

AG 301/2020 (1/3)

PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF AGRICULTURE

FIRST SEMESTER FINAL EXAMINATION 2020

AG 301: PLANT PATHOLOGY I

DATE OF EXAMINATION: 24th JUNE 2020

TIME: 8:20 AM

TIME ALLOWED: 2 HOURS

TOTAL MARKS: 50

MODEL ANSWER

INFORMATION FOR CANDIDATES

1. Sanitize your hands before entering the room and wear face masks during the examination
2. You have 10 minutes to read the paper. You must not begin writing during this time.
3. Write your name and student number clearly on the front page of your answer booklet.
4. Answer all the questions only in the answer booklet provided. No other papers will be accepted.
5. This is a closed book examination. Notes and textbooks are not allowed during the examination.
6. The marks for each question are given within parentheses at the end of each question.
7. All mobile phones must be switched **OFF**.

Part A: Answer ALL the Questions

1. Define the following terms: (8)

Cross-resistance- Resistance to one chemical in a particular group also confers resistance to other chemicals of the same group

Cross protection - Protection of a plant from the infection of a virulent strain of virus by inoculating the plant with a mild strain of the same virus

Vertical resistance – Different level of resistance against different races of the pathogen. It is controlled by major genes and also called qualitative resistance.

Polycyclic plant disease – Pathogens that have many cycles of reproduction within a cropping season. As soon as the pathogens reproduce they take part in secondary infection.

Sedentary endoparasitic nematode – enter into plant tissue and feeds without moving about.

Virus indexing

Import permit - A special authorization granted by the plant protection service of the country to allow entry of prohibited plant or plant product

Phytosanitary certificate - certifies to the foreign plant protection agency that this shipment has been inspected and found to conform to phytosanitary import requirements of the of the importing country as specified in the export summary for that country

2. **Multiple Choice Questions** (Please write only the appropriate number that corresponds to the correct answer) (5)

A. Striga is

- i. a hemiparasitic higher plant that can transmit the virus diseases
- ii. a holoparasitic higher plant that can transmit the virus diseases
- iii. both a & b
- iv. none of the above

Answer: ii

B. Which of the following is a long-term surviving asexual structure?

- i. zygosporangium
- ii. sclerotium
- iii. oospore
- iv. ascospore
- v. none of the above

Answer: ii

C. An antispore is a chemical that

- i. kills the fungi
- ii. temporarily inhibit fungal growth without killing it
- iii. inhibit spore production without affecting vegetative growth
- iv. all of the above

Answer: iii

D. A facultative saprophyte is best described as

- i. mostly parasite, but under certain conditions can live as a saprophyte
- ii. mostly saprophyte, but under certain conditions can become a parasite
- iii. live and multiply only on living hosts
- iv. both a and b

Answer: i

E. A pesticide is a chemical that

- i. kills the fungi
- ii. temporarily inhibit fungal growth without killing it
- iii. inhibit spore production without affecting vegetative growth
- iv. none of the above

Answer: iv

3. **TRUE or FALSE** questions (please write only the correct answer) (5)

- a. Pathogen with wide host range can be managed by crop rotation.
TRUE or **FALSE**
- b. Bacteria can enter into the host through direct penetration.
TRUE or **FALSE**
- c. Pathogen resistance is quite common in case of broad-spectrum fungicides but rare in case of systemic fungicides
TRUE or **FALSE**
- d. Potato Dextrose Agar (PDA) is a synthetic culture media.
TRUE or **FALSE**
- e. The purpose of using agar powder in the preparation of PDA is to supply the nutrients to the culture medium.
TRUE or **FALSE**

4. Match up the following diseases with the correct causal organisms:

(Write only the appropriate alphabet representing the correct disease against the causal organism) (5)

- a) Club root of crucifers *Streptomyces scabies* (**d**)

- | | | |
|----------------------------|---------------------------------|-------|
| b) Late blight of potatoes | <i>Hemileia vastatrix</i> | (e) |
| c) Coffee rust | <i>Mycosphaerella musicola</i> | (e) |
| d) Potato scab | <i>Phytophthora infestans</i> | (b) |
| e) Sigatoka of banana | <i>Plasmodiophora brassicae</i> | (a) |

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PART B: Answer All the Questions

5. Describe the sequential steps for identifying a new plant disease. (4)

Answer:

- The organism (s) must be consistently associated with all the infected plant parts examined
- Isolate the organism (s) in culture, purify it and study the characteristics
- Inoculate the susceptible host with the purified organism (s), it should develop the symptoms similar to those in step 1
- Re-isolate the organism (s) from the inoculated plants, purify, study the characteristics and these should be same as in step 2.

6. What is the difference between the host-specific and non-host specific toxins? (2)

Answer:

Host-specific toxin- toxin that are toxic only to the host plants, little or no toxicity to non-susceptible plants. It must be present for the microorganisms to cause disease

Non-host specific toxin – toxins that are toxic to both host and non-hosts (wide host range). It can increase the extent of the disease, but not essential for the microorganisms to cause disease.

7. Briefly describe the major strategies to avoid fungicide resistance. (5)

Answer:

- Reduce Fungicide use
 - apply when and where necessary
 - use as a part of integrated program
- Diversify fungicide treatments
 - avoid repeated use of fungicide w/same mode of action
 - use mixtures of fungicides w/different mode of action

➤ Proper monitoring

8. Briefly explain the sanitation practices to reduce the initial plant disease inoculum (5)

Answer:

- Seed treatment (hot water, chemicals)
- Seed indexing, certification
- Crop rotation
- Elimination of alternative hosts
- Deep ploughing of crop residues
- Burning of crop residues
- Shoot meristem culture
- Chemical eradication

9. Discuss the various mechanisms of biological control with suitable examples. (7)

Answer:

1. Antibiosis

- The antagonist produces substance(s) that could be an antibiotic, lytic enzyme, volatile substance, or toxin that effectively targets and destroys pathogen.
- Control of *Gaeumannomyces graminis tritici* (Take-all of Wheat) by *Pseudomonas fluorescens* strain 2-79
- *P. fluorescens* produces the antibiotic Phenazine and is toxic to take-all pathogen
- Control of Crown gall- Peach, apple, Plum, grape (*Agrobacterium tumefaciens*) by *Agrobacterium radiobacter* strain K-84 that produces the antibiotic Agrocin.

2. Substrate or Site Competition

- Exists between organisms that require the same resource for growth and survival. Use of the resource by one organism reduces its availability for the other organism. Competition for space or nutrients usually takes place between closely related species.
- Control of *Heterobasidium annosum* (Root rot of Conifers) with *Phlebia gigantea*

3. Parasitism

- When an antagonist lives as a parasite on a pathogen.
- Control of *Sclerotinia minor* by *Sporidesmium sclerotivorum*. Inoculum of *S. sclerotivorum* infects the sclerotium of *S. minor*
- *Trichoderma harzianum* infects and parasitize mycelia of *Rhizoctonia* and *Sclerotium* and the cells collapse

4. Hypovirulence

- The plant is inoculated with inactive pathogens, low doses of pathogens, pathogen-derived chemicals or with non-pathogen species to stimulate an immune response.
- Control of *Cryphonectria parasitica* (Chestnut blight) by hypovirulent strain of the same fungus

5. Cross protection

- Protection of a plant from the infection of a virulent strain of virus by inoculating the plant with a mild strain of the same virus.
- Control of Citrus tristesa by inoculating with a mild strain of the same virus
- Control of Papyra ring spot by inoculating with a mild strain of the virus against the severe strain
- Control Tomato mosaic virus with a mild strain

10. List down four control measures for plant parasitic nematode. (4)

Answer:

- Resistant Variety
- Crop rotation
- Fallow
- Cover crops
- Organic amendments
- Trap crop
- Biological control (antagonistic fungi, bacteria)
- Hot water treatment
- Physical control- heat, flooding
- Chemical control