



## The Effect of Some Attractive Media on The Number of Marriage Partners, Eggs Weight and Lifetime of Black Soldier Fly (*Hermetia illucens* L.)

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### Abstract

The black soldier fly (BSF) *Hermetia illucens* L. (Diptera: Stratiomyidae) is widely used in biorecycling organic waste has gained huge popularity in different industrial. And commercial sector because of its excellent potential to treat organic waste and high biomass production. The obstacle experienced during the rearing process was that a small number of eggs were obtained, therefore efforts were made to increase the black soldier fly population by providing bait in the form of attractants. Media bait technique in the form of several media with a specific and pungent aroma, so that it will lure BSF females to mate, lay eggs, extend life time. The present study deal to investigation of different number of mating pairs, eggs weight dan lifetime as function respon of different lure media. This study used a completely randomized design (CRD) with (1) cassava tape, (2) Fermented bran (3) rotten pineapple (4) rotten banana media with each treatment repeated 6 times with the variables observed were the number of mating pairs of fly (per day), egg weight, and life span of imago. each attractant medium had an effect on the number of mating females, the weight of the eggs laid and the length of life of BSF. The best medium was rotten pineapple media (number of mating pairs 55 pairs of BSF, and egg weight laid 0.007 per day) while the worst medium was fermented bran media with a long life (10.9 days)

Keywords : Attractant media *Hermetia illucens*, life time imago, mating activity, ovipositing

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### 1. Introduction

The black army fly (*Hermetia illucens* L.) is only known as a bioconversion agent for organic waste. These flies are generally often found in places where organic waste piles up and are not dangerous, because they do not cause disease in humans. These flies can be used as animal feed supplements because of their high protein and fat content, in addition, the remnants of released frass can be used as liquid organic fertilizer and biofuel as a promising alternative energy source. According to [1] protein sourced from insects has economic value, is environmentally friendly and has an important role in nature. Insects are reported to have high feed conversion efficiency and can be reared and mass produced.

Cultivation or rearing of black army flies by the

public has recently increased. Many people experience obstacles, such as larval performance and low imago productivity capacity, causing a high production burden during the process of rearing black army flies. Therefore, efforts are needed to overcome the high production burden by optimizing the performance of the imago, such as increasing the number of mating partners, egg productivity and short life span. Studies on attractant media from fermented waste are important things to study. So far, information about fermented attractant media related to the number of mating partners, egg productivity is still low.

Artificial media in the form of an attractant is something that can be given as an attractant for black army flies for mating and as an oviposition for female flies when laying eggs. In addition, several attractant media that have been fermented become one of the factors that play an im-

portant role in determining the quantity and quality of eggs. Research conducted by [2] showed that decay from organic matter can attract and cause black army flies to mate and lay eggs.

The provision of fermented attractant media from several pineapples, bananas, bran and tapai will cause an aroma that can cause flies to mate, lay eggs and prolong their life. The aromas of this fermentation in the form of organic acids, CO<sub>2</sub> alcohol, acetal dehid, ethyl acetate will increase mating activity. These compounds are also beneficial for imago in the form of strategies to choose the most optimal feed for larval development. According to the research of [3] that black army flies are attracted to decaying organic waste, volatile compounds such as acetaldehyde, acetic acid, ethyl acetate produced from fruit fermentation. Besides that, the physical condition of the fermented attractant media in the form of color, texture, water content will affect the behavior of imago in laying eggs.

## 2. Materials and Methods

This research was carried out from December 2020 to March 2021. Research on the effect of several fermented attractant media on the number of mating partners, egg weight, and life span of flies was conducted at the Hope Animal House, Experimental Cage, Animal Husbandry Study Program, Faculty of Agriculture, Sriwijaya University.

### 2. Making Attractant Media

#### 2.1 Making Fermentation Bran

Making fermented bran begins by weighing 200 grams of fine bran, 200 grams of fish pellets, and 200 grams of shrimp paste. Prepare a black bucket (diameter 21 cm), then add 200 grams of fine bran, 200 grams of fish pellets, and 200 grams of shrimp paste into the bucket and stir until all ingredients are mixed. After the ingredients are mixed, add enough water until all the ingredients start to get moist. Stir again until all ingredients are mixed. Then put in a large plastic bag, then pressed until the air in the plastic is reduced. After the air in the plastic is removed and then tied tightly using a rope. Then put in a bucket with a tight lid (without air) and wait for 3 days. After 3 days, the fermented bran was removed from the bucket and weighed as much as 200 grams. Then put into a small bowl with a diameter of 13 cm. At the top of the bowl covered with a net and tied with a rubber band. Furthermore, the fermented bran is put in and arranged into the black army fly mating cage.

#### 2.2 Making Pineapple, Banana and Cassava Tape Media

Pineapple, banana and cassava tapai are cut into small pieces using a knife. Furthermore, the rotten pineapple, rotten banana and cassava tapai were crushed until the texture of each medium became half smooth. Then the rotten pineapple, rotten banana and tapai were put into a small bowl with a diameter of 13 cm with 200 grams of each medium. At the top of the bowl covered with a net and tied with a rubber band. Furthermore, the media is inserted and arranged into the mating cage of the black soldier fly that has been provided.

#### 2.3 Provision of Test Animals

The Black Army Flies (*H. illucens*) were obtained from the Harapan Animal House in the Experimental Cage, namely the Animal Husbandry Department, Sriwijaya University, as many as 960 individuals. The Black Army flies were then transferred to the mating cage by using a 200 ml collecting bottle., 40 flies were added to each available mating cage with a male to female ratio of 1:1. Each treatment consisted of 6 replicate cages, so that the total flies in each treatment were 960 black soldier fly.

#### Observation Variable

##### 1. Number of Pairs of Black Army Flies (*H. illucens*)

Observation of the number of mating black army flies was done by counting the number of mating pairs of black army flies (pairs per day). As many as 960 flies were put into the mating cage which already contained the appropriate attractant media for each treatment and placed in a room exposed to sunlight. Furthermore, the mating activity was observed every day at 08.00, 10.00, 12.00, 14.00 and 16.00 WIB.

##### 2. Egg Weight

A place for laying fly eggs is provided, namely a thin piece of wood measuring (10 cm long, 3 cm wide, 0.5 cm high). After that, 3 pieces of thin wooden planks are arranged and given a gap with small tacks. Then at each end of the wood tied using a rubber band. The wood that has been arranged is placed on top of each of the attractant media that has been provided. Female flies will usually lay eggs in cavities of thin wooden planks in dry and protected conditions. This observation was carried out by weighing the eggs produced by female flies every 3 days until all the flies in the cage died. Harvesting eggs is done by scraping the eggs that have been attached to thin pieces of wood slowly using a cutter, then the eggs are weighed using an analytical balance and the egg weight of each attractant

medium is recorded.

### 3. Longevity of the Black Army Flies (*H. illucens*)

Observation of the life span of the black soldier fly begins when the pupa becomes an imago. Then the observation of the life span of the black army fly (*H. illucens*) was carried out by counting and recording the number of flies that died per day, until all the flies in the cage were exhausted.

#### Data Presentation and Analysis

The presentation of data on the number of pairs of mating flies, egg weight and length of life of black army flies is presented in tabular form. Data analysis of the egg weight of the black soldier fly (*H. illucens*) was carried out by using one way - analysis of variance (ANOVA) at a 95% confidence level ( $P < 0.05$ ) using SPSS 25.0 software. If each treatment shows a significant difference, it can be continued with a further test, namely the Duncan Multiple Range Test (DMRT) test to determine the effect of each treatment on the observed parameters.

## 3. Results and Discussion

### 3.1 Number of Black soldier Flies Mating Pairs (Pairs per day)

Table 4.1. Average Number of Black Army Flies Mating Pairs on Several Fermented Media (pairs per day)

Treatment	Observation Day									Total	Average
	1	2	3	4	5	6	7	8	9		
Fermentation Bran	0	0	2	4	5	1	0	0	0	12	1.33
Fermented Pineapple	4	9	7	22	9	3	1	0	0	55	6.11
Fermented Banana	2	0	6	2	5	2	0	0	0	17	1.89
Tapai Cassava	3	0	1	9	3	2	1	0	1	20	2.22

Table 4.1 shows that the day of observation affects the number of mating pairs of flies. The longer the observation day, the fewer the number of mating flies. The number of mating pairs is closely related to the aroma that comes from each given attractant medium. The aromas that come from the fermentation products in the form of alcohol, ethyl acetate, ketones, CO<sub>2</sub> in each medium are different, this is thought to affect the number of mating pairs of flies. Because in the diptera group of alcohol compounds, CO<sub>2</sub>, acetal dehid, organic acids will stimu-

late males to find females The longer the observation days of this attractant compound will decrease, it can be seen that the longer the observation the number of mating pairs decreases. It can be seen that the highest number of mating pairs was on days 4 and 5. This was related to the high level of attractant compounds that responded to mating activity in black army flies. According to [4] the mating period of black army flies takes place ,third to eighth day then adult flies will show a decreasing tendency to mate.

In Table 4.1 It can be concluded that the order of attractant media that is most attractive to black army flies is rotten pineapple attractant media with an average of 6.11 pairs, on tapai with an average of 2.22 pairs, rotten bananas with an average of 1.89 pairs, while which is less attractive to black army flies is fermented bran media with an average of 1.33. according to with the research of [5] who reported that fruit odors were more efficient at attracting black soldier flies compared to attractants such as household food scraps and chicken manure.

In Table 4.2, it can be seen that the application of different fermented media had an effect on egg weight. The application of fermented bran had a different effect on the treatment of fermented pineapple media, but had no effect on the treatment of fermented banana and cassava tapai. This is due to the number of eggs produced in the ovarioles of the black army fly imago. The number of mature eggs is related to the utilization of nutrients derived from the feed given during the larval stage. The quality and quantity of

ty obtained by prospective male and female imago during the larval stage.

Based on Table 4.2. The highest egg weight was found in rotten pineapple attractant media, which was 0.067 mg. Meanwhile, the lowest egg weight was found in the fermented bran attractant medium, which was 0.010 mg. This happened because the fermented bran attractant media did not produce a pungent smell, so that the fermented bran was less attractive to female flies to lay eggs. According to research by [6] that fruit odors are more attractive to black army flies or are more likely to stimulate egg laying behav-

ior of black army flies. This is in line with the research of [7] that the rotten media emits volatile compounds into the air that can be detected by female flies.

with a range of 4-13 and 5-13 with an average of 13.3 males and 15 females.

**Table 4.2. Average Weight of Eggs laid by Black Army Flies on Different Fermented Media**

Treatment	Egg Weight (mg)
Fermentation Bran	0.023 ± 0.010a
Fermented Pineapple	0.150 ± 0.067b
Fermented Banana	0.047 ± 0.043a
Tapai Cassava	0.087 ± 0.047a

Description: Treatment P0 = fermented bran, treatment P1 = fermented pineapple, treatment P2 = fermented banana and P3 = cassava. Tape. The differences on superscripts in the same row represent the statistical significant difference at  $p < 0.05$

**Table 4.3. Lifespan of Black Soldier Flies Imago on Some Fermented Media (Days)**

Treatment	Male		Female	
	Range	Average	Range	Average
Dedak Fermentasi	7-13	10.9	7-13	20
Nanas Terfermentasi	4-13	13.3	5-13	15
Pisang Terfermentasi	4-13	13.3	6-13	17.1
Tapai Singkong	4-13	13.3	5-13	15

The media attractant that has been fermented on the black army fly aims as a place or attractor for the black army fly when positioning the eggs. Female flies will look for a pungent sweet-sour smell to lay their eggs. This aroma comes from fruits that have rotted. So that when the eggs hatch, the offspring will be guaranteed food. According to [8] when the fly reproduction process occurs, flies will like a distinctive growing medium and when these flies like the scent, the fly will want to live and thrive in that medium.

In the research that has been done, the results obtained from the length of life of male and female flies in each cage using several attractant media that have been fermented, namely fermented bran, rotten pineapple, rotten banana, and cassava tape. While in cages containing media attractant rotten bananas, the lifespan of males is 4-13 with an average of 13.3 and females is in the range of 6-13 days with an average of 17.1, rotten pineapple and tapai cassava have the same lifespan for both males and females.

Media that has been fermented can affect the length of life of both male and female black army flies. Each of the media used contains a liquid in the form of fermented juices that can be used by flies as an energy source and can affect their lifespan. The more energy the black army fly harnesses, the shorter its lifespan will be. On the other hand, the more energy that is used for each medium, the longer its life span. There are differences in the length of life of males and females, it is seen that the length of life of males is shorter than that of females. This is in line with [8] that this weight difference can allow female flies to accumulate higher energy reserves than male flies.

#### 4. Conclusion

Attractant media with different aromas will affect the number of pairs of BSF flies that mate, the weight of the eggs produced and the length of life. The best media for attracting is rotten nenea media, while the worst is fer-

mented bran media

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