

Fig. 3.15
House improvement reduces the resting places available to triatomine bugs.



Fig. 3.16
Resting places in walls can be filled with plaster, which can be applied by hand and smoothed by hand or with a trowel.

the white residue with a hammer and mixing it with water. After plastering, the walls can be painted to improve their appearance with, for example, a whitewash of lime and water.

2. Prepare a mixture of mud and, for strength, very short pieces of straw. Apply a layer of this material to the wall and make sure the entire wall surface is

completely smooth. If a thick layer is needed, it is advisable to apply the mud and straw mixture in two or even three thin layers to avoid cracking. Each layer should be allowed to dry before the next one is applied. However, for better adherence the surface should be wetted before another layer is applied (Fig. 3.17).

Cement plaster

So as to improve durability a final layer of concrete should be applied, i.e. a mixture of cement, sand and water. As before, this layer should be applied to a wetted surface for better adherence and should be wetted periodically to prevent cracking.

Cement plaster may become detached if:

- the wall is not wetted before plastering;
- the plaster is not wetted to slow down drying;
- the plaster is of poor quality, i.e. contains too little cement.

Wire reinforcement

Additional strength may be provided to cement plaster by adding wire netting (chicken or fencing wire) (Fig. 3.18). Ideally the wire reinforcement should be used on all walls but priority should be given to those most exposed to rain.

Attach the wire netting before the layer of cement is applied. For the greatest possible strength the netting should be in the middle of this layer. Direct contact between mud plaster and netting may cause the latter to corrode rapidly.

Floors

Especially in Central America where *Triatoma dimidiata* is a vector, floors should be included in house improvement. This could involve smoothing floor surfaces,



Fig. 3.17

The surface has to be wetted before the next layer of plaster is applied, in order to improve adherence and prevent cracking caused by excessively rapid drying.

compacting them and covering them with a layer of cement (Fig. 3.19). Cracks that appear subsequently should be filled.

The roof

In areas where traditional roofing materials provide hiding places for bugs (thatched roofs in Venezuela, roofs of wood and soil in Argentina and Bolivia), it is best to replace them by tiles or sheets of corrugated iron.

Tiles have the advantage that, like the traditional roof materials, they insulate houses against heat or cold and look more attractive than corrugated iron; furthermore, they can also be produced locally. However, tiles are heavy and require special construction of roof timbers to carry the load (Fig. 3.20).

Corrugated iron roofs offer the advantage of being widely available and relatively cheap (Fig. 3.21). Fitting the sheets is easy. However, they do not insulate houses against heat or cold and are noisy in heavy rain.

Another roof material is *acerolitos*, a sandwich construction of two layers of aluminium foil with asphalt between. Sheets of this material offer good insulation against temperature extremes but are more vulnerable to damage and more expensive than corrugated iron. Fibre-reinforced cement sheets offer similar advantages but they are heavier and more vulnerable to damage.

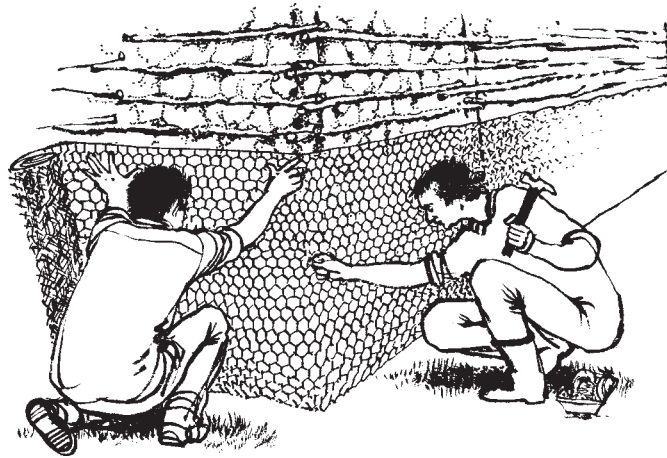


Fig. 3.18
Cement plaster can be reinforced with wire netting.



Fig. 3.19
Resting places in floors can be filled and covered with a layer of cement.

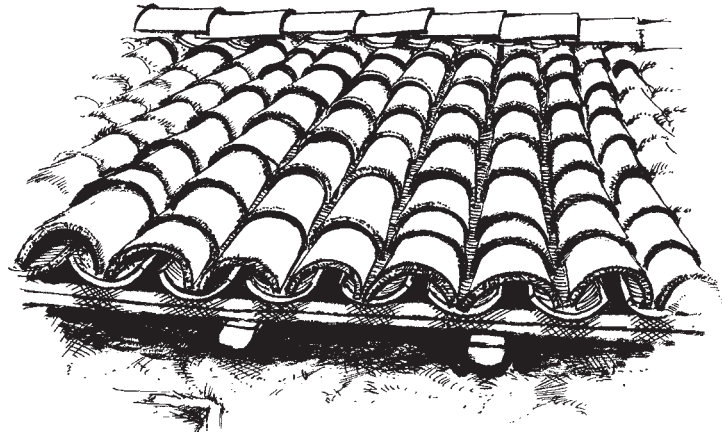


Fig. 3.20
Tiles are a suitable traditional roofing material for the improvement of houses.



Fig. 3.21
Corrugated iron sheets do not offer a suitable habitat to triatomine bugs.

New houses

Where a new house is to be built or an old one is not worth improvement by the methods described above and has to be replaced, it is recommended that durable materials such as cement, fire-baked bricks or timber be used. If these materials are unavailable or too expensive, it is possible to avoid cracking of mud walls: the earth can be stabilized against erosion and shrinkage by the addition of bitumen (asphalt), cement, lime or straw, or a combination of these materials.

In some areas the traditional sun-dried, unbaked blocks of adobe are already of good quality because of the addition of straw and because of naturally occurring elements in the local soil.

Pressed stabilized soil blocks

High quality mud blocks that are more durable than ordinary blocks and can support more weight can be made by compaction in a mechanical press (Fig. 3.22). The blocks are made at the building site, and this greatly reduces the amount of materials to be transported. Very strong and water resistant, stabilized



Fig. 3.22

High-quality building blocks can be made by compacting soil under pressure in a mechanical press.

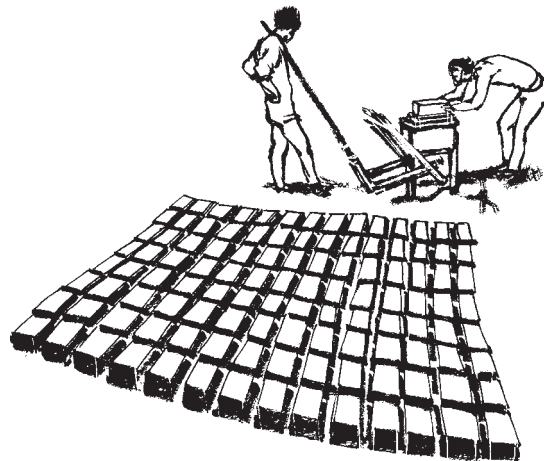


Fig. 3.23

Blocks produced by mechanical presses have to be cured for 2–3 weeks before being used.

soil–cement blocks can be made by compacting a mixture of cement (about 5–8%) and soil. Blocks of similar strength can be made by using 7–10% lime. The soil should be dry enough to be crushed to pass through a 6-mm mesh sieve. This is necessary to ensure effective mixing with the cement, which should ideally coat all the soil particles. The soil should preferably contain 5–30% clay. The blocks have to be left to cure for 2–3 weeks before being used (Fig. 3.23). They should be stacked in piles 3–5 days after being pressed, and covered to protect them from rain.¹

¹ Further information is available from the Building Research Establishment, Garston, Watford, England.

Pressed and stabilized blocks can be left unplastered, as the blocks should remain crack-free. Mortar joints should be filled completely and flush-pointed to ensure the absence of voids that could serve as habitats for the bugs.

For low-cost construction the press can be used to make sun-dried blocks of soil without the addition of cement. In this case further improvement can be achieved by plastering the walls with cement; the brick walls should be wetted before plastering.

The press can be operated by one person; with a crew of three or more the machine can be run continuously while the digging and mixing of soil and the stacking of new blocks is going on. Depending on the type of machine, a three-person crew can produce at least 20 blocks an hour. Several types of hand-operated presses have been developed.

Advantages and disadvantages of pressed stabilized soil bricks as compared with ordinary sun-dried mud bricks or mud-and-wattle

Advantages

- Durability, longer life of houses.
- Better appearance.
- Fewer cracks in walls which could offer hiding places to insects.
- Better surface for painting and plastering.
- Because the blocks are less porous than adobe, they offer a suitable surface for spraying of residual insecticides against bugs or malaria mosquitos.

Disadvantages

- Although suitable for individual use the press has to be bought and used by community cooperatives or small-scale business enterprises to make it economically viable.
- Soil preparation is tedious.

Improvement of the peridomestic environment

Fences, roofs and wall constructions of animal shelters and storage places for agricultural products and firewood can be modified so that triatomine bugs do not easily find suitable hiding places in them (Fig. 3.24) (13).

Impregnated mosquito nets

Mosquito nets can provide a physical barrier between bloodsucking insects and sleeping persons. However, if not properly tucked in under the mattress or if it has holes that allow insects to enter and feed, the net will be ineffective. Even when a net is properly used, the body may make contact with it, thus allowing the insects to feed. In addition, mosquito nets are not effective against bloodsucking insects that live in mattresses, such as bedbugs (*Cimex*) and triatomine bugs. Hungry bugs can survive for long periods and are likely to persevere until they manage to feed.

Impregnation of the net with a quick-acting pyrethroid insecticide should prevent these problems. The use of impregnated mosquito nets results in the killing of bedbugs, lice and fleas, as well as mosquitos (Fig. 3.25). Although the

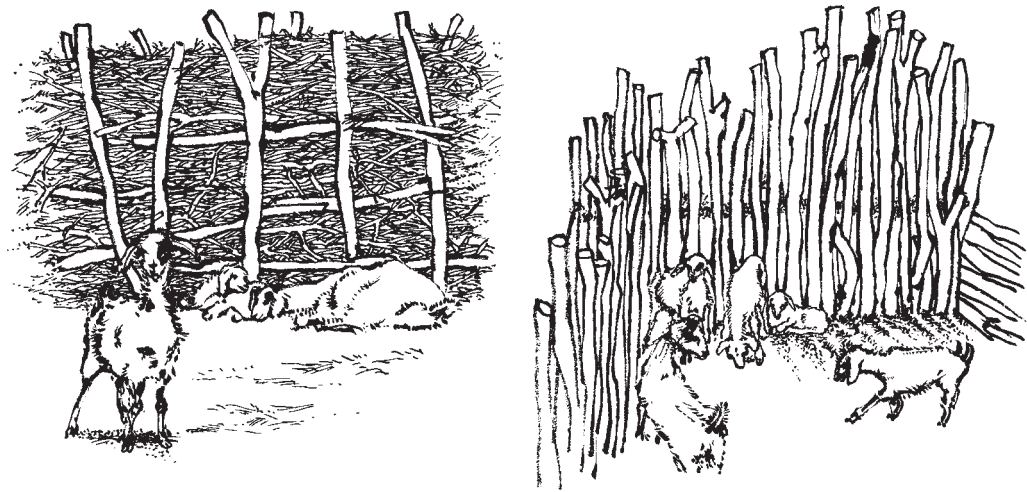


Fig. 3.24
Fences for goat corral. The fence on the right has fewer hiding places for bugs than the one on the left.

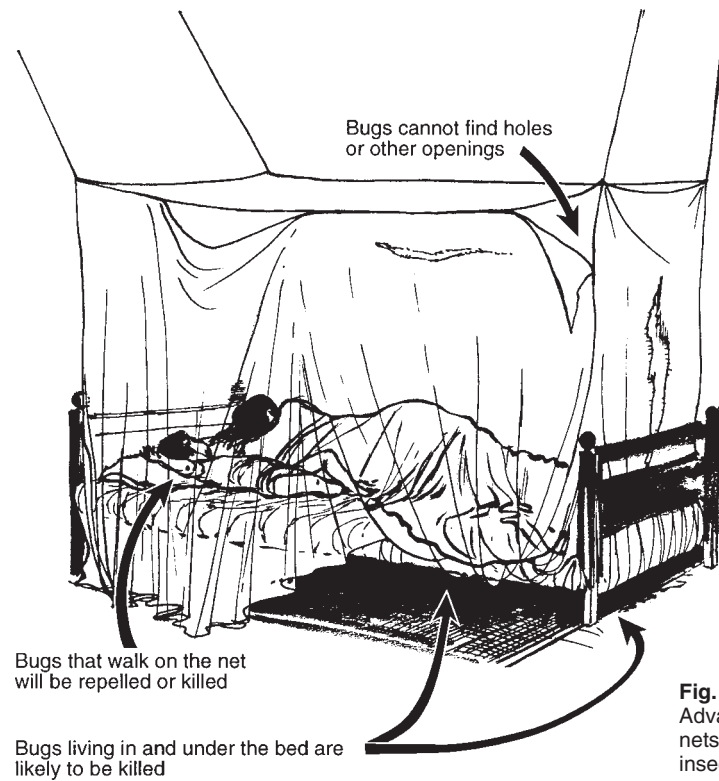


Fig. 3.25
Advantages of mosquito nets impregnated with an insecticide.

effectiveness of this method against triatomine bugs is still under investigation, it is likely that they will be killed or repelled, especially the more vulnerable nymphal stages.

Impregnated mosquito nets might be useful for self-protection in areas where no official control activities are carried out. In addition, they could be part of a programme based on community participation aiming to maintain the results obtained by government campaigns. They are not intended as alternatives to wall-spraying or house improvement.

Chapter 1 provides more information on mosquito nets and how to impregnate them with an insecticide.

Fumigant canisters

Disposable fumigant canisters consist of small cans of insecticide, with a fuse sticking out from the top (Fig. 3.26). When the fuse is lit, insecticidal smoke is released for a short period (Fig. 3.27). One can is sufficient for the fumigation of about 15 m³ of air. Thus a room of 3 × 5 × 2 m = 30 m³ would need two canisters. In general there should be about two canisters for each room where people or animals sleep. For optimum smoke dispersal the doors between rooms should be left open. During fumigation the gases should penetrate into the hiding places of the bugs. Irritated bugs leave their hiding places and may be killed. For maximum effectiveness all openings of houses should be closed. An hour after a canister has been lit the house can be ventilated and re-entered.

Fumigant canisters may be appropriate in areas where triatomine bugs have been successfully controlled and where house-spraying is no longer carried out on a routine basis. If houses are reinfested, they and the houses immediately surrounding them can be treated quickly and cheaply in this way (14).¹

Advantages and disadvantages of fumigant canisters

Advantages

- The use of canisters does not require special training.
- The method works best in combination with other control methods. In Argentina it has allowed the frequency of house-spraying to be reduced from twice a year to once a year during the surveillance period.

Disadvantages

- The residual activity is short. Bugs may reappear in a treated house within a few months.
- If repeated frequently, the method is expensive.

Use

- The can has to be lit on a fire-resistant surface on the floor away from flammable objects.

¹ Information on the availability of fumigant canisters can be obtained from Pest and Insecticide Research Centre (CIPEIN), Zufriategui 4380, Buenos Aires, Argentina.



Fig. 3.26
After being lit, fumigant canisters produce a smoke that kills insects.

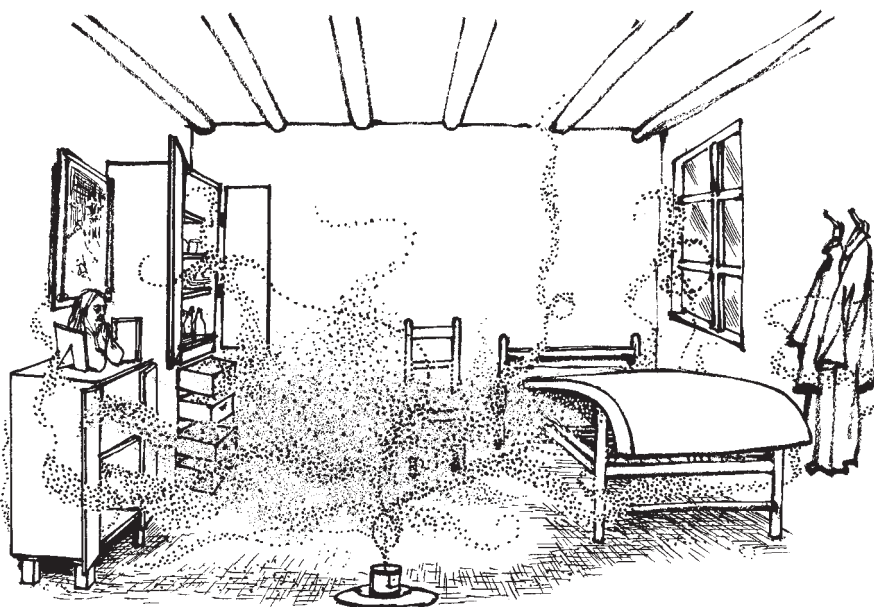


Fig. 3.27
The fumigant canister burns for up to 15 minutes.

- Windows and external doors should be closed and food, drinks and animals removed.
- Cupboards with clothes and other potential hiding places for bugs should be opened.
- Doors between rooms should be opened.
- After lighting the cans, wait at least an hour before re-opening the doors and windows for ventilation.
- Allow the house to ventilate for 30 minutes before re-entering.

Safety

The vapour released from the canister contains insecticides (e.g. dichlorvos, lindane and pyrethroid) of very low toxicity to mammals, birds and humans. The method is considered safe for the user. However, during the process of fumigation, people should leave their houses and return only after ventilation has continued for about 30 minutes (with doors and windows open).

The risk of setting fire to houses is very slight since the combustion occurs without a flame.

Surveillance

In areas where large-scale vector control activities with residual wall-spraying have been successful in suppressing or eradicating triatomine bugs it is important to keep a lookout for their reappearance in houses. This would be a signal for either the house owners or the responsible authorities to take action.

Three different strategies can be distinguished for the organization of surveillance activities:

- The government control programme puts special field inspectors in charge of surveillance in certain areas (15).
- Some members of the community are provided with materials and trained to carry out surveillance. They keep the government control programme informed. For example, schoolchildren may be asked to collect the bugs and take them to a teacher, who sends them to the health authorities.
- As part of the primary health care approach, some community members are trained as health workers, and they are in charge of surveillance and re-treatment activities, among other things (16).

The first strategy is the most expensive. The third requires the presence of a well organized primary health care system. It is essential that communities and individual house owners participate in surveillance activities. The health authorities should provide information and educational materials, posters and brochures to motivate communities to participate. Community surveillance, if properly organized, saves the authorities much work and money and is likely to improve the quality of control operations.

Surveillance methods

Collecting by hand

The most direct method of detecting bug infestations is to check potential hiding places with a flashlight (Fig. 3.28). Deep crevices and other hiding places can be sprayed with an irritant substance or flushing-out agent, such as a 0.5% solution of a synthetic pyrethroid or pyrethrum in kerosene, to drive out the bugs (17, 18). The spray can be applied with a hand-held plastic spray-gun of the type used for spraying house plants (Fig. 3.29). Any bugs and eggs should be collected with forceps and taken to a teacher or health worker who can identify the species and contact a vector control officer.



Fig. 3.28
Cracks in walls and other potential hiding places can be checked for the presence of bugs.



Fig. 3.29
Deep cracks and crevices in walls may be sprayed with an irritant or flushing-out agent to drive the bugs out of their hiding places.

Surveillance boxes

A less laborious but less precise method involves the use of cardboard boxes that offer hiding places to the bugs. The boxes can be disassembled easily and examined at regular intervals—for example once a month—for bugs, eggs or streaks of faeces on paper or cardboard inside the boxes. Various kinds of box have been designed and tested (16, 19). All are flat and have holes in the sides or bottom and folded paper or cardboard inside (Fig. 3.30). The boxes are nailed to walls at a height of 1.5 m and close to beds, and out of reach of children (Fig. 3.31).

On inspecting the boxes it is important to draw a circle round any faecal streaks to prevent confusion between different observations (Fig. 3.32). Any bugs present should be put in a plastic bag, matchbox or other container and sent for examination to teachers or the health authorities.

Since other insects, such as cockroaches and bedbugs, might also use the boxes as a hiding place, it is important to be able to recognize triatomine bugs and their

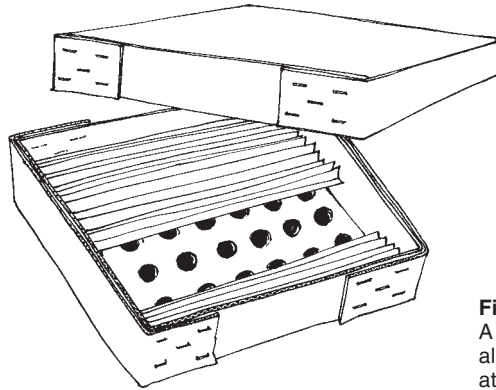


Fig. 3.30
A surveillance box. In the bottom are holes that allow the bugs to enter. Pleated paper provides attractive hiding places.

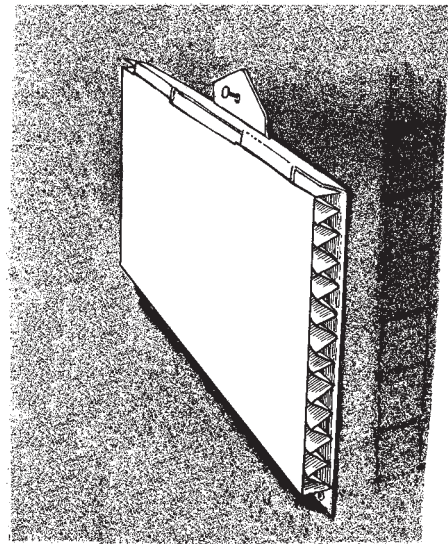
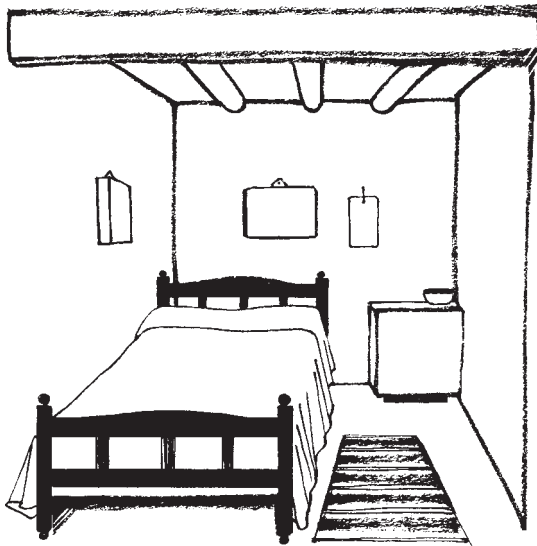


Fig. 3.31
The surveillance boxes are hung against walls close to beds and out of reach of children.

eggs and faeces. Keys for the determination of the origin of faecal deposits have been published elsewhere (20, 21).

Surveillance sheets

A simpler method involves tacking sheets of coloured paper to the walls of the house in order to pick up recent deposits of bug faeces. If the papers are marked with the date they are put up, it is possible to tell during which period the bugs were present. Faecal streaks on a recently attached paper provide reliable evidence of current infestation. The best places to attach the papers are on walls close to beds. The sheets are considered to be as sensitive as surveillance boxes (20, 22).

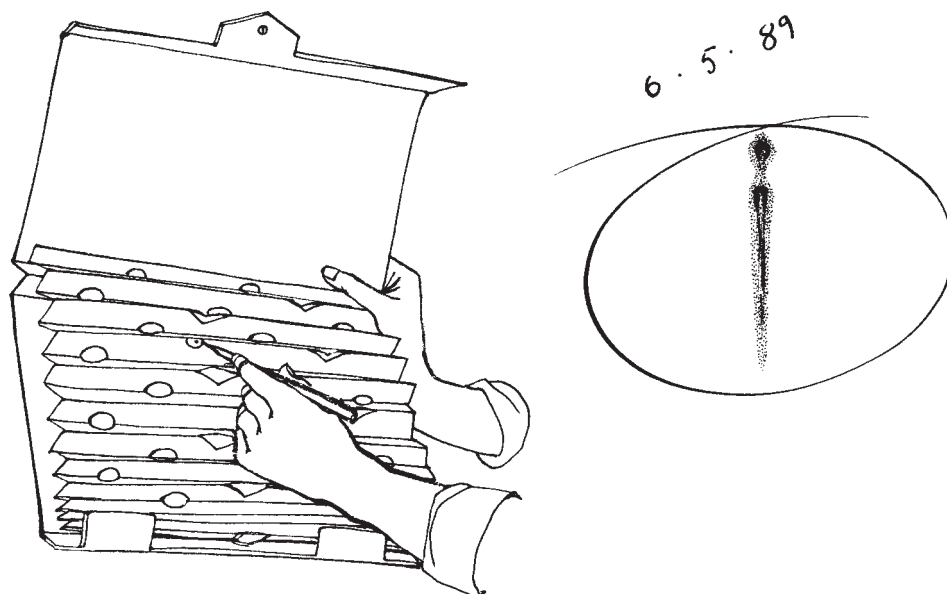


Fig. 3.32
Draw a circle around any faecal streak and note the date. As shown on the right, faecal streaks on vertical surfaces are distinctive.

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