Study of vegetable waste product as alternative artificial feed to life cycle of *Hermetia illucens*

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Abstract. Research about artificial food and life cycle of *Hermetia illucens* was conducted. Alternative of organic animal feed is definitely needed cause its safe, cheap and healthy. A descriptive research was conducted by investigate *H. Illucens* fecundity, and life cycle with alternative feed contain of bran leftover vegetables and milk. The result showed that female fecundity was resulting 750 eggs per day on average. Length of the life cycle is 29 - 41 days. Range of first larvae is 1 - 2 days with 0,1 - 0,3 cm in length. range the second larvae is 4-6 days with 0,4-0,6 mm in length, the third instar around 7-10 days with 0,65-1,0 cm in length, fourth Instar is around 11-13 day with 1,1-2,4 cm in length. BSF prepupae 2,1 – 2,5 cm in length. BSF pupae 2,3- 2,4 cm in length with a range 15-23 days. BSF pupae 2,3- 2,4 cm in length with a range 24 -31 days. The adult is 29-41 days with 2,2-2,4 in length. This show organic material can be turned into BSF biomass.

1. Introduction

Black Soldier Fly (BSF), *Hermetia illucens* classified as one of the Dipteran Order. Recently researcher in Insect and food technology were focussed on it. Role of BSF maggot become alternative to solve environment, feed alternative, energy and Healthy. Since it was known as feed alternative, that can be used still not yet known the function as supplement and furthermore as main source of protein [1,2]. BSF maggot is a source of protein is an unlimited source as well as animal feed, aqua culture and it useful also for decomposing debris of vegetable, feed, and harvest [3].

BSF larvae are one of promising food alternative in fishery and veterinary since it has high nutrition. The prepupae stadium compose of protein 12% and fat 35% also amino acid and adequate mineral that can keep in long time [4,5]. Thus, BSF larvae have complete nutrition and can support animal for growing. It acts as an alternative protein source for replacing soybean or meat. It is notice that chicken and other animal need energy, protein, mineral, and vitamin that BSF can fulfil it either with low cost. BSF larvae can replace soybean role as much as 96% [5].

BSF larvae convert food into biomass [6]. The processing of bio composting from larvae BSF is effective so it can use as wide-scale where the accumulation of organic was get rid of [7]. BSF can consume organic material in wide scale and it has very potential to manage waste product [8-9]. Goal of this research is to know influence of BSF larvae of vegetable waste product to life cycle of *H. Illucens*. 
2. Methods
This research was carried out at botanical garden Universitas Pendidikan Indonesia from April-May 2018. A descriptive as used in this research to know bsf biomass change on various organic materials. A six pairs of adult *H. illucens* were insect into the box that made from wood with 80 X 60 X100 cm in measurement. They were everyday give solution which composed of Bran $\frac{1}{4}$ kg, milk 250 ml and vegetable 200 g until they were mate and hatched.

Larvae kept in a box made of net and topped covered gauze. Each box was feed by artificial food filled and labelled. Observations were made every day at 9:00 to 15:00 pm. The method used is the method of rearing. Do observations from egg, larvae, pupa to imago. At the moment an egg stadia, parameters measured and observed the number of eggs produced and they viability, length of larvae and pupae also imago

The number of individuals who have survived from egg to imago phase is calculated and recorded. The percentage value is calculated by the formula.

3. Result and Discussion
*H. illucens* (BSF) imago has a blackish body and in a couple of days can be sprightly mate and laying eggs while its life only for about 6-10 days. On mate process a female expels a calling behaviour which is at the same time producing sex pheromone, after mating the female put egg near artificial food (Figure 1).

![Figure 1. Mating process of *H. Illucens* with artificial diet media](image)

Those six couples were mates with back to back position. After four day, they were producing eggs (Table 1) with a duration of three days. Base on the observation the female were expelling sex pheromone by lift the bottom of abdomen tip and the male were responses by surrounding the female, and they were mate which day one produce 770 eggs, day two produce 730 eggs and day three produce 750 eggs.

|          | I  | II | III | Average |
|----------|----|----|-----|---------|
| *H. illucens* Eggs | 770 | 730 | 750 | 750     |

Base on the table the fecundity average of *H. Illucens* is 730, this result showed the capability of female bsf to produce eggs. The female can result egg cluster around 500 and 900 eggs [2,4].
Table 2. The length of larvae phase *H.* *illucens* gave by artificial food.

| Stadia     | N  | day length | average of length (cm) |
|------------|----|------------|------------------------|
| Instar 1   | 730| 1 – 2      | 0.1 - 0.3              |
| Instar 2   | 670| 4 – 6      | 0.4 – 0.6              |
| Instar 3   | 630| 7 – 10     | 0.65 – 1.0             |
| Instar 4   | 570| 11 – 15    | 1.1 – 2.0              |
| Prepupae   | 470| 15 – 23    | 2.1 - 2.5              |
| Pupae      | 450| 24 – 31    | 2.3 – 2.4              |
| Adult      | 425| 29 – 41    | 2.2-2.4                |

Base on Table 2 and Figure 2 range of the length of BSF life cycle is between 29-41 days, range of first larvae is between 1- 2 days with 0.1- 0.3 cm in length, range of the second larvae is 4-6 days with 0.4-0.6 mm in length, the third instar is around 7-10 days with 0.65-1.0 cm in length, fourth instar is between 11-13 day with 1.1-2.4 cm in length. The range of BSF pre pupae is between 2.1–2.5 cm in length with a range 15-23 days The range of BSF pupae is between 2.3-2.4 cm in length with a range 24 -31 days. The adult is 29-41 days with arrange between 2.2-2.4 in length. This show organic material can be turn into BSF biomass.

Figure 2. Life cycle of *H. Illucens*. 
The survival ship from its fecundity until F1 adult is 60%, starting with 730 individual, first instar 730 individual, second larva 670 individual, third larva 630 individual, fourth larva 570 individual, prepupae 470 individual, pupa 450 individual and survive until 425 imago at F1 generation. Life cycle of *H. Illecens* is 25 – 42 days [10].

In tropical and tropical climate. BSF grow in every year that it can be conducted in green house. Since it has a thick cuticle, it can stand with acid conditions and from higher temperature [11]. Larvae can survive on winter particularly when they were in large population or live in decompose are which can insulate temperature. Heat also can trigger pupation and eggs exclusion and imago usually mate and oviposition on 24 °C until 40 ° C or more than 99.6% oviposition in a field at 27.5-37.5 °C (81.5-99.5°F). [12]

### 4. Conclusion

The life cycle of BSF in artificial media goes in a good form 29-41 days.

### 5. References

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