

÷ INSECTS BENEFITS AND HARMS

511 Zoo
Second lecture
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Beneficial aspects of insects

1- Pollination



Pollination is the transport of pollen from the anthers (male part) of one flower to the stigmata (female part) of another plant of the same species.

- More than 65% of flowering plants are pollinated by animals, such as insects, snails and bats, but insects play a dominant role.
- Coleoptera, Hymenoptera, Lepidoptera, and Diptera are the major insect orders involved.
- Baker (1968) and Crane *et al.* (1995) indicated that most primitive angiosperms were pollinated by insects, especially beetles.



- Plant adaptations that ensure or increase the efficiency of insect pollination
- Four major categories include:
 - 1- Those that attract the insect to the flower so that pollen will be encountered.
 - Petal colors of **yellow**, **blue**, **blue-green**, **purple**, or those that reflect or absorb high amounts of UV light are attractive. Flowers that appear one color to humans may actually appear different colors to insects because they can see different wave length.
 - Nectar guides, pigmentation arranged near the center of the flower, are often vital in bee-pollinated flowers.
 - Flowers odor either resembles decaying meat or releasing strong perfumes.

- 2- Plants that have sticky pollen or pollen pockets to adhere to the insect body. Where pollens are transported from flower to another with maximal efficiency and minimal loss.
- 3- Insects that have long proboscis, such as Lepidoptera and bees can feed on plants that reward the insect with either pollen or nectar. Because nectar is located deep within the flower. However, some plants are pollinated by insects that receive no nectar or pollen rewards. These flowers mimic carrion oviposition sites sufficiently that eggs may actually be deposited in the flowers.
- 4- Plant diversity factor. The more abundant the species of flower in localized areas, the more likely the pollinator will visit and specialize on this plant.

Insect efficiency in utilizing flowers

- May be both **structural** and **behavioral**.
- **First** the seeking **behavior** must occur during periods when flowering and nectar flow occur. For generalized feeders, such as bumblebees and many beetles, this may involve activity during several hours of most days, but for the more specialized insects, this also involves having life cycles synchronized (matched) with the plant.

➤ Many insect pollinated plants are important supplements and luxury foods to both human and livestock, including beans, peas, tomatoes many fruits, cotton, tea, peppers, lettuce, melons, many nuts, onions, garlic, carrots and coca.



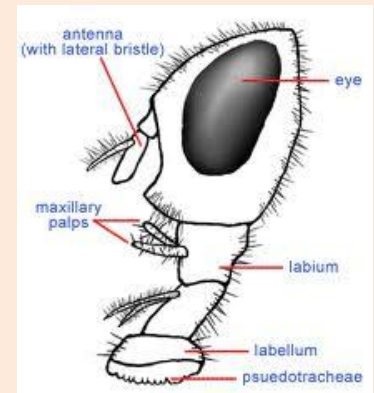
➤ The honeybee is of prime importance as crop pollinators. In the US, farmers pay hive owners to bring in these bees to pollinate their crop.



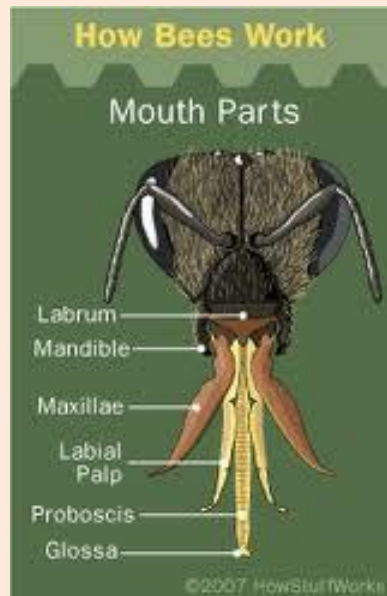
➤ **Second**, Pollen and/ or nectar must be collected and ingested efficiently. Bees illustrate high degree of specialization. As honeybees move about the flower, pollen is picked up by body hair, then the pollen is brushed off by their legs into pollen basket on their hind legs (**structural**).



- Beetles are attracted mainly by odors to flowers that are dull in color and often lacking in nectar.
- Short-tongued (sponging mouthparts) flies are attracted to flowers in which nectar volume is low or absent, and food consists mainly of pollen and extrafloral nutrients.



- Bees and long-tongued flies are attracted to brightly colored flowers where both nectar and pollen are abundant.



2- Trashburners and Soil Builders

- **Trashburner** indicate organisms involved in degradation and recycling dead plants and animals.
- The most common decomposers are the bacteria and fungi; however, many insects feed directly on and burrow into both plant and animal dead bodies.
- The insects not only directly assist in the recycling but also break the outer barriers of the dead bodies and enhance invasion by bacteria and fungi.

- Many kinds of insects of orders Diptera (flies) and Coleoptera (beetles) are attracted to dead bodies (Kim et al., 2014).
- Recently different insect species have been associated with criminal investigation to help investigators in determining postmortem interval (PMI) (Byrd and Castner, 2009)
- Larvae of some insects such as Diptera and Coleoptera recycle feces through burrowing and feeding. In some instances involving dung beetles, the feces are formed into balls and are rolled to suitable sites.



- **Soil building** :Is closely related to decomposition.
- It is the breakdown of plant and animal remains and the mixing of this material with soil.
- **Example :Termites** assume the role of recycling woody material and enriching the arid clay soil with calcium, magnesium and potassium.



3- Insect products

1- Silk

- commercial silk is a product of the **silk worm caterpillar** (Lepidoptera)



2- Honey

- A product of honey bees, represents concentrated and partly hydrolyzed nectar. The principle sugar in nectar is sucrose, which is broken into glucose and fructose by salivary enzymes as the bee returns to the hive. This fluid is regurgitated from the crop into comb cells where the solution is concentrated by bees fanning their wings and evaporating water from the mixture.

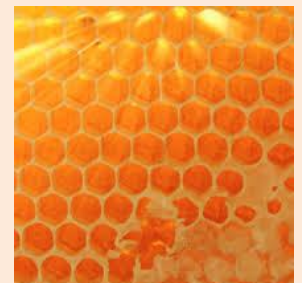


Once the mixture is concentrated to approximately 80% sugar, the cells are sealed with wax for further use by the bees, although human usually intervene at this stage and reap the rewards.



3- Beeswax

- Honeybees produce beeswax to build their combs. Honeybee workers produce this wax by specialized hypodermal glands on the fourth to seventh abdominal segments.
- Beeswax is utilized in many products form smokeless candles to cosmetics.





4- Other substance

- such as royal jelly (from honeybee), cantharidin (from certain beetles) and cochineal dye (from certain bugs).



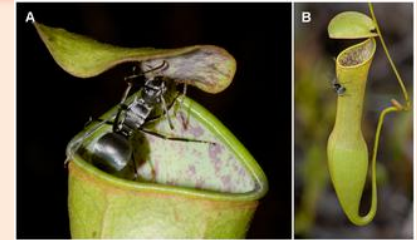
4-Insects as Food

- Insects are important components in the diet of birds, comprising 50-60% of their food.
- Mammals also include insects in their diets. Some animals are occasional consumers, such as bears, whereas others, including mole, bats have become nearly specific insect feeders.
- Insects are also a good source of food for humans. Many areas of the world have 5-40% of their protein from insect sources.



5– Control of other organisms

- Plants can also capture insect as for food. The pitcher plants form a hollow chamber between their leaves to capture insects lured to the plant by its flowers and the pitcher itself.
- Fifteen of the 26 orders of insects have species that naturally parasitize or prey on other organisms. Hymenoptera and Diptera contain the greatest number of such species.
- The use of these insects, as well as the use of other organisms, in management programs, is termed biological control.



6– Science and Medicine

- Until recently the use of insects for scientific experiments has not been widespread because of their small size and attendant requirement for delicate and precise instrumentation.
- Genetics has been a discipline in which some species have been used extensively such as fruit fly species (*Drosophila*). Much of our current knowledge of human mutations, sex-linked inheritance and other classical genetic studies was obtained from experiments with these flies.



- Environmental quality (Indicator of pollution) often can be monitored to a degree through observing insects, particularly the aquatic insects.
- Engineers are using data obtained from insect structure in developing robots.
- Insect - purified antimicrobial peptides (from different insect body components) , are nowadays investigated against a diversity of microorganisms as alternate candidate to the developing resistance towards conventional antibiotics.

- Insects are used to reveal information in forensic studies through determining the waves of insect infestations of the corpse. The insects and their developmental stages aid investigators in determining time of death and other vital interferences.
- Scientific community will continue to run to insects as experimental animals because of their rapid life cycle, relative structural and behavioral simplicity, low cost of rearing and diversity.
- Over years, insects have been used in treating patients having gangrene. This was discovered during World War 2 when maggot infested wounds often healed better than those receiving medical aid.

7- Aesthetics and Religion

- Many of arthropods are of considerable aesthetic, cultural and religious value.
- Many jewelry and religious artifacts contained insects.
- Insects are referred to in written word of the Muslims Quran
- Insects have had songs and literature written about them.





➤ Many flower gardens exist throughout the United States designed to be attractive to butterflies. Where gardeners and others enjoy the color of both the flowers and insect throughout the summer.



Harmful Aspects

1- Human Diseases transmission

- Insects serve as vectors (carriers) of the major human diseases
- 25% of all European in 1348 dead because of plague.
- Some insect-transmitted diseases: malaria, dengue, yellow fever, leishmaniasis, etc..

2-Sting, Bites and Allergies

- People generally perceive insects as annoying creatures and invaders of human privacy and property.
- Children are learned to avoid insects and other arthropods
- Insects, however, can be more than simply annoying as they protectively use their stings and mouthparts.
- About 30% of people stung by hymenopterous insects develop at least a transitory sensitivity to the inserted venom, and about 3% suffer serious reaction.

- Social wasps, fire ants and honeybees pose the greatest threat. Some people may die because of their bites.
- In addition to stings by Hymenoptera, the following insects commonly bite humans: Diptera (mosquitoes, black flies, stable flies, horse flies, deer flies, tsetse flies and sand flies), Hemiptera (bedbugs, assassin bugs, backswimmers, giant water bugs), Siphonaptera (fleas) and Anoplura (sucking lice).

- In addition to stings and bites, numerous other allergic responses also have been reported. These include some respiratory reactions as asthma.



3- Entomophobia

- Insects, spiders and various other arthropods frequently induce annoyance and worry that may lead to a nervous disorder.



4- The effect of insects on Livestock and Domestic Animals

- Insects are frequent parasites of domestic animals.
- Some species feed on domestic animals only as adults, such as biting flies, while others spend only a developmental stage on or within the animal host, usually as larvae such as bot flies.
- In addition to livestock losses caused by insect feeding, insects also inflict damage by pathogen transmission.

- Insects can transmit various pathogen to livestock including virus, unicellular parasites and parasitic worms.
- Many livestock diseases are carried by insect vectors such as nagana, equine encephalitis.
- Also the ingestion of certain toxic insects can injure livestock and domestic animals.

5-The harmful effects of insects on plants

- Some insects are plant pollinators.
- Sometimes this relationship is harmful, for examples some insects use plant as food so they destroy many plants.
- Excluding pollen and nectar, as estimated 50% of all insects feed on plants, either by chewing or by sucking sap or lysed tissue these insects are known as phytophagous insects. Some insects feed on specific plants, while other feed on a wide variety of plants.
- If feeding is extensive, the plant may die, but most healthy plants can withstand insects infestation under normal condition.

- Damage to the plants may come from causes other than insect feeding. Insects may carry plant diseases, primarily viral and microplasmal diseases. Many plant viruses are known to be transmitted by insects, species of Homoptera as vector; aphids alone transmit more than 275 of these viruses. Beetles are also of the most common disease vector of plant viruses.
- Damage to stored foodstuffs by direct feeding of insects or by contamination may be great.
- Books may be damaged by a variety of insect pests, including termites, book lice and Thysanura; termites feed mainly on the paper, and book lice and Thysanura prefer the glue and bindings.



Homework???

Describe the structure of
honeybee sting....



ANY
questions?

A person's hands are visible holding a small, square chalkboard with a light-colored wooden frame. The chalkboard has a black surface with the words "ANY" and "questions?" written in white chalk. The background is a plain, light-colored wall.