

# SNAIL COMPOSITION AND ITS CERCARIAE IN HIEP PHUOC RICE FIELD OF NHA BE DISTRICT, HO CHI MINH CITY, VIETNAM

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**Abstract** – A study of cercariae and snail composition by morphological analysis method in Hiep Phuoc rice field of Nha Be District, Ho Chi Minh City, Vietnam, was carried out in October 2022 (the wet season) and February 2023 (the dry season). A total of 738 snails were collected, and eight snail species belonging to eight genera and six families were identified. Six snail species were found in the wet season, and seven snail species were found in the dry season. Only *Sermyla tornatella* was infected with trematode (cercariae stage), and the prevalence in the dry season (1.4%) was higher than in the wet season (0.9%) ( $P > 0.05$ ). The other seven snail species were cercariae-free. Four cercariae morphotypes were recovered from *Sermyla tornatella*, including *Transvesotrema* cercariae, *Pleurolophocercous* cercariae, *Xiphidio* cercaria, and *Echinostome* cercariae. Further research on snails and their cercariae in other waterbodies should be done in Nha Be District to identify the snail diversity and sources of trematodes to contribute to developing tilapia culture and other fish species with trematode free.

**Keywords:** cercariae, rice field, snails.

## I. INTRODUCTION

Nha Be is a suburb district of Ho Chi Minh City where only Hiep Phuoc Commune has rice cultivation with a total rice field area of 52.19 ha [1]. In 2019, Pham et al. [2] found that Nile tilapia (*Oreochromis niloticus*) cultured in ponds in Nha Be district was infected with metacercariae of *Haplorchis pumilio* with a prevalence of 0.2% (N = 580). In a published study conducted in 2022, snails in five canals supplying water to fishponds in Nha Be district were collected

to check whether snails in these canals had cercariae, but all snails were found to be free of cercariae. The question was raised for the source of metacercariae in tilapia, specifically if cercariae existed in snails in rice fields, then followed waterways and invaded the pond through water from runoff or ditches to tilapia ponds. In the report by Pham and Nguyen [3], *Pleurolophocercous* cercariae was cercariae of *Haplorchis pumilio* in the family of Heterophyidae. Therefore, snails in the rice fields in Hiep Phuoc Commune, the only rice field area in Nha Be District, were collected and examined to check whether *Pleurolophocercous* cercariae existed in snails in the rice fields. If the answer was yes, one of the sources of metacercariae of *Haplorchis pumilio* in tilapia in this area could be identified.

## II. LITERATURE REVIEW

Research on trematode is needed as Keiser and Utzinger [4] state that foodborne trematodiasis is an emerging public health problem, particularly in Southeast Asia. There is little information about the clinical importance of infections with minute intestinal flukes; however, if people are heavily infected, it can cause serious gastrointestinal symptoms [5]. For liver flukes, infections can cause substantial clinical or subclinical disease [6]. The intestinal flukes and liver flukes have similar life cycles [7] with a three-host life cycle, including snails as the first intermediate host, fish as the second intermediate host, and fish-eating animals and humans as the definitive host [8].

Snail species of the Thiaridae and Bithynidae are primarily the intermediate hosts for the heterophyid trematode species [9]. *Melanoides tuberculata*, *Thiara* and *Terabia granifera* are the first intermediate hosts of heterophyids [10]. *Melanoides tuberculata* is the host of *Haplorchis*

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*pumilio* [11–13] and *Thiara granifera* is commonly infected with *H. pumilio* [12].

Bui et al. [14] carried out a study and found ten snail species in rice fields in Nam Dinh Province, and most of the snails belonged to the families of Bithyniidae, Stenothyridae and Planorbidae. Nguyen et al. [15] studied an An Hoa rice field of Tuy An District, Phu Yen Province, and found nine snail species, in which *Melanoides tuberculata*, *Sermyla tornatella*, *Tarebia granifera*, *Bithynia* sp. and *Thiara scabra* infected cercariae of trematodes. Nguyen and Pham [16] collected eight snail species in rice fields of Can Gio District, Ho Chi Minh City, and recovered cercariae from *Bithynia* sp. and *Melanoides tuberculata*, including Xiphidio cercariae, Furcocercous cercariae and Pleurolophocercous cercariae. Nha Be district is also a district of Ho Chi Minh City, and if snails have Pleurolophocercous cercariae, one of the questions for metacercariae in tilapia in this district can be answered. Consequently, the study on cercariae from snails in rice fields in Nha Be District was implemented.

### III. RESEARCH METHODOLOGY

#### A. Study areas

Hiep Phuoc rice field in Hiep Phuoc Commune was chosen to carry out the research because it was a unique rice field with an area of 52.19 ha in Nha Be District of Ho Chi Minh City [1].

#### B. Sampling of snails

Two cross-sectional studies on snails were carried out in October 2022 (the wet season) and in February 2023 (the dry season). Snail sampling was done by using a hand net and hands with gloves to collect snails in the cell of 0.4 m wide x 10 m long along the bank of the rice field. For each season, fifteen samples were collected in the rice field, with 500 m between the two sampling sites. Each sample was washed, then transferred to cloth bags, and transported to the laboratory for examination. Snails were identified as species following the keys of Dang et al. [17].

#### C. Examination of snails for cercariae

Snails were examined for trematode infection (cercariae stage) by shedding method [18]. Each

snail was put separately in 100 mL small plastic beakers and left for 24 hours for shedding. Cercariae were checked twice per day at 8:00 a.m and 12:00 p.m for two days. Cercariae were recognized by using systematic key references [18, 19].

#### D. Data analysis

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

## IV. RESULTS AND DISCUSSION

### A. Results

#### Snail composition and distribution in rice field

Eight snail species belonging to eight genera and six families were collected and identified by using morphological methods. Six snail species were found in the wet season and seven snail species were found in the dry season. *Thiara scabra* only appeared in the wet season whereas *Pythia plicata* and *Hydrorissioia elegans* were collected only in the dry season. The other six snail species were found in both seasons and *Sermyla tornatella* was the most abundant (Table 1).

A total of 738 samples of snails were collected in the wet season in October 2022 (301 snails) and the dry season in February 2023 (437 snails). Three snail species had high numbers of occurrence, including *Sermyla tornatella* (69.2%), *Melanoides tuberculata* (13.6%), and *Pomacea canaliculata* (10.4%). The other five snail species had low percentages, including *Gyraulus chinensis* (2.7%), *Hydrorissioia elegans* (1.9%), *Stenothyra conica* (1.8%), *Pythia plicata* (0.3%) and *Thiara scabra* (0.1%) (Table 2).

#### Cercariae morphotypes infected in snails

Only *Sermyla tornatella* was found to be infected trematode (cercariae stage). The prevalence of cercariae infection in the dry season (1.4%) was higher than in the wet season (0.9%), but there was no significant difference ( $P < 0.05$ ). For the overall prevalence in two seasons, it was

Table 1: Snail composition in Hiep Phuoc rice field of Nha Be District, Ho Chi Minh City, Vietnam

No	Family	Genus	Snail species	Wet season (October 2022)	Dry season (February 2023)
1	Ampullariidae	<i>Pomacea</i>	<i>Pomacea canaliculata</i> (Lamarck, 1828)	15	62
2	Stenothyridae	<i>Stenothyra</i>	<i>Stenothyra conica</i> (Dang & Ho, 2012)	2	11
3	Planorbidae	<i>Gyraulus</i>	<i>Gyraulus chinensis</i> (Dunker, 1848)	18	2
4	Thiaridae	<i>Melanooides</i>	<i>Melanooides tuberculata</i> (Müller, 1774)	34	66
5		<i>Sermyla</i>	<i>Sermyla tornatella</i> (Lea, 1850)	231	280
6		<i>Thiara</i>	<i>Thiara scabra</i> (Müller, 1774)	1	0
7	Ellobiidae	<i>Pythia</i>	<i>Pythia plicata</i> (Férussac, 1821)	0	2
8	Pomatiopsidae	<i>Hydrorissioia</i>	<i>Hydrorissioia elegans</i> (Bavay, 1895)	0	14

Table 2: Percentage contribution of each snail species in Hiep Phuoc rice field of Nha Be District, Ho Chi Minh City, Vietnam

No	Snail species	Wet season (10/2022)		Dry season (3/2023)		Two seasons	
		N	(%)	N	(%)	N	%
1	<i>Hydrorissioia elegans</i> (Bavay, 1895)	0	0	14	3.2	14	1.9
2	<i>Gyraulus chinensis</i> (Dunker, 1848)	18	6.0	2	0.5	20	2.7
3	<i>Melanooides tuberculata</i> (Müller, 1774)	34	11.3	66	15.1	100	13.6
4	<i>Pomacea canaliculata</i> (Lamarck, 1828)	15	5.0	62	14.2	77	10.4
5	<i>Pythia plicata</i> (Férussac, 1821)	0	0	2	0.5	2	0.3
6	<i>Sermyla tornatella</i> (Lea, 1850)	231	76.7	280	64.1	511	69.2
7	<i>Stenothyra conica</i> (Dang & Ho, 2012)	2	0.7	11	2.5	13	1.8
8	<i>Thiara scabra</i> (Müller, 1774)	1	0.3	0	0	1	0.1
	Total	301	100	437	100	738	100

1.2%. The other seven snail species were free of cercariae (Table 3).

The result showed that four cercariae morphotypes were found in *Sermyla tornatella* from the researched rice field. Transvesotrema cercariae were more common and recovered from three snails. The other three cercariae morphotypes including Xiphidio cercariae, Pleurolophocercous cercariae and Echinostome cercariae were found in three snails (Table 4).

### B. Discussion

The total snail species in the wet season (N = 6) was a little lower than in the dry season (N = 7). This finding was different from Nguyen et al. [15], Nguyen and Pham [16], who found that snail populations were typically more abundant in the rainy season, which provide good conditions for the multiplication of snails. In addition, increasing rain in the wet season led to an increase in snail populations in the area [20]. The explanation for the finding in this research was that Hiep Phuoc rice field in Can Gio was operated by mainly rainwater, and October was the end of the wet season. Therefore, water in the

rice field gradually decreased, providing living conditions for snails similar to the dry season, so total number of snail species was not very different.

The total number of snail species in this study was the same as the finding from Nguyen and Pham [16], with eight snail species in two rice fields in the Can Gio District of Ho Chi Minh City. They were the same because the two districts are adjacent, and both rice fields use rainwater for rice cultivation. However, the number of snails in this study is much lower than what Bui et al. [14] collected in a rice field in Nam Dinh Province with ten snail species or Nguyen et al. [15] found in An Hoa rice field of Tuy An District, Phu Yen Province, with nine snail species. Generally, the total snail species in rice fields in different conditions were not the same. Nevertheless, more research on snails in rice fields needs to be done to find the variety of snail species in rice fields in Vietnam.

It was interesting that the Nha Be and Can Gio Districts of Ho Chi Minh City had snail species and snail composition in rice fields that were almost similar when comparing the top three snail

Table 3: Trematode prevalence in snails in Hiep Phuoc rice field of Nha Be District, Ho Chi Minh City, Vietnam

Snail species	Wet season (October 2022)		Dry season (February 2023)		Two seasons	
	Infected snails / Collected snails	Prevalence (%)	Infected snails / Collected snails	Prevalence (%)	Infected snails / Collected snails	Prevalence (%)
<i>Sermyla tornatella</i>	2/231	0.9	4/280	1.4	6/511	1.2

Table 4: Cercariae morphotypes in infected snails in Hiep Phuoc rice field of Nha Be District, Ho Chi Minh City, Vietnam

Cercariae	Wet season (October 2022)	Dry season (February 2023)
	<i>Sermyla tornatella</i>	<i>Sermyla tornatella</i>
Xiphidio cercariae	1	0
Pleurolophocercous cercariae	0	1
Echinostome cercariae	1	0
Transvesotrema cercariae	0	3

species. The dominant snail species in rice fields of Can Gio were *Sermyla tornatella* (47.6%), *Pomacea canaliculata* (27.2%) and *Melanoides tuberculata* (14.0%) [16] whereas the top three snail species in Nha Be District were *Sermyla tornatella* (69.2%), *Melanoides tuberculata* (13.6%) and *Pomacea canaliculata* (10.4%). The research by Nguyen et al. [15] found the three highest snail species in rice fields of Phu Yen Province were *Bithynia* sp., *Pomacea* sp. and *Tarebia grannifera*. It can be concluded that snail species and composition in rice fields were similar if they were in similar living conditions and different from different areas.

*Sermyla tornatella* had the highest percentage in this research and was the only snail species infected with cercariae in Hiep Phuoc rice field of Nha Be District. No *Sermyla tornatella* was found in the rice field of Cu Chi District of Ho Chi Minh City, the completely freshwater area [21], but it was collected a lot in rice fields in Can Gio District (N = 1253), and all of them were free of cercariae [16]. However, *Sermyla tornatella* was one of five snail species infected with trematodes (cercariae stage) in Tuy An District, Phu Yen Province [15]. *Melanoides tuberculata* in this study was also prevalent after *Sermyla tornatella*, but all of them had no cercariae. This finding was different from Nguyen et al. [15] in that *Melanoides tuberculata* had the highest

prevalence, and it was also infected in rice fields in Can Gio [16].

For the cercariae infection, the prevalence in the dry season was higher than in the wet season ( $P > 0.05$ ). In this study, four *Sermyla tornatella* were infected with trematode in the dry season, and two of them had cercariae in the wet season. This finding is similar to the findings of Nguyen et al. [15], that infection by trematode larvae in snails was high in the dry season and low in the wet season because of the temperature. The finding in this study also agreed with Nkwengulila and Kigadye [22], that the prevalence of cercariae fluctuated by season as it was high in the dry season and decreased in the wet season. However, the result of this research was completely different from the findings of Nguyen and Pham [16], that the prevalence in the wet season was much higher than in the dry season. Although the two districts belonged to Ho Chi Minh City, the result in Nha Be in this research was different from the finding from Can Gio; therefore, the different natural conditions might affect the trematode prevalence in snails when compared between seasons.

*Transvesotrema cercariae* were more common than other cercariae morphotypes. It was different from the other previous studies in that *Xiphidio cercariae* seemed to have a more frequent occurrence than the others [22]. One more interesting finding was that pleurolophocercous cercariae were found in *Sermyla tornatella* in this research. Pham et al. [2] reported that tilapia was infected with metacercariae of *Haplorchis pumilio*, the species belonging to Heterophyidae [23]. Pham and Nguyen [3] said that pleurolophocercous cercariae were the cercariae of Heterophyidae and *Sermyla tornatella* in this research was found infected with pleurolophocercous cercariae, the cercariae of metacercariae of *Haplorchis pumilio*. Pleurolophocercous cercariae in *Sermyla tornatella* were one of the sources of

trematode infection in tilapia cultured in ponds in Nha Be District. However, more study on the prevalence of tilapia juveniles when stocking into the ponds needs to be conducted to find if they were infected before being released into the ponds. Moreover, more research on cercariae in snails in other water bodies of Nha Be in the different months should be done to find a better answer for one of the reasons why tilapia was infected with trematodes.

## V. CONCLUSIONS

Eight snail species belonging to eight genera and six families were identified. Only *Sermyla tornatella* was infected with trematode (cercariae stage), and the prevalence in the dry season (1.4%) was higher than in the wet season (0.9%) ( $P > 0.05$ ). The other seven snail species were cercariae-free. Four cercariae morphotypes were recovered from *Sermyla tornatella*, including *Transvesotrema* cercariae, *Pleurolophocercous* cercariae, *Xiphidio* cercaria, and *Echinostome* cercariae. Further research on this subject in different months and other water bodies should be done in Nha Be District and other places to identify the sources of trematodes in cultured ponds.

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