UNIVERSITY OF SARGODHA

Plant resistance to insect pests

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Type of resistance

1. Ecological resistance
2. Genetic nature of resistance
3. Physiological resistance

1. **Ecological resistance**
   - –Known as apparent resistance or pseudorsistance
   - –Relies more on environmental conditions than on genetics
   - –Cultivars involved are potentially susceptible
   - –Should be carefully used

–**Types of ecological resistance**

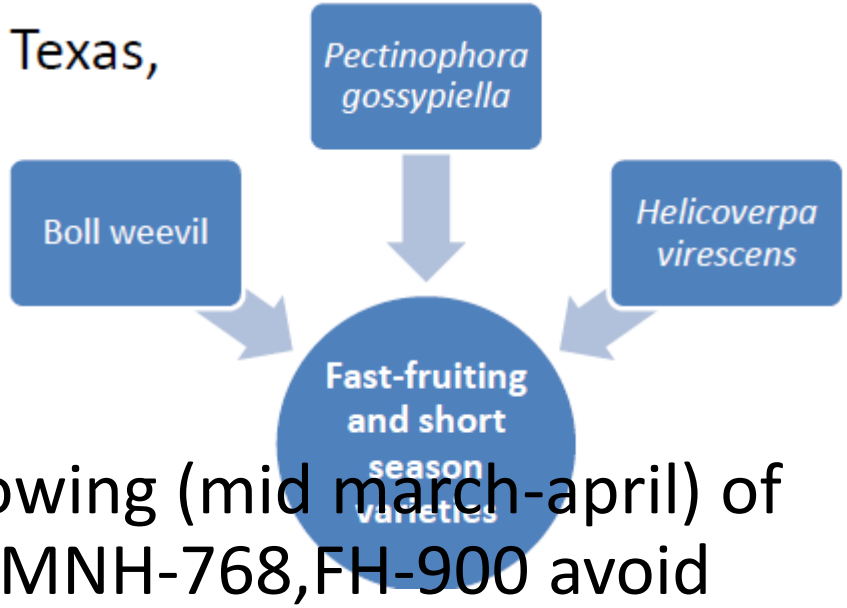
A. Host evasion

B. Induced resistance

C. Host escape

A.Host evasion

- Plant passes through a susceptible stage quickly
- or Exposure to insect is reduced
- e.g., in Texas,



- e.g., in Pakistan, early sowing (mid march-april) of cotton varieties such as MNH-768,FH-900 avoid whitefly and jassid attack at early stages, when they attack in humid season, plant bear it

B.Induced resistance

–Temporary resistance which is derived from plant condition or its environment or plant response to its environment

–e.g.,

I. Plant environment such as soil moisture level, fertilization

I. High N-level increases aphid survival, High K-level decreases aphid survival

II. Plant response such as production of phytoalexins and development of biopesticides (harpin)

I. **Phytoalexin** (phenolic compounds) produced by plants in response to disease or insects

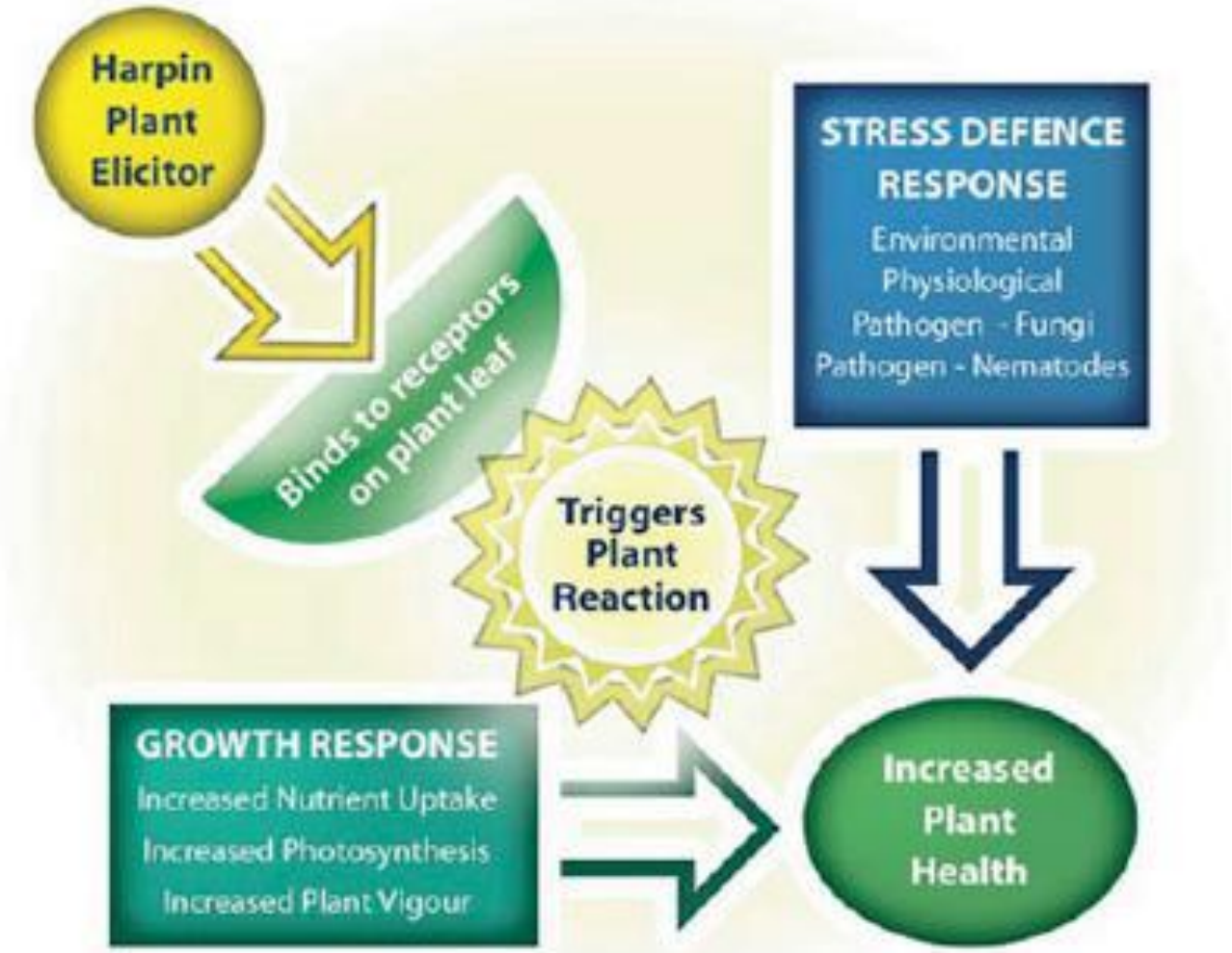
–Phytoalexin act as allomones and deter other insects to feed

–Experiment on soybeans

- fungus (*Phytophthora megasperma) was inoculated in soybeans, level of phytoalexin increased in cotyledons and act as feeding deterrent against Mexican bean beetle larvae (Epilachna varivestis) (example of vaccines in human)*

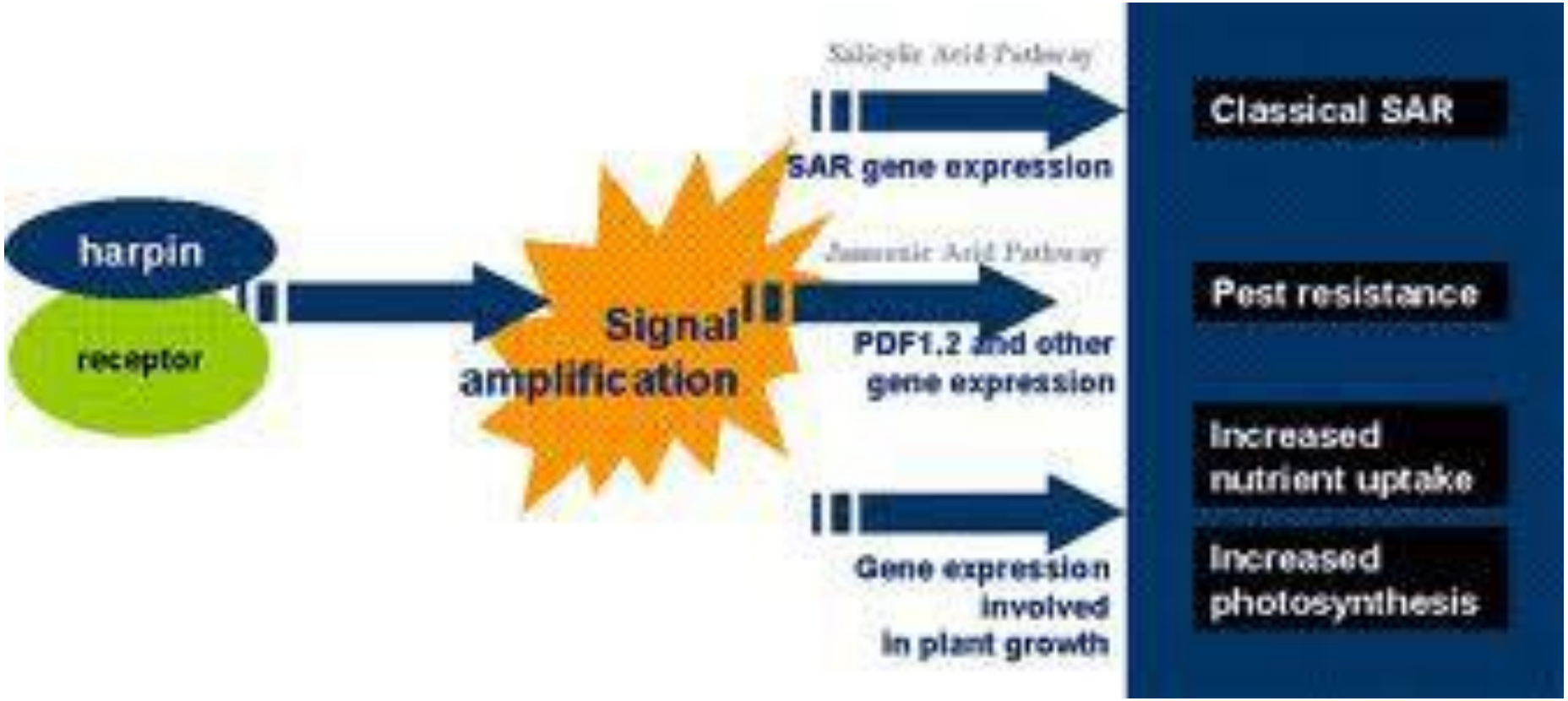
II. Development of biopesticide (Harpin)

Mode of action of Harpin



C. Host escape

1. Susceptible host plant escape pest infestation
2. Uninfested plant are not resistant


harpin
receptor
Signal amplification
Salicylic Acid Pathway
SAR gene expression
Jasmonic Acid Pathway
PDF1.2 and other gene expression
Gene expression involved in plant growth
Classical SAR
Pest resistance
Increased nutrient uptake
Increased photosynthesis

Genetic nature of Resistance

–**The type of resistance which relies on the genetic background**

- It helps to identify and recombine/incorporate resistant genes (through genetic engineering (Bt varities) or breeding)
- Resistance varieties have resistant plant genes that confer resistance to pest population
- **Gene-for-gene relationship is important**

Gene-for-gene relationship

- The gene-for-gene relationship was discovered by **Harold Henry Flor,** who was working with rust (*Melampsora lini) of flax (Linum usitatissimum).*

- Flor was the first who studied the genetics of both the host and parasite and integrated them into one genetic system.

- **Flor H.H. (1942). "Inheritance of pathogenicity in Melampsora lini". Phytopath 32: 653–669.**

- Gene-for-gene relationships studied in insects as well.
- plant and insect interaction is controlled by pairs of **matching genes.**

–One is a plant gene called the **resistance (R) gene**.

–The other is a insect gene called the **avirulent (Avr) gene.**

- So, plants producing a specific R gene product are resistant towards a insect that produces the corresponding Avr gene product.
- If insect have **virulent gene** instead of normal Avr gene, it will code for an enzyme that detoxifies the toxic protein of plant.
- This phenomenon allows the insects to attack resistant plant and over a period of time, virulent genotype will replace the avirulent genotype.
- As a result, **biotype or virulent** population of insect is produced

Biotypes

- Different populations of insect species that vary in their virulence to a plant (cultivar/variety)
- e.g., biotype have developed in Aphid, whitefly, brown planthopper on rice

- Feed on milkweed
- Milkweed contains highly toxic **cardenolides** and other substances such as **terpenoids, pregnane glucosides, alkaloids, cyclitols and flavonol glucosides,** which are all stored in pressurized latex canals
- milkweed cardenolides, are metabolized by **aldehyde reductase.**

- Finally, a single amino-acid substitution in the Na^+, K^+-ATPase of the butterfly confers insensitivity to one of the host-plant cardenolides.