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The effect of additional silk worm (*Tubifex sp.)* on artificial feed on the number of larva Guppy fish (*Poecilia reticulata*)

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ABSTRACT

Aquaculture does not only cover consumption fish production, there is also ornamental fish production. Guppy fish *(Poecilia reticulata)* is one of the popular ornamental fish because of its many varieties and easy maintenance and cultivation.The aim of the study was to evaluate the effect of giving silk worms *(Tubifex sp.)* on spawning parent guppy *(Poecillia reticulata)* and to analyze the appropriate dose of silk worms on spawning brood guppy (*Poecillia reticulate*). This study used an experimental method with the addition of tropical almond leaf powder. The experimental design used was a completely randomized design (CRD) consisting of 5 treatments, namely treatment P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, silk worms). 10%), P3 (85% artificial feed, 15% silk worms), P4 (80% artificial feed, 20% silk worms) and each treatment was repeated 3 times. The results showed that the addition of silk worms *(Tubifex sp.)* in artificial feed significant effect on the parameters of absolute weight growth of broodstock, feed conversion ratio, gonadosomatic index, and the number of larvae produced. Meanwhile, the survival rate parameters for both broodstock and guppy larvae had no significant effect.The highest average value of each parameter occurred in the P4 treatment.

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1. Introduction

Aquaculture does not only cover consumption fish production, there is also ornamental fish production. Fish cultivation for ornamental purposes has a high commodity value. The ease of maintaining freshwater ornamental fish is one of its advantages (Lesmana, 2009). Guppy fish

(Poecilia reticulata) is one of the popular ornamental fish because of its many varieties and easy maintenance and cultivation. Guppies male like the male betta fish *(Betta splendens)* has a more attractive morphology than the female betta fish *(Betta splendens)*. Both in domestic and international markets, this fish has a high commercial value (Sarida et al., 2011 in To'bungan, 2017). Market demand for ornamental fish, especially guppy fish, continues to increase both domestically and abroad, and the available stock is not sufficient to meet this demand, so it is necessary to increase production to meet market demand.

Gonadal development and fecundity that can be regulated by parental nutrition is one strategy to increase production. The composition of broodstock feed has recently received a lot of attention for various types of fish (Bromage, 1995 in Alwi, 2015). The feed selected to support the gonadal maturation and fecundity process must meet various criteria, including ease of access, low cost, and nutritional content (Fadli, 2016).

Silkworm *(Tubifex sp.)* is a natural food commonly used in ornamental fish cultivation. Silkworms *(Tubifex sp.)* were chosen as natural food because apart from having a relatively cheap price, they also have high nutritional content. Silkworms contain protein and fat which are high enough to be used as natural food to increase the reproduction of guppies *(Poecillia reticulata).* Therefore, based on the above background, this research was carried out so that the authors could find out whether the administration of silk worms *(Tubifex sp.)* with different percentages could affect the number of guppy fish *(Poecillia reticulata)* larvae.

The research aims to evaluated the effect of giving silk worms *(Tubifex sp.)* on the spawning of brood guppy *(Poecillia reticulata)*and to analyze the appropriate dose of silk worms for spawning guppies *(Poecillia reticulate)*. And the benefits obtained in this study are that it can provide information and data about the use of silk worms as natural food that can increase fecundity or the number of guppy fish *(Poecillia reticulata)* larvae.

2. Material and methods

2.1 Time and place

This research was conducted for 49 days at the Aquaculture Laboratory, Department of Fisheries and Marine Sciences, Faculty of Agriculture, University of Mataram.

2.2 Tools and materials

The tools and materials used in this research are: Aerator, Aquarium, Silk worms, DO meter, Hp/camera, Parent guppies, Artificial feed, PH meter, Hanna checker, Sipon Hose, Ammonia test reagent, Sewer, Thermometer, Digital scale

2.3 Research methods

1. Treatment

The research design used was a completely randomized design (CRD) consisting of 5 treatments with 3 replications for each treatment so that 15 experimental units were obtained, including:

P0: 100% artificial feed/control
P1: 95% artificial feed, 5% silk worms.
P2: 90% artificial feed, 10% silk worms.
P3: 85% artificial feed, 15% silk worms.
P4: 80% artificial feed, 20% silk worms.

2. Adaptation Stage

Before starting this research, the process of adapting the biota to the environmental conditions at the research site and the feed to be tested was carried out. The water used in this research is taken from wells that have been deposited for 2-3 days and have been filtered. This adaptation process takes one week to complete.

3. Trial Unit

An aquarium measuring 30x30x30 with a total of 15 units was used as an experimental unit. Each experimental unit has three fish in one aquarium with a ratio of 2:1. Before using the aquarium, the aquarium is thoroughly cleaned to prevent the spread of disease pathogens such as bacteria and fungi that can harm the test animals. After that, fill the aquarium with water. The test water must be put into the tank before being poured into the test aquarium.

4. Guppy Fish Care

The maintenance of guppy fish in this study was divided into 3 stages, namely as follows:

a. Parent Maintenance

Parent guppies used in this study amounted to 75 fish, with a stocking density of 10 fish per aquarium for male fish and 5 fish per aquarium for female fish. Feed is given as much as 5% of body weight with a frequency of twice a day, at 08.30 and 16.30.Feeding is given according to the treatment. Parent rearing was carried out for 3 weeks.

b. Spawning

After 3 weeks of rearing the male and female parents were moved into breeding containers with a ratio of 2 males and 1 female, for feeding according to the treatment continued until the guppies gave birth. The spawning process for brood fish is carried out for 2 weeks.

c. Larvae Maintenance

After the guppy fish larvae are born, they are immediately separated from the mother. The feed given to the larvae is silk worms that have been mashed so that they match the larva's mouth opening, for feeding it is given on an ad-libitum basis. with a frequency of twice a day, at 08.30 and 16.30. Larval rearing was carried out for 2 weeks.

Quality control (temperature, pH, DO, ammonia, and temperature) is carried out once a week. Every morning before feeding, siphoning is carried out, replacing up to 20% of the total water in the tank. Every day during the study period, fish health was monitored, namely by studying the behavior of guppies. Unhealthy fish usually have a smaller appetite and are less aggressive.

5. Observation Variable

a. Survival Rate (SR) Parent and Larva

According to Effendi (1997) in Saputra (2018), the survival rate (SR) can be estimated by applying the formula to calculate the number of live fish at the end of the treatment.

$$SR=(Nt/No)\times 100\%$$

Information:
SR = Degree of survival (%)
Nt = At the end of the rearing process, the total number of live fish (tails) is calculated
No = At the beginning of the maintenance process, count the number of live fish (tails)

b. Parent Absolute Weight Growth

According to Effendi (1997) in Saputra (2018), said absolute weight growth can be expressed by the formula:

$$G = Wt-Wo$$

Information:
G = Absolute Weight Growth
Wt = Average fish weight at the end (gr)
Wo = Average weight of fish at the beginning (gr)

c. Feed Covertion Ratio (FCR) Parent

The feed conversion ratio is calculated according to Effendie (1997) in Saputra (2018), as follows:

$$FCR = F/((Wt+D)- Wo)$$

Information:
FCR = Feed conversion ratio
F = total amount of food provided (gr)
Wt = Total weight of fish at the end of the study (gr)
Where = initial total weight of fish (gr)
D = Weight of dead fish in the study (gr)

d. Gonado Somatic Index (GSI) Parent

The Gonado Somatic Index was calculated according to Abarike & Yeboah (2016) in Setyaningrum & Eko (2016), as follows:

$$GSI = (\text{Gonad Weight})/(\text{Total Body Weight}) \times 100\%$$

e. Number of Guppies Larvae *(Poecillia reticulata)*

Parent guppies that have given birth, are separated between the parent guppy fish and their larvae. These guppy fish larvae were placed in different containers and then the number of larvae produced by the guppy fish was calculated.

f. Water quality parameters

Water quality has a major effect on the survival of fish, and also has an indirect impact on the reproduction of guppies. The water quality parameters observed in this study were DO, Ammonia, Ph, and Temperature.

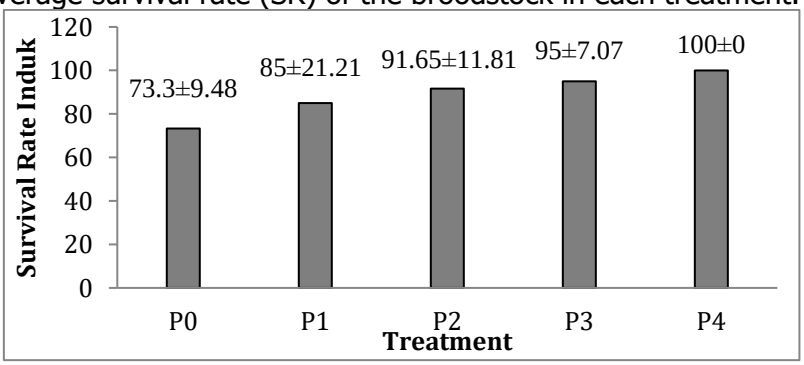
2.3 Data Analysis

Data obtained first analyzed for normality with the normality test. Furthermore, by using the homogeneity test, the data that had been checked for normality were retested for homogeneity. If the data is judged to be abnormal or inhomogeneous, the data transformation is performed before checking for variance. Meanwhile, if the data obtained are normal and homogeneous, analysis of variance can be used to test the diversity.

3. Results and Discussion

3.1 Survival Rate (SR) Parent Guppy Fish (Poecillia reticulate)

The results of the study showed that during the 21 day rearing period there was a difference in the average survival rate (SR) of the broodstock in each treatment. (Figure 1)



Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

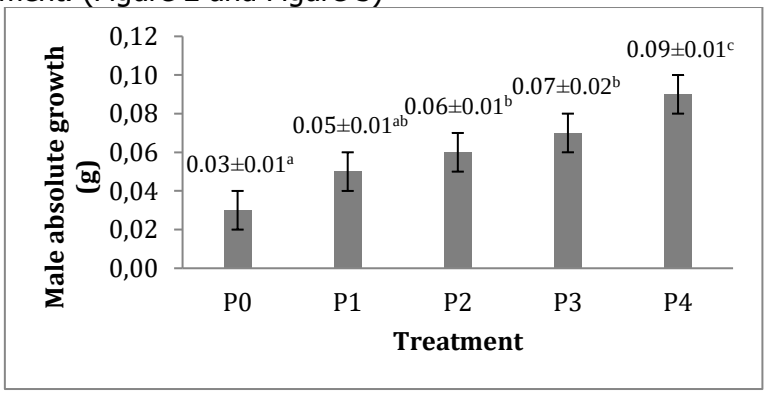
Figure 1. Parent SR Survival Rate

From the results obtained after the study, the lowest parent SR value occurred in treatment P0 73.3% and the highest SR value occurred in treatment P4 at 100%. In treatment P1, P2, and P3 there were also deaths, but not as much as in treatment P0. After the ANOVA test, the data

obtained during the study showed insignificant results (> 0.01). The number of maternal guppy (Poecillia reticulate) deaths occurred at the beginning of the study, this is thought to be caused by the mother guppy fish experiencing stress due to not being able to adapt well.According to Renita (2016), survival rates >50% are considered good, 30-50% are considered moderate, and less than 30% are considered bad. Fish adaptation to food and habitat, health status, stocking density, and water quality that supports fish growth all play a role in survival rates.

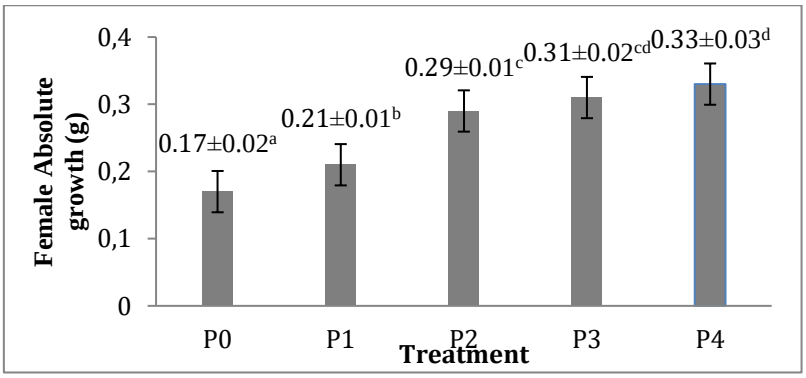
3.2 Absolute Weight of Male and Female Parent

The results showed that during the 21-day rearing period there was a difference in the average growth in the absolute weight of the male parent and the absolute weight of the female parent in each treatment. (Figure 2 and Figure 3)



Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

Figure 2. Graph of absolute weight of male parent



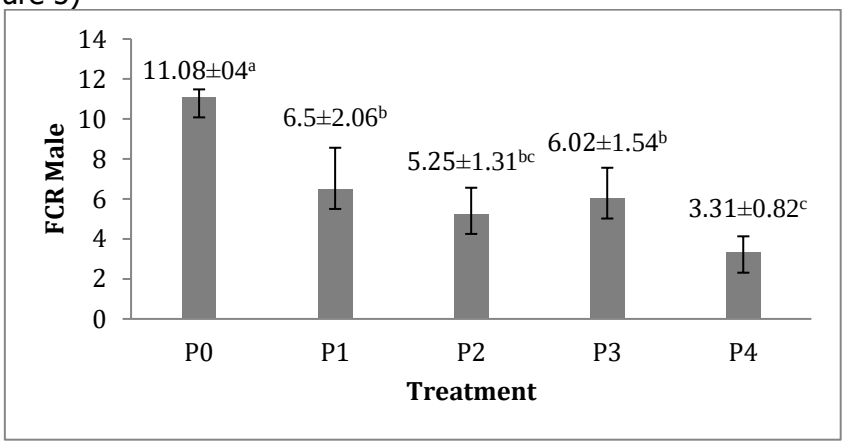
Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

Figure 3. Graph of absolute weight of female parent

The absolute weight growth value can be seen in 2. Graph of Absolute Weight of Male Parent and Figure 3. Graph of Absolute Weight of Female Parent Based on the results obtained during the study, the highest absolute weight growth of male parent was in treatment P4 with an average value of 0.09 grams and a value of 0.09 grams. The lowest average occurred in the P0 treatment with an average value of 0.03 grams. In females, the highest absolute weight growth average value was found in P4 treatment with an average value of 0.33 grams, while the lowest value occurred in P0 treatment with an average value of 0.17 grams. The high growth yield in the P4 treatment both in male and female parents, According to Anggraeni, (2013) in Rihi, (2019) The availability of protein in feed has a direct impact on fish growth. Protein is a source of energy and minerals that fish need for growth.

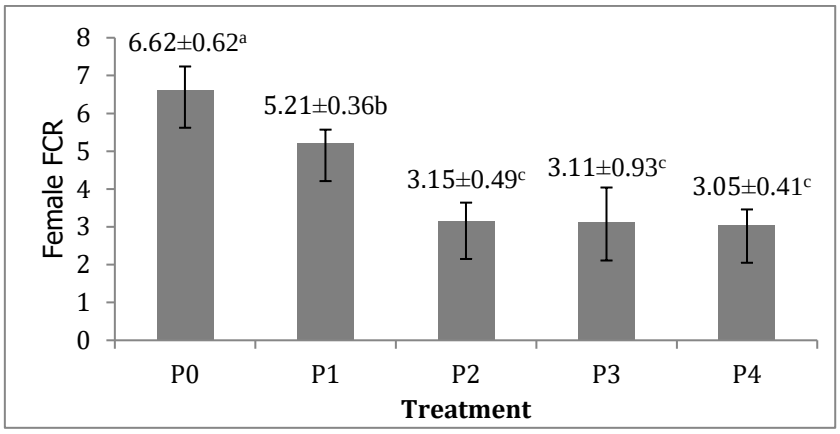
3.3 Feed Conversion Ratio (FCR) Male and Female Parent

The results showed that during the 21 day rearing period there were differences in the average value of the Feed Conversion Ratio (FCR) of male and female parents in each treatment. (Figure 4 and Figure 5)



Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

Figure 4. Male parent FCR



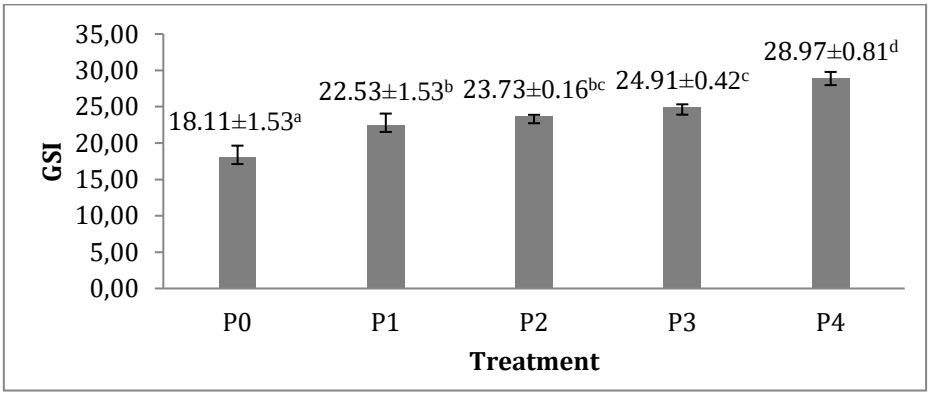
Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

Figure 5. Female parent FCR

From the results of the study on male broods, it can be seen in Figure 5. The FCR graph of Male Parent found that the highest conversion value was found in treatment P0 with an average feed conversion value of 11.08, and the lowest feed conversion value occurred in treatment P4 with an average conversion value of 3.31. The results of the study on the female parent can be seen in Figure 7. The female parent FCR graph also found similar results where the highest feed conversion value was found by treatment P0 with an average value of 6.62 and the lowest conversion value was found in treatment P4 with an average value an average of 3.05. From these results it can be assumed that the low conversion value in P4 treatment (80% artificial feed and 20% silk worms) was due to the addition of silk worms in the treatment, so that the parent guppy more quickly digests the feed given so as to increase its growth. According to Idawati et al., (2018) Silkworms have a softer body structure so they are easier to digest by seeds. The silkworm body has a softer structure so it is preferred.

3.4 Gonadosomatic Index (GSI) Parent

The results showed that during the 21-day rearing period there was a difference in the average Gonadosomatic Index (GSI) value for each treatment. (Fig. 5)



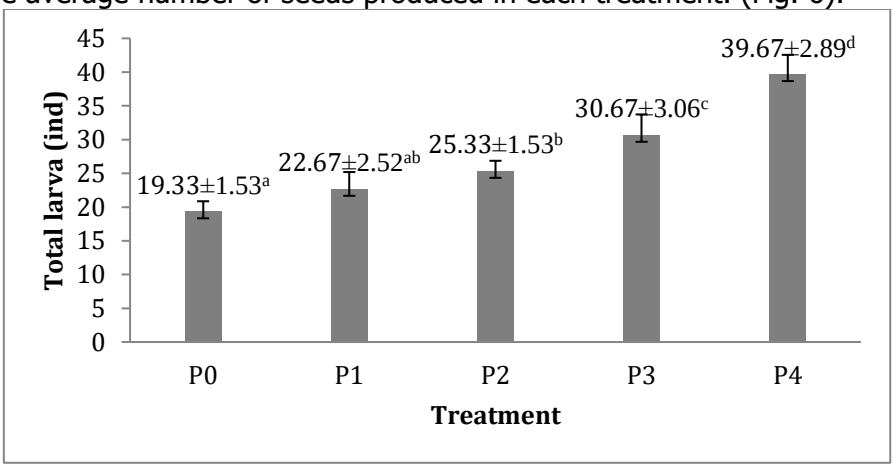
Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

Figure 5. Gonad somatic index (female)

From the results of the research that has been carried out, it shows that the average gonadosomatic index value in each treatment is different where the lowest value occurs in treatment P0 with an average gonadosomatic index value of 18.11%, and the highest gonadosomatic index value occurs in the treatment P4 with a value of 28.97%. This is thought to be due to the nutritional content contained in P4, especially the high protein content so that it can affect the level of gonad maturity. According to Sotolu, (2010) in Kusuma (2016) stated that the protein content of feed affects the increase in gonadal size and weight of the gonads besides Akankal et al., (2011) in Kusuma (2016) stated that catfish parent to produce yolk must be fed containing protein, fat, calcium and phosphate.

3.5 Number of Larva

The results showed that during the 14 days of the parent spawning period there was a difference in the average number of seeds produced in each treatment. (Fig. 6).



Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

Figure 6. The number of larvae

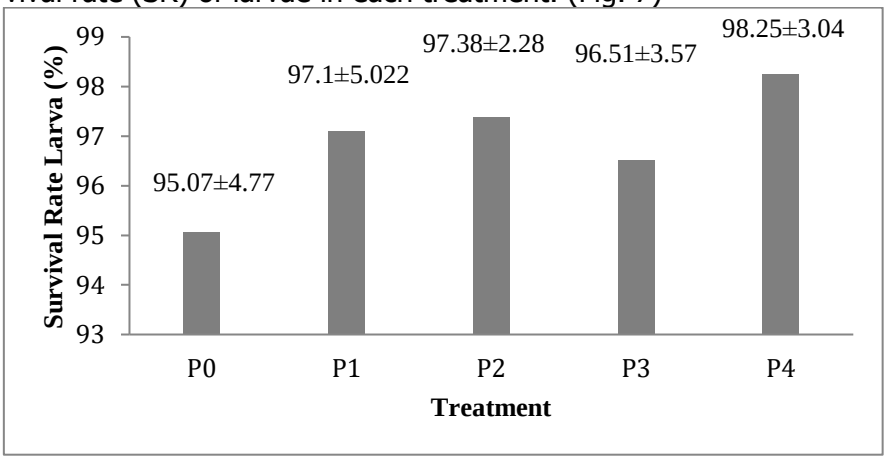
From Fig. 8 Graph of the number of larvae can be seen that the treatment P0 (control) had the lowest average number of seeds with a value of 19.33. Meanwhile, the highest average number of tillers occurred in P4 treatment (80% artificial feed and 20% silk worms) with an average value of 39.67. This is presumably because silk worms (*Tubifex sp.)* have a fairly high nutritional content, especially protein and fat content so that silk worms can be used as natural food to increase the fecundity of guppy fish (*Poecillia reticulate*), according to Wijayanti, 2010 in

Putri, 2018 silk worms have Nutrient content in the form of crude protein 64.47%, crude fat 17.63%, ash 7.48%, BETN 10.06% and water content 11.21%.

The most vital nutrient for growth, reproduction, and other body activities is protein (Madu, 1989 in Alawi, 2015). Fish also use protein as an energy source (Machiel and Henkel, 1987 in Alawi, 2015). This energy is important for oocyte formation and final maturation of the ovary (Jansen et al. 1995 in Alawi, 2015).

3.6 Survival Rate (SR) Larva Guppy *(Poecillia reticulate)*

The results of the study showed that during the 14 days of rearing there was a difference in the average survival rate (SR) of larvae in each treatment. (Fig. 7)



Information: P0 (100% artificial feed/control), P1 (95% artificial feed, 5% silk worms.), P2 (90% artificial feed, 10% silk worms), P3 (85% artificial feed, 15% silk worms), and P4 (artificial feed 80%, silk worm 20%)

Figure 7. Survival Rate of Guppy larvae

From the results obtained after the study, the lowest SR value occurred in treatment P0 of 95.07% and the highest SR value occurred in treatment P4 of 98.26%. However, after the ANOVA test the results obtained did not have a significant effect. This is thought to be due to the larvae of guppy fish *(Poecillia reticulate)* which are less than a month old, cannot adapt to the environment or are attacked by diseases because the body's organ functions do not function properly so they are easy to die. According to Karayucel et al., (2006) in Priyono, (2013), gapi fish kept in an aquarium for 50 days have a survival rate of 70-98 percent. Many deaths are estimated to occur during the larval stage, because at the larval stage fish are very susceptible to death due to poor water quality and disease.

3.7 Water quality

Water quality plays a very important role in the success of fish farming. Water quality measurements including temperature, pH, Do, and ammonia were carried out once a week during the study. The results of water quality measurements during the study can be seen in Table 1.

Parameters	Treatment				
	P0	P1	P2	P3	P4
DO	7.15-7.43	7.20-7.53	7.3-7.6	7.5-7.67	7.53-7.95
Temperature	27.07-28	26.87-28	26.87-28.20	26.8-28.2	26.8-28.2
Ph	6.95-7.7	6.8-7.65	6.7-7.6	6.75-7.6	6.65-7.5
Ammonia	0.08-0.11	0.05-0.09	0.04-0.09	0.03-0.07	0.02-0.04

The temperature range obtained during the study 26.8-28.2ºC. From the results obtained, it can be said that the water temperature during the study was very good for supporting the life of guppies (*Poecillia reticulate*). according to Nelson, (1984) in Primary, (2018) the optimal water temperature range for guppies is 25-28°C. The pH of the water during the study ranged from the results of the measurement of the degree of acidity or pH during the study ranged from 6.65-7.7. From these results, it can be concluded that the dissolved pH content can be said to be optimal to support the life of guppy fish. This statement is reinforced by Boyd (1990) in Primary et al. (2018) which states that the optimal pH range for tropical ornamental fish ranges from 6-9. Dissolved oxygen (DO) The results of the measurement of dissolved oxygen content or DO during the study ranged from 7.15-7.95. From these results, it can be concluded that the dissolved oxygen content can be said to be optimal to support the life of guppy fish, this statement is reinforced by Sukmara et al. (2008) in Ibrahim et al. (2017),For the maintenance of guppies, the dissolved oxygen concentration should not be less than 3 mg/L, and the results of the measurement of ammonia content during the study ranged from 0.02 to 0.11. From these results it can be said that ammonia levels during the study can support the life of guppies. This statement is reinforced by Effendi, (2003) in Malik et al., (2019) which states that ammonia levels <0.2 are quite good and can support the life and growth of guppies.

4. Conclusion

Based on the results of the study it can be concluded that the addition of silk worms *(Tubifex sp.)* to artificial feed had a significant effect on the parameters of absolute weight growth of broodstock, broodstock feed conversion ratio, gonadosomatic index, and the number of larvae produced. Meanwhile, the survival rate parameter for both broodstock and guppy larvae had no significant effect, and the highest average value for each parameter occurred in treatment P4. While the lowest number occurred in the P0 treatment, namely without the addition of silk worms in the artificial/control feed. So it can be said that the best dose of silk worms occurred in treatment P4 followed by treatment P3, P2, P1 and P0.

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