

Lecture (2)

÷ INSECTS BENEFITS AND HARMS



Beneficial aspects of insects

Pollination

Aesthetics and Religion

Trash burners and Soil Builders

Science and Medicine

Insect products

Control of other organisms

Insects as Food

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.**



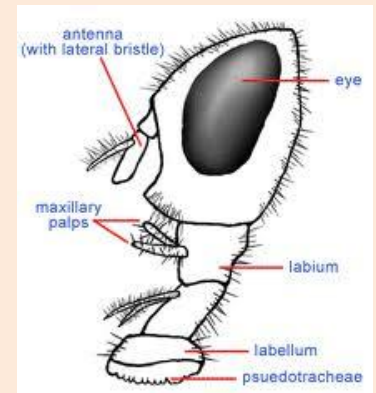
➤ **Second**, Pollen and/ or nectar must be collected and ingested efficiently. Bees illustrate high degree of specialization. As honeybees move about the flower, pollen is picked up by body hair, then the pollen is brushed off by their legs into pollen basket on their hind legs (structural).



- **Beetles are attracted mainly by odors to flowers that are dull in color and often lacking in nectar.**

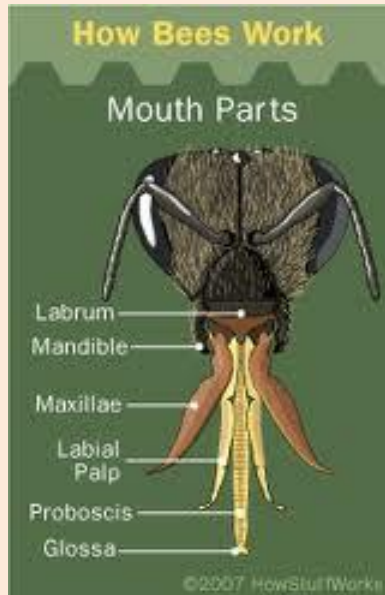


- **Short-tongued (sponging mouthparts) flies are attracted to flowers in which nectar volume is low or absent, and food consists mainly of pollen and extrafloral nutrients.**





- **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.

Degradation

Most common decomposers are bacteria and fungi; however, many insects feed directly on and burrow into both plant and animal dead bodies

Insects not only directly assist in recycling but break outer barriers of dead bodies and enhance invasion by bacteria and fungi



Recycling

Larvae of some insects recycle feces through burrowing and feeding. In some instances involving dung beetles, feces are formed into balls and are rolled to suitable sites



- **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)**



➤ **Soil building** :Is closely related to decomposition. It is the breakdown of plant and animal remains and 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.





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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.
- 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.



5- Control of other organisms

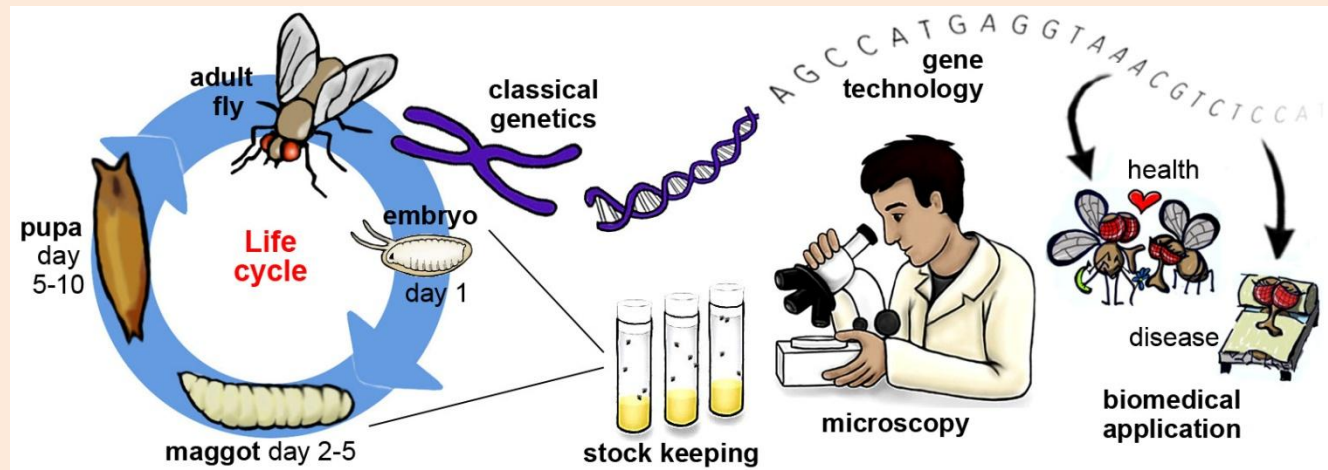
- Fifteen of the 26 orders of insects have species that naturally parasitize or prey on other organisms. Hymenoptera and Diptera contain the greatest number of such species.
- The use of these insects, as well as the use of other organisms, in management programs, is termed **biological control**.



6- Science and Medicine

Uses in Science:

- Much of our current knowledge of **human mutations**, **sex-linked inheritance** and other **classical genetic studies** was obtained from experiments with flies such as fruit fly species (*Drosophila*).
- 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.



- **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 coast of rearing and diversity.**



➤ **Uses in Medicine:**

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.

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

**Human Diseases
transmission**

Entomophobia

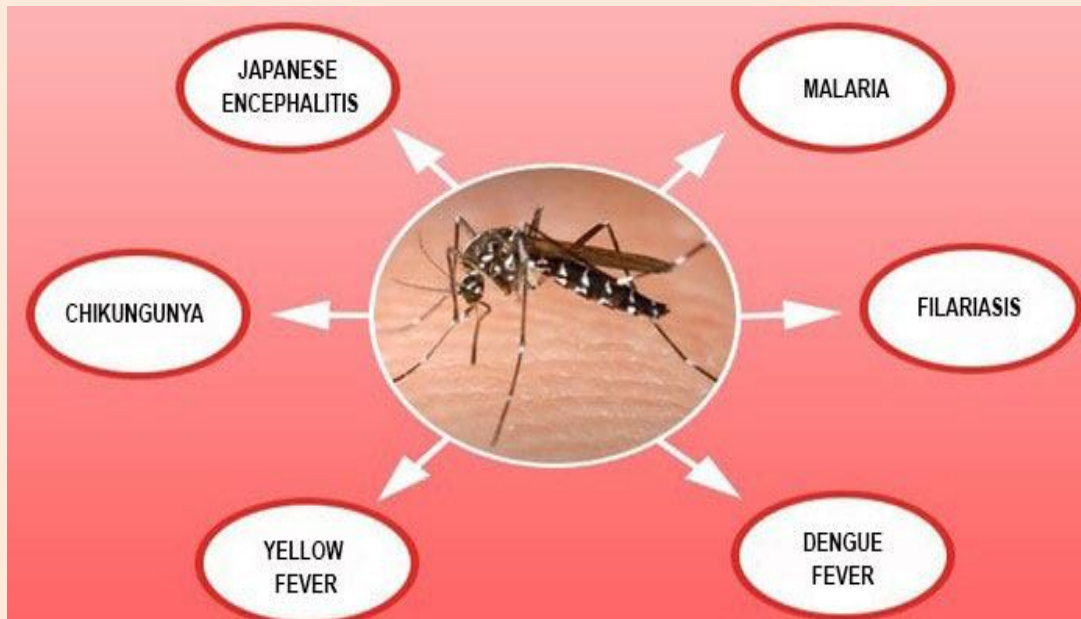
**Effect of insects on Livestock and
Domestic Animals**

Effects of insects on plants

Sting, Bites and Allergies

1- Human Diseases transmission

Examples of insect-transmitted diseases

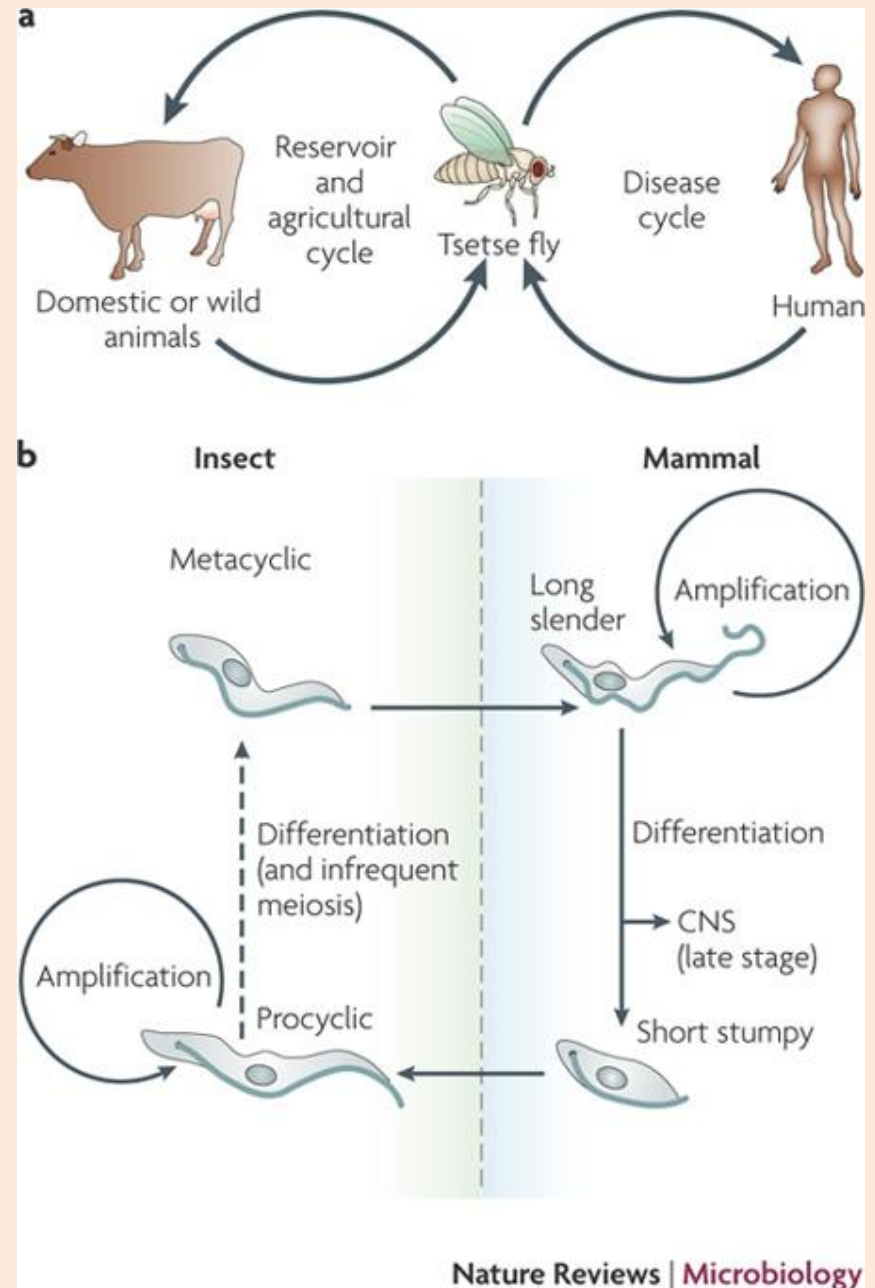


4- The effect of insects on Livestock and Domestic Animals

- **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.



2-Sting, Bites and Allergies

- People generally perceive insects as annoying creatures and invaders of human privacy and property.
- 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.



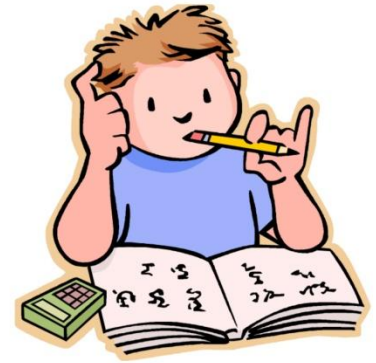
5-The harmful effects of insects on plants

Some insects are plant pollinators. Sometimes this relationship is harmful, for examples some insects use **plant as food so they destroy many plants.**

Damage to the plants may come from causes other than insect feeding. Insects may carry **plant diseases**, primarily viral and micro-plasmal 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.....

A person's hands are visible on the left and right sides, holding a small, square, light-colored wooden-framed chalkboard. The chalkboard has a black surface with the words "ANY" and "questions?" written in white chalk. "ANY" is in all caps and a slightly larger font, while "questions?" is in a smaller font and lowercase. The background is a plain, light-colored wall.

ANY
questions?