

# INTESTINAL PARASITES OF MAN IN NORTHERN BOHOL, PHILIPPINES, WITH EMPHASIS ON SCHISTOSOMIASIS

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## INTRODUCTION

Suspicious cases of schistosomiasis in Trinidad, Bohol were first reported in 1956. One year later cases were confirmed in two barrios of the municipality of Trinidad. A survey was conducted in 1958 and results were published 10 years later (Blas and Dazo, 1968). The overall infection rate in two northern municipalities, Trinidad and Talibon was 30%. The present study, conducted in November and December, 1977, was undertaken by the Schistosomiasis Control Council, in conjunction with the local Schistosomiasis Control Team, and the U.S. Naval Medical Research Unit No. 2 (NAMRU-2) in order to assess the current status of schistosomiasis in Bohol and to provide documentation for the general problems of parasitic diseases in this rural area of the Philippines.

## DESCRIPTION OF AREA

Bohol is one of the Visayan Islands east of Cebu (Fig. 1) in the Philippine archipelago.

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The municipalities of Talibon and Trinidad are located along the north coast. Both municipalities are drained by the Ipil river and its tributaries. Climatically Bohol has no dry season yet there is a pronounced maximum rainfall period from November to January.

## MATERIALS AND METHODS

Subjects who volunteered were registered, given stool cartons and instructed to return the next day with a fecal specimen. One or two grams of feces were placed in a screw-capped bottle containing 10% formalin and mixed thoroughly. Specimens were subsequently examined by direct and formalin-ether concentration methods at the NAMRU-2 laboratory in Taipei, Taiwan. Hookworm larvae were recovered from Harada-Mori stool culture of approximately 100 randomly selected stool specimens for specific identification (Hsieh, 1962).

The population sampled was compared with the expected age and sex distribution of the standard rural Philippine population. There was no significant difference in our sample with regards to sex, however, age-groupings were significantly different than would be expected by chance (Fig. 2). Younger age groups (20 years) were over represented and conversely older age groups were under represented.

## RESULTS

Intestinal parasites were commonly diagnosed in residents of North Bohol. One or

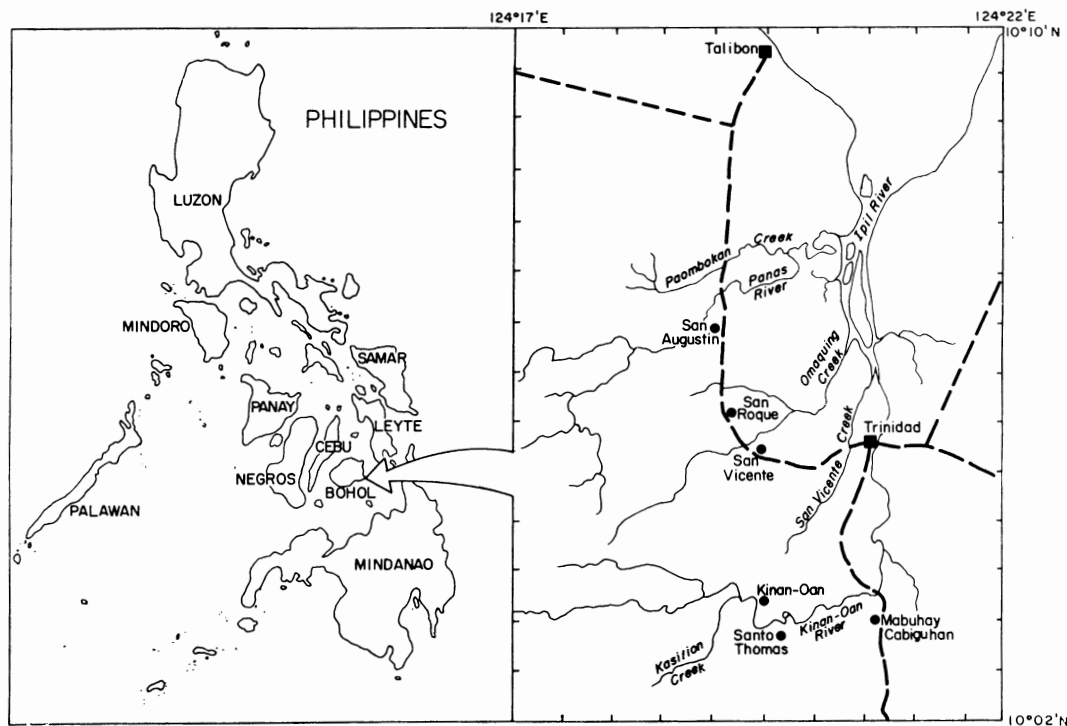


Fig. 1—Map of the Philippine Islands illustrating the barrios surveyed along the north coast of Bohol.

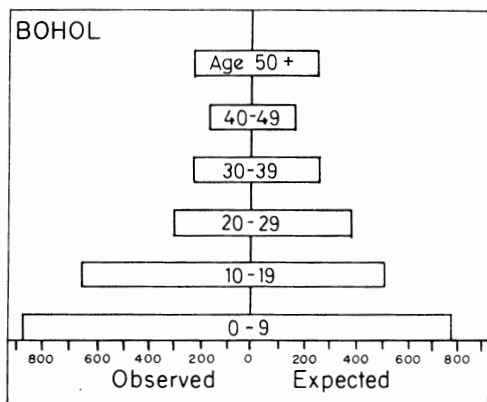


Fig. 2—Comparison of observed and expected age distribution of sampled populations in Bohol.

more intestinal parasite was detected in 91% of the specimens examined. However, schistosomiasis was detected in only 5.4% of the stool specimens examined from barrios where schistosomiasis was previously reported. The endemicity of *S. japonicum* in the municipality

of Talibon was very low (1.6%) with all cases from the barrio, San Roque. In the municipality of Trinidad, schistosomiasis was still endemic to all four barrios surveyed. In San Vicente, 11.1% of the sampled residents were infected with *S. japonicum*; in Mabuhay Cabiguhan, 7.4%; in Santo Tomas, 7.2% and in Kinan-Oan, 6.5% were infected.

Prevalence rates of intestinal protozoans are shown in Table 1. *Entamoeba coli* was found in 25% of the specimens examined and *E. histolytica*, *Endolimax nana* and *Giardia lamblia* infections were detected in 5 to 7%, other intestinal protozoan parasites were detected in 2% or less.

Soil-transmitted nematodes were the most common intestinal parasites detected. Hookworm infections were diagnosed in 71%; *Trichuris trichiura* in 57% and *Ascaris lumbricoides* in 45% of the residents who

Table 1  
Intestinal parasites of man in North Bohol, Philippines, 1977.

	Trinidad (972)*	Talibon (722)	North Bohol (1694)
<b>Protozoa</b>			
<i>Entamoeba histolytica</i>	4.9**	5.3	4.9
<i>Entamoeba hartmanni</i>	2.8	1.2	2.1
<i>Entamoeba coli</i>	22.5	29.8	25.3
<i>Endolimax nana</i>	8.0	5.7	7.1
<i>Iodamoeba bütschlii</i>	1.1	2.4	1.6
<i>Giardia lamblia</i>	5.9	6.8	6.3
<i>Chilomastix mesnili</i>	0.4	2.6	1.3
<b>Helminths</b>			
<i>Trichuris trichiura</i>	54.3	62.9	57.8
<i>Ascaris lumbricoides</i>	42.8	46.3	44.5
Hookworm	73.1	69.3	71.4
<i>Enterobius vermicularis</i>	0.8	1.1	1.0
<i>Strongyloides stercoralis</i>	1.9	1.3	1.6
<i>Schistosoma japonicum</i>	8.0	1.6	5.4

\*Number examined. \*\*Age - sex adjusted rates.

submitted stool specimens. *Strongyloides stercoralis* larvae and *Enterobius vermicularis* eggs were seen in less than 2%. Hookworm cultures revealed that 97% of these infections were *Necator americanus*; *Anclystoma duodenale* was identified in the remainder.

A variety of trematode eggs were infrequently detected. Dicrocoelid-like eggs were found in 2 residents of Mabuhay Cabiguhan. Heterophyid eggs were seen in one specimen of Mabuhay, Cabiguhan and in three specimens of San Roque. *Paragonimus*-like eggs were found in one specimen from Kinao-Oan and two specimens from San Roque. In San Agustin echinostome-like eggs were detected in one specimen.

Cestode eggs were detected twice; taeniid eggs were seen in one specimen from Santo Tomas and *Hymenolepis diminuta* eggs were found in one specimen from San Vicente.

When the age and sex distribution of intestinal parasites were computed (Table 2), there were no distinct patterns with the possible exception of *S. japonicum* which was found in almost twice as many males as females.

## DISCUSSION

In the Philippine Islands, Oriental schistosomiasis is endemic to 6 of 13 major islands with Bohol the most recent island to be declared endemic (Blas and Dazo, 1968). When originally surveyed, using a direct fecal examination technique, 30% of the population examined were found infected with *S. japonicum*. In 1977, however, only 5.4% of the residents from the same areas were found infected using both direct and concentration methods.

Table 2

Age and sex distribution of intestinal parasites of man in North Bohol, Philippines, 1977.

	Sex		Age in years					
	Male (817)*	Female (877)	0 - 9 (650)	10 - 19 (411)	20 - 29 (185)	30 - 39 (164)	40 - 49 (115)	50+ (163)
<b>Protozoa</b>								
<i>Entamoeba histolytica</i>	5**	4	3	3	6	7	7	10
<i>Entamoeba hartmanni</i>	2	3	2	2	2	2	1	5
<i>Entamoeba coli</i>	22	28	19	28	23	37	26	32
<i>Endolimax nana</i>	6	8	5	6	11	9	7	9
<i>Iodamoeba butschlii</i>	1	2	1	2	2	2	1	3
<i>Giardia lamblia</i>	7	7	11	9	3	3	1	1
<i>Chilomastix mesnili</i>	2	1	1	1	1	1	0	3
<b>Helminths</b>								
<i>Enterobius vermicularis</i>	1	1	1	2	0	1	0	1
<i>Trichuris trichiura</i>	58	57	53	63	58	59	61	55
<i>Ascaris lumbricoides</i>	44	47	55	48	43	37	23	31
Hookworm	75	66	62	75	70	74	74	85
<i>Strongyloides stercoralis</i>	2	1	1	2	0	1	0	1
<i>Schistosoma japonicum</i>	7	4	3	8	7	9	3	2

\*Number examined. \*\*Percentages expressed to nearest whole number.

Schistosomiasis control efforts in Bohol were not initiated until 1976 when a Schistosomiasis Control Team was established in Trinidad. However, unpublished results of the team's first two years of operation also suggested that the schistosomiasis problem in Bohol had decreased significantly since 1958 without planned intervention by man.

The terrain of North Bohol is not level but consists of many small rolling hills and valleys. Even in 1958 it was noted by Blas and Dazo (1968) that the endemic areas in the municipalities of Trinidad and Talibon were limited. Colonies of *Oncomelania hupensis* were usually associated with palawan plants which were found in swamps along creeks and in depressions formed between adjoining hills.

The most reasonable explanation for the spontaneous decline in the prevalence of

schistosomiasis in the area is intensive agricultural use of all lowlands available as a result of population pressure. Wet rice fields are cultivated up to the edges of the numerous hills that characterize this area of Bohol and oncomelanid snails do not thrive in either sloping terrain or constantly cultivated and flooded rice fields. In northern Bohol areas suitable for oncomelanid habitat are the same areas that now are intensively cultivated for wet rice production.

In spite of the general recognition of widespread parasitism in the Philippines, only scant attention has been given to basic biomedical surveys in recent years. Relatively little is known about the species of parasites present in the scattered insular populations, patterns of distribution, parasite prevalence and density, seasonal fluctuations and ecological relationship. Until recently most studies

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have usually been incidental to other activities or reports from hospitals and penal institutions (Kuntz, 1960).

Tubangui (1947) emphasized the importance of intestinal parasites to the overall health situation of the Philippines and this contention was amply supported and reviewed by Cabrera (1970). However, past and recent surveys in the Philippines have been geographically limited as illustrated by Cabrera and in Table 3. Since 1970 Jueco *et al.*, (1973) determined the prevalence and intensity of intestinal parasitism on Talim Island and a series of biomedical surveys were conducted throughout the Philippines (Cross *et al.*, 1970; 1977 a,b) which documented the problem on intestinal parasitism in rural areas of Northern Luzon, Cebu and North Samar.

Cabrera's (1971) review of the status of intestinal parasites of man in the Philippines from 1908-1970 concluded that most common intestinal parasites were *A. lumbricoides* and *T. trichiura* (Table 3). Biomedical surveys, conducted throughout the Philippines in the 1970s using identical stool examination techniques (Cross *et al.*, 1970; 1977a, b.; unpublished data), confirmed that soil-transmitted helminths were the most frequently diagnosed parasites. Hookworms were usually found less often than were either *A. lumbricoides* or *T. trichiura*. In Bohol, however, hookworms were the most common soil-transmitted parasites.

Parasitic protozoan infections in Bohol were representative of the general pattern seen in rural areas of the Philippines in the recent

Table 3  
Prevalence<sup>‡</sup> of common intestinal parasites of man in the Philippines.

	Areas and Number Examined				
	Philippines 1908-1969 (+152,000)	Luzon (4231)	Talim Island (2083)	Samar (1394)	Cebu (1014)
<b>Protozoa</b>					
<i>Entamoeba histolytica</i> *	-	-	2	5	5
<i>Entamoeba hartmanni</i>	-	-	-	1	3
<i>Entamoeba coli</i>	-	-	27	16	12
<i>Endolimax nana</i>	-	-	-	6	12
<i>Giardia lamblia</i>	-	-	5	3	10
<i>Iodamoeba bütschlii</i>	-	-	-	0	0
<b>Helminths</b>					
<i>Ascaris lumbricoides</i>	83	65	92	77	50
<i>Trichuris trichiura</i>	52	78	94	90	53
Hookworms	36	30	8	65	22
<i>Schistosoma japonicum</i>	-	0	0	15	1**
Source	Cabrera, 1970	Cross <i>et al.</i> , 1970	Jueco <i>et al.</i> , 1973	Cross, <i>et al.</i> , 1977a	Cross <i>et al.</i> , 1977b

<sup>‡</sup> Percentages rounded to nearest whole number. \*only large race of *E. histolytica* considered.

\*\*Considered imported cases.

surveys conducted by the Ministry of Health and NAMRU-2 teams. The infection rate for *E. histolytica* (5%) and the infection rate for *G. lamblia* (6%) were typical. However, the infection rate for *E. coli* (25%) in Bohol is higher than those reported in other areas of the Philippines in recent years.

A comparison of changes in prevalence rates of helminth infections other than schistosomiasis in Bohol from 1958 to 1977 is *A. lumbricoides* in Trinidad decreased from 67% to 43% (-24%) and in Talibon from 55% to 46% (-9%). Hookworm infections on the other hand increased remarkably in both Trinidad and Talibon, from 32% to 73% (+41%) in Trinidad and from 50% to 69% (+19%) in Talibon. The prevalence of trichuriasis remained relatively stable in Trinidad (-3%) but increased (+13%) in Talibon. One reason for the decline in ascariasis might be the availability of effective and inexpensive anthelmintics. The marked increase in hookworm infections is difficult to interpret but might be a result of crowded conditions in the barrios surveyed as a result of the population growth during the past twenty years without noted improvements in sanitation. This contrasts with the usual decrease in hookworm infections in tropical areas undergoing urbanization. For example, in Jakarta, the hookworm prevalence has decreased from 70% in 1952 to 2% in 1979 (Purnomo, pers. comm.). The inconsistent change in trichuriasis rates is not understood. These results are not in phase with the overall changes in soil-transmitted helminth patterns as reported by Cabrera (1971). In comparing pre-commonwealth prevalences of soil-transmitted helminths to those obtained during the present Republic, Cabrera noted an increase in ascariasis and a decrease in both trichuriasis and hookworm infection rates.

The variety of possible endoparasite zoonoses that were diagnosed in residents of northern Bohol deserved comments. First,

since only one stool sample was examined these reports may be spurious, however, there are a number of reports in the literature that indicate that these parasitoses are real in the Philippines and that they are due to food habits of indigenous populations in the outer islands of the Philippines (Arambulo, 1974).

Discrocoeliid-like eggs are probably those of didynozoid trematodes which were spuriously obtained by eating marine, flying fish (Carney *et al.*, 1975). Paragonimiasis is endemic to the Philippines and in the Visayan Islands low mountain crabs are prepared in such a manner that cooking utensils become contaminated and in turn contaminate foods that are eaten raw. Heterophyid metacercariae have been found in a wide variety of fresh and brackish-water fish in the Philippines that are common in the islander's diet (Arambulo, 1974).

Taeniasis is found throughout the islands with *Taenia saginata* more common than *T. solium*. However, infections occur where meats are eaten raw or partially cooked. In Leyte, human cases of taeniasis determined to be due to *T. solium* are thought to have originated from eating raw pork but Arambulo (1974) suggests that this possibility be investigated. Hymenolepiasis in man is rare in the Philippines, however, *Hymenolepis diminuta* is the more common cestode of rats and, thus occurs more frequently in man.

## SUMMARY

A survey for intestinal parasites with emphasis on Oriental schistosomiasis was conducted in the townships of Trinidad and Talibon, Bohol Province, Philippines and approximately 1,700 stool samples were examined. *Schistosoma japonicum* is still endemic to these areas of northern Bohol but infection rates were much lower than expected, 5% rather than 30%. Soil-transmitted helminths were

the most common parasitic infections. Hookworms were found in 71% of the samples tested, most infections were due to *Necator americanus* 97% and *Ancylostoma duodenale* accounted for only 3%. *Trichuris trichiura* and *Ascaris lumbricoides* eggs were diagnosed in 58% and 45% respectively of the fecal samples examined. Other helminths and protozoan parasites detected were *Enterobius vermicularis*, *Strongyloides stercoralis*, *Entamoeba histolytica*, *Entamoeba hartmanni*, *Entamoeba coli*, *Endolimax nana*, *Iodamoeba bütschlii*, *Giardia lamblia* and *Chilomastix mesnili*.

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#### REFERENCES

- ARAMBULO III, P.V., (1974). The natural nidity of zoonoses in the Philippines. *Inst. J. Zoon.*, 1 : 58.
- BLAS, B.L. and DAZO, B.C., (1968). Schistosomiasis survey and preliminary control work in the province of Bohol. *J. Phil. Med. Ass.*, 44 : 80.
- CABRERA, B.D., (1971). A review of the parasitic diseases of the gastrointestinal system in the Philippines. *In: Proceedings of the 7th SEAMEO Tropical Medicine Seminar on Infectious Diseases of the Gastrointestinal System, Taipei, Taiwan, 28 September - 2 October 1970*, pp. 39-52.
- CARNEY, W.P., JOESOEF, A., ROGERS, V., TIBULUDJI, N., SEPUTHRA, I.G. and HOEDOJO. (1975). Intestinal and blood parasites of man in Timor. *Bull. Penelitian Kesehatan*, 3(2):1.
- CROSS, J.H., BANZON, T., MURRELL, K.D., WATTEN, R.H., and DIXON, J.J., (1970). A new epidemic diarrheal disease caused by the nematode *Capillaria philippinensis*. *Industry Trop. Hlth.* 7 : 124.
- CROSS, J.H., WHEELING, C., BANZON, T., BASACA-SEVILLA, V. and SEVILLA, J., (1977a). Amoebiasis and intestinal parasitic infections in population on Cebu Island, the Philippines. *Ann. Trop. Med. Parasit.*, 71 : 435.
- CROSS, J.H., BANZON, T., WHEELING, C.H., COMETA, H., LIEN, J.C., CLARK, R., PETERSON, H., SEVILLA, J. and BASACA-SEVILLA, V., (1977b). Biomedical survey in North Samar Province, Philippine Islands. *Southeast Asian J. Trop. Med. Pub. Hlth.*, 8 : 464.
- HSIEH, H.C., (1962). A test-tube filter-paper method for the diagnosis of *Ancylostoma duodenale*, *Necator americanus*, and *Strongyloides stercoralis*. *WHO.Tech. Rep. Ser.*, 225 : 27.
- JUECO, N.L., PALAYPAY, M.A. and ACEREMO, L., (1973). Prevalence and intensity of intestinal parasitism on Talim Island, Binagonan, Rizal, Philippines. *Southeast Asian J. Trop. Med. Pub. Hlth.*, 4 : 582.
- KUNTZ, R.E. and LAWLESS, D.R., (1960). Intestinal protozoans and helminths in the indigenous population and employees associated with a naval air station in the Philippines. *Milit. Med.*, 125 : 561.
- TUBANGI, M.A., (1947). A summary of the parasitic worms reported from the Philippines. *Phil. J. Sci.*, 76 : 225.