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ANALYSIS OF THE DIFFERENCE OF COLOR *FLY GRILL* TO FLAT DENSITY IN TANJUNG PERAK TEMPORARY WASTE DISPOSAL SURABAYA

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ABSTRACT The port is the largest level of mobilization so that the potential for disease transmission and the risk of becoming a suitable habitat as a place for breeding disease vectors include flies. Flies are insects that have a sensitivity to certain color differences but not all colors can be recognized. This study aims to analyze the differences in the color of the *fly grill* against the density of flies at Tanjung Perak TPS Surabaya. This type of research is a quasi-experiment with approach *cross-sectional*. The population of the study was all fly species in Tanjung Perak TPS Surabaya. The research sample was taken by *cluster random sampling technique* with a sample size of 6 repetitions. Data analysis with the *Kruskal Wallis test*. The results of this study indicate that there are at least a pair of colors *fly grill* that has significant color differences in fly density with a significant value of 0.039 ($\rho < \alpha$). The order of the color of *fly grill* the most preferred until it is not liked by flies is yellow, red, white and blue. The conclusion of this study is that there is a significant difference in color to *fly grill fly* density, and the color of the *fly grill* most preferred by flies is yellow and the color that is least preferred by flies is blue. The advice given is to repaint the blue color in the building of the trash or container that has been corrosive, garbage transportation is carried out routinely.

***Keywords**: Flies Density, Color of the fly grill, Temporary Waste Disposal*.

1. Introduction

the port is a place for learning or stopping ships that carry many passengers and goods, as well as a boat stop coming from various regions. According to the Ministry of Health of the Republic of Indonesia (2008)[1] the port is the entrance or exit of diseases from one region to another. Ports are very potential for disease transmission, considering that ships coming and going from one port to another carrying various goods and passengers can become a medium for transmitting the disease.

Associated with sea and airports as public service places with various supporting facilities will be at risk of being suitable habitat as a place for breeding disease vectors including flies. Flies are insects that move more using wings (flying) in the form of membranes. Only occasionally move using his feet. Therefore, the fly colonies are quite extensive so that disease transmission can easily occur to human health which can cause *cholera*, *typhus*, *dysentery* and diarrheal diseases or *gastroenteritis* (Maryantuti, 2007)[2].

The impact that can be caused if the level of fly density is high and not immediately carried out control or eradication that can cause diseases such as gastrointestinal infections such as *dysentery*, diarrhea, *typhoid*, *cholera*, and worm infections. The impact that is often caused by fly vectors is a diarrheal disease because one of the causes of diarrhea is the contamination of food

and drinks by bacteria carried by flies. Flies are considered disturbing because they always land in dirty places like garbage. If the food infested by flies is contaminated by microorganisms both bacteria, protozoa, worm eggs/larvae or viruses that are carried and released from the mouth of the fly and if eaten by humans, it can cause diarrheal disease (Andriani, 2007)[3] in (Manalu, *et. al*., 2012)[4].

Efforts that can be made to reduce or suppress the fly population is an effort to eliminate fly breeding places by reducing the sources that allow flies to breed by preventing the laying of flies in potential breeding sites. These potential places include, among other things, residential harbors, including landfills. The condition of the trash can allow flies to breed, which is moist and enough food is available.

Flies density control needs to be done by measuring the density of flies in the environment around the port. Measurements made to see the density of flies using the *fly grill* is a simple tool used in the measurement of fly density by placing it in a place where the fly density will be measured (Manalu, *et al*., 2012)[4]. *The fly grill* that is used should be painted in white, but in this study not only uses white but also uses yellow, red and blue paint, with the aim to find out the color that is most preferred or disliked by flies so that it can be used to control flies.

Flies have phototropic properties, namely attraction to light so that flies are active during the day and rest at night (Prabowo, 1992)[5]. The attraction of flies to light, led to a study of the level of illumination caused by color, flies were more interested in yellow (Wulandari, *et al.*, 2015)[6] and white (Sayono, *et al*., 2012)[7], and flies are less interested in blue (Azwar, 1989)[8].

Therefore, in this study, researchers wanted to analyze the differences in color *fly grill* against fly density at polling stations, and to know the colors that were most liked and disliked by flies, so that they could later be used as an effort to control or reduce the number of flies by applying trash cans, cover food or drink with color that is not liked by flies.

2. Research Methods

This study uses a quasi-experimental research design with the design of *Posttest-Only Design*. Approach *Cross-Sectional*. With the design as follows:

X_1 ----------→ Y_1
X_2 ----------→ Y_2
X_3 ----------→ Y_3
X_4 ----------→ Y_4

Description:
X_1 is the treatment of *fly grill* the white.
X_2 is the treatment *fly grill* of yellow.
X_3 is the treatment of *fly grill* the red.
X_4 is the treatment of *fly grill* the blue.
Y_1 is the measurement value *fly grill* white.
Y_2 is the measurement value *fly grill* yellow.
Y_3 is the value of measurement *fly grill* the red.
Y_4 is the value of the measurement *fly grill* in blue.

The population of this study was all fly species in the Tanjung Perak Temporary Waste Disposal Site (TPS) Surabaya. The sample of this study is that some of the flies that perch on each *fly grill* are white, yellow, red and blue which are installed in the Tanjung Perak Temporary Waste Disposal Site (TPS) Surabaya. Determination of the sample is calculated by Federer formula as follows:

$$(n-1)\,(t-1) \geq 15$$
$$(n-1)\,(4-1) \geq 15$$

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$$(3n - 3) \geq 15$$
$$3n \geq 18$$
$$n \geq 6$$

Description:
n: Number of repetitions
t: Number of treatments

From the formula of 4 times the treatment can get 6 repetitions. The location of this study was at TPS Roro Terminal and TPS Gapura Surya Nusantara Terminal. The instruments in this study were observation sheets and fly density measurements using the *fly grill* a yellow, white, red and blue, *Stopwatch* and *Hand Counter*. Processing data using statistical tests with the test *Kruskal Wallis*.

3. Results and Discussion

3.1 Number of Flies Density

Based on the results of research conducted for 7 days in two different places it was known that the number of fly densities was obtained as follows:

Table 1 Average Flies Density

No.	Measurement Location	Day	The color of the *fly grill*				Average
			White	Yellow	Red	Blue	
1.	TPS Terminal Gapura Surya Nusantara	Day 1	4	6	4	3	6,50
		Day 2	15	21	14	14	
		Day 3	5	7	5	4	
		Day 4	4	5	4	1	
		Day 5	4	5	4	3	
		Day 6	5	21	4	2	
		Day 7	2	6	8	2	
Average density of flies			6	10	6	4	
2.	TPS Terminal Roro	Day 1	4	5	5	2	5,64
		Day 2	14	20	15	14	
		Day 3	5	6	2	2	
		Day 4	5	4	4	3	
		Day 5	3	4	3	6	
		Day 6	2	2	6	8	
		Day 7	2	5	5	2	
Average density of flies			5	7	6	5	
Average overall fly density			5,29	8,36	5,93	4,71	6,07

Based on Table 1 it was found that the average fly density at Gapura Surya Nusantara Terminal TPS was the highest for 6.50 tails per *block grill*, but based on the color of the *fly grill* the average density of yellow flies is 10 tails per *block grill*, red and white are 6 tails per *block grill* and the lowest is in blue as many as 4 tails per *block grill*. While the average density of flies at TPS Roro Terminal is 5.64 per *block grill*, but based on the color of the *fly grill* the average density of yellow flies is 7 tails per *block grill*, the red color is 6 tails per *block grill* and white and blue is 5 tails per *block grill*.

3.2 Identification of the Different Colors of the Fly grill a Fly strap

Measurements have been made with the color treatment of *fly grills* different, resulting in the coloring of the *fly grill* with the highest and lowest number of fly densities, following the full results.

Table 2 Color Categories *Fly grill* Flies with the Lowest and Highest Density

No.	Measurement Location	Day	Lowest	Highest
1.	TPS Terminal Gapura Surya Nusantara	Day 1	*fly grill* warna biru	*fly grill* warna kuning
		Day 2	*fly grill* blue, red	*fly grill* yellow
		Day 3	*fly grill* blue	*fly grill* yellow
		Day 4	*fly grill* blue	*fly grill* yellow
		Day 5	*fly grill* blue	*fly grill* yellow
		Day 6	*fly grill* blue	*fly grill* yellow
		Day 7	*fly grill* blue, white	*fly grill* red
2.	TPS Terminal Roro	Day 1	*fly grill* blue	*fly grill* yelow, red
		Day 2	*fly grill* blue, white	*fly grill* yellow
		Day 3	*fly grill* blue, red	*fly grill* yellow
		Day 4	*fly grill* blue	*fly grill* white
		Day 5	*fly grill* white, red	*fly grill* blue
		Day 6	*fly grill* yellow, white	*fly grill* blue
		Day 7	*fly grill* blue, white	*fly grill* yellow, red

Based on Table 2 that the average color of *the fly* grill gate terminal TPS Surya Nusantara and Roro Terminal is *fly grill* blue and *grill fly.* yellow colored. But the coloring that has the lowest fly density is the *fly grill* blue. While the one that often has the highest fly density is the *fly grill* yellow. So it can be concluded that blue is the color that flies don't like, while yellow is the color that flies like.

3.3 Analysis of color differences in fly grill fly density Density

density data were then analyzed using the *Kruskal Wallis test* to determine the color difference of *fly grill* to fly density. The results of the analysis by the *Kruskal Wallis test* showed a significant value of 0.039 ($\rho < \alpha$) which means that H0 was rejected so that there was at least a pair of colors *fly grill* that had a significant difference in fly density. To determine the color of *the fly grill* different do a different test using test, *Mann Whitney* the obtained results of the calculation as follows:

Table 3 Test Results Difference

Color comparison		Significant	Information	Decision
White	Yellow	0,033	<0,05	There is a difference
	Red	0,422	>0,05	There is no defference
	Blue	0,242	>0,05	There is no defference
Yellow	Red	0,161	>0,05	There is no defference
	Blue	0,023	<0,05	There is a difference
Red	Blue	0,066	>0,05	There is no defference

Based on Table 3 can be seen that there is a difference between *fly grill* white with yellow and *fly grill* yellow in color blue. However, the more effective color that can be used to control fly density is *fly grill* the blue. So it can be concluded that the color sequence of *fly grill* the most preferred not liked by flies is yellow, red, white and blue.

3.4 Discussion

3.4.1 Number of Flies Density

Based on the results of flies density measurements that it is known that the average fly density in the Gapura Surya Nusantara Terminal TPS is 6.50 tails per *block grill* and the average density of flies at TPS Terminal Roro is 5.64 per *block grill*. While based on color, the average density of flies as a whole is yellow, which is 8.36 per *block grill.*

Meanwhile, the average density of flies every day is different because researchers do not use the same time, so there are several days measured in the morning and some are measured

during the day. This might affect the amount of fly density, according to the theory that fluctuations in the number of flies will increase at temperatures of 21ºC - 32ºC and will decrease in temperature / temperature <10ºC or more> 49ºC, and optimum fly activity at 90% humidity. reproduce optimally (Ministry of Health, 2001)[9]. The results of measurements were carried out in the morning with an average temperature of 30ºC and average humidity of> 70% and during the day with an average temperature of> 32ºC and average humidity of <70%. Based on the results of these measurements, the difference between the morning and afternoon is quite far, which can be seen in Appendix 7 that the density of flies on day 1 and day 2 of the fly density is quite far, possibly due to environmental factors such as temperature/temperature/temperatures, it is caused by the type of waste that is present in polling stations, namely rubbish that is easily decomposed and causes unpleasant odors, so that it becomes the attraction of flies such as wet waste and dry waste from the rest of the activities around the port (Inayah, *et al*., 2012)[10].

Based on the results of the average density of flies, the densest locations are at the TPS Gapura Surya Nusantara Terminal. The density of flies at TPS Gapura Surya Nusantara Terminal is due to the high level of passenger mobilization, so the amount of waste produced is high and the risk of disease transmission. The amount of density of flies in the trash is more than 2 birds per *grill block*, it is necessary to control and improve waste management, in accordance with the Decree of the Director General of PPM & PLP No. 281-II / PD.03.04.LP / 1989 (Ministry of Health, 2008)[1]. This was also regulated in the Republic of Indonesia PERMENKES No. 50 of 2017, that public places and facilities, both facilities and infrastructure, such as landfills at port locations, must be protected from vectors and disease-carrying animals, namely fly (Indonesian Ministry of Health, 2017)[11].

In addition, Prabowo (1992)[5] states that the 7-20 tail density index per *block grill is* categorized as dense and needs to be carried out on observation of breeding sites and control planning. Seeing the distance of flying flies that can travel a considerable distance and see the nature of the fly itself which tends to not like to fly continuously but likes to perch, it is necessary to note the spread of diseases carried by flies. Flies can transmit diseases biologically and mechanically, which can harm humans, including health, such as transmitting diseases that can cause *cholera*, *typhus*, dysentery and diarrheal diseases (Maryantuti, 2007)[2].

In anticipation of a disease caused by flies originating from the nearest port polling station, the officials should always maintain environmental hygiene, including containers because basically flies like dirty places such as garbage, so they need to be kept clean because polling stations in the port are close to food vendors. avoid contamination of flies.

3.4.2 Identification of Different Colors of *Fly Grill Fly* strap

The results showed that the average density with the sequence of colors *fly grill* most preferred *fly grill* is the yellow, red, white and blue. This shows that the *fly grill* that is mostly hit by flies is yellow. While the average density of blue flies has the lowest average density, so it can be concluded that blue is the color that is least preferred by flies.

This research is supported by Kusnaedi's opinion (in Sayono, *et al.*, 2012)[7], which states that "flies are more interested in yellow" and according to Azwar (in Sayono, *et al.*, 2012)[7] that "flies less interested (afraid) in blue ". On the *fly grill* color of the yellow, the number of flies solids is more than the other colors. This study was supported by Rustina (2010)[12] that "yellow has the highest attraction to insects".

This is if related to the explanation in the Ministry of Health (1992)[13] that flies include insects that are phototropic or like light or light. An object reflects light and has light properties depending on the wavelength produced by the object. The Metcalf in (Bangun, 2009)[14] states that

insects are more interested in the yellow-green spectrum with wavelengths of 500-600 nm. Thus, flies are very fond of yellow. In addition, when compared with previous studies by Inayah, *et al*., (2012)[10], the average density of flies is the highest to the lowest, starting with yellow, red, green and blue.

This is almost the same as what was done by researchers, which is the highest average density of flies to the lowest, namely yellow, red, white and blue. So that by knowing the colors that are most disliked and liked by flies can be controlled by flies by reducing the number of flies that perch on food and drinks and trash bins, namely by using food and beverage coverings and trash cans that are blue, white or red.

All this time, there have been blue containers available at polling stations. However, there is still a high number of fly densities due to waste transportation that has not been routinely carried out, cleaning at polling station locations is still lacking, so that garbage is scattered around the polling stations, container closures are always open and there is still a lack of monitoring of fly density at polling stations and eradicating with insecticides or larvacides.

3.4.3 Analysis of color differences on *fly grill fly* density

Based on the results of the study it can be seen that there is a significant difference in color *fly grill* on the density of flies in the Tanjung Perak Port Temporary Disposal Site (TPS) Surabaya. This result is in accordance with the research conducted by Munandar *et al.* (2018)[15] which states that there is a difference in the color of the *fly grill* to the number of flies that perch significantly. In addition, research conducted by Arif & Munawar (2018)[16] shows that a significant value of 0.00 (<0.05) indicates that there is a difference between the color of the *fly* grill and the density of flies in the landfill. This research was also conducted by Nur (2006)[17] who stated that at least a pair of colors *fly grill* was different from the number of flies that landed significantly.

This is related to the theory in Prabowo (1992)[5], that flies are phototropic insects, that is, interest in light so that flies are active during the day and rest at night. Flies are insects that have a good vision system which is a compound eye. Compound eyes are a vision system that consists of thousands of lenses and are very sensitive to movement. Receptors on compound eyes have many omissions. Ommatidia functions to regulate the frequency of light entering the eye.

In human wavelengths that can respond to a range of 400-700 nm in red as a peak, so the response of the human eye to color is also more varied. Whereas in flies has a narrow response with a wavelength of 300-550 nm in yellow as a peak. So that flies prefer yellow (Masitoh, 2003)[18].

So that in this study there need to be container repairs at TPS Gapura Surya Nusantara Terminal and TPS Roro Terminal as an effort to control the fly by replacing containers that are in poor condition or damaged under new conditions or by re-checking containers in blue so that they can reduce flies that perch. And fly control measures need to be taken by improving *hygiene* environmental and sanitation by reducing and eliminating fly breeding sites with the method of garbage disposal from the start of collecting, transporting and properly managed garbage disposal that can eliminate fly media, prevent between flies and feces containing germs, protect food, eating utensils and people in contact with flies (Subagyo, *et al*., 2013)[19].

4. Conclusions

The average density of flies at TPS Gapura Surya Nusantara Terminal on the *fly grill* white is 6 tails per *grill block*, the *fly grill* yellow is 10 tails per *grille block*, the *fly grill* red is 6 tails per *block grill* and the *fly* grill blue by 4 tails per *grill block*. The average fly density at TPS Roro Terminal on the *fly grill* white is 5 tails per *block grill*, *the fly grill* yellow is 7 tails per *block grill*, the *fly grill* red

is 6 tails per *block grill* and the *fly* blue grill is 5 tails per *block grill*. The *fly grill* color of the that is most preferred by flies is yellow, while the coloring of the *fly grill* that is least preferred by flies is blue. There is a significant difference in the minimum of a pair of colors *fly grill* against fly density. Effective coloring is done for control, namely blue.

Suggestions for agencies are: It is recommended to repaint the blue color in the building of trash, containers and garbage transport trucks that have been corrosive and the transportation of garbage is carried out routinely or every day and does not leave trash at the polling station and routine cleaning at the polling station so there is no garbage scattered around the polling station. For further research, you should develop further research using a *fly grill* with striking colors such as black, green and yellow; how to catch flies can use a *Sticky trap in* order to identify the types of flies perched and measurements of the density of flies should be done in the morning at the same time.

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