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CONTAMINATION OF SOIL-TRANSMITTED HELMINTH (STH) EGGS ON FLY VECTORS AT THE SUKAWINATAN FINAL DISPOSAL SITE (TPA) IN PALEMBANG CITY

Muhammad Fadhlu Ridho[1], Dalilah[2*], Dwi Handayani[2], Gita Dwi Prasasty [2], Susilawati [2]

[1]Faculty of Medicine, University of Sriwijaya, Palembang, Indonesia
[2]Department of Parasitology, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia

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***Corresponding author :**
Dalilah
Bagian Parasitologi, Fakultas Kedokteran, Universitas Sriwijaya, Palembang, Indonesia

Email:
dalilah@fk.unsri.ac.id

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ABSTRAK

Di Indonesia, prevalensi infeksi STH bervariasi antara 2,5%-62% terutama pada penduduk menegah ke bawah dengan sanitasi yang buruk. Penularan infeksi STH dapat terjadi melalui *fecal-oral*, penetrasi larva melalui kulit, dan vektor mekanik. Lalat yang berperan sebagai vektor mekanik sangat tertarik pada tempat pembuangan sampah yang memiliki sumber makanan mendukung dalam aktivitas perkembangbiakannya. Penelitian ini bertujuan untuk mengamati adanya kontaminasi telur STH pada lalat di TPA Sukawinatan Palembang. Hasil penelitian ini diharapkan dapat memberikan wawasan mengenai peran lalat dalam penyebaran telur STH dan menjadi dasar dalam upaya pengendalian vektor lalat. Penelitian menggunakan studi observasional deskriptif dengan desain potong lintang. Pengamatan dilakukan secara mikroskopis dengan pengolahan sampel menggunakan teknik sedimentasi. Dari pengamatan 59 sampel yang telah dibuat dari 598 ekor lalat, ditemukan 17 sampel (28,8%) terkonfirmasi positif telur STH. Jumlah dan jenis telur STH yang ditemukan adalah sebanyak 24 buah telur *T. trichiura*. Dapat disimpulkan, terdapat kontaminasi telur STH pada lalat di TPA Sukawinatan Kota Palembang.

ABSTRACT

Contamination of Soil-Transmitted Helminth (STH) Eggs on Fly Vectors at The Sukawinatan Final Disposal Site (TPA) in Palembang City. In Indonesia, the prevalence of soil-transmitted helminths (STH) infection ranges from 2.5% to 62%, primarily affecting lower socioeconomic groups with poor sanitation. STH transmission can occur through fecal-oral routes, skin penetration of larvae, and mechanical vectors**.** This study examines STH egg contamination in flies at the Sukawinatan Landfill, Palembang, to understand their role in transmission and support vector control strategies. The research employs a descriptive observational study with a cross-sectional design. Observations were conducted microscopically with sample processed using the sedimentation technique. From 59 samples prepared from 598 flies, 17 samples (28.8%) were confirmed positive for STH eggs. The total number and type of STH eggs found were 24 Trichuris trichiura eggs. In conclusion, STH egg contamination was detected on flies at the Sukawinatan Landfill in Palembang City.

INTRODUCTION

Flies are vectors that belong to the order *Diptera*, [1] suborder *Cyclorrhaphae*, and comprise more than 116,000 species distributed across the globe.[2] Several important families include *Muscidae* (which consists of various types of house flies, horn flies, and stable flies), *Calliphoridae* (various types of green bottle flies), and *Sarcophagidae* (commonly known as flesh flies).[2,3] Various species of flies, such as the green bottle fly (*Chrysomya megacephala*) and the common housefly (*Musca domestica*), are considered harmful and typically inhabit environments closely associated with human activity.[4]

Flies act as mechanical vectors in the transmission of foodborne diseases,[5] such as diarrhea, typhoid, dysentery, cholera, and helminth infections.[6,7] They are capable of carrying pathogens, including eggs or larvae of Soil-Transmitted Helminths (STH) like *Trichuris trichiura*, *Ascaris lumbricoides*, *Strongyloides stercoralis*, hookworms, and *Trichostrongylus* sp. These pathogens can adhere to various parts of the fly's body, including the wings, legs, mouthparts, and other body surfaces.[7,8] Helminth infections are endemic in several subtropical and tropical regions due to the warm and humid soil conditions required for their life cycle development.[9,10]

Transmission of STH infection can occur through fecal-oral route, larval penetration through the skin, and mechanical vectors.[9] Flies act as vectors that contaminate food and drinks, thus infecting them with STH eggs, which can then enter the human body.[11,12] STH infections can be caused by several factors that allow the worm species to complete their life cycle.[12] Areas with poor sanitation, for example, can increase the prevalence of intestinal nematode infections by up to 80%.[12]

In a study conducted by Febiola et al. (2022) at the 3R (Reduce, Reuse, and Recycle) Temporary Disposal Site in Kartini Palembang, 631 flies were identified across 61 sample pools. The study found 23 sample pools (37.7%) that showed the presence of STH eggs, with the distribution of M. domestica at 6.56%, C. megacephala at 21.31%, and Lucilia sp. at 9.83%.[13] The study confirmed the presence of STH in flies found around the waste disposal environment. However, to date, no similar research has been conducted at the Sukawinatan Landfill in Palembang, which has different environmental characteristics and a larger volume of waste. Therefore, this study focuses on identifying the number and types of flies and analyzing the potential contamination of STH eggs, which play a role in initiating the spread of disease in the area. The findings of this study are expected to provide an overview of the risk of STH infection transmitted through flies as mechanical vectors, thereby encouraging the community to improve personal and environmental hygiene to prevent such infections.

METODE

This study employed a descriptive observational design with a cross-sectional approach. The research began with fly sampling conducted in the environment of the Sukawinatan Final Disposal Site (TPA) in Sukarami District, Palembang City. The process of identifying and differentiating fly species faced several challenges, particularly due to anatomical similarities among species from the same family.[14] Observations and sample examinations were carried out at the Bio-optics Laboratory and the Medical Chemistry Laboratory of the Faculty of Medicine, Sriwijaya University (FK UNSRI). The study was conducted from July to November 2024.

The samples in this study consisted of flies captured within a radius of approximately 200 meters (±650 ft) from the entrance gate of the Sukawinatan Landfill, using a sweeping net in the surrounding area of Sukarami District, Palembang City. Sampling was conducted on Monday, September 16, 2024, during the morning to midday period, between 08:30 AM and 12:00 PM local time (WIB). Flies are phototropic insects, meaning they are attracted to light, which is why their population tends to increase during the daytime, especially when the temperature exceeds 20°C.[15]

Fly identification was carried out using the *Feedlot and Dairy Fly Identification Chart*,[14] followed by classification and grouping based on species into pooled fly samples. Each pooled sample placed in a centrifuge tube contained approximately 10 flies of the same species. The identification of STH egg contamination was performed using a microscope and the reference guide *Structures That Resemble Helminths and Cestode Eggs*.[16]

Results

The results of the study on the identification of the number and types of flies at the Sukawinatan Landfill, Palembang City, are presented as follows:

Table 1. Distribution of fly samples and frequency of STH egg contamination.

Fly species	Counts	Positive STH (n, %)	Negatif STH (n, %)	Total pool sample (n, %)
M. domestica	405	11 (18,6%)	29 (49,2%)	40 (67,8%)
Lucilia sp	57	2 (3,4%)	4 (6,8%)	6 (10,2%)
C. megacephala	136	4 (6,8%)	9 (15,3%)	13 (22%)
Total	598	17 (28,8%)	42 (71,2)	59 (100%)

A total of 598 flies from three species were successfully identified at the Sukawinatan Landfill, Palembang, with *M. domestica* being the most dominant (67.7%), followed by *C. megacephala* (22.8%) and *Lucilia sp*. (9.5%). The species *Fannia sp*. and *Sarcophaga sp*. were not found during the sampling process. Of the 59 sample pools examined, 17 samples (28.8%) showed STH egg contamination. M. domestica exhibited the highest contamination rate (18.6%), followed by C. megacephala (6.8%) and Lucilia sp. (3.4%).

Table 2. Morphological characteristics of the identified fly species.

Fly Species	Size (mm)	Body color	Distinctive Features
M. domestica	6-8	Gray with 4 dark stripes on the thorax	The 4th wing vein bends sharply, prominent reddish eyes
Lucilia sp.	±10	Metallic green	Large red eyes, less hairy thorax
C. megacephala	8-14	Bluish metallic green	Males have holoptic eyes (almost fused), females have dichoptic eyes

Musca domestica

Figure 1. Fly species M. domestica; (1) Dorsal view, (2) Frontal view, and (3) Lateral view.

***Lucilia sp*.**

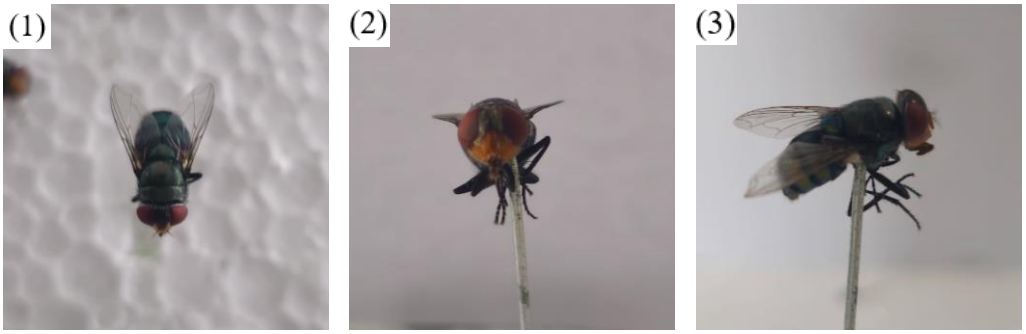

Figure 2. Fly species *Lucilia sp*; (1) Dorsal view, (2) Frontal view, and (3) Lateral view.

Chrysomya megacephala

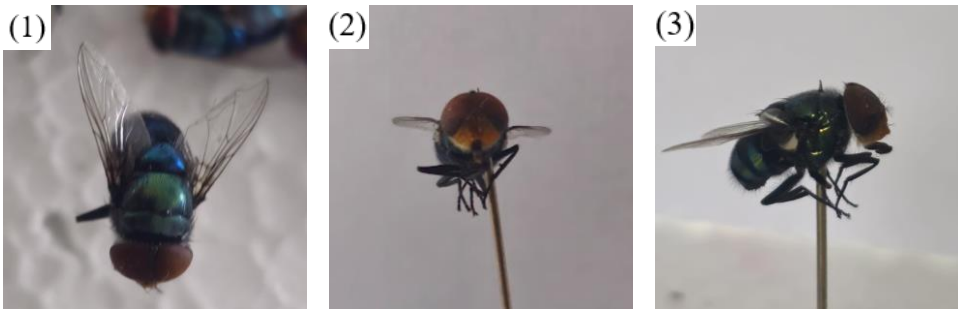

Figure 3. Fly species *C. megacephala*; (1) Dorsal view, (2) Frontal view, and (3) Lateral view.

Tabel 3. Identification of the number and types of STH eggs found in the samples.

Fly species	Helminth Egg Species					Total	(%)
	A. lumbri-coides	*T.trichiura*	Hookworm	*S.stercoralis*	*Tricho-strongylus sp.*		
M. domestica	0	16	0	0	0	16	66,6
Lucilia sp.	0	4	0	0	0	4	16.7
C. megacephala	0	4	0	0	0	4	16,7
Total	0	24	0	0	0	24	100

Out of the 24 identified STH eggs, 16 eggs (66.6%) were found in *M. domestica*, while *Lucilia sp.* and *C. megacephala* each contained 4 eggs (16.7%). All detected eggs were from *T. trichiura*, with no evidence of other STH species such as *A. lumbricoides*, hookworms (Ancylostoma/Necator), *S. stercoralis*, or *Trichostrongylus sp*.

***Trichuris trichiura* egg**

The STH eggs identified in the 17 positive samples (28.8%) were eggs of *T. trichiura*. The *T. trichiura* eggs found in the samples exhibited the characteristic barrel-shaped morphology, surrounded by a shell with colorless mucoid plugs at both poles.

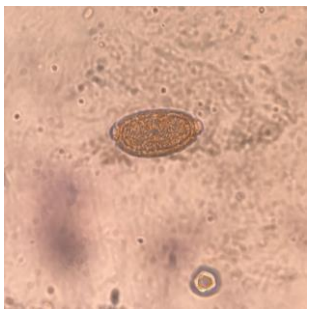

Figure 4. The microscopic magnification of 40 × 10 for *T. trichiura* eggs

DISCUSSION

Identification of Fly Sample and Quantity

Based on the identification of fly species collected from the Sukawinatan Landfill in Palembang City, the total number and species composition consisted of three species, there are 57 *Lucilia sp*. (9.5%), 136 *C. megacephala* (22.8%), and 405 *M. domestica* (67.7%). Musca domestica was the most abundant species, followed by *C. megacephala* and *Lucilia sp*. These findings align with a study by Prajnawita et al. (2020)^17 conducted at two distinct locations—Ambulu and Pakusari Landfills. The *M. domestica* dominated both sites, with 289 individuals (91%) out of 318 at Ambulu Landfill and 316 individuals (81%) out of 387 at Pakusari Landfill.

Musca domestica (house flies) were found in large numbers at the final disposal site or waste accumulation areas. This is due to the fact that *M. domestica* is a cosmopolitan fly species,

omnivorous feeding habits, and exceptionally high reproductive capacity. These biological characteristics enable rapid population growth in environments with abundant food resources, particularly in waste accumulation sites and landfills.[18] Consequently, *M. domestica* species were captured in greater numbers due to their widespread abundance and ease of collection in these environments.

The lower population density of Calliphoridae compared to Muscidae may result from a combination of ecological factors (habitat and food preferences), temperature, and humidity. *Chrysomya megacephala* typically breeds in liquid or semi-liquid organic matter of animal origin, including fresh or decomposed meat, fish, carrion, and feces-contaminated soil.[19] This species thrives under high temperatures and low humidity conditions, with peak activity occurring during daylight hours, particularly in the afternoon.[20] Adult flies demonstrate rapid adaptation to organic substrates found in human settlements or areas with access to carrion or food waste.[21] *Lucilia sp*., another common Calliphoridae species, is frequently associated with feces, refuse, and carcasses. It ranks among the most prevalent species within this family.[3]

In locations such as the Sukawinatan Landfill, food sources like blood or fresh meat are not present, which likely explains the absence of Sarcophaga sp. flies, as they may not survive due to the lack of necessary nutrients for reproduction. Sarcophaga sp. (flesh flies) are typically found in protein-rich substrates such as blood and decaying animal tissue (carcasses). These conditions play a vital role in the development of their eggs and the sexual maturation of the species.[18]

Identification of STH Egg Contamination in Flies

Examination results revealed that 17 out of 59 fly samples (28.8%) tested positive for STH egg contamination. The highest number of positive samples was found in the *M. domestica* species, while the lowest was observed in *Lucilia sp*. This variation is closely related to the differing number of fly samples analyzed across species. Given that *M. domestica* accounted for the largest number of samples, the prevalence of STH egg contamination was correspondingly higher. No contamination by other helminth eggs such as *Ascaris lumbricoides*, *Strongyloides stercoralis*, hookworms, or *Trichostrongylus* sp. was detected in this study.

Flies act as vectors in the transmission of foodborne diseases,[5] including diarrhea, typhoid, dysentery, cholera, and helminthiasis.[6,7] They can serve as carriers of Soil-Transmitted Helminth (STH) eggs, which may be found on various parts of their bodies such as wings, legs, mouthparts, and other body segments.[7,8] The *M. domestica* has been identified as a carrier of more than 100 pathogens, including fungi, bacteria, viruses, and parasites.[6] Several factors such as morphology, anatomy, body size, food substrates, and the structure of the proboscis can influence both the quantity and types of parasites present on flies.[22]

Landfills receive waste from various sources and of different types.[23] This diversity influence the types of STH eggs identified in fly samples. One of the STH eggs found in flies is *T. trichiura*. Fly bodies may become contaminated with helminth eggs after coming into contact with feces-contaminated areas, such as water, soil, or vegetables previously exposed to intestinal nematode parasites.[24] At the Sukawinatan Landfill, large quantities of organic waste such as vegetables are present. Contaminated vegetables can act as transmission agents, carrying helminth eggs to humans or animals. Flies that land on this waste may serve as vectors, potentially increasing the risk of parasitic infection. These findings highlight the importance of proper waste management practices, including the separation of organic and inorganic waste, the implementation of hygienic waste

disposal systems, and fly population control through optimized sanitation, to reduce the risk of disease transmission caused by STH infections.

Sampel Identification of Quantity and Types of STH Eggs Detected in Samples

The examination results showed that 17 out of 59 fly samples (28.8%) tested positive for the presence of a total of 24 *Trichuris trichiura* eggs. The distribution of the detected eggs included 4 eggs (16.7%) from *Lucilia* sp. samples, 4 eggs (16.7%) from *Chrysomya megacephala* samples, and 16 eggs (66.6%) from *Musca domestica* samples.

This finding is not consistent with the results of a study conducted by Baharul in 2021,[25] in which 36 fly samples from several species—*Fannia* sp., *M. domestica*, *C. megacephala*, and *Lucilia* sp.—captured at Kamboja Market, Ilir Timur I District, Palembang, were examined and found to contain STH egg contamination consisting of 1 *T. trichiura* egg, 1 hookworm egg, and 12 *Ascaris lumbricoides* eggs. The discrepancies in findings may be attributed to the absence of contact between other STH eggs and the fly bodies. In addition, the behavioral patterns of flies—frequently moving between locations and flying over long distances—may lead to the detachment or transfer of STH eggs from the fly's body to other surfaces before detection during laboratory analysis.[26]

Trichuris trichiura is capable of producing between 2,000 and 10,000 eggs per day. The eggs are deposited into the soil via human feces and become infective after an incubation period of approximately 2 to 3 weeks in moist soil under warm temperatures.[27] These eggs require favorable environmental conditions, such as shaded and moist soil, to develop from the initial to the infective stage. Such conditions are commonly found in tropical or subtropical regions with poor sanitation.[28]

The eggs of *Trichuris trichiura*, when ingested by humans, can cause trichuriasis, a parasitic infection in the large intestine and cecum. This helminth can cause intestinal tissue damage, trigger inflammation, and impair nutrient absorption, which can significantly affect the health status of the infected individual. Symptoms include anemia, bloody diarrhea, abdominal pain, malnutrition, and weight loss.[29] However, mild infections often do not exhibit typical symptoms.[24]

CONCLUSION

Out of a total of 59 samples, consisting of 40 *M. domestica* samples, 13 *C. megacephala* samples, and 6 *Lucilia sp.* samples, 17 samples (28.8%) were confirmed positive for *T. trichiura* eggs. The distribution of contamination was as follows: 11 *M. domestica* samples (18.6%), 4 *C. megacephala* samples (3.4%), and 2 *Lucilia sp.* samples (6.8%). The results of this study confirm that flies at the Sukawinatan Final Disposal Site (TPA) in Palembang City can act as mechanical vectors in the transmission of STH eggs, particularly from the *T. trichiura* species. These findings highlight the importance of preventive measures, such as maintaining personal and environmental hygiene, as well as reducing exposure to flies as potential vectors of various diseases.

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