MAHARASHRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE

SEMESTER END THEORY EXAMINATION

B.Sc. (Hons.) Agriculture

Semester :	IV (New)	Term:	II	Academic Year:	2023-24
Course No.:	ELE PATH-243	Title :	Biofertilizers, Biocontrol agents and Biopesticides		
Credits :	3(2+1)				
Day & Date:		Time (hrs.) :	3hrs.	Total Marks :	80

Note: 1. Solve **ANY EIGHT** questions from **SECTION 'A'**.

2. All questions from **SECTION 'B'** are compulsory.

3. All questions carry equal marks.

4. Draw neat diagrams wherever necessary.

SECTION 'A'

Q.1	**a)**	**Write in details about the growth characteristics of *Rhizobium* and *Azospirillum.***	**4 Marks**
Ans:		Answer should be included morphological and physiological characteristics of each organism. Morphology - Unicellular, cell size, shape, motility, Gram reaction. Physiology -Nature, C-source, N-source, respiration, media.	
Q.1	**b)**	**Write in short about nitrogenase enzyme with it's components.**	**4 Marks**
Ans:		Answer should be included in brief description on following points: Nitrogenase-Enzymes which mediates the reduction of N_2 to NH_3, acetylene to ethylene. Components - Fe (Iron), protein, Mo-fe- protein and general mechanism.	
Q.2	**a)**	**Describe the cross inoculation groups of *Rhizobia.***	**4 Marks**
Ans:		Leguminous plants of one or more genera or species develop root nodules in association with the same varieties or species of *Rhizobium*. Answer should be include following legume rhizobia cross inoculation: a) Rhizobium - Pea, bean, clover, alfalfa, lupine, soybean & cowpea. b) Mesorhizobium - Cicer, Chickpea, Birdsfoot. c) Sinorhizobium - Alfafa, Sweelclover. d Bra rhizobium - Soy bean, lupins.	
Q.2.	**b)**	**Write in brief the various application methods of carrier based biofertilizers.**	**4 Marks**
Ans:		Answer should be included following methods with example: i) Seed treatment / pelleting, ii) Root dipping, iii) Set treatment. iv) Soil application, v) Biofertigation, vi) Foliar application.	
Q.3	**a)**	**Mention the strategies of marketing of bioagents.**	**4 Marks**
Ans:		Answer should be included on following points: Farmers acceptance, large demand, economically marketed, good quality products, well labelled packaging material, shelf life, storage and transport facilities, retail outlet, marketing network, pricing of biofertilizer, lucrative trade discount, institutional and agencies.	
Q.3	**b)**	**Write the importance of *Pseudomonas* as a biocontrol agent.**	**4 Marks**

Ans:		Brief description as a biocontrol agents includes: Secretion of pyoverdine, fluorescent yellow green siderophore, produces - pyocyanin, thioquinolobactin , induces systemic resistance in the host plant production of antagonistic compound *viz.*,phenanzine.	
Q.4	a)	**What are the ideal features for establishing insectary ?**	**4 Marks**
Ans:		Following points should be include: Design, rearing technique, environmentally controlled insect rearing chambers, high PAR lighting system, transportation, insect proof net house, lace to row flora and fauna	
Q.4	b)	**Write in short about the importance of HaNPV.**	**4 Marks**
Ans:		Explanation on following points should be included: HaNPV: One of the insect pathogen infecting *Helicoverpa* armigera larva, it is species specific virus, compatible with IPM concept because host specificity, does not affect predator and parasitoids, pathogenicity may alleviate insecticide resistant problem, how to incorporate polyhydra into diet.	
Q.5	a)	**Describe about packaging material and labelling requirement for biopesticides.**	**4 Marks**
Ans:		Different packaging materials and standard Labelling: Name of biopesticides, name of crop ,net weight, batch number, lot number, instruction on storage, direction for use and application rate, expiry date, manufacturers name, registration number, address with seal	

Q.5	b)	**Describe the importance of *Metarhizium* biopesticides.**	**4 Marks**
Ans:		Answer should be included the economic importance of the bioagent, types of insect controlled with examples, microbial insecticide.	
Q.6	a)	**Enlist the factors responsible for effectiveness of bio control agents on soil borne plant pathogen and explain one of them in brief**	**4 Marks**
Ans:		I) Abiotic factors- soil temperature, type, pH, moisture, nutritional status, concentration of heavy metals, interactions among the abiotic factors. 2) Biotic factors- soil organisms, host plant.	
Q.6	b)	**Write in short about the importance of *Verticillium***	**4 Marks**
Ans:		Answer should be included the economic importance of the bioagent, types of insect controlled with examples, microbial insecticide.	
Q.7	a)	**Mention the microbiology of decomposition of major constituents of soil organic matter and plant residues.**	**4 Marks**
Ans:		Answer should be included on following points: Decomposition of cellulose, hemicelluloses, chitin, lignin, protein, lipids, starch, pectin with micro-organism involved.	
Q.7	b)	**Write in short about Indian standard specification for *Azotobacter* inoculants.**	**4 Marks**
Ans:		Answer should be included according to Indian standard specifications on following parameters: Base, cell number at the time of manufacture and at the time of expiry, Expiry period, Permissible contamination, pH, strain, carrier, others nodulation, dry matter *etc.*	

Q.8	**a)**	**Mention the brief account of classification of biofertilizer based on used microorganisms.**	**4 Marks**
Ans:		The explanation should be included in brief bacterial, actinomycetal, fungal, algal biofertilizers in related to nitrogen fixing (symbiotic, associative symbiotic. non symbiotic), nutrients solubilisation, mobilization, P absorbing and antagonistic micro-organisms	
Q.8	**b)**	**Write in short about the importance of *Trichogramma***	**4 Marks**
Ans:		*Trichogramma*: Egg parasitoid, one of the most important group biotic agent for suppression of general lepidopteron pest, large number of species of *Trichogramma* are distributed throughout world of which 26 species recorded in India. Biology - Egg period, larval period, pupal and adult period.	
Q.9	**a)**	**Write in brief the quality assessment tests for *Azotobacter***	**4 Marks**
Ans:		Following points should be included i) Streak on Jensen's N-free medium- Colonies are gummy, raised with or without striations, viscous & often sticky', pigmentation, ii) Gram stain-reaction - Gram negative, iii) pH of carrier - 6.5 to 7.5, iv) N-fixation - should not be less than 10 mg/g of sucrose utilized, v Total late count- 10^7/ carrier.	
Q.9	**b)**	**Write in short about mode of action and plant diseases controlled by *Trichoderma***	**4 Marks**
Ans:		Mode of action- Competition, mycoparasitism, antibiosis, stimulation of plant resistance and defence mechanism, lysis. Plant disease control-explaination with example	
Q.10	**a)**	**Describe the role of NiF and Nod gene in BNF**	**4 Marks**
Ans:		**Answer should be included:** **Nif genes:** Cluster having at least 17 genes involved in atmospheric nitrogen, nitrogenase complex and converting to ammonia, synthesis and regulation of nitrogenase, location regulatory proteins involved in nitrogen fixation, example. **Nod gene:** Nod gene signaling molecules, flavorioid secretion, protein Nod D and nodulation process, Structure of nod factor and enzymes encoded by the common nod genes, host specificity	
Q.10	**b)**	**Describe nitrogen cycle along with the involvement of biochemical process**	
Ans:		Description of Biochemical process involved in nitrogen cycle. It should be included following reactions by citing example of microorganism responsible for their biochemical reactions: a) Proteolysis , b) Ammonification, c) Nitrification , d) Nitrate reduction, e) Denitrification.	

SECTION 'B'

Q.11. Match the Pairs
Ans:

i). Nitrogen fixing actinomycetes	:	(c) Frankia
ii). Acquatic fern as a biofertilizer	:	(g) Azolla
iii). Nematode disease	:	(e) *Paecilomyces*
iv). *Fusarium* wilt disease	:	(h) *Trichoderma*
v). Symbiosis	:	(b) Positive association between the microbes
vi). *Trichogramma*	:	(d) Egg parasitoid
vii). BT	:	(a)*Bacillus thuringiensis*
viii). *Rhizobium japonicum*	:	(f) Soybean

Q.12. Do as directed
Ans:

a) Enlist any two species of *Rhizobium*. (*Rhizobium phaseoli, Rhizobium japonicum*)

b) What do you mean by biopesticide ? (Definition: bio entities which are controlling pests)

c) Enlist any two micro-organisms which are used as bio control agents.
(*Trichoderma hamatum, Pseudomonas strita*)

d) Define the concept of biofertilizer
(bio entities which are providing nutrient to plant or fixing elements into fertilizer for plant)

e) Write the long form of AMF: **Arbuscular Mycorrhizal Fungi**

f) Write the contribution of any two scientists in biofertilizers.
1. M.W. Beijerinck: He was the first to isolate N-fixing bacteria from root nodules of legumes and name is *Bacillus radicicola* (now known as *Rhizobium sp.)* in 1888

2. J.B. Boussingualt: He mentioned the concept of biological nitrogen fixation.

g) Enlist any two books related to biofertilizers, biocontrol agents and biopesticides
1.Biological control of insect pest suppression (Coppel& Martin 1977)
2. Biological control of Insect Pests (Ignacimuthu & Jayaraj 2003)

h) Which species of *Azotobacter* occurs in acid soils?
: ***Azotobacter chroococcum***

Course Teacher & Instructor: Dr. P. H. Ghante (Associate Professor)
Head
Cell No. 7030705495
phghante@gmail.com
COA, Dharashiv