

# WINTER BREEDING OF *CULEX QUINQUEFASCIATUS* SAY IN COLUMBUS, GEORGIA

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During the past decade we have noted the occurrence from time to time of varying numbers of *Culex quinquefasciatus* Say larvae and adults throughout the winter months at different localities in the State of Georgia. These more or less random observations established the fact that this species overwinters in this latitude in both the larval and adult stages, and the persistence of very small larvae, even during the coldest months, suggested that reproductive activity might continue throughout the winter.

The literature contains many references to the overwintering habits of anopheline species, but fewer on the corresponding activities of the southern house mosquito. Dyar, 1922, and Matheson, 1944, describe *Culex quinquefasciatus* as a species that survives the winter in the more northern sections of the country as gravid, hibernating females. Dozier, 1936, Carpenter, 1941 and Shlaifer and Harding, 1946, observed larvae of this species during the

winter season in Louisiana, Arkansas, and Tennessee, respectively, but did not record finding egg rafts or other data indicative of reproductive activities. Hinman, 1931, found breeding and biting activities of *Culex quinquefasciatus* continuing through the winter at New Orleans, and Horsfall, 1937, observed egg rafts of this species as late as December 3 in Arkansas.

So far as we have been able to ascertain, the overwintering habits of this mosquito in Georgia have not been adequately studied, and this paucity of information on its bionomics in a latitude where climatic conditions differ considerably from those prevailing in the areas investigated by the workers previously cited appeared to warrant a more thorough investigation of the behavior of *Culex quinquefasciatus* in Georgia during the colder months.

Several considerations prompted the selection of the city of Columbus, Georgia (Latitude 32°, 31' N.) as the principal locality for the study. The city-county

health department is keenly interested in mosquito control, and encouraged the investigation by supplying personnel to assist in collecting data. In addition, Columbus enjoys the somewhat dubious advantage of a wealth of permanent and semi-permanent aquatic situations which are ideal for the propagation of *Culex quinquefasciatus*. The city contains approximately four thousand street catch basins located on combination storm and sanitary sewers, and a system of surface drains, practically all of which hold water the year round. These mosquito breeding areas are supplemented by many other and diverse situations of a less permanent nature mostly in the form of water-holding domestic rubbish which may be found littering private premises in the less favored portions of this and many other cities. These numerous breeding habitats produce swarms of domestic mosquitoes, which in addition to providing ample material for study, necessitate that the health department carry on a control program during the warmer months for their suppression.

The collection of data for this study began on October 18, 1955, somewhat in advance of the official beginning of winter and continued through March 20, 1956. The months of October, November, December and January were unusually cold and dry with temperatures ranging from one to eighteen degrees below normal for the greater portion of this period. The preceding summer and autumn also had been exceptionally dry, and this protracted drought prevented the accumulation of water in artificial receptacles on private premises and in some ground pools and ditches. Consequently, from October until February *Culex* breeding was more or less restricted to the more permanent situations, and principally to the street catch basins. Weekly collections demonstrated the presence of *Culex quinquefasciatus* egg rafts, larvae, and adult mosquitoes in these situations throughout the greater part of the winter. Viable egg rafts were collected from the catch basins in every month from October through

January. Twenty-four egg rafts were found on December 28 following a week in which the mean minimum temperature was 45° F. A maximum number of eight egg rafts was found in a single catch basin on that day. It seems worthy of note that several egg rafts were collected on January 5 and again on January 18 following periods of 5 and 9 days, respectively, when the daily minimum temperature was near to or below the freezing point. Both larvae and adult mosquitoes were particularly numerous in the catch basins. Random dips in these environments with an ordinary pint capacity enameled dipper frequently produced from 100 to 300 larvae of all stages per dip. These numbers were actual counts and not estimates. The interior walls of the catch basins appeared to be the favored diurnal resting places for adult *Culex*. They were difficult to capture in these shelters, but were easily dislodged and forced to fly out by raking over the interior walls with a bamboo pole. The numbers thus observed were surprisingly large and included both male and female mosquitoes. Even during the coldest weather, estimates of the total adult mosquitoes dislodged from individual catch basins were frequently as high as one hundred or more. The aggregate numbers of adult mosquitoes finding refuge in these protected shelters during the winter must be tremendous, and are very likely responsible for the majority of the complaints of biting activity which are discussed later. In Georgia, the males of this species appear to be more hardy than their homologues further north which are said by Matheson (1944) to die at the advent of cold weather. Male *Culex* in Columbus were sometimes observed in active flight when air temperatures were at the freezing point.

From October through January very few adult mosquitoes were found in diurnal shelters other than the catch basins. This probably resulted from a combination of the following circumstances. First, continued dry weather had

all but abolished the domestic production of mosquitoes on private premises which undoubtedly depleted the population of adults immediately adjacent to these shelters. Second, from 1946 through 1951 all outbuildings and similar daytime resting places for adult *Culex quinquefasciatus* in Columbus were given seasonal treatments with residual DDT sprays. It is possible that enough of the chemical remains on the interior walls of these shelters to discourage mosquitoes from resting on the treated surfaces. Third, the temperatures and humidity prevailing in the catch basins probably provide a micro-climate more favorable for the survival of mosquitoes than other less protected shelters offer. It was not feasible to measure air temperature inside the catch basins; however, our records show that daytime water temperatures in the basins did not go below 52° F. This is several degrees warmer than the temperatures attained in unprotected surface waters, and it is probable that the air temperatures in the basins were consistently higher than those recorded outside.

Precipitation, in the form of rain, which began on the first of February and continued intermittently throughout the month, flushed out the street catch basins and surface drains so effectively that neither egg rafts nor larvae could be found in these situations for the greater part of the month. At the same time, however, the precipitation filled wash pots, metal drums, old auto tires and similar water-holding debris on private premises in the city and after the first week in February, egg rafts and larvae began to appear in these containers. Air temperatures fluctuated during February and March from a minimum of 27° F. on February 29 to a maximum of 82° F. on March 7. By the middle of March *Culex* breeding had become fairly common throughout the city, and since spring had arrived in this portion of Georgia by March 20, our investigations were terminated on that date.

These studies were supplemented by observations made during the winter

months in other parts of Georgia. On January 9, hundreds of adult male and female *Culex quinquefasciatus* were observed resting beneath a bridge on Ocapilco Creek, a sluggish, sewage-polluted stream at Moultrie, Georgia. One egg raft and numerous larvae and pupae of this species were collected from quiet spots along the edge of the stream. On January 16, enormous numbers of *Culex* larvae in all stages of development were found in another sewage-polluted stream at Adel, Georgia. One egg raft was collected and numerous adult *Culex quinquefasciatus* were dislodged from beneath vegetation and stone piles. On March 9, large numbers of larvae of this species were discovered in ground pools at Augusta, Georgia, and many adult mosquitoes were seen resting on the overhanging banks of the pools. Numerous complaints about the biting activities of mosquitoes were received throughout the winter by the health department in Columbus, and on one occasion late in December, complaints became so vociferous that it was deemed necessary to larvicide the street catch basins in that section of the city. At Baxley, Georgia, similar complaints were received with such frequency during the colder months that it was necessary to continue routine larviciding operations throughout the entire winter.

The results of these studies demonstrate that from approximately the fall line southwards, *Culex quinquefasciatus* is able to carry on reproductive activities throughout the entire winter in Georgia, and that even in abnormally cold weather, it maintains itself in sufficient numbers to create occasional problems of mosquito control. It seems reasonable to assume that the reproduction and survival of considerable numbers throughout the winter results in a rapid buildup of mosquito populations early in the spring and summer. This might be prevented by initiating control operations late in the winter.

The nuisance value of *Culex quinquefasciatus* is sufficiently great to place it in

the category of a major pest regardless of any relationship to human health and welfare. There are an almost infinite number of breeding places available for this mosquito in the urban areas of the state, and the total number of persons affected annually by the attacks of this insect must be counted in the thousands. In addition to the painful bites inflicted on its victims, this mosquito is known to serve as the vector of human filariasis and also as the vector of several diseases of domestic animals. It also seems worthy of note that the virus of western equine encephalitis was recently isolated from this species in North Carolina. R. W. Chamberlain (personal communication) has found that *Culex quinquefasciatus* is refractory to infection by this organism. He is of the opinion that the isolation resulted from the presence of the virus in bird blood which had been freshly ingested by the mosquito, and that it does not necessarily mean that this mosquito would be able to transmit the disease. The isolation of the virus from this species, however, is interesting and not entirely without significance.

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**SUMMARY.** Investigations in Columbus, Georgia and other urban areas of the state during the fall and winter of 1955-1956 demonstrate that both breeding and biting activities of *Culex quinquefasciatus* continue during every month from October through March. The relationship of this species to human welfare is briefly discussed.

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