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Observation on Collecting *Oncomelania hupensis* When Opening The Sluices During Flood Season in Yangtze River

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ABSTRACT

To ascertain whether *Oncomelania hupensis* can spread into the ditch when a floodgate was open, an observation was made in the snail-ridden area during the flood season of Yangtze River in Jia Yu County from July to september 1987.

The snails were collected at the ditch inside the floodgate for 71 hours and 25 minutes within 9 days. The flow through the net was 179-982 m^3, 145 snails were gained with blocking net at the flow speed of 0.02-1 meter/second, its average density was 0.81 snails/1000 m^3 (0.21-6.73 snails/1000 m^3). The number of gained snail at the lower section of the ditch were 6.25 times as high as that caught at the upper section. The number of snails in water was decreasing with the depth of the water. The area of 846 m^2 was scooped inside the floodgate for 5 days, its average density was 1.52 snails/m^2. The area of 220 m^2 was scooped around the opening outside the floodgate for 4 days, its average density was 0.63 snails/m^2 of all the gained snails, 98.79% were young with a whorl under 6.5

The result showed that when the floodgate was sluiced for irrigation, snails could spread into the ditch and thus snail-ridden areas increased accordingly.

KEY WORDS : *Schistosoma japonicum, Oncomelania hupensis*

INTRODUCTION

The fact that *Oncomelania hupensis* could drift down with or without a carrier on the Yangtze River has already been reported. (Handbook of prevention and treatment schistosomiasis, 1981 & Fang, 1984). But it was not confirmed whether snail could drift into the ditch when the floodgate was sluiced for irrigation during the flood season. In our province, there are hundreds of floodgate in the snail-ridden areas along the Yangtze River. It was reported that in these regions, the snail areas are increasing over the years. To clarify whether snails can drift into the ditch when the floodgate was open, an observation was made in Jai Yu County from July to September 1987.

The objectives of this investigation were to determine if the snails are transported with water flow when the floodgate was open for irrigation, sources of snails inside and outside of the floodgates, and to recommend appropriate measures for snail management in the Yangtze River areas.

MATERIALS NAD METHODS

Field condition: The observation was carried out at the Shaung - Yi floodgate which was located at the bank of the Yangtze River in Pai-Zhou town of Jiayu County (Figure 1 & 2). The heavy snail-ridden area was located along the banks outside the floodgate. Inside the floodgate was the main canal connected by a ditch of about 400 meter long. The main canal was 100 miles long and snail-free when it was first constructed in 1959. Because the gate was sluiced every year, the snail ridden area was found to be 2 mu (1 mu = 0.00667 ha) along the main canal in 1979, and increased to 900 mu by the end of 1987.

Blocking snails: Blocking net was made of nylon screen of 42 mesh/cm, the mouth of the

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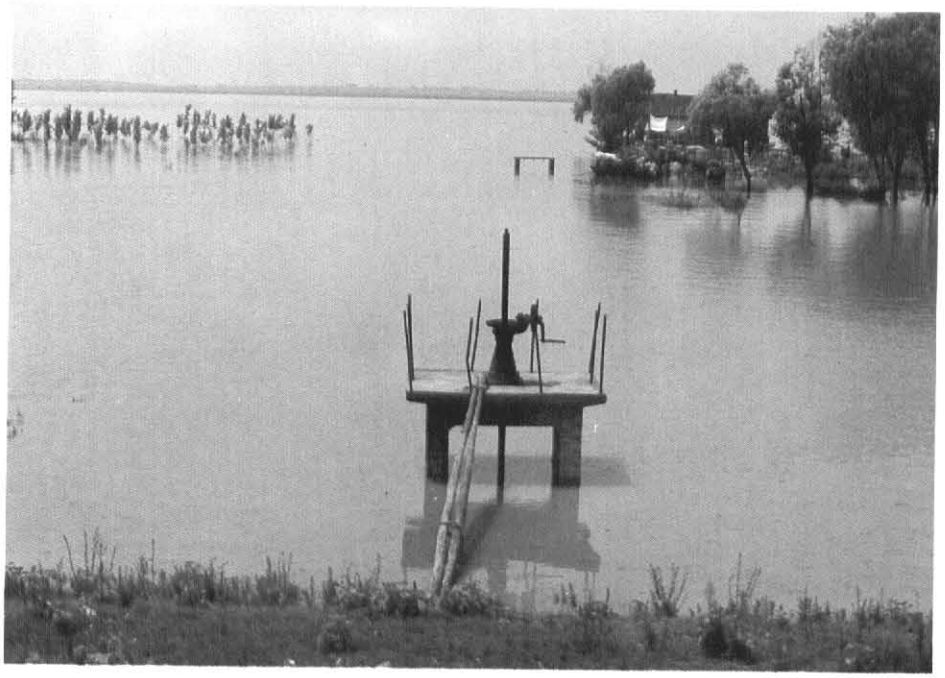

Figure 1. Floodgate on Yangtze River during flood.

Figure 2. floodgate on Yangtze River during non-flooding season.

net is of rectangle-form (a length of 1 m, a width of 0.5 m, and a depth of 1 m) with tapering bottom. Several nets were connected by nylon rope according to the width of the ditch.

Two sets of blocking net were put at the upper section and the lower section in the ditch respectively (Figure 3 & 4). There was no weed at the upper section, however at the lower section weed was abudant on both sides of the ditch. All nets were put at different depth of water.

Scooping snails: Scooping net was also made of nylon screen (Figure 5 & 6). The mouth of the net is of triangular, the length was 1 m for each side with tapeing bottom, attached to a long stick.

Scooping snails was done according to systematic sampling, the distance between two points was 5 m, and one square meter of surface water was scooped each time. Meanwhile, during the period of observation the flow speed of water, the hour of collecting snail, the water level, weather and related data were recorded, the gained snail in every net was carefully counted. Scoopings were done inside and outside flood gates (figure 7 & 8).

RESULTS AND DISCUSSION

Collecting snails with blocking net at different time and speed of water in the ditch. The hydrological data was based on the record of the local Water Conservancy Station, the floodgate was open for 29 days and the total flow of water was 963,018 m^3 through the ditch from July to September. During this period, the actual time in collecting snail was 71 and 25 min within 9 days, and the flow of water was 179,982 m^3 through the net. One hundred and forty five snails were gained, its average density was 0.81 snails/1000 m^3 (0.21-6.73 snails/1000 m^3). The increase and decrease of the average density of gained snail didnot correlate with the change of the current velocity at different days and the speeds of water, but at the same day, as the speed of water increased the average density of snails also increased. (Table 1).

Collecting snails at different sections in the ditch: 125 live snails were gained at the lower section, and 20 at the upper section in the ditch at the speed of water of 0.02-1m/sec. The number of gained snails at the lower section was 6.25 times as high as that of the upper section in the ditch (Table 2).

Table 1. Number of snails collected at different time and speed of water in ditch.

Date	Speed of water (h/s)	Hours of collecting snail (h.min.)	Area of collecting net (m^2)	No. of gained snails	Flow* through net (m^3)	Average density of snails (snails/1000 m^3)
July 20	1.0	1 h	1.5	16	5400	2.96
July 26	0.5	6 h 20 min	1.5	28	18000	1.56
July 27	0.6	18 h 25 min	1.5	14	33750	0.42
July 28	0.8	5 h 30 min	1.5	5	23760	0.21
August 13	0.06	5 h 30 min	3.0	24	3564	6.73
August 14	0.04	6 h 20 min	3.5	9	3192	2.82
August 14	0.02	6 h 20 min	3.5	1	1596	0.63
September 18-20	0.24	30 h	3.5	48	90720	0.53
Total		71 h 25 min	19.5	145	179982	$\bar{X}$ = 0.81

*Flow through net = Speed of water x Hours of collecting snail x Area of collecting net.

Figure 3. Blocking snails along the ditch at upper section of the ditch.

Figure 4. Blocking snails at different depths of water at lower section of the ditch

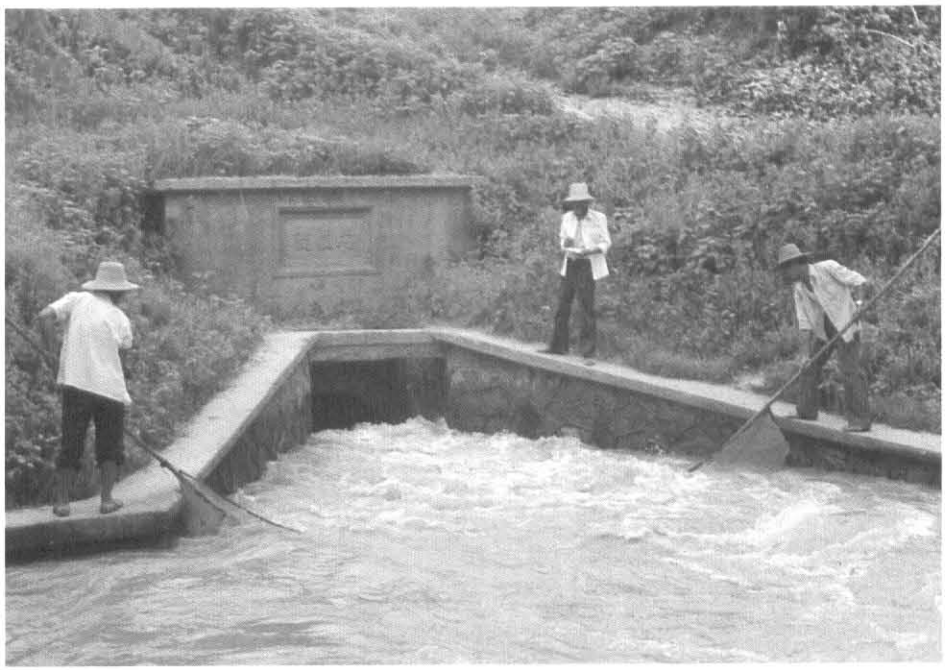

Figure 5. Scooping snails inside the floodgate during sluicing for irrigation.

Figure 6. Scooping snails along ditchbank during sluicing for irrigation.

Figure 7. Scooping snails outside floodgate.

Figure 8. Scooping snails outside floodgate along ditchbank.

Table 2. Number of snails collected at different sections in the ditch.

Speed of water (m/sec)	Upper Section			Lower section		
	Hours of collecting snail (h.min.)	Area of collecting net (m^2)	No. of gained snails	Hours of collecting snail (h.min.)	Area of collecting net (m^2)	No. of gained snails
0.02	6 h 20 min	3.5	1	—	—	—
0.04	—	—	—	6 h 20 min	3.5	9
0.06	5 h 40 min	3.0	1	2 h 40 min	3.0	24
0.2	10 h	3.5	3	10 h	3.5	26
0.3	5 h	3.5	3	5 h	3.5	16
0.5	3 h 20 min	1.5	5	3 h 20 min	1.5	22
0.6	6 h 30 min	1.5	3	6 h 30 min	1.5	11
0.8	4 h 40 min	1.5	1	4 h 40 min	1.5	4
1.0	20 min	1.5	3	40 min	1.5	13
Total	41 h 50 min	19.5	20	39 h 10 min	19.5	125

Table 3. Number of snails collected at different depths of water in the ditch.

Depth of blocking net (cm)	Hours of collecting snail (h)	Area of collecting net (m^2)	No. of gained snails	Average density of snails (snails/h/m^2)
Water surface to 50	23 h	33	140	0.1845
50 to 100	37 h	17	5	0.0079

Table 4. Scooping snails on the water surface inside and outside the floodgate at different periods.

Date	In ditch inside the gate			Around the bank outside the gate		
	Area of scooping snails (m^2)	Detectable rate of snails in scoop (%)	Average density of snails (m^2)	Area of scooping snails (m^2)	Detectable rate of snails in scoop (%)	Average density of snails (m^2)
July 20	94	95.74	1.73	60	16.67	0.27
July 27	180	36.67	1.29	60	10.00	0.05
July 28	200	54.00	1.62	—	—	—
August 13	212	68.87	1.53	40	35.00	0.25
September 18	160	41.25	1.51	60	43.33	1.82
Total	846	$\bar{X}$ = 56.26	$\bar{X}$ = 1.52	220	$\bar{X}$ = 25.45	$\bar{X}$ = 0.63

Collecting snails at different depth of water in the ditch: Blocking net was put under water at different depths, the result showed that the gained snails from the water surface to 50 cm depth was higher than that gained at 50 to 100 cm depth (Table 3).

Scooping snails on the water surface inside- and outside the gate at different periods: From July to September, scooping snails was taken 5 times inside the gate, and an area of 846 m^2 was inspected. The detectable rate of snail in scoop was 56.25% with average density of 1.52 snails/m^2. Four scoopings were taken outside the gate, and an area of 220 m^2 was inspected. The detectable rate of snail in scoop was 25.45% with average density of 0.63 snails/m^2 (Table 4).

The proportion in whorl of gained snail: 98.79% of the gained snail were young with whorl under 6.5 among 1567 snails examined, only 8 older snails were found (0.005%). As number of days increased, the snails developed more whorls and approached maturity (Table 5).

Collecting snails was carried out at Shaungyi floodgate during July to September 1987 for 9 days. The result showed that when the floodgate was sluiced for irrigation, snail could drift with the running water into the ditch. The snails could be gained at the speed of water of 0.02-1 m/s in the ditch. The number of gained snails differed with varying current velocity in the same day, the higher the current velocity, the higher number of snails gained. However, on certain days, the number of snails gained did not increase with the increase of the velocity of water, it was probably due to the spatial distribution of the snails in the Yangtze River, and further observation is needed.

The number of blocked snails at lower section was 6.25 times higher than that caught at the upper section in the ditch. It might be due to the weediness of the vegetation in the ditch. There was no weed at the upper section, but the weed was thick at the lower section along the banks of the ditch. The surface water of 320 m^2 was scooped at the upper section, with no snail found, while 846 m^2 of surface water scooped at the lower section yielded average density of 1.52 snails/m^2. It was considered that whenever the gate was sluiced, the snail could follow the running water into the ditch, part of the snails also drifted into the main canal directly, while others anchored on the weed at the lower section. As the water speed became faster or when the weed was stirred by blocking net, the snails on the weed would drop down and then drifted into the net. It was concluded that the gained snails at the upper section were those from outside the gate at that very day, but the gained snails at the lower section were those already present on that day and also those which attached on the weed in the previous days. Moreover, the

Table 5. The proportion in whorl of gained snails.

Date	No. of gained snail	Whorl proportion				
		3.5 whorls (%)	4.5 whorls (%)	5.5 whorls (%)	6.5 whorls (%)	7.5 whorls (%)
July 20	184	-	46.20	32.07	20.65	1.09
July 6-28	617	5.35	34.68	45.55	14.26	0.16
August 13-14	368	3.80	28.80	41.06	25.80	0.54
September 18-20	398	-	13.57	51.50	31.41	3.52
Total	1567	3.0	29.29	44.42	22.08	1.21

Figure 9. Searching for snails in the shelterbelt outside the floodgate duringdry season.

figure 10. Oncomelania snails on tree trunk.

number of snails in water decreased with the depth of the water. Such finding conformed with those of Yin *et al.* (1987).

To ascertain that the collected snails in the ditch were from outside the gate, the water surface of 220 m^2 was scooped around the bank of the river outside the gate, 139 live snails were gained with average density of 0.63 snails/m^2. It was therefore confirmed that the snails were from outside the gate.

Seventy five trees were surveyed in the shelterbelt outside the gate (Figure 9 & 10) in dry season, 78.7% of the trees had snails on the trunk, its average density was 12.44 snails/tree. The inspected quadrats were arranged that the distance between two points was 5 m, and the snails on the ground at the shelterbelt was searched, a quadrate was on square foot and altogether 108 quadrats were inspected. The detectable rate was 45.40%, and its average density was 1.77 snails/$foot^2$. The result showed that the high density of snails outside the gate was one of the major factors that caused the snails to get through the gate.

Of all gained snails 98.79% were young with the whorl under 6.5 among the 1567 snails. The snail of 7.5 whorl was 1.21%, only 0.005% was old snails. In other words, the young snails played a significant role in the spread.

The results suggested that to prevent the snails from spreading, the floodgates that were located in the snail-ridden areas should not be open for irrigation until snails around the gate and the upper reaches of the river was thoroughly eradicated. This is to prevent people and livestock from contacting with snails and to contain the snails inside the floodgate for necessary extermination.

ACKNOWLEDGMENTS

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