STUDIES OF THE MALARIA PROBLEM IN PORTO RICO EVIDENCE OF FLIGHT OF ALBIMANUS

Paper X

In Panama, regular extensive flights of anophele's were observed in the evening and early in the morning. Except for observations of Dr. Howard, already recorded, nothing definite was actually observed, possibly because no concentrated heavy-breeding areas were encountered and food was not very far from the breeding grounds. Certain observations would seem to indicate that possibly concentrated flights did occur or that at certain periods mosquitoes were active. At two stations which were under constant observation throughout the year unsually large catches were found, twice in one and once in the other without any observable change in the breeding area within a radius of one kilometer to account for it. Catches would be considered small alongside of those in Panamá but anything over 25-50 was exceptional in our work. Both of these stations, one especially (No. 15 at Paja), were in the center of low lands where there was more or less continuous breeding. In No. 15, mosquitoes were constantly caught all year round, though regularly also in the other (No. 4). Late in August a catch on a horse of two hundred and ten albimanus was made at No. 15 and again late in October a catch of two hundred and seventy albimanus. Except for one week all other catches were below fifty.

At the other station the highest previous catch had been thirtyfour when the first few days in December a catch of one hundred and eighty-one albimanus was made and most of these were found in and under a house in which no anopheles had ever been found in the daytime.

Since observations were not made every night it is impossible to say how often this sort of thing happens, but it would seem to indicate that at least on certain occasions flight of anopheles would seem to be more concentrated and to greater distances than usual. More information is needed on the frequency of these flights and what influence they may have on malaria incidence. In this area it would seem that the short constant nightly flights in comparatively small numbers of anopheles mosquitoes from breeding areas near at hand would seem sufficient to account for most of the malaria.

HABITS OF ADULT ANOPHELES GRABHAMII

Methods of study were the same as used for anopheles albimanus. In only nine out of the sixty day stations, were grabhamii ever found as against forty-four for albimanus.

In eleven of the twenty-seven night stations, or forty per cent, grabhamii was never found at any time during the year. Eight of these were to north or south of low land between town and ocean which is the part nearest the outlet to the sea and with highest salt content. In the center of this area, however, they were occasionally found. The other stations in which they were not found were back in the hills. None were ever caught at night in the town and on one occasion only were they found in the daytime when three were found in one house.

PROPORTION OF CATCHES ON HORSES AND ON HUMAN BEINGS OR IN THE HOUSES

A much higher percentage of grabhamii were caught on horses than for albimanus. Of almost four hundred grabhamii caught during the period of study, only seven per cent were caught on human beings or dwellings at night. As already indicated, grabhamii was also found feeding on cows.

REGIONS OF HIGH AND LOW GRABHAMII DENSITY

The amount of grabhamii breeding was such much less than that of albimanus except for a short period and the number of adults caught was smaller.

The average catch in the beach stations was only 0.4, that at those stations in center of fields, 2.5, while in the stations to the south bordering the low lands the average was 5.0. Catches back in the hills amounted to very little (Table XX).

The highest catch was one of one hundred and eight in a station bordering the low lands to the south which was adjacent to a region previously a heavy albimanus breeder but which had changed almost entirely to grabhamii.

STUDIES OF THE MALARIA PROBLEM IN PORTO RICO

TABLE XX

CATCHES OF GRAHAMII MOSQUITOES ACCORDING TO LOCATION OF STATIONS

Location	Number of catches	Total grabhamii	Average per catch	
Beach	41	18	0.4	
Center of cane fields	47	120	2.5	
Border Hills	43	212	5.0	
	1			

Flight Observations.

Nothing positive was observed concerning flight of grabhamii but it would seem that catches were fairly localized to regions of known breeding and the low catches on the beach would seem to further indicate that the more salty waters were not favorable for grabhamii. Flight of this mosquito would not ordinarily seem to be very strong.

HABITS OF ADULT

Anopheles vestitipennis

In only two day stations were vestitipennis caught (numbers 15 and 34). Number fifteen (Pajas) was in the center of cane fields where vestitipennis was first found in October and No. 34 was to the south in a house bordering the cane fields. The density of this anopheline never was great either at night or in the daytime.

Vestitipennis were caught in half of night stations at some time during the year. All were in stations in or bordering the cane fields. An average of 0.3 mosquitoes was found for the beach stations, 3.5 for stations in center of cane fields and 0.6 for stations to south of low lands.

TABLE XXI

CATCHES OF VESTITIPENNIS MOSQUITOES ACCORDING TO LOCATION OF STATIONS

Location	Number of catches	Total Vest.	Average per catch	
Beach	28	9	0.3	
Cane fields	28	97	3.5	
Border Hills	17	11	0.65	
Beach. Cane fields Border Hills.	28 28 17	9 97 11		

The highest catch was one of thirty-eight near a big bayou (Caño San José) where the first larvae were found but in which very few were ever found afterward. The first adults were caught not very far away near another bayou (Afluente) next to the river. In the general region of these two bayous the most vestitipennis were

PORTO RICO HEALTH REVIEW

caught. During the wet season, however, there was heavy vestitipennis breeding in the temporary water deposits in the cane-field ditches in this region and it is probable that most of these mosquitoes came from these.

It is possible, even probable, that all breeding places of this mosquito were not found, for-

(1) Before larvae had been identified early in the work one adult was found near "Afluente" in which nothing but albimanus larvae were found.

(2) Rather large isolated catches were found after most of known vestitipennis breeding areas had ceased to be of importance. One who has attempted to trace the source of mosquitoes in the low lands of a tropical country can well appreciate the difficulties. This same difficulty was observed in case of grabhamii on one or two occasions. It is possible that since these mosquitoes can breed in the presence of extensive vegetation, breeding areas are more easily overlooked.

PROPORTION OF CATCHES ON HORSES AND ON HUMAN BEINGS OR IN HOUSES

Of one hundred and forty-four vestitipennis adults, only twelve, or 8.5 per cent, were caught on human beings or in houses at night. No observations were recorded of this mosquito biting other domestic animals than the horse.

It is not safe to generalize too soon on the habits of a mosquito on which observations are few, but it would seem that in common with others this mosquito does not often choose dwellings for day resting place.

It feeds on human beings but also seems to be very fond of the horse. Adults were caught at times when it was a little difficult to locate the breeding place but in general, adults were caught only near the breeding grounds. Numbers of mosquitoes were small so that little can be said about distance of flight but nothing was found to indicate that it was a strong flier.

OBSERVATIONS OF ADULT MOSQUITOES IN THE LABORATORY

No extensive experiments were made but the following notes are made by Mr. Johnson:

(1) It was very easy to keep vestitipennis alive in the laboratory for at least two weeks. It is the most active feeder of the three species and will feed readily twenty-four hours after hatching. Biting takes place very readily in both light and shade and it was easier to get vestitipennis to bite human beings than albimanus.

(2) Albimanus can usually be induced to bite in the daytime but with greater difficulty than vestitipennis.

(3) Grabhamii was the hardest to induce to feed on human blood. On a tubeful taken to bed and placed against the arm only half had fed by morning. Mr. Johnson notes that the members of this species are generally found engorged with raisin juice in the laboratory.

The observations of both albimanus and grabhamii agree fairly well with observations in the field.

SEASONAL VARIATIONS IN DENSITY OF ADULT ANOPHELES

All mosquitoes caught in the day and night station already described were brought to the laboratory and classified, An analysis of the record thus obtained shows considerable weekly variation, but as night catches were only made as a rule every three weeks at each station a monthly average of catches would seem to be more reasonable. The data is thus presented as average monthly catches per station: (1) of day station, (2) of night station, (3) the two combined. As the results of catches at those stations in which no adults were ever caught do not influence the average representing seasonal changes they are omitted from the present calculations. Anopheles Albimanus.

When presented as average monthly catches per station the data shows that at no time were catches large but the record of albimanus catches would seem to show a definite and regular seasonal change.

TABLE XXII

CATCHES OF ALBIMANUS ADULTS BY THE MONTH

Month	Number of visits to stations		Mosquitoes Canght		Average catch per visit				
	Day	Night	Total	Day	Night	Total	Duy	Night	Total
June	104	47	151	37	103	140	0.4	2.2	0.9
July	95	22	127	24	26	50	0.25	1.2	0.4
August	152	11	163	27	265	292	0.18	24.0	1.8
September	158	15	173	75	137	212	0.47	9.1	1.2
October	159	24	183	133	489	622	0.8	20.4	3.4
November	106	14	120	131	297	428	1.2	21.1	3.6
December	147	25	172	70	359	429	0.5	9.0	2.5
January	130	25	155	49	112	161	0.4	4.5	1.0
February	121	23	144	19	113	132	0.2	4.9	0.9
March	159	44	203	31	173	204	0.2	4.0	1.0
April	119	28	137	14	200	214	0.1	7.1	1.8

31

PORTO RICO HEALTH REVIEW

The night catches show a high point in Angust—mainly due to one large catch—and then a high point in November when unusually large catches were not numerous but adults were found more generally distributed. After November there is a drop through December to the lowest point which was reached in January, February and March. April shows a slight rise again. In general this is the same series of events shown by the larval catches. Even the day catches show a definite rise in November. The average of day and night catches shows the greatest rise to be in November with a smaller rise in August. Adult observations were not well established until August so that data before that cannot well be compared with that afterwards.

32