HELMINTHS IN SOUTHERN PORTO RICO

AN ANALYSIS OF 2,200 FECAL EXAMINATIONS

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This study has been conducted to establish the incidence of different helminths in the southern part of Porto Rico, and to establish any variation in the helminth distribution due to the factors, age, sex, race, locality, etc.

A total of 2,200 fecal specimens, each from a different individual were examined. Fourteen towns in the southern and western parts of the island are represented, but the towns of Guayama, Mayagüez and Ponce present over ninety per cent of the total number. Two thousand samples come from urban, and two hundred from rural communities.

METHOD: A minimum of four direct smears of each specimen was examined. These were prepared by taking the amount of feces held on the broad end of a toothpick, placing it on a slide and then pressing a cover glass on top until a fairly even smear was produced. When necessary the samples were slightly moistened with distilled water in order to favor even distribution on the slide. Old dried out samples were discarded. In nearly fifty per cent of the specimens, the "Brine Flotation Method" with saturated Nacl solution was used in addition.[1]

The parasite distribution of urban and rural populations is shown in Table A. See also Graph I.

TABLE A

	Total Specimens	Positives	Negative	Positives per cent
Urban Population	2,000	1,325	675	66.25
Rural Population	200	181	19	90.05
Urban Population Female	1,000	639	361	63.9
Rural Population Female	110	97	13	88.18
Urban Population Male	1,000	686	314	68.6
Rural Population Male	90	84	6	93.33
Urban Population Hookworm	2,000	349	1,651	17.45
Rural Population Hookworm	200	136	64	68.
Urban Population T. T.	2,000	1,164	836	58.2
Rural Population T. T.	200	152	48	76

(1) Results obtained by direct smear and flotation method to be given in a subsequent paper.

Among the samples from urban population there were 285 from colored individuals with sixty-six and two-thirds per cent positive. Of these 140 were from males with seventy per cent positive, and 145 females with 63.5 per cent positive. These percentages of positives, as well as those obtained for hookworm and Trichuris trichura were incredibly close to the figures obtained for white individuals of corresponding sexes. Of the 1,325 positive urban samples, 438 had two or more parasites and only seventy had three or more. The following table shows the combination of parasites in two thousand urban specimens.

TABLE B

Kind of Parasite	Female	Male	Total	Percentage Positive
1. Trichuris trichura	390	357	747	37.35
2. Hookworm, Trichuris trichura	89	94	183	9.15
3. Hookworm	37	51	88	4.4
4. Ascaris lumbricoides, Trichuris trichura	34	22	56	2.8
5. Schistosoma mansoni, Trichuris trichura	24	56	80	4
6. Schistosoma mansoni	3	21	24	1.2
7. Hookworm, Schistosoma mansoni Trichuris trichura	9	12	21	1.05
8. Trichuris trichura, Strongyloides intestinalis	7	14	21	1.05
9 Hookworm, Ascaris lumbricoides Trichuris trichura	10	9	19	.95
10. Ascaris lumbricoides	10	7	17	.85
11. Hookworm, Strongyloides intestinalis, Trichuris trichura	5	9	14	.70
12. Tenia nana, Trichuris trichura	3	5	8	.40
13. Strongyloides intestinalis	5	3	8	.40
14. Hookworm, Strongyloides intestinalis	2	5	7	.35
15. Hookworm, Schistosoma mansoni	.....	5	5	.25
16. Ascaris lumbricoides, Schistosoma mansoni, Trichuris trichura	2	3	5	.25
17. Ascaris lumbricoides, Hookworm	3	1	4	.20
18. Hookworm, Schistosoma mansoni Strongyloides intestinalis, Trichuris trichura	1	3	4	20
19. Schistosoma mansoni, Strongyloides intestinalis, Trichuris trichura	1	2	3	.15
20. Schistosoma mansoni, Strongyloides intestinalis	2	1	3	.15
21. Tenia nana	2	.....	2	.10
22. Hookworm, Ascaris lumbricoides Schistosoma mansoni, Trichuris trichura	.....	2	2	.10
23. Schistosoma mansoni, Hookworm Tenia nana, Strongyloides intestinalis, Trichuris trichura	.....	1	1	.05
24. Tenia saginata, Strongyloides intestinalis	.....	1	1	.05
25. Tenia saginata	.....	1	1	.05
26. Hookworm, Schistosoma mansoni Ascaris lumbricoides, Strongyloides intestinalis, Trichuris trichura	.....	1	1	.05
Total	639	686	1,325	66.25

By age groups the urban samples were distributed as shown in the following table:

TABLE C

PARASITE DISTRIBUTION IN 2,000 URBAN SPECIMENS

Age	Positive	Negative	Total	Trichuris trichura	Hookworm	Ascaris lumb.	Schistosoma mansoni	Strong lat.	Tenia nana	Tenia saginata
Under 1 year	.....	3	3	.....	.....	.....	.....	.....	.....	.....
1 to 2 years	23	49	72	20	1	6	.....	.....	.....	.....
2 to 5 years	38	54	92	36	4	12	.....	.....	.....	.....
5 to 10 years	565	219	784	533	74	42	66	17	8	.....
10 to 20 years	292	148	540	344	119	41	51	17	3	2
20 to 30 years	170	85	255	125	88	1	13	17	.....	.....
30 to 40 years	72	69	141	58	34	.....	10	6	.....	.....
40 to 50 years	34	27	61	26	10	.....	3	3	.....	.....
50 to 60 years	23	14	37	16	15	1	4	.....	.....	.....
Over 60 years	8	7	15	6	4	1	.....	2	.....	.....
Total	1,325	675	2,000	1,164	349	104	147	62	11	2
In per cent	66.25	33.75	100	58.25	17.45	5.2	7.35	3.1	0.55	0 10

Their distribution into age groups by sexes is shown in Tables D and E.

TABLE D

PARASITE DISTRIBUTION IN 1,000 URBAN SPECIMENS—MALE

Age	Positive	Negative	Total	Trichuris trichura	Hookworm	Ascaris lumb.	Schistosoma mansoni	Strong lat.	Tenia nana	Tenia saginata
Under 1 year	.....	1	1	.....	.....	.....	.....	.....	.....	.....
1 to 2 years	13	27	40	12	1	2	.....	.....	.....	.....
2 to 5 years	16	26	42	15	1	6	.....	.....	.....	.....
5 to 10 years	275	99	374	259	33	19	44	8	2	.....
10 to 20 years	192	54	246	172	56	15	35	11	3	1
20 to 30 years	89	34	123	59	51	1	13	10	.....	1
30 to 40 years	47	40	87	34	23	.....	8	6	.....	.....
40 to 50 years	27	18	45	20	9	.....	3	3	.....	.....
50 to 60 years	21	11	32	15	15	1	4	0	.....	.....
Over 60 years	6	4	10	4	4	1	.....	2	.....	.....
Total	686	314	1,000	590	193	45	107	40	5	2
In per cent	68.6	31.4	100	59	19.3	4.5	10.7	4	.5	.2

TABLE E

PARASITE DISTRIBUTION IN 1,000 URBAN SPECIMENS—FEMALE

Age	Positive	Negative	Total	Trichuris trichura	Hookworm	Ascaris lumb.	Schis-tosoma mansoni	Strong Int.	Tenia nana	Tenia saginata
Under 1 year	.....	2	2	.....	.....	.....	.....	.....	.....	.....
1 to 2 years	10	22	32	8	.....	4	.....	.....	.....	.....
2 to 5 years	22	28	50	21	3	6	.....	.....	.....	.....
5 to 10 years	290	120	410	274	41	23	22	9	6	.....
10 to 20 years	200	94	294	172	63	26	16	6	.....	.....
20 to 30 years	81	51	132	66	37	.....	.....	7	.....	.....
30 to 40 years	25	29	54	24	11	.....	2	.....	.....	.....
40 to 50 years	7	9	16	6	1	.....	.....	.....	.....	.....
50 to 60 years	2	3	5	2	.....	.....	.....	.....	.....	.....
Over 60 years	2	3	5	2	.....	.....	.....	.....	.....	.....
Total	639	361	1,000	575	156	59	40	22	6	0
In per cent	63.9	36.1	100	5 75	15.6	5.9	4	2.2	.6	.....

Comparison of the results shown in tables *C*. *D*. and *E*. in percentage equivalents will be readily understood by reference to the following graphs:

Graph II for total number of positives
Graph III for Trichuris trichura
Graph IV for Hookworm
Graph V for Ascaris lumbricoides
Graph VI for Schistosoma mansoni

There was a total of 916 specimens from Guayama; 444 females and 472 males. For distribution by age groups and sexes see tables *F* and *G*.

TABLE F

PARASITE DISTRIBUTION IN 444 SAMPLES FROM GUAYAMA—FEMALE

Age	Positive	Negative	Total	Trichuris trichura	Hookworm	Ascaris lumb.	Schis-tosoma mansoni	Strong Int.	Tenia nana	Tenia saginata
Under 1 year	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 to 2 years	2	1	3	2	.....	.....	.....	.....	.....	.....
2 to 5 years	.....	4	4	.....	.....	.....	.....	.....	.....	.....
5 to 10 years	221	88	309	214	30	17	24	6	3	.....
10 to 20 years	86	28	114	80	25	7	16	.....	.....	.....
20 to 30 years	3	5	8	2	2	.....	.....	.....	.....	.....
30 to 40 years	2	3	5	2	1	.....	.....	.....	.....	.....
40 to 50 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
50 to 60 years	.....	1	1	.....	.....	.....	.....	.....	.....	.....
Over 60 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	314	130	444	300	58	24	40	6	3	.....

TABLE G

PARASITE DISTRIBUTION IN 472 SPECIMENS FROM GUAYAMA—MALE

Age	Positive	Negative	Total	Trichuris trichiura	Hookworm	Ascaris lumb.	Schistosoma mansoni	Strong Int.	Tenia nana
Under 1 year	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 to 2 years	.....	1	1	.....	.....	.....	.....	.....	.....
2 to 5 years	3	4	7	1	.....	.....	.....	2	.....
5 to 10 years	233	58	291	225	30	13	41	6	1
10 to 20 years	90	26	116	78	24	7	31	7	1
20 to 30 years	8	5	13	4	6	1	1	1	.....
30 to 40 years	16	6	22	10	7	.....	5	3	.....
40 to 50 years	6	6	12	6	1	1	1	.....	.....
50 to 60 years	5	3	8	3	5	.....	2	.....	.....
Over 60 years	2	.....	2	2	1	.....	.....	.....	.....
Total	363	109	472	329	74	22	81	19	2

A total of 679 specimens from Ponce were examined; 402 females and 277 males. Their distribution by age groups and sexes is shown in tables H and I.

TABLE H

PARASITE DISTRIBUTION IN 402 SPECIMENS FROM PONCE—FEMALE

Age	Positive	Negative	Total	Trichuris trichiura	Hookworm	Ascaris lumb.	Schistosoma mansoni	Strong Int.	Tenia nana
Under 1 year	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 to 2 years	3	12	15	2	.....	.....	.....	.....	.....
2 to 5 years	21	21	42	19	13	6	.....	.....	.....
5 to 10 years	65	29	94	62	11	8	.....	2	3
10 to 20 years	87	48	135	73	35	12	.....	1	.....
20 to 30 years	35	28	63	.....	25	17	.....	4	.....
30 to 40 years	16	18	34	15	4	.....	2	.....	.....
40 to 50 years	4	8	12	3	1	.....	.....	.....	.....
50 to 60 years	1	1	2	1	.....	.....	.....	.....	.....
Over 60 years	2	3	5	2	.....	.....	.....	.....	.....
Total	234	168	402	177	79	43	2	7	3

TABLE I

PARASITE DISTRIBUTION IN 277 SPECIMENS FROM PONCE—MALE

Age	Positive	Negative	Total	Trichuris Trichura	Hookworm	Ascaris lumb.	Schistosoma mansoni	Strong Int.	Tenia nana
Under 1 year	.....	3	3	.....	.....	.....	.....	.....	.....
1 to 2 years	2	15	17	2	.....	.....	.....	.....	.....
2 to 5 years	13	22	35	13	1	5	.....	.....	.....
5 to 10 years	38	27	65	34	4	3	2	2	.....
10 to 20 years	47	25	72	42	13	2	.....	.....	2
20 to 30 years	31	9	40	21	26	.....	1	2	.....
30 to 40 years	15	10	25	9	8	.....	.....	2	.....
40 to 50 years	4	5	9	2	2	.....	.....	.....	.....
50 to 60 years	7	3	10	3	6	1	.....	.....	.....
Over 60 years	.....	1	1	.....	.....	.....	.....	.....	.....
Total	157	120	277	126	60	11	3	6	2

There was a total of 377 specimens from Mayagüez; 235 males and 142 females. Their distribution by age groups and sexes is shown in tables *J.* and *K.*

TABLE J

PARASITE DISTRIBUTION IN 142 SPECIMENS FROM MAYAGÜEZ—FEMALE

Age	Positive	Negative	Total	Trichuris trichura	Hookworm	Ascaris lumb.	Schistosoma mansoni	Strong Int.	Tenia nana
Under 1 year	.....	2	2	.....	.....	.....	.....	.....	.....
1 to 2 years	7	11	18	5	.....	4	.....	.....	.....
2 to 5 years	2	3	5	2	.....	.....	.....	.....	.....
5 to 10 years	4	2	6	4	.....	.....	.....	.....	.....
10 to 20 years	22	12	34	18	5	6	.....	1	.....
20 to 30 years	37	18	55	33	11	.....	.....	3	.....
30 to 40 years	8	7	15	8	.....	.....	.....	.....	.....
40 to 50 years	3	4	7	3	.....	.....	.....	.....	.....
50 to 60 years	.....	.....	.....	.....	.....	.....	.....	.....	.....
Over 60 years	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	83	59	142	73	16	10	0	4	0

TABLE K

PARASITE DISTRIBUTION IN 235 SPECIMENS FROM MAYAGÜEZ—MALE

Age	Positive	Negative	Total	Trichuris trichura	Hookworm	Ascaris lumb.	Schistosoma mansoni	Strong int.	Tenia nana
Under 1 year	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 to 2 years	9	14	23	8	1	2	.....	.....	.....
2 to 5 years	1	.....	1	1	.....	.....	.....	.....	.....
5 to 10 years	4	1	5	3	2	1	.....	1	.....
10 to 20 years	50	7	57	44	19	5	4	3	1
20 to 30 years	48	20	68	32	19	.....	11	7	.....
30 to 40 years	16	23	39	15	6	.....	3	1	.....
40 to 50 years	16	9	25	12	5	.....	2	3	.....
50 to 60 years	9	4	13	9	4	.....	2	.....	.....
Over 60 years	1	3	4	1	.....	.....	.....	.....	.....
Total	154	81	235	125	56	8	22	15	1

Graph VII compares the total infestation of different helminths in the three towns of Ponce, Mayagüez and Guayama.

Comments: The higher incidence in total numbers of parasites, in Trichuris trichura and in Hookworm found in rural population as compared with urban is to be expected since sanitary and hygienic conditions prevailing in the country are much more favorable for the infestation with helminths than in the city. Especially is this true, in connection with hookworm infestation.

The fact that the incidence of helminthic infestation is about the same for white and colored people is also to be expected in Porto Rico where there is hardly any difference in living conditions between the two races. Furthermore, colored people usually dwell in the cities by choice and this would tend to make the incidence among them smaller than otherwise.

By far the most common parasite of southern Porto Rico is the Whipworm. Especially is this true of urban population among which it is over three times as common as the hookworm. (See Graph I.) This is to be explained by the fact that its egg is characterized by great power of resistance to drying, that the parasite affects all ages very heavily because of its direct method of infecting man. An intermediate host or larval stage in the ground are not necessary for infestation to take place. Furthermore, efforts for its dislodgment from the human intestines by therapeutic methods are usually of no avail.

In the case of the hookworm which needs to have a cycle of larval development and shedding of its covering in the ground before infestation can occur, it is only in the country where optimun condi-

tions exist for its development and for infestation of the barefooted population, that its figures come anywhere near those of infestation with Trichuris trichura. (See Graph 1.) Due to this larval development in the ground we find a very low rate of infestation in children of urban population. (See Graph IV.)

Parasite infestation with most helminths predominates in the male sex, especially so, after the first decade of life. This predominance is most marked in the case of parasites requiring a stage of development outside the human body. Our figures demonstrate this very well, except in the case of Ascaris lumbricoides where the incidence is a little higher for females than for males. (See Graph V.)

This sexual difference in incidence appears most marked for Schistosoma Mansoni. (See Graph VI.) The reason for this is evident if we stop to consider the cycle of development of the Schistosoma mansoni egg outside the human body. The egg hatches in water and the myracidium swims toward the light, seeking its proper snail host. If successful it enters the feelers of a fresh water snail (planorbis) and is developed into a sporocyst in three to four days' time. At the end of the fifth to sixth day this forms daughter sporocysts which migrate to the hepato-pancreas about the twentieth day and form tubular branches. The cercariae form in these daughter sporocysts. Under proper influence of sun and heat the cercariae escape from the snail and swin around seeking the proper mammalian host. Since bathing and swimming in springs and rivers is more commonly practiced by the male sex we naturally expect a higher incidence of infestation with Schistosoma mansoni in this sex.[1]

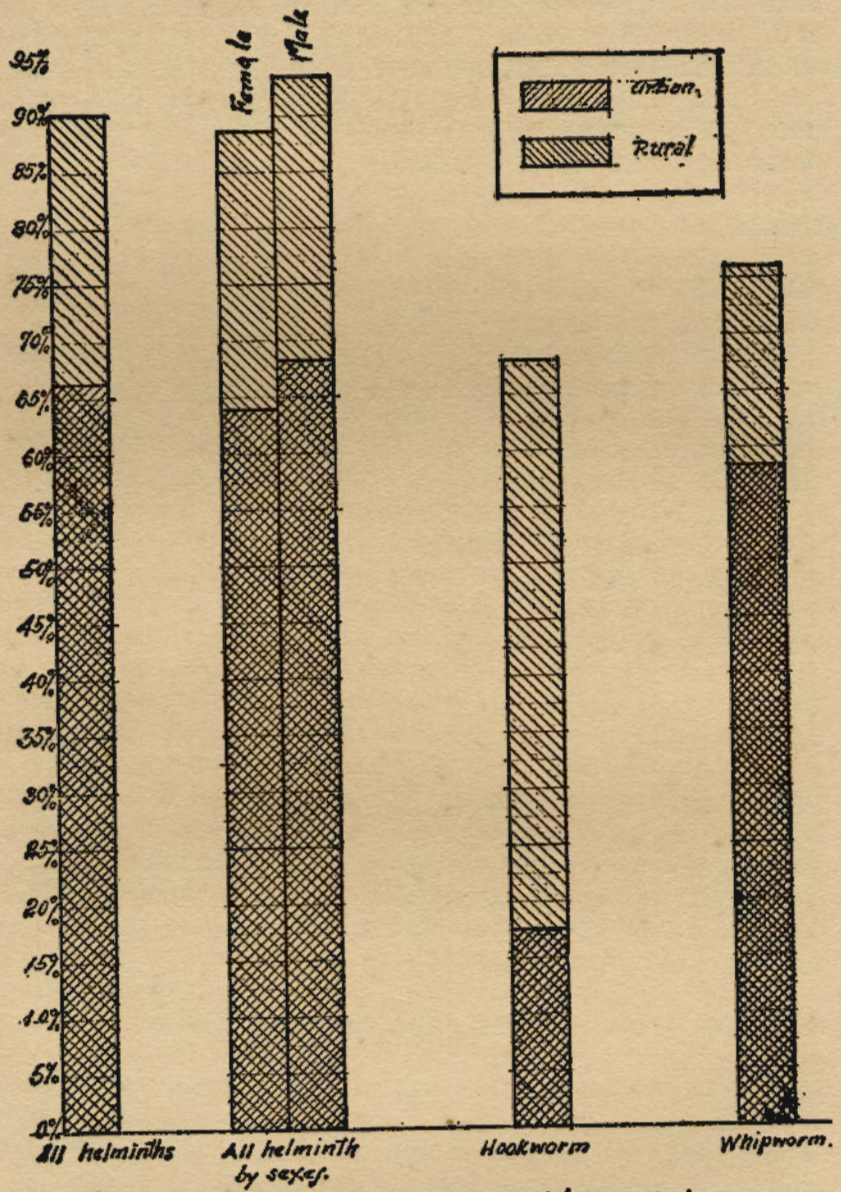
The peak of infestation for different parasites occurs at different ages. For Trichuris trichura, it reaches over sixty per cent and occurs from five to twenty years of age, but the parasite is pretty evenly distributed throughout the other age groups also. The Hookworm has its peak of thirty to forty per cent in the third decade. It comes down, slowly, in the second decade and reaches a very low level in the first.

Ascaris lumbricoides seldom occurs after the end of the second decade. Its peak, around ten per cent, is reached from one to five years. Schistosoma mansoni, occurs most frequently after the close of the first decade. Tenia nana, is not very uncommonly found in children in Porto Rico. The same is true in the United States. Stiles reports over five per cent infestation in children of a Washington, D. C. orphanage. We found this parasite eleven times in two thousand urban specimens, an incidence over five per cent.

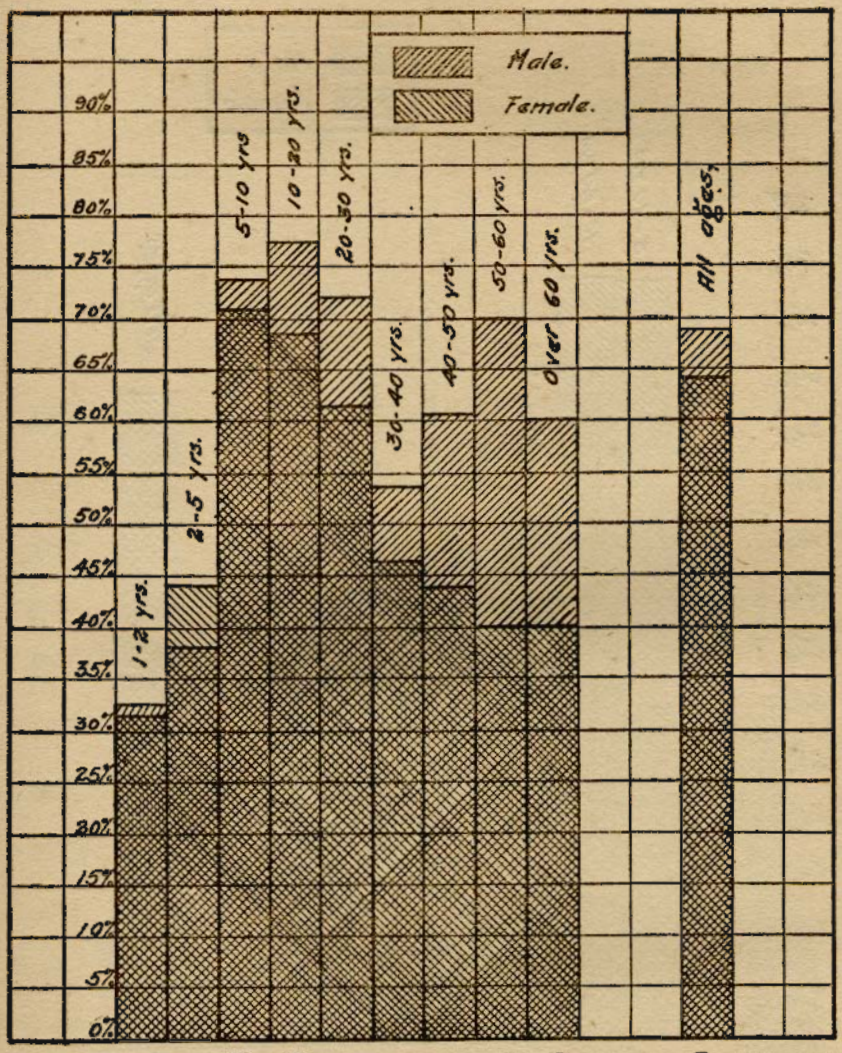
[1] A very high incidence ought to prevail among washer women.

Strongyloides intestinalis occurs at any age after infancy. We found it in sixty-two instances, an incidence a little over three per cent. In its differentiation from Hookworm we could pay little attention to the dictum that when larvae are found in the stools "call them Strongyloides" and when eggs are found "call them Hookworm," since a large majority of our fecal specimens were over twenty-four hours old. The differentiation of the filariform larval stage of these two helminths offers little difficulty but in the differentiation of their rabditidiform larval stage one must be most careful and diagnose Strongyloides only after careful examination with the high dry power of the microscope by its comparatively large genital anlage and the rather small buccal cavity.

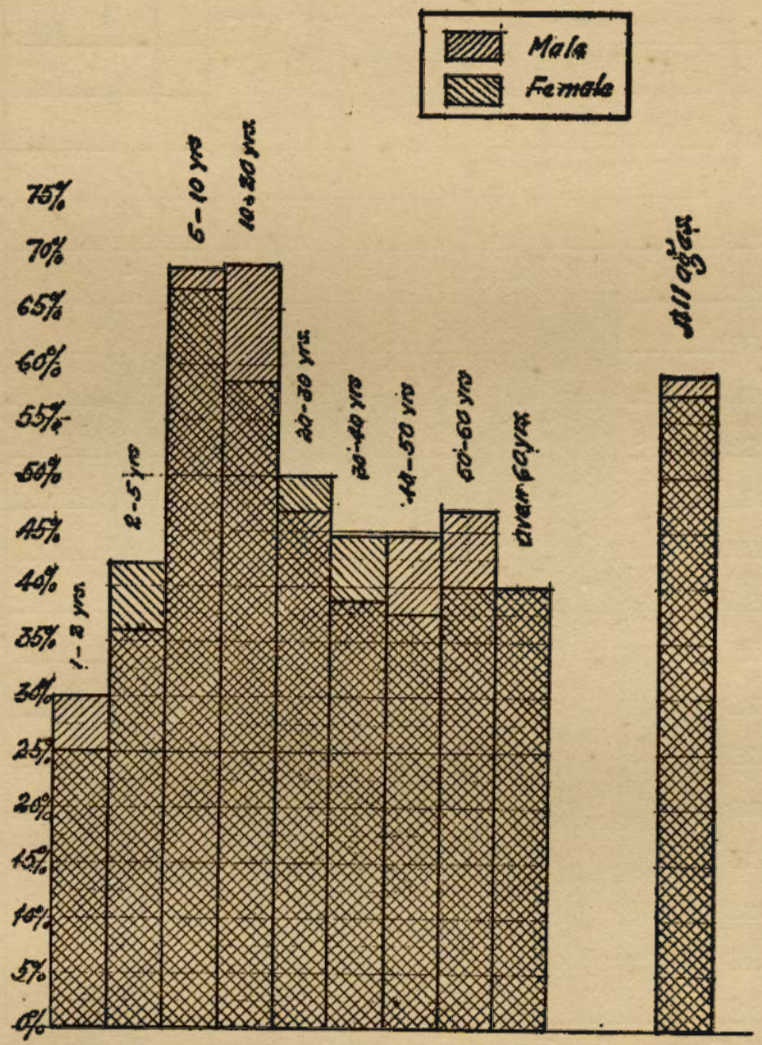
Guayama shows a much higher incidence of Schistosoma mansoni than Mayagüez, and Mayagüez a much higher one than Ponce. (See Graph VII).



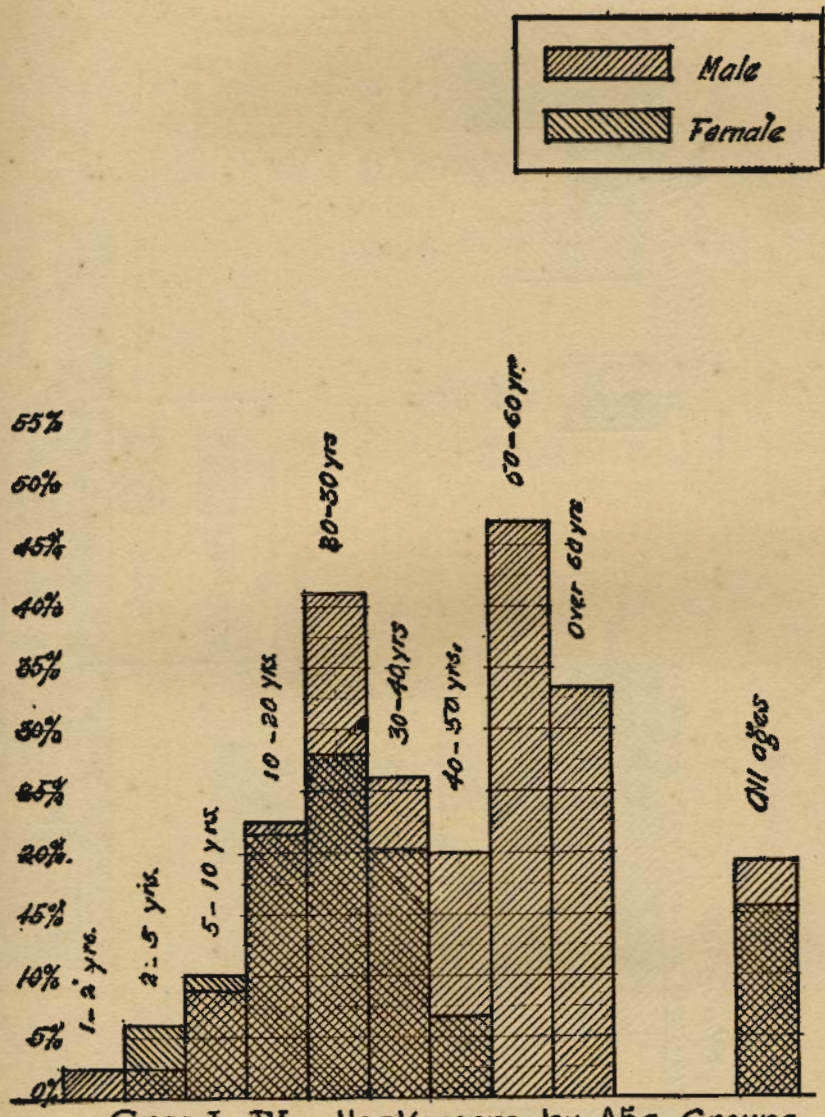
Graph I— Comparison of Parasite Incidance between Urban and Rural Population.



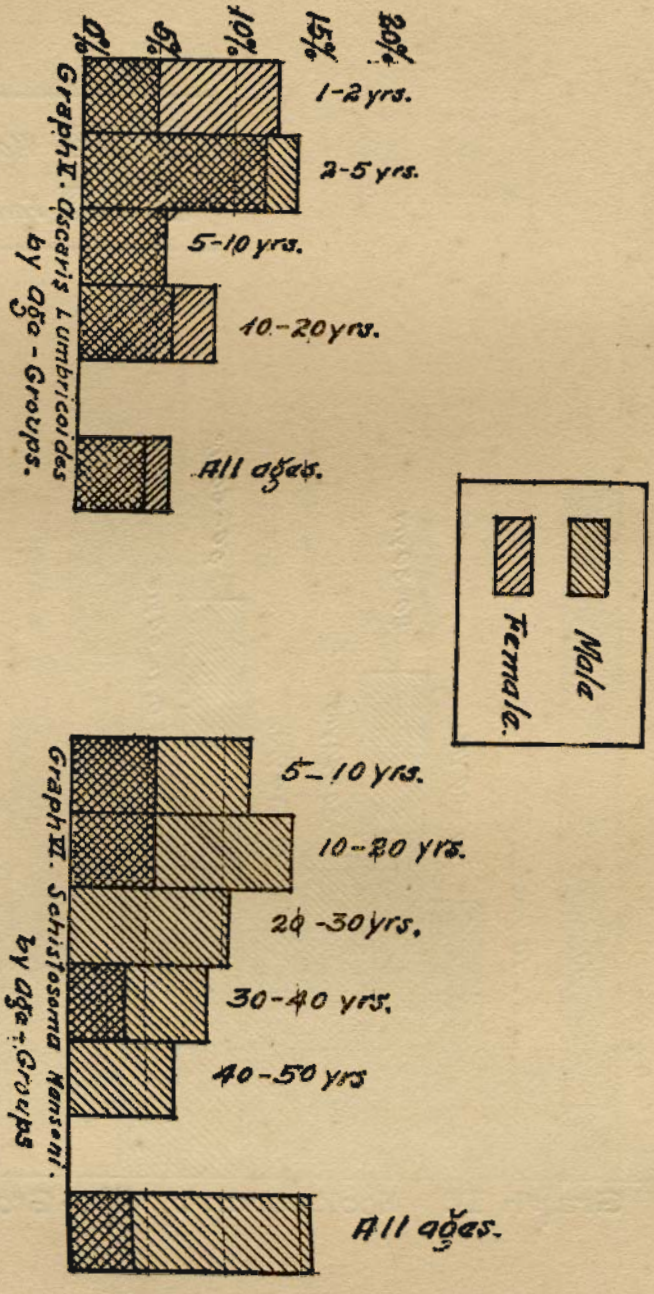
GRAPH. II – PERCENTAGE OF POSITIVE SPECIMENS. BY AGE GROUPS.

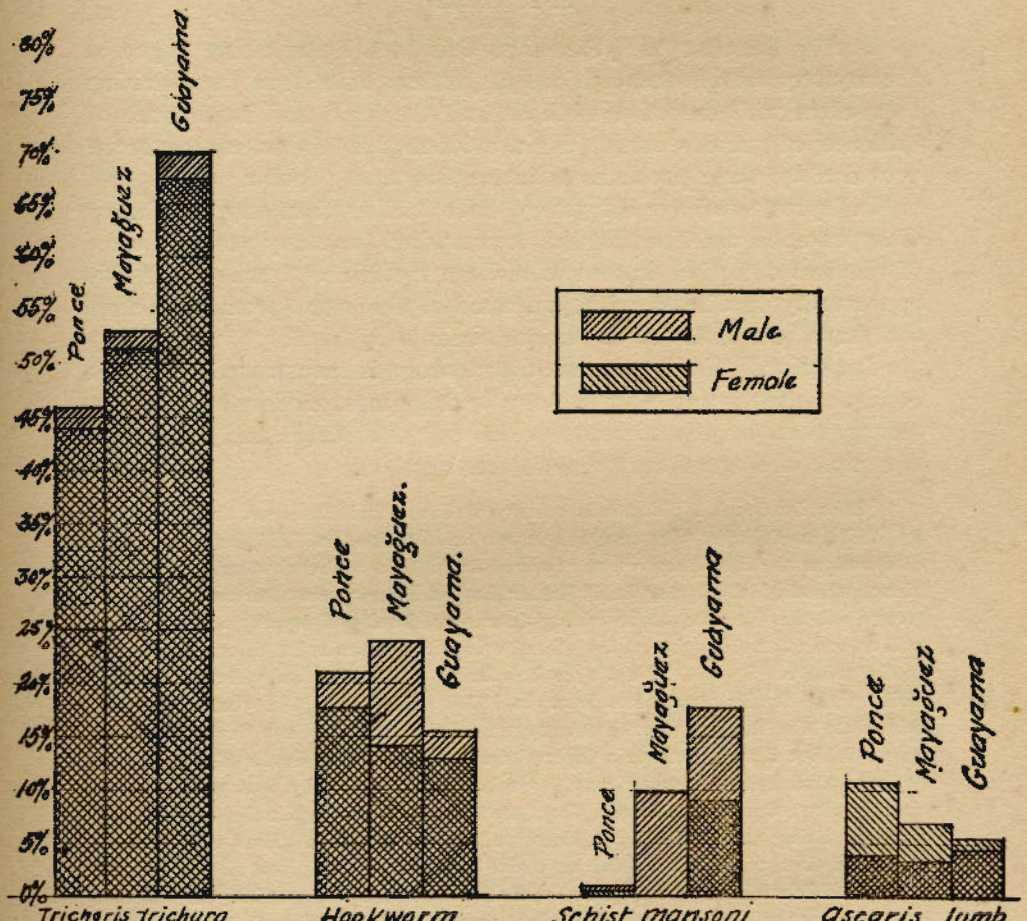


Graph III.— Trichuris Trichura by Age-Groups.



Graph IV. Hookworm. by Age-Groups.


0%
5%
10%
15%
20%
1-2 yrs.
2-5 yrs.
5-10 yrs.
10-20 yrs.
All ages.
Graph II. Ascaris Lumbricoides by Age-Groups.
Female.
Male
5-10 yrs.
10-20 yrs.
20-30 yrs.
30-40 yrs.
40-50 yrs
All ages.
Graph III. Schistosoma Mansoni. by Age-Groups



Graph VII – Showing Parasite Incidence by Towns