VECTOR CONTROL SERIES

COCKROACHES
Training and Information Guide

WORLD HEALTH ORGANIZATION
Vector Biology and Control Division

1985
FOREWORD

It is recognized that there is an acute shortage of vector control specialists in many countries. Accordingly, if vector control is to be improved and made more widely available, there is no choice but to transfer some of the responsibilities for such control to less specialized workers in the community through the Primary Health Care approach. This trend will require a number of persons to become familiar with the biology, ecology and control of arthropods that carry disease-producing organisms. To provide guidance to these individuals who are not professional entomologists, but who will be working on the control of disease vectors, the WHO Division of Vector Biology and Control has developed this vector control series as a training and information guide.

This series will provide relevant technical information in as simple a manner as possible and will highlight acceptable methods of vector control. It is believed that health educators and those working in this type of health delivery system will be able to extract the necessary information and utilize it in a way that is relevant to their own working environment.

In order to improve the value and usefulness of this guide, evaluation forms are attached and users are requested to send the completed forms to the WHO Division of Vector Biology and Control in Geneva so that their comments may be taken into consideration when the guide is revised.
VECTOR CONTROL SERIES

TRAINING AND INFORMATION GUIDE

COCKROACHES

WORLD HEALTH ORGANIZATION

VECTOR BIOLOGY AND CONTROL DIVISION

1985

The issue of this document does not constitute formal publication. It should not be reviewed, abstracted, quoted or translated without the agreement of the World Health Organization. Authors alone are responsible for views expressed in signed articles.

Ce document ne constitue pas une publication. Il ne doit faire l'objet d'aucun compte rendu ou résumé ni d'aucune citation ou traduction sans l'autorisation de l'Organisation mondiale de la Santé. Les opinions exprimées dans les articles signés n'engagent que leurs auteurs.
CONTENTS

I. INTRODUCTION

II. LIFE HISTORY AND BIOLOGY

III. WHY COCKROACHES ARE IMPORTANT

IV. SPECIES (TYPES) OF COCKROACHES FOUND IN HOUSES

V. WHAT TO DO ABOUT COCKROACH INFESTATION
   A. PREVENTION BY CLEANLINESS AND MAKING HOUSES BETTER
   B. CONTROL BY CHEMICAL INSECTICIDES
      - METHODS OF APPLICATION
      - FREQUENCY OF APPLICATION
      - PRECAUTIONS
      - RESISTANCE TO INSECTICIDES
   C. THE ROLE OF THE COMMUNITY IN COCKROACH PREVENTION
      AND CONTROL

VI. GLOSSARY OF TERMS

VII. SELECTED BIBLIOGRAPHY

VIII. EVALUATION
    A. QUESTIONNAIRE FOR SELF-EVALUATION
    B. QUESTIONNAIRE FOR RETURN TO THE DIVISION OF
       VECTOR BIOLOGY AND CONTROL
I. INTRODUCTION

Cockroaches are the most common and troublesome pest in many homes and buildings. Their filthy habits, ugly appearance and bad smell, make them particularly objectionable and disliked. Moreover, some people develop allergies* to cockroaches when they are exposed to them often.

In addition, cockroaches may carry the germs (organisms) causing diseases of the bowels - diarrhoea, dysentery, typhoid fever, food poisoning and cholera - from the rubbish bin and drains and sewers to the food of man.

Cockroach species* vary a good deal in size. Adults of some species are only about 2-3 mm in length while others may be more than 80 mm.

II. LIFE HISTORY AND BIOLOGY

Cockroaches are flattened from top to bottom and vary in colour from tan to light brown to black, except for certain colourful tropical species. When the insect is at rest (Fig. 1), the head is bent downward and backward under the "pronotum"* or back plate shaped like a shield. The head has one pair of long filamentous (thread-like) antennae* or "feelers", two large eyes (similar to other insects), and

* Terms marked with an asterisk are defined in Section VI
- Glossary of Terms.
chewing mouthparts. The pronotum covers the bases of the head and wings. Typically, the forewings are coloured and leatherlike, while the hind wings are clear and filmy or membranous.

![Diagram of a cockroach with labeled parts]

Fig. 1. SIDE VIEW OF THE COCKROACH

Some species have short wings and a few are wingless. Both males and females have large, segmented cerci at the top of the abdomen. Males can be seen to differ from females by the form and shape of the last abdominal segments. The adult males generally have a more thinner longer abdomen while the female abdomen is fatter and more rounded. In addition, males have styl* near their cerci.

Cockroaches are active during the nighttime and hide during the daylight hours in cracks and crevices in walls, door frames and furniture and in secure places in bathrooms, cupboards, steam tunnels, animal houses, basements, electric devices and drains. They live in groups. Their life stages (life cycle*) are egg, nymph* and adult (Fig. 2).
The Egg

The female cockroach lays eggs in groups, surrounded by a more or less hard protective covering, forming an egg case or "ootheca". Upon its completion the egg case is either left in some suitable place or carried externally or internally within the female.

The egg cases may be used to tell different species. Those of the most common species are carried externally and laid a day or two after formation.

Fig. 2. LIFE CYCLE OF THE COCKROACH
The Nymph (young cockroach)

The young cockroaches or nymphs usually look like adults except for size. When the tiny nymphs come out by cracking open the egg case, they do not have wings or fully developed sexual organs. Growth occurs by the shedding* of the exoskeleton (or outside covering) of the cockroach from time to time. This process is called moulting (Fig. 3). Often the cockroach passes through 5 to 10 moults* before becoming an adult.

Fig. 3. MOULTING OF THE COCKROACH NYMPH

The Adult

Males mature faster than females and have fewer moults during their life as a nymph. The newly born cockroaches are light coloured. Adult cockroaches have two pairs of wings. Most common pest cockroaches are weak flyers but many tropical species fly very well. Adults and offspring* move out from their shelter to feed at the same place.
At a single mating, the male provides enough sperm fluid to fertilize all the eggs of the female throughout her life. Eggs are usually produced within a few days following mating.

III. WHY COCKROACHES ARE IMPORTANT

Cockroaches use their chewing-type mouthparts to feed on many types of foodstuffs, in addition to household wastes such as garbage and sewage. They can be found wherever people prepare or store foods for themselves or their domestic animals, and they are potential contaminants unless the food is adequately or well protected. Although they prefer starchy or sugary sources of food, they may feed on almost any substance if more desirable foods are unavailable.

Cockroaches are potential contaminants of food unless it is adequately protected.

The most disgusting and potentially dangerous features of cockroach behaviour are their habits of regurgitating (vomiting up) some of their partly digested food and dropping faeces, often at the same time as they are feeding. They also produce secretions which give a persistent (long-lasting) and special (characteristic) smell to areas visited by them.

Cockroaches move freely from building to building or from drains and severs or latrines to human habitations. Since they feed on human faeces and human food, they can carry disease organisms (germs) with them, making them a potential health risk to man (Fig. 4).
Fig. 4. COCKROACHES ARE POTENTIAL CONTAMINATORS OF FOOD
Cockroaches have been shown to carry disease organisms in the laboratory and found to be contaminated with about 40 different species of bacteria that are pathogenic to man, including organisms causing plague, leprosy, typhoid fever, food poisoning, etc. The most important cockroach species involved are the German cockroach, the Oriental cockroach and the American cockroach.

Cockroaches may pass on some of the worms (helminths) that are parasitic to man. They may also catch, carry, and excrete various viruses such as the Coxsackie virus and several strains of poliomyelitis. They are suspected of being vectors of infectious hepatitis.

Cockroaches can carry and pass on unchanged, disease-producing organisms.

Cases of ill-effects due to body contact between man and cockroaches are well established. They have been blamed for causing dermatitis or itching of the skin and swelling of the eyelids. Certain species produce secretions which are irritating to some persons.

IV. SPECIES (TYPES) OF COCKROACHES FOUND IN HOUSES

Cockroaches are a highly successful form of insect life. About 3,500 named species of living cockroaches have been described. A few species have become used to living closely with man. Some of these will now be described in some detail.
The German Cockroach

The German cockroach, *Blattella germanica*, (Fig. 5) is found in most places of the world. It is well fitted to living closely with man and is a frequent household and restaurant pest. The German cockroach is one of the smallest of domestic or household cockroaches, measuring 10-15 mm in length. Males are light yellowish-brown, while females are slightly darker.

![Image of German Cockroach](image)

Fig. 5. GERMAN COCKROACH

Adults of both sexes develop at about the same time, and usually mate within the first 7-10 days of adult life. The female carries the egg case, sticking out from the abdomen, until shortly before the young come out.

An egg case, to hold a number of eggs, appears on a mated female within a few days, depending on the temperature, and is usually completely formed in 24-48 hours. Normally, egg cases vary in the number of eggs inside them from 37-44. A female will produce 4-8 egg cases during her life. The young may come
out from the egg case even before it is dropped by the female. They moult 5-7 times over a period of 30-60 days.Adults normally live more than 100 days. An infestation consists of many more young than adults.

The adults can fly but rarely do so. German cockroaches commonly enter the house with boxes of bottled drinks or bags of potatoes, onions or other foodstuffs that were infested in an insanitary, poorly cleaned foodstore.

If the lights are turned on in a heavily infested kitchen at night, the cockroaches will leave in a hurry from dishes, utensils, working surfaces and the floor towards shelter.

German cockroaches are commonest in the kitchen and places where food is stored or processed, but also often occur in the bathroom and sometimes throughout a building. Thousands have been observed in a heavily infested restaurant.

The Oriental Cockroach

The Oriental cockroach, Blatta orientalis, (Fig. 6) is another important pest species, but it is found mainly in the cooler, more temperate regions. It does not occur widely in the Orient (Eastern Asia) despite its common name.
It is a blackish species, 20–27 mm long, the female with triangular (three-sided) wing pads and the male with short wings reaching one-half to two-thirds the length of the abdomen. They are the same dark brown to black colour all over the body of the insect.

Fig. 6. ORIENTAL COCKROACH

The Oriental cockroach lives a long time. In temperate areas, the insects may spend more than one winter as nymphs so their life cycle may require more than two years. However, under optimum (the best) conditions as short a time as six months or less may be enough for their development.

Eggs may be laid at all times of the year, and there may be as many as ten nymphal molts. Most adult Oriental cockroaches are seen in the spring and summer. They have a strong nasty smell and are much disliked because they live in drains, sewers and other filthy or unsanitary places.
The best temperature range for the Oriental cockroach is 20–29 °C. As a result, it is usually found in the lower levels of houses where the temperature is cooler. This means basements, cellars, drain pipes and sewers, behind cupboards, inside walls, under floor coverings, etc. These living places or habitats need not be damp, but the insects need moisture, especially at higher temperatures. Sometimes, the cockroach is found in the upper levels of buildings which it has reached by following water pipes.

The American Cockroach

The American cockroach, Periplaneta americana, (Fig. 7) has a worldwide distribution, but probably it is not found as far northward as is the German cockroach. It is most common in tropical Africa and on the Indian subcontinent. It likes to live in a temperature of about 28 °C, but it is active from 21–33 °C. The American cockroach is found in restaurants, food processing plants, foodstores, bakeries, and other places where food occurs. This species has a strong appetite for beer and sweets of various kinds, such as soft drinks in opened bottles, but it will eat such nonfood substance as starch and glue and damage books and pictures.

The American cockroach is large in size with adults measuring about 35–40 mm in length. Larger and smaller individuals may sometimes be seen. Males and females are about the same size. The sexes can be separated by the fact that males have both cerci and styli, whereas the female lacks the two styli. All stages of this cockroach are a shining red to chocolate brown in colour.
Wings are fully developed in adults, extending slightly beyond the abdomen in males, but are about the same length as the abdomen in females. Egg cases are rather small measuring about 8 mm in length, and are very dark brown.

The life cycle may be as short as six months or as long as three years depending upon the temperature, and the nymphs normally moult 7-13 times.

Historically, these cockroaches have been of importance as pests in the cookhouse or galley and cargo hold of ships. They are found in latrines, outhouses, rubbish or garbage dumps, drains and sewers and sewage treatment plants. While not a common household kitchen pest, they may be found there. They feed on anything and can live on almost any organic matter.
SOME OTHER COCKROACHES

a. **Australian cockroach**:  
   *(Periplaneta australasiae)*  
   Occurs in many parts of the tropical and subtropical regions of the world. It is a household problem in many places. It has a pale yellow stripe on each forewing extending for about one-third of its length. It has a design on the pronotum (back plate) similar to, but clearer than, that of the American cockroach.

b. **Large-brown cockroach**:  
   *(Periplaneta brunnea)*  
   It appears to like warmer climates more than does the American cockroach. It is found in foodstores and surrounding areas, houses, sewers, etc.

c. **Smoky-brown cockroach**:  
   *(Periplaneta fuliginosa)*  
   This species is subtropical rather than tropical. It is dark in colour all over its body. It is often found around garages, woodpiles, and tends to be an outdoor species.

d. **Brown-banded cockroach**:  
   *(Supella longipalpa)*  
   Is a nearly worldwide cockroach. It is found throughout houses, sometimes in electric clocks, radios and television sets which provide warm, dark hiding places, though such places provide little or no water.

e. **Madeira cockroach**:  
   *(Leucophaea maderae)*  
   This cockroach is more or less tropical. It tends to be an outdoor species. Its natural foods are parts of plant. It is commonly found in fruit stores, foodstores, buildings where plants are grown, etc.
V. WHAT TO DO ABOUT COCKROACH INFESTATION

The presence of adults and many sizes of nymphs is an indication of a well established colony.

A. PREVENTION BY CLEANLINESS AND MAKING HOUSES BETTER

Prevention is the key to cockroach control.

This means taking steps to:

(a) reduce as much as possible cockroach entry into buildings, and
(b) discourage infestations by cleanliness.

Cockroaches enter homes or other buildings from out-of-door habitats or they may move from nearby homes or apartments.

Another important means of entry for cockroaches into houses is in infested containers of food, laundry, luggage, or other packages of this kind. Some common examples are soft-drink cases, egg crates, bags of potatoes or onions, and laundry or luggage containing dirty clothing. All packages of this kind should be carefully inspected for cockroaches before they are brought into a building.

If cockroach infestations are to be prevented, or even satisfactorily controlled*, conditions within the houses must be made unsatisfactory for their development. This means getting rid of areas such as the ones shown in Figure 8 a & 8 b which the cockroach likes, keeping basements and areas underneath the building dry, and making food and water unavailable.

If a cockroach could not find a good home, it would not stay.
Fig. 8. CONDITIONS SUITABLE FOR INFESTATION BY COCKROACHES

(a) INSIDE HOUSES
(b) AROUND HOUSES
Food should be stored in tightly covered containers (Fig. 9 a & 9 b), or in refrigerators. All areas must be kept very clean so that no bits of food or organic matters remain for the cockroach to find. Rubbish bins must be securely covered and they should be emptied on a regular schedule, e.g. daily. Sources of water should be carefully controlled to reduce its availability to infesting populations of cockroaches.

Cleanliness, reducing suitable areas for cockroach harboursages*, and preventing their entry into homes and other buildings are the most important means of control (Fig. 10). Carrying out these measures may make other direct control measures unnecessary.

To be clean is cheaper than to buy chemical insecticides* to kill cockroaches.

(a) 

(b)

Fig. 9. PROPER STORAGE OF FOODSTUFF
Fig. 10. PREVENTION OF COCKROACH INFESTATION BY CLEANLINESS AND REDUCING THE HARBOURAGE AREAS

In some instances, improvement in buildings may limit infestations. Openings through floors and door frames should be closed to prevent the entry of cockroaches. Drainwater and sewer pipes and other utility service lines such as drinking water pipes, electric main entering the building should be carefully examined.
B. CONTROL BY CHEMICAL INSECTICIDES

Chemical insecticides are used a lot in cockroach control. The following suggestions should be used as guidelines only (Table 1).

Organophosphates, carbamates, synthetic pyrethroids, and organochlorines are the main types of chemical compounds used on a worldwide basis, especially for residual applications, that is the method of using a insecticide so that it will remain active for a period of a month or more on surfaces to which it has been applied.

While liquid sprays are best used for cockroach control by well-trained sprayman, dusts of 1% bendiocarb, 2% diazinon and others are sometimes employed. Combinations of dust and spray treatment may be more effective than either alone. Dusts move well in a current of air and can sometimes be used effectively in areas that are difficult or impossible to reach with sprays, such as the interior of hollow walls or floors. There are also formulations containing insecticides such as propoxur or permethrin which can be put on as varnishes or clear paint.

Several chemicals may be bought as baits or poisoned food for the control of cockroaches. A powder containing 1.9% dichlorvos is made up by having water added to it to form a paste. Baits are usually more effective under conditions of low populations of cockroaches or as an additional method to other treatments, rather than as a means of controlling great numbers of the insects in an area.

---

1 For more details on insecticides, technical documents on the subject should be read, including the WHO publication on "Chemical methods for the control of arthropod vectors and pests of public health importance", 1984, which may be obtained from the WHO sales agent in your country or directly from the WHO Distribution and Sales Service, WHO, CH-1211 Geneva 27, Switzerland.
<table>
<thead>
<tr>
<th>Type of application</th>
<th>Insecticide formulation and percentage of active ingredient</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual spray</td>
<td>Bendiocarb 0.24-0.48% EC; diazinon 0.5% EC; chlorpyrifos 0.25-0.5% EC, Solu; malathion 3% EC, Solu; propoxur 1% EC, Solu; permethrin 0.125-0.25% EC</td>
<td>Food Areas: Cover or remove all food. Apply in cracks and crevices only. Do not use as space application. Nonfood Areas: Spray or brush around door and window casings, baseboards of closets, storage areas, openings around pipes, and entries from outdoors.</td>
</tr>
<tr>
<td>Indoor baits</td>
<td>Dichlorvos 1.9%; propoxur 2%</td>
<td>Apply in hollow walls or on paper or other material which will permit removal in accessible areas.</td>
</tr>
<tr>
<td>Aerosol</td>
<td>pyrethrins 0.6% plus synergists</td>
<td>Useful for survey, or spot treatment for a few cockroaches.</td>
</tr>
<tr>
<td>Ultra-Low volume space spray</td>
<td>propetamphos 2% plus dichlorvos 0.5%</td>
<td>Remove or cover all food. Open all drawers and cupboards. Apply at rate of 2 g/m³. Allow adequate ventilation before re-entry of persons to the rooms.</td>
</tr>
<tr>
<td>Indoor dusts</td>
<td>Diazinon 2%; permethrin 0.5%; bendiocarb 1%</td>
<td>Apply in cracks and crevices where insects hide. Apply in fuse boxes, on electric wires where sprays may damage the insulation.</td>
</tr>
</tbody>
</table>

EC = Emulsifiable concentrate; Solu = Solution.

Chemicals with an immediate knockdown action are often used in cockroach control to give results quickly and to improve complete control, i.e. * synergest pyrethrins combined with a residual insecticide such as permethrin or propetamphos plus dichlorvos to give a lasting effect.
METHODS OF APPLICATION

Insecticides may be applied in several ways:

Residual sprays are usually applied with a compressed air sprayer of the proper size for the job at hand. The spray should be applied as coarse particles, rather than as a mist, to moisten surfaces thoroughly but not to the point of the water running off or dripping. Special attention should be given to application in places such as food service establishments where there is a danger of contaminating the food and where in some countries only "crack and crevice" treatments may be legally permitted. A "pinstream" narrow jet nozzle should be used to give a proper application of chemicals to cracks, crevices, or areas that are hard to reach; whereas a broader spray "fan" nozzle will be useful for giving the proper amount of chemical for other treatments. A paint brush can be used to apply the insecticide when other equipment is not available. The treatment of runways or passages used by the insect and harbourage areas must be thorough for effective control.

An aerosol or space spray may be used with an irritant or repellent which drives the cockroaches from their harboursages into areas sprayed with the residual insecticide.
Dusts may be used within wall void spaces or cavities, false ceilings and other harborage areas which cannot be reached. They disperse well, distributing the powder, and may penetrate deep into cracks and crevices (Fig. 11).

**Fig. 11. APPLYING INSECTICIDE DUST TO CRACKS AND CREVICES**

Dusts can be applied with a hand-operated puff duster of the plunger, or bellows type (Fig. 12). They should be applied so as to make a light, uniform film on the treated surfaces.

**Fig. 12  HAND-OPERATED DUSTER OF THE BELLOWS TYPE**
Heavy dust deposits may repel or drive away cockroaches and may cause them to move to untreated areas or places more out of reach. When used together with residual sprays, dusts should be used only after the sprayed surfaces are dry again.

The value and effect of baits are mainly on being sure they are placed at sites where cockroaches are usually found and where there is little or no food to compete with the bait.

- FREQUENCY OF APPLICATION

How long the deposits of insecticides remain effective depends upon a number of factors such as the chemical used, its formulation, the type of surface to which it is applied, and the amount of wearing or rubbing off that occurs.

The period during which the insecticide is effective varies greatly between applications made to painted compared with unpainted surfaces, and between the various types of natural and artificial (synthetic) materials commonly used in building and furnishing of houses.

The insecticidal deposit may be reduced by frequent washing of a surface, or it may be made nearly useless through becoming covered with dust or other material.

In addition, the need for retreatment may depend upon how well the first application is carried out and the extent to which reinfestation is occurring.

Do a good job and you may not have to treat as often. Remember that insecticides cost money.
For most cockroach species, retreatments are necessary and should be made at the best time to kill any cockroaches remaining in the premises, as well as to prevent reinfestation. Practical experience is extremely valuable in deciding when to retreat.

- PRECAUTIONS

Care should be taken to avoid contamination of food or the placing of insecticides where children may come in contact with the residues. In special situations, such as the treatment of zoos or pet shops, residual sprays or dusts cannot be used. In such cases it may be possible to use limited, carefully-controlled pesticide applications, or some chemical with a low toxicity* to vertebrate* animals.

No chemical insecticide should be used in cockroach control unless it has been officially approved for that purpose. Registration- and use- approval may vary from one country to another. As some formulations may stain fabrics, wallpaper, floor tiles or other household materials, the user should obtain information on this subject before making treatments with them.

- RESISTANCE TO INSECTICIDES

The development of resistance to insecticides* in cockroaches has mainly occurred in the German cockroach, which had become resistant to chlordane and other organochlorine compounds in many countries of the world. Following this situation, organophosphorus and carbamate compounds are now increasingly used in cockroach control.
C. THE ROLE OF THE COMMUNITY IN COCKROACH PREVENTION
AND CONTROL

Control of domestic cockroaches should be organized on a community-wide scale. The first effort should be directed at careful surveys* and studies of existing cockroach problems, including the reservoir or residual populations. When making surveys, the vector control staff should note these signs of cockroach infestation: shed cockroach skins and egg cases; and stains or excreta of cockroaches. When cockroach infestations are heavy, experienced people can detect a characteristic musty smell.

After the problem is thoroughly understood, efforts should be made to organize educational programmes to inform the community of local places infested with cockroaches and the importance of cockroaches in health and hygiene*. Citizens should be aided and encouraged to reduce or eliminate cockroach harbourage sites, carry out measures to get rid of cockroaches, and improve the environmental sanitation of the home and public areas. Finally, control methods needing the use of chemical insecticides and other methods, as described above, should be carried out. By following this procedure, an integrated or combined programme aimed at permanently controlling or reducing cockroach infestations can be successful. Cockroach control is likely to remain a piecemeal affair, with only temporary reduction or riddance from individual buildings or units followed by reinfestation, unless a programme of this type is carried out.
VI. GLOSSARY OF TERMS

ALLERGY
Unusual sensitiveness to the action of a substance or insect.

ANTENNAE
Sensory organs, feelers, found in a pair on the head of insects.

ARTHROPOD
An animal belonging to the phylum Arthropoda in the animal kingdom, having a hard jointed exoskeleton and paired, jointed legs. The phylum includes, among other classes, the Arachnida and the Insecta, many of which are important medically as parasites or as vectors of organisms capable of causing disease in man.

BIOLOGY
The science that deals with the phenomena of life and with living organisms in general.

CERCUS
One of a pair (cerci) appendages, believed to be a sense organ, situated at the posterior (back) end of many insects.

COLONY
A group of insects living together.

CONTAMINATORS
Anything that pollutes, soils, taints or infects, such as an insect or animal in respect to food or a substance in respect to the environment or surroundings.
CONTROL

Of insects (or other undesirable animals), the restriction of the population density of such insects to a level below that at which they can be harmful to the interests of man.

DERMATITIS

Inflammation of the skin.

ECOLOGY

The study of the interrelationship between organisms and their environment (including other organisms).

EXCRETA OR Faeces

Matter cast out as waste from the body.

FORMULATION

The way of making various types of insecticide preparations such as dusts, water-dispersible powders, suspensions, solutions, emulsifiable concentrates and for slow-release of the active insecticide ingredient.

HABITAT

The natural home of an insect.

HARBOURAGE

Place of shelter.

HEPATITIS

An infectious virus disease which affects the liver.

HYGIENE

Principles of health and sanitary science.

INFESTATION

The presence of a number of troublesome insects in a place or on the body.
INSECTICIDE
A chemical substance or a mixture of substances used to kill insects. It may be used as a liquid, powder, fine spray or as a vapour. The term "larvicide" is usually applied to an insecticide that kills immature stages of insects, and the term "adulticide" or "imagocide" to an insecticide that kills mature or adult forms.

IRRITATING
Itching or intolerable excitement of an organ of the body.

LIFE CYCLE
Stages of development through which an organism passes between fertilization of the egg of one generation and the same stage in the following generation. The term is sometimes used loosely to mean the number of days between egg-deposition and the attainment of sexual maturity.

MOULT
Shedding of skin of young stages before reaching the adult stage.

NYMPH
An immature stage in the life cycle of certain animals after hatching, resembling the adult in appearance.

OFFSPRING
Insect's young or dependants.

ORGANIC
Compound substances formed from matter containing carbon.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARASITE (PARASITIC)</td>
<td>A plant or animal that lives at the expense of another living organism (host), in which it shelters and from which it obtains food. It may or may not have a harmful effect on the host.</td>
</tr>
<tr>
<td>PATHOGENIC</td>
<td>Causing or giving rise to disease.</td>
</tr>
<tr>
<td>PEST</td>
<td>Any animal or plant that is destructive, otherwise harmful, or present in sufficient numbers to be considered a nuisance by man.</td>
</tr>
<tr>
<td>POLIONYELITIS</td>
<td>A virus disease which affects mainly children causing inflammation of the spinal cord, leading to paralysis.</td>
</tr>
<tr>
<td>POTENTIAL</td>
<td>Existing and ready for action, but not yet active, i.e. able to become, or possible.</td>
</tr>
<tr>
<td>PRONOTUM</td>
<td>The dorsal (back) plate of an insect prothorax.</td>
</tr>
<tr>
<td>RESISTANCE TO INSECTICIDES</td>
<td>A characteristic that renders a given population of an insect species resistant to a given insecticide although the species is normally susceptible to that insecticide, resulting in the species being no longer controlled by the insecticide in the area concerned.</td>
</tr>
<tr>
<td>SECRETION</td>
<td>A substance put out by the body.</td>
</tr>
<tr>
<td>SHEDDING</td>
<td>Let fall off.</td>
</tr>
</tbody>
</table>
SPECIES A taxonomic category consisting in a group of individuals that have common characteristics and that can interbreed to produce fertile offsprings.

STYLUS One of a pair (styli) of small pointed processes on or near the external genitalia of an insect.

SURVEY To examine for some specific purpose; to inspect or consider carefully; to review in detail.

SYNERGIST A substance which increases the insecticidal action of another, so that the effect is greater than either substance used separately.

VECTOR An arthropod or other animal that carries a parasite from one host to another host. The vector may or may not be essential for the completion of the life cycle or the parasite. If it is not essential, it is referred to as a "mechanical vector".

VERTEBRATES Animals including mammals, birds, reptiles, amphibians and fishes which have a spinal column or a notochord.

TOXICITY The degree that a substance is poisonous.
VII. SELECTED BIBLIOGRAPHY


VIII. EVALUATION

A. QUESTIONNAIRE FOR SELF-EVALUATION

Complete with the correct answer:

1. Cockroaches may carry the organisms causing diseases such as (page 2):
   
   (a) ..................  (b) ..................  (c) ..................

2. The life stages of cockroaches are (pages 3-5):
   
   (a) ..................  (b) ..................  (c) ..................

3. Eggs of cockroaches are deposited in a case called ................. which can be carried ............ or ........ (page 4)

4. The process of growth of nymphs is called ..................
   (page 5)

5. State three reasons why the cockroach is important in public health (pages 6, 8):
   
   (a) ..................................................
   (b) ..................................................
   (c) ..................................................
6. Match the characteristics and the species of cockroaches:
   (pages 9, 11, 12, 14)
   a. Particularly abundant in tropical Africa and Indian subcontinent
      (.............)
   b. Life-cycle may require more than two years (.............)
   c. It is one of the smallest domestic cockroaches
      (.............)
   d. Found in fruit stores and buildings where plants are grown
      (.............)

Species: the Madeira cockroach; the German cockroach;
the Oriental cockroach; the American cockroach.

7. The key to cockroach control is .........................
   this involves taking two steps (page 15):
   (a) ..................................................
   (b) ..................................................

8. The signs of cockroaches infestation are (page 25):
   (a)..................................................
   (b)..................................................
   (c)..................................................
   (d)..................................................

9. State at least five insecticides commonly used in cockroach control (page 20):
   (a) ............ (b) ............ (c) ............
   (d) ............ (e) ............

10. State four methods of insecticide application (pages 21-23):
    (a) .................... (b) ....................
    (c) .................... (d) ....................
B. QUESTIONNAIRE FOR RETURN TO VBC

To be filled by readers and trainers.

You can help us to improve VBC's documents by answering the following questions:

TITLE OF DOCUMENT: .................................................................
                      .................................................................

YOUR NAME: .................................................................

ADDRESS: .................................................................
                      .................................................................
                      .................................................................

POSITION/JOB: .................................................................

How long have you been working in vector control? ..............

Please answer by putting a circle around the box which gives your opinion, also where appropriate add your comments:

How was the presentation of this document?

very good    good    fair    bad

How important for your work was the information provided in this document?

very important important not very important not at all important
What do you think about the terminology?

<table>
<thead>
<tr>
<th>easy</th>
<th>clear enough</th>
<th>difficult</th>
<th>very difficult</th>
</tr>
</thead>
</table>

Comments: ............................................................................................................................
..................................................................................................................................................
..................................................................................................................................................
..................................................................................................................................................

Which information did you find irrelevant for your work?
..................................................................................................................................................
..................................................................................................................................................
..................................................................................................................................................
..................................................................................................................................................

What do you think about the illustrations?

<table>
<thead>
<tr>
<th>poor</th>
<th>fair</th>
<th>good</th>
<th>very good</th>
</tr>
</thead>
</table>

What do you think about the style of writing?

<table>
<thead>
<tr>
<th>too simple</th>
<th>very easy to read</th>
<th>just easy enough</th>
<th>not easy</th>
</tr>
</thead>
</table>

Was the document the right length?

<table>
<thead>
<tr>
<th>too short</th>
<th>about right</th>
<th>too long</th>
</tr>
</thead>
</table>
How valuable were the different sections of this document?

<table>
<thead>
<tr>
<th></th>
<th>Extremely valuable</th>
<th>Valuable</th>
<th>Of little value</th>
<th>No value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life history and biology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public health importance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey and surveillance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments: ........................................................................................................
........................................................................................................
........................................................................................................

Please send your comments either through the WHO channels in your country or by post to:

Division of Vector Biology and Control,
World Health Organization,
1211 Geneva 27,
Switzerland.