

Preferensi and Biologi

by Nuraeni Nuraeni

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Preference and biology of moril bombyx in feed-made mixed red beans (*Phaseolus vulgaris*) ingredients

S Nuraeni, A Sadapotto and C A Lestari

Forest Insect and Protection Laboratory, Faculty of Forestry, Hasanuddin University, Makassar, Indonesia

E-mail: nuraenisitti@gmail.com

Abstract. This study aims to determine the preference and biology of mory L Bombyx with an artificial diet based on mixtures of red beans. This research should provide information to farmers and other users on the development of silkworms. This research was conducted from September to October 2018. The study consisted of five steps: the first step of disinfection, handling newly hatched caterpillars, feeding, observation of temperature and humidity. The variables observed in this study were the amount of artificial food consumed by the larvae, the nutrient content of the artificial food (carbohydrate, fat, protein and water content), the growth index, the larval length, the weight larvae, cocoon fresh weight, cocoon skin weight, larval survival power percentage. Silkworms can consume the percentage of artificial foods made from red bean mixtures with the highest feeding capacity of 558.11 g, mixed with mulberry leaves and bean flour red. The larvae. However, artificial feeding did not have a positive influence on the survival of silk larvae.

6 1. Introduction

Indonesia is one of the tropical countries that develops natural silk business. This is because Indonesia has natural conditions suitable for the growth of silkworms and mulberry as the feed of silkworms. Natural silky is also an activity that can be categorized in the form of agro-industry. This activity includes several other activities and is a series of activities that need each other. The series of activities includes mulberry planting, silkworm nursery, silkworms maintaining, cocoon harvesting, and cocoon spinning into silk thread [1].

Mori L. Bombyx Silkworm is a type of monophagous insect that can produce silk yarn fibers from one stage of its life development process which has four stages in its life cycle, namely eggs, larvae, pupae, and imago. Besides, silkworms also have high economic value as producers of silk fibers that are useful for textiles, high-quality surgical threads, and parachutes and cannot be defeated by artificial silk fibers [2].

The silkworm feed needs to be taken care of in maintenance. The source of silkworm feed must always be available at all times when the larvae need. Larval growth, larval reproductive, and development depend on the quality and quantity of feed consumed. Silkworms that eat mulberry leaves will produce quality cocoon silk [3].

The tropical condition is one of the causes of different caterpillar offspring in nutritional needs, growth, and cocoon parameters. Feed consumption has a direct impact on the weight of the larvae, the weight of the cocoon, the amount of silk produced, and the number of eggs. Some researchers state

that nutritional efficiency varies between the descendants of one silkworm and another. Variations in species depend on climatic conditions. The efficiency of feed conversion in cocoons that are absorbed and digested into the body varies significantly under the influence of mulberry varieties, season, and nutritional quality. Mulberry leaves have greater importance on the regulation of absorption, digestion, and food digestibility in the larval phase. Absorption and digestion have a direct relationship with the growth and silk production in silkworms.

So far, we know that silkworms only eat mulberry leaves as their daily-food. However, currently, artificial feed is essential for silkworms because, with this feed, it can sustain a lack of food availability in certain seasons. In the dry season, many mulberries leave to dry out and fall so that artificial feed becomes a way out to meet the nutritional needs of silkworms.

2. Methods

2.1. Research location.

This research was conducted from September to October 2018 which was carried out at the Forest Protection, and Insect Laboratory of the Faculty of Forestry and the nutritional content test was carried out at the Laboratory of Chemistry and Animal Feed, Faculty of Animal Husbandry, Hasanuddin University.

2.2. Sampling

Sampling was carried out at the Social Forestry Center and the Ministry of Environment, Bili-bili, Gowa Regency.

2.3. Research procedure

1. *Disinfection. Disinfection aims to sterilize or prevent the attack of pathogens against silkworms.*
2. *We are handling newly hatched caterpillars. The first step in the maintenance of newly hatched caterpillars is the equipment and materials preparation — maintenance of small newly hatched caterpillars.*
3. *Feeding. Before feeding to larvae to be treated with artificial feed, the feed was first measured with the same weight for all treatments. After measuring then divided by 3 equals the weight for giving morning, afternoon and evening. Each feed was divided equally for all replications and flattened on each side. Provision of artificial feed is carried out on the instar V according to the treatment specified in Table 1.*
4. *Temperature and Humidity Observations. Temperature and Humidity Observations was carried out every day until the cocoon harvest, which is morning, afternoon, evening. Record this temperature and humidity using thermo-hygrometer.*
5. *Length and Weight of the larvae Observation. Length and weight of the larvae observation were carried out in the maintenance of silkworms from a different tray. The number of larvae observed was 30 multiplied by four treatments. So, the total caterpillar observed was 120. Measurement and weighing were carried out on a sample of 10 larvae of each treatment and replication.*
6. *Data Analysis. Data were analyzed using Variance Analysis (Analysis of Variance, ANOVA). If the treatment gives a real influence, then further analysis is carried out, namely (Tukey Test) which is commonly called a real difference test (BNJ) to see the value of each treatment differently.*

3. Results and discussion

3.1. Artificial Feed Amount Consumed by Instar V Larvae

The amount of artificial feed consumed by silk larvae can be seen in figure 1.

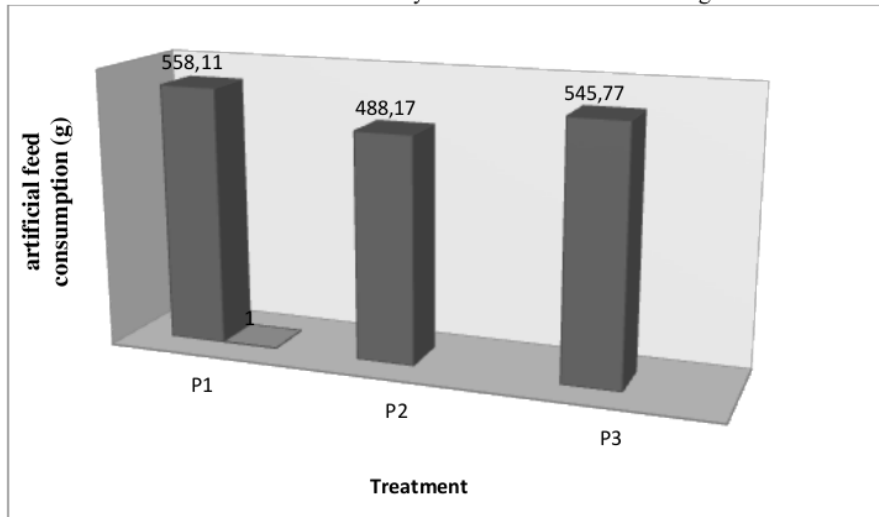


Figure 1. Artificial feed Amount consumed by instar V larvae

In figure 1 shows that the consumption of artificial feed most eaten by larvae is treatment 1 (mulberry leaves 44%: 32% red beans) which means the content of mulberry leaves is higher than the red beans, which is 558.11 g. The lowest consumption of larvae was P2 (mulberry leaves 31%: red beans 45%), which meant lower mulberry leaf content of 488.17 g. This is caused by the eating behavior of silkworms influenced by three eating stimulants found in mulberry leaves, namely: *attractants*, namely stimulants that guide the caterpillar to feed including citrate, *terpinyl acetate*, *linalyl acetate*, *linalool*, β - γ hexanol. *Biting factors*, which are stimulants for biting include β -*sitosterol*, *isoquercitrin* or morine and *swallowing factors* that help ingestion include cellulose and its cofactors are sucrose, inositol, organic phosphate, and silica [4].

One of the researches [4] mulberry leaves is currently the only source of silkworm feed. The supply of natural silkworm feed requires much labor, especially for the management of fodder plants and maintenance of silkworms. In addition to providing mulberry leaves continuously, an extensive area is needed.

Silkworm artificial feed development has been widely observed in Indonesia for practical purposes, but until now, it has not been adequately applied. Artificial feed components from several previous studies show that the use of mulberry leaves is designed as little as possible, ranging from 25-40% [4]. This causes the artificial feed to contain only a fragrance of mulberry leaves, which serves as an identifier for silkworms to recognize their feed

3.2. Feed Analysis.

Based on the research results that have been done, so the test results were obtained the nutritional content of mulberry leaves and artificial feed made from a mixture of mulberry leaves and red beans, we can see in table 1.

Table 1. Mulberry Leaf Nutrition Content

Nutrient	% Dry ingredients Mulberry *	% Dry ingredients of Artificial Feed **
Water content	85.47	88.53
Ash content	10.92	4.47
Crude fiber	10.52	1.12
Crude fat	2.89	2.18
Crude Protein	18.43	20.38
BETN	57.24	71.85

* Mulberry Source: Syahrir, et al., (2009).

** Artificial Feed Source: Analyzed at the Laboratory of Chemistry and Animal Feed, Faculty of Animal Husbandry, Hasanuddin University, 2018

The artificial feed analyzed for nutritional content was P3 treatment, which was the same content of mulberry leaves and red beans (38%: 38%). We can see this in Table 5, namely the moisture content of the artificial feed is higher compared to mulberry leaves wherein artificial feed, the water content is 88.53% while mulberry leaves 85.47%. Furthermore, at artificial feed ash levels look lower than mulberry, which is 4.47% while for mulberry leaves it alone has an ash content of 10.92%. Similarly, crude fiber and crude fat of artificial feed are lower than mulberry leaves, where crude fiber in artificial feed is 1.12%, and crude fat is 2.18% while mulberry leaves have crude fiber worth 10.52% and crude fat is worth 2.89%. This is inversely proportional to the protein and carbohydrates present in artificial feed. Protein and carbohydrate-protein content is higher compared to mulberry leaves, namely protein contained in artificial feed 20.38% while protein for mulberry leaves is only 18.43% while artificial carbohydrate feed is 71.85% and mulberry leaf carbohydrate is 57.24 %. Nutrients in silkworm feed are essential factors that influence the growth of silkworms [5]

3.3. Larval Growth Percentage.

Based on the research results on larval growth that has been carried out, the results of the larval growth index, increase in larval length, and weight gain of larvae can be seen in table 5.

Table 2. Silkworm Larvae Growth

Treatment	Growth Index	Larvae Length Growth (cm)	Larvae Weight Increase (g)
P0	242.98 c	1.233 c	1.038 d
P1	552.45 b	1.916 b	2.223 c
P2	665.03 a	2.216 a	2.497 a
P3	656.68 a	2.173 a	2.421 b
BNJ	23,24 *	0,12 *	0,053 *

Remarks: the numbers in the same column followed by the same letters are not significantly different at the 5% level according to the Tukey-Test

The silkworm larvae growth is presented in Appendix 2 and can be seen in table 2 which shows that the fastest-growing growth index is treatment two larvae with feed formulations consumed previously are mulberry leaves which are less than the red beans. While the lowest growth index

obtained by the control treatment with the previous feed formulation is mulberry leaves with treatment standards.

From the Tukey's further test results showed that the growth index (P2 and P3) in the treatment of artificial feed tended to be the same. However, control/P0 (feeding only with mulberry leaves) and P1 with mulberry feed consumption 44%: 32% showed significantly different results, but when compared with further tests of the nested-form shows significantly different results.

3.4. *Silkworm larvae length increase is presented in Appendices 3 and four, which can be seen in Table 2.*

The results of the analysis show that the larvae length increase in P2 and P3 treatments looks the same or not significantly different. However, when compared with control/P0 (feeding only with mulberry leaves) and P1 with mulberry feed formulation, 44 %: 32% artificial feed showed significantly different results (significantly different). While the analysis of larval weight gain in all treatments showed significantly different results. Bodyweight growth and body length are essential parameters of silkworm life, and all of that will depend on better food quality, consumption level, and utilization coefficient[6].

3.5. *Cocoon Quality.*

Based on the research results of the cocoon quality that has been done, the results of cocoon weight, cocoon skin weight, and the ratio of cocoon skin are obtained, as shown in table 3

Table 3. Cocoon Quality

Treatment	Cocoon weight	Cocoon Skin Weight (g)	Cocoon Skin Ratio (%)
P0	0,769 b	0,139 a	18,267
P1	0,690 c	0,119 b	16,758
P2	0,802 a	0,094 c	12,308
P3	0,813 a	0,090 c	11,400
BNJ	0,026*	0,015 *	1,75 *

Remarks: the numbers in the same column followed by the same letters are not significantly different at the 5% level according to the Tukey-Test

*Comparison of Tukey Test Results with Nested Patterns

The cocoon analyzed quality is P0, P1, P2, and P3. This can be seen in table 3. From the analysis results of the fresh cocoon weight, the results were significantly different (significantly different) in treatments P0 and P1. However, the treatment of P2 and P3 shows the same results and is not significant or not significantly different. While the variance analysis results on cocoon skin weights are the same as fresh cocoon weights, and the cocoon skin ratio shows results that tend to be the same (not significantly different).

One of the researches [7] which revealed the relevance of productivity and quality of silkworm cocoon and silk thread was strongly influenced by the condition of feed in the form of mulberry leaves. The quantity and quality of mulberry leaves are influenced by mulberry type, seed quality, intensive cultivation techniques while the quantity and quality of mulberry leaves are influenced by the mulberry type, seed quality, intensive cultivation techniques. Seed quality is very important for quality trees[8]. While the quantity and quality of silk yarn besides being influenced by mulberry cultivation techniques and maintenance of silkworms, it is also strongly influenced by the latest reeling and re-reeling technology and modern machinery that can produce good quality silk threads so that it can compete in the international market.

3.6. Larvae Survival.

The silk larvae survival presented in Appendix 5 can be seen in Figure 2.

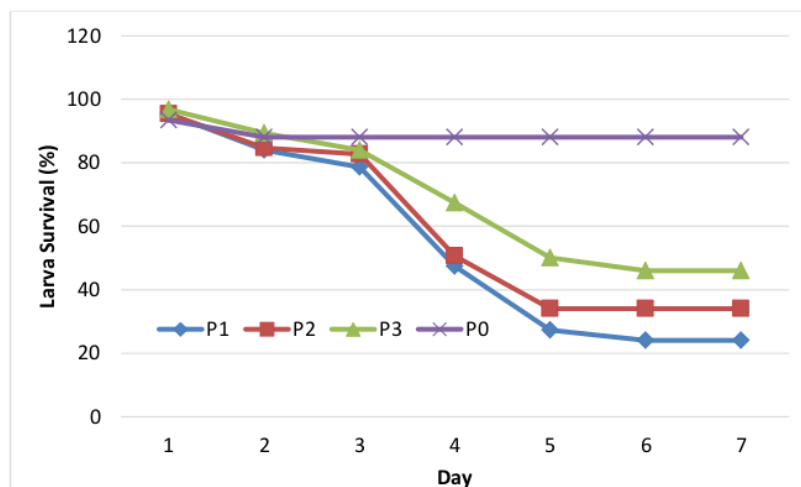


Figure 2. Larvae survival during Instar V Phase

The larvae survival in the three treatments showed results that decreased in tendency compared to control. This is because artificial feed harms the survival of larvae. One of the research results that revealed the relationship between feed and the survival of silkworms is research [9]. He suggested that macro nutrition and micronutrients are the main factors that influence the survival and resilience of silkworms to diseases both directly and indirectly. Besides the influential feed, the temperature, humidity, and lighting of the maintenance room are also very influential for the survival of the larvae.

4. Conclusion

From the research results that have been done, it can be concluded that silkworms can consume artificial feed made from red bean mixture with the highest feeding capacity of 558.11 g mixed with mulberry leaves and red bean flour 44%: 32% on instar V. Besides that, the artificial feed provision influences the caterpillar growth index, larval length, and larval weight. However, artificial feeding has not given a good influence on the survival of larvae.

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