

M.Sc. 1st Semester; Course Code: Zoo-09-GE; Unit: I

1.1. Life cycle and control of major insect vectors of human diseases viz. Sand fly

Sandfly, Phlebotomus spp

Phlebotomus argentipes



A male *Phlebotomus* fly

Scientific classification

Kingdom:	Animalia
Phylum:	Arthropoda
Class:	Insecta
Order:	Diptera
Family:	Psychodidae
Subfamily:	Phlebotominae
Genus:	<i>Phlebotomus</i> Loew 1845

Species

P. alexandri
P. ariasi
P. azizi
P. balcanicus
P. brevis
P. chabaudi
P. kyreniae
P. langeroni
P. longicuspis
P. longiductus
P. major
P. mascittii

P. papatasi
P. perfiliewi
P. perniciosus
P. riouxi
P. sergenti
P. simici
P. tobbi

Phlebotomus is a genus of "sand flies" in the Diptera family Psychodidae. In the past, they have sometimes been considered to belong in a separate family, Phlebotomidae, but this alternative classification has not gained wide acceptance.

Epidemiology

Cutaneous leishmaniasis

A disease transmitted by *Phlebotomus*, in North Africa; *Leishmania infantum* = green, *Leishmania major* = blue, *Leishmania tropica* = red. In the Old World, *Phlebotomus* sand flies are primarily responsible for the transmission of leishmaniasis, an important parasitic disease, while transmission in the New World, is generally via sand flies of the genus *Lutzomyia*. The protozoan parasite itself is a species of the genus *Leishmania*. Leishmaniasis normally finds a mammalian reservoir in rodents and other small animals such as canids (canine leishmaniasis) and hyraxes. The female sand fly carries the *Leishmania* protozoa from infected animals after feeding, thus transmitting the disease, while the male feeds on plant nectar. *Phlebotomus* species are also vectors for bartonellosis, verruga peruana, and pappataci fever, an arboviral disease caused by sandfly fever viruses such as the Naples and Sicilian strains of the genus *Phlebovirus* (family *Bunyaviridae*), which also includes the closely related Toscana virus. In Egypt, two species of medical importance are *Phlebotomus papatasi* and *P. langerni*. These flies are short-lived. Females are bloodsuckers at night; males feed on plant juices. Adults are poor fliers, they usually hop for short distances.

Morphology

Adults are about 1.5–3.0 mm long and yellowish in colour, with conspicuous black eyes, and hairy bodies, wings, and legs. The oval lanceolate wings are carried erect on the humped thorax. Males possess long prominent genital terminalia known as claspers. Females have a pair of anal recti.

Lifecycle

The minute eggs (0.3–0.4 mm) are more or less ovoid in shape and usually brown or black, and careful examination under a microscope reveals that they are patterned. Some 30–70 eggs are laid singly at each oviposition. They are thought to be deposited in small cracks and holes in the ground, at the base of termite mounds, in cracks in masonry, on stable floors, in poultry houses, amongst leaf litter and in the Americas between buttress-roots of forest trees. The type of oviposition site presumably varies greatly according to species. Although eggs are not laid in water they require a microhabitat with high humidity. They are unable to withstand desiccation and hatch after 4–20 days, although hatching may likely be delayed in cooler weather. Larvae are mainly scavengers, feeding on organic matter such as fungi, decaying forest

leaves, semi-rotting vegetation, animal faeces and decomposing bodies of arthropods. Although some species, especially of the genus *Phlebotomus*, occur in semiarid areas, the actual larval habitats must have a high degree of humidity. Larvae may be able to survive by migrating to drier areas if their breeding places are temporarily flooded. There are four larval instars. The mature larva is 3–6mm long and has a well-defined black head which is provided with a pair of small mandibles; the body is white or greyish and has 12 segments. Ventrally the abdominal segments have small pseudopods, but the most striking feature is the presence on the head and all body segments of conspicuous thick bristles with feathered stems, which in many species have slightly enlarged tips. They are called matchstick hairs, and they identify larvae as those of phlebotomine sand flies. In most species the last abdominal segment bears two pairs of conspicuous long hairs called the caudal setae. First-instar larvae have two single bristles, not two pairs. Larval development is usually completed after 20–30 days, the duration depending on the species, temperature and availability of food. In temperate areas and arid regions sand flies may overwinter as diapausing fully grown larvae. Prior to pupation the larva assumes an almost erect position in the habitat, the skin then splits open and the pupa wriggles out. The larval skin is not completely cast off but remains attached to the end of the pupa. The presence of this skin, with its characteristic two pairs of caudal bristles, aids in the recognition of the phlebotomine pupa. Adults emerge from the pupae after about 6–13 days. The life cycle, from oviposition to adult emergence, is 30–60 days, but extends to several months in some species with diapausing larvae. In temperate areas adults die off in late summer or autumn and species overwinter as larvae, with the adults emerging the following spring. It is usually extremely difficult to find larvae or pupae of sand flies, and relatively little is known about their biology and ecology.

Classification

Phylum:	Arthropoda.
Class:	Insecta.
Order:	Diptera
Family:	Psycodidae.
Genus:	<i>Phlebotomus</i> .
Species:	(a) <i>P. papatasii</i> (b) <i>P. Sergenti</i> (c) <i>P. argentipes</i>

Distribution: Found in the warm countries.

Bites: Only female sandfly can bite in the dwelling at night. It takes shelter during day in holes and crevices in wall, in dark room and store room etc.

Breeding: The eggs are laid in damp and dark places in cattle sheds and poultry.

Feeding: Mostly species are nocturnal in habit.

Dispersal: The range of flight is 200 yard from their breeding places.

Life Span: Average life of sandfly is about 2 weeks.

General Characters

The body of sandfly consists of three parts:

Head: The head bear a pair of long and hairy antenna. Palpi and proboscis and one pair of prominent black eyes are present.

Thorax: The thorax bears a pair of wings and three pair of legs. The wings are upright in shape and hairy. The 2nd longitudinal vein is branched twice. The legs are long and slender and out of proportion to the size of the body.

Abdomen: The abdomen has ten segments and is covered with hairs. In the female the tip of abdomen is rounded while in male claspers are attached to last abdominal segment.

Medical Importance:

Causes sandfly fever, kala-azar, oriental sore and leishmaniasis.

Life cycle

The life cycle of sandfly is characterized by complete metamorphosis, having 4 developmental stages.

Egg: The female generally lays eggs in the damp dark places in the cattle sheds & poultry. The eggs vary from **40-60** in numbers, brownish in color. The eggs measure about **0.4** mm in length. Eggs hatch in **1-2** weeks.

Larva: The larva is maggot like structure, having large head, thorax and abdomen and two long bristle on last abdominal segment. Larva feed on decaying organic matter and become a pupa in about **2** weeks.

Pupa: Pupa are found in cracks and crevices in the wall. The pupa stage lasts for about **1** week.

Adult: The average life of a sandfly is about **2** weeks.

Control measures

Sandfly are easily controlled because they do not move long distance from their breeding places.

- i) **Insecticide:** Lindane has been proved effective. Spraying should be done in the human dwellings, cattle sheds and poultry. Its residue may remain effective for a period of 3 months.
- ii) **Sanitation:** Removal of shrubs and vegetation, filling of cracks and crevices in the wall & floor and distance of cattle sheds and poultry from human habitations.