

Medical Entomology Lecture 1 Third Year Students Department of Biology College of Education Salahaddin University - Erbil Second semester 2024

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Definitions

Entomology: It is a science that deals with the study of insects in general

What are the main branches of entomology?

The branches of Entomology include : Insect Ecology, Insect Morphology, Insect Pathology, Insect Physiology, Insect Taxonomy, Insect Toxicology, medical and veterinary entomology

- Medical entomology: Branch of entomology which deals with insects which affect the health and well-being of man and vertebrate animals.
- Medical entomology is the science that studies insects and other arthropods that have health interests due to their pathogen role or vector.

TYPES OF PROBLEMS CAUSED BY insects

ANNOYANCE

ENVENOMATION

ALLERGIC REACTIONS INVASION OF HOST TISSUES

INSECTS-BORNE DISEASES FOOD CONTAMINANTS FEAR OF INSECTS DELUSORY PARASITOSIS TOXINS AND VENOMS

Insects of Medical Importance

- 1-Directly cause damage to human tissue
- 2-Act as Vectors for disease-causing organisms
- 3- serve as intermediate host for some diseases
- 4- Provide useful medical services/drugs
- 5-Are useful model systems in genetic Studies

Stinging Insects

- Belong to the order Hymenoptera, Includes Paper wasps, Yellow Jackets, Honey bees and Fire Ants

 Have specialized venom glands attached to "sting"





120 micron

Envenomation Symptoms

- Allergic reactions
- Happen on the second (or later) sting
- Antibodies to venom over-react and produce chemicals (like histamines) that can damage neighboring cells.
 Severe allergies can lead to anaphylactic حساسيه shock, a potentially deadly swelling of the airways and other tissues.
- -If you've been allergic once, you've got a 60% chance of being even more allergic next time.

Biting Insects

-Saliva from several biting insects acts as an allergen in many people

- This can lead to intense itching حکه when bites

are numerous:





Insects As Vectors

-Several Biting Flies and Reduviid Bugs carry infective stages of disease causing pathogens. They are responsible for spreading diseases like:

- Malaria (Mosquitoes in genus Anopholes)
- Plague (Rodent Fleas)
- West Nile Virus (Mosquitoes)
- Typhoid/Cholera/Dysentary (Muscid Flies)

Malaria

-Caused by 4 species of protists in the genus plasmodium

- Anopholes sp. Mosquitoes transmit the infective stage of malaria

Active Plasmodium destroy large quantities of red cell

- There are 300-500 million infections/yr world wide , with 1 million death

Trypanasomiasis (Sleeping Sickness)

Caused by (*Trypanosoma brucei*) two subspecies <u>*Trypanosoma*</u> <u>brucei gambiense</u>) *Trypanosoma brucei rhodesiense*) and, *Trypanosoma* cruzi.)

Carried from host to host blood-sucking tsetse flies Trypanosome infection is characterized by a series of progressive symptoms:

- Swelling at bite
- Immune reaction (swelling of lymph nodes, etc)
- Infection and swelling of CNS
- Possible heart failure

These flies are found throughout middle Africa, where the disease affects 66 million people in 36 countries

Pharmaceutically Important Insects

Venom is extracted from insects that sting in order to test people for allergies and to treat allergies in a series of small injections.

Apitherapy



Many people with MS use bee venom instead of drugs (CNN) One of the major peptides in bee venom, called Melittin, is used to treat inflammation in sufferers of Rheumatoid Arthritis and Multiple Sclerosis.

Melittin blocks the

expression of inflammatory genes, thus reducing swelling and pain.

 It is administered by direct insect sting, or intramuscular injections.

Maggot Debridement Therapy

- Recognized as useful by WWI surgeons
 Used for
 - v removing dead tissue from wound
 - v Preventing infection
 - v Speeding healing process



 An extract, Allontoin, is used for treating the infectious bone disease, Osteomyelitis

"Beetle Juice" Therapies



Cantharidin – the blistercausing oil found in several families of beetles (most notably, Meloidae)

- Mistorical use by Greeks and Romans
- v Aphrodisiac????
- Currently accepted by FDA in 2004 for treatment of warts and other skin problems





In East Africa, army ants are used as "Natural Sutures." These ants jaws are so powerful that the natives use them to staple wounds together by forcing them to bite them and then break off their body.

large **army ants** which are typically found in central and eastern Africa, but sometimes can be found in Asia. Because of their strong jaws, they are used as emergency sutures, when nothing else is available. Often times, the smaller villages found in the Congo and around Africa will use them since band-aids aren't necessarily available.

Insect Genetics





The Drosophila Genome



What Can We Learn From a Fly?

v How genes work

- By using mutation studies and gene mapping:
- v Organization/Location
- v What genes code for which proteins
- v Development



- v Which cells become what body part, when and HOW!
- Proteins, enzymes, and neurotransmitters involved.

The transmission of pathogens by insect may be **vertical** or **horizontal**.

Vertical transmission is the passage of parasites directly to subsequent life stages or generations within vector populations.

Horizontal transmission describes the passage of parasites between vector and vertebrate hosts.



Three types of vertical transmission are possible within vector populations:

transstadial,

transgenerational, and

venereal transmission.

Transstadial transmission

is the sequential passage of parasites acquired during one life stage or stadium through the molt to the next stage(s) or stadium.

Transstadial transmission is essential for the survival of parasites transmitted by mites and hard ticks that blood feed once during each life stage and die after oviposition.

Transgenerational transmission

- *is defined as the vertical* passage of parasites by an infected parent to its offspring.
- Some parasites may be maintained
- transgenerationally for multiple generations, whereas others require horizontal transmission for amplification.
- Transgenerational transmission normally occurs *transovarially (through the* ovary) after the parasites infect the ovarian germinal tissue.

Venereal transmission is the passage of parasites between male and female vectors and is relatively rare.

There are many types of horizontal transmission, depending upon the role of the arthropod in the life cycle of the parasite:

mechanical, biological (multiplicative, developmental, and cyclodevelopmental).

Rather than the direct contact from man to man

Horizontal vs Vertical Transmission



Mechanical transmission occurs when the parasite is transmitted among vertebrate hosts without amplification or development within the vector, usually by contaminated mouthparts. Arthropods that are associated intimately with their vertebrate hosts and feed at frequent intervals have a greater probability of transmitting parasites mechanically.

