UNIVERSITY OF SARGODHA

Plant resistance to insect pests

Dr. M. Asam Riaz

Assistant Professor

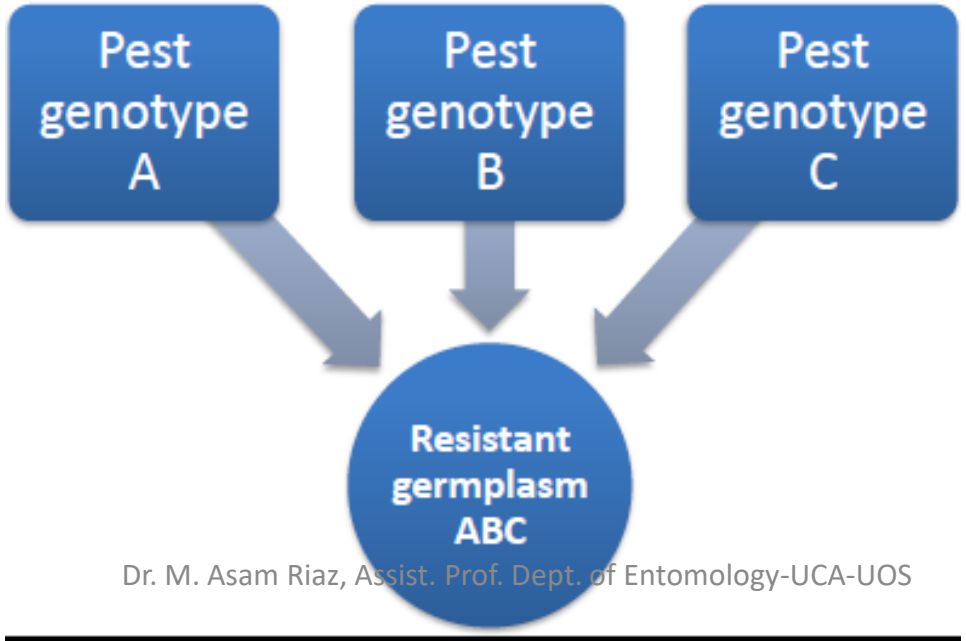
Entomology, College of Agriculture, University of Sargodha, Sargodha, Pakistan

Type of resistance based on epidemiology/inheritance

1-Horizontal resistance

–When a cultivar express resistance against a broad range of pest genotypes

–Confered by many plant genes and also known as **polygenic resistance**

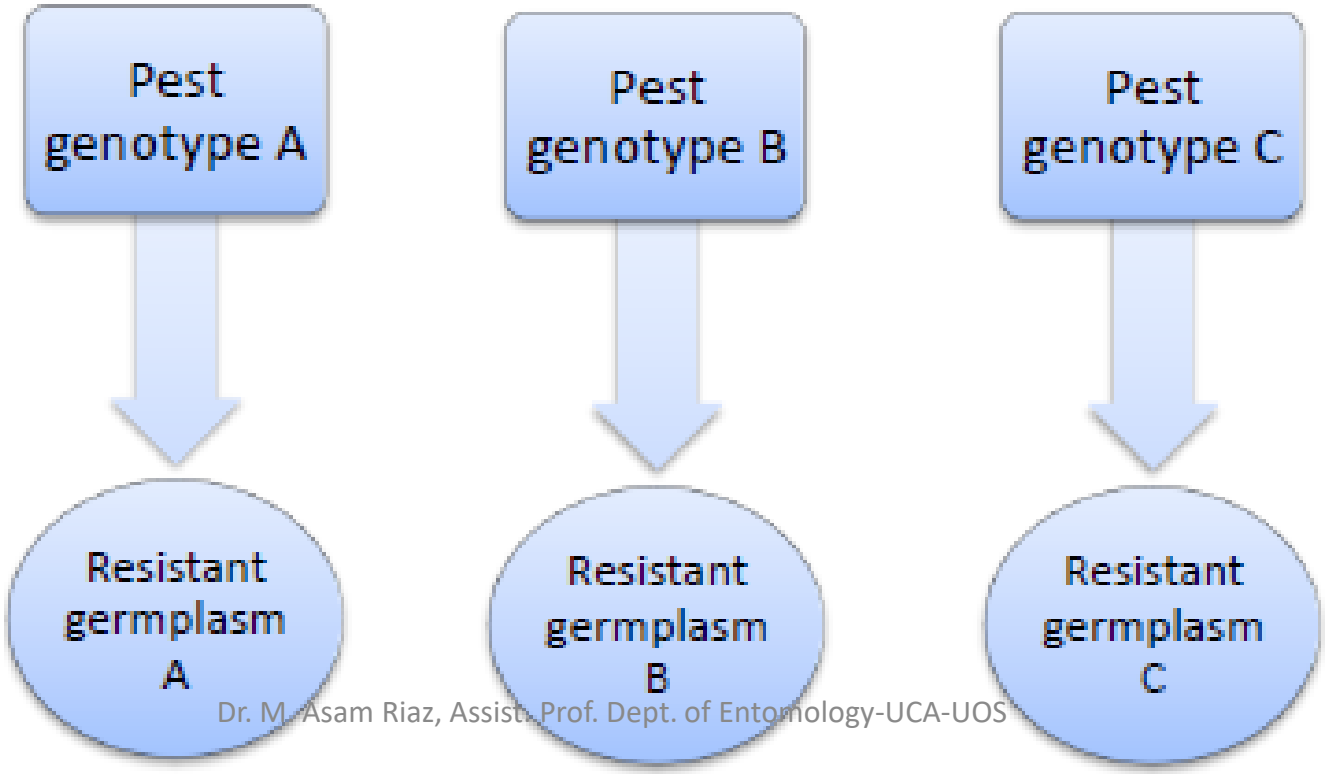


- In horizontal resistance, stepwise accumulation of genes is done (by selective breeding)
- most desirable to use in pest management. b/c
- Less chances of biotype
- Horizontal resistance has low heritability and is difficult to incorporate but long lasting.

2- Vertical resistance

–When a cultivar express resistance to **one or a few genotype** of pest

–Confered by one or a few plant genes and also known as **oligogenic resistance**



–advantage is that Genes are **easier to incorporate** in new variety as compare to horizontal resistance (identify the resistance gene, incorporate and released)

–Vertical resistance is **not useful** as compare to horizontal resistance because of development of biotypes

–e.g.,

- **Rice IRRI** varieties with ***bph5, bph6*** **and** ***bph 7*** genes are resistant to brown planthopper.
- **Rice hybrid** resistance **to green leafhopper and brown planthopper** (parent inbred lines have resistant genes) (in china)
- **Wheat cultivar** resistant to greenbug
- **Corn lines** resistant to corn rootworm
- **Bt variety of cotton** resistant to lepidopterous

Mechanism of resistance

a)Avoidance: insect avoid the contact with allelochemical

1. Avoidance by Genetics (oviposition on specific host)
2. Avoidance by Learning process (larvae learn after bitting)

b)Excretion: insect excrete out the allelochemical just after ingestion

Laurence et al., 2007. The evolutionary ecology of insect resistance to plant chemicals. TRENDS in Ecology and Evolution Vol.22 No.6

c)Sequestration: enzyme binds with the allelochemical without biotransformation (Glutathion S-transferases, UDP-glycosyl transferases)

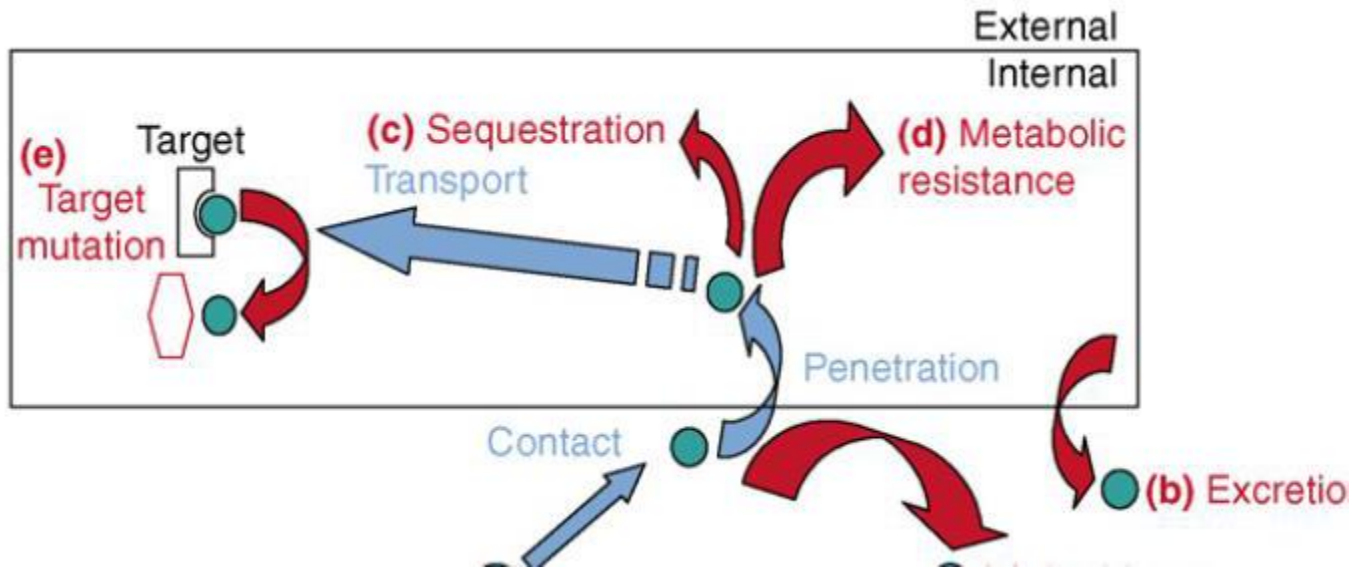
d)Metabolic resistance: biotransformation of allelochemicals

i.Cytochrome P450 monooxygenases (P450s or CYPs for genes),

ii.Glutathione S-transferases (GSTs) and the

iii.Carboxylesterases (COEs).

e)Target site mutation: target site of allelochemical mutate



Allelochemical

(a) Avoidance

Example of allelochemicals and their

Type of allelochemicals	Target site	Resistance mechanism	Example
Alkaloids	1. Neuroreceptors (inhibition); 2. Ion channels (antagonist); 3. Nucleic acids (disruption of DNA synthesis); 4. Feeding (deterrent owing to bitterness); 5. Enzymes (inhibition)	Modification of nicotine synthesis by salivary glucose oxidase	*Helicoverpa zea* (Lepidoptera)
Terpenoids	1. Nervous system (inhibition of acetylcholine esterase); 2. feeding (deterrent owing to physical barrier and bitterness); 3. growth and development inhibitor (pheromone analog)	Repression of genes involved in biosynthetic pathways	*Spodoptera exigua* (Lepidoptera)

Flavonoids and phenolic acids	1. Respiration (inhibition); 2. Growth (inhibition)	1. Ingestion avoidance 2. Decrease of toxin levels in gall tissue Glycosylation by UDP – glycosyl–transferase; 3. sequestration and/or excretion	*Manduca sexta* (Lepidoptera) Pontania sp. (Hymenoptera) Bombyx mori (Lepidoptera

Munduca sexta
(Tobacco Hornworm)

Pontania sp.
(Willow leaf gall sawfly)

Bombyx mori
(Silkworm)