FRESHWATER SNAIL AS INTERMEDIATE HOST OF TREMATODE IN WATER CHANNELS OF PALANGKA RAYA CITY

KEONG AIR TAWAR SEBAGAI INANG INTERMEDIET TREMATODA DI ALIRAN AIR KOTA PALANGKA RAYA

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Abstract

Most of the area of Palangka Raya City consists of peat swamp land that is flooded almost all year round and river flows area. Therefore, there are many species of snails that can be found in rivers and peat swamp water. The existence of snails in peat swamp ecosystems and river flows as an intermediary host for intestinal worms for mammals and humans is essential information for human-environmental health studies. Research on the capability of snails as hosts of Trematodes on peat swamp land and river flows in Palangka Raya City has never been done. Research methods include the collection and identification of snail’s and identification Trematode larvae. We collected 557 snails, and the identification showed the identity of our samples were Ampullariidae: Pila sp., Pomacea sp., Viviparidea: Bellamya sp., and Planorbidae: Indoplanorbis sp. Pila sp. was 35.90%, the most common snail found at the study site compared to Pomacea sp., Bellamya sp., and Indoplanorbis sp.. The results of this study, snail observations confirmed the presence of trematode larvae, namely cercariae and redia. This study is the first information regarding the presence of Trematodes in the snail body at the research area.

Keywords: Cercariae, Host, Redia, Snail, Water Channel

Abstrak


Kata kunci: Aliran air, Cercariae, Inang, Keong, Redia

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INTRODUCTION

Palangka Raya City is located at 113030’–114007’ East Longitude and 1035°–2 024’ South Latitude (Badan Pusat Statistik, 2018). The city of Palangka Raya consists of five sub-districts, namely Pahandut, Sabangau, Jekan Raya, Bukit Batu, and Rakumpit sub-districts. Most of the land in Palangka Raya City is a water area, and the canals are filled with water throughout the year. Apart from being a source of livelihood, the community uses this waterway for fishing, catching fish, planting kale, defecating, picking fern leaves (local name: kalakai), cutting water grass, and hunting for snails as a food source. There are many species of snails in water channels that can be observed. The presence of snails in water channels is an intermediary host for intestinal helminth on mammals and humans active in waterways.

According to Malatji et al. (2020) family of Lymnaeidae snails act as intermediate hosts of Trematode in humans and mammals. The species of snails that can be intermediate hosts for Trematode include Brodia sp., Bellamya sp., Melanoides sp., Indoplanorbis sp., and Lymnaea sp. (Chontananarth & Wongsawad, 2013; Jabal et al., 2022). In addition, Indoplanorbis sp., Gyraulus sp., Lymnea sp., Bellamya sp., Pomacea sp., Melanoides sp., and Melanoides sp. as another host for Trematode (Annida & Paisal, 2014). Recent works also pointed out that Lymnea sp. and Biomphalaria sp. as Trematode hosts (Anucherngchai et al., 2016). Helminth that can infect snails belongs to the Trematodes class. This infection occurs through the medium of water.

According to Luka and Mbaya (2015), about 16 of the 1,700 snails were positive for cercariae. Ten of them are Bulinus sp with cercariae, six of which are species of Lymnae natalensis with Cercariae of Fasciola sp. (Luka & Mbaya, 2015). Trematodes require water in their life cycle and need snails as the first intermediate host (Rondelaud et al., 2014). Humans and livestock can be infected by eating immature aquatic plants, not using hand and foot protection when active in the water and drinking water that contains metacercariae. To date, there was no information about the potential of snails as hosts for Trematodes in waterways in Palangka Raya City. The current study aimed to provide the initial information regarding the species of snails that can be an intermediate host for Trematode and observed larvae of the Trematode symbiont in Palangka Raya City.

MATERIALS AND METHODS

This study is a descriptive survey to determine the diversity of snails as Trematode hosts and the distribution of Trematode larvae in water channels in Palangka Raya City. The stages of this research are snail collection, laboratory examination, identification of snails, identification of Trematode larvae, and data analysis. The research was done from July to December 2021. Laboratory investigation was done at the Biomedical Laboratory, Faculty of Medicine University of Palangka Raya, Indonesia.

Data was collected by taking snails found in waterways using simple random sampling. The snail is put in a plastic bag according to the location. Next, determine the coordinates of the location of the snail using GPS. The snails were brought to the laboratory for examination. The snails were measured and identified by comparing the snail morphology. The snails are placed in a petri dish and crushed the snail shells slowly using a mortar. The snails were measured and identified by comparing the snail morphology. The snails are placed in a petri dish and crushed the snail shells slowly using a mortar. Then, drip distilled water on the crushed snail body and observe using a compound microscope for the presence of Trematode larvae (sporocysts, redia, and cercariae) in the body of snail. The data were analyzed descriptively about the species and distribution of snails and Trematode larvae. Identification of the types of snails and Trematode larvae refers to the identification guidelines and existing references (Chontananarth & Wongsawad, 2013; Anucherngchai et al., 2016).

RESULT

Snail collections were found in five locations of water channels across Palangka Raya City (Table 1). The classification of snails found was Ampullariidae: Pila sp., Pomacea sp., Viviparidea:
Bellamya sp., Planorbidae: Indoplanorbis sp. (Figure 1). The number of snails collected was 557 snails. The most common snail species found were Pila sp. with 35.90% occurrence frequency compared to Bellamya sp. was 30.52%, Pomacea sp. was 14.36%, Indoplanorbis sp. was 19.21%. Morphologically, Pila sp. found in the current study is closely related to Pila ampullacea. Pila ampullacea has a yellow-brown shell and enlarged underside, measuring 27–56 mm and 24–49 mm wide.

In our study, the morphological characteristics of Bellamy sp. were pyramidal in shell shape, shell towers with sticking out type, and rounded bottom of the shell. The color of the shell is brownish-green or yellowish green. The surface of the shell has slightly prominent strokes forming circular lines. At the top, there is a transverse line with the characteristics of a thick protrusion (keel). The periphery is slightly angular or has an obtrusive line. In adult snails, the hook is more rounded. Shell was 6–7 cm in size. The thread is relatively deep, and the end of the shell is slightly pointed but is generally eroded. The umbilicus is open, not too wide. The mouth of the shell is rounded, the top is narrowed, and the bottom is rounded. The shell cover is rather complex (horseshelled), the vortex is somewhat in the middle (subcentral), and the details are like a circular and centralized ring. The shell height was 34-40 mm, the width was 22-26 mm, and the shell mouth height was 16-17 mm. The Pomacea sp. has a globose shell with an oval to round aperture. The color of this snail was green to brown with no spiral bands on the shell. The Indoplanorbis sp. has an oval to round opening with a thin shell.

Table 1. Location and species of snail in Palangka Raya City

<table>
<thead>
<tr>
<th>Location</th>
<th>Species</th>
<th>Latitude/longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.Obos 14 (Menteng)</td>
<td>Bellamya sp.</td>
<td>2°14’52.4”S 113°53’14.5”E</td>
</tr>
<tr>
<td>Suka Damai (Tanjung Pinang)</td>
<td>Bellamya sp.</td>
<td>2°12’56.2”S 113°56’24.2”E</td>
</tr>
<tr>
<td>B. Koetin (Palangka)</td>
<td>Pomacea sp.</td>
<td>2°12’58.8”S 113°53’41.2”E</td>
</tr>
<tr>
<td>G.Obos IX (Menteng)</td>
<td>Pila sp.</td>
<td>2°13’45.5”S 113°53’16.2”E</td>
</tr>
<tr>
<td>Adonis Samad (Langkai)</td>
<td>Pomacea sp.</td>
<td>2°14’57.9”S 113°55’34.1”E</td>
</tr>
<tr>
<td>RTA Milono (Langkai)</td>
<td>Pila sp.</td>
<td>2°15’47.4”S 113°55’10.2”E</td>
</tr>
<tr>
<td>Mangku Raya (Kereng Bangkirai)</td>
<td>Pila sp.</td>
<td>2°17’40.0”S 113°54’15.8”E</td>
</tr>
<tr>
<td>Bukit Tunaggal (Tangkiling)</td>
<td>Indoplanorbis sp.</td>
<td>1°58’50.5”S 113°44’50.1”E</td>
</tr>
</tbody>
</table>

Figure 1. The morphological appearance of snails in the current study. Pila sp. (a), Bellamya sp. (b), Pomacea sp. (c), and Indoplanorbis sp. (d)

The habitat of Pila sp., Pomacea sp., and Bellamya sp. was in the swamp area of Menteng and irrigation canals in Tangkiling. The plants around the snail are water grass and water hyacinth. Indoplanorbis sp. was only found in the ditch of the Tangkiling with water grass around the Tangkiling water channels (Figure 2). The snail population was different in each habitat.

The investigation of the snail revealed the Trematode larva’s occurrence in the snail body, with the type of redia and cercariae (Figure 3). The number of redia found was 15 and cercariae was four (Table 2). The life cycle type of cercariae in the Bellamya sp. and Pomacea sp. is...
megarulous with the characteristics of this type of elongated cercariae characterized by prominent granules.

Figure 2. Habitat of snails in research site: (a, b, c) habitat of Pila sp., Pomacea sp., and Bellamya sp., and Indoplanorbis sp. (d)

Figure 3. The Trematode larvae’s redia (a) and cercariae megarulous (b). The magnification of the microscope 400x

Table 2. The distribution of redia and cercariae on snails in this study

<table>
<thead>
<tr>
<th>Snails</th>
<th>(n)</th>
<th>(m²)</th>
<th>Larvae Trematode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sporocyst</td>
</tr>
<tr>
<td>Bellamya sp.</td>
<td>170</td>
<td>1.5</td>
<td>0</td>
</tr>
<tr>
<td>Pila sp.</td>
<td>200</td>
<td>2.2</td>
<td>0</td>
</tr>
<tr>
<td>Pomacea sp.</td>
<td>80</td>
<td>3.4</td>
<td>0</td>
</tr>
<tr>
<td>Indoplanorbis sp.</td>
<td>107</td>
<td>1.4</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>557</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
DISCUSSION

Indonesia is a tropical country with health problems such as parasitic infections that cause helminthiasis. One of the common parasites is *Trematode*. Several diseases are caused by *Trematodes*, such as paragonimiasis, schistosomiasis, fascioliasis, and fasciolopsiasis (Poerwanto et al., 2020). Based on the habitat and definitive host, *Trematodes* parasitic to humans are divided into six groups, namely blood flukes, liver flukes, pancreatic flukes, lung flukes, throat flukes, and intestinal flukes.

The *Trematode* larval stage usually infects the snail’s liver (Chen et al., 2013). *Pila* sp. is the most dominant snail in this study and was collected from reservoirs near water hyacinth plants. This finding was contrary to previous reports, which stated that this snail was obtained from the swamps around the residence area (Budiati, 2016; Jabal et al., 2022). *Pila* sp. belongs to the family *Ampullariidae*. Previously, the occurrence of this snail was reported from Makassar (South Sulawesi) and Papuyu River (South Kalimantan). Our specimen was identical to *Pila ampullacea*, which has a yellow-brown shell and enlarged underside, measuring 27–56 mm and 24–49 mm wide (Yendri et al., 2013). *Pilla* sp. can live even in dry habitat conditions for a long time and are usually found in ponds and swamps (Marwoto & Isnaningsih, 2014).

The following snail in our study was *Bellamya* sp. The habitats of this snail are swamps, ponds, and rice fields (Budiati, 2016). Characteristics this snail has such as a round shell shape and yellow to dark brown. This snail is difficult to control in the environment. This snail has strong adaptability to the habitat environment (Isnaningsih & Marwoto, 2011). We also noted the *Pomacea* sp., collected from rice fields, irrigation canals, and ponds. In line with *Pilla* sp., we also obtained *Pomacea* sp. from the resident’s irrigation area.

The genus *Indoplanorbis* is taxonomically derived from the family *Planorbidae*, Order *Basommatophora*, Subclass *Pulmonata*, Class *Gastropod*, and Phylum *Mollusca*. and is widely distributed in South Asia and Southeast Asia, from India, Philippines, Japan, Indonesia, Thailand (Anorital & Annida, 2011; Mcdermott et al., 2014). This snail plays a significant role because it has the potential to be an intermediary for intestinal *Trematodes* and cercarial dermatitis. This snail is the first and second intermediate host of *Echinostoma* spp., and these worms can cause intestinal damage in humans, other mammals, and birds. Cercarial dermatitis is itching and rash on the skin due to exposure to *cercariae* from *Trematode* (Anorital & Annida, 2011; Mcdermott et al., 2014).

The current study is the first report of *cercariae* and *redia* in freshwater snails in Palangka Raya. This study found the *cercaria megalourus* type in *Bellamya* sp. and *Pomacea* sp. The characteristic of *megalourus cercaria* is elongated granules along the *Trematode* body. The oral sucker is positioned at the anterior terminal next to the pharynx. A ventral sucker is placed in the middle of the body. A ventral sucker was found in the middle of the body. The bifurcate esophagus was found between the ventral sucker and the pharynx. Prior reports describe that a unique type of this cercarial is the presence of many adhesive gland cells sited at the tip of its tail (Anucherngchai et al., 2016).

Freshwater snails were found from various locations in several areas in Palangka Raya. *Pila* sp. was the most dominant species in various locations in this study. *Pila* sp. is mainly found in Palangka Raya City due to the snail’s ability to adapt to the different habitats and the abundance of food sources for this genus in various areas in Palangka Raya City. *Pila* sp. was the most common snail collected in Suka Damai, Tanjung Pinang, compared to other areas. This snail can survive even though the habitat conditions are dry for quite a long time. *Pila* sp. can be found in ponds and swamps (Marwoto & Isnaningsih, 2014). The habitat of *Pila* sp. is in the reservoir, and there are water hyacinth plants and swamps around people’s homes (Budiati, 2016; Jabal et al., 2022).

The *redia* and *cercariae* are essential features in the *Trematode* life cycle. The *redia* is elongated and cylindrical, with a pointed anterior end with a blunt posterior end. The oral funnel resembles a sucker, and the pharynx is visible anteriorly. In *redia*, there are several anterior parts, and in the posterior part, there is a locomotor appendage that functions as a foot or a means of supporting *redia* motility (Stunkard, 2014). *Trematodes* have two *redia* development patterns, the
first redia are often called mother redia, and the second redia are called daughter redia. The mother redia phase contains germ cells and the following redia candidates, while the daughter redia is redia containing the cercariae candidates that are ready to be released (Phalee et al., 2015).

*Cercariae* are equipped with tails for active swimming in search of a definitive host and the next suitable intermediate host. *Cercariae* have a body shape similar to other cercariae; therefore, it is recommended to use molecular analysis (Bogitsh et al., 2019). *Cercariae* have two body parts that compose it: the body and tail. *Cercaria* organs include suckers, the digestive tract, and excretory systems. The cercariae have specific organs in their bodies. The specialized organs are penetrating glandular cells, cystogenous glands, and mucoid glands. In addition, cercariae also have a stylet or spear mouth for penetration. Primordial genitalia in cercariae develops into male and female reproductive systems. The organ is located close to the sucker on the ventral sucker (Bogitsh et al., 2019).

In this study, we did not find any sporocyst cells in the snail. Generally, the sporocysts have a round body shape, while the adult sporocysts are elongated like pouches. The edges of the body are plain flat and have no indentations. Mature sporocysts resemble redia but do not yet have specific internal organs. Inside the adult sporocyst, there are granules. Granules are germ cells. Germ cells then develop into gonads redia. In general, the young sporocysts have a round body shape, while the adult sporocysts are elongated like pouches (Phalee et al., 2015).

Indonesia has various diseases caused by *Trematode* infections, such as paragonimiasis, schistosomiasis, fascioliasis, and fasciolopsiasis. It is crucial to disseminate the information about snail-bearing *Trematode* to the Indonesian people. Those mentioned diseases are commonly fostered by people's habits such as consuming freshwater, raw food, field activities, irrigation canals activities, or fishing in freshwaters without wearing boots. The manifestations that arise from infection with Trematode are different, depending on the localization of the Trematode's habitat on the body part of the definitive host and the toxins released by the Trematode. Trematode species such as *Clonorchis* spp., *Opisthorchis* spp., and *Fasciola* spp. are parasites that live in the bile ducts of the liver and will cause jaundice due to inflammation and blockage of the bile ducts it can be accompanied by hepatomegaly (Ghaflar, 2015).

**CONCLUSION**

The current study is the first information on *cercariae* and redia on the snails in Palangka Raya. The result confirmed that there were four snails, namely *Pila* sp., *Pomacea* sp., *Bellamya* sp., in Menteng, Tanjung Pinang, Kereng Bangkirai, Langkai, Tangkiling, and Palangka. *Indoplanorbis* sp. found in Tangkiling. The number of redia phases was higher than cercariae, and no sporocyst was found. In addition, the cercariae type was megarulous type which infects *Pomacea* sp., and *Bellamya* sp. Periodical monitoring should be done to collect more ecological and taxonomical information on snails and *Trematode* larva in the future studies.

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