are many who do not fall definitely into either class. In these the diet must be determined more or less experimentally, and probably will have to be varied from time to time.

A PRELIMINARY NOTE ON THE HIBERNATION OF MOSQUITOS.

BY

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IN THE BRITISH MEDICAL JOURNAL of April 13th Dr. M. J. Wright records some interesting experiments concerning the resistance of mosquito larvæ to cold. It is truly a remarkable feature that larvæ, both *Culex* and *Anopheles*, are able to withstand a temperature of about 4° C. for a period of two weeks.

Early in December, 1900, Mr. T. V. Theobald, of Wye, Kent, sent a number of *Anopheles* larvæ to Major Ross, which have been kept continuously in a greenhouse at a temperature of from 15° C. to 32° C., and although they are often seen feeding on the green protococcal growth supplied, they show apparently very little increase in size, and none have as yet changed into pupæ.

Dr. Wright infers from his observations that the larval form is that in which "hibernation" takes place, never having found adult mosquitos during the winter months. Here his observations differ most markedly from ours, which we wish now to record in a short preliminary account. It may be mentioned that throughout the winter session a supply of *Culex* adults has been obtainable for class purposes at this school.

On February 17th, during a period of very cold weather, four *Anopheles* were caught at a farm some 13 miles from Liverpool, in North Cheshire. A large number of *Culex* (four species) were also captured here. The *Anopheles* were identified by Mr. T. V. Theobald as *A. maculipennis*. The mosquitos were found in the following situations: cellar, dairy, cheese room, pantries, lumber rooms, and in some disused bedrooms at the top of the house; also in the wash-house and whey-tankhouse abutting on the house, and in the coach-house, tool sheds, and privies at some distance away. No mosquitos could be found in the stables, cowsheds, pigsties, haylofts, and henpens. Many of the farmhouses of this district of Cheshire are old, and have no damp-proof courses. In the disused cellars the walls and the beams supporting the ground floor were soaking with moisture, and small ferns grew in the crevices of the tiled floor, and patches of moss and mould on the surface of the walls. Here thousands of mosquitos, chiefly *Culex*, blackened the walls and rafters. In the dairies they were found on the damp areas, resting on and in the crevices of the plaster; very few were seen on the drier parts. Similarly, in the other places on the damp portions many mosquitos were observed, especially behind boxes, slates, boards, barrels, and other articles resting against the wall.

Since the date mentioned, *Anopheles* have been collected on four occasions from farms in the North and Mid-Cheshire. The Mid-Cheshire farm is at a distance of about 35 miles from Liverpool, and here *Anopheles maculipennis* occurred in about the same number and in similar situations as in the North Cheshire farms. About 20 *Anopheles* were collected at each farm.

In all these sites it was noted that the majority of the mosquitos of the genus *Culex* were found on the parts of the damp walls near the ground, while *Anopheles* were generally caught near the ceiling.

During the coldest weather the attitude both of *Culex* and *Anopheles* was peculiar and characteristic. The under surface of the thorax and abdomen was applied closely to the walls, while the legs were stretched straight out, almost at right angles to the body. The absence of the characteristic attitude of *Anopheles* (at an angle to the surface), and the fact that both *Culex* and *Anopheles* assumed the peculiar outstretched attitude, made it difficult at first sight to distinguish specimens of the two genera, especially since among the *Culex* was a species having wings spotted somewhat similarly to *Anopheles*

(*Culex annulatus*); but on close inspection, even in the positions described, the characteristic angle, seen in side view, between the direction of the head and thorax, and of the abdomen of *Culex*, served to distinguish the genera. In this peculiar attitude the mosquitos were very difficult to rouse; the mouth of a bottle could be easily placed over them without disturbing them, and, in fact, one had to lift them up on to their legs by the rim of the vessel, and then no attempt was made to fly; they would crawl lazily along the neck of the bottle. How long these mosquitos remain in this position during the winter months is not very easy to determine, but it was noticed that many of the *Culex* on the damper patches were wholly or partially enveloped in a thick mould which had grown in and around their bodies, thus fixing them in the attitude described.

On very cold days this attitude was observed even in the cages in which the mosquitos had been kept. On warmer days at the farms, and on taking the caged mosquitos into a warm room, they reassumed their ordinary attitudes.

It has been mentioned above that mosquitos were not found, or only very rarely, in stables, pigsties, and henpens frequented by animals. Such places are generally comparatively dry, constantly disturbed, and warmed by the presence of horses and cattle at night.

A number of the *Anopheles* collected by us have been kept in a damp cage in the animal house of the Thompson-Yates Laboratories at a temperature of 5° to 10° C., no food having been supplied; only two of the number have died during the month we have kept them in this condition.

There can, therefore, be no doubt that mosquitos of both genera "hibernate" during the winter months in England, and it seems certain that not only the adults but, from Dr. Wright's experiments, the larval forms also provide for the continuation of the species during the cold weather.

It is of interest to note that among the numbers of mosquitos of both genera collected by us, a male was never found; and moreover that all the females with which we carried on a number of experiments, or which we dissected, had been fertilised (proved by the presence of spermatozoa in the spermatheca, or by the hatching out of larvæ from deposited eggs). A number of experiments relating to the bionomics of the English *Anopheles maculipennis* are at present being undertaken, and we hope to be able to communicate the detailed results at a later date. Some interesting facts may, however, be now recorded.

If these mosquitos be kept in a dry cage they die in a few days, whereas, as stated above, they can be kept probably for months in a damp cage in the cold, during which time they preserve what we propose to call the "hibernating" attitude. On introducing them into a warm room they quickly become active, and both *Anopheles* and some species of *Culex* eagerly feed on blood on inserting the hand into the cage darkened by covering with a cloth. They then feed eagerly every day for four or five days, but subsequently only occasionally. Eggs were laid on the fifth, sixth, seventh, and eighth days, which hatched out in 24 or 48 hours. It was noted that many of the *Anopheles* died after depositing a batch of eggs.

We have further observed that having once fed on blood it is necessary to continue the feedings at least every other day, otherwise the ovaries cease to develop and the insects die though water is supplied. This confirms our experiments made in West Africa,¹ with this difference, however, that there, by regular feeding, we were able to keep *Anopheles costalis* and *A. funestus* alive for a considerable period; while in the present case of *A. maculipennis*, which had been hibernating, most of them died soon after laying eggs.

REFERENCE.

¹ Report of Liverpool Malaria Expedition in Nigeria, 1901, pp. 37-45.

TRANSMISSION OF SMALL-POX BY LETTER.—An epidemic of small-pox at Saginaw, Michigan, is said in the *New York Medical Journal* of April 6th to have been traced to a letter. The official in charge of the quarantine squad traced the fact that the first patient was a young lady who had recently had a letter from her lover, a soldier of the United States army in Alaska, in which he stated that he was just recovering from small-pox. The epidemic, apparently started by this letter, is said to have had altogether 34 victims.