

Medical Entomology and Parasitology

Chapter 1




Parasites are organisms that live inside or outside the body of another organism belonging to a different species (host) and derives nutrition from it.

Parasites having detrimental disease causing effect on host are called **pathogens**.

Parasites have traditionally been restricted to three main groups that include **protozoa, helminths and arthropods**.

Parasitism is thus a heterospecific association where one organism lives inside or outside the body of another organism (host) derives nutrition.



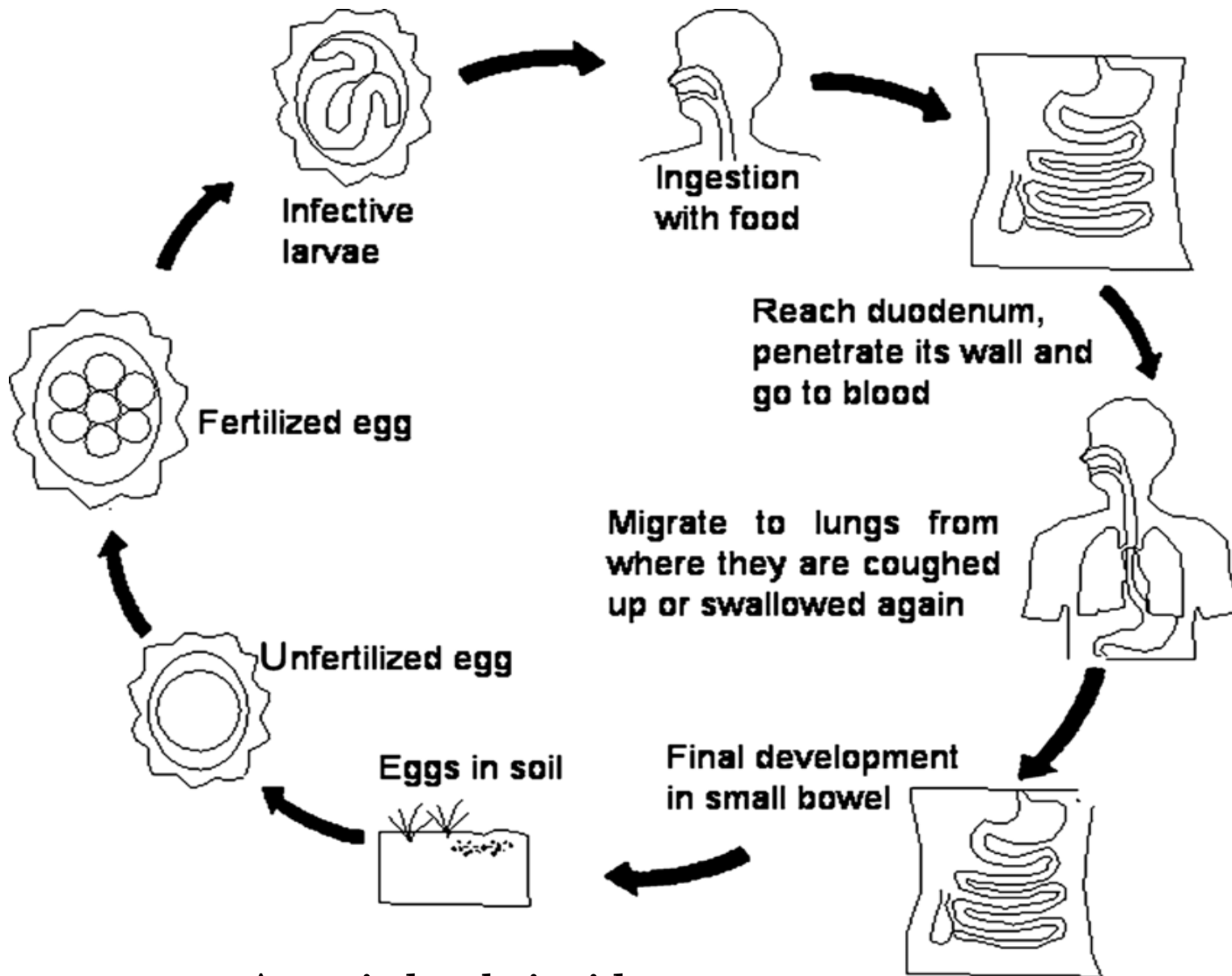
Parasite	Vector/intermediate host	Disease
Entamoeba histolytica	-	Amoebic dysentery
Giardia intestinalis	-	Giardiasis
Plasmodium	Female Anopheles	Malaria
Trypanosoma	Tse tse fly, Reduviid bugs	African Sleeping Sickness/Chagas disease
Leishmania	Sand Fly	Kalazar/oriental sore
Schistosoma	Snail	
Taenia	Cow/pig	Taeniasis
Fasciola hepatica	Snail	
Ascaris lumbricoides	--	
Ancylostoma duodenale	-	
Wuchereria bancrofti	Culex	Filaria

Parasitology is the branch of biology that is concerned with the study of parasites. In the process, it gives focus to various characteristics of the parasite (morphology, life-cycle, ecology, taxonomy, etc), the type of host they infect/affect and the relationship between the two.

Parasitology also encompasses some elements of such fields as entomology, helminthology, and epidemiology among others.

Medical entomology is the branch of science that deals with insects that cause disease or that serve as vectors of organisms that cause disease in humans.

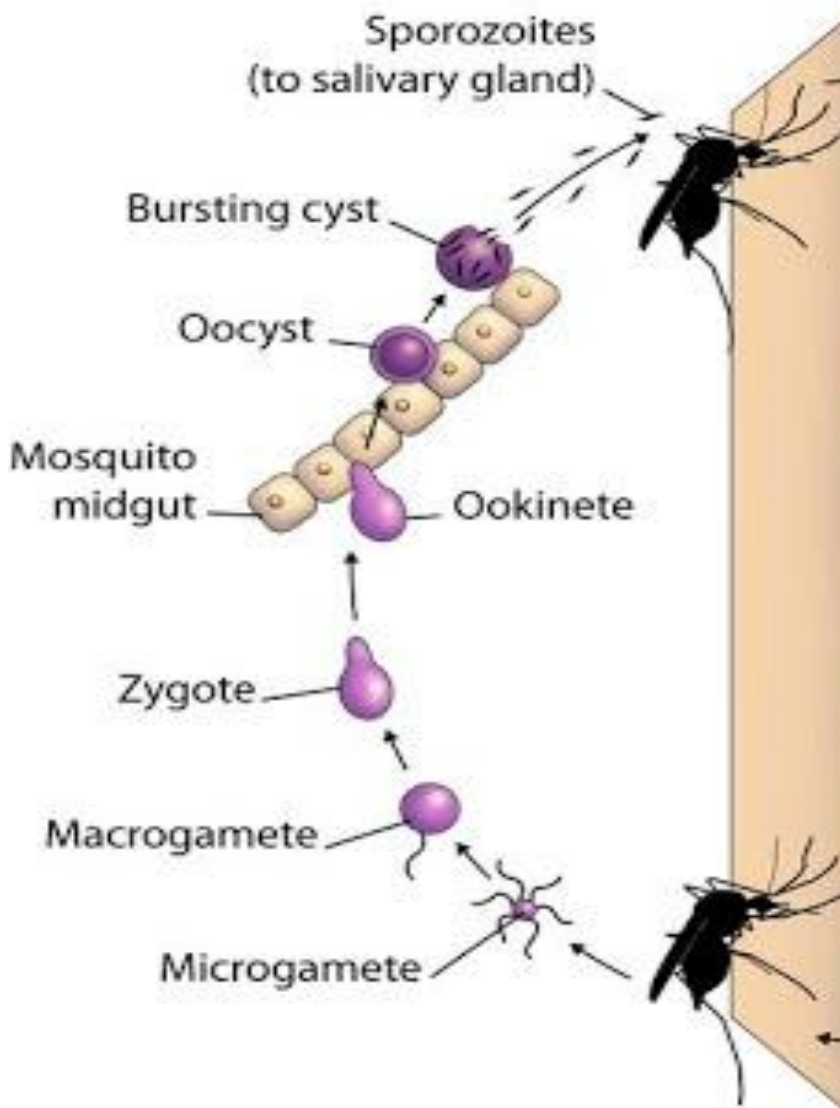




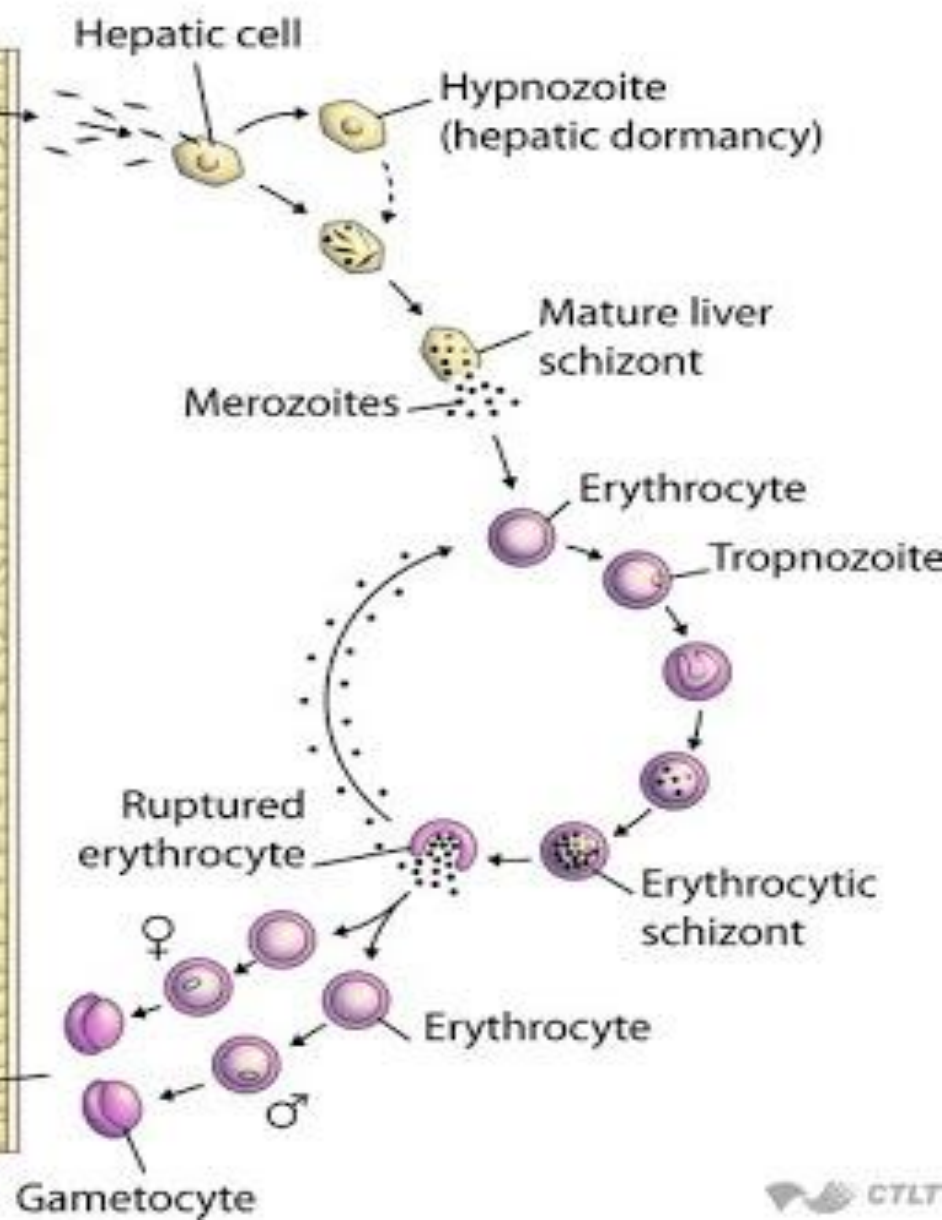
Ascaris lumbricoides



Cycle in Mosquito

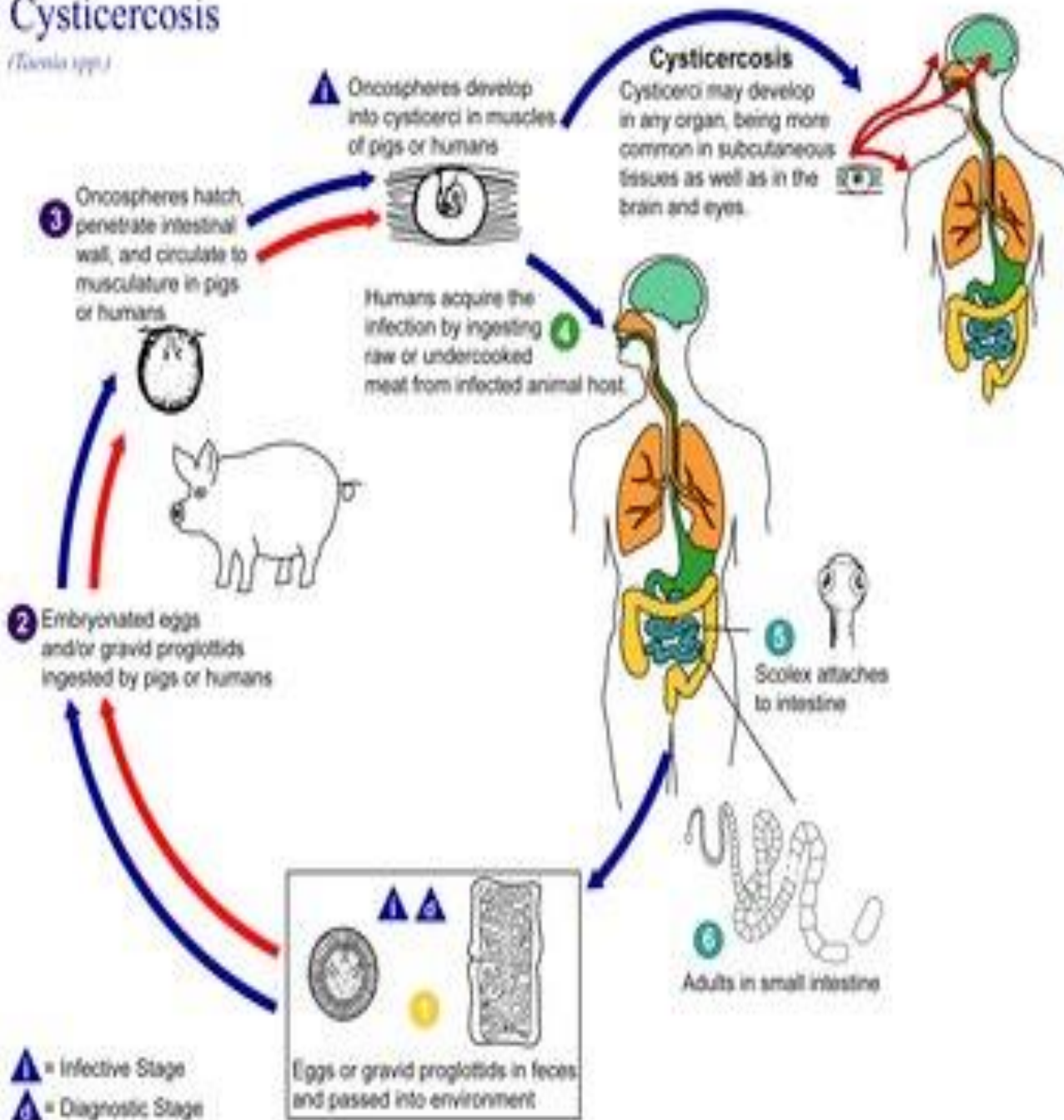


Cycle in Human



Cysticercosis

(*Taenia spp.*)



Classification of Parasites: There are various ways of

Categories of Parasites

1. *Ectoparasites*

These are parasites that live on the outside of their hosts, for example, ticks, fleas and mosquitoes. These parasites only attach onto the outer surface of their hosts to suck their blood meal.

Pediculus, Cimex, Ticks, Xenopsylla (rat flea)

2. *Endoparasites*

These are parasites that live within their hosts, for example, the common roundworms, *Ascaris lumbricoides* and the pork tapeworm, *Taenia solium*. These two parasites are found in the intestines of their hosts.



3. *Facultative parasite*

These are parasites that are usually free-living but that can become parasitic when they accidentally enter the host, either through ingestion, a wound or other body opening. Examples include certain free-living amoebas of the genus *Naegleria* and free-living nematodes belonging to the genus *Micronema*. In humans, both cause serious diseases, which are usually fatal.

4. *Obligatory parasite*

These are parasites that are completely dependent on the host for their requirements for survival during part or all of their lives.

Eg: *Plasmodium*, *Ascaris*, *Ancyclostoma*



5. Accidental or incidental parasite

These are parasites that establish themselves in or on a host in which they do not normally live. While accidental parasites usually do not survive in the wrong host, they may be extremely pathogenic. One example is the dog roundworm, *Toxocara canis* which may infect humans and cause a disease known as visceral larva migrans. *Echinococcus granulosus*

6. Permanent parasites

These are parasites that live their entire adult lives within or on their hosts. Examples include the filarial worm, *Wuchereria bancrofti* which causes the disease known as elephantiasis in man; the digenean blood fluke, *Schistosoma haematobium* which causes the disease known as schistosomiasis in man, and the human malarial parasite, *Plasmodium falciparum*.

7. Temporary or Intermittent parasite

These are parasites, for example, **mosquitoes or bedbugs**, that only feed on the host then leave. Another example is *Cordylobia anthropophaga* - a muscid fly that causes myiasis in man, small rodents, monkey and dogs. The fly lives through its several stages in the skin of man, and only leaves the skin in order to continue its development into a pupa and adult outside the body of man.

8. Monogenetic, Digenetic and Trigenetic Parasites:

Parasites requiring one/two/three hosts to complete its life cycle. Eg:- *Ascaris* sp, *Entamoeba* sp - Monogenetic Parasite, *Plasmodium* sp, *Wuchereria* sp - Digenetic parasite, *Paragonimus* sp - Trigenetic Parasite

9. Parasitoids

These are organisms that are typically parasites early in their development but that finally kill their hosts during or at the completion of development. The term parasitoid usually refers to insects, typically flies or wasps belonging to the Order Diptera and Hymenoptera respectively, whose immature stages feed on the bodies of their hosts, usually other insects, before finally killing them.

Categories of Hosts

1. Definitive host

This is a host in which a parasite reaches its sexual maturity and performs sexual reproduction. For example, the Female *Anopheles* mosquito is the definitive host for the malaria parasite, *Plasmodium*, while human beings are the definitive hosts for the parasite, *Schistosoma*.

However, not all parasites undergo sexual reproduction. For these, the host that is most important to humans is arbitrarily considered the definitive host. For example, the parasite that causes sleeping sickness in human beings and nagana in cattle, *Trypanosoma*, does not have a sexual cycle. However, since it is most important in the vertebrate hosts, these are arbitrarily considered the definitive hosts.

2. Intermediate host

This is a host in which some development of the parasite occurs but in which it does not reach sexual maturity. For example, human beings are the intermediate hosts for the malaria parasite, *Plasmodium*. and snails of the genus *Bulinus* are the intermediate hosts for the parasite, *Schistosoma*. Certain species of trematodes (flatworms) have two intermediate hosts. These are the primary and secondary intermediate hosts.

3. Paratenic or Transport host

This is a host that harbours a parasite in an arrested state of development even though the parasite remains alive and viable, ready to infect a subsequent suitable host.

4. Reservoir host

This is any animal which harbours a parasite but is itself unharmed by the parasite hence acts as a source of infection to others.

Dog is the reservoir host of *Leishmania* (kalazar) in some countries.



Vectors are organisms which transmit the pathogen from one host to another and the pathogen actually enters the body of the vector completing a part of its life cycle in there.

Eg: *Anopheles* (Female) mosquito is the vector of Plasmodium thereby spreading malaria

Carriers are organisms which mechanically transmit the pathogen from one host to another and the the pathogen does not enters the body of the carrier with no part of its life cycle being completed in there.

Example : House fly (*Musca domestica*) for amoebiasis



Mosquito as Vectors: -

Mosquito : Mosquito belongs to Phylum Arthropoda and order Diptera. Mosquitoes constitute the most important single family of insect from the stand point of human health.

The important groups of mosquito in India which are related to disease are the Anopheles, Culex and Aedes.


General Characters :

(i) Body divided into three segments- head, thorax & abdomen. (ii) Compound eye present. (iii) The thorax is large & rounded in appearance & bears two pair of thoracic wings & three pairs of legs. (iv) The abdomen is long & narrow.

Vector	Disease	
<i>Anopheles stephensi</i> <i>Anopheles minimus</i>	Malaria	
<i>Culex fatigans</i> <i>Culex pipiens</i>	Bancroftian Filariasis	
	Encephalities	
<i>Aedes aegypti</i> <i>Aedes fluviatilis</i>	Dengu	
	Yellow fever	



Control Method of Mosquitoes :

1. **Control of Breeding:** Stagnant water must be avoided. Cleaning of drain and garbage.
 2. **Control of Larva:** Use of mineral oil and Panama Larvicide for larval destruction.
 3. **Control of adult:** Use of insecticide parathion, malathion etc.
 4. **Personal Protection:**
 - a) Use of mosquito net at night, net in doors and windows.
 - b) Use of mosquito repellent cream and oil.
 - c) Use of long sleeved clothes.
 5. **Biological Control:** A wide range of small fish feed readily on mosquitoes larva . So fishes like Telapia, Gappi, Gambusia are released into the drain to control larva.
 6. **Genetic Control:** In recent years, control of mosquitoes by genetic method such as sterile male technique, cytoplasmic incompatibility chromosomal translocations & gene replacement have been explored.
- Mechanical Control:** (i) Killing of mosquitoes by hand.
(ii) Use of mosquito net & other mechanical devices.
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Sand flies as vectors

Sand flies are small insects, light or dark brown in colour. They are smaller than mosquitoes.

They belong to order Diptera. The important one of sand flies are –

- (a) *Phlebotomus argentipes*, (b) *Phlebotomus papatasi*
(c) *Phlebotomus sergenti*, (d) *Sergentomyia minutus*

General Characters:

- (i) Head bears a pair of long, slender & hairy antennae, palpi & a proboscis. (ii) The thorax bears a pair of wings & three pairs of legs. (iii) The second longitudinal vein on the wings branches twice, the first branching takes place in the middle of the wing. (iv) The abdomen has 10 segment & is covered with hair.

Disease transmitted by sand fly : In human *Phlebotomus argentipes* & *P. papatasi* transmits three day fever, cutaneous leishmaniasis & kala-azar.

