Effect of Gamal Leaves Extract (*Gliricidia sepium*) on Growth Rate and Feed Conversion Ratio of Bileh Fish (*Rasbora* sp.)

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Abstract. This study aimed to determine the effect of adding gamal leaf extract in artificial feed on the growth rate and feed conversion ratio of bileh fish (*Rasbora sp.)*. The method used in this research is the experimental method, with Completely Randomized Design experimental design. There were four treatments (P) given, with three replicates. The treatments were gamal leaf extract added to artificial feed at different doses, control/P1 = 0 ml/kg, P2 = 10 ml/kg, P3 = 20 ml/kg and P4 = 30 ml/kg feed. The research steps included the preparation of research containers, experimental fish, preparation of extracts and feed, maintenance of fish-fed experimental feed and collection of research data. Parameters calculated and evaluated included SGR (specific growth rate), ALG (absolute length growth), FCR (feed conversion ratio), and SR (survival). Data analysis used statistics (Anova). The results showed that the addition of gamal leaf extract had a significant effect on SGR, PPM, and FCR parameters ($P < 0.05$) but did not have a significant effect on SR parameters ($P > 0.05$). The best treatment was P4 (30 ml/kg) with SGR 1.57%, PPM 1.19cm, FCR 3.09 and SR 91.11%.

Keywords: Gamal leaves · feed · growth · bileh fish

1 Introduction

Bileh fish (*Rasbora* sp) is a local fish that lives in the fresh waters of Aceh province, Indonesia. Fish of the *Rasbora* genus are scattered in various parts of Indonesia and can be found in the waters of the islands of Sumatra, Java, Kalimantan and Sulawesi [1]. Bileh fish in each region has its own name based on the region, such as on the island of Java it is called 'wader' fish and on the island of Sumatra it is called 'bada' fish, 'seluang' fish, or 'pantau' fish. There are many species of the *Rasbora* genus. Several types of Rasbora fish are endemic, such as *Rasbora tawarensis* which is only found in

M. Fadilah et al. (Eds.): IcoBioSE 2021, ABSR 32, pp. 481–489, 2023.
https://doi.org/10.2991/978-94-6463-166-1_58

the freshwater lakes of Central Aceh [2] and *Rasbora maninjau* which is only found in Maninjau lake, West Sumatra [3].

Morphologically, *Rasbora* fish has an elongated body shape, slightly flattened on the ventral side and bulging dorsally. *Rasbora* fish can reach 16 cm in length and weight of 15–20 g, with habitats in lakes and rivers [4]. Some of the fish of the *Rasbora* genus that have been successfully cultivated are: *Rasbora Lateristriata* [5], *Rasbora Argyrotaenia* [6] and *Rasbora Tawarensis* [7]. This small fish has the potential to be developed as a new candidate for aquaculture biota.

Fish growth is strongly influenced by the feed given. Quality feed with complete nutrition and high protein will support the maximum growth rate of fish. The obstacle in the cultivation business or the production of aquaculture biota is the high price of feed, with details of the total cost of feed production reaching 70–80% [8]. Feeds with high protein content are expensive in the market because these feeds use animal raw materials in pellet production. Utilization of local raw materials from vegetable sources is an alternative, so that the cost of producing artificial feed is more efficient. One of the local vegetable raw materials that can be used to increase feed protein is gamal leaf (*Gliricidia sepium*).

Gamal leaf is a high protein green material, which has the potential to reduce dependence on fish meal in artificial feed production. *Gliricidia sepium* contains 20–30% crude protein, 15% crude fiber, and 60–65% digestibility [9]. Olopade *et al.*, [10] reported that gamal leaves contain protein = 16.88%, crude fiber = 16.97%, ash content = 10.37%, calcium = 0.20%, phosphorus content = 0.40%, and gross energy of 3.01% based on dry weight. The results of the research by Apriani *et al.*, [11] reported gamal leaves added in artificial feed (75% gamal leaves and 25% commercial feed) had an effect on the growth of gouramy fry and could reduce the use of commercial feed. The results of the same study were also reported by Islama *et al.*, [12] which stated that the addition of gamal leaves in artificial feeds had an effect on the growth and conversion ratio of tilapia seed feed. There is no research on the use of gamal leaves on the growth rate of Bileh fish, so this research needs to be done. The aim of this study was to examine the effect of gamal leaf extract in artificial feed on the growth of bileh (*Rasbora* sp.).

2 Methods

2.1 Research Design

The research was conducted from November to December 2021 at the Aquaculture Laboratory of FPIK Universitas Teuku Umar, West Aceh Regency - Indonesia. The study was conducted experimentally using CRD (Completely Randomized Design) with one treatment factor. Four treatments (P) were given, with three replications (U). The treatments were gamal leaf extract added to artificial feed at different doses, control/P1 = 0 ml/kg, P2 = 10ml/kg, P3 = 20 ml/kg and P4 = 30 ml/kg feed.

2.2 Research Procedures

The container used was an aquarium measuring 60 x 40 x 40 cm^3 as many as 12 pieces for the maintenance of bileh fish. The aquarium must be clean and sterile from disease.

Each aquarium was installed with aeration to supply dissolved oxygen (DO). Bileh fish (*Rasbora* sp.) was obtained from the Unit Pembenihan Rakyat (UPR) Mina Mandiri, Nagan Raya Regency. The fish used were long, ranging from 2.5 to 2.7 cm. Fish brought from UPR were acclimatized in advance for 3 days in the laboratory. Each aquarium was filled with 30 fish/container with a total of 360 fish used.

The artificial feed used was commercial feed with low protein content. This low protein feed was used to see the extent to which gamal leaf extract could increase feed protein. Gamal leaves obtained from the West Aceh region were dried in the sun, then the dried gamal leaves were mashed with a blender so that they became powdered gamal leaves. The extraction process used the maceration method. The results of gamal leaf extract were sprayed onto artificial feed according to the experimental design. While the feed was dried in the sun to dry. Furthermore, the proximate test was carried out on feed that was ready to be added to extract at the Laboratory of Food and Agricultural Product Analysis, Syiah Kuala University. The amount of feed given to the bileh fish was 5% of the weight of the biomass fish, with feeding times at 08.00 am, 01.00 pm and 06.00 pm.

Provision of artificial feed with additional extracts was carried out during the fish rearing period, which was 40 days. The quality of the maintenance water was controlled by siphoning when it was dirt. Water replacement was done when the water was cloudy. Observations and data collection were carried out on the first day (beginning of the study) once a week and the last day of the study. The data were taken and evaluated according to the research parameters.

2.3 Research Parameters

2.3.1 Specific Growth Rate (SGR), SGR Calculation Refers to Aggraeni and Abdulgani [13]:

$$\mathrm{SGR}(\%/\mathrm{day}) = \frac{\ln Wt - \ln W0}{\mathrm{t}} x100$$

where: ln Wt = weight of fish at time t (grams), ln W0 = weight of fish at time 0 (grams), t = day of observation.

2.3.2 Absolute Length Growth (ALG), the Calculation of ALG Refers to Aggraeni and Abdulgani [13]:

$$\mathrm{ALG(cm)} = \mathrm{Lt} - \mathrm{Lo}$$

where: Lt= length of fish at the end of rearing (cm), Lo= length of fish at the beginning of rearing (cm)

2.3.3 Feed Conversion Ratio (FCR), FCR calculation Refers to Djajasewaka [14]:

$$FCR = \frac{\mathrm{F}}{(\mathrm{Wt} + \mathrm{D}) - Wo}$$

where: *Wo* = weight of fish at the beginning of the study (grams), Wt = weight of fish at the end of the study (grams), D = weight of dead fish (grams), F = amount of feed given/consumed during the study (grams).

2.3.4 Fish survival rate (SR), SR Calculation Refers to Goddard [15]:

$$SR(\%) = \frac{\text{Finalnumberoffish(individual)}}{\text{Initialnumberoffish(individual)}} x100$$

2.4 Data analysis

The research data were collected and tabulated using Microsoft excel, then the data were tested for normality and homogeneity. If the data were homogeneous, then the data were tested statistically (Anova). If the test showed a significant effect ($p < 0.05$), then Duncan's further test was carried out at a 95% confidence level. Data analysis used SPSS 21.0 software.

3 Results and Discussion

Gamal leaf extract added to artificial feed affects bileh fish (*Rasbora* sp.). The effect of bileh growth is seen from the growth parameters SGR and ALG. SGR values ranged from 0.74–1.57%. Based on ANOVA analysis, gamal leaf extract significantly affects the SGR parameter of bileh fish ($P < 0.05$). Furthermore, the ALG values ranged from 0.97 to 1.19 cm. Based on ANOVA analysis, gamal leaf extract significantly affects the ALG parameter of bileh fish ($P < 0.05$). Duncan's follow-up test results were significantly different in the treatment of SGR and ALG parameters. The research data from SGR and ALG show a multilevel pattern, where the higher the dose of gamal leaf extract given, the better the growth (SGR & ALG). Furthermore, the SGR and ALG data are presented in Fig. 1 below.

The FCR values of bileh fish fed with gamal leaf extract in artificial feed ranged from 3.09 to 4.18. The results of statistical analysis (Anova) showed that the extract of gamal leaves had a significant effect on the FCR of bileh fish ($p < 0.05$). Furthermore, Duncan's further test was carried out on the FCR of bileh fish. The results of the analysis showed that treatment P2, treatment P3, and treatment P4 did not show significant differences, but the three treatments were significantly different from treatment P1. The survival rate ranged from 87.78 to 91.11%. The results of the statistical test (Anova) showed that the addition of gamal leaf extract in artificial feed did not significantly affect the survival rate of bileh fish ($p > 0.05$) (Fig. 2).

Artificial feed that has been added with gamal leaf extract is tested proximate. The test results showed that protein, carbohydrate and other levels were different in each treatment. The highest protein content was found in P4 with 29.92% and the lowest was 25% in P1 (without the addition of gamal leaf extract). The highest carbohydrate content was in P4 with 50.02% and the lowest was 47.75% in P1 (without the addition of gamal leaf extract). The highest fat content was found in P4 with 4.43% and the lowest was

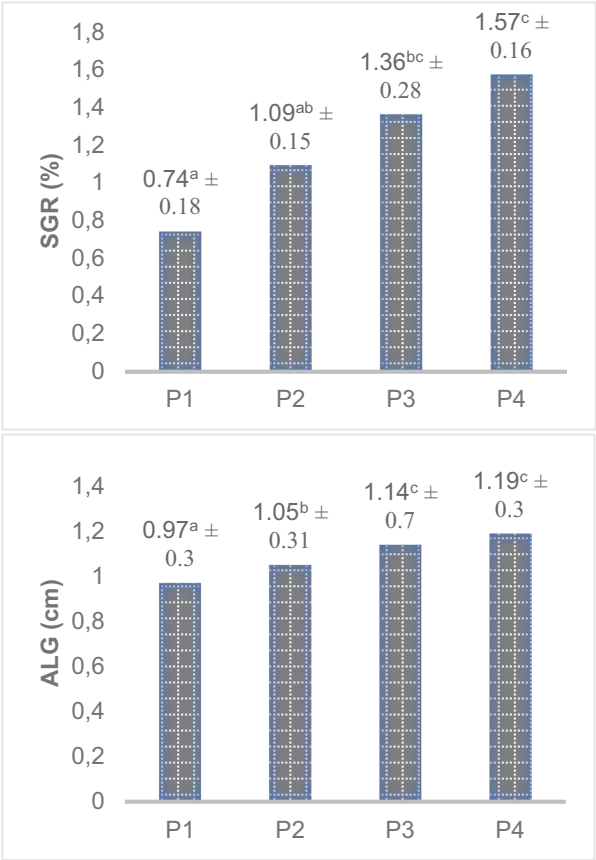

Fig. 1. SGR and ALG values of bihed fish given gamal leaf extract in artificial feed. Note: Different superscript letters in the figures above show significant differences ($p < 0.05$).

4.13 in P1 (without the addition of gamal leaf extract). The treatment with the addition of gamal leaf extract contained higher protein when compared to without the addition of extract. Proximate test data shows the potential for utilizing gamal leaves as an additional ingredient to increase protein levels in artificial feed. Gamal leaves are easy to obtain and widely available in nature, farmers can utilize gamal leaves to reduce the price of high protein feed. Further proximate test data are presented in Table 1 below.

Based on the research data, gamal leaf extract influenced specific growth rate, absolute length growth, and feed conversion ratio but did not affect bileh survival. The growth of bileh fish occurs due to the positive impact of optimal rearing environmental conditions and the provision of gamal leaf extract. The highest SGR and ALG growth values were found in the P4 treatment with a value of 1.57% and 1.19 cm, respectively. While the lowest values of SGR and ALG were found in treatment P1, namely 0.74% and 0.97 cm, respectively. The difference in the growth value of bileh fish could be caused by the ability of fish to consume and utilize feed nutrients which were then converted

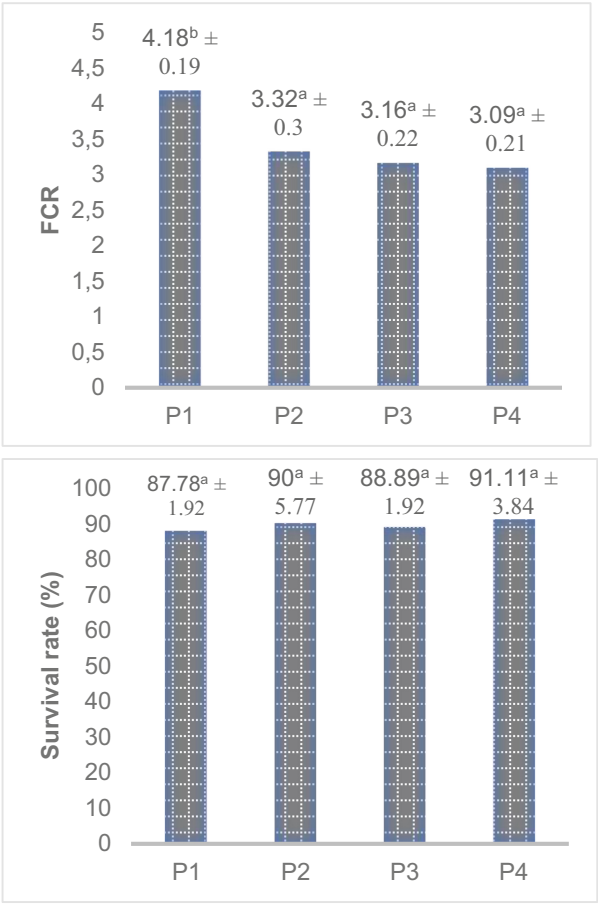

Fig. 2. FCR value and survival rate of bileh fish given gamal leaf extract in artificial feed. Note: Different superscript letters in the figures above show significant differences ($p < 0.05$).

into energy for growth. Aggraeni and Abdulgani [13] in their research explained that high or low SGR values were related to the ability of fish to utilize feed nutrients to be stored in the body and convert them into energy. In addition, the difference in growth in this study was also caused by the protein content in the feed. The protein value content in the treatment of the addition of extracts (P2, P3, P4) had a higher level of value when compared to P1. This was due to the addition of gamal leaves extract at P2, P3 and P4, so that an increase in protein content occurred in the feed. The highest protein content was found in treatment P4 with a value of 29.92% and the lowest in treatment P1 of 25.02% (Table 1 Proximate test results of feed). The high and low levels of protein in the feed will affect the growth rate of fish [12]. The use of Gamal leaves had a positive impact on the growth of bileh fish. This is in line with the research of Apriani *et al.*, [11] and Islama *et al.*, [12] explained that the use of gamal leaves in artificial feed will

Table 1. The proximate test results data

Parameter	Treatment			
	P1	P2	P3	P4
Protein Content (%)	25,02	25,65	26,35	29,92
Carbohydrate Content (%)	47,75	49,62	50,28	50,02
Fat Content (%)	4,13	4,38	5,17	4,43
Fiber Content (%)	2,1	2,26	2,17	1,98
Water Content (%)	9,25	11,82	10,94	8,07
Ash Content (%)	6,28	6,28	5,09	5,58

have a positive effect on the growth of gouramy (*Osphronemus gourami*) and tilapia (*Oreochromis niloticus*) seeds.

The FCR value is the ratio of the weight of the feed given and the resulting body weight. The greater the FCR value, the more feed needed to produce 1 kg of fish meat [16]. The lowest FCR value was found in treatment P4 with a value of 3.09 and the highest was in treatment P1 with a value of 4.18. The FCR values obtained in this study were still relatively high. The high FCR value was caused by the bileh fish which were still in the domestication process, so the fish needed time to adapt and adjust to the type of feed given [17]. Variations in FCR values occurred due to the ability of the fish's body to process metabolism and the fat content contained in the treated feed (Table 1 Proximate test results). According to Fitriani *et al.*, [18], the feed conversion ratio is strongly influenced by the source of fat contained in the feed. The survival rate of fish given gamal leaves extract in the feed had no significant effect. Gamal leaf extract was safe and did not have a negative effect on the survival of bileh fish in all treatment. The highest SR value was found in P4, which was 91.11% and the lowest was in treatment P1, which was 87.78%. The SR value was classified as good in each treatment (> 85%) because the maintenance was carried out in a controlled manner. The survival rate of fish is influenced by the ability of fish to adapt to its environment, good water quality, and the ability to consume the feed provided [19].

4 Conclusion

The addition of gamal leaves extract in artificial feed had a significant effect on the SGR, ALG, and FCR of bileh fish ($p < 0.05$) but had no significant effect on the survival of bileh fish ($p > 0.05$). The best treatment was the addition of gamal leaf extract at a dose of 30 mL/kg of feed (P4), which resulted in an SGR value of 1.57%, ALG of 1.19 cm, FCR of 3.09 and SR of 91.11%. Commercial feeds with low protein content could utilize gamal leaves extract to increase protein levels in feed.

Acknowledgments. This research was carried out through university collaboration research (PKPT) funding in 2021. Research contract number: 002/UN59.7/TL/2021. Thanks to Kemdikbudristek RI for the funding and LPPM-PM UTU for the administrative assistance.

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