TYPES AND MECHANISMS

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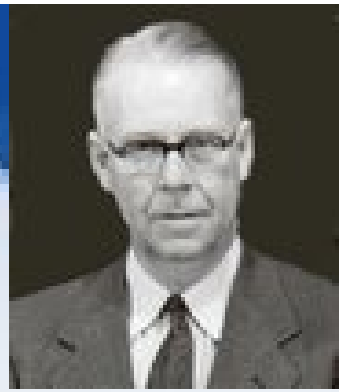
Host Plant Resistance (HPR)



ñThose characters that enable a plant to avoid, tolerate or recover from attacks of insects under conditions that would cause greater injury to other plants of the same speciesò

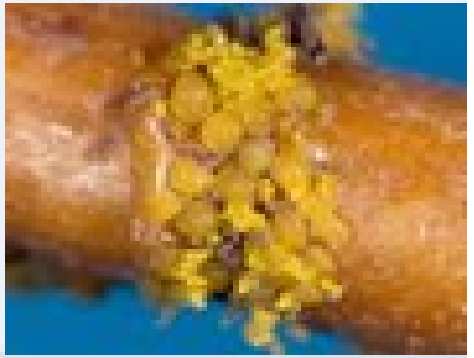
Painter R. H. (1951)

ñThose heritable characteristics possessed by the plant which influence the ultimate degree of damage done by the insectò

Maxwell F. G. (1972)

Historical milestones in the development of HPR

- In 3rd centaury BC Theophrastus recorded difference in disease susceptibility among crops
- 1782: ñUnderhillò variety of wheat reported resistant to Hessian fly in USA.
- 1817- Sorghum crop reported to be resistant to grasshoppers, *Melanoplus* spp.
- 1831: ñWinter Majetinò variety of apple reported resistant to woolly apple in USA.
- 1890: Control of grape phylloxera in Europe by grafting of European grapevine scions to resistant North American rootstocks.



- **1860s-** C.V. Riley grafted European grapes on American rootstocks resistant to grape phylloxera (introduced from N. America) (also introduced downy mildew é led to ñBordeaux mixò fungicide)
- **1914-** At Kansas State University R.H. Painter began breeding efforts for the scientific development of cultivars resistant to Hessian fly. Painter is widely recognized as the **"Father of Host Plant Resistance."**
- **1935-** Cotton reported to be resistant to leafhoppers, *Empoasca* spp.
- **1973-** The first BPH-resistant variety with Bph 1 gene, 1R26, was released

Science of plant resistance

1. **Preworld war II era**
2. **Immediate Post world war II era**
3. **Era of Environmental awareness of recent year**

Prior to world war II

1. Mainly co-operative effects was made by scientists, plant breeder and entomologist to develop resistant cultivar.
2. 2nd era showed significant studies of biology, HP interaction to the exploitation of newly developed organic chemical pesticides
3. Third era since, 1960 there has been further steps towards IPM. This IPM was conditioned by 2 major factors.

   (1) development of resistant to insecticide

   (2) Environmental pollution by insecticide

HPR is one of the important components in IPM in the new era.

Resistance can be assessed by these four characteristics

- Resistance is heritable and controlled by one or more genes.
- Resistance is relative and can be measured only by comparison with a susceptible cultivar of the same plant species.
- Resistance is measurable, i.e. its magnitude can be qualitatively determined by analysis of the standard scoring system, or quantitatively by insect establishment.
- Resistance is variable and is likely to be modified by the biotic and abiotic environments.

Types of Resistance

I. **Ecological resistance (Pseudoresistance)**

- Apparent resistance which is the result of transitory character in potentially susceptible host

i. **Host evasion** ï host pass through most susceptible stage quickly or at a time when insect numbers are reduced

Early maturity, Late planting, Late maturity

ii. **Induced resistance** ï Temporarily increased resistance resulting from condition of plant environment

Soil moisture, Fertility

iii. **Escape** ï lack of infestation due to inadequate pest load

II. Genetic Resistance

A. Number of genes

a) Monogenic resistance: Controlled by single gene, Easy to develop easy to break
b) Oligogenic resistance: Controlled by few genes
c) Polygenic resistance: Controlled by many genes

B. Major or Minor genes

a) Major gene resistance: Controlled by one or few major genes (vertical resistance)
b) Minor gene resistance: Controlled by many minor genes (Adult resistance or mature resistance or field resistance or horizontal resistance)

C. Biotype reaction

a) Vertical resistance: Effective against specific biotypes (specific resistance)
b) Horizontal resistance: Effective against all the known biotypes(Non specific resistance)

III. Based on population/Line concept

a) Pureline resistance: Exhibited by lines which are phenotypically and genetically similar

b) Multiline resistance: Exhibited by lines which are phenotypically similar but genotypically dissimilar

IV. Multitrophic intercations

a) Cross resistance: Variety with resistance incorporated against a primary pest, confers resistance to another insect.

b) Multiple resistance: Resistance incorporated in a variety against different environmental stresses like insects, diseases, nematodes, heat, drought, cold, etc.

V. Based on evolutionary concept

a) Sympatric resistance: Acquired by co-evolution of plant and insect (gene for gene) Governed by major genes

b) Allopatric resistance: Not by co-evolution of plant and insect.Governed by many genes

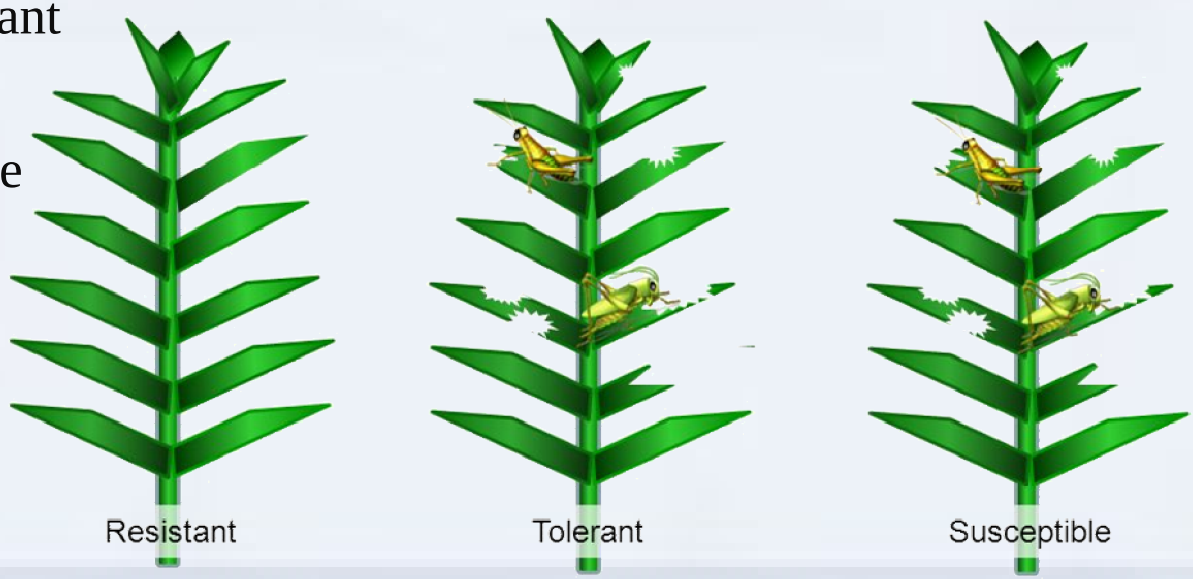
VI. Intensity of resistance

Two scale to measure the degree of resistance

A. Absolute scale

B. Relative scale ï

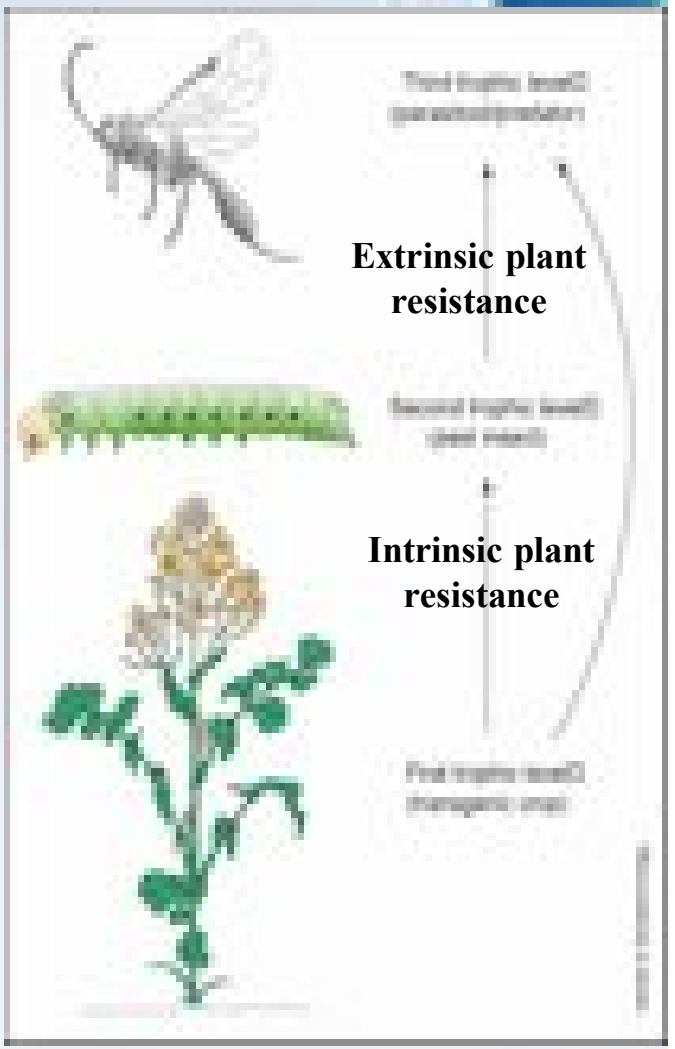
- Highly resistance
- Resistant
- Moderately resistant
- Susceptible
- Highly susceptible



VII. Multitrophic interactions

a) Intrinsic resistance : Through physical (Trichomes or toughness)or chemical (Toxins or digestibility) or both (Glandular trichomes or resins)

b) Extrinsic resistance :Natural enemies (Third trophic level) of insect pest(second trophic leve) benefit the host plants (First trophic level) by reducing the pest abundance



Factors that affect resistance expression

- Physical Factors
- Plant Nutrition
- Biotic Factors
  - Plant factors
  - Pest factors
    - Biotype
    - Initial infestation level