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Detection of Parasitic Contamination in Nile Tilapia (*Oreochromis niloticus*) and Fresh Spinach (*Amaranthus hybridus*) from Pramuka Market, Samarinda

Tria Lestari Agus Salim[1], Febry Rahmadhani Hasibuan[1*], Hasbiah[1], Nova Hariani[1], Muhammad Fahril Azhar[1], Irene Helena Sitorus[1], Erina Yulistin Sianipar[1], Jia Rahmawati[1]
[1]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Mulawarman, Samarinda, 75119, East Kalimantan, Indonesia.

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***Corresponding Author**
Febry Rahmadhani Hasibuan (febryrahmadhani@fmipa.unmul.ac.id)

Abstract

This preliminary study aimed to detect parasitic contamination in Nile tilapia (*Oreochromis niloticus*) and fresh spinach (*Amaranthus hybridus*) sold at Pramuka Market, Samarinda, as part of an effort to assess biological food safety at the local market level. A descriptive observational design was employed. Samples comprised three Nile tilapia and 200 grams of spinach obtained from Pramuka Market, Samarinda. Ectoparasite examination in fish was conducted using the mucus-scraping method on the body surface and gills, while parasite egg examination in spinach was performed using the simple flotation method. Parasite identification was based on morphological characteristics observed under a light microscope. Examination of three Nile tilapia specimens revealed that one individual (33.3%) harbored the ectoparasite *Trichodina* sp. on the gill mucus. Examination of 200 g of fresh spinach revealed one egg presumptively identified as *Fasciola* sp., based on its oval morphology, yellowish-brown coloration, and the presence of an operculum. This study detected indications of parasitic contamination in both fish and spinach samples from Pramuka Market, Samarinda, suggesting a potential biological risk in fresh food commodities sold at the market. However, due to the limited sample size and the absence of molecular confirmation, these results should be interpreted as indicative rather than conclusive and cannot be generalized. Further studies with larger sample sizes and molecular confirmation (e.g., polymerase chain reaction) are recommended to support more comprehensive food safety surveillance.

Keywords: *Biological food safety; Trichodina sp.; Fasciola sp.; Nile tilapia; fresh spinach; Traditional market*

Abstrak

Penelitian pendahuluan ini bertujuan untuk mendeteksi cemaran parasit pada Nile tilapia (*Oreochromis niloticus*) dan bayam segar (*Amaranthus hybridus*) yang beredar di Pasar Pramuka, Samarinda, sebagai bagian dari upaya kajian keamanan pangan hayati di tingkat pasar lokal. Penelitian menggunakan desain observasional deskriptif. Sampel terdiri dari tiga ekor Nile tilapia dan 200 gram bayam yang diperoleh dari Pasar Pramuka, Samarinda. Pemeriksaan ektoparasit pada ikan dilakukan dengan metode *scraping* lendir pada permukaan tubuh dan insang, sedangkan pemeriksaan telur parasit pada bayam dilakukan dengan metode flotasi sederhana. Identifikasi parasit dilakukan berdasarkan ciri morfologi yang diamati di bawah mikroskop cahaya. Pemeriksaan pada tiga ekor Nile tilapia menunjukkan bahwa satu ekor (33,3%) mengandung ektoparasit *Trichodina* sp. pada lendir insang. Pemeriksaan pada 200 gram bayam menemukan satu telur yang diduga *Fasciola* sp., dengan morfologi berbentuk oval, berwarna cokelat kekuningan, dan memiliki operkulum. Penelitian ini mendeteksi indikasi cemaran parasit pada sampel ikan dan bayam dari Pasar Pramuka, Samarinda, yang mengindikasikan potensi risiko biologis pada komoditas pangan segar yang beredar di pasar tersebut. Namun, karena keterbatasan jumlah sampel dan belum adanya konfirmasi molekuler, hasil ini bersifat indikatif dan tidak dapat digeneralisasikan. Penelitian lanjutan dengan jumlah sampel yang lebih besar dan konfirmasi molekuler (misalnya, *polymerase chain reaction*) disarankan untuk mendukung surveilans keamanan pangan yang lebih komprehensif.

Kata Kunci: *Keamanan pangan hayati; Trichodina sp.; Fasciola sp.; Nile tilapia; Bayam segar; Pasar tradisional*

1. INTRODUCTION

Biological food safety constitutes a fundamental pillar in the protection of public health against foodborn disease. Within this framework, biological contamination by pathogenic microorganisms including parasites has emerged as a strategic concern at both global and national levels. A substantial body of research indicates theat fresh food products, particularly leafy vegetables and fish, are highly susceptible commodities to parasitic contamination. This vulnerabbility is primarily sttributed to the inherent characteristics of their production processes, which are heavily dependen ton aquatic environmental quality and the sanitary conditions of agricultural land (Zeynudin *et al.*, 2024).

Foodborn zoonotic parasites represent a critical issue in food microbiology, owing to their life cycles, which involve a complex transmisión chai extending from the environment (Gabriël *et al.*, 2023). Parasitic genera such as *Trichodina* sp. in fish and *Fasciola* sp. in vegetables exemplify biological agents whose presence in fresh food products indicates a potential risk of contamination originating from unsanitary cultivation environments (Atma *et al.*,, 2025; Loginova *et al.*, 2024).

Nile tilapia (*Oreochromis niloticus*) is a highly popular freshwater fishery commodity in Indonesia, owing to its rapid growth, ease of cultivation, and high economic value. Meanwhile, spinach (*Amaranthus hybridus*) is a green leafy vegetable widely consumed by the public due to its abundant vitamin and mineral content. Both commodities possess characteristics that render them susceptible to parasitic contamination : Nile tilapia is potentially exposed to parasites through por pond wáter quality, whereas spinach may become contaminated via irrigation system thate carry parasite eggs from the surrounding agricultural environment (Sanggita *et al.*, 2023; Arsyad *et al.*, 2025).

Previous studies have demonstrated that leafy vegetables such as spinach prossess broad and grooved surfaces, which facilitate the attachment and survival of parasite eggs on plant tissues (Loginova *et al.*, 2024). Similarly, in fish, ectoparasites such as *Trichodian* sp. are commonly found on the gill mucus and body surfaces, particularly under conditions of deteriorating wáter quality and high stocking density (Khoirunnisa *et al.*, 2022). Both of these conditions reflect existing gaps in the food production and distributions systems, which may potentially compromiso biological food safety at the consumer level.

In Samarinda, particularly at Pramuka Market one the primary distribution centers for fresh food products serving the local community information regarding the presence of parasitic contamination in Nile tilapia and fresh spinach remains extremely limited. This concern is further reinforced by the fact that Samarinda has been designated as one of the pilot locations for the World Health Organization (WHO) program, Five Keys to Safer Traditional Markets. In its initial assessment, the program identified the absance of documented wáter quality monitoring and the limited implementation of higiene protocols in local traditional markets. These findings are consistent with a national survey, which reported that fewer than 10% of traditional markets in Indonesia have met health and sanitation standards (World Health Organization, 2023; World Health Organization, 2024; World Health Organization, 2025). Early detection of parasitic contamination in food products constitutes a critical step in microbiological surveillance to prevent the potential transmisión of zoonotic diseases. Simple detection methods, such as microscopic examination using the mucus scarping technique on fish and the flotation surveillance at the traditional market level (Atma *et al.*, 2025).

Based on the foregoing discussion, this study aims to detect the presence of parasitic contamination in Nile tilapia and fresh spinach sold at Pramuka Market, Samarinda, as part of an effort to assess biological food safety. The results of this study are expected to provide a preliminary overview of the risk of biological contamination in local food commodities and to serve as a foundation for more comprehensive food safety surveillance in the future.

2. METHOD

2.1. Research Design

This study employed a descriptive observational design to detect parasitic contamination in two fresh food commodities, namely Nile tilapia (*Oreochromis niloticus*) and fresh spinach (*Amaranthus hybridus*), obtained from Pramuka Market, Samarinda. The research was conducted during April–May 2026. Sampling was carried out at Pramuka Market, Samarinda, while the examination and identification of parasites were performed at the Laboratory of Animal Ecology and Systematics, 1st Floor, Building C, Department of Biology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Samarinda. As this study constitutes a preliminary detection with a limited sample size, the data obtained were analyzed descriptively without inferential statistical testing.

2.2. Population and Sample

Samples were collected purposively based on freshness criteria in the second week of April 2026 at Pramuka Market, Samarinda. The sample comprised three Nile tilapia (*Oreochromis niloticus*) and 200 g of fresh spinach. The total population was not quantified, as this exploratory study focused on qualitative detection rather than prevalence estimation. Therefore, the sample was not intended to be statistically representative, but rather to provide preliminary data on ectoparasite and parasite egg presence in commonly purchased fresh commodities. Ectoparasite examination was conducted by mucus scraping from the body surface and gills, observed under a light microscope at 40× and 100× magnification. Parasite eggs in spinach were examined using a saturated sugar flotation method, followed by microscopic observation at 40× magnification. Morphological identification followed standard taxonomic keys for Trichodina sp. and *Fasciola* sp. eggs. Data were analyzed descriptively without inferential statistics due to the small sample size and exploratory design. Thus, findings are preliminary and not generalizable to the broader commodity population at Pramuka Market.

2.3. Research Prosedure

2.3.1 Examination of Ectoparasites in Nile Tilapia

The examination of ectoparasites in Nile tilapia was performed using the mucus scraping method on the body surface and gills. The procedure was conducted as follows:

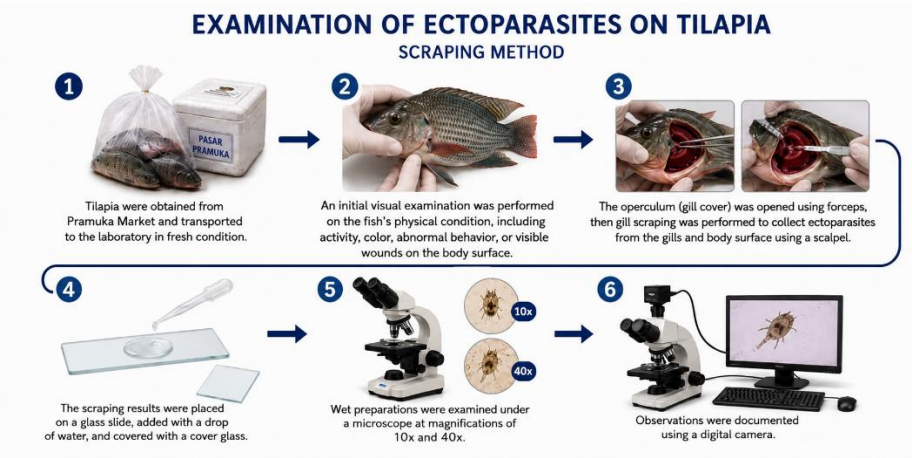

Figure 1. Procedure for Ectoparasite Examination in Nile Tilapia Using the Scraping Method

2.3.2 Examination of Parasite Eggs in Fresh Spinach

The examination of parasite eggs in fresh spinach was performed using the simple flotation method. The procedure was conducted as follows:

Figure 2. Procedure for Parasite Egg Examination in Fresh Spinach Using the Simple Flotation Method

2.4. Data Analysis

Data acquired from microscopic observations were analyzed descriptively, comprising both qualitative (parasite presence or absence) and simple quantitative (parasite abundance) data. Given that this study was designed as an exploratory preliminary survey with a constrained sample size, no inferential statistical tests were applied.

3. RESULT AND DISCUSSION

3.1. Result

Examination of Nile tilapia (*Oreochromis niloticus*) and fresh spinach (*Amaranthus hybridus*) samples obtained from Pramuka Market, Samarinda, revealed the presence of parasitic contamination in both food commodities. Of the three Nile tilapia examined, one fish (33.3%) tested positive for ectoparasites on the gill mucus, which was identified as *Trichodina* sp. based on its rounded body shape, the presence of a denticular ring on the ventral surface, and the characteristic rotational movement observed at 40× magnification (Figure 3). The remaining two fish showed no evidence of parasites on either the body surface or the gills.

Figure 3. Trichodina sp. observed in the gill mucus of Nile tilapia (*Oreochromis niloticus*) at 40× magnification.

Examination of a 200 g spinach sample using the simple flotation method detected one parasite egg, presumably of *Fasciola* sp. The egg was oval, yellowish-brown, with a thin, smooth shell and an operculum at one end (Figure 2). Identification was based on morphological similarity to *Fasciola* sp. eggs described in the literature (Loginova *et al.*, 2024).

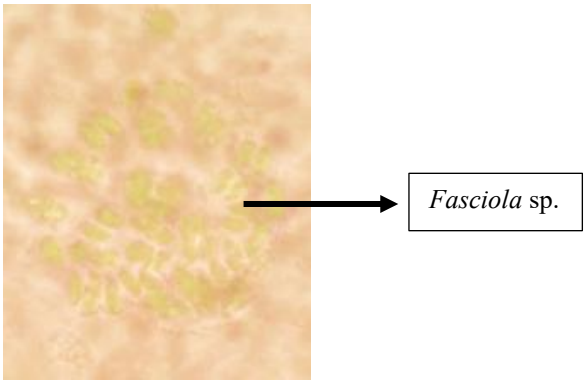

Figure 4. A parasite egg presumably of *Fasciola* sp. detected in a fresh spinach sample using the simple flotation method (magnification 40×).

Table 1. Results of ectoparasite examination in Nile tilapia (*Oreochromis niloticus*) and parasite egg detection in fresh spinach (*Amaranthus hybridus*) from Pramuka Market, Samarinda.

Sample	Parasite Detected	Location	Status / Quantity
Nile Tilapia 1	*Trichodina sp.*	Gill mucus	Positive (1 specimen)
Nile Tilapia 2	Not detected	-	Negative
Nile Tilapia 3	Not detected	-	Negative
Fresh Spinach (200 g)	*Fasciola sp. (suspected)*	Leaf surface	Positive (1 egg)

3.2. Contamination of *Trichodina* sp. in Nile Tilapia

This study successfully detected the presence of the ectoparasite *Trichodina* sp. in the gill mucus of Nile tilapia obtained from Pramuka Market, Samarinda. *Trichodina* sp. is a ciliated protozoan belonging to the family Trichodinidae, which is commonly found to infect freshwater fish, particularly under conditions of deteriorating water quality and high stocking density (Gabriel *et al.*, 2023). This parasite attaches to the gill surface using an adhesive disc equipped with denticles, which mechanically irritates and damages the epithelial cells of the gills (Smith *et al.*, 2019).

From the perspective of food microbiology, the presence of *Trichodina* sp. in Nile tilapia sold at traditional markets reflects the weak implementation of sanitation in cultivation and distribution processes (Risal & Mursalim, 2025). The prevalence of this parasite is relatively high, as reported by Lestari (2024), who recorded a rate of 72.91% in Nile tilapia (Sari *et al.*, 2024). Although *Trichodina* sp. in fish is generally not directly transmissible to humans through cooked meat, some literature has cautioned that this parasite has the potential to cause digestive disturbances if ingested raw or undercooked (Azizah *et al.*, 2022). Therefore, in addition to reducing product quality due to clinical symptoms in fish (excessive mucus production and pale gills), the presence of this parasite also serves as an early warning of poor post-harvest handling hygiene, which poses a risk to consumer health (Harlina *et al.*, 2023). In the context of biological food safety, the detection of *Trichodina* sp. in Nile tilapia sold at Pramuka Market serves as an early warning signal that the fishery production and distribution systems in Samarinda still have gaps that may allow biological contamination to occur.

3.3. Contamination of *Fasciola* sp. in Fresh Spinach

This study detected a single egg presumed to be *Fasciola* sp. in a spinach sample obtained from Pramuka Market. *Fasciola* sp. is a trematode worm responsible for fascioliasis, a zoonotic disease affecting the liver and bile ducts. Its life cycle involves freshwater snails as intermediate hosts and herbivorous mammals as definitive hosts, with vegetable contamination occurring through irrigation water contaminated with eggs shed in livestock feces (Zeynudin *et al.*, 2024). The morphology of the detected egg (oval shape, yellowish-brown color, and the presence of an operculum) is consistent with descriptions of *Fasciola* sp.; however, morphology-based identification has inherent limitations, particularly in distinguishing between *F. hepatica* and *F. gigantica*. Since only a single egg was found, this finding remains presumptive rather than a confirmed species identification; nevertheless, it serves as an important signal regarding the risk of parasitic contamination in fresh vegetables (Norizuki *et al.*, 2015).

This finding is significant because spinach is often consumed raw or lightly cooked. Leafy vegetables possess broad surface areas that facilitate the attachment of parasite eggs. Studies conducted in various countries have demonstrated that parasitic contamination of fresh vegetables constitutes a serious public health concern, with prevalence rates varying according to environmental sanitation and agricultural practices (WHO, 2025). Despite the small number of eggs detected, this single finding remains meaningful in the context of food safety surveillance, as it indicates a potential risk of fascioliasis transmission if vegetables are not thoroughly washed and properly cooked. This observation aligns with research indicating that leafy vegetables carry the highest risk of parasitic contamination (Gawdat & Elmosalamy, 2023).

3.4 Implications for Biological Food safety

These findings indicate a potential biological risk in fresh food commodities at Pramuka Market. Theoretically, contamination with Trichodina sp. in fish is presumed to be associated with aquaculture water quality, while the *Fasciola*-like egg found in spinach is presumed to originate from contaminated irrigation wáter (Gabriël *et al.*, 2023) . However, these factors were not directly measured; therefore, this discussion remains hypothetical. Nevertheless, these findings provide an initial justification for strengthening food safety surveillance in traditional markets (WHO, 2023). Key considerations include monitoring aquaculture and irrigation water quality, training vendors on hygienic food handling, and fostering inter-agency collaboration in integrated surveillance. Further research with broader sample coverage is needed to strengthen the evidence and support local food safety policies.

3.5 Study Limitations

This study has several limitations. First, the limited sample size (three Nile tilapia and 200 g of spinach) precludes generalization of the findings. Second, parasite identification was based solely on microscopic morphology without molecular confirmation (PCR); therefore, the *Fasciola*-type egg finding remains presumptive. Third, water quality and environmental sanitation parameters were not measured, so the contributing factors to contamination could only be discussed theoretically. Nevertheless, this study retains value as a preliminary investigation, providing an initial overview of parasitic contamination in fresh food at Pramuka Market, Samarinda. These findings are consistent with broader concerns about food safety in traditional markets, where a 2020 Indonesian Ministry of Health survey found that only slightly over 10% of traditional markets met health and sanitation standards (World Health Organization, 2024), and with global evidence of parasitic contamination in fresh produce (Zeynudin *et al.*, 2024). The detection of parasites in this study serves as a foundation for more comprehensive future research as well as input for policymakers in efforts to enhance biological food safety at the local level.

4. CONCLUSION

This preliminary study detected indications of parasitic contamination in samples of Nile tilapia and spinach obtained from Pramuka Market, Samarinda. One of the three Nile tilapia examined (33.3%) harbored *Trichodina* sp., and a single egg presumed to be *Fasciola* sp. was found in the spinach sample. These findings suggest a potential biological risk in fresh food commodities sold at the market. However, due to the limited sample size and the absence of molecular confirmation, these results should be interpreted as indicative rather than conclusive, and they cannot be generalized. Further studies with larger sample sizes and PCR confirmation are strongly recommended to support more comprehensive food safety surveillance.

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