training was organise to develop entrepreneurship skill of commercial bee keeping in students of Sc category
7. One photograph

1. Title: One day training on "Mass Production Techniques for Entomopathogenic Fungi"
2. Sponsorer: ICAR under Sc-Sp plan
3. Date and duration: 18/02/2022 duration one day
4. Participants: Students from Sc-category
5. Schedule of training programme:
6. Special feature: training was organise to develop entrepreneurship skill in mass production of entomopathogenic fungi in students of Sc category
7. One photograph

Radio/TV talks:

Sr. No.	Name of person	Topic	Date	Medium
1	Dr. A. L. Narangalkar	Insect pest management in mango orchard	22/10/2020	On line phone in programme on sahyandri
2	Dr. A. L. Narangalkar	MadhumakshikaPalan"	12 October, 2021	Mumbai Doordarshan
3	Dr. B. D. Shinde	Management of Mango Pests	October 2021	AIR Ratnagiri
4	Dr. M. S. Karmarkar	Use of different types of traps for insect pest management	30/03/2021	AIR, Ratnagiri
5	Dr. A. L. Narangalkar	"MadhumakshikaPalan: GhawayachiKalji	14th March, 2022	Sahyandri Mumbai Doordarshan

Other extension activities:

1. Department has supplied 250 Kg. Fipronil 0.3 % WDG insecticide and 250 kg Lambda cyhalothrine insecticides free of cost to the farmers in university adopted village Kudawale for the management of rice pests.
2. Mango blossom protection campaign was implemented by the department staff by guiding the farmers regarding insect pests of mango and spray schedules.

a. **Publications:** Provide the details of the following publications published by the Department/Section in bibliographical form

Books :

'Aamba Pik Sanrakshan' – Book.2014, 2017.
Laghu Margadarshak Pustika (Aambapik) October, 2016.
Laghu Margadarshak Pustika (Bhatpik), December, 2017.
Laghu Margadarshak Pustika (Aambapik) March, 2019.

Laghu Margadarshak Pustika (Aambapik) March, 2022.

Booklet/bulletin

Folders

Aambyavaril pramukh kidi va roganchi olakh aani vyawasthapan, Nov, 2022

Aambyavaril phalmashichya vyawasthapanasathi rakshak saplyancha vapar. Nov, 2022

Souvenir/Proceedings of Seminar/Symposia/Conference/Workshop Organized

Training manuals of the training programme organized

Journal Research papers

Sr. No.	Title of paper	Name of Authors	*Name of journal*	NAAS Rating
1	Larvicidal efficacy of some chitin synthesis inhibitors against *Spodopterafrugiperda* (J.E. Smith) (Lepidoptera: Noctuidae)	Mansoor, R.S. Mule, **K.V. Naik** and V.A. Rajemahadik	*J. Exp. Zool. India* 2022, 25 (1): 371-376	**5.25**
2	Effect of sowing datesagainst pod borer complex infesting dolichos bean, *Lablab purpureus* (L.) sweet	M.N. Kengare, K.V. Naik and V.N. Jalgaonkar	*The Pharma Innovation Journal* 2022, SP-11 (3): 748-750	**5.23**
3	Eco-friendly management of pod borer complex infesting dolichos bean, *Lablab purpureus*(L.) sweet by using biopesticides	M.N. Kengare, K.V. Naik and V.N. Jalgaonkar	*The Pharma Innovation Journal* 2022, SP-11 (3): 751-755	**5.23**
4	Seasonal incidence of tobacco caterpillar, *Spodoptera litura* (Fabricius) infesting cabbage, *Brassica oleracea* var. *capitata* L.	P.S. Shigwan , K.V. Naik,M.S. Karmarkar, P.B. Sanap and A.V. Mane	*The Pharma Innovation Journal* 2022	**5.23**
5	Seasonal incidence of aphids infesting cabbage, *Brassica oleracea* var. *capitata* L.	P.S. Shigwan , K.V. Naik, M.S. Karmarkar, P.B. Sanap and A.V. Mane	*The Pharma Innovation Journal* 2022	**5.23**
6	Effect of dates of transplanting on aphids infesting cabbage, *Brassica oleracea* var. *capitata* L.	P.S. Shigwan, K.V. Naik, M.S. Karmarkar, P.B. Sanap and A.V. Mane	*The Scientist* 2023	**6.85**
7	Biology of pod borer (*Maruca vitrata*) infesting Dolichos bean under laboratory conditions	S. B Shelke, **B. D Shinde,** P. S Chopkar, R.J Choudhari, RM Samrit and AL Uparkar	Journal of Entomology and Zoology Studies, E-ISSN: 2320-7078 P-ISSN: 2349-6800, 2021; 9(1): 636-644	**5.53**
8	To screen some brinjal cultivars against shoot and fruit borer, Leucinodes orbonalis	RS Shigaonkar, B. D Shinde, SB Shelke, PS Chopkar, SM Durge and RJ Choudhari	The Pharma Innovation Journal, ISSN (E): 2277-7695 ISSN (P): 2349-8242, 2022; 11(1): 1337-1341	**5.23**
9	To evaluate the efficacy of insecticides against pod borer, *Maruca vitrata (*Fabricus) infesting Dolichos bean	S. B Shelke, B. D Shinde, PS Chopkar, SM Durge and RJ Choudhari	The Pharma Innovation Journal, ISSN (E): 2277-7695 ISSN (P): 2349-8242 2022; 11(1): 1342-1348	**5.23**

10	Seasonal incidence of major sucking pests on okra	Sapkal S. D, Mehendale S. K, Shinde B. D, Sanap P. B and Chavan SS	The Pharma Innovation Journal, ISSN (E): 2277-7695 ISSN (P): 2349-8242 2022; 11(3): 68-72	**5.23**
11	Screening of different okra genotypes against Jassid, *Amrasca biguttula* biguttula (Ishida)	Sapkal S. D, Mehendale S. K, Sanap P. B, Shinde B. D and Chavan SS	The Pharma Innovation Journal, ISSN (E): 2277-7695 ISSN (P): 2349-8242 2022; 11(3): 288-292	**5.23**
12	Seasonal incidence of fall armyworm *Spodoptera frugiperda* (J. E. Smith) infesting maize in Konkan region of Maharashtra	J. J Dubale, B. D Shinde, S. K Mehendale, P. S Bodake and S. V Sawardekar	The Pharma Innovation Journal, ISSN (E): 2277-7695 ISSN (P): 2349-8242 2022; 11(12): 1837-1841	**5.23**
13	Biology of fall armyworm *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera; Noctuidae) on maize in Konkan region of Maharashtra	J. J Dubale, B. D Shinde, S. K Mehendale, P. S Bodake and S. V Sawardekar	The Pharma Innovation Journal, ISSN (E): 2277-7695 ISSN (P): 2349-8242 2022; 11(12): 1842-1845	**5.23**
14	Management of black aphid, *Pentalonia nigronervosa* (Coquerel) (Hemiptera: Aphididae) infesting banana under controlled field conditions	V Amsavalli, B. D Shinde, A. L Narangalkar, S. V Sawardekar and M. S Joshi	The Pharma Innovation Journal, ISSN (E): 2277-7695 ISSN (P): 2349-8242, 2022; 11(11): 1478-1482	**5.23**
15	Biology of black aphid, *Pentalonia nigronervosa* (Coquerel) (Hemiptera: Aphididae) on host red banana and taro under laboratory condition	V. Amsavalli, B. D. Shinde , A. L. Narangalkar , S. V. Sawardekar, M. S. Joshi	International Journal of All Research Education and Scientific Methods (IJARESM), ISSN: 2455-6211 Volume 10, Issue 11, November-2022	Impact Factor: 7.429
16	Evaluation of gladiolus (*Gladiolus* spp.) varieties for flowering characters and yield under Konkan agroclimatic Conditions of Maharashtra	Arfa A Ainarkar, Mandar H Khanvilkar, Mahesh M Kulkarni, Nitesh V Dalvi, **B. D Shinde,** Abdulraqueeb A Ainarkar and Mayuri S Mhatre	The Pharma Innovation Journal ISSN (E): 2277-7695 ISSN (P): 2349-8242 2023; 12(2): 3159-3161	**5.23**
17	Effect of leaf morphological parameters of okra varieties on the incidence of two spotted spider mite, *Tetranycusurticae*	**R.S. Mule**, K.G. Patel, AbhishekShukla and R. Sangavi	*Pestology*, 2021	2.33
18	Effect of incidence of two spotted spider mite, *Tetranychusurticae* on the biochemical parameters of different okra varieties	**R.S. Mule**, K.G. Patel, AbhishekShukla and R. Sangavi	*Pestology*, 2021	2.33
19	Ovicidal efficacy of some chitin synthesis inhibitors against *Spodopterafrugiperda* (J.E. Smith) (Lepidoptera: Noctuidae)	Mansoor, **R.S. Mule,** K.V. Naik and V.A. Rajemahadik	*J. Exp. Zool. India*, 2022	5.25
20	Varietal screening of okra against two spotted spider mite, *Tetranychusurticae* Koch.	**R.S. Mule,** K.G. Patel, AbhishekShukla	*Pestology*, 2022	2.33

		and R. Sangavi		
21	Survey of banana skipper, *Erinota torus* (Evans.) in Sindhudurg district of Maharashtra	S.S. Munj, S.S. Gurav, **R.S. Mule,** A.Y. Munj, P.B. Debaje, K.S. Malshe and M.V. Thakur	*Biological Forum*, 2022	5.11
22	Comparative biology of rice moth, *Corcyra cephalonica* (Stainton) (Lepidoptera: Pyralidae) on rice varieties	R. Bankapur, **R.S. Mule,** S.S. Gurav, J.J. Kadam, S.S. Munj and S.R. Dethe	*The Pharma Innovation Journal*, 2022	5.23
23	Management of banana skipper, *Erionota torus* (Evans.) (Hesperiidae: Lepidoptera) infesting banana under field conditions	S.S. Munj, S.S. Gurav, A.Y. Munj, **R.S. Mule,** K.V. Malshe and M.V. Thakur	*The Pharma Innovation Journal*, 2022	5.23
24	Efficacy of different insecticides against sunflower capitulum borer (*Helicoverpaarmigera*)	S.R. Patel, S.D. Desai, **R.S. Mule,** V.A. Rajemahadik, R.G. Kale, A.K. Shaikh and S.R. Dethe	*The Pharma Innovation Journal*, 2022	5.23
25	Estimation of loss due to two spotted spider mite, *Tetranychusurticae*Koch (Acari:Tetranychidae) infesting okra	**R.S. Mule,** K.G. Patel and AbhishekShukla	*Pestology*, 2023	2.33
26	Effect of vermiwash on growth of entomopathogenic fungi *Lecanicillium lecanii*	**S. N. Kale**	Insect Environment , 24 (4), 2021	-
27	Impact of different bee attractants for the orientation of stingless bee for pollination in radish *Raphanus sativus* (L.)	Shaik A. K., Wankhede S. M. Sanap P. B. **Kale S. N.,** Waman A. G., Patil S. R.	The Pharma Innovation Journal 11 (12), 2022	5.23
28	Effect of different layers of cereals on infestation and development of pulse beetle (*C. maculates*) infesting Kabuli gram	Dethe S. R., **S. N. Kale,** V. P. Sawant, M. S. Joshi, S. R. Patil, R. G. Kale, Radhika N. B., Gitte M. B.	The Pharma Innovation Journal 12 (1), 2023	5.23
29	Effect of essential oils against pulse beetle *Callosobruchus maculates* (Fab.) Coleoptera: Chrysomellidae) under laboratory conditions.	Gitte M. E., Sawant V. P., **Kale S. N.,** Rajemahadik V. A. And Dethe S. R.	The Pharma Innovation Journal 12 (01), 2023	5.23

Full length research papers published in Proceedings of Seminar/Symposia /Conference/Workshop

10. Details of other activities (for e.g. seed production, production of other commodities etc)

11. Contact Information

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12. News and Events