

CONTRASTING *WUCHERERIA BANCROFTI* MICROFILARIA RATES IN TWO MANGYAN-POPULATED PHILIPPINE VILLAGES

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Abstract. Lymphatic filariasis caused by infection with *Wuchereria bancrofti* and *Brugia malayi* is endemic in 45 of 77 provinces in The Philippines. To prepare the island of Mindoro for mass treatment using diethylcarbamazine and albendazole, complete census data were collected in rural villages. A sample of individuals selected from each of two adjacent villages was examined for microfilaremia. Microfilariae were detected from thin smears in 34 (13%) of 272 patients examined from the village of Bayanan and 10 (3.4%) of 292 in the village of Mangangan ($P < 0.01$, by chi-square test). In these villages, the majority of those infected were members of the ethnic group known as Mangyans: 33 (97%) of 24 in Bayanan and 7 (70%) of 10 in Mangangan (risk ratio = 89, 95% confidence interval = 33–240, $P < 0.001$.) In children examined who were less than 10 years of age ($n = 165$), girls were more commonly infected than boys, even though the proportion of males in the general population was greater. Understanding sociocultural characteristics and related behaviors in future observations among the Mangyan may help to explain local differences in the distribution of filariasis. This information should also be helpful in designing more culturally appropriate strategies for the control of lymphatic filariasis among ethnic minorities in The Philippines.

INTRODUCTION

Lymphatic filariasis due to infection with *Wuchereria bancrofti* and *Brugia malayi* is endemic in 45 of 77 provinces in The Philippines.^{1,2} A limited survey conducted by the Philippines Department of Health in 1996 determined that Mindoro Province, the seventh largest island in the Luzon group, had a microfilarial rate of 1.5%.² In 2000, the Philippine Department of Health stepped up efforts for control and prevention of lymphatic filariasis as part of a worldwide campaign by the World Health Organization (WHO) for the elimination of lymphatic filariasis.³ Central to the Philippine National Filariasis Control Program is the mass treatment of all populations at risk of infection, including those in hard-to-reach areas. In anticipation of conducting mass anti-filarial treatment in all endemic regions, review of past census data noted that some rural villages in Mindoro inhabited by cultural minorities had not been surveyed. Therefore, two remote villages identified by provincial health authorities were subjected first to complete census collection. Second, 564 persons selected from these two communities were screened for microfilaremia and analyzed in the context of the population demographics.

MATERIALS AND METHODS

Study site. Mindoro is an island province located 130 km south of Manila. The remote rural villages of Bayanan and Mangangan were chosen by local health officials as study sites because complete census data was needed,¹ and community participation in the census collection would provide an opportunity to determine microfilaremia rates.² Both villages are situated within the municipality of Baco town, which is 15 kilometers from Calapan, the capital of Oriental Mindoro (Figures 1 and 2). The climate of these villages ranges from 20°C to 35°C with a relatively dry season from January to April and wet conditions during the rest of the year. The terrain of these villages is rugged and steep, particularly as they approach the perimeter of Mount Halcon (elevation = 8,030 feet.)

The residents of these villages belong to two major cultural groups: the Tagalogs and the Mangyans. Tagalogs are the most common ethnic group and are fully acculturated into the mainstream way of life in economics and politics. Conversely, the Mangyans are the original inhabitants of Mindoro and are traditionally reclusive from society. The present-day Mangyans have descended from the original inhabitants of Mindoro Province and have essentially retained the culture and way of life of the early Mangyans. Present day Mangyans live at higher elevations in the mountains, far from the mainstream population, where they survive by farming root crops and fruits.

Procedures. A series of community assemblies were held in the two villages to explain to all residents the nature of the program sponsored by the Philippines National Filariasis Control Program. The research team exerted special effort during these assemblies to conduct health education sessions for all residents, among which were an unexpectedly large number of Mangyans, an ethnic tribe that traditionally had not benefited from mainstream medical and health services. It was emphasized that participation into the study was voluntary and non-participation would not preclude anti-filarial treatment if evidence of filariasis was found in the village. The research team also briefed local health workers from different zones within each village as to the objectives for the study being undertaken, including all field procedures and their roles in facilitating the implementation of the project.

The research team was composed of personnel from three partner institutions, namely, the Philippine Department of Health, the University of the Philippines, and Michigan State University. Permission to undertake filarial field studies in the villages was obtained from the Regional and Provincial Health Offices of the Philippine Department of Health, the Offices of the Provincial Governor of Mindoro and Municipal Mayor of Baco, and other local administrative officials. Ethical clearance to conduct the research was obtained from the ethical review boards of the Committee on Research Implementation and Development at the College of Medicine, University of the Philippines, Manila, and the University Committee on Human Subjects at Michigan State University.



FIGURE 1. Map of Mindoro Island, The Philippines. The study sites of Bayanan and Mangangan are small villages located southwest of the capital city of Calapan, near the foot of Mount Halcon. Study sites (area outlined in gray) are enlarged in Figure 2 to show distribution of households.

Census data collection and parasitologic studies. Basic demographic information was collected by health department officials from all members of each household in both villages. Data included name, sex, ethnicity, and birth date ($n = 3,200$). Census data was collected first, before seeking households for parasitologic studies. Individuals were selected from each of the two villages for parasitologic studies. Subjects for parasitologic studies were identified by visiting every other household in each village. The first household in each village was identified by its proximity to paths leading to the village. Members of each household were informed of the nature of the survey, individual informed consent was obtained, and nighttime blood was collected.

For three consecutive nights, capillary blood was collected by the research team between the hours of 10:00 PM until 2:00 AM for optimum detection of nocturnally periodic microfilariae. Thin smears ($60 \mu\text{L}$ of blood) were prepared for each patient. The blood smears were stained with Giemsa for the detection of microfilariae by light microscopy. Microfilarial counts were determined for each positive sample and expressed as the total number of microfilariae per milliliter of blood. During the course of these three nights, blood was collected from 526 subjects. After parasitologic studies were completed and the presence of filariasis was confirmed, mass treatment using diethylcarbamazine and albendazole was provided for all the residents of the two villages.

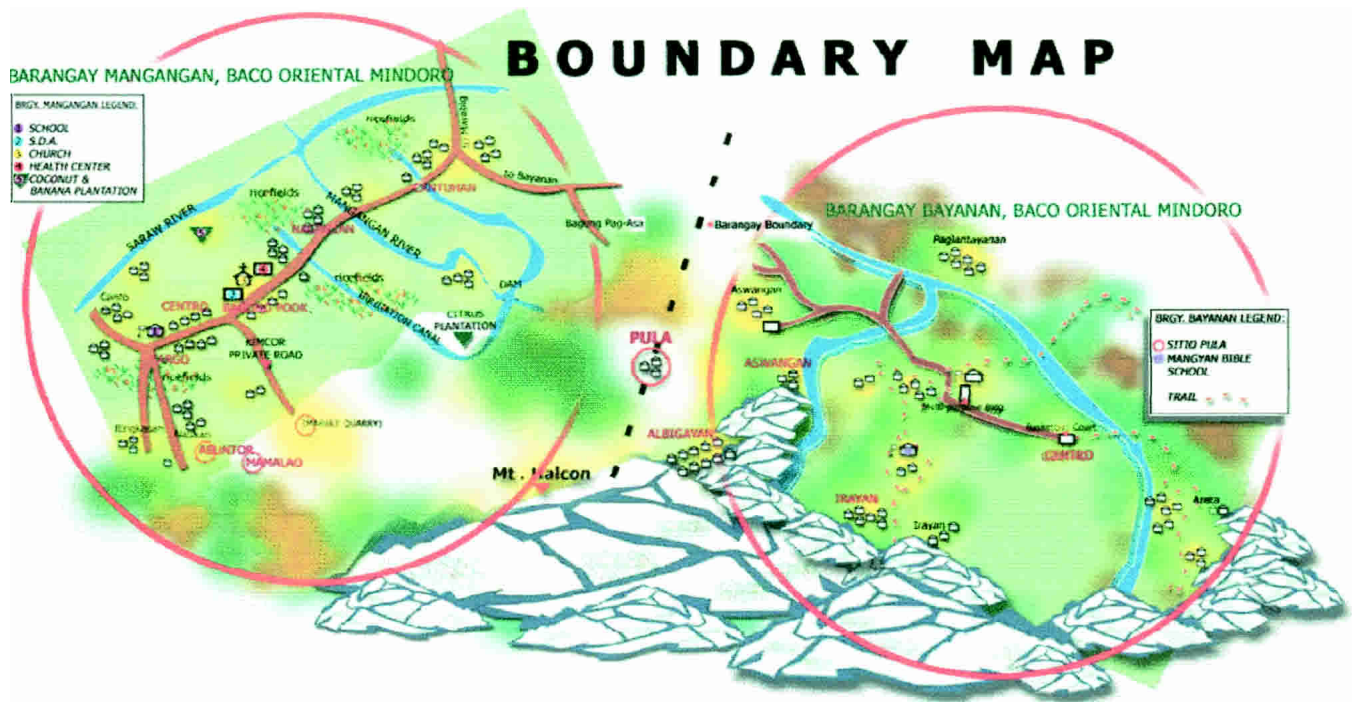


FIGURE 2. Map of the neighboring barangays (villages) of Bayanan and Mangangan, showing similarities in distribution of households, paths, their proximity to one another, and the higher elevations of Mount Halcon. SDA = Sitio Department Administration.

Statistical analysis. Statistical Packages for the Social Sciences (SPSS, Inc., Chicago, IL) were used to analyze population census data and the results of parasitologic studies.

RESULTS

Bayanan, a village that occupies a land area of 1,935 square hectares, has a total population of 1,237 people. Mangangan, a neighboring village, has a land area of 1,071 square hectares and a total population of 1,983 residents. The majority (79.9%) of the residents in Bayanan are Mangyans and 20.1% are Tagalogs. The reverse is true for the village of Mangangan; the majority of its residents are Tagalogs (11% Mangyans and 89% Tagalogs). The similarities in age and sex distribution in all 3,220 residents of Bayanan and Mangangan are shown in Figure 3.

Parasitologic studies. In Bayanan, 272 (22%) of the 1,237 residents were examined for the presence of microfilariae in their blood. This included 160 males and 112 females. Two hundred-three (75%) of the 272 were Mangyans. In the adjacent village of Mangangan, blood was collected from 292 (15%) of 1,983 residents. This included 144 males and 148 females, and only 8 (2.7%) of the 292 were Mangyans. The age and sex distribution of subjects from whom blood was collected was similar to the census data for the total populations (Figure 4.).

Microfilariae were detected in 34 (12.9%) of 272 patients examined from Bayanan. Of those that were microfilariae positive, 22 were males and 12 were females (Table 1). Ten (3.4%) of 292 patients examined in Mangangan were microfilariae positive. These 10 were composed of five males and five females. Thus, the microfilarial positivity rate in Bayanan is approximately four-fold higher than in Mangangan ($P < 0.01$,

by chi-square test). The majority of those infected were Mangyans: 33 (97.06%) of 34 in Bayanan and 7 (70%) of 10 in Mangangan.

In both villages, there were more microfilaria-positive females than microfilaria-positive males in the younger age groups (≤ 10 years old.) However, overall there were 27 microfilaricemic males and 17 microfilaricemic females. In Bayanan (34 microfilaricemic subjects), microfilaria-positive males dominated the 26–50-year-old age group. The sex distribution of microfilarial positivity for Bayanan and Mangangan (10 microfilaricemic subjects) is shown in Figure 5 for all age strata. The mean microfilarial count for all microfilaria positive subjects in Bayanan was 669 microfilariae/mL of blood. Females had a higher mean microfilarial count (724 microfilariae/mL) than males (640 microfilariae/mL), although this difference was not statistically significant. The mean microfilarial count in Mangangan (597 microfilariae/mL) was significantly lower than that in Bayanan. In contrast to what had been observed for Bayanan, males in Mangangan have a significantly higher mean microfilarial count (800 microfilariae/mL) than females (393 microfilariae/mL).

DISCUSSION

This survey of lymphatic filariasis in two remote adjacent villages in Baco, a municipality of Oriental Mindoro, was conducted as part of the Philippine Department of Health's efforts toward the global program of WHO for the elimination of lymphatic filariasis.⁴ Previous surveys by the Philippine Department of Health in the province of Mindoro for the detection of microfilaremia prior to the WHO elimination program had not included rural villages due to their remoteness from roads and major towns. Prior to 1997, the restric-

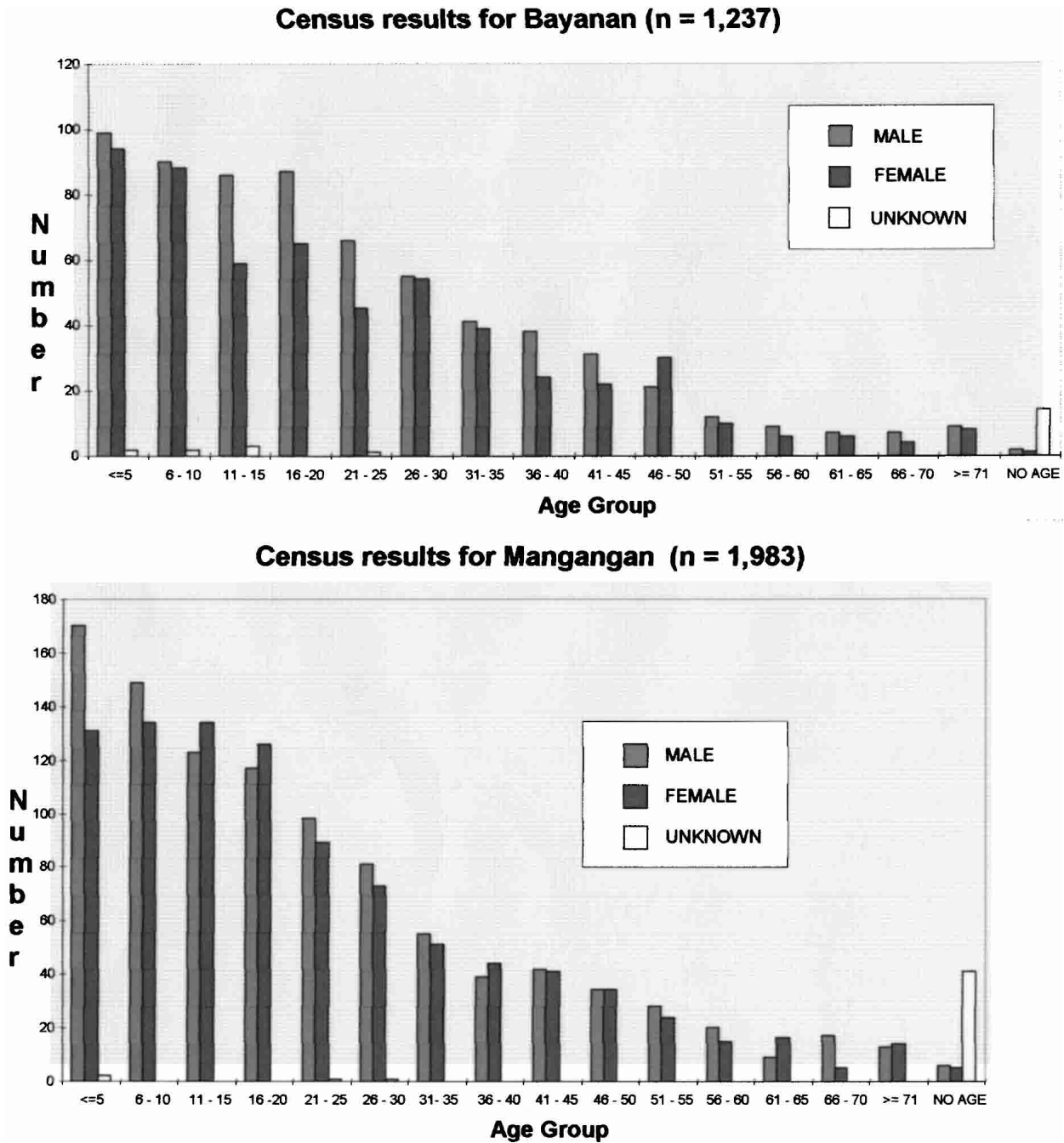
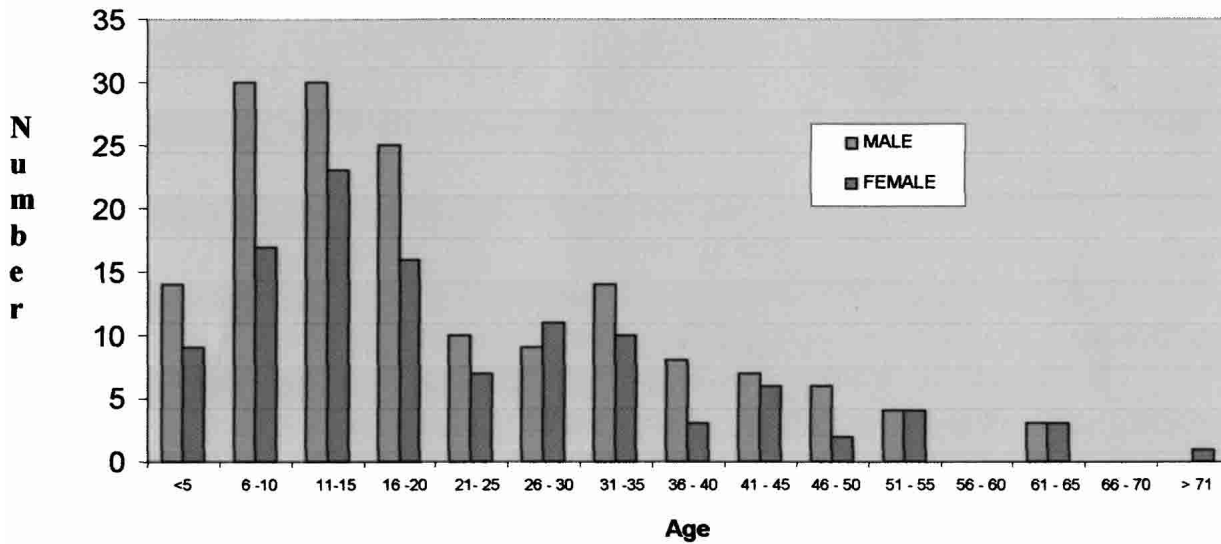


FIGURE 3. Census results including sex distribution in different age (years) groups for all the residents in the two villages with a combined population of 3,220. Bayanan: n = 1,237; Mangangan: n = 1,983

tions imposed by human resources and budgetary constraints clearly had limited effective efforts by the National Filariasis Control Program. At that time, single drug treatment with diethylcarbamazine was administered only to persons who were determined to be microfilariae positive. The current control strategy is based on mass treatment of all residents in lymphatic filariasis endemic areas, and thus requires greater expenditures for personnel time and chemotherapy acquisition/delivery. In recent years, additional governmental and non-governmental funding was obtained to map filarial-endemic areas to identify communities in need of mass chemotherapy with two drugs, diethylcarbamazine and albendazole.

Given the absence of mass chemotherapy in rural Mindoro prior to this study, it was expected that microfilaria prevalence might be higher than the 1.5% previously reported rate for other areas in the province.¹ Indeed, that was also the conclusion of this study also: microfilarial prevalences were higher at 13% and 3.4%, respectively, for the villages of Bayanan and Mangangan. However, it was not expected that the microfilaria rates would be so different between the two villages, given their proximity to each other, and given the further assumption that the two villages seemed to have similar environmental risks for disease transmission (mosquito habitat) based on initial inspection of topography and forest covering.

Age and sex distribution of subjects in Bayanan examined for filariasis



Age and sex distribution of subjects in Mangangan examined for filariasis

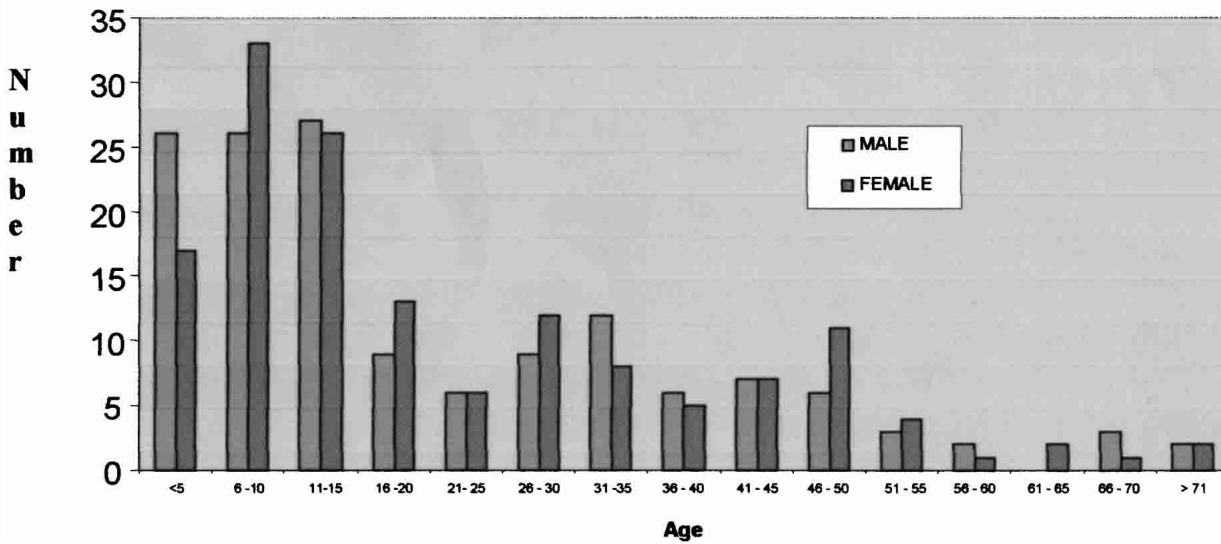


FIGURE 4. Sex distribution in different age (years) strata of the subjects examined for microfilaremia. Bayanan: n = 272; males = 160, females = 112. Mangangan: n = 292; males = 144; females = 148.

Mangyans comprised the majority of those found to be microfilaria-positive; 33 (97%) of 34 in Bayanan and 7 (70%) of 10 in Mangangan. Although the age and sex distribution of subjects selected for microfilaria studies was similar to the general population census, suggesting a random sample had been obtained, microfilarial rates were distinctly different between the two villages. Population demographics showed that Bayanan is populated mostly by Mangyans (80% of the total population) whereas in Mangangan, the Mangyans comprise only 11% of the total population. In the sample population used in the study for both villages, the Mangyans comprised 75% of the subjects from Bayanan and 2.7% of subjects from Mangangan. These differences translate into a risk ratio of 89 for the Mangyan people compared with the Tagalogs in these villages (95% confidence interval = 33–240, $P < 0.001$.) The

TABLE 1
Microfilariae positivity in two neighboring villages in the Philippines*

Village and number studied	Microfilariae positive	Prevalence
Bayanan		
Total (n = 272)	34	12.50%
Males (n = 160)	22	13.75%
Females (n = 112)	12	10.71%
Mangangan		
Total (n = 292)	10	3.42%
Males (n = 144)	5	3.47%
Females (n = 148)	5	3.38%

* The microfilarial rate in Bayanan, a village with a predominantly Mangyan population, is significantly higher than in the neighboring village of Mangangan ($P < 0.001$, by chi-square test). In these villages, Mangyans represented 97% and 70%, respectively, of the microfilaria positive subjects.

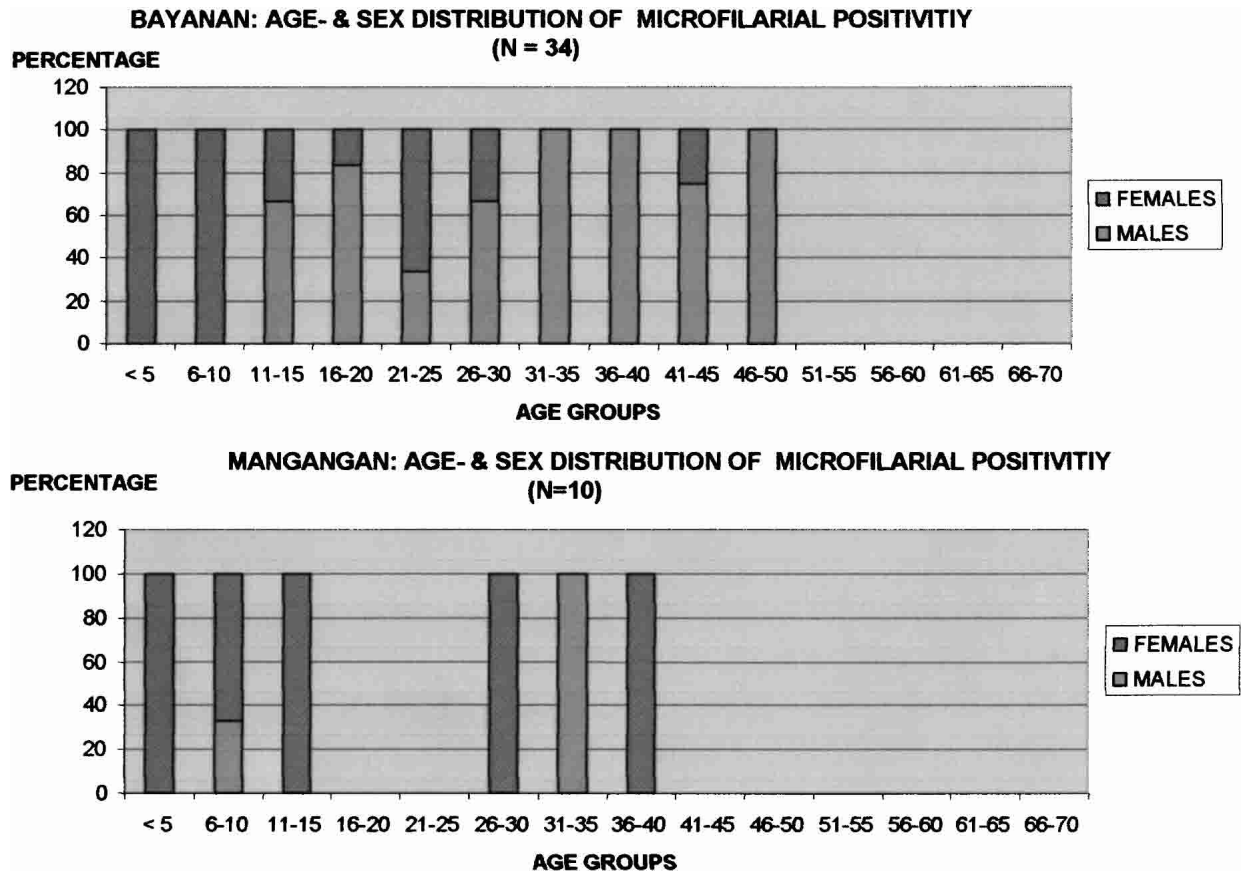


FIGURE 5. Sex-specific microfilarial positivity rates in different age (years) groups from the neighboring villages of Bayanan and Mangangan. Thirty-four subjects in Bayanan (22 males and 12 females) and 10 subjects in Mangangan (5 males and 5 females) were found to harbor microfilaria in their blood.

significant differences in ethnic composition of these two neighboring villages had been previously unrecognized by local health authorities in Mindoro.

It was not the aim of this study to determine the factors that contribute to the higher risk of microfilarial positivity among the Mangyans, since this was an unexpected finding. However, speculation for this difference, based upon limited knowledge of Mangyan lifestyles, points to the role of occupation as a contributing factor. Mangyans of both sexes have been known to spend both days and nights sleeping or working in the forests as they forage for food and raw materials for their woven wares. Greater occupational or behavioral exposure to vectors may account for the higher overall microfilarial prevalence in Mangyans.⁵ The observation that a higher percentage of young females less than 10 years old were more frequently infected than males of the same ages could have several possible explanations. First, the numbers of infected females in these age groups was small ($n = 7$); thus, this may not be a real association. Alternatively, this could be a selection bias introduced because of the way households were identified for parasitologic studies. Overall, there were only 44 microfilaria-positive subjects of the 564 tested. However, the trend toward a higher number of infections in young girls was very similar in both villages (Figure 5), in spite of three times more microfilaria-positive subjects in one village,¹ and a trend toward greater numbers of male children in most age groups less than 21 years old.²

There is a need for further sociocultural studies and other related risk behavior studies to elucidate the factors that put the Mangyans, male or female, at greater risk of filarial infection compared with the Tagalogs. More information is needed to identify behaviors that might place young Mangyan girls at increased risk of filariasis. An example of sex-specific behaviors among the Mangyans that have an impact on women's health was noted in previous anthropologic studies of different Mangyan groups.^{6,7} Married Mangyan women were discouraged from routine bathing and hair care, in an effort to discourage unwanted attention from males other than their spouses. Differences in the degree of personal hygiene and skin care could be significantly different between Tagalog and Mangyan females. In the present study, there was no evidence or suggestion that men had previously been given access to antifilarial treatments from other sources. It is unknown whether highland Mangyans live in closer proximity to growths of abaca plants, (*Abaca textilis* or Manila hemp) a known risk factor for contact with the unique night-biting, container-breeding mosquito *Aedes poicilius*, the major vector of filariasis in The Philippines. Vector studies have not been recently done to determine if other species of mosquitoes are responsible for disease transmission in areas inhabited by the Mangyans.

Recently, we designed a qualitative, open-ended anthropologic study of Mangyan knowledge, attitudes, and behaviors in the Bayanan and Mangangan populations. These new data

are under analysis, but presently appear inconclusive as to the above questions (Ramirez BL and others, unpublished data). In time, understanding culture-specific factors associated with increased risk of filariasis should help in designing more culturally appropriate strategies for the disease control. Present efforts to determine subtle sociocultural differences between Mangyan and Tagalog behaviors may provide a hypothesis that can be tested in subsequent longitudinal filariasis surveys now planned to examine the effectiveness of mass chemotherapy.

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