

## ARTICLES

NOTES ON THE ECOLOGY OF *CULISETA* MOSQUITOES  
FOUND IN THE PACIFIC NORTHWEST

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The genus *Culiseta* Felt, tribe Culicini, is represented by five species in the Pacific Northwest—*morsitans* (Theo.), *inornata* (Will.), *impatiens* (Wlkr.), *incidens* (Thom.), and *maccrackenae* D. & K. Only *inornata* and *incidens* are abundant or widely distributed enough to be of economic importance. *C. morsitans* and *maccrackenae* are rare species found in small numbers in only a few localities. *C. impatiens* is more widely distributed, but its range is limited to wooded mountain areas.

The information presented here has been compiled from field notes and observations made by the writer and other personnel<sup>1</sup> connected with the Corvallis, Oreg., field station of the Bureau of Entomology and Plant Quarantine over a period of 21 years. The territory covered includes Oregon, Washington, and Idaho.

*Culiseta maccrackenae*: This species has been found in only a few localities in southwestern Oregon. The larvae were taken in August in fresh-water ditches and pools, the borders of which were lined with trees and brush. Associated with them were *Culiseta incidens*, *Culex territans* Wlkr., and *Culex stigmatosoma* Dyar.

*Culiseta morsitans*: This species has been found only in Oregon and Washington. Most of the larvae were collected in spring and early summer and were found only in dense tule swamps. Associated with *morsitans* were *incidens* and *Culex tarsalis* Coq. One August collection of larvae made near Ellensburg, Wash., was

from the bogs of a nearly dry swamp filled with reeds and tules, and associated with them were larvae of *inornata* and *Anopheles* sp. *C. morsitans* larvae are difficult to find, as they seek shelter in the most inaccessible places where tules and other swamp vegetation are the heaviest.

Light traps have taken a few adults in several locations where larvae could not be located. Traps located at Ft. Stevens and Scappoose, Oreg., and at several places near Yakima, Wash., captured adults from June to September, and a trap near Sunny-side, Wash., from May to September.

*Culiseta impatiens*: This species is found in timbered mountain areas. It has been collected in all three states. The usual larval habitat is shady pools bordering mountain meadows, but occasionally larvae are found in open, unshaded pools. They appear soon after the snow melts in the spring, but collections have been made as late as August. These summer collections have all come from shady, cool situations. The author's earliest collection was made in April. Several species of *Aedes* are found associated with *impatiens* and occasionally *incidens* or *inornata*. Not much information has been obtained on the adults. They are timid but severe biters. A few have been taken in hand collections of mosquitoes and occasionally in light traps.

*Culiseta incidens*: This is a common mosquito in western Oregon and Washington. It is also found throughout the rest of the Northwest, but is rather rare in southeastern Oregon and southern Idaho. It breeds from sea level to elevations around 5000 feet. Larvae have been taken from brackish water in rocks along

<sup>1</sup>Including H. H. Stage, C. M. Gjullin, E. F. Knippling, and A. W. Lindquist.

the coast and in pools on the margin of tidal flats. They are found in stagnant ponds, woodland pools, and are numerous in log ponds, all of which contain acid water heavily charged with organic material. The larvae, however, have not been taken in alkaline water or in water grossly contaminated with sewage or animal excretions. They are also found in ornamental lily ponds, along the borders of sluggish streams, in roadside ditches, and in many types of artificial containers, such as rain barrels and empty cans, and occasionally in tree cavities and cellars. Stock-watering troughs are favorite breeding places, especially in early spring. Hydrogen-ion determination of waters from 11 geographical locations gave an average pH of 6.7 with a range of 6.1 to 7.4. Maximum reproduction of *incidens* occurs in cool to moderate temperatures. This species is more numerous in early spring and late fall. Early-spring breeding is usually in open, sunny situations, and during the midsummer months it is confined to cooler, shady places.

A rain barrel standing in an open, sunny place was kept under observation one entire season. Egg rafts of *incidens* were first seen on March 29. Until about the last of May this was the only species present. At that time *Culex tarsalis* and *picipiens* L. appeared and gradually increased in numbers while *incidens* decreased until by midsummer it had disappeared. In September *incidens* appeared again in numbers and continued breeding until November.

In the hotter interior section of Oregon, midsummer larval collections have come from cool, shady places. For example, three collections made in Klamath County in August, 1932, all came from well-shaded locations and from cool spring water.

*C. incidens* is the first species to become active in the spring and the last to breed in the fall. Egg rafts and larvae were found one year in February and in most years by March they are rather common. The latest fall date larvae were observed

was December 8. *C. incidens* is usually found alone in the early season. Later it is commonly associated with *Culex tarsalis* and *Anopheles punctipennis* (Say) and less commonly with *Culex pipiens*, *stigmatosoma*, *apicalis* Adams, and other species of *Culiseta*.

The females overwinter. They have been taken from root cellars in late winter in Yakima County, Wash., and from vacant cabins, sheds, and storage rooms throughout the winter in the Willamette Valley. The life cycle of *incidens* is longer than that of some other species. Under controlled laboratory conditions at 80° F. it required 17 to 18 days. In an outdoor shaded cage during July and August at temperatures slightly above normal it required 28 to 30 days.

*C. incidens* is not a serious pest of man; its preferred hosts are fowls or domestic animals. However, under certain conditions and in some localities it is very annoying to man. It will readily enter houses, and bites at dusk or in deep shade. The females are timid and easily repelled, but they bite severely. Records of 10-minute collections show that a small number of *incidens* have been taken biting, and it is also interesting to note that these collections were made on cool, cloudy days.

*Culiseta inornata*: This species is well distributed throughout the Northwest, but is especially abundant in the interior irrigated areas. The larvae have been found near sea level and at elevations over 6000 feet. *C. inornata* breeds under various conditions. These diversified habits suggest that there may be two or more strains of the species. It is found in western Oregon and Washington in cool, shady places, at high elevations in cold water, and in greatest numbers in midsummer in open, waste irrigation water. Although the species is well distributed throughout the more temperate areas, it is never found in great numbers. Perhaps high temperature and sunlight are optimum conditions for maximum reproduction. The larvae prefer alkaline or neutral water. They have been found in numbers in pools where the

ground was white with alkali deposits. Hydrogen-ion determinations of breeding waters showed them all to be alkaline except water from a woodland pool, which had a pH of 6.4.

Only scattered and limited breeding of *inornata* was found on field trips through eastern Oregon and southern Idaho in April and early May, but when the same areas were revisited in June and July the species was abundant. In western Oregon and Washington few larvae have been collected before the middle of May. The author's information on how late the species will breed in the fall is limited, but late-September collections have contained all instars of larvae as well as pupae.

In areas west of the Cascade Mountains *inornata* is usually found associated with *incidens*, *Culex tarsalis*, and *Anopheles punctipennis*; in mountain areas with *Culiseta impatiens* and sometimes with *Aedes* sp.; and in irrigated areas with *Culex tarsalis* and *Anopheles freeborni* Aitken. In the last habitat it was produced in large numbers in poorly drained areas, where surplus water collected in depressions and roadside ditches. Over-

wintering females have been collected from root cellars in Yakima County, Wash., and from sheds and outbuildings in other localities.

*C. inornata* is numerous enough in many localities to be a serious pest to domestic animals, which appear to be its preferred hosts. It will bite man, although timid and easily discouraged. Ten-minute collections of mosquitoes taken in areas where *inornata* is common usually contain a small percentage of this species. It will mate and reproduce under laboratory conditions. In one case newly emerged males and females confined under a lantern globe over water were observed mating the same day they emerged.

Collections from a light trap operated for a number of years in each of several locations give some interesting information on the geographical and seasonal distribution of the species. These collections show that *inornata* is much more numerous in irrigated sections in eastern Oregon than in western Oregon. Not only were the daily catches larger but also a higher percentage of the total mosquitoes caught was *inornata*. The records for the Willa-

TABLE 1.—Trap collections showing seasonal abundance of mosquitoes and prevalence of *Culiseta inornata*

Location	Years	Average daily catch of mosquitoes					Per cent of <i>inornata</i> in total catch				
		May	June	July	Aug.	Sept.	May	June	July	Aug.	Sept.
Willamette Valley, western Oregon:											
Vicinity of Portland	4-8	—	1.1	1.0	0.5	0.4	—	4.9	4.1	2.8	2.9
Scappoose	1-2	2.2	2.1	2.5	3.5	4.8	30	3	1.3	3	5.5
Fern Ridge Dam	1-4	—	1	2.3	1.3	0	—	13.3	15.9	12.7	0
Cottage Grove Dam	3	—	.4	.4	.2	—	—	39	26	18	—
Average	—	2.2	1.2	1.6	1.4	1.7	30	15	11.8	9.1	2.8
Irrigated areas:											
Summer Lake, eastern Oregon											
2-3	—	99	181	142	—	—	—	37.5	28.5	39	—
Three locations in Idaho in 1944											
Ellensburg, Wash.	1-2	1.2	6.3	6.9	12.3	14.1	80	72	29	27.4	26.3
Sunnyside, Wash.	1-2	1.1	.9	.5	1.0	2.1	3.2	8	1.4	1.6	8.8
Buena, Wash.	2	.6	1.4	2.9	9.2	6	17	21.8	—	—	—
Yakima, Wash.	2	.3	1.4	2.6	2.9	3.0	30	11.5	7	8	16
Naches, Wash.	2	1.1	2.4	2.9	4	—	42	18	11	14	—
Average	—	.7	16	28.3	24.8	6.3	28.7	25	13.9	18	17

mette Valley show a rather uniform distribution throughout the summer. The collections from irrigated sections show an average increase in numbers from May to July and then a decrease in September.

Summary: Five species of *Culiseta* mosquitoes are known in the Pacific Northwest, but only two, *incidens* and *inornata*, are of economic importance. *C. morsitans* and *maccrackenae* are rare species with limited distribution. *C. impatiens* is found in limited numbers only in wooded mountainous regions.

*C. incidens* finds optimum environment in the temperate climate of Oregon and

Washington, but occurs in limited numbers throughout the region. The larvae prefer cool, acid water, and are the first species to be found in early spring and the last in the fall.

*C. inornata* is well distributed throughout the Northwest, but is of economic importance only in irrigated sections, where it breeds in large numbers in waste irrigation water. This species prefers alkaline water, and maximum reproduction occurs during the midsummer months.

Both species overwinter as adults. They occasionally bite man, but are more important as pests of livestock or poultry.

## THE BLACKFLY PROBLEM IN ALASKA

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Extensive studies of biting Diptera in Alaska have been undertaken during recent years. Although the work was carried on most intensively during the summers of 1947 and 1948, studies were continued by various workers associated with the Alaska Insect Control Project through 1951. This project was conducted by the U. S. Bureau of Entomology and Plant Quarantine under a transfer of funds from the Department of Defense to the Bureau. Much of the work was directed toward solution of the serious mosquito problems of the Territory, but as time and resources permitted studies were made of the biology and importance of the other biting Diptera. The importance of blackflies as pests of man and livestock in many parts of the United States and Canada made it imperative that as much as possible be learned about these insects in Alaska.

The studies on biology and taxonomy confirm earlier reports of the abundance of blackflies in Alaska, and show that at

least 36 species are found there (Stone 1952). This is a larger number than is now known from any State in the United States or from any Province of Canada. Many of the species that cause severe pest problems in the United States and Canada are abundant in Alaska, yet curiously enough there have been few records of blackflies actually biting man. Reports are numerous of annoyance caused by swarms hovering about people's heads and crawling about their faces. Local residents relate stories of hunters and miners who have suffered severely from the bites of "gnats," which were probably blackflies, but in some cases might also have been one of the very large species of *Culicoides* common in Alaska.

During 1948 three survey trips were undertaken, which covered most of the highway system of Alaska. Observations were made at approximately 200 localities, most of which were visited twice and many three times during the season. Observations were also made at Naknek in