

FILARIASIS IN PORTO RICO

I. PROGRESS REPORT ON GENERAL SURVEY.

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Filariasis has undoubtedly existed in Porto Rico for a long time, probably since the introduction of negro slaves from Africa. In order to ascertain to what extent the infection occurs and to outline if possible the infected districts, a survey, of which the following data constitute the first progress report, was initiated in May 1927. It is expected that the survey will be concluded by the end of this year (1928). The final report will include a discussion of the clinical manifestations of the infection, not taken up in the present report, though lymphangitis and elephantiasis will be the subject also of a special report by Drs. F. W. O'Connor and G. Burke. One of us (A. Burke) has made a special investigation of the family incidence of filariasis to be published as the second study of this series.

An examination of a representative number of people from every section of the island has been our objective. To date we have examined 3,857 persons, most of whom lived in 31 localities, including six institutions, in 24 municipal districts. As the accompanying map shows, the localities studied are well scattered over the island.

In most of the places investigated notice of our visit and its purpose had been given out in advance by the local health officer, the physician, or the school principal, and the people examined were volunteers who responded for blood examination. Although in such a response there may be factors of selection, we believe that on the whole the groups have been fairly representative of the general population. All ages have been represented from babes in arms to patriarchs of 90. The proportion of men, women and children has varied in different places, owing to circumstances.

The survey has consisted of (1) blood examinations of a number of persons in each district investigated and, (2) a search for evidence of mosquito breeding with special reference to the common house mosquito (*Culex*). The mosquito investigations have been necessarily somewhat cursory in many places on account of the limited time available.

The total number of persons examined thus far is 3,857. The number in each place has varied considerably. In general we have aimed to examine at least a hundred persons in every locality, but in four instances the number of people presenting themselves in the single evening available was less than 50. On the other hand, it has been possible to examine most of the inmates of several large institutions.

As the accompanying map shows, the districts investigated are scattered rather widely over the island, including coastal plain, foot hills and high hilly interior. And while we cannot predict what the complete survey will show, we are inclined to the opinion that the districts already studied give a fair idea of the infection rate as well as of the distribution of the infection, though it is quite possible that the southeastern section from Humacao to Guayama, not yet investigated, may show an incidence well above the average. On the other hand, we anticipate a low incidence in the high plateau country around Barranquitas and Orocovis, soon to be studied.

The persons examined fall into two groups:

1. Residents of public or private institutions in which the inmates usually remain for a considerable period. These institutions were the Boys' Charity School, Girls' Charity School, Robinson Orphanage for Girls, Blanche Kellogg Institute for Girls, all in Santurce, the Boys' Reform School near Mayagüez, and the Polytechnic Institute at San Germán. From these institutions blood samples of 940 individuals were obtained.

2. Volunteers among the general population. From the following 25 localities 2,803 persons were examined:

Santurce, Puerta de Tierra (San Juan), Loíza (new), Trujillo Alto, Hato Tejas (Bayamón), Manatí in the north.

Fajardo at the eastern end.

Aguirre, Coamo, Central Mercedita, Ponce, Yauco, Ensenada, Guánica on the south.

Caguas, San Lorenzo, Aguas Buenas, Cidra, Cayey, Aibonito, Comerío, Utuado and Lares in the interior.

Technique of Blood Examination:

The collection and examination of blood samples has undergone considerable modification as the survey has progressed. At first blood was taken from the ear, but it was soon found that time and effort could be saved by using the finger instead. The period for taking blood ranged from seven o'clock to half past ten at night. In the beginning the method of examination consisted in taking several drops of blood between two microscopic slides, and examining the

preparation immediately. All preparations showing microfilariae were stained the following day with a Romanowsky stain or hematoxylin. The time consumed in the fresh examination so limited the number of cases handled that the delayed examination was resorted to. This consists in making thick smears, dehemoglobinizing the slides in water the following morning, and then staining by the usual hematoxylin method. All positives are preserved for future reference.

Findings in Institutions:

Among the five institutions investigated the two charity schools furnish comparative figures of considerable interest. Since the boys and girls in the respective schools come from all parts of the Island, it would have been surprising if some of them had not been found to harbor micro-filariae. But a marked difference is noted between the two institutions as regards the infection rate, which is only 3.53 per cent among the girls, while among the boys it is 10 per cent. No mosquito nets are used in either institution. *Culex fatigans* is rarely found at the Girls' Charity School but is abundant at the Boys' Charity School. On several occasions immature filariae were found in mosquitoes captured at the latter. That infection takes place in the Boys' Charity School itself is clearly indicated by a correlation of infection rate with length of residence, the rates among the several groups being directly proportional to the time spent at the institution. No such relationship is noted at the Girls' Charity School.

Whether contraction of the infection locally is responsible for the high incidence at the Boys Reform School near Mayagüez can not be stated. These boys are somewhat older than those at the Boys' Charity School in Santurce, and it is possible that some or all of the positive cases may have acquired the infection before admission. But since *Culex fatigans* was found breeding abundantly in various receptacles about the premises a local spread could not be excluded. It is believed that heavy breeding of *Culex* also occurs on adjacent private lands.

Filariasis should cause no great concern at the Blanche Kellogg Institute in Santurce since relatively few mosquitoes have been encountered there, and the girls are required to sleep under nets which are inspected nightly by a supervisor. Only three of the girls were found infected. At the George O. Robinson Orphanage, Santurce,

where 2 out of 50 girls were positive, investigation of mosquito breeding and of the opportunities for infection was incomplete.

Findings in General Population:

Data respecting the places investigated, the number of cases examined, number of positives and per cent of positives are given in the accompanying table. Though the main facts are clearly presented in the table a few of the findings merit special comment or explanation.

All but five of the 114 miscellaneous cases were patients in the Presbyterian Hospital, as were also the 56 cases from the general population of Santurce. The total number of persons examined in the hospital was 227; of which the remaining 57 are distributed among the various localities where a special investigation was made.

BLOOD EXAMINATION FOR MICROFILARIAE

Place	Number Examined	Number Positive	Percent Positive
Santurce, general	56	2	3.57
Santurce, Boys' Charity School	279	28	10.
Santurce, Girls' Charity School	314	11	3.50
Santurce, Robinson Orphanage	50	2	4.
Santurce, Blanche Kellogg Institute	62	3	4.76
San Juan, Puerta de Tierra	115	15	13.00
Lolza Nueva	49	3	6.12
Fajardo	121	8	6.61
Aguirre	113	5	4.42
Central Mercedita	18	1	5.65
Ponce	19	1	5.26
Yauco	43		
Ensenada	108	1	0.92
Guánica	38		
San Germán, Polytechnic Institute	114	2	1.75
Mayagüez, Boys' Reform School	120	11	9.16
Aguadilla	408	37	9.06
San Sebastián	124	11	8.87
Manatí	62	2	3.22
Hato Tejas (Bayamón)	109	10	9.17
Trujillo Alto	108		
Agua Buenas	73	4	5.48
Caguas	258	15	5.81
San Lorenzo	101	6	5.94
Cidra	148	7	4.73
Cayey	85	3	3.53
Aibonito	105	3	2.85
Coamo	162	2	1.85
Total	3,857	197	5.11

The district of Puerta de Tierra in San Juan has long been known as a focus of filariasis and it was for this reason that we included it among the localities investigated. Our figures show an infection rate of 13.04 per cent. This figure would have been considerably higher had we included a group of cases examined because of a lymphangitis

or elephantiasis. As other investigators have frequently observed, microfilariae can seldom be demonstrated in the peripheral blood of such individuals. In the Puerta de Tierra district the problem of spread of filariasis is clearly linked up with the storage of water for domestic use and the resulting excessive *Culex* breeding.

In Aguadilla conditions similar to those in Puerta de Tierra prevail. This town, which is situated at the western end of the Island, is notorious not only for the prevalence of elephantiasis but for its abundance of domestic mosquitoes. For the latter, household water storage is, we believe, largely responsible. As in Puerta de Tierra, the microfilarial rate, 9.06 per cent, would have been much greater but for the inclusion of a group of cases selected because of a lymphangitis or elephantiasis.

The insufficient number of persons examined at Ponce, Central Mercedita, Loíza (new), Manatí, Yauco and Guánica, precludes any conclusions on the findings in these localities beyond the statement that occasional positives were found.

Fajardo showed a fairly heavy rate 6.61 per cent which doubtless would have been larger had the persons examined been chosen at random. The majority examined were members of the National Guard, many of whom lived under more favorable conditions than the average person, with less chance of infection, that is, better protection against mosquitoes. The same statement applies also the students of the Polytechnic Institute at San Germán. The two positives from this group came from known infected districts, and therefore probably did not acquire the infection in San Germán.

No infections were found among the people examined at Utuado, Trujillo Alto, and Lares. These three towns belong to the high interior, though Trujillo Alto really lies in the foot hills. Comerío, also in the interior, showed a low rate with only 2 positives out of 150 examined.

San Sebastián though fairly close to Lares, where there were no positives, showed a high incidence—8.27 per cent. The town is in a low valley, only about 200 feet above sea level and belongs to the coastal zone rather than to the interior. Also domestic mosquitoes occur in San Sebastián in abundance whereas in Lares nearby, at an elevation of some 1,200 feet they are scarce. Furthermore, inquiries revealed the fact that many of the persons found infected in San Sebastián had lived at the neighboring town of Aguadilla on the sea, where a comparatively high filariasis rate has been demonstrated.

In this connection it should be emphasized that in Porto Rico not

only are distances short, the maximum between any two points being only about 135 miles, but facilities for travel are so well developed, that it is often difficult to determine where a chronic infection, such as filariasis, may have been contracted. For example, two of the positive cases from Hato Tejas, a barrio of Bayamón, which has a rate of 9.17 per cent, were chauffeurs, and they said their work often took them to places at some distance from their homes. Hato Tejas is devoted chiefly to the cultivation of grapefruit and pineapples which are brought by truck frequently at night to the docks at Puerta de Tierra (San Juan). The chauffeur, asleep unprotected from mosquitoes in this filarious district while his truck is being unloaded, may thus readily become infected.

Since many of the farm laborers of Aguirre are recruited from other sections some of the positives found there may have contracted their infection elsewhere. However many of them come from the high interior where filariasis seems to be relatively uncommon.

Ensenada where *Culex fatigans* was found to be rare, appears almost free from filariasis, though we heard of cases of lymphangitis and elephantiasis. The only case showing microfilaria was a girl of five years, the earliest age at which we have encountered the infection, though in another paper Dr. Alice Burke reports a case of probable filarial lymphangitis in a child of two years. The girl referred to above had always lived at Ensenada. All 38 residents of Guánica were negative, though the town is heavily infested with *Culex fatigans*. It may be that the series was too small, and that a wider study would have shown more positives. At Trujillo Alto where over a hundred people were examined we found a similar paradoxical situation; that is, an abundance of *Culex* but no filariasis. Both of these districts should be investigated further with the object of finding the explanation.

SUMMARY

Blood examinations for microfilariae have been made on 3,857 persons, of whom 3,743 lived in 31 localities, which were especially investigated, and 114 from miscellaneous places not yet studied.

Of the 31 localities investigated only five failed to show positive cases, but in only three of the five (Lares, Utuado and Trujillo Alto) was the number of persons examined considered sufficient to indicate absence of infection. In the remaining 26 localities the blood infection rate varied from 0.92 to 13.04 per cent, with an average for the entire series of 5.11 per cent. The total number of positive cases was 197.

The extensive road system in Porto Rico, giving cheap and rapid transportation, makes possible active movements of the population, thus facilitating the spread of infections such as filariasis and rendering difficult the localization of endemic foci.

Culex mosquitoes were found in every locality investigated but the extent of breeding varied markedly on account of local conditions. Household storage of water was found to be a very important factor in several places.

Though the survey is incomplete it is clear that filariasis shows in Porto Rico the same predilection for warm moist coastal areas as has been noted in other endemic regions.

No filarial worm of man other than *Wuchereria (Filaria) bancrofti* has been encountered.

OUTLINE MAP OF PORTO RICO SHOWING TOWNS WHERE FILARIASIS WAS INVESTIGATED

