This Pocket Book on integrated vector management has been produced for Vector Intervention Teams and for the villagers they advise. It provides basic information and illustrations of the main methods for controlling human disease vectors

It is designed so that it can be reproduced easily and cheaply. It is printed in black and white and illustrations are line drawings, so when the staples are taken out, A4 photocopies can be made, then the copies stapled together into a new booklet.

The Pocket Book is published together with a more comprehensive Integrated Vector Management Manual.

For more information, see:

www.yaoundefoundation.org

or email to:

info@yaoundefoundation.org

DRAFT

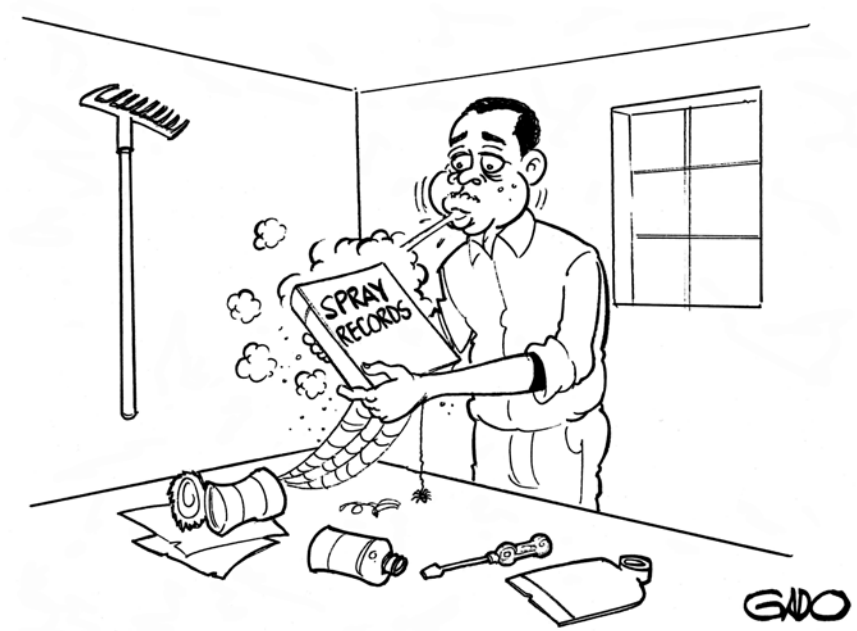
Integrated Management of Human Disease Vectors and Nuisance Insects

A pocket book for Vector Intervention Teams

KEEPING RECORDS

Record keeping on vector control is very important. All information on vector numbers, and control activities should be carefully recorded so that a complete report can be compiled later.

There are various forms for keeping these records and these will be issued by YIF staff.



ACKNOWLEDGEMENTS

This Pocket Book is an output from the Yaounde Initiative Foundation pilot project in the Sanaga Valley, funded by the Ministry of Planning and Regional Development, Syngenta Professional Products Division and Imperial College Consultants UK.

The authors are also extremely grateful to the rural communities and scientists who have contributed to this publication.

Illustrations are reproduced courtesy of the World Health Organization, the Food and Agriculture Organization and Ellen Cooper.

INTRODUCTION

People living in rural areas of Cameroon and other African countries suffer from the bites of mosquitoes and blackflies. These insects transmit serious diseases and are also a major nuisance as their bites interfere with people working in the field and prevent their sleeping properly at night.

This pocket book shows how to tackle these vectors and nuisance insects to improve the quality of life and life expectancy of rural communities and help increase agricultural productivity.

It is designed so that it can be reproduced easily and cheaply. It is printed in black and white and all illustrations are line drawings, so that when the staples are taken out, A4 photocopies can be made, then the copies stapled together into a new booklet.

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Pesticide poisoning and First Aid

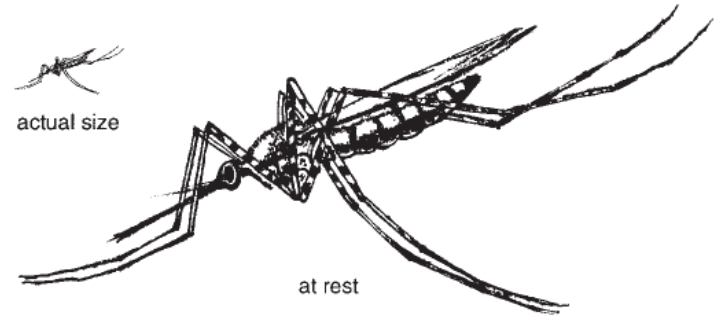
Symptoms/signs of poisoning

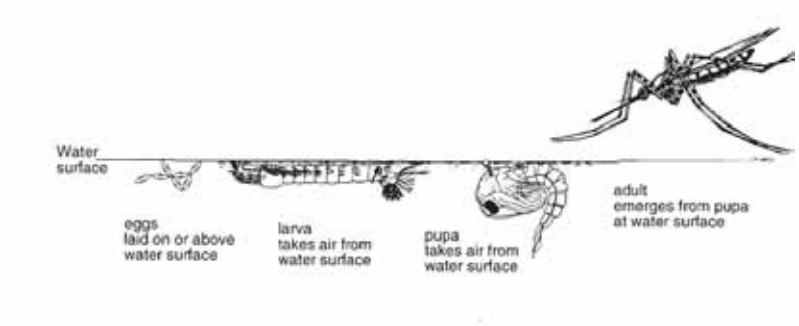
- Dizziness, feeling sick, tiredness, worry, excitedness, sweating, salivation, shaking hands, stomach cramps, blurred vision, pupils of the eyes become very small, unconsciousness.

First aid

- Act quickly - speed is essential
- Check breathing and give artificial respiration if necessary
- Wash contaminated skin or eyes with plenty of water
- Remove contaminated clothing
- If the patient is unconscious, lie them down on their side
- Call for transport to a medical centre
- Continue First Aid during transport to medical help
- Take the pesticide container or label with you so that medical staff can identify the best treatment.

TABLE OF CONTENTS





Safe disposal of pesticides and packaging

Concentrated product

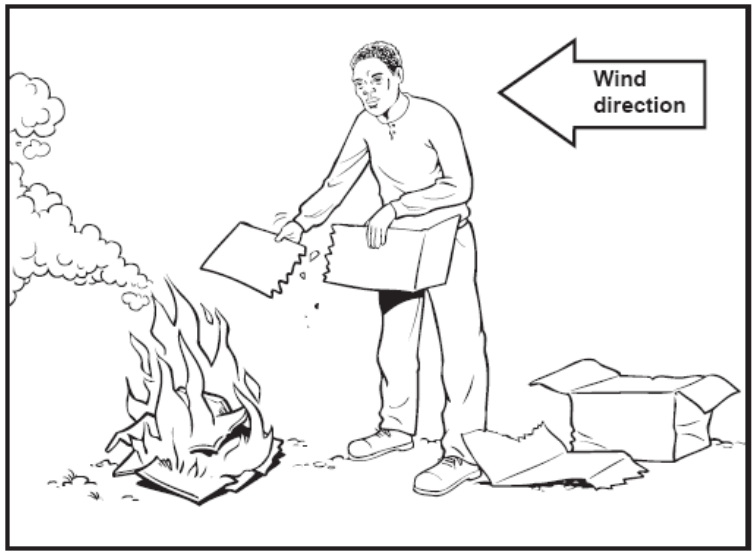
- Try to return it to the retailer if possible
- Never try to burn concentrated product

Diluted spray mix

- Try not to mix so much that there is spray mix to be disposed of
- Dilute it ten times with water and spray onto waste ground away from water or houses
- Wash sprayers three times with water and spray onto vegetation or waste ground as above.
- NEVER pour washings in rivers/streams

Pesticide containers

- Wear protective clothing as for mixing/filling
- Rinse containers three times and use the washings to dilute the spray mix
- Puncture and bury metal and plastic containers
- Burn cardboard packs - note wind direction and always stand UPWIND of the fire.



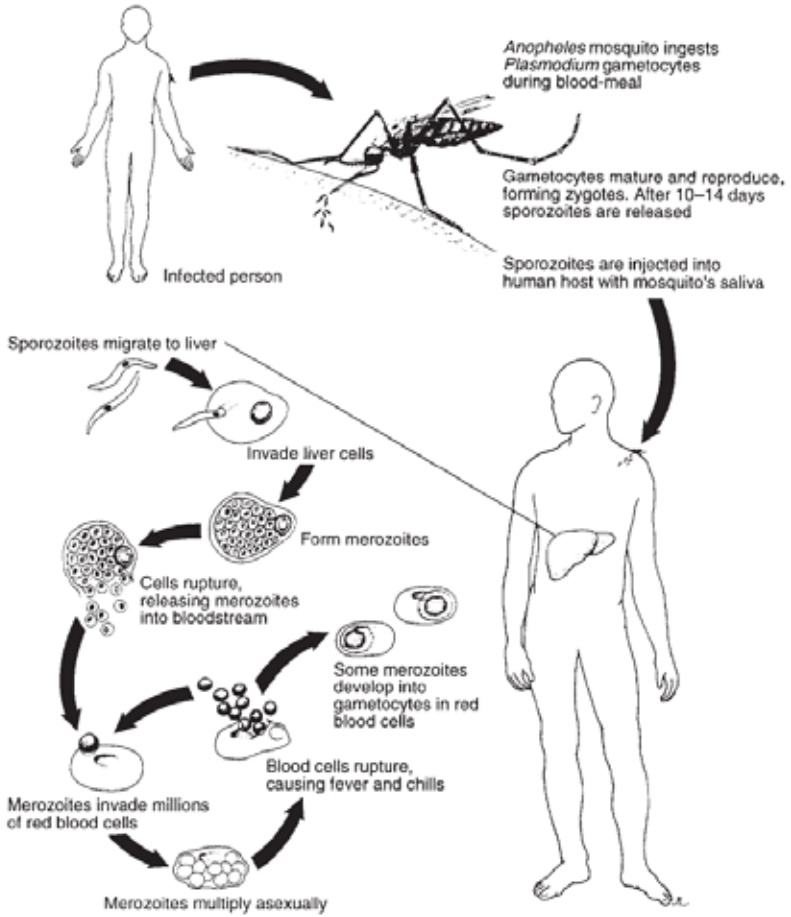
Mosquitoes and their life cycle

There are several different types of mosquito, but they all have similar life cycles. The adult female mosquito feeds on the blood of a person or animal, then lays eggs in water. The eggs hatch into larvae, which feed in the water for a few days, then turn into pupae and become adults. The female adults then need to bite people or animals again to get blood and produce eggs.

Only the *Anopheles* mosquitoes transmit malaria, but other mosquitoes transmit other diseases.

Anopheles mosquitoes enter houses and they always bite at night.

They can be distinguished from other species of mosquito by the fact that their proboscis is in line with their abdomen, and when they are resting they are tilted forward with their abdomen higher than their heads.

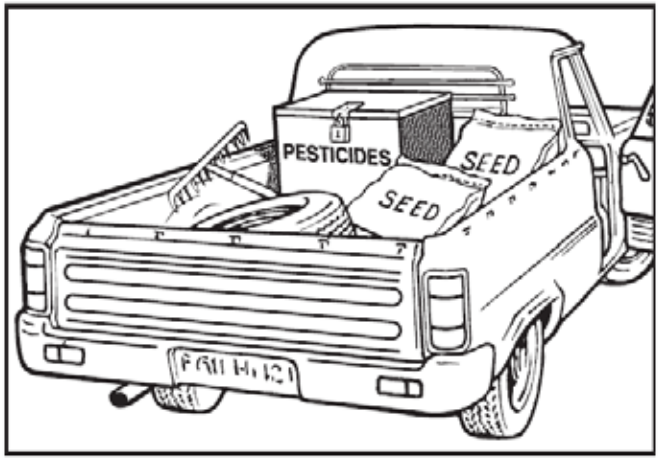


Safety in storage of pesticide

- Keep pesticides stored in a secure locked cupboard or storage box outside the house
- Never keep pesticides near beds or cooking areas or within reach of children
- Only buy sufficient pesticide for your immediate needs
- Avoid storing pesticides for a long time because they may become ineffective or start leaking.

Safety when transporting pesticides

- Never transport pesticides with people, food or animal feed
- Transport pesticides in a locked box in the back of a pick-up truck, or in the boot of the car - never in the passenger compartment
- Always carry some absorbent material (such as toilet paper) and soap and water to clean up any spills.



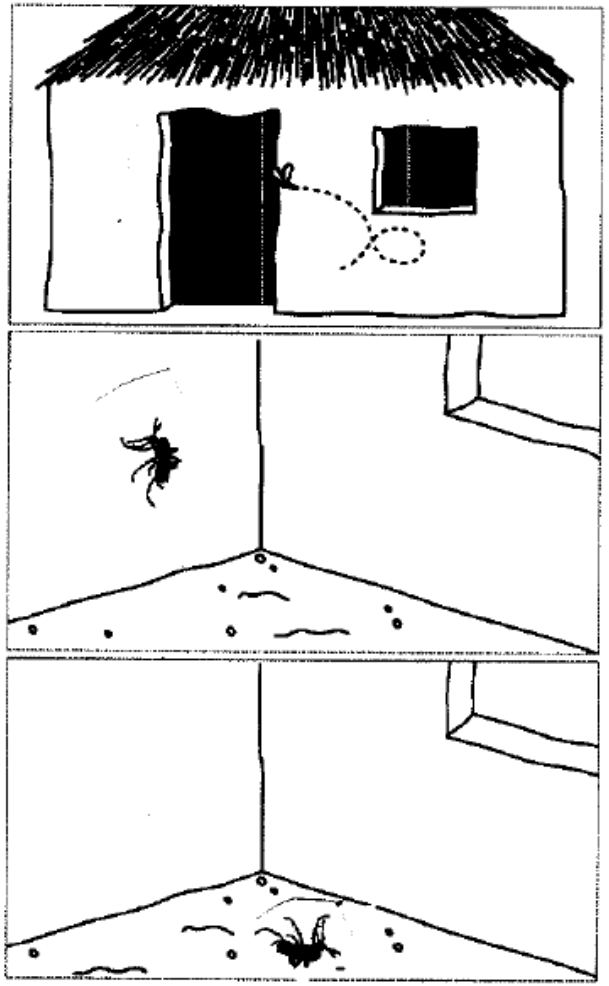
Malaria and how it is transmitted

Malaria is a disease caused by a tiny parasite that damages the red blood cells in humans. These parasites are transmitted from one person to another by *Anopheles* mosquitoes, when they bite.

It is a serious disease. It is estimated that over 600 million people are affected each year and there are up to 3 million people killed each year, especially in sub-Saharan Africa.

Young children are especially susceptible to the disease.

There are many different symptoms including fever, headaches, sweating, tiredness, diarrhea and vomiting.



Operator protection (continued)

Safety in applying pesticides

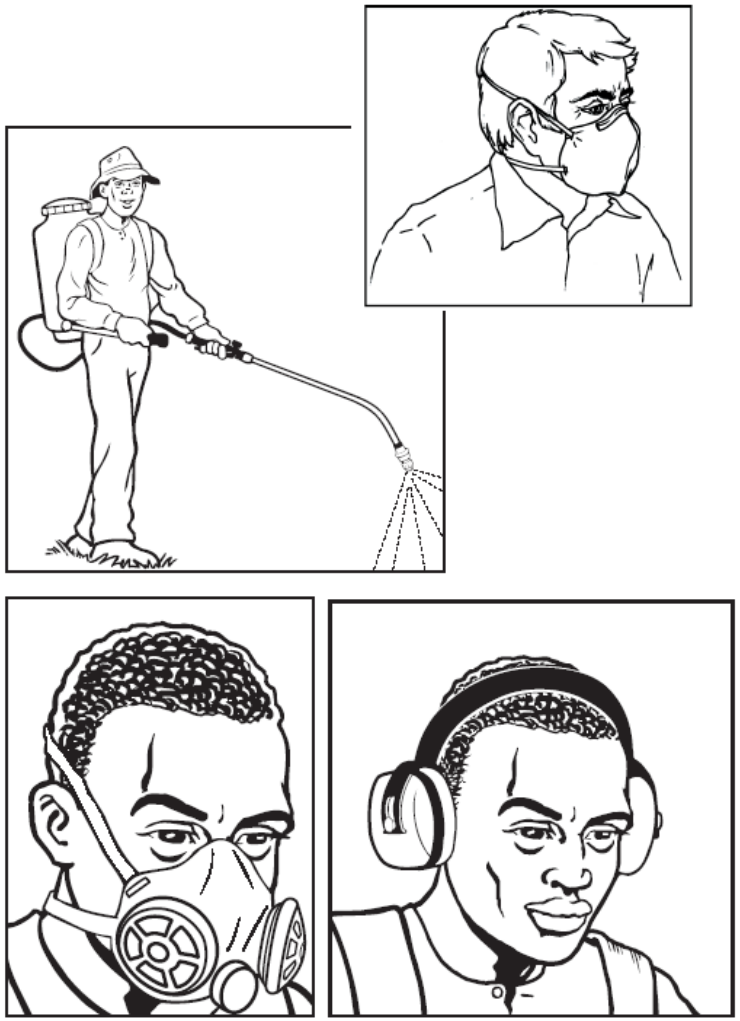
During spraying, the operator is using diluted pesticide so less protective clothing is needed than when filling and mixing. He/she should wear:

- cotton clothes to cover the body (long trousers with legs worn outside the boots, long sleeves)
- shoes/boots that cover the feet (NEVER sandals)
- a hat
- always have soap and water available to clean spilled pesticide off the skin.

Additional protection

Some special cases where additional protection is required are listed below:

- respiratory protective equipment (respirator) should be used during fogging and dusting
- ear defenders should be used with loud motorized equipment such as foggers or mistblowers.



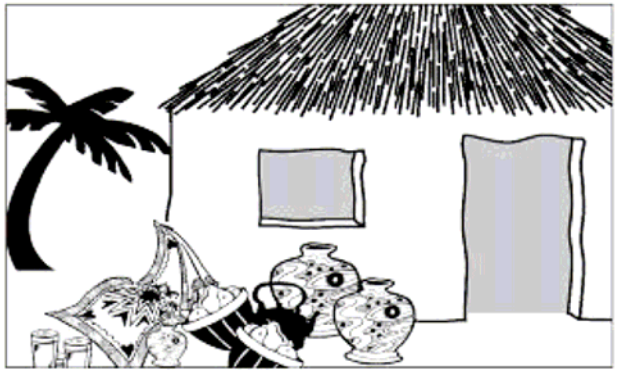
Indoor residual spraying (IRS)

Mosquitoes that enter houses often rest on walls before biting a person. Spraying the walls inside houses with insecticide kills them when they land on the surface.

IRS was a successful technique using DDT about 30 years ago, but DDT was abandoned in most countries due to environmental concerns when it was used extensively in agriculture.

The World Health Organisation has recently endorsed the use of DDT for IRS in an effort to reduce the number of people suffering and dying from malaria.

Other insecticides, such as lambda cyhalothrin, are now available for use on wall surfaces.

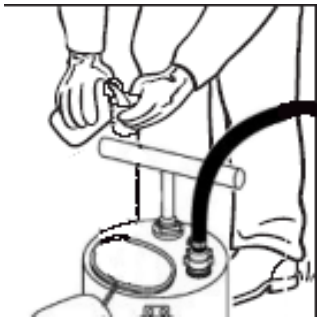


Operator protection

Mixing and filling (+ cleaning/maintaining sprayers)

These are the most dangerous operations with pesticides since the operator is handling concentrated product. Operators should wear:

- gloves or plastic bags on hands
- eye protection – a visor will stop pesticide splashing onto the face. If a visor is not available, goggles or even glasses or sun glasses will protect the eyes
- cotton clothes to cover the body (long trouser legs worn outside the boots, and long sleeves)
- shoes or boots which cover the feet (NEVER sandals)
- a hat
- waterproof apron or large plastic bag to cover the front of the body
- always have soap and water available to clean spilled pesticides off the skin.



Procedure for Indoor Residual Spraying

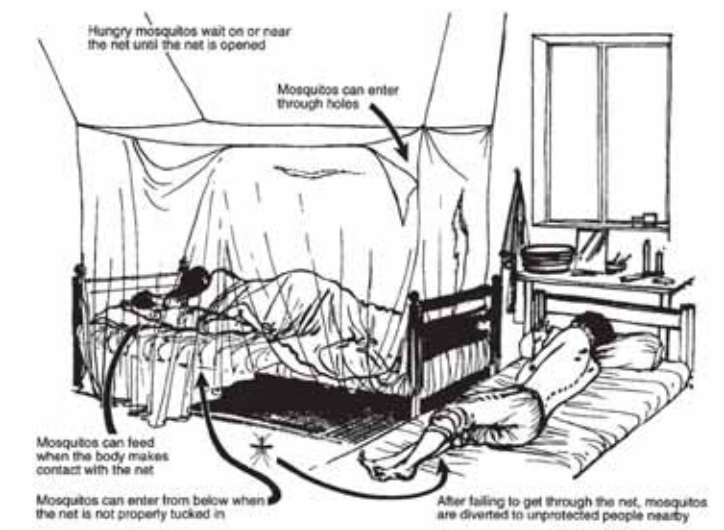
Before spraying inside a house remove as many items as possible and then cover furniture remaining with a plastic sheet

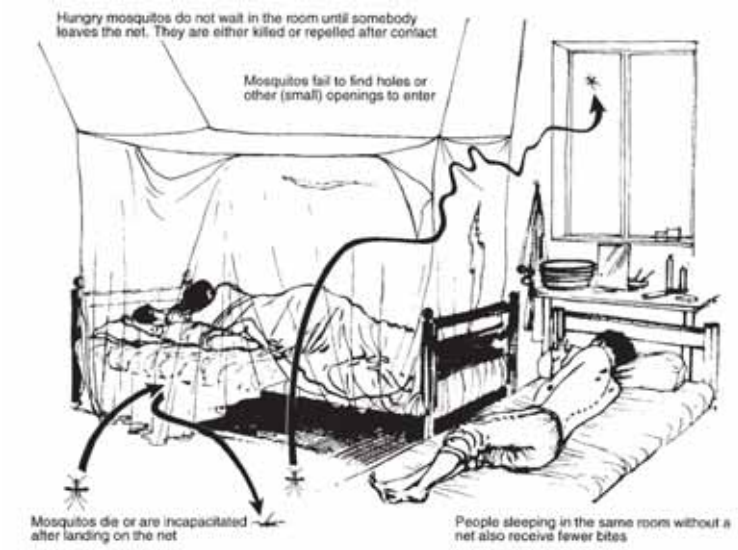
The spray operator must wear overalls, gloves, hat and goggles.

The insecticide [10ml of ICON 10 CS] is added to 8 litres of water in the sprayer tank. The operator then replaces the lid, shakes the sprayer and pumps air into the tank to increase the pressure.

The operator enters the house and starting in the room furthest away from the main door, sprays each wall with a series of vertical swaths.

When the spray is dry the plastic sheet can be removed and the items that were taken outside can then be returned into the house.





SAFETY IN USING PESTICIDES

Pesticides can enter people's bodies:

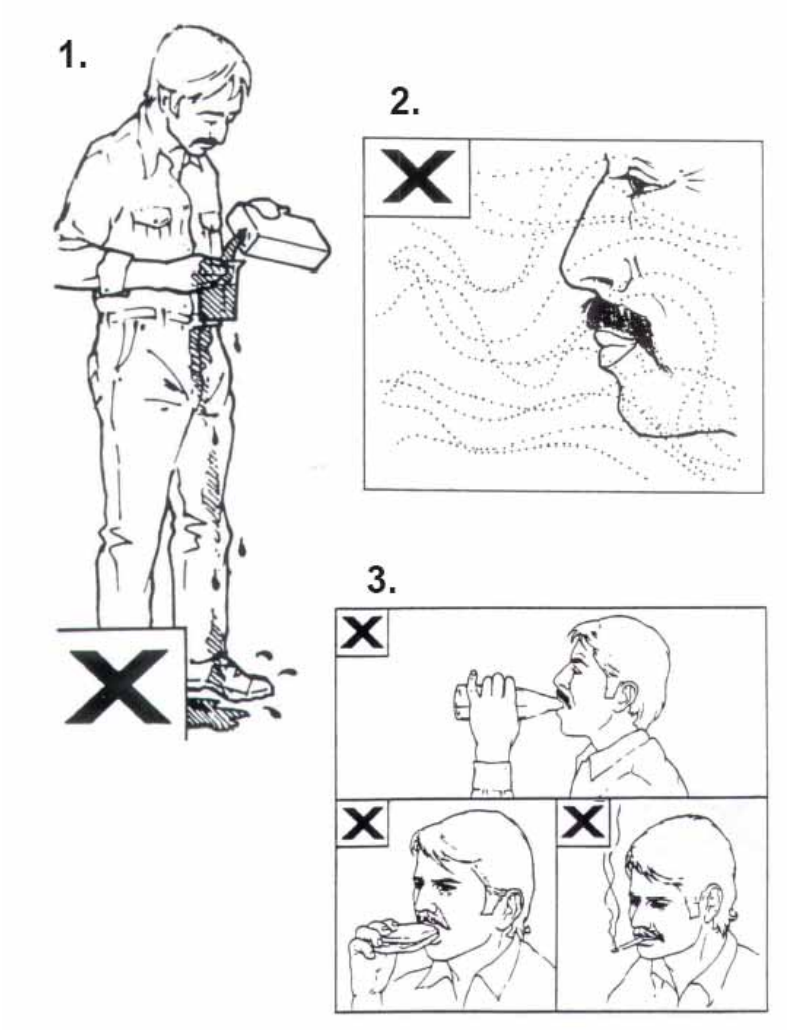
1. through the skin (if it leaks on the skin)

2. through the lungs (if it is breathed in)

3. through the stomach (if it is swallowed)

NOTE: sprayer operators are most at risk of exposure to pesticide when they are preparing spray solutions because they are handling the concentrated pesticide product. Sprayer operators should take special care to avoid contact with this concentrated product by using the right protective clothing (see page 42).

During spraying, the operator is applying diluted pesticide so the protective clothing requirements are slightly less (see page 10).



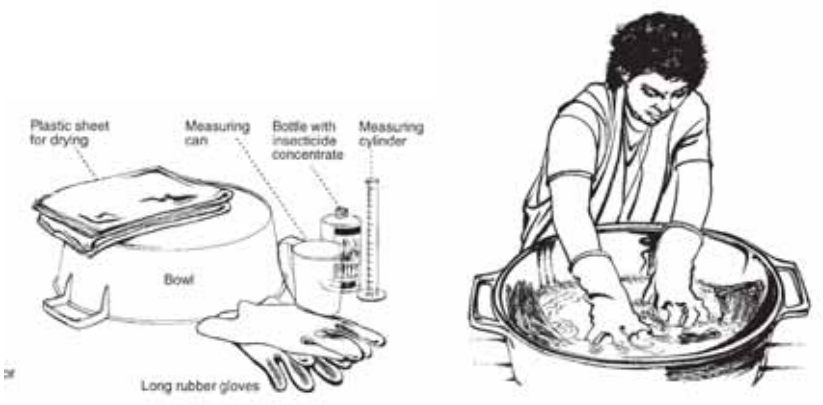
Insecticide Treated Nets (ITNs)

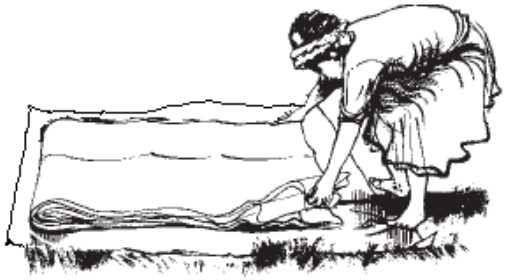
Mosquito nets stop mosquitoes biting people while they are sleeping, provided the net is not torn. If the net is treated with insecticide then mosquitoes trying to get inside the net will touch the treated net and be killed. This protects the person inside the net and stops the mosquito flying to another house in the village.

If all the houses in a village have an ITN and everyone sleeps under the nets, the population of *Anopheles* mosquitoes will be reduced. It is most important that children under FIVE years of age and pregnant women sleep under an ITN.

Treated nets can be washed if they get dirty or dusty, but usually have to be retreated with insecticide every year.

Some nets have insecticide impregnated into the fibre they are made from and are effective for about 5 years without retreatment. These are called Long Lasting Insecticide Treated Nets (LLITNs).

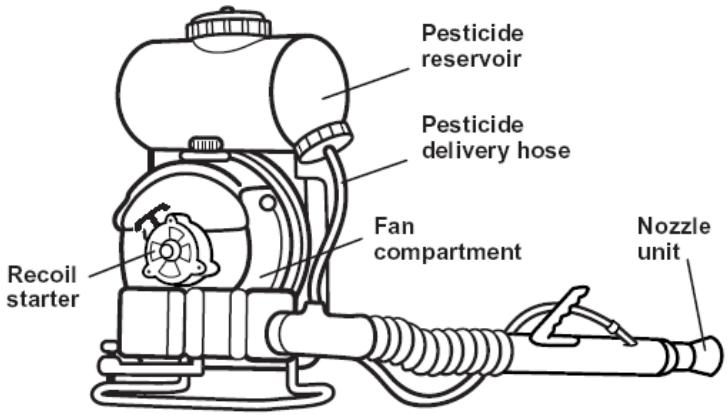


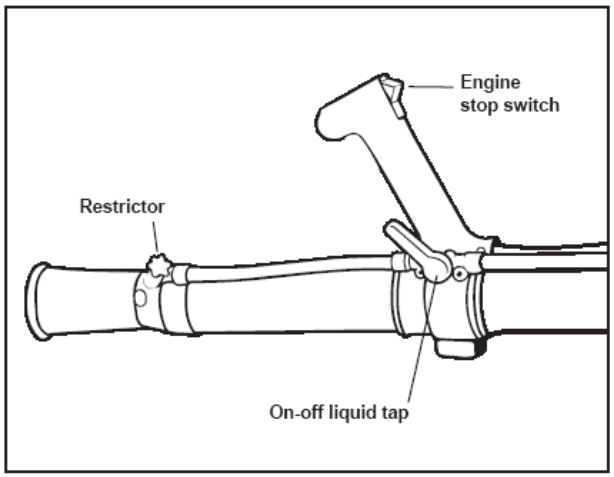


MB sprayers (mistblowers)

MB sprayers have a petrol engine and fan to produce an airblast. This makes the spray and carries it a few meters. These can be used for misting inside and outside houses, and around worksites, and for spraying tree crops.

- Always calibrate before use – see protocols.
- Always use MB sprayer with the engine running at full speed so that small droplets are produced and carried away from the operator
- If pesticide is being mixed in the sprayer, always half fill the tank with water first, then add pesticide, shake, top up with water, shake again
- Spray when there is a light wind and it is not too hot. Mornings and late afternoons are best
- Always direct the airblast crosswind or downwind, never upwind. The airblast may be strong but the wind will still carry spray back onto the operator if it is directed upwind
- Clean the sprayer by rinsing with water and spray the washings over vegetation. Do this 3 times
- Stop the engine at the end of the day by shutting off the petrol supply to keep the spark plug clean.



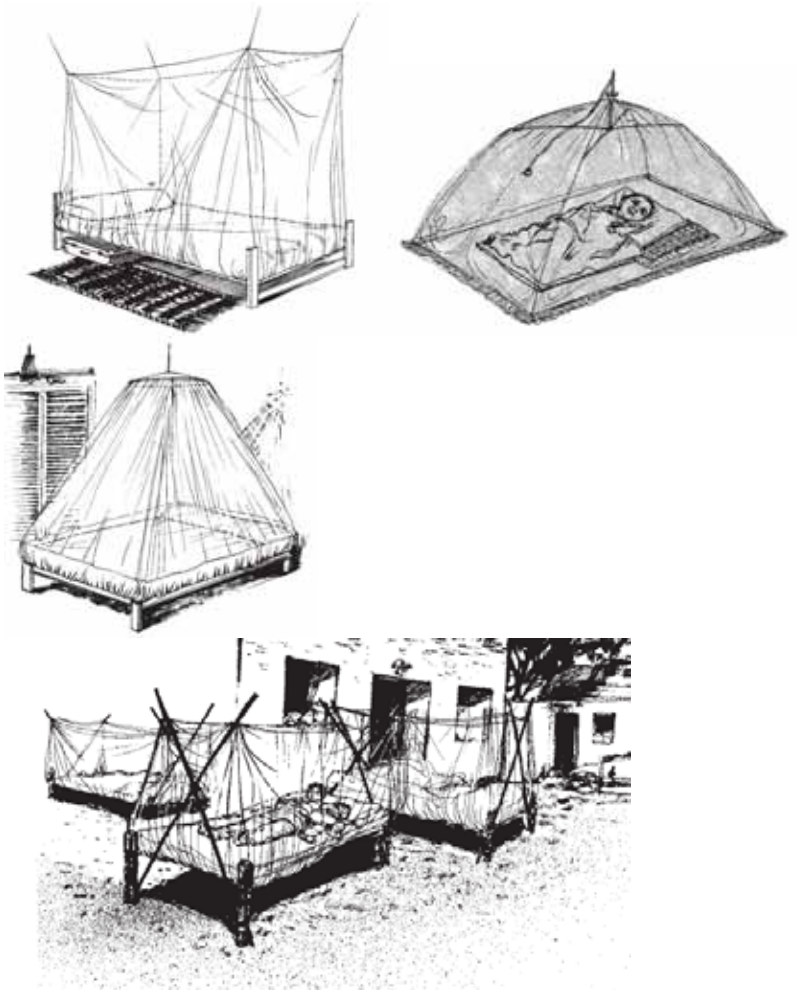


Procedure for treating nets

If the net has not been previously treated, nets need to be soaked in water in which the correct amount of insecticide has been added. This is done outside in an open area. Some lines of string need to be fixed so that the wetted bed nets can be hung up to dry.

The person treating the nets should wear overalls and gloves.

- Add 2.5ml of ICON 10SC to between 0.5 to 2 litres of water **per net** in a bowl, or larger container. Stir well with a stick;
- Add the nets to the liquid to soak for several minutes pressing and squeezing it using the gloved hands;
- Remove each net separately allowing surplus liquid to drain back into the container;
- Place the net on a plastic sheet in the shade to dry a little. After an hour or so, hang the treated net on the line or on a bush to allow it to dry fully;
- When dry the net can be taken into the house and fixed above a bed.



CS sprayers (compression sprayers)

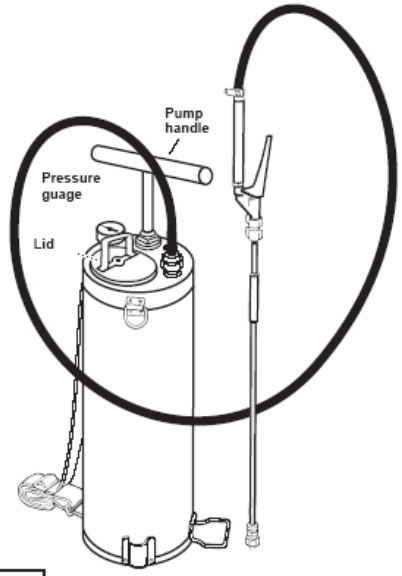
CS sprayers are pumped up to pressurise them before spraying (then regularly afterwards). Worn over the shoulder with a single strap. These are used for Indoor Residual Spraying, but are also useful for spraying small crop areas and bush crops on steep ground where the sprayer operator may need a spare hand to hold onto branches.

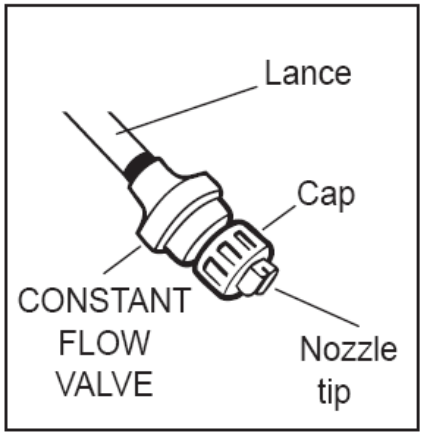
NOTE: pressure in the tank decreases during spraying, but a constant flow valve will maintain a constant pressure spray from a CS sprayer.

Always calibrate before spraying – see protocols. If pesticide is being mixed in the sprayer, always half fill it with water first, then add pesticide, shake the sprayer, top up with water and shake again. Do not take the filter out and stir the spray liquid with a stick. Use a funnel with a strainer to fill the sprayer.

Never blow a blocked nozzle – soak it in water and clean it with a soft brush (not with a metal object)

Clean the sprayer after use by rinsing with water 3 times and spraying the washings over vegetation.





Installing a bednet

Fix one or more nails to the wall by the bed or any wooden part of the roof above the bed.

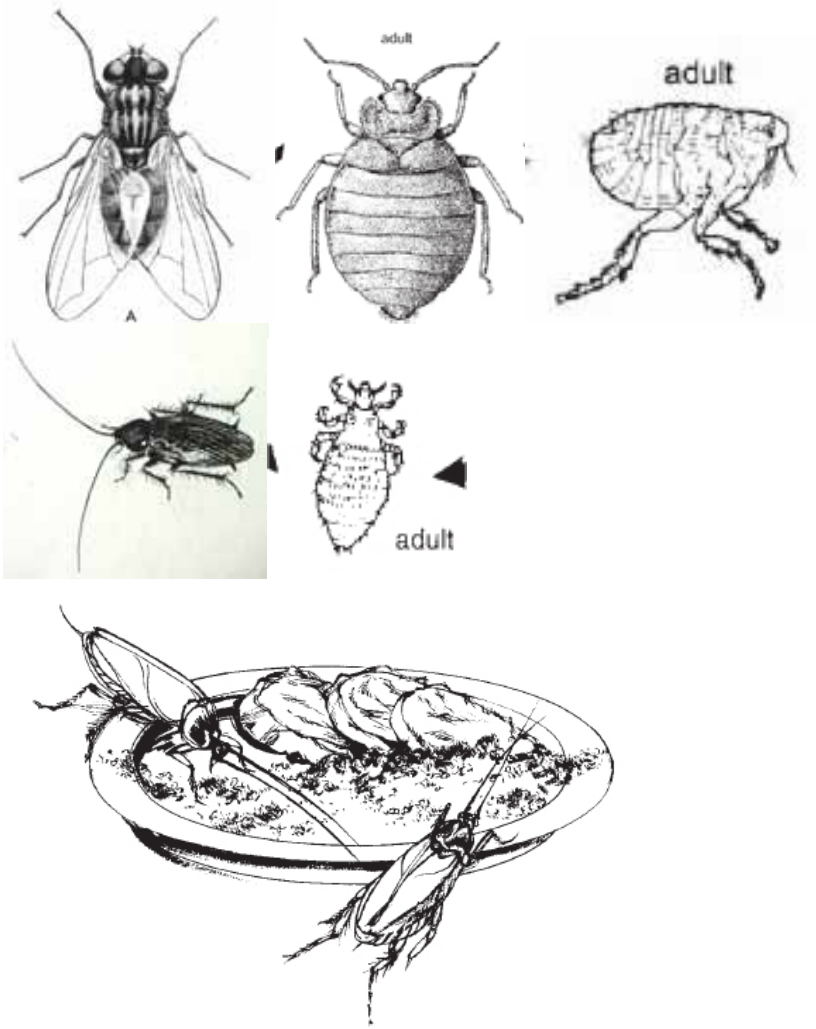
Attach a string to the net so that the string can be tied to the nail or other support so the net hangs over the bed and the bottom edge can be tucked in under the mattress so there is no opening large enough for mosquitoes to enter while the person is sleeping.

While asleep, do not touch the inside of the net – mosquitoes can bite through the mesh before they die.

Other vectors and nuisance insects

There are many other insects that transmit diseases and cause nuisance and suffering in the village. Many of these are also killed by mosquito control methods.

- House flies feed on food and rubbish and can transmit germs to people. They can also be a severe nuisance.
- Bedbugs feed on people at night and are a severe nuisance. The blood loss in infants can cause anaemia
- Fleas bite people to suck blood and can cause irritation and extreme discomfort. They can also transmit the Plague – a serious bacterial disease, and other diseases
- Cockroaches feed at night – crawling over food, rubbish and sewage. They can therefore cause severe intestinal infections such as diarrhoea, dystentery, typhoid and cholera in humans that eat the food they have contaminated with germs.
- Lice feed on human blood and cause severe irritation and itching, as well as transmitting diseases such as Typhus.



Misting of insecticides in or around houses

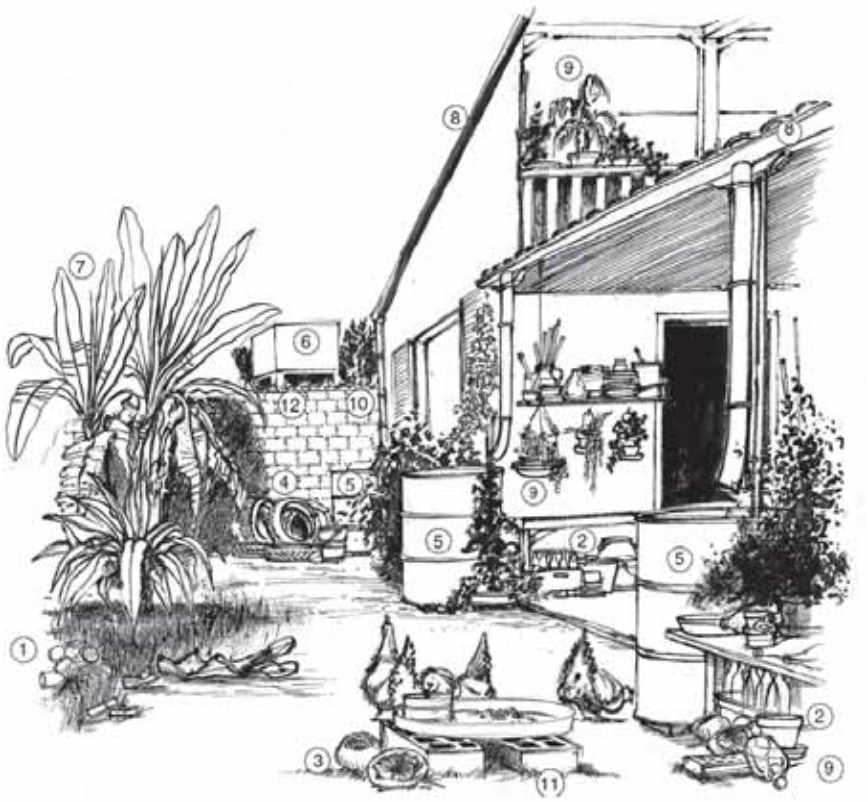
As an alternative to IRS, in some areas, an insecticide mist is applied either inside or around the outside of houses.

Inside houses.

Follow the same procedure as IRS but instead of spraying each wall with a compression sprayer, the insecticide is applied using a strong air flow to project the insecticide into each room of the house.

Outside houses

Spray is projected up in the eaves and roof space from outside the house. Spray is also applied to any vegetation and out-houses next to the house where mosquitoes may rest before entering a house.



Protection of people from blackfly

Traditionally those who have to work near the river, such as fishermen and farm workers, have covered their body and face as much as possible to reduce the number of blackfly bites. But flies continue to irritate as they continue to try and penetrate the clothing.

Further protection may be obtained by wearing over a long sleeved shirt, a sleeve of material impregnated with insecticide. The netting used to make bednets can be sown to form a sleeve that covers the arms and wrists. Similarly a sleeve over the ankles can be worn.

The aim is to kill the blackflies so that they do not continue to be a nuisance and try to bite.

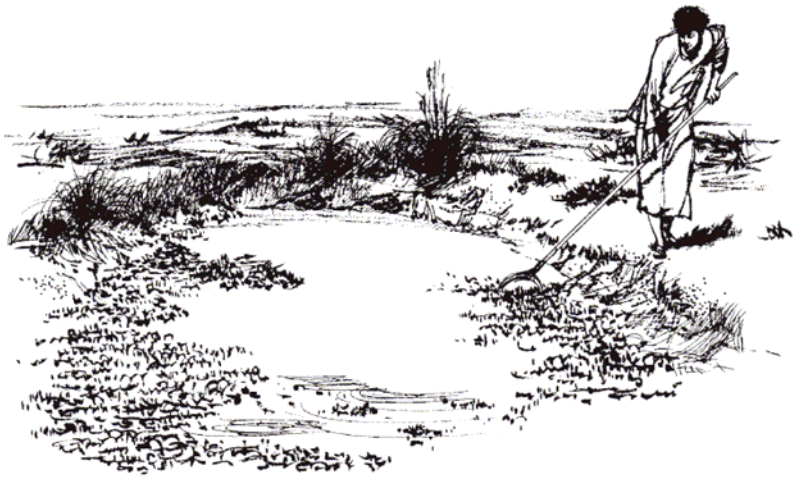
Repellant creams can also be used, but are a continuous expense and can be uncomfortable in hot conditions.

Preventing mosquitoes breeding in the village

After rain, water can collect in places around houses. Where possible these should be drained as this water can provide an ideal breeding site for mosquitoes.

These places include thrown away tins and plastic containers, bottles, coconut husks, old car tyres, drums and barrels, blocked roof gutters, holes in construction blocks or bricks.

Villagers should not store water in uncovered drums or other containers as mosquitoes can also breed in these. Latrines should also be covered.



Controlling blackflies

Blackflies are controlled by adding an insecticide to the river to kill the larvae.

The insecticides temephos, permethrin and *Bacillus thuringiensis* (Bti) are used. The particles of Bti are only suitable for application when the water in the river is at very low level. The other insecticides are formulated to mix with the river water and can be effective for several kilometers downstream from where they are applied.

The correct amount of insecticide must be applied to maintain a particular concentration for at least 10 minutes as it passes downstream through the rapids.

The insecticide should be applied across the river so that all sections of the flow of water contain the larvicide as it flows through different sections of the river.

30
Pic of application to river

Treating larval breeding sites

If there is a pond that cannot be drained and it is decided to control the larvae, apply a larvicide, such *Bacillus thuringiensis* (Bti) or pyriproxyfen as recommended .

The larvicides can be applied using the same equipment as used with IRS or if granules are used these can be scattered by hand over the water surface.

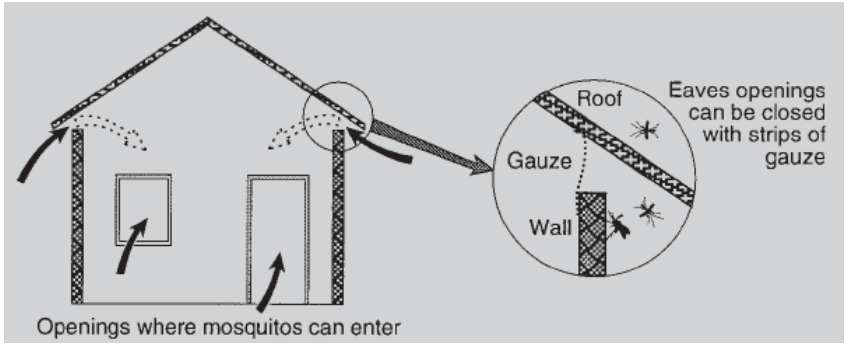
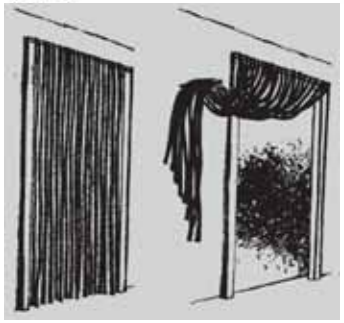


Fig. 1.84
Treated screening in the eaves need not fit exactly because mosquitos are unlikely to find openings (© WHO).

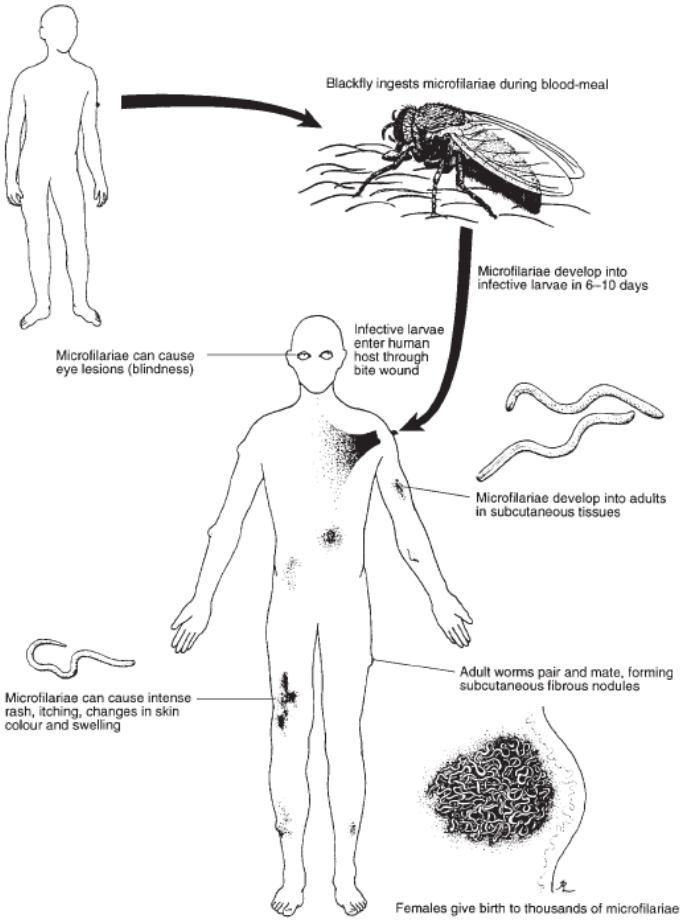


Onchocerciasis (river blindness)

Onchocerciasis is an infection caused by the parasite *Onchocerca volvulus*. With a heavy infections the person can have one or more of the three conditions; dermatitis, eye lesions, and/or subcutaneous nodules. Skin samples are examined under a microscope to identify the parasite . The World Health Organisation (WHO) estimates that about 17.7 million people are affected by it around the world. About 99% of infected persons are in Africa. Onchocerciasis is commonly treated with an oral medicine called Ivermectin.

When an infected blackfly feeds on a person, the *Onchocerca* larvae penetrate the wound and develop in nodules under the skin. They can live there for about 15 years. For about 9 years the female worms produce microfilariae, usually found in the skin, where they can be ingested by the next blackfly that bites. In the black fly the microfilariae move from the insect gut to the thorax and then to the mouthparts ready to infect another person.

When the microfilariae reach the eyes of the person, they lead to blindness.

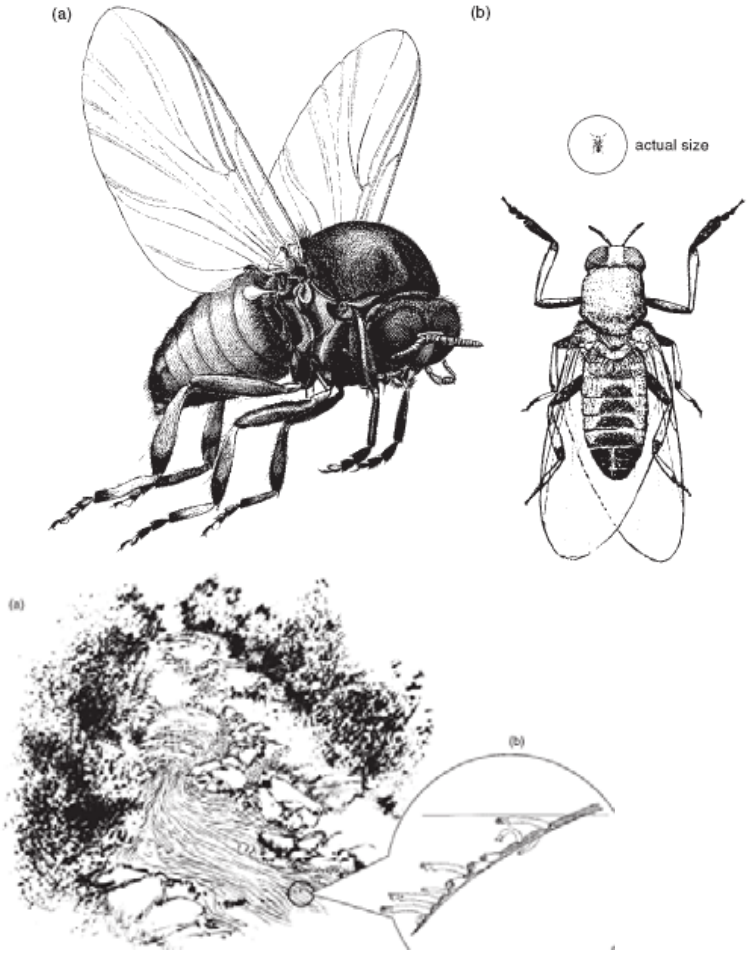


Screening and sealing of houses

Mosquitoes can enter houses through the many openings that are often present. They will fly through the gaps between walls and the roof (the eaves) and any open doors and windows or other gaps in walls.

Villagers can reduce the number of mosquitoes in their houses if they block as many opening as possible. As it is important to maintain airflow through the house, the eaves should be covered with mesh or net screens that allow air to come into the house. The edges of screens must be carefully fixed so there are no gaps. Strips of wood can be nailed over the mesh to hold it to the top of the walls and roof support. The gaps between the actual roof and its support may need to be closed separately.

Pieces of insecticide treated netting can also be fixed across open doorways or as curtains at windows, and doors can be fitted with a row of plastic strips.



Blackflies (especially *Simulium damnosum*)

These small biting insects are a considerable nuisance during the daytime, especially when working near rivers.

The blackflies are also very important vectors as they transmit the small filarial parasite *Onchocerca volvulus*, which can cause the disease onchocerciasis or river blindness.

The larvae of this vector live in the fast moving water at rapids along rivers. They cling to stones and vegetation and feed by filtering small particles of food from the water.

The adult blackflies, like mosquitoes, need a bloodmeal to produce eggs.