

NOTES ON *CULICOIDES* IN ALASKA (Diptera, Heleidae)

R. I. SAILER,¹ E. P. MARKS,² AND S. LIENK³

The following observations on Alaskan punkies (*Culicoides*) are based for the most part on data accumulated by the Alaskan Insect Control Project during 1948. The project was directed by the former Bureau of Entomology and Plant Quarantine under funds transferred from the Department of Defense. Some additional data were obtained by the senior author during the summers of 1951 and 1953.

We acknowledge the generous assistance of Alan Stone and W. W. Wirth, of the Entomology Research Branch, U.S.D.A., in providing identifications. We are also indebted to Cpl. B. L. Morris, Air Force weather observer, who accompanied the survey party in 1948 from August 22 to September 8 and recorded data on adult activity of black flies and punkies. He also collected many of the specimens associated with the data. B. V. Travis, project leader; and J. D. Gregson, Canadian liaison officer, assisted in the initial attempts to find and rear immature *Culicoides tristriatulus* Hoffman.

So far as the Project was concerned, the *Culicoides* work was of secondary importance and no attempt was made to conduct a sustained study program on these insects. Nevertheless, numerous observations were made which add to the existing information on the biology, distribution and pest importance of the Alaskan punkies.

PREVALENCE AND IMPORTANCE. In addition to observations made at Anchorage, Valdez, and Fairbanks, data on abundance and flight habits were obtained from sta-

tions along the entire Alaskan highway system during two survey trips. The first trip was made between July 9 and July 25, the second between August 22 and September 8, 1948.

During the first trip, punkies were encountered in numbers sufficient to be included in routine landing counts* at only 3 out of a total of 173 stations (Valdez area excluded). During the second trip, punkies were encountered at 14 out of 151 stations, and at 10 of the 14 landing counts were more than 10.

Fourteen encounters with the punkies during a trip covering 18 days and 1,000 miles of highway may not be impressive, but the significance of this number of observations is greatly increased when it is weighed against factors known to affect flight activity of punkies. Perhaps the most important of these factors is the time during which the observations were made.

Most of the stations were visited between 8 a.m. and 6 p.m. At Valdez a series of observations indicated that activity was declining by 8 a.m. while the evening peak was not reached until after 7 p.m. It should also be noted that, even though the population at Valdez was numerous enough to produce peak counts of 200, a series of 11 observations made August 25 between 8 a.m. and 6 p.m. produced only 5 positive counts. Of the remaining 6 only 1 observation could be disregarded because of unfavorable wind or temperature conditions. This suggested that at Valdez the chance of encountering a positive punkie count at any randomly selected time between 8 a.m. and 6 p.m. was 1 in 2.

Of the 151 observations taken at high-

¹ Entomology Research Branch, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.

² Washburn University, Topeka, Kansas.

³ New York State Agricultural Experiment Station, Geneva, New York.

* Number of punkies landing on the front and back of two fully clothed men during a 68-second period. The count period followed a 5-minute period during which weather observations were recorded.

way stations, 38 were made under either wind or temperature conditions that would prevent flight activity. If the 1-in-2 figure found at Valdez was applicable to the 113 remaining stations, 56 might have produced positive counts. The fact that 14 were positive could mean that approximately 21 percent of the area traversed by highways was infested by a measurable population of punkies during the time of the second survey trip in 1948. This would assume that both punkie populations and observation stations were randomly distributed. Actually no punkies were encountered at elevations higher than 2,800 feet, and since at least 20 of the 113 observations were made at stations above that elevation, punkies were accordingly more common in lowlands than the figures cited above would indicate.

The most severe punkie annoyance noted in Alaska during 1948 was observed at Valdez (see Fig. 1). There, a large population of *Culicoides tristriatulus* was present in the city and on the nearby tidal flats as early as June 18. During the first half of July, dock workers were compelled to wear head nets and gloves during

periods of most intense punkie activity. The periods usually lasted for about 2 hours each morning and evening. Residents of the city seldom tried to work in their yards or gardens during these hours, and a swarm of punkies would accompany anyone who walked along the street.

The punkie population was most abundant on the tidal flats adjacent to the city. However, observations made on July 7 between 7:05 and 9:05 p.m. showed *tristriatulus* to be present in the valley up to 7 miles northeast of Valdez. The number of individuals diminished rapidly beyond 2.5 miles from the city. Punkies remained numerous until after the middle of July, when aerial spray greatly reduced their numbers and adverse weather restricted the flight activity of survivors. Local residents credited the reduction to the spraying operations, but they also expressed the opinion that the population normally declined after the middle of July.

When Valdez was revisited on August 24 and 25, *tristriatulus* was still numerous along the tidal flats, but none was seen in the city. At this time the two-man landing count did not exceed 200. In July the

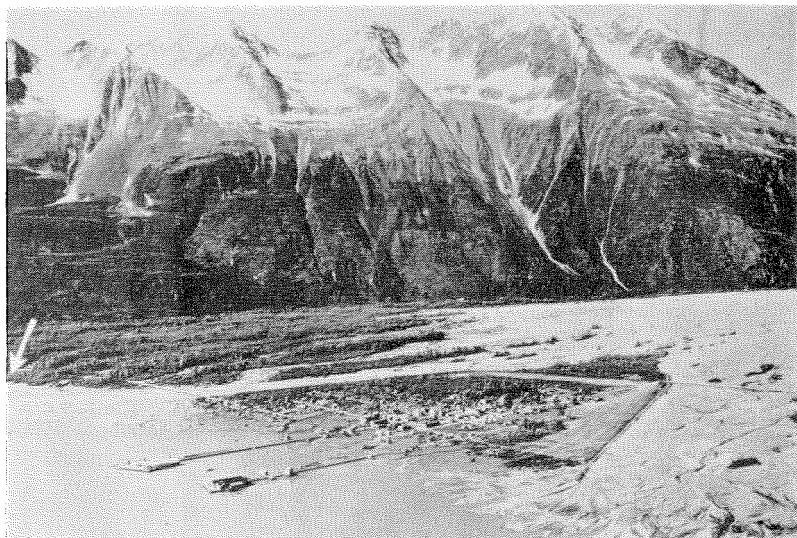


FIG. 1. Aerial view of Valdez, Alaska. Typical of southeastern coastal areas where *Culicoides tristriatulus* Hoffman is a problem. Arrow points to site of adult activity studies.

count was often above 300 punkies landing in a minute on a dark felt hat worn by one observer!

Near Anchorage punkies were seldom encountered except on the tidal flats along Cook Inlet, where they were most prevalent between August 9 and September 15. The highest counts were observed on the flats near Eklutna. Here the standard two-man count reached 40, at times when conditions were nearest optimum for flight activity. *Culicoides yukonensis* Hoffman was the predominant species in samples collected at Eklutna.

In mid-July of 1951 *Culicoides yukonensis* was causing the residents of Fort Yukon serious annoyance. Many children had suffered severely from bites which the townsmen attributed to "gnats." We found that few people distinguished between the Simuliidae and the Heleidae. The former were often numerous and annoying, although they seldom bit. It was obvious from the characteristic appearance of the bites that the less conspicuous punkies were the source of most of the trouble. The population was about as numerous as that observed at Valdez on August 25-26, 1948. Punkies were much less numerous at Fort Yukon in 1953, the counts being less than 10 percent of those obtained in 1951. This difference might reflect a seasonal factor, since the observations in 1953 were made a week earlier than those of 1951.

In general, it appears that punkies are most likely to be of serious importance along the south and southeastern coast on or near extensive tidal flats. At Valdez the problem was found to be most serious during July but to persist in a diminishing degree until September. In the interior of Alaska nuisance populations may be encountered in low land or poorly drained areas from early July to mid-September.

Wherever encountered, punkies were aggressive biters. Often, when only a few were around, they would land, bite, and escape, leaving only a reddening spot as evidence of their presence. On the tidal flats near Valdez in July 1948, exposed

personnel suffered a degree of annoyance that was fully equal to that caused by the pest population of mosquitoes prevalent in the Fairbanks area in the same year. At Fort Yukon in July 1951 the punkies caused much more annoyance than the unusually low mosquito populations present that year.

The effect of heleid bites was observed to vary considerably from person to person. For most people the bites are less troublesome than those of simuliids and perhaps more troublesome than those of mosquitoes. A person exposed to a large population of punkies soon looks like a measles patient. The spots itch with an accompanying burning sensation, and on some people they may persist for three or four days. Despite their numbers and aggressive behavior, the punkies at Valdez never entered houses, and those already crawling or even feeding on a person would take flight as soon as their host entered a tent or other shelter.

LARVAL HABITAT OF *Culicoides tristriatulus* HOFFMAN. Following our observations in 1948, Williams (1951) spent the summer of 1949 at Valdez, where he made an intensive study of the bionomics of *Culicoides tristriatulus*. Our observations at Valdez were limited to two weeks between July 2 and 17, but during the last week in July we obtained some additional information at Fish Creek Flats near Anchorage.

Most of our data were negative, and much of the information we did obtain was obtained independently by Williams. From Williams' observations it is apparent that our attempts to locate immature stages were misdirected. He found larvae and pupae concentrated in a zone of the "flats" that was covered by 80 to 90 percent of all daily high tides or along the banks of fresh water streams which were covered by overflow water at each daily high tide.

Of approximately 50 muck samples that were tested for larvae, 8 were taken from a marshy area near Robe Lake about 4 miles inland from Valdez; most of the others came from a marshy part of the

tidal flat west of town. The samples were taken along a 300-yard transect from the road to the base of the mountain. All were negative except two, from which 3 pupae were recovered. The two positive samples came from the lowest part of the transect, near the outer limit of the high-tide zone in which Williams found larvae to be most numerous.

Our second attempt to find and rear immature *Culicoides* resulted in the discovery of heleid pupae on the surface of a 1-inch-deep pool on Fish Creek Flats a short distance southwest of Anchorage (see Fig. 2). This pool was covered by

but one were females. The two remaining specimens were species of *Dasyhelea*.

On July 27, seven muck samples were taken at the same pool; all samples contained heleid larvae and pupae. Seven apparently mature larvae and 15 pupae were removed for rearing. Two of the larvae pupated and the one that emerged was *C. tristriatulus*. Eleven of the pupae also produced *C. tristriatulus*. The remainder were *Dasyhelea* and *Bezzia*.

On July 29, 13 muck samples were taken along a line running the length of the flats parallel to Fish Creek. One sample taken 200 yards downstream from the pool



FIG. 2. Fish Creek Flats near Anchorage, showing habitat of immature *Culicoides tristriatulus* Hoffman.

some high tides, but was well above the zone covered by average daily high tides. *Scirpus pacificus* Britton was the predominant plant growing in and about the pool. The pool was visited on July 26 and again the following day and a total of 16 pupae were collected and placed in rearing tubes. The first adult emerged the same day and the last emerged on July 30. Of the 14 adult *C. tristriatulus* which emerged all

where the July 26-27 collections were made was found to contain numerous small heleid larvae. The characteristics of this pool were very similar to those of the first. All other samples were negative. Three additional *C. tristriatulus* emerged from pupae collected on this date from the original pool.

Additional samples taken from the original pool on August 2 and 9 contained

numerous small heleid larvae but no additional mature larvae or pupae were found. Samples taken August 16 from a *Triglochin-Scirpus* marsh on Eagle River Flats located north of Anchorage also contained large numbers of very small heleid larvae.

ADULT ACTIVITY OF *Culicoides tristriatulus* HOFFMAN. An intensive study of the effect of weather on the flight activity of *C. tristriatulus* was undertaken at Valdez between July 2 and 17. This study was primarily concerned with flight activity as reflected by the landing rate. The results have been reported by Pratt (1949). Observations on two other aspects of adult behavior are recorded below.

(1). Male swarms of *C. tristriatulus* were seen about 7 p.m. on July 2. Our party had just arrived at Valdez and equipment for detailed weather observations had not been unpacked. Since numerous swarms were seen, we assumed that there would be subsequent opportunities for detailed study. This did not prove to be true, for no additional swarms were seen, although the area was under close observation through July 17.

The swarms observed on July 2 were made up of a few dozen to several hundred individuals. They hovered at an elevation of about 8 feet, and their location remained unchanged during an observation period of about 5 minutes. All specimens captured by sweeping through the swarms with a collecting net were males. About 6 swarms were seen, all located on the tidal flats west of Valdez in the area crossed by the road to Mineral Creek. The weather was fair, sun low in the sky, temperature about 60° F., and wind velocity less than 0.5 mile per hour.

(2). Observations were made on the hiding place or shelter sought by the adult *tristriatulus* during times when conditions were not favorable for flight. Extensive sweeping of the vegetation on the tidal flats, as well as at the edge of the flats, gave meager results. On one occasion several punkies were taken by sweeping 6 to 8 inches above the ground through the scattered vegetation of the flats, about 600

yards from the edge of the woods. These specimens were taken at 7 p.m. on July 14, just before a period of intense flight activity.

Whether these adults were flying or resting was not determined.

On July 15, eleven men, assigned to test various repellents, were spaced at 20-yard intervals in a line running from the woods out on to the flats. The line was formed as the wind velocity dropped and before punkie flight activity started. The first landings were reported about 200 yards from the edge of the woods. Tests were repeated once during each of the two following days. On both days the line was formed before any punkies appeared. On July 16 punkies were first seen flying in the low vegetation about 40 yards from the edge of the woods. A few seconds later landings were reported at this point and subsequent landings followed progressively in both directions. On July 17 the first landings were reported simultaneously at the edge of the woods and at 40 yards out on the flats.

During the line test on July 16 one of the men reported seeing a punkie crawl out of the moss on the ground and fly away. Two more punkies, both female, were obtained by pulling the moss apart and digging among the tangled grass roots. These were about one inch below the surface of the moss. A third specimen was found among grass roots beneath a log. At another place several adults were found when a rotten log was rolled over. These specimens were crawling about on the moist under-surface of the logs. Others were seen to land on the log and crawl quickly into cracks and holes. These observations were made during a period of intense flight activity. On July 17 punkies were again found under logs and in grass roots. They were seen at 5 a.m. when large numbers were in flight and again at 8 a.m. when none were flying.

These observations suggest that adults of *tristriatulus* find shelter in almost any dark, moist retreat that is available in the area where they may be at the end of

favorable flight conditions. The fact that specimens were found among tangles of grass roots as much as one inch below the surface of the ground emphasizes the importance of timing the application of adulticides to coincide with periods of maximum flight activity.

LARVAL HABITATS OF *Culicoides yukonensis* HOFFMAN. In 1948 nothing was known concerning the habitat of immature *Culicoides yukonensis*. Quite by accident we obtained information concerning adult emergence from a breeding site in the Fairbanks area.

On June 5, we placed an emergence trap in a stream one mile north of College, Alaska. The trap was designed to capture emerging simuliids and consisted of a 3'×3'×3' packing box that was light proof except for two openings near the top into which fruit jars were fitted. These jars were set at an angle and contained some alcohol into which the specimens fell and were preserved. Figure 3 shows the stream as it appeared when the trap was put in place and Figure 4 shows the trap in the position where it remained until September.

In addition to thousands of Simuliidae

the trap captured 89 *Culicoides yukonensis*. The first punkie was captured June 19 and the last was taken July 2. Males were taken daily during the two-week period but more than half emerged June 26 through 29. The first female emerged June 25 and more than three-fourths of the 29 females captured were taken during the last four days of the emergence period. Sixty males to 29 females suggest a 2:1 sex ratio.

The stream in which the trap was placed was from 1 to 3 feet wide during most of the season, and ranged from 6 to 10 inches deep. Stream flow was less than $\frac{1}{4}$ foot per second. The bottom consisted of muck with some fine gravel where current was most swift. The stream channel was choked by trailing *Carex* and was unshaded except for emergent vegetation and tall grasses growing along the banks. The trap was near the outlet of a shallow, 20-acre bog-margined lake. The watershed consisted of about 2 square miles of poorly drained land sparsely covered by brush and second growth spruce and birch. The water carried a heavy organic stain during most of the summer, but was almost clear in May when runoff was heaviest. The



Fig. 3. Stream one mile north of College, Alaska, site of trap in which *Culicoides yukonensis* Hoffman were captured.



FIG. 4. Trap in which 89 adult *Culicoides yukonensis* Hoffman were captured. Photograph taken June 5, 1948. Stream level 3 inches higher than when *yukonensis* emerged.

following pH readings were taken: June 7, 7-; June 15, 7.5; July 1, 7-.

The stream was still frozen over on May 8, but by May 13 most of the ice was gone. Runoff did not subside until May 26. Thereafter the water level remained quite constant. Weekly temperature records from May 8 to September 15 ranged from 32° F. on May 8 to 75° F. on June 15. Average water temperature for the period of observation was 52.5° F.

Although most of the area under the trap was covered by moving water, a portion was near and, depending upon the water level, at times included, a segment of stream margin. The small number of adult females encountered in the area during July and August would support the conclusion that the breeding area in the vicinity of the stream must have been somewhat limited and perhaps was restricted to a very narrow band at the water's edge.

It is of interest to compare our observations with those of Frohne (1953), who studied *yukonensis* in the Cook Inlet area near Anchorage. He found that adults of both sexes emerged over a period of a

month from (1) the saturated sphagnum mat bordering a bog lake, and (2) wet *Carex* marshes included within the bog. He added that his data did not exclude other similar "boggy" habitats.

The most striking difference between Frohne's data and ours concerns season of emergence. Frohne, using traps similar to ours, took a single male on July 15 at a *Carex* marsh location, but no additional specimens until July 31. Thereafter his trap counts increased daily until peak emergence was reached on August 9. Emergence fell off rapidly until August 13. Thereafter, only occasional females were taken until the last week of August when emergence ceased.

If the breeding site where our observations were made is typical of the Fairbanks area, *yukonensis* emerges in central Alaska more than a month earlier than it does in the Cook Inlet area. Adult activity observed at Fort Yukon during the first half of July in 1951 and 1953 virtually eliminates the possibility that our data represented an atypical situation.

Assuming that only one generation is involved and that the population of *yukon-*

ensis in central Alaska and that of the Cook Inlet area belong to the same species, we must look to the environment of the two regions for an explanation for the difference in season of emergence. It seems likely that the marked difference in the climate is responsible, for although "break-up" at Fairbanks may occur as much as a month later than at Anchorage, actually the season advances much more rapidly at Fairbanks. Summer temperatures at Fairbanks are much higher than at Anchorage and the days are also longer, thus speeding up both plant and animal development. Even so, it is surprising that emergence takes place more than 4 weeks later at Anchorage.

SPECIES KNOWN FROM ALASKA. Sailer, Marks, Gregson, and Morris (1949) listed locality data for *Culicoides* collected by the Alaska Insect Project during 1948. Wirth (1951) published a paper on Alaskan *Culicoides* based in large part on the same material. From his paper it is evident that many of the records cited by Sailer *et al.* are erroneous. According to Wirth, *biguttatus* (Coquillett) is not known from Alaska, and previous records for this species have been based on poorly marked specimens of *obsoletus* (Meigen). Specimens from interior Alaska which Sailer *et al.* reported as *tristriatulus* were identified by Wirth as *cockerellii* (Coquillett).

Six species of *Culicoides* have been recorded as found in Alaska and are listed below, accompanied by a summary of the known distribution of each.

Culicoides obsoletus (Meigen). Jenkins (1948) reported *obsoletus* as the most abundant and widely distributed of the Alaskan *Culicoides*. Wirth, on the other hand, reported the species from only one inland locality. Present information indicates it to be one of the most common punkies in lowland areas of southeastern Alaska (Frohne and Sleeper 1951), northward along the coast to Cook Inlet. It is also known from as far north as 70 miles northeast of Fairbanks on the Steese Highway. Other records show the species to be widely distributed in central Alaska though it has not been collected in nearly

so many localities nor in such large numbers as *yukonensis*.

Culicoides tristriatulus Hoffman. Sailer *et al.* (1949) recorded *tristriatulus* from three inland localities. These records conflicted with evidence that the immature stages lived in the intertidal zone of coastal marshes (Williams, 1951). Wirth (1951) was able to show that the inland records actually applied to *cockerellii*. The remaining published records show that *tristriatulus* is a common species along the coasts of Prince William Sound, Cook Inlet, and Kodiak Island. The species is known to be a serious pest at Valdez, where it is most numerous in late June through the first half of August.

Culicoides cockerellii (Coquillett). The four localities from which Wirth (1951) recorded *cockerellii* are all north of Copper Center between the Chugach and Alaska ranges. All records were made between August 29 and September 8. At one locality on the Glenn Highway (mile 137.5) the species was numerous enough to cause the survey party considerable annoyance during the few minutes spent there at about 4:30 p.m. on September 7.

Culicoides yukonensis Hoffman. This species has been recorded from Haines northward to Fort Yukon. Most records are from areas where lowland muskeg is prevalent; however, one specimen was captured at an elevation of 3000 feet in the Chugach Range near Anchorage. The species appears to be the most common punkie north of the coastal ranges and is probably found throughout the tree zone of central Alaska. Earliest seasonal records are the Fairbanks emergence trap captures between June 19 and July 2. Present records show the species to be most numerous between mid-July and mid-September. Frohne (1953) found adult emergence in the Cook Inlet area to take place more than a month later than the emergence we observed at Fairbanks.

In mid-July of 1951 *yukonensis* was causing the inhabitants of Fort Yukon serious annoyance. Fort Yukon was visited again during the first week of July in 1953. The species was much less num-

erous than in 1951, and it is quite possible that emergence in the area was not complete.

Culicoides alaskensis Wirth. *Culicoides alaskensis* is known from Valdez, Anchorage (Wirth, 1951), and Fortuna Ledge (Berg, 1953). All collections were made between July 9 and August 15. Nowhere does the species appear to be common.

Culicoides unicolor (Coquillett). Wirth (1951) recorded *unicolor* from four southeastern coastal localities and from Fairbanks. The Fairbanks record was based on two specimens captured in the emergence trap mentioned in the discussion of *yukonensis*. Wirth noted that these two specimens differed noticeably from those taken at Valdez. In view of the marked difference between the environment of southeastern Alaska and that of Fairbanks, it is likely that the Fairbanks specimens actually represent a different species. The earliest seasonal record for *unicolor* is June 19 and the latest, July 30.

Literature Cited

BERG, C. O. 1953. A preliminary survey of the biting Diptera of the lower Yukon Valley.

Alaska Div. A.A.A.S., Proc. 2nd Alaskan Sci. Conf., Sept. 4-8, 1951, pp. 303-308.

FROHNE, W. C. 1953. Where does the Alaskan punkie, *Culicoides yukonensis* Hoffman, breed? Alaska Div. A.A.A.S., Proc. 2nd Alaskan Sci. Conf., Sept. 4-8, pp. 348-351.

FROHNE, W. C., and SLEEPER, D. A. 1951. Reconnaissance of mosquitoes, punkies, and blackflies in southeastern Alaska. Mosquito News 11(4):209-213.

JENKINS, D. W. 1948. Ecological observations on the blackflies and punkies of central Alaska. Mosquito News 8(4):148-54.

PRATT, R. L. 1949. Weather and Alaskan insects. Office Quartermaster General R.D.B., Environmental Protection Section, Rept. 156, pp. 1-25.

SAILER, R. I., MARKS, E. P., GREGSON, J. D., and MORRIS, B. L. 1949. Punkies (Heleidae); pp. 27-30 in—Bureau of Entomology and Plant Quarantine, Division of Insects Affecting Man and Animals. Progress Report, Alaska Insect Project for 1948. Interim Report No. 0-137, pp. 1-88.

WILLIAMS, R. W. 1951. Observations on the bionomics of *Culicoides tristriatulus* Hoffman, with notes on *C. alaskensis* Wirth and other species at Valdez, Alaska, Summer 1949. Ann. Ent. Soc. Amer. 44:173-183.

WIRTH, W. W. 1951. The genus *Culicoides* in Alaska. Ann. Ent. Soc. Amer. 44:75-86.

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