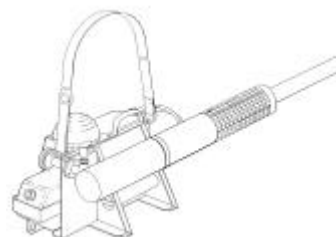


**Vectors
Nuisances
And their
Control**

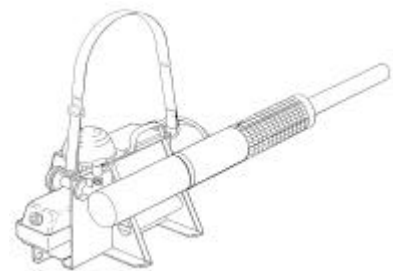


Thermal Fog Application



pulsFOG Dr. Stahl & Sohn GmbH

House Fly



Important fly species include the common house fly (*Musca domestica*), the lesser house fly (*Fannia canicularis*), the face fly or autumn fly (*Musca autumnalis*), fruit flies or vinegar flies (*Drosophila* spp.), the blue bottle (*Calliphora erythrocephala*), the flesh fly (*Sarcophaga carnaria*) and the stable fly (*Stomoxys calcitrans*).

The stable fly differs from the other fly species in that it is the only one to require blood for egg

production; therefore it bites and feeds on man, cattle and other livestock. Flies breed mainly in warm, dry areas. The adults feed on different kinds of vegetable and animal matter, but also on sweat and faeces. They lay hundreds of eggs in decaying organic matter in which the maggots remain throughout their development. Flies are prevalent everywhere, in dwelling houses, in restaurants, in canteens, hospitals, cattle sheds and other livestock housing,

slaughter houses, food factories.

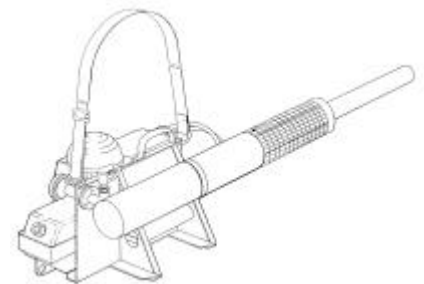
But also outdoors there is no lack of them, on refuse dumps, in facilities for the disposal of sewage and effluent, in market places, streets, camping sites, etc.

In all countries of the world, flies are of importance as carriers of germs of different diseases which they transmit to man and animals (e.g. dysentery, typhoid, cholera, salmonellas).

House Fly Larvae



Musca domestica



Control of adults

For the control of adult flies in private domestic premises, there are many biocides available to be used by householders. For non-residual control of flies in dwelling houses, factories and in workrooms, use cold fog, thermal fog or mist formulations. In playgrounds, parks, streets, and on garbage dumps in residential districts, only a fog or ULV application will be effective. In stables and other livestock buildings, a residual effect is essential. Therefore treat walls, ceilings and Windows of these buildings with a residual insecticide (allow for occurrence of resistance) The use of an encapsulated formulation of short-lived



Fly control in livestock installation

biocide in sensitive areas are the preferential choice. In rooms where foods are processed or stored, particular attention must be given to the risk of contaminating foods when applying insecticides for the control of flies. Therefore, biological and non chemical protective measures to prevent build up of fly infestations should always be taken first, e.g. keep garbage bin areas clean and tidy; use garbage bins with close fitting lids; fit fly screens on Windows; do not leave foods exposed. Only if these measures prove to be inadequate should insecticides be used. In food areas, the insecticides are applied mainly as space Sprays and dry fogs. Outside these areas and especially in the area where garbage is kept, the insecticides should be used as residual sprays. A proven method is to use a bait spray combined with an attractant.

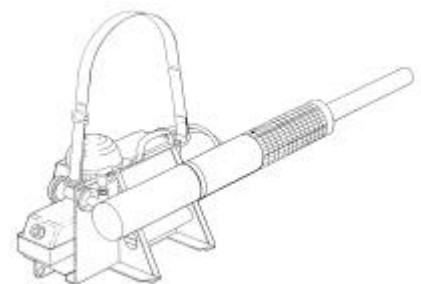
Control of larvae

In breeding sites: Small bogs, cesspools and pits, liquid manure pits, effluent ponds, septic tanks, etc. frequently harbour fly larvae which, if left to breed freely, give rise to serious problems. Therefore, it is essential to eliminate these foci of infestation when and wherever possible, either by mechanical methods like drainage and filling in or by the use of insecticides In order to minimize buildup of fly populations in cattle sheds and other livestock buildings, it is important to control maggots in dung and liquid manure. Dung should be sprayed with an biological biocide such as a chitin synthesis inhibitor.



Vector control along the roads

Sandfly



There are several different genera of sandflies. The most important are *Phlebotomus* (North Africa, Middle and Near East, West Asia, East Africa); *Sergentomyia* (U. S. S. R., Iran, Iraq, China, Africa, India, South America, Central America) and *Lutzomyia* (North, Central and South America). They are small, dark-coloured, bloodsucking Diptera. They occur in swarms from spring to autumn, in tropical regions all the year round, and attack man and animals. Sandflies deposit their eggs mostly in damp recesses on the ground, in wild animal burrows, in crevices in walls and rocks, in silt, mud and decaying Vegetation; these sites are also the habitats of the larvae. The adults live

mostly outdoors but sometimes they invade dwelling houses. Sandflies are not only nuisances. Their bites cause severe pain, and sandflies are vectors of several diseases including cutaneous leishmaniasis (Aleppo boil or oriental sore), visceral leishmaniasis (kala azar), mucosal leishmaniasis, and sandfly fever.

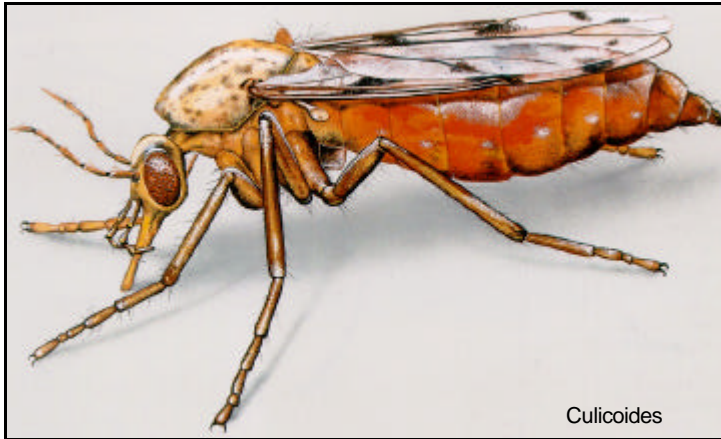


Street fogging

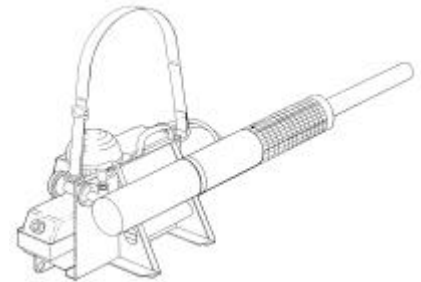
For the control of sandflies in huts or houses etc., it is

recommended to spray walls with residual insecticides, which continue to act for several months. Sprays applied for the control of mosquitoes in anti-malaria campaigns have an additional bonus in the drastic reduction of sandflies. Sandfly infestation can be reduced also by spraying mosquito screens on windows.

For the control of sandflies outdoors e.g. in holiday camps, villages, small towns and workcamps, fog applications are recommended using thermal or non-thermal aerosol formulations. Especially in outbreak of a leishmaniasis epidemic, rodent harbourages should be dusted with appropriate chemicals.



Biting Midge



Biting midges (family *Ceratopogonidae*), also known by the name of punkies in some regions, sometimes are mis-called sandflies (this common name, however, is reserved for *Phlebotomus* species). They rank among the smallest of bloodsucking flies (0.5 to 1.5 mm). The most important species belong

to the genera *Culicoides*, *Leptoconops*, *Forcipomyia*, and *Austroconops*. Biting midges breed mainly in swamp areas, salt marshes, fresh water inlets, moist organic soils, etc. The bloodsucking adults are mainly of importance for the great annoyance of their bites. However,

some *Culicoides* species transmit certain filarial worms and arboviruses to man and animals.

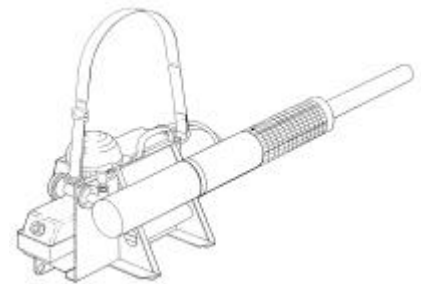
Biting midges are controlled by applying larvicides where possible, by fogging in holiday resorts and residential areas, as well as by using repellents applied by persons on exposed parts of their body.



Amphibian vehicles are the ideal carriers for the application equipment against vectors having their habitat nearby water and marshes.



Tsetse Fly



The different species of tsetse flies (*Glossina* spp.) occur in West, Central, East and South Africa. Some species live in the dry savannah regions, others in the wet Guinea savannahs. Their breeding sites and habitats are located close to rivers, streams and other bodies of water, mostly in trees, bushes and scrub, where cattle rest or pass by. Reproduction in tsetse flies is of a particular form known as adenotrophic viviparity, because the egg contains enough yolk for the embryo to complete its uterus by larva is nourished in the nutrients derived from the mother. Larval development is completed in the uterus, development, and the

and the fully developed third-instar larvae are then deposited by the mother, burrow into the soil and pupate close to the surface. Tsetse flies transmit the causal organisms (*Trypanosoma* spp.) of sleeping sickness to man and of nagana disease to cattle. Reservoirs of the trypanosomes responsible for these diseases are antelopes and other wild animals which themselves do not become ill. When a tsetse fly bites and feeds on one of these animals infected with trypanosomiasis, it takes up with its blood meal a number of trypanosomes and injects them again into the next

victim like people or domestic animals.

Control of tsetse fly is conducted during the dry period. One treatment with a pulsFOG machine is usually adequate to keep it under control for months. In some cases, however, it is necessary to make aerial applications in the early morning hours or late afternoon.

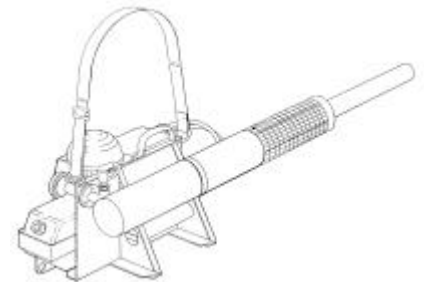


Trees and bushes are the preferred habitat of tsetse fly

Blackfly



Simulium



Blackflies (*Simulium* spp.) are widespread especially in several countries of the African and American continents. They breed in unpolluted, rapidly-flowing waters which can range from small streams to huge rivers. The females lay their eggs on aquatic plants or on stones at water level. The adults have a considerable range of flight, usually many kilometres.

Blackflies are important not only as nuisances but also as vectors of onchocerciasis which can lead to blindness.

The causal organism of this disease, a filarial worm (*Onchocera* spp.) parasitizes man as its principal host.

Large areas in Africa (especially in West Africa), that are suitable for agricultural use, have been rendered uninhabitable by onchocerciasis. The disease, also commonly known as river blindness, is prevalent also in parts of Mexico, Guatemala and Venezuela.

Effective residual control of blackflies is obtained by treating their breeding sites in flowing waters with larvicides applied from helicopters, fixed-wing aircraft or boats using also pulsFOG BIO machines which provide larger droplet sizes up to 100 µm. Non-residual control of adults as nuisances can be obtained by standard fogging with thermal fog or non-thermal fog formulations), using ground applicators or aircraft.

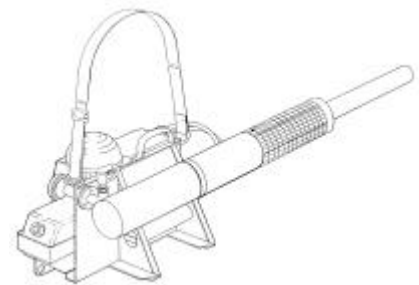


Vector control with amphibian vehicle

Cockroaches



Blattella germanica



Many cockroach species are known. Three important ones are the following: The American cockroach (*Periplaneta americana*) which takes one year to complete its development. Just as long as the somewhat smaller dark brown Oriental cockroach (*Blatta orientalis*). The still smaller yellowish-brown German cockroach (*Blattella germanica*) has the shortest life-cycle; it completes its development in 2 to 3 months. This explains why it is the most common species in many countries. Cockroaches originated in the tropics but now they occur in virtually all regions. They thrive best in a warm

environment where the air is moist. In hotels, restaurants, kitchens, hospitals and homes, food processing plants, supermarkets, commercial establishments, breweries, Stores, aircraft, ships, etc. Cockroaches tend to avoid light. They hide during the day, which is the reason why they are seen so seldom despite their frequent presence and abundance. Cockroaches are omnivorous creatures. They are especially fond of starchy and sweetened foods, meat, dairy products and vegetable products



Blatta orientalis



Periplaneta americana

Cockroaches



Crack and crevice treatment



Cockroaches are successfully controlled in animal Stables with a thermal fogger and in underground sewage channels with a specially designed machine for this treatment (model pulsFOG K-10sp SAN)



Foremost among the many kinds of damage caused by cock-roaches is the contamination of human food. As a result, a wide range of disease-causing organisms (e.g. streptococci, salmonellas, etc.) can be transmitted by cockroaches to man and animals. But the economic losses sustained as a result of their direct feeding damage are also most substantial.

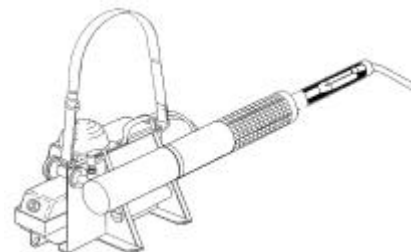
Cockroaches are controlled by thoroughly spraying and fogging their breeding places, harbourages and run-ways with residual insecticides applied with standard type knapsack sprayers or in large rooms with foggers. For the treatment of cockroach harbourages that are not

easily accessible and not reached with a spray e.g. false ceilings, walled-in passageways, voids or heating ducts, it is recommended to make an additional application of a fog concentrate especially in the evening and night when they are active. Spray applications with residual insecticides: Thoroughly treat all likely cockroach hiding places like cracks, crevices and joints; also behind and beneath cupboards, shelves, refrigerators, sinks, etc.; along the bases of kitchen equipment, behind facings of cookers and dishwashing machines; ducting, elevator shafts, stairways, storerooms, and enclosed spaces where refuse containers are located. Avoid contact with spray mist,

spray at a low pressure. For general treatments against all occurring insect pests including cockroaches (in industrial premises, etc.) where a residual action is not required, it is recommended to use a thermal fog or cold fog with appropriate machines such as pulsFOG. In rooms where foods are processed or stored, sprays must be applied with absolute care. It is most essential to avoid contamination of foods or of surfaces on which foods are handled and processed. Therefore, applications of insecticides in such rooms must be limited to crack and crevice treatments and spot treatments with hand sprayers.



Ants



More than 6,000 species of ants with greatly differing habits (nest construction; mode of formation of a new colony; nutrition) are known. Most have beneficial aspects, for example as scavengers or, like the wood ant, *Formica rufa* in Europe, by feeding on insects. Other species must be classified as pests because they feed on seeds and plants, and invade houses and other premises. In particular, Pharaoh's ant (*Monomorium pharaonis*) which invades houses and hospitals, feeds on a variety of edible materials preferably proteins and fats, and what is more may transmit disease germs. A nest is established by a newly mated, winged queen.

She remains there after she has laid her eggs. When the grub-like larvae hatch from the first batch of eggs, the queen feeds them until they pupate. Adult workers emerge from the pupae and these then nurse, tend and feed the larvae hatching from new batches of eggs laid by the queen, as well as the queen herself. In some species, winged sexual forms are produced; the males and females emerge on a nuptial flight, mate, and the fertilized females establish new nests. Ants forage for food in houses, stores, gardens, etc. Their food varies according to species, and includes sweet materials, fatty foods, meat, also plant parts like roots, leaves and fruits.

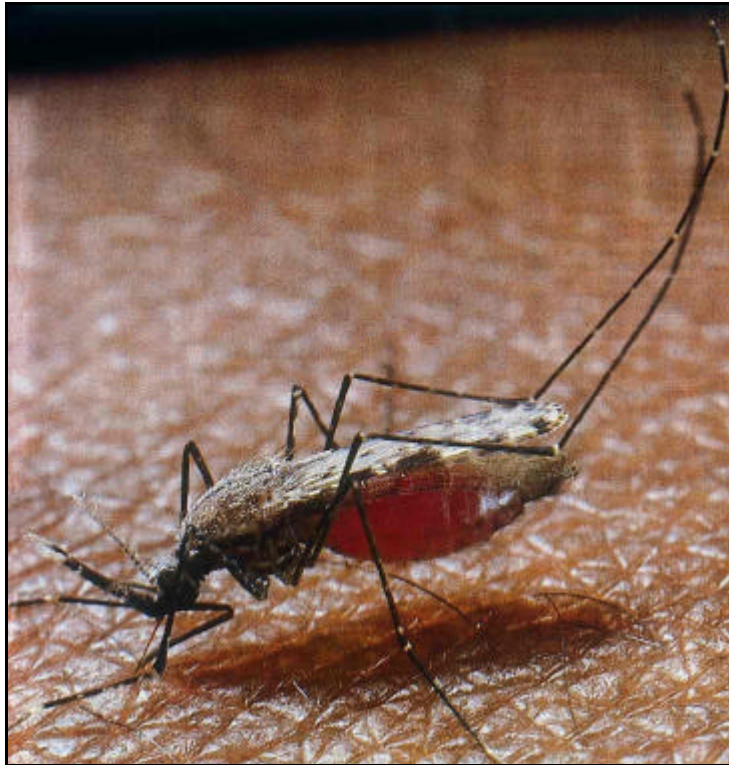
The control of ants is made difficult by their highly developed social organization and the location of their nests in places where it is not easy to gain access. Outdoors, on industrial premises, in gardens, parks, etc., successful control of ants depends upon effective treatment of nests so that eggs, larvae, pupae and queens will all be destroyed. PulsFOG designed a specially fogging machine (the ANT EATER) to treat the underground nests through the runways and channels used by the ants.

Pharaoh's ants feed on animal proteins too, so special baits are required for their control.



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Mosquitoes



Since the different mosquito species belong to the same zoological group, they have a number of common characteristics. With their piercing and sucking mouthparts, the females withdraw from mammals (humans and animals) the blood they require for egg production. The larvae always develop in water. Whereas the mosquito season in the moderate zones is generally from Spring to Autumn,

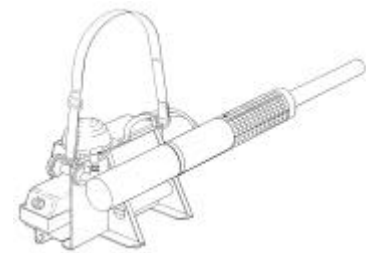
mosquitoes are active all the year round in the hot, humid tropics. Most species hide during the day and do not become active until dusk and during the night. They are not only nuisances; they are especially dangerous as vectors of many diseases. They are subdivided into three main groups: house mosquitoes (*Culex* spp.), yellow fever mosquitoes (*Aedes* spp.) and malaria

mosquitoes (*Anopheles* spp.).

House mosquitoes (*Culex* spp.)

Mosquitoes of this group breed close to dwelling houses in urban and rural areas, mainly in muddy waters, and also in rice fields. *Culex* species are transmitters of diseases, including encephalitis, filariasis and various arbovirus infections.

Mosquitoes

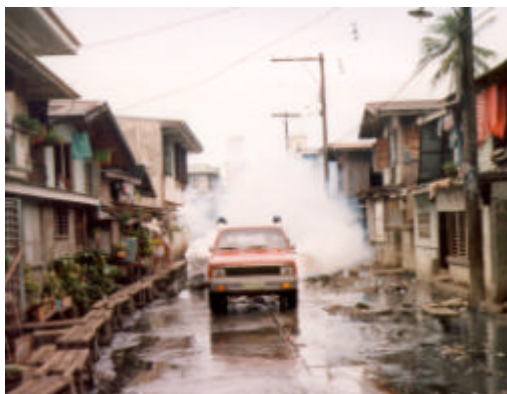


Yellow Fever Mosquitoes
(*Aedes spp.*)

This group comprises many species prevalent especially in urban areas. *Aedes* larvae breed in clean or lightly polluted water. The

adults fly mostly at dusk and during the night. *Aedes* species transmit pathogens of different diseases e.g. yellow fever, dengue fever, dengue haemorrhagic fever.

The recommendations for the control of mosquitoes differ according to species, developmental stage and habitat.



Street fogging against vectors



Vector control along the roads

**Mosquito
Larvae**



Control of larvae with liquid, dust or granular formulations of insecticides can be accomplished by using hand sprayers or dusters, or else by employing more sophisticated machines and equipment such as pulsFOG- BIO Fogging ground

equipment providing enlarged droplet sizes with water based formulations or aircraft.

It is recommended to use biocides formulated as liquid concentrates (LC). They are increasingly replacing oil formulations for the following reasons:

1. They are applied with a water based carrier and

2. As concentrates, they are easier and less costly to transport and to handle in contrast to the large amount of a "ready to use" oil-formulation

3. They have less impact and are less harmful on the environment

Granules act excellently in dense and inaccessible vegetation and are successfully applied by aircraft.





Mosquitoes



Malaria mosquitoes (*Anopheles spp.*)

Their biology

Malaria mosquitoes (*Anopheles spp.*) are among the most serious vectors of diseases in man. More than 40 species of *Anopheles* mosquitoes, which become active at twilight, during darkness and at dawn, transmit the pathogens (plasmodia) of malaria. The geographical spread of malaria is closely linked to the favourable climatic conditions for the malaria mosquito. These pests find ideal temperatures,

humidity and suitable breeding grounds in the tropical and sub-tropical latitudes of Central and South America, Africa, the Middle East and in large parts of Asia.

The *Anopheles* female usually deposits her eggs singly on the water surface, and the various *Anopheles* species prefer different types of breeding waters. Depending on the species, breeding sites range from clean waters rich in oxygen through irrigation ditches and marshy pools to stagnant

ponds and paddy fields. The larvae lie horizontally below the water surface. Adult mosquitoes are characterized by their elongated body which they hold at a downward angle relative to the resting surface.

The females seek out human dwellings or animal quarters in search of blood meals. Some species prefer an indoor habitat where they rest during the day and attack at night, and others remain out-doors.

AEROSOLSYSTEMS

Worldwide fight against mosquitoes and other vectors using pulsFOG thermal foggers



Street fogging



Vector control along the roads



WEST AUSTRALIAN TUESDAY DECEMBER 16 1986



John Paynter conducts war against mosquitoes using a pulsFOG thermal fogger

A double attack on mosquitoes

THE Mandurah and Murray shire councils are waging war against mosquitoes.

They have combined their resources to combat the pests that flourish in wetland areas at Geogrup Lake, the Serpentine and Murray Rivers, in estuary delta areas and other samphire flats.

The strategy includes the use of scouting parties, booby traps, motorised chemical warfare, river-based attacks and even air strikes.

The war is expected to cost ratepayers \$77,000 and even then the mosquitoes can only be controlled to tolerable

levels, not wiped out.

The two local authorities decided to work together on the problem because mosquitoes, showing no respect for boundaries, zoom across from the Murray to satisfy their bloodlust in Mandurah.

The Mandurah council's mosquito-control programme starts with householders, who help by denying the insects access to breeding areas such as rainwater tanks.

Other volunteers check wetlands near their homes and report breeding areas to the council. The larvae are then

destroyed with insecticide-impregnated sand or a liquid bacterial toxin.

The insecticide is usually applied by an operator walking over the breeding grounds, although an aircraft was used in October. The council also hangs up special traps.

Another ploy is chemical fogging from four-wheel-drive vehicles and from a boat borrowed from the Murray Shire Council. The Murray council's side of the programme mainly involves surveying breeding areas and killing the mosquito larvae with insecticides. - Keith Bates



Street fogging

Street fogging against nuisance insects

Mosquito control operation using all terrain vehicle

