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Original Article

The effect of alternative feed on the growth of *Bombyx mori* L. in Renggeang Village, Polewali Mandar Regency, West Sulawesi, Indonesia

Pengaruh pakan alternatif terhadap pertumbuhan *Bombyx mori* L. di Desa Renggeang, Kecamatan Polewali Mandar, Sulawesi Barat, Indonesia

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ABSTRACT

Mulberry (*Morus* sp.) is the primary feed for silkworms (*Bombyx mori* L.) and determines cocoon quality. However, limited land availability and seasonal changes pose challenges for a consistent mulberry leaf supply, prompting research into alternative feeds. This study aimed to evaluate the effects of alternative feeds on the growth of *B. mori*, including the length and width of silkworms, the number of live and dead silkworms, and the feed consumption of silkworms. A total of 500 silkworms were divided into six treatments with three replicates each. The treatments were mulberry leaves (K), castor leaves (P1), cassava leaves (P2), broiler chicken feed (P3), castor and mulberry leaves combination (P4), cassava and mulberry leaves combination (P5), broiler chicken feed and mulberry leaves combination (P6). Combined feeds were given at a 1:1 ratio. The results confirmed that *B. mori* exclusively feeds on mulberry leaves, as no silkworms survived on P1, P2, or P3 treatments. All combination feed treatments (P4, P5, P6) showed that silkworm growth results were not significantly different from the control treatment (K). Therefore, we recommend using all combination feeds as an alternative feed in *B. mori* cultivation. However, the best combination feed treatment was shown by P6 with the highest silkworm length and width (3.69 cm; 0.57 cm) and the highest feed consumption (44.16 grams), and P5 with the highest percentage of survival rate (75%) and the lowest percentage of death rate (25%).

Key words: alternative feed, artificial feed, silkworm cultivation, silkworm growth

ABSTRAK

Murbei (*Morus* sp.) merupakan pakan utama ulat sutera (*Bombyx mori* L.) yang menentukan kualitas kokon. Keterbatasan lahan serta adanya pergantian musim menimbulkan tantangan untuk ketersediaan daun murbei sehingga mendorong penelitian tentang pakan alternatif. Penelitian ini bertujuan untuk menghitung pengaruh pemberian pakan alternatif terhadap pertumbuhan ulat sutera *B. mori*, yang meliputi panjang dan lebar ulat sutera, jumlah ulat sutera yang hidup dan mati serta konsumsi pakan ulat sutera. Pakan alternatif diberikan pada 500 individu ulat sutera yang terbagi ke dalam enam perlakuan dengan masing-masing tiga ulangan. Perlakuan yang digunakan adalah daun murbei (K), daun jarak (P1), daun singkong (P2), pakan ayam broiler (P3), kombinasi daun jarak dan murbei (P4), kombinasi daun singkong dan murbei (P5), serta kombinasi pakan ayam broiler dan daun murbei (P6). Pakan kombinasi menggunakan perbandingan 1:1. Hasil penelitian ini memperkuat pernyataan bahwa ulat sutera *B. mori* hanya memakan daun murbei sehingga tidak ada ulat yang hidup pada perlakuan P1, P2, dan P3. Semua perlakuan pakan kombinasi (P4, P5, P6) menunjukkan hasil pertumbuhan ulat sutera yang tidak berbeda nyata dengan perlakuan kontrol (K). Oleh karena itu, kami merekomendasikan penggunaan semua pakan kombinasi sebagai pakan alternatif dalam budi daya ulat sutera *B. mori*. Meskipun demikian, perlakuan pakan kombinasi paling baik ditunjukkan oleh P6 dengan panjang dan lebar ulat sutera paling tinggi (3,69 cm; 0,57 cm) dan konsumsi pakan paling tinggi (44,16 grams) serta P5 dengan persentase jumlah ulat yang hidup paling tinggi (75%) dan persentase kematian paling rendah (25%).

Kata kunci: budi daya ulat sutra, pakan alternatif, pakan buatan, pertumbuhan ulat sutera

INTRODUCTION

The silkworm (*Bombyx mori* L.) is an insect extensively cultivated for its valuable silk fibers. The growth and production of silkworms are greatly influenced by environmental factors, particularly the type of feed provided (Hailu 2016). The selection of appropriate feed affects silkworm growth, health, and cocoon, making it essential to analyze the impact of feed type on silkworm performance. Silkworms play a crucial role in the silk industry, providing raw materials for fabrics, clothing, and other textiles (Harishkumar et al. 2023). The practice of rearing silkworms and producing silk has a history spanning thousands of years in various countries, especially China, Japan, India, and other Asian nations.

While global demand for silk fibers continues to rise in line with developments in fashion, production has declined in many regions (Rostina et al. 2018). In Indonesia, for example, several silk-producing centers, such as those in South Sulawesi and Sukabumi, are no longer operational. To date, silk thread production still depends on conventional cultivation, where *B. mori* silkworms are fed fresh mulberry leaves (Farhaeni et al. 2022). Despite efforts to intensify production, silkworm cultivation in areas like South Sulawesi and Sukabumi remains constrained by the extensive land required to grow mulberry trees. Not everyone interested in silkworm farming can afford to provide large enough plots of land. For example, rearing one box of eggs (approximately 10,000 eggs) requires at least 3,500 m^2 of mulberry plantation (Agustarini et al. 2020).

To address this limitation, various studies have explored the development of alternative feeds. For example, Onaga (2021) successfully formulated and tested a specialised formula for alternative silkworm feed for different silkworm strains. Several strains, including Chinese and Japanese and hybrids from the Silkworm Breeding Center, have been developed to adapt to the alternative feeds. Research has also identified optimal moisture content for artificial feeds to support silkworm growth and productivity (Tanjung 2022). Continued efforts focus on improving feed formulas to boost silkworm productivity (Hemmatabadi et al. 2016). Zhang et al. (2017) found that feeds with higher protein content improve silkworm growth and silk quality, while good fiber content also supports optimal development and production. Previous studies confirm that feed quality and nutritional balance significantly affect cocoon performance (Yang et al. 2015; Wei et al. 2019). Providing silkworms with balanced, high-quality feed can enhance survival, cocoon yield, and silk fiber quality.

Instead of the mulberry leaves, an alternative artificial feed supported by recent studies is broiler chicken feed. Kumaidi & Ekastuti (2013) found that using broiler chicken feed can result in superior silkworm characteristics, including increased body mass, cocoon mass, and improved cocoon quality. The primary nutrient requirements of silkworms, such as carbohydrates, proteins, and fats, are similar to those of broiler chicken feed (Borah et al. 2020). Therefore, experiments testing broiler chicken feed as an alternative to mulberry leaf are needed. This study aimed to evaluate the effects of alternative feed on the growth (length and width), survival, and feed consumption rate of *B. mori*.

MATERIAL AND METHOD

This study was conducted from May to November 2023 in Ranggeang Village, Limboro Subdistrict, Polewali Mandar Regency, West Sulawesi. The study consisted of four stages: silkworm acclimatization, feeding, data collection, and data analysis.

Silkworm acclimatization

Silkworm acclimatization involves transitioning the silkworms from their previous environment at Balai Penerapan Standar Instrumen Lingkungan Hidup dan Kehutanan (BPSILHK) Makassar to the new environment in Ranggeang Village. Upon arrival in the new environment, the caterpillars were in a dormant state in the third instar phase. They transitioned to the fourth-instar phase upon exposure, followed by immediate growth measurements. The silkworms were placed in a tray with mulberry leaves and lime. Opening the box caused them to wake up and start feeding on the mulberry leaves. Lime serves as an antiseptic to prevent disease development. Mulberry leaves were sourced from intentionally cultivated plants, while cassava and castor leaves were also included. Successful acclimatization was determined by the awakening and feeding behavior of all caterpillars without any fatalities.

Silkworm feeding

Silworm feeding involved using mulberry leaves as control, supplemented by alternative feeds such as cassava leaves (Prijono et al. 2023), castor leaves (Nofandra 2009), and broiler chicken feed (Kumaidi & Ekastuti 2013). Young leaves, characterized by their light green color and soft veins from the first five leaves, were used. Leaves were not washed and were prepared accordingly for different instar stages. Broiler chicken feed obtained from local markets was mixed with water to form a paste-like consistency. A ratio of 1:1 was used for all combinations. Six feeding treatments were administered, varying combinations of mulberry leaves with other feeds (Figure 1): K: silkworms fed only mulberry leaves; P1: silkworms fed only castor leaves; P2: silkworms fed only cassava leaves; P3: silkworms fed only broiler chicken feed; P4: silkworms fed a combination of castor and mulberry leaves; P5: silkworms fed a combination of cassava and mulberry leaves; P6: silkworms fed a combination of broiler chicken feed and mulberry leaves.

Feeding was carried out three times daily (morning, afternoon, and evening) for instars 3, 4, and 5. The caterpillar enters a dormant state whenever they transitions between instars (from third to fourth, fourth to fifth, and fifth to cocooning); during this period, no food is provided, only a sprinkle of lime. While the silkworms were dormant, windows and ventilation were opened to maintain air circulation. The leaves were arranged alternately between the tip and base portions.

Data collection

The data collected in this study included (1) length of silkworm (cm), (2) width of silkworm (cm), (3) feed consumption (grams), (4) number of surviving silkworms (individuals), and (5) number of dead silkworms (individuals). Data were collected at the end of each instar phase (instars 3, 4, and 5).

Data analysis

Silkworm length and width, as indicators of growth, were analyzed statistically by comparing the averages between treatments using ANOVA. If significant differences were found, the honestly significant difference (HSD) test/Tukey test was applied. The same procedure was used to analyze feed consumption. The

Figure 1. Alternative food variations for silkworms. K: silkworms fed only mulberry leaves (control); P1: silkworms fed only castor leaves; P2: silkworms fed only cassava leaves; P3: silkworms fed only broiler chicken feed; P4: silkworms fed with combination of castor and mulberry leaves; P5: silkworms fed with combination of cassava and mulberry leaves; and P6: silkworms fed with combination of broiler chicken feed and mulberry leaves.

survival rate was calculated based on the number of surviving silkworms (Taufika et al. 2022), and the death rate was calculated for the number of dead silkworms (Taufika et al. 2022). All statistical analyses were performed using SPSS 26.

$$\text{Survival rate (\%)} = \frac{\text{the number of silkworms that survive the third instar phase}}{\text{the number of silkworms surviving in the fifth instar phase}} \times 100$$

$$\text{Death rate (\%)} = \frac{\text{silkworm mortality rate in the final phase}}{\text{silkworm mortality rate in the early phase}} \times 100$$

RESULT

Growth of silkworms

The results of this study indicate that providing mulberry leaves as feed has the most significant effect on silkworm growth (length and width). The findings also confirm that *B. mori* prefers mulberry leaves (*Morus* spp.) over other plant leaves. This is indicated by the greater length and width of silkworms fed mulberry leaves (length 4.21 cm; width 0.62 cm) compared to P1 (length 0.62 cm; width 0.16 cm), P2 (length 0.53 cm; width 0.15 cm), and P3 (length 0.62 cm; width 0.16 cm). These values were the lowest, even when compared to silkworms fed mixed feed (P4, P5, and P6). This suggests that if there is a shortage of mulberry leaves, mixing them with other leaves is preferable to feeding silkworms only alternative leaves. The differences in length and width for treatments K, P4, P5, and P6 were significantly greater than for treatments P1, P2, and P3 (Table 1). These results were further examined using an honest significant difference (HSD) test.

The HSD test showed that alternative feed treatments had varying effects on silkworms at each instar stage. The best growth in instar 3 was observed in the mixed feed treatment of castor and mulberry leaves (P4), with a length of 2.32 cm and width of 0.44 cm ($p < 0.05$). In instars 4 and 5, the best growth was found in the mulberry-only treatment (K) ($p < 0.05$). Although not the best, silkworms could survive on mixed feed. The best silkworm growth for mixed feed was achieved with the combination of broiler chicken feed and mulberry leaves (P6), with a length of 5.06 cm and width of 0.70 cm. The HSD test also showed that silkworms in treatments P1, P2, and P3 did not survive into instars 4 and 5, while silkworms in treatments K, P4, P5, and P6 remained alive (Table 2). This contributed to the lower average length and width of silkworms in treatments P1, P2, and P3. The ANOVA test confirmed a significant difference between treatments P1, P2, P3, and treatments K, P4, P5, P6.

Feed consumed of silkworm

Silkworm feed consumption increased with age (instar stage). The highest feed consumption was shown by the P6 treatment, namely 14.5 grams in the instar 3, increasing to 35.5 grams and 82.5 grams in the instars 4 and 5, resulting in an average total feed consumption of 44.16 grams. This feed consumption was the highest, even when compared to the control treatment, which was only 41.16 grams. However, the ANOVA test showed that there was no significant difference in feed consumption between the K and P4, P5, and P6 treatments ($p > 0.05$). The lowest feed consumption was observed in treatments P1, P2, and P3 because the silkworms only reached instar 3 (Table 3).

Survivorship and death of silkworms

The results of this study showed that the number of surviving silkworms decreased with increasing instar age, but the percentage chance of survival increased with each subsequent instar age. For example, in treatment K, were 19.5 individuals alive in instar 3, decreasing to 10 individuals in instar 4 and 9 individuals in instar 5. This can be interpreted as 9 individuals that died in instar 3, but only 1 died in instar 4 (Table 4). This suggests that the chance of silkworm survival improves with instar age. This is supported by data on mortality: the death

Table 1. The average of silkworms growth on various types of feed combinations based on the ANOVA test

Treatments	Silkworm length (cm) ± Standard deviation	Silkworm width (cm) ± Standard deviation
K	4.21 ± 1.99 a	0.62 ± 0.17 a
P1	0.62 ± 0.94 b	0.16 ± 0.24 b
P2	0.53 ± 0.80 b	0.15 ± 0.22 b
P3	0.62 ± 0.94 b	0.16 ± 0.24 b
P4	3.60 ± 0.98 a	0.54 ± 0.09 a
P5	3.58 ± 1.22 a	0.56 ± 0.13 a
P6	3.69 ± 1.35 a	0.57 ± 0.13 a

The same letters indicate no significant differences ($p > 0.05$); different letters indicate significant differences ($p < 0.05$). K: mulberry leaves; P1: castor leaves; P2: cassava leaves; P3: broiler chicken feed; P4: castor and mulberry leaves combination; P5: cassava and mulberry leaves combination; P6: broiler chicken feed and mulberry leaves combination.

Table 2. Details of silkworms growth on various types of feed combinations using the honest significant difference (HSD) test

Instar	Treatments	Silkworm length (cm) ± Standard deviation	Silkworm width (cm) ± Standard deviation
3	K	1.75 ± 0.17 ab	0.41 ± 0.05 a
	P1	1.88 ± 0.14 ab	0.48 ± 0.01 a
	P2	1.60 ± 0.10 a	0.45 ± 0.02 a
	P3	1.88 ± 0.06 ab	0.48 ± 0.02 a
	P4	2.32 ± 0.35 b	0.44 ± 0.09 a
	P5	2.04 ± 0.12 ab	0.41 ± 0.03 a
	P6	2.04 ± 0.33 ab	0.42 ± 0.03 a
4	K	4.73 ± 0.25 a	0.65 ± 0.05 a
	P1	-	-
	P2	-	-
	P3	-	-
	P4	4.13 ± 0.11 b	0.58 ± 0.02 a
	P5	3.96 ± 0.05 b	0.56 ± 0.05 a
	P6	3.96 ± 0.41 b	0.56 ± 0.05 a
5	K	6.16 ± 0.75 a	0.80 ± 0.00 a
	P1	-	-
	P2	-	-
	P3	-	-
	P4	4.36 ± 0.15 b	0.60 ± 0.00 b
	P5	4.73 ± 0.46 b	0.70 ± 0.00 c
	P6	5.06 ± 0.11 b	0.70 ± 0.05 c

The same letters indicate no significant differences (p > 0.05); different letters indicate significant differences (p < 0.05). K: mulberry leaves; P1: castor leaves; P2: cassava leaves; P3: broiler chicken feed; P4: castor and mulberry leaves combination; P5: cassava and mulberry leaves combination; P6: broiler chicken feed and mulberry leaves combination.

Table 3. The average of silkworm feed consumption on various types of feed combinations

Treatments	Feed consumption (grams)			Feed consumption (grams) ± Standard deviation*
	Instar 3	Instar 4	Instar 5	
K	29 ± 2.82	36.5 ± 4.94	58 ± 19.79	41.16 ± 16.31 a
P1	24 ± 0	-	-	-
P2	26 ± 0	-	-	-
P3	18 ± 0	-	-	-
P4	26 ± 0	25 ± 0	46 ± 1.41	32.33 ± 10.61 a
P5	28.5 ± 3.53	29 ± 7.07	63 ± 2.82	40.16 ± 18.08 a
P6	14.5 ± 4.94	35.5 ± 6.36	82.5 ± 0.70	44.16 ± 31.35 a

*The same letters indicate no significant differences (p > 0.05); different letters indicate significant differences (p < 0.05). K: mulberry leaves; P1: castor leaves; P2: cassava leaves; P3: broiler chicken feed; P4: castor and mulberry leaves combination; P5: cassava and mulberry leaves combination; P6: broiler chicken feed and mulberry leaves combination.

rate in treatment K, in instar 3, was zero individuals (no silkworms died), increased to 9.5 individuals in instar 4, and then decreased to 1 individual in instar 5 (Table 5). The highest survival rate was shown by treatment P5, namely 75% and the lowest death rate was 25%.

DISCUSSION

The results of this study confirm that the main food source for *B. mori* is mulberry leaves (*Morus* spp.), consistent with its species designation. The limited range of feed types consumed by *B. mori* is due to its domestication. Wild silkworms, such as *Samia ricini* (Donovan), *Samia cynthia* (Drury), and *Attacus atlas* Linnaeus, can feed on other types of leaves, including castor leaves (Shakilla et al. 2022; Aisah et al. 2017; Setiyawan & Fitasari 2018; Endrawati et al. 2020; Arifin & Endrawati 2023).

An important finding in this study is that silkworms fed with a mixed feed were still able to survive and had body size not significantly different from those of

Table 4. The average and percentage of survivorship silkworms on various types of feed combinations

Treatments	Average of survivorship silkworm (individual)			Total*	Survival rate (%)
	Instar 3	Instar 4	Instar 5		
K	19.5 ± 9.19	10 ± 12.72	9 ± 11.31	12.83 ± 10.08 a	46.15
P1	26 ± 0	-	-	-	-
P2	26 ± 0	-	-	-	-
P3	26 ± 0	-	-	-	-
P4	24 ± 5.65	13.5 ± 3.53	10.5 ± 2.12	16.00 ± 7.07 a	43.75
P5	26 ± 0	20 ± 1.41	19.5 ± 2.12	21.83 ± 3.43 a	75
P6	27 ± 0	19.5 ± 2.12	18.5 ± 3.53	21.67 ± 4.54 a	68.51

*The same letters indicate no significant differences (p > 0.05); different letters indicate significant differences (p < 0.05). K: mulberry leaves; P1: castor leaves; P2: cassava leaves; P3: broiler chicken feed; P4: castor and mulberry leaves combination; P5: cassava and mulberry leaves combination; P6: broiler chicken feed and mulberry leaves combination.

Table 5. The average and percentage of dead silkworms on various types of feed combinations

Treatments	Average of survivorship silkworm (individual)			Average ± Standard deviation*	Death rate (%)
	Instar 3	Instar 4	Instar 5		
K	0	9.5 ± 3.53	1 ± 1.41	5.25 ± 5.37 a	53.84
P1	0	26 ± 0	-	26 ± 0 b	100
P2	0	26 ± 0	-	26 ± 0 b	100
P3	0	26 ± 0	-	26 ± 0 b	100
P4	0	10.5 ± 9.19	3 ± 1.41	6.75 ± 6.89 a	56.25
P5	0	6 ± 1.41	11.5 ± 12.02	3.25 ± 3.30 a	25
P6	0	7.5 ± 2.12	4 ± 1.41	4.25 ± 4.03 a	31.48

*The same letters indicate no significant differences (p > 0.05); different letters indicate significant differences (p < 0.05). K: mulberry leaves; P1: castor leaves; P2: cassava leaves; P3: broiler chicken feed; P4: castor and mulberry leaves combination; P5: cassava and mulberry leaves combination; P6: broiler chicken feed and mulberry leaves combination.

silkworms fed only mulberry leaves ($p < 0.05$) (Table 1). This may offer a solution for the limited supply of mulberry leaves. Significant differences in body size were observed for silkworms fed only castor leaves (P1), cassava leaves (P2), and broiler chicken feed (P3) ($p < 0.05$). All the silkworms in these treatments died upon reaching instar 4 (Table 2). This may be due to decreased appetite. *Bombyx mori* uses chemosensory receptors to detect suitable feed; it will not consume leaves or feed if its receptors do not recognize specific compounds. Kumaidi & Ekastuti (2013) reported that *B. mori* did not consume artificial feed composed entirely of broiler feed; it only consumed broiler feed when mixed with mulberry flour or betasitosterol. The best result was obtained with a combination of 25% mulberry flour, 75% broiler feed, and 0.5% beta-sitosterol. The ineffectiveness of castor leaves as *B. mori* feed was also reported by Nofandra (2009), who noted that feeding with 80% mulberry leaves plus 20% castor leaves produced deformed cocoons with an average weight of 17.38 grams, significantly different from the 100% mulberry leaf feed, which produced cocoons weighing only 6.78 grams.

In general, the level of feed consumption increased with instar age. Feed consumption in instar 5 was higher than in instars 3 and 4 (Table 3). This aligns with nutritional requirements for silkworm growth. Similarly, Hapsari et al. (2018) reported that the feed requirement for 28-day-old Hong Kong caterpillars (*Tenebrio molitor* Linnaeus) was 0.032 grams, increasing to 0.062 grams at 50 days of age. This increase was accompanied by increased body weight from 0.073 grams at 28 days to 0.134 grams at 50 days. Choosing the right mulberry leaf is also essential to maximize the growth and quality of *B. mori* cocoons. According to Faradilla et al. (2022), mulberry leaves in vitro culture yielded higher-quality cocoons than mulberry leaves propagated by cuttings. In addition, the type of silkworm and mulberry leaf should be considered.

The silkworm survival rate in instar 3 was the highest (100%) because observations began at that stage, so no mortality occurred. The silkworm's ability to adapt to new feed was observed in instar 4, where the survival rate declined (51.28% in treatment K). However, silkworms were able to adapt to the mixed feed as shown by the increased survival rate in instar 5

(90% in treatment K) (Table 4). This is consistent with the mortality rate, which increased in instar 4 (48.71% in treatment K), but decreased in instar 5 (10% in treatment K) (Table 5). This suggests that silkworms require time to adapt to new feed. For example, honey bees placed in a new area should not be disturbed for 6 days (Rompas et al. 2023). Singh et al. (2018) also reported that the number of surviving *B. mori* decreased between days 1–21, but no deaths occurred from days 22–31.

In conclusion, broiler chicken feed has the potential to be an alternative feed for silkworms when mixed with mulberry leaves. This is supported by the results of this study, which show that among the mixed feed treatments, the average length and width of the silkworms in P6 were the highest and were not significantly different from the control (K) (Tables 1 and 2), and the highest feed consumption (Table 3). This may be because broiler chicken feed has a complete and standardized nutritional composition. According to SNI (8173.3:2015), broiler chicken feed contains a maximum water content of 14%, crude protein of 22%, crude fat of 5%, crude fiber of 6%, amino acids, and metabolic energy of up to 3100 kcal/gram. Therefore, broiler chicken feed can be a suitable alternative feed for silkworms as it has similar nutrient requirements (carbohydrates, protein, and fat) (Kumaidi & Ekastuti 2013). The combination treatment of cassava and mulberry leaves (P5) also showed a good effect on survival and death rates (Tables 4 and 5). This result is interesting because only *S. ricini* has been reported to prefer cassava leaves as food (Prijono et al. 2023). Further research to determine the causes and relationship between cassava leaves and *B. mori* is highly warranted.

CONCLUSION

Mulberry leaves are the primary feed source for silkworms (*B. mori*). Castor leaves, cassava leaves, and broiler chicken feed (without a mixture of mulberry leaves) cannot be used as the primary feed for silkworms. However, a mixture of mulberry leaves with other types of feed, such as castor leaves, cassava leaves, and broiler chicken feed, can be used as an alternative feed if the supply of mulberry leaves is limited or scarce. Based on the findings of this study, the recommended mixture is broiler chicken feed combined with mulberry leaves (as it supports good growth in length and width and the highest feed consumption) and a combination of cassava and mulberry leaves (as it supports the highest survival rate and the lowest death rate).

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REFERENCES

Agustarini R, Andadari L, Minarningsih, Dewi R. 2020. Conservation and breeding of natural silkworm (*Bombyx mori* L). *IOP Conference Series: Earth and Environmental Science*. 533:1–14. DOI: https://doi.org/10.1088/1755-1315/533/1/012004.

Aisah, Muridin, Parmaji. 2017. Potensi produksi pakan ulat sutera alam (*Attacus atlas*) di Kecamatan Belitang Mulya Kabupaten Oku Timur. In: *Prosiding Semnas IIB Darmajaya (Bandar Lampung, 25 Oktober 2017)*. pp. 487–509. Bandar Lampung: IIB Darmajaya.

Arifin Z, Endrawati Y. 2023. Karakterisasi kualitas floss ulat sutera eri (*Samia cynthia* ricini) [Abstract]. Available at: http://repository.ipb.ac.id/handle/123456789/122714 [accessed 4 Mei 2024].

Borah SD, Saikia M, Boro P. 2020. Rearing performance of two selected eco-races of eri silkworm (*Samia ricini* Donovan) fed with castor and borpat leaves during spring and autumn season in Assam. *Journal of Entomology And Zoology Studies*. 8:1921–1925.

Endrawati YC, Fuah AM, Ramadhan RD. 2020. Produktivitas ulat sutra (Samia cynthia rinici) yang diberi pakan daun berbeda [Abstract]. Available at: http://repository.ipb.ac.id/handle/123456789/101754 [accessed 4 April 2024].

Faradilla E, Erni M, Adelia JK, Arini R. 2022. Budi daya ulat sutera dengan pemberian pakan daun murbei hasil kultur in vitro terhadap kualitas kokon dan benang sutera. *Jurnal Hutan Tropis*. 6:1–8. DOI: http://dx.doi.org/10.32522/ujht.v6i1.5833.

Farhaeni M, Guntar EL, Martini L. 2022. Analysis prospects for future development of silk sari because of agrotourism activities. *Jurnal Ekonomi dan Bisnis Jagaditha*. 9:139–153. DOI: https://doi.org/10.22225/jj.9.1.2022.139-153.

Hapsari DGPL, Fuah AM, Endrawati. 2018. Produkivitas ulat hongkong (*Tenebrio molitor*) pada media pakan yang berbeda. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan*. 6:53–59.

Harishkumar J, Kumara RR, Kiran NR, Ravikumara K, Metha V. 2023. Silkworm: Diversity and advances in silk production. In: *Diversity and Advances in Silk Production*. Walnut publication.

Hailu A. 2016. Assessment of growth and performance of silk worms (*Bombyx mori* L.) on mulberry leaves at Jimma. *South West Ethiopia*. 6:10–16.

Hemmatabadi RN, Seidavi A, Gharahveysi S. 2016. A review on correlation, heritability and selection in silkworm breeding. *Journal of Applied Animal Research*. 44:9–23.

DOI: https://doi.org/10.1080/09712119.2014.987289.

Kumaidi A, Ekastuti DR. 2013. Pertumbuhan dan produktivitas ulat sutera *Bombyx mori* L. yang diberi pakan ayam broiler. *Acta Veterinaria Indonesiana.* 1:1–7. DOI: https://doi.org/10.29244/avi.1.1.1-7.

Nofandra MH. 2009. *Efek Substitusi Daun Murbei (Morus alba) dengan Daun Jarak Pagar (Castor curcas) dalam Pakan terhadap Bobot, Berat dan Kualitas Kokon Ulat Sutera (Bombyx mori).* [Thesis]. Malang: Universitas Brawijaya.

Onaga L. 2021. 8 A Matter of taste: Making artificial silkworm food in twentieth-century Japan. In: *Engineering Life, Envisioning Worlds*. pp. 115–134. Chicago: University of Chicago Press. DOI: https://doi.org/doi:10.7208/chicago/9780226783574-009.

Prijono, A, Rawana, Nugroho, YH. 2023. Budidaya ulat sutera daun singkong hasil agroforestry sederhana di Widodomartani Ngemplak Sleman Yogyakarta Indonesia. *Jurnal Wana Tropika.* 13:44–51.

Rompas JJI, Kiroh HJ, Kawatu MMH, Rotinsulu MD. 2023. *Mengenal Lebah Madu (Apis spesies).* Manado: Penerbit Yayasan Bina Lentera Insan.

Rostina, Musa CI, Kurniawan AW, Gani HA. 2018. Determinant factors affecting the business performance of silk enterprises in Wajo Regency. *Advances in Social Science, Education and Humanities Research.* 226:1153–1156. DOI: https://doi.org/10.2991/icss-18.2018.242.

Shakilla A, Zamarudah Z, Rahmasari DA, Aini SN, Mardiyani SA. 2022. Pelatihan pemanfaatan daun jarak (*Ricinus communis*) sebagai pakan ulat sutera eri. *Cendekia: Jurnal Pengabdian Masyarakat.* 4:7–12. DOI: https://doi.org/10.32503/Cendekia.v4i1.2118.

Singh H, Kumar A, Anjana, Kumar L. 2018. Age specific lige table of mulberry silk worm *(Bombyx mori* Linneaus race Nistari) on the different cultivar of mulberry silk. *Journal of Pharmacognosy and Phytochemistry.* 7:18–21.

Tanjung M. 2022. Growth and productivity of silkworm *Bombyx mori* L. (Lepidoptera: Bombicidae) given mulberry (*Morus* sp.) it contains vitamin B1. *International Journal of Ecophysiology*. 3:153–161. DOI: https://doi.org/10.32734/ijoep.v3i2.10092.

Taufika R, Sumarmi S, Hartatie D. 2022. Pemeliharaan Ulat grayak (*Spodoptera liturina* Fabricius) (Lepidoptera: Noctuidea) menggunakan pakan buatan pada skala laboratorium. *AGROMIX.* 13:47–54. DOI: https://doi.org/10.35891/agx.v13i1.2866.

Wei L, Zhong J, Xu Y. 2019. Effect of different diets on the cocooning performance of silkworm (*Bombyx mori L.). Modern Agricultural Science And Technology.* 3:105–107.

Yang H, Lu Y, Zhang Z, Li B, Zhao P. 2015. The influence of different feeds on the cocooning performance of silkworm (*Bombyx Mori*). *Sericologia*. 55: 423–431.

Zhang Y, Guo J, Ren Z, Liu C, Pan G. 2017. Effects of different diets on silkworm growth and silk quality. *Journal of Textile Research.* 38:123–127.