

**BREEDING PLACES OF Aedes PSEUDODIANTAEUS
SMITH AND DIANTAEUS H., D., & K. IN ALASKA.**

By W. C. FROHNE¹ and R. G. FROHNE, Anchorage, Alaska.

With an admirably complete description of a new mosquito, *Aedes pseudodiantaeus*, Dr. Marion Smith (1952) redescribed *A. diantaeus* with which the new species had been confused. She noted the occurrence of both species in Alaska, the new one on the basis of a single larva. In a later personal communication Dr. Smith suggested that *pseudodiantaeus*, like *diantaeus*, probably belongs among the common Alaskan mosquitoes. The type habitat in Massachusetts and the breeding places in northern Michigan, where Irwin (1942, 1943) found *pseudodiantaeus* during a study of mosquito production of bog mats, are *quaking* bogs. The purpose of the present paper is to report the occurrence of *pseudodiantaeus* in certain Alaskan *quaking* bogs and to characterize this habitat of predilection. Differences in the larval ecologies of *pseudodiantaeus* and *diantaeus* are noted.

Aedes diantaeus H., D., and K.

Diantaeus is a holarctic mosquito, rare and local in northern Europe, Siberia, and North America. In Alaska the species is evidently commonplace between 60 and 66 degrees North latitude over a vast subarctic area which includes Anchorage, Fairbanks, and the Interior highway system. Jenkins (1948) reported *diantaeus* to be "fairly common" there after reconnaissance of 1947 of the Alaska Insect Project. Subsequent local surveys of the AIP and the Arctic Health Research Center confirmed his findings. Based on frequency and abundance *diantaeus* has been placed ninth, or in the middle of the list of 16 or 17 mosquitoes of Anchorage and Fairbanks, respectively. There is, of course, local variation in abundance. In our survey of 1953 in the Copper River region, 200-250 miles from either Anchorage or Fairbanks, we found *diantaeus* slightly less common; 13 (12%) of 112 larval collections contained *diantaeus* wigglers. However, these larvae were collected more often than *Aedes impiger*, *cinereus*, *pseudodiantaeus*, *Culiseta impatiens*, *Anopheles* sp., and several uncommon or rare species. They were, on the other hand, less frequent and generally much less abundant than *Aedes communis*, *punctor* (complex),

¹ Arctic Health Research Center, Public Health Service, Department of Health, Education, and Welfare, Anchorage, Alaska.

pionips, *fitchii*, *excrucians*, *cataphylla*, *Culiseta alaskaensis*, *morsitans*, and *Culex territans*.

In Alaska *diantaeus* is not an early species, although it has been so regarded in Saskatchewan by Rempel (1953). In the Copper River region the eggs hatched before the middle of May and large wigglers were most commonly encountered the last week of that month. Thus of 44 collections dipped May 7-10, only one included *diantaeus* wigglers, but when these marked pools, except a few which had dried up, were redipped May 21-24 there were 8 *diantaeus* collections among the 39 wiggler collections. The pool habitats and the *diantaeus* larvae were quite transitory, as the third dipping made June 2-4 indicates. By that time only about half of the original pools contained any water, and *diantaeus* occurred in only 4 of the total of 29 wiggler collections. It was notable, however, that the *diantaeus* larvae, which were among the latest wigglers to hatch in these mostly evanescent vernal pools, frequently pupated and emerged at the very nick of time before they dried up. *Diantaeus* developed just as fast, apparently, and pupated over the same period in the semi-permanent bog pools and one permanent quaking bog as in the vernal pools.

The larval habitats of *diantaeus* outside Alaska are varied. Smith (1952) considers bog fringes and stagnant ditches in woods typical. For Alaska Jenkins reported open sphagnum-heath bogs, temporary vernal pools, depressions containing *Carex*, grass, or *Equisetum*, and the margins of permanent pools. Our field notes on the Copper River collections similarly characterize the breeding places as: *Carex* inclusions of a large bog; moss-*Potentilla palustris* pools; barren potholes in dense black spruce forest; open vernal *Branchipus* pools; deep roadside ditches bordered by scrubby willows; and shallow, mossy ditches either open or partly shaded. It would be premature to attempt definition of the habitat or selection of preferred habitats. Negatively, brackish waters and the open waters of lakes may be excluded. Otherwise the Alaskan surveys indicate no more than indiscriminate breeding in natural depressions so varied as to include the temporary or permanent, barren or rankly occupied by higher plants, exposed to the sun or densely shaded; clear or turbid; colorless or tea-colored, acid or alkaline.

A helpful adjunct to the descriptions of the breeding areas of a mosquito is the list of associated wigglers. The associations actually express complicated ecological conditions in a form understandable especially to mosquito workers. Unfortunately, however, many northern mosquitoes show remarkably wide tolerances

to different habitats. *Diantaeus* is such a species. The fact that two species, e.g. *diantaeus* and *communis*, are often associated in Alaska is not enough to prove similar habitat preferences although this association indicates a high degree of tolerance of the larvae and a non-selectiveness by the ovipositing females of one or both species. The different degrees of association of the various Alaskan wigglers with *diantaeus* result from overlapping seasonal occurrences, relative frequencies, and even unintentional selective sampling. Thus for the case at hand, *diantaeus* with *communis*, the stragglers of the abundant, early *communis* are almost ubiquitous in the study area, and also being sluggish late in May, frequently from peritrich *Aufwuchs*, are easily caught. It is suggested to mosquito workers searching for *diantaeus*, however, that the association of *diantaeus* with *excrucians* and with *fitchii* may be due primarily to similar habitat preferences and that therefore the pools and ditches of *fitchii* and the weedy ponds of *excrucians* should be thoroughly dipped.

Representative associations of *diantaeus* with other Alaskan wigglers are provided by Jenkins and the Copper River survey of 1953: Jenkins found *diantaeus* associated with *punctor* 12 times, *excrucians* 8 times, *communis* 6 times, and with *fitchii*, *pionips*, and *Culiseta morsitans* 4 times each. For the 14 collections containing *diantaeus* in the copper River survey *communis* occurred in 10, *pionips* in 9, *fitchii* in 6, *punctor* (complex) in 5, *excrucians* in 4, *cataphylla* in 1, and *Culiseta morsitans* in 2.

Wesenberg-Lund in Denmark, who first described the larva of *diantaeus*, was impressed with the red-brown color of his wigglers. Later authors do not mention larval color. Eight random collections mostly including large larvae were rechecked on this point after we noticed that in certain pools all the *diantaeus* wigglers were red-brown and could be conveniently separated alive with the naked eye. However, although in 4 of the 8 collections all the *diantaeus* larvae were red-brown, they were olive-grey or dull-brown in three, and pale tan with a yellowish cast in one.

Aedes pseudodiantaeus Smith

Pseudodiantaeus is restricted to the nearctic region so far as known. Smith (1952) gives the relatively few distribution records in the U. S., Canada, and Alaska. In the present study the species was collected from two quaking bogs beside the Edgerton Cutoff (road) in the Copper River valley. One bog is located one-half mile north of Chitina on the east side of the highway at elevation

about 590 feet. The other one is approximately a mile northwest of Liberty Falls on the southwest side of the road at about 1,000 feet elevation.

The Chitina quaking bog, polluted by a refuse dump, was characterized by low wiggler densities. On May 10 it was mostly still frozen and no dipping was done until May 21: scattered *communis* and *punctor*, 3d, 4th stages; 3 *pseudodiantaeus*, 2d stage. On June 3: 1 *punctor*, 1 *excrucians*, 4th; 14 *Culiseta morsitans*, 2d, 3d; 17 *pseudodiantaeus*, 2d-4th, mostly 3d. June 29: no *Aedes* larvae taken; 3 *Culiseta morsitans*, 3d, 4th; numerous *Culex territans*, 1st-3d; several *Anopheles* sp., 1st, 2d stages.

The Liberty Falls quaking bog, which is completely natural, was characterized by high wiggler densities, especially of *pseudodiantaeus*, the dominant species. Dr. Smith mentions taking 15 or 20 *pseudodiantaeus* to the dip in the Belchertown, Mass., bog; similar densities obtained during the first half of June in this Alaskan bog. These teeming wigglers inhabit a zone which dries up in July shoreward of the moss. First dipped May 9: *punctor* complex, *communis*, many 2d. On May 21: *communis*, *punctor* complex, many 4th; *pseudodiantaeus*, 2d, abundant. On June 2 a representative collection of 143 wigglers gave: 58% *pseudodiantaeus* 2d, 3d mostly, 4th; 21% *communis*, 3d, 4th mostly; 9% *Culiseta morsitans* 2d, 3d; 1% *excrucians*, 2d, 3d. *Odonata* nymphs, *Mochlonyx* sp., *Paradixa* sp., water beetles, and tadpoles of the arctic frog were also numerous. On June 16 a comparable dipping of 216 larvae there gave: 51% *pseudodiantaeus*, 3d, 4th; no *communis*, *diantaeus*, or *excrucians*; and 30% *Culiseta morsitans*. *Culex territans* 1st and 2nd stages had appeared and 2 small *Anopheles* sp. were noted.

It will be useful to distinguish the quaking bogs favored by *pseudodiantaeus* from more numerous and vastly more extensive wet areas loosely called bogs in Alaska. Bogs result from poor drainage and incomplete decomposition so that in cool, glaciated, northern regions like Alaska they may be commonplace. To plant ecologists "a bog is characterized by conifers (black spruce), ericads, peat-forming mosses, commonly sphagnum, and by a cushion-like substratum of raw peat." (Moss, 1953.) The same author has been especially helpful to us because he has distinguished two series of bogs in Alberta which are easily recognizable in Alaska: (1) *Drepanocladus-Carex* bogs; (2) *Sphagnum-Ledum-Picea* bogs. The succession is from (1) to (2). "Where the larger masses of water are retarded or partially imprisoned in the more or less well-defined

drainage basis (of a network of sluggish drainage canals) 'quaking' muskegs result." (Wyatt and Leahy cited in Moss, l. c.). Both the Chitina and the Liberty Falls bogs are examples of (1) although two different species of *Drepanocladus* bog moss are involved. We are indebted to Dr. Elva Lawton for identification of *D. aduncus Kneiffi* Warnst. from the Chitina bog and *D. exannulatus* (Gümb.) Warnst. from the Liberty Falls bog.

The higher plants growing in the *Drepanocladus-Carex* quaking bogs in Alaska where *pseudodiantaeus* was collected are an assemblage much less characteristic than those of *Sphagnum-Ledum-Picea* bogs. The similar appearance of the Chitina and Liberty Falls bogs is due primarily to the *Drepanocladus* moss mat and to *Carex*, but the abundant occurrence of buckbean (*Menyanthes trifoliata*) and marsh cinquefoil (*Potentilla palustris*), chiefly as indistinct zones, contributes to the similarity. The other higher plants found there, like most of the wigglers of these bogs, are common, tolerant, northern species of wet places.

Preliminary examination of the bog waters themselves show the pH of both bogs fluctuates from 6.5 to 7.3 and that their micro-biotas are peculiarly similar. Two identical *Cosmarium*, one species each of *Closterium* and *Euastrum* were the common desmids of both. Meanwhile as additional *pseudodiantaeus* breeding areas are sought the *Drepanocladus-Carex* quaking bogs are easily recognized by the *Drepanocladus-Carex* mats alone.

REFERENCES

- Irwin, W. H. 1942. The role of certain northern Michigan bog mats in mosquito production. *Ecol.* 23: 466-477.
- . 1943. The mosquitoes of three selected areas in Cheboygan County, Michigan. *Pap. Mich. Acad. Sci., Arts & Let.* 28: 379-396.
- Jenkins, D. W. 1948. Ecological observations on the mosquitoes of central Alaska. *Mosquito News* 8(4): 140-147.
- Moss, E. H. 1953. Marsh and bog vegetation in northwestern Alberta. *Can. J. Bot.* 31(4): 448-469.
- Rempel, J. G. 1953. The mosquitoes of Saskatchewan. *Can. J. Zool.* 31(4): 433-509.
- Smith, Marion E. 1952. A new northern *Aedes* mosquito, with notes on its close ally, *Aedes diantaeus* H., D., & K. (Diptera, Culicidae). *Bull. Brooklyn Ent. Soc.* 47(1): 19-28 and 47(2): 29-40.

