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Research Article

FRESHWATER SNAIL DIVERSITY AND TREMATODE PREVALENCE (CERCARIAE STAGE) IN SNAILS IN SMALL CANALS OF CU CHI DISTRICT, HO CHI MINH CITY

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ABSTRACT

The research on snail species composition by morphological analysis method in the sixth-level canals in Cu Chi district, Ho Chi Minh City showed that eight snail species belonging to eight genera and five families were collected. Snails were sampled in the dry season (March 2022) and the rainy season (May 2022). Only snails in Kenh Lang – Ben Muong canal were infected trematodes. Furcocercous cercariae were recovered from Clea helena in the dry season with a prevalence of 2.3%. Xiphidio cercariae were found in Sinotaia lithophaga (in the dry season) and Filopaludina sumatrensis (in two seasons) with a prevalence of 4.0% and 3.5%, respectively. The trematode prevalence in the dry season was higher than in the wet season; however, there was no significantly different for Filopaludina sumatrensis (P>0.05). The findings provided information about the diversity of snails and trematode infection in the area. Further research in the different water bodies should be done in Cu Chi district and other places to identify the infected snail species and conserve the rare and precious snail species.

Keywords: canal; cercariae; Cu Chi; snail; trematode

1. Introduction

Freshwater snails play an important role in the ecology system in water bodies and daily life of Vietnamese (Do, 2015). A lot of research on the diversity of snail species has been done in previous years. There were 47 freshwater snail species in the North of Vietnam (Dang et al., 1980). In Nam Dinh province, 16 snail species in two communes of Nghia Phu district of this province were collected, and species of the Bithyniidae, Stenothyridae, and

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Planorbidae dominated in rice fields and small canals (Bui et al., 2010). In two communes of Tuy An district, Phu Yen province, 11 snail species were found, in which *Bithynia* sp. and *Filopaludia sumatensis* were more abundant than the others (Nguyen et al., 2014). In Vinh Long and Dong Thap provinces, 14 freshwater snails were discovered in rice fields, fish ponds, and canals, and *Lymnaea swinhoei* had the highest percentage (Ha et al., 2014).

Cercariae were also found in snails in different studies. Parapleurolophocercous and pleurolophocercous cercariae occupied the most common type of cercariae in snails in eight snail species in Nam Dinh province in the North of Vietnam (Bui et al., 2010). Twelve cercariae species in eight families were recorded from *Bithynia fuchsiana*, *Parafossarulus striatulus* (Bithyniidae), and *Melanoides tuberculata* (Thiaridae) (Besprozvannykh et al., 2013). Pleurolophocercariae, Xiphidiocercariae, Echinostome, Monostome, and Gymnocephalus were obtained from 11 snail species in two communes of Tuy An district, Phu Yen province (Nguyen et al., 2014). Xiphidiocercariae, Furcocercariae, and Parapleurolophocercous were recovered from seven snail species in Ninh Binh province (Nguyen et al., 2015). Cercariae of Echinostome, Monostome, Parapleurolophocercous, Xiphidiocercariae, Fucocercariae, Gymnocephalous, and Megalurous were found in nine snail species in Ninh Binh province and Ha Noi city (Pham et al., 2019).

The research result by Madsen et al. (2015) showed that snails were mainly distributed in canals, fish ponds, and rice fields, with the highest trematode prevalence in small canals. However, there was no information about the presence of snails and cercariae prevalence in snails in canals in Cu Chi district, the biggest inland district of Ho Chi Minh City. A study on snail distribution in this area and cercariae infection could contribute to the identification of infected snails and conserve the precious snail species.

2. Materials and methods

Study areas

According to Decision No 40/2019/QĐ-UBND by Ho Chi Minh City People's Committee dated 20 December 2019, there were two sixth-level canals in Cu Chi district, including Dia Phan canal and Kenh Lang – Ben Muong canal, so they were chosen for the study in March and May 2022 (Table 1). Dia Phan canal was 10.9 km long, and Lang The - Ben Muong canal had a length of 11.0 km. These sixth-level canals were the lowest range in the waterway system in Ho Chi Minh City, which was connected directly to canals supplying water to rice fields, cash crops, fish farms, and residential areas.

Table 1. *Total sampled ponds in small canals in Cu Chi district*

No	Name of canal	Samplings in March 2022	Samplings in May 2022
1	Kenh Dia Phan	10	10
2	Kenh Lang-Ben Muong	10	10

Sampling of snails

Two cross-sectional studies on snails were carried out in March 2022 (the dry season) and May 2022 (the wet season). Snail sampling was done using a 25-cm wide dredge to scrape the canal bottom from 1.0 m out of the canal bank and back to the bank. A total of ten such samples were taken at different habitats in each canal for snail examination. Each sample was washed in the canal water, and collected snails were transferred to cloth bags and transported to the laboratory, where they were analyzed. Snails were identified as species following the keys of Dang et al. (1980) and Madsen and Nguyen (2014).

Examination of snails for cecariae

Snails were examined for trematode infection (cercariae stage) by shedding method (Frandsen and Christensen, 1984; Bui et al., 2010) in 100 mL small plastic beakers and left for 24 hours for shedding. Cercariae were recognized by using systematic key references (Frandsen & Christensen, 1984; Schell, 1985).

Collecting information on households and domestic animals in the research canals

The presence of houses in the canal areas was observed, and the occurrence of domestic animals like dogs, cats, and ducks was collected by using the questions to ask all household heads in the research area.

Data analysis

Microsoft Excel 2010 was used for data entry, and SPSS (Statistical Package for Social Sciences version 20) was applied for data analysis. The Chi-squared test was used to compare the difference in prevalence between seasons. A value of $P < 0.05$ was considered significant.

3. Results and discussion

3.1. Snail composition in canals

Eight snail species belonging to eight genera and five families were collected and identified. *Thiara scabra* was found in Dia Phan canal while it was absent from Kenh Lang-Ben Muong. The other seven snail species were available in the two research canals (Table 2).

Table 2. *Snail composition in canals in Cu Chi district*

Dia Phan canal			**Kenh Lang-Ben Muong canal**		
Family	**Genus**	**Species**	**Family**	**Genus**	**Species**
Thiaridae	*Melanoides*	*Melanoides tuberculata*	Thiaridae	*Melanoides*	*Melanoides tuberculata*
	Thiara	*Thiara scabra*			
Viviparidae	*Filopaludina*	*Filopaludina sumatrensis*	Viviparidae	*Filopaludina*	*Filopaludina sumatrensis*
	Sinotaia	*Sinotaia lithophaga*		*Sinotaia*	*Sinotaia lithophaga*
Ampulariidae	*Pomacea*	*Pomacea* sp.	Ampulariidae	*Pomacea*	*Pomacea* sp.
	Pila	*Pila polita*		*Pila*	*Pila polita*
Bithyniidae	*Bithynia*	*Bithynia* sp.	Bithyniidae	*Bithynia*	*Bithynia* sp.
Buccinidae	*Clea*	*Clea helena*	Buccinidae	*Clea*	*Clea helena*

Melanoides tuberculata dominated in Dia Phan canal in both the dry season (74.4%) and the wet season (34.1%). In Kenh Lang-Ben Muong canal, *Sinotaia lithophaga* had the highest percentage (45.4%) in the dry season, and *Clea helena* occupied the biggest amount of snails (53.0%) in the wet season (Table 3).

Table 3. *Percentage contribution of each snail species in canals in Cu Chi district*

Species	**In the dry season (March, 2022) (Dia Phan canal)**		**In the dry season (March, 2022) (Kenh Lang-Ben Muong canal)**		**In the wet season (May, 2022) (Dia Phan canal)**		**In the wet season (May, 2022) (Kenh Lang-Ben Muong canal)**	
	Total	(%)	Total	(%)	Total	(%)	Total	(%)
Melanoides tuberculata	119	74.4	13	8.6	148	34.1	7	2.8
Pila polita	4	2.5	6	3.9	2	0.5	4	1.6
Thiara scabra	1	0.6	0	0.0	1	0.2	0	0.0
Filopaludina sumatrensis	7	4.4	22	14.5	144	33.2	63	24.9
Sinotaia lithophaga	13	8.1	69	45.4	79	18.2	31	12.3
Pomacea sp.	13	8.1	5	3.3	34	7.8	7	2.8
Bithynia sp.	3	1.9	0	0.0	19	4.4	7	2.8
Clea helena	0	0.0	37	24.3	7	1.6	134	53.0
Total	**160**	**100**	**152**	**100**	**434**	**100**	**253**	**100**

A total of 999 snails representing eight species were collected, and *Melanoides tuberculata* was dominated with 287 snails. This agreed with the research in Nghia Hung district, Nam Dinh province, located in the Red River Delta in Northern Vietnam, by Henry Madsen et al. (2015) that *Melanoides tuberculata* was the most popular species in canals, rice fields, and fish ponds. *Filopaludina sumatrensis* was not found in canals in the research by Nguyen et al. (2014), but it was abundant in canals in this study with 236 snails. *Clea* sp. was rare in Vinh Long and Dong Thap province (Ha et al., 2014). It was not found in the studies by Bui et al. (2010) and Nguyen et al. (2014), but it was plenty in Kenh Lang-Ben Muong canal. It seemed that the environment in this study was suitable for *Melanoides tuberculata, Filopaludina sumatrensis, Clea* sp., and *Sinotaia lithophaga*. However,it was not a suitable habitat for other snail species like *Pomacea* sp., *Bithynia* sp., *Pila polita,* and *Thiara scabra.*

3.2. Households and domestic animals in the research canals

There were ten houses along Dia Phan canal and four houses on the canal bank of Kenh Lang-Ben Muong canal. No domestic animals in the research areas, except for seven dogs and 80 ducks, were found in four houses in Kenh Lang-Ben Muong canal (Table 4). Many rice fields were around Dia Phan canal, and farmers used pesticides there. In the area along Kenh Lang-Ben Muong canal, most places were wild plants, and no cultivation was done, only some grass to grow as food for cows.

Table 4. *Total dogs and ducks in the research area*

No	Name of canal	Total households	Total dogs	Total ducks
1	Kenh Dia Phan	10	0	0
2	Kenh Lang-Ben Muong	4	7	80

The collected information showed that these two canals were far from residential areas. Pesticides were used in the rice fields. Water exchange might bring water with pesticide residues into the water in Dia Phan canal, so it must affect the life of organisms there, including cercariae. The availability of dogs and ducks in Kenh Lang-Ben Muong canal made the environment more polluted as the dogs feces ran into the canals via run-off and ducks have swum in the canals. Therefore, eggs from the feces of dogs and ducks might contain eggs of flukes (WHO, 1995; Nguyen et al., 2008) and snails infected. The presence of dogs and ducks in the canal areas must be one of the main reasons why snails were infected in Kenh Lang-Ben Muong canal, and cercariae were absent from snails in Dia Phan canal.

3.3. Cercariae morphotypes infected in snails

Snails in Dia Phan canal had cercariae-free; however, snails in Kenh Lang-Ben Muong canal were infected trematodes. *Furcocercous cercariae* were recovered from *Clea helena* in the dry season with a prevalence of 2.3%. *Xiphidio cercariae* was found in *Sinotaia lithophaga* (in the dry season) and *Filopaludina sumatrensis* (in both dry and wet seasons) with a prevalence of 4.0% and 3.5%, respectively (Table 5). For *Filopaludina sumatrensis*, the trematode prevalence in the dry season was higher than in the wet season, but there was no significantly different ($P>0.05$).

Table 5. *Number of snails infected with different cercariae morphotypes in Kenh Lang-Ben Muong canal*

No	Snail species	Infected snails/ Total samples	Prevalence (%)	Morphotypes of cercariae	
				Dry season (March 2022)	Wet season (May 2022)
1	*Bithynia* sp.	0/7	0	X	X
2	*Filopaludina sumatrensis*	3/85	3.5	*Xiphidio cercariae*	*Xiphidio cercariae*
3	*Melanoides tuberculata*	0/20	0	X	X
4	*Pomacea* sp.	0/12	0	X	X
5	*Sinotaia lithophaga*	3/100	4.0	*Xiphidio cercariae*	X
6	*Thiara scabra*	0/0	0	X	X
7	*Clea helena*	4/171	2.3	*Furcocercous cercariae*	X
8	*Pila polita*	0/10	0	X	X

All snails from small canals were found cercariae (Nguyen et al., 2015), but only three snail species in this study were infected trematodes because there must be fewer risks in this research area or the kinds of canals were not the same. In Dia Phan canal, all snails had cercariae-free because the pesticide residue from rice fields pouring into the canal might kill cercariae if there were any. Moreover, no domestic animals like dogs and ducks were raised, so less chance for trematode eggs appeared in the canal to infect snails as small trematode infection were common in dogs and ducks (WHO, 1995; Nguyen et al., 2008; Nguyen et al., 2015). On the contrary, three snail species in Kenh Lang-Ben Muong canal were infected. This canal was located in an area with most wild grass, and there were seven dogs raised on the canal bank and 80 ducks on the bank and in the water of the canal. Therefore, the trematode eggs from dogs and duck feces might fall into the canals, and snails would be infected.

Melanoides tuberculata had the highest prevalence in all water bodies (Nguyen et al., 2014), and *Bithynia* sp. had the high prevalence in ponds of giant gourami (Pham and Tran, 2021). Howver, they had cercariae free in this research. Similar to Bui et al. (2010), no cercariae were found from species of Ampulariidae in Dia Phan and Kenh Lang-Ben Muong canals. *Filopaludina sumatrensis* and *Sinotaia lithophaga* of Viviparidae had no cercariae as found by Nguyen et al. (2014).They, however, were infected with *Xiphidio cercariae* in this research, the most prevalent of cercariae in snails in ponds and streams (Nkwengulila & Kigadye, 2005). *Clea helena,* snail species, was also found in the research by Ha et al. (2014), infected *Furcocercous cercariae.* This finding was quite interesting because no information about the trematode prevalence of *Clea helena* was reported in the previous research in Vietnam (Bui et al., 2010; Nguyen et al., 2014; Nguyen et al., 2015; Pham & Tran, 2021), more research on this snail species should be done in the future.

Nine snails were found infected trematodes in the dry season, and only one snail had cercariae in the rainy season in this research. This finding was similar to the previous studies that infection by trematode larvae in snails was different from the season. Prevalence was high in the dry season and low in the wet season (Nkwengulila & Kigadye, 2005; Pham & Tran, 2021) due to the temperature (Nguyen et al., 2014). The exact reason why snails had a higher prevalence of trematode in the dry season than in the wet season should be examined more in the future in order to contribute to the control of fishbone zoonotic parasites.

4. Conclusions

Eight snail species belonging to eight genera and five families were collected from the sixth-level canals in Cu Chi district. Only snails in Kenh Lang-Ben Muong canal were infected trematodes. *Furcocercous cercariae* were recovered from *Clea helena* in the dry season with a prevalence of 2.3%. *Xiphidio cercariae* were found in *Sinotaia lithophaga* (in the dry season) and *Filopaludina sumatrensis* (in two seasons) with a prevalence of 4.0% and 3.5%, respectively. The trematode prevalence in the dry season was higher than in the wet season ($P>0.05$). More research should be done in Cu Chi district and other places to identify the diversification of cercariae and snail species.

❖ ***Conflict of Interest:*** *Authors have no conflict of interest to declare.*

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THÀNH PHẦN LOÀI ỐC NƯỚC NGỌT VÀ TỈ LỆ NHIỄM SÁN LÁ SONG CHỦ TRÊN ỐC (GIAI ĐOẠN CERCARIAE) THU ĐƯỢC TRONG KÊNH NHỎ Ở HUYỆN CỦ CHI, THÀNH PHỐ HỒ CHÍ MINH

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TÓM TẮT

Nghiên cứu thành phần loài ốc theo phương pháp hình thái trong kênh cấp VI ở huyện Củ Chi, Thành phố Hồ Chí Minh được thực hiện vào tháng 3/2022 (mùa khô) và tháng 5/2022 (mùa mưa). Kết quả thu được 8 loài ốc thuộc 8 giống, 5 họ. Chỉ có ốc trong Kênh Láng-Bến Mương nhiễm ấu trùng sán lá. Ốc Clea helena nhiễm Furcocercous cercariae vào mùa khô với tỉ lệ 2,3%. Xiphidio cercariae được tìm thấy trong ốc Sinotaia lithophaga vào mùa khô và ốc Filopaludina sumatrensis nhiễm cả 2 mùa với tỉ lệ nhiễm lần lượt là 4,0% và 3,5%. Tỉ lệ nhiễm trong mùa khô cao hơn mùa mưa, nhưng không có sự khác biệt có ý nghĩa thống kê đối với ốc Filopaludina sumatrensis (P>0.05). Kết quả nghiên cứu góp phần cung cấp thông tin về đa dạng thành phần loài ốc và tỉ lệ nhiễm sán lá trên ốc trong khu vực. Cần tiếp tục nghiên cứu trong các thủy vực khác nhau ở Củ Chi và các địa phương khác nhằm xác định những loài ốc chứa nguồn bệnh và bảo tồn những loài ốc quý hiếm.

Từ khóa: kênh; cercariae; Củ Chi; ốc; sán lá song chủ