

PRELIMINARY PROGRESS REPORT

Do Male Mosquitoes Fly as Far as Females?  
Is the Flight Range of all Mosquitoes the Same?

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For 25 years I have been under the impression that male mosquitoes remain near their breeding places. Often it has been observed that mosquitoes swarm and mate at marshes and that the males remain near the breeding places. It is a sort of rule of thumb among mosquito workers, to look for males as an indicator to nearby breeding. In my experience I have thought that this observation has worked very satisfactorily. In sleuthing for hidden breeding places of Anopheles and Culex I have been under the impression, many times, that I have been rewarded. In tracing the source of Aedes vexans in villages I am guilty of having instructed our inspectors to look for male mosquitoes in order to determine whether or not vexans annoyance originated in nearby wet lots rather than from long distance flights. I have never found in literature any proof that the female of the species flies farther than the male.

With these thoughts in mind an opportunity presented itself during the past summer to prove or disprove this rule of thumb. There was a large marsh perhaps 40 acres in extent which had been flooded, the flood waters had receded leaving concentrated pools of perhaps 12 acres teeming with mosquito larvae. The rains had not been sufficient to cause vexans breeding generally only several large marshes within flight range of the district would produce large broods. From these marshes to the west and south of the District I expected only a mild annoyance

from flight. Having on hand already mixed a sufficient quantity of aniline dye I decided to dust this area and trace the flight of both male and female mosquitoes. This was done by carefully observing the progress of the larvae in order to apply stain to both males and females. As soon as the males began to emerge the marsh was dusted with brown aniline dye, the next day with red aniline dye, the third day with violet, the fourth day with yellow. In this way the entire brood was stained. Following the dusting, mosquitoes were caught in 12 New Jersey light traps stationed at varying distances from 1 to 14 miles away. Catches were made over a period of 52 days, during the first 17 days catches were made each night, thereafter twice each week. The total number of mosquitoes in the traps was 23,000. To date 12,000 mosquitoes have been examined yielding 72 stained mosquitoes, a ratio of 1 stained mosquito to 166 unstained.

I might digress here a moment to state that, in the staining experiments carried out in this District in 1936, the method of catching was entirely different. In the 1936 experiment, after staining the mosquitoes in the marshes, they were recovered by hand-catching using a test tube with ether soaked cotton. Four men in four trucks caught during the day over a period of 39 days. In this experiment only day-biters were captured and only females; whereas in the experiment of 1942 the New Jersey traps yielded all species including the non-biters as well as females and males in which I was particularly interested.

The New Jersey traps caught a total of 23,000 mosquitoes, one-half of which have been examined to date. These consisted of 4378 males and 7629 females. Each of these mosquitoes was dipped in an aniline dye solvent under a low power microscope. Seventy-two specimens were found to be stained, 32 males and 40 females.

TABLE I  
COMPARISON OF FLIGHT RANGE OF MALE  
AND FEMALE MOSQUITOES

Number and species of  
 stained mosquitoes recovered

Distance in miles from Marsh	Aedes vexans		Culex pipiens		Culiseta inornatus		Anopheles puncti- pennis		Anopheles quadri- maculatus		Total
	F	M	F	M	F	M	F	M	F	M	
1	3	1	3	1	1						8
1½	1										1
2½											0
5	1										1
5½	1										1
6		1		2							3
8	3	3									6
8		7		4			1		1		13
9½	2		2	2							6
10½	3										3
10½							1				1
14	6	9	10	2	1						28
Totals	20	21	15	11	2	0	2	0	1	0	72

Referring to Table I it will be noted that the males of *Aedes vexans* and *Culex pipiens* fly as far as the females. Insufficient numbers of *Culiseta inornatus*, *Anopheles punctipennis* and *Anopheles quadrimaculatus* were recovered to compare the relative flight range of males and females.

Is the Flight Range of all Mosquitoes the Same?

Fortunately during this experiment there were six species of mosquitoes emerging at the time the marsh was dusted, *Aedes vexans* and *Culex pipiens* constituted the larger numbers. However there were present in lesser num-



It will be noted in Table II that on the first day after application of each color the maximum distance flown by *Aedes vexans* was 14 miles and that the maximum distance flown by *Culex pipiens* during the first day was  $9\frac{1}{2}$  miles. These distances were flown, in from 4 to 16 hours, as the dusting of the marshes was stopped at about 3 P.M. The traps were timed to go on at 7 P.M. and go off at 7 A.M.

The question has arisen whether or not the distances shown in the tables are covered in a single initial flight or by progressive flights. There are instances in the table showing that the maximum flight was made in less than 16 hours. However the column showing average distances would indicate that for the first three days both *vexans* and *pipiens* reached the point of capture by progressive flights.

Table II shows that one of the two *Culiseta inornata* reached a maximum distance of 14 miles, that two *Anopheles punctipennis* averaged nine miles reaching a maximum distance of  $10\frac{1}{2}$  miles and that one *Anopheles quadrimaculatus* reached a maximum distance of 8 miles on the second day after staining. The longest recorded distance flown by *Anopheles quadrimaculatus* heretofore, 2.7 miles, was reported by Darling, 1925. *Psorophora ciliata* were quite numerous and annoying at the marsh, however no stained specimens have been recovered to date.

Summarizing the data in Table I it is noted that a striking correlation exists between the flight range of *Culex pipiens* and *Aedes vexans*. In fact, so far, evidence in Table I shows that the flight range of all five species might be the same.

Percentage of Stained Mosquitoes Recovered

Species	1-5 mile zone	5-10 mile zone	10-15 mile zone
<i>Aedes vexans</i>	17%	42%	41%
<i>Culex pipiens</i>	15%	39%	46%

The remaining one-half of mosquitoes taken in the New Jersey traps will be examined for color within the next two months.

Incidentally in the staining experiment of 1938 one *Aedes dorsalis* was found at a distance of seven miles from the point of staining. In a collection of mosquitoes taken at the marsh while staining operations were in progress considerable specimens of *dorsalis* were identified. However they constituted only a small percentage of the mosquitoes emerging, most of which were *Aedes vexans*.