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THE POPULATION OF FLIES IN CIKOLOTOK LANDFILL, PASAWAHAN DISTRICT, PURWAKARTA REGENCY, INDONESIA

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ABSTRACT

Background: *The flies act as mechanical vectors of disease to the digestive tract, such as cholera, typhoid, dysentery, and others. There are a lot of flies in a variety of habitats, one of the preferred habitat is on landfills. The first step to controlling flies is a preliminary survey with collecting data about the population of flies. In the Cikolotok landfill, it has never done a survey population of flies.*
Aims: *This study aims to look the number of flies and the priority area for fly control, the most active time of flies, and species of flies in Cikolotok landfill, Pasawahan District, Purwakarta Regency, Indonesia.*
Methods: *This study was an observational-descriptive research. The flies were observed based on the fly that caught by the flypaper trap and cone trap mounted on 3 areas, i.e. area of sorting garbage, area of stockpiling garbage and area of waste treatment. Data were analyzed by univariate method.*
Results: *The results showed that the density of flies in Cikolotok landfill per point range between 0-179 flies/15 minutes in every 2-hour. The area that had the highest number of flies is area of sorting garbage with 528 flies. The most active time of flies was in a span of 7:00-9:00 am. The species of flies were found are Chrysomya megacephala (52%), Musca domestica (45%) and Sarcophaga bullata (3%).*
Conclusion: *Sorting garbage area has the highest number of flies and C. megacephala more found in landfill because of physical condition of garbage and the condition of area itself. The flies are more active in a span of 07:00-09:00 due to the condition of physical environment. Monitoring, fly control, research about fly-borne disease and relocation of cattle are needed to control the flies and the effects.*

Keywords: *Population of flies, landfill, Cikolotok landfill, preliminary survey*

INTRODUCTION

The fly is one of the insects which has important positions in the field of health. In the world of public health, the flies act as mechanical vectors of disease to the digestive tract, such as cholera, typhoid, dysentery, and others [1]. Universally, a member of the *Calliphoridae*, *Muscidae*, *Oestridae*, *Psychodidae*, *Simulidae*, *Glossinidae*, and *Tabanidae* family have significance in public health [2]. There are a lot of flies in different areas, for example in place of watery, sandy, in plant, under bark and stones, dirt, etc. One of the preferred habitat of the flies was on garbage dumps (landfill). This is because the garbage is an important source in the process of the breeding of flies. Even for urban areas, garbage become the site of the main breed [2].

To date, there has been no further research about the adverse effects on health of flies in the landfill. However, there was worm infestation incidence experienced by the informal waste picker at the landfill. This is based on research conducted by Ottay which stated that there is a relationship between the incidences of worm infestation with behaviour of informal waste picker in Sumompo landfill [3]. The incidence of diarrhea was also experienced by informal waste picker at the landfill, even though there has been no further research if it caused by flies [4]. However, the adverse effects of flies should remain a concern. Myiasis incidence both in humans and in animals is likely to occur [5]. Fast and random deployment of flies also makes it enable to approach the nearest settlement area from the landfill [6]. Rudianto and Azizah stated that the closer the distance between settlement with the landfill in Kenep Village, the number of fly density and the percentage of incidence of diarrhea is higher [7].

This study divided the research site into three, namely sorting garbage area, stockpiling garbage area, and waste treatment area. The division was based on the fact that because of the vast area of landfill and for the effective and efficient process of fly control, authors believed that dividing the research site is important to look for the priority area of control. The survey of the population of flies needed as a reference for the control of flies number and density, which is about when, where and how to control the flies need to be implemented effectively and efficiently [8]

Cikolotok landfill has a capacity approximately 5.6 ha located in Margasari Village, Pasawahan District, Purwakarta Regency, Indonesia. The amount of garbage that daily transported approximately 200 m^3/day. Cikolotok landfill using the method of final disposal system named controlled landfills [9], and according to the Head Section of Waste Management, it has never done a survey of fly population before. This research aims to look at the number of flies and priority area for fly control, active time of flies, and species of flies in Cikolotok landfill, Pasawahan District, Purwakarta Regency,Indonesia.

METHODS

Study design

This research was observational-descriptive study. The study was done at the Cikolotok landfill, Indonesia, and the identification process at the Padjadjaran University. The study was conducted in the month of August 2012. All obtained data was processed by univariate analysis.

Research site

The observation area was divided in three areas, namely in area of sorting garbage, area of stockpiling garbage, and area of waste treatment.The classification of this area based on the functions of each area. For the determination of the observation points of the flies population, the garbage sorting area (area P) and the garbage stockpiling area (area T) consists of 5 points, which was determined by selecting a midpoint area (P1 and C1 point) and then selecting the remaining 4 points on the ends of each area (P2, P3, P4, P5, T2, T3, T4, and T5). For the waste treatment area (area O), the observation point was determined based on the number and function of installation, i.e. 3 points (aerobics pond [O1], facultative pond [O2], and maturation pond [O3]) (See Figure 1). The determination is based on the reason that the flies that are on the landfill are very active to move and there is possible that traps installed lost compete with natural attractant of the landfill itself, then it is needed more than one measurement point [10].

Measurements of the physical environment and the number of flies

The field observations started with measuring the physical environmental conditions which affect the activity of flies (temperature, air humidity, wind speed, and light intensity), and then attach

the trap to calculate the number of flies on the points that have been determined per area by turns. The tool that used was traps with adhesive (sticky trap), as it has been applied by Toyama and Lole [10,11]. Researchers used flypaper trap (paper with adhesive glue insects) measuring 29 x 19.5 cm, lot sold in the market. At each point of measurement was performed for 15 minutes, after which the flies that stuck to be calculated [10]. This activity was done in every 2 hours and in a span of 07:00 until 13:00 [12].

Trapping flies for identification

Trapping flies for identification was done in different days. This activity was carried out for 2 hours based on the results of a time span of active flies (after the calculation the number of flies). Trap done using cone trap based on the shape and size of Darr, Drlik, Olkowski, and Olkowski version [13]. Cone trap was placed on the same points when measurring of the number of flies. Flies that get caught in the cone trap given of chloroform and then put in to container which is then taken to a lab to be identified. The containers were differentiated per observation area.

Identification of flies

The identification of flies was done by staff of Laboratory of Entomology, Department Pests & Plant Disease, Faculty of Agriculture, Padjadjaran University. The identification was based on Borror, Triplehorn, and Johnson's book in Bahasa Indonesia version, *Pengenalan Pelajaran Serangga* (Edisi Keenam), translated by Soetiyono Partosoedjono and edited by Mukayat Djarubito Brotowidjoyo, published in 1996 by Gadjah Mada University Press. The book is widely used in the identification process of insects in Indonesia, for example is the study from Falahudin, Pane, and Mawar [14]. The results of identification were based on the certificate No: 001/LARPA/KLINTAN/IX/2012.

Figure 1. Floor plan of the Cikolotok landfill with points of observation research (in scale 1:1000)

RESULTS

Distribution and Active Time of Flies

In the area of sorting garbage, the overall number of flies that get caught were 528 flies. The number of flies mostly were on a span of 07:00-09:00 with 333 flies. In the area of stockpiling garbage, the overall number of flies were 16, and total flies mostly were on a span of 07:00-09:00 with 7 flies. In the area of waste treatment, the overall number of flies was 0 or not obtained flies at all (See Table 1).

From the results of the Table 1 show data that flies in Cikolotok landfill per point are ranged between 0-180 flies/15 minutes in every 2-hour. The area that has the highest density of flies is area of sorting garbage. In addition, based on the calculation in the three areas of the landfill, the most active flies is in a span of 7:00-9:00.

Table 1. Distribution of total flies trapped in Cikolotok landfill on August 11th, 2012

Area	Point	Measure Time			Sub Total (per area)
		07:00-09:00	09:00-11:00	11:00-13:00	
Sorting garbage	P1	162	71	13	
	P2	56	47	14	
	P3	21	9	3	
	P4	42	10	2	528
	P5	52	23	3	
	Sub Total (per time)	333	160	35	
Stockpiling garbage	T1	3	1	0	
	T2	1	2	1	
	T3	1	1	1	
	T4	1	0	0	16
	T5	1	2	1	
	Sub Total (per time)	7	6	3	
Waste treatment	O1	0	0	0	
	O2	0	0	0	
	O3	0	0	0	0
	Sub Total (per time)	0	0	0	
	TOTAL	340	166	38	544

Species of flies

Trapping was implemented in the next days from 07:00 until 09:00, based on the active time of the flies. Obtained flies as many as 40 flies, which were all derived in the area of sorting garbage (See Table2). After going through the process of identification, obtained 3 species of flies, namely *Chrysomya megacephala* by as much as 21 flies (52%), *Musca domestica* as much as 18 flies (45%), and *Sarcophaga bullata* as much as 1 flies (3%).

Table 2. The total number of flies obtained and identified in Cikolotok landfill on August 12th, 2012

Species of flies	Area			Number of obtained species
	Sorting	Stockpiling	Waste treatment	
M. domestica	18	0	0	18
C. megacephala	21	0	0	21
S. bullata	1	0	0	1
TOTAL	40	0	0	40

DISCUSSION

The area which has the highest number of flies is the sorting garbage area, with 528 flies. The reason are the sorting garbage area has physical garbage that was new, fresh, and wet, like waste of meat or vegetables, because of this area will be the first area to be occupied by the garbage that came from around Purwakarta Regency. Flies prefer garbage with this condition [15]. In addition, the most component of garbage in Cikolotok landfill that found is organic material, as much as 75% [9]. Furthermore, based on observation in the field is obtained that in the area of garbage sorting there is a lot of cattle which makes this area become places to eat even a place to dump of the feces. The condition makes flies more like this area because other than garbage, there are feces from the cattle

(Figure 2). On the other hand, there is a lot of informal waste picker who lived temporary in this area, even for eat.

Figure 2. Cattle on sorting garbage area in Cikolotok landfill

In the stockpiling area, the obtained number of flies was 16 flies, less than garbage sorting area. One of the cause is the garbage in stockpiling area has a dry physical condition, in contrast to the sorting area. For the waste treatment area that are not flies at all because of treatment environment is free-of-garbage and the results of any treatment not pose a strong scent that makes the flies attracted to activities in this area—although it has optimum physical environmental conditions for the activity of flies. There is a possibility the flies live in these two areas, but they are more interested in the condition of sorting garbage area.

The flies are more active in a span of 07:00-09:00 due to the condition of the physical environment that supports the existence of flies. The temperature and humidity in a span of 07:00-09:00 to approach optimal condition for activity of flies. In the area of sorting garbage was obtained temperature 29-32°C with humidity of 50-60%, in the area of stockpiling garbage was obtained temperature 32°C with humidity of 37-38%, and in the area of waste treatment was obtained temperature of 28-30°C with humidity of 60%. According to the Directorate General of Eradication of Communicable Disease and Environmental Health of Settlements (Direktorat Jenderal Pengendalian Penyakit Menular & Penyehatan Lingkungan Permukiman/Dirjen PPM & PLP), the flies begin flying at the temperature of 15°C and its optimal activity at temperature of 20-25°C. The flies are inactive at temperatures below 7.5°C and above 45°C will make the flies death. The optimal humidity favored for flies is 90% [8]. For comparison, in a span of 9:00-11:00, the temperature in sorting garbage area was 34°-36°C with humidity of 30-34%. In stockpiling garbage area, the temperature was 36°C with humidity of 28-30%. In waste treatment area, the temperature was 33°C with humidity of 34-36%. In a span of 11:00-13:00, the temperature in sorting garbage area was 39°-40°C with humidity of 22%. In stockpiling garbage area, the temperature was 40°C with humidity of 22%. In waste treatment area, the temperature was 38°-39°C with humidity of 24%.

The intensity of the light also affects. Fly is a phototropic insect, which love sunlight/rays, but can be active with the artificial rays in the night [8]. Light intensity obtained in three areas was ranged between 54000-56000 lux. However, because the more daylight, temperature and humidity become not optimal to support the activity of the flies, then the activity of the flies lower. The effect of light on the flies depending entirely on the temperature and humidity [8].

The wind speed at any time and in every area was an average speed of 0.1 km/hour. The flies are very actively looking for food in a calm wind and soft breeze, and will reduce its activities in the strong wind [8]. According to Sir Francis Beaufort, the wind speed can be categorized is quiet on the range 0 up to 1.5 km/h [8]. Therefore in every area and timeframe categorized as calm wind, but time span of 7:00-9:00 which became most active time flies is returned based on temperature and humidity.

The results of the identification shows that the species of *C. megacephala* more found in landfill. This is similar to the research results of Hestiningsih which stated that flies *C. megacephala* dominantly found in landfill or laystall in Yogyakarta [16]. However, the results of this research in contrast to the results of research conducted by Sumarsono in Jatibarang landfill, Semarang City, where the types of flies that found were the *M. domestica* flies [17]. The *C. megacephala* flies breed in the liquid or semi liquid material derived from animals, including meat (fresh or rotten), fish, carrion, and soil containing feces [15]. These conditions are in accordance with the conditions in the field, especially in the area of sorting garbage. This fly has a movement to land between contaminated and clean substrates and can makes them a potential pathogen vector [6].

M. domestica (known as housefly) is the major urban and agricultural species of pest fly in the world [6]. The housefly is important because it is ubiquitous and utilizes many proteinaceous materials, including garbage and human and animal feces, and can develop very quickly [6]. *S. bullata* (known as flesh flies), from family Sarcophagidae, are attracted to animal carcasses and decaying meat, and many deposit living larvae instead of eggs [6]. These flies are known to cause myiasis in humans and animals [6]. All of those species are act as mechanical vector and can be contaminated with more than a hundred different pathogenic organism, such as prions, viruses, bacteria, protozoa, helminths, and fungi, and can cause diseases like diarrhea, salmonellosis, shigellosis, cholera, ascariasis, typhoid, yaws, etc. [6,15,18,19]. Furthermore, those flies also can cause myiasis both in human and animal (cattle) [5,18].

The measurement of the density of flies using fly grill based on technical of Dirjen PPM & PLP [8], which was adapted from Scott and Littig [20], can be used in all places, such as settlements, industry, public places, and others, but is not effectively used in landfill. The cause is the difficulty to count the flies at the moment they stood on fly grill as well as population flies is high and active. Therefore, the development of the survey method using trap flies with a sticky nature (sticky trap) can be used in landfill because it is more effective than fly grill [10,11]. Furthermore, because of the vast area itself, the authors decide to divide the research site (into 3 areas) in order to be more effective in fly control.

Toyama and Lole also stated that monitoring and control of flies periodically is very necessary, at least it is hebdomadal period [10,11]. Yet it had done a survey of fly population and if see the magnitude of the number of flies from researcher's survey at the Cikolotok landfill, fly control and periodic monitoring is indispensable. The reason is the fly have flight distance ranges from 1 to 1.5 km [1,8] can be even more extensive and much more with the help of the wind, animals, and vehicles [6], such as garbage truck or dustcart, which allows these insects to neighborhood residents, where the distance to the nearest settlement of Cikolotok landfill is 2 km [9]. It is also supported by space between landfill and settlement consisting of rice field area (the open space) and the route to the landfill must pass through settlement areas.

CONCLUSION

Garbage sorting area is the area that has the highest number of flies, with 528 flies. The reason is because the physical conditions of the garbage, a lot of cattle feces, and has human activity (informal waste picker) that support flies to breed. The flies are more active in a time span of 07:00-

09:00 due to the condition of physical environment that supports the existence of flies. *C. megacephala* more found in landfill, especially in the area of sorting garbage, because the area condition that support the flies breed, like the conditions of the garbage and soil. Informal waste picker, the cattle, and nearby resident from landfill have fly-borne disease and myiasis risk. From the findings, it is necessary for Sanitary and Landscape Gardening Office (Dinas Kebersihan & Pertamanan) of Purwakarta Regency to build a plan to monitor the fly activity in the landfill and fly control, especiallyin garbage sorting area in a time span of 07:00-09:00 with residual chemical. Moreover, the Health Office (Dinas Kesehatan) of Purwakarta Regency needs to do a survey or research about the effect of the distance between landfill and settlements about fly-borne disease. In addition, because there is a lot of informal waste picker, their health must be considered too. The expectation to Animal Husbandry and Fisheries Office (Dinas Peternakan & Perikanan) of Purwakarta Regency to relocate the cattle to the outside of landfill. It is to prevent cattle for being exposed by myiasis and they eat the garbage that not healthy for animal health.

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