

FLIES

SANDFLIES

The vectors of the human leishmaniasis are phlebotomine sandflies of the genus *Phlebotomus* in the Old World and *Lutzomyia* in the New World. Most *Phlebotomus* species inhabit semi-arid and savannah areas; in contrast, *Lutzomyia* species occur mostly in forested areas. *Phlebotomus* sandflies, including the species that is the principal vector of kala azar in India, are quite common in Sri Lanka. Adult sandflies can be readily recognized by their minute size (1.5 – 3 mm in length), hairy appearance, relatively large black eyes and long, stilt-like legs. The mouthparts which are small and inconspicuous are adapted for blood-sucking. The wings are held erect over the body when the fly is at rest.



Adult male Phlebotomine sandfly

Life cycle

About 15 - 100 eggs are laid in each batch of eggs. They are deposited in small cracks and holes in the ground, at the base of termite mounds, in cracks in masonry, etc., Although the eggs are not laid in water, they require a moist microhabitat with a high humidity. The larvae hatch out in 1-3 weeks. They are mainly scavengers, feeding on organic matter. Although some species especially of the genus *Phlebotomus* occur in very dry areas, the actual larval habitats must have a high degree of humidity. There are 4 stages in larval development. The larva turns into a pupa after about 19-60 days. Adults emerge from the pupa in about 7-14 days. It is usually difficult to find the larvae or pupae sandflies and little is known about their biology and ecology.

Adult behavior

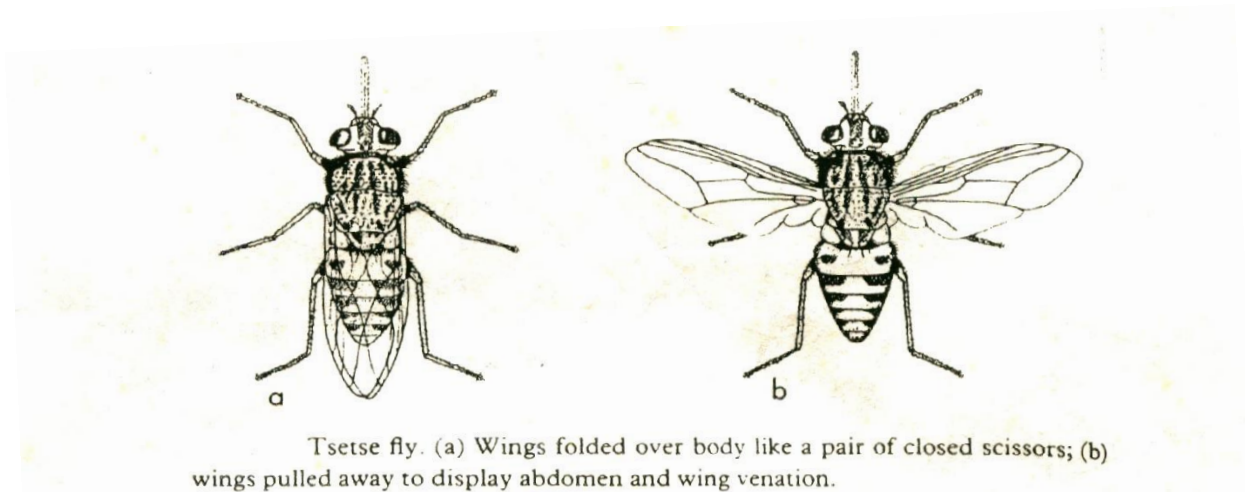
Both sexes feed on plant juices. Females in addition suck blood from a variety of vertebrates. Biting is usually restricted to dusk/dawn and the night. Most species are exophagic but a few are also endophagic. Sandflies have a characteristic hopping type of flight. During the day adult sandflies rest in sheltered, dark, and humid sites with dry surface such as tree trunk, ground litter and foliage in the forest, animal burrows, termite mounds, etc.,

Control

The leishmaniasis are usually not considered sufficiently important enough to justify expenditure on controlling the insect vectors. The sandflies however, are very susceptible to most residual insecticides. In areas where insecticides were used for the control of malaria vectors eg. India, there were drastic reductions in sandfly populations followed by interruption of the transmission of Leishmania. With the cessation of spraying however, the sandflies returned and transmission recommenced.

TSETSE FLIES

The vectors of African trypanosomiasis caused by *Trypanosoma brucei gambiense* or *Trypanosoma brucei rhodesiense*) are tsetse flies of the genus *Glossina*. Adult tsetse flies are yellowish or brownish black in colour and a little larger (6 – 15 mm) than houseflies. They are readily distinguished from all other biting flies and similar sized non-biting flies, by the combination of a rigid and forwardly projecting proboscis and a characteristic wing venation. In between veins 4 and 5 there is a closed cell which looks like an upside-down hatchet (axe) and is therefore called a 'hatchet cell'



Tsetse flies also differ from most flies in that at rest the wings are placed over the abdomen like the closed blades of a pair of scissors. Both male and female tsetse bite man, in addition to a large variety of animals. They take blood meals about every 2-3 days and feed during the day.

The adult female produces a single egg after a blood meal. This egg hatches within the uterus after about 3 - 4 days and the larva develops to maturity in about 4 - 5 days, still within the uterus. It is then deposited on loose soil or sand in a shaded site. Immediately after deposition, it burrows under about 2 – 5 cm of soil and turns into a pupa. After some weeks of pupation, the adult emerges, forces its way to the surface and flies away.

Adult flies are usually found in woody vegetation, resting on twigs, branches and trunks of trees and bushes. Based on their morphology, behaviour and preferred habitat, tsetse flies are separated into 3 groups: the *fuscus* group, the *morsitans* group and the *palpalis* group.

Trypanosoma brucei gambiense is transmitted mainly by the *palpalis* group. This group is associated with vegetation along the edge of rivers and lakes and transmits disease wherever human and tsetse activities interact, for example at watering points, etc.

Trypanosoma brucei rhodesiense on the other hand is transmitted mainly by the *morsitans* group which is found in savannah areas and open woodland. Exposure to infection is therefore mainly occupational: herdsman, hunters and tourists going on safari, etc.

BLACKFLIES

See notes on onchocerciasis.

NON-BLOODSUCKING FLIES

The non-blood sucking flies have sponge-like mouthparts adapted for sucking liquids or minute particles. The larval stage usually lives in dead or decaying material. They can affect human in one of two ways:

1. When the larvae invade the tissues – a condition known as myiasis
2. Mechanical transmission of disease-producing organisms

MYIASIS

Fly larvae (also known commonly as maggots or flesh-fly larvae) may attack cutaneous tissues (healthy skin or wound) body openings such as the nose, ears and eyes, the gut or the urogenital system. In cutaneous myiasis the larvae burrow through necrotic or healthy tissue, aided by secondary bacterial infection and possibly by proteolytic secretions. When the larvae mature, they migrate out of the host, in an effort to reach soil and pupate. The larvae deposited in the nose, eyes etc. may either remain there or migrate to the sinuses and adjoining tissues. Urethral infections cause dysuria, haematuria and pyuria, and are thought to be due to the invasion of larvae deposited upon the genitalia. Intestinal myiasis is largely accidental, through ingestion in food. Larvae that are able to live in the intestinal tract may cause nausea, vomiting and diarrhoea.

Classification of myiasis-causing flies

Myiasis can be produced by a large number of species of flies. They may be classified into the following groups, according to the preferred site for deposition of eggs or larvae.

1. Specific (obligatory)
2. Semi-specific (facultative)
3. Accidental

The **specific** flies deposit their eggs or larvae in or near the tissues of the obligate hosts and the larvae inevitably become parasites by invading the skin or the atria. Flies of this group include *Chrysomya*, *Cordylobia*, *Dermatobia*, and *Wohlfahrtia* spp. These species usually parasitize various farm animals and only occasionally attack man.

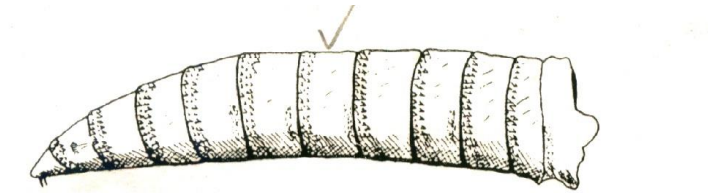
The **semi-specific** flies usually deposit their eggs or larvae in decaying flesh or vegetable matter and less frequently as facultative parasites in diseased tissues or neglected wounds. This group includes *Sarcophaga*, *Calliphora*, and *Phormia* spp.

The **accidental** myiasis-producing flies deposit their larvae in excreta or decaying organic material and at times in food. A person becomes infected by the accidental ingestion of the eggs or larvae or by the contamination of open wounds, or atria. These flies are of many different species.

Human infection with flesh fly larvae mostly occurs in those with open suppurating ulcers, and in infants and small children, especially those with nasal discharges who sleep unscreened out of doors. The deposited larvae are able to penetrate the tender skin of infants and produce lesions that look like furuncles.

Morphology

The mature 3rd stage larvae of the non-blood sucking fly usually has a broad, truncated posterior end, a narrow anterior with hook like processes and paired papillae, and a spinose area on each segment. Certain structures are useful for species identification, especially the posterior spiracles on the last abdominal segment.



Treatment

If the larvae are in an open wound, it may be treated with 15% chloroform in vegetable oil – the larvae emerge and can be removed with forceps.

In Sri Lanka, turpentine is often used for this purpose. If the larvae are under unbroken skin, the breathing apertures on the surface may be covered with Vaseline or petroleum jelly, thus inducing the larvae to emerge. Surgical removal after local anaesthesia, or a through wound toilet under general anaesthesia may be necessary.

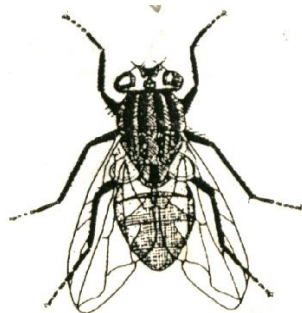
Prevention and Control

To prevent myiasis in humans, it is necessary to control infestation in animals through the use of larvicides and other measures. Destruction of carcasses and the disposal of offal reduces the breeding grounds of certain species. Persons, especially infants with nasal discharges or individuals with open suppurating wounds should not sleep in the open.

***Musca domestica* (housefly)**

The common housefly infests human houses throughout the world. The eggs are laid in lots of about 100 - 150, in animal dung or refuse (garbage) where the larvae feed and then pupate in soil. In about 7 - 10 days, the adult emerges. It has a lifespan of about one month. The adult fly feeds on anything from faeces or garbage to food on a table. Houseflies have extremely sticky feet and they regurgitate (vomit) and defecate while feeding. Therefore, they act as mechanical vectors of pathogenic bacteria, protozoa and helminth eggs and larvae, especially of enteric disease organisms.

Control is a community measure, since flies travel long distances, but screening or trapping can protect individual houses. Adequate control involves the elimination of breeding places such as garbage heaps and animal and human excreta. To prevent breeding in garbage dumps, the dump should be covered with soil daily and only the working edge kept exposed. Insecticides may be used to treat animal excreta or garbage or to spray the inside of houses but insecticide resistance is a serious problem.



Adult fly of *Musca domestica*