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| **Original Research** |

Detection of Nematode on Feces of Snail at Malang, East Java

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| ABSTRACT  |  | **ARTICLE INFO** |
| *Acathina fulica* is a terrestrial mollusk that often invades terrestrial vegetation that has tropical and subtropical climates. *Acathina fulica* has been widely reported in environments as diverse as urban areas, forests, capoeiras, caatings, plantations, decomposing materials, savannahs and vegetable gardens. Soil is source of food and a defense strategy for *A. fulica*, therefore it has an important role for them. Therefore, *A. fulica* may be host several species of nematodes. Microscopic examination of snails *A. fulica* fecal samples in Cemorokandang Village, Malang City using the native method aimed to detect *Rhabditis* spp. The results showed that 14 (12.5%) out of 112 samples contained *Rhabditis* spp. The genus rhabditisbelongs to the Rhabditidae family and is one of the free-living nematodes. This species has long been known and of concern in the veterinary world. The genus rhabditis has been reported to have infected humans and have been isolated from urine samples, vaginal swab, and human stool. The research was conducted in the dry season with low rainfall. Nematode of the genus *Rhabditis* spp. can be naturally found in humid places and decaying organic matter. |  | **Article history**Received: November, 11th 2024Revised: February, 4th 2025Accepted: February, 4th 2025Published: March, 15th 2025**Keywords***Acathina fulica* Dry season Nematode *Rhabditis* spp.MalangSnail |
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INTRODUCTION

*Acathina fulica* is a terrestrial mollusk that often invades terrestrial vegetation that has tropical and subtropical climates. The food that is usually consumed in nature is so varied that *A. fulica* is known as a broad spectrum herbivore with at least 500 species of plants. This land snail was spread by humans in 19th century from Estern Equatorial Africa to India, Sri Lanka, and Southeast Asia [(Dumidae](#Dumidae) *[et al](#Dumidae)*[., 2019)](#Dumidae). In addition, this snail has also spread to Japan, China, Madagascar, Australia, the Pasific, the Caribbean Basin, the United States and South America (Columbia, Venezuela, Ecuador, Brazil, Argentina) [(Morocoima](#Morocoima) *[et al](#Morocoima)*[., 2014)](#Morocoima).

*A. fulica* can have a shell length up to 19 cm, so this snail is also called the largest land snail. This snail are polyphagous and have a voracious nature. They can damage vegetables and other food crops. Snails are also reported to eat algae and moss. The snail is also known to consume bones, carrion, limestone that serve as their source of minerals. Not supringsingly, this snail become recognized as one of the most damaging pests in the world [(Meyer, Hayes and Meyer, 2008)](#Meyer). This species is an intermediate host of nematode *Angiostrongylus cantonensis* (*A. cantonensis*) which can cause eosinophilic meningitis and angiostrongyliasis ocular in human. Therefore, nematodes can cause zoonotic disease and become a world health problem, especially in Asian countries and some Pacific regions [(Liu](#Liu) *[et al](#Liu)*[., 2011)](#Liu).

Snails are active in the morning and evening, when it is cloudy or rainy, humid environmental conditions and more often avoid direct sunlight ([Morocoima](#Morocoima) *[et al](#Morocoima)*[., 2014](#Morocoima)). The body of a snail consist of a shell structure and a soft body. Generally, this snail shell resembles a spiral cone tube that is brown in color and has a dark spots. The shell of *A. fulica* consists of three parts, namely an apex, a conical axis or columella, and the largest loop or body whorl. Snails have a soft body protected by a shell and can hide in it at any time [(Leu *et al*., 2021)](#Leu).

It is often difficult to differentiate where the snail head ends and the leg part so the snail is called cephalopodium which is the typical morphology of all gastropods [(Nordsieck, 2011)](#Nordsieck). Snails will secrete clear foamy mucus when they fell threatened. This mucus originates from the contraction of the chepalopod gland located in the lateral region of the upper cephalopodium. The body of snails has a defense system, namely mucus which has acidic, neutral and sulfat properties [(Morocoima](#Morocoima) *[et al](#Morocoima)*[., 2014)](#Morocoima).

*Acathina fulica* has been widely reported in environments as diverse as urban areas, forests, capoeiras, caatings, plantations, decomposing materials, savannahs and vegetable gardens [(Onyshi](#Onyshi) *[et al](#Onyshi)*[., 2018)](#Onyshi). Soil is source of food and a defense strategy for *A. fulica*, therefore it has an important role for them. Therefore, *A. fulica* may be a host of several species of nematodes. Reported in Brazil the mollusks naturally infected with larvae of *A. abstrusus*, *Rhabditis* sp., *Strongyluris* sp. and *Angiostrongylus cantonensis* [(Silva *et al*., 2020)](#Silva). *A. fulica* has also been reported in Columbia to be naturally infected larvae of *Strongyluris* sp., *A. cantonensis* and *A. abstrusus* [(Cordoba-R, Patino-Monoya and Giraldo, 2017)](#Cordoba).

Globally, *A. fulica* is utilized as a food and raw materials in the cosmetic industry. Nutrition and protein in snail meat are quite high with low fat content therefore, several European countries such as France, Spain, Portugal consume a lot of snail meat. Snail meat and mucus are also used for traditional medicine by the community as an alternative to healing minor wounds and toothaches. In addition, snail slime is believed to be useful for treating various disease such as abortion, menstrual pain, eye inflammation, itching, rheumatism, heart disease and mild skin disease [(Damayanti *et al*., 2020)](#Damayanti).

The genus *Rhabditis* has been reported to have infected humans and have been isolated from urine samples, vaginal swab, and human stool samples [(Teschner *et al*., 2014)](#Teschner). For the first time, *Rhabditis* spp. reported in Bangladesh infecting a 12 years old child. The origin of the infection remains unknown. The patient has a history of frequent contact with soil and animals [(Nath *et al*., 2023)](#Nath). Therefore, the purpose of this study is to find out nematode infection in the feces of *A. fulica* especially in Malang region, East Java. Because the information on the nematode infection in *A. fulica* is lacked.

MATERIALS AND METHODS

**Sampling**

 A total of 112 snails were captured in their habitat such as behind damp bushes, behind damp tress or rocks, and behind grassy in the early morning from urban areas in Cemorokandang Village, Malang, East Java states during the months of July to September 2024 in the dry season with low rainfall rates. Samples were collected from four different areas, south, north, west and east of Cemorokandang village with 28 samples each, in the morning or evening. After collection, snails were placed in closed container box with several holes for air circulation and kept in the laboratory in darkness. They were fed with vegetables ad libitum [(Liboria](#Liboria) *[et al](#Liboria)*[., 2010)](#Liboria). The container divided into five compartments with 5-7 snails in each compartment. To avoid mixing feces of one snail with another, every day the feces collected, then the snails whose feces have been collected and separated from the cage and one by one labeled for fecal examination.

Fecal Examination

The method of fecal examination in this study is using the native method. In the native method, a small amount of feces is taken (20 mg average) and then placed on the object glass. Give one to two drops of aquades, stir until smooth then cover with a glass cover. Check with a microscope with 100x magnification. Positive samples were indentified and prevalence rates were calculated using the formula:

Prevalence (%) = $\frac{Total of positive samples}{Total of samples taken}x 100$

RESULTS AND DISCUSSION

Microscopic examination of snails *A. fulica* fecal samples in Cemorokandang Village, Malang City using the native method aimed to detecting nematode infection in the feces of *A. fulica*. However, this study only found *Rhabditis* spp. The results showed that 14 (12.5%) out of 112 samples contained *Rhabditis* spp. Samples were collected from the Cemorokandang village area in four different areas, from north, south, west and east areas. The prevalence can show in the Table 1. The genus rhabditis belongs to the Rhabditidae family and is one of the free-living nematodes. This species has long been known and of concern in the veterinary world [(Nath](#Nath) *[et al](#Nath)*[., 2023)](#Nath).

**Table 1.** Prevalence of *Rhabditis* spp. from Fecal Samples in Snail at Cemorokandang Village, Malang

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| --- | --- | --- | --- |
| **Location** | **Total Sampel** | **Positif Result** | **Prevalence (%)** |
| **North** | 28 | 5 | 17.8 |
| **South** | 28 | 3 | 10.7 |
| **West** | 28 | 4 | 14.2 |
| **East** | 28 | 2 | 7.0 |
| **Total** | 112 | 14 | 12.5 |

*Rhabditis* nematode has similarities with Strongyloides. Therefore, clear characteristic are needed to distinguish and diagnose these two nematodes. In the posterior part, the rhabditis larva has a long, tapered tail with whip-like a tip, while the tail of *Strongyloides* is relatively smaller, never exceeding 15% of the total body length [(Tehrani](#Tehrani) *[et al](#Tehrani)*[., 2019)](#Tehrani). This species is have a bulbous enlargement of the mid-esophagus and the buccal capsul is longer than that of *Strongyloides*. Generally, Rhabditis have curved spicules with narrow anterior ends. While Strongyloides are comparatively less curve with broad and bluntly rounded anterior end (Fig 1.). Another important point to differentiate Strongyloidesand Rhabditis is the presence of male and female adult larvae. In Strongyloides it is easier to find female larvae, while male larvae live freely in nature. In cases of Rhabditis, the eggs closest to the vulva are eggs that contain adult larvae, therefore they are ready to be released by the mother [(Nath](#Nath) *[et al.](#Nath)*[, 2023)](#Nath).

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**Figure 1**. Larva of *Rhabditis* spp. by 100x magnification. (a) female larva; v: opening vulva, (b) anterior of larva; e: esophagus, bc: buccal capsul, (c) posterior of larva; t: tail

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**Figure 2.** Area where the snails were collected

 In fact, cases of rhabditiasis in humans are rare in the world. Most of these parasites are found in humid places, soil and organic matter. Therefore, infections that occur in humans are caused by prolonged contact with contaminated soil or decaying plants. In addition, humans who have a weak immune system will be more susceptible to infection with *Rhabditis* spp. The snail samples used in this study were taken from abandoned yard with many wild plants and close to residential areas. Sometimes residents throw organic waste in the empty yard to be used as natural compost. *A. fulica* grows in urban environments that have poor basic sanitation, unfinished construction, humid environment in direct contact with rubbish and waste [(Ohlweiler](#Ohlweiler) *[et al](#Ohlweiler)*[., 2010)](#Ohlweiler). Therefore, it is inevitable that snails will be infected with various kinds of nematodes, one of which is Rhabditis [(Murray, Rosenthal and Pfaller, 2021)](#Murray). *Acathina fulica* is close to human life and can be found in garden, plantation. Therefore, it is very possible for humans to come into direct contact with this snail. *Acathina fulica* fecal contamination of vegetables, fruit, water source, and soil are a source of infection for nematode transmission.

The research was conducted in the dry season with low rainfall. The result in this research showed that 14 (12.5%) out of 112 sampled contained *Rhabditis* sp. Nematode of the genus *Rhabditis* sp. can be naturally found in humid places and decaying organic matter. According to [Silva](#Silva) *[et al.](#Silva)*[, 2020](#Silva), as for moisture there was a significant relationship with the frequency of *A. fulica* and the positivity for nematodes of the genus Rhabditis. Further studies are recommended to determine infection of Rhabditis during the rainy season so that the number of positive feces samples can be compared during the dry and rainy season.

CONCLUSION

Microscopic examination of snails *A. fulica* fecal samples in Cemorokandang Village, Malang City using the microscopy examination method showed that 14 (12.5%) out of 112 samples contained *Rhabditis* spp. This research conducted in the dry season with low rainfall intensity showed few positive stool sample results. Further studies are recommended to determine infection of Rhabditis during the rainy season to shows the relationship between humidity, snail invasion and the survival Rhabditisin nature.

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AUTHORS’ CONTRIBUTION

SLT assisting the experiments. K and SLT revised the manuscript. MI, SE and PH contributed as a co-author and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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ETHICAL APPROVAL

The experimental protocol was approved by the Animal Care and Use Committee of Faculty Veterinary Medicine, Universitas Airlangga, Surabaya No. 1.KEH.130.09.2024

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