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

1. **Name of the Department/Section :** This should act as the front page of the Department/Section. The salient features of the Department/Section including the historical background should find the place on this page. One or two photographs providing the glimpses of the Department/Section should also be provided.

2. **About Department:** Department of Plant Pathology was established with establishment of College of Agriculture, Dapoli initially under jurisdiction of MPKV, rahuri. Subsequently, upon establishment of Konkan Krishi Vidyapeeth on 18th May 1972, full-fledge Department came into existence to cater the need of teaching, research and extension activities related to Plant Pathology. PG programme in the Department started from academic year 1984-85 and Ph.D. programme with intake capacity of two students started from 1999.

3. **Academic** Programmers: Provide the details of each doctoral programme as

a. Doctoral Programmes

Name of the programme:

Semester No.	Term No.	Course No.	Credits	Title of the course offered by the department
I	**I**	PL PATH 601	2+1=3	Advances in mycology
		PL PATH 602	2+1=3	Advances in virology
		PL PATH 603	2+1=3	Advances in Plant Pathogenic Prokaryotes
II	**II**	PL PATH 604	2+1=3	Molecular basis of the host pathogen interaction
		PL PATH605	2+1=3	Principles and Procedure of Certification
		PL PATH 606	2+1=3	Plant Biosecurity and Safety
III	**I**	PL PATH 691	0+1=1	Doctoral Seminar -I
		PL PATH 699	0+75=75	Doctoral Research
IV	**II**	PL PATH 692	0+1=1	Doctoral Seminar -I
V		PL PATH 699		Doctoral Research
VI		PL PATH 699		Doctoral Research

Course Curricula and syllabi:

b. Masters Programmes

Name of the programme:

Semester No.	Term No.	Course No.	Credits	Title of the course offered by the department
I	I	PL. PATH. 501	2+1=3	Mycology
		PL. PATH. 502	2+1=3	Plant Virology
		PL. PATH. 505	2+1=3	Principals of Plant Pathology
II	II	PL. PATH. 503	2+1=3	Plant Pathogenic Prokaryotes
		PL. PATH. 506	0+2=2	Techniques in Detection & Diagnosis of Plant Diseases
		PL. PATH. 515	2+1=3	Disease of Field & Medicinal crops
III	I	PL. PATH. 507	2+1=3	Plant Nematology
		PL. PATH. 591	0+1=1	Master's Seminar
		PL. PATH. 599	0+30=30	Master Research
IV	II	PL. PATH. 599		Master Research

Course Curricula and syllabi:

c. Bachelor Programmes

Semester No.	Term No.	Course No.	Credits	Title of the course offered by the department
I	**I**	MIBO 111	2(1+1)	Introductory Microbiology
II	**II**	PATH 121	3(2+1)	Fundamentals of Plant Pathology
III	**I**	PATH 232	2(1+1)	Principles of Integrated Disease Management
IV	**II**	ELE PATH 243	3(2+1)	Biofertilizers, biocontrol agents and biopesticides
V	**I**	PATH 354	3(2+1)	Diseases of Field and Horticultural Crops and their Management – I
VI	**II**	PATH 365	3(2+1)	Diseases of Field and Horticultural Crops and their Management-II
VIII	**II**	ELM PATH 486	10(0+10)	Mushroom Cultivation Technologies

Course Curricula and syllabi of each subject:
B.Sc. (Agri.)

Course :	MIBO 111		**Credit:**	2(1+1)	**Semester-I**
Course title:	Introductory Microbiology				

Syllabus

Theory

Introduction. Microbial world: History of Agril. Microbiology, Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial nutrition: classification of nutrients Macroelements, Microelements, growth factors, culture media, nutritional classification of microorganisms Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon.

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic.Azolla, blue green algae and mycorrhiza.Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.**Mushrooms- edible and poisonous types, nutritive values, Culturing and production techniques.**

Practical

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture.Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil-bacteria, fungi, actinomycetes.Methods of isolation and purification of microbial cultures.Isolation of *Rhizobium* from legume root nodule.Isolation of *Azotobacter* from soil.Isolation of *Azospirillum* from roots.Isolation of BGA.Staining and microscopic examination of microbes.Simple Staining, Negative staining and Gram Staining. Isolation of P and silicon Solubilizing Microbes, Mycorrhiza, Isolation of cellulose and Pectin degrading microbes for agro waste management

Course :	PATH 121		**Credit:**	3(2+1)	**Semester-II**
Course title:	Fundamentals of Plant Pathology				

Syllabus

Theory

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work.Terms and concepts in Plant Pathology.Pathogenesis.Cause and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, Phytoplasmas, spiroplasmas,viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes. Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues,modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions,sub-divisions, orders and classes.Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.Viruses: nature, architecture, multiplication and transmission.Study of phanerogamic plant parasites.Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, *Anguina* etc.)Principles and methods of plant disease management.Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipments and microscopy. Preparation of media,isolation and Koch's postulates. General study of different structures of fungi.Study of symptoms of various plant diseases.Study of representative fungal genera.Staining and identification of plant pathogenic bacteria.Transmission of plant viruses.Study of phanerogamic ant parasites.Study of morphological features and identification of plant parasitic nematodes.Extraction of nematodes from soil.Study of fungicides and their formulations.Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

Course :	PATH 232		**Credit:**	2(1+1)	**Semester-III**
Course title:	Principles of Integrated Disease Management				

Syllabus

Theory

IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of diseases and pest risk analysis.Methods of detection and diagnosis of diseases. Measurment of lossess causes due to diseases. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the disease management.Survey surveillance and forecasting of plant diseases. Development and validation of IPM module.Implementation and impact of IPM (IPM module for diseases. Safety issues in pesticide uses. Political, social and legal implication of IPM.Case histories of important IPM programmes.

Practical

Methods of diagnosis and detection of various plant diseases, Methods of plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents,Mass multiplication of *Trichoderma, Pseudomona*s, NPV etc. identification of diseases and their management. Crop (agro-ecosystem) dynamics of selected diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by diseases . Awareness campaign at farmers' fields.

Course :	ELE PATH 243		**Credit:**	3(2+1)	**Semester-IV**

Course title:	Biofertilizers, biocontrol agents and biopesticides

Syllabus

Theory

Biofertilizers: Introduction and types and importance of biofertilizers, Biopesticides and bioagents in agriculture and organic farming system, History of biofertilizers production Classification of biofertilizers microorganisms used in biofertilizers production. A study of growth characteristics of various microbes used in biofertilizers production. Nitrogen cycle in Nature. Process of nodule formation ,Role of Nif and Nod gene in Biological Nitrogen fixation, Enzyme nitrogenase and its component, Biochemistry of nitrogen fixation, Cross inoculation groups amongst *Rhizobium*, Methods used for the studying selection of efficient strain of *Rhizobium* .Quality standard for biofertilizers different methods of application of biofertilizers, role of microorganisms in decomposition of organic farm wastes, methods of quality control assessment in respect of biofertilizers, Strategies of Mass multiplication and packing Registration of biofertilizers. Strategies of marking and Registration with CIB of bioagents and biopesticides

Importance of *Trichoderma*spp., *Pseudomona*s spp. and *Bacillus* spp. as a biocontrolagents,Mechanism of disease control by thses organisms bioagents .Types of diseases controlled bioagentsformulations, Effectiveness of bioagentsagainst seed borne and

soil borne plant pathogens, Mass multiplication and packing , Strategies of marking, and Registration with CIB and organic farming institute

Importance of *Trichogramma, Cryptolaemus, Chrysoperla,* NPV and entomofungal pathogens. Establishing insectary for host insects and natural enemies, Mass production of *Verticillium/Beauveria/Metarhzium/Nomuraea/Paecilomyces*/*Hirsutella thompsoni/Trichoderma,/Pseudomonas/Bacillus/Potash Mobilizers/Sulphuroxidizers /organic matter decomposers*

Practical

Equipment, machinery and tools used for biofertilizers,Biopesticides and bioagents production. Preparation of media used for isolation and culturing of biofertilizers : Jensen's agar, NFb medium, Yeast extract manitol agar, BGA-medium, Pikovaskaya's medium ; Isolation of *Rhizobium* from root nodulesIsolation*Azotobacter* from rhizosphere of cereal crops, *Beijernickia,Acetobacter*from soil,*Azospirillium*from roots of graminicious plants, BGA from soil, Mycorrhizae from the roots,PSMsulphur oxidizing microorganisms, ion chealator, potash mobilizers ,organic matter decomposers and their isolation in pure culture form. Estimating the efficiency of *Rhizobium* through pot culture experiments and through nodulation tests in test tubes and Leonard jar.. Preservation of cultures of these organisms. Production of commercial biofertilizers*viz*. *Rhizobium, Azotobacter, Azospirillum*and *Acetobacter* : selection of efficient strains, carriers and their sterilization, mother culture preparation, mass multiplication using shake culture method, mixing of culture and carriers and preparation of packets. Production of carrier based and grain based phosphate solubilizing biofertilizers.

Methods of mass multiplication of BGA and *Azolla*.A large scale production of decomposting cultures.Va-mycorrhiza : growth on Guinea grass roots and observations for root colonization. Preparation of VA-mycorrhizal inoculum.

Methods of application of*Rhizobium*, *Azotobacter*, *Azospirillum* and phosphate solubilizing biofertilizers. Methods of application of *Azolla* and blue green algal biofertilizers in paddy farming.Production of compost cultures.

Quality control of biofertilizers : ISI standards specified and estimating the viable bacterial count in carrier based biofertilizers. Storage of biofertilizer packets. Visit to biofertilizer plants. Preparation of plan of biofertilizer production unit and proposal of loan.

Biopesticide and bioagents :Mass production of *Trichogramma, Cryptolaemus, Crysoperla,*MassHaNPV, and EPN. Importance of*Verticillium/Beauveria/ Metarhzium/Nomuraea/ Paecilomyces*/*Hirsutellathompsoni/Trichoderma,/Pseudomonas/Bacillus/ organic matter decomposers.* Testing of quality parameters and standardization of biopesticides.

Course :	PATH 354		Credit:	3(2+1)	Semester-V
Course title:	Diseases of Field and Horticultural Crops and their Management – I				

Syllabus

Theory:

Symptoms, etiology, disease cycle and management of major diseases of following crops:

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, Khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot; Finger millet: Blast and leaf spot Groundnut: early and late leaf spots, wilt.Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic.

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight;

Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight;
Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium;
Note: Students should submit 50 pressed and well-mounted specimens.

Course :	PATH 365		Credit:	3(2+1)	Semester-VI
Course title:	Diseases of Field and Horticultural Crops and their Management – II				

Syllabus

Theory

Symptoms, etiology, disease cycle and management of following diseases:

Field Crops:Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle;Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and PokkahBoeng;Sunflower: Sclerotinia stem rot and Alternaria blight; Rust, Downy mildewMustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot;Gram: wilt, grey mould and Ascochytablight;Lentil: rust and wilt;Cotton: anthracnose, vascular wilt, and black arm;Pea: downy mildew, powdery mildew and rust

Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew;Citrus: canker and gummosis,Grape vine: downy mildew, Powdery mildew and anthracnose;Apple: scab, powdery mildew, fire blight and crown gall;Peach: leaf curl,Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic;

Cucurbits: Downy mildew, powdery mildew, wilt;Onion and garlic: purple blotch, and Stemphylium blight;Chillies: anthracnose and fruit rot, wilt and leaf curl;Turmeric: leaf spot, Coriander: stem gall,Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histo-pathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems.Collection and preservation of plant diseased specimens for herbarium.Note: Students should submit 50 pressed and well-mounted specimens.

M.Sc. (Ag.) Plant Pathology

(Recent Advances should be included in all courses time to time)

I. Course Title: Mycology

II. Course Code: Pl PATH 501

III. Credit Hours: 2+1

Aim of the course

To study the nomenclature, classification and characters of fungi.

Theory

Unit I

Introduction, definition of different terms, basic concepts. Importance of mycology in agriculture, relation of fungi to human affairs. History of mycology. Importance of culture collection and herbarium of fungi. Somatic characters and reproduction in fungi. Modern concept of nomenclature and classification, Classification of kingdom fungi: Stramenopila and Protists.

Unit II

The general characteristics of protists and life cycle in the Phyla Plasmodiophoromycota, Dictyosteliomycota, Acrasiomycota and Myxomycota. Kingdom Stramenopila: characters and life cycles of respective genera under Hypochytriomycota, Oomycota and Labyrinthulomycota.

Unit III

Kingdom fungi: General characters, ultrastructure and life cycle patterns in representative genera under Chytridiomycota, Zygomycota, Ascomycota; Archiascomycetes, Ascomycetous yeasts, Pyrenomycetes, Plectomycetes, Discomycetes, Loculoascomycetes, Erysiphales and anamorphs of ascomycetous fungi.

Unit IV

Basidiomycota; general characters, mode of reproduction, types of basidioearps and economic importance of Hymenomycetes. Uridinales and Ustilaginales; variability, host specificity and life cycle pattern in rusts and smuts. Mitosporic fungi; status of asexual fungi, their teliomorphic relationships, Molecular characterization of plant pathogenic fungi. Classification of Fungi according to Krik 2008

Practical

1. Detailed comparative study of different groups of fungi;
2. Collection of cultures and live specimens;
3. Saccardoan classification and classification based on eonidiogenesis;
4. Vegetative structures and different types of fruiting bodies produced by slime molds,stramenopiles andtrue fungi;
5. Myxomycotina: Fructification, plasmodiocarp, sporangia, plasmodium and aethalia.
6. Oomyeota; Somatic and reproductory structures of *Pythium*, *Phytophthora*, downy mildews and *Albugo*, Zygomycetes: Sexual and asexual structures of *Mucor, Rhizopus*, General characters of VAM fungi. Ascomycetes; fruiting structures, Erysiphales, and Eurotiales ;
7. General identification characters of Pyrenomycetes, Discomycetes, Loculo- ascomyeetes and Laboulbenio-mycetes, Basidiomycetes; characters, ultrastruetures and life cycle patterns in Ustilaginomycetes and Teliomycetes, Deuteromycetes;
8. Characters of Hyphomycetes and Coelomycetes and their teliomorphic and anamorphic states, Collection, preservation, culturing and identification of plant parasitic fungi;
9. Application of molecular approaches and techniques for identification of fungal pathogens

I. Course Title: Plant Virology
II. Course Code: Pl PATH 502
III. Credit Hours: 2+1

Aim of the course

To acquaint with the structure, virus- vector relationship, biology and management of plant viruses.

Theory

Unit I

History and economic significances of plant viruses. General and morphological characters, composition and structure of viruses. Myco-viruses, arbo and baculo viruses, satellite viruses, satellite RNAs, phages, viroids and prions. Origin and evolution of viruses and their nomenclature and classification.

Unit II

Genome organization, replication in selected groups of plant viruses and their movement in host. Response of the host to virus infection: biochemical, physiological, and symptomatically changes. Transmission of viruses and virus-vector relationship. Isolation and purification of viruses.

Unit III

Detection and identification of plant viruses by using protein and nucleic acid based diagnostic techniques. Natural (R-genes) and engineering resistance to plant viruses.

Unit IV

Virus epidemiology and ecology (spread of plant viruses in fields, host range and survival).
Managementof diseases caused by plant viruses.

Practical

- Study of symptoms caused by plant viruses (followed by field visit);
- Isolation and biological purification of plant virus cultures;
- Bioassay of virus cultures on indicator plants and host differentials
- Transmission of plant viruses (Mechanical, graft and vector and study of disease development)
- Plant virus purification (clarification, concentration, centrifugation, high resolution separation andanalysis of virions), Electron microscopy for studying viral particle morphology;
- Antisera production, Detection and diagnosis of plant viruses with serological (ELISA), nucleic acid(Non-PCR—LAMP, Later flow micro array and PCR based techniques);
- Exposure to basic bio-informatie tools for viral genome analysis and their utilization in developing detection protocols and population studies (BLASTn tool, Primer designing software, Bioedit tool, Claustal X/W, MEGA Software).

Course Title: Plant Pathogenic Prokaryotes II. Course Code: Pl PATH 503
Credit Hours: 2+1

Aim of the course

To acquaint with plant pathogenic prokaryote (procarya) and their structure, nutritional requirements, survival and dissemination.

Theory

Unit I

Prokaryotic cell: History and development of Plant bacteriology, history of plant bacteriology in India. Evolution of prokaryotic life, Prokaryotic cytoskeletal proteins. Structure of bacterial cell. Structure and composition of gram negative and gram-positive cell wall; synthesis of peptidoglycan; Surface proteins; Lipopolysaccaride structure; Membrane transport; fimbrae and pili (Type IV pili); Mechanism of flagellar rotatory motor and locomotion, and bacterial movement; Glycocalyx (S-layer; capsule); thebacterial chromosomes and plasmids; Operon and other structures in cytoplasm; Morphological feature of fastidious bacteria, spiroplasmas and Phytoplasmas.

Unit II

Growth and nutritional requirements. Infection mechanism, role of virulence factors in expression of symptoms. Survival and dispersal of phytopathogenic prokaryotes.

Unit III

Taxonomy of phytopathogenic prokarya: Taxonomic ranks hierarchy; Identification, Classification and nomenclature of bacteria, phytoplasma and spiroplasma. The codes of Nomenclature and characteristics. Biochemical and molecular characterization of phytopathogenic prokaryotes.

Unit IV

Variability among phytopathogenic prokarya: general mechanism of variability (mutation); specialized mechanisms of variability (sexual like process in bacteria- conjugation; transformation; transduction); and horizontal gene transfer.

Unit V

Bacteriophages, L form of bacteria, plasmids and bdellovibrios: Structure; Infection of host cells; phage multiplication cycle; Classification of phages, use of phages in plant pathology/ bacteriology, Lysogenie conversion; H Plasmids and their types, plasmid borne phenotypes. Introduction to bacteriocins. Strategies for management of diseases caused by phytopathogenic prokaryotes.

Practical

- Study of symptoms produced by phytopathogenic prokaryotes;
- Isolation, enumeration, purification, identification and host inoculation of phytopathogenicbacteria;
- Stains and staining methods;
- Biochemical and serological characterization;
- Isolation of genomic DNA plasmid;
- Use of antibacterial chemicals/ antibiotics;
- Isolation of fluorescent *Pseudomonas,*
- Preservation of bacterial cultures;
- Identification of prokaryotic organisms by using 16S rDNA, and other genesequences;
- Diagnosis and management of important diseases caused by bacteria andmollicutes.

Course Title: Plant Nematology II. Course Code: Pl PATH 504 III. Credit Hours: 2+1

Aim of the course

To project the importance of nematodes in agriculture and impart basic knowledge on all aspects of plant nematology.

Theory

Unit I

Characteristics of Phylum Nematoda and its relationship with other related phyla, history and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; usefulnematodes; economic importance of nematodes to agriculture, horticulture and forestry.

Unit II

Gross morphology of plant parasitic nematodes; broad classification, nematode biology, physiology and ecology.

Unit III

Types of parasitism; nature of damage and general symptomatology; interaction of plant-parasitic nematodes with other organisms.

Unit IV

Plant nematode relationships, cellular responses to infection by important phytonematodes; physiological specialization among phytonematodes.

Unit V

Principles and practices of nematode management; integrated nematode management.

Unit VI

Emerging nematode problems, Importance of nematodes in international trade andquarantine.

Practical

I. Studies on kinds of nematodes- free-living, animal, insect and plant parasites;
II. Nematode extraction from soil;
III. Extraction of migratory endoparasites, staining for sedentary endoparasites;
IV. Examination of different life stages of important plant parasitic nematodes, their symptomsand histopathology.

Course Title: Principles of Plant Pathology II. Course Code: Pl PATH 505

Credit Hours: 2+1

Aim of the course

To introduce the subject of Plant Pathology, its concepts and principles.

Theory

Unit I

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic andabiotic causes of plant diseases.

Unit II

Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and hostnutrition on disease development.

Unit III

Host parasite interaction, recognition concept and infection, symptomatology, disease development-role of enzymes, toxins, growth regulators; defence strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens.

Unit IV

Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance

Unit V

Disease Management strategies. Principles of Disease management. Role of plant quarantine regulations in India. Post entry quarantine. Role of Cultural methods, chemicals, Biopesticides and Bioagents, resistant varieties, biotechnology and its implication in management of plant diseases. Pesticide registration and label claims of fungicides.

Practical

I. Basic plant pathological techniques;
II. Isolation, inoculation and purification of plant pathogens and proving Koch's postulates;
III. Techniques to study variability in different plant pathogens;
IV. Purification of enzymes, toxins and their bioassay;
V. Estimation of growth regulators, phenols, phytoalexins in resistant and susceptibleplants.

Course Title: Techniques for Detection and Diagnosis of Plant Diseases II. Course Code: Pl PATH 506

Credit Hours: 0+2

Aim of the course

To impart training on various methods/ techniques/ instruments used in the studyof plant diseases/pathogens.

Practical

i. Detection of plant pathogens 1. Based on visual symptoms, 2. Biochemical test 3.
ii. Using microscopic techniques, 4. Cultural studies; (use of selective media to isolate pathogens).
iii. Biological assays (indicator hosts, differential hosts) 6. Serological assays 7. Nucleic acid-based techniques (Non-PCR—LAMP, Later flow microarray and PCR based- multiplex, nested, qPCR, immune capture PCR, etc.);
iv. Phenotypic and genotypic tests for identification of plant pathogens
v. Molecular identification (16S rDNA and 16s-23S rDNA intergenic spacer region sequences- prokaryotic organisms; and eukaryotic organism by ITS region) and whole genome sequencing;
vi. Volatile compounds profiling by using GC-MS and LC-MS;
vii. FAME analysis, Fluorescence *in-situ* Hybridization (FISH), Flow Cytometry, Phage display technique, biosensors for detection of plant pathogens;
viii. Genotypic tools such as genome/ specific gene sequence homology comparison by BLAST (NCBI and EMBL) and electron microscopy techniques of plant virus detection and diagnosis.

Course Title: Principles of Plant Disease Management II. Course Code: Pl PATH 507
Credit Hours: 2+1

Aim of the course

To acquaint with different strategies for management of plant diseases.

Theory

Unit I

Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures of plant diseases. Disease resistance and molecular approach for disease management.

Unit II

History of fungicides, baetericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy, nature, properties and mode of action of antifungal, antibacterial andantiviral chemicals. Label claim of fungicides.

Unit III

Application of chemicals on foliage, seed and soil, role of stickers, spreaders and other adjuvants, health cis-o-cis environmental hazards, residual effects and safety measures

Practical

i. Phytopathometry
ii. Methods of *in-vitro* evaluation of chemicals, antibiotics, bio agents against plantpathogens;
iii. Field evaluation of chemicals, antibiotics, bio agents against plant pathogens;
iv. Soil solarisation, methods of soil fumigation under protected cultivation;
v. Methods of application of chemicals and bio control agents;
vi. ED and MIC values, study of structural details of sprayers and dusters;
vii. Artificial epiphytotic and screening of resistance.

Course Title: Epidemiology and Forecasting of Plant Diseases
Course Code: Pl PATH 508
Credit Hours: 1+0

Aim of the course

To acquaint with the principles of epidemiology and its application in disease forecasting.

Theory

Unit I

Epidemic concepts, simple interest and compound interest disease, historical development. Elements of epidemics and their interaction. Structures and patterns of epidemics. Modelling, system approaches and expert systems in plant pathology.

Unit II

Genetics of epidemics. Models for development of plant disease epidemics. Common and natural logarithms, function fitting, area under disease progress curve and correction factors, inoculum dynamics. Population biology of pathogens, temporal and spatial variability in plant pathogens.

Unit III

Epidemiological basis of disease management. Survey, surveillance and vigilance. Remote sensing techniques and image analysis. Crop loss assessment.

Unit IV

Principles and pre-requisites of forecasting, systems and factors affecting various components of forecasting, some early forecasting and procedures based on weather and inoculum potential, modelling disease growth and disease prediction. Salient features of important forecasting models.

Course Title: Diseases Resistance in Plants
Course Code: Pl PATH 509
Credit Hours: 2+0
Aim of the course
Theory
Unit I
Introduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centres as sources of resistance, disease resistance terminologies. Disease escape, on-host resistance and disease tolerance.
Unit II
Genetic basis of disease resistance, types of resistance, identification of physiological races of pathogen, disease progression in relation to resistance, stabilizing selection pressure in plant pathogens.
Unit III
Host defence system, morphological and anatomical resistance, pre-formed chemicals in host defence, post infectional chemicals in host defence, phytoalexins, hypersensitivity and its mechanisms. Genetic basis of relationships between pathogen and host, Gene-for-gene concept, protein-for-protein and immunization basis, management of resistance genes. Strategies for gene deployment.

Course Title: Ecology of Soil Borne Plant Pathogens
Course Code: Pl PATH 510
Credit Hours: 1+1
Aim of the course
To provide knowledge on soil-plant disease relationship.
Theory
Unit I
Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi. Interaction of microorganisms.
Unit II
Types of biocontrol agents. Inoculum potential and density in relation to host and soil variables, competition, predation, antibiosis and fungistasis. Conducive and suppressive soils.
Unit III
Biological control- concepts and potentialities for managing soil borne pathogens.
Potential of *Trichoderma* and fluorescent *Pseudomonas* in managing plant diseases.
Practical
- Quantification of rhizosphere and rhizoplane microflora with special emphasis on pathogens;
- Pathogenicity test by soil and root inoculation techniques, correlation between inoculum density of test pathogens and disease incidence, demonstration of fungistasis in natural soils;
- Suppression of test soil-borne pathogens by antagonistic microorganisms;
- Isolation and identification of different biocontrol agents;
- Study of various plant morphological structures associated with resistance, testing the effect of root exudates and extracts on spore germination and growth of plant pathogens;
- Estimating the phenolic substances, total reducing sugars in susceptible and resistant plants;
- Estimating the rhizosphere and root tissue population of microorganisms (pathogens) in plants.

Course Title: Chemicals and Botanicals in Plant Disease Management

Course Code: Pl PATH 511

Credit Hours: 2+1

Aim of the course

To provide knowledge on the concepts, principles and judicious use of chemicals and botanicals in plant disease management.

Theory

Unit I

History and development of chemicals; definition of pesticides and related terms; advantagesand disadvantages of chemicals and botanicals.

Unit II

Classification of chemicals used in plant disease managementand theircharacteristics.

Unit III

Chemicals in plant disease control, viz., fungicides, bactericides, nematicides, antiviral chemicals and botanicals. Issues related to label claim.

Unit IV

Formulations, mode of action and application of different fungicides; chemotherapy and phytotoxicity of fungicides.

Unit V

Handling, storage and precautions to be taken while using fungicides; compatibility with other agrochemicals, persistence, cost-benefit ratio, factor affecting fungicides. New generation fungicides and composite formulations of pesticides.

Unit VI

Efficacy of different botanicals used and their mode of action. Important botanicals used against diseases. General account of plant protection appliances; environmental pollution, residues and health hazards, fungicidal resistance in plant pathogens and its management.

Practical

1. Acquaintance with formulation of different fungicides and plant protection appliances;
2. Formulation of fungicides, bactericides and nematicides;
3. *In- vitro* evaluation techniques, preparation of different concentrations of chemicalsincluding botanical pesticides against pathogens;
4. Persistence, compatibility with other agro-chemicals;
5. Detection of naturally occurring fungicide resistant mutants of pathogen;
6. Methods of application of chemicals.

Course Title: Detection and management of Seed Borne Pathogens
Course Code: Pl PATH 512
Credit Hours: 2+1
Aim of the course
To acquaint with seed-borne diseases, their nature, detection, transmission, epidemiology, impacts/ losses and management.
III. Theor
yUnit I
History and economic importance of seed pathology in seed industry, plant quarantine and SPS under WTO. Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seeds.
Unit II
Recent advances in the establishment and subsequent cause of disease development in seed and seedling. Localization and mechanism of seed transmission in relation to seed infection, seed to plant transmission of pathogens.
Unit III
Seed certification and tolerance limits, types of losses caused by seed-borne diseases in true and vegetatively propagated seeds, evolutionary adaptations of crop plants to defend seed invasion by seed-borne pathogens. Epidemiological factors influencing the transmission of seed-borne diseases, forecasting of epidemics through seed-borne infection.
Unit IV
Production of toxic metabolites affecting seed quality and its impact on human, animal and plant health, management of seed-borne pathogens/ diseases and procedure for healthy seed production. Seed health testing, methods for detecting microorganism.
Practical
1. Conventional and advanced techniques in the detection and identification of seed- bornefungi, bacteria and viruses;
2. Relationship between seed-borne infection and expression of the disease in the field.

I. Course Title: Biological control of Plant Pathogens

II. Course Code: Pl PATH 513

III. Credit Hours: 1+1

IV. Aim of the course

To study principles and application of eco-friendly and sustainable management strategies ofplant diseases.

V. Theor

yUnit I

Concept of biological control, definitions, importance, principles of plant disease managementwith bioagents, history of biological control, merits and demerits of biological control.

Unit II

Types of biological interactions, competition: mycoparasitism, exploitation for hypovirulence, rhizosphere colonization, competitive saprophytic ability, antibiosis, induced resistance, mycorrhizal associations, operational mechanisms and its relevance in biological control.

Unit III

Factors governing biological control, role of physical environment, agroecosystem, operational mechanisms and cultural practices in biological control of pathogens, pathogens and antagonists and their relationship, biocontrol agents, comparative approaches to biological control of plant pathogens by resident and introduced antagonists, control of soil-borne and foliar diseases. Compatibility of bioagents with agrochemicals and other antagonistic microbes.

Unit IV

Commercial production of antagonists, their delivery systems, application and monitoring, biological control in IDM, IPM and organic farming system, biopesticides available in market.Quality control system of biocontrol agents.

VI. Practical

- Isolation, characterization and maintenance of antagonists, methods of study of antagonismand antibiosis, application of antagonists against pathogen in-*vitro and in vivo* conditions;
- Preparation of different formulations of selected bioagents and their mass production;
- Quality parameters of biocontrol agents;
- One-week exposure visit to commercial biocontrol agent's production unit.

I. Course Title: Integrated Disease Management II. Course Code: Pl PATH 514

III. Credit Hours: 2+1

IV. Aim of the course

To emphasize the importance and the need of IDM in the management of diseases of importantcrops.

V. Theor

yUnit I

Introduction, definition, concept and tools of disease management, components of integrated disease management- their limitations and implications.

Unit II

Development of IDM-basic principles, biological, chemical and cultural disease management.

Unit III

IDM in important crops- rice, wheat, cotton, sugarcane, chickpea, rapeseed and mustard, pearl millet, pulses, vegetable crops, fruit, plantation and spice crops.

VI. Practical

- Application of physical, biological and cultural methods
- Use of chemical and biocontrol agents, their compatibility and integration in IDM. Demonstration of IDM and multiple disease management in crops of regional importance as project work.

Course Title: Diseases of Field and Medicinal cops II. Course Code: Pl PATH 515

III. Credit Hours: 2+1

Theory

Unit I

Diseases of Cereal crops- Rice, wheat, barley, pearl millet, sorghum and maize.

Unit II

Diseases of Pulse crops- Gram, urdbean, mungbean, lentil, pigeonpea, soybean and cowpea.

Unit III

Diseases of Oilseed crops- Rapeseed and mustard, sesame, linseed, sunflower, groundnut,castor.

Unit IV

Diseases of Cash crops- Cotton, sugarcane.

Unit V

Diseases of Fodder legume crops- Berseem, oats, guar, lucerne.

Unit VI

Medicinal crops- *Plantago,* liquorice, mulathi, rosagrass, sacred basil, mentha,ashwagandha, *Aloe vera.*

IV. Practical

Detailed study of symptoms and host parasite relationship of important diseases ofabove-mentioned crops;

Collection and dry preservation of diseased specimens of important crops.

I. Course Title: Diseases of Fruits, Plantation and Ornamental Crops II. Course Code: Pl PATH 516

III. Credit Hours: 2+1

IV. Aim of the course

To acquaint with diseases of fruits, plantation, ornamental plants and their management.

Theory

Unit I

Introduction, symptoms and etiology of different fruit diseases. Factors affecting disease development in fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond, strawberry, citrus, mango, grapes, guava, ber, banana, pineapple, papaya, fig, pomegranate, date palm, custard apple and their management.

Unit II

Symptoms, mode of perpetuation of diseases of plantation crops such as tea, coffee, rubber and coconutand their management.

Unit III

Symptoms and life cycle of pathogens. Factors affecting disease development of ornamental plants such as roses, gladiolus, tulip, carnation, gerbera orchids, marigold,chrysanthemum and their management.

V. Practical

Detailed study of symptoms and host parasite relationship of representative diseasesof plantation crops;

Collection and dry preservation of diseased specimens of important crops.

I. Course Title: Diseases of Vegetable and Spices
Crops II. Course Code: Pl PATH 517

III. Credit Hours: 2+1

IV. Aim of the course

To impart knowledge about symptoms, epidemiology of different diseases of vegetables andspices and their management.

Theory

Unit I

Nature, prevalence, factors affecting disease development of tuber, bulb, leafy vegetable, crucifers, cucurbits and solanaceous vegetables. Diseases of crops under protected cultivation.

Unit II

Symptoms and management of diseases of different root, tuber, bulb, leafy vegetables, crucifers, cucurbits and solanaceous vegetable crops.

Unit III

Symptoms, epidemiology and management of diseases of different spice crops such as black pepper, nutmeg, saffron, cumin, coriander, turmeric, fennel, fenugreek and ginger. Biotechnological approaches in developing disease resistant transgenics.

V. Practical

Detailed study of symptoms and host pathogen interaction of important diseases of vegetableand spice crops.

I. Course Title: Post-Harvest
Diseases II. Course Code: Pl
PATH 518

III. Credit Hours: 1+1

IV. Aim of the course

To acquaint with the post-harvest diseases of agricultural produce and their eco- friendlymanagement.

Theory

Unit I

Concept of post-harvest diseases, definitions, importance with reference to management and health, principles of plant disease management as pre-harvest and post-harvest, Types of post-harvest problems both by biotic and abioticfactors.

Unit II

Role of physical environment, agro-ecosystem leading to quiescent infection, operational mechanisms and cultural practices in perpetuation of pathogens, pathogens and antagonist and their relationship, role of biocontrol agents and chemicals in controlling post-harvest diseases, comparative approaches to control of plant pathogens by resident and introduced antagonists.

Unit III

Integrated approaches in controlling diseases and improving the shelf life of produce using nutritional, bio-control agents and other agents, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for health hazards.

Unit IV

Study of symptoms, toxicosis of various pathogens, knowledge of Codex Alimentarious for each product and commodity. Physical and biological

agents/ practices responsible for development/ prevention of post-harvest diseases- traditional and improved practices.

V. Practical

Isolation, characterization and maintenance of post-harvest pathogens, application ofantagonists against pathogens *in uivo* condition;
Comparative efficacy of different fungicides and bioagents;
Study of different post-harvest disease symptoms on cereals, pulses, oilseed, commercial crops, vegetables, fruits and flowers;
Visit to cold storage.

I. Course Title: Plant Quarantine and Regulations II. Course Code: Pl PATH 519

III. Credit Hours: 1+0

IV. Aim of the course

To acquaint the learners about the principles and the role of plant quarantine in containmentof pests and diseases, plant quarantine regulations and set-up.

Theory

Unit I

Historical development in plant quarantine, Definitions of pest, and transgenics as per Govt. notification; Organizational set up of plant quarantine in India. relative importance; quarantine — domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/ diseases and their status.

Unit II

Acts related to registration of pesticides and transgenics. History of quarantine legislations, Salient features of PQ Order 2003. Environmental Acts, Industrial registration; APEDA, Import and Export of bio-control agents.

Unit III

Identification of pest/ disease free areas; contamination of food with toxigens, microorganisms and their elimination; Symptomatic diagnosis and other techniques to detect pest/ pathogen infestations; VHT and other safer techniques of disinfestation/ salvaging of infected material.

Unit IV

WTO regulations; non-tariff barriers; Pest risk analysis, good laboratory practices for pesticide laboratories; pesticide industry; Sanitary and Phytosanitary measures. Visit to plant quarantine station and PEQ facilities.

Ph. D. (Ag.)

Course Contents Ph.D. in Plant Pathology

I. Course Title: Advances in Mycology II. Course Code: Pl PATH 601

III. Credit Hours: 2+1

IV. Aim of the course

To acquaint with the advances in mycology

V. Theory

Unit I

General introduction, historical development and advances in mycology. Recent taxonomic criteria, morphological criteria for classification. Serological, chemical (chemotaxonomy), molecular and numerical (computer-based assessment) taxonomy. Interaction between groups: Phylogeny, Micro conidiation, conidiogenesis and sporulating structures of fungi imperfecti.

Unit II

Population biology, pathogenic variability/vegetative compatibility. Heterokaryosis and parasexual cycle. Sex hormones in fungi. Pleomorphism and speciation in fungi. Mechanism of nuclear inheritance. Mechanism of extra -nuclear inheritance. Biodegradation.

Unit III

Ultra-structures and chemical constituents of fungal cells, functions of cell organelles. Mitosis, meiosis, gene action and regulation. Effects of fungal interaction with host plants and other microorganisms; parasitism, symbiosis and eommensalism.

Unit IV

Genetic Improvement of Fungal strains. Fungal biotechnology. Fungi mediated synthesis of nano particles — characterization process and application. Mycotoxins problems and its management.

VI. Practical

- Isolation, purification and identification of cultures, spores and mating typedetermination;
- Study of conidiogenesis-Phialides, porospores, arthospores;
- Study of fruiting bodies in Aseomycotina;
- Identification of fungi up to species lev el;
- Study of hyphal anastomosis;
- Morphology of representative plant pathogenic genera form different groups of fungi;
- Molecular characterization of fungi.

I. Course Title: Advances in Plant Virology II. Course Code: Pl PATH 602

III. Credit Hours: 2+1

IV. Aim of the course

To educate about the advanced techniques and new developments in plant virology.

Theory

Unit I

Origin, evolution and interrelationship with animal viruses. Virus morphology, structure, architecture, replication (overview of host and viral components required), assembly and virus specific cytological effects in infected plant cells. Mechanisms leading to the evolution of new viruses/ strains: mutation, recombination, pseudo- recombination, component re-assortment, etc.

Unit II

Major vector groups of plant viruses and their taxonomy, virus-vector relationship, molecular mechanism of virus transmission by vectors. Terminologies used in immunology and serology. Classification, structure and functions of various domains of Immunoglobulins. Production of Polyclonal and monoclonal antibodies for detection of viruses. Immuno/ serological assays (Slide agglutination tests, Test tube precipitation test,

Double agar diffusion test, ELISA (DAC, DAS, TAS), Dot Immuno Binding Assay, and nucleic acid- based assays for detection of plant viruses.

Unit III

Polymerase Chain Reaction based (PCR, reverse transcriptase PCR, multiplex PCR, Nested PCR, Real time/ q PCR) and non-PCR based: LAMP, Fluorescent in sitehybridization (FISH), dot blot hybridization. Plant virus genome organization (General properties of plant viral genome-information content, coding and non- coding regions),replication, transcription and translational strategies of pararetroviruses, geminiviruses, tobamo-, poty-, bromo, cucumo, ilar, tospoviruses, satellite viruses and satellite RNA. **Unit IV**

Gene expression, regulation and viral promoters. Genetic engineering with plant viruses, viral suppressors, RNAi dynamics and resistant genes. Virus potential as vectors, genetically engineered resistance, transgenic plants. Techniques and application of tissue culture for production of virus free planting materials. Phylogenetic grouping system based on partial/ complete sequences of virus genomes and using of next generation sequencing technology in plant virus discovery.

V. Practical

Purification of viruses, SDS-PAGE for molecular weight determination, production ofpolyclonal antiserum, purification of IgG and conjugate preparation;

Acquaintance with different serological techniques (i) DAC- ELISA (ii)DAS-ELISA (iii) DIBA (iv) Western blots (v) (ab) 2-ELISA. Nucleic acid isolation, DOT-blot,southern hybridization, probe preparation, and autoradiography;

PCR application and viral genome cloning of PCR products, plasmid purification, enzyme digestion, sequencing, annotation of genes, analysis of viral sequences (use of gene bank, blast of viral sequences and phylogeny;

Bioinformatics analysis tools for virology (ORF finder, Gene mark, Gene ontology, BLAST, Clustal X/W, Tm pred and Phylogeny programs)

Course Title: Advances in Plant Pathogenic Prokaryotes II. Course Code: Pl PATH 603

III. Credit Hours: 2+1

IV. Aim of the course

To learn about the latest developments in all the plant pathogenic prokaryotes as a whole.

Theory

Unit I

Prokaryotic cell: Molecular basis for origin and evolution of prokaryotic life, RNA world, prokaryotic cytoskeletal proteins. Flagella structure, assembly and regulation. Structure and composition (bacteria) cell wall/ envelop, Types of secretion systems (TI to TIV) and their molecular interaction, fimbriae and pili (Type IV pili), Bacterial chromosomes and plasmids, other cell organelles. Growth, nutrition and metabolism in prokaryotes (Embden-Meyerhof Parmas (EMP) pathway, Phosphoketolase Pathway and Entner Doudoroff Pathway).

Unit II

Current trends in taxonomy and identification of phytopathogenic prokaryote: International code of nomenclature, Polyphasic approach, New/ special detection methods for identification of bacterial plant pathogens. Taxonomic ranks hierarchy; Identification, Advances in classification and nomenclature.

Unit III

Bacterial genetics: General mechanism of variability (mutation), specialized mechanisms of variability. Transposable genetic elements in bacteria-integron and prophages, Mechanism of gene transfer. Pathogenicity islands, horizontal gene transfer, Bacterial Pan-Genome.

Unit IV

Bacteriophages: Composition, structure and infection. Classification and use of phages in plant pathology/ bacteriology. Host pathogen interactions: Molecular mechanism of pathogenesis: Pathogenicity factors of soft rot, necrosis, wilt, canker, etc. Immunization, induced resistance/ Systemic Acquired Resistance, Quorum sensing. Bacterial pathogenicity and virulence: Molecular mechanism of virulence and pathogenesis, bacterial secretion systems, pathogenicity of bacterial enzymes that degrade the cell walls, Role of hrp/ hrc genes and TALE effectors. Synthesis and regulation of EPSs.

Unit V

Beneficial Prokaryotes-Endophytes, PGPR, Phylloplane bacteria and their role in disease management. Endosymbionts for host defence. Advances in management of diseases caused by prokaryotes: genetic engineering, RNA silencing; CRISPR cas9.

VI. Practical

Pathogenic studies and race identification, plasmid profiling of bacteria, fatty acid profiling of bacteria, RFLP profiling of bacteria and variability status, Endospore, Flagella staining, Test for secondary metabolite production, cyanides, EPS, siderophore, specific detection of phytopathogenic bacteria using species/ pathovar specific primers;

Basic techniques in diagnostic kit development, Molecular tools to identify phytoendosymbionts;

Important and emerging diseases and their management strategies.

II. Course Code: Pl PATH 604 III. Credit Hours: 2+1

. Course Title: Molecular Basis of Host- Pathogen

IV. Aim of the course

To understand the concepts of molecular biology and biotechnology in relation to host plant-pathogen interactions.

v.

Theory

Unit I

History of host plant resistance and importance to Agriculture. Importance and role of biotechnological tools in plant pathology. Basic concepts and principles to study host pathogen relationship. Molecular genetics, imaging and analytical chemistry tools for studying plants, microbes, and their interactions.

Unit II

Different forms of plant-microbe interactions and nature of signals/ effectors underpinning these interactions. Plant innate immunity: PAMP/ DAMP. Molecular basis of host-pathogen interaction-fungi, bacteria, viruses and nematodes; recognition system, signal transduction.

Unit III

Induction of defence responses- HR, programmed cell death, reactive oxygen species, systemic acquired resistance, induced systemic resistance, pathogenesis related proteins, phytoalexins and virus induced gene silencing. Molecular basis of gene- for-gene hypothesis; R-gene expression and transcription profiling, mapping and cloning of resistance genes and marker-

aided selection, pyramiding of R genes. Gene for gene systems: Background, genetics, phenotypes, molecular mechanisms, races, breakdown of resistance (boom-and-bust cycles), Coevolution-arms race and trench warfare models, Metapopulations, cost of resistance, cost of unnecessary virulence, GFG in agricultural crops vs. natural populations, Durability of resistance, erosion of quantitative resistance. **Unit IV**

Pathogen population genetics and durability, virus's vs cellular pathogens. Gene deployment, cultivar mixtures. Disease emergence, host specialization. Circadian clock genes in relation to innate immunity. Biotechnology and disease management; development of disease resistance plants using genetic engineering approaches, different methods of gene transfer, biosafety issues related to GM crops.

VI. Practical

Protein, DNA and RNA isolation, plasmid extraction, PCR analysis, DNA and Proteinelectrophoresis, bacterial transformation;

Gene mapping and marker assisted selection;

Development and use of molecular markers in identification and characterization ofresistance to plant pathogens and their management.

I. Course Title: Principles and Produces of Certification II. Course Code: Pl PATH 605

III. Credit Hours: 1+0

IV. Aim of the course

To acquaint with the certification procedures of seed and planting material.

Theory

Unit I

Introduction to certification. International scenario of certification and role of ISTA, EPPO, OECD, etc. in certification and quality control. Case studies of certification systems of USA and Europe. National Regulatory mechanism and certification system including seed certification, minimum seed certification standards. National status of seed health in seed certification. Methods for testing genetic identity, physical purity, germination percentage, seed health, etc. Fixing tolerance limits for diseases and insect pests in certification and quality control programmes.

Unit II

Methods used in certification of seeds, vegetative propagules and *in-vitro* cultures. Accreditation of seed testing laboratories. Role of seed/ planting material health certification in national and international trade.

I. Course Title: Plant Biosecurity and Biosafety II. Course Code: Pl PATH 606

III. Credit Hours: 2+0

IV. Aim of the course

To facilitate deeper understanding on plant biosecurity and biosafety issues in agriculture.

Theory

Unit I

History of biosecurity, Concept of biosecurity, Components of biosecurity, Quarantine, Invasive Alien Species, Biowarfare, Emerging/ resurgence of pests and diseases. Introduction and History of biosecurity and its importance.

Unit II

National Regulatory Mechanism and International Agreements/ Conventions, viz., Agreement on Application of Sanitary and Phytosanitary (SPS) Measures. World Trade Organization (WTO), Convention on Biological Diversity (CBD), International Standards for Phytosanitary Measures, pest risk analysis, risk assessment models, pest information system, early warning and forecasting system, use of Global Positioning System (GPS) and Geographic Information System (GIS) for plant biosecurity, pest/ disease and epidemic management, strategies for combating risks and costs associated with agroterrorism event, mitigation planning, integrated approach for biosecurity.

Unit III

Biosafety, policies and regulatory mechanism, Cartagena Protocol on Biosafety and its implications, Issues related to release of genetically modified crops. Emerging/ resurgence of pests and diseases in the changing scenario of climatic conditions. Issues related to release of genetically modified crops.

4. Infrastructure

a. Laboratories : At present Department possesses three laboratories for undergraduate practices and one laboratory for PG & Ph.D. including Post Entry Quarantine work. In addition a separate laboratory and production unit on mushroom cultivation is functional for hands on training for UG students with the financial aid of ICAR during 2007. Recently a separate laboratory and commercial production of Bio-fertilizer and Bio-formulations is established during 2021 with financial aid of RKVY.

b. Name of the important instruments/facilities: This include various instruments and equipments that include autoclave, hot air oven, laminar flow benches, BOD incubator, deep fridge, refrigerator, students microscopes, binocular microscope, research microscope with microphotographic attachment, water distillation unit, colony counter, laboratory balance, refrigerated centrifuge, PCR machine, spectrophotometer, PH meter, rotary shaker, fermentors and related other equipments.

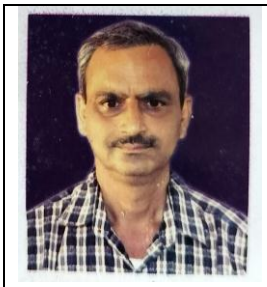
c. Activities: : Various practical related activities are demonstrated and actually performed by the students that include preparation of temporary and permanent mounts, collection of plant disease specimens, diagnosis of plant diseases, pathogenicity test, evaluation of fungicides and Bio-formulation, isolation of pathogenic and beneficial microbes morphology, physiology and biochemical characters of micro organisms, preparation of laboratory media plant quarantine activities, evaluation of microbes for beneficial purpose etc.

In addition, faculty members are involved in research and extension activities.

d. 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. Makarand Shriniwas Joshi
Post Held	Professor & Head
Date of Birth	24.12.1963
Qualification	Ph.D.
Area of Specialization	Plant disease epidemiology
Experience (Years)	35 years
Research Projects guided PhD M.Sc. B.Tech.	 8 18
Present area of teaching & research	Bio-control
Contact details Land line No. Mobile Fax Email	 9420639320 hod.plpath@gmail.com

Name of the Faculty	Dr. Jeevan Jayaram Kadam
Post Held	Associate Professor
Date of Birth	05.03.1974
Qualification	Ph.D.
Area of Specialization	Plant Pathology
Experience (Years)	19 years
Research Projects guided PhD M.Sc./M.Tech B.Tech.	 M.Sc. - 6
Present area of teaching & research	Plant Pathology
Contact details Land line No. Mobile Fax Email	 9423378008 Jjkdm1234@gmail.com

Name of the Faculty	Dr. Rajendra Ganesh Bhagwat
Post Held	Associate Professor
Date of Birth	24/04/1965
Qualification	Ph.D
Area of Specialization	Plant Pathology
Experience (Years)	32 years 10 months
Research Projects guided PhD M.Sc./M.Tech B.Tech.	 M.Sc. - 6
Present area of teaching & research	Plant Pathology
Contact details Land line No. Mobile Fax Email	 9404764830 rajendrabhagwat24@gmail.com

Name of the Faculty	Dr. Rajesh Rangrao Rathod
Post Held	Assistant Professor
Date of Birth	29.03.1975
Qualification	Ph.D.
Area of Specialization	Plant Pathology
Experience (Years)	18 years
Research Projects guided PhD M.Sc./M.Tech B.Tech.	 M.Sc. - 7
Present area of teaching & research	Plant Virology
Contact details Land line No. Mobile Fax Email	 7773952307 excusemeraj@yahoo.co.in rrrathod@dbskkv.ac.in

Name of the Faculty	Dr. Ranapratap Anaji Raut
Post Held	Assistant Professor
Date of Birth	14.03.1990
Qualification	Ph.D., NET
Area of Specialization	Biopesticide Formulation, Nematology
Experience (Years)	8 years
Research Projects guided PhD M.Sc./M.Tech B.Tech.	
Present area of teaching & research	Bio-control
Contact details Land line No. Mobile Fax Email	 7507568931 raraut@dbskkv.ac.in rpraut2210@gmail.com

b. Research staff: The name of the research staff member like SRA and JRA.

	Name of the Faculty	Dr. ShrikantChandrakant Rite
	Post Held	Junior Research Assistant
	Date of Birth	01/07/1986
	Qualification	Ph.D (Ag) Plant Pathology
	Area of Specialization	Plant Pathology
	Experience (Years)	10 Years
	Research Projects guided PhD M.Sc./M.Tech B.Tech.	
	Present area of research	Mushroom Production
	Contact details Land line No. Mobile Fax Email	 - 9422549424 - shrikantrite@gmail.com

	Name of the Faculty	Dr. Hemant Dattatraya Pawar
	Post Held	Junior Research Assistant
	Date of Birth	04/09/1985
	Qualification	Ph.D (Ag.), NET
	Area of Specialization	Plant Pathology
	Experience (Years)	10 years
	Research Projects guided PhD M.Sc./M.Tech\ B.Tech.	
	Present area of research	Bio-fertilizer production
	Contact details Land line No. Mobile Fax Email	 7387700616 hdpawar@dbskkv.ac.in hpworlds2625@gmail.com

6. Instructional Farm

a. Location: College of Agriculture, Dapoli

b. Infrastructure: such as irrigation facilities (source: well, irrigation system: drip, etc).

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

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

Laminar Air Flow

BOD Incubator

Autoclave

Hot air Oven

Compound Microscope

Binocular microscope

Colony counter

Ultra centrifuge

7. Research Activities and Achievements (including projects)

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:

1. **Control of powdery mildew of Mango. (1983)**

Bavistin (0.2%), three sprays at 15 days interval was found most effective; this was followed by Morestan (0.2%).

2. **Pre- harvest control of anthracnose on Alphonso fruits : (1983)**

Two sprays at 20 and 10 days before harvest with Bavistin (0.2%) and Captan (0.2%) were found significantly superior over others.

3. **Control of post- harvest fruit rots of mango : (1983)**

Bavistin (0.2%) and Captan (0.2%) were found significantly superior and on par with each other in controlling post – harvest fruit rots of mango by fruit dipping for 2 minutes.

4. **Management of stone grafts mortality of mango : (1988)**

The survival of mango stone grafts is increased by providing sufficient sunlight in polyshed, avoiding water stagnation in bags and clipping (partial) of leaves of weak grafts at early stage of etiolation.

5. **Chemical control of Red Rust of mango : (1988)**

Bordeaux mixture 1% was found most effective followed by Blitox and Fytelon at 0.25% in controlling Red Rust of mango. First spray in November – December and further two sprays at 15 days interval.

6. **Chemical control of pink disease of mango : (1988)**

Three sprays of Bordeaux mixture (1%) at an interval of 15 days were recommended for control of pink disease of mango. First spray be initiated from June.

7. **Chemical control of powdery mildew of mango : (1988)**

Three sprays of Sulphur (0.2%) or Calixine (0.05%) or Karathane (0.1%) or Bavistin (0.1%) or Saprol (0.1%) should be given at an interval of 15 days, starting from the panicle emergence. However, considering the economics, Sulphur (0.2%) was cheapest and could control Red mites hence it should be recommended.

8. **Chemical control of powdery mildew of mango : (1992)**

Three sprays of Bayletan (0.1%) or Systane (0.1%) or Karathane (0.1%) for control of powdery mildew of mango starting from initiation of flowering at 15 days interval.

9. **Studied on Stem bleeding / gummosis disease in young mango plantation.**

The study indicated that no pathological reason is responsible for the gummosis, since during repeated isolation no organisms could be isolated. However, in survey the plantations in soil containing more of sand, the problem perhaps related to soil and water relation of mango plants or nutrients imbalance. The soil pH was acidic (5 -5.5). Accordingly in consultations with soil scientists, Dolomite 2kg/plant was recommend to the farmers and the problem was solved.

10. **Chemical control of Loranthus on mango : (1996)**

Spraying with Glyphosate (1%) after mechanical removal of loranthus from mango branch and repeating two more sprays at fortnightly interval is recommended for effective control of loranthus re-emergence on mango.

11. **To study the fungicide residue levels in Alphonso fruits : (1996)**

The fungicides viz, Punch (0.05%), Karathane (0.05%), San 619 F (0.05%), Topas (0.05%), Bayleton (0.1%), Bonyard (0.1%) used for spraying have residue below detectable level (BDL). The fruits dip in Carbendazim (0.5%) also have residue below detectable level.

12. **Control of loranthus by plant based oils : (1998)**

Application of Cashewnut Shell Oil on houstorial cut portion, immediately after mechanical removal of loranthus may be recommended for effective inhabitation of loranthus re- emergence.

13. **Chemical control of powdery mildew of mango : (1997)**

Considering the high cost and effectiveness a Bayleton @ (0.1%) may be recommended at least for one spray during the peak period of powdery mildew of mango.

14. **Chemical control of powdery mildew of mango : (2000)**

Considering the cost and effectiveness three sprays of Hexaconazole (0.05%) at 15 days interval may be recommended for control of natural incidence of powdery mildew of mango.

15 **Control of branch drying disease of mango (Preventive control) : (2002)**

Considering the reasonable cost and effectiveness one spray of Bordeaux mixture (1%) or Mancozeb (0.3%) or Copper Oxychloride (0.3%) may be recommended for preventing the branch drying disease of mango.

16. **Control of branch drying disease of mango (Curative control) : (2002)**

Considering the cost and effectiveness application of Bordeaux paste (10%) on infected area after removing disease portion may be recommended for protecting branch drying disease of mango.

17. **Cleaning of sooty mould infected mango fruits : (2002)**

Considering the effectiveness of Bleaching Solution in removing sooty mould and to avoids post- harvest fruit rot, washing of sooty mould effected mango fruits in Bleaching solution (0.05%) followed by fruit dip treatment with Carbendazim (0.05%) may be recommended.

18. **Management of Mango Anthracnose : (2009)**

Considering the effectiveness and cost, alternate three sprays of Carbendazim (0.1) ,Propineb (0.2%) and Thiophanate methyl (0.1%) at ten days interval is recommended for control of natural incidence of Anthracnose on vegetative flush of mango during rainy season .

19 **Management of Blossom blight of Mango. : (2010)**

Considering the cost and effectiveness, two sprays of Carbendazim (0.1%) or Propineb (0.2%) or Thiophanate methyl (0.1%) or Carbendazim + Mancozeb (0.2%) or Tricyclazole (0.1%) at 10 days interval be recommended for management of blossom blight disease of mango. Spraying should be started just initiation of flowering flush.

20 **Management of fruit drop of sapota : (2010)**

Three sprays of fungicide containing Metalaxyl 8% + Mancozab 64% @ 0.2% are recommended for control of fruit drop of sapota caused by *Phytophthora* spp. First spray be given on the onset of monsoon followed by two more sprays at monthly interval. Sticker @ 0.2% be used in fungicide solution.

21 **Management of leaf blight and foot rot of black pepper : (2010)**

For management of leaf blight and foot rot of black pepper caused by *Phytophthora capsici* spraying of 1% Bordeaux mixture and drenching of 0.1% Copper oxychloride or spraying of 0.3% Potassium phosphonate and soil application of *Trichoderma harzianum* @ 50 g/vine with 1 kg of neem cake is recommended twice in the rainy season, first application be given with onset of monsoon- June and second application during August.

22 **Control of growth of green algae : (2011)**

The application of Azolla @ 10 kg/ha before puddling for the control of growth of green algae in rabi rice is recommended.

23 **Management of Post harvest fruit rot of Mango. : (2012)**

For effective management of post harvest fruit rot of Alphonso mango fruit dip treatment in 50^{0} C hot water solution of potassium metabisulphite (0.05%) for 10 minute is recommended

24 **Management of downy mildew disease of cucumber : (2012)**

For management of downy mildew disease of cucumber in kharif season under Konkan conditions it is recommended to trail the crop on ground using *Glyricidia* mulch coupled with first spray of metalaxyl + mancozeb @ 0.2% (20 g./10 litre) at the time of initiation of flowering follwed by two sprays of copper oxychloride @ 0.2% (20 g./10 litre) at an interval of 15 days.

25 **Management of Koleroga of arecanut : (2012)**

For effective management of Koleroga of arecanut, application of 111 Urea – Sulpala briquettes amended with Fosetyl AL 0.3% (3 g./10 litre) or 76 Konkan Annapurna briquettes amended with Fosetyl AL 0.3% (3 g./10 litre), per tree in last week of May followed by two more applications at an interval of one month by digging 15-20 cm deep holes with applicator at a distance of 1 meter away from the tree trunk is recommended.

26 **Studies On Leaf Blight Of Cashew : (2013)**

Three sprays of Carbendazim (0.1%), or Mancozeb (0.2%) or Bordeaux mixture (1.0 %) at one month interval are recommended for effective management of leaf blight disease of cashew. The first spray be given at the onset of monsoon.

27 **Management of pre and post emergence damping off of dolichos bean : (2013)**

For effective management of pre and post emergence damping off and getting higher yield and net returns from dolichos bean, pre sowing seed treatment with *Tricoderma* formulation@ 5 g/ Kg + Carbendazim @ 1 g / Kg is recommended.

28 **Cost Effective Management of post harvest Anthracnose of mango by pre- and post harvest treatments : (2014)**

For effective management of post harvest fruit rot of Alphonso mango fruit dip treatment in hot water at 52^0C for 10 minutes is recommended.

29 **Integrated management of fruit drop of sapota (2017)**

Phytosanitation followed by soil application of *Trichoderma* @ 250gm/plant and three sprays of three sprays of Bordeaux mixture @ + (1%) is recommended for management of *Phytophthora* fruit drop of sapota. The first spray should be given on the onset of monsoon and subsequent two sprays at an interval of 30 days.

30 **Management of bacterial leaf blight of rice : (2020)**

For cost effective management of bacterial leaf blight of rice, application of recommended dose of fertilizer (RDF) and two sprays of *Pseudomonas fluorescens* @ 200 ml per 10 litre water at 15 days interval (30 & 45 DAT) is recommended.

31 **Management of anthracnose of mango : (2021)**

For the effective management of natural incidence of anthracnose on vegetative flush of mango in rainy season, three sprays of Carbendazim 12% + Mancozeb 63 % WP (0.2%) or Copper oxychloride (0.3%) at 10 days interval are recommended.

32 **Management of powdery mildew of mango : (2021)**

For the effective management of powdery mildew of mango, three sprays of Sulphur 55.16% SC (0.3%) or Carbendazim 12% + Mancozeb 63 % WP (0.2%) at 10 days interval are recommended. First spray should be taken at the initiation of diseas

33 **Management of branch drying of Mango : (2022)**

For cost effective management of branch drying disease of mango the application of Bordeaux paste (10%) or cow dung slurry 80% on infected portion after removing disease bark is recommended.

34 **Management of Mango stem/branch epiphytes : (2022)**

For the effective management of mango stem/branch epiphytes *Pyrrosia lanceolata* the application of paraquat weedicide @ 3 ml per liter of water with help of roller or one or two sprays of copper sulphate 10 g or salt 60 g per liter of water at the end of mansoon season is recommended.

35 **Management of bud necrosis disease of watermelon : (2023)**

For effective reduction of watermelon bud necrosis disease and subsequent increase in yield and net returns following integrated management practice is recommended.

- Use of black polythene mulching (30 μ) before sowing
- Drenching of *Pseudomonas fluorescens* 5g/lit.at true leaf stage
- Use of blue sticky trap (30 trap / ha) in the field 4. Spraying of Imidachloprid 17.8 SL (0.3 ml/lit.) at 30 DAS.
- Spraying of Azadiractin 10000 PPM @ (2 ml/lit.) at 45 DAS.

c. Research Outcome/Findings: Provide the details of the important research findings/outcome of the research experiments conducted along with relevant photographs

d. Completed Research Projects/Programmes/Schemes

Title: Production of different Bio-fertilizers

UR Nos.:

Objectives: Commercial production Bio-fertilizers

Name of PI/ Co-PI: PI- Dr. M. S. Joshi, **Co-PI-** Dr. J. J. Kadam

Sponsoring Agency: RKVY

Duration: 3 years, 2014-15 to 2016-17

Total Outlay: 1.8 cr

Summary of Achievements: Production- *Rhizobium*, *Azotobacter*, *Azospirillium* and *Trichoderma*

Relevant Photographs:

e. Ongoing Research Projects/Programmes/Schemes: Production of different Bio-formulations using advanced techniques.

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

Name of the candidate:
Degree for which the thesis/project report submitted:
Year of submission:
Name of the Guide/Co guide:
Abstract:

Title of the thesis	**:**	Management of Tomato (*Lycopersiconesculentum* Mill.) Fungal Wilt incited by *Fusarium oxysporum* f. sp. *Lycopersici.*
Name of the student	**:**	Miss. Gadhave Amruta Dattatray
Regd. No.	**:**	ADPM/18/2613
Name and Designation of the Research Guide	**:**	Dr. Pushpa D. Patil Professor(CAS), Plant pathology, Regional Agricultural Research Station, Karjat Dist- Raigad.
Year of award of degree	**:**	August, 2020

THESIS ABSTRACT

Fusarium wilt of tomato(*Lycopersiconesculentum* Mill.) caused by *Fusarium oxysporum* f. sp. *lycopersici* has been emerging as one of the major threats to profitable cultivation of tomato crop. Therefore, present study was undertaken with the objectives *viz.*,isolation, characterization and pathogenicity, *in vitro* efficacy of fungicides, bioagentsagainst *Fusarium oxysporum* f. sp. *lycopersici* and integrated management of the *Fusarium oxysporum* f. sp. *lycopersici*wilt disease of tomato, during 2019-20, at the Department of Plant Pathology, College of Agriculture, Dapoli.

The pathogen *Fusarium oxysporum* f. sp. *lycopersici* was successfully isolated on Potato Dextrose Agar plates, characterized and proved its pathogenicity. Based on symptomatology, pathogenicity, and morphological characteristics, the test pathogen was identified and confirmed as *Fusarium oxysporum* f. sp. *lycopersici*

All of the 13 fungicides (six systemic, four contact and three combi-fungicides), six bioagent evaluated *in vitro* were found antifungal / fungistatic to*Fusarium oxysporum* f. sp. *lycopersici*, and resulted with its significant mycelial growth inhibition, over untreated control. However, the Propiconazole 25% EC, Tebuconazole 25.9% EC, Difenconazole 25% EC an (systemic) ; Captan 50% WP, Copper hydroxide 77% WP, Zineb 75% WP, Mancozeb 75% WP, Chlorothalonil 75% WP and Propineb 70% WP (contact) and Carboxin 37.5% + Thiram 37.5% WP, Carbendazim 25% + Mancozeb 50% WS, Carbendazim 25% + Flusilazole 12.5% SC, Metalaxyl 8% + Mancozeb 64% WP, Hexaconazole 4% + Zineb 68% WP and Trifloxystrobin 25%+Tebuconazole 50% WG (combi) were found most effective, with cent per cent (100%) mycelial growth inhibition of the test pathogen.

Among the bioagents tested, *T. harzianum, T. virens, T. koningii, T. viride, T. hamatum* and *Pseudomonas fluorescens*, were found most effective, with significantly highest mycelial growth inhibition of the test pathogen, over untreated control.

All those most effective fungicides and bioagents integrated (alone and combination) and applied as seedling treatment and soil application were found to reduce disease incidence over untreated control (sick soil). However, based on performance superiority, the most effective treatments in their order of merit were : Carbendazim 50% WP + *T. harzianum* resulted with (72.21%) maximum disease reduction, followed by Carbendazim 50% WP resulted with (62.96%) disease reduction, Carbendazim 25% + Mancozeb 50 % WS resulted with (61.10%) disease reduction,*T. harzianum* resulted with (55.55%) disease reduction, Carbendazim 50% WP + *T. virens* resulted with (53.07%) disease reduction,Carbendazim 25% + Mancozeb 50 % WS + *T. harzianum* resulted with (35.18%) disease reduction , *T. virens* resulted with (33.32%) disease reduction but Carbendazim 25% + Mancozeb 50 % WS + *T. virens* showed lowest disease reduction (25.81%).Thus,*Fusarium* wilt disease of tomato could efficiently be manged only with integration of the known effective fungicides andbioagents.

Title of the Thesis	**:**	"Investigations on leaf blight and die-back of Cashewincited by *Cylindrocladium* spp."
Name of the student	**:**	Mr. DawaleMukundBalasaheb
Regd. No.	**:**	ADPM/18/2609
Name and Designation of theResearch Guide	**:**	Dr. P. G. Borkar Associate Professor Department of Plant Pathology, College of Agriculture, Dapoli
Year of Award of Degree	**:**	2020

THESIS ABSTRACT

The present studies on "Investigations on leaf blight and die-back of Cashew incited by *Cylindrocladium* spp."was carried out at Department of Plant Pathology, College of Agriculture, Dapoli during 2019-20.

Cylindrocladium spp was isolated successfully from cashew plant specimens showing leaf blight and die-back symptoms by standard tissue isolation technique.Colony was slow growing. It was white, fluffy, circular at initial stage later turned into orange to pale pinkish in colourand then with a distinct violet bluish margin within a period of 10-12 days.

Pathogenicity of *Cylindrocladium* spp was successfully proved on one year old seedling of cashew (cv: Vengurla-4). Artificially inoculated cashew seedlings exhibited typical symptoms within 10-12 days of inoculation. Symptoms developed as, scattered, brown, circular to irregular spots, which later coalesced to cover maximum surface of the leaf lamina. The inoculated leaves dried, cringed and hanged on the stem.

Morphological characteristics of the isolated fungus were compared with the description in reviewed literature as well as the information available on standard websites for fungal identification such as www.indexfungorum.com and www.mycobank.org. On the basis of this comparison the pathogen was identified as *Cylindrocladium* spp.

Among the solid media evaluated, maximum radial growth of *Cylindrocladium* spp was observed on PDA (8.85 cm) followed by Richard's agar (8.42 cm), Malt extract agar (8.18 cm), Asthana and Hawker's agar (7.14 cm), Czapek's dox agar (4.47 cm), Host leaf extract agar (4.13 cm) and minimum growth observed on Water agar (2.98 cm).

Among all the 10 fungicides/ fungicide combinations under study, complete inhibition of the mycelial growth occurred in mancozeb (0.00 mm) and metalaxyl in combination with mancozeb. They were followed by zineb plus hexaconazole (12mm), Chlorothalonil (12.33mm),carbendazim (15.67mm),zineb(17.33mm), Hexaconazole (17.67mm), thiophenate methyl (18.00mm), copper oxy-chloride(26.00mm)and copper hydroxide (27.00), respectively. Maximum growth (90.00) was recorded in control.

Title of thesis : Investigations on *Pyricularia grisea* inciting blast of finger millet

Name of the student : Nile Santosh Maruti

Regd. No. : ADPM-18/2612

Name of Guide : Dr. J. J. Kadam

Year of award of degree : 2020

THESIS ABSTRACT

The present investigation was undertaken with an aim to find out resistant or tolerant germplasm lines/varieties of finger millet to *Pyricularia grisea* causing blast disease and to explore different botanicals, bio-agents and fungicides for effective management of blast disease of finger millet under natural epiphytotic condition in *Konkan* region of Maharashtra.

The fungus associated with blast infected finger millet plant was isolated on potato dextrose agar medium and on proving of Koch's postulates the pathogenic fungus was identified as *Pyricularia grisea*.

Among the eighteen germplasm lines and two varieties of finger millet which were evaluated for their resistance to blast disease (*P. grisea*) under natural field condition, none of the germplasm line/variety was found immune to blast infection. However, three germplasm lines namely N3, N20 and N26 didn't showed any blast symptoms on neck and fingers. N5 and N27 were showed resistant reaction to neck and finger blast infection. Seven germplasm lines *viz.,* N2, N4, N7, N24, N25, N29 and N30 were moderately susceptible to all three types of blast (leaf, neck and finger). Only Dapoli safed-1 showed susceptible reaction for all the three blast types.

Bulb extract of *Allium sativum* and rind extract of *Sapindus mukorssi* were expressed complete inhibition of *P. grisea.* Leaf extracts of *Nicotiana tabacum, Lantana camara* and *Azadirachta indica* were also found effective against the test pathogen which showed 72.22%, 62.97% and 62.22% inhibition, respectively.

In, *in vitro* evaluation of bio-agents, *Trichoderma harzianum* was emerged as the potential antagonist of *P. grisea* which showed 83.33 per cent inhibition of the fungus and was followed by *T. virens* (80.74%) and *Aspergillus niger* (70.37%). While, *Pseudomonas fluorescens* (49.08%) and *T. viride* (48.14%) were less effective in inhibiting the mycelial growth of *P. grisea.*

All the fungicides evaluated *in vitro* showed significant inhibition of pathogen. Tricyclazole 75% WP (0.06% and 0.1%), carbendazim 50% WP (0.1%), hexaconazole 5% EC (0.1%), mancozeb 75% WP (0.2%) and combi product carbendazim 12% + mancozeb 63% WP (0.15%) were the most effective fungicide which showed complete inhibition of the mycelial growth of the pathogen. These were followed by combi product tebuconazole 50% + trifloxystrobin 25% WG (0.05%) and Copper oxychloride 50% WP (0.25%) with 84.08 and 52.22 per cent inhibition of mycelial growth, respectively over control.

The results of field trial revealed that, seed treatment with tricyclazole @ 3gm/kg + 2 sprays of tricyclazole @ 0.06% and seed treatment with tricyclazole @ 3gm/kg + 2 sprays of hexaconazole @ 0.1% at 15 days interval found superior among all the treatments against the blast disease of finger millet caused by *Pyricularia grisea*. Botanicals and bio-agents were also controlled the disease but were less effective as compared to fungicides.

Title of thesis	:	Studies on bacterial wilt of potato caused by *Ralstonia solanacearum* (Smith) Yabuuchi
Name of the student	**:**	Umesh Ramdas Phondekar
Regd. No.	**:**	ADPM/18/2608
Name and Designation of Research Guide	**:**	Dr. R. G. Bhagwat Jr. Plant Pathologist, Irrigation Scheme, Central Experiment Station, Wakwali Dapoli-415 712, Dist. Ratnagiri (M.S.)
Year of award of degree	**:**	2020

THESIS ABSTRACT

Potato (*Solanum tuberosum* L.) is a winter crop which can be well grown under subtropical environments in India. Bacterial wilt caused by *Ralstonia solanacearum* (Smith) Yabuuchi is a extremely destructive bacterial plant pathogen that causes severe wilting of many economical crop plants. The disease is responsible for yield loss in potato up to 70% in India.

The typical symptoms of bacterial wilt of potato were observed as: the tender leaves lost their turgidity from top of the branches, lower leaves turned pale yellow, followed by drooping and drying of leaves and eventually plant death.

The isolation of *R. solanacearum* was carried out by streak plate method on TZC agar medium. Colonies of test bacterium were appeared as: dull white or creamy colour, irregularly round fluidal colonies and opaque with light pink or red center.

The pathogenicity test of *R. solanacearum* was proved by applying two methods *viz*., soil drenching and seed dipping method on Potato Cv. Kufri pukhraj in pot culture under glass house condition.

All morphological and biochemical tests were carried out and the results revealed that, *R. solanacearum* was Gram negative in reaction and positive for KOH solubility, acid production, starch hydrolysis, catalase test, production of hydrogen sulphide, Motility test and Casein hydrolysis test.

Isolation of native strains of *Pseudomonas fluorescens* from rhizospheric soil samples of potato was carried out by serial dilution and pour plate method by using selective King's B medium.

All morphological and biochemical tests were carried out to identified isolates of *Pseudomonas fluorescens* and the results revealed that, all the five isolates of *P. fluorescens* were Gram negative in reaction, rod shaped, developed small to medium, smooth, glistening colonies

on king's B medium and showed positive reaction for siderophore production, catalase, gelatin liquefication, Starch hydrolysis and denitrification test while negative for gram staining test.

All five isolates of *P. fluorescens* were *in vitro* evaluated against *R. Solanacearum,* However, significantly highest inhibition zone was recorded by isolate Pf2 (12.75 mm) followed by isolate Pf3 (11.75 mm), isolate Pf5 (9.5 mm), isolate Pf4 (9.0 mm) and it was least with isolate Pf1 (7.75 mm).

Among eight promising germplasms / cultivars / varieties of potato were screened against *R. solanacearum* under bacterial wilt sick plot condition, five entries were found moderately susceptible, two varieties were found susceptible and one entry was found highly susceptible to bacterial wilt disease of potato. Similarly, under artificial conditions of the glass house, one entry was found moderately resistant, three varieties were found moderately susceptible, two varieties were found highly susceptible and two varieties were found susceptible to bacterial wilt disease.

Title of thesis	**:**	**Studies on seed mycoflora of beans *viz.*,Lablab bean, Horsegram and Cowpea**
Name of the Student	**:**	**NirgudeYogesh Krishna**
Regd. No.	**:**	**2610**
Research Guide	**:**	**Dr. R. R. Rathod Assistant Professor, Department of Plant Pathology,**
Year of award of degree	**:**	**2020-21**

THESIS ABSTRACT

The present investigation entitled **"Studies on seed mycoflora of beans *viz*., Lablab bean, Horsegram and Cowpea"** carried out in laboratory of the Department of Plant Pathology, College of Agriculture, Dapoli, Dr.BalasahebSawantKonkanKrishiVidyapeeth, Dapoli, Dist.- Ratnagiri (M.S.) during 2019-20, with objectivesto isolate, identify and characterize major seed mycoflora of beans *viz*. Lablab bean, Horse gram and Cowpea, to detect major seed mycoflora of beans *viz*. Lablab bean, Horse gram and Cowpea by various seed health testing methods, to evaluate *in vitro* (the delete)efficacy of fungicides against the major seed mycoflora of beans *viz*. Lablab bean, Horse gram and Cowpea.

All of the three seed health testing methods tested(*viz*., Blotter paper method, Agar plate method and PDA method), were found effective to detect the seed mycoflora of beans. The mycoflora detected by these seed health testing methods were *Alternariaalternata*, *Fusariumoxysporum*, *Aspergillusniger*, *Aspergillusflavus*, *Rhizopusstolonifer* and *T. harzianum*,found associated with seeds of beans. Among the three methods studied, the efficient method was blotter paper method, followed by Agar plate method and PDA method.

Microorganisms play an important role in affecting the seeds, of which the fungi causes maximum losses. The per cent frequency of association was found maximum with the seeds of lablab bean were *Alternariaalternata* (72.83-75.75%) followed by *Fusariumoxysporum* (70.58-71.16), *Aspergillusflavus* (64.08-70.41%), *Aspergillusniger* (50.5-72.66%), *Trichodermaharzianum* (42.5-73.16%) and *Rhizopusstolonifer* (47.83-60.66%). Similarly, the per cent frequency of horsegramseed association detected by all the seed health testing methods, was found maximumin respect to *Alternariaalternata* (72.08-73.75%) followed by *Aspergillusniger* (68.58-73.25%), *Fusariumoxysporum* (67.83-72.58%), *Aspergillusflavus* (62.16-65.33%), *Trichodermaharzianum* (54.66-61.5%) and *Rhizopusstolonifer* (50.83-56.08%) and with the seeds of cowpea the per cent frequency of association of mycoflora detected by all the seed health testing methods was found maximum in respect to *Alternariaalternata* (72.16-72.66%) followed by *Fusariumoxysporum*

(51.75-70.00%), *Aspergillusniger* (48.5-48.16%), *Rhizopusstolonifer* (46.5-72.08%), *Aspergillusflavus* (47.33-62.5%) and *Trichodermaharzianum* (41.91-54.66%).

All the seed dressing fungicides evaluated *invitro* with recommended dosages were found effective against test pathogens *viz*., *A.alternata* and *Fusariumoxysporum*. The fungicide carbendazim 50% WP @ 0.2%,resultedin 100 per cent inhibition of mycelial growth of the pathogens over untreated control. Other fungicides *viz*., Mancozeb 75% WP, Benomyl 50% WP, Thiophanate methyl 70% WP, Captan 75% WP, Thiram 75% WPand Carboxin 75% WP were found to significantly inhibit the mycelial growth of the test pathogens over untreated control.

Title of thesis	:	Epidemiology and Management of *Alternaria* Leaf Spot of Cabbage.
Name of the student	**:**	Snehal Balkrishna Nimbalkar.
Regd. No.	**:**	ADPM/19/2676
Name and Designation of Research Guide	**:**	Dr. R. R. Rathod Assistant Professor, Department of Plant Pathology, College of Agriculture , Dapoli, Dapoli-415 712, Dist. Ratnagiri (M.S.)
Year of award of degree	**:**	2021

THESIS ABSTRACT

Alternaria leaf spot of cabbage caused by *Alternariabrassicicola* (Schw.) Wiltsh.is one of the major disease and it is responsible for low production and productivity of cabbage. Hence, a study on 'Epidemiology and management of *Alternaria* leaf spot of cabbage' was carried out.

The pathogenic fungus was isolated on PDA medium from diseased leaves of cabbage and pathogenicity of fungus was proved on the Saint variety of cabbage.

Laboratory studies of seven botanicals showed that Soapnut, Neem, Lantana, Garlic was effective in controlling mycelial growth of *Alternaria* leaf spot disease causing pathogen. In case of four bio-agents studied,*Trichodermaharzianum* and *T. viride*were found most effective in controlling mycelial growth of pathogen. The *Pseudomonas fluorescence* and *Bacillus subtilis* were failed to control mycelial growth effectively.

Different weather parameters and their correlation with disease development were studied. From the correlative and regressive studies it was revealed that, the spread and development of *Alternaria*leaf spot of cabbage was greatly influenced by temperature (max. and min.), relative humidity (morning and evening), wind speed, bright sunshine and evaporation. In this case minimum temperature(R=0.916), evening relative humidity RH-II(R=0.786), wind speed(R=0.926) and evaporation (R=0.557)were significantly positively correlated with PDI. Morning relative humidity RH-I (R=0.143) was non significantly positively correlated and maximum temperature (R= -0.151) and bright sunshine hours (R= -0.361) were non significantly negatively correlated with PDI.The multiple step down regression analysis revealed that the variation in PDI of *Alternaria* leaf spot of cabbage was influenced by wind speed and minimum temperature.

Among botanicals used for *in vivo* study, Soapnut was found most effective against the disease withPDI12.85%over control. Also Neem, Lantana and Garlic extracts were foundsignificantly effective in controlling disease with PDI over control (14.35%), (15.41%) and (23.66%), respectively. While among two fungal bio-agents, *T. harzianum* found most effective against *A.brassicicola* followed by *T. viride*with PDI 10.18% and 10.96%, respectively over control.

Hence, from the experiment it can be concluded that, in case of botanicals,two sprays of each, Neem and Lantana at 10% concentration at 15 days intervalfound effective whereas, in case of bio-agents, two sprays of each *Trichoderma harzianum* or *T. viride* at 2% concentration at 15 days intervalwereeffective for management of *Alternaria*leaf spot of cabbage.

Title of thesis	**:**	**Studies on Phomopsis blight and fruit rot of Brinjal incited by *Phomopsis vexans* (Sacc and Syd.)**
Name of the Student	**:**	**Tambe Towhid Noor Mohd**
Regd. No.	**:**	**2611**
Research Guide	**:**	**Dr. P. D. Potphode**
Year of award of degree	**:**	**2020-21**

THESIS ABSTRACT

The present investigation entitled **"Studies on Phomopsis blight and fruit rot of Brinjal incited by *Phomopsis vexans* (Sacc and Syd.)"** carried out in laboratory of the Department of Plant Pathology, College of Agriculture, Dapoli, Dr.BalasahebSawant Konkan KrishiVidyapeeth, Dapoli, Dist.- Ratnagiri (M.S.) during 2020-21, with objectivesto isolate, study pathogenicity and symptomatology of Phomopsis Blight and fruit rot of brinjal, to study morphological and cultural characters of the pathogen,to evaluate *in vitro*efficacy of fungicides, botanicals and bio-agents against Phomopsis blight of brinjal.

The fungus associated with Phomopsis blight and fruit rot was isolated on potato dextrose agar medium and after proving of Koch's postulates the pathogenic fungus was identified as *Phomopsis vexans.*

Morphological studies revealed that mycelium is hyaline, branched, septate and uneven in thickness. There were two types of conidia present alpha and beta conidia. Alpha conidia were hyaline, single celled, sub cylindrical with guttilae. Beta conidia were hyaline, single celled, filiform and guttilae were absent. Pycnidia were black-dark brown, globose, scattered unevenly on culture and minute in size.

Cultural studies were carried out on eight different solid media. From the study it was observed as oat meal agar (89.8 mm) proved to be best for mycelial growth and sporulation of the pathogen followed by potato dextrose agar (87.9 mm). Which were at par with each other.

All fungicides inhibited the growth of pathogen up to some extent. Best results were obtained by carbendazim50% WP and carbendazim 12% + mancozeb 63% WP which completely inhibited growth of pathogen. Followed by hexaconazole 5% EC (88.88 %), mancozeb 80% WP (80.74), thiophenate methyl 70%WP (80.04 %) and chlorothalonil 75%WP (79.04 %), the least inhibition (64.15 %) was recorded in sulphur 75 % WP.

All phytoextracts inhibited the growth of pathogen up to some extent but soapnut extract showed the best results (100 %) followed by garlic bulb extract (71.56%). Rest of the extracts were also superior to the control. Least (17.48 %) inhibition was observed in tobacco leaf extract.

Among the biocontrol agents used *Trichoderma harzianum*showed the maximum (74.44 %) inhibition of pathogen, followed by *Trichodermaviride*(66.33 %), *Psudomonasfluorescens*(60.58 %) and least (56.67 %) was observed in *Aspergillus niger*.

Title of thesis	**:**	"Integrated management of anthracnose disease of bottle gourd."
Name of the student	**:**	Joshi Sanika Sanjay
Regd. No.	**:**	ADPD/16/0246
Name and designation of Guide	**:**	***Dr. P.G.Borkar*** Associate Professor, Department of Plant Pathology, College of Agriculture, Dapoli- 415 712
Year of award of degree	**:**	2019

THESIS ABSTRACT

The anthracnose of bottle gourd incited by *Colletotrichum lagenarium* (Syn. *C. orbiculare*) is emerging as a major disease of bottle gourd in Konkan region. In a survey conducted to record severity of bottle gourd anthracnose, the highest mean disease intensity (55.56%) was observed in Dapoli followed by Mandangad (40.59%) from Ratnagiri district.

The fungal growth on solid medium was robust, compact with distinct zonation at specific distance. Initially the growth was olivaceous grey to green which gradually turned black with a pinkish tinge at maturity. Mycelium was septate, hyaline and branched about 2-5 µm in diameter. Conidia were hyaline, single celled measuring about 12 - 14 X 4 - 4.5 µm and guttulate with single oil globule. The disease appeared in the form minute, irregular yellow spots on leaves. These spots enlarged into brown necrotic lesions surrounded by yellow halo. Morning relative humidity (r=0.57) and wind speed (r=0.87) were significantly positively correlated with disease intensity.

Screening of sixteen varieties / germplasm revealed that, seven varieties *viz*. Gambhir, Kolhapur local, Sarita, Moon, Indam 204, BOTH-YK-03, Warad were susceptible and nine others- Indo Holland, Naveen, Semal BSS 951, Ankur Amit, Shruti, BOTH-YK-01, 02, 04, Samrat were highly susceptible.

Among the bio-agents, *Trichoderma viride* was the most effective with inhibition of 55.56 per cent. Out of seven phto extracts/organicals, cow urine at 30 per cent concentration imparted inhibition of 86.33 per cent. Among the fungicides, Propiconazole (0.1%), Thiophanate Methyl (0.1%), Benomyl (0.25%) and Carbendazim 12% plus Mancozeb 63% (75WP) @ 0.25%, completely (100%) inhibited the mycelial growth of *C. lagenarium*.

Under field conditions, Benomyl (0.25%) was found to be the most effective fungicide with PDI of 28.00 per cent. The highest yield 19.43t/ha was recorded from Propiconazole (0.1%) with highest ICBR of 0.63.

Seed treatment with *T.viride* + three sprays with Propiconazole (0.1%) was the best treatment in integrated management with the lowest disease intensity (24.35%). The maximum yield (20.71t/ha) was recorded from seed treatment with *T.viride* + three sprays of Propiconazole (0.1%) with ICBR of 0.80.

Title of thesis	:	Studies on Foot rot of finger millet incited by *Sclerotiumrolfsii*Sacc.
Name of the student	:	Shri.Uttam Krishna Sawant
Regd. No.	:	0248
Year of Admission	:	2016-17
Name and Designation of Research Guide	:	Dr. M. S. Joshi Professor, Department of Plant Pathology, College of Agriculture, Dapoli
Year of award of degree	:	2020

THESIS ABSTRACT

Finger millet (*Eleusinecoracana* (L.)Gaertan) is one of the important nutritious millet crops for both grain and forage which is nutritionally superior to many cereals with fair amount of proteins, minerals,calcium, fiber and vitamins in abundance.Foot rot of finger millet is endemic disease under Dapoli conditions during *Kharif*season. The present investigation was therefore carried out to study this disease in detail and to find out strategies for its management. The diseased samples were subjected to standard tissue isolation technique and direct placing of sclerotiaon Potato Dextrose Agar (PDA) medium which yielded white, compact fluffy mycelium covering the entire Petri plate within four days. Fully grown colony produced whitish sclerotia with pale brown colored tinge at the beginning and later turned dark brown.

The pathogenicity test was confirmed and the pathogen was identified as *Sclerotiumrolfsii*Sacc.The study of morphological characters of *S. rolfsii* causing foot rot of finger millet indicated that the colony of the isolate was white, fluffy, compact mass growing in radial fashion with average colony growth rate 28.01 mm/day. After 4 days of incubation, the sclerotial bodies emerged at the periphery of the colony. The mycelium entwined to form white minute knots hardened later on to form compact sclerotia with pinkish to dark brown tinge. On an average 1706 sclerotia mostly spherical; admeasuring 1.07 mm were recorded in each plate. During the early stage of sclerotial development, the color of sclerotia was white to pale light brown; however, the color changed to dark brown after12-15 days of incubation. The average test weight of 1000 sclerotia was 26.4 g.

Investigations on physiological characteristics revealed that the maximum dry mycelia weight (621 mg) was obtained at temperature 30 ^{0} C andthe least mycelia dry weight (102.13 mg) was found at 5 ^{0}C.

Among carbon sources, Sucrose recorded maximum mean dry mycelia weight (645.20 mg) and the minimum mean DMW (97.33mg) was recorded in lactose.Effect of various nitrogen sourceson dry mycelia weight of *S. rolfsii* revealed that the DMW in different nitrogen sources ranged between 349.96 mg to 791.43 mg with the maximum mean dry mycelia weight(791.43 mg) in peptone and minimum(349.96 mg) in Calcium nitrate. Experimental study of eight different levels of pH from 1 to 8 on effect on dry mycelia weight of the pathogen revealed that DMW was within a range of 50.76 mg to 529.96 mg. Maximum mean DMW (529.96 mg) was obtained at pH 5 and it was significantly superior to remaining pH levels and minimum mean DMW(50.76 mg) was recorded at pH 2.

Effect of spacing on disease incidence revealed that 20 cm x 15 cm spacing recorded minimum per cent disease incidence(5.44)and the highest PDI (10.95) was recorded at15 cmx 10 cm.

The effect of fertilizer doses on per cent disease incidence (PDI) ranged between 8.06 to 8.85. The maximum PDI (8.85) was observed in F_1 (80:40:0 N, P_2O_5, K_2O kg ha^{-1}(RDF) without FYM) and the minimum PDI (8.06 was observed in F_3(80:40:40 N, P_2O_5, K_2O kg ha^{-1}(RDF) with 5 tons of FYM ha^{-1}). The interaction of spacing and fertilizes P_5xF_3 (20 cm x 15 cm and 80:40:40 N,P_2O_5 ,K_2O kg ha^{-1}(RDF) with 5 tons of FYMha^{-1}) recordedthe lowest PDI(4.91) and the highest PDI 12.19 was recorded by interaction P_1 x F_1 (15 cm x 10 cm and 80:40:0 N,P_2O_5,K_2O kg ha $^{-1}$ (RDF) without FYM).

Interaction of spacing and fertilizers resulted in the highest yield of 33.88 q ha^{-1} in P_5 x F_5(20cm x 15 cm and 120:60:60 N,P_2O_5,K_2O kg ha $^{-1}$(RDF) with FYM 5ton ha^{-1}) and the lowest yield (22.89 q ha^{-1}) in P_1 x F_1(15 cm x 10 cm and 80:40:0 N,P_2O_5,K_2O kg ha^{-1}(RDF) with FYM 5tons ha^{-1}).

Host range study revealed that 16plant species (Pigeon pea, Cowpea, Horse gram,Mungbean,Lablabbean,Rice,NagliSafed,NagliDapoli1,Chilli,Brinjal,Tomato,Groundnut,Seas ame,Aster,Gerbera,Chrysanthemum) were infected by the pathogen *S. rolfsii*.Only one host marigoldproved itself as non-host crop to *S. rollfsii.*

The varietal screening revealed that in *Kharif* 2018 and *Kharif* 2019, 15 entries were highly resistant, 6 were resistant, 14 moderately susceptible and 28 susceptible. In both years none of the variety exhibited more than 50 per cent disease incidence and thus no any variety was highly susceptible to foot rot of finger millet incited by *S. rolfsii* .

Seed treatment with *T. harzianum* @ 5 gm kg^{-1} seedplus root dipping in *T. harzianum* solution plus application of Neem cake @ 50 g $hill^{-1}$ at transplanting recorded the lowest mean per cent disease incidence (3.69) andthe maximum average yield for 2 years was 34.54 q ha^{-1}.

Name of Student : Miss.Josiya Joy

Research Guide : Dr. R.R. Rathod

Year of Submission : 2019

Management of White Rust (*albugo candida*) (pres.) kuntze) of Mustard (*brassica juncea* l.)

ABSTRACT

In Konkan region of Maharashtra State, since recent past, white rust disease has been emerging as a serious threat to mustard cultivation during winter season. Therefore, present study was undertaken with the objectives *viz.*, pathogenicity, *in vitro* efficacy of fungicides and organics against *A. candida*, integrated management of the disease during Rabi, 2018-19, effect of weather variables on white rust disease of mustard and evaluation of mustard varieties/germplasms/advanced breeding lines against white rust disease, at the Department of Plant Pathology, College of Agriculture, Dapoli.

Pathogenicity of *A. candida* was proved by spraying sporangial suspension on mustard seedlings. Based on symptomatology, pathogenicity, and sporangial characters, the test pathogen was identified and confirmed as *Albugo candida* (Pers.) Kuntze. All of the 16 fungicides (seven systemic, five contact and two combi-fungicides), seven each phytoextracts and essential oils evaluated in vitro were found antifungal *A.candida*, with its significant sporangial germination inhibition, over untreated control. However, Metalaxyl 35% SD, Metalaxyl 4%+ Mancozeb 68% WP, Chlorothalonil 75% WP were found most effective. Among the test phytoextractsNeem leaf extact (*Azadirachtaindica*) and among essential oils, Garlic oil (*Allium sativum*), were found most effective, with significantly highest sporangial germination inhibition of the test pathogen, over untreated control.

Field integration of various fungicides, phytoextracts and essential oils (alone and in combination) as seed treatments and foliar sprays significantly reduced mustard white rust disease, over untreated control, along with enhanced seed and straw yields and betterICBR. Based on performance merit, the best treatments were Metalaxyl 35% SD-ST@ 6g/kg + Metalaxyl 4%+ Mancozeb 68% WP- FS @0.25% Metalaxyl 4%+ Mancozeb 68% WP -FS @ 0.25% + *Azadirachtaindica* @ 20% >Metalaxyl 4%+ Mancozeb 68% WP- FS @ 0.25% >Metalaxyl 35% SD-ST @ 6g/kg + Chlorothalonil 75% WP- FS @ 0.15%. Based on ICBR, the most economical treatment found were Metalaxyl 35% SD- ST @ 6g/kg + Metalaxyl 4%+ Mancozeb 68% WP- FS @ 0.25% (ICBR: 3.02), Metalaxyl 35% SD-ST @ 6g/kg + Chlorothalonil 75% WP- FS @ 0.15% (ICBR: 2.71), Metalaxyl 35% SD- ST @ 6g/kg (ICBR: 2.64), Thus, from the present field study, it is inferred that seed treatment of Metalaxyl 35% SD + three foliar sprayings of Metalaxyl 4%+ Mancozeb 68% WP @ 0.25% could be employed to manage effectively and economically the mustard white rust disease.

Positive and highly significant correlation was recorded between the white rust disease intensity and the weather parameters *viz.*,T_{min} (0.478), wind speed (0.820), bright sunshine hours (0.543) and evaporation (0.923), whereas T_{max} was found significantly and positively correlated (0.199) with white rust disease intensity. All those 19 mustard varieties/germplasms/ advanced breeding lines evaluated against white rust disease, were susceptible under natural epiphytotics.

Name of Student :Mr. YogeshNirgude
Research Guide : Dr. R.R. Rathod
Year of Submission : 2020
Studies on Seed Mycoflora of Beans *viz*.,Lablab bean, Horsegram and Cowpea

THESIS ABSTRACT

The present investigation entitled **"Studies on seed mycoflora of beans *viz*., Lablab bean, Horsegram and Cowpea"** carried out in laboratory of the Department of Plant Pathology, College of Agriculture, Dapoli, Dr.BalasahebSawantKonkanKrishiVidyapeeth, Dapoli, Dist.- Ratnagiri (M.S.) during 2019-20, with objectives of, to isolate, identify and characterize major seed mycoflora of beans *viz*. Lablab bean, Horse gram and Cowpea, to detect major seed mycoflora of beans *viz*. Lablab bean, Horse gram and Cowpea by various seed health testing methods, to evaluate *in vitro* (the delete) efficacy of fungicides against the major seed mycoflora of beans *viz*. Lablab bean, Horse gram and Cowpea.

All of the three seed health testing methods attempted (*viz*., Blotter paper method, Agar plate method and PDA method), were found effective to detect the seed mycoflora of beans. The mycoflora detected by these seed health testing methods were *Alternariaalternata*, *Fusariumoxysporum*, *Aspergillusniger*, *Aspergillusflavus*, *Rhizopusstolonifer* and *T. harzianum*, found associated with seeds of beans. Among the three methods studied, the efficient method was blotter paper method, followed by Agar plate method and PDA method.

Microorganisms paly an important role in affecting the seeds, of which the fungi causes maximum losses. The per cent frequency of association was found maximum with the seeds of lablab bean were *Alternariaalternata* (72.83-75.75%) followed by *Fusariumoxysporum* (70.58-71.16), *Aspergillusflavus* (64.08-70.41%), *Aspergillusniger* (50.5-72.66%), *Trichodermaharzianum* (42.5-73.16%) and *Rhizopusstolonifer* (47.83-60.66%). Similarly, the per cent frequency of horsegram seed association detected by all the seed health testing methods, was found maximum in respect to *Alternariaalternata* (72.08-73.75%) followed by *Aspergillusniger* (68.58-73.25%), *Fusariumoxysporum* (67.83-72.58%), *Aspergillusflavus* (62.16-65.33%), *Trichodermaharzianum* (54.66-61.5%) and *Rhizopusstolonifer* (50.83-56.08%) and with the seeds of cowpea the per cent frequency of association of mycoflora detected by all the seed health testing methods was found maximum in respect to *Alternariaalternata* (72.16-72.66%) followed by *Fusariumoxysporum* (51.75-70.00%), *Aspergillusniger* (48.5-48.16%), *Rhizopusstolonifer* (46.5-72.08%), *Aspergillusflavus* (47.33-62.5%) and *Trichodermaharzianum* (41.91-54.66%).

All the seed dressing fungicides evaluated *invitro* at their recommended dosages were found effective against test pathogens *viz*., *A.alternata* and *Fusariumoxysporum*. The fungicide carbendazim 50% WP @ 0.2%, resulted in 100 per cent inhibition of mycelial growth of the pathogens over untreated control. Other fungicides *viz*., Mancozeb 75% WP, Benomyl 50% WP, Thiophanate methyl 70% WP, Captan 75% WP, Thiram 75% WP and Carboxin 75% WP were found to significantly inhibit the mycelial growth of the test pathogens, over untreated control.

Name of Student: Miss. SnehalNimbalkar
Research Guide : Dr. R.R. Rathod
Year of Submission : 2021
Epidemiology and Management of *Alternaria* leaf spot of cabbage

THESIS ABSTRACT

Alternaria leaf spot of cabbage caused by *Alternariabrassicicola* (Schw.) Wiltsh.is one of the major disease and it is responsible for low production and productivity of cabbage. Hence, a study on 'Epidemiology and management of *Alternaria* leaf spot of cabbage' was carried out.

The pathogenic fungus was isolated on PDA medium from diseased leaves of cabbage and pathogenicity of fungus was proved on the Saint variety of cabbage.

Laboratory studies of seven botanicals showed that Soapnut, Neem, Lantana, Garlic was effective in controlling mycelial growth of *Alternaria* leaf spot disease causing pathogen. In case of four bio-agents studied,*Trichodermaharzianum* and *T. viride*were found most effective in controlling mycelial growth of pathogen. The *Pseudomonas fluorescence* and *Bacillus subtilis* were failed to control mycelial growth effectively.

Different weather parameters and their correlation with disease development were studied. From the correlative and regressive studies it was revealed that, the spread and development of *Alternaria* leaf spot of cabbage was greatly influenced by temperature (max. and min.), relative humidity (morning and evening), wind speed, bright sunshine and evaporation. In this case minimum temperature(R=0.916), evening relative humidity RH-II(R=0.786), wind speed(R=0.926) and evaporation (R=0.557)were significantly positively correlated with PDI. Morning relative humidity RH-I (R=0.143) was non significantly positively correlated and maximum temperature (R= -0.151) and bright sunshine hours (R= -0.361) were non significantly negatively correlated with PDI.The multiple step down regression analysis revealed that the variation in PDI of *Alternaria* leaf spot of cabbage was influenced by wind speed and minimum temperature.

Among botanicals used for *in vivo* study, Soapnut was found most effective against the disease with PDI 12.85% over control. Also Neem, Lantana and Garlic extracts were found significantly effective in controlling disease with PDI over control (14.35%), (15.41%) and (23.66%), respectively. While among two fungal bio-agents, *T. harzianum* found most effective against *A.brassicicola* followed by *T. viride*with PDI 10.18% and 10.96%, respectively over control.

Hence, from the experiment it can be concluded that, in case of botanicals,two sprays of each, Neem and Lantana at 10% concentration at 15 days intervalfound effective whereas, in case of bio-agents, two sprays of each *Trichodermaharzianum* or *T.viride* at 2% concentration at 15 days interval were effective for management of *Alternaria* leaf spot of cabbage.

Name of Student : Miss.RohiniGaonkar
Research Guide : Dr. R.R. Rathod
Year of Submission : 2022
Management of Stem rot Disease of Papayacaused by P*ythiumaphanidermatum*

ABSTRACT

Stem rot disease is one of the most serious fungal diseases of papaya and is widespread in many parts of the world.Primarily,chemical-based plant protection products have been used for a long time to manage stem rot disease in papaya, which in turn helped to raise the output. Plant protection measures, however, could have unfavourable negative impacts on the environment and human health. The purpose of this study is to emphasize the efficacy of plant protection based on integrated use of bio-agents, organics and optimal use of fungicides.Hence, an *in vitro* study was conducted at Department of Plant Pathology, College of Agriculture,Dapoli, Ratnagiri, Maharashtra and an *in vivo* study was conducted using best selected treatments at CES, Wakawali for integrated management of the disease.

By using tissue segment method, the fungus associated with stem rot of papaya was isolated using PDA medium and then purified by single hyphal tip method.Pathogenicity of the fungus was proved using soil inoculation method and it was further confirmed using Koch's postulate.

Among different non-systemic, systemic and combi fungicide evaluated at different concentrations against the test pathogen using Poisoned food technique, Metaalxyl 35% SG at 0.3% and 0.4% exhibited highest per cent inhibition of 79.7% and 83.11%, respectively.Among the organic amendments tested at different concentrations using Poisoned food technique, stored cow urine was found most effective in suppressing the mycelial growth of pathogen which showed the per cent inhibition of 72.00% and 73.67% at 10% and 15% concentrations, respectively, whereas vermicompost was found effective at 20% concentration with per cent inhibition of 76.44%. Among the fungal bio-agents evaluated, bio-agent *T. longibractum* showed an effective inhibition of the pathogen with highest mycelial growth inhibition of 74.44% and the bacterial bio-agent i.e., *Pseudomonas fluorescens* (Pf5) exhibited per cent inhibition of 76.11% which was found to be the most effective of all the antagonists evaluated against *P. aphanidermatum.*

In vivo study was carried out by using best selected fungicides and organics, results revelead that among all the integrated treatments, Treatment T_3- Metalaxyl(4%)+Mancozeb(64%) @2.5g/lit. recorded highest per cent reduction over control i.e., 61.75%.

Name of Candidate: Miss. A. C. Murudkar
Degree: M. Sc. (Agri)
Year of Submission: 2021
Name of Research Guide: Dr. J. J. Kadam

Abstract

The study was carried out to control the rice borer in Konkan region of Maharashtra by investigating the suitability of different plant extract biological agents and fungicides.The pathogenic fungus leaf scald was grown on potento dextrose agar medium and it was proved that the pathogenic fungus was*Microdochiumoryzae*, fulfilling Koch's theory.The growth of the pathogenic fungus on potato dextrose agar medium appeared white, soft, cottony, then the color of the fungus changed to pale white.The filaments of this fungus were found to be fine, colorless, membranous, with numerous branches. come onFungal seeds of the fungus are reddish in color, unicellular to crescentic in shape and9-13 x 3-4 micrometers in size were observed, somewhat depressed in the middle.

In the laboratory, the highest growth of the fungus was observed on potato dextrose agar and carrot agar medium.On a medium prepared from 10% extract of Neem and Ritha plants, *Microdochiumoryzae*fungus was found to be controlled by 71.11 and 59.06 percent, respectively. Leaf extracts of ghaneri and ramphal plants were found to be effective in controlling fungal growth by 47.43 and 46.29 percent, respectively.

All the fungicides used in the laboratory were found to be effective in controlling fungal growth. *Microdochiumoryzae*showed 100% control with copper oxychloride 50% WP (0.25%) and carbedazim 12% + mancozeb 63% WP (0.1%). Propiconazole 25% EC (0.1%), Difenconazole 25% EC (01%) and combination fungicide Tebuconazole 50% + Trifloxystrobin 25% WG (0.05%) also controlled growth of pathogenic fungi: 82.40, 81.85 respectively. And 80.55 percent was found to be effective.Copper oxychloride 50% WP (0.25%) and Carbedazim 12%, Mancozeb 63% WP (0.1%) fungicides were found to be the most effective for control of the naturally occurring root rot in the field.

Name of Candidate: Miss. M. D. Jadhav
Degree: M. Sc. (Agri)
Year of Submission: 2014
Name of Research Guide: Dr. J. J. Kadam

8. Abstract:

Red rot incited by *Colletotrichum falcatum* Went. was observed on sugarcane in the fields of Dr. B.S.K.K.V., Dapoli, Dist. Ratnagiri (M.S.) in the range of 11.62 to 29.14 per cent during 2012 to 2014. Symptoms produced by *C. falcatum* on the midrib appeared as red bright elongated lesions with ashy grey centre. The leaves showed drooping and withering. In severe cases, the whole crown dried. The stalk showed longitudinal reddening of the internal tissues interrupted with white patches extending crosswise of the stalk. The rind loose its natural bright colour and at the end, affected plant died. The pathogenicity of *C. falcatum* was proved on sugarcane (variety CO-86032).

On oat meal agar medium the fungus produced abundant greyish white aerial mycelium, profused, dense, centrally fluffy and raised colony, cottony, fluccose almost white in young cultures, became light ashy grey in 7 to 10 days. Later on turned to dark grey with salmon pink coloured fructification. The fungus produced thin, hyaline, septate, profusely branched hyphae containing oil droplets. The conidia of *C. falcatum* were falcate, hyaline, aseptate, 20-38 x 5-7 um containing 1-2 oil globule (guttulate).

Maximum vegetative growth and fructification of *C. falcatum* was recorded on oat meal agar, PDA, Cane juice agar and Glucose peptone agar medium. Similarly, oat meal broth supported maximum vegetative growth followed by potato dextrose and glucose peptone broth. Among the different fungicides tested in vitro, Copper oxychloride(0.25%), Carbendazim (0.1%), Bordeaux mixture (1%), Thiophenate methyl(0.1%), Propiconazole (0.05% and 0.1%), Hexaconazole (0.05% and 0.1%),Difenconazole (0.1%) and combi product of Iprodione + Carbendazim(0.1%) completely inhibited the mycelial growth of *C. falcatum*. Among different plant extracts evaluated, maximum per cent inhibition of mycelial growth of *C. falcatum* was achieved due to 10 per cent fruit extract of soapnut (88.15 %) followed by wild brinjal (87.44%) and Garlic (66.66%). For biological control, complete inhibition of the *C. falcatum* was achieved due to *Trichoderma harzianum* followed by *Saccharomyces cerevisiae* NCIM-3315 and *T. viride.*

Name of Candidate: Miss. V. P. Kharbadkar
Degree: M. Sc. (Agri)
Year of Submission: 2022
Name of Research Guide: Dr. J. J. Kadam

8. Abstract:

Leaf blight of chrysanthemum caused by *Alternaria alternata* is one of the major fungal disease and is the major hurdle in successful cultivation of chrysanthemum. The fungus associated with diseased plant tissue was isolated following standard tissue isolation technique on potato dextrose agar medium. The pathogenicity of isolated fungus was proved on chrysanthemum (variety: Charlie) following Koch's postulates and the pathogen was confirmed as *Alternaria alternata*.

Chrysanthemum plant naturally infected with the blight disease, manifested typical symptoms on leaves that appeared initially as numerous small yellow-brown spots. Such spots later enlarged in size and had target like concentric rings, that turned dark brown to black. Further, the spots were coalesced into large necrotic patches that finally resulted in drying and death of the entire affected leaf and entire plant. The causal fungus produced off white to greyish, cottony, profuse mycelial growth which later turn dark greyish to black in colour on PDA. The fungal culture showed concentric zonations. Microscopic observation of *Alternaria alternata* revealed the presence of dark brown and septate mycelium having irregular branching. The mycelial width was ranged from 5.37-7.18 um. The conidia were oval to ellipsoidal in shaped, muriform and showed

presence of 2-6 transverse and 1-3 longitudinal septa tapering gradually to form a swollen beak at the apex which ranged from 9.75-12.33 pm. Conidial size was ranged from 29.35-32.37 x 5.32-8.92 m.

Screening of different varieties of chrysanthemum against *Alternaria alternata* in vivo revealed that, only one variety "Red Star" showed resistant reaction against the disease with only 4.90 per cent disease incidence. Varieties namely Agnishikha, Royal white, Smolla white and Zizucha yellow showed moderately susceptible reaction against the disease with disease incidence of 27.38%, 29.48%, 33.19% and 37.63%, respectively

Plant extracts namely, Soapnut rind extract and neem leaf extract were most significantly effective in inhibiting the mycelial growth of *Alternaria alternata* with 73.04% and 68.30%, respectively. Wild brinjal and Rui were least effective in controlling the mycelial growth of *A. alternata* with 31.82 and 20.96 per cent inhibition, respectively.

Among the different fungicides evaluated in vitro, Propiconazole (0.1%) was most effective in inhibiting growth of *A. alternata* with 94.07 per cent followed by Azoxystrobin. (0.1%), tebuconazole + trifloxystrobin (0.05%), difenconazole (0.1%) with 89.44%, 89.00%, 88.00% inhibition.

Trichoderma koningii, *T. harzianum* and *T. longibrachiatum* were found potential bio-control agent against *A. alternata* which showed complete inhibition *in vitro*. *Pseudomonas fluorescens* strain-1 and *P. fluorescens* strain-3 were also effective against *A. alternata* with 68.82 and 61.15 per cent inhibition of mycelial growth.

Name of Candidate: Mr. P. V. Joshi
Degree: M. Sc. (Agri)
Year of Submission: 2015
Name of Research Guide: Dr. J. J. Kadam

8. Abstract:

Tip blight of jackfruit caused by *Colletotrichum gloeosporioides* (Penz.) Penz and Sacc. was observed for the first time in Dapoli tehsil of Ratnagiri district (M.S.) in moderate to severe form. Disease infection was started as water soaked lesion on growing tips. It caused shrinking of the infected twigs and showed bronze discolouration. The infected shoot appeared grey coloured at the centre with black coloured acervuli. In advanced stage of the disease infected tissue of leaf petiole was broken at the centre and leaf remained hanging and dried. Water soaked spots with yellow halo were also developed on leaves which coalesced and caused blightening of leaves and then defoliation. The pathogenicity of *C. gloeosporioides* (Penz.) Penz. and Sacc. was proved on jackfruit (variety: Konkan Prolific).

On potato dextrose agar medium, the fungus produced greyish-white, fluffy, lanose, cottony growth. Later, the colony turned to grey coloured with salmon or pink coloured sporulation. The fungus produced thin, hyaline, septate, profusely branched hyphae with 1.8-2.6 um width. The conidia were hyaline, single celled with round ends, oval to oblong and slightly constricted at the centre measuring 14.4-17.3 X 3.0-4.9um and with 1 or 2 central oil globules.

Maximum vegetative growth and sporulation of the causal fungus was recorded on potato dextrose agar medium and oat meal agar medium. Similarly, potato dextrose broth supported maximum vegetative growth followed by oat meal broth and Richard's broth.

In host range studies mango, cashew, kokum, jamun and rose apple showed susceptible reaction to *C. gloeosporioides* (Penz.) Penz. and Sacc. Among the different plant extracts evaluated, maximum per cent (inhibition of fungal growth was achieved due to 10% bulb extract of garlic 74.38 %) followed by soapnut extract (51.97 %).

Among the different fungicides tested in vitro, Bordeaux mixture (1%), carbendazim (0.1%), propiconazole (0.05% and 0.1%), thiophenate methyl (0.1%), mancozeb (0.25%), hexaconazole (0.05% and 0.1%) and combination product of metalaxyl+ mancozeb (0.05% and 0.1%) completely inhibited the mycelial growth of C. gloeosporioides (Penz.) Penz. and Sacc.

Under field conditions, combi product metalaxyl (4%) + mancozeb (64%) was found the most effective fungicide for control of tip blight of jackfruit which showed 86.99 % reduction in the disease over control and it was followed by Bordeaux mixture (1%) and carbendazim (0.1%) which gave 86.73 % and 82.24 % reduction in disease, respectively.

Name of Candidate: Mr. R. C. Agale
Degree: M. Sc. (Agri)
Year of Submission: 2013
Name of Research Guide: Dr. J. J. Kadam

8. Abstract:

Blight (purple blotch) incited by *Alternaria porri* was observed on onion in some pockets of Konkan region of Maharashtra in the range of 14.72 to 26.54 per cent during 2011 to 2013. Symptoms produced by *Alternaria porri* were shown on leaves resulted in small, water soaked, sunken more or less oval shaped spots, yellowing and lesions girdled leaves, causing them to fall over or hang down and finally complete drying of leaves. The pathogenicity of *A. porri*was proved on onion plants in pots.

The investigation on cultural and morphological characters of *A. porri*, the fungus showed fluffy, lanose to loose, cottony, aerial and greenish grey to black colonies on oat meal agar medium. Hyphae were septate and irregularly branch, conidiophores were arose singly or in group, straight, pale to light brown, measured 90-100 x 9-12 µm. Conidia were solitary, straight to curve, obclavate and measured 52.7-126.4 x 9.26-16.20 µm having long beak with 6-11 transverse and 0-3 longitudinal septa.

Maximum vegetative growth of *A. porri* was recorded on oat meal agar followed by host extract agar, Richard's agar and Asthana & Hawkar's agar. Similarly, host extract broth supported maximum vegetative growth followed by oat meal and Richard's broth.

The maximum growth of *A. porri* was observed in maltose followed by sucrose, dextrose and fructose as carbon source and urea followed by potassium nitrate and sodium nitrate as source of nitrogen. The pH level 4.0-6.0 was found as ideal for the growth of *A. porri*

Among the different fungicides tested in vitro against the pathogen, propiconazole (0.1%) and combi product of iprodione + carbendazim (0.1 and 0.05%) completely inhibited the mycelial growth of *A. porri*. Among different plant extracts tested against *A. porri* maximum per cent inhibition of mycelial growth was achieved due to 10 per cent cinnamon extract (72.22%) followed by soapnut (64.77%) and jatropha (64.44%). For biological control, complete inhibition of the *A. porri* was achieved due to *Trichoderma harzianum* and *Aspergillus niger* followed by *T. viride* and *Pseudomonas fluorescens*.

Name of Candidate: Mr. S. M. Nile
Degree: M. Sc. (Agri)
Year of Submission: 2020
Name of Research Guide: Dr. J. J. Kadam

8. Abstract:

The present investigation was undertaken with an aim to find out resistant or tolerant germplasm lines/varieties of finger millet to *Pyricularia grisea* causing blast disease and to explore different botanicals, bio-agents and fungicides for effective management of blast disease of finger millet under natural epiphytotic condition in Konkan region of Maharashtra.

The fungus associated with blast infected finger millet plant was isolated on potato dextrose agar medium and on proving of Koch's postulates the pathogenic fungus was identified as *Pyricularia grisea*.

Among the eighteen germplasm lines and two varieties of finger millet which were evaluated for their resistance to blast disease (P. grisea) under natural field condition, none of the germplasm line/variety was found immune to blast infection. However, three germplasm lines

namely N3, N20 and N26 didn't showed any blast symptoms on neck and fingers. N5 and N27 were showed resistant reaction to neck and finger blast infection. Seven germplasm lines viz., N2, N4, N7, N24, N25, N29 and N30 were moderately susceptible to all three types of blast (leaf, neck and finger). Only Dapoli safed-1 showed susceptible reaction for all the three blast types.

Bulb extract of Allium sativum and rind extract of *Sapindus mukorssi* were expressed complete inhibition of P. grisea. Leaf extracts of Nicotiana tabacum, Lantana camara and Azadirachta indica were also found effective against the test pathogen which showed 72.22%, 62.97% and 62.22% inhibition, respectively.

In, in vitro evaluation of bio-agents, *Trichoderma harzianum* was emerged as the potential antagonist of P. grisea which showed 83.33 per cent inhibition of the fungus and was followed by *T. virens* (80.74%) and *Aspergillus niger* (70.37%). While, *Pseudomonas fluorescens* (49.08%) and *T. viride* (48.14%) were less effective in inhibiting the mycelial growth of *P. grisea*.

All the fungicides evaluated in vitro showed significant inhibition of pathogen. Tricyclazole 75% WP (0.06% and 0.1%), carbendazim 50% WP (0.1%), hexaconazole 5% EC (0.1%), mancozeb 75% WP (0.2%) and combi product carbendazim 12% + mancozeb 63% WP (0.15%) were the most effective fungicide which showed complete inhibition of the mycelial growth of the pathogen. These were followed by combi product tebuconazole 50% + trifloxystrobin 25% WG (0.05%) and Copper oxychloride 50% WP (0.25%) with 84.08 and 52.22 per cent inhibition of mycelial growth, respectively over control.

The results of field trial revealed that, seed treatment with tricyclazole @ 3gm/kg + 2 sprays of tricyclazole @ 0.06% and seed treatment with tricyclazole @ 3gm/kg + 2 sprays of hexaconazole @ 0.1% at 15 days interval found superior among all the treatments against the blast disease of finger millet caused by *Pyricularia grisea*. Botanicals and bio-agents were also controlled the disease but were less effective as compared to fungicides.

Name of Candidate: Mr. S. M. Pandav
Degree: M. Sc. (Agri)
Year of Submission: 2012
Name of Research Guide: Dr. J. J. Kadam

8. Abstract:

The collar rot disease of gerbera caused by *Sclerotium rolfsii*Sacc. was noticed in the range of 21.60 to 45.20 per cent in greenhouses from different tahasils of Ratnagiri district. Symptoms produced by *Sclerotium rolfsi* were shown on collar resulted in rotting of basal stem portion which turned brown to dark brown with shrinking of the stem in the affected region and partial drying of tender shoots and finally, the plants collapsed. The pathogenicity of *S. rolfsii*was proved on gerbera plants in pots. The dark brownish lesions developed on stem and shriveling of the stem extended above the collar. Thick mycelial mat and whitish pre-mature and later on brownish sclerotia were developed around collar region of the affected plant.

The investigation on varietal reactions of gerbera against *Sclerotium rolfsii* showed that among the varieties tested only one variety 'Goliyat' was found to be resistant variety.

Formaldehyde @ 5 per cent and ethyl alcohol @ 70 per cent showed complete inhibition of *sclerotial* germination. Sclerotia exhibited viability for 150 days when stored at ambient temperatures. Among the different fungicides tested in vitro against the pathogen, hexaconazole (0.1%), propiconazole (0.1%), mancozeb (0.1% and 0.2%) and captan (0.1%) completely inhibited the mycelial growth and sclerotia formation of *S. rolfsii*. For biological control, *Trichoderma viride* (87.77 % and 11 nos.) and *Trichoderma harzianum* (81.11% and 15 nos.), were proved as the potential antagonists of *S. rolfsii*. Among different plant extracts tested against *S. rolfsii* maximum per cent inhibition of mycelial growth and less number of sclerotia formation was achieved due to soapnut 10 per cent (81.11% and 12 nos.).

9. Extension Activities

a. The training programmes organized

1. **Title:**Mushroom Production Training, held at Awashi, Tal- Dapoli, Dist- Ratnagiri
   Sponsorer: Department of Plant Pathology, College of Agriculture ,Dapoli
   Date and duration:02/09/2020 (one day)
   Participants:
   (Nature of the participation -**Farmers**, and no. of participants = **12**)
   Schedule of the training programme: 02/09/2020
   Special feature of the training programme: Nil

2. **Title:** Mushroom Production Training, held at Ade, Tal- Dapoli, Dist- Ratnagiri
   Sponsorer: Department of Plant Pathology, College of Agriculture ,Dapoli
   Date and duration:07/09/2020 (one day)
   Participants:
   (Nature of the participation -**Farmers**, and no. of participants = **13**)
   Schedule of the training programme: 07/09/2020
   Special feature of the training programme: Nil

3. **Title:** Mushroom Production Training, held at Dahagaon, Tal- Dapoli, Dist- Ratnagiri
   Sponsorer: Department of Plant Pathology, College of Agriculture ,Dapoli
   Date and duration:08/10/2020 (one day)
   Participants:
   (Nature of the participation -**Farmers**, and no. of participants = **75**)
   Schedule of the training programme: 08/10/2020
   Special feature of the training programme: Nil

4. **Title:** Mushroom Production Training, held at Borje, Tal- Pen, Dist- Raigad
   Sponsorer: Department of Plant Pathology, College of Agriculture ,Dapoli
   Date and duration:26/08/2021(one day)
   Participants:
   (Nature of the participation -**Farmers**, and no. of participants = **30**)
   Schedule of the training programme:26/08/2021
   Special feature of the training programme: Nil

5. **Title:** Mushroom Production Training, held at College of Agriculture, Dapoli Tal- Dapoli, Dist- Ratnagiri
   Sponsorer: Department of Plant Pathology, College of Agriculture ,Dapoli
   Date and duration:19-20/03/2022(Two day)
   Participants:
   (Nature of the participation -**Farmers**, and no. of participants = **34**)
   Schedule of the training programme:19-20/03/2022
   Special feature of the training programme: Nil

6. **Title:** Mushroom Production Training, held at College of Agriculture, Tal- Khed, Dist- Ratnagiri
   Sponsorer: Department of Plant Pathology, College of Agriculture ,Dapoli
   Date and duration:11-13/10/2022(Three day)
   Participants:
   (Nature of the participation -**Farmers**, and no. of participants = **26**)
   Schedule of the training programme:11-13/10/2022
   Special feature of the training programme: Nil

7. **Title:** Mushroom Production Training, held at Lote, Tal- Khed, Dist- Ratnagiri
   Sponsorer: Department of Plant Pathology, College of Agriculture, Dapoli
   Date and duration:30-31/01/2023(Two day)
   Participants:
   (Nature of the participation -**Farmers**, and no. of participants = **15**)
   Schedule of the training programme: 30-31/01/2023
   Special feature of the training programme:for Farm Women

b. Seminar/Symposia/Conference/Workshop Organized

Title: Recent Trends in Disease management of Horticulture crops

Sponsorer: IPS West Zone and Dr.BalasahebSawant Konkan KrishiVidyapeeth, Dapoli.

Date and duration: 19-20 October, 2011
Participants: (Nature of the participation and no. of participants)
Scientists, Teachers, Academics, Students etc. were takes participation in symposium.

Schedule of the Seminar/Symposia/Conference/Workshop:19-20 October, 2011

Key Note Speakers along with their topic of speech

1. Plant healthcare: A holistic approach for production of horticultural crops.
   S.J. Kolte.
2. Biopesticide technology for tomorrow's problems.
   Sabalpara, A.N. and Lalit Mahatma
3. Status and management strategies for bacterial wilt of solanaceous crops.
   Ramesh, R.
4. Viral diseases of banana and their management.
   Diwakar, M.P. and P.A. Fugro.
5. Vineyard specific weather forecasting and disease risk estimation, a tool for effective management of downy mildew in grapes under adverse conditions.
   Sawant, S.D. and P.G. Adsule.
6. Diseases of mango in coastal zone, their management and challenges.
   Dalvi,M.B., S. A. Chavan and P.D. Patil.
7. Integrated management of important diseases of ginger and turmeric.
   Datar, V.V.
8. Crop protection industry: An overview.
   Mandokhot, Arun M., A. S. Indulkar and VineelBhurke.
9. *Colletotrichumgloeosporioides*: an important fungal pathogen of horticultural crops in humid tropics.
   Joshi, M S.

No. of papers presented: 94

Whether papers published in abstract/full length form? If so provide the details in bibliographical format.
: Papers published in Abstract form
One photograph

c. Farmer Melawa Organized

Title:
Sponsorer:
Date and duration:
Participants: (Nature of the participation for eg. Farmers, Govt official, Academician etc and no. of participants)
Name of the speakers along with their topics
One photograph

d. Radio/TV Talks delivered by the staff members of the Department/Section:

Topic	Date of Broadcast	Place of Recording / Broadcasting	Year
Dr. M. S. Joshi, Professor and Head			
1.Jaivik khate vaparanyachya Paddhati	26-07-2023	All India Radio, Ratnagiri	2023
2. Velvargiya bhajipala pikanche rog niyantran	16-08-2022	All India Radio, Ratnagiri	2022
3. Ambyavaril bhuri rogache niyantran	12-2015	All India Radio, Ratnagiri	2015
Dr. J. J. Kadam, Associate professor			
1. Bordeaux mixture ani Bordeaux paste tayarkarnyachipaddhat	25-12-2008	All India Radio, Ratnagiri	2008
2. Konkanatilkelipikavarilrogvyavasthapan	10-12-2008	All India Radio, Mumbai	2008
3. Ambyatilfalkujkarananiupay	26-04-2010	All India Radio, Ratnagiri	2010
4. Amba mohoravaril rogancha velich bandobast	20-12-2010	All India Radio, Ratnagiri	2010
5. Bhat pikavaril rogacha velich bandobast	09-07-2012	All India Radio, Ratnagiri	2012
6. Pavsalyat amba ani chiku bagetil roganch niyantran	12-08-2013	All India Radio, Ratnagiri	2013
7. Amba kadhani purvi ani kadhani pachhat yenarya rogancha bandobast	03-02-2015	All India Radio, Ratnagiri	2015
8. Amba kadhani pachhat rog vyavasthapan	29-03-2016	All India Radio, Ratnagiri	2016
9. Bhat pikatil roganch niyantran	10-07-2019	All India Radio, Mumbai	2019
10. Bhat pikavaril pramukh roganche niyantran	07-08-2019	Sahyadri, KrishiDarshan	2019
Dr. R. A. Raut, Assistant Professor			
Kaju mohor savrakshan	19-11-2018	Sahyadri, AmachiMatiAmachi Manas	2018
Ambyavaril mahtvache rog ani tyanche niyantran	02-03-2020	Sahyadri, AmachiMatiAmachi Manas	2020
Dr. R. R. Rathod,**Assistant Professor**			
Kharif pikanvaril RogVyavasthapan- shetkariprashna	27/06/2009	Hello Kashtakaar, Akola	2009
Bhajipala pikanvaril Rog Vyavasthapan- shetkari	01/09/2009	Hello Kashtakaar,	2009

prashna		Akola	
Shetkari Prashna aani uttare	19-20/09/2009	Hello Kashtakaar, Akola	2009
Dr. H. D. Pawar, Jr. Research Assistant			
Velvargiya Bhajipala pikan varil RogVyavasthapan	23/11/2018	All India Radio, Mumbai	2018
Bhat Pikavaril Rog Tyanche Vyavasthapan	24/07/2023	All India Radio, Ratnagiri	2023

e. Farmer-Scientist Forum: The name of the form along with the in charge of the forum, members of the forum (name, address and phone number) and activities of the forum be provided here.

f. Other Extension Activities: Provide the details of any other notable extension activities performed by the Department/Section

g. Publications:

1. Post Graduate Research Work At A Glance, 2011
2. Viral Diseases of Vegetable Crops, 2011
3. Ambya varil Rog aani tyanche vyavasthapan, 2011
4. Ambya pikavaril Roganchi olakh aani vyavasthapan, 2018
5. Bhat pikachya roganchi olakh aani tyanche Vyavasthapan, 2014
6. Naral pik sanrakshan Tantradnyan, 2013
7. Souvenir and Abstracts: Symposium on Recent Trends in Disease Management of Horticultural Crops, 2011

10. **Details of other activities (for e.g. seed production, production of other commodities** etc) : Production of Oyster Mushroom
11. **Contact Information**

Name of the Head: Dr. M. S. Joshi
Name of the Department: Plant Pathology
Postal Address: College of Agriculture, Dapoli
Landline Number:
Mobile Number: 9420639320
Fax:
Email: hod.plpath@gmail.com

12. **News and Events**