

OBSERVATIONS OF HIBERNATING MOSQUITOES IN MASSACHUSETTS

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During the winter of 1944-1945 observations were made on the overwintering of mosquitoes in four war areas of Massachusetts in connection with malaria control and prevention activities of the U. S. Public Health Service. These areas were near Ft. Devens at Ayer, Cushing General Hospital at Framingham, Camp Miles Standish at Taunton, and the Boston Area Station Hospital at Waltham.

During the summer months, mosquitoes were abundant in all of the areas studied. In adult resting stations not affected by control work, several hundred anophelines often were observed at one time; culicines were taken in light traps in numbers over 200 per night; larval collections of both culicines and anophelines yielded 100 or more large larvae per 100 dips on numerous occasions.

Of seventy-five mosquito resting stations utilized for checking the efficacy of the summer control program, seven were observed to contain resting mosquitoes at the end of September, 1944, after the first killing frosts apparently had stopped mosquito breeding. The seven stations were visited weekly throughout the winter and in only three of these were mosquitoes found until March 15, 1945. It is assumed that these individuals oviposited later in the spring. The four species of mosquitoes observed in the stations included *Anopheles quadrimaculatus* Say, *Anopheles punctipennis* Say, *Culex pipiens* Linnaeus, and *Culex apicalis* Adams.

During the observation period from October 1, 1944, to March 15, 1945, the minimum temperature recorded was -8° F. and the maximum 86° F. All of the observation stations were at least partially protected from the elements and temperatures taken at the time of each visit all were within a few degrees of the outside temperature. Immediately after the first

heavy frosts at the end of September, few if any mosquitoes were noted. However, during the second week in October, large numbers were observed and from then until the studies ceased, the numbers fluctuated greatly although a gradual but decided decrease occurred.

There was a noticeable activity among the mosquitoes throughout the study period even during the coldest months. Movement within the resting stations was determined by drawing circles of about 6 inches diameter with chalk around selected resting mosquitoes. Each position was identified with a date. It was found that no mosquito occupied the same spot for more than two weeks. Within this period, there occurred at least a slight shifting of position within the circle and frequently a shift to the edge or a few feet beyond the circle. Not infrequently a mosquito would disappear or an apparent new one appear. Even during the dead of winter, a flashlight beam held on a resting mosquito for a few seconds would bring a responsive movement of the legs. If the beam was held on the mosquito for more than a couple of minutes, the insect invariably would fly a short distance.

The darker corners of the resting stations appeared to be most attractive to the resting mosquitoes. As the winter progressed the mosquitoes gradually moved upward and usually were found on the ceiling or the uppermost part of a vertical surface. Crevices, ceiling corners, and small, dark recesses were most attractive. Dampness or dryness did not repel them and they rested without apparent discrimination on brick, cement, stone, wood, rusting steel beams, and copper screening.

At the start of the survey, the anophelines assumed their typical normal resting position with the longitudinal axis of the body at an angle to the resting surface.

As the winter progressed, the resting position changed to that usually described for hibernating anophelines, the bodies pressed to the resting surface with the longitudinal axis parallel to the surface.

The three stations in which mosquitoes occurred throughout the study period are distinguished from the others only in the degree of shelter offered. All three were basement structures. One, the cellar of a stone building originally used as a greenhouse workshop, had walls of brick and stone covered with mortar on the inside and a brick ceiling similarly finished. The floor was partially concrete with the remainder hard packed earth. The second was the cellar of an old vacant house. Here again the walls were of mortared stones with one red brick alcove. The ceiling was of wood with roughly hand-hewn beams. The floor also was of concrete or hard packed earth. The third station was under a New England type barn with a stone foundation and a doorless opening at one end. Here the floor was of earth well saturated with manure and water. The ceiling consisted of rough wooden beams overlaid by crude boards. Hogs or cattle occupied the cellar in varying numbers during the summer. Of all of the other observation stations only one was subterranean, a tunnel in daily use as a passageway for the transportation of ashes from a furnace. This station harbored large numbers of mosquitoes during November and December all of which disappeared by the end of January. It is thought that the mosquitoes may have been disturbed and driven out by the constant use of the passageway.

Although the literature indicates that hibernating mosquitoes have been observed in houses, privies, stables, barns, caves, tree holes, and hollow logs, all available references are concerned with more southerly latitudes. Stations in the above mentioned categories were included in the Massachusetts observations and only the subterranean shelters harbored mosquitoes throughout the winter.

Unpublished data, collected by the office of Malaria Control in War Areas in the U. S. Public Health Service District No. 1, show that *A. quadrimaculatus* adults were collected continuously throughout the winter months at West Point, New York. Here again the collection stations were sub-surface, consisting of concrete target pits on a shooting range. Movement was established by collecting all observed mosquitoes each week and noting that new specimens appeared on the following visit. West Point is slightly south of Massachusetts but has similar climatic conditions and temperature ranges.

In summary, it may be stated that observations in Massachusetts during 1944-1945 indicate that *A. quadrimaculatus*, *A. punctipennis*, *C. pipiens*, and *C. apicalis* pass the winter in subterranean resting places that are comparatively well sheltered from the elements. In these places temperatures reached 0° F. and below on occasion. Movement in the hibernating individuals could be stimulated even in the coldest weather by a flashlight beam, and shifts in positions continued throughout the winter period.