

## NOTES ON HEAD- AND BODY-LICE AND UPON TEMPERATURE REACTIONS OF LICE AND MOSQUITOES.

BY F. M. HOWLETT.

### I. ON HEAD- AND BODY-LICE.

THE examination of a large number of individual lice in India, where the facilities for obtaining material are unusually good, has impressed me with the fact that the characters ordinarily given as differentiating *corporis* from *capitis* are all to a greater or less extent inconstant and unreliable. In general, however, *capitis* is more heavily chitinized and the chitin is of a darker colour with less smooth outlines. The size is very variable, but *corporis* has an easier life and is more often large.

My assistant Mr Patel and I have both reared *capitis* on the body, to ascertain whether the changed conditions would affect these characters in any way. Our experiments were carried out in 1912 and 1913 at the Pusa Research Institute, and gave practically identical results. The lice when put on the body showed a distinct tendency to migrate to the head, and had to be put back again at intervals, but this character was markedly modified in their offspring, some of whom showed no definite tendency headwards. The eggs of these (F. 1) individuals were mostly laid on clothing; a few (in my case) on the hairs of the body, but fewer than those on the clothing. In the next (F. 2) generation the migratory tendency had very largely disappeared, and though a few individuals still showed it to some extent it was much less definite than in their grandparents. The majority did not show it at all. Chitinization and colour were also greatly modified in the *corporis* direction: I can best express the extent to which this modification had gone by saying that I am convinced that if these F. 2 adults had been sent without explanation to an expert for identification, more than 75 % of them would have been pronounced to be *corporis*, and the remainder would nearly all have run an excellent chance of being put into the same category as slightly aberrant forms. The total number of F. 2 lice was in my case something over 40. When the experiment

was stopped they had laid a few eggs (about a dozen) on clothing, but none were discovered on hairs. After these eggs and all the lice had been removed, none subsequently hatched on the body, as they would have done had any eggs been laid on hairs and escaped detection.

## II. A TEMPERATURE-REACTION OF LICE AND MOSQUITOES.

Some years ago I described the curious action of warm surfaces in stimulating female mosquitoes to bite. A glass tube full of hot water was brought near the net cage in which mosquitoes were confined, and they made attempts (more or less vigorous according to the species of mosquito) to bite the warm surface of the tube, their efforts in the case of several species being extremely vigorous.

I should correct here an error made in that paper: it was stated that one of the species which exhibited the reaction was *Culex fatigans*. In reality the *Culex* referred to was an unidentified species, and should read *Culex sp.* The paper was written in England, and on returning to India I not only discovered the error, but found that it was a rather unfortunate one, as on carrying out some further experiments with accurately identified *fatigans* it became evident that they did *not* react to the hot tube, but formed a marked and curious exception to the rest of the species experimented with, of which the majority gave a very definitely positive reaction.

It is noteworthy that this temperature-reaction in mosquitoes is exhibited only by females, and it should probably be regarded as a normal component of the blood-sucking habit. The case of *Phlebotomus*, which sucks blood from cold-blooded animals as well as from man, has not yet been investigated but might give results of interest. In 1911 I made some observations on the rat-flea without getting any very definite results, but the experiments were ill-devised and not conclusive: as far as they went they seemed to indicate the absence of any definite positive reaction such as is found in mosquitoes. When circumstances permit I hope to take up this investigation again with the object of ascertaining in what way and to what extent the reaction to warm surfaces is exhibited by each of the different groups of insects which suck blood from warm-blooded animals.

In the case of *Pediculus humanus*, the head- and body-lice, I have made some rough observations on the effect of bringing warm objects near the insect. A quarter-inch tube of thin glass filled with hot water was generally used, its temperature being between 35° and 50° C. The effect of bringing such a tube within an inch or so of a louse is to stimulate

it to a remarkable display of activity. It moves in the general direction of the tube, and in doing so displays a frantic eagerness of movement which is not only amusing but quite foreign to its ordinary method of locomotion. If the tube is brought near a louse which is in the act of feeding, it may show some excitement, but does not ordinarily relinquish its hold.

The reaction has a certain practical value as affording a means of greatly facilitating the removal of lice from the body, more particularly in the case of head-lice, whose removal from the hair generally entails a good deal of trouble.

If a comb, warmed enough to be pleasantly hot to the hand, be used, the lice become much excited and are as it were tempted into the open instead of sticking to their dug-outs among the bases of the hairs. The comb thus gets free play among them, and they are removed with a very marked economy of time and trouble. I have had hearty testimonials to the value of this method of dealing with an insect which is especially troublesome in India.

The temperature-reaction of *Phthirus pubis*, as tested by the hot tube, seems to be essentially similar to that of *Pediculus*. When feeding they are generally little affected, but at other times become greatly excited and move with remarkable eagerness and rapidity. If the hot tube be brought near a *Phthirus* laid on its back on the table, the insect's wild efforts to reach it attain an intensity which is almost pathetic.

How far this reaction of lice can be considered as parallel to that of female mosquitoes I have not tried to ascertain. In both cases a hot body has a markedly stimulating effect; in mosquitoes it results in a general excitement and marked eagerness to bite; in lice it certainly results in rapid and excited movement, and this would be of advantage to the insect in securing the wider distribution of the species by infecting anyone whose body came in contact with that of their host. It may be worth noting that I have recently tried the effect of placing half-a-dozen lice on the hairy part of the fore-arm and then laying over them the corresponding part of the other arm. Four trials were made, and in each case one or more lice were found to have been transferred after the arms had been in contact for periods varying between 15 and 30 seconds.

Dispersal may very possibly be the only advantage accruing from the reaction, but on the other hand there might also exist some connection between the act of blood-sucking and the temperature of the surface. I have not observed it, but if such a connection exists, its demonstration would probably require experiments much more careful than the rough observations referred to in this paper.