

Effectiveness of breeding larvae of the black soldier fly (*Hermetia Illucens* Linnaeus, 1758) on bran substrate

Dinara Allabergenova^{1,*}, Gulom Kultoev², Abdurahim Mamatkulov², Panji Aliyarov², and Nodirbek Mullabaev²

¹Tashkent branch of the Samarkand State University of Veterinary Medicine, Tashkent, Chilanazar district, 35a, 100066 Uzbekistan

²Tashkent State Agrarian University, Tashkent region, Qibray district, Universitet str. 2a, 100140 Uzbekistan

Abstract. The black soldier fly *Hermetia illucens* breeding began in the 90s of the 20 century and was considered as an ecological solution for turning agricultural waste into a protein-rich organic compound. Two problems can be solved by breeding flies: firstly, agricultural and food waste is disposed of in an ecological way, and secondly, valuable protein raw materials are obtained. Through this technology, the shortage of important nutritional components for the aquaculture and poultry sector will be eliminated. In addition, this component is very close to the content of fish meal, which is deficient in composition, and can be used instead of fish meal within the specified amount. The advantages of this component are that the product reaches mass within 10 days and can be preserved by drying. The decrease in the price of this product, mainly due to the utilization of agricultural waste, shows that this product is promising. Today, the black soldier fly has been cultivated in Uzbekistan, and the technology of cultivation in bran has been mastered. In the conditions of Uzbekistan, the cultivation process requires scientifically based information in order to determine which feed substrate is cheap and convenient. The conducted research is aimed at determining the growth and nutritional coefficient of bran and the development cycle and cost of this nutritional substrate. The article presents information from tests on raising black soldier fly hatchlings on bran nourishment substrate. Based on the information gotten, the timing of the advancement of larvae within the bran item, as well as the wholesome esteem of the bran, were indicated.

1 Introduction

Insect account for around 80% of worldwide species differing qualities, and they are the foremost far reaching course of arrive creatures in terms of number and biomass, characterized by tall efficiency and mass generation. Within the final decade, there has been an around the world intrigued in creepy crawlies as a crude fabric for the generation of profoundly edible bolster protein, oils with interesting properties, cancer prevention agents,

* Corresponding author: raximbergenovnadinara@gmail.com

immunomodulators, and modern drugs [1-3]. In later a long time, the increment within the populace has led to an increment within the request for nourishment [4].

This, in turn, appeared the have to be inquire about unused sources of crude materials. In this respect, within the generation of fish items, a part of consideration is paid to bolster crude materials, which are particularly viable [5].

On the basis of laboratory and personal experiments, the characteristics of *H. illucens* breeding from egg to mature *H. illucens* were studied, the bioconversion of Uzbekistan bran was determined, and it is considered urgent to conduct research on other nutritional substrates [6].

The efficiency of natural objects developed in such frameworks is inseparably connected with the quality of feed. *H. illucens* hatchlings can be utilized as a component within the planning of delicate nourishes as a source of such quality protein crude fabric [7]. The nourishment *H. illucens* larvae straightforwardly depends on the nourish substrate, and the composition of the larvae when pig excrement is utilized as a nourish substrate is displayed within the table underneath [8-10].

Table 1. *Hermetia illucens* developed in pig fertilizer larval composition.

Indicator	Percentage shares of substances, %
Proteins	42.1
Fats	34.8
Fiber	7.0
Humidity	7.9
Nitrogen-free extractives	1.4
Ash	14.6
Calcium	5.0
Phosphorus	1.5

2 Materials and methods

Experiment was conducted in a closed building in Qibray area of Tashkent locale (Uzbekistan) between May 3-30, 2022. Containers and boxes with dimensions of 25×17×3 cm and 60×40×20 cm were used for cultivation. Wheat bran and 5 grams of *H. illucens* eggs were utilized as the beginning fabric for development, and these eggs were set on a 25×17 cm stainless metal work (mesh 2 mm). After hatching of the larvae, a substrate dampened with wheat bran was utilized.

After complete absorption of the substrate, sieves (3 mm and 5 mm mesh) were used to separate the zoohumus from the larvae. During the experiment, taking into account the nutritional requirements of the *H. illucens* larvae at each stage, i.e., for each stage during growth, creating a sufficient density and environment for growth, and obtaining 4 kg of larvae from each gram of *H. illucens* eggs was carried out. Nourishment accounts were recorded in dry mass.

3 Results and discussion

A color and size description of the developmental stages of the *H. illucens* is given in Figure 1. According to these studies, the first larval stage lasts about 15 days. Larvae are whitish-yellow in color and can reach sizes of up to 5.0 mm ± 0.5 mm. In the second stage, which lasts 1 day, they increase in size to 12 mm. The third age stage (pupae) lasts 8 days and reaches a size of 19 mm. During this period, the larvae change their color to dark brown and become harder in structure. The cocooning process lasts about 10 days, after which the adult

fly emerges from the pupa only to mate and lay eggs. By drying and crushing the grown larvae, you can get a delicate nourish added substance within the frame of flour.

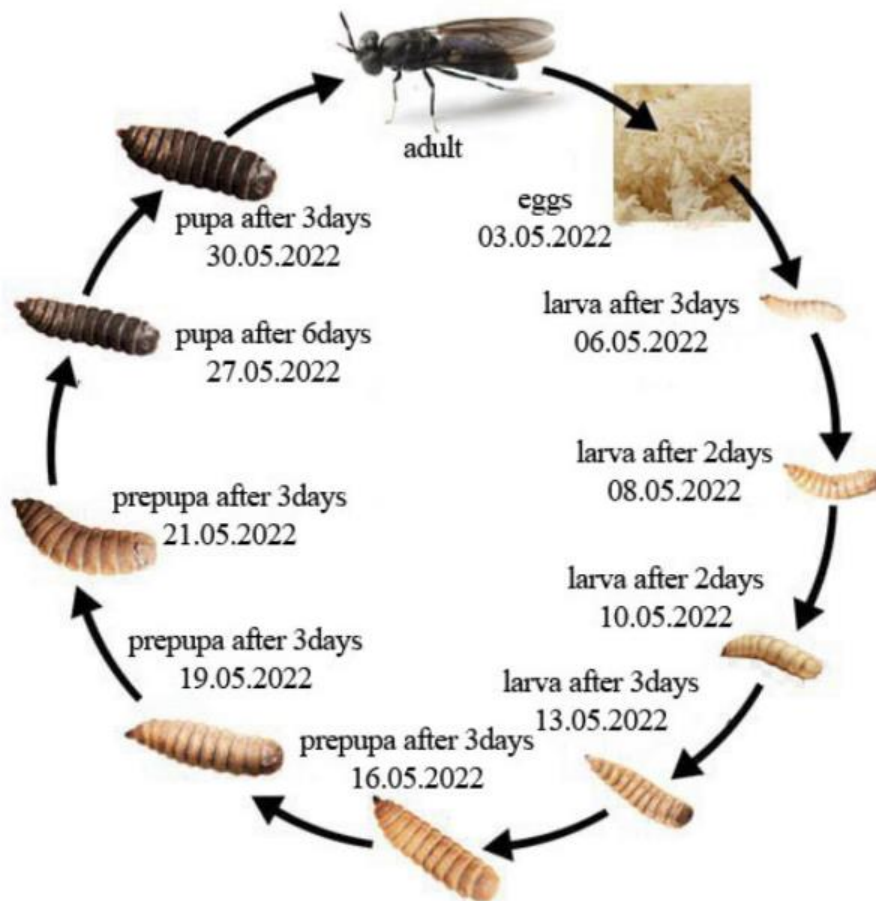


Figure 1. *H. illucens* developmental period experiment expressed by the date.

Our experiment began with the collection of grown-up fly eggs. A substrate with a humidity of 70% was prepared from bran and placed in a container measuring 25×17×3 cm with a thickness of 2 cm. After that, 5 grams of collected eggs were placed on an iron mesh with eggs placed on the substrate. The larvae fully hatched from the eggs on the 3rd day of incubation. After the larvae had totally eaten the substrate, they were exchanged to a bigger cage with measurements of 60×40×20 cm with 1 kg of bran substrate with a dampness substance of 70% (Figure 2).

After two days, as the larvae at this arrange develop exceptionally quick and their weight and estimate have expanded, the number of cages in which they are put was expanded to 4, and 1 kg of dry bran bolster was set in each cage. After completely processing the nourishment in these cells, they were isolated employing a sifter and exchanged to 5 cells, and they went through nourishment, trap larvae weight and zoohumus weight were returned. In this box, 1 kg of feed was prepared for each cell, and the larvae were divided into 5 equal boxes, and 808 grams were distributed (Figure 2).



Figure 2. Development stages of *H. illucens* and processed larval meal.

Black soldier larvae in our tests weighed 4040 grams 5 days after being brought forth. These 5 cells were not changed until the conclusion of the trial. Changes occurred only with a decrease in the need for feed, the prepupa stage, and the amount of food changed due to a change in the frequency of feeding during the pupa stages. On the 11th day of the experiment, the larvae were 15-25%, on the 14th day 35-45%, on the 17th day 65-70%, on the 20th day 75-85%, on the 25th day 90% and on the 27th day they were fully pupated. and at this stage, feeding is stopped. A comfortable environment with no direct sunlight was created for the pupa, and the moisture content was maintained at the required level. In our studies, the pupation period was 27 days, and the prepupation period was 11 days, which means that the development

period of the black soldier fly in May weather in Uzbekistan is much shorter than the data provided by other scientists (Table 2).

Table 2. Spent bran nutrient substrate by the date of the experiment, weight of larvae and weight of resulting zoohumus.

Date	Stage name	Spent feed	Total weight of larvae	Zoohumus weight
3.05.2022	Ovulation	100 gr		
6.05.2022	Larval	1 kg		
8.05.2022	Larval	4 kg		
10.05.2022	Larval	10 kg	4040 gr	3800 gr
13.05.2022	Larval	10 kg	8965 gr	13080 gr
16.05.2022	Prepupa	10 kg	13011 gr	21100 gr
19.05.2022	Prepupa	5 kg	15598 gr	30070 gr
21.05.2022	Prepupa	7.5 kg	18574 gr	34320 gr
27.05.2022	Prepupa	7.5 kg	21486 gr	39220 gr
30.05.2022			20741 gr	48020 gr

4 Conclusion

H. illucens is undemanding to outside variables, and with negligible speculation and small exertion, noteworthy victory can be accomplished in breeding this species in Uzbekistan. Within the experiment of larvae’s within the bran substrate within the Tashkent locale, the complete advancement period was considered and it was decided that the dietary coefficient of bran is 2.56. With such results, if we take into account that 75% of the water in black soldier is present in the weight loss rate calculation, 1 kg of dry mass can be obtained from 4 kg of live larvae.

This implies that in the event that the cost of bran is 3000, the cost of the body of *H. illucens* is 12,000 UZS in terms of US dollars (04/10/2023). Presently it is possible to plan scientific work to improve breeding technologies of this black soldier fly on other cheaper raw material substrates and to use larvae as a feed additive. According to the above, the black soldier fly is a promising research object because it is used as a feed additive for farm animals, poultry and aquaculture, and this insect is related to the current direction of environmentally safe bioutilization of organic waste.

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