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THE LOUSE AND ITS RELATION
TO DISEASE

ITS LIFE-HISTORY AND HABITS
AND
HOW TO DEAL WITH IT

BY

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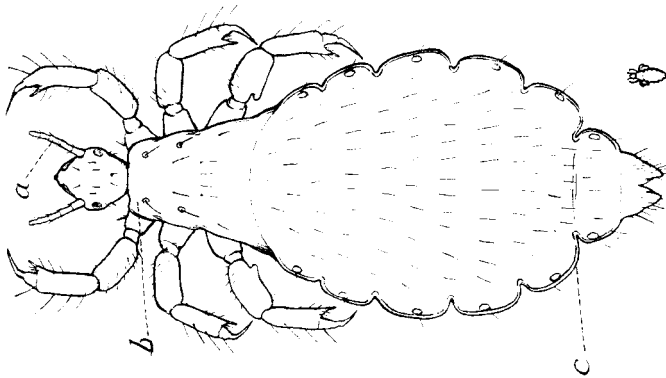


FIG. 1.

THE *CROTOLUS* 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 antennae), *b* (width of body behind neck), and *c* (depth of the clefts between the segments).

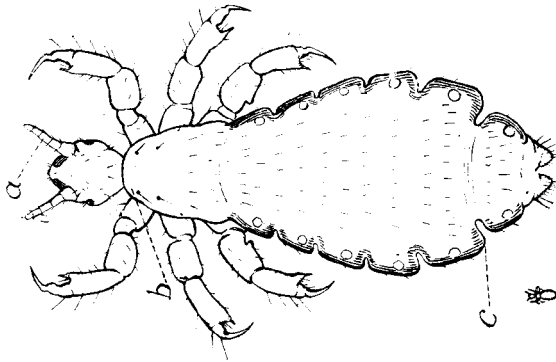


FIG. 2.

THE HEAD LOUSE (female).

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INTRODUCTION.

No less than three species of louse are parasitic upon the body of man, namely, the Head Louse, the Clothes or Body Louse, and the Crab Louse. These creatures figured early in the literature of the world, and find a place in Herodotus, in Aristophanes, in Plutarch, and in many other early authors. In olden times, kings and emperors are reputed to have fallen victims to them, and old medical treatises report many well-nigh incredible cases of infection terminating in the death of the patient. Many strange errors concerning lice used formerly to abound, and Galen maintained that lice penetrated below the surface of the skin to breed.

Recent scientific research has dispelled such notions and at the same time proved these vermin to be, under certain conditions, a serious menace to the public health. Typhus fever and certain forms of relapsing fever are known to be conveyed through the agency of lice, and strict measures are consequently being taken to suppress pediculosis among the troops now on active service in France and elsewhere, and also among the civil population at home.

THE LOUSE.

THE THREE SPECIES OF LOUSE AND THEIR MODE OF OCCURRENCE.

THE HEAD LOUSE (*Pediculus capitis*, De Geer).

THE CLOTHES LOUSE (*Pediculus humanus*, Linnæus).

THE CRAB LOUSE (*Phthirus pubis*, Linnæus).

THE Head Louse and the Clothes Louse resemble each other very closely. In both the body is flat, much longer than broad, and broader behind than in front. The head is relatively small, with two simple eyes situated one on each side behind a five segmented antenna. The integument of the louse is unusually thick, tough and leathery, a fact which may account for the difficulty in killing lice. All lice are completely wingless. They maintain their hold upon their victims by means of six strong legs provided with powerful claws. Through the mouth, a small hole at the anterior end of the head, the louse, when it is about to feed, pushes out its mouth-parts—a complex, elongate apparatus for puncturing the skin and for sucking the blood, which forms its sole diet. In the Head Louse and the Clothes Louse the sexes are readily distinguished by reference to the extreme posterior end of the body, which is round in the male and bifid in the female. A large, sharp, pointed organ is seen sometimes protruding from the posterior end of the body of the male. This is a part of the reproductive apparatus, and must not be mistaken for a sting, which is entirely absent in the louse.

The Crab Louse, which does not particularly concern us here, differs considerably from the other two species of human louse, being, above all, characterised by the shape of the body, which is

short and broad and broader in front than behind. It is generally confined to the pubic hairs.

The Head Louse occurs chiefly on the head; it may also be found on other parts of the body. The Clothes Louse attaches itself mainly to the underclothing, and to that side of it which is in contact with the body. Both species occasionally straggle on to other animals, and in the collection of the British Museum are specimens taken on monkeys, cats, dogs, and pigs. The chimpanzee harbours a louse called *Pediculus schäffi*, Fahrenholz, which is peculiar to it and which is a near relation of the *Pediculi* on man. Various species of lice occur on all sorts of mammals from the elephant to the shrew mouse; but no true lice are known to parasitize marsupials (kangaroos, wallabies, etc.) or monotremes (the duckbill and the spiny echidna). The insects known as bird lice do not suck the blood, and belong to a different order.

Human lice show considerable variation, especially in colour, according to the races of mankind on which they live. Thus the louse of the West African is almost black.

HOW TO DISTINGUISH THE HEAD LOUSE FROM THE CLOTHES LOUSE.

The Clothes Louse differs so little from the Head Louse that it is necessary to indicate carefully its distinguishing characters. These may be summarised as follows, under separate heads:—

Size. The Clothes Louse is larger than the Head Louse:—

	Mean length in millimetres.	
	Males.	Females.
Clothes Louse	3·19	4·13
Head Louse	2·46	3·03

In a series of measurements the smallest adults of the Clothes Louse were larger than the largest examples of the Head Louse.

Colour. In this country the Clothes Louse is pallid, almost colourless, and the Head Louse is of a cindery grey colour. When swollen with blood both look darker.

Form. In the Clothes Louse the body immediately behind the head is broader than it is at the same place in the Head Louse. The lateral angles between the segments of the hind part of the body are appreciably sharper in the Head Louse than in the Clothes Louse, and the clefts which run in from the sides between the segments are deeper. (Compare Figs. 1 and 2, *b* and *c*.)

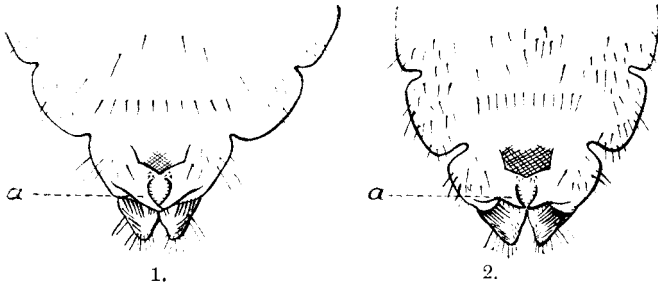


FIG. 3.

THE POSTERIOR END OF THE BODY OF THE FEMALE (VENTRAL SURFACE).

1. The Clothes Louse. 2. The Head Louse.

a. The Gonopod.

Both figures are magnified 25 times.

Gonopods. These are a pair of minute flap-like appendages at the posterior end of the body on the lower surface of the female. In the Clothes Louse each gonopod is narrower towards the tip than it is in the other species (see Fig. 3).*

THE LIFE-HISTORY.

Every louse is hatched from an egg, laid and carefully attached by a female. It was at one time believed that lice were spontaneously generated from dirt. The eggs, or "nits," are small

* The antennae (or feelers) of the Head Louse are usually thicker than in the Clothes Louse. It has also been claimed that the hairs on the under surface of the hind body of the female are always fewer and smaller in the Clothes Louse than they are in the other. The difference in the shape of the eggs figured by Cholodkovsky is probably founded on an error of observation. It is possible that on investigation noteworthy physiological differences between the two species will be found.

oval bodies of a dirty white colour, truncated at one end, through which the young louse emerges. At the other end each egg is attached separately to a hair in the case of the Head Louse (see

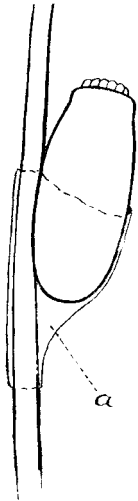


FIG. 4.
EGG OF HEAD LOUSE
FASTENED TO A HAIR.
a. The sticky substance.
Magnified about 40 times.

Fig. 4), or, as a rule, to a strand or fibre of the underclothing in the case of the Clothes Louse, by means of a sticky substance secreted by the female at the moment of egg-laying.

The following facts concerning the life-history of the Clothes Louse sufficiently discountenance the old opinion that a louse could become a grandfather in twenty-four hours. The eggs hatch in from eight days to five weeks, according to temperature and perhaps other conditions, and the young louse begins to draw blood at once. It differs from the adult parasite only in its smaller dimensions, proportionately larger legs, in the arrangement and number of hairs on the body, and in the presence of only three perfectly jointed segments in the antennae. In the adult there are five. The sexual organs do not mature until the adult stage is reached.

The growth of the young louse proceeds by three moultings of the skin, each moult being accompanied by a slight progressive change. There are therefore three distinct stages in the life-history. The results of experiments made in breeding lice under laboratory conditions indicate that each moult occurs at an interval of about four or five days, the final moult into the adult form taking place about the twelfth day after the egg was hatched. The newly emerged female does not begin to lay until two or three days later. Each female for the rest of its adult life continues to lay four or five eggs a day. A male louse in the adult stage lives for a period of about three weeks, and an adult female for about four weeks, under laboratory conditions. Thus from the time of its hatching from the egg to the death of

the adult the life of the louse—from the cradle to the grave—lasts about five or six weeks. It is important to remember that an egg may hatch five weeks after it has been laid.

HABITS.

Lice depend entirely upon the body for their existence and quickly die apart from it. The Clothes Louse cannot live for any length of time upon discarded clothing. In these respects the louse differs profoundly from the bug and the flea, which may be considered only as occasionally living upon the body.

When feeding, the Clothes Louse usually anchors itself in the underclothing by one or more of its six claws, with the head depressed and in contact with the skin. Schiödte, a Danish naturalist, gives the following description of a Clothes Louse when transferred to the back of his hand after he had confined it for some time in a tube without food so as to increase its thirst:—“Scarcely does the abominable little monster feel the heat of the skin before it lays aside its former disheartened attitude and begins to feel at ease; its antennae oscillate for joy and it stretches all six legs complacently out from the body. But though the pleasure and surprise at the sudden transportation into congenial surroundings for the first moment eclipse everything else, hunger soon asserts its claim, sharpened as it is by the long fast which has rendered the stomach and intestines quite transparent. The animal raises itself on its legs, walks on a few steps, seeking and feeling its way with its antennae while we follow it with a magnifier. Presently it stops, draws in its legs a little, arches its back, bends its head down towards the skin at an oblique angle, while it probes a small dark and narrow organ repeatedly forwards and draws it back through the fore end of the head; at last it stands still with the point of the head firmly abutted against the skin,” the mouth-parts are then buried in the skin and the louse begins to suck in the host’s blood.

INFECTION.

Pediculosis is always common in the poorer quarters of most towns and villages, and has for years been rampant in the public elementary schools. In 1912 the Medical Officer of Health in one of our northern counties reported that at the present rate of progress it would be several years before pediculosis among school children was reduced to 10 or 15 per cent., the main difficulties being constant reinfection in dirty homes and the absence of a safe and practicable remedy.

The louse passes directly from person to person, and people of a cleanly habit are liable to become verminous through contact with verminous persons in crowds, in railway carriages, with bedding in hotels and lodging houses.

The Clothes Louse always becomes abundant and troublesome wherever human beings—soldiers, for example, on a long campaign—are gathered together in large numbers with infrequent opportunities for changing their clothing and washing. Pediculosis was rife among the French in the retreat from Moscow, among the Russians in the Crimean War, among the Americans in the American Civil War, among our own soldiers during the South African War, and it is notoriously present among the troops in the present war.

LICE AND DISEASE.

It is now regarded as conclusively proved* that exanthematic typhus, the disease which has devastated Serbia, is conveyed by the Clothes Louse, possibly by the Head Louse also, a fact which explains the frequent occurrence of typhus among troops on active service. The prevention of typhus, therefore, is largely a question of exterminating lice.

* See "Comptes Rendus des Séances de l'Académie des Sciences," Vol. 158, No. 13, Mar. 30th, 1914, p. 964; and also "Nature," No. 2377, Vol. 95, May 20th, 1915, p. 321.

Both the Clothes Louse and the Head Louse are instrumental in spreading European relapsing fever, and also the relapsing fever of North Africa, by inoculation with the minute organisms known as *Spiroschaudinnia*. The method of infection is thought to be due to the irritation of the louse's bite causing the patient to scratch and thus to crush the louse and at the same time to produce an abrasion of the skin. Scratching the irritated parts should, therefore, be avoided.* The virus of typhus is probably conveyed in the same way. But it can also be transmitted by the simple puncture of the louse.†

The Head Louse also has come under suspicion of causing phlyctenular conjunctivitis, a disease of the eye frequent in infants and children. The spread of tubercle, leprosy, plague and other diseases have also been attributed to the agency of lice, but on insufficient evidence.

PREVENTIVE AND REMEDIAL MEASURES.

A horrible mixture of hog's blood with wine and essence of roses was recommended as a cure by Thos. Mouffet in the year 1634. A great variety of remedies have been warmly recommended by various authors down through the ages, and biologists and chemists are still engaged at the present time in finding one which is both efficacious and practicable, and at the same time inexpensive. In ordinary life, under normal conditions, the best preventive is strict personal cleanliness and the careful avoidance of those on whom the insects are likely to be found. This becomes a counsel of perfection where men are crowded together as in the case of troops on a campaign. In South Africa it is said that the Government has supplied the troops with flowers of sulphur sewn into small bags of thin calico and secured to the underclothing next to the skin. As a deterrent in uninfested cases this may probably prove effective.

* See Patton and Cragg's "Text-book of Medical Entomology," p. 528.

† It seems probable that the infection of the virus of typhus is hereditary in the louse, being transmitted to the next generation through the egg.

The best remedial measures, when once the vermin have established themselves, for the Clothes Louse are frequent baths, frequent changing of the clothes, immersion of infested garments in gasoline, petrol or paraffin, or scalding the clothes. Garments should be carefully turned inside out and the seams and folds and other lurking places exposed. For the Head Louse a 2 per cent. solution of carbolic may be used, and is said to be effective against the "nits," which are harder to kill than the insects themselves. Sulphur ointment and "white precipitate" are commonly used, but cannot be recommended. If necessary the hair, even in girls, should be cut short, and petrol, paraffin, turpentine, xylol, benzene, or kerosene applied to the scalp. Great care should be taken as these are inflammable. They should not be allowed to remain for long on the scalp. A fine comb is useful for detecting vermin and removing them and the "nits."

When pediculosis is prevalent among troops it is much more difficult to deal with. Soldiers in camp in the South of England have adopted the following method and found it thoroughly satisfactory. Infested men were directed to take a hot bath, dry themselves, and then lather the body with Cresol soap solution (Jeyes Fluid, $1\frac{1}{2}$ oz.; soft soap, $1\frac{1}{2}$ lb.; water, 10 galls.), and allow the lather to dry on. Shirts were washed in the same mixture in boiling water; tunics and trousers were turned inside out, and the lather rubbed well into the seams and allowed to dry on. Blankets were also soaked in the solution and then washed in the ordinary way.

Dr. Kinloch, in the course of some recent experiments which are still proceeding, concludes that for practical purposes the destruction of lice and "nits" is best secured by immersion of the clothing in a petrol or benzene bath. To this end, however, if danger from fire and waste of petrol is to be avoided when clothes are dealt with on a large scale, such a bath and extractor must be used as are employed in a dry-cleaning apparatus. A petrol bath is necessary particularly for uniforms and woollen garments. For underclothing he recommends immersion in a soap solution containing 2 per cent. trichlorethylene or 10 per cent.

tetrachlorethane. But it is doubtful whether the employment of two such poisonous substances is justifiable.

Prof. Maxwell-Lefroy recommends an oil emulsion of the following constituents :—

Crude Mineral Oil	5½ pints.
Soft Soap	3 lbs.
Water	About ½ a pint.

A refined form of this crude oil emulsion has been prepared and is now placed on the market under the name " Vermijelli," by Messrs. Bowley & Sons, Wellington Works, Battersea.

An investigation has been carried out by the R.A.M.C., and the relative values of the different vermicial substances tested in the field, the experiments being made in France with batches of twenty-five men. Among the substances used were :—

- Naphthalene with 2 per cent. Iodoform and 2 per cent. Creosote (called conveniently N.C.I.).
- Naphthalene and 2 per cent. Iodoform alone.
- Vermijelli.
- Mercury Powder.
- Mercury Ointment.

As a result, the actual measures recommended for use among our troops at the front are the dusting of N.C.I. on the clothes and the use of Vermijelli according to the instructions issued with each tin.

FURTHER INFORMATION ON LICE.

Further information on the structure and life-history of the Clothes Louse should be sought for in Patton and Cragg's "Text-book of Medical Entomology" (price 21s. net, published by the Christian Literature Society for India: London, Madras and Calcutta. 1913).

See also "The Minor Horrors of War," by Dr. A. E. Shipley, F.R.S. (Smith, Elder & Co., 1915, price 1s. 6d. net, in

paper cover, or 2s. net, cloth), and "Insects Injurious to the Household," by Glenn W. Herrick (Macmillan Company, New York, 1914, price 7s. 6d.).

The following is a short list of articles and papers which have recently been published concerning remedial measures:—

"Note on a Successful Method for the Extermination of Vermin Infecting Troops," by S. M. Copeman, *British Medical Journal*, for 6th Feb., 1915, p. 247.

"Flowers of Sulphur and Lice," by A. E. Shipley, *British Medical Journal*, for 27th Feb., 1915, p. 295.

"A Method of Rapidly Exterminating *Pediculi capitis*," by Arthur Whitfield, *Lancet*, Vol. 183, 1912, p. 1648.

"The Destruction of Mosquitoes, Fleas, Flies, Pediculi, and Other Insect Carriers of Disease," by J. S. Purdy, in the Report of the 13th Meeting of the Australian Association for the Advancement of Science, 1912, p. 662.

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