

2. Title: Survey of the Parasites of Central Thailand with special reference to Fasciolopsis buski.

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#### OBJECTIVES

The primary objective of this study was to delineate the endemic areas of Fasciolopsis buski in Thailand and to ascertain the ecological conditions necessary for its development. The prevalence of other intestinal parasites was also examined.

#### DESCRIPTION

In each province surveyed an effort was made to select villages that would most likely represent the surrounding areas. When a village was selected for study, arrangements were made with the school principal, or village headman, for the people to deliver stool specimens the morning following the day in which they received stool cups. Their name, age, sex and address, along with the appearance and consistency of the stool were recorded at the time of collection. Special attention was given to school age children as the prevalence of F. buski was found to be higher in this age group (Sadun and Maiphoom, 1953; Sadun, 2496).

The findings reported are based on single stool specimens, each of which was examined by two different methods: Formalin—ether concentration (F—E) and Merthiolate, Iodine, Formalin (MIF). By using both the concentration technique and the MIF it was possible to compare the two as to the efficiency with which certain infections could be detected, as well as to maintain a sample of each stool for future reference. The MIF method does not concentrate the specimen and in this respect is similar to a direct smear. As many surveys conducted use only the direct smear method this information may be useful as a means of comparison.

In order to determine the status of F. buski infections in Thailand today (whether on the increase or decrease) several of the villages in which individuals were found positive by Sadun and Maiphoom in 1953 were resurveyed in 1968 and the results compared.

Several areas, in addition to central Thailand, were surveyed throughout the North and Northeastern Provinces in an effort to find other foci of F. buski. Many low-lying areas in which water was known to collect, or where lakes were located, were surveyed.

#### PROGRESS

A total of 6,324 persons from 14 provinces were examined. The results from the basin region are summarized in Table 1, those from the surrounding provinces in Table 2. Fasciolopsis buski was found only in the basin region, all other areas surveyed proved negative, including an area near Phayao (Chiengrai Province) in Northern Thailand that was reported to be a focus of F. buski infection. A repeat examination of over 300 individuals in this area failed to turn up any infections. No significant differences were found between males and females in prevalence of any of the parasites, however, slightly more females (22%) were infected with F. buski than males (18%), a trend which is the reverse of that found by Hsieh (1959).

Table 3 compares the prevalence of F. buski in three areas from the 1953 survey (Sadun and Maiphoom) and our 1968 survey. Because of the shift in the ecology of the Thonburi area the snails and water plants necessary for F. buski transmission are now only found along the river banks and in some isolated canals, however, the soil transmitted parasites, such as the hookworms, now flourish in this area. From the 1953 survey it was found that approximately 5% of those examined had hookworm infections; in 1968 over 14% were infected. The Pak Hai district was found to be an area where a very high percentage of those examined were positive for F. buski. This shows a tremendous increase from the 1953 survey, although the description of the area given by Sadun and Maiphoom is still accurate today. This apparently indicates a rather recent introduction of this parasite into the area.

Figure 1 depicts the prevalence of F. buski in five different areas as a function of the prevalence of the soil transmitted helminths. From this it can be seen that as the prevalence of F. buski increases the soil transmitted helminths (including Ascaris, Trichuris, hookworm and Strongyloides) decrease. In Pak Hai, where over 70% of those examined had F. buski, only about 4% were infected with the soil transmitted parasites. In Amphur Sena, where only 1% had F. buski over 23% had the soil transmitted forms. This is probably due to the fact that in areas where there is a great deal of F. buski there is little or no dry ground on which the soil transmitted forms can develop. This would explain why few other parasites were found in other surveys for F. buski in Thailand (Sadun, 2496).

The results of the comparison between the F-E concentration and the MIF methods are summarized in Table 4. With protozoan infections there are generally large numbers of organisms per gram of feces and the concentration method proved to be no more effective than the MIF in the detection of these infections. However, the concentration method was much more effective in the detection of helminthic infections, reflecting the fact that helminth eggs and larvae are usually found in far fewer numbers than protozoans.

No special techniques were used for the detection of Taenia and Enterobius vermicularis infections, so these values are probably much lower than actual prevalence.

## DISCUSSION

As the ecological conditions within central Thailand are gradually changing there is a definite shift in the numbers and types of parasites found. In most of the areas immediately surrounding the basin, the prevalence of the soil transmitted parasites is increasing. This is also indicated by the higher prevalence of hookworm in the Thonburi area (between 1953 and 1968). It can be seen (Tables 1 & 2) that almost twice as many persons living in the drier areas have Ascaris, Trichuris and hookworm infections as persons from the basin.

The parasites (and commensals) that are spread by direct contact, such as the protozoans and E. vermicularis, were found in greater numbers in the basin. This results from the fact that, as there is little dry ground, the houses are usually built in small clusters with many families living in close association, thus providing the personal contact necessary for the spread of these organisms.

Giardia lamblia infections were found in almost equal numbers in all provinces surveyed (approx 8%), regardless of the ecology of the area. Infections were very common in young children, but as age increased the numbers of infections encountered decreased at a rather regular rate. Many extremely heavy infections were found with resulting severe diarrhea.

Entamoeba histolytica was rather common among the people examined from the basin (3.2%), however, in the majority of cases there seemed to be little or no detectable signs or symptoms.

Opisthorchis viverrini is a serious health problem in Northeastern Thailand, though the infection rates are quite low throughout the rest of the country. Almost twice as many cases of opisthorchiasis were found in the basin as in the surrounding areas, which is probably due to the abundance of fish within the basin.

TABLE 1 Results of examination of 3,329 persons from the basin region

PARASITE	Totals		AGE GROUPS (EXPRESSED AS % POSITIVE)						
	# Inf.	% Inf.	1-4 (138 exam.)	5-14 (2,587 exam.)	15-24 (99 exam.)	25-44 (295 exam.)	45-60 (154 exam.)	over 60 (56 exam.)	
<i>E. histolytica</i>	106	3.2	1	3	5	3	3	4	
<i>E. coli</i>	674	20.2	9	21	18	19	19	25	
<i>G. lamblia</i>	268	8.0	14	9	5	3	3	0	
<i>I. butschlii</i>	187	5.6	4	6	7	4	7	7	
<i>E. nana</i>	507	15.2	8	14	19	20	26	16	
<i>C. mesnili</i>	9	0.3	0	0.3	0	0.7	0	0	
<i>O. viverrini</i>	42	1.3	0	1	3	3	4	9	
<i>F. buski</i>	667	20.0	12	22	24	17	7	7	
<i>H. nana</i>	13	0.4	0	1	1	0	0	0	
<i>H. diminuta</i>	1	0.03	0	0.03	0	0	0	0	
<i>Taenia sp.</i>	13	0.4	0	0.2	0	1	3	0	
<i>T. trichiura</i>	55	1.6	1	2	0	0	0.6	0	
Hookworm	262	7.9	3	7	8	12	10	11	
<i>S. stercoralis</i>	40	1.2	1	1	0	1	1	2	
<i>E. vermicularis</i>	178	5.3	5	6	2	3	2	5	
<i>A. lumbricoides</i>	156	4.7	2	6	2	0.3	1	0	

TABLE 2 Results of examination of 2,993 persons from the area surrounding the basin

PARASITE	Totals		AGE GROUPS (EXPRESSED AS % POSITIVE)						
	# Inf.	% Inf.	1-4 (60 exam.)	5-14 (2,677 exam.)	15-24 (152 exam.)	25-44 (72 exam.)	45-60 (24 exam.)	over 60 (8 exam.)	
	<i>E. histolytica</i>	40	1.3	0	1	0.6	1	0	0
<i>E. coli</i>	480	16.0	10	16	16	11	4	12	
<i>G. lamblia</i>	253	8.4	13	9	7	4	0	0	
<i>I. butschlii</i>	117	3.9	2	4	5	3	0	0	
<i>E. nana</i>	329	11.0	10	11	10	8	17	0	
<i>C. meshli</i>	4	0.1	0	0.1	0	0	0	0	
<i>O. viverrini</i>	22	0.7	2	0.5	1	6	0	12	
<i>H. nana</i>	3	0.1	0	0.1	0	0	0	0	
<i>Taenia</i> sp.	9	0.3	0	0.3	0	1	4	0	
<i>T. trichiura</i>	95	3.2	0	3	5	0	0	0	
Hookworm	461	15.4	8	16	14	10	25	12	
<i>S. stercoralis</i>	53	1.8	0	2	1	3	0	0	
<i>E. vermicularis</i>	115	3.8	2	4	2	0	0	12	
<i>A. lumbricoides</i>	322	10.8	10	12	5	3	0	0	

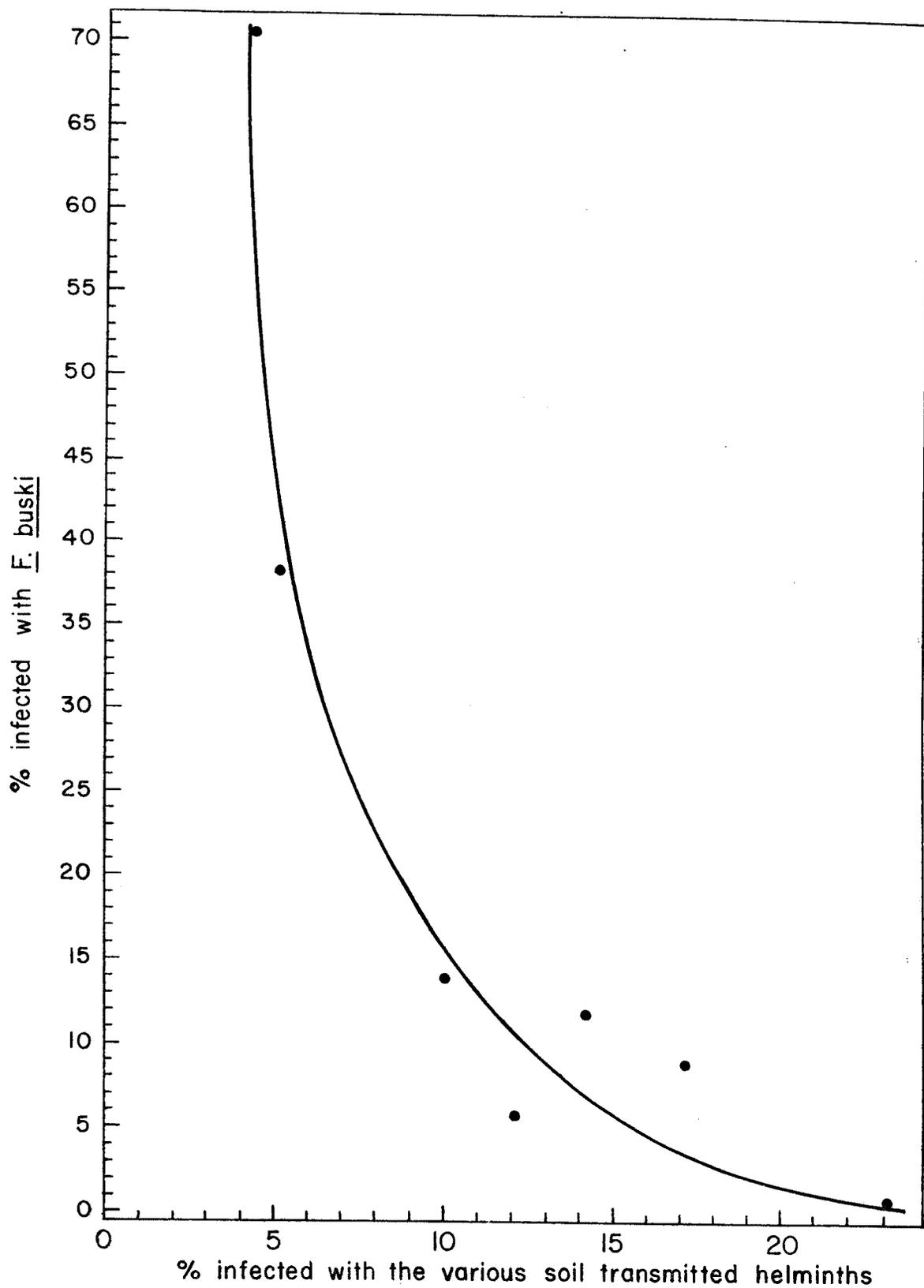
TABLE 3 Comparison of the prevalence of F. buski infections in three areas between 1953 and 1968 (1953 data from Sadun and Maiphoom).

AREA	1953		1968	
	# Exam	% Pos	# Exam	% Pos
<b>Thonburi</b>				
Talingchan	173	10	275	0
Bangkoknoi	49	8	54	0
<b>Nakorn Pathom</b>				
Prapraton	169	1	177	0
Tamsala	238	2	60	0
<b>Pak Hai</b>				
Lard Shid (combined)	354	15	454	72

TABLE 4 A comparison between F-E concentration and MIF in detecting the various infections encountered. Exam. 6,324

PARASITE	Total number of Infections found	# detected with F-E only	# detected with MIF only	# detected with both F-E & MIF	Total detected with F-E		Total detected with MIF	
					#	%	#	%
<i>E. histolytica</i>	146	26	28	92	118	81	120	82
<i>E. coli</i>	1154	125	60	969	1094	95	1029	89
<i>G. lamblia</i>	521	31	49	441	472	91	490	94
<i>I. butschlii</i>	304	56	21	227	283	93	248	82
<i>E. nana</i>	836	88	98	650	738	88	748	89
<i>C. mesnili</i>	13	7	2	4	11	85	6	46
<i>O. viverrini</i>	64	48	10	6	54	84	16	25
<i>F. buski</i>	667	84	20	563	647	97	583	87
<i>H. nana</i>	16	0	2	14	14	87	16	100
<i>H. diminuta</i>	1	0	0	1	1	100	1	100
<i>Taenia sp.</i>	22	9	2	11	20	91	13	59
<i>T. trichiura</i>	150	89	9	52	141	94	61	41
Hookworm	723	322	99	302	624	86	401	55
<i>S. stercoralis</i>	93	52	14	27	79	85	41	44
<i>E. vermicularis</i>	293	180	37	76	256	87	113	39
<i>A. lumbricoides</i>	478	61	43	374	435	91	417	87
Total	5481	1178	494	3809	4987	91	4303	79

Figure 1.



The tapeworms Taenia spp., Hymenolepis nana and H. diminuta were found only rarely and are probably not a serious health problem.

With the population of the basin at close to  $\frac{1}{2}$  million persons, it is estimated that well over 100,000 of them are infected with F. buski at any given time. In areas such as Pak Hai, where 72% of those examined were found infected, it is conceivable that nearly 100% of the indigenous population have F. buski at one time or another. Within the endemic areas there are times during the year when many people from outside the basin come in to help with the harvests. This provides an excellent opportunity for the spread of the disease to other parts of Thailand, however no foci have yet been found outside of the central plain. As has been found in other studies, there are few other helminthic infections found in areas with F. buski.

#### REFERENCE

1. Sadun, E.H., and C. Maiphoom. 1953. Studies on the epidemiology of the human intestinal fluke, Fasciolopsis buski (Lankester) in Central Thailand. *Am. Jour. Trop. Med. Hyg.* 2 (6): 1070-1084.
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3. Plaut, A.G., K. Sanyakorn, C. and G.S. Manning. A clinical study of Fasciolopsis buski in Thailand. *Trans. Roy. Soc. Trop. Med. & Hyg.* In Press.