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PREVALENCE OF *LYMNAEA* SNAILS IN LAHORE DISTRICT AND THEIR ERADICATION BY A MULLUSCICIDE COPPER SULPHATE

T. HUSSAIN, H.A. HASHMI, M.S. KHAN AND A. TANVEER

College of Veterinary Sciences (TH, HAH, MSH) and Department of Zoology, University of the Punjab (TA), Lahore, Pakistan

Abstract: The study was designed to assess the pevalence of the *Lymnaea* snails, identification of infected and non-infected snails with intermediate stages of liver fluke and to recommend suitable copper sulphate concentration as molluscicide under laboratory and experimental pond conditions. Prevalence of *Lymnaea* species was found to be 42% and infection of *Lymnaea* snails with intermediate stage of *Fasciola hepatica* ranged between 38% and 69% in five habitats studied during the period from October 1992 to March 1993. Copper sulphate dilution 1 mg/100 ml (10 ppm) was found to be effective as molluscicide and safe for other aquatic fauna and vegetation.

Key words: *Lymnaea, mulluscides*, snails, seasonal variations, *Fasciola hepatica*, *Fasciola gigantica*.

INTRODUCTION

A large number of diseases of man and animals have been reported to be transmitted through different species of snails. Transmission of human trematode infections, including clonorchosis, paragonomosis, intestinal fluke infection and schistosomiasis through snail vectors have been reported (Webb, 1984). Among trematodes, members of Fasciolidae, Dicrociliidae, Paramphistomatidae and Schistostomatidae are transmitted in animals through snail vectors. Of all trematodes of veterinary importance, members of the family Fasciolidae belonging to the genus *Fasciola* are responsible for causing fascioliasis in cattle, buffaloes and sheep. The disease has been reported to be of world wide prevalence. *Fasciola hepatica* and *F. gigantica*, the causative agents of Fasciolosis in livestock are transmitted through different *Lymnaea* species of snails (Soulsby, 1982). *Lymnaea auricularia, L. rufescense* and *L. andersolana* have been reported as fasciolosis transmitter in India (Prasad *et al.*, 1987). Prevalence of *L. rufescens, L. acuminata* and *L. auricularia* have been confirmed in different districts of Sindh by Sarwar (1956). *Lymnaea* species of snails are usually found on decaying floating leaves (42.73%), aquatic submerged vegetation (34.08%), wood-logs and floating objects (16.12%). Lymnaeid snails are rarely found from the bottom of the ponds. Similar findings have been reported from this laboratory (Tanveer *et al.*, 1990).

For the control of any parasite, its life cycle has to be interrupted. For the purpose

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snail (vector) can be eradicated by the use of molluscicides. Some 7000 compounds have been screened as molluscicides (Ritchie and McMullen, 1961). Ivermectin was used as a molluscicide by Okafor (1990). Mius *et al.* (1990) used acetaldehyde and metaldehyde as a molluscicide. Bayluside 70% wettable powder has been applied in large irrigation canal and lakes in Mali by Madsen *et al.* (1986). Copper sulphate has slow solubility and high specific gravity hence it is only toxic to organisms ingesting them on the bottom of water bodies and therefore comparatively harmless to other aquatic life. It is freely available and easily applicable (Anon, 1973; Cheng, 1975).

In the present study prevalence of *Lymnaea* snails, rate of their infection with intermediate stages of liver fluke and their correlation with meteorological conditions in Lahore district was studied. Moreover, study on the efficacy of different concentrations of copper sulphate as molluscicide *in vitro* and *in vivo* was undertaken.

MATERIALS AND METHODS

Collection of snails

One thousand snails were collected fortnightly from five places in Lahore, 200 from each of the National Ravi park (adjacent to river Ravi at Shahdara), Bansi Sagar fish pond (Mustafa-abad, Cantt), Botanical garden pond (University of the Punjab), a pond located in Lawrence garden and Mustafa-abad drain.

Snails were brought to the laboratory for their identification and of intermediate stage of *Fasciola* spp. Identification of snails was done by the details given by Malek and Cheng (1974). After every fifteen days snails were collected and brought to the laboratory. For this purpose the number of dead and alive snails were taken under consideration. The time of collection wasnot considered. While transferring the snails from the acclimated temperature to the room temperature, the snails were first brought to the required temperature slowly within 2 hours, in order to avoid mortalities due to sudden temperature shock.

Identification and maintenance of Lymnaea snails

The snails have thin shell usually with a prominent acute spire and a large, often flaring aperture, varying from horn-color to black, lip acute and simple; tentacles flattened; eggs laid in jelly; radula with unicuspid central tooth, jaws composed of three pieces, one large transversely elongate piece and two, small ones; foot rounded behind. The maintenance of snails was done as suggested in the manual published by MAFF (Ministry of Agriculture, Fisheries and Food, 1986).

Identification of Trematodes

The identification of immature stages of trematodes was done according to the techniques described in MAFF (1986).

Application of molluscicide (Copper sulphate)

Two standard doses of copper sulphate *i.e.*, 1 mg/66 ml suggested by Osterberg (1987) and 1 mg/100 ml ponds located in the College of Veterinary Sciences, Lahore and 4 laboratory aquaria. Comparative efficacy of the two concentrations of $CuSO_4$ was

assessed by the rate of mortality of the snails and safety of other aquatic fauna. Standard temperature (25 ± 1.5°C) with pH 7.4 was tried to and water 3000 ml/2 snails was kept to maintain as a standard habitat in the laboratory as described by Tanveer *et al.* (1989).

Collection of meteorological data

Meteorological data of distt. Lahore was recorded to study the correlation of habitats of snails as well as of intermediate stages of liver fluke under local conditions.

Estimation of water

Volume in liters of the cylinder shaped experimental pond was calculated by the formula $\pi r^2 h$, where r is radius and h is the height ofthe cylinder.

Statistical analysis

Data were analysed by using statistical test formula and the values obtained was compared with the tabulated values under 10 degree of freedom tonote the significant difference for the molluscicide dilutions.

RESULTS AND DISCUSSION

A total of 8000 snails were collected from five places in and around Lahore, which included different genera namely; *Lymnaea, Gyraulus, Physa, Bulinus* and *Oncomelania*. The percentage being, 42.36, 19.11, 12.29, 12.54 and 13.7 respectively. However, out of 8000 snails only 2465 (30.8%) were found alive during whole of the study period.

The study was undertaken during the period from October 1992 to March 1993. It was found that monthwise percentage of *Lymnaea* spp. were 30.8, 16, 15.78, 0, 28.46 and 64.02% from October 1992 to March 1993. Further details have been given in Table I. Monthwise prevalence of snail has been studied by different research workers. Mushtaq (1983) claimed that *Lymnaea* snails were maximum in number when the temperature was warmest and minimum in November when the temperature was coldest. The present findings are in agreement with these studies but different with Hassan *et al.* (1984) who reported the highest prevalence (28.55) of *Lymnaea* snails during the month of January but lowest in June to October, in Fayum province of Egypt. The difference may be due to different ecological conditions in both studies.

Five places were studied during the present work. It was found that from October to March, the prevalence of alive snails in Ravi fish pond was 11% in October and no snails could be found in other months as fish pond became dry. In Mustafa Abad drain 33% in October, 0% in November, December and January, 38.54% in February and 46.23% in March, alive *Lymnaea* spp. were found. In Jinnah garden (experimental *Lymnaea* snails rearing pond) during January and February no snails could be recovered. From Bunsi Sagar fish pond 35.7%, 7.5%, 0.0%, 6.75% and 9.93% whereas from Botanical gardens 13.46%, 8.69%, 12.98%, 0% and 0% alive *Lymnaea* snails were recovered during the months from October to March, respectively. The findings which clearly indicate the lowest prevalence during the winter months. It was noticed that *Lymnaea* spp. disappeared in Ravi Fish Pond due to dryness of pond. The results

Table I: Prevalence of alive snails belonging to different genera collected from various study areas.

		October		November		December		January		February		March		Total	
		T	A	T	A	T	A	T	A	T	A	T	A	T	A
L	No.	804	232	635	57	789	48	330	-	229	80	602	427	3389	844
	%age	40.2	30.8	45.68	16	49.37	15.7	41.25	-	28.62	28.4	50.16	64	42.39	34.69
G	No.	406	178	291	111	245	115	171	66	166	95	250	93	1529	658
	%age	20.3	23.63	18.18	31.15	15.37	37.7	21.37	66	20.75	33.8	20.83	13.8	19.17	26.69
P	No.	175	37	175	74	320	69	63	23	188	36	62	26	983	265
	%age	8.75	4.9	10.93	20.7	120	22.62	7.87	23	23.5	12.81	3.8	3.88	12.28	10.75
B	No.	270	146	229	68	147	65	89	8	83	18	183	69	1003	374
	%age	13.5	19.38	14.37	19.18	9.18	21.31	11.12	8	10.37	6.4	15.4	10.29	12.53	15.17
O	No.	345	160	270	46	99	8	147	3	134	52	101	55	1096	324
	%age	17.25	21.24	16.87	12.93	6.18	2.62	18.37	3	16.75	18.5	8.4	8.2	13.7	13.14
Total		2100	853	1706	456	1800	405	900	200	900	381	1299	770	8100	2565

Abbreviations: L = *Lymnaea*, G = Gyraulus, P = Physa, B = Bullrinus, O = Oncomelania, T = Total No. of snails, A = alive snail.

Note: The percentage was calculated with reference to total numbers collected per month.

substantiated with the findings of Mushtaq (1983) who claimed that *Lymnaea* cannot live long in an environment devoid of water as they are least resistant to desication.

The temperature and humidity are other factors for the survival of *Lymnaea* spp. and other snails, as it has been studied by Tanveer *et al.* (1989). They conclude that the optimal temperature for *Lymnaea* spp. was 26±1°C whereas the minimum lethal temperature noted was 40°C. During December 1992 and January, 1993 the minimum temperature ranged between 9.4°C and 6.7°C, respectively which is detrimental for the survival of snails. That is why, during this period the *Lymnaea* snails could not be found in the ponds. Effect of humidity has also been studied by Mushtaq (1983) who referred that maximum number of snails in the month with least humidity (May) and the minimum number in the month with high humidity were recovered. The humidity levels relating to the recovery of snails are given in Table II.

Six experiments in duplicate were conducted in fish aquaria and experimental pond to observe the effect of copper sulphate dilutions *i.e.*, 1 mg/66 ml of water and 1 mg/100 ml of water. Each experiment consisted of 28 snails of different genera as well as for each dilution. The results showed that 1 mg/66 ml dilution showed mortality dilution of snails between 46.42% and 60.71%. Unpaired t-test showed no significant difference amongst the two dilutions when compared with the tabulated value at 10 degree of freedom at x/2 levels. It was observed that 1 mg/66 ml of dilution was obviously better and effective for the control of snails. However, fingerlings of fish present in the 1 mg/100 ml dilution were not affected at all even up to 72 hours whereas all snails were killed within 22 hours of medication. A lot of work has been undertaken for the use of copper sulphate as molluscicide by number of workers (Webb, 1984).

Table II: Effect of average relative humidity (percent) on the snails population.

	October	November	December	January	February	March
Average Humidity	62	71.5	73.5	64.9	60.0	58.9
Total snails	2000	1600	1800	800	800	1200
Alive snails	753	356	305	100	281	670

Copper sulphate as effective molluscicide has been used by many workers and it has been found that 10 ppm concentration can be used with better safety index and less cost of its treatment.

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