Original article DOI: 10.19027/jai.22.1.27-35

Effect of oodev and turmeric powder dietary supplementations on the reproductive performance of sunset platy fish *Xiphophorus maculatus*

Pengaruh penambahan oodev dan tepung kunyit pada pakan terhadap performa reproduksi ikan plati sunset *Xiphophorus maculatus*

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(Received June 09, 2022; Accepted July 06, 2022)

ABSTRACT

Plati fish is a freshwater ornamental fish with great demand due to its beautiful body shape and color, besides the price is affordable. The main problem faced by plati fish farmers is that the production targets have not been achieved to meet the market needs. This study aimed to examine the effect of the oodev and turmeric powder and the combination of both added into the fish diet on the reproductive performance of plati fish broodstock. The experimental design in this study used a completely randomized design with four treatments, i.e treatment A (control), B (oodev 0.5 ml/kg broodstock), C (turmeric powder 3%/kg feed), and D (oodev 0.5 ml/kg broodstock + turmeric powder 3%/kg feed). There were three replications for each treatment. The observed parameters included the percentage of pregnant broodstocks, the percentage of labored broodstocks, the frequency of labored broodstocks, larvae production, and the survival rate of the larvae. The data were analyzed using ANOVA and further tested with Duncan's test with a 95% confidence level. The results showed that the addition of oodev, turmeric flour, and a combination of both into the feed every one week increased the average production of larvae. Total larval production in all treatments was sorted from the highest in treatment D, B, C, and and the lowest was A treatment with larvae production of 428, 251, 209, and 93, respectively. The addition of oodev 0.5 ml/kg broodstock, turmeric powder 3%/kg feed, and the combination of both into the feed increased larval production three, two, and five times higher compared to the control, respectively. The percentage of survival of the larvae is sorted from the highest in treatment D, B, C, A, i.e. 97.51%, 95.79%, 95.65%, and 93.32%, respectively.

Keywords: larvae, oodev, platy, turmeric powder

ABSTRAK

Ikan plati merupakan ikan hias air tawar yang banyak diminati masyarakat karena memiliki bentuk dan warna tubuh yang indah, selain itu harganya yang terjangkau membuat ikan ini laris di pasaran. Permasalahan utama yang dihadapi pembudidaya ikan plati adalah belum tercapainya target produksi untuk memenuhi kebutuhan pasar. Penelitian ini bertujuan mengkaji pengaruh penambahan oodev dan tepung kunyit serta kombinasi keduanya yang diberi pada pakan terhadap performa reproduksi induk ikan plati. Rancangan percobaan pada penelitian ini menggunakan rancangan acak lengkap dengan empat perlakuan, yaitu: perlakuan A (kontrol), B (oodev 0,5 ml/kg induk), C (tepung kunyit 3%/kg pakan), dan D (oodev 0,5 ml/kg induk + tepung kunyit 3%/kg pakan). Terdapat tiga ulangan pada masing-masing perlakuan. Parameter penelitian yang diamati yakni persentase induk bunting, persentase induk melahirkan, frekuensi induk melahirkan, produksi larva, dan tingkat kelangsungan hidup larva. Data diolah menggunakan ANOVA dan diuji lanjut dengan uji Duncan dengan selang kepercayaan 95%. Hasil menunjukkan bahwa penambahan oodev, tepung kunyit, dan kombinasi keduanya pada pakan setiap satu minggu dapat meningkatkan rata-rata produksi larva yang dihasilkan. Produksi larva total diurut dari yang terbanyak adalah perlakuan D (428 ekor), B (251 ekor), C (209 ekor), dan terendah adalah A (93 ekor). Penambahan oodev 0,5 ml/kg induk, tepung kunyit 3%/kg pakan, dan kombinasi keduanya pada pakan meningkatkan produksi larva sebanyak tiga, dua, dan lima kali dibanding kontrol. Persentase kelangsungan hidup larva diurut dari yang tertinggi terdapat pada perlakuan D (97,51%), B (95,79%), C (95,65%), dan terendah adalah A (93,32%).

Kata kunci: larva, oodev, plati, tepung kunyit

INTRODUCTION

Platy fish is a freshwater fish that has beautiful shape and body with low cost and relatively easy to maintain, which causes this fish is highly demanding in the market. Platy fish can be reared along with other fish in an aquarium due to non-aggressive movement (Fahriza *et al*., 2017). Platy fish can also be used as a live feed type for other ornamental fish, such as arowana, snakehead, red tail catfish, etc. This is because platy fish have a brighter color than other live feed (Junior *et al*., 2005). Based on DJPB (2021), the platy fish production in Indonesia was 44,168 fish in 2020, as further behind the target at 71,683 fish, although has been increasing for many years. However, the increased production is still unable to fulfill the production target. The production target of platy fish in 2019 based on DJPB (2019) was 89,000 fish and 17,800 fish on the first quarter, however the platy fish production on the first quarter was only 10,101 fish. Therefore, an effort to improve the platy fish production is necessary to fulfill the production target. This effort is carried out by hormonal induction and natural ingredient supplementation to increase fish productivity level.

Oodev is one of the synthetic hormones that can accelerate gonad maturity in fish. Oodev contains pregnant-mare serum gonadotropin (PMSG) and antidopamine. PMSG contains follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH is functioned to stimulate vitelogenesis process and support the follicle development (Sari *et al*., 2016), thereby inducing the oocyte maturation process (Dhewantara & Rahmatia, 2017). Antidopamine is functioned to inhibit dopamine performance, which positively impacts on gonadotropin hormone secretion (Hoga *et al*., 2018). Turmeric is a natural material that functioned to increase feed digestibility level and help improve feed absorption process in the body, besides stimulating the liver to synthesize vitelogenin process. Turmeric contains good nutrients for fish health, such as curcumin, essential oils, vitamin B1, B2, B6, B12, vitamin E, phytosterols, fatty acids, and carotenoids (Farida *et al*., 2018).

Oodev and turmeric can induce fish reproduction performance. Several studies used the following materials through feed and produced the highest result compared to separate usage. Astuti *et al*. (2016) stated that the combination of 0.5 ml/kg broodstock oodev and 0.25 g/kg broodstock turmeric per two weeks could accelerate the reproduction performance of catfish. Based on Purwati *et al*. (2017), the combination of 0.25 ml/kg broodstock oodev and 480 mg/100g feed turmeric could also accelerate the gonadal maturation in striped catfish. A study on the effect of oodev and turmeric powder on the reproductive performance of livebearer fish has not been evaluated before. Therefore, the application of oodev and turmeric powder dietary supplementation at a dosage following the previous studies is expected to improve the reproductive performance of the sunset platyfish.

MATERIALS AND METHODS

This study used a factorial completely randomized design experimental method with two factors and three replications on each treatment. The detailed treatments were:

A: without oodev and turmeric powder treatment
B: oodev 0.5 mL/kg broodstock + 0% turmeric powder
C: without oodev + turmeric powder 3%/kg feed
D: oodev 0.5 mL/kg broodstock + turmeric powder 3%/kg feed

Materials

The sunset platy fish used in this study were 4 months old from ornamental fish culturist in Bogor, West Java. The male broodstock used had an average weight of 0.75 ± 0.07 g, while the female broodstock used had an average weight of 2.08 ± 0.47 g.

Tank and water preparation

The thirty-six units of tank in this study were prepared as broodstock rearing (12 units), giving-birth tank (12 units), and larval rearing (12 units). The tank was a styrofoam box at 47×37×20 cm^3 volume. Before using, the tank was disinfected with potassium permanganate. All tanks were filled with water by 26 L and equipped with aeration system. For giving-birth tank, a fry trap was set to separate the larvae away from their broodstocks. Before using, the rearing water was aerated for two days and filtrated with dacron, zeolith stone, and active carbon. This treatment was performed in an aquarium at 60×40×40 cm^3 size.

Acclimatization and broodstock selection

Before applying the treatment, fish were reared separately between male and female for 14 days to adapt the fish with the experimental environment and feed. Broodstock candidates were selected based on health, body abnormality, and appetite. The 40 selected broodstocks (20 males and 20 females) were paired to form 12 pairs (12 males and 12 females). Female platy fish as broodstocks were non-pregnant fish, characterized by the distended belly and transparent yellow gravid spot. Before pairing, these broodstocks were reared for a week separately and fed until apparent satiation. The feed intake between male and female broodstocks was recorded for a week.

Feed production

The feed used was a floating pellet (NRD) at 500-800 µm size with 55% protein, 9% lipid, and 9% fiber. The pellet was prepared weekly at 1.36 g for each treatment. The pellet was weighed following the feed intake for a week and packed in a plastic bag. Oodev with the following dosage was diluted with 1 ml water and added with 0.01 mg commercial binder (progol), then mixed until homogenous. This solution was sprayed onto the pellet evenly with a 1 cc syringe. The turmeric powder with the following dosage was sprayed evenly onto the pellet. The sprayed pellet was then air-dried and kept in a jar. Meanwhile, pellet for control treatment was unsprayed with any mixture.

Broodstock rearing and giving-birth broodstock

Selected broodstocks were reared in rearing tanks for pairing. The number of platy fish in a tank was maintained as one pair. Platy fish broodstocks were fed in the morning and evening until apparent satiation. Siphoning was performed every three days and the water was exchanged by half of the rearing medium volume. Paired and pregnant female broodstocks were characterized by enlarged abdomens and reddish gravid spots.

The female broodstocks with the following characteristics were transferred to the giving-birth tanks prepared with fry traps, so the broodstocks were unable to gulp the larvae. The larvae born were counted and the time of birth was recorded. The larvae were then transferred to larval rearing tanks. The frequency of giving birth was observed during the experiment period.

Larval rearing

The larvae were reared in larval rearing tanks. Larvae were fed *ad libitum* with nauplii *Artemia* prepared since the previous day on the second to fifth day after hatching (DAH) in the morning and evening. Larvae on the sixth to 14th DAH were fed *ad libitum* with *Tubifex* sp. twice a day in the morning and evening. Siphoning was performed every three days and the water was exchanged by half of the rearing medium volume.

Water quality

Water quality parameters measured during the study were temperature, pH, dissolved oxygen (DO), total ammonia nitrogen (TAN), nitrite, and nitrate (Table 1). Temperature and pH were measured everyday at 06.00 and 16.00 GMT +7 in all rearing media. DO, TAN, nitrite, and nitrate were measured at the final experimental period. These parameters were measured by sampling the tank of each treatment, then B and D treatments for larval rearing tank. The water quality of broodstock and larval rearing media were still within a good range for platy fish.

Parameters

The data obtained from the samples of each treatment were used to determine the reproduction performance of platy fish. The reproduction

Table 1. Water quality parameters.

Paremeter	Treatment				Literature
	A	B	C	D	
Temperature	26.5–28.0	25.5–27.5	26.5–30.0	26.0–30.0	25–30*
pH	7.3–7.5	6.7–7.3	6.5–7.1	7.0–7.5	6.5–8.0**
DO (mg/L)	6.5–7.9	6.5–7.5	7.0–7.9	6.8–7.6	>5**
TAN (mg/L)	0.079–0.154	0.163–0.313	0.224–0.393	0.25–0.458	<0.5***
Nitrite (mg/L)	0.029–0.0444	0.032–0.039	0.030–0.043	0.034–0.042	<0.2****
Nitrate (mg/L)	0.311–0.519	0.382–0.448	1.348–4.460	1.633–4.485	<40****

Note: *Lusianti 2013; **Andria dan Rahmaningsih 2018; ***Silaban *et al*. 2012; ****Juliyanti *et al*. 2016

performance aspects contain pregnant broodstock percentage, broodstock birth percentage, larval production per broodstock, larval survival rate, and broodstock birth frequency.

Pregnant broodstock percentage

The pregnant broodstock percentage from each treatment was calculated with the following formula:

$$\text{Pregnant broodstock percentage (\%)} = \frac{\sum\text{Pregnant broodstock}}{\sum\text{Total broodstocks}} \times 100$$

Birth percentage

The platy fish that have given birth were marked by deflated abdomen and transparent anal area. Larvae were born gradually for 12-24 hours. The birth percentage was calculated from the number of birth broodstock divided by the number of pregnant broodstocks. The percentage of birth broodstock on each treatment was calculated using the following formula:

$$\text{Birth Percentage (\%)} = \frac{\sum\text{Birth broodstock}}{\sum\text{Pregnant broodstock}} \times 100$$

Birth frequency

Birth broodstock frequency was the number of birth incident for 77 days of experimental period. The incidence of birth was observed and recorded to obtain the re-birth period.

Larval production

The larval production was determined based on the average number of larvae born from a broodstock in each treatment.

Larval survival rate

The survival rate of larvae was the ratio of total larvae on the 14th DAH and initial period. The survival rate value was calculated using the following formula:

$$SR = \frac{Nt}{No} \times 100$$

Note:

SR = survival rate (%)
Nt = total larvae on the 14th DAH (larvae)
No = total larvae on the initial rearing period (larvae)

Data analysis

Data were composed of pregnant broodstock percentage, birth percentage, larval production in each treatment, and survival rate of larvae. These data were processed using Microsoft Excel and statistically analyzed using ANOVA, then assessed further with the Duncan's test with 95% confidence level with SPSS 25.0. Meanwhile, the birth frequency was processed using Microsoft Excel and analyzed descriptively.

RESULTS AND DISCUSSIONS

Results

Broodstock pregnant percentage

The pregnancy percentage in all treatments for 77 days is presented in Figure 1. The pregnant broodstock percentage in all treatments is 100%. This condition indicates no significant difference among treatments.

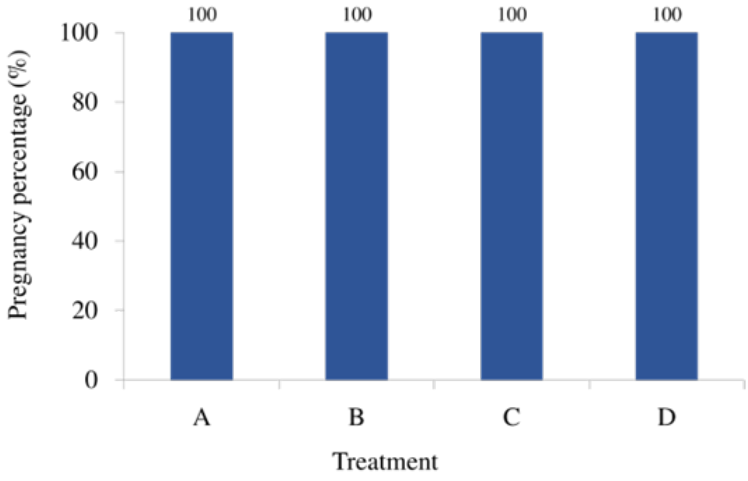

Figure 1. Percentage of pregnant platy fish broodstock for 77 days of experimental period. Note: A (control), B (0.5 ml oodev), C (3% turmeric powder), and D (0.5 ml oodev + 3% turmeric powder).

Birth percentage

The birth percentage of platy fish for 77 days is presented in Figure 2. The birth percentage in all treatments is 100%. This condition indicates no significant difference among treatments.

Birth frequency

The birth frequency and number of larvae in each birth for 77 days is presented in Figure 3. The highest average birth frequency was found in the B treatment (oodev 0.5 ml), namely three births, while the lowest was found in the A treatment (control), namely one birth. The average birth frequency in the D treatment (0.5 ml oodev + 3% turmeric powder) and C treatment (3% turmeric powder) was two and one birth, respectively.

Larval production

The average larval production in each treatment is presented in Figure 4. The larval production range was among 31-143 larvae with the highest value was obtained from the D treatment (0.5 ml oodev + 3% turmeric), namely 143 ± 12 individuals. This value was significantly different from the A (control), B (0.5 ml oodev), and C (3% turmeric) treatments. The larval production

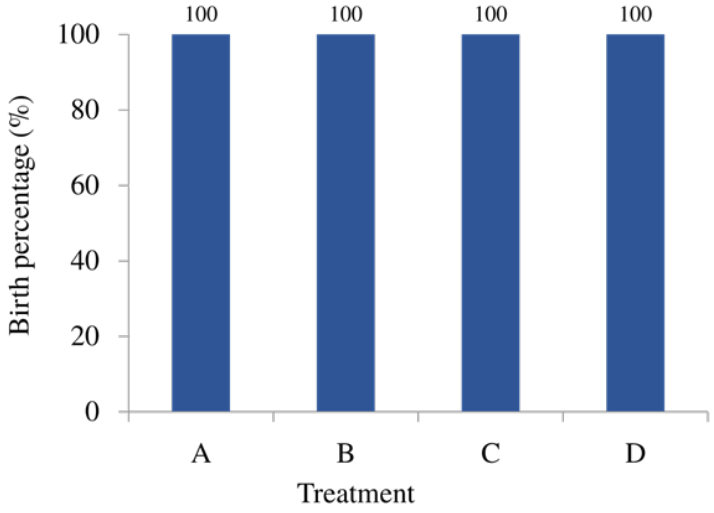

Figure 2. Birth percentage of platy fish for 77 days of experimental period. Note: A (control), B (0.5 ml oodev), C (3% turmeric powder), and D (0.5 ml oodev + 3% turmeric powder).

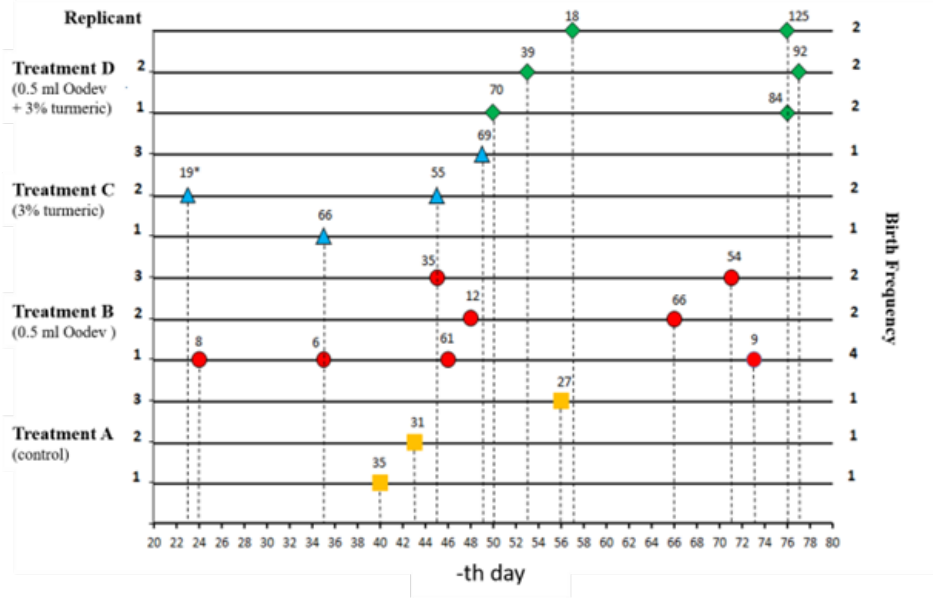

Figure 3. Birth frequency, total larvae, and birth incident. Note: A (control), B (0.5 ml oodev), C (3% turmeric), D (0.5 ml oodev + 3% turmeric). *Numbers in each birth period show the total larvae produced.

in the B treatment was 84 ± 6 individuals, which was significantly different from the C treatment at 70 ± 4 individuals. The C treatment was significantly different from the A treatment at 31 ± 4 individuals.

Survival rate

The larval survival rate was calculated on the 14th postbirth day. The highest survival rate was obtained from the D treatment (0.5 ml oodev + 3% turmeric) at 97.51%, while the lowest survival rate was obtained from the A treatment (control) at 93.32%. The survival rate of larvae in C treatment (3% turmeric) and B treatment (0.5 ml oodev) were 95.65% and 95.79%, respectively. The survival rate based on the Duncan's test were insignificantly different among treatments (P>0.05). The survival rate of the larvae is presented in Figure 5.

Discussions

Based on the study results, the female platy fish broodstocks from each treatment were all pregnant. This condition proves that the application fo 0.5 mL/kg broodstock oodev and 3%/kg feed turmeric powder dietary supplementation has no effect on male and female broodstock pairing success. Similarly, Anjani *et al.* (2020) reported

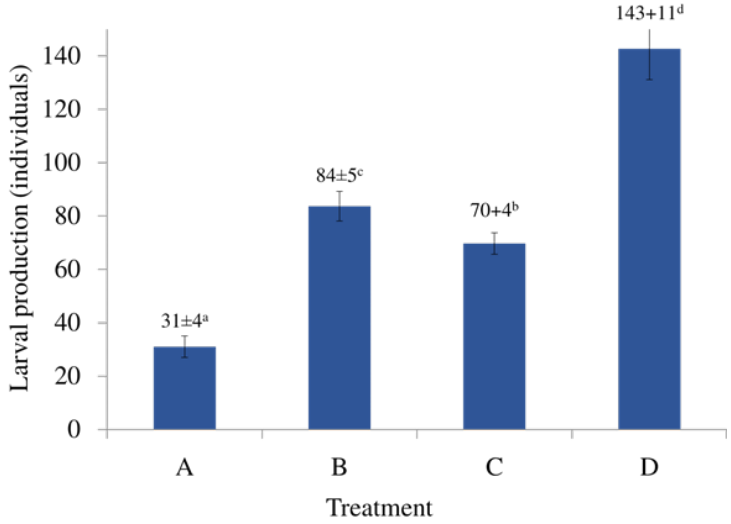

Figure 4. Platy fish larval production for 77 days of experimental period. Note: A (control), B (0.5 ml oodev), C (3% turmeric powder), and D (0.5 ml + 3% turmeric powder). Different superscript letters show a significant different value based on the Duncan's test (P<0.05).

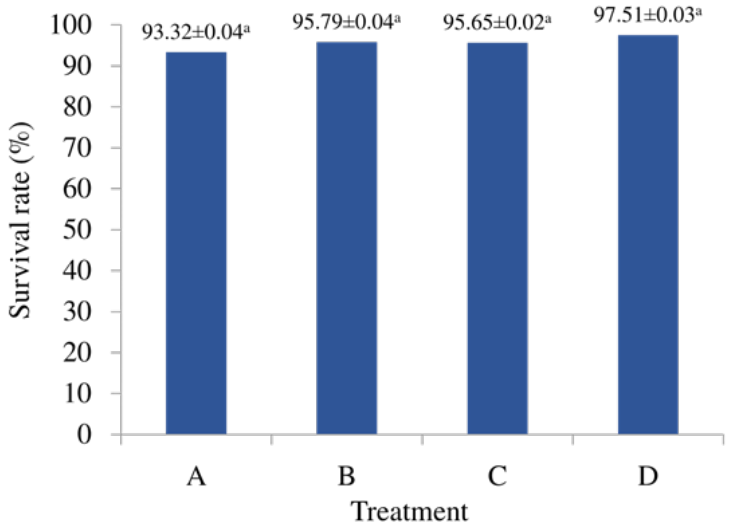

Figure 5. Survival rate of larvae after 14 days of rearing. Note: A (control), B (0.5 ml oodev), C (3% turmeric powder), and D (0.5 ml + 3% turmeric powder). Different superscript letters show a significant different value based on the Duncan's test (P<0.05).

that female guppy broodstock could become completely pregnant with and without 0.5-1.0 ml/kg oodev dietary supplementation. Also, the age of the platy fish used in this study was 4-6 months, whereas Taradhipa *et al*. (2018) stated that platy fish begins to reproduce at 3-5 months, so the platy fish used have entered a productive age. For ready-to-reproduce broodstocks, the female broodstock had dark yellow-colored eggs visible in its urogenital, while the male broodstock had a gonopodium because of differentiated anal fin, which could actively help pair with the female broodstock (Parawangsa *et al*., 2020). All pregnant platy fish broodstock could entirely give birth.

The giving-birth female broodstock is characterized by a darker gravid spot with visible larval eye spot (Nurlina & Zulfikar, 2016). The environmental parameters during the experimental period were still in an optimum range for platy fish to live and breed, thereby supporting the pairing and birth process in platy fish. The birth frequency for 77 days in order was B, D, C, A treatments, namely at three, two, one, and one birth. This condition means that 0.5 ml/kg broodstock oodev can increase the birth frequency. However, the birth frequency did not affect the larval production, as the larval production in the D treatment was higher than in the B treatment. Total larvae born at each birth varied due to the asynchronous development of the embryos in livebearer fish, resulting in different embryo size (Lokman *et al*., 2016).

Larval production in each treatment obtained from the study was about 31-143 individuals with a significant difference among treatments. This condition reveals that the application of 0.5 ml/kg broodstock oodev and 3%/kg feed turmeric dietary supplementation can induce the larval production of sunset platy fish. This result was similar to several studies that stated the use of 0.5 ml/kg oodev supplementation could increase the fecundity level of catfish (Sari *et al*., 2016) and guppy larvae production (Anjani *et al*., 2020). This condition occurred as oodev contains pregnant-mare serum gonadotropin (PMSG) and anti-dopamine. PMSG contains follicle stimulating hormone (FSH) and luteinizing hormone (LH). PMSG plays a role in increasing the FSH concentration in blood, which can stimulate the theca layer and synthesize testosterone to produce 17β-estradiol for the formation of vitellogenin in the liver.

This can support the growth of ovarian follicles. The number of developing follicles determines the number of eggs produced by the female broodstock (Sari *et al*., 2016). Increasing the LH hormone in fish can increase the final gonadal maturation and ovulation processes (Tahapari & Dewi, 2013). Based on the study results, dietary supplementation of 3%/kg feed turmeric increased the production of platy larvae 2.25 times higher than the control. This was thought as turmeric could improve the reproductive performance of the broodstock. Increased reproductive performance was caused by the curcumin found in turmeric, functioned as a hepatoprotector to helap repair liver and oviduct cell tissues.

Turmeric can stimulate the liver to synthesize vitelogenin and promote follicle development (Ibrahim *et al*., 2018). According to Dewi (2015), the dietary supplementation of turmeric powder could accelerate the gonadal maturation in striped catfish (*Pangasianodon hypophthalmus*). Vitamin E found in turmeric could also improve the reproductive performance as this vitamin is an antioxidant that can protect cells from toxic substances such as free radicals. Free radicals can interfere the endocrine glands, resulting in an imbalance production of gonadotropin hormones (Wahyudi *et al*., 2016). Larval production in the D treatment increased 4.81 times greater than the control treatment.

This was suspected as the properties of each material worked synergistically and supported one another, so the benefits were better than just applying one material. Hormones in oodev play a role to accelerate the vitellogenesis process in the liver, while turmeric plays a role in helping repair liver cells to support the vitellogenesis process. This condition was supported by Lestari *et al*. (2016), that the application of 0.5 ml/kg broodstock oodev and 3% turmeric powder/kg feed could accelerate the gonadal maturation in tinfoil barb, while Mizan *et al*. (2018) stated that the following materials could improve the reproductive performance of kissing gourami. According to Arfah *et al*. (2018), the application of 0.25 ml oodev/kg broodstock and 480 mg turmeric powder/100 g feed could accelerate the gonadal maturation in catfish. In addition, turmeric improves the liver performance in nutrient metabolism for egg yolk formation, which then accelerates the oocyte development.

The application of 0.5 ml oodev/kg broodstock and 3% turmeric powder/kg feed had no negative impact on the survival rate of the larvae, as the

data presents that the survival rate of the larvae calculated on 14th DAH was quite high at 93.32% - 97.51% and no significant different was found among treatments. Moreover, there are several factors that influenced the larval survival rate in breeding activity, such as feed availability, environmental parameters, fish health, and water quality parameters (DO, ammonia, temperature, and pH (Adewolu *et al*., 2008). Based on Table 1, the water quality parameters during the experimental period were still in an optimum range for fish to live and grow.

CONCLUSIONS

The application of 0.5 ml oodev/kg broodstock and turmeric powder 3% /kg feed increases the larval production two to five times greater than the control. This material combination can also produce the number of larvae better than single material only.

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