Benha University
Faculty of Science
Entomology department
First semester 2019

Medical Entomology & Microbiology
Time: 2 hours
Date: 13/01/2019

## *General Entomology (3) 240E; for 2nd year students*

## AQ: First question: (24M)

**AQ (A) - Write briefly on the following (select three only)** **(16 marks)**

- **Plant bioactive specialized compounds (one example).**
  Chemical compounds produced by plants have traditionally been divided into primary and secondary metabolites. The primary metabolites are used for growth, development and reproduction. The secondary metabolites, nowadays known as bioactive specialized compounds, are on the other hand used to protect the plant against herbivory and microbial pathogen infection, to attract pollinators and seed-dispersing animals, and as agents in plant-plant competition and plant-microbe symbiosis. Bioactive specialized compounds are targeted especially against biological systems unique to herbivores, such as the nervous, digestive and endocrine organs], and are produced both constitutively and upon induction. Bioactive specialized compounds also make a major contribution to the specific odors, tastes and colors of plants. In general, bioactive specialized compounds may act as repellents for generalist insects, and as attractants for specialist insects. Toxic compounds will intoxicate generalist herbivores, while specialists are forced to invest resources in detoxification mechanisms, and their growth and development will therefore slow down. Bioactive specialized compounds are Alkaloids, Cyanogenic Glucosides, Glucosinolates Phenolics and Terpenoids.

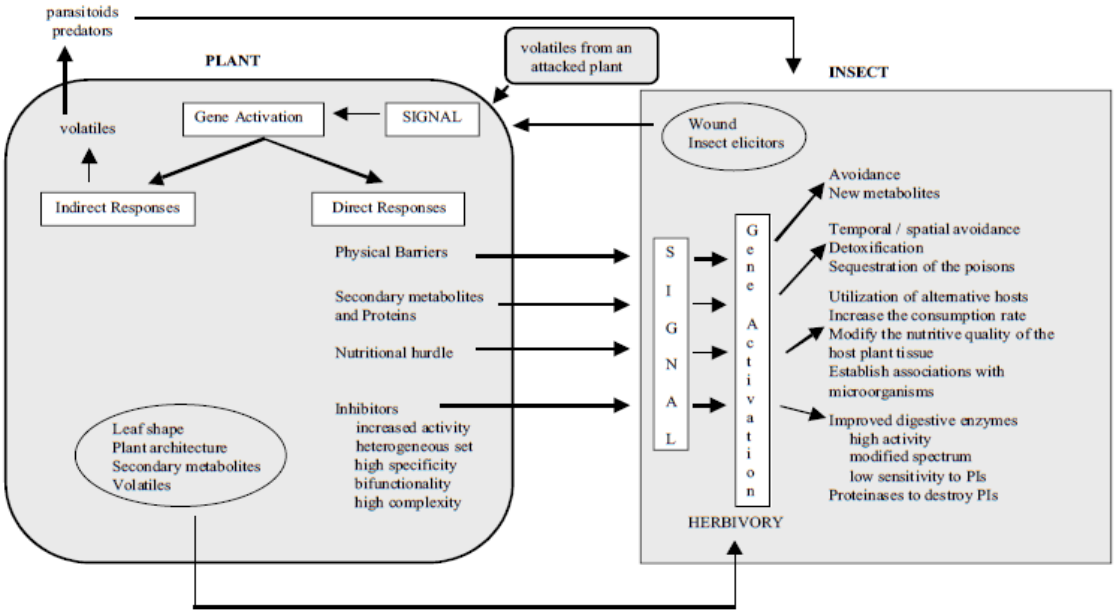
- **Characterization of antibiosis**.
  Antibiosis is an adverse effect that a plant may have on the pest because of chemicals or structures the plant possesses. Plants produce a wide variety of defensive compounds (allelochemicals) that protect them from herbivores. These compounds may react as .
  -Reduce growth - inhibit reproduction ,
  -Alter physiology - delay maturation ,
  -Results in increased mortality - reduced longevity
  - Induce various physical or behavioral abnormalities.

- **Plant trichomes**.
  Plant surfaces may further be covered by thorns and spines, for protection mainly against mammals, and trichomes (hairs) against insects. Removal of trichomes results in increased feeding and growth of herbivorous insects. Trichomes have moreover been shown to increase in number in response to insect feeding. Glandular trichomes contain glands that produce volatile or non-volatile bioactive natural products or proteins that repel, deter or poison insects. Non-glandular trichomes, on the other hand, prevent small insects from making contact with the surface, limit their movement or function as entrapment devices.
  In addition to feeding and movement impedance, trichomes can influence the attachment of insects to the leaf surface. An enhanced level of defense is achieved by those plant species or biotypes that present glandular trichomes. Broad spectrums of chemical substances have been described from glandular trichomes such as alkaloids flavonoides, triterpenesChlorosis.

- **Chlorosis.**
  Chlorosis is a condition in which leaves produce insufficient chlorophyll. As chlorophyll is responsible for the green colour of leaves, chlorotic leaves are pale, yellow, or yellow-white. The affected plant has little or no ability to manufacture carbohydrates through photosynthesis and may die Ornamental pest insects may be divided into two groups by the way they feed: (1) sucking types (scales, aphids, mealybugs, whiteflies, true bugs, thrips, and mites. (2) Chewing types (grasshoppers, beetles, sawflies, and caterpillars).

**AQ (B) - Explain the interaction between plants and insects** **(8 marks)**
**(**Select **four** elements only).

| **Plant** | **insect** |
|---|---|
| Secondary metabolites and Proteins | Detoxification |
| Physical Barriers | Avoidance New metabolites |
| increased activity | Improved digestive enzymes |
| Nutritional hurdle | Modify the nutritive quality of host plant tissue |




## AQ: Second Question: (24M)

**AQ (A) - Give the reasons (select two only):** **(8 marks)**

- **Volatiles organic compounds are considered indirect defense response.**
  Some plants characterized by enable them to withstand or recover from insect or disease damage. An example of breeding for tolerance is the development of corn plants with vigorous root systems that can compensate when they are attacked by corn rootworms
  Plants can offer predators like ants, mites and bugs small chambers in the juncture of the midrib and the vein used as nesting or refuge sites (domatia).Volatile organic compounds can be released from the plant in huge amounts when it is attacked by herbivores. Other VOCs like methyl salicylate and methyl jasmonates, monoterpenes such as limonene, linalool are usually released within 24 h after attack

- **Food bodies, nesting and refuge sites are considered tolerance forms.**

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Plants can offer predators like ants, mites and bugs small chambers in the juncture of the midrib and the vein used as nesting or refuge sites (domatia). Ant domatia are restricted to the tropics plant areas, while mite and bug leaf domatia can also be found in temperate regions. Removal of leaf domatia will reduce the amount of mites on the flower Viburnum tinus [380], while adding domatia to cotton plants will increase the numbers of trips and bugs, leading to improved plant performance.

- **Trichomes can be repel, deter or poison the insects**

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In addition to feeding and movement impedance, trichomes can influence the attachment of insects to the leaf surface. An enhanced level of defense is achieved by those plant species or biotypes that present glandular trichomes. Broad spectrums of chemical substances have been described from glandular trichomes such as alkaloids flavonoides, triterpenes

**AQ (B) - Compare between the following with examples: (8 marks)**

| **Direct damage** | **Indirect plant damage** |
|---|---|
| Direct damage occurs when the insect pest causes visible harm to the host organism. There are different degrees of damage in this category. The most serious type of direct damage is when the part to be harvested is damaged by the insect pest. For example, a single codling Moth caterpillar can ruin a large apple | Insect acts as a vector for a parasite or pathogen. mechanical transmission; typically the insect picks up the parasite on its body surface while feeding on the host organism and it may either deposit the parasite on to a new host body or else may contaminate the food which will later be eaten by the host. Many insect pests are fluid feeders and these can mechanically transmit pathogens and parasites by contamination of the proboscis. In agriculture almost all virus diseases are spread by feeding insects-aphids |
| **Alkaloids** | **Terpenoids** |
| - The true alkaloids are biosynthesized from amino acids in the roots and accumulated above ground.<br>- found in the Leguminosae spp. (legumes), Liliaceae spp. (lilies), Solanaceae spp.<br>- They are well known for their metabolic effects in mammals, e.g., caffeine, nicotine and cocaine, and have probably evolved as defense against insect herbivory.<br>- They reach the often alkaline digestive tracts of some insect | - biosynthesized from acetyl-CoA or glycolytic intermediates<br>- They are classified by the number of isoprene units or five-carbon elements (CH3–CH2–CH–(H3C)2);<br>- volatile monoterpenes and sesquiterpenes called essential oils, with well-known repellent and toxic effects on insects<br>- Many of them play a role in plant defense, both as components in resin or as volatiles, acting as antifeedants, repellents, toxins or as modifiers of insect development |

| | |
|---|---|
| herbivores, they are quickly reduced and forms toxic, | |
| **Repellents** | **Deterrents** |
| Repellents are plant defense compounds that prevent or reduce contact between the insect and the substrate. i.e plant volatile that are specific to their host plant. | Deterrents Alleleochemical compounds such as alkaloids, fLavonoids, terpene, lactones and phenols that prevents insects form eating or plant injuring. |

**AQ (C) - Put the sign ( ✓ ) or (X) <u>with correct</u> in front of each of the following statements (8 Marks)**

| | The Statements | |
|---|---|---|
| 1 | **Extrafloral Nectar** are released from plant flowers, vegetative parts and roots | **X (Volatile OC)** |
| 2 | Botanical insecticides considered an antixenosis | **X (antibiosis)** |
| 3 | bioactive specialized compounds referred to **plant primary** metabolites | **X (Secondary)** |
| 4 | The release of hydrogen cyanide (HCN) in plants may also damage the plant itself | ✓ |
| 5 | Latex and resins are plant products stored under internal pressure | ✓ |
| 6 | Volatile organic compounds (VOC) attract pollinators and predators or repel herbivores as well as in communication between or within plants | ✓ |
| 7 | Deterrents are unpalatable food like alkaloids, flavonoids, terpenes, lactones and phenols | ✓ |
| 8 | Trichomes can be considered as antixenosis and antibiosis | ✓ |
| 9 | Chitinases inhibit the absorption of nutrients when contact with the glycoproteins lining the intestinal area of insect herbivores | **X (lectins)** |
| 10 | Caffeine, morphine and atrophine are defense alkaloids compounds | ✓ |

***With best wishes***
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***Dr/ Hesham Abd El Halim***