

Year: 2077

Level: B. Sc. Ag. Sixth Semester

Subject: Introductory Resistance Breeding (PLB 304)

1. What is gene for gene hypothesis? In which situation horizontal resistance is more effective than vertical resistance of host against the pathogens?
2. Why partial resistance is more durable than hypersensitivity resistance?
3. How do the breeders minimize the over or under estimation of resistance?
4. Suppose you are a breeder, how do you apply non durable resistance in a sensible way? List the points.
5. Non preference and non acceptance mechanisms are the defence mechanisms of host against insects. In which situation such mechanisms do work properly?

Internal Examination, July 2076

1. What is gene for gene hypothesis? Explain with examples.
 2. What are multilines and cultivar mixtures? Is it feasible to develop a multiline cultivar of potato with resistance to *Phytophthora infestans*? What about a multiline cultivar of wheat?
 3. Enlist the main factors that influence the over and or under estimation of resistance. Briefly explain with example about inter plot interference that influence the over and or under estimation of resistance.
 4. What is partial resistance? Briefly explain about the components of partial resistance with examples.
 5. What are race and forma specialis? How many races in figure A and forma specialis in figure B are present in following examples? Justify.
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Cultivars	Isolates of Pathogen (reaction)					
	1	2	3	4	5	6
7 A	+	-	+	+	-	+
B	+	+	+	+	-	-
C	+	-	-	-	-	+
D	+	+	+	+	+	+
E	+	-	+	-	+	-
F	+	+	-	-	+	+

Figure A

Cultivars	Isolates of Pathogen (reaction)					
	1	2	3	4	5	6
Sp(A) C1	+	+	-	-	+	+
Sp(A) C2	+	+	-	-	+	+
Sp(B) C1	-	-	+	+	+	+
Sp(B) C2	-	-	+	+	+	+
Sp(C) C1	+	+	+	+	+	+
Sp(C) C2	+	+	+	+	+	+

Figure B

6. In breeding material of wheat crop the infection by rust fungi is described in the following way.

S. N.	Cultivar	Observation
1	A	15 MR
2	B	0 R
3	C	95 S
4	D	25 MS
5	E	5 S
6	F	1R
7	G	80 MS
8	H	70 MR
9	I	10 S
10	J	5 R

What is meaning of the **letters and figures** and what aspects of infection are described by them? Which of the 10 cultivars do you **select** to include in the breeding program for resistance and which are the worst cultivars why?

7. Effect of rust on yield reduction of 8 wheat cultivars with different levels of tolerance and or resistance is given below. With the help of that given information write that which one is most tolerant, resistant, sensitive and susceptible? Which cultivar do you recommend to grow? Give your logical views.

Cultivars	Infection leaf area (%)	% yield reduction		
		Observed	Due to	
			Lack of resistance	Lack of tolerance
C1	50	50	25	25
C2	50	50	40	10
C3	50	50	50	0
C4	50	50	70	-20
C5	30	30	25	05
C6	25	25	25	0
C7	40	40	10	30
C8	15	15	18	-03

Internal Examination, June 2075

- Differentiate between vertical/race specific and horizontal/race non-specific resistance. What type of cultivars do you grow in race specific and race non-specific conditions? Explain with figures and examples.
- Most of the plant breeders do not prefer hypersensitive resistance to partial resistance. Why? Present your logics with examples.
- Enlist major sources of disease resistance. Why weedy and or wild species are sometime not considered one of the best parents that are taken in hybridization program? Present your logics with examples.

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4. Two homozygous host plants are intercrossed. Both have the same dominant major gene for hypersensitivity resistance. One of the two plants, however also has a dominant gene for suppression of resistance. The other plant has a recessive allele on the suppressor locus that does not interfere with the expression of resistance. In what frequencies do you expect resistant and susceptible phenotypes in the two parents, F1 and F2 after inoculation with a pathogen isolate carrying the corresponding allele for avirulence? Present and interpret your result.
5. With the help of following given results, which cultivar has the **highest** level of partial resistance and which one has the lowest? Give your logics.

Components of partial resistance	Cultivars			
	A	B	C	D
Infection frequency (%)	95	40	60	85
Latency period (hours)	03	04	06	07
Spore production/uredospore	100	120	150	200

6. With the help of following given table, (i) write down the compatible (+) and incompatible (-) reaction types in the respective boxes of the table. (ii) Find which is the best resistant and which one is the most susceptible reaction type? (iii) Give the race indications for A, B, C and D isolates.

Host Genotypes	Pathogen genotypes			
	A ₁ a ₁ a ₂ a ₂ a ₃ a ₃ a ₃ a ₃	A ₁ A ₁ A ₂ a ₂ a ₃ a ₃ a ₄ a ₄	a ₁ a ₁ a ₂ a ₂ a ₃ a ₃ A ₄ A ₄	A ₁ A ₁ A ₂ A ₂ A ₃ A ₃ A ₄ A ₄
	Isolate A	Isolate B	Isolate C	Isolate D
r ₁ r ₁ r ₂ r ₂ r ₃ r ₃ r ₄ r ₄				
R ₁ r ₁ R ₂ r ₂ r ₃ r ₃ r ₄ r ₄				
r ₁ r ₂ R ₂ r ₂ r ₃ r ₃ r ₄ r ₄				
R ₁ r ₁ r ₂ r ₂ R ₃ r ₃ R ₄ R ₄				
R ₁ r ₁ R ₂ R ₂ R ₃ R ₃ R ₄ R ₄				

7. What is the principle of pyramiding of genes? Interpret the result based on following given information about type of resistance and durability.

Crop	Variety	Pathogen	Durability (years)
Rice	V1	P1	15
	V2	P2	15
	V3	P3	15
Wheat	V1	W1	15
	V2	W2	15
	V3	W3	2
Maize	V1	M1	3
	V2	M2	15
	V3	M3	15

INTERNAL EXAMINATION