

BRITISH MUSEUM (NATURAL HISTORY)

ECONOMIC SERIES No. 2

# THE LOUSE AS A MENACE TO MAN

ITS LIFE-HISTORY  
AND  
METHODS FOR ITS DESTRUCTION

BY

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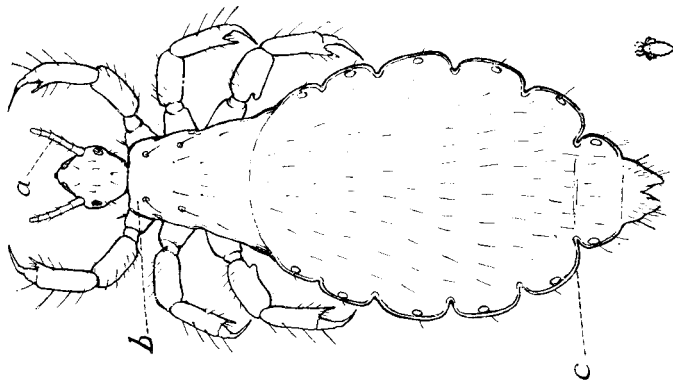


FIG. 1.

THE CLOTHES LOUSE (female).

The small figures indicate the natural size. The large figures are magnified 20 times. Note the difference in size and the differences at the parts marked *a* (thickness of antenna), *b* (width of body behind neck), and *c* (depth of clefts between the segments).

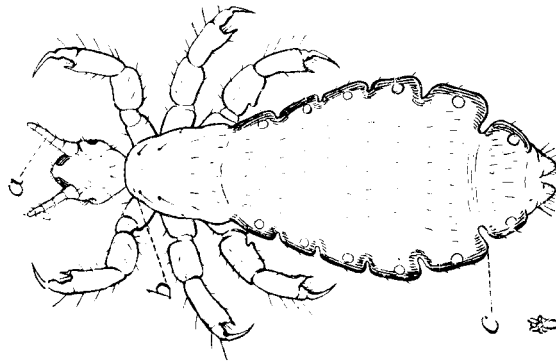


FIG. 2.

THE HEAD LOUSE (female).

## PREFACE.

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THE present pamphlet is intended to replace, in the Economic Series, No. 2—"The Louse and its Relation to Disease," which was written by the late Mr. Bruce F. Cummings, and is now out of print. Dr. James Waterston, to whom its preparation has been entrusted, has kept in view the object of making the results of recent researches more readily available.

There is a considerable literature dealing with the louse-problem. An excellent treatment of it is to be found in Dr. Ll. Lloyd's "Lice and their Menace to Man" (London, 1918). Mr. A. W. Bacot, Lister Institute of Preventive Medicine, has made the use of insecticides against lice his special study, while the whole field of louse bionomics, anatomy and control has received admirable treatment by Professor G. H. F. Nuttall, F.R.S., in the pages of "Parasitology" (Vol. X). To the latter two gentlemen Dr. Waterston is especially indebted for helpful discussion in the preparation of the following pages.

C. J. GAHAN,  
*Keeper of Entomology.*

BRITISH MUSEUM (NATURAL HISTORY),  
*November, 1921.*

## PREFACE TO THE SECOND EDITION.

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PROFESSOR G. H. F. Nuttall, F.R.S., has kindly read again the original pamphlet. He has not found it necessary to make more than one or two verbal alterations, and the second edition is therefore virtually a reprint of the first.

N. D. RILEY,  
*Keeper of Entomology.*

*26th April, 1933.*

# THE LOUSE

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## I.—LIFE-HISTORY AND HABITS.

**Lice and their Relations.**—Lice are small, entirely wingless, parasitic insects, whose only food is mammalian blood. The young louse does not differ markedly from its parents, and, like them, is completely dependent for sustenance on a suitable host. Even the eggs require to be laid in close proximity to the host's skin to secure a suitable temperature for incubation. Holding this in mind, one may dismiss any statement to the effect that lice breed in or from dirt. The whole life-cycle of a louse is bound up with that of its host. The louse is a "permanent and obligate dependent," and the fact considerably simplifies the problem of its destruction.

The affinities of these blood-sucking pests have long been a matter of dispute. It is now widely agreed, however, that lice are more nearly allied to the so-called "Bird-lice" (Mallophaga), and possibly by now distant ancestors to the "Book-lice" (Psocidae), which are mandibulate insects, than to any other groups. Recent researches have shown that many Mallophaga seize every casual opportunity of imbibing their host's blood (e.g. when a bird has been shot), and the decisive point in the evolution of the blood-sucking mammalian lice must have occurred when the mandibles of the ancestral form were lost, new piercing organs developed (chiefly by the modification of chitinous structures lying on the under surface of the throat anteriorly) and the richer diet permanently adopted in preference to one consisting of hair, feathers or scurf.

**Human Lice.**—On man three forms of lice (*Pediculus humanus humanus*, L.; *Pediculus humanus corporis*, De G.; and *Phthirus pubis*, Leach) occur. Other mammalian lice may, it is true, stray temporarily on to man; but it is doubtful whether such visitors feed, much less are able to survive, in their new quarters. Hog lice (*Haematopinus suis*, L.) have been reported, however, to attack man.

**The "Crab" or Pubic Louse.**—*Distinguishing features.*—Of the three species enumerated, the last—the crab louse—is readily recognised by (a) its small size and square body; (b) the blunt or truncate head (pointed in the other two); (c) the relatively enormous and strongly developed legs; (d) the prominent spiracles, or breathing apertures, and (e) extreme inertness. *Phthirus pubis* is generally found in the pubic and perianal hairs, or in the armpits, and occasionally among the eyelashes, from which its removal is a matter of difficulty. But it may also occur in the eyebrows or beard, and, in fact, on any part of the body where the hair is suitable. It does not, however, infest the head, to whose straight hair it has difficulty in holding on. Beyond causing feverish symptoms (which may be due to the saliva injected in biting) the "crab" louse is not known to have any effect on the health of those it attacks. *It has not been proved to carry any disease.* Special notes for its destruction are given on p. 19, and it may be sufficient here to mention the essential facts in the life history of this species.

*Life History.*—The eggs, which have the cap or operculum mammillated or covered with globular swellings, are broadly attached to the base of their supporting hair. Up to 26 eggs may be laid by one female. They hatch in 7–8 days, and the life-cycle is complete in 3–4 weeks. Young crab lice cling tenaciously to a *single* hair of their host, but the adults anchor themselves to *two*, grasping one at each side. Of all human lice the "crab" keeps most constantly close to the host's skin, and its feeding is an almost continuous process. This species is practically stationary throughout its short life, during which it may not move more than two inches from its birth-place. When it moves it does so *sideways*. The hair at one side is slowly released, and another grasped by the freed legs. The other of the two hairs originally held is now given up and the body is dragged across to the new position. Crab lice quickly die away from their host—few surviving a day at a temperature of 16°–20° C. (60°–68° F.). The presence of crab lice is indicated by the eggs or nits; by pale blue grey spots one-twelfth to one-eighth of an inch in diameter; and, after a time, by a variable amount of itching. Adult crab lice are disseminated by actual contact with an infested person. The eggs are scattered with the hair to which they are attached and may be found in latrines (where the original host has indulged in scratching), in which also the adults themselves are occasionally to be encountered.

**Head and Body Lice.**—The body louse and the head louse have in recent years been closely studied, and their distinguishing features and mutual relations very thoroughly debated. As regards morphology, it may be conceded that no single character is demonstrable whereby the two can at once and invariably be separated. At the same time typical examples of the forms are extremely distinct. The head louse is generally smaller, darker, and more horny, with thicker antennae and deeply cut abdominal divisions, contrasting sharply with the larger, paler body louse, whose

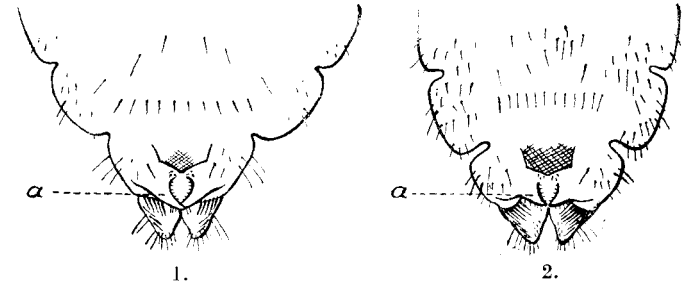


FIG. 3.  
THE POSTERIOR END OF THE BODY OF THE FEMALE (VENTRAL SURFACE).  
1. The Body Louse. 2. The Head Louse.  
a. The Gonopod.  
Both figures are magnified 25 times.

antennae are slender and the sides of the abdomen merely undulated. The head louse, again, lays fewer eggs at a time, and attaches them to hair. It is a more active insect, and feeds oftener and more sparingly. But these differences break down when tested in detail and over a period of time. Head lice and body lice breed freely with one another either way (at least when under control), and their hybrids are fertile for several generations. Head lice forced to live for some time under conditions suitable to body lice acquire the characters of the latter. As to the usual stations of the forms, head lice quite often occur on the body, whereas body lice are extremely rare on the head.

The most natural explanation of the difference between head and body lice, and of their mutual relation, appears to be that the former is more primitive. The genus *Pediculus* has a restricted host range, being found only on man and some of the higher apes, e.g. the chimpanzee, whose parasite (*Pediculus schaffi*, Fahrenholz) recalls our head louse rather than the body louse. Apart from

*P. schaffi*, which is a good species, any other *Pediculus* (e.g. *P. consobrinus*, Piaget) reported from monkeys in captivity, are nothing more than human head lice. The body louse appears to be an offshoot from the head louse stem, developed, it is reasonable to believe, with the acquisition of clothing by its host, and at the present day the two forms are in a labile state.

*Life History.*—The following account of the life of the body louse will apply with slight modification to the head louse also.

*Egg and Oviposition.*—The eggs of the body louse are about one twenty-fifth of an inch long, by about one-sixteenth broad (fig. 4). The female lays up to 300 eggs at the rate of 8 to 12 a day. They may be deposited either on cloth or on hair, no decided preference for either situation having as yet been proved to exist. In ovipositing the female grasps the hair between two small triangular appendages (the gonopods) situated towards the apex of the abdomen ventrally behind the genital opening (fig. 3). A drop of a quickly hardening cement now exudes from that opening and immediately afterwards the egg appears, its posterior end being instantly fixed

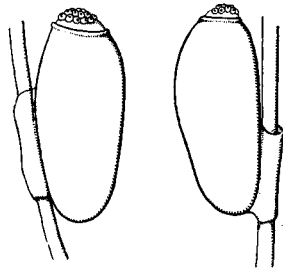


FIG. 4.

EGGS OF BODY LOUSE  
FASTENED TO A HAIR.

down by the cement. The act is completed by the louse walking forward and leaving the egg in position. The cement and egg shell are of a chitinous nature, and resist the action of solvents which suffice to destroy the hair or fabric on which oviposition has taken place. An agent, however, which fails to destroy the cement may be effective in loosening its hold on the substratum, and this may be taken advantage of in removing nits—at least, from living hair.

At one end (anterior) of the egg or nit is a small tuberculate lid or operculum, which opens and may be removed at the hatching of the larva. The anterior operculum and the posterior (generally tube-like) cement mass render the louse nit one of the most easily recognised among insect eggs. After hatching, nits become opaque and white, and even silvery when massed. In this condition they are conspicuous objects, and their discovery is a danger-signal which should not be neglected. Such a warning is necessary, for

many people are so insensitive to the attacks of lice that the finding of nits is the readiest proof of the presence of these pests.

*Incubation.*—The time that elapses between oviposition and hatching varies greatly, according to the temperature maintained. No eggs will hatch if kept at a temperature of 22° C. (71.6° F.) or under, nor, whatever be the conditions, till 4 days after laying. By keeping a batch of eggs alternately at 30° C. and 10° C., hatching has been delayed for 35 days. At about 35° C. (95° F.) eggs hatch in 6–8 days. This means that under natural conditions, near the body, and assuming that the clothing next the body is not removed at night, about a week may be taken as the normal period required for incubation.

*Hatching.*—When the young larva is about to emerge, air, which percolates through the egg lid, is pumped backwards by the pharynx, and, passing through the gut, is expelled by the anus. In this way a cushion of air gathers behind the larva which is ultimately pressed up against the operculum with sufficient force to open the latter. A few minutes later the young louse is free from its shell and may at once proceed to feed.

*Active Life.*—Between the egg and adult stages a louse moults its skin three times. These changes occur at from 2–4 day intervals, and the whole development, from the laying of an egg to the appearance of the adult louse, may, under the most favourable conditions, take only 16–17 days. As adults, lice may live from 3–5 weeks, according to the facilities they have for feeding, temperature, etc. Exceptionally a louse has survived 45 days. The average length of life from the hatching of the egg to the death of the adult may therefore be assumed not to exceed two months. To complete what has been said of the life cycle it may be mentioned that mating (which occurs many times) may take place so early in the adult life that a female has been observed to lay fertile eggs within 24 hours after the last moult.

*Dissemination of Lice.*—(a) *Spreading by Direct Contact.*—The essential factor in the spread of lice is a person who has already been parasitised, and, as a rule, transference to a clean person is effected by contact of a more or less direct kind. This simple fact requires to be insisted upon. Contact has long been recognised as the determining condition of dissemination in the case of the crab louse, but it is no less true of head and body lice as well, with regard to whose spread many misconceptions

are prevalent. Lice neither arise "spontaneously" from filth, nor is there any necessary connection between dirt and lousiness, though conditions conducive to self-neglect and the tolerance of dirt on the body favour the increase of lice there if they have once gained a foothold. The importance of close association between infested and clean persons in spreading these pests was abundantly demonstrated during the late war, when men were crowded for long periods in dug-outs, or herded together in prison camps. In civil life lice are disseminated by similar contact, and if the results are less striking and obtrusive than they have lately been to those on active service, it is only because the conditions are now less aggravated. Contact may be mediate or immediate. An infested man parts with some of his lice to his neighbour at a meal, or to his bedfellow. Head lice pass from nurse to child, or in school, when heads come together at work or play. More mediate is the transference effected when discarded lousy clothing is put on, or an infested bed occupied by a clean person. Lice may also be spread by brushes or by caps hanging in close proximity.

The normal activity of both head and body lice, which is greater than is commonly supposed to be the case, is responsible for spreading of this kind; but, in certain circumstances—temperature being the decisive condition—lice will leave their host without the stimulus afforded by contact with a fresh victim. Broadly speaking, body lice tend to leave a host whose temperature rises above or falls below the normal. They are stirred to activity by violent exercise on the part of their host, while, in cases of fever, they will be found moving on the upper blankets. Similarly after their host's death lice appear, sometimes in enormous numbers, while the body is cooling, and migrate to surrounding objects. At such times they readily attach themselves to fresh hosts. Lice, indeed, when dispersed by any cause, are quick to respond to warmth and at once fasten on any textile that touches them. Thus they soon find out a new occupant in a bed, and can be picked from a smooth floor by merely flicking a towel across it. For this reason the wearing of linen overalls is to be recommended where lice are likely to be encountered.

(b) *Casual Spreading, e.g. by Wind, Flies, etc.*—These parasites are also spread in many casual ways. One striking instance was reported during the war, when some badly infested men were stripped for medical examination. As they stood thus, the wind blew lice

from their bodies on to the bystanders. A similar case came under the writer's observation during the loading of some railway trucks, in which operation a heavily parasitised man took part. As the sacks were heaved over, lice were jerked from this man's garment, fell down between the trucks, and, in some cases, blown by puffs of wind on to the boots of the officer in charge.

Heavily infested carriers also may drop lice at intervals, though no violent exertion has been made. In this way the insects may occur on benches, floors, etc. Body lice are also easily shed during disrobing or by the subsequent scratching in which the carrier may indulge. From the loose, dirty tresses of a girl whose head was covered with lice, the lowermost individuals have been watched dropping from time to time, being apparently pushed off in the struggle for a foothold.

Domestic animals, particularly dogs, on occasion carry lice from one person to another. On dogs human lice occur generally on the head. On one occasion I was able to follow the complete process of transference. The dog picked up the louse whilst nuzzling among some verminous bedclothes. The insect at first moved off to the longer hair on the scalp, but (possibly finding the temperature too high) returned in a little while to the short hair above the mouth, from which it was wiped, in due course, on to the clothing of a fresh host.

Lice have also been seen to be transported by house flies, to which they had probably become attached when the latter settled on the person or garments of the original carrier. In the same way a dragon fly, settling on a dead animal, has been noted to carry off *Mallophaga*.

While it cannot be contended that transferences of so accidental a nature are of much practical importance in the spread of lice, the possibility of such occurrences must be borne in mind, and may explain cases of infestation otherwise obscure.

**Incidence, etc., of Lousiness.**—(a) *Influence of Sex, Age, etc.*—Head lice are commoner on women and children; body and crab lice on men. All three may exist on one host. Head lice and body lice on the same person frequently keep to the stations implied by their trivial names, but no hard and fast rule can be laid down. When head lice occur alone they may (particularly in old people) be found in almost any situation. When only body lice are present they do not, in my experience, often invade the head. I have,

however, seen them in this position swarming on a baby. Lice of all kinds are often found in numbers on old people—simply through neglect.

The greater prevalence of head lice on women and children is probably due to several factors, e.g. the hair is more commonly worn long; opportunities of passing from host to host are very frequent; the body is less hirsute; differences in underclothing, etc.

(b) *Seasonal prevalence.*—It has been shown that in Britain lice are more numerous in winter than during the summer months. This is accounted for partly by the more frequent changes of clothing necessary in summer and partly it is the direct result of an increase in temperature, which reacts detrimentally on developing ova and larvae. In Macedonia, during the heat of August, on shirts exposed to the sun, lice were noted already dead when the garment had been taken off. These examples had all the appearance of having been sweated to death.

**Degree of Infestation.**—As to the number of lice that may be present on a single person, no satisfactory figures for a dense infestation are available. In ordinary cases they are to be reckoned in tens and hundreds. On one army shirt some 10,000 adult lice and as many nits have been counted. But even the latter figures give no just idea of the myriads of lice that are occasionally to be encountered on some unfortunate being.

**Evidence of the Presence of Lice.**—The finding of nits on the hair, is, of course, diagnostic. When lice are suspected to be present, the *back of the head* should be carefully combed, bringing the stroke upwards and forwards. Unless present in numbers body lice are generally removed with the shirt or undergarments, on which search should be made.

**Bites.**—An insect bite can be told from other cuticular swellings by the presence of a central puncture filled by a plug of blood, or serum. Old louse bites are surrounded often by a discoloured area for a fortnight or longer. Otherwise lice bites have no peculiar feature.

**Factors Favourable to the Increase of Lice.**—Obviously of great importance in spreading lousiness are all conditions imposing crowded accommodation on people without facilities for ridding themselves of their parasites. The scandalous history of German concentration camps has underlined this lesson.

So far as individual carriers are concerned, the most dangerous are those (by no means inconsiderable in numbers) who have a natural or an acquired insensitiveness to louse bites.

Infants and old people, the feeble-minded at all times, neglected invalids, healthy people who, through carelessness or force of circumstances, go long without a change of clothing—are all apt to become lousy and to spread their trouble. The dirty, slovenly and careless are not necessarily a danger to the community in this connection, provided they are able to change their clothing frequently. There is ultimately no mystery as to the spread of lice—it is caused by the most commonplace neglect of personal hygiene. Further, as there is now a growing public conscience in this matter, and no one would willingly become lousy or remain so, it seems evident that poverty and a low standard of living are the permanent sources of lousiness. A long step towards the solution of the louse problem would be taken if the poorest amongst us were assured of a weekly change of underclothing!

**Guarding against Lousiness.**—The best general prophylaxis is a frequent change of clothing. When this is not feasible, and one is constantly exposed to infestation, the day clothing should be sprinkled thickly with powdered naphthalene and loosely packed at night into a tin box with a close-fitting lid. In the morning the day clothes are taken out and replaced by the night clothes—the same naphthalene doing duty for both. Allow 1 oz. naphthalene to 1 cubic foot. So far as the writer knows, there is no repellent or specific prophylactic against the insidious invasions of lice, and the articles sold for this purpose are useless nostrums.

## II.—LICE AND DISEASE.

The list of diseases now proved to be originated by lice is greater than that standing against any other of man's insect enemies.

**Typhus Fever.**—Of these maladies typhus fever is the most deadly. It is carried by lice *and by lice alone*. Even in the 17th century a connection between lice and typhus had been suspected and suggested, but definite proof that the insect is a causative agent

### III.—DESTRUCTION OF LICE.

The problem of louse destruction is limited and simplified by one important consideration. From the nature of the case measures for delousing need not be contemplated, except in a very secondary way, against particular premises or haunts. Lice may have many disseminating hosts, but there is never in any real sense a local centre of distribution. It is true that during the war one got accustomed to such phrases as "lousy billets" or "lousy dug-outs," but terms like these are slipshod and misleading, and if literally accepted may involve one in much avoidable expenditure of time, energy and money. A room with defective flooring under which organic matter has accumulated may become infested with fleas and cockroaches, or, if the woodwork is much cracked, with bugs, but *a place is louse-infested only in the sense that the people living or meeting there are verminous*. Of course, during delousing operations care has to be exercised to prevent the scattering of the parasites, which might then be communicated from floors, etc. With this proviso one may say that the problem of louse destruction resolves itself into (a) the cleansing of the lousy person, and (b) the destruction of the insects and eggs on clothing, bedding, etc. It is further desirable that, in dealing with clothing, care should be taken to sterilise any adherent faecal matter in cases where thorough washing is impracticable.

Lice may be destroyed by heat (moist or dry) or by the use of various chemical substances. These attacks may, in practice, be combined, but the particular method to be employed must be indicated by circumstances. It is safe to say that, when applicable, dry heat is at once the cheapest, simplest, easiest and most efficient means to employ.

**Treatment of Person.**—The destruction of lice on the person, if gone about thoroughly, presents no difficulty. The head and body require somewhat different treatment. If both are infested the head should be first dealt with.

Provided that the presence of lice on the body is detected at an early stage of infestation, that bites are few, and nits not observed, it is sufficient after stripping to smear the skin thickly with undiluted paraffin emulsion (p. 18), which must be well worked into the

hair, e.g. in the axillae. A hot bath and clean clothing should follow. If the infestation is severe and nits abound, it is necessary to remove the body hair before applying the emulsion. First rough clip with scissors (or with clippers No. 0 or No. 1) and complete with a safety razor, dropping all the hair removed into a 2 per cent. lysol solution. If the hair is not removed it will require to be treated after the hot bath with strong vinegar, or (preferably) 10 per cent. acetic acid. When this has been rubbed in the nits will, in a short time, loosen, and may be removed with a fine tooth comb. Disrobing before the bath should be done over a newspaper, standing on linoleum or wood, not over a carpet, and the clothes as they are taken off should be rolled up and put into some safe receptacle (e.g. a smooth enamelled bath or deep sink) till they can be dealt with.

In cleansing the head it is preferable, but not essential, first to crop the hair as short as possible. Paraffin oil (preferably), or its emulsion, should next be rubbed in thoroughly, and a towel tightly wrapped turban-wise round the head, covering up the scalp entirely. The head should remain swathed in this manner for an hour, and (if it alone requires treatment) it is no bad plan to leave the towel on overnight. In the shorter time all the lice present should have been accounted for; the only advantage of the overnight treatment is to make sure that all the nits are killed. After the towel is taken off the head should be thoroughly shampooed and combed, to remove the dead lice and nits which should have been previously loosened by acetic acid (see above) applied before the hair is dry.

The addition of 5 per cent. (1 in 20 pts.) of sassafras oil, oil of eucalyptus, oil of cedarwood, tar oil, etc., to the paraffin is to be recommended, as it renders the dressing more toxic and more rapidly lethal to the insects.

**NOTE.**—In all ordinary cases the above treatment should be effective in ridding the body or head of lice. Thoroughness is, however, so essential to success, and so easily missed, that a second application, after an interval of ten days, is advisable. The paraffin oil used should be the purest obtainable. Lower grades of the oil are quite efficient insecticides, but their action on the skin is uncertain. As a rule, the use of pure paraffin involves no inconvenience, but, in certain cases, it may cause some cuticular irritation. Here the use of paraffin emulsion is indicated. The emulsion should contain at least 30 per cent. of the oil, and its action



lice present on garments will be dead and the eggs either hatched or shrivelled up within ten days or a fortnight. A fortnight, however, should be regarded as the minimum time under the most favourable conditions for employing this method. With the ordinary fluctuations of temperature and humidity occurring in these islands stored clothing should not be regarded as above suspicion till three, or preferably four, weeks have elapsed. It is essential that, during storage, clothing, etc., should be isolated.