CULISETA INORNATA (WILLISTON) AND TEMPERATURE IN UTAH[1]

JAY E. GRAHAM[2] AND IVER E. BRADLEY[3]

Culiseta inornata (Williston) is an abundant species of mosquito in Utah. The larvae are found commonly early in the spring and may reach peaks of abundance at any time during late spring or summer. The adults are among the first mosquitoes to be noticed in the spring and are usually the first species to be taken in light traps. Adult populations of *C. inornata,* as measured by New Jersey light traps, may reach peaks at any time during the summer. For example, in 1963 greater numbers of this species were taken in August than at any other time of the year, but in 1964 populations remained relatively constant throughout the summer. This pattern of seasonal abundance is different in Utah from that in most areas in the United States. This has been well summarized by Barr (1958).

> "The seasonal cycle of *inornata* has been partially investigated. In the south (Louisiana, Mitchell, 1907; Arkansas, Thibault, 1910; Carpenter, 1941), it is a winter mosquito while in more northerly areas (Illinois, Ross, 1947; Missouri, Harmston, 1952) it appears to be more common in the spring and fall with a more or less definite period of inactivity in the middle of the summer. Records in the University of Minnesota collection are mostly in April to June and September to October, suggesting a bimodal peak of abundance; however these times coincide with the periods of greatest activity of the females, viz., entering and leaving hibernation quarters . . . . In the northwestern states (Yates, 1953) the numbers of adults appear to be rather uniform throughout the summer. In some areas there appear to be two generations a year, e.g. Ross (1947) says: 'In Illinois the species apparently has an early spring and late summer generation with a fairly definite period of inactivity during the hottest part of the summer. The two-brooded condition is especially pronounced in southern Illinois, where the first wave of adults comes out in April and early May and the next September and October.' In other areas, particularly in the extreme north, there are said to be several generations a year (Hearle, 1926; Mail, 1934; Rempel, 1950)."

This pattern of seasonal abundance indicates that high temperatures may decrease abundance or reduce activity of this species. There is some evidence that during warmer periods estivation may occur in the egg state (Wilkins and Breland, 1949) but Barr (op. cit.) indicates there is a possibility that estivation occurs in the adult stage.

In 1963 the South Salt Lake County Mosquito Abatement District began a

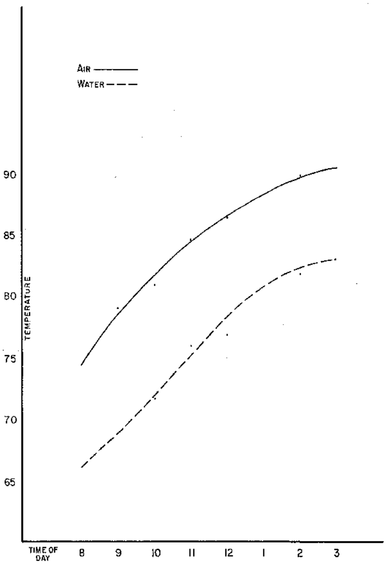

FIG. 1.—Average air and water temperatures and time of day at mosquito sources in July, 1963.

---

[1] Supported in part by N.I.H. Grant #AI 03067-04.

[2] South Salt Lake County Mosquito Abatement District.

[3] University of Utah.

study of water temperature in mosquito sources to determine what relationships might exist between temperature and various species of mosquito larvae. This study is part of a continuing study of mosquito larval populations and their ecology conducted by the district in cooperation with the University of Utah and the Salt Lake City Mosquito Abatement District and financed in part by a grant from the National Institutes of Health.

Inspectors for the district are required to collect a sample of larvae from each pool where they are found and to record various data. The data recorded that apply to this study are date, location, water and air temperature and degree of shade. The larvae are later identified in the laboratory. For this study over 4800 pools were sampled representing practically all of the mosquito production in the district. When numbers of this magnitude are involved, statistical techniques can be used and meaningful probability statements derived regarding the reliability of the data. The confidence level for all the data reported in this paper is above 99 percent and, in most cases, is in excess of 99.99 percent.

Since data were collected throughout the working day both water and air temperatures should show differences correlated with the time of day the data were collected. (Fig. 1).

If average water temperatures are compared for different species of mosquito larvae, differences in water temperature due to the time of day that the data were collected would have an effect only if some species tended to be collected at particular times during the day. In our data no relationship exists between time of day and species collected. Differences in the average temperatures of pools containing larvae of different species must be regarded as being related to the species.

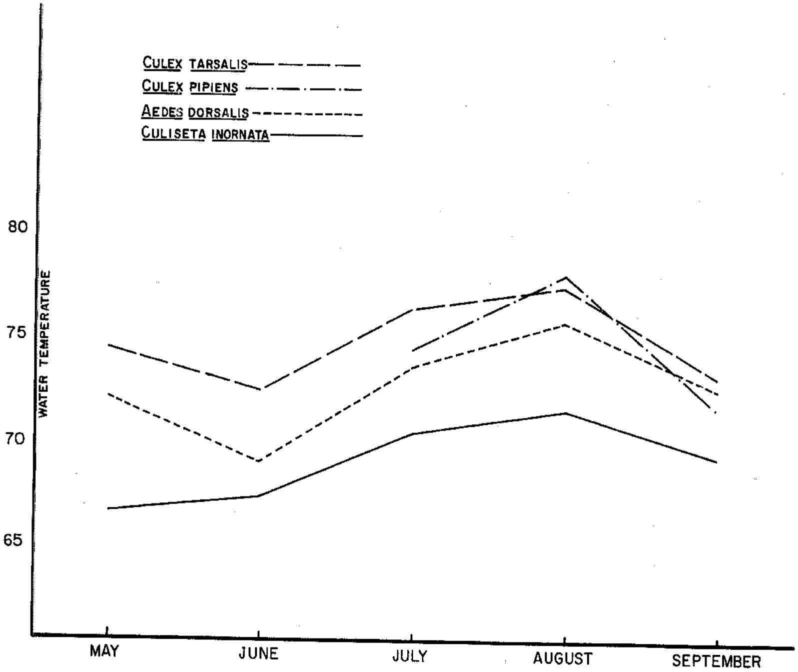

FIG. 2.—Average water temperature of mosquito sources with one species of mosquito, 1963.

Average water temperatures for all mosquito producing areas were not collected over a 24-hour period because of expense and other problems. Air and water temperatures were collected for selected pools for 24 hours. In these examples air temperatures were higher than water temperatures until shortly after sunset. At sunset air temperatures dropped sharply and remained lower than water temperatures until after sunrise. Water temperatures declined from about 6:00 p.m. until about 6:00 a.m. and reached a low point almost as low as the coolest air temperature. The pattern of air and water cooling in mosquito sources during a 24-hour period may be significantly different in Utah than in some other areas and could have appreciable effect on mosquito larval habitats.

The four most abundant species of mosquitoes in Salt Lake County in order of abundance are *Aedes dorsalis* (Meigen), *Culex tarsalis* Coquillet, *Culiseta inornata* (Williston) and *Culex pipiens* Linnaeus, and the data reported here are for these species. In some cases *Culex pipiens* is omitted because samples were too few for the data to be reliable. Larvae of these species were found in all ranges of temperature during the summer but not equally. Average water temperature for *C. inornata* found alone (i.e. no other species were taken in the sample) were lower than for other species found alone. (Fig. 2).

Average temperatures for pools with more than one species of larvae were lower for pools that had *C. inornata* as one of the species present than the pools that did not have this species but the temperatures were closer together than when

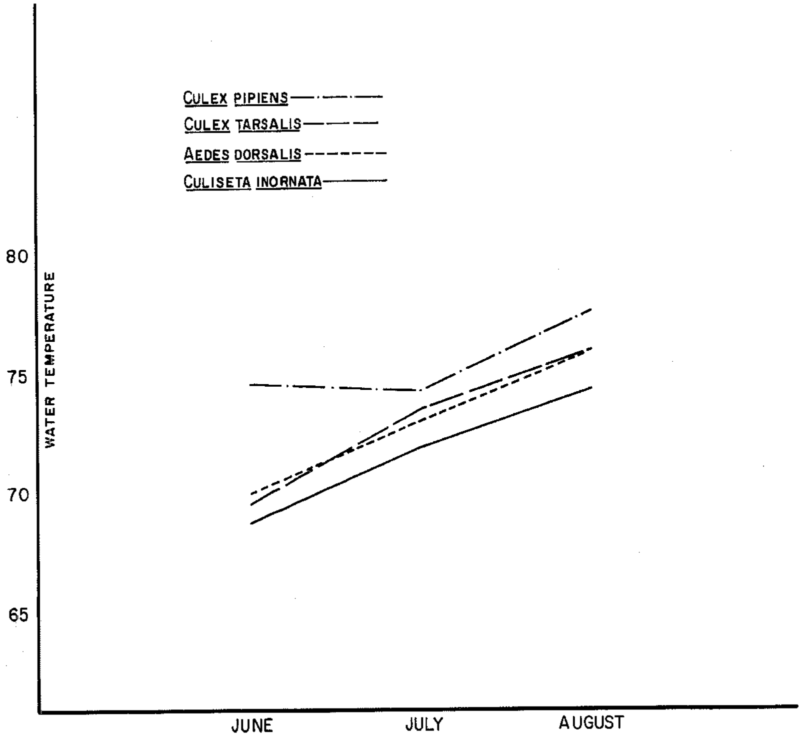

FIG. 3.—Average water temperatures for mosquito sources with more than one species of mosquito—1963.

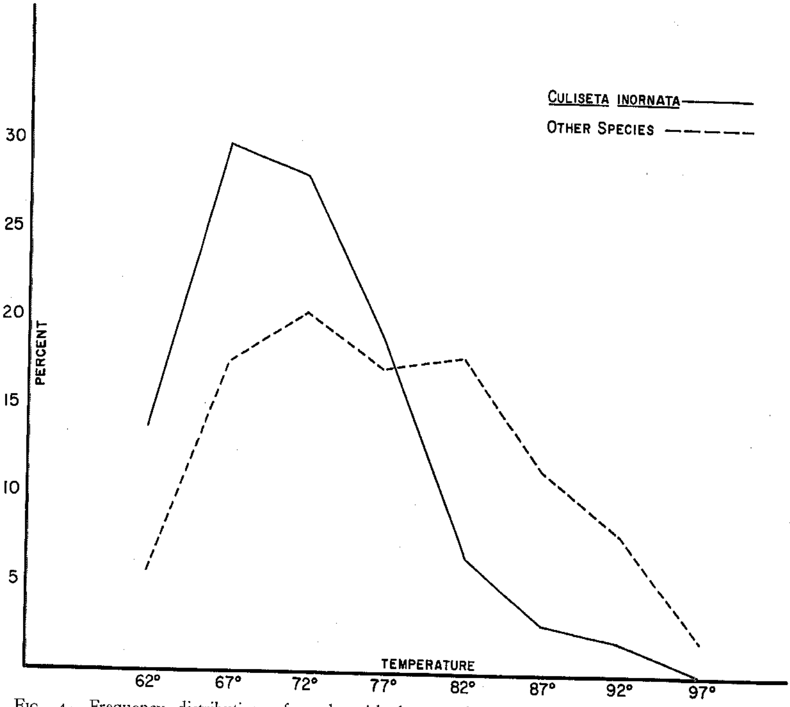

FIG. 4.—Frequency distribution of pools with larvae of *Culiseta inornata* and other species according to temperature—August, 1963.

only one species was found in a pool. (Fig. 3).

The frequency distribution of mosquito larval habitats in relation to temperature during August 1963 is shown in Fig. 4. Similar patterns were obtained for other months but differences between *C. inornata* and other species were not as great in cooler months.

One of the most obvious factors influencing the temperature of mosquito producing bodies of water is shade. For purposes of this study inspectors recorded the degree of shade from 0 to 100 percent. These data were later aggregated into four categories as follows: (A) from 0 to 25 percent, (B) from 25 to 50 percent, (C) from 50 to 75 percent and (D) from 75 to 100 percent. Most mosquito producing areas were in category (A). When species were graphed for each category it was found that *C. inornata* was found less often in category (A) and more often in the other categories than the

Average temperature and shade of pools with *Culiseta inornata* larvae and pools with other species of mosquito larvae.

	Percent Shade	Average Water Temp.	No. of Spots	Relative Frequency
Culiseta inornata	0–25	72.1	173	.62
	25–100	67.0	106	.38
Others	0–25	75.5	398	.89
	25–100	72.7	50	.11

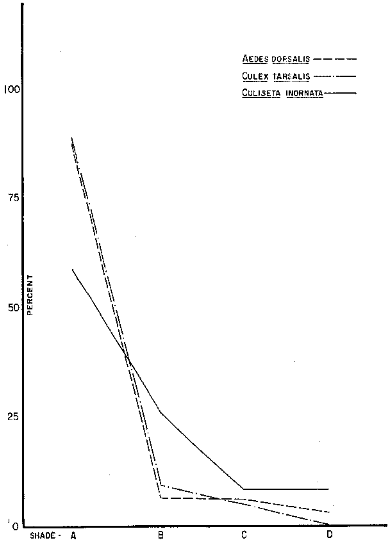

FIG. 5.—Frequency distribution of pools with larvae of *Culiseta inornata, Aedes dorsalis* and *Culex tarsalis* according to shade, May, 1963; (A) 0–25, (B) 25–50, (C) 50–75, (D) 75–100.

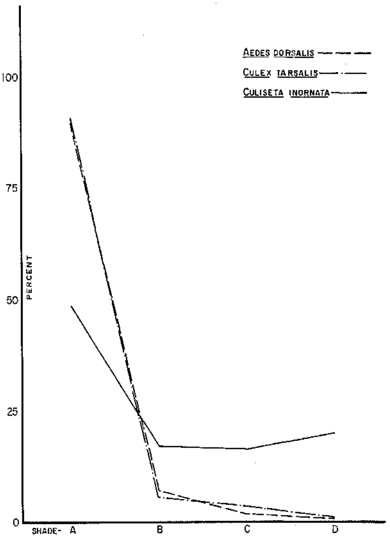

FIG. 6.—Frequency distribution of pools with larvae of *Culiseta inornata, Aedes dorsalis* and *Culex tarsalis* according to shade, August, 1963; (A) 0–25, (B) 25–50, (C) 50–75, (D) 75–100.

other common species. This preference for shaded areas increased as the summer temperatures increased. (Figs. 5 and 6.)

Average temperatures of shaded pools were, as expected, cooler than the unshaded pools. Unshaded pools with larvae of *C. inornata* were cooler than pools with other species whether shaded or not.

SUMMARY AND CONCLUSIONS

Data collected in the South Salt Lake County Mosquito Abatement District in 1963 demonstrate that the average temperature of pools with larvae of *Culiseta inornata* (Williston) is cooler than the average temperature of pools without larvae of this species. *C. inornata* is also found more frequently in shaded areas in Utah than other mosquito species studied but even unshaded pools with this species were cooler than shaded pools with other species. These data demonstrate a greater abundance of this species in cooler water and indicate that the amount of larval habitat of suitable temperature range may be a factor in determining the seasonal abundance of *Culiseta inornata*.

Literature Cited

BARR, A. R. 1952. The thermal death times of the aquatic stages of some American dark-winged anophelines. Amer. Jour. Hyg., 55:170–181.

WILKINS, O. P., and BRELAND, O. P. 1949. Recovery of the mosquito *Culiseta inornata* (Williston) from dry material. Proc. Entom. Soc. Wash., 51:27–28.