

## Identification of *Soil Transmitted Helminths* Eggs on Flies in KM 5 Market, Palembang City

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### Abstract

The prevalence of *Soil Transmitted Helminths* (STH) infection in the world is still high, especially in areas with poor sanitation. This condition is often found in markets which becomes a favorite place for flies. Flies are insects that have the ability to fly far and habits of life that move around so they can become human health problems as mechanical vectors of STH infection. Therefore, this study aimed to find out the type and number of flies, and the contamination of STH eggs in flies in Pasar KM 5 Palembang City. This research was an observational descriptive study with a cross sectional design. The samples of this study were caught with accidental sampling using insect nets and fly traps. The samples processing and observation were made at the Biooptic and Chemistry Medic Laboratory, Faculty of Medicine Sriwijaya University. The number of flies obtained 419 flies and consisted of 136 *Musca domestica* (32.4%), 183 *Chrysomya megacephala* (43.7%), and 100 *Lucilia sp.* (23,9%). From 42 total samples studied, 14 samples positively contaminated with STH eggs (33.4%), that consisting of 3 samples of *Musca domestica* (7.2%), 6 samples of *Chrysomya Megacephala* (14.3%), and 5 samples of *Lucilia sp.* (11,9%). The number of STH eggs obtained 17 eggs, consisted of 16 eggs of *Ascaris lumbricoides* (94.1%) that was 3 eggs in *Musca domestica* (17.7%), 7 eggs in *Chrysomya megacephala* (41.1%), and 6 eggs in *Lucilia sp.* (35.3%), and 1 egg of *Trichuris trichiura* in *Chrysomya megacephala* (5.9%). The conclusion was that there was contamination of STH eggs on flies in KM 5 Market Palembang City.

**Keywords:** Eggs, Flies, Market, *Soil Transmitted Helminths*

### 1. Introduction

Flies are health nuisance insects, as mechanical vectors in the spread of disease in humans. Flies belong to the order *Diptera* with more than 116,000 species worldwide. The various types of fly families include *Muscidae* (house flies, horn flies), *Calliphorida* (green flies), and *Sarcophagidae* (flesh flies).<sup>1</sup>

Flies like dirty places like traditional markets. There are conditions that strongly support the development of flies are warm temperatures, high humidity, and an abundance of food sources such as organic waste and animal waste.<sup>2</sup> Flies have the ability to fly far up to 10 km. The living habits of flies that move from dirt and dirty places can carry pathogens on their bodies in the form of

bacteria, fungi, viruses, and parasitic worms.<sup>2</sup> The behavior of these flies become a spreading factor of helminthiasis caused by STH infection.

STH or *Soil Transmitted Helminths* are intestinal nematodes which are the main cause of intestinal parasitic infections in humans and transmitted through contaminated soil.<sup>3</sup> There are several species of STH that most important to humans, namely *Ascaris lumbricoides* (roundworms), *Necator americanus* and *Ancylostoma duodenale* (hookworms), *Trichuris trichiura* (whipworms), *Strongyloides stercoralis*, and *Trichostrongylus sp.*<sup>4</sup>

STH infections are often found in tropical and subtropical climates, especially in areas with inadequate sanitation and poor hygiene. According to 2020 data by WHO<sup>5</sup> there are

more than 1.5 billion people or 24% of the world's human population infected with STH.

Based on study by Ruru<sup>6</sup>, the analysis of environmental sanitation implementation in KM 5 Traditional Market Palembang City was still poor and under requirements. These conditions and the abundance of food sources in traditional markets are ideal for breeding flies as mechanical vectors of STH infection.<sup>7</sup> Therefore, necessary to know more about the contamination of STH eggs on flies in KM 5 Traditional Market, Palembang City. This information useful to increase insight and awareness of sanitation of the public, especially those living around the market to avoid STH infection caused by flies as mechanical vectors.

## 2. Method

This study was a descriptive observational study with a cross sectional design. This study was carried out from August to November 2021 and at the Biooptics Laboratory and Medical Chemistry Laboratory, Faculty of Medicine, Sriwijaya University.

The sample of this study was all flies caught in all places that found many flies to live. The collection of fly samples was carried out at KM 5 Market Palembang City, using insect nets and fly traps from 08.00-10.00 WIB. all samples were taken and killed in 2 ways, placing the samples in the freezer and using chloroform.

Flies were identified using a magnifying glass and Pictorial Identification Key Book to Common Feedlot Flies. Then they grouped according to their species, every 10 or not reaching of 10 of same species flies became one sample. The samples placed in reaction tube with 3ml of NaOH 0.1%N for one hour. The flies was set aside and the fluid was sentrifuged at 3000rpm in three minutes. The sediment was placed in object glass and gived one drip of eosin. The observation of STH egg contamination using a microscope with 10x or 40x magnification, and the Bench Aids Book for the diagnosis of intestinal parasites.

## 3. Results

Based on Table 1, the samples were carried out from four different locations : Temporary Shelters (TPS), fish vendor areas, meat vendor areas (beef, buffalo, chicken), and vegetable vendor areas. 419 flies were caught and the most samples were found in the fish vendor area as many as 153 flies and the least in the vegetable vendor area as many as 40 flies. The type and number of flies obtained consisted of 3 species, that is 136 *M. domestica* (32.4%), 183 *C. megacephala* (43.7%), and 100 *Lucilia sp.* (23.9%).

Table 1. Identification of the type and number of flies found.

Flies Species	Temporary Shelter (*)	Fish Area	Meat Area	Vegetable Area	Total	%
<i>Musca domestica</i>	50 (5)	31 (3)	35 (4)	20 (2)	136 (14)	32.4
<i>Fannia sp.</i>	0	0	0	0	0	0
<i>Chrysomya megacephala</i>	28 (3)	75 (7)	70 (7)	10 (1)	183 (18)	43.7
<i>Lucilia sp.</i>	13 (2)	47 (5)	30 (3)	10 (1)	100 (10)	23.9
<i>Sarcophaga sp.</i>	0 (0)	0	0	0	0	0
<b>Total</b>	<b>91</b>	<b>153</b>	<b>135</b>	<b>40</b>	<b>419 (42)</b>	<b>100</b>

\* grouping of samples

**Musca domestica**

The morphological characteristics observation of *M. domestica* (house fly) has length of about 6-9 mm and light to dark gray, has 4 longitudinal stripes clear colored of the thorax, pale brown abdomen, wings with sharply curved 4 veins close with 3 veins, and a pair protruding big eyes (Fig. 1).

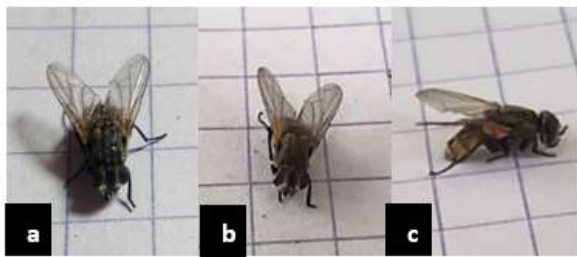


Figure 1. *M.domestica* fly (a) Top view. (b) Front view. (c) Side view.

**Chrysomya megacephala**

The morphological characteristics observation of *C. megacephala* has length about 8-14 mm, metallic bluish-green body, and a pair of big red eyes (Fig.2)

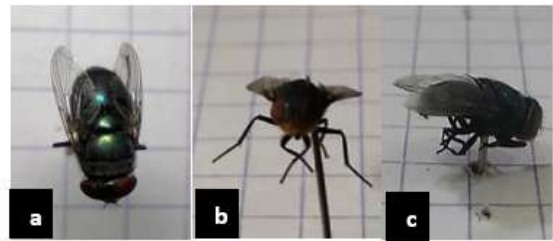


Figure 2. *C. megacephala* fly (a) Top view. (b) Front view (c) Side view.

**Lucilia sp.**

The results of the morphological characteristics observation of *Lucilia sp.* has a smaller size compared to the *C. megacephala* fly in the same family *Calliphoridae* which is ±10 mm, metallic green body, and a pair of large red eyes (Fig. 3).

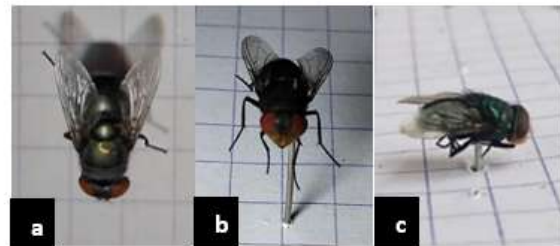


Figure 3. *Lucilia sp.* (a) Top view. (b) Front view. (c) Side view

**Identification of STH Egg**

Table 2 shows us that *C. megacephala* has the most STH eggs (7 eggs of *A. lumbricoides*)

and has not find of *Hookworm*, *S. stercoralis*, and *Trichostrongylus sp* eggs.

Table 2. Frequency distribution of the number of fly samples contaminated with STH eggs

Fly Species	STH Egg Contamination								Total	%	
	Positive						Negative				
	n	Type of STH Eggs					%	n			%
Al		Tt	Hw	Ss	Ts						
<i>Musca domestica</i>	3	3	0	0	0	0	7.2	11	26.2	14	33.4
<i>Fannia sp.</i>	0	0	0	0	0	0	0	0	0	0	0
<i>Chrysomya megacephala</i>	6	7	1	0	0	0	14.3	12	28.5	18	42.8
<i>Lucillia sp.</i>	5	6	0	0	0	0	11.9	5	11.9	10	23.8
<i>Sarcophaga sp.</i>	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>14</b>	<b>16</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>33.4</b>	<b>28</b>	<b>66.6</b>	<b>42</b>	<b>100</b>

Desxcription : Al : *A. lumbricoides*  
Tt : *Trichuris trichiura*;  
Hw : Hookworm

Ss : *Strogylus stercoralis*;  
Ts : *Trichostrongylus Sp.*

Based on table 2 above, total number of STH eggs in 14 samples of flies was 17 eggs, consisting of 16 eggs of *A. lumbricoides* (94.1%)

and 1 egg of *T. trichiura* (5.9%). The location with the most STH eggs found was in the meat sales area as many as 7 eggs (41.2%) (Table 3).

**Table 3. Frequency distribution of the number and types of STH eggs in contaminated fly samples**

Location	Fly Sample	STH Egg Contamination					Total	%
		<i>A. lumbricoides</i>	<i>T. trichiura</i>	<i>hook worm</i>	<i>S. stercoralis</i>	<i>Trichostrongylus sp.</i>		
TPS	MD 1	1	0	0	0	0	6	35.3
	MD 2	1	0	0	0	0		
	CM 1	2	0	0	0	0		
	CM 2	2	0	0	0	0		
Fish	CM 1	1	0	0	0	0	3	17.6
	LC 1	1	0	0	0	0		
	LC 2	1	0	0	0	0		
Meat	MD 1	1	0	0	0	0	7	41.2
	CM 1	0	1	0	0	0		
	CM 2	1	0	0	0	0		
	LC 1	1	0	0	0	0		
	LC 2	2	0	0	0	0		
Vegetable	CM 1	1	0	0	0	0	1	5.9
<b>Total</b>		16	1	0	0	0	17	
<b>%</b>		94.1	5.9	0	0	0	100	

Description: TPS = Temporary Shelter  
 MD = *Musca domestica*  
 CM = *Chrysomya Megacephala*  
 LC = *Lucilia sp.*

***Ascaris lumbricoides* infertile corticated eggs**

The *A. lumbricoides* eggs in Figure 4 were infertile eggs, had an oval shape, longer than the fertile eggs, containing granules like, lined with thin walls with an outer layer that still had a layer of albumin (corticated).



**Figure 4. *Ascaris lumbricoides* infertile corticated eggs observed under microscope with 40x magnification.**

***Ascaris lumbricoides* infertile decorticated eggs**

The *A. lumbricoides* eggs in Figure 5 were infertile eggs, had an oval shape, longer than the fertile eggs, containing granules like, lined

with thin walls with an outer layer that did not have a layer of albumin (decorticated).



**Figure 5. *Ascaris lumbricoides* infertile decorticated eggs observed under microscope with 40x.**

***Ascaris lumbricoides* fertile decorticated eggs**

The *A. lumbricoides* eggs in Figure 6 were fertile egg had a oval shape, lined with outer thick walls but did not have a layer of albumin (decorticated).



Figure 6. *Ascaris lumbricoides* fertile decorated eggs observed under microscope with 40 x magnification

### ***Trichuris trichiura* eggs**

The *T. trichiura* eggs in Figure 7 have a distinctive shape, which is like a crock or barrel, yellow tengguli in color, and has clear mucoid plug.



Figure 7. *Trichuris trichiura* eggs observed under microscope with 40x magnification

## **4. Discussion**

The most flies were caught in fish and meat sales because this area has a pungent odor and a humid environment that is favored by flies. The most common flies found were *C. Megacephala* this flies like fish and meat sales area which provide a food source with low carb and high protein that good for development the eggs.<sup>14</sup>

Types and numbers of flies found in this study almost have similarities with study in 2018 by Putri<sup>4</sup>, which is obtained 232 flies consisting of of 127 *M. domestica*., 26 *Fannia sp.*, 56 *C. megacephala*, 21 *Lucilla sp.*, and 2 *Sarcophaga sp.* In this study there are similarities on species of flies found are *M. domestica*, *C. megacephala*, and *Lucilla sp.* This result also have similarities with study in 2017 by Ryani, et al<sup>14</sup>, which is obtained 338 flies, consisting of 250 *C. Megacephala* (74%) and 88 *M. domestica* (26%). In this study, there are

similarities on the most caught flies are *C. megacephala*. However, the number and type flies found on this study has differences with another study such as with study in 2019 by Wulandari, et al<sup>8</sup>, only obtained 2 species consisting of *C. megacephala* and *M. domestica* as many as 380 flies.

The differences of this study obtained probably due to differences supportive conditions for flies development like temperature, humidity, and the food sources available such as item sale and organic waste in each market.<sup>2</sup>

In this study, the meat sales area (beef, buffalo, chicken) were the most common STH eggs were found in flies, as many as 7 eggs (41.2%). This is because flies like smelly organic ingredients and rotten. Based on direct observation, many merchants sold their foods with only put a tarp on the ground. This allows flies to land on the ground and dirt around the market. This condition can be one of STH contamination factors on the body of flies.

The role of flies as a mechanical vector of disease in humans and animals, as well as a nuisance insect wich is disturbances in peace and cleanliness. Various pathogens that can be transmitted through flies are bacteria, viruses, protozoa, and eggs worm.<sup>9</sup> In this study the most common fly found is *C. megacephala*, followed by *M. domestica* and *Lucilla sp.* Green flies are known that has more lower potential as a mechanical vector of pathogenic agents compared to *M. domestica* flies.<sup>10</sup>

*C. megacephala* known to be able transmit myiasis to the eyes, bones, and other organs through open wounds. These flies are also potential as mechanical vectors of pathogenic bacteria *E. coli* which can cause infection and foodborne diseases.<sup>9,10</sup> According to several studies, *C. megacephala* has close relationship between the number of flies and the presence of *A. lumbricoides* eggs, with the influence of sanitation environment.<sup>11</sup> Larvae flies *C. megacephala* also known has play a role in

forensic entomology as a reference in knowing postmortem interval minimum.<sup>12</sup> Meanwhile, *M. domestica* is known to have potential as mechanical vectors of various pathogens such as *Escherichia*, *Campylobacter*, *Chlamydia*, *Salmonella*, and *Shigella*. This fly also associated with diarrhea, dysentery, typhoid fever, tuberculosis and parasitic worms.<sup>13,14</sup> Some worm eggs that can be carried by *M. domestica* are *A. lumbricoides*, *Hookworm*, *T. trichiura*, *S. stercoralis*, and *E. Vermicularis*.<sup>15</sup>

Flies can transmit worms to human by carrying infective worm eggs and later contaminate the infested food, through dirt, vomit or transfer agent diseases that are on the surface of the body such as on legs, wings, mouth and other limbs.<sup>2,6</sup> Infertile STH eggs are known to not infect humans if ingested, whereas fertile eggs need suitable soil to grow to be infective eggs and later infect humans. The eggs of *A. lumbricoids* will become infective after 18 days or a few weeks, while the eggs of *T. trichiura* will become infective form within 3-6 weeks in a suitable environment, such as moist soil, shady and suitable temperature.<sup>10,18,27</sup> Food that contaminated with infective STH eggs if accidentally ingested by humans could enter the intestinal digestive tract. Eggs can hatch into larvae and become adult worms then transmit helminthiasis.<sup>7</sup> One worm is known to cause loss of carbohydrates, protein, and blood from the human body so that it can cause diseases such as anemia, malnutrition, stunting, decreased nutritional status and growth and development, and can reduce cognitive abilities in children.<sup>8,16</sup>

Based on the results, the most number of STH found are in *C. megacephala* flies as many as 8 eggs (47%). This species is closely related to feces, a source of good protein and substrate for egg development, as well as the body size of fly is bigger than other species and has a lot of hair that allows more contamination.<sup>17</sup>

The most eggs found were 16 eggs of *A. lumbricoides*. *A. lumbricoides* eggs are mostly found in environmental conditions with poor sanitation and other conditions factors for egg development such as clay soil, areas with high humidity, and temperatures between 25°-30° C.<sup>10,18</sup> The number of *A. lumbricoides* eggs found was because these eggs compared to other types of STH eggs were more resistant to immersion in various hard chemicals like 0.1% NaOH that used in this study. This egg is also more resistant to extreme temperatures, which can be survive in cold temperatures <8°C and will die at temperatures >40°C.<sup>18,19</sup> The results of this study are in line with study by Laili, et al<sup>15</sup> obtained from 150 green flies found 13.33% contaminated with *A. lumbricoides* eggs and 13.33% contaminated *Hookworm* eggs. This result is also in line with study by Edmond<sup>20</sup>, obtained from 2583 *M. domestica* and 766 *C. megacephala* found 4 eggs worm *A. Lumbricoides*. From these studies, there are similarities in the types of STH eggs obtained, *A. lumbricoides* eggs.

In this study, only 1 egg of *T. trichiura* was found. These eggs are often found in conditions environment with poor sanitation and can survive on temperature optimal 30°C in loamy, moist and shady soil.<sup>10,25</sup> it was may related to the method that used to killed flies in this study, by using a freezer. This method can damage eggs because the *Trichuris sp.* eggs are not resistant to cold temperatures and can be damaged at temperature < 8°C.<sup>19</sup> These results are in line with study by Ryani, et al<sup>14</sup> that obtained from 338 flies found 6.25% flies *C. Megacephala* are positive carrying *T trichiura* and *Hookworm* eggs.

However, this study has differences with another study such as with study in 2017 by Saputri, et al<sup>8</sup>, obtained from 60 flies found 18.2% were contaminated with *Hookworm* eggs. The differences of this study probably due to the absence of contact between the STH eggs and the fly's body and the flies living

habits that fly away and move around so the STH egg is already detached from the fly's body or attached to other surfaces before it can be identified in the laboratory.

## 5. Conclusion

Based on the results and discussion of the study can be concluded that there was contamination of STH eggs in traditional market.

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