STUDIES OF THE MALARIA PROBLEM IN PORTO RICO

DISTRIBUTION OF MALARIA

Paper XIII

Table XXXIII shows number of cases of malaria in the various regions found during the year. Also is shown the number of people in census per case of malaria in each district. It will be seen that the most malaria was found on the beach both on west and east side of river. (Area No. 1.) The town and Piche did not have a relativly high average. An unusually small amount was found to the east of lowlands (area 8) and to the south of lowlands east of the river (area 9). The land at the latter areas is higher than the rest and the main water deposits there are large bayous—Caño de los Machos, Caño San José and Afluente. Considerable malaria was reported here the year before and at beginning of work heavy breeding was found in Caño San José approximately one kilometer away. Except for short intervals during the year, very little breeding was found here nor at any time in the other bayous. Much breeding took place in temporary water deposits, however.

As much as or more malaria was found in the first period at the beach (area 1) and in Piche (area 2) and in all portions east of river. (Areas 9, 0.) Three regions showed definite increases during the second period—the town (area 3), the portion to south lowland west of river (area 6), and the portion away from low lands but bordering cane fields south of the town on road to Manatí (area 7). Two of these areas (Nos. 3 and 7) were easily a kilometer away from heavy breeding except during the rainy season when temporary water deposits with breeding were abundant close by. The beach (area No. 1) showed extensive temporary water deposits in second period with breeding on high land near houses but there was less malaria during that period than the period preceding.

TABLE XXXIII

DISTRIBUTION OF CASES OF MALARIA IN THE STUDY AREA

Area Location	Total Cases	Population	Population per case
1. Beach	57	1,239	22
2. Piche	23	729	32
3. Town	37	1,136	31
4. Pajas	2	49	24
5. Esperanza (')	.....	.....	.....
6. Border Hills	27	1,716	26
7. Inland	44	1,375	31
8. Road to Manati	7	562	80
9. East of Cane	11	433	40
Total	208	6,239	30

The small colony of "Paja" (area 4) with 49 people who were mainly adult laborers, was particularly interesting. Only two cases of malaria developed there and it was not sure but what one of these brought it with him when he moved in although this colony was located in the center of the heaviest breeding and more albimanus were caught there than anywhere else. It was also surrounded by a small pasture in which horses were always kept at night and generally some oxen. Whether these acted as a protection is not known.

RELATIVE IMPORTANCE OF SPECIES OF ANOPHELES AS VECTORS

In no case was malaria seen to increase near where grabhamii was breeding most heavily and in one case (area 6) it dropped considerably in the third period when the most grabhamii adults were caught there and breeding was very heavy nearby. The fact that malaria is quite abundant at all seasons but least so when grabhamii is most active and that during the summer months grabhamii is very scarce would seem to indicate that this mosquito is not of great importance in this region.

The most malaria was found when albimanus was relatively more abundant and one of the highest rates was found at the beach (No. 1) where grabhamii breeding was the highest and adults very few.

DATA FROM GREENE'S REPORT ON SEASONAL VARIATION IN INCIDENCE OF MALARIA

Further information that may be of interest is shown in Greene's report of work at Aguirre. Conditions are somewhat different there but this problem was mainly one of breeding in permanent water deposits and the temperatures are more or less similar. The low period is in April, May and June; there is a slight rise in July and

August; but the peak is reached in November and December. This certainly would seem to correspond, at least as far as the peak in November and December is concerned, with the peak in albimanus activity as found in Barceloneta work.

Albimanus is a known carrier of malaria and it is probable that it is responsible for the major portion of disease here. Greene found grabhamii infected in nature but it seems to be active at a time of year when malaria is not pronounced and it is not nearly so abundant as albimanus. Its fondness for human blood is also not so pronounced as that of albimanus. It is possible that in this region it is not an important carrier of the disease.

Definite information on vestitipennis is lacking, but the mere fact of its limited distribution and the shortness of its period of activity would tend to rule it out as of much importance.

The information on seasonal variation in malaria incidence is not complete and more extended observations are necessary before definite conclusions can be drawn.

SECOND CENSUS AND INDEXES

The peak in albimanus production was not clearly observed until after it had passed and by that time the Christmas holidays and those of the first week in January were approaching. The second census and determination of indexes were therefore made in the last half of January and first part of February, after the peak in albimanus had passed. It was just at the close of wettest period and when grabhamii was at its height. It was hoped to make this index at height of season for albimanus or when malaria was most abundant.

The three indexes, (1) History, (2) Spleen and (3) Parasite, were again determined more or less in the same manner as for the first index. Blood smears were examined only from a representative portion of the populaton to the west of Manatí river but it was so distributed that it probably gave a good idea of the index for the whole.

History and spleen indexes, especially the history index, showed much less malaria than in the previous year. A very low figure for the history index (two per cent) was obtained which was all out of proportion to other findings. Only a relatively small proportion of cases found positive during the year by sickness of inspector were reported as positive in the history index. The result would seem of very doubtful value.

Spleen Index.

Of one thousand one hundred and ninety-three children examined, one hundred and fifty-one or 12.6 per cent had palpable spleens. The rate was almost half that of the rate in May and June of previous year. More children in the first few years of life were examined than in first census.

The higher rates were still observed in population bordering cane fields to north and south (Table XXXIV) though the town showed a relatively high rate as did the area back away from lowlands. The population to the east (area 9) showed a great reduction.

TABLE XXXIV

DISTRIBUTION OF MALARIA AS SHOWN BY SECOND INDEXES

Area	Blood			Spleen		
	Total Examined	Positive	Percent Positive	Total Examined	Palpable	Percent Palpable
1.5. Beach Esperanza	81	30	37.0	328	46	14.2
2. Piche	89	14	15.7	144	17	11.8
3. Town	147	33	22.4	222	33	14.7
4. Pajas	11	2	18.2	.....	.....	.....
6. Border Hills	95	19	20.0	210	30	14.2
7. Inland	.....	.....	.....	45	5	11.0
8. Road to Manati	.....	.....	.....	156	11	7.0
9. East of Cane	.....	.....	.....	88	9	10.0
Total	423	98	23.0	1,193	151	12.6

The higher rates were still observed in the older children and especially low was the rate in the first few years of life.

TABLE XXXV

RESULTS OF SECOND PARASITE AND SPLEEN INDEXES BY AGE GROUPS

Age Groups	Spleen			Parasite		
	Total Examined	Palpable	Percent Palpable	Total Examined	Positive	Percent Positive
0- 1	66	0	0	26	1	4.0
2- 4	339	18	5.3	66	19	28.8
5- 9	451	75	16.6	74	20	27.0
10-14	300	51	17.0	40	9	22.4
15-18	37	7	19.0	211 (*)	49	23.6
Total	1,193	151	12.6	417 *	98	22.5

Parasite Index.

Of four hundred and twenty-three smears examined, ninety-eight or twenty-three per cent were found positive. The rate is thus

somewhat lower than for the first index in June 1924. When considered by areas the predominant features are the relatively high rate in the beach population (area 1), the lower one in Piche (area 2) and in hills bordering fields to the south (area 6). When considered by ages, the index shows a low index in the first two years of life though from then on it seemed to be quite constant through late childhood and early adult life. The low rates in area five, which area was adjacent to the heaviest breeding of grabhamii when that mosquito was most active, are possible of importance in indicating the relative unimportance of this mosquito. In Barceloneta both spleen and blood indexes have shown low rates in the first few years of life and it would seem that malaria is least common at that age.

Movement of Population.

The value of all indexes is properly greatly lessened by the extensive changes in residences of people included in the study. All of these changes could not be closely followed and sometimes people moved two and three times in the year so that it was difficult to know just where they ought to be included in the study. Many moved away for a time and then returned.

Of the 1,065 houses taken in census there were only 489 in which no changes in inhabitants took place outside of births and deaths. Thirty-five houses were vacant at time of second census that were occupied during the first. Twenty-six new houses were built and twenty destroyed during the year. Following figures show approximately the number of people moving out and in:

TABLE XXXVI

MOVEMENT OF POPULATION

People moved in From		People moved out To	
Coast towns	198	Coast towns	465
Mountains	80	Mountains	162
Within the area	674		
Not known	230	Not known	164
Births	79	Deaths	39

To other coast towns, 465.

These people mainly went to San Juan and neighboring towns of Manatí and Arecibo, though a large number went to Aguadilla and Dorado. Several returned from Dorado with an acute attack of malaria contracted there at the time of an epidemic.

To mountain—162.

These went mainly to neighboring municipalities of Ciales and Utuado.

Not known—164.

This group included a large proportion of labor which moves about often and about whose whereabouts few people are informed.

PEOPLE MOVED IN

From other coast towns—198.

Fewer came from coast towns than went out. Wages were poor and the second census was taken early in cutting season. The first census was taken late in season when there was probably the maximum labor in the area. After the cutting season a large number moved out as shown by the figures.

From mountains—80.

From the area under study—674.

There were large numbers encountered in houses in second census whose previous residence could not be located. A large number apparently had lived in houses just outside the study area. It seems, however, that many people move about and this applies not only to individuals but to entire families. While families and individuals move about a great deal and sometimes to great distances it seems that they usually return sooner or later to the region in which they were born. Travel is easy in Porto Rico. Roads are numerous and good and if one does not care to walk there are numerous public conveyances. In the small town of Barceloneta one may often see eight to ten public cars lined up in the center of town, and even with this number it is said that often one cannot find a car when it is needed.