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STUDIES ON FILARIASIS IN THE REPUBLIC OF THE PHILIPPINES

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Institute of Hygiene
University of the Philippines
Manila, Philippines

August 1966

U. S. ARMY RESEARCH AND DEVELOPMENT GROUP
FAR EAST
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A B S T R A C T

Blood surveys in the Province of Palawan resulted in prevalence rates of 4.7, 4.2 and 0.8 per cent for W. bancrofti, B. malayi and mixed infection respectively. Malayan filariasis had a very restricted distribution compared to bancroftian filariasis. Males had higher microfilaremia rates than females for both species. Children had higher microfilaremia rates in malayan and lower in bancroftian filariasis. Average microfilarial density was higher in bancroftian than malayan and males had higher microfilarial density than females in the two species. Similar survey in Jolo resulted in a prevalence rate of 11.4 per cent. Atypical microfilariae found together with typical ones, when examined in detail revealed that they were also of W. bancrofti. Microfilaremia rates in males were higher than in females and rates were higher among older age groups. In Jolo there were more children with microfilaremia compared to Palawan. Extent of abaca plantation and magnitude of filariasis in all municipalities of Jolo showed no correlation, but "poblaciones" located near abaca plantations had higher prevalence rates. Aedes (Finlaya) poecilus, is the vector of filariasis in Jolo island which confirmed previous finding in Sorsogon, another abaca raising province. Malayan filariasis cases treated with diethylcarbamazine were observed for side reactions. Fever, joint pains, chilliness and headache were the most common reactions and were directly related to microfilarial density. Culex fatigans and Aedes albopictus were not susceptible to experimental infection with B. malayi whereas Mansonia bonneae showed high infection rates. Filaria larvae in M. bonneae required 10 days to reach the infective stage. Filariasis in an abaca raising province has higher prevalence involving younger children with the vector breeding in the leaf axils of the abaca plant. Side reactions should always be anticipated in proven cases of filariasis treated with diethylcarbamazine; hence, this drug may be used as a "therapeutic test" in clinical filariasis where microfilariae are not demonstrable. Malayan filariasis is not likely to be influenced by urbanization.

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Introduction

Prior to 1964, filariasis in the Republic of the Philippines has always been reported as being caused by periodic Wuchereria bancrofti. There are 56 provinces in the Philippines; 48 of these have already been surveyed for filaria by the Filaria Control Pilot Project of the National Department of Health. The disease was found endemic in 29 of these provinces. A total of 2^82,712 persons coming from 4^8 provinces have been examined with an overall microfilaria rate of 3.7 per cent[4]. In a similar survey conducted by Rozeboom and Cabrera[5] in 1955, a definite correlation between the distribution of abaca plantations and filariasis endemicity was established. This correlation has been attributed to Aedes (Finlaya) poecilus, the principal vector in these areas, breeding in the rain water accumulated in the axils of the abaca plants[1]. In this same survey there were two localities found endemic for filariasis but without abaca plantations. The first is an isolated pocket of bancroftian filariasis in Calaccad Valley, Mountain Province, Luzon, among the Kalinga tribes with an overall microfilaremia rate of about 11 per cent. The study in Calaccad Valley have shown that Anopheles minimus flavirostris is the important mosquito vector in that area[7]. The second endemic spot is in the forested area of Palawan. Previous firdings here so far are (1) the presence of subperiodic Brugia malayi reported for the first time in the Philippines, with Mansonia bonneae as the mosquito vector[2,8]; (2) the endemicity of Wuchereria bancrofti in the Brugia malayi endemic zone with Anopheles minimus flavirostris as the important vector, confirming a similar finding in Calaccad Valley[9]; (3) the occurrence of both species of microfilaria in some individuals with observations of microfilarial periodicity[3].

Since malayan filariasis in the Philippines has just recently been reported for the first time, it was thought necessary to study the clinical signs and symptoms manifested by people suffering from this disease. It was also of interest to note the responses of individuals to a course of treatment with diethylcarbamazine.

Some of the more common household pest mosquitoes in the Philippines are Culex fatigans and Aedes albopictus. Culex fatigans has been found to play some role in the transmission of bancroftian filariasis in the Bicol areas[12]. Aedes albopictus on the other hand is quite abundant in rural and forest areas in the Philippines. In order to determine whether these mosquitoes were susceptible to infection with Brugia malayi, they were allowed to feed on some of our microfilaria carriers and were dissected starting from a few days after engorgement to 12 days later.

Since we were unable to make more than a limited observation in experimental infection of Mansonia bonneae with B. malayi in previous reports[8], we were interested to find out its relative susceptibility as compared to Culex fatigans and Aedes albopictus.

Aside from Palawan Province, there are other areas in the Philippines that are located rather close to British North Borneo. These are a group of islands and islets called the Sulu Archipelago, where some of the people

indulge in unlawful trade with Borneo just like some of the people in southern Palawan. Way back in 1964 I requested around 100 night blood smears among patients from Sulu Public Hospital. Using Wilson's technic of staining(10), ten slides were found positive for microfilariae. Six of these smears had typical microfilariae of W. bancrofti while four slides had atypical ones. Based on color changes alone and examined under low magnification, these atypical microfilariae seemed to conform to the description of B. malayi.

The purposes of the present study were therefore: (I) to determine the extent and distribution of bancroftian and malayan filariasis in Palawan; (II) to confirm the existence of filariasis in Sulu Archipelago and possibly determine the probable vector species of mosquitoes; (III) to study the clinical manifestations of malayan filariasis and responses of cases to a course of treatment with diethylcarbamazine; and (IV) to determine whether some common pest mosquitoes are susceptible to infection with B. malayi.

I. Extent and Distribution of Filariasis in Palawan Province.

Palawan comprises a group of islands located at the southwesternmost portion of the Republic of the Philippines, about 7°4' - 12°24' North latitude and 116°55' - 120°21' West longitude. It has a total area of about 14,755 square kilometers and a population of about 163,000. North of the main island are the islands of Linapacan, Culion, Coron and Busuanga, while south of it are the islands of Bugsuk and Balabac. Palawan has a mixture of inhabitants, the original indigenous groups or tribes and immigrants coming from Luzon, Visayas and Sulu. The aboriginal groups are the Tagbanuas who are the most numerous in the island and who occupy the central part including the eastern and western coasts; the Palawanos inhabit the meridional part of the island including the east and west coasts; in the south are the Quenoys who are non-christianized and considered unfriendly, and dwell in the mountains and caves of Lad-da, Panalingaan, Ransang and Culasian. Lastly we have the Batacs occupying the mountains north of Puerto Princesa, in sitios along the Babuyan river. Scattered in various parts of the island, particularly so in Brooke's Point and Quezon are the Mohammedans or Muslims who immigrated from Sulu. Our survey covered all these groups of people except the "Quenoys", because no guide would undertake the job of taking us to them.

Most houses in the villages are built on posts so that the floor is made of split wood or bamboo while the roofs and walls are thatched with "nipa" or palm leaves. It is not uncommon to find houses with only three walls.

The principal occupation of these indigenous inhabitants is the cultivation of rice using the "kaingin" system, wherein the trees of a chosen patch in the forest are cut down, dried under the sun and later burned over during the dry season. At the start of the rainy season the

cleared area is seeded with rice. Each family has on the average two of these cleared plots which are cultivated and planted for a period of 2-3 years. Then another patch of the forest is again chosen and cleared. We have seen these people clear such areas and it is a pity to see giant trees of the hard type cut down only to be burned. When harvest of rice is poor, people resort to sweet potato, corn, taro and cassava. The nutritive value of their diet is undoubtedly below par, since they often eat rice seasoned only with salt. Fruits are quite rare except for a handful of bananas, papayas, guavas and a few others. Domestic animals are few and vegetables are limited. Others engage in fishing and hunting wild pigs using explosives inserted inside a sweet potato which they call "pig bomb".

The immigration of people from Luzon and the Visayan islands has in a way improved the method of farming with the use of a plow and carabao. More vegetables, poultry and pigs are being raised. Unfortunately the indigenous inhabitants prefer their own primitive method of farming over the method introduced by the immigrants. Hence, in the near future the indigenous tribes will be eventually driven up in the mountains with the immigrants occupying the valleys.

The classification of Philippine climate is based on the types of rainfall, inasmuch as the temperature differences in the archipelago are very slight. There are four types of climate based upon the presence or absence of a dry season and of a maximum rain period(11). Palawan has both types 1 and 3. For details on this, the reader may refer to fig. 1 and table 1. The Province of Palawan is rather mountainous with several rivers and mountain streams that serve as good breeding places for Anopheles minimus flavirostris, the principal malaria vector which was also found to be the vector of bancroftian filariasis(9). In barrio Panitian, Quezon, located on the west coast of Palawan, is a large fresh water swamp thickly wooded with giant Pandanus which presumably serves as the breeding place for Mansonia bonneae mosquitoes(6). A similar type of swamp is nowhere to be found in Palawan Province as reported by our men. The roads are very poor and are constructed to connect only the municipalities. Roads connecting towns, barrios and sitios are still lacking so that one has to hike in order to reach these places, and the distances between them are rather great.

Materials and Methods

Inasmuch as both Wuchereria bancrofti and Brugia malayi filariasis have been found endemic in the Province of Palawan(6,7) blood smears were taken not earlier than 1900 hours. After recording the pertinent data on survey forms, two thick blood smears per glass slide of approximately 20 mm^3 each, were taken from the finger. These smears were allowed to dry overnight; dehemoglobinized completely in water and stained with Giemsa according to the method of Wilson(12). We adopted the house-to-house blood survey method because of the great distances between houses, and our desire to include all members of the household.

The stained smears were examined under a compound microscope at low magnification. Although species identification was possible by color changes as adopted by Wilson[12] still all positive slides were restained with Delafield's hematoxylin for a more accurate species identification. In most instances Giemsa staining was done in the field while the staining with Delafield's hematoxylin was done at the Institute of Hygiene. We also tried to fix the dehemoglobinized smears with methyl alcohol and later stained them upon arrival at the laboratory. This last method eliminated staining procedures in the field.

Results

Distribution and Prevalence of Filariasis

The coverage of the blood survey is quite extensive (fig. 2). We were able to obtain smears from the northernmost portion to the southernmost tip of the province of Palawan. The results of the blood survey for microfilaria are presented in table 2. The towns of Busuanga, Coron, Culion and Linapacan forming the Calamian group of islands were found not endemic for filariasis. In the northern tip of the mainland of Palawan, El Nido (Bacuit), Taytay, and Roxas were essentially negative except for one B. malayi case in Silanga, Taytay. In Puerto Princesa, out of 417 persons, 8 (1.9 per cent) were found positive for Wuchereria bancrofti. Of the 8 cases 5 were Tagbanuas and 3 were Batacs. South of Puerto Princesa, the first endemic spot is Aborlan with 7 positives out of 68 persons examined or a microfilaremia rate of 10.3 per cent. All cases turned out to be due to Wuchereria bancrofti among Tagbanuas. The next endemic spot is Quezon. Out of 737 persons examined 28 (3.8 per cent) were positive for W. bancrofti, and 154 (20.9 per cent) were positive for Brugia malayi. A total of 25 (3.4 per cent) persons had both species of microfilaria in their blood. The overall microfilaremia rate for the municipality is about 28 per cent, combining the two species. One will note that Panitian, Gungnan, Marerong, Kamting, Tagbanata, Tagpisa, Malatgac and Taganilac form the "hot bed" for Brugia malayi infection. This may be explained by the fact that all these "sitios" are located along the border of the fresh water swamp called "kakrokan" (meaning crocodile) with Mansonia bonnae found abundant almost all the year round[8].

The other endemic area for filariasis south of Puerto Princesa is Brooke's Point. Of 1,055 persons examined 133 (12.6 per cent) were found positive for W. bancrofti and a single case of Brugia malayi. Brooke's Point therefore is the focus of highest endemicity for Wuchereria bancrofti infection. The sitios of Kalandanum, Sandoval, Lumañgoy, Tarusan, Malitob, Sapa, Tagnato, Sumbiling, Tagpisa and Katipunan are the specific areas with high infection rates.

The islands south of the mainland are Balabac and Bugsuk, with the former having been found to be non-endemic for filaria. The island of Bugsuk was not surveyed by our team, due to lack of water transportation to that area.

A grand total of 3,726 persons were examined for the Province of Palawan and 176 (4.7 per cent) were positive for Wuchereria bancrofti and 156 (4.2 per cent) were positive for Brugia malayi. Combining the two species we got an overall microfilaremia rate of 8.9 per cent for the entire province, with 28 persons (0.8 per cent) found positive for both species.

This survey revealed no additional focus of malayan filariasis outside Quezon, an area which was previously surveyed(2,8).

Age and Sex Distribution

Table 3 shows the total cases for Palawan classified by age and sex and presented graphically in figures 3 and 4. One sees that the microfilaremia rate for males exceeded that of the females in almost all ages for both species with the differences being statistically significant ($t = 3.4$ (W.b.) and 5.8 (B.m.) $P < .001$). It is to be noted too that no bancroftian filariasis case was found below 6 years of age. The highest microfilaremia rates of bancroftian filariasis among males are found in ages 21-35 and 56-60 years all greater than 10 per cent. Among the females the highest rates are found in ages 21-25, 46-50 and 61 years and over ranging from 8.1 to 10.7 per cent. In the malayan filariasis on the other hand, the highest rates among males are found in ages 6-10 and 26-45 ranging from 7.4 to 8.5 per cent. Among females the highest rate is with the 1-5 age group being 11.4 per cent.

Approximately 42.3 per cent of the B. malayi cases for both sexes are less than 16 years of age compared to only 10.3 per cent of the W. bancrofti cases. The microfilaremia rate for these ages are 1.5 and 5.6 per cent for W. bancrofti and B. malayi respectively. Comparison of these rates with those above 16 years (7.9 per cent (W.b.) and 4.6 per cent (B.m.) gave a statistically significant difference for W. bancrofti ($t = 9.6$ $P < .001$) and a none significant difference for B. malayi.

Figure 5 presents the infection rates for W. bancrofti and B. malayi for the different age groups. It can be seen that the infection rate for W. bancrofti exceeds those of B. malayi in ages 16 years and over. However, the difference between the rates (all ages, both sexes) is not statistically significant.

Tables 4 and 6 and figures 6 and 7 show the age and sex distribution of the cases found in the municipalities of Brooke's Point and Quezon. These tables are shown to give truer prevalence figures since most of the cases were found in these two municipalities. For Brooke's Point the rates for W. bancrofti among males exceeded those among females in almost all age groups except in ages 6-15, 46-50 and 61 years and over. Prevalence rates ranging from 15.7 to 25.8 per cent were found in ages 21-60 years for the total. The difference in rates between the two sexes is 6 per cent, which is statistically significant ($t = 2.9$, $P < .01$). For the municipality of

Quezon, the prevalence rates for B. malayi among males also exceeded those of the females and the difference between them is also statistically significant ($t = 3.2$, $P < .01$). It is only in ages 1-5 and 56-60 years where the prevalence rates of females exceeded those among males. For both sexes prevalence rates ranging from 24.6 to 50 per cent are found in ages 1-10, 31-45 and 61 years and over.

Infection Rates Among Immigrants

Included in the blood survey were immigrants from different parts of the country. The Zambaleños, from Zambales, Luzon has the greatest number; of 268 examined 38 were found positive or a microfilaremia rate of 14.2 per cent. Next comes the Muslims from Sulu numbering 232 persons examined with 6 positives or a microfilaremia rate of 2.6 per cent. Other immigrants from the Visayas, Ilocos and Bicol regions whose number were relatively small were all found negative.

Intensity of Microfilaremia

Table 6 presents the microfilarial densities among municipalities where cases of B. malayi and/or W. bancrofti were found. For Puerto Princesa with 8 cases of W. bancrofti, it ranges from 3.0 to 12.0 mf. per positive with an average count of 6.4 per positive for the municipality. For Aborlan, there were 7 cases of W. bancrofti with an average count of 9.1 per positive. For Quezon, the average microfilarial count for B. malayi among the various sitios ranged from 1.0 to 222.0 mf. per positive with an average of 27.2 mf. for the municipality. For W. bancrofti it ranged from 2.0 to 39.0 mf. per positive with an average of 12.5 mf. for the municipality. In Brooke's Point the average microfilarial count for W. bancrofti ranged from 2.5 to 174.0 per positive with an average of 39.5 mf. for the municipality.

Classification of Parasitemia

We tried to classify the intensity of parasitemia by locality according to the method of Fan and Hsu(5) and the results presented in table 7.

The classification by age and sex of the average microfilarial count per positive are shown in tables 8, 9 and 10. It can be seen in table 8 that the males have higher microfilarial densities compared to the females. In the case of B. malayi we obtained an overall average microfilarial count of 28.7 among males and 21.1 among females per 20 mm^3 of blood as against 34.3 and 21.2 respectively for W. bancrofti. It appeared that age had no influence on the microfilarial density.

Table 11 shows the distribution of cases by intensity of microfilaremia. For B. malayi cases about 26.5 per cent of the males and 26.9 per cent of the females showed counts between 26-822 per 20 mm^3. For

W. bancrofti 26.6 per cent of the males and 16.) per cent of the females showed counts between 26-822 per 20 mm^3. The highest microfilarial count for B. malayi was 459 for the males and 144 for the females. Among the W. bancrofti cases, it was 822 for the males and 187 for the females.

Discussion

Earlier filaria surveys in Palawan were rather limited in coverage and were more or less concentrated in selected localities like Quezon, Brooke's Point and Aberlan. No survey, as far as we knew, was done covering the whole province of Palawan.

In this paper are included the results of previous surveys by Rozeboom and Cabrera (1964)(8). An attempt was made to obtain prevalence figures for the whole island and its geographic distribution. If we were to divide Palawan into three portions, namely north, central and south, the result of our survey showed that filariasis is absent in the northern portion and is found endemic in the central and southern portions.

It has been observed that the northern part is not as densely wooded as the central and southern portions and that only mangrove swamps are found in the area. Majority of the inhabitants in the north call themselves "Cuyonins" and their habits and customs are no different from the rest of the Filipinos. The single case of B. malayi filariasis was a 22 year old male, who probably resided for a considerable length of time in the municipality of Quezon and that he was visiting with friends or relatives in Taytay at the time of the survey.

The distribution of malayan filariasis seemed to be confined in the municipality of Quezon, probably because of the existence of a favorable epidemiologic environment in the area such as, the extensive growth of giant pandanus covering practically the entire area of the fresh water swamp which presumably serves as an ideal breeding place for the mosquito vector. On the other hand the transmission requirements for bancroftian filariasis are not as restrictive as the malayan type and hence they have a much wider distribution. Bancroftian filariasis occur not only in the Brugia malayi endemic zone but also in areas quite distant from the swamp-forest area like Puerto Princesa, Aberlan, and Brooke's Point. The prevalence of malayan filariasis ranged from 8.7 to 49.1 per cent, while those of bancroftian filariasis were from 1.2 to 60 per cent.

As mentioned earlier, Palawan is very mountainous with many large as well as small mountain streams that serve as breeding places for A. minimus flavirostris during the rainy season. This rugged terrain makes many places inaccessible, hence the malaria eradication units find it difficult if not impossible to reach the hinterlands. Studies made by Rozeboom and Cabrera(9) in Odiong, a sitio of Panitian, Quezon, have shown that A. minimus flavirostris also serves as the vector of bancroftian filariasis, and as long as the problem of malaria eradication remains unsolved, bancroftian filariasis

will persist along side with malaria. The same authors[8] found that the risk of exposure to infection due to B. malayi if about the same for all age groups which has been confirmed by this present report. In bancroftian filariasis however, the microfilaremia rate from age 16 years and over is five times as much compared with the younger age group. This is possibly due to the biting habits of the mosquito vectors, the intrinsic incubation period of the disease and the difference in exposure risk between these age groups.

Comparison of microfilaremia rates for the overall total surveyed population showed a highly significant difference between sexes. It must be noted that males have consistently higher microfilaremia rates as well as higher densities compared to females for both species.

The risk of infection among immigrants is entirely dependent upon several factors, namely; (1) the proximity of their settlement site to endemic foci, (2) length of stay in these areas and (3) working and sleeping habits. The Zambalefios for example, have chosen for their settlement area, a place within the endemic zone for B. malayi bordering the "kakrokan" swamp. These people for sure acquired their infection from Quezon. Among the "Muslims", who settled at Brooke's Point, it will be rather difficult to trace the primary source of their infection because their place of origin in also endemic for filariasis. It is but logical to assume that if the prevailing epidemiologic conditions remain unchanged immigrants settling in these areas will acquire the disease in due time.

Classification of the intensity of microfilaremia by locality according to the method of Fan and Hsu[5] showed that the majority of endemic areas have very light and light degrees of microfilaremia. Moderate microfilaremia was found on two of 39 areas endemic for W. bancrofti and one out of 19 areas endemic for B. malayi, and none of the areas studied could be classified as "heavy".

Summary and Conclusion

Filariasis caused by Wuchereria bancrofti and by Brugia malayi in the province of Palawan was found endemic in the central and southern portions. W. bancrofti infection has a wider distribution than B. malayi, which is restricted to areas where fresh water swamps obtain. The prevalence rates for each species of filaria are practically equal with a combined rate of 8.8 per cent for the entire province.

The microfilaremia rates among males exceeded the females in almost all ages for both species of filaria. In B. malayi infection microfilaremia rates in children aged 1-15 years were higher than those of the older age groups and the reverse in true with W. bancrofti infection.

The microfilarial densities among cases of W. bancrofti are higher than those for B. malayi cases. Age does not appear to influence microfilarial densities for both species.

Filariasis due to Brugia malayi is endemic only in the municipality of Quezon.

References

1. Cabrera, B.D. and Tugangui, M. Studies on filariasis in the Philippines. III. Aedes (Finlaya) pcicilius (Theobald), the mosquito intermediate host of Wuchereria bancrofti in the Bicol Region. Acta Med. Phil., 7:221, 1951.

2. Cabrera, B.D. and Rozeboom, L.E. Filariasis in Palawan, Philippine Islands, Nature, 202:725, 1964.

3. Cabrera, B.D. and Rozeboom, L.E. The periodicity characteristics of the Filaria Parasites of Man in the Republic of the Philippines. Amer. Jour. Epid., 81:192, 1965.

4. Estrada, J.P. and Basio, D.G. Filariasis in the Philippines, Jour. Phil. Med. Assoc., 41:100, 1965.

5. Fan, P.C. and Hsu, J. Filariasis in Free China, Part VIII. Epidemiology and Treatment of Filariasis, Inter-Regional Seminar in Filariasis, 22 Nov. 1965, Manila.

6. Rozeboom, L.E. and Cabrera, B.D. Filariasis in the Philippine Islands. Amer. Jour. Hyg., 63:140, 1956.

7. Rozeboom, L.E. and Cabrera, B.D. Filariasis in Mountain Province, Luzon, Republic of the Philippines, Jour. Med. Ent., 1:1[illegible], 1964.

8. Rozeboom, L.E. and Cabrera, B.D. Filariasis caused by Brugia malayi in the Republic of the Philippines, Amer. Jour. Epid., 81:200, 1965.

9. Rozeboom, L.E. and Cabrera, B.D. Filariasis caused by Wuchereria bancrofti in Palawan, Republic of the Philippines, Amer. Jour. Epid., 81:216, 1965.

10. Wilson, T. Differences between the microfilariae of Wuchereria malayi and Wuchereria bancrofti in Giemsa-stained thick blood films. Trans. Roy. Soc. Trop. Med. Hygiene, 50:54, 1956.

11. Climatological Division, Weather Bureau, Manila. The climate of the Philippines.

12. Baisas, F.E. Notes on Philippine mosquitoes, XIX. The mosquito problem in the control of filariasis in Sorsogon Province. Phil. Jour. Sci., 86:71, 1958.

Table 1. Average Monthly Rainfall (in inches) and Monthly Average Number of Rainy Days for Four Towns of Palawan as of 1960.*

MONTH	Brooke's Point	Coron	Cuyo	Puerto Princesa
Number of Years on Record	14	11	52	14
January	2.75 (6)	1.48 (2)	0.68 (2)	1.49 (4)
February	1.72 (4)	0.26 (2)	0.33 (11)	1.11 (3)
March	2.79 (6)	0.30 (1)	0.31 (1)	2.37 (4)
April	2.27 (5)	1.18 (2)	1.28 (3)	1.66 (5)
May	4.84 (10)	6.65 (10)	7.78 (14)	5.34 (13)
June	6.49 (14)	14.44 (19)	13.24 (20)	6.72 (15)
July	6.42 (13)	14.91 (18)	16.70 (23)	7.13 (15)
August	7.63 (17)	19.53 (21)	15.23 (21)	7.43 (17)
September	5.73 (14)	17.79 (19)	14.49 (21)	8.69 (17)
October	6.45 (13)	11.40 (14)	11.20 (17)	8.14 (17)
November	7.13 (14)	5.51 (8)	5.99 (8)	8.04 (15)
December	7.79 (10)	5.02 (5)	2.94 (5)	4.66 (9)
ANNUAL	62.01 (126)	98.37 (121)	90.17 (136)	63.28 (134)

* Source: Average Monthly Rainfall in the Philippines, Weather Bureau, Philippines, 1960.

Table 2. Blood Survey for Microfilaria in Several Municipalities of Palawan, 1965*.

Municipality (1)	Number Examined (2)	Positive for W. bancrofti No. (3)	Positive for W. bancrofti % (4)	Positive for B. malayi No. (5)	Positive for B. malayi % (6)	Positive for Both No. (7)	Positive for Both % (8)
1. BUSUANGA							
Cheey	17	—	0.0	—	0.0	—	0.0
Salvacion	31	—	0.0	—	0.0	—	0.0
San Rafael	37	—	0.0	—	0.0	—	0.0
TOTAL	85	—	0.0	—	0.0	—	0.0
2. CORON							
Banga	51	—	0.0	—	0.0	—	0.0
Malbato, Bintuan	42	—	0.0	—	0.0	—	0.0
Bintuan	33	—	0.0	—	0.0	—	0.0
Buenavista, Busuanga	16	—	0.0	—	0.0	—	0.0
Guadalupe	45	—	0.0	—	0.0	—	0.0
San Nicolas	73	—	0.0	—	0.0	—	0.0
Turda	9	—	0.0	—	0.0	—	0.0
TOTAL	269	—	0.0	—	0.0	—	0.0
3. CULION							
Betnongan	38	—	0.0	—	0.0	—	0.0
Igay	24	—	0.0	—	0.0	—	0.0
Patag	21	—	0.0	—	0.0	—	0.0
TOTAL	83	—	0.0	—	0.0	—	0.0
4. LINAPACAN							
San Nicolas	14	—	0.0	—	0.0	—	0.0
Sugod, San Miguel	30	—	0.0	—	0.0	—	0.0
TOTAL	44	—	0.0	—	0.0	—	0.0
5. EL NIDO							
El Nido	39	—	0.0	—	0.0	—	0.0
Corong-corong	30	—	0.0	—	0.0	—	0.0
Villa Libertad	26	—	0.0	—	0.0	—	0.0
TOTAL	95	—	0.0	—	0.0	—	0.0

Table 2 (Continued):

Municipality (1)	Number Examined (2)	Positive for W. bancrofti No. (3)	% (4)	Positive for B. malayi No. (5)	% (6)	Positive for Both No. (7)	% (8)
6. TAYTAY							
Calatan	61	—	0.0	—	0.0	—	0.0
Silanga	32	—	0.0	1	3.1	—	0.0
Taytay-Pal	58	—	0.0	—	0.0	—	0.0
Danlig	131	—	0.0	—	0.0	—	0.0
TOTAL	282	—	0.0	1	0.4	—	0.0
7. ROXAS							
Barbacan, San Nicolas	49	—	0.0	—	0.0	—	0.0
Capayas	58	—	0.0	—	0.0	—	0.0
Tumarbong	141	—	0.0	—	0.0	—	0.0
Roxas Proper	131	—	0.0	—	0.0	—	0.0
TOTAL	379	—	0.0	—	0.0	—	0.0
8. PUERTO PRINCESA							
Bahili	174	5	2.9	—	0.0	—	0.0
Tapul	80	1	1.2	—	0.0	—	0.0
New Panganga	99	—	0.0	—	0.0	—	0.0
Mauyon, San Vicente	29	2	6.9	—	0.0	—	0.0
Kabayugan, San Rafael	7	—	0.0	—	0.0	—	0.0
Kalakuasan, Tanabag	28	—	0.0	—	0.0	—	0.0
TOTAL	417	8	1.9	—	0.0	—	0.0
9. ABORLAN							
Sagpangan	54	5	9.3	—	0.0	—	0.0
Maringit	14	2	14.3	—	0.0	—	0.0
TOTAL	68	7	10.3	—	0.0	—	0.0
10. QUEZON							
Panitian	137	—	0.0	14	10.2	—	0.0
Gungnan	57	—	0.0	28	49.1	1	1.8
Marerong	53	2	3.8	26	49.1	4	7.5
Kambing	84	—	0.0	25	29.8	3	3.6
Tagbanaba	83	—	0.0	23	27.7	—	0.0

Table 2. (Continued):

Municipality (1)	Number Examined (2)	Positive for W. bancrofti No. (3)	Positive for W. bancrofti % (4)	Positive for B. malayi No. (5)	Positive for B. malayi % (6)	Positive for Both No. (7)	Positive for Both % (8)
Tagpisa	47	1	2.1	12	25.5	4	8.5
Malatgac	39	6	15.4	11	28.2	8	20.5
Sarangsan	3	—	0.0	—	0.0		0.0
Odiong	14	5	35.7	—	0.0	2	14.3
Napuaran	3	1	33.3	—	0.0	—	0.0
Inigan	5	1	20.0	--	0.0	1	20.0
Taganilao	17	2	11.8	7	41.2	—	0.0
Magino	9	—	0.0	—	0.0	—	0.0
Tapsan	2	—	0.0	—	0.0	—	0.0
Tinaguan Pati	11	—	0.0	1	9.1	—	0.0
Tabon	59	—	0.0	—	0.0	—	0.0
Tumarbong	9	1	11.1	—	0.0	—	0.0
Sabsaban	17	2	11.8	--	0.0	—	0.0
Tagbai	10	1	10.0	—	0.0	—	0.0
Sawangan	69	5	7.2	6	8.7	2	2.9
Calumpang	9	1	11.1	1	11.1	—	0.0
TOTAL	737	28	3.8	154	20.9	25	3.4
II BROOKE'S POINT							
Abo-Abo	91	—	0.0	1	1.1	—	0.0
Barenbareng	43	—	0.0	—	0.0	--	0.0
Amas	30	—	0.0	—	0.0	—	0.0
Ipilan	49	1	2.0	—	0.0	—	0.0
Macagua	17	—	0.0	—	0.0	—	0.0
Tagdao	13	—	0.0	—	0.0	—	0.0
Tubtub	44	—	0.0	—	0.0	—	0.0
Mainit	38	2	5.3	—	0.0	—	0.0
Pañgobilian	106	—	0.0	—	0.0	—	0.0
Buligay	25	[illegible]	0.0	—	0.0	—	0.0
Kolandanum	65	17	26.2	—	0.0	—	0.0
Sandoval	25	10	40.0	—	0.0	—	0.0
Lumangcy	44	8	18.2	—	0.0	--	0.0
Tarusan	82	19	23.2	—	0.0	—	0.0
Malitob	30	11	36.7	—	0.0	—	0.0
Tagmay a	37	5	13.5	—	0.0	—	0.0
Sapa	14	4	28.6	—	0.0	—	0.0
Barangkas	34	5	14.7	—	0.0	—	0.0
Sarab	32	—	0.0	—	0.0	—	0.0
Sareng	31	2	6.4	—	0.0	—	0.0
EEA Camp	21	—	0.0	—	0.0	—	0.0
Ric Tuba	32	—	0.0	—	0.0	—	0.0
Tagnato	28	12	42.8	—	0.0	—	0.0
Sumbiling	49	17	34.7	—	0.0	1	2.0
Biliran	19	3	15.8	—	0.0	1	5.3
Tagpisa	20	5	25.0	—	0.0	1	5.0

Table 2 (Continued):

Municipality	Number Examined	Positive for W. bancrofti No.	%	Positive for B. malayi No.	%	Positive for Both No.	%
Tagulango	3	—	0.0	—	0.0	—	0.0
Tamparan	8	—	0.0	—	0.0	—	0.0
Katipunan	20	12	60.0	—	0.0	—	0.0
Bulilluyan	5	—	0.0	—	0.0	—	0.0
TOTAL	1055	133	12.6	1	0.1	3	0.3
12. BALABAC							
Poblacion	126	—	0.0	—	0.0	—	0.0
Indalawan	12	—	0.0	—	0.0	—	0.0
Camarisaan	74	—	0.0	—	0.0	—	0.0
TOTAL	212	—	0.0	—	0.0	—	0.0
PALAWAN*	3726	176	4.7	156	4.2	28	0.8

* Included in this table are the results of the survey of 975 persons in Palawan done in 1964 by Lloyd E. Rosebeom and Benjamin D. Cabrera.

Table 3. Microfilaremia Rates, By Age and Sex, Palawan, 1965*

Age in Years	Number Examined			Positive for W. bancrofti						Positive for B. malayi					
				Male		Female		Total		Male		Female		Total	
	M	F	Total	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Less than 1	1	1	2	—	0.0	—	0.0	—	0.0	—	0.0	—	0.0	—	0.0
1-5	169	135	304	—	0.0	—	0.0	—	0.0	9	5.3	15	11.1	24	7.9
6-10	325	262	587	3	0.9	4	1.5	7	1.2	24	7.4	13	5.0	37	6.3
11-15	272	240	512	8	2.9	6	2.5	14	2.7	12	4.4	5	2.1	17	3.3
16-20	220	237	457	16	7.3	8	3.4	24	5.2	13	5.9	5	2.1	18	3.9
21-25	239	156	396	27	11.3	13	8.3	40	10.1	15	6.3	3	1.9	18	4.5
26-30	224	178	402	28	12.5	10	5.6	38	9.4	19	8.5	3	1.7	22	5.5
31-35	138	90	228	18	13.0	4	4.4	22	9.6	11	7.7	2	2.2	13	5.7
36-40	142	103	245	13	9.2	6	5.8	19	7.8	12	8.4	2	1.9	14	5.7
41-45	99	69	168	7	7.1	3	4.3	10	6.0	8	8.1	1	1.4	9	5.4
46-50	90	74	164	7	7.8	6	8.1	13	7.9	3	3.3	1	1.4	4	2.4
51-55	75	35	110	5	6.7	2	5.7	7	6.4	3	4.0	1	2.8	4	3.6
56-60	40	30	70	5	12.5	—	0.0	5	7.1	—	0.0	1	3.3	1	1.4
61 & over	54	28	82	2	3.7	3	10.7	5	6.1	3	5.6	—	0.0	3	3.6
TOTAL	2088	1638	3726	139	6.6	65	4.0	204	5.5	132	6.3	52	3.2	184	4.9

* Included in this table are the results of the survey of 975 persons in Palawan done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.

Table 4. Microfilaremia Rates, by Age and Sex, Brooke's Point, Palawan, 1965*.

Age in Years	Number Examined			Positive for B. malayi						Positive for W. bancrofti					
				Males		Females		Total		Males		Females		Total	
	M	F	Total	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1-5	52	49	101	—	0.0	—	0.0	—	0.0	—	0.0	—	0.0	—	0.0
6-10	83	67	150	—	0.0	—	0.0	—	0.0	1	1.2	3	4.5	4	2.7
11-15	89	52	141	1	1.1	—	0.0	1	0.7	5	5.6	5	9.6	10	7.1
16-20	63	83	146	1	1.6	—	0.0	1	0.7	13	20.6	5	6.0	18	12.3
21-25	72	49	121	2	2.8	—	0.0	2	1.6	18	25.0	8	16.3	26	21.5
26-30	55	43	98	—	0.0	—	0.0	—	0.0	16	29.1	5	11.6	21	21.4
31-35	45	21	66	—	0.0	—	0.0	—	0.0	14	31.1	3	14.3	17	25.8
36-40	36	30	66	—	0.0	—	0.0	—	0.0	9	25.0	4	13.3	13	19.7
41-45	28	22	50	—	0.0	—	0.0	—	0.0	4	14.3	3	13.6	7	14.0
46-50	27	24	51	—	0.0	—	0.0	—	0.0	3	11.1	5	20.8	8	15.7
51-55	19	10	29	—	0.0	—	0.0	—	0.0	4	21.1	2	20.0	6	20.7
56-60	10	8	18	—	0.0	—	0.0	—	0.0	4	40.0	—	0.0	4	22.2
61 & over	13	5	18	—	0.0	—	0.0	—	0.0	1	7.7	1	20.0	2	11.1
TOTAL	592	463	1055	4	0.7	—	0.0	4	0.4	92	15.5	44	9.5	136	12.9

* Included in the table are the results of the survey of 297 persons in Brooke's Point, Palawan done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.

Table 5. Microfilaremia Rates, By Age and Sex, Quezon, Palawan, 1965*.

Age in Years	Number Examined			Positive for B. malayi						Positive for W. bancrofti					
				Males		Females		Total		Males		Females		Total	
	M	F	Total	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1-5	41	35	76	9	22.0	15	42.8	24	31.6	--	0.0	—	0.0	—	0.0
6-10	64	39	103	24	37.5	13	33.3	37	35.9	2	3.1	1	2.6	3	2.9
11-15	43	33	76	11	25.6	5	15.2	16	21.1	3	7.0	1	3.0	4	5.3
16-20	50	44	94	12	24.0	5	11.4	17	18.1	3	6.0	3	6.8	6	6.4
21-25	48	31	79	12	25.0	3	9.7	15	19.0	6	12.5	5	16.1	11	13.9
26-30	74	44	118	19	25.7	3	6.8	22	18.6	11	14.9	4	9.1	15	12.7
31-35	29	15	44	11	37.9	2	13.3	13	29.5	3	10.3	1	6.7	4	9.1
36-40	37	20	57	12	32.4	2	10.0	14	24.6	4	10.8	1	5.0	5	8.8
41-45	23	8	31	8	34.8	1	12.5	9	29.0	—	0.0	—	0.0	—	0.0
46-50	16	11	27	3	18.8	1	9.1	4	14.8	4	25.0	1	9.1	5	18.5
51-55	10	8	18	3	30.0	1	12.5	4	22.2	--	0.0	—	0.0	—	0.0
56-60	5	3	8	—	0.0	1	33.3	1	12.5	—	0.0	—	0.0	—	0.0
61& over	5	1	6	3	60.0	—	0.0	3	50.0	—	0.0	—	0.0	—	0.0
TOTAL	445	292	737	127	28.5	52	17.8	179	24.3	36	8.1	17	5.8	53	7.2

* Included in this table are the results of the survey of 563 persons in Quezon, Palawan done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.

Table 6. Microfilarial Densities (20 mm^3) by Municipality, Palawan, 1965*.

Municipality	No. Exam.	Number Positive for W.b.	Number Positive for B.m.	Ave. Mf. Count for W. bancrofti per Pos.	Ave. Mf. Count for W. bancrofti per no. exam.	Ave. Mf. Count for W. bancrofti per mm^3	Ave. Mf. Count for B. malayi per pos.	Ave. Mf. Count for B. malayi per no. exam.	Ave. Mf. Count for B. malayi per mm^3
TAYTAY									
Calatan	61	—	—	0	0	0	0	0	0
Silanga	32	—	1	0	0	0	2.0	0.06	0.003
Taytay-Pal	58	—	—	0	0	0	0	0	0
Danlig	131	—	—	0	0	0	0	0	0
TOTAL	282	—	1	0	0	0	2.0	0.01	0.001
PUERTO PRINCESA									
Bahili	174	5	—	6.6	0.19	0.009	0	0	0
Tapul	80	1	—	12.0	0.15	0.008	0	0	0
New Panganiban	99	—	—	0	0	0	0	0	0
Mauyon	29	2	—	3.0	0.21	0.011	0	0	0
Kabayugan	7	—	—	0	0	0	0	0	0
Kalakunsan	28	—	—	0	0	0	0	0	0
TOTAL	417	8	—	6.4	0.12	0.006	0	0	0
ABORLAN									
Sagpangan	54	5	—	11.6	1.07	0.054	0	0	0
Maringit	14	2	—	3.0	0.43	0.022	0	0	0
TOTAL	68	7	—	9.1	0.94	0.047	0	0	0
QUEZON									
Panitian	137	—	14	0.0	0.	0.0	5.6	0.58	0.029
Gungnan	57	1	29	5.0	0.09	0.004	18.8	9.56	0.478
Marerong	53	6	30	5.8	0.66	0.033	32,5	18.40	0.920
Kamting	84	3	28	13.7	0.49	0.024	26.8	8.95	0.448
Tagbanaba	83	—	23	0	0	0	16.8	4.66	0.233
Tagpisa	47	5	16	14.0	1.49	0.074	16.9	5.76	0.288
Malatgao	39	14	19	16.0	5.74	0.287	58.7	28.59	1.430
Sarangaan	3	—	—	0	0	0	0	0	0
Odicng	14	7	2	10.8	5.42	0.271	17.5	2.50	0.125
Napunran	3	1	—	31.0	10.33	0.516	0	0	0
Inigan	5	2	1	39.0	15.60	0.780	222.0	44.40	2.220
Taganilao	17	2	7	3.0	0.35	0.018	29.4	12.12	0.606
Magino	9	—	—	0	0	0	0	0	0

Table 6 (Continued):

Municipality	No. Exam.	Number Positive for W.b.	Number Positive for B.m.	Ave. Mf. Count for W. bancrofti Per Pos.	Ave. Mf. Count for W. bancrofti Per No. Exam.	Ave. Mf. Count for W. bancrofti Per mm³	Ave. Mf. Count for B. malayi Per Pos.	Ave. Mf. Count for B. malayi Per No. Exam.	Ave. Mf. Count for B. malayi Per mm³
Tapean	2	—	—	0	0	0	0	0	0
Tinaguan Pati	11	—	1	0	0	0	5.0	0.45	0.022
Tabon	59	—	—	0	0	0	0	0	0
Tumarbong	9	1	—	3.0	0.33	0.016	0	0	0
Babsaban	17	2	—	2.0	0.24	0.012	0	0	0
Tagbai	10	1	—	2.0	0.20	0.010	0	0	0
Bawangan	69	7	8	11.8	1.20	0.060	35.3	4.10	0.205
Calumpang	9	1	1	5.0	0.60	0.030	1.0	0.11	0.005
TOTAL	737	53	179	12.5	0.90	0.045	27.2	6.61	0.331
BROOKE'S POINT									
Abo-Abo	91	—	1	0	0	0	2.0	0.02	0.001
Barongbarong	43	—	—	0	0	0	0	0	0
Amas	30	—	—	0	0	0	0	0	0
Ipilan	49	1	—	9.0	0.18	0.009	0	0	0
Macagua	17	—	—	0	0	0	0	0	0
Tagdao	13	—	—	0	0	0	0	0	0
Tubtub	44	—	—	0	0	0	0	0	0
Mainit	38	2	—	6.5	0.34	0.017	0	0	0
Pañgobilian	106	—	—	0	0	0	0	0	0
Buligay	25	—	—	0	0	0	0	0	0
Kolandanum	65	17	—	28.9	7.57	0.378	0	0	0
Sandoval	25	10	—	40.5	16.20	0.810	0	0	0
Lumangoy	44	8	—	40.8	7.41	0.371	0	0	0
Tarusan	82	19	—	42.5	9.84	0.492	0	0	0
Malitob	30	11	—	127.1	46.60	2.330	0	0	0
Tagmaya	37	5	—	174.0	23.51	1.176	0	0	0
Sapa	14	4	—	19.8	5.64	0.282	0	0	0
Barangkas	34	5	—	18.2	2.68	0.134	0	0	0
Sarab	32	—	—	0	0	0	0	0	0
Sarong	31	2	—	2.5	0.16	0.008	0	0	0
PEA Camp	21	—	—	0	0	0	0	0	0
Rio Tuba	32	—	—	0	0	0	0	0	0
Tagnato	28	12	—	11.4	4.89	0.244	0	0	0
Sumbiling	49	18	1	19.2	7.04	0.352	7.0	0.14	0.007
Biliran	19	4	1	19.2	4.05	0.202	4.0	0.21	0.011
Tagpisa	20	6	1	6.6	3.95	0.198	5.0	0.25	0.012
Tagulañgo	3	—	—	0	0	0	0	0	0
Tamparan	8	—	—	0	0	0	0	0	0
Katipunan	20	12	—	19.2	11.50	0.575	0	0	0

Table 6 (Continued):

Municipality	No. Exam.	Number Positive for W.b.	Number Positive for B.m.	Ave. Mf. Count for W. bancrofti Per Pos.	Ave. Mf. Count for W. bancrofti Per No. Exam.	Ave. Mf. Count for W. bancrofti Per mm^3	Ave. Mf. Count for B. malayi Per Pos.	Ave. Mf. Count for B. malayi Per No. Exam.	Ave. Mf. Count for B. malayi Per mm^3
Bulilluyan	5	—	—	0	0	0	0	0	0
TOTAL	1055	136	4	39.5	5.10	0.255	4.5	0.02	0.001
PALAWAN	3726	204	184	30.1	1.65	0.082	26.6	1.31	0.066

* Included in this table are the results of the survey of 975 persons in Palawan done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.

Table 7. Distribution of Municipalities Found Positive For Either W. bancrofti or B. malayi, By Intensity of Parasitemia, Palawan, 1965.

MUNICIPALITIES	Average Mf. Count Per Positive (20 mm^3) Very Light (1-10 mf.)	Light (11-100 mf.)	Moderate (101-250 mf.)	Heavy (over 250 mf.)
Taytay	Silanga (B.m.)			
Pto. Princesa	Bahili (W.b.) Mauyon (W.b.)	Tapul (W.b.)		
Aborlan	Maringit (W.b.)	Sagpañgan(W.b.)		
Quezon	Gungan (W.b.) Marerong (W.b.) Panitian (B.m.) Odiong (W.b.) Napuaran (W.b.) Taganilao(W.b.) Tinaguan Pati (B.m.) Tumarbong(W.b.) Sabsaban (W.b.) Tagbai (W.b.) Calumpang(W.b.& B.m.)	Gungnan (W.b.) Marerong (B.m.) Kambing (W.b. & B.m.) Tagbanaba(B.m.) Tagpisa (W.b. & B.m.) Malatgao(W.b. & B.m. Odiong (B.m.) Inigar (W.b.) Taganilao (B.m.) Sawangan (W.b. & B.m.)	Inigan (B.m.)	
Brooke's Point	Abo-Abo-(B.m.) Mainit (W.b.) Ipilan (W.b.) Sarong (W.b.) Sumbiling(B.m.) Biliran (B.m.) Tagpisa (B.m.)	Kclandanum(W.b.) Sandoval (W.b.) Lumangoy (W.b. Tarusan (W.b.) Sapa (W.b.) Barangkas (W.b.) Tagnato (W.b.) Sumbiling (W.b.) Biliran (W.b.) Tagpisa (W.b.) Katipunan(W.b.)	Malitob (W.b.) Tagmaya (W.b.)	
TOTAL	Taytay (W.b.) Pto. Princisa (W.b.) Aborlan (W.b.) Brooke's Point (B.m.)	Quezon (W.b. & B.m.) Brook's Point (W.b.)		

Table 8. Average Microfilarial Densities (20 mm^3) by Age and Sex, Palawan, 1965*.

Average Mf. Count for B. malayi

Age in Years	Male			Female			Total		
	Per Pos.	Per No. Exam.	Per mm^3	Per Pos.	Per No. Exam.	Per mm^3	Per Pos.	Per No. Exam.	Per mm^3
Less than 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-5	17.7	0.94	0.047	10.7	1.19	0.060	13.3	1.05	0.052
6-10	14.3	1.10	0.055	21.4	1.06	0.053	17.1	1.08	0.054
11-15	39.3	1.74	0.087	18.0	0.38	0.019	33.1	0.96	0.048
16-20	49.7	2.94	0.147	21.0	0.34	0.017	41.7	1.64	0.082
21-25	2.2	0.14	0.007	25.7	0.49	0.024	6.1	0.28	0.014
26-30	42.4	3.59	0.178	49.3	0.83	0.042	43.3	2.37	0.118
31-35	32.4	2.58	0.129	79.0	1.76	0.088	39.5	2.25	0.112
36-40	40.3	3.41	0.171	34.5	0.67	0.034	39.5	2.26	0.113
41-45	23.0	1.86	0.093	5.0	0.07	0.004	21.0	1.12	0.056
46-50	20.3	0.68	0.034	2.0	0.03	0.002	15.8	0.38	0.019
51-55	75.3	3.01	0.151	4.0	0.11	0.006	57.5	2.09	0.104
56-60	0.0	0.0	0.0	4.0	0.13	0.006	4.0	0.06	0.003
61 & over	2.3	0.13	0.006	0.0	0.0	0.0	2.3	0.08	0.004
TOTAL	28.7	1.82	0.091	21.1	0.67	0.034	26.6	1.31	0.066

Table 8 (Continued):

Average Mf. Count for W. bancrofti

Age in Years	Male			Female			Total		
	Per Pos.	Per No. Exam.	Per mm^3	Per Pos.	Per No. Exam.	Per mm^3	Per Pos.	Per No. Exam.	Per mm^3
Less than 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-10	31.3	0.29	0.014	35.8	0.54	0.027	33.8	0.40	0.020
11-15	21.4	0.63	0.032	4.0	0.09	0.004	13.9	0.38	0.019
16-20	47.2	3.44	0.172	37.9	1.28	0.064	44.1	2.32	0.116
21-25	30.1	3.40	0.170	16.5	1.37	0.068	25.6	2.59	0.130
26-30	18.5	2.31	0.116	6.7	0.38	0.019	15.4	1.46	0.073
31-35	62.3	8.13	0.406	32.8	1.46	0.073	57.0	5.50	0.275
36-40	21.5	1.47	0.074	11.3	0.66	0.033	18.4	1.42	0.071
41-45	15.8	1.12	0.056	13.3	0.58	0.029	15.1	0.90	0.045
46-50	14.3	1.11	0.056	57.8	4.69	0.234	34.4	2.72	0.136
51-55	5.6	0.37	0.018	7.0	0.40	0.020	6.0	0.38	0.019
56-60	150.4	18.80	0.940	0.0	0.0	0.0	150.4	10.74	0.537
61 & over	15.5	0.57	0.028	8.7	0.93	0.046	11.4	0.70	0.035
TOTAL	34.3	2.28	0.114	21.2	0.54	0.027	30.1	1.65	0.082

* Included in this table are the results of the survey of 975 persons in Palawan done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.

Table 9. Average Microfilarial Densities (20 mm^3), By Age and Sex, Quezon, Palawan, 1965*.

Average Mf. Count for B. malayi (20 mm^3)

Age in Years	Male			Female			Total		
	Per Pos.	Per No. Exam.	Per mm^3	Per Pos.	Per No. Exam.	Per mm^3	Per Pos.	Per No. Exam.	Per mm^3
1-5	17.7	3.88	0.194	10.7	4.51	0.226	13.3	4.20	0.210
6-10	14.8	5.56	0.278	21.4	7.13	0.356	17.1	6.16	0.308
11-15	42.5	10.88	0.544	18.0	2.73	0.136	34.9	7.34	0.367
16-20	53.2	12.78	0.639	21.0	2.39	0.120	43.8	7.91	0.396
21-25	2.2	0.56	0.028	25.7	2.48	0.124	6.9	1.32	0.066
26-30	42.3	10.88	0.544	49.3	3.36	0.168	43.3	8.08	0.404
31-35	32.4	12.28	0.614	79.0	10.53	0.526	39.5	11.68	0.584
36-40	40.3	13.08	0.654	34.5	3.45	0.172	39.5	9.70	0.485
41-45	23.0	8.00	0.400	5.0	0.62	0.031	21.0	6.10	0.305
46-50	20.3	3.81	0.191	2.0	0.18	0.009	15.8	2.33	0.116
51-55	75.3	22.6	1.130	4.0	0.50	0.025	57.5	12.78	0.639
56-60	0.0	0.0	0.0	4.0	1.33	0.066	4.0	0.50	0.025
61 & over	2.3	1.40	0.070	0.0	0.0	0.0	2.3	1.17	0.058
TOTAL	22.6	8.36	0.418	21.1	3.76	0.188	27.2	4.60	0.230

Table 9 (Continued):

Average Mf. Count for W. bancrofti (20 mm^3)

Age in Years	Male			Female			Total		
	Per Pos.	Per Nc. Exam.	Per mm^3	Per Pos.	Per Nc. Exam.	Per mm^3	Per Pos.	Per Nc. Exam.	Per mm^3
1-5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-10	10.0	0.31	0.016	16.0	0.41	0.021	12.0	0.35	0.018
11-15	17.3	1.21	0.061	4.0	0.12	0.006	14.0	0.74	0.037
16-20	39.3	2.36	0.118	20.7	1.41	0.071	30.0	1.91	0.096
21-25	5.8	0.73	0.036	8.6	1.09	0.054	7.1	0.99	0.050
26-30	13.4	2.00	0.100	6.5	0.59	0.030	11.6	1.47	0.074
31-35	8.7	0.90	0.045	14.0	0.93	0.046	10.0	0.91	0.046
36-40	4.8	0.51	0.026	4.0	0.20	0.010	4.6	0.40	0.020
41-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46-50	7.2	1.81	0.091	46.0	4.18	0.209	15.0	2.78	0.139
51-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56-60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61 & over	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	12.4	1.00	0.050	12.6	0.74	0.037	12.5	0.90	0.045

* Included in this table are the results of the survey of 563 persons in Quezon, Palawan done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.

Table 10. Average Microfilarial Densities (20 mm^3) By Age and Sex, Brooke's Point, Palawan, 1965*

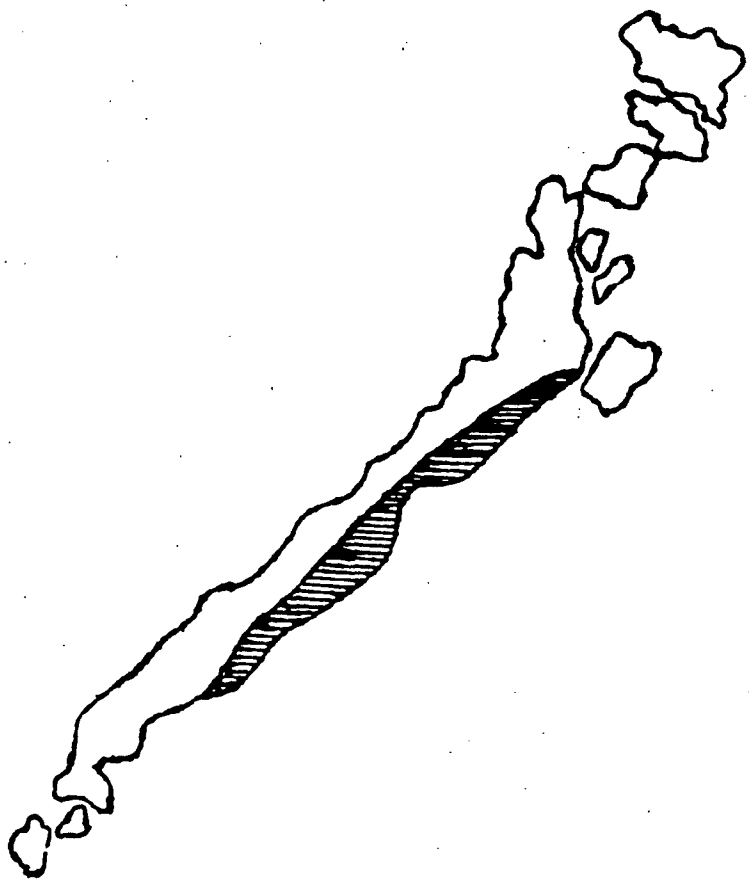
Age in Years	Number Examined M	F	Total	No. Pos. for W. bancrofti M	F	Total	Average Mf. Count for W. bancrofti (20 mm^3) Male per pos.	per exam.	per no. per mm^3	Female per pos.	per exam.	per no. per mm^3	Total per pos.	per exam.	per no. per mm^3
1-5	52	49	101	--	--	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-10	83	67	150	1	3	4	74.0	0.89	0.044	42.3	1.90	0.095	50.2	1.34	0.067
11-15	89	52	141	5	5	10	23.8	1.34	0.067	4.0	0.38	0.019	13.9	0.98	0.049
16-20	63	83	146	13	5	18	49.1	10.13	0.506	48.2	2.90	0.145	48.8	6.02	0.301
21-25	72	49	121	18	8	26	40.8	10.19	0.510	21.4	3.49	0.174	34.8	7.48	0.374
26-30	55	43	98	16	5	21	22.9	6.67	0.334	7.4	0.86	0.043	19.24	4.12	0.206
31-35	45	21	66	14	3	17	77.5	24.11	1.206	39.0	5.57	0.278	70.7	18.21	0.911
36-40	36	30	66	9	4	13	29.0	7.25	0.362	13.0	1.73	0.086	24.1	4.74	0.237
41-45	28	22	50	4	3	7	20.2	2.89	0.144	13.3	1.82	0.091	17.3	2.42	0.121
46-50	27	24	51	3	5	8	23.7	2.63	0.132	60.2	12.54	0.627	46.5	7.29	0.364
51-55	19	10	29	4	2	6	6.5	1.37	0.068	7.0	1.40	0.070	6.7	1.38	0.069
56-60	10	8	18	4	—	4	187.2	74.90	3.745	0.0	0.0	0.0	187.2	41.61	2.081
61 +	13	5	18	1	1	2	30.0	2.31	0.116	22.0	4.40	0.220	26.0	2.89	0.144
TOTAL	592	463	1055	92	44	136	46.0	7.15	0.358	26.0	2.47	0.124	39.5	5.10	0.255

* Included in the table are the results of the survey of 297 persons in Brooke's Point, Palawan, done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.

Table 11. Distribution of Cases, By Intensity of Microfilaremia, Palawan, 1965*.

Microfilariae Count Per 20 mm^3	B. malayi			W. bancrofti		
	Male	Female	Total	Male	Female	Total
1-5	70	22	92	46	22	68
6-10	18	8	26	19	9	28
11-25	9	8	17	37	23	60
26-50	15	7	22	21	5	26
51-100	9	5	14	10	2	12
101-200	8	2	10	2	4	6
201-822	3	—	3	4	—	4
TOTAL	132	52	184	139	65	204

* Included in this table are the results of the survey of 975 persons in Palawan done in 1964 by Lloyd E. Rozeboom and Benjamin D. Cabrera.



L E G E N D

1st Type - Two pronounced seasons, dry from November to April, wet during the rest of the year.

2nd Type - No dry season with a very pronounced maximum rainfall from November to January.

3rd Type - Seasons not very pronounced, relatively dry from November to April and wet during the rest of the year.

4th Type - Rainfall more or less evenly distributed throughout the year.

Fig. 1. Map of Palawan showing the two types of climate of the province.

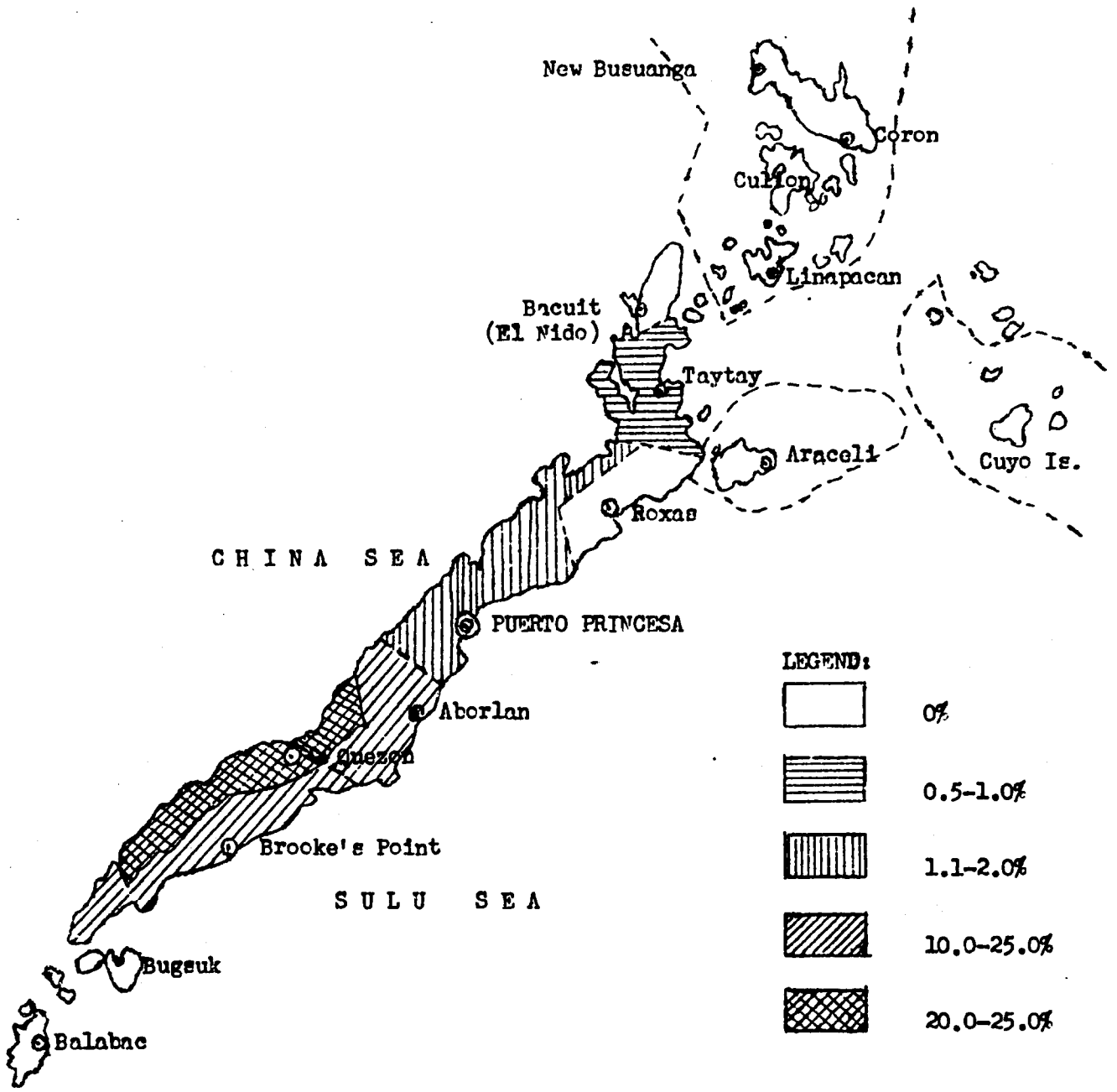


Figure 2. FILARIASIS PREVALENCE, PALAWAN, 1965.

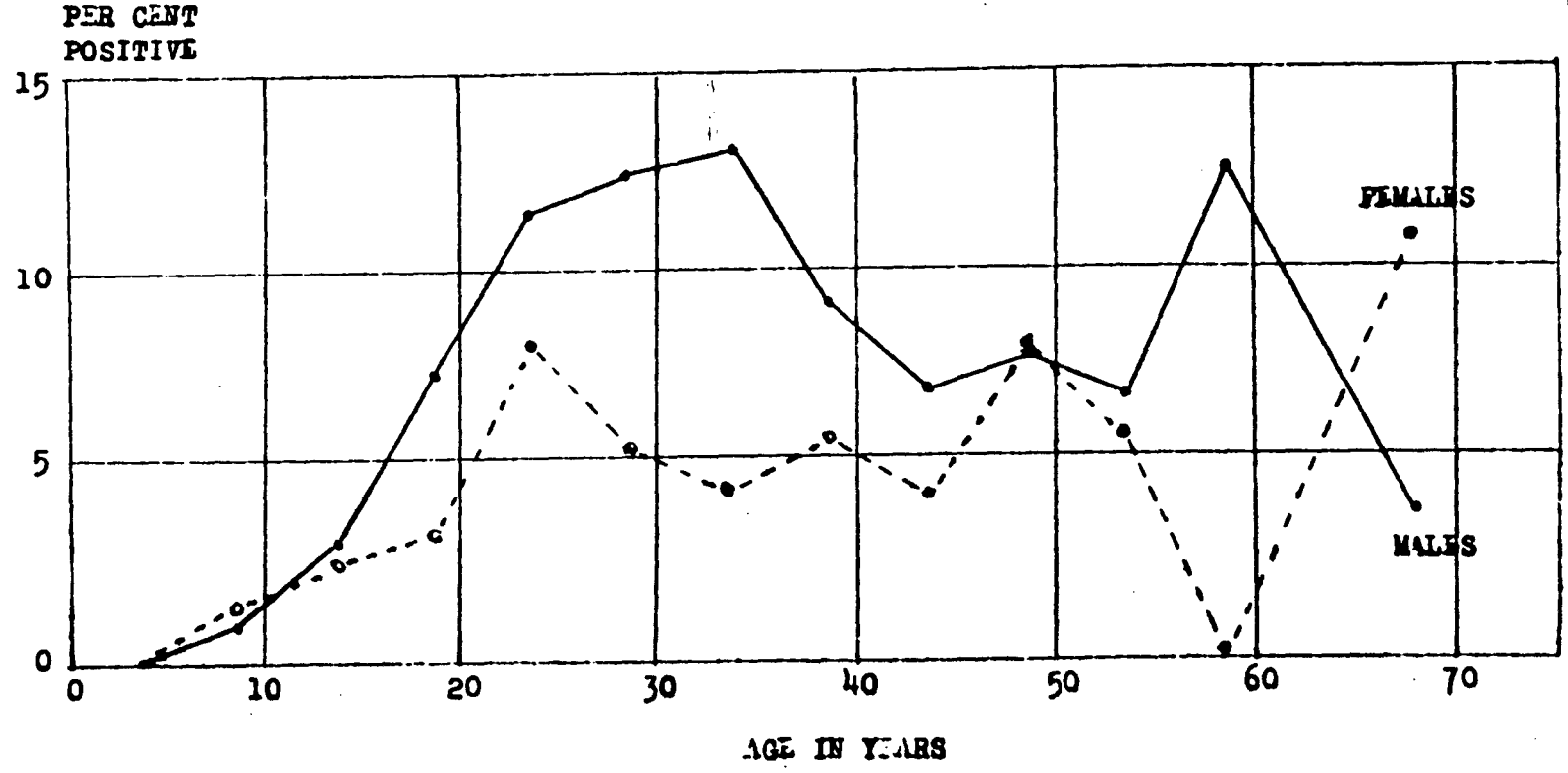


FIGURE 3. W. BANCROFTI PREVALENCE, BY AGE AND SEX, PALAWAN, 1965.

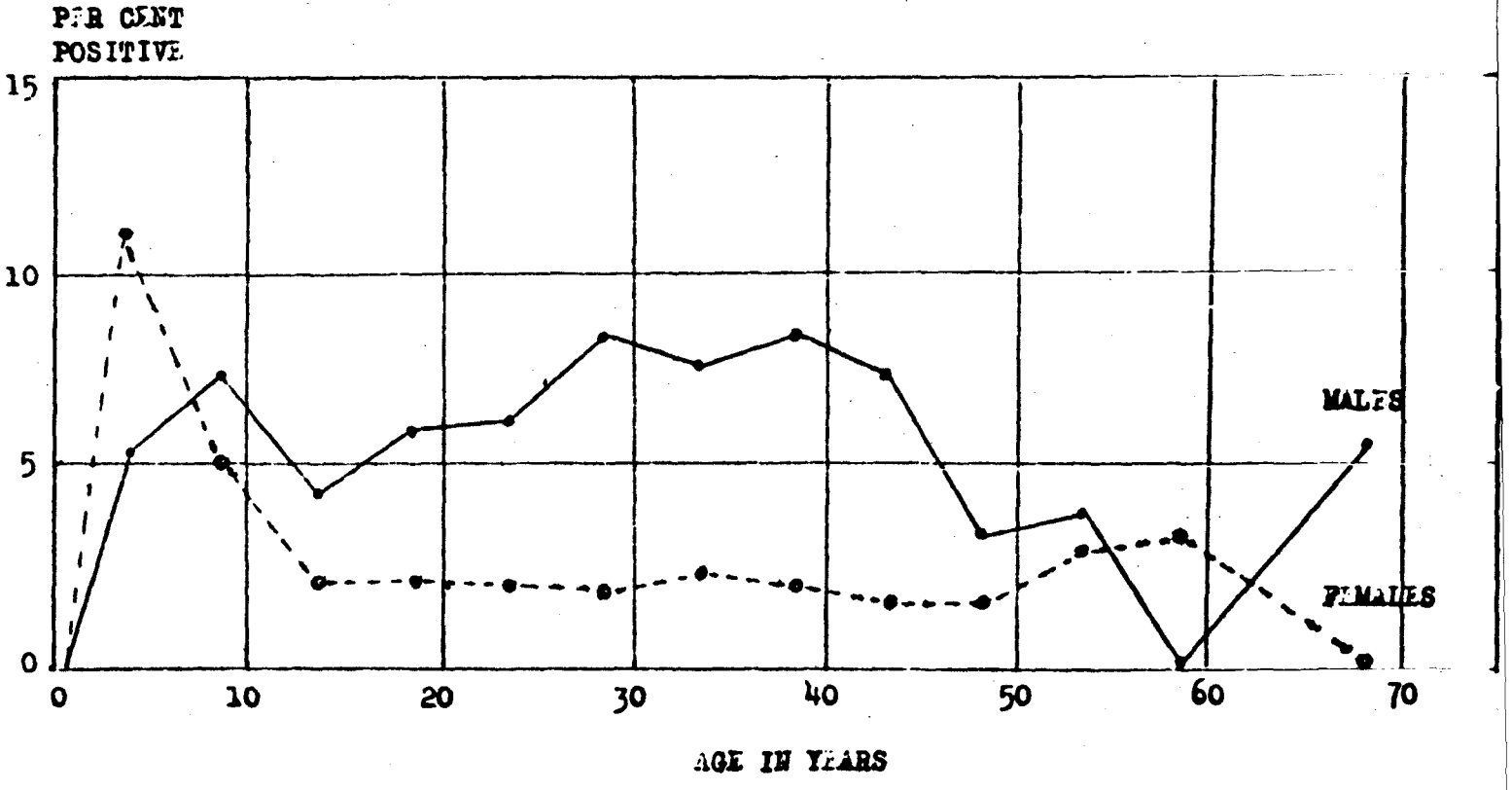


FIGURE 4. B. MALAYI PREVALENCE, BY AGE AND SEX, PALAWAN, 1965.

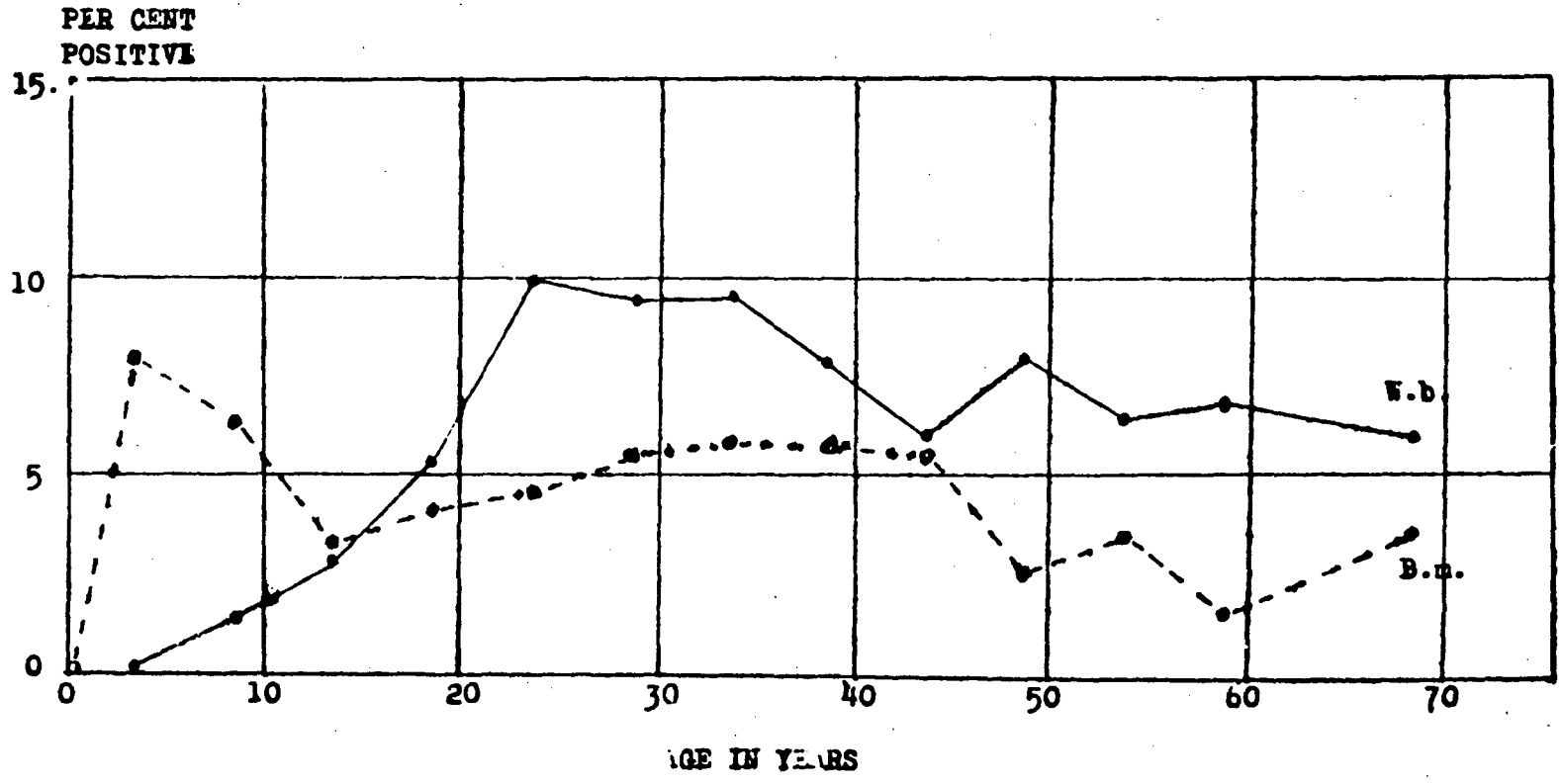


FIGURE 5. W. BANCROFTI AND B. MALAYI PREVALENCE, BY AGE, PALAWAN, 1965.

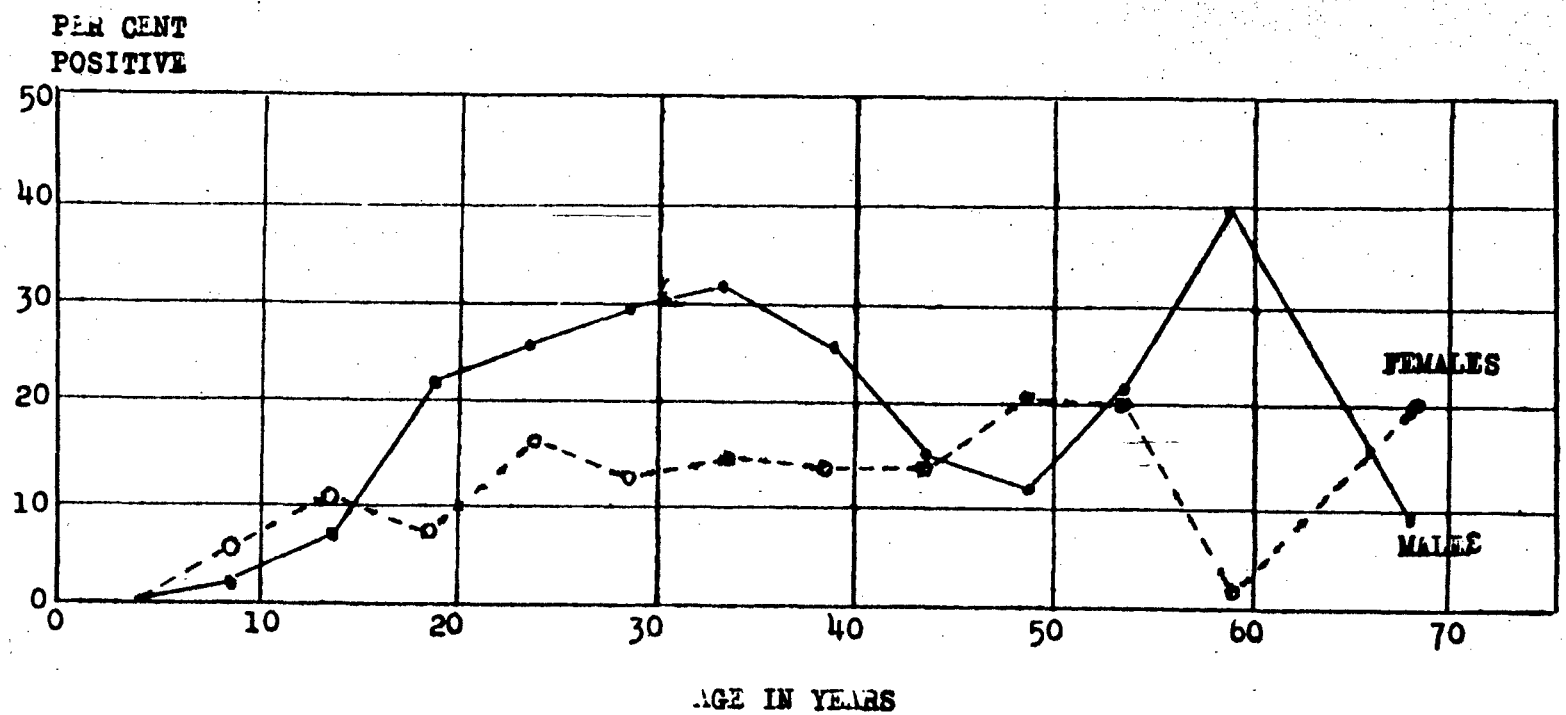


FIGURE 6. W. BANCROFTI PREVALENCE, BY AGE AND SEX, BROOKE'S POINT, PALAWAN, 1965.

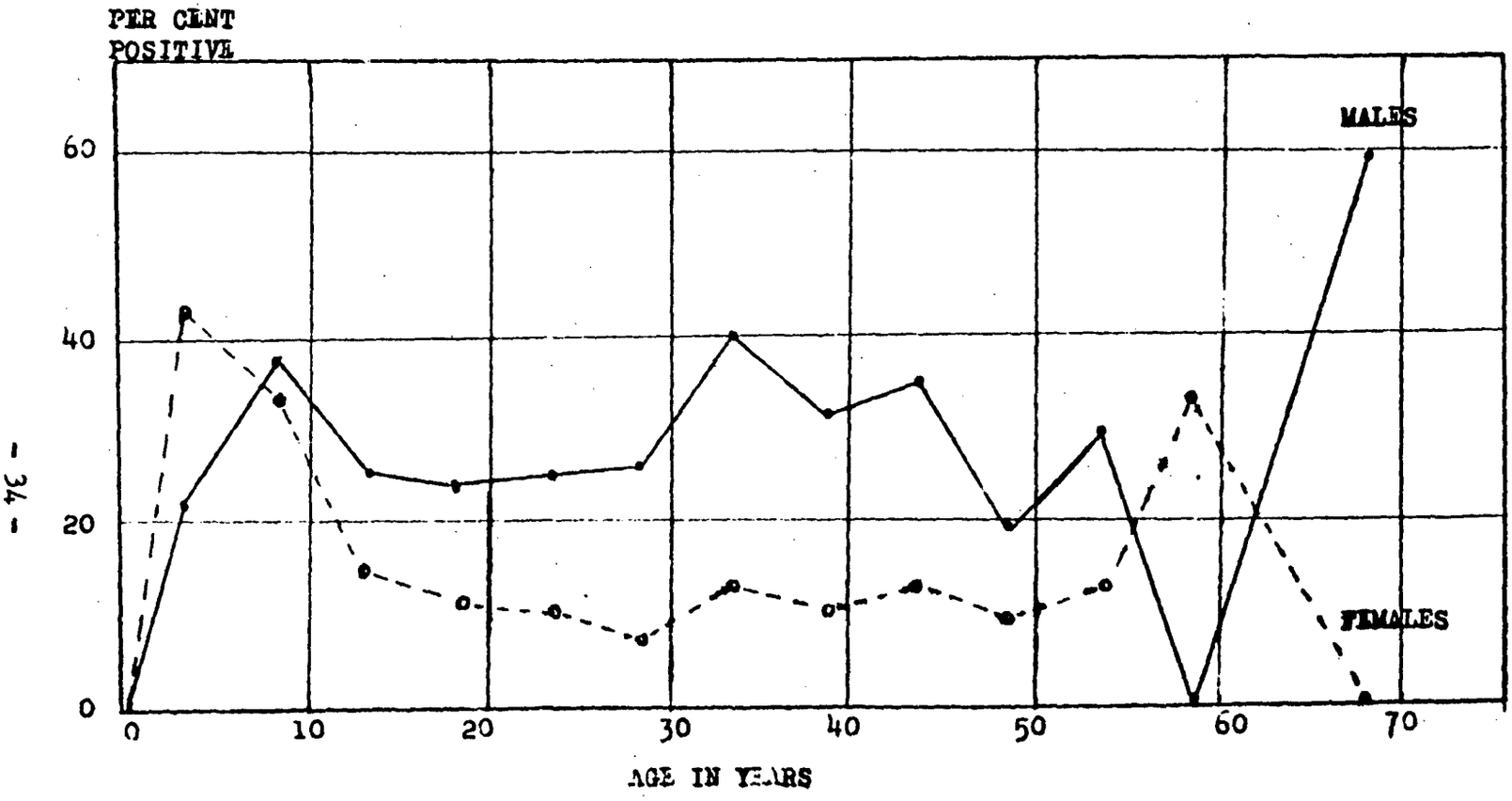


FIGURE 7. B. MALAYI PREVALENCE, BY AGE AND SEX, QUEZON, PALAWAN, 1965.

PART II

Blood Surveys for Microfilaria in Jolo, Sulu

The Province of Sulu consists of a chain of islands and islets which are of volcanic and coral origin, and are called Sulu Archipelago. These islands are located about 118°20'-122° West longitude and 4°40'-6°-30' North latitude. Some of the larger islands are Jolo, Tapul, Siasi, Tawi-Tawi, and Sibutu. Jolo island is about 210 kilometers away from North British Borneo whereas Tawi-Tawi is only about 65 kilometers away from Borneo. The province has an estimated population of 395,600. Jolo island alone has a population of about 197,000 as of July 1, 1966*. The capital of Sulu Province is Jolo town, (fig. 1).

As in the case of Palawan, Jolo island has a mixture of indigenous inhabitants namely: Tausug, Samal and Badjac. These groups all belong to the "Muslim" population of the Philippines. The Tausugs and Samals are mixed on a number of islands with the former being more numerous in the north while the latter predominate in the southern portion of the archipelago. The Tausugs are vigorous, proud people who consider themselves as superior "muslim" group because they were the first "Islamized" and achieved the highest political development. The Samals and Badjaos are friendly and meek. The latter move with the wind and tide on their small houseboats and are called "sea gypsies"(1). Aside from these indigenous inhabitants, Jolo has some christian population who immigrated from Luzon, Visayas and Mindanao.

Jolo island has much fewer mountains and hills compared to Palawan. The principal industries are farming, fishing, pearl industry and mat weaving. Their main agricultural products are coconut, abaca, root crops (cassava, sweet potato) rice and corn. They have wild fruit trees like mangosteen, durian, marang, lanzones, etc.; also some domestic fruits like bananas, papayas, mangoes and very scanty vegetables. The protein in their diet is derived mostly from beef, chicken and fish.

The climate is warm and moist and the archipelago is located outside of the typhoon belt. Rainfall is more or less evenly distributed throughout the year hence it is classified as type four. This type of precipitation makes the area very suitable for abaca industry.

Most of the houses, although built on posts are made of much stronger materials (lumber) as compared to the houses of Palawanos which are made mostly of bamboos. Because of the scarcity of residential areas in Jolo town proper, some houses are actually constructed over the sea water. A wooden bridge which is approximately a quarter of a kilometer in length

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* Estimate based on the 1948-1960 census figures for Sulu Province using exponential method.

leads from the street to the farthest house towards the sea. The bridge has several side ramifications leading to the door or entrance of each house in the area, hence these houses have no stair case or ladder.

Materials and Methods

Blood survey procedures:

The technics employed in the preparation of blood smears here are the same as those used during the Palawan survey included in this report. However the method of obtaining the blood from the inhabitants was different. Whereas in Palawan we went from house to house to get the smears, in Jolo the people assembled in designated places. The "head man" or "barrio captain" were informed of our mission a day or two prior to the actual operation and they gathered the people in their respective barrios. Blood smears were taken from 1900 to about 2300 hours. In addition to the blood survey in the field, we also made night blood survey on new admissions in Sulu Public Hospital for a period of 3 weeks.

In the course of the examination of blood smears stained with Giemsa according to Wilson(2) we found that majority of the positive smears contained what appeared to be two types of microfilariae. Some of the microfilariae had purple sheath (atypical), others were without purple sheath (typical). We made separate microfilarial counts for these two types of microfilariae for all the 526 positive blood smears.

Mosquito collections and dissections:

In order to determine the most probable mosquito vector of bancroftian filariasis in this area we have to collect adult mosquitoes for dissection. We used a carabao-baited trap and a human-baited trap in the collection of mosquitoes. The former was set outdoor, near the abaca plantation while the latter was set inside a house. Mosquitoes were gathered early the next morning by means of a glass-tube aspirator and kept in separate containers. These mosquitoes were anaesthetized with chloroform and sorted according to species under a stereoscope. Legs and wings were detached and discarded while the head, thorax and abdomen were teased separately in 3 drops of normal salt solution or a glass slide. These were examined for filaria larvae using a compound microscope to detect the stage I larvae and the dissecting microscope for stages II and III. When in doubt as to the identity of larvae, a compound microscope was always used.

Results

The entire island of Jolo consisting of eight municipalities was covered quite thoroughly in this blood survey for a period of 4 weeks. A total of 4,593 persons (2,373 males and 2,220 females) were examined. There were 526 persons found positive for microfilariae of W. bancrofti or a microfilaremia rate of 11.4 per cent.

microfilaremia rate of 11.4 per cent.

Distribution and Prevalence:

The distribution of bancroftian filariasis by municipality is shown in table 1 and figure 2. It appears that Indanan, Camp Andres (Luuk), Bilaan, Panamao (Seit) and Taglibi are the municipalities with high microfilaremia rates ranging from 13.7 to 17.3 per cent. Jolo, Parang and Maimbung have microfilaremia rates ranging from 3.4 to 6.2 per cent. We were able to make blood survey right in the center of the town (poblacion), in six of the eight municipalities, and it turned out that the disease was present in the 6 poblacions. The poblacion of Camp Andres (Luuk), Panamao and Indanan had prevalence rate of 13.7, 8.7 and 8.6 per cent respectively while the poblacion of Parang, Bilaan and Jolo had prevalence rates ranging from 1-6.4 per cent with Parang having the lowest. We found that all the eight municipalities in the island of Jolo were endemic for bancroftian filariasis.

Age and Sex Distribution:

The age and sex distribution of the persons surveyed by municipality are seen in table 2a-h and figure 4a-h. It appeared that in general males have higher microfilaremia rates compared to females and the older age groups seemed to have higher microfilaremia rates. This is true in all the eight municipalities surveyed. There were 2 boys and 7 girls under age group 1-5 years with microfilaremia, coming from Parang, Indanan, Camp Andres (Luuk), Panamao and Taglibi. Four of the girls came from Panamao. One will notice that a marked increase in prevalence rates are most evident after the age of 20 years in all the eight municipalities.

Table 3 and figure 3 present the frequency distribution of the total persons surveyed in Jolo island by age and sex. It can be seen that males in general have higher microfilaremia rates in almost all ages. The total microfilaremia rate for the males was 12.9 per cent compared to 9.9 per cent for the females. When both sexes are combined, the microfilaremia rates in the older age groups starting from 16-20 and above were higher than those in the younger age groups. Total microfilaremia rates of 15 per cent and over can be observed starting at age group 16-20 years and over. This finding is similar to the results we obtained in our Palawan survey. One must note however that the age group 1-5 years had a microfilaremia rate of 1.4 per cent compared to zero per cent in the Palawan survey. The youngest cases were three girls aged 3 years and a 3 year old boy, while the oldest case was a 70 year old female.

Table 4 and figure 5 show the summary of the microfilaremia rate of the eight municipalities by sex. The microfilaremia rates for males are higher compared with those of the females in seven of the eight municipalities. It is in the municipality of Indanan alone where the females have a

slightly higher microfilaremia rate than the males, a difference of 0.1 per cent.

Intensity of Microfilaremia:

Table 5a-h show the frequency distribution of cases by sex and by intensity of microfilaremia for each of the eight municipalities. In seven of the eight municipalities (88 per cent) the highest microfilarial count was always on a male. It was only in Camp Andres (Luuk) wherein a female had higher microfilarial count over a male.

Table 6 shows the total frequency distribution of cases by sex and by intensity of microfilaremia in Jolo island. The highest microfilarial count of 326 was found on a 45 year-old male from Taglibi and a 48 year-old female from Indanan with 186 microfilarial count. There were 33 cases, (19 males and 14 females) or 6.3 per cent, having microfilarial counts beyond 100 per 20 mm^3 of blood.

Table 7 shows the intensity of microfilaremia per 20 mm^3 blood by age and sex in Jolo island. The highest average microfilarial count per positive among males was 62.9 among the 41-45 age group whereas among females it was 52.4 among the 46-50 age group. For the total average microfilarial count per positive the males had 33.0 compared to 25.3 for the females. It seems that among female children (1-15 years) the average microfilarial count per positive is higher compared to the male children of the same age.

Table 8 gives the median microfilarial count per 20 mm^3 blood for the eight municipalities by sex. The median microfilarial count per 20 mm^3 of blood among males is 19 compared to 13 among the females. For both sexes combined the median microfilarial count is 17 per 20 mm^3 of blood. It can be observed that for both sexes combined, the municipality of Bilaan has the highest median microfilarial count followed by Panamao, with the municipality of Jolo having the lowest median. Considering the sexes separately, in 4 of the 8 municipalities, namely, Taglibi, Indanan, Camp Andres (Luuk) and Maimbung, the males have higher median microfilarial count compared with the females. In the municipalities of Jolo, Bilaan, Panamao and Parang, females have higher median microfilarial count compared with males.

Blood survey of new admissions in Sulu Public Hospital:

The patients admitted in this hospital came practically from all municipalities of the Province of Sulu. Table 9 shows the frequency distribution of the patients surveyed. A total of 174 (91 males and 83 females) patients were included in this survey. Blood smears were taken after 1900 hours. Microfilaremia rates of 12.1 per cent for the males and 9.6 per cent for the females were obtained. For both sexes combined the microfilaremia rate was 12.1 per cent. The youngest patients (a male and a female) found with microfilaremia belong to the 16-20 age group while the

oldest positive patients (2 males and 2 females) were in the 56-60 age group.

Staining reaction of microfilarial sheath with Giemsa stain:

Table 10 shows the intensity of microfilaremia of positive smears by presence or absence of purple sheath. It can be seen that there were as many cases with purple sheath (atypical microfilariae) as there were cases without purple sheath (typical microfilariae).

We tried to explain the existence of both typical and atypical microfilariae among the subjects by the probable difference in the origin. We thought that the typical microfilariae were of human origin while the atypical ones were of animal origin. Hence we took night blood smears of some cats and dogs, but the results were all negative.

A more detailed examination of both the typical and atypical microfilariae under oil immersion revealed that they were identical and conformed with the description of W. bancrofti microfilariae. In order to further ascertain the species of microfilariae some of the positive slides were destained and later stained with Delafield's Hematoxylin at the Institute of Hygiene. Examination of these slides even under high dry alone, revealed that they are one and the same species, namely, Wuchereria bancrofti microfilariae.

Extent of abaca plantation in relation to magnitude of W. bancrofti prevalence:

Table 11 gives the proportion of land area planted with abaca in the 8 municipalities of Jolo. It can be seen that the municipality of Indanan has the most extensive abaca plantation, (28.1 per cent). As seen in table 4, Indanan has a prevalence rate of 16.7 per cent. Our findings show no statistically significant correlation between extent of abaca plantation and the magnitude of W. bancrofti prevalence in the 8 municipalities of Jolo island (refer to table 4).

Table 12 shows the extent of abaca plantation in hectares for the Province of Sulu as of 1962. There are no abaca plantation in 8 of the 22 municipalities of Sulu Province. All the eight municipalities of Jolo island are engaged in abaca industry with planted areas ranging from 20-1,550 hectares. Out of 5 of the bigger islands, we have covered so far only Jolo in this survey.

Entomologic Studies:

A survey of the area at the first day of our stay revealed the presence of extensive abaca plantation. Cabrera and Tubangui(3) obtained high natural infection rates, with many stage III larvae in Aedes (Finlaya)poecilus, found breeding in the collection of water of the abaca leaf axils in Sorsogon. Based on this previous finding, and since the existing environmental

conditions in Jolo island are very similar if not identical to those in Sorsogon, we found no need to do extensive mosquito dissection.

The results of mosquito collections and dissections are shown in table 13. Aedes (Finlaya) poecilus was the most abundant mosquito caught in the two traps. Of 523 mosquitoes caught in the traps 230 (44 per cent) were Aedes (Finlaya) poecilus. There were only 12 adult mosquitoes belonging to 2 genera that entered the human baited trap together with 112 Aedes (Finlaya) poecilus in contrast to 291 mosquitoes belonging to 4 genera together with 118 Aedes (Finlaya) poecilus that entered the carabao baited trap. It appeared that most of these other species of mosquitoes were zoophilic while Aedes (Finlaya) poecilus were both anthropophilic and zoophilic.

Not one of the other species of mosquitoes harbored filaria larvae. There were four adult Aedes (Finlaya) poecilus out of 118 (3.4 per cent) that harbored filaria larvae and 8 of 112 (7.1 per cent) that harbored larvae. These mosquitoes were collected from the carabao-baited and human-baited traps respectively. The total infection rates in mosquitoes were 1 and 6.4 per cent from carabao-baited and human-baited traps respectively.

We also aspirated the collection of water in the leaf axils of the abaca plants with a long glass pipette with a rubber bulb and we found several silvery larvae of Aedes (Finlaya) poecilus.

Discussion

Viewed from the airplane, we noticed that Jolo island is not as mountainous and with much less forest areas compared to Palawan. Whereas in Palawan one would notice the thick virgin forest, in Jolo island one could see instead, coconuts and abaca plantations.

Despite the bad peace and order situation in Jolo island, we were able to cover all the eight municipalities and succeeded in taking night blood smears from 4,593 inhabitants, in a period of four weeks.

Examination of the first batch of slides stained according to Wilson(3) confirmed the presence of microfilariae reacting differently to Giemsa staining. Detailed examination of the microfilariae under oil immersion revealed that both types conformed with the description of W. bancrofti microfilariae. We are unable to explain the existence of microfilariae whose sheath reacted differently to Giemsa stain. We were entertaining the possibility that one of these microfilariae came from a different host.

In general the males showed higher microfilaremia rates compared to the females. This finding seemed to point out that filariasis in abaca raising communities is an occupational disease. Males go into the abaca plantation to cut and strip the plant before it is sold in the market, thus

exposing themselves to the bites of Aedes (Finlaya) poecilus. However, since the mosquito vector enter houses as well, to take a blood meal, the entire household are equally exposed to infection(4).

Microfilaremia rates among adults is higher compared to the children. This may be explained by the cummulative process of the infection. Although infection could take place inside the house at night, additional infection takes place among children and adults working in the abaca plantation during the day. Aedes (Finlaya) poecilus do bite at night and during the day as well(4). The occurrence of microfilaremia in the very young children (1-5 years) could be explained again by the biting habits of the vector and its density in the locality.

The intensity of microfilaremia was higher among people surveyed in Jolo island compared to those surveyed in Palawan. It was also found that males had higher intensity of microfilaremia than among females. Both findings may be due to heavier worm burden secondary to more frequent exposure to the bites of infected mosquitoes.

It is of interest to note that if one compares the prevalence rates of the inhabitants of the entire Jolo island as shown in table 2 with the prevalence rates of the hospital patients in table 8, they are almost the same. A prevalence rate of 12.9 per cent (Jolo island) against 12.1 per cent (hospital) for males; 9.9 (Jolo island) against 9.6 per cent (hospital) for females; the total rates being 11.4 (Jolo island) and 12.1 per cent (hospital) respectively.

The absence of a significant correlation between extent of abaca plantation and the magnitude of filaria infection in Jolo island can best be explained by the short distances between municipalities and the overlapping of abaca plantations from one municipality to the other. It might be of interest to mention that whenever "poblaciones" were located near abaca plantations, the prevalence rates of the disease were high. A positive correlation could be expected if one makes a survey among inhabitants coming from those islands of the archipelago where abaca is absent and where abaca is present.

The results of our limited collections and dissections of wild caught mosquitoes, pointed to Aedes (Finlaya) poecilus as the vector of bancroftian filariasis in Jolo island. This finding has confirmed previous finding in Sorsogon(4). There were 12 Aedes (Finlaya) poecilus out of 230, found harboring filaria larvae of W. bancrofti in various stages of development. Four of these mosquitoes came from the carabao-baited trap and 8 were caught from the human-baited trap. The infection rates of Aedes (Finlaya) poecilus from the human-baited trap was much higher than those from the carabao-baited trap.

Summary and Conclusion

A total of 4,593 night blood smears were taken among inhabitants coming from the eight municipalities of Jolo island. Examinations of these smears gave a microfilaremia rate of 11.4 per cent. Blood survey of newly admitted patients at the Sulu Public Hospital gave a finding similar to that for the entire Jolo island.

Microfilaremia rates in males were higher than in females in almost all ages. Combining the two sexes the microfilaremia rates were higher in the older age groups than in the younger age groups.

Males had higher microfilarial counts compared to the females with a median microfilarial count of 17 per 20 mm^3 blood when the two sexes were combined.

Examination of Giemsa stained thick smears revealed the presence of microfilariae with purple sheath mixed with those without purple sheath. Detailed examination of both types however, showed that they were identical and conformed with the description of W. bancrofti microfilaria.

Extent of abaca plantation was not correlated with the magnitude of filariasis prevalence in the 8 municipalities of Jolo island.

The vector of bancroftian filariasis in Jolo island is Aedes (Finlaya) poecilus, which confirmed previous findings in Soreogon Province, another abaca raising community. In both localities the vector was found breeding in the collection of water in the leaf axils of abaca plants.

References

1. Stone, R.L. Some aspects of muslim social organization (mimeograph copy). Institute of Philippine Culture, 1962.

2. Wilson, T. Differences between the microfilariae of Wuchereria malayi and Wuchereria bancrofti in Giemsa-stained thick blood films. Trans. Roy. Soc. Trop. Med. Hyg. 50:54-57, 1956.

3. Cabrera, B.D. and Tubangui, M. Studies on filariasis in the Philippines. III. Aedes (Finlaya) poicilius (Theobald), the mosquito intermediate host of Wuchereria bancrofti in the Bicol Region. Acta Med. Phil. 7:221-229, 1951.

4. Baisas, F.E. Notes on Philippine Mosquitoes. XIX. The mosquito problem in the control of filariasis in Sorsogon Province. Phil. Jour. Sci. 86:7-120, 1957.

Table 1. *W. bancrofti* Prevalence Rates By Municipality, Jolo Island, Sulu, 1966.

Municipality	Number Examined	Number Positive	Per Cent Positive
PARANG	1,169	49	4.2
Poblacion	207	2	1.0
Lumbaan	139	8	5.8
Lagasan	93	-	0
Lipunos	71	2	2.8
Saldang	69	4	5.8
Biid	150	9	6.0
Danapa	32	3	9.4
Kapok-kapok, Laum Suah	52	1	1.9
Tambon	83	11	13.2
Payuhan	58	6	10.3
Liang	102	1	1.0
Bukah-bukah	113	2	1.8
INDANAN	1,172	196	16.7
Poblacion	104	9	8.6
Pasil	218	33	15.1
Panabuan	133	19	14.3
Lampaki	151	21	13.9
Bunut	234	58	24.8
Timbangan	235	44	18.7
Tagbak	97	12	12.4
MAIMBUNG	292	18	6.2
Baunuh	103	6	5.8
Lapa	91	-	0
Tandupatong	77	10	13.0
Matukol	21	2	9.5
LUUK (Camp Andres)	529	91	17.2
Camp Andres (Poblacion)	233	32	13.7
Niyog-niyog	117	30	25.6
Linga	72	12	16.7
Lambago	59	10	16.9
Tayungan	48	7	14.6

Table 1 (Continued):

Municipality	Number Examined	Number Positive	Number Positive
BILAAN (TALIPAO)	373	51	13.7
Poblacion	94	6	6.4
Kamuntayan	62	10	16.1
Buntud	100	2	2.0
Kuhao	117	33	28.2
PANAMAO (SEIT)	306	49	16.0
Poblacion	69	6	8.7
Tina	41	9	22.0
Tiptipon	78	17	21.8
Gaggil	118	17	14.4
TAGLIBI (PATIKUL)	336	58	17.3
Mampallan	12	4	33.3
Liang	129	18	14.0
Tugas	104	19	18.3
Bauno, Bangkal	91	17	18.7
JOLO (Poblacion)	416	14	3.4
TOTAL	4,593	526	11.4

Table 2 a. W. bancrofti Prevalence Rates, By Age and Sex, Parang, Sulu, 1966.

Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	91	1	1.1	101	1	1.0	192	2	1.0
6-10	177	4	2.2	154	3	1.9	331	7	2.1
11-15	61	6	9.8	50	-	0	111	6	5.4
16-20	24	1	4.2	59	7	11.9	83	8	9.6
21-25	39	3	7.7	35	1	2.8	74	4	5.4
26-30	39	5	12.8	67	1	1.5	106	6	5.7
31-35	34	6	17.6	64	1	1.6	98	7	7.1
36-40	30	3	10.0	37	1	2.7	67	4	6.0
41-45	13	-	0	18	-	0	31	-	0
46-50	10	2	20.0	20	-	0	30	2	6.7
51-55	9	-	0	5	-	0	14	-	0
56-60	4	2	50.0	9	1	11.1	13	3	23.1
61 & over	11	-	0	8	-	0	19	-	0
TOTAL	542	33	6.1	627	16	2.6	1,169	49	4.2

Table 2 b. W. bancrofti Prevalence Rates, By Age and Sex, Indanan, Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	107	-	0	89	2	2.2	196	2	1.0
6-10	177	21	11.9	146	13	8.9	323	34	10.5
11-15	50	7	14.0	48	7	14.6	98	14	14.3
16-20	42	6	14.3	33	6	18.2	75	12	16.0
21-25	43	13	30.2	32	8	25.0	75	21	28.0
26-30	46	15	32.6	51	17	33.3	97	32	33.0
31-35	29	8	27.6	45	8	17.8	74	16	21.6
36-40	48	13	27.1	65	18	27.7	113	31	27.4
41-45	23	4	17.4	22	7	31.8	45	11	24.4
46-50	10	3	30.0	17	5	29.4	27	8	29.6
51-55	4	1	25.0	8	1	12.5	12	2	16.7
56-60	12	6	50.0	9	2	22.2	21	8	38.1
61 & over	3	2	66.7	13	3	23.1	16	5	31.2
TOTAL	594	99	16.7	578	97	16.8	1,172	196	16.7

Table 3 c. W. bancrofti Prevalence Rates, By Age and Sex, Bilaan (Talipao), Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
-5	28	-	0	18	-	0	46	-	0
-10	53	3	5.7	39	5	12.8	92	8	8.7
-15	24	4	16.7	15	2	13.3	39	6	15.4
-20	27	5	18.5	24	4	16.7	51	9	17.6
-25	17	4	23.5	9	2	22.2	26	6	23.1
-30	22	3	13.6	16	1	6.2	38	4	10.5
-35	7	2	28.6	8	3	37.5	15	5	33.3
-40	3	-	0	9	-	0	12	-	0
-45	18	5	27.8	13	3	23.1	31	8	25.8
-50	3	1	33.3	3	-	0	6	1	16.7
-55	2	1	50.0	5	-	0	7	1	14.3
-60	1	-	0	1	-	0	2	-	0
& over	6	3	50.0	2	-	0	8	3	37.5
TAL	211	31	14.7	162	20	12.3	373	51	13.7

Table 2 d. W. bancrofti Prevalence Rates, By Age and Sex, Luuk (Camp Andres), Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	30	-	0	46	1	2.2	76	1	1.3
6-10	71	4	5.6	43	6	14.0	114	10	8.8
11-15	20	3	15.0	26	3	11.5	46	6	13.0
16-20	24	5	20.8	7	2	28.6	31	7	22.6
21-25	29	6	20.7	9	1	11.1	38	7	18.4
26-30	35	11	31.4	29	4	13.8	64	15	23.4
31-35	17	2	11.8	15	3	20.0	32	5	15.6
36-40	25	11	44.0	26	6	23.1	51	17	33.3
41-45	12	1	8.3	15	2	13.3	27	3	11.1
46-50	15	7	46.7	7	2	28.6	22	9	40.9
51-55	3	1	33.3	4	1	25.0	7	2	28.6
56-60	8	1	12.5	4	2	50.0	12	3	25.0
61 & over	2	-	0	7	6	85.7	9	6	66.7
TOTAL	291	52	17.8	238	39	16.4	529	91	17.2

Table 3 c. W. bancrofti Prevalence Rates, By Age and Sex, Maimbung, Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	29	-	0	20	-	0	49	-	0
6-10	33	-	0	27	2	7.4	60	2	3.3
11-15	36	2	5.6	23	-	0	59	2	3.4
16-20	9	-	0	3	-	0	12	-	0
21-25	23	5	21.7	13	2	15.4	36	7	19.4
26-30	15	2	13.3	8	1	12.5	23	3	13.0
31-35	3	-	0	7	1	14.3	10	1	10.0
36-40	4	1	25.0	7	1	14.3	11	2	18.2
41-45	7	-	0	8	-	0	15	-	0
46-50	3	-	0	1	-	0	4	-	0
51-55	2	1	50.0	5	-	0	7	1	14.3
56-60	-	-	-	-	-	-	-	-	-
61 & over	2	-	0	4	-	0	6	-	0
TOTAL	166	11	6.6	126	7	5.6	292	18	6.2

Table 3 f. W. bancrofti Prevalence Rates, By Age and Sex, Pamanc (Sait), Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	30	-	0	37	4	10.8	67	4	6.0
6-10	32	4	12.5	24	1	4.2	56	5	8.9
11-15	8	1	12.5	14	1	7.1	22	2	9.1
16-20	8	3	37.5	5	1	20.0	13	4	30.8
21-25	14	4	28.6	9	-	0	23	4	17.4
26-30	13	4	30.8	16	6	37.5	29	10	34.5
31-35	10	5	50.0	11	2	18.2	21	7	33.3
36-40	10	1	10.0	11	1	9.1	21	2	9.5
41-45	6	1	16.7	7	2	28.6	13	3	23.1
46-50	4	1	25.0	7	-	0	11	1	9.1
51-55	6	3	50.0	6	1	16.7	12	4	33.3
56-60	1	1	100.0	2	-	0	3	1	33.3
61 & over	7	1	14.3	8	1	12.5	15	2	13.3
TOTAL	149	29	19.5	157	20	12.7	306	49	16.0

Table 8 a. W. Bancroft Prevalence Rates, By Age and Sex, Taglibi (Patikul), Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	33	1	3.0	25	-	0	58	1	1.7
6-10	38	6	15.8	44	2	4.5	82	8	9.8
11-15	1	-	0	4	-	0	5	-	0
16-20	8	1	12.5	5	3	60.0	13	4	30.8
21-25	20	6	30.0	8	1	12.5	28	7	25.0
26-30	20	6	30.0	20	2	10.0	40	8	20.0
31-35	8	2	25.0	7	-	0	15	2	13.3
36-40	14	4	28.6	9	3	33.3	23	7	30.4
41-45	14	4	28.6	9	2	22.2	23	6	26.1
46-50	13	3	23.1	16	1	6.2	29	4	13.8
51-55	6	6	100.0	3	-	0	9	6	66.7
56-60	3	1	33.3	1	-	0	4	1	25.0
61 & over	2	-	0	5	4	80.0	7	4	57.1
TOTAL	180	40	22.2	156	18	11.5	336	58	17.3

Table 3 h. *W. bancrofti* Prevalence Rates, By Age and Sex, Jolo, Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	21	-	0	22	-	0	43	-	0
6-10	53	1	1.9	35	1	2.8	88	2	2.3
11-15	42	1	2.4	13	-	0	55	1	1.8
16-20	33	3	9.1	12	-	0	45	3	6.7
21-25	20	1	5.0	16	-	0	36	1	2.8
26-30	32	3	9.4	22	-	0	54	3	5.6
31-35	6	1	16.7	10	-	0	16	1	6.2
36-40	15	-	0	12	1	8.3	27	1	3.7
41-45	11	1	9.1	15	-	0	26	1	3.8
46-50	4	-	0	6	-	0	10	-	0
51-55	-	-	0	4	-	0	4	-	0
56-60	3	-	0	3	-	0	6	-	0
61 & over	-	-	0	6	1	16.7	6	1	16.7
TOTAL	240	11	4.6	176	3	1.7	416	14	3.4

Table 3. *W. bancrofti* Prevalence Rates, By Age and Sex, Jolo Island, Sulu, 1966.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
1-5	369	2	0.5	358	8	2.2	727	10	1.4
6-10	634	43	6.8	512	33	6.4	1,146	76	6.6
11-15	242	24	9.9	193	13	6.7	435	37	8.5
16-20	175	24	13.7	148	23	15.5	323	47	14.6
21-25	205	42	20.5	131	15	11.4	336	57	17.0
26-30	222	49	22.1	229	32	14.0	451	81	18.0
31-35	114	26	22.8	167	18	10.8	281	44	15.6
36-40	149	33	22.1	176	31	17.6	325	64	19.7
41-45	104	16	15.4	107	16	15.0	211	32	15.2
46-50	62	17	27.4	77	8	10.4	139	25	18.0
51-55	32	13	40.6	40	3	7.5	72	16	22.2
56-60	32	11	34.4	29	5	17.2	61	16	26.2
61 & over	33	6	18.2	53	15	28.3	86	21	24.4
TOTAL	2,373	306	12.9	2,220	220	9.9	4,593	526	11.4

Table 4. W. bancrofti Prevalence Rates, By Sex and Municipality, Jolo Island, Sulu, 1966.

Municipality	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
Jolo	240	11	4.6	176	3	1.7	416	14	3.4
Taglibi (Patikul)*	180	40	22.2	156	18	11.5	336	58	17.3
Indanan	594	99	16.7	578	97	16.8	1,172	196	16.7
Bilaan (Talipao)	211	31	14.7	162	20	12.3	373	51	13.7
Panamao (Seit)	149	29	19.5	157	20	12.7	306	49	16.0
Luuk (Camp Andree)	291	52	17.8	238	39	16.4	529	91	17.2
Maimbung	166	11	6.6	126	7	5.6	292	18	6.2
Parang	542	33	6.1	627	16	2.6	1,169	49	4.2
TOTAL	2,373	306	12.9	2,220	220	9.9	2,593	526	11.4

Table 5 a. Intensity of Microfilaremia, By Sex, Parang, Sulu, 1966.

Microfilarial Count Per 20 mm^3 blood	Male	Female	Total
1-5	14	3	17
6-10	5	3	8
11-25	5	7	12
26-50	5	3	8
51-88	4	-	4
TOTAL	33	16	49

Note: Highest microfilarial count:
28 year-old male Mf: 88
18 year-old & 7 year-old females Mf: 43

Table 5 b. Intensity of Microfilaremia, By Sex, Indanan, Sulu, 1966

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	24	31	55
6-10	14	14	28
11-25	20	20	40
26-50	18	14	32
51-100	16	7	23
101-200	5	11	16
201-216	2	-	2
TOTAL	99	97	196

Note: Highest microfilarial count:
35 year-old male Mf: 216
48 year-old female Mf: 186

Table 5 c. Intensity of Microfilaremia, By Sex, Bilaan, Sulu, 1966.

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	7	1	8
6-10	1	3	4
11-25	8	5	13
26-50	5	6	11
51-100	6	4	10
101-156	4	1	5
TOTAL	31	20	51

Note: Highest microfilarial count:
45 year-old male Mf: 156
6 year-old female Mf: 124

Table 5 d. Intensity of Microfilaremia, By Sex, Luuk (Camp Andres) Sulu, 1966.

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	15	18	33
6-10	6	7	13
11-25	10	6	16
26-50	12	6	18
51-100	6	1	7
101-170	3	1	4
TOTAL	52	39	91

Note: Highest microfilarial count:
11 year-old male Mf: 160
24 year-old female Mf: 170

Table 5 e. Intensity of Microfilaremia, By Sex, Maimbung, Sulu, 1966.

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	1	2	3
6-10	-	2	2
11-25	6	2	8
26-49	4	1	5
TOTAL	11	7	18

Note: Highest microfilarial count:
12 year-old male Mf: 49
27 year-old female Mf: 33

Table 5 f. Intensity of Microfilaremia, By Sex, Panamao (Seit), Sulu, 1966.

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	6	3	9
6-10	4	3	7
11-25	9	5	14
26-50	4	5	9
51-100	5	3	8
101-177	1	1	2
TOTAL	29	20	49

Note: Highest microfilarial count:
21 year-old male Mf: 177
11 year-old female Mf: 114

Table 5 g. Intensity of Microfilaremia, By Sex, Taglibi, Sulu, 1966.

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	7	9	16
6-10	6	2	8
11-25	8	3	11
26-50	7	1	8
51-100	9	3	12
101-200	2	-	2
201-236	1	-	1
TOTAL	40	18	58

Note: Highest microfilarial count:
45 year-old male Mf: 326
19 year-old female Mf: 76

Table 5 h. Intensity of Microfilaremia, By Sex, Jolo, Sulu, 1966.

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	6	1	7
6-10	1	-	1
11-25	-	2	2
26-50	1	-	1
51-100	2	-	2
101-144	1	-	1
TOTAL	11	3	14

Note: Highest microfilarial count:
20 year-old male Mf: 144
10 year-old female Mf: 20

Table 6. Intensity of Microfilaremia, By Sex, Jolo Island, Sulu, 1966.

Microfilarial Count Per 20 mm^3 Blood	Male	Female	Total
1-5	80	68	148
6-10	37	34	71
11-25	66	50	116
26-50	56	36	92
51-100	48	18	66
101-200	16	14	30
201-326	3	-	3
TOTAL	306	220	526

Note: Highest Microfilarial Count:

45 year-old Male Mf: 326 (Tagliti)
48 year-old Female Mf: 196 (Indanan)

Table 7. Intensity of Microfilaremia Per 20 mm^3 Blood, By Age and Sex, Jolo Island, Sulu, 1966.

Age in Years	Male				Female			
	No. Exam.	No. Pos.	Total Mf. Count	Average Mf. Count Per Pos.	No. Exam.	No. Pos.	Total Mf. Count	Average Mf. Count Per Pos.
1-5	369	2	7	3.5	358	8	111	13.9
6-10	634	43	1,054	24.5	512	33	718	21.8
11-15	242	24	770	32.1	193	13	493	37.9
16-20	175	24	893	37.2	148	23	796	34.6
21-25	205	42	1,380	32.8	191	15	638	42.5
26-30	222	49	1,580	32.2	229	32	561	17.5
31-35	114	26	587	22.6	167	18	314	17.4
36-40	149	1.33	1,265	36.8	176	31	722	23.3
41-45	104	16	1,006	62.9	107	16	384	24.0
46-50	62	17	532	31.3	77	8	419	52.4
51-55	32	13	334	25.7	40	3	53	17.7
56-60	30	11	393	35.7	29	5	67	13.4
61 & over	33	6	341	56.8	53	15	294	19.6
TOTAL	2,373	306	10,092	33.0	2,220	220	5,570	25.3

Table 8. Median Microfilarial Counts of 8 Municipalities Per 20 mm^3 Blood, By Sex, Jolo Island, Sulu, 1966.

Municipality	Male	Female	Total
Jolo	5	14	7
Taglibi	23	5	17
Indanan	19	13	16
Bilaan	24	30	27
Panamao	19	22	20
Luuk (Camp Andres)	18	7	10
Maimbung	22	9	18
Parang	8	15	10
TOTAL	19	13	17

Table 9. *W. bancrofti* Prevalence Rates of New Admissions to the Sulu Public Hospital, March 29 to April 18, 1966, By Age and Sex.

Age in Years	Males			Females			Total		
	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.	Number Examined	No. Pos.	% Pos.
0-1	1	-	0	-	-	-	1	-	0
2-5	3	-	0	2	-	0	5	-	0
6-10	2	-	0	2	-	0	4	-	0
11-15	3	-	0	4	-	0	7	-	0
16-20	11	1	9.1	9	1	11.1	20	2	10.0
21-25	14	-	0	7	-	0	21	-	0
26-30	17	1	5.9	16	2	12.5	33	3	9.1
31-35	16	2	12.5	8	1	12.5	24	3	12.5
36-40	6	2	33.3	11	-	0	17	2	11.8
41-45	6	3	50.0	9	1	11.1	15	4	26.7
46-50	6	-	0	6	-	0	12	-	0
51-55	1	-	0	2	1	50.0	3	1	33.3
56-60	2	2	100.0	7	2	28.6	9	4	44.4
61 & over	3	-	0	-	-	-	3	-	0
Unknown	-	-	-	-	-	-	-	2	-
TOTAL	91	11	12.1	83	8	9.6	174	21	12.1

Table 10. Intensity of Microfilaremia of 526 W. bancrofti cases, By Presence or Absence of Purple Sheath, Jolo Island, Sulu, 1966.

ut purple th Microrial Count 20 mm³ blood	With Purple Sheath Microfilarial Count Per 20 mm³ Blood								
	0	1-5	6-10	11-25	26-50	51-100	101-156	Total	Per Cent of Total
01 - 265	-	-	-	-	-	1	-	1	0.2
01 - 200	1	1	2	2	2	1	-	9	1.7
51 - 100	9	5	3	8	8	7	2	42	8.0
26 - 50	10	12	10	15	8	1	1	57	10.8
11 - 25	12	18	14	29	9	4	2	88	16.7
6 - 10	15	22	10	13	3	2	-	65	12.4
1 - 5	59	52	31	17	7	1	-	167	31.8
0	-	58	13	12	6	4	4	97	18.4
OTAL	106	168	83	96	43	21	9	526	
Cent of otal	20.2	31.9	15.8	18.2	8.2	4.0	1.7		100.0

Table 11. Proportion of Land Area Planted with Abaca in 8 Municipalities of Jolo Island, Sulu, 1962.

MUNICIPALITY	Total Land Area in Hectares	Total Land Area Planted with Abaca in Hectares	Per Cent of Land Area Planted with Abaca
Indanan	5,517	1,550	28.1
Jolo	1,353	20	1.5
Luuk (Camp Andres)	23,503	950	4.0
Maimbung	6,600	350	5.3
Panamao (Seit)	8,757	400	4.6
Parang	16,329	950	5.8
Patikul (Taglibi)	13,744	900	6.5
Talipao (Bilaan)	16,650	405	2.4
TOTAL	92,453	5,525	6.0

Table 12. Areas of Abaca Grown in the Province of Sulu in Hectares By Municipality, 1962*.

MUNICIPALITY	No. of Barrios	Hectares
1. Balimbing	9	5
2. Bongao	17	6
3. INDANAN	18	1,550
4. JOLO	11	20
5. Cagayan de Sulu	15	3
6. LUUK	35	50
7. MAIMBUNG	13	350
8. Marungas (Bangas)	3	-
9. PANAMAO	19	400
10. Pangutaran	19	-
11. PARANG	37	950
12. Pata	13	5
13. PATIKUL	34	900
14. Siasi	30	105
15. Simunal	15	-
16. Sitangkay	13	-
17. South Ubian (Ubian Timbang)	15	-
18. TALIPAO	22	405
19. Tandu' Bas	32	-
20. Tapul	21	1
21. Tungkil	12	-
22. Turtle Island	1	-
TOTAL		5,650

* As reported by Ramon P. Yanga, Provincial Agriculturist, Jolo, Sulu, November 8, 1962.

Table 13. Natural Infections in Mosquitoes, Jolo Island, 1966

MOSQUITO (Species)	CARABAO - BAITED					HUMAN - BAITED				
	No. dissected	Number Positive Stages I	II	III	Per Cent Positive	No. dissected	Number Positive Stages I	II	III	Per Cent Positive
Anopheles vagus	9	-	-	-	-	-	-	-	-	-
" peditaeniatus	1	-	-	-	-	-	-	-	-	-
" karwari	1	-	-	-	-	-	-	-	-	-
" pseudo-barbirostris	-	-	-	-	-	3	-	-	-	-
Anopheles franciscoi	3	-	-	-	-	-	-	-	-	-
" subpictus	-	-	-	-	-	3	-	-	-	-
Aedes (Finlaya) poecilus	118	3[a]	-	1[b]	3.4	112	2[c]	6[d]	-	7.1
Aedes aegypti	1	-	-	-	-	-	-	-	-	-
" albopictus	1	-	-	-	-	-	-	-	-	-
Culex summorosus	33	-	-	-	-	-	-	-	-	-
" gelidus	20	-	-	-	-	-	-	-	-	-
" fuscocephalus	12	-	-	-	-	-	-	-	-	-
Armigeres joloensis	23	-	-	-	-	1	-	-	-	-
" malayi	174	-	-	-	-	5	-	-	-	-
" magnus	3	-	-	-	-	-	-	-	-	-
TOTAL	399	3	-	1	1.0	124	2	6	-	6.4

a - 73 larvae in the thorax
b - 4 larvae in the head and thorax
c - 29 larvae in the thorax
d - 23 larvae in the thorax

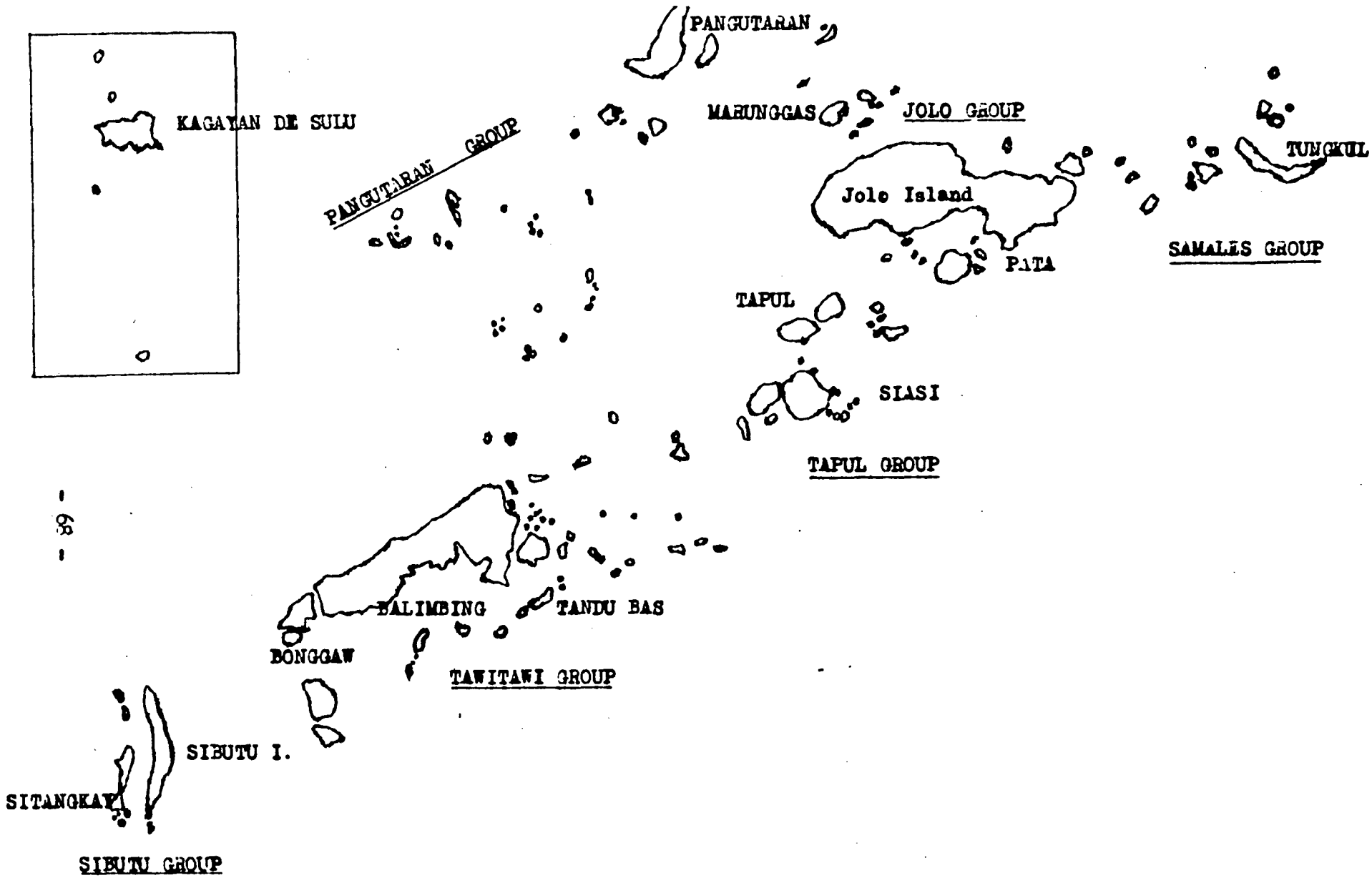


Fig. 1. Map of Sulu Archipelago.

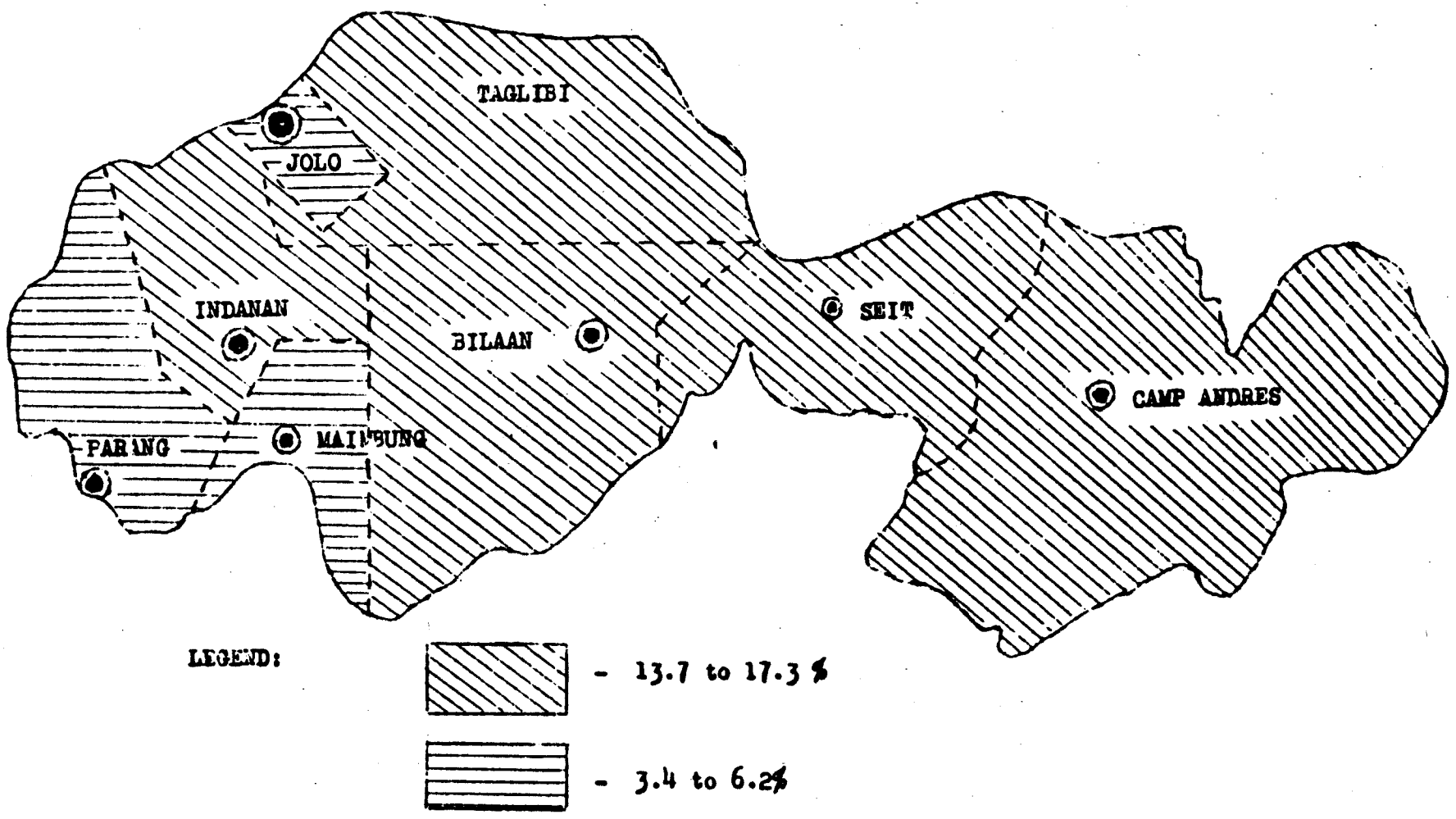


Fig. 2. Map of Jolo Island showing prevalence rates of bancroftian filariasis in the 8 municipalities, Sulu, 1966.

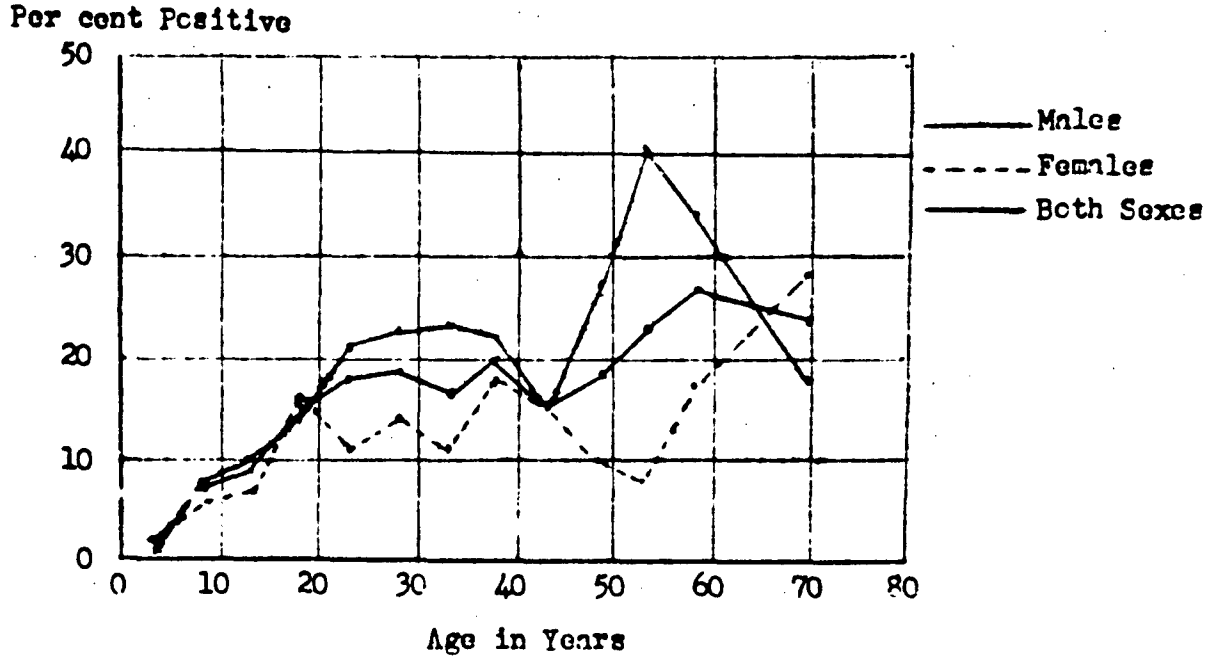
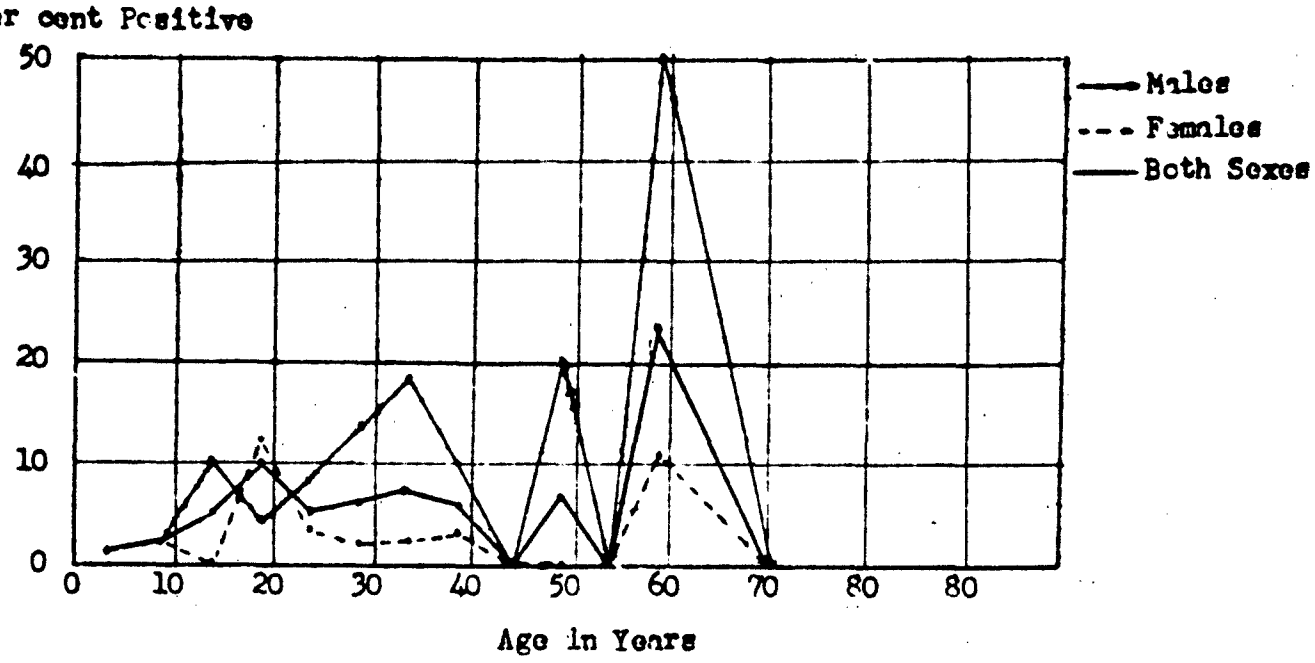


Figure 3. W. bancrofti Prevalence Rates, By Age and Sex, Jolo Island, Sulu, 1966.

(a) Parang, Sulu



(b) Indaran, Sulu

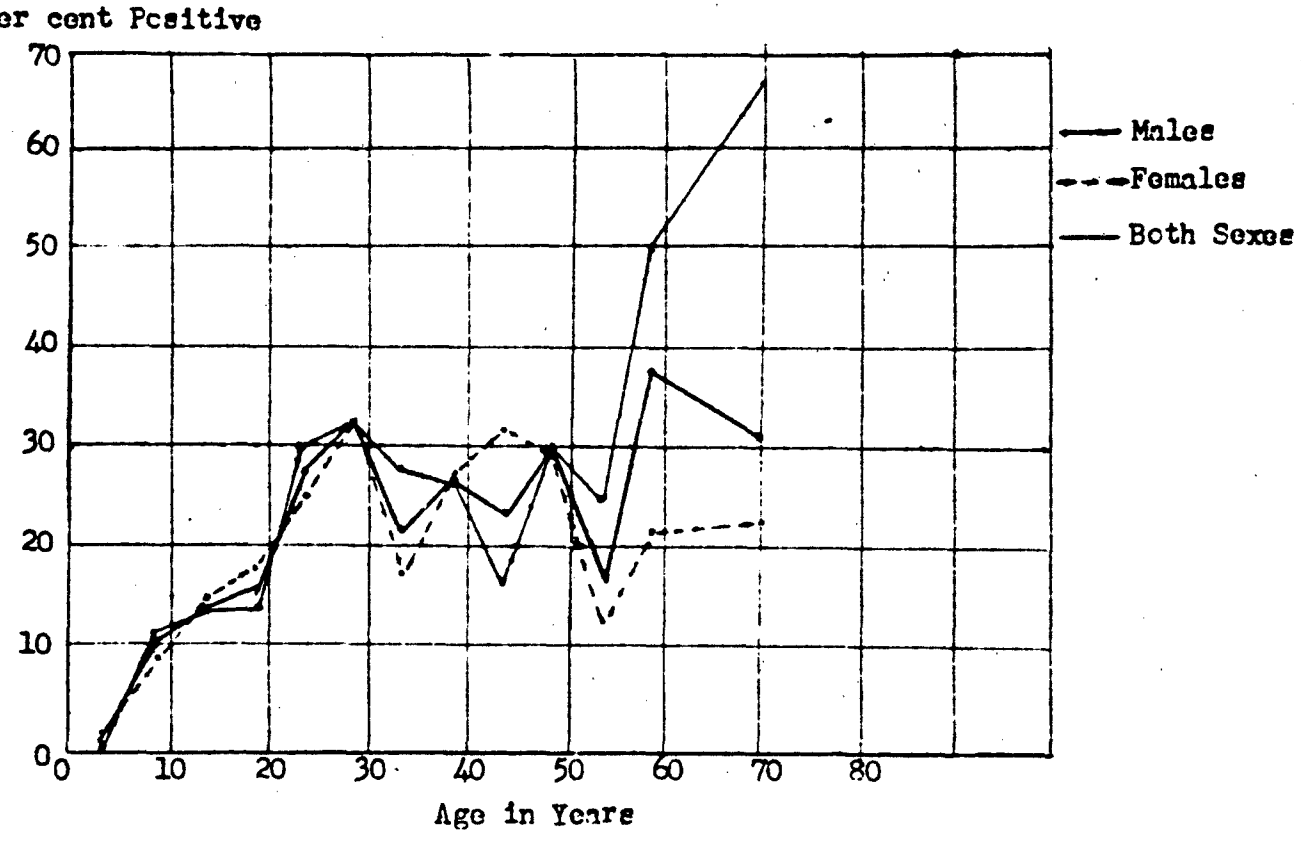
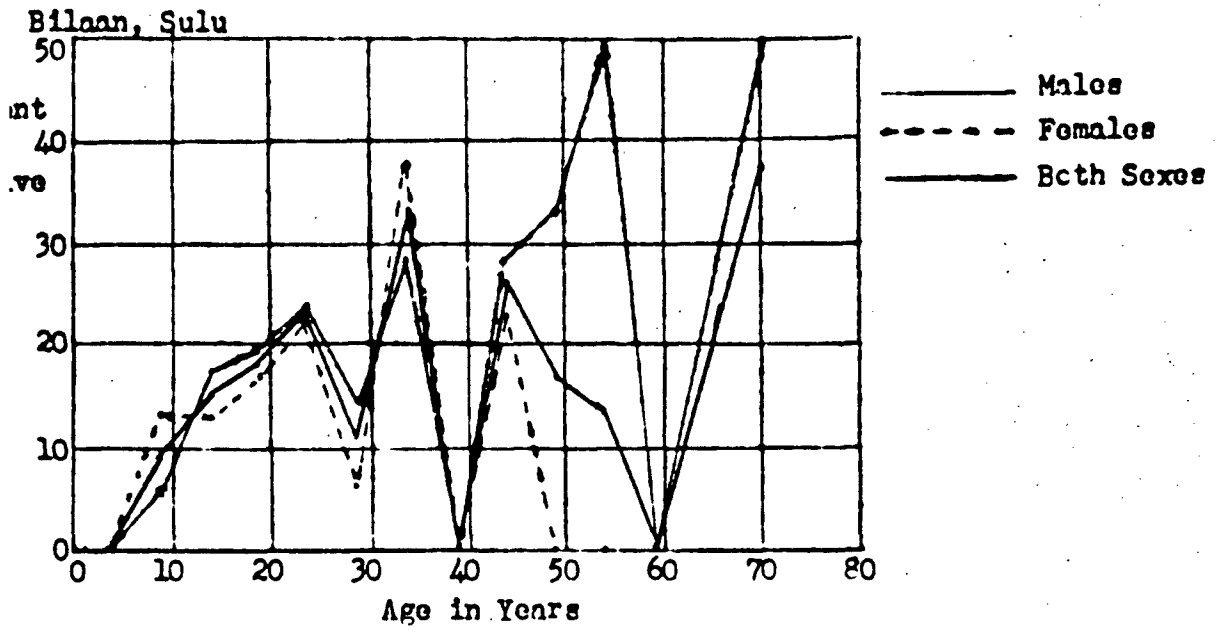


Figure 4a-b. W. Bancrofti Prevalence Rates of Municipalities, By Age and Sex, Jolo Island, Sulu, 1966.



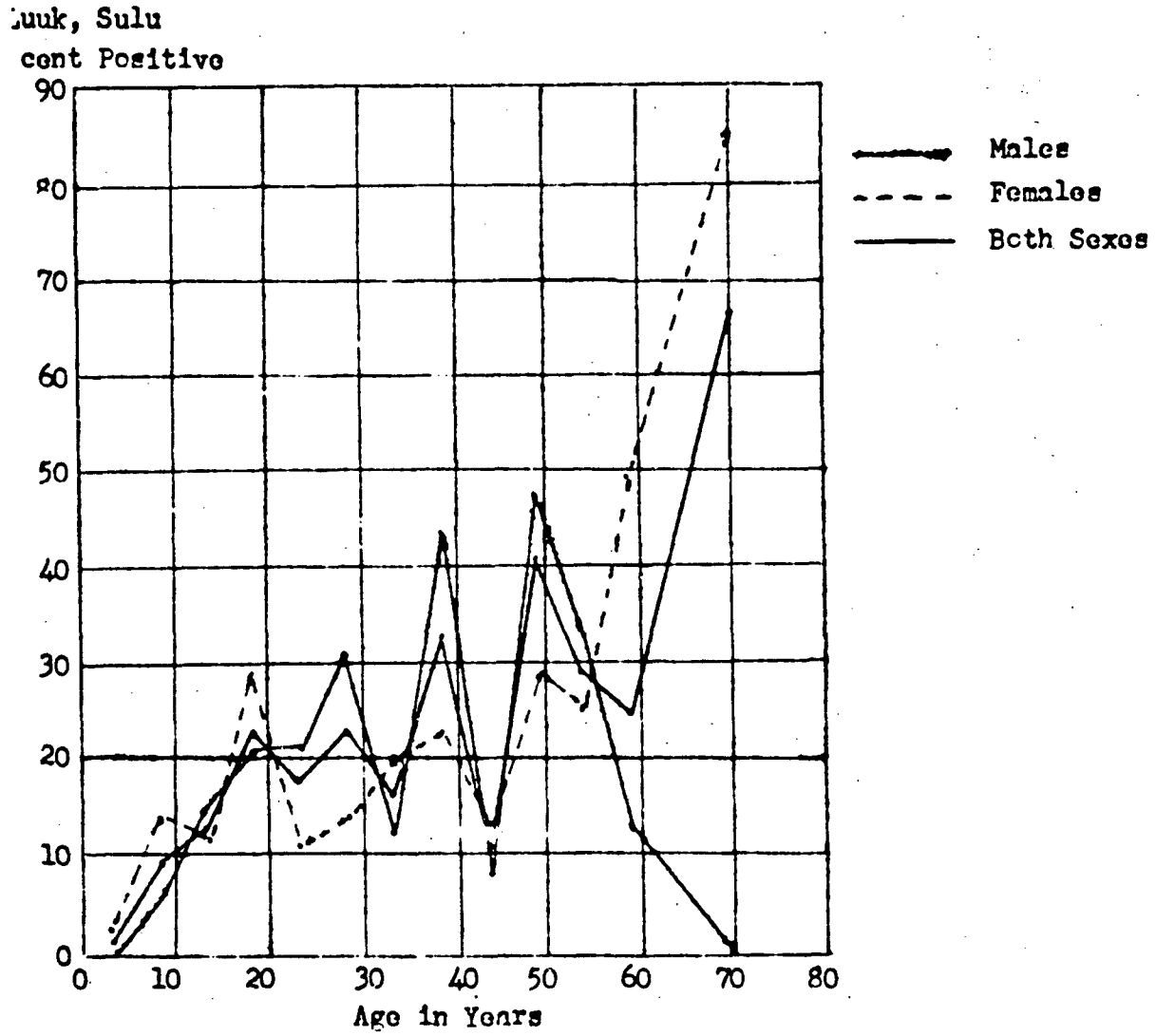
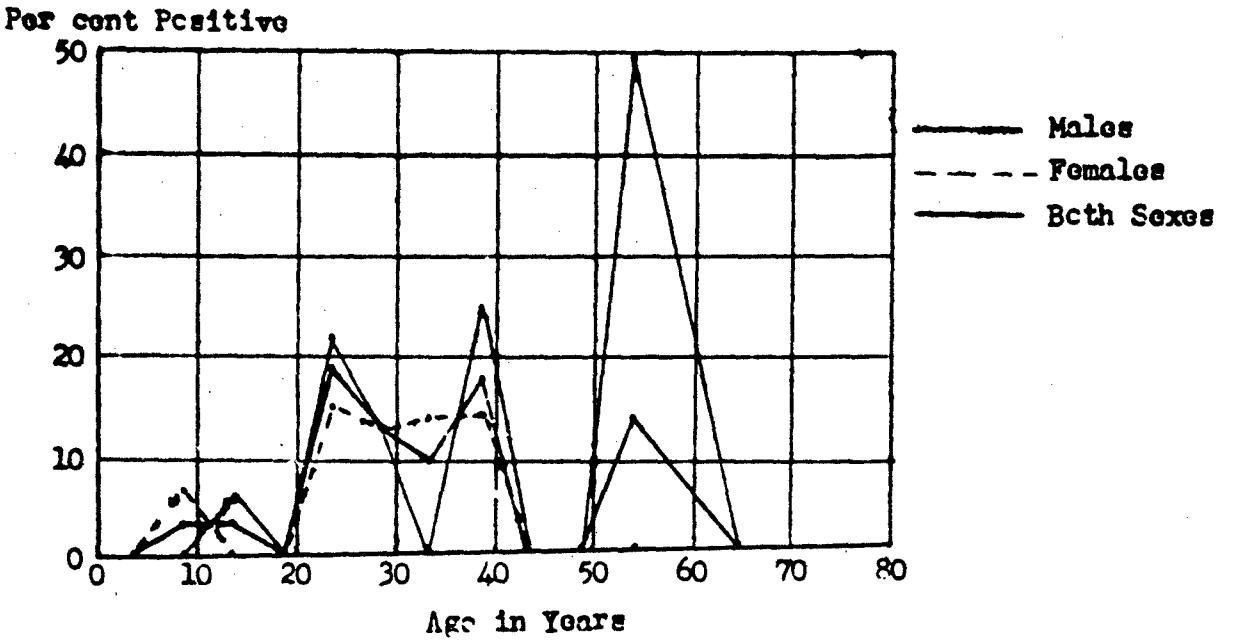


Figure 4 (Continued)

(e) Maimbung, Sulu



(f) Panamao, Sulu

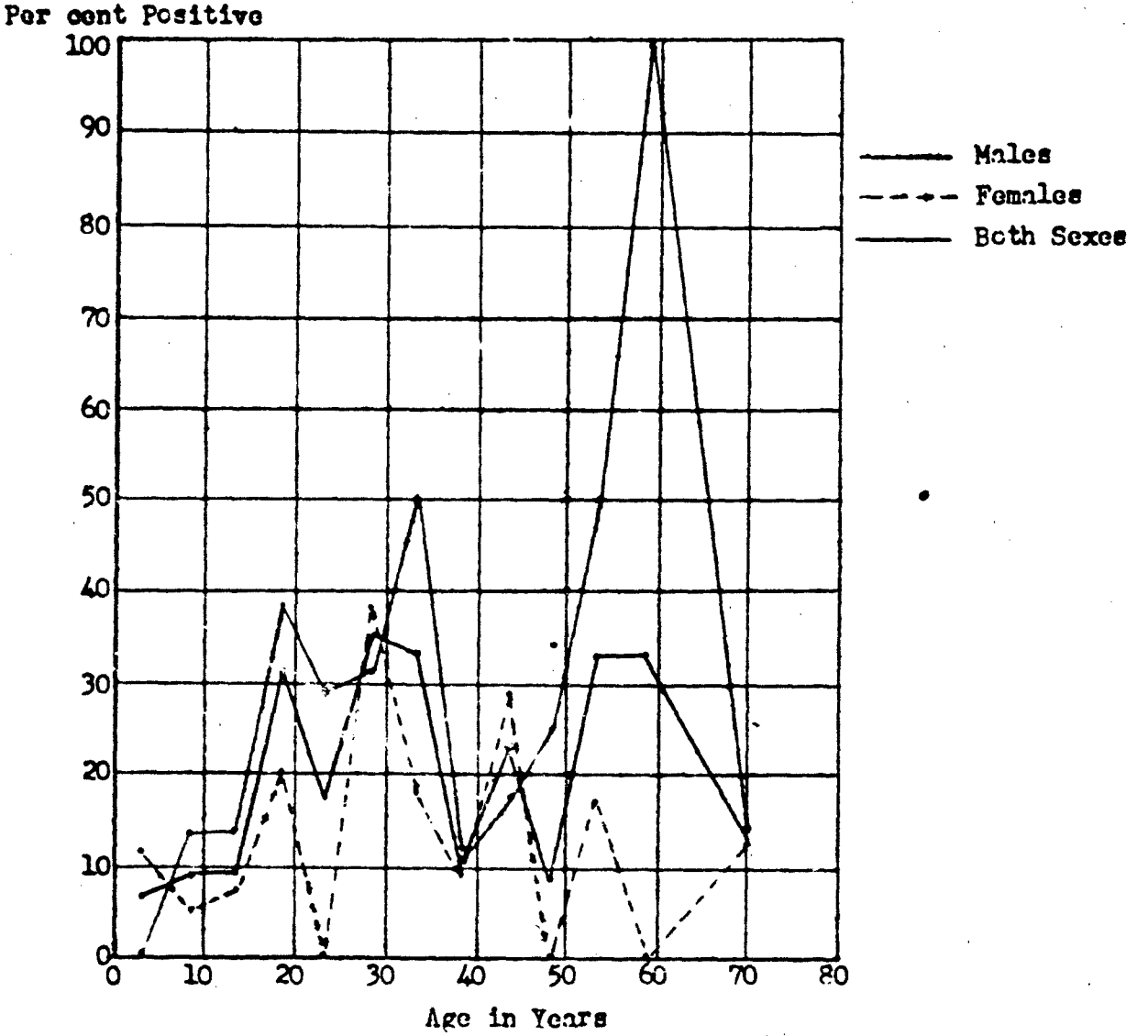
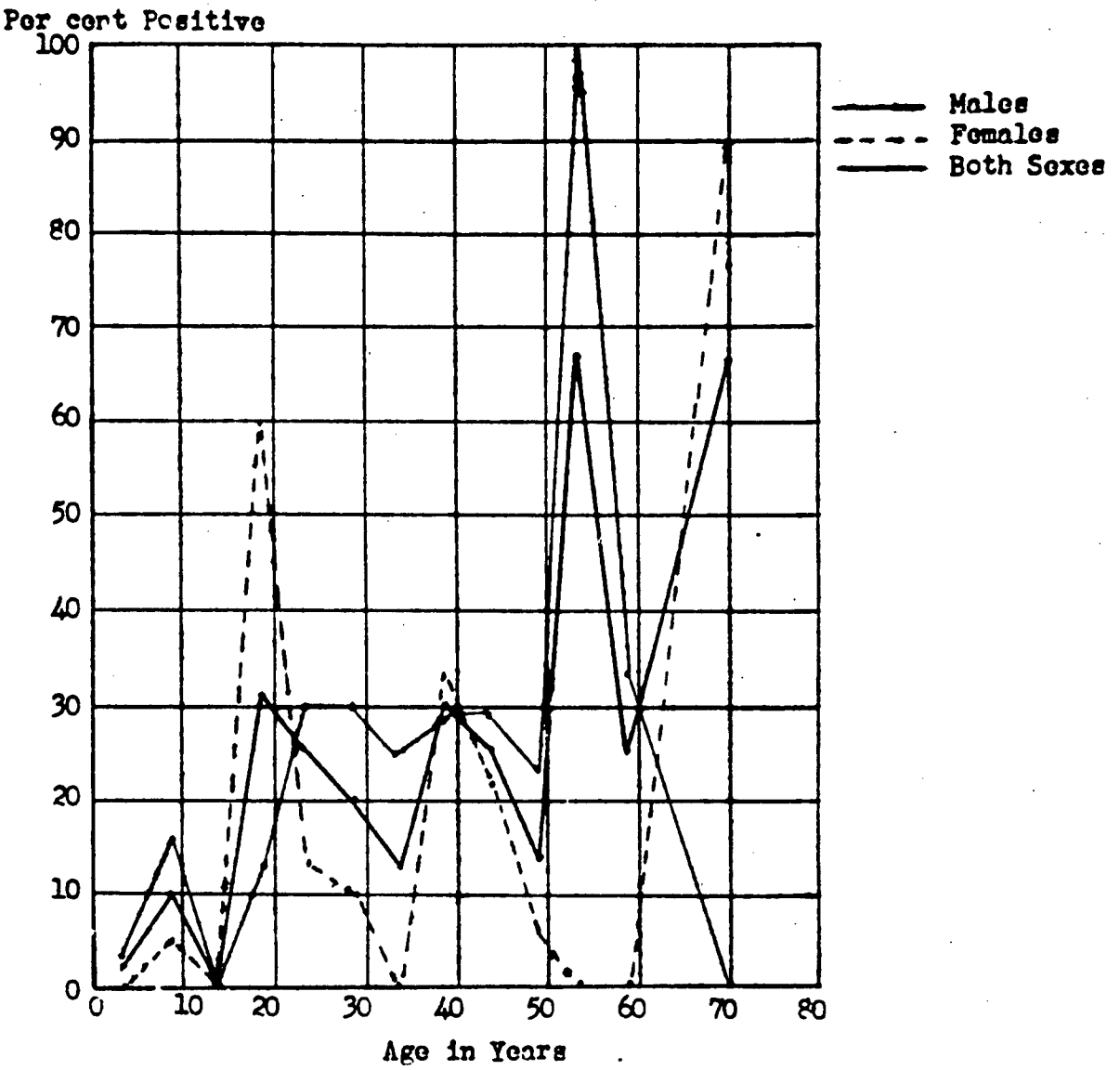


Figure 4 (Continued)

(g) Tagliti, Sulu



(h) Jolo, Sulu

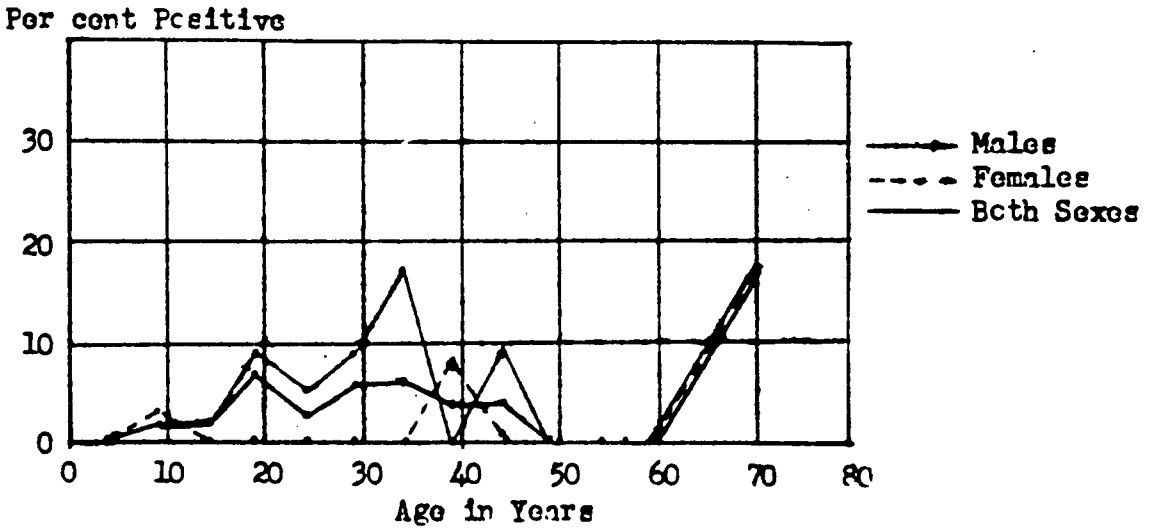


Figure 4 (Continued):

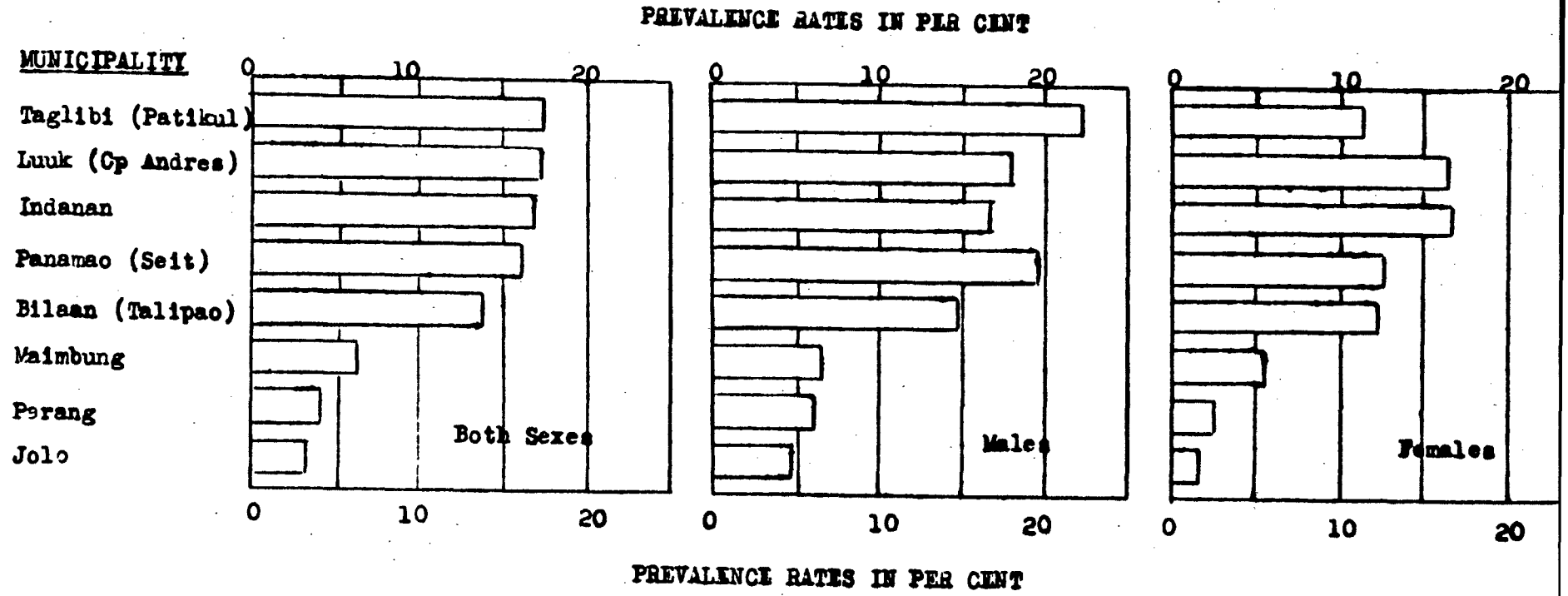


FIGURE 5. W. bancrofti Prevalence Rates of the 8 Municipalities, Jolo Island, Sulu, By Sex, 1966.

PART III

CLINICAL OBSERVATIONS OF MALAYAN FILARIASIS CASES TREATED WITH DIETHYLCARBAMAZINE (HETRAZAN) IN PALAWAN

Heretofore recognized filariasis cases in the Republic of the Philippines have been of the bancroftian type. Since malayan filariasis in the Philippines has only recently been reported for the first time[1,2], it was thought necessary to study the clinical signs and symptoms manifested by people suffering from this disease, and to determine their responses to a course of treatment with diethylcarbamazine. While the drug has been effective in the treatment of early or acute cases of clinical filariasis associated with lymphangitis and recurrent filarial fever and in clearing the blood of microfilariae among carriers[4], it was deemed worthwhile to set up an effective and a practical dosage schedule that would be applicable on a nationwide basis.

Materials and Methods

Our team left for Palawan in January this year to treat some of the people we previously found suffering from malayan filariasis[2]. We succeeded in gathering only 44 cases (28 males and 16 females) and 26 cases came from sitio Gungnan and 18 from sitio Kambing of barrio Panitian, Quezon. Of the 44 cases, 39 had microfilaremia, and 5 although negative for microfilariae, were considered clinical cases because of enlarged legs. The ages of these with microfilaremia ranged from 2 to 52 years with microfilarial counts ranging from 1 to 196 per 20 mm^3 blood.

At about eight O'clock in the evening, a 20 mm^3 of blood was taken from each patient's finger; this was followed by a physical examination. A pre-treatment temperature reading was taken and together with all other data, were recorded in individual treatment forms.

As early as seven o'clock the following morning, another temperature reading was made, followed by the administration of diethylcarbamazine at a dose of 6 mg/kg body weight. In order to determine the initial appearance of fever following the first dose of the drug during the first day of treatment, temperature readings were made every two hours for the first twelve hours. Another measured sample of blood was extracted from each patient, twelve hours after the drug was given. All other symptoms during this first day were also recorded. From the second to the twelfth day of treatment, temperature readings were obtained only three times daily. Measured blood samples were taken nightly since it is at this time that the microfilarial density is highest.

Results

Physical findings. - The physical findings of the patients included in this study are shown in table 1. Thirteen of the cases (8 males and 5 females) manifested no clinical signs. Among those with clinical symptoms

the most common were enlarged epitrochlear (26 cases) and inguinal (21 cases) lymph glands. One appeared to be an early elephantiasis of the scrotum.

Microfilarial count in relation to highest body temperature. - Table 2 presents the relationship between microfilarial density with highest body temperature obtained during the course of treatment. Six or 13.6 per cent, showed maximum body temperature greater than 40 degrees centigrades; 37 to 84.0 per cent had maximum body temperatures higher than 38 degrees centigrade. All the 23 cases with microfilarial counts of 11 and above attained highest body temperatures ranging from 38.5 to 40.4 degrees centigrade. It must be noted however, that a 13 year-old male with a microfilarial count of 9 per 20 mm^3 of blood reached the higest body temperature recorded (40.6 degrees centigrade). With the dosage used in this study (6 mg/kg body weight daily for twelve days), fever reactions were higher among those with higher microfilarial counts, a finding in agreement with that of Sasa et al.(5)

On the basis of Sasa's criterion for "fever" of a temperature reading of at least 37.3 degrees centigrade, 42 or 95.5 per cent of the cases had fever. All the 31 cases with microfilarial counts of 4 or more per 20 mm^3 blood had temperatures of 38.1 degrees centigrade or higher. Of the 8 cases with microfilarial counts between 1-3, seven manifested fever ranging from 37.3 to 39.8 degrees. Only two, or 4.5 per cent of the cases were never febrile. These two cases had microfilarial counts of 0 and 1 respectively per 20 mm^3 of blood. Ten of the 44 cases (22.7 per cent) had low grade fever the night prior to drug administration.

Microfilarial count in relation to time interval between intake of drug and appearance of fever. - Table 3 shows the relationship between microfilarial count and the time required from intake of drug to first appearance of fever. It can be seen that 13 or 29.5 per cent were febrile at the start of treatment. Among the 27 cases who were afebrile at the commencement of treatment, 24 or 88.9 per cent took from 4 to 9 hours from initial intake of drug to appearance of fever. It can be seen that the higher the microfilarial density the earlier was the onset of fever. This is further illustrated in fig. 1.

Number of days with fever. - Table 4 shows the distribution of cases by number of days with fever. On the whole the average duration of fever is 3 days which generally appeared during the first day of treatment, as shown in fig. 1.

Relationship between microfilarial density and other side reactions. - Table 5 and fig. 2 summarizes the relationship between microfilarial density and the frequency of occurrence of other side reactions. All cases with a microfilarial density of 4 or higher, experienced chilliness during the treatment. Cases with counts of 11 or more experienced headache. Dizziness, nausea and vomiting were not related to microfilarial density

confirming the findings of Sasa et al.(5). On the average, 86.3 per cent f the cases experienced joint pains at various regions of the body together with headache; 84.0 per cent experienced chilliness; 61.3 per cent confined to bed; 29.5 per cent complained of dizziness; 20.4 per cent omited and 9.0 per cent had nausea. Among these who experienced joint ains, 3 had localized lymphadenitis occurring from the second to the ourth day after start of treatment and lasting for a few days. There ere 27 cases confined to bed due to various side reactions and these had icrofilarial counts ranging from 1 to 196 per 20 mm^3 blood. There were 1 cases who complained of vague abdominal pains. Table 6 shows that side eactions other than fever were observed as early as 5 hours. There were ases whose side reactions appeared two days after the start of treatment nd lasted from a few hours to about two days. It can be seen in this ame table that the most frequent side reactions occurring side by side ith fever are chilliness and headache. Joint pains although more numerous ppeared later (10 hours) and was experienced also among few afebrile cases.

The toxic reactions caused by diethylcarbamazine may be grouped into: 1) those due to the drug itself such as headache, dizziness, nausea and omiting and (2) those which are allergic in nature and secondary to the estruction of the parasites, such as fever, local inflammation around lood worms, pruritus, etc.(4).

Time interval from treatment to the disappearance of microfilariae n the blood. - Table 7 shows the time interval from administration of the rug to the complete disappearance of microfilariae in a measured sample f blood. This interval ranges from a few hours after drug intake to as ong as 9 days after. It is also shows that the higher the microfilarial ount at the start of treatment, the longer is the time required to clear he blood of microfilariae. Of the 39 microfilariae cases, one with 165 icrofilariae at the start of treatment, remained positive even after the ast dose of the drug.

Discussion

Various schedules of diethylcarbamazine administration have been sed in different countries. Kessel (1964) stated that in American Samoa, onthly administration of 6 mg/kg body weight for six months, following aily doses of 6 mg/kg body weight for six days, produced very good esults(6). Sasa et al.(1963) have shown that little difference is noted n the effect of the drug on the parasite so long as the total dosage is trictly followed.

As a standard regime of treatment, most workers recommend 6 mg/kg ody weight of diethylcarbamazine in single or divided doses at daily, eekly or monthly intervals for a total of 6-12 doses(4). The total of oses would amount to about 72 mg/kg body weight (3.2 gm for adults above 5; 2.5 gm for 12-14 and 1.6 gm for those under 11 years of age). This

treatment regime was shown to reduce the microfilarial count either to zero in most patients, or to negligible levels in a few instances(5). The administration of the drug had no appreciable effect among chronic cases with hydrocele, chylocele, chyluria and elephantiasis except to arrest further progress of the disease, presumably by the destruction of the parasite(4).

Sasa et al. have shown that efficacy of diethylcarbamazine in the treatment of microfilarial carriers or early clinical cases was directly related to the total dose of the drug in a given course of treatment. Total doses less than 30 mg/kg body weight failed to clear the blood of microfilariae and the microfilarial density usually returned to pre-treatment level after some time. On the other hand, total doses of about 70 mg/kg body weight or higher, gave negative post-treatment blood examination which was maintained for a number of years, except for a number of cases that still showed few microfilariae after a few months(5).

Since fever as well as other side reactions are directly related to microfilarial density, it is suggested that microfilarial count be performed on all patients before the start of drug administration. In this way the physician would be aware of what his patients may experience during the course of treatment, depending upon the microfilarial count.

In the present series of cases, the average duration of fever was three days after the start of treatment, but forty per cent had fever lasting for four days. Some of the patients manifested fever beyond 5 days, as seen in figure 1, but these were not considered as side reactions because there were intervening afebrile periods. We attributed this recurrence of fever to other causes such as respiratory tract infection or possibly an exacerbation of chronic malaria. Fever usually disappeared after 3 to 5 days despite the continuance of drug administration up to the twelfth day; this is in accord with the presumption that during the destruction of microfilariae, certain substances are released in the circulation which are pyrogenic in nature(4).

It was observed that side reactions in their order of frequency were joint pains, headache and the feeling of chilliness, etc. Joint pains were found in 86.3 per cent of our cases which were not experienced by patients with bancroftian filariasis as reported by Sasa et al.(5). Three of our patients developed localized lymphadenitis in the dorsal aspect of the thighs but without lymphangitis; again this finding was not observed by Sasa et al. among their bancroftian filariasis cases. It is presumed that localized lymphadenitis are usually associated with the presence of adult parasites in these inflamed areas which are destroyed in the tissue by the drug. This clinical sign appeared 2 to 4 days after the start of treatment and subsided after a few days. Sixty-one per cent of the cases were confined to bed because of various side reactions (as against 43 per cent of Sasa's cases) but were up and about after 1-2 days. The

ppearance and disappearance of these side reactions paralleled that of ever reaction. From the above comparisons, as well as from Hawking's bservations(4) it appears that fever and other side reactions are more rencunced in malayan than in bancroftian filariasis.

In general, patients with the lower microfilarial counts became lood smear negative earlier than those with higher counts. On the average, he measured blood samples became negative after 2.5 days following the dministration of diethylcarbamazine. One patient remained positive even fter the completion of the course of treatment. The microfilarial count n this particular case was reduced to a very negligible level, too low ven to infect the mosquito vector. A few cases with low microfilarial unts, however, took longer time for the blood smear to become negative.

Summary and Conclusion

A total of 44 persons with malayan filariasis coming from two sitios n Quezon municipality in Palawan were treated with diethylcarbamazine and heir responses to treatment evaluated. The do.e of diethylcarbamazine used n this report was 6 mg/kg body weight daily for 12 days or a total dose of 2 mg/kg.

Majority of cases had enlargement of epitrochlear and inguinal lymph lands; seven had elephantiasis of either the leg or scrotum, and about ne-third of the subjects showed no physical gns.

Microfilarial densities are directly related to the rise in tempera- ure - the higher the microfilarial count the higher the fever. Approximately 95 per cent of cases had fever ranging from 37.3° to 40.6° C. nd 89 per cent of them had fever from 4 to 9 hours after drug administra- ion. Fever appeared earlier among those with high microfilarial counts. he average duration of fever was about 3 days.

Microfilarial densities are likewise related to the appearance of ther side reactions such as joint pains, chilliness, headache, etc. - the igher the microfilarial density, the earlier these side reactions appeared. izziness, nausea and vomiting showed no definite relation to microfilarial ensity. These side reactions appeared as early as 5 hours after drug dministration to as late as 2 days after and lasted from a few hours to bout 2 days.

The time required to clear the measured blood sample of microfilariae s directly related to microfilarial density, that is, those with higher icrofilarial counts required longer time for the parasite to disappear ompletely in the peripheral blood smear.

Another side reaction observed was localized lymphadenitis but with- ut lymphangitis on the dorsal aspect of the thighs which appeared 2-4 days fter commencement of the drug and subsided a few days later.

References

1. Cabrera, B.D. and Rozeboom, L.E.: Filariasis in Palawan, Philippine Islands. Nature, 202:725, 1964.

2. Rozeboom, L.E. and Cabrera, B.D.: Filariasis Caused by Brugia malayi in the Republic of the Philippines. Am. Jour. of Epid., 81:200, 1964.

3. Cabrera, B.D. and Rozeboom, L.E.: The Periodicity Characteristics of the Filaria Parasites of Man in the Republic of the Philippines. Am. Jour. of Epid., 81:192,1964.

4. Hawking, F.: A Review of Progress in the Chemotherapy and Control of Filariasis since 1955. Bull. Wld. Hlth. Org., 27:855, 1962.

5. Sasa, M. et al.: Studies on Epidemiology and Control of Filariasis Observations on the carriers of Wuchereria bancrofti in the Amami Islands with special reference to the effects and side reactions of diethylcarbamazine. The Japanese Jour. of Exp. Med., 33:4, 1963.

6. Ciferri, F., Siliga, N., Long, G. and Kessel, J.F.: A Filariasis Control Programme in American Samoa. Working Paper presented at Inter-Regional Seminar on Filariasis WHO, Manila, Nov., 1965.

Table 1. Physical Findings of 44 Filaria Cases Treated with Diethylcarbamazine, Quezon, Palawan, 1966.

ysical Findings	Males		Females		Total	
	No.	%	No.	%	No.	%
ephantiasis:						
1. Right leg below the knee	1	3.6	1	6.2	2	4.5
2. Both legs below the knee	2	7.1	-	-	2	4.5
3. Scrotum	1	3.6	-	-	1	2.3
larged glands:						
1. Epitrochlear	17	60.7	9	56.2	26	59.1
2. Inguinal	20	71.4	1	6.2	21	47.7
3. Axillary	3	10.7	-	-	3	6.8
Clinical Symptoms	8	28.6	5	31.2	13	29.5
TAL NUMBER OF CASES	28		16		44	

Table 2. Microfilarial Counts and Highest Body Temperature of 44 Filaria Cases Treated, Quezon, Palawan, 1966.

Highest body temperature in degrees centigrade	Microfilarial Count ($20\ mm^3$)						
	0	1-3	4-10	11-30	31-100	101-196	Total
40.1 - 40.6	-	-	1*	2	1	2	6
39.7 - 40.0	-	2	2	1	4	2	11
39.3 - 39.6	-	1	-	4	4	-	9
38.9 - 39.2	-	-	4	-	2	-	6
38.5 - 38.8	-	-	-	-	1	-	1
38.1 - 38.4	1	2	1	-	-	-	4
37.7 - 38.0	3	1	-	-	-	-	4
37.3 - 37.6	-	1	-	-	-	-	1
37.2 or less	1	1	-	-	-	-	2
TOTAL	5	8	8	7	12	4	44

* 13 year-old male with only 9 microfilariae per $20\ mm^3$ blood.

Table 3. Distribution of Cases by Time Interval Between Intake of Drug to Appearance of Fever During First Day of Treatment, Quezon, Palawan, 1966.

Time Interval Between Intake of Drug to the Rise in Body Temperature to 37.3° C or greater in hours	Microfilarial Count (20 mm^3)						
	0	1-3	4-10	11-30	31-100	101-196	Total
10 - 12	-	1	-	1	1	-	3
9 -	-	-	1	-	1	-	2
8 -	-	-	1	-	-	-	1
7 -	-	1	-	1	1	1	4
6 -	1*	1	-	-	2	-	4
5 -	-	2	3	1	4	2	12
4 -	1*	-	-	-	-	-	1
Temperature 37.3°C or greater at the start of treatment	-	3	2	4	3	1	13
No temperature rise beyond 37.2°C	3*	1	-	-	-	-	4
TOTAL	5	9	7	7	12	4	44

* Clinical Cases

Table 4. Distribution of Cases by Number of Days with Fever, Quezon, Palawan, 1966.

Days with Fever	Number of Cases		
	Male	Female	Both Sexes
No fever	2	-	2
1	3	1	4
2	3	1	4
3	7	4	11
4	10	8	18
5	3	2	5
TOTAL	28	16	44

Table 5. Relationship Between Microfilarial Density and Other Side Reactions in the Course of Treatment of 44 Filarial Cases, Quezon, Palawan, 1966.

Microfilarial Count per 20 mm³	Other Side Reactions							Number Treated
	Joint Pains	Headache	Chilliness	Confined to Bed	Dizziness	Vomiting	Nausea	
101 - 196	4 (100%)	4 (100%)	4 (100%)	4 (100%)	2 (50%)	- (0%)	1 (25%)	4
31 - 100	11 (91.7%)	12 (100%)	12 (100%)	10 (83.3%)	3 (25.0%)	4 (33.3%)	1 (8.3%)	12
11 - 30	7 (100%)	7 (100%)	7 (100%)	6 (85.7%)	2 (28.6%)	2 (28.6%)	- (0%)	7
4 - 10	7 (87.5%)	6 (75%)	8 (100%)	4 (50%)	1 (12.5%)	2 (25%)	1 (12.5%)	8
1-3	5 (62.5%)	5 (62.5%)	4 (50.0%)	3 (37.5%)	2 (25.0%)	1 (12.5%)	- (0%)	8
0	4 (80%)	4 (80%)	2 (40%)	- (0%)	3 (60%)	- (0%)	1 (20%)	5
TOTAL	38 (86.3%)	38 (86.3%)	37 (84.0%)	27 (61.3%)	13 (29.5%)	9 (20.4%)	4 (9.0%)	44

Table 6. Daily Records Frequency Distribution of Filaria Cases Treated, By Time of Observation after Start of Treatment and Side Reactions, Quezon, Palawan, 1966.

ne of Obser-tion after art of treat-ment	Number Exam-ined	Body Temperature		Other Side Reactions						
		Less than 37.3°C	37.3°C and over	Joint Pains	Head-ache	Chilli-ness	Con-fined to bed	Dizzi-ness	Vomit-ing	Nau-sea
5 hours	13	2	11	2	1	3	1	2	-	-
7 hours	13	-	13	2	5	8	3	1	-	-
10 hours	29	2	27	12	11	22	10	-	-	-
1 day	34	15	19	19	13	14	10	3	3	1
2 days	44	20	24	22	10	4	16	3	5	2
3 days	41	27	14	21	3	1	1	1	1	2
4 days	41	36	5	10	2	-	-	1	-	-
5 days	15	14	1	2	—	-	-	-	-	-
6 days	36	22	14	-	-	-	-	-	-	-
7 days	17	5	12	-	-	-	-	-	-	-
8 days	29	23	6	-	-	-	-	-	-	-
11 days	21	11	10	-	-	-	-	-	-	-

NOTE: 10 of the 44 cases were febrile before treatment.

Table 7. Time Interval From Treatment to Disappearance of Microfilariae Among Filaria Cases Treated, Quezon, Palawan, 1966.

ne Interval m Treatment Disappearance Microfilariae	Microfilarial Counts at start of Treatment					
	1-3	4-10	11-30	31-100	101-196	Total
Fore treatment	8	8	7	12	4	39
5 hours	-	1	-	-	-	1
10 hours	-	2	-	1	-	3
11 hours	-	1	-	-	-	1
12 hours	5	1	1	-	-	7
13 hours	-	-	1	-	-	1
14 hours	-	1	1	-	-	2
2 days	2	1	2	2	1	8
3 days	-	1	-	6	-	7
4 days	-	-	-	1	-	1
5 days	1	-	1	-	-	2
6 days	-	-	1	1	1	3
7 days	-	-	-	-	1	1
9 days	-	-	-	1	-	1
12 days	-	-	-	-	1*	1

till positive on the 12th day.

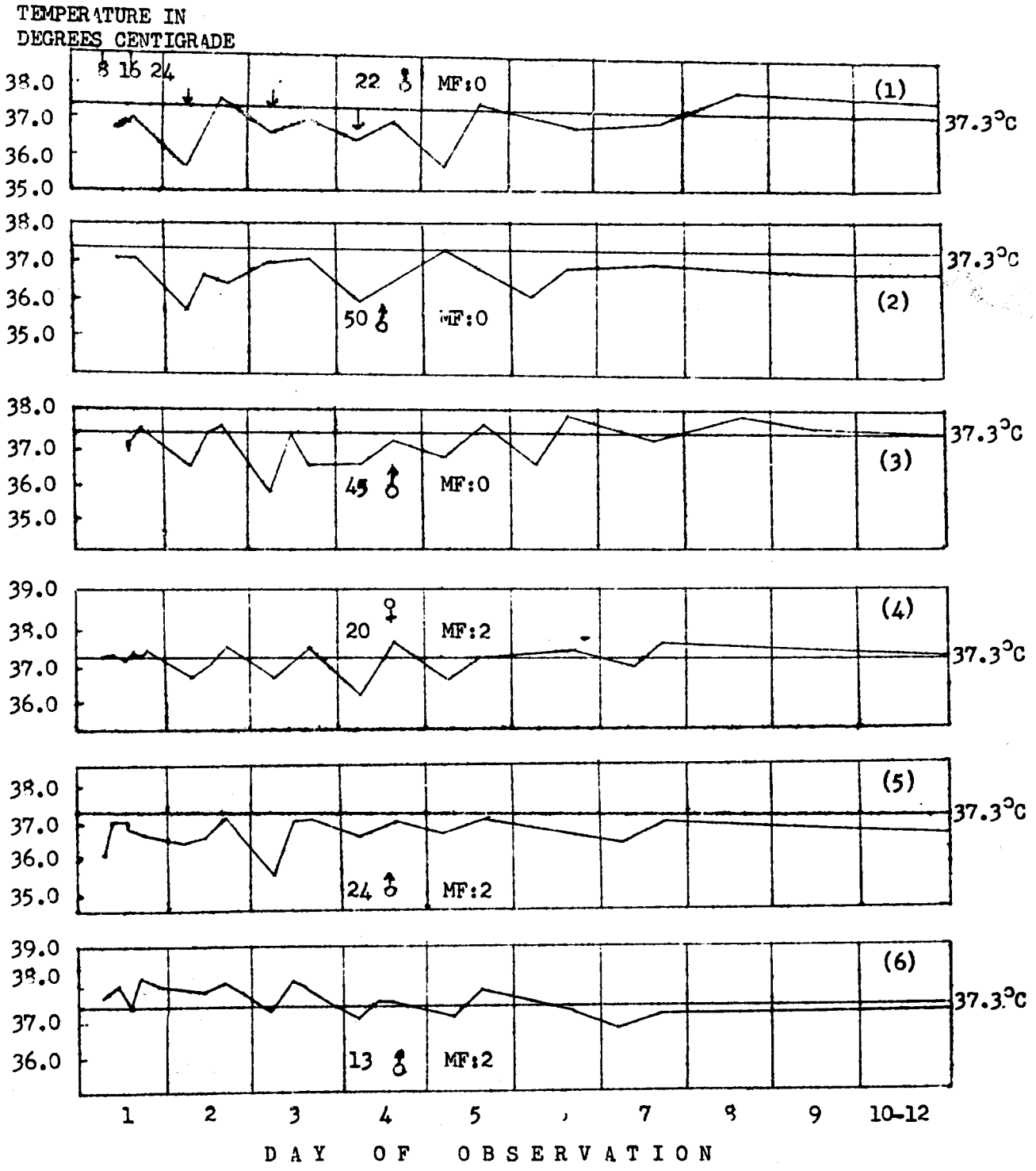


Fig. 1. Body Temperature Changes of Patients in the Course of Treatment, Quezon, Palawan, 1966.

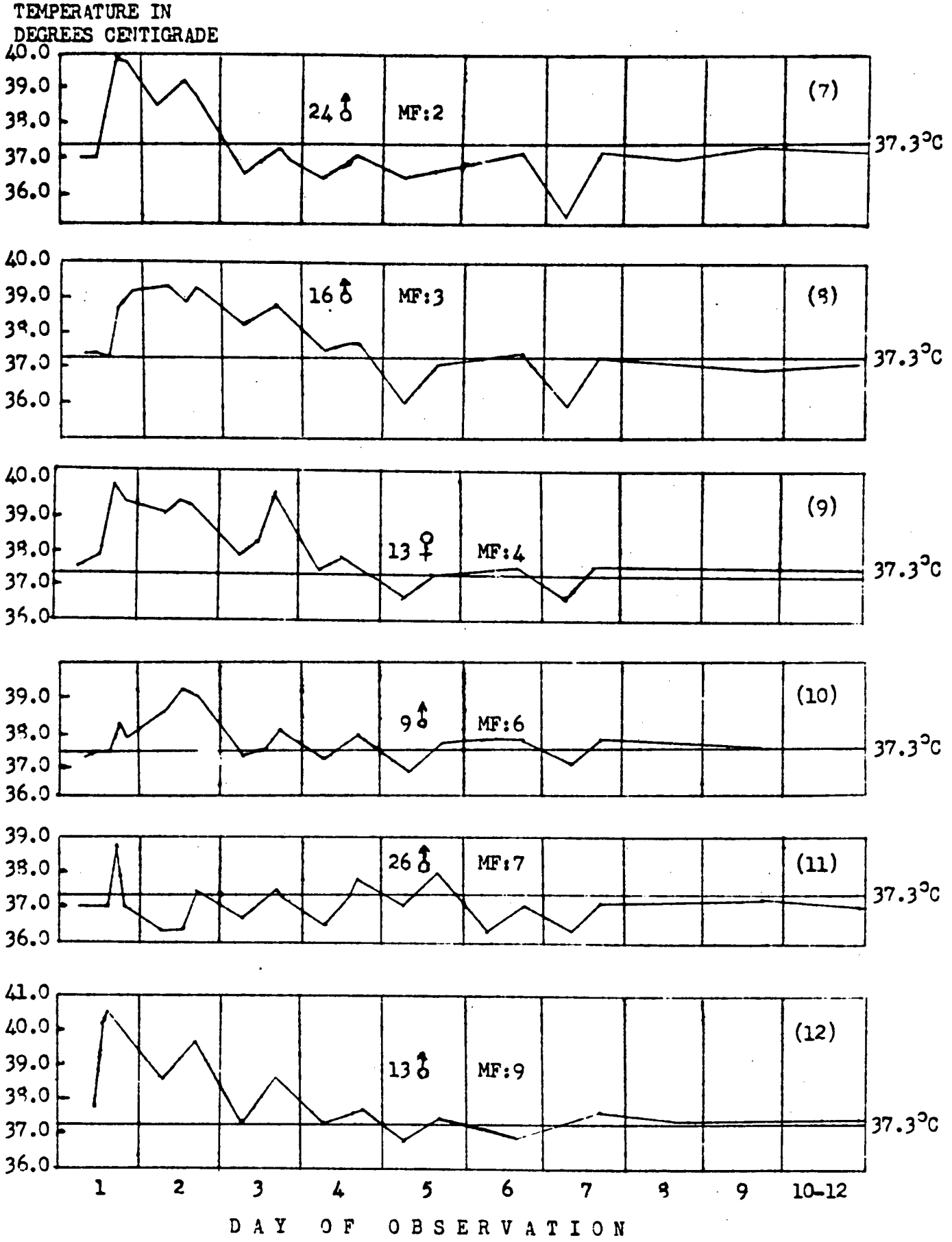


Fig. 1. (Continued)

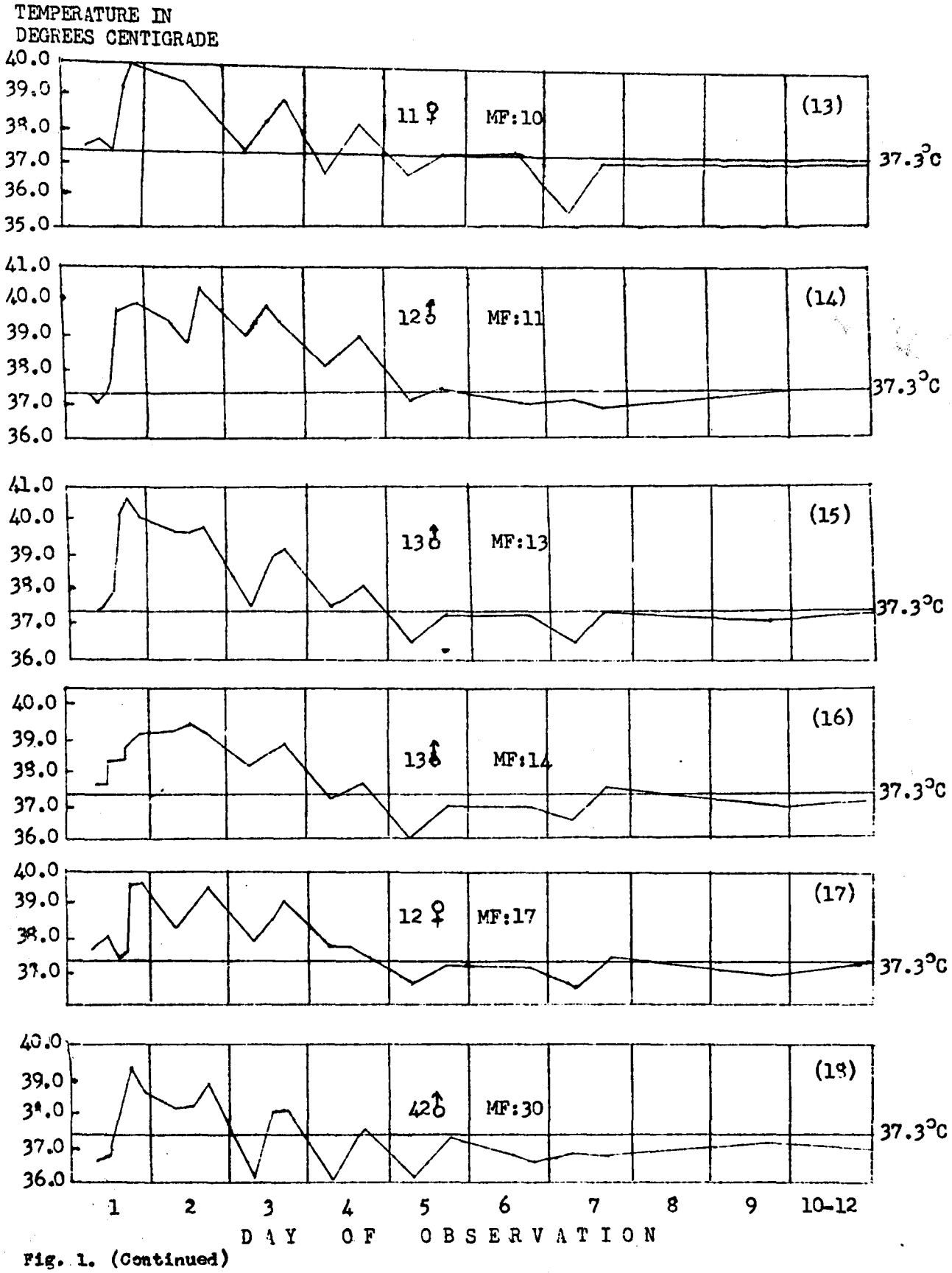
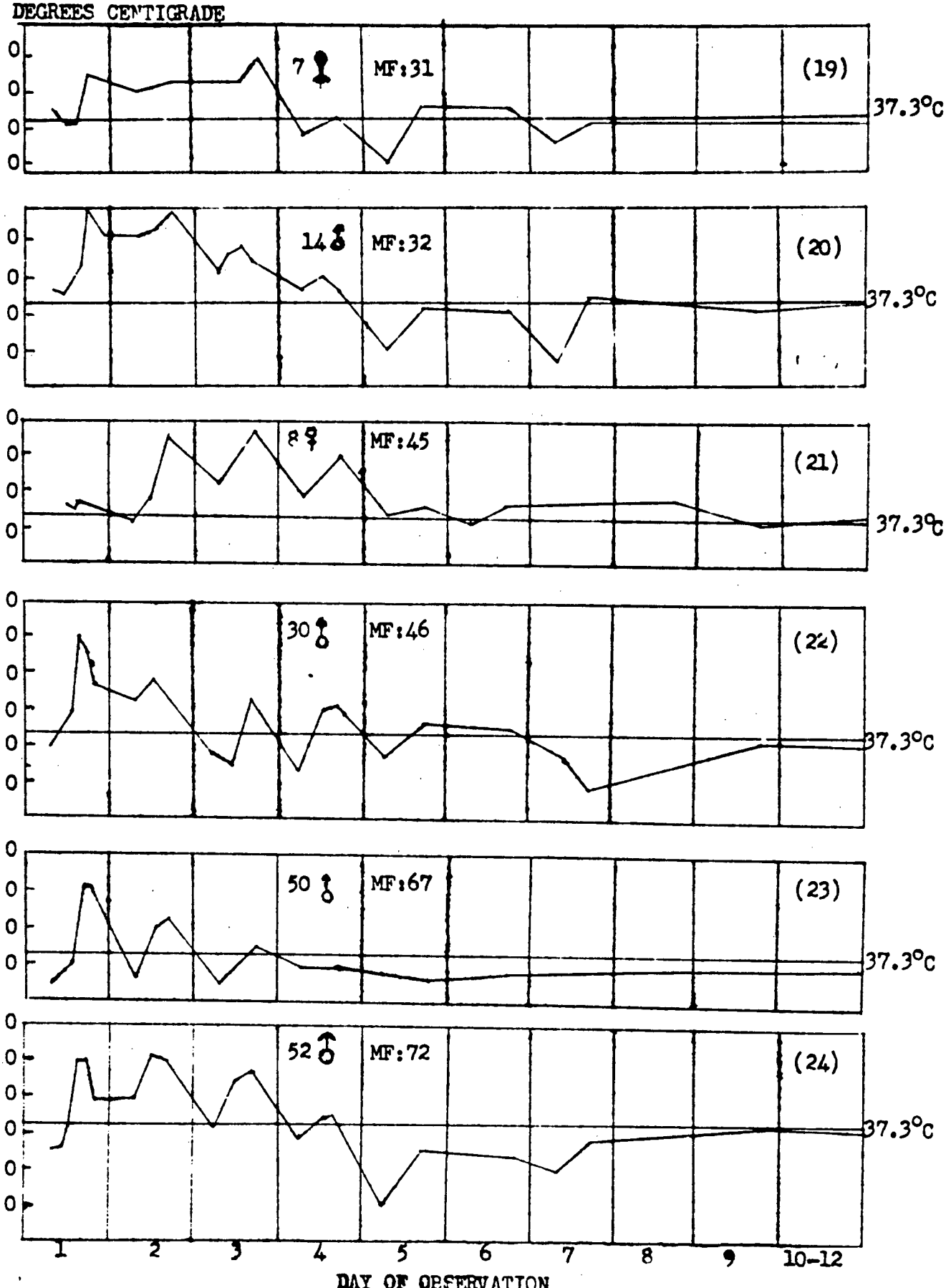


Fig. 1. (Continued)



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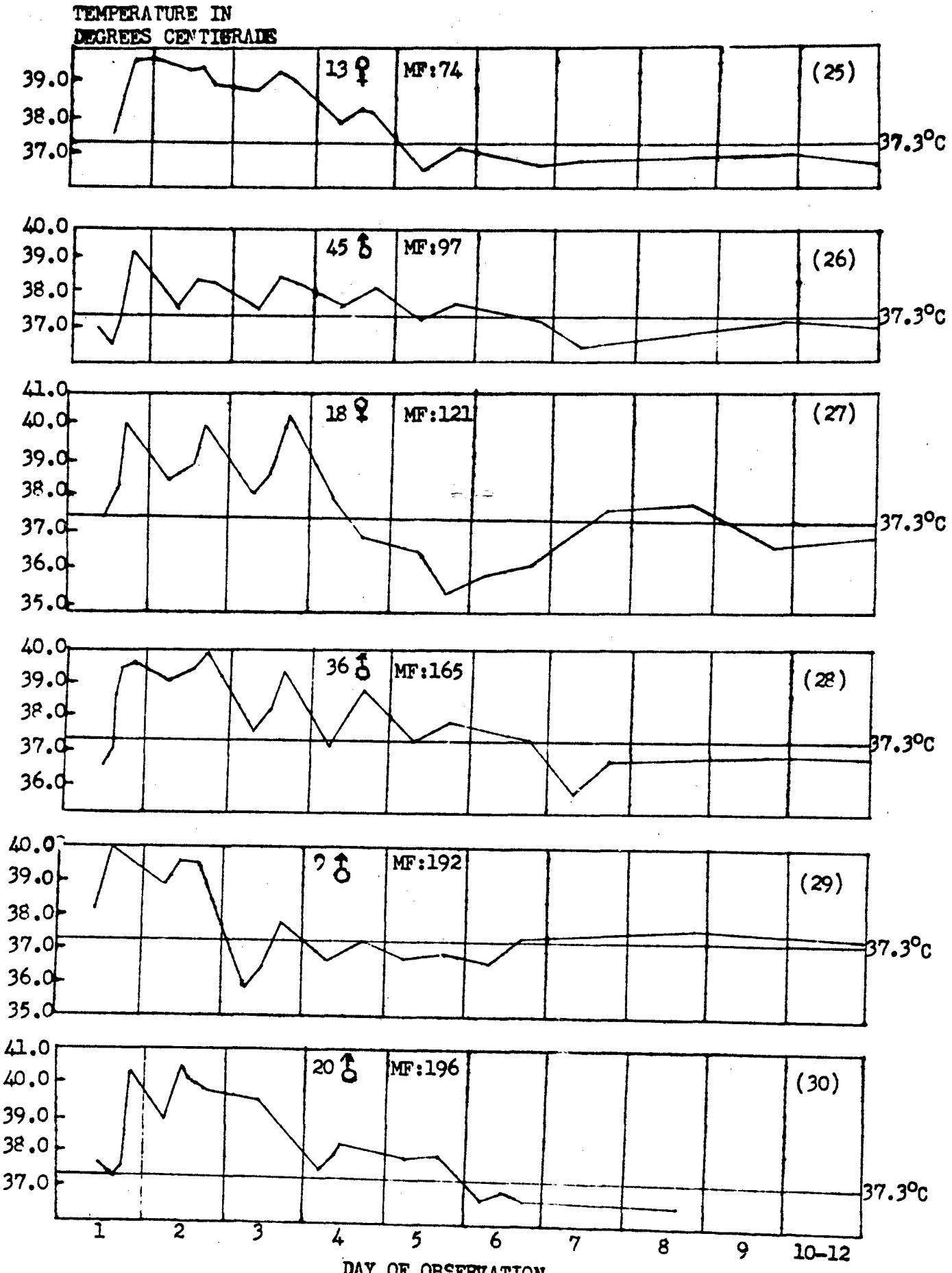

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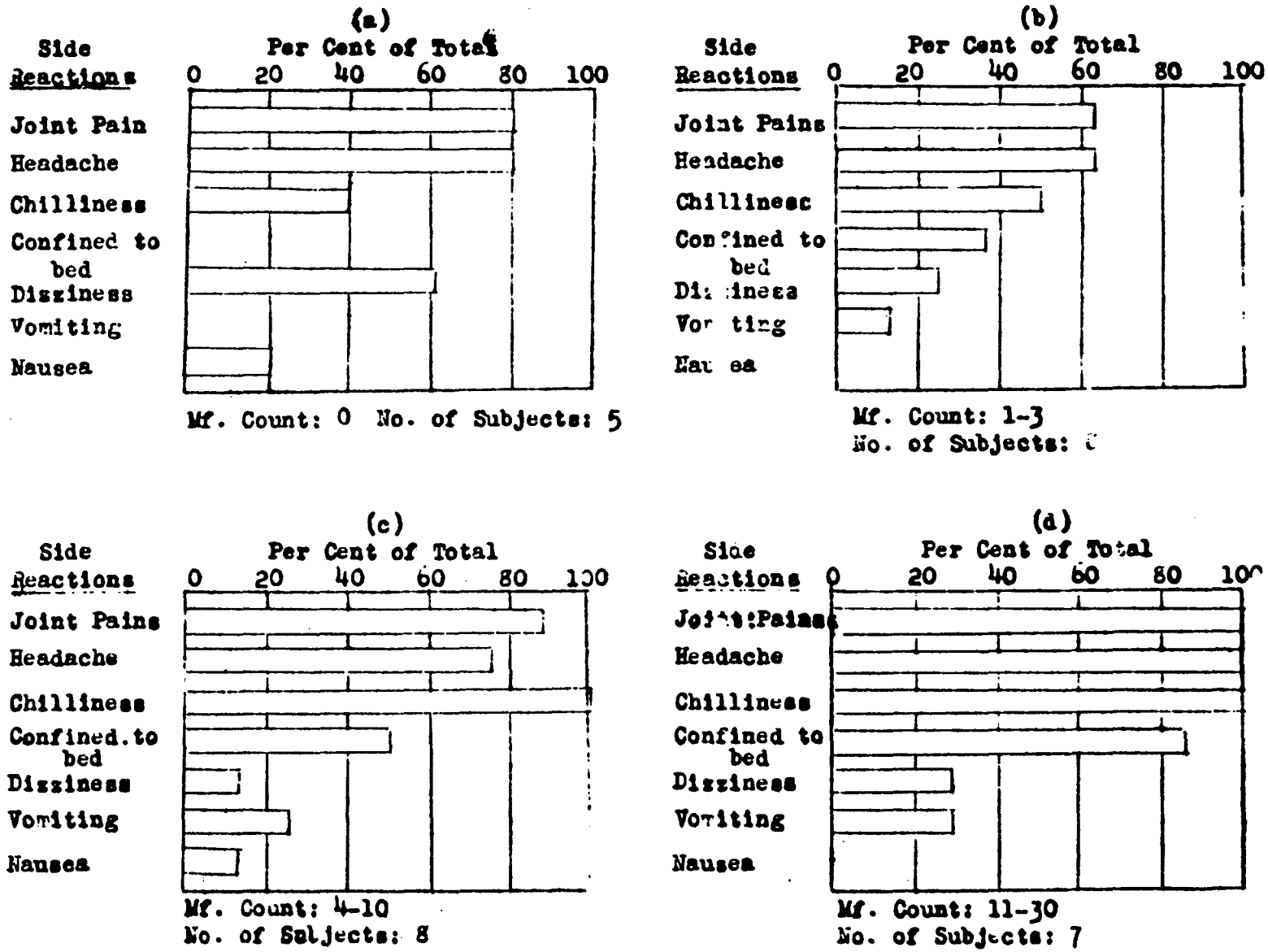
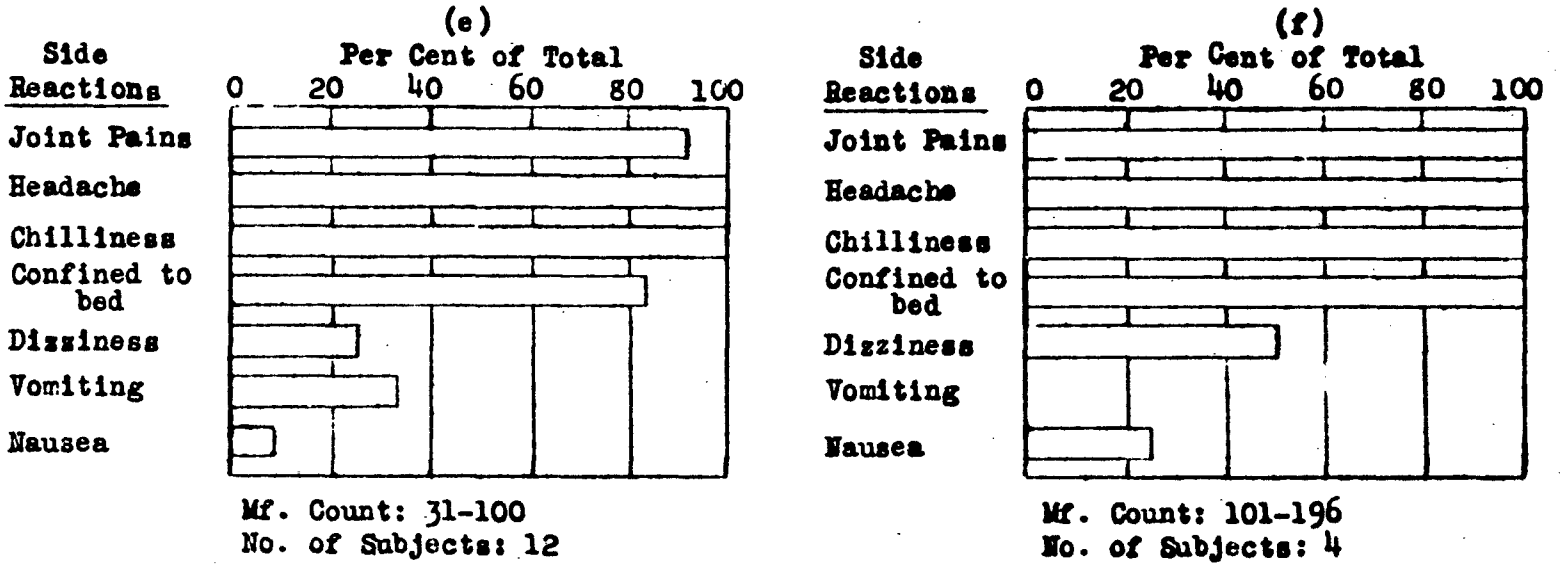


Figure 2. Other Side Reactions in the Course of Treatment of 44 Filaria Cases By Microfilarial Count, Quezon, Palawan, 1966.



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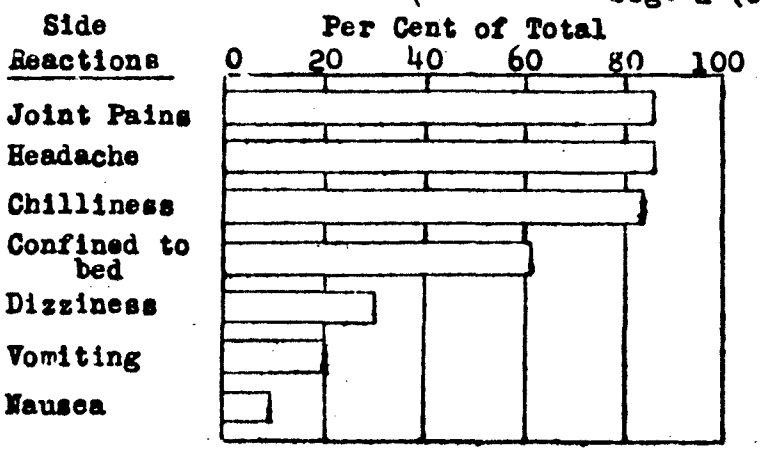

Figure 2g. Other Side Reactions in the Course of treatment of 44 Filaria Cases, Quezon, Palawan, 1966.

PART IV.

Susceptibility of Common Household Pest Mosquitoes to Experimental Infection With Brugia malayi Microfilaria, Compared to the Principal Vector.

Culex fatigans is the most common household pest mosquito in the ilippines, particularly in the urban areas. In other parts of the world ke India for example where the principal vector of bancroftian filariasis Culex fatigans(1), the existence and density of this mosquito goes hand hand with urbanization. In the Philippines, Cabrera and Tubangui(1951); zeboom and Cabrera (1956) observed the complete development of W. bancrofti laria larvae in experimentally infected Culex fatigans(2,3). In Screen Province, another endemic area for bancroftian filariasis, this mosquito s been found to harbor the parasite at various stages of development in ture(4).

Aedes albopictus in the Philippines is found rather abundant inside d around houses in the rural areas. We have observed this mosquito to be undant in forest areas during our field trips in remote places.

These two species are about the most common household pests mosquitoes the Philippines today. Hence I thought it worthwhile to determine their sceptibility to experimental infection with Brugia malayi microfilariae. though Mansonia bonneae is the principal vector of malayan filariasis in e Philippines, Rozeboom and Cabrera (1965) were unable to make enough servations on experimental infections of this mosquito with Brugia malayi(5). would be of interest to run a parallel experiment with this mosquito to- ther with Culex fatigans and Aedes albopictus.

Materials and Methods

The supply of Aedes albopictus adults came from the insectary of the laria Eradication Training Center in Manila. The Culex fatigans adults re hatched from pupae collected from a street canal in Manila. These two ecies of mosquitoes were held in cages made of a pint-sized cardboard linders with the open ends covered with bobbinette. The mosquitoes were pt moist with a wet piece of cotton. Raisins and sugar solution were used feed the mosquitoes. There were 6 of these cardboard cylinders with proximately 50 Culex fatigans adults in each cage and 3 cages of Aedes bopictus adults. All these cages were packed in a 2 x 2 square feet cardard box lined with wet filter paper and hand towels hoping to obtain a gh humidity inside the box. Despite all these precautions we had high rtality rates among our mosquitoes, particularly the Aedes albopictus.

The principal vector of malayan filariasis in Palawan is Mansonia nneae. The adult mosquitoes were collected as they attacked the human it stationed just outside our field laboratory at about 1800 hours. These

were caught by means of a glass-tube aspirator and kept in 5 cardboard cylinder cages.

All 3 species of mosquitoes were starved for 12-24 hours prior to feeding experiments. There were 5 microfilaria positive donors used in this experiment. Just before the start of the feeding experiment, thick blood smears amounting to 20 mm^3 were obtained from each volunteer. These were allowed to dry overnight, dehemoglobinized and stained with Giemsa the following morning according to the method of Wilson(6). Microfilarial counts were done to give us an estimate of the microfilarial density in the peripheral blood of each subject. Then the donors were made to place one or two of these cardboard cylinder cages between their thighs for 30-60 minutes.

At the end of the feeding period the unfed mosquitoes were separated from the engorged ones. The cage containing the fed mosquitoes were labeled properly and placed aside for observation. We had no trouble making Mansonia bonneae feed on our subjects but we encountered difficulty in making the Culex fatigans and Aedes albopictus feed on our subjects, probably because the nights were too cold for them. In order to find out if our experimental mosquitoes actually imbibed some microfilariae with their blood meal, we dissected 1 or 2 mosquitoes right after engorgement. The gut was dissected out and the blood was smeared on a drop of normal salt solution. Active microfilariae when present could be easily detected.

The cages were checked daily for dead or dying mosquitoes which were dissected for developing filaria larvae. Live mosquitoes were sacrificed at intervals after feeding until about 12-14 days.

In the actual dissection procedure, mosquitoes were anaesthetized with chloroform in a test tube, wings and legs were detached and discarded; the head, thorax and abdomen were placed in 3 separate drops of saline on a glass slide and teased apart with dissecting needles. Dissections were done under a dissecting microscope, but where early stages were seen, these were examined for details under a compound microscope. The number and stage of development of larvae and the portion of the mosquito where these were found were recorded for each mosquito.

Results

The results of the experimental infections of three species of mosquitoes (under field conditions) with B. malayi microfilariae are summarised in tables 1 and 2. The microfilarial counts of the carriers per 20 mm^3 blood ranged from 13-267.

It can be seen in table 1 that only M. bonneae is susceptible to B. malayi microfilariae. Culex fatigans and Aedes albopictus were not susceptible to B. malayi although observations showed that both species

of mosquitoes have ingested microfilariae with their blood meal. Of the 184 Culex fatigans and Aedes albopictus mosquitoes that fed on B. malayi carriers, none were found to harbor any developing stages of the filaria larvae.

With regards to M. bonneae, observations showed an infection rate (mosquitoes infected over mosquitoes fed) of 83, 82, 63, 0 and 5% per cent for those that fed on carriers with 267, 196, 27, 17 and 13 microfilariae per 20 mm^3 blood respectively. There were only 6 mosquitoes involved in the zero infection rate. It seems that the higher the microfilarial count of the B. malayi in the peripheral blood, the greater is the infection rate among the mosquitoes.

The stage I larvae of W. bancrofti were seen on the 4th day, the stage II larvae on the 6th day and the stage III larvae were seen on the 10th day after feeding.

Attempts were made to determine the per cent of infected mosquitoes with stage III larvae and the mature larval density from the tenth day onward is shown in the last two columns of table 1. It can be seen that the per cent of mosquitoes with stage III larvae ranged from 15-100 per cent and the mature larva density from 1.5-10.6 per infective mosquito among M. bonneae fed on different B. malayi carriers.

Table 2 shows the distribution of larvae by location in the 3 body segments of M. bonneae mosquito for each date of dissection. It can be seen that both stage I and II larvae were found only in the thorax. Stage III larvae were found in all three segments of the body of the mosquito but were more concentrated on the head and the thorax. It might be worth mentioning here that we have observed some stage III larvae in the palpi, eyes, antennal base and legs of the infected mosquito. The average larval density per mosquito is high among M. bonneae fed on B. malayi carriers having high microfilarial count.

No attempts were made to determine the death rate and/or survival rate of mosquitoes due to insufficient data, and that fact that we were working under field conditions.

Discussion

Mansonia bonneae adult females are very vicious biters, so that practically every single mosquito fed on our microfilaria carriers in a relatively short period. The fact that these mosquitoes were caught right from within their natural environment may help explain the ease we experienced in making them feed on the subjects.

Culex fatigans and Aedes albopictus were brought all the way from Manila to the municipality of Quezon. The trip per se was about 12-14

hours by plane, bus, boat and on foot. The mosquitoes must have had a tough time during the trip so that they were not in a position to bite. Another possibility is the fact that there was a change in the temperature from high to low. The nights in Quezon were relatively cold compared to those in Manila.

In future work it would be a much better set up if the microfilaria carrier could be transported to Manila rather than bringing the mosquitoes to a remote endemic area. The mosquitoes would then be in better condition to bite and then placed in an insectary with the right temperature and humidity. This set-up would give better results on mosquito survival rates, etc.

There were a few Mansonia bonneae mosquitoes which we considered as naturally infected with B. malayi based on the finding of stage III larvae on the 4th day after feeding.

With the information gathered from this short experiment, we can determine with ease the different developmental stages of the filaria larvae. We know now the approximate time required for the different larval stages of the local strain of B. malayi to develop, so that future experiments of this sort may be duly guided by this report.

One must also bear in mind that whereas stages I and II are confined mostly in the thorax, stage III may be seen in practically any part of the mosquito especially when the infection is heavy. It might be a good practice to tease the mosquito quite thoroughly so as not to miss the detection of the larvae.

Summary and Conclusion

Culex fatigans and Aedes albopictus from Manila were not susceptible to infection with B. malayi microfilariae.

Mansonia bonneae, the known principal vector of malayan filariasis in Palawan, had high infection rates up to 83 per cent. This rate appeared to be correlated with the intensity of microfilaremia in the donor.

The infective stage (stage III) of B. malayi takes approximately 10 days to develop with stages I and II on the 4th and 6th day respectively after feeding.

Whereas stages I and II are found mostly in the mosquito thorax, stage III can be found in practically all parts of the mosquito particularly the head and thorax.

References

1. Pattanayak, S. Critical Review of Control Operation Against W. bancrofti filariasis in India by Combine Methods. Filariasis working paper. Inter-Regional Seminar on Filariasis, 22 Nov. - 1 Dec. 1965, WHO, Manila.

2. Cabrera, B.D. and Tubangui, M. Studies on Filariasis in the Philippines. III. Aedes (Finlaya) poicilius (Theobald), the mosquito intermediate host of Wuchereria bancrofti in the Bicol Region. Acta Med. Phil. 7:221-229, 1951.

3. Rozeboom, L.E. and Cabrera, B.D. Filariasis in the Philippine Islands. Am. Jour. Hygiene, 63:140-149, 1956.

4. Baisas, F.E. Notes in Philippine Mosquitoes. XIX. The mosquito problem in the control of filariasis in Sorsogon Province. Phil. Jour. Sci. 86:71, 1958.

5. Rozeboom, L.E. and Cabrera, B.D. Filariasis Caused by Brugia malayi in the Republic of the Philippines. Am. Jour. of Epidemiology, 8:200-215, 1965.

6. Wilson, T. Differences between the microfilariae of Wuchereria malayi and Wuchereria bancrofti in Giemsa-stained thick blood films. Trans. Roy. Soc. Trop. Med. Hyg. 50:54-57, 1956.

Table 1. Experimental mosquito infection, dissected 0-12 days after feeding on B. malayi carriers, Palawan, 1966.

MOSQUITO (Species)	Mf. Count per 20 mm^3 blood	Number of mosquitoes fed	Days after feeding	Number dissected	Number Positive Mosquitoes All stages	Number Positive Mosquitoes Stage III	Per cent Infected	Per cent with Stage III	Stage III per mosquito
C. fatigans	196	102	0	2	-	-	0	0	0
			5	15	-	-	0	0	0
			7	14	-	-	0	0	0
			8	64	-	-	0	0	0
			10	7	-	-	0	0	0
C. fatigans	192	3	5	3	-	-	0	0	0
C. fatigans	27	42	7	16	-	-	0	0	0
			8	26	-	-	0	0	0
A. albopictus	196	37	0	1	-	-	0	0	0
			5	5	-	-	0	0	0
			7	5	-	-	0	0	0
			8	26	-	-	0	0	0
M. bonnease	267	18	10	4	3	3	75.0	100.0	4.7
			11	14	12	11	85.7	91.7	5.4
			Total...	18	15	14	83.3	93.3	5.3
M. bonnease	196	122	0	2	-	-	0	0	0
			3	2	-	-	0	0	0
			4	25	23	3*	92.0	13.0	2.7
			5	6	6	-	100.0	0	0
			6	11	6	-	54.5	0	0
			7	18	16	-	88.9	0	0
			9	28**	22	-	78.6	0	0
			11	4	3	3	75.0	100.0	9.0
			12	20	19	18	95.0	94.7	10.6
			Total...	116	95	24	81.9	25.3	9.2

ɔle 1. (Continued):

) S Q U I T O (Species)	Mf. Count per 20 mm^3 blood	Number of mosquitoes fed	Days after feeding	Number dissected	Number Positive Mosquitoes All stages	Stage III	Per cent Infected	Per cent with Stage III	Stage III per mosquito
bonnese	27	70	4	10	8	-	80.0	0	0
			7	24	7	-	29.2	0	0
			8	11	9	-	81.8	0	0
			10	13	13	2	72.2	15.4	1.5
			12	7	7	7	100.0	100.0	8.4
			Total...	70	44	9	62.8	20.4	6.9
bonnese	17	6	6	6	-	-	0	0	0
bonnese	13	12	6	3	1	-	33.3	0	0
			8	1	1	-	100.0	0	0
			9	8	5	-	62.5	0	0
			Total...	12	7	-	58.3	0	0

* Natural infections.

** A total of 34 mosquitoes were to be dissected but 6 were too dry for dissection.

Table 2. Results of experiments in which M. bonneae were dissected 9-12 days after feeding on B. malayi carriers, Palawan, 1966.

Carrier & Mf. Count per 20 mm³ blood	No. of days after feeding	No. of mosquitoes dissected	NUMBER OF LARVAE PER MOSQUITO																					
			Abdomen Stages						Thorax Stages						Head Stages						Total Stages			
			I		II		III		I		II		III		I		II		III		I		II		III	
			M	R	M	R	M	R	M	R	M	R	M	R	M	R	M	R	M	R	M	R	M	R	M	R
A	10	4	-	-	-	-	-	-	-	-	4.2	0-12	2.0	0-8	-	-	-	-	1.5	0-3	-	-	4.2	0-12	3.5	0-9
267	11	14	-	-	-	-	-	-	-	-	2.5	0-10	1.7	0-7	-	-	-	-	2.6	0-7	-	-	2.5	0-10	4.3	0-14
	0	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	4	25	-	-	-	-	-	-	4.3	0-8	-	-	-	-	-	-	-	-	0.3*	0-6	4.3	0-8	-	-	0.3*	0-6
	5	6	-	-	-	-	-	-	7.2	5-10	-	-	-	-	-	-	-	-	-	-	7.2	5-10	-	-	-	-
	6	11	-	-	-	-	-	-	3.1	0-7	-	-	-	-	-	-	-	-	-	-	3.1	0-7	-	-	-	-
	7	18	-	-	-	-	-	-	13.4	0-26	1.1	0-11	-	-	-	-	-	-	-	-	13.4	0-26	1.1	0-11	-	-
196	9	28	-	-	-	-	-	-	-	-	8.3	0-15	-	-	-	-	-	-	-	-	-	-	8.3	0-15	-	-
	11	4	-	-	-	-	-	-	-	-	-	-	3.0	0-5	-	-	-	-	3.0	0-5	-	-	-	-	6.0	0-10
	12	20	-	-	-	-	1.6	0-12	-	-	2.3	0-14	4.2	0-20	-	-	-	-	3.7	0-20	-	-	2.3	0-14	9.5	0-33
	4	10	-	-	-	-	-	-	1.3	0-3	-	-	-	-	-	-	-	-	-	-	1.3	0-3	-	-	-	-
C	7	24	-	-	-	-	-	-	0.5	0-2	-	-	-	-	-	-	-	-	-	-	0.5	0-2	-	-	-	-
	8	11	-	-	-	-	-	-	-	-	1.5	0-3	-	-	-	-	-	-	-	-	-	-	1.5	0-3	-	-
27	10	13	-	-	-	-	-	-	-	-	1.3	0-3	0.1	0-1	-	-	-	-	0.06	0-1	-	-	1.3	0-3	0.2	0-2
	12	7	-	-	-	-	0.8	0-4	-	-	-	-	3.8	0-7	-	-	-	-	3.7	1-6	-	-	-	-	8.4	3-13
D	6	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11																										
E	6	3	-	-	-	-	-	-	-	-	0.3	0-1	-	-	-	-	-	-	-	-	-	-	0.3	0-1	-	-
	8	1	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-
13	9	8	-	-	-	-	-	-	-	-	1.5	0-4	-	-	-	-	-	-	-	-	-	-	1.5	0-4	-	-

M - Mean; R - Range

* Natural infections

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ABSTRACT Blood surveys in the Province of Palawan resulted in prevalence rates of , 4.2 and 0.8 per cent for W. bancrofti, B. malayi and mixed infection respective- Malayan filariasis and a very restricted distribution compared to bancroftian ariasis. Males had higher microfilaremia rates than females for both species. ldren had higher microfilaremia rates in malayan and lower in bancroftian ariasis. Average microfilarial density was higher in bancroftian than malayan . males had higher microfilarial density than females in the two species. Similar vey in Jolo resulted in a prevalence rate of 11.4 per cent. Atypical microfila- e found together with typical ones, when examined in detail revealed that they e also of W. bancrofti. Microfilaremia rates in makes were higher than in females . rates were higher among older age groups. In Jolo there were more children h microfilaremia compared to Palawan. Extent of abaca plantation and magnitude filariasis in all municipalities of Jolo showed no correlation, but "poblacions" ated near abaca plantations had higher prevalence rates. Aedes (Finlaya) poecilus the vector of filariasis in Jolo island which confirmed previous finding in sogon, another abaca raising province. Malayan filariasis cases treated with thylcarbamazine were observed for side reactions. Fever, joint pains, chilliness l headache were the most common reactions and were directly related to microfila- l density. Culex fatigans and Aedes albopictus were not susceptible to experi- tal infection with B. malayi whereas Mansonia bonneae showed high infection rates. aria larvae in M. bonneae required 10 days to reach the infective stage. Filari- is in an abaca raising province has higher prevalence involving younger children h the vector breeding in the leaf axils of the abaca plant. (Cont'd)

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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