SPATIAL AND TEMPORAL PATTERN OF SCHISTOSOMIASIS IN FIELD RATS *(RATTUS NORVEGICUS)* IN SELECTED BARANGAYS OF CATARMAN, NORTHERN SAMAR, PHILIPPINES

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ABSTRACT

A total of forty (40) field rat samples were collected from the four (4) selected barangays of the municipality of Catarman, Northern Samar, Philippines from August 2017 to November 2017. Out of the forty (40) rat samples seventeen (17) were found infected with *Schistosoma japonicum* resulting in a prevalence rate of 42.50%, of which 30.0% (12/40) were males and 70.0% (28/40) were females. Results showed that the month of November got the highest sampled rats caught with twenty two (22) heads, while the lowest is on August with only three (3) heads and with 41.0% and 66.7% rate of infection for schistosomiasis, respectively. With regard to weather condition, it shows that out of the seventeen (17) sampled field rats found infected with schistosomiasis, eleven (11) or 65% of those were retrieved on a sunny weather and six (6) or 35% from a rainy season. This findings implies that weather condition play a vital role in the spread & transmission of Schistosomiasis, given the fact that field rats are considered as the multiplier host of the said parasitic infection in both domestic animals & human beings.

Keywords: Schistosomiasis, Field rats; Spatial pattern; Temporal pattern

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INTRODUCTION

Known since ancient times, schistosomiasis ranks second to malaria among the parasitic diseases with regard to the number of people infected and those at risk. (Steinmann, Keiser, *et al.*). Schistosomes infect about 200 million people worldwide and in the Philippines, around 6.7 million people live in areas where this parasite is endemic.

Schistosoma japonicum is the main causative agent of the disease in the Philippines. The disease has socioeconomic impact as it mostly affects farmers and thus, hampers productivity.

In the Philippines, rats play a significant role in the maintenance and transmission of the disease and this is the reason why schistosomiasis remain difficult to eradicate and control because of the abundance of these pests. Rats are not only reservoir hosts but are also important source of infection as definitive hosts. The rat role should be stressed should human and animal schistosomiasis be controlled.

Rats play an important role in the transmission and preservation of the disease and disease eradication programs should not only focus on the treatment of infected species, as the disease can be cured with inexpensive drugs but the risk of them getting reinfection is high specially if the source of income involves working on the field as farmers for they come in contact with infected water often. Control of the disease also means control of the intermediate (snails) and reservoir hosts (rats). Mapping the pattern of schistosomiasis infected rats in selected barangays of Catarman, Northern Samar, Philippines can show the degree of endemicity in an area. This study can provide data regarding the risks of people and animals against schistosomiasis and can also help in determining control strategies.

Epidemiological research on schistosomiasis, using quantitative methods in carefully defined populations, has been recommended as a sound basis for developing and testing appropriate schistosomiasis control strategies. The integrated use of geographical information system (GIS), remote sensing and geostatistics, has provided new insights into the ecology and epidemiology of schistosomiasis at a variety of spatial scales. (Robinson, 2000).

Objectives of the Study:

To describe the spatial and temporal pattern of schistosomiasis from August to November in field rats in selected barangays of Catarman, Northern Samar.

To determine the prevalence of Schistosomiasis in the four (4) selected barangays of Catarman, Northern Samar.

MATERIALS AND METHODS

Collection of Samples

Field rats were collected from the four (4) selected barangays of the municipality of Catarman, Northern Samar to determine the prevalence of schistosomiasis(Figures 1). The researcher targeted ten (10) rats per barangay, and bought live rats from the farmers. The latter was given adequate briefing and mouse traps was provided to them.

Figure 1. Live field rat samples in rat traps

Examination of Samples:

Each sampled rat was euthanized and dissected for adult schistosomes (Figure 2). The abdominal cavity was incised and opened using a sharp scalpel blade to expose the internal organs. Search of schistosomes was made in all visceral organs like the liver, lungs and other solid internal organs (Figure3). The small and large intestines with their mesenteries intact was also examined for easy recovery of the adult schistosome. Incidental finding of other species of parasites was collected and placed in appropriate containers for identification and was recorded. Recovered schistosomes was separated from their organ attachment and was placed in petri dishes and was allowed to relax so as to come up with well stretched out specimens for easy morphological identification.

Figure 2.Dissection of field rat samples

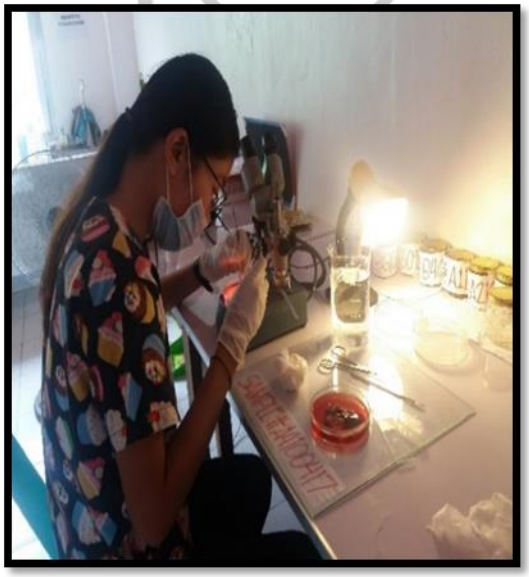

Figure 3.Examination of samples under a stereoscope

Mapping and Tabulation of Results

The resulting prevalence per barangay was used to create the spatial pattern (choropleth map) of the disease in the four (4) selected barangays of Catarman, Northern Samar using a Quantum Geographical Information Software (QGIS). At the end of the study, a line graph of the disease prevalence in Catarman, Northern Samar and parasite load in field rats was generated using a spreadsheet software.

RESULTS AND DISCUSSION

A total of forty (40) sampled field rats from the four (4) selected barangays of the Municipality of Catarmanwere collected. Caught field rats were examined for the presence of Schistosoma japonicum infection. During the four (4) month duration of this study from August to November 2017, the number of field rats caught are presented in Table 1 below.

Collection Period	Sampled Rats Caught	Infected		Not Infected	
		No.	%	No.	%
AUGUST	3	2	66.70	1	33.30
SEPTEMER	4	3	75.00	1	25.00
OCTOBER	11	3	27.30	8	72.70
NOVEMBER	22	9	41.00	13	59.00
TOTAL	40	17	42.50	23	57.50

Table 1. Temporal rate of infection (August to November)

Out of the forty (40) sampled rats collected, there were only three (3) rats caught during the month of August and two (2) were found positive with *Schistosoma japonicum*with sixty six point seventy per cent (66.70%) infection rate. During the month of September four (4) field rats were caught and three (3) were found positive with the said parasite with seventy-five per cent (75.00%) rate of infection. For the month of October there were eleven (11) rats caught but only three (3) were found infected with twenty seven point thirty (27.30%) per cent rate of infection. While for the month of November a total of twenty two (22) field rats were caught and nine (9) were infected with *Schistosoma japonicum* infection having forty one (41.00%) per cent infection rate. Based on the data gathered, the month of

September got the highest rate of infection followed by the month of August, then November, and the least was during the month of October. The result of this present study parallels with the study of Kamiya et al. (1990) who investigated the fluctuation of*S. japonicum*infection in field rats in Dagami, Leyte for one year period. They stated that during the dry season (April to July) prevalence tended to be highest and showed fluctuation tending to lower down during the rainy season (October to February) of the year.

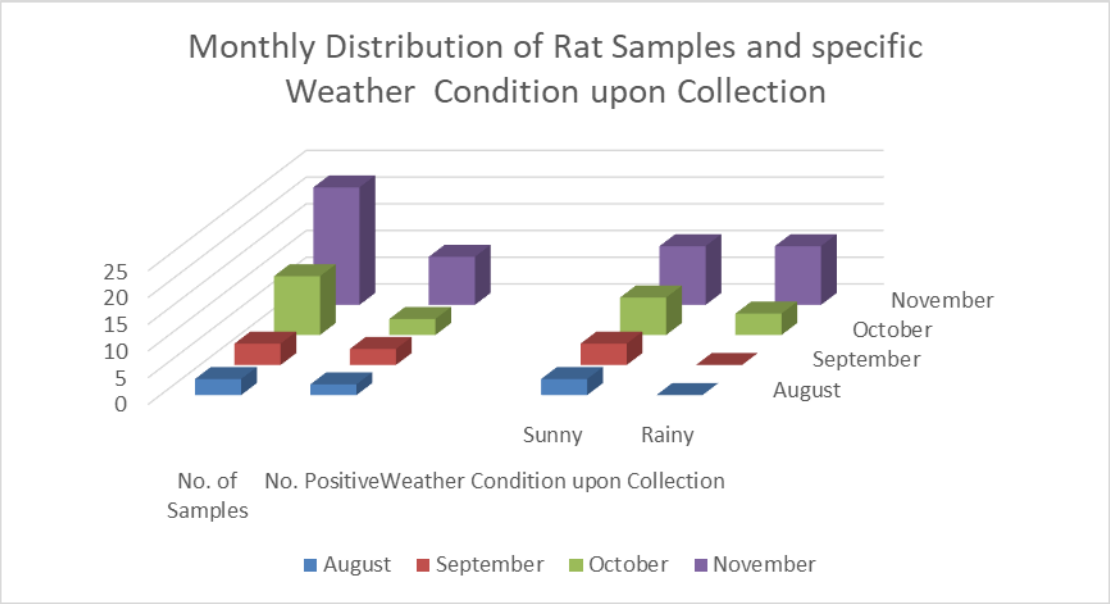

Figure 4.Shows the number of samples, positive rats and weather condition at Collection by a specific month.

The results of this study also shows that out of the seventeen (17) sampled field rats found infected with Schistosomiasis, eleven (11) or 65% of those were retrieved on a sunny weather and six (6) or 35% from a rainy weather. The researcher could not relate this result to the weather condition since the period of the study was limited to four months only. Nevertheless, there were reports from authorities (Blas, et al.) that the annual rainfall pattern is a contributory factor to the existence of the snail intermediate host. Further, Oncomelania snails can survive periods of drought because they possess an operculum capable of closing the shell opening (Bayani, et al.).

Location of Adult Schistosomes upon Recovery and Parasite Load

Of the schistosomes recovered upon necropsy, most of the parasites were obtained on the mesenteric veins of field rats (Figure 5) except for one sampled field rat which has adult schistosomes on both portal vein and mesenteric veins.

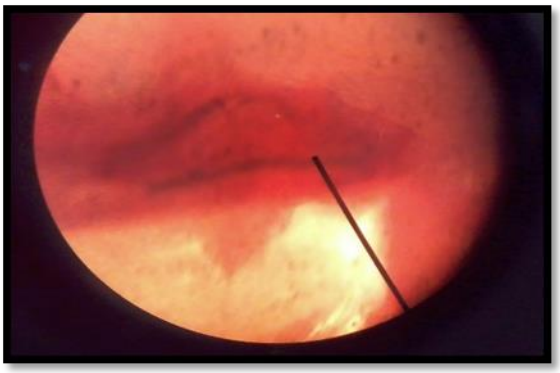

Figure 5. Schistosomes in mesenteric vein

As shown in Table 2, a very low level of parasitism on the field rats was observed wherein in one sampled rat ten (10) schistosomes were recovered; two (2) rats with five (5) schistosomes; one (1) rat with three (three) adult schistosomes. Three (3) field rats with two (2) schistosome parasites recovered and nine (9) samples with one (1) adult schistosome recovered. Only one or two adult parasites recovered in majority of the positive samples, except for one sample (Figure 6) which the researcher recovered sixty-two (62) adult schistosomes a manifestation of a chronic type of infection (Soulsby, 1982; Urquhart et al., 1987; Bowman and Lynn, 1999; McManus et al., 2010; Leonardo et al., 2012).

Figure 6. A field rat from Brgy. Daganas positive of schistosomiasis with 62 extracted adult *S. japonicum*

Table 2. Parasite load of the positive samples

Area	Positive Field Rat Sample	Parasite Load
A	A1	1
	A2	1
	A9	5
	A10	1
B	B1	1
	B3	1
	B4	1
	B7	62
	B8	5
	B9	1
C	C1	3
	C5	2
	C6	2
	C7	1
	C9	10
	C10	1
D	D7	2

The mesenteric veins of this sampled rat appeared occludedon gross inspection (Figure 7) and upon perfusion of the veins adult schistosomes were easily recovered (Figure 8).

Legend:
Area A: Brgy. Libjo
Area B: Brgy. Daganas
Area C: Brgy. Old Rizal
Area D: Brgy. Macagtas

Figure7. Mesenteric veins of Sample B7. The veinsare extremely occluded with adult schistosomes.

The 17 field rats infected with Schistosoma japonicum were also found to be infected with other parasites.

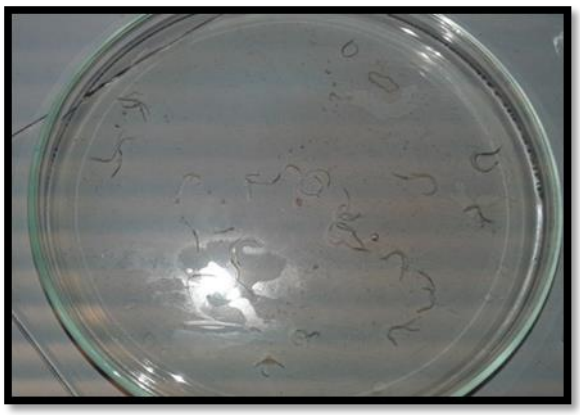

Figure 8. Recovered adult schistosomes in petri dish with warm water.

Prevalence Rate

As shown in Table 3below, out of the sampled field rats 30.0% (12/40) were males and 70.0% (28/40) were females. Further, seventeen (17) field rats out of forty (40) were found to be infected with Schistosoma japonicumresulting in a prevalence rate of 42.50%. Out of these infected sampled rats, Brgy. Daganas and Old Rizal both obtained the highest infection rate with identical sixty (60%) percent, followed by Brgy. Lib
jo wit forty (40%) percent and Brgy. Macagtas with ten (10%) percent. Also shown in Table 3 is the prevalence rate between sexes where male field rats had higher infection rate of twenty two point five per cent (22.50%) than female rats with only twenty (20%) percent . This present study conforms with the work of Cabrera (1976) and Estopa, et al. (2016) in that male rats were more exposed to schistosome infection as they scavenged wider area while females are limited as they took care of their cubs.

Table 3. Prevalence rate of *Schistosoma japonicum* infection in field rats in Catarman, N. Samar, Philippines

	Sampled Field Rats	MALE (12)				FEMALE (28)				Total No. of Infected (N=40)	
		Infected		Not Infected		Infected		Not Infected		No	%
		No	%	No	%	No	%	No	%		
LIBJO	10	1	10.0	2	20.0	3	30.0	4	40.0	4	40
DAGANAS	10	5	50.0	1	10.0	1	10.0	3	30.0	6	60
OLD RIZAL	10	3	30.0	0	0	3	30.0	4	40.0	6	60
MACAGTAS	10	0	0	0	0	1	10.0	9	90.0	1	10
TOTAL	40	9	22.50	3	7.50	8	20.00	20	50.00	17	42.50%

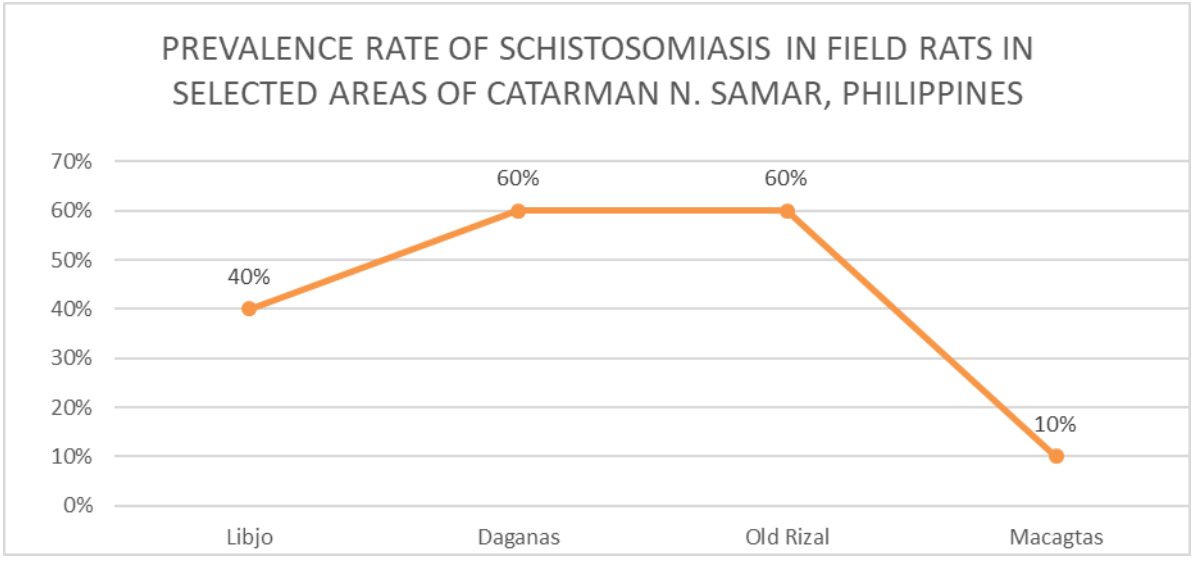

Figure 9. Prevalence rate of Schistosoma japonicum in field rats in the four (4) barangays of Catarman, Northern Samar, Philippines.

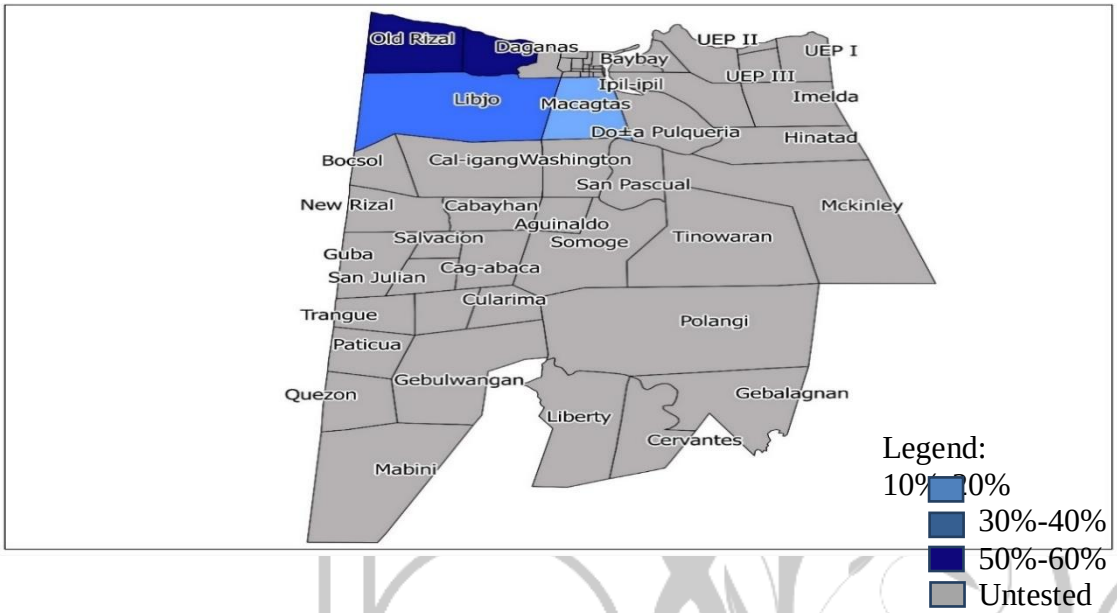

Figure 10. Choropleth Map of the Prevalence of Schistosomiasis in Field Rats in 4 areas of Catarman Northern Samar, Philippines.

SUMMARY AND CONCLUSION

This study was conducted to describe the spatial and temporal pattern of schistosomiasis in field rats in a four-month period from August to November in selected barangays of Catarman, Northern Samar, Philippines. Based on the results gathered, the month of November got the highest sampled rats caught with twenty two (22) heads, while the lowest is on August with only three (3) heads and with 41.0% and 66.7% rate of infection for schistosomiasis, respectively. With regard to weather condition, it shows that out of the seventeen (17) sampled field rats found infected with schistosomiasis, eleven (11) or 65% of those were retrieved on a sunny weather and six (6) or 35% from a rainy season. Of the four barangays surveyed, Shistosomiasis has the highest prevalence in Bgy. Daganas and Bgy Old Rizal with the same 60% infection rate, followed by Bgy. Libjo with 40% and the least at Bgy. Macagtas with only 10%.

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