PRODUCTION OF FEMALE GIANT FRESHWATER PRAWN (*Macrobrachium rosenbergii*) THROUGH HORMONAL INDUCTION

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ABSTRACT

The objective of this experiment was to find out the appropriate dosage for producing homogametic female of giant freshwater prawn (*Macrobrachium rosenbergii* de Man) by feminization. This experiment was carried out at Research Institute for Freshwater Fish Breeding and Aquaculture, Sukamandi. The giant freshwater prawn at PL-5 stage was treated orally by estradiol-17ß. Estradiol-17ß was given orally. The dosage levels are 0, 30, 50, and 70 mg/kg of feed. The hormonal feed was given for 30 days. Prawns were reared in aquaria for 30 days and hapas for 60 days. The parameters observed are sex ratio, survival rate, total length, and body weight. The results showed that estradiol-17ß increased production of female giant freshwater prawn. The best dosage was 70 mg/kg of feed that could produce 65.33% ± 5.64% of female. Survival rate and growth of giant freshwater prawn were not affected by estradiol-17ß ($P<0.05$).

KEYWORDS: giant freshwater prawn, estradiol-17ß, sex ratio

INTRODUCTION

One of the alternatives to increase productivity of giant freshwater prawn is by using biological character of its male that is growing faster than female. In the same group of age, the size of male is bigger than female. The maximal weight that can be reached by male is three fold (42—102 g) heavier than female (19—51 g) after three months of rearing (Hadie & Supriatna, 1998). Total length of male giant freshwater prawn could reach 25 cm and just 15 cm for female (Bardach *et al.*, 1972). This biological potency can be applied to increase production of giant freshwater prawn by monosex culture.

Sex can be reversed on giant freshwater prawn to produce male population has been done by 17α-methyltestosterone. But, there is still any contradictory, principally for food safety. Therefore, it is not recommended to use steroid hormone directly for fish consumption. To obtain 100% of males, one of its alternative is by produce homogametic female (ZZ) by sex reversal. In mating of normal male and female of giant freshwater prawn, the probability to produce female and male is 1:1 (Spencer *et al. in* Kusmini *et al.*, 2001). But with homogametic female that mated with normal male (ZZ) will produce 100% of males.

Sex can be reversed either naturally or artificially (Yatim, 1986). Natural sex reversal is caused by environmental factor with no change in genetic structure. Artificial sex reversal is the effort of man to direct development of reproduction organ by giving material that can induce sex changing. According to Chan & Yeung (1983), artificial sex reversal aims at producing organism that has sex phenotype different from its sex genotype. In fish, the formation of steroid hormone is not yet happened before sex differentiation, so gonad formation can be directed by using synthesized steroid hormone (Yamazaki, 1983; Hunter & Donaldson, 1983).

Differentiation sex in fish depends on species. Malecha *et al.* (1992) suggested that undifferentiated gonadal tissue of giant freshwater prawn (*Macrobrachium rosenbergii*) is labile for short time but becomes determined with age, as in vertebrates. Male determina-

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tions genes do not function immediately during the larval to post larval period, but act sometime later in early juvenile development. However, in female, complete reversal of sexual function and near complete reversal of secondary sexual morphology take place approximately 30 days after metamorphosis to the post larval stage.

Estrogen could influence sex differentiation directly. Carman *et al.* (1998) *in* Kusmini *et al.* (2001) suggested that estradiol-17ß is the most effective estrogen hormone that can determine sex differentiation in red tilapia to be female by dipping (immersion) method. The immersion of red tilapia larval in 150 µg/L of estradiol-17ß for 18 days could produce 86.6% of females (Durant *et al.*, 1985 *in* Kusmini *et al.*, 2001). In giant freshwater prawn, application estradiol-17ß with dosage 40 mg/kg of feed could produce only 52.58% of female and with dosage 3 mg/L by immersion could produce 60.66% of female. Based on this result, we need to improve feminization technique for giant freshwater prawn.

The objective of this research is to find out the appropriate dosage for producing homogametic female of giant freshwater prawn (*Macrobrachium rosenbergii* de Man) by feminization. The kind of hormone that use for feminization is estradiol-17ß.

MATERIALS AND METHODS

This research was carried out at Research Institute for Freshwater Fish Breeding and Aquaculture Sukamandi for five months, from July-November 2004. During treatment, prawns were reared in laboratory for 30 days. For growing, prawns were reared in ponds for 60 days. Sexing process was done in laboratory.

Randomized design was applicator to determine the effect of estradiol-17ß that was given orally on sex ratio. Four levels of estradiol-17α dosage were applied as treatment. The hormone dosages are 0, 30, 50, and 70 mg/kg of feed. Each treatment was replicated three times.

Estradiol-17α hormone were soluted in ethanol 70%, with comparation 12,5 mg of hormone per 50 mL of ethanol. Hormonal solution sprayed to feed. Hormonal feed were given for 30 days, four times a day. After treatment prawn were fed by juvenile feed, three times a day for 60 days.

Giant freshwater prawns at PL-5 stage were treated in aquaria (60 x 40 x 50 cm^3) for 30 days. Aquaria were completed by heater and aeration. Water quality is controlled by siphoning and water changing. After treatment, prawns were reared in hapas (2 x 1 x 1 m^3) for 60 days.

Data were collected after three months of rearing. The main parameter is sex ratio and the support parameter is survival rate and growth. Data were analyzed statistically by ANOVA and differences among treatment means were examined by LSD test.

RESULTS AND DISCUSSION

Sex ratio

Estradiol-17ß that mixed with feed could increase percentage of female giant freshwater prawn ($P<0.05$). Dosages at level 70 mg/kg of feed gave the best response (65% ± 5.64%) Table 1.

Survival rate

Survival rate of giant freshwater prawn at the end of experiment is between 38%—41%. Survival rate for each treatment was not different statistically ($P<0.05$). It means that estradiol-17ß did not affect survival rate. Table 2

Table 1. Sex ratio of giant freshwater prawn treated by estradiol-17α orally at different dosages

Dosage of estradiol-17ß (mg/kg)	Sex ratio *)	
	Male (%)	Female (%)
0	49.04-6.54	50.96-6.54 [a]
30	42.26-8.80	57.74-8.80 [ab]
50	37.54-2.28	62.46-2.28 [ab]
70	34.67-5.64	65.33-5.64 [b]

*) Values followed by same letter are not significantly different ($P<0.05$)

Table 2. Survival rate of giant freshwater prawn at the end of experiment

Dosage of estradiol-17ß (mg/kg)	Survival rate (%) *)
0	40.67 ± 5.46 [a]
30	39.56 ± 4.44 [a]
50	40.00 ± 4.06 [a]
70	38.89 ± 1.68 [a]

*) Values followed by same letter are not significantly different (P<0.05)

Growth

After three months of rearing, total length of giant freshwater prawn was between 6.53—6.57 cm. Based on statistically analyzed, there was no differences between treatment (P<0.05). It means that estradiol-17ß did not affect total length.

Body weight of giant freshwater prawn at the end of experiment is between 2.10—2.17 g. Body weight for each treatment was not different statistically (P<0.05). It means that estradiol-17ß did not affect body weight.

DISCUSSION

Estradiol-17ß given orally to giant freshwater prawn at PL-5 stage could affect hormonal system in its body. Hormonal treatment in labile period, could determine organism to be male or female (Yamazaki, 1983; Hunter & Donaldson, 1983). Sumantadinata & Carman (1983) *in* Kusmini *et al.* (2001) said that the purpose of hormonal application is for disturbing hormonal balancing in blood that in sex differentiation period is very ascertain to determine organism to be male or female.

The results from this experiment showed that percentage of female still could be increased by increasing level dosage of estradiol-17ß. Effectivity of hormonal treatment in sex reversal technique is affected by some factors like hormone delivery, dosage, environment, treatment duration, hormone variety, and steroid endurance in body (Zairin, 2002). According Piferrer (2001) that sensitivity of exogenous steroid hormone on sex differentiation depends on gonadogenesis. Before gonadogenesis, its sensitivity is very low and increase when formation and growth of gonad by cell development. The peak sensitivity is taken place when sex has been differentiated physiologically and than decrease after differentiated of sex tissue.

Survival rate of giant freshwater prawn was between 38%—41% and it was not different for every treatment (P<0.05). Hunter & Donaldson (1983) said that if hormonal dosage is too over it can cause gonadal formation pressure, paradoxial effect and mortality. In this experiment, hormonal dosage is still safe for survival rate.

Estrogen treatment could increase growth of fish (Zairin, 2002). According Piferrer (2001) that addition of synthetic hormone with optimal dosage could induce growth. But, if hormonal dosage is too over it can pressure growth. In this experiment, total length and body weight of giant freshwater prawn was not

Table 3. Total length and body weight of giant freshwater prawn at the end of experiment

Dosage of estradiol-17ß (mg/kg)	Total length *) (cm)	Body weight *) (g)
0	6.57 ± 0.15 [a]	2.10 ± 0.20 [a]
30	6.53 ± 0.21 [a]	2.13 ± 0.21 [a]
50	6.57 ± 0.06 [a]	2.13 ± 0.06 [a]
70	6.57 ± 0.15 [a]	2.17 ± 0.15 [a]

*) Values followed by same letter are not significantly different (P<0.05)

affected by estradiol-17ß treatment. It is suggested, that estradiol-17ß dosage was not optimal.

CONCLUSION

Estradiol-17ß increased percentage of female giant freshwater prawn. The best dosage 70 mg/kg of feed, producing 65.33% ± 5.64% of females. Survival rate and growth were not affected by estradiol-17 ß ($P<0.05$) application.

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