

MEDICAL ENTOMOLOGY

Definition

Study of arthropods of medical importance .

It is an important branch of preventive medicine.

Class :
Insecta

Class :
Arachnida

Class :
Crustacea

1. Mosquitoes :
Anophelines
Culicines

2. Flies :
Houseflies
Sandflies
Tsetse flies
Blackflies

3. Human Lice :
Head and body
lice; Crab lice

4. Fleas :
Rat fleas
Sand fleas

5. Reduviid bugs

1. Ticks :
Hard ticks
Soft ticks

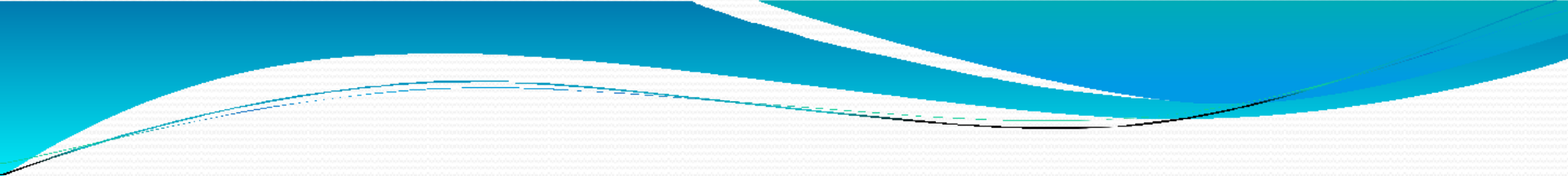
2. Mites (Chiggers) :
Leptotrombidium
and trombiculid
mites;
Itch mite

1. Cyclops

TABLE 2

Distinctive characters of arthropods of medical importance

| | Insecta | Arachnida | Crustacea |
|-------------------|---|--|------------------------------|
| 1. Body divisions | Head. thorax abdomen | Cephalothorax and abdomen (no division) in some cases | Cephalothorax and abdomen |
| 2. Legs | 3 pairs | 4 pairs | 5 pairs |
| 3. Antennae | 1 pair | None | 2 pairs |
| 4. Wings | One or two pairs; some are wingless | None | None |
| 5. Where found | On land | On land | In water |



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graph TD; A[TRANSMISSION OF ARTHROPOD BORNE DISEASES] --> B[DIRECT CONTACT]; A --> C[MECHANICAL TRANSMISSION]; A --> D[BIOLOGICAL TRANSMISSION]
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TRANSMISSION OF ARTHROPOD BORNE DISEASES

DIRECT
CONTACT

MECHANICAL
TRANSMISSION

BIOLOGICAL
TRANSMISSION

- **Direct contact** – directly transferred from man to man through close contact
eg. Scabies & pediculosis
- **Mechanical transmission**- transmitted mechanically by vectors
eg – diarrhoea, dysentery etc
- **Biological transmission**- disease agent undergoes developmental changes with or without multiplication in vectors



3 types of biological transmission

I. Propagative

only multiplication NO cyclical change

eg -plague bacilli in rat flea

ii. Cyclo-developmental

only cyclical changes NO multiplication

eg- Filarial parasite in culex mosquito,

iii. Cyclo-propagative

BOTH multiplication n cyclical changes

eg- malarial parasite in anopheles mosquito

MOSQUITO

- 4 imp groups of mosquito in India
 1. *Anopheles*
 2. *Culex*
 3. *Aedes*
 4. *Mansonia*

The adult mosquitoes



Culex



Anopheles



Aedes



Mansonia

- Body consists of 3 parts

A. HEAD- i. A pair of large compound eyes

ii. A long proboscis with which mosquito bites

iii. A pair of palpi on either sides of proboscis

iv. A pair of antennae [male-bushy. Female- less bushy]

A. THORAX- i. A pair of wings dorsally

ii. Three pairs of legs ventrally

B. ABDOMEN- ten segments [last 2 modified to form external genitalia]

- **ANOPHELES**

Species

An. culicifacies (cause **RURAL** MALARIA)

An. (found in **FOREST & FRINGES**)

fluviatilis (cause **URBAN** MALARIA)

An. stephensi (found in North east states)

An. diriusimus etc

Diseases- malaria

filaria[outside India]

➤ Sits at **45 degree**

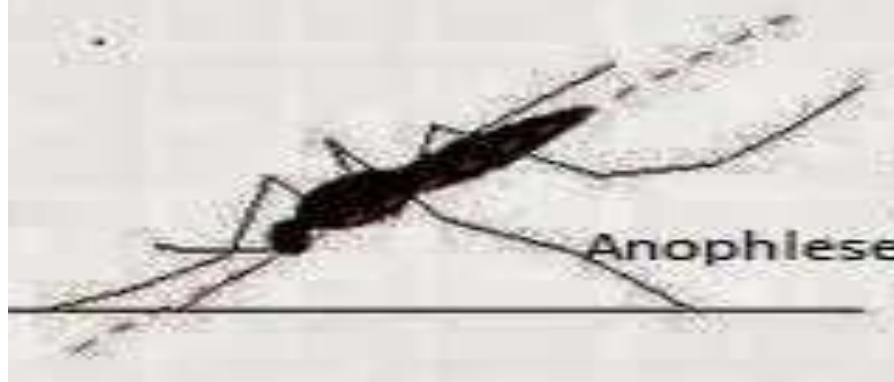
➤ **FRESH WATER** breeding



Profwaqarhussain.blogspot.com



Culex/Aedes



Anopheles

- **CULEX** (nuisance mosquito)

species -

Culex fatigans (*C. quinquefasciatus*)

Diseases-

- . Bancroftian filariasis
- . JE
- . West Nile fever

- Rapid urbanization and industrialization without adequate drainage are responsible for its spread
- Breeds in **dirty water** collection
- Flight range – **11kms**
- **HUNCHBACK** appearance



CULEX MOSQUITO

Culex

Identification features

- When at rest, the body exhibits **hunch back** (i.e. the thorax makes an angle with the abdomen)
- Wings unspotted
- Buzzing noise produce by beating of wings,



- **AEDES**

White stripes on black body – so also known as **Tiger mosquito**.

Species

- . *Aedes aegypti*
- . *Aedes vittatus*
- . *Aedes albopictus*

Diseases

Dengue

DHF

Yellow fever

Filariasis outside India



- ✓ Abundant during rainy season
- ✓ breeds in **artificial accumulation** of water eg . Tin ,broken bottles etc
- ✓ Lays eggs **singly CIGAR** shaped
- ✓ Bites during **daytime**
- ✓ Flight range **100meter**
- ✓ **Aedes aegypti INDEX**- % House showing showing breeding of Aedes larva
 - upto **400m** area around port
 - should be **less than 1%**



- **FEEDING HABIT**

female – Hematophagous(require blood meal)

male – plant juice (never bite)

- **TIME OF BITING**

mostly evening or early part of night

- **RESTING HABIT**

rest during day in dark and cool corners

- **BREEDING HABIT**

Anopheles – clean water

Culex- dirty polluted water

Aedes- artificial water collection

Mansonia- water containing aquatic vegetation



- **HIBERNATION**

Adult mosquito hibernate in unfavourable conditions like extreme winter

- **DISPERSAL**

Generally do not fly far from breeding place EXCEPT Culex (**up to 11kms**)

- **LIFE SPAN**

varies from 8 to 34 days

influence by temperature and humidity

males are short lived

MOSQUITO CONTROL MEASURES

➤ ANTI LARVAL MEASURES

- a. Environmental control
- b. Chemical control
- c. Biological control

➤ ANTI-ADULT MEASURES

- a. Residual sprays
- b. Space sprays
- c. Genetic control

➤ PROTECTION AGAINST MOSQUITO BITES

- a. Mosquito nets
- b. screening
- c. Repellents

ANTI LARVAL MEASURES

- **A- ENVIROMENTAL CONTROL**

- ✓ most important step – to eliminate breedingplaces
(**source reduction**)
- ✓ Source reduction comprises minor engineering methods such as **filling, levelling and drainage of breeding places and water management.**

- **B- CHEMICAL CONTROL**

- ✓ commonly used larvicides
 - a. Mineral oil
 - b. Paris green
 - c. Synthetic insecticides

- **Mineral oils**

When applied on water oil spreads and forms a thin film which **cuts off the air supply** to the mosquito larvae and pupae. eg mosquito larvicidal oil, fuel oil, diesel oil etc.

- **Paris green**

- Chemical composition-**copper acetoarsenite**.

- Acts as **stomach poison**.

- Mainly kills **anopheles larvae** because they are **surface feeders**.

- **Synthetic insecticides**

- examples of most effective organophosphorous larvicides

Fenthion

Chlorpyrifos

Abate

C- BIOLOGICAL CONTROL

-some fish feed readily on mosquito larvae.

Eg. *Gambusia affinis*

Lebister reticulatus

ANTI ADULT MEASURES

A- RESIDUAL SPRAYS

-Eg. **DDT** [most commonly used]

Malathion

Propoxur

Lindane

B- SPACE SPRAYS

-Sprayed as mist or fog

-Pyrethrum Extract:

Pyrethrin (active principle)

-it acts as **nervepoison**

C- GENETIC CONTROL

-Sterile male technique

-Cytoplasmic incompatibility

-chromosomal translocations

-sex distortion etc

PROTECTION AGAINST MOSQUITO BITES

- **A- MOSQUITO NETS**

- >size- 0.0475 inch diameter

- >no of holes in one squareinch-150

- **B- SCREENING**

- >Screening of the building is done with copper and bronze gauge.

- >costly but excellent results.

- **C-REPELLENTS**

- >Eg.Diethyltoluamide(DEET)-most common

- Dimethyl carbate

- Indalone

- >short duration of protection

HOUSE FLIES

➤ Important species:

Musca domestica-most common

M. vicina

M. nebulosa etc

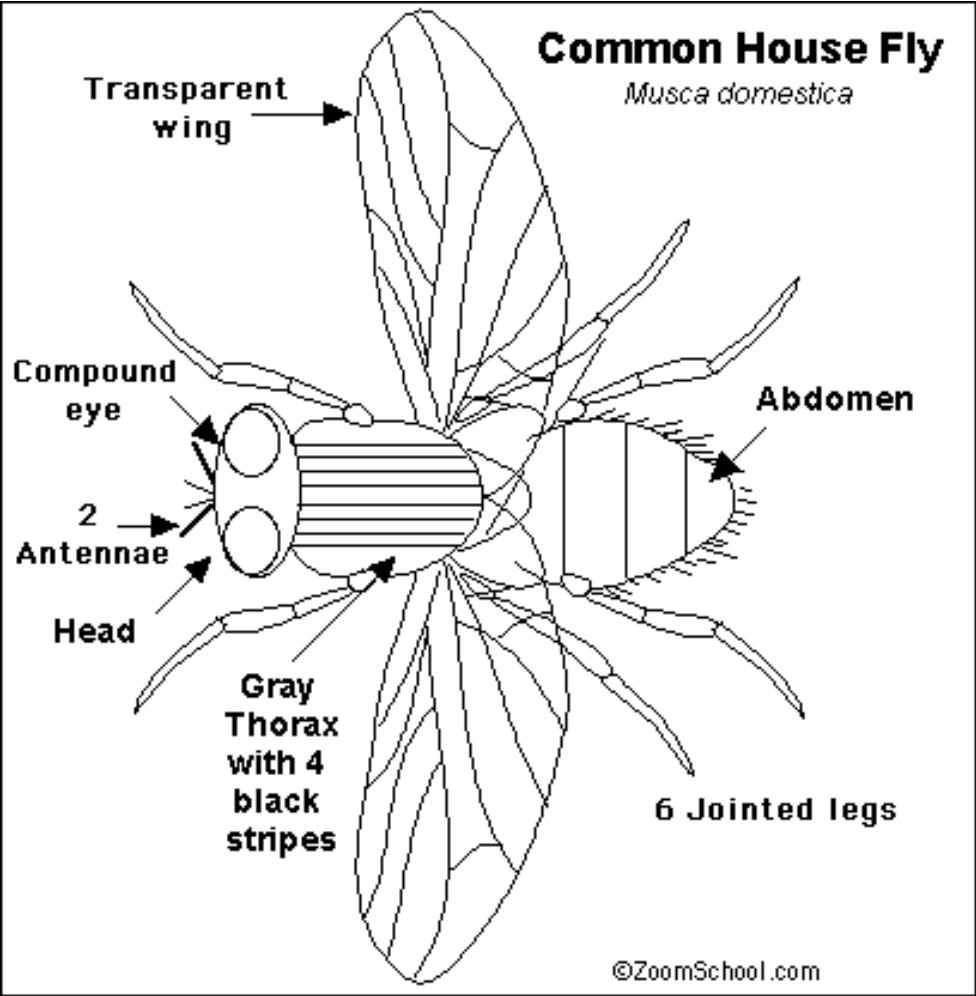
General characters

- Mouse grey in colour
- Body divided into
 - Head
 - Thorax
 - Abdomen
- **HEAD:** A pair of antennae
- A pair of large compound **eyes (male-close together; female-set apart widely)**
- A retractile proboscis (sucking liquid foods)

- **THORAX**: Marked with 2-4 dark longitudinal stripes which is characteristic of genus *musca*
- A pair of wings
- 3 pairs of legs
- covered with numerous short and stiff hairs known as Tenent Hairs
- **ABDOMEN**: segmented and shows light and dark markings

Common House Fly

Musca domestica



HOUSE
FEMALE



1973



FLY
MALE



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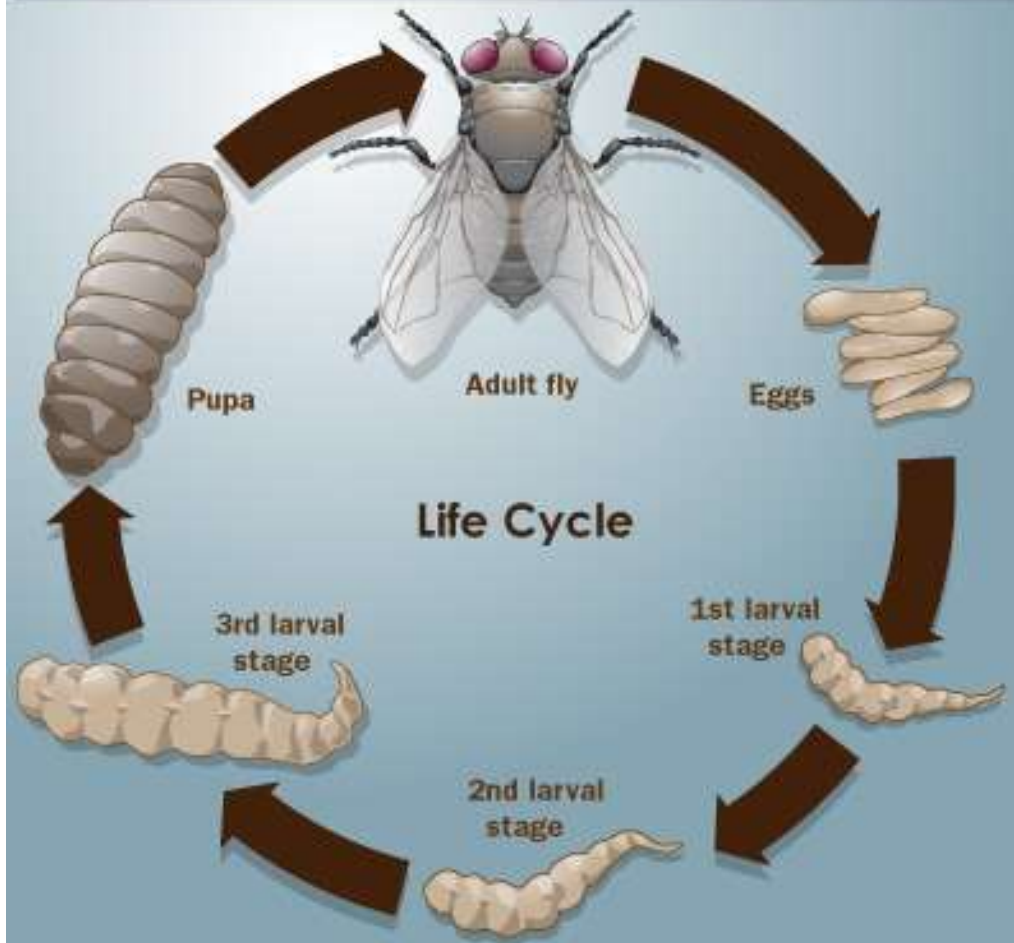


- **LIFE HISTORY**

- **EGG** :The female lays from about **120-150** eggs at one sitting in moist decaying organic matter
- **LARVA**:Also known as **Maggot**.They are white segmented and footless with a narrow anterior end and broad posterior end.
- **PUPA**:dark brown and **barrel** shaped
- **ADULT**:Life span upto **15-25** days

How HouseFlies Work

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- **BREEDING HABITS:**

- Fresh horse manure

- Human excreta

- Manure of other animalsetc

- **FEEDING HABITS:**

- can NOT eat solid foods.it vomits on solid food to make a solution of it and sucks in a liquid state.

- **RESTLESSNESS:**

- help in spread of infection mechanically.

- **RESTING HABIT:**

- Rest on vertical surfaces and hanging objects.

- **DISPERSAL:**

- Normally remain close to breeding places but they disperse frequently upto 4 miles.

- **TRANSMISSION OF DISEASE:**

Disease transmitted

Typhoid and Paratyphoid fevers

Diarrhoeas and dysentery

Cholera

Gastroenteritis etc..

MODE OF TRANSMISSION:

1. Mechanical transmission
2. Vomit drop
3. Defecation

CONTROL MEASURES

- 1. ENVIRONMENTAL CONTROL
 - Storing garbage & kitchen waste in bins with tight lids
 - Provision of sanitary latrines
 - Stopping open air defecation etc
- 2. INSECTICIDAL CONTROL
 - a) Residual sprays- DDT, lindane, malathion, fenthion etc
 - b) Space sprays- pyrethrin , DDT, HCH
 - c) Larvicide- diazinon, dimethoate

- **3.FLY PAPERS**

- contains resin and castor oil
- applied to the stripes of wire and hung up in places where flies abound

- **4.PROTECTION AGAINST FLIES**

- screening of house, hospitals, food markets etc

- **5.HEALTH EDUCATION**

- Health education regarding disease transmission and fly awareness

Control of Cyclops:

Control of cyclops is particularly important as they are the intermediate hosts of Dracontiasis or guinea worm disease. Man acquires infestation by drinking water containing cyclops. Guinea worm disease is a public health problem in Rajasthan, Maharashtra, Madhya Pradesh, Andhra Pradesh and Tamil Nadu.

Cyclops are controlled by the following methods:

- (a) **Physical:** Straining and boiling of water are physical methods useful for providing individual prophylaxis. Straining of water through a fine cloth removes cyclops and boiling of water kills cyclops readily as they cannot withstand a temperature beyond 60°C.
- (b) **Chemical :** Chlorine 5 ppm destroys cyclops and larvae of guinea worm. Lime at a concentration of 4 g per gallon of water is found very efficient for killing cyclops. Another insecticide, Abate at a concentration of 1 mg/l is effective in killing cyclops.
- (c) **Biological:** Gambusia and barbel fishes feed on cyclops and they have been used for the eradication of cyclops in Karnataka state. Apart from these measures which have to be employed in the endemic areas, the most satisfactory and permanent method for controlling cyclops in drinking water is to provide piped water supply or tube wells. Abolition of step wells must be accomplished in rural areas.



Guinea worm disease

2. RODENTS

Rodents live in close association with man and they are part of our environment. In addition to their being hazard to our health, they can also cause damage to buildings, grains, food stuffs and other household commodities. Rodents are generally classified into two distinct groups, domestic and wild.

Domestic rodents: As they live close to man they are of greater public health concern. They include the common black rat (**Rattus rattus**) the Norway rat (**R.norvegicus**) and the houses mouse (**Mus musculus**). **Rattus rattus** is a domestic animal with a restricted area of movement. It is good climber and it generally infests the roofs of houses. It can also burrow and is capable of infesting even ships. Therefore it is of considerable public health importance. The Norway rat is a semidomestic animal and it frequents sewers, drains as well as houses.

R.rattus is generally called the house rat, whereas **R. norvegicus** is known as the sewer rat

Wild rodents: Wild rodents in our country include **Tatera indica** which is a natural reservoir of plague and **Bandicota bengalensis**, **D.indica**, **Millardia meltada**, **M.gleadowi** and **Mus booduga**.

Rats are instrumental in spreading a number of diseases. These are:

- (i) **Bacterial** : Plague, tularemia and salmonellosis
- (ii) **Viral** : Encephalitis, Lassa fever and hemorrhagic fever.
- (iii) **Rickettsial** : Scrub typhus, marine typhus and rickettsial pox.
- (iv) **Parasitic** : Leishmaniasis, amoebiasis, trichinosis, chagas disease and Hymenolepsis diminuta.
- (v) **Others** : Rat bite fever, leptospirosis, histoplasmosis and ring worm etc.

The mode of transmission may be direct through rat bite e.g. rat bite fever, through contamination of food and water e.g., salmonellosis, leptospirosis and through rat fleas e.g., plague and typhus.

Control of rodents:

- (a) **Sanitary measures:** Environmental sanitation plays important role in the eradication of rats. If the basic requirements of food, water and shelter are denied to rats, their population will gradually decrease. The measures required for achieving this comprise of i) proper storage, collection and disposal of garbage, ii) proper storage of food stuffs and grains iii) construction of rat proof

houses, godowns and ware houses, and iv) elimination of rat burrows permanently blocking them with concrete.

- (b) **Trapping:** Trapping is a simple operation and can cause only temporary reduction of rat population. Haffkine Institute, Bombay has developed a trap which can trap 25 rats at a time. These rats are then killed by drowning them in water.
- (c) **Rodenticides:** Single dose rodenticides are popularly used for controlling rats. These include barium carbonate and zinc phosphide. Barium carbonate is a weak rodenticide and is not fully reliable as it is easily detected by rats in the baits. Zinc phosphide is now extensively used in the ratio of 1 part to 10 parts of wheat or rice flour and mixed with a few drops of edible oil in order to make it more attractive for rats. Rats are killed within 3 hours after consuming the bait.
- (d) **Fumigation:** It is a very effective method of destroying both rats and rat fleas. The fumigants used are calcium cyanide (Cyanogas), carbon disulphide, methyl bromide and sulphur dioxide etc. Cyanogas has been used very extensively in our country for the fumigation of rat burrows. It is pumped into rat burrows in powder form by a special pump called the cyanogas pump. About 2 ounces of poison is pumped into each burrow and thereafter the burrow is sealed promptly. On contact with moisture the cyanogas powder generates hydrogen cyanide gas which is lethal to both rats and their fleas.

3. OTHER ANIMALS

Like rodents some animals are also part of man's biologic environment and they serve as reservoir host of a number of diseases. The WHO lists more than 150 diseases and infections of these animals which are communicable to man. These diseases and infections are known as 'Zoonoses' or 'Zoonotic diseases'. Some of the important zoonoses are depicted in the Table-4.3.

Our country has the largest animal population in the world. India being basically a land of agriculture, the association between man and animals is also the closest. The available information shows that a large number of zoonotic infections (e.g. brucellosis, rabies, tuberculosis, leptospirosis and hydatid disease etc.) occur in different parts of the

country

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Table 4.3 Important Zoonoses Prevalent in India

| Diseases | Causative Agent | Animal(s) involved |
|--------------------------|------------------------|--------------------------------------|
| Viral | | |
| 1. Rabies | Lyssavirus type 1 | Dog, Fox, Jackal |
| 2. Japanese encephalitis | J.E. Virus | Birds, Pigs, Horses |
| 3. KFD | KFD virus | Monkeys, rodents |
| Bacterial | | |
| 1. Anthrax | B. anthracis | Pigs, herbivores cattle, |
| 2. Brucellosis | <i>Brucella</i> spp | Sheep, goats, pigs, dogs, horses. |
| 3. Leptospirosis | L. interrogans | Rodents, cats, dogs. |
| 4. Plague | Y. pestis | Rodents |
| 5. Salmonellosis | <i>Salmonella</i> spp | Mammals, birds |
| 6. Tuberculosis | M. tuberculosis | Cattle, sheep, goats, dogs, pigs. |
| Parastic | | |
| 1. Hydatidosis | E. granulosus | Dog, cow, sheep |
| 2. Taeniasis | T. saginata | Cattle |
| 3. Cysticercosis | T. solium | Swine |
| 4. Leishmaniasis | L. donovani | Dogs, rodents |
| 5. Toxoplasmosis | T. gondii | Cats, mammals, birds. |

A close-up photograph of a pink flower with a bright yellow center, set against a solid teal background. The flower is in sharp focus, showing the texture of its petals and the intricate details of its stamens. The text 'Thank you so much!' is overlaid on the right side of the image in a yellow, cursive font.

*Thank
you so
much!*

