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TUNDRA MOSQUITOES AT NAKNEK, ALASKA PENINSULA

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The author participated in the geographic resurvey of the Katmai National Monument of 1953–4 under National Park Service auspices, which enabled him to determine the common mosquitoes of the subarctic tundra along the Bering Sea near Naknek, Alaska. Hereabouts tundra from the northwest and forest from the northeast meet the eastward fringes of the Aleutian grasslands in a stalemated struggle for ecological dominance. The critical transition, where the trees characteristic of the upper Alaska Peninsula straggle and stop, drowned by tundra or choked by Calamagrostis grass, lies near Naknek. For relatively few miles farther out the Peninsula the watercourses are still delineated by wide margins of white spruce, alder, willow and birch before the landscape, apart from the volcanic mountains, becomes open tundra and/or Aleutian grasslands, altogether. The transitional, boggy, wooded valleys near Naknek exhibit a more varied biota than the open tundra. The grasslands, spotty and limited in the study area, were disregarded.

Larval Habitats

On the tundra, hordes of mosquitoes of a few species were found breeding in innumerable, monotonously similar waters. The adults were experienced in July, 1953, and the larvae were dipped from 45 representative habitats the following May and June. Four moderately distinctive types of larval habitats may be recognized from the common plants in and around them: (1) Sphagnum mat depressions with *Rubus chamaemorus*, Petasites, etc.; (2) Carex ponds; (3) Shallow, weedy, *mud-bottomed ponds*, eutrophic with diverse aquatics such as *Ranunculus*, *Hippuris*, *Equisetum*, cowslip, *Potentilla palustris;* and (4) Barren, sepia-brown bog pools, dystrophic, fringed by *Carex*, *Chamaedaphne*, willows, and other shrubs. Types 1 and 2 are generally distributed over the boggy tundra, which is often characterized by *Eriophorum*, *Ledum*, and *Betula nana*. Types 3 and 4 are restricted to the transitional, brushy valleys.

The eight species of mosquitoes, the number of times each was collected, and the habitat types follow: *Aedes punctor* (Kby.) complex, including two varieties of *punctor* and one of *hexodontus*, 42 collections in habitat types 1, 2, 3, 4; *A. excrucians* (Wlk.), 12 in Types 1, 2, 3, 4; *A. communis* (DeG.), 11 in Types 2, 3; *A. fitchii* (F. & Y.), 1 in Type 2; *Culiseta morsitans* (Theob.), 1 in Type 4. *Culiseta alaskaensis* (Ludl.) and *C. impatiens* (Wlk.) were taken as adults only, in the wooded King Salmon Valley.

The *Aedes punctor* complex overshadows the other mosquitoes and includes the most typically tundra forms at Naknek. The tundra mosquitoes reported by Stage and McKinlay (1946) from Nome and by Knight (1948) from Umiat, though rather individual lists probably because of local factors, also include *Aedes punctor* (and *communis*). With respect to *punctor*, a ubiquitous, abundant, adaptable, and variable pest mosquito in Alaska, it is of paramount importance to determine whether the "tundra" varieties described by Knight (1951) from Umiat and Canadian *arctic* tundras occur also on *subarctic* tundra at Naknek. It is hoped a subsequent survey may identify the *punctor* forms of the Aleutian grasslands which stretch about a thousand miles to the southwest.

The *Aedes punctor* Complex

Adult females of the *punctor* complex can seldom be identified with certainty. The larvae, however, differ consistently, though with some overlapping, so that Knight (1951) was able to prepare a useful larval key to five species and descriptions of "tundra" varieties of two of them. With this key *Aedes abserratus* (F. & Y.)[1], *aboriginis*, and *punctodes* were ruled out at Naknek, and the larvae were run down mostly to *punctor*, some to *hexodontus*. Almost all the *punctor* larvae and all the *hexodontus* fitted the "tundra" varieties of Knight rather well, as is shown in subsequent paragraphs.

The *hexodontus* fourth stage larva possesses 5–9 comb teeth while *punctor* has 10–19 (Knight's key). A frequency distribution by comb teeth of 274 permament mounts of Naknek larvae follows: 5 teeth in one

[1]Vockeroth (1954) has shown *A. abserratus* (F. & Y.) is the correct name for *A. implacabilis* (Dyar.)

larva; 6 in 9; 7 in 14; 8 in 13; 9 in 10; 10 in 21; 11 in 17; 12 in 79; 13 in 25; 14 in 57; 15 in 13; 16 in 13; 17 in 1; 18 in 1. The population curve is bimodal with a very low peak at seven teeth indicating *hexodontus* and a high one at 12 teeth for *punctor*. The "tundra" varieties proposed by Knight were next compared with the Naknek larvae which had been separated into *punctor* and *hexodontus*.

The "tundra" variety of *punctor* is distinguished by double lateral abdominal hairs. The lateral hairs of segment II are always double or triple. They are 97–100 percent single in "type *punctor*" variety. The same hairs of segments IV–VI are single in "type *punctor*" variety but only 48–70 percent single in the "tundra" variety (Knight). Naknek material: Lateral hairs of II are always, and of IV–VI usually, double. Thus Naknek *punctor* larvae key out to the "tundra" variety. However, the several exceptions are presumably "type *punctor*" variety; all their lateral hairs are single. The "tundra" variety of *punctor* totalled 366 (60 percent) of 616 larvae of all kinds even though sampling was selective to favor the habitats of other species.

The difference between "type *hexodontus*" variety and the "*tundra*" variety of *hexodontus* recognized by Knight depends on the upper (5th) and lower (6th) head hairs. They are generally single in the "tundra" variety, generally double in the "type *hexodontus*" variety. Head hairs of 33 of 37 Naknek *hexodontus* larvae with comb teeth 5–8 were intact for study. Of 27 (82 percent) of the 33 larvae these hairs were entirely single. In none were all four or even three hairs double. The Naknek *hexodontus* larvae therefore closely resemble Knight's "tundra" variety. As a further check 24 larvae with 9–10 comb teeth, though possibly *punctor* or intergrades rather than *hexodontus*, certainly do not fit "type *hexodontus*" variety, since 17 larvae (71 percent) have single head hairs. It is most reasonable to believe with Knight that larvae with nine comb teeth actually belong to *hexodontus*, with 10 to either species. All the Naknek *hexodontus* are referable to the "tundra" variety.

It has been noted that *hexodontus* and *punctor* larvae are separated in Knight's key solely by number of comb teeth. He found, however, that *punctor* (both varieties) has head hairs 5 and 6 *single or double.* Since in the "tundra" variety of *hexodontus* the same hairs are usually single, a higher percentage of double head hairs would be expected at Naknek of *punctor* "tundra" variety than of *hexodontus* "tundra" variety. This is actually the case. Of 168 *punctor* larvae (12–18 comb teeth) 66 percent have all hairs 5 and 6 single like *hexodontus* "tundra" variety, but 34 percent thus had one or more double, providing further agreement between the definitions of Knight and the Naknek larvae.

Seasonal History

The phenological data, though incomplete, will assist later workers. The larvae reached the fourth instar in the same chronological succession observed in other subarctic Alaskan surveys: (1) *Communis;* (2) *Punctor* complex; (3) *Excrucians;* (4) *Fitchii;* (5) *Morsitans.* Undoubtedly, *impatiens* and *alaskaensis* were missed because their larvae are later still. In 1954, *communis* hatched before April 15 in the earliest pools and fourth stage larvae were first collected May 6 when the pools were still acquiring thin ice overnight. *Punctor* complex larvae hatched throughout May,

beginning probably about April 23, Since most of the *excrucians* larvae were second or third stage by June 6, it is presumed the earliest hatched about May 15.

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