

INTESTINAL AND BLOOD PARASITES IN THE TORRO VALLEY, CENTRAL SULAWESI, INDONESIA

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INTRODUCTION

In Indonesia, *Schistosoma japonicum* is known to be endemic only in the Lindu and Napu valleys of Central Sulawesi (Sudomo and Carney, 1974). Both are high mountain valleys geologically similar (Carney *et al.*, 1977a) and endowed with environmental factors favorable to the survival of hosts necessary for transmission of Oriental schistosomiasis. The Lindu Valley is drained by the Gumbasa River and the Napu Valley by the Lariang River. These adjacent drainage systems empty into the Strait of Makassar at different points. Each has been surveyed systematically and a few cases of human schistosomiasis found outside the known endemic foci (Cross *et al.*, 1975; Carney *et al.*, 1976). Investigations revealed that these persons were most likely infected in the Lindu or Napu valleys (Sudomo and Carney 1974; Carney *et al.*, 1977a). However, Carney *et al.*, (1977b) suggest that transmission might occur further along the course of the Lariang system than previously described. The Torro Valley is in the Lariang drainage system and is geographically close and environmentally similar to the Lindu and Napu schistosomia-

sis foci. This, as well as reports of persons with symptoms compatible with schistosomiasis living in the Torro Valley prompted us to conduct a human parasite study there.

DESCRIPTION OF THE AREA

The Torro Valley is in the Takolekadju mountain range of the Kulawi District, Donggala Regency of Central Sulawesi at approximately 120° 1' East longitude and 1° 31' South latitude (Fig. 1). The valley is drained by the Salo Pebatua River which empties into the Salo Lariang. The valley floor is approximately 700 meter above sea level and is generally flat and well drained, except for an impenetrable marsh in the southwest corner. High mountains surround the valley on three sides and are covered with tropical rain forests. The climate is characterized by high temperatures and humidity typical of equatorial areas. The valley size was not determined, but is sufficiently large to support a population of 1,147 indigenous Torajans, all of whom are farmers; Christianity is the predominant religion. The dwellings are not closely clustered but spread throughout the valley.

MATERIALS AND METHODS

The methods, unless otherwise stated, are those used in previous surveys in which stool specimens were obtained and night finger blood smears made (Clarke *et al.*, 1974). All analyses were conducted at the NAMRU-2 laboratory at Jakarta.

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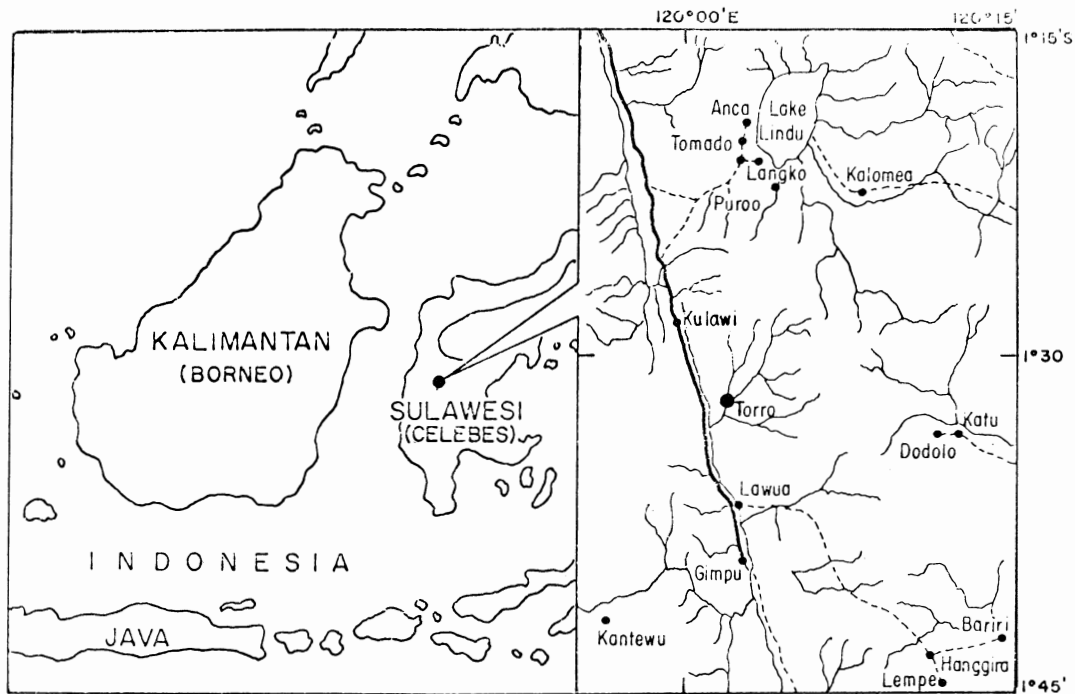


Fig. 1—Map of Central Sulawesi showing the Torro Valley in relation to the Lake Lindu and Gimpu areas of the Kulawi district in the Donggala Regency.

RESULTS

A total of 392 inhabitants was surveyed as intact household units. Table I shows the prevalence of parasites by age and sex distribution of the study population. Hookworm infection (71%) was highly prevalent while exceptionally low prevalences were found for *Ascaris lumbricoides* (3%) and *Trichuris trichiura* (2%). *Enterobius vermicularis* was found in 1%. Echinostome ova were detected in the feces of one 14-year-old male.

Entamoeba coli (23%) was the most prevalent intestinal protozoa followed by *Giardia lamblia* (14%), *Endolimax nana* and *Iodamoeba bütschlii* (9% each), and *Entamoeba histolytica* (8%). One 4 year old male was passing *Isospora* sp. oocysts.

Brugia malayi microfilariae were detected in blood smears of 25% of the persons examined

with a median density (MfD₅₀) of 7.8 per 20 μ l blood (range 1-227). Elephantiasis was noted in only two persons indigenous to the valley. *Plasmodium vivax* was found in 4% and *Plasmodium falciparum* in 2% of the blood smears from persons examined. Similar to findings with intestinal parasites there were no statistically significant differences in the distribution of malaria or filaria between males and females. While microfilaremia appeared early in life and occurred at high rates throughout all age groups, malaria was most prevalent in the 0-9 year age group.

Physical examinations for detecting enlarged livers and spleens were performed on 206 persons in the supine position. Spleens were palpated in 111 persons (54%), livers were felt below the right costal margin in 45 (22%). Forty-two (20%) had enlargement of both liver and spleen. The spleen rate in 45 children

Table 1

Blood and intestinal parasites from residents of the Torro Valley, Central Sulawesi, Indonesia.

Parasite	Age in Years						Sex		Total
	0-9	10-19	20-29	30-39	40-49	50+	Male	Female	
Intestinal	(72)	(78)	(48)	(43)	(26)	(20)	(152)	(135)	(287)
<i>Entamoeba histolytica</i>	1*	13	4	7	15	15	11	5	8
<i>Entamoeba coli</i>	18	26	21	26	23	25	23	22	23
<i>Endolimax nana</i>	6	6	6	16	8	20	8	10	9
<i>Iodamoeba bütschlii</i>	7	12	6	12	12	10	8	11	9
<i>Giardi lamblia</i>	31	12	6	7	12	0	13	15	14
<i>Ascaris lumbricoides</i>	6	3	0	0	8	0	4	1	3
<i>Trichuris trichiura</i>	0	4	0	2	8	0	1	3	2
Hookworm	46	79	79	79	73	85	78	63	71
<i>Enterobius vermicularis</i>	4	0	0	0	0	5	2	1	1
Blood	(86)	(85)	(53)	(46)	(25)	(21)	(167)	(149)	(316)
<i>Brugia malayi</i>	12	28	38	22	44	14	29	20	25
<i>Plasmodium vivax</i>	10	5	0	0	0	0	2	6	4
<i>Plasmodium falciparum</i>	2	4	2	0	0	0	1	3	2

Number examined in parenthesis.

*Percentage expressed to the recurrent whole number.

aged 2-9 years was 36%. The average enlarged spleen of these children was 1.8 as graded by the method of Hackett.

Although not systematically observed and recorded, ovalcytosis of greater than 15% of red blood cells was commonly found on peripheral blood films.

No oncomelanid snails were found in a cursory survey conducted randomly throughout the valley.

DISCUSSION

The results of this survey are similar to surveys conducted elsewhere on Sulawesi and other rural areas in Indonesia in showing a high prevalence of intestinal and blood dwelling parasites. This survey, however,

revealed three parasitological observations of particular interest to us.

First, *S. japonicum* was not endemic in the Torro Valley. This agrees with the theory proposed by Carney *et al.*, (1978), that transmission of Oriental schistosomiasis in the Lariang drainage system of Central Sulawesi is limited to an area delineated by the coordinates 1°20' S and 1°30' S latitude and 120° 30' E longitude at elevations varying between 1000-1200 meters. The Torro Valley lies outside these coordinates and is at least 250 m lower than endemic foci. Our negative finding is not conclusive since only 25% of the human population of Torro was examined for *S. japonicum* ova; no rodents or other mammals were examined and the search for molluscan hosts was not exhaustive.

Secondly, the prevalences of *A. lumbricoides* (3%) and *T. trichiura* (2%) compared to a prevalence of hookworm of 71% are low for Indonesia in general yet similar to findings in other mountainous areas of Sulawesi (Clarke *et al.*, 1974; Carney *et al.*, 1974, 1977a and b). In surveys conducted elsewhere in Indonesia, these soil transmitted helminths are usually found to be highly endemic and have roughly similar prevalence rates (Cross *et al.*, 1977). The high hookworm endemicity indicates indiscriminate defecation, environmental conditions favorable to larval development and behavioral patterns, walking barefooted, bringing persons in direct contact with infective larvae. The finding of low prevalence rates of *T. trichiura* and *A. lumbricoides* in all age groups suggests as yet unidentified environmental factors, in this area of Sulawesi unfavorable for the embryonation of *T. trichiura* and *A. lumbricoides* eggs to the infective stage.

Thirdly, considering the low rate of overt filarial disease among indigenous residents of the Torro Valley, a 25% prevalence of *B. malayi* microfilaremia was an unexpected finding. Recent surveys in highland areas of Central Sulawesi indicate *B. malayi* microfilaremia rates to be low. Clarke *et al.*, (1974) found only 1.2% positives in the nearby Bada and Gimpu areas. However, high microfilaremia rates were observed in residents of the Torro Valley many years ago (Tesch, 1937). Apparently, the indigenous populations of man and filaria have involved into a relationship satisfactory to the parasite and tolerable to the host. To quote Beaver (1970), "In areas of undisturbed endemicity, infection without evident disease is common". *Brugia malayi* in Sulawesi is nocturnally periodic and is transmitted by *Anopheles barbirostris* (Partono *et al.*, 1972; Atmosoedjono, 1976).

Malaria is at a mesoendemic level as judged by parasite and spleen rates in the 2-9 year old group, and transmission is considered to be stable in the area.

Ovalocytosis was first reported to be common among Torajan inhabitants of the immediate region by Bonne and Sandground in 1939. A recent survey of residents of the Lake Lindu Valley of Central Sulawesi revealed that 148 (49%) of 300 persons examined had 15% or more ovalocytes on peripheral blood smears (Trobaugh, unpublished data). Hereditary ovalocytosis is associated with varying degrees of accelerated red blood cell destruction and hepatosplenomegaly. The combined effects of malaria and hereditary ovalocytosis would seem to be a plausible explanation of our finding of high rates of hepatic and splenic enlargements.

SUMMARY

Approximately 300 blood and fecal specimens were examined in a parasitologic survey of indigenous inhabitants of the small isolated Torro Valley in the mountains of Central Sulawesi. *Schistosoma japonicum* was not found although the parasite is endemic in the neighboring Lindu and Napu valleys. Hookworm infection (71%) was the most common helminthiasis. The prevalences of ascariasis (3%) and trichuriasis (2%) are low for Indonesia in general but similar to those found in nearby mountainous areas of Sulawesi.

Intestinal protozoa endemic to the area are: *Entamoeba histolytica* (8%), *E. coli* (23%), *Endolimax nana* (9%), *Iodamoeba butschii* (9%) and *Giardia lamblia* (14%). *Plasmodium vivax* infections were found in 4% and *P. falciparum* in 2% of persons examined. *Brugia malayi* microfilaremia was found with a prevalence of 25%. The high rate of

splenic (54%) and hepatic (22%) enlargement found on examination of 206 persons of all ages is considered to be a result of combined effects of endemic malaria and hereditary ovalocytosis.

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