Benha University
Faculty of Science
Entomology department
First semester 2016/2017
**2nd and 4th level students**

Botany & Chemistry
Time: 2 hours
Date: 28/12/2016

## *General Entomology (3) 240E*

## Answer questions:

**AQ1- Give the reasons (select two only): (10 marks)**

- **Waxes and Crystals, Nesting and Refuge Sites considered an Indirect Defense Response.**
  Epicuticular waxes form films and crystals that cover the cuticle of most vascular plants. Aside from their role in desiccation tolerance and protection against pathogens, they also increase the slipperiness, which hinder non-specialized insects from populating the leaf surfaces. Recently, it was shown that oviposition of *P. brassicae* on *A. thaliana* induce changes in the wax composition, increasing the amount of fatty acid tetratriacontanoic acid (C34), while decreasing the amount of tetracosanoic acid. 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, 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, while adding domatia to cotton plants will increase the numbers of trips and bugs, leading to improved plant performance. In a similar way to the FBs, domatia is inducible by ants.

- **Volatiles considered an Indirect Defense Response.**
  More than 1000 volatile organic compounds (VOCs), primarily consisting of 6-carbon aldehydes، alcohols, esters and various terpenoids are released from plant flowers, vegetative parts or roots. VOCs are used to attract pollinators and predators or repel herbivores as well as in communication between or within plants. Furthermore, VOCs have been shown to 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. Studies have shown that predators associate VOCs, especially terpenoids, with the presence of prey

- **Herbivorous Insect Generalists are poorly succeeded on plants unlike Specialist Insects.**
  Herbivorous insects can be divided into generalists and specialists according to their lifestyles. Specialization is defined by the number of host species; the more plant species an insect eats on. Specialists' survival is constrained by the presence of their specific host plant. Specialists can evolve adaptations such as the detoxification or the sequestration of poisons. Coevolution with specialists can create counter-adaptations in the form of insect-specific defense responses

**AQ2- Mention the relation between the plants and insects** **(8 marks)**

(From Schematic table give four interaction elements between plants and insects)

| **Plant** | **insect** |
|---|---|
| Physical Barriers | Avoidance New metabolites |
| Secondary metabolites and Proteins | Detoxification |
| volatiles | Increase the consumption rate |
| Nutritional hurdle | Modify the nutritive quality of host plant tissue |

**AQ3- Write briefly on the following (select two only)** **(10 marks)**

- **Proteinase Inhibitors**

  Four different classes of endopeptidases or proteinases, found in the midgut region of the insect digestive tract, are used by insect herbivores to cleave internal peptide bonds in plant proteins. The most common are the serine proteases, which are found in Coleoptera, Lepidoptera and Orthoptera, which all have neutral or alkaline pH in their midgut lumen content. Plants have inhibitors for all four classes of proteinases, which can delay larval development without directly causing mortality [286]. They are supposed to inhibit the proteolytic activity of midgut enzymes and thereby decrease the availability of amino acids.

- **Alkaloids**

  The widely distributed bioactive natural products alkaloids are prevalently found in the Leguminosae spp. (legumes), Liliaceae spp. (lilies), Solanaceae spp. (nightshade plants) and Amaryllidaceae sp. (Amaryllis). 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. The true alkaloids are biosynthesized from amino acids in the roots and accumulated above ground. They reach the often alkaline digestive tracts of some insect herbivores, they are quickly reduced and forms toxic, uncharged, hydrophobic tertiary alkaloids, which can easily pass through membranes.

- **Cyanogenic Glucosides**

  The cyanogenic glucosides (CNglcs), are found in more than 2600 species from more than 550 genera and 150 families, covering all vascular plant classes including angiosperms, both monocotyledons and dicotyledons. CNglcs are amino acid derived glucosides, originating from aromatic or branched-chain amino acids, such as tyrosine. In intact plant tissues, the CNglcs are stored in the vacuole. When the plant tissue is fragmented, for instance due to feeding, the CNglcs are exposed to β-glucosidases located in either the plastids or the apoplast, which leads to hydrolysis and the formation of a sugar and a cyanohydrin that spontaneously decomposes into toxic hydrogen cyanide (HCN) and a ketone or aldehyde.

**AQ4- Complete the following:** **(10 marks)**

**a**. Bioactive specialized compounds are targeted especially against biological systems unique to herbivores, such as **the nervous, digestive and endocrine** organs.

**b**. In general, bioactive specialized compounds may act as **repellents** for generalist insects and as **attractants** for specialist insects.

**c**. The true alkaloids are biosynthesized from amino acids in the roots and accumulated above ground such as **caffeine** and **solanidine**, **morphine** and **atrophine**.

**d**. When lectins come into contact with the glycoproteins lining the intestinal area of insect herbivores, they inhibit the **absorption of nutrients**

**e**. Trichomes can be divided into two distinct categories, **glandu1ar** and **non-glandular**.

**AQ5. Put the sign ✓ or X in front of each of the following statements (10 Marks)**

| The Statements | |
|---|---|
| Volatile organic compounds are released from plant flowers, vegetative parts or roots | ✓ |
| Type of Plant trichomes, leaf hooked hairs immobilized and starved bedbugs to death | ✓ |
| bioactive specialized compounds referred to plant secondary metabolites | ✓ |
| The release of hydrogen cyanide (HCN) in plants may also damage the plant itself | ✓ |
| Latex and resins are stored under internal pressure | ✓ |
| Most galls are caused by mites and insects | ✓ |
| Trichomes can be considered as antixenosis and antibiosis | ✓ |
| Volatile organic compounds is secreted on leaves and shoots to attract predators and parasitoids | x |
| Extrafloral nectar (EFN) attract pollinators and predators or repel herbivores as well as in communication between or within plants | x |
| Plant galls are formed from abnormal vegetative growth produced by a plant under the influence of an insect only. | x |

***With best wishes***
***Dr/ Mohamed M. Baz***