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VECTOR CONTROL SERIES

LICE

Training and Information Guide

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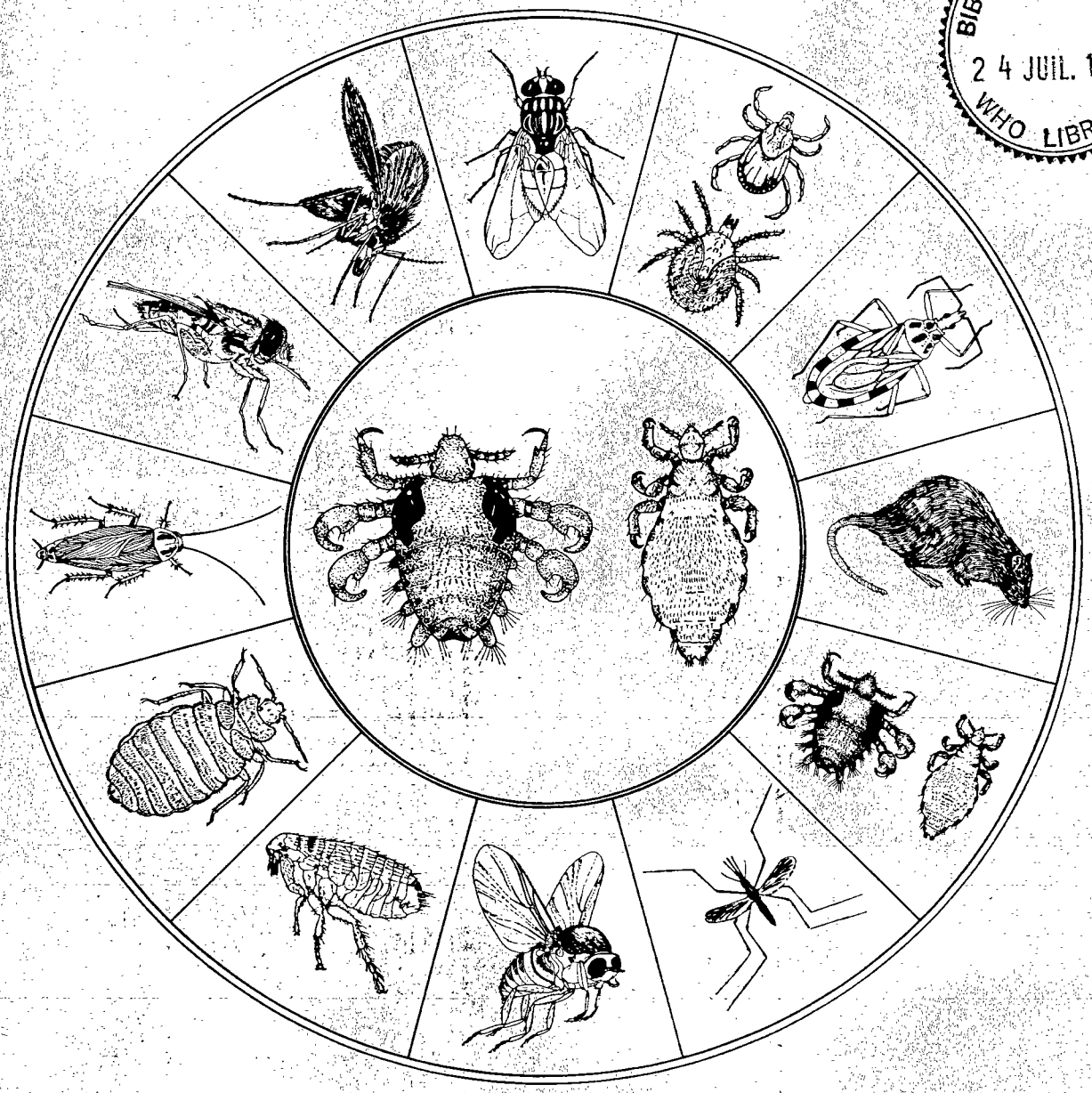

WORLD HEALTH ORGANIZATION
Vector Biology and Control Division

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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.

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VECTOR CONTROL SERIES

TRAINING AND INFORMATION GUIDE

L I C E

W O R L D H E A L T H O R G A N I Z A T I O N

VECTOR BIOLOGY AND CONTROL DIVISION

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CONTENTS

I. INTRODUCTION

Lice have been closely associated or linked with man for centuries. Infestation* with lice occurs today in many countries and causes important public health problems in a number of both developing and developed countries. The various forms and species of human lice depend for survival on the human body, as they will not normally feed on other animals. In addition to the fact that all species of human lice are nasty vermin*, one form - the human body louse - acts as a vector* of two serious epidemic diseases: typhus and relapsing fever, both of which may cause the death of many people if not treated. There are three species* of human lice: the human body louse, the head louse, and the crab or pubic louse. Each form or species of louse presents a different public health problem. These three species can all live on a single person and do not compete with one another as they live on different parts of the body.

In many parts of the world, commonly used insecticides* can no longer control or reduce the problem of infestation with lice due to their resistance* to these chemicals.

II. LIFE HISTORY AND BIOLOGY*

These wingless flattened insects have legs that can grasp hairs. Adult lice have mouthparts adapted for entering the skin and sucking blood. When not in use, the mouth parts are

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*Terms marked with an asterisk are defined in Section V - Glossary of Terms.

pulled back within the head. Their legs are short and stout, with a large claw on one or more of the three pairs of legs for grasping and holding onto hairs (Fig. 1).

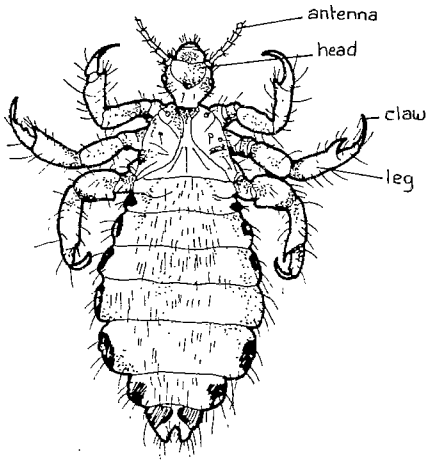

Fig. 1. HUMAN BODY LOUSE

The body and head louse look alike, but their living habits are different, and only the body louse is responsible for disease transmission*, i.e. passing a disease from man to man.

All lice infestation on man come either directly or indirectly from another human.

Certain features of the biology and life history of all species of human lice are the same: they suck blood, live on only one type of host* and have a three-stage life cycle* (Fig. 2). Lice undergo gradual metamorphosis* with three moults* during the young (nymph) stages as they increase in size to the adult stage. The most suitable temperature for the life cycle of lice is 32 ^{o}C, and they leave a dead body immediately infesting other people close by.

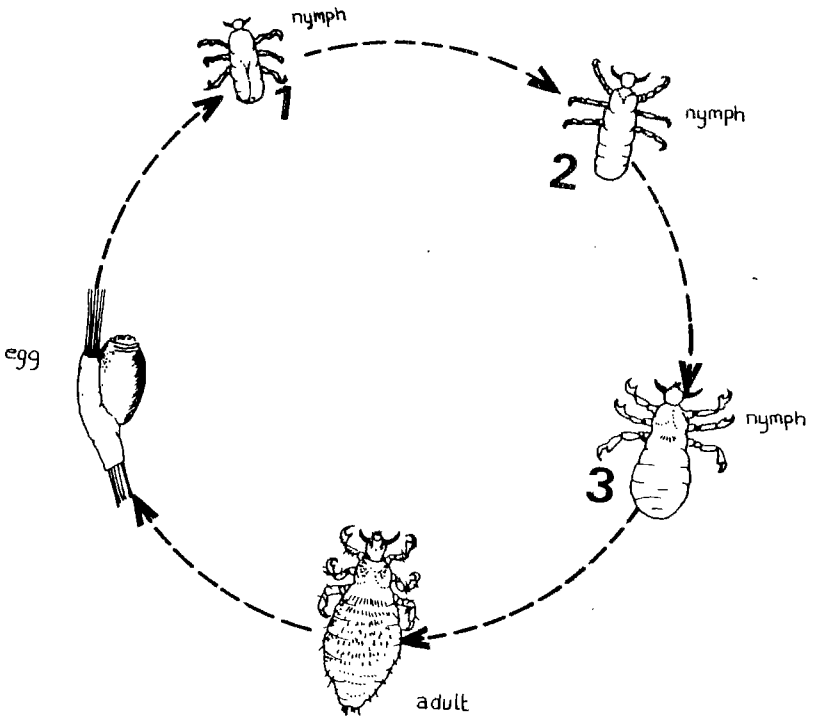

Fig. 2. LIFE CYCLE OF THE HEAD LOUSE

The Egg

The egg has a cap at one end to admit air during development of the embryo* and to make it easy for the escape of the young insect (Fig. 3).

The size of the egg is a little larger than a pin head.

Females of the head louse attach their eggs (nits) on hair close to the scalp. The eggs are fixed with a kind of glue difficult to dissolve. Eggs of the crab louse are also cemented to body hairs, particularly in the pubic region*. In the body louse, the females fix their eggs to fine threads on clothes.

The eggs of the head louse will not hatch at temperatures below 22 °C. The most suitable temperature for hatching or bringing the young from the egg is about 31 °C, at which they will emerge in just seven days.

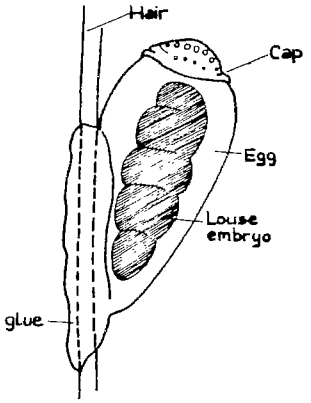

Fig. 3. EGG OF HEAD LOUSE

On hatching, the egg is shining white and as the hair grows, it becomes visible. Hatched eggs are more visible than unhatched ones. Eggs which are more than 6 mm from the scalp have already hatched.

The Nymph* (young louse)

After leaving the egg, the young louse or nymph moults three times before becoming a sexually mature adult. The nymphal stages require about 7-13 days or longer for development depending in great part upon temperature.

The Adult

The adult body of the head louse looks like the nymph except that it is larger and sexually mature. The extended body has three parts: a head, a fused chest and a segmented abdomen (stomach) over three-fifths of the body length. The male is smaller than the female. Mating occurs often and at any time in the adult's life.

Eggs are laid 24 to 48 hours after mating, depending upon temperature conditions. Female body lice may lay 9 or 10 eggs per day with a total of 200 to 300 eggs in their lifetime. Female head lice lay fewer eggs, depositing about four per day for a total of about 50 eggs in a lifetime.

Human lice depend upon human blood for living. They suck blood for long periods of time but do not necessarily become engorged*. Head lice feed about five times per day whereas body lice feed about four times per day.

It is rare to find human lice away from man as they cannot live long away from a host. Head and body lice may be picked up by personal contact and by putting on infested clothes. Head lice may be passed on by using infested brushes and combs.

III. WHY ARE LICE IMPORTANT?

Lice have been a pest or plague to man since ancient times and have caused a vast amount of human misery, as vectors of disease responsible for the deaths of many humans, and historically take their place as killers beside mosquitos and fleas.

Body lice occur in many parts of the world where normal healthy (hygienic) measures of washing, bathing and changing clothes are not possible or not carried out (Fig. 4 & 5). Until the introduction of the insecticide DDT during World War II, fighting troops and prisoners of war were commonly louse-infected. Such are the conditions under which louse-borne diseases can spread, but poverty and poor hygiene alone will not cause louse infestation. However, they do encourage the spread of lice if they exist. Nevertheless, even in highly clean areas such as costly private schools, children can be infested. Both head and crab lice continue to exist and are annoying problems in almost all countries.

Louse bites cause more or less intense irritation*. Infested people, therefore, tend to scratch themselves and this may lead to dermatitis*, impetigo* and similar conditions,

Fig. 4. BEGGAR WITH LOUSE-INFESTED CLOTHING

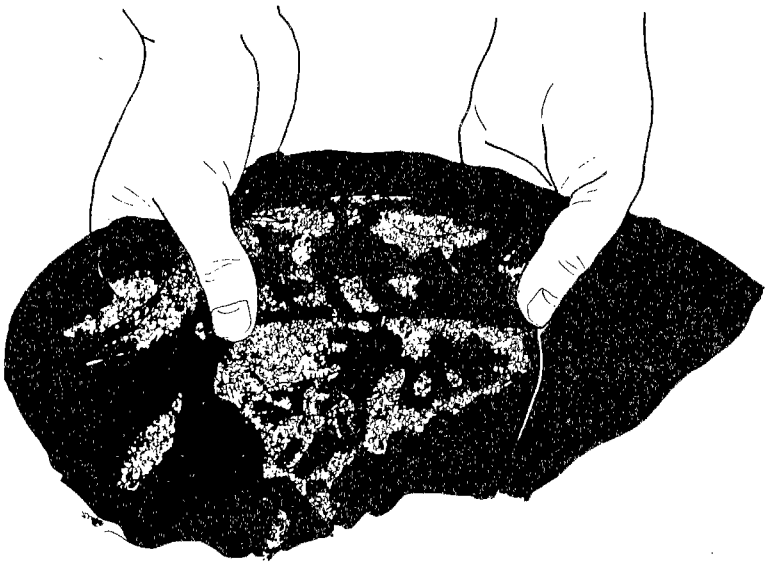

Fig. 5. CLOTH INFESTED WITH LICE

mainly infections caused by the bacterial organism*, Staphylococcus*. Some individuals are much more sensitive to louse bites than others, but everybody suffers to some extent.

> Of the three forms of human lice, only body lice are disease vectors.

Since man is the only reservoir or host of louse-borne diseases, the importance of body lice as disease vectors depends upon the existence of a disease focus* in the area and the commonness or prevalence of lice in the human community.

A. LICE SPECIES ATTACKING MAN

1. Body Lice

The body louse, Pediculus humanus, (Fig. 1) is most commonly found where the clothing is in direct contact with the body including the underwear, crotch or fork of trousers, armpits, waistline, neck and shoulders. It is more common in clothing in colder climates. The louse is in danger of death if clothing is removed.

In general, body lice are 10% to 20% i.e. one tenth to one fifth larger than head lice and are often lighter coloured. An adult louse will live four weeks or more on its host and can survive 8-10 days away from the host.

2. Head Lice

The head louse, Pediculus capitis, (Fig. 6) is grey, but often copies the colour of its host's hair. Head lice are most often found in children. They are most common on the back of the head and behind the ears. The female louse attaches her eggs (nits) to the hair close to the scalp where the best temperatures and conditions of dampness exist for the egg to hatch.

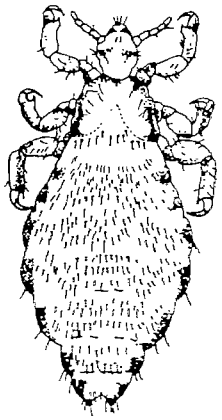

Fig. 6. HEAD LOUSE

Empty egg shells remain fixed to the hairs after hatching. This may confuse or mislead those checking for louse infestation. However, empty shells can be distinguished or seen to be different by their shiny, "papery" look; whereas, the unhatched eggs are pearly, yellow-white and opaque or dull. Nits grow out from the scalp with the growing hair, and can be used to tell the duration or length of time of an infection. Human hair grows at about one centimetre per month. Thus in the case of a nit found four centimetres from the scalp, infection probably took place four months earlier.

3. Crab Lice

The crab or pubic louse, Phthirus pubis (Fig. 7) is greyish white and crab-like in appearance. Crab lice are most commonly found on hair in the pubic and perineal regions* but in heavy infestations may spread to other hairy areas of the body: chest, thighs, axillae*, eyebrows, eyelashes or beard.

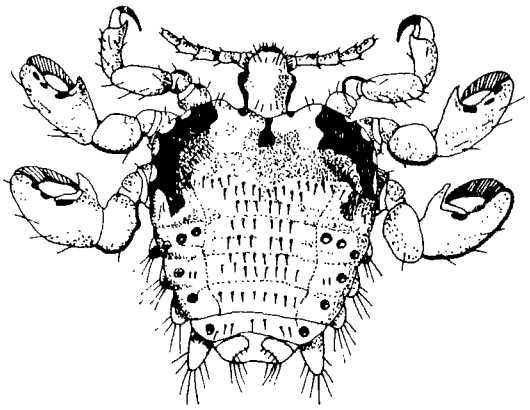

Fig. 7. CRAB OR PUBIC LOUSE

Crab lice are most often found in young sexually active adult humans, but have been found in children. Their choice of habitat* appears to be based on the fact that their claws are adapted for grasping coarse and widely spaced hairs. Eggs are cemented to the body hair, particularly in the pubic region. Egg laying is at a lower rate than body or head lice, being around three eggs per day for a total of about 30 eggs.

- How lice travel and spread

The normal spread of lice occurs under conditions where human beings live close together or are touching each other, e.g. in crowded sleeping quarters or when people are forced to live crowded together. It is easy to understand, therefore, why widespread body louse infestations are often a result of war or natural disasters in groups of prisoners or refugees. As regards the head louse, the close contacts of family life are ideal for spread, and the crab louse often passes to the partner during sexual contact.

Accidental spread may also occur in a variety of ways, e.g. by direct contact in crowded public resorts or transport, or indirectly by means of cushions, chair covers or seats. The common use of bedding, towels, clothing or hair brushes and combs by a number of people may also spread lice from one person to another. Stray hairs from combing may convey lice or their eggs and it is likely that this is a means of spreading of head lice. A possible but unlikely source of infestation by pubic lice is the seats of ill-kept public water closets.

All forms of lice live badly away from their normal habitat and soon starve to death. The risk of infestation with lice is therefore greater through close contact of family life,

somewhat less through close association of children at play and least through contact with fomites* (louse-infested furniture and other articles arising from contact with infested persons).

B. DISEASES TRANSMITTED BY LICE

1. Louse-Borne Typhus

Louse-borne typhus (LBT) is an acute, highly infectious disease which may occur as rapidly spread epidemics in man.

The human body louse is the vector of this disease, and it does well under socioeconomic conditions where its control* is difficult. It takes up the disease organism, Rickettsia prowazeki*, from the blood of infected persons from early in the disease until about the tenth day. About half of the lice that fed on a typhus patient become infected. The disease organism multiplies in the gut of the louse, invade the stomach linings and destroy the cells so that human blood in the stomach spreads throughout the body of the louse turning it pink. Such lice always die within two weeks after infection.

From two to six days after taking an infective blood meal, rickettsiae appear in the faeces* of the lice and provide the infective organism. Louse excrement* dries to a fine black powder easily blown about, and it can infect small wounds (e.g. scratch marks) or through the conjunctiva* or mucous membranes. The organism remains alive in dried faeces for a long time - at least 60 days. It is therefore dangerous to handle clothing or bedding of typhus patients. Patients with recrudescent* typhus can infect lice and be the source of new outbreaks.

Although louse-borne typhus continues to be a problem, particularly in the highlands of some countries of Africa and Central and South America, accurate incidence* and statistics of death from the disease for these areas are lacking. Over the last seven years in Africa, the greatest number of cases have been reported in Burundi, Ethiopia and Rwanda. While the annual number of cases of louse-borne typhus has declined in Burundi and Rwanda, the number in Ethiopia continues to amount to between 7000 and 17000 cases per year.

In the Americas, louse-borne typhus is common in parts of Mexico, Guatemala and other countries of Central America and in the Pacific Coast countries of South America. It is reported from Bolivia, Peru and Ecuador, and has occurred in Argentina and Venezuela. The statistics reported do not show the amount of the problem. In these countries, specific surveys have shown that louse-borne typhus is endemic* amongst local populations of remote areas, occurring as small village outbreaks or in isolated compounds.

Statistics on the occurrence of louse-borne typhus elsewhere in the world are almost totally lacking. The disease occurs in the Himalayas, and possibly also in other highland or cold areas of Asia. Typhus is present in Europe today primarily as Brill-Zinsser disease or recurrent typhus.

2. Louse-Borne Relapsing Fever

Louse-borne relapsing fever is caused by a spirochaete*, Borrelia recurrentis. The disease now occurs mainly in Ethiopia and the Sudan; there are small foci* (centres of infection) elsewhere in East and West Africa with occasional cases in South and Central America.

Outbreaks of relapsing fever, like those of louse-borne typhus, are most frequent during wars and natural disasters. The disease is frequent where there is poor personal hygiene, poor sanitation and crowded living conditions.

Body lice take up the disease organism from the blood of infected persons, especially during bouts or fits of fever. They can be found in the louse's stomach for a few hours, but nearly all are digested. Sometimes, however, a few remain and appear about a week later in the insect's body cavity.

> Infection can only occur if a man crushes an infected louse and releases the disease organism into a scratch or mucous membrane. This happens frequently among louse-infected individuals who may destroy some of their lice by bursting them between finger nails.

3. Trench Fever

This rickettsial* disease due to Rochalimaea quintana causes intermittent fever, aches and pains all over the body and many relapses, but has a low death rate. Trench fever is a rather mild disease and is believed to be passed from man to man by the body louse. Infection takes place by contamination* of abraded skin* with infective louse faeces.

IV. WHAT TO DO ABOUT LICE INFESTATION

The three kinds of lice that infest man differ greatly in their habits and present distinct public health problems that require different methods of control. The methods used call for two levels of attack:

- treatment of an individual or small groups, and
- mass control of the population.

Louse infestations seldom occur as single cases. Whatever control method is used, it must be carefully chosen and used to get rid of sources of reinfestation.

A. WASHING OF CLOTHES

Good personal hygiene including regular changes to clean clothing usually prevents body lice infestation on the host. However, this is not always possible, especially in remote rural areas where:

(1) individuals may own only a single piece of clothing;

(2) there is little or no access to water; and

(3) washing facilities are lacking.

Soap and cold water alone are not sufficient to get rid of an infestation. To solve the problem, clothing must be boiled with water and soap, a method which is used in many villages around the world.

B. HEAT TREATMENT

An alternative to insecticides is heat treatment. Temperatures well above that sufficient to kill lice or eggs on the surface are required to get through clothing or bedding. Clothes should be kept in air over 70 °C for an hour, but care should be taken against scorching* where necessary. Hot water also kills lice. If water is too hot to put ones arm into, it will rapidly kill lice.

C. INSECTICIDES[1]

Insecticides suitable for treatment of louse-infested people are given in Table 1. These are applied in the form of dust, lotion, shampoo or aerosol.

- CONTROL OF BODY LICE

Control against body lice should be started in those areas where louse-borne disease is occurring, or where the threat of disease transmission is greatest. The urgency of the measures will be decided on as to whether the aim is to stop transmission of disease, or to reduce the amount of lice infestation to a point where disease transmission becomes unlikely.

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[1] For more details on insecticides, consult relevant technical documents including the WHO publication on "Chemical Methods for the Control of Arthropod Vectors and Pests of Public Health Importance", 1984.

Table 1. INSECTICIDES COMMONLY EMPLOYED IN CONTROL OF HUMAN LICE

Insecticide name	Type of Chemical	Formulation*	Concentration of active ingredient (%)
Bioallethrin	PY	Lotion Shampoo Aerosol	0.3-0.4 0.3-0.4 0.6
Carbaryl	C	Dust	5.0
DDT	OC	Dust Lotion	10.0 2.0
Deltamethrin	PY	Lotion Shampoo	0.03 0.03
Iodofenphos	OP	Dust	5.0
Lindane	OC	Dust Lotion	1.0 1.0
Malathion	OP	Dust Lotion	1.0 0.5
Permethrin	PY	Dust Lotion Shampoo	0.5 1.0 1.0
Propoxur	C	Dust	1.0
Temephos	OP	Dust	2.0

OC = Organochlorine; OP = Organophosphate;
C = Carbamate; PY = Synthetic pyrethroid.

The best formulation for mass treatment is dusting powder. This is easily shipped, readily stored and easily applied by any type of dusting apparatus from compressed air dusters to hand-operated dusters and even application by hand. Dust leaves obvious signs on the clothing and may be refused by people, unless the purpose is properly explained.

Where louse populations are susceptible* to DDT, 10% DDT dusting powder is the insecticide of choice. It has a very low toxicity* to humans and as a dusting powder against lice is not likely to contaminate or pollute the environment. Where resistance to DDT has occurred, one of the other compounds listed in Table 1 may be used.

For individual treatment about 30 g of DDT per person should be applied evenly over those inner surfaces of clothing that touch the skin, with special attention to seams, folds and tops of socks. Simple hand dusting equipment is operated by squeezing the duster between the fingers (Fig. 8). For mass

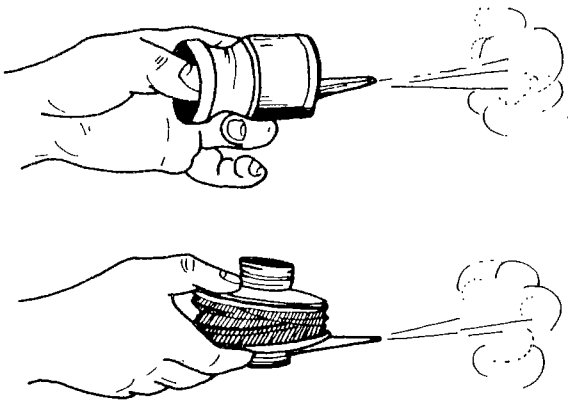

Fig. 8. HAND DUSTERS

treatment of large groups of people, clothing need not be removed and hand-operated dusters or motor-driven air compressors with as many as ten duster heads can be used. About 50 g of powder is shaken or blown into the clothing through the neck openings, up the sleeves and from all sides of the loosened waist or trousers. In delousing women, it is appropriate to use women applicators. However, if the insecticide is applied by males, an extra quantity may be introduced down the neck of the dress and application at the waistline omitted. The socks, head covering and bedding should also be treated.

One thorough treatment of infested clothing with insecticides such as DDT and malathion should be enough. Retreatments may be required at intervals of 8 to 10 days if infestation persists or reinfestation is expected.

- CONTROL OF HEAD LICE

Head louse infestation is heaviest in children. In some countries, girls tend to be more heavily infested with head lice than do boys. It is a common scene in tropical countries to see females cleaning their hair from lice with the help of another family member (Fig. 9).

Fig. 9. CLEANING THE HAIR FROM HEAD LICE

The eggs,"nits", are the easiest to discover when inspecting for head lice. They are most commonly attached to the hair, close to the scalp behind the ear. The comb (Fig. 10) is a vital weapon against the nits. It may not remove the lice because they are mobile, but it may cripple them, causing their eventual death.

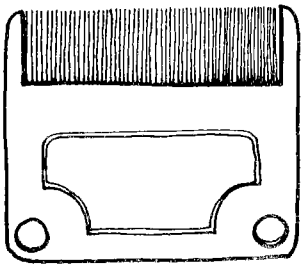

Fig. 10. THE COMB IS AN ESSENTIAL WEAPON AGAINST NITS

With schoolboys or men, a very close hair cut or even shaving the head to remove the eggs and all later stages is a simple, cheap method of controlling head lice, but not one that is well accepted. With women and girls, other methods need to be used. Both the lice and the eggs must be destroyed. Vinegar will not destroy the glue which holds the eggs to hairs, as was once commonly supposed. The safest and best materials for head louse control are lotions containing 1% permethrin, or 2% DDT, or insecticide dusts containing 1% lindane or 1% malathion. The following method for using lotion is safe and easy to follow:

1. Shampoo and dry the hair thoroughly.

2. Seat person in a chair with the head tilted backward and the eyes covered with a towel.

3. Apply the lotion freely to the hair and scalp with a brush and swab. Work against the way the hair grows and spread the lotion to all the hair as well as the whole scalp.

4. Comb the hair in the usual manner.

5. After 24 hours, wash the hair with soap and water.

6. Dry, comb and brush the hair to remove the dead lice and loosened eggs.

The application of 1% lindane or 1% malathion dust is also effective, although it does not look well. The dust should remain on the scalp 24 hours in order to produce a complete kill. A second treatment 7 to 10 days later will kill all the lice that have hatched out since the first treatment.

When these insecticides are not available, as may be the case following a civil disaster or in some rural areas, it may be necessary to use older treatments. In such cases, 2% of a 50% cresol and soap solution or a mixture of 50% kerosene and 50% of any mild vegetable oil may be used. These substances should be applied thoroughly to wet hair, and the head is then bound up in a towel for at least an hour. The hair may then be washed, thoroughly dried, and combed to remove any dead lice or eggs which have been loosened.

- CONTROL OF CRAB LICE

A simple treatment for crab louse control is shaving or cutting the infested hair to remove adults, immature stages, and eggs glued to hairs. Powders or lotions used for body or head lice control are effective. They are applied by rubbing into the hair. Treated parts should not be washed for at least 24 hours after application. If one application is not sufficient, retreatment may be carried out at 4-7 day intervals.

In recent years, crab lice have been reported on the eyelashes of people, particularly young children. An eye ointment containing 0.25% physostigmine has been recommended.

- RESISTANCE

Body louse resistance to DDT has become widespread throughout the world. Resistance to lindane has also increased and, more recently, malathion resistance has been reported from Burundi, Egypt and Ethiopia. The World Health Organization provides standardized test methods, instructions and kits for susceptibility studies and determinations. Resistance in head lice has been reported, but is still not well defined or documented.

> If an insecticide does not kill lice, it may mean that the lice have become resistant to it, and in such a case, it is necessary to change the insecticide.

V. GLOSSARY OF TERMS

ANTENNAE	Sensory organs, feelers, found in pairs on head of insect.
ABRADED SKIN	Injured skin.
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.
AXILLA	The small hollow beneath the arm, where it joins the body at the shoulder, also called armpit.
BIOLOGY	The science that deals with the phenomena of life and with living organisms in general.
CONJUNCTIVAE	Tissue membranes connecting inner eyelid and eye-ball.
CONTAMINATION	The unintentional entrance into a material (e.g. food or the environment) of any foreign substance, matter or organism.

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 inter-relationship between organisms and their environment (including other organisms).
EMBRYO	The early developing stage of an organism, especially the developing product of fertilization of an egg.
ENDEMIC	Of a disease; means that it is regularly found among people in a country.
ENGORGED	Congested or full of blood meal.
EXCREMENT or FAECES	Matter cast out as waste from the body.
FOCUS	The chief centre of an infection or infestation.
FOMITES	Substances capable of carrying infection.
FORMULATION	The product of a pesticide prepared in accordance with a specific method such as emulsions, solutions, suspensions, dusting powders, etc.

FUMIGATION	A process that uses gaseous agents to kill animals (especially arthropods and rodents).
HABITAT	Place where an insect normally lives and breeds.
HOST	An organism upon which another organism lives parasitically.
IMPETIGO	An infectious skin disease with pustules.
INCIDENCE	The rate at which the number of new cases of a specific disease or infestation occurs during a certain period.
INFESTATION	1. The invasion of the surface of the body of a host by parasites. 2. The harbouring of parasites on the surface of the body, or (in the case of body lice) in clothes.
INSECTICIDE	A chemical substance or a mixture of substances used to kill insects. It may be applied as a liquid, powder, fine spray or as a vapour.
IRRITATION	Intense itching of an area 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 subsequent generation. The term is sometimes used loosely to mean the number of days between egg-laying and the reaching of sexual maturity.

METAMORPHOSIS	In insects, the series of changes through which the insect passes in its development from the larval through the pupal, or nymph, to the adult stage.
MOULT	Shedding of skin of young stage before reaching the adult stage.
NYMPH	An immature stage in the life-cycle of certain animals in which they resemble the adult in appearance.
ORGANISM	A single living thing - virus, bacteria or other microorganism, or insect or animal.
PERINEAL REGION	Part of the body between the genital organs and the rectum.
PUBIC REGION	Groin, private parts, hairs on these.
RECRUDESCENT (TYPHUS)	The breaking out of symptoms of typhus after a temporary recovery.
RESISTANCE TO INSECTICIDE	A characteristic or quality that makes a population of an insect species immune to a given insecticide to which the species is normally susceptible, so that it is no longer controlled by the insecticide in the area concerned.
RICKETTSIOSIS	A group of diseases caused by pathogens belonging to the genera Rickettsia or Rochalimaea, made up of small microorganisms occurring in the lumen of the gut in lice, fleas, ticks and mites.

SCORCHING	Burning a surface with flame or heat-rays so as to discolour or injure, giving pain.
SPECIES	A taxonomic category comprising a group of organisms that have common characteristics and that can interbreed to produce fertile offspring.
SPIROCHAETES	One group of small infectious agents belonging to the genera Borrelia or Spirochaeta, made up of flexible, undulating, spiral-shaped rods.
STAPHILOCOCCUS	A Gram-positive bacterial genus growing in clusters causing boils and abscesses.
SUSCEPTIBLE TO INSECTICIDE	Sensitive to, can be controlled by the insecticide.
TOXICITY (INSECTICIDES)	The quality of being poisonous; it can be acute or chronic, in animal or man.
TRANSMISSION	The passing or sending of an infection or arthropod from one person to another.
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 of the parasite. If it is not essential, it is referred to as a "mechanical vector".
VERMIN	A collective name for obnoxious insects such as bugs, fleas and lice, and troublesome animals such as mice or rats.

VI. SELECTED BIBLIOGRAPHY

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4. World Health Organization. Technical Report Series, No. 655, 1980. (Resistance of vectors of disease to pesticides. Fifth report of an Expert Committee on Vector Biology and Control).

5. World Health Organization. Instructions for determining the susceptibility or resistance of body lice and head lice to insecticides. WHO unpublished document, WHO/VBC/81.841, 1981.

6. World Health Organization. Working Group on Rickettsial Diseases. Rickettsioses: a continuing disease problem. Bulletin of the World Health Organization, 60: 157-164 (1982).

7. World Health Organization. Chemical methods for the control of arthropod vectors and pests of public health importance. Geneva, WHO, 1984.

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VIII. EVALUATION

A. QUESTIONNAIRE FOR SELF-EVALUATION

Complete with the correct answer:

1. The three species of human lice are (page 2):
   (a).....
   (b).....
   (c).....

2. Lice undergo gradual metamorphosis and have three stages:
   (a)..... (b)..... (c).....

   Louse nymph molts ..... times and requires .....days for development (pages 4, 5).

3. What are the main characteristics of the adult louse (page 6):
   (a).....
   (b).....
   (c).....

4. Why are we concerned about lice? (pages 6-8)
   (a).....
   (b).....
   (c).....

5. State four characteristics of the body louse (pages 7-9):
   (a).....
   (b).....
   (c).....
   (d).....

6. State four characteristics of the head louse (pages 9, 10):
   (a).....
   (b).....
   (c).....
   (d).....

7. State four characteristics of the crab louse (pages 10, 11):
   (a).....
   (b).....
   (c).....
   (d).....

8. What are the conditions under which the lice travel and spread? (pages 11, 12)
   (a).....
   (b).....
   (c).....
   (d).....

9. Recognize the characteristics of the disease (pages 12-14):
   1. Acute highly infectious disease .....
   2. Occurs if a man crushes an infected louse and releases spirochaetes .....
   3. Infected people generally experience many relapses .....

10. What are the methods of control against body lice? (pages 15-19)
   (a) .....
   (b) .....
   (c) .....
   (d) .....

11. What insecticides would you use against the head louse?
(page 20)
(a) .....
(b) .....
(c) .....
(d) .....

12. What is the simple treatment for crab louse control ?
(page 23)
.....
.....
.....

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: .....

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

Please answer by putting a circle around the box which gives your opinion, also where approriate 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?

easy	clear enough	difficult	very difficult

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

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

What do you think about the illustrations?

poor	fair	good	very good

What do you think about the style of writing?

too simple	very easy to read	just easy enough	not easy

Was the document the right length?

too short	about right	too long

How valuable were the different sections of this document?

	Extremely valuable	Valuable	Of little value	No value
Life history and biology				
Public health importance				
Survey and surveillance				
Control				

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

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

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