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SEASONAL INCIDENCE OF MOSQUITOES IN THE UPPER COOK INLET, ALASKA

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Little or nothing is known of the densities and seasonal incidence of mosquitoes in most parts of Alaska. There is a real need for quantitative data to supplement the available lists of species. With the present day rapid development of adulticiding control programs, emphasis should be placed more than ever on the vicious, far-ranging, long-lived adults.

Recent mosquito control trials in the vast permafrost areas of the Arctic Slope (Jachowski & Schultz, 1948) and of the

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interior valleys (Blanton *et al.,* 1950) include reports of very high mosquito densities. Stage & Chamberlin (1945) studied abundance and seasonal incidence at a point near the center of the present area of study by analyzing the mosquito catches of a non-baited cutworm moth trap. The present study reports weekly densities of mosquitoes from May 14 to September 17, 1950, as indicated by landing rate counts in 22 localities. About a third of the human population of Alaska lives in the study area.

METHODS

The counting stations were selected near towns, homesteads and other developed areas without reference to mosquito breeding habitats. Mosquito landing rates as determined by Blanton *et al.,* (1950) were chosen to indicate the densities. The area weekly landing rates are totals of the 22 individual locality rates, themselves the highest of several station rates.

Wind, temperature, humidity, and light are factors known to influence insect activity. In order to be reasonably sure that the landing rates reflected density of mosquitoes much more than weather conditions, several precautions were routinely followed: (1) Counts were made on three or four different days each week. (2) Counts were discontinued when wind velocities exceeded 2–3 mph. except at distant stations. (3) Stations were established in shaded, sheltered situations. (4) Instead of a three minute wait at each station before counting, which was found adequate by Blanton *et al.,* the observer waited ten minutes. (The effect of the longer wait was to increase the number of stations positive for mosquitoes rather than to raise the weekly landing rate appreciably). (5) The highest of several landing rates at a station was used. (6) The time and the temperature at ground surface level were recorded.

Six easily recognizable categories of mosquitoes were counted separately. Since it is not feasible to identify specifically adult female mosquitoes of the dark-legged *Aedes* complex the several species were lumped in counting. However, Jenkins (1948) and Sailer *et al.,* (1949) have shown by studies of the larvae in a part of this area that most of these *Aedes* are *punctor* (Kby.) and *communis* (DeG.). The other categories counted were: *Aedes flavescens* Müller; *Aedes excrucians* (Wlk.) plus *fitchii* (Flt.) and Yng.; *Anopheles occidentalis* D. and K.; *Culiseta impatiens* (Wlk.); and *Culiseta alaskaensis.* (Ludl.).

RESULTS

The counts showed the dark-legged *Aedes* to be by far the most important pests. *Culiseta impatiens* was in second place, and *C. alaskaensis* third. Combined landing rates for *C. impatiens* and *alaskaensis* were nearly as great as the peak rates for *Aedes* spp., but the latter had a biting season twice as long. The other categories were local and the data indicate that they can be ignored for control purposes. *Aedes flavescens* was abundant, to be sure, on two widely separated brackish marshes in midsummer, but the species did not disperse in consequential numbers as much as a quarter mile. An occasional *Anopheles occidentalis* bit during a ten day period in late May at an Eklutna station only. *Aedes excrucians* and/or *fitchii* were encountered nine times at five different stations in July and August at low landing rates of no practical importance. Specimens collected on five of those occasions were identified by the tarsal claws (Vockeroth, 1950). Four lots were *excrucians;* one was *fitchii* and *excrucians.*

Landing rates of the dark-legged *Aedes* were unexpectedly low. The highest individual station count was fifteen. For the week of peak densities (landing rate 67), the maximum station count was ten. The average that week (June 18) was 3.05. By way of contrast, in the Interior Blanton *et al.,* (1950) reported average station counts at Birch Hill, near Fairbanks, June 14 and 25, 1948, of 32 and 8 respectively. At Umiat July 2, 1949, Col. Blanton could not count the swarms of landing *Aedes* but estimated the average count at 364. There is, however, evidence that 1950 was

an unfavorable mosquito breeding season in the Upper Cook Inlet. There was only 0.46 inch of precipitation according to the Weather Bureau at Anchorage during the 147 days, January 4-May 11, and a deficiency of 1.46 inches still existed July 25. The *Aedes* and the abnormally reduced larval habitats were, however, widespread. Thus of 386 counts made over the entire season of eighteen weeks 155 (or 40%) were positive for biting *Aedes*.

The two species of *Culiseta* inaugurated the annual mosquito problem at breakup about a month before the earliest *Aedes* appeared on the wing. In fact, a truck equipped with an aerosol dispenser was used against them in the streets of Anchorage. They invaded homes and offices and bit avidly. Unfortunately, the routine landing rates were not determined until the third week in May when the peak of biting activity had passed. *C. alaskaensis* was first observed biting April 18. *Culiseta* landing rates declined to a nadir in July. Remarkably, the emergence in late June and in July and August of a huge population did not appreciably raise the landing rates. In fact, no *C. alaskaensis* was attracted to the observer in the field after July 2. Landing rates, of course, measure only the segment of the population which is inclined to bite. It was thus of interest to study the apparent non-biting habit of these species during the summer and early fall.

A comparison of the biting habits of hibernators from the previous year with mosquitoes which had emerged during the current season was made in the following way: (1) One hundred hibernators (mostly *C. impatiens*) were caught in nature May 14 and 15 and observed in the laboratory until death. They took sugar-water, bit and engorged, and oviposited one or more times during the remainder of May, and June and July. Then during a period of low humidity most of them died. About a dozen, however, rescued with damp towels, lived on through August until the last two died September 14, at an adult age probably exceeding a year. (2) About 20,000 adults of *C. impatiens*, including a few hundred *alaskaensis*, were reared in the laboratory. Except for several hundred, which were progeny of the hibernators of (1), these were dipped from a grossly polluted impoundment in Anchorage. At intervals of a few days all during the latter half of July, and in August and September, the females were observed mating and were offered opportunities to bite. Both sexes took sugar-water, and even a few of the males continued active into October when the last mated pair was observed October 4. But the females would scarcely bite. At the end of September a total of only twenty bites, including some failures to engorge, had been observed. However, in late September and early October after a sudden mortality of more than half of the females, the survivors began to bite the observer at the relatively much higher rate of several each morning. Small numbers also bit a rabbit left in the insectary overnight. By this time no *C. alaskaensis* survived and no fall biting was observed for this species. *Alaskaensis* may not have mated in the laboratory for the spermathecae of two dissected August 24 were empty. Spermathecae of 10 of 11 *impatiens* were full of active spermatozoa. Prior to the onset of fall biting by *impatiens*, unsuccessful efforts to induce biting had been made by refrigeration at 32–39 degrees F. for periods up to two weeks, and by withholding sugar-water. It was concluded that these species actually bite only after aging more than two months or, ordinarily only after overwintering.

The landing rates of *C. alaskaensis* were seen to rise with warmer temperatures for two weeks in June when densities of the species must have been falling. These upward fluctuations are probably activity increases rather than density increases. These hardy hibernators leave winter quarters as early as April 18, and it is improbable that any have not dispersed before the end of May. New emergences from pupae may be disre-

garded since they are few. In July and August when most of the hatch takes place the species has landing rates of zero. Furthermore, the other important categories, viz. *Aedes* spp. and *C. impatiens* showed similar increases in landing rates which were determined at higher temperatures up to 70 degrees F. It was seldom warmer than this after 4 P.M. Increases in landing rates of *Aedes* spp. during the hatching season must be affected by both temperature and new emergences. Pratt (1949) at Fairbanks observed that the activity of *Aedes* spp. decreased rapidly when temperatures were above 80 degrees F. Evidently then, accurate comparisons of densities based on landing rates require counting at similar moderate temperatures over a period of several weeks.

As the landing rates of the *Culiseta* species became low in early June, the rates of dark-legged *Aedes* rapidly rose. The public spoke of a change from big mosquitoes to little ones. The peak of *Aedes* landing rates was reached the week ending June 18. It is interesting to note and indicative of the precise periodicity of Arctic mosquitoes that Stage and Chamberlin (1945) also found the *Aedes* peak in the period June 11–15 in 1944. The mosquitoes then dispersed. The seasonal peak was reached during the week ending July 23, more than a month after the peak landing rates. Biting was experienced at 81% of the counting stations that week. It is therefore a quite mistaken idea that the mosquito problem in this part of Alaska is limited to a relatively short period of about a month in June and July. Rather, the trouble is most acute in this shorter period. The need for anti-mosquito measures extends from the middle of May until the end of August, a period of approximately three months.

SUMMARY AND CONCLUSIONS

Mosquito densities determined weekly by the landing rate method in twenty-two localities of the Upper Cook Inlet, Alaska, May 14-September 17, 1950, indicated:

(1) Relatively low densities prevailed;

(2) The important pests were (a) *Aedes* spp. (chiefly *punctor* and *communis*) during June, July, and August; (b) *Culiseta impatiens* and *alaskaensis* in late April, May, and early June.

(3) *Aedes flavescens, excrucians* and *fitchii,* and *Anopheles occidentalis* were local and/or uncommon and of no practical importance.

References

BLANTON, F. S., TRAVIS, B. V., SMITH, NELSON, AND HUSMAN, C. N. 1950. Control of Adult Mosquitoes in Alaska with Aerial Sprays. *J. Econ. Ent.,* 43(3):347–350.

JACHOWSKI, LEO A., AND SCHULTZ, CARLOS. 1948. Notes on the Biology and Control of Mosquitoes at Umiat, Alaska. *Mosquito News,* 8(4):155–165.

JENKINS, DALE W. 1948. Ecological Observations on the Mosquitoes of Central Alaska. *Mosquito News,* 8(4):140–147.

PRATT, RICHARD L. 1949. Weather and Alaskan Insects. Office of the Quartermaster General, Environmental Protection Section. Report No. 156. 25 pp.

SAILER, R. I., LIENK, S., SOMMERMAN, K. M., MARKS, E. P., ESSELBAUGH, C. O., JEFFERSON, G., RIDENOUR, M., DOVER, L. N. 1949. Mosquitoes (Culicidae). Progress Report of the Alaska Insect Project for 1948. Interim Report No. 0–137, Surgeon General's Office, Dept. of the Army. 88 pp., mimeo.

STAGE, H. H., AND CHAMBERLIN, J. C. 1945. Abundance and Flight Habits of certain Alaskan Mosquitoes as determined by means of a Rotary-type Trap. *Mosquito News,* 5(1):8–16.

VOCKEROTH, J. R. 1950. Specific Characters in Tarsal Claws of some Species of *Aedes.* Canadian Ent. 82(7):160–162.