Selective breeding technique: Pandu and Kunti tilapia (Oreochromis niloticus) broodstock candidates at PBIAT Janti, Klaten-Central Java

S H Samara1,4, A W Fathurrozi2 and Sutarno3
1Department of Fish Health Management and Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya 60115 Indonesia
2Aquaculture Program, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya 60115 Indonesia
3PBIAT Janti, Klaten, Indonesia
4Corresponding author: Email: syifania.hanifah@fpk.unair.ac.id

Abstract. Tilapia (Oreochromis niloticus) is a freshwater aquaculture commodity with high demand and economic value. With developing breeding technology, hybrid tilapia also grows in popularity. Pandu tilapia is a strain of Singapore tilapia, while Kunti tilapia is a GIFT (Genetically Improved Farmed Tilapia) strain. To ensure the continuity of good fingerling stock, the individual selection needs to be conducted on Pandu and Kunti Tilapia broodstock candidates. The family selection method was chosen using 125 pairs of broodstock candidates. The male and female ratio is 1:1 with horizontal breeding where a broodstock was mated with another fish from its own family or strain to ascertain that there is no cross-breeding. Larvae hatched from the spawning were reared in a nursery pond, then graded. The top 50% fish was reared until reaching the adult stage and bred again. The broodstock candidates were then tested for its performance and mass spawned.

1. Introduction
Tilapia is one of the leading commodities for freshwater aquaculture in Indonesia. National tilapia production in 2010 was recorded at 464,191 tons and increased to 999,695 tons in 2014 [1]. FAO determined that Indonesian tilapia production ranks third largest in the world [2]. This significant increase requires an adequate supply of fingerlings both in terms of quality and quantity.

Improvements to the genetic quality of fish can be made through selective breeding or breeding programs. Tilapia breeding has begun, including bringing in several types of superior varieties from breeding results from abroad [3]. Tilapia breeding activities by utilizing existing variations in the country have also begun by introducing several varieties of tilapia [4].

Efforts to improve the quality of tilapia broodstock that will be used in the aquaculture activity can be made by selecting high-quality fingerling. The fingerlings will be kept until becoming broodstock through genetic selection. Genetic selection is a breeding program or selective breeding. Genetic screening of fish aims to improve the genetic makeup of the parent fish to be used so that it can produce superior and productive seeds [5].

Selective breeding only uses crosses of broodstock fish that have the best characteristics in the population [6]. For example, Larasati tilapia (Red Tilapia Strain Janti) has been produced in PBIAT Janti by referring to breeding programs between the Kunti strain GIFT parent (GG) and the male
Pandu Singapore (SS) strain [7]. Larasati tilapia is very popular because it grows fast, has thick flesh, and resistant to environmental changes also *Streptococcus agalactiae* bacteria [8]. This study aims to determine and analyze selective breeding techniques for Pandu and Kunti tilapia at PBIAT Janti, Klaten, Central Java.

2. Material and methods

2.1 Sample preparation

The samples were Pandu and Kunti tilapia broodstock (125 pairs). The average size of males was 40 cm and 1000 g of weight while the female was 30 cm with 300-400 g of weight. The breeding was used the traditional method (without the addition of chemical compound) with the ratio of 1:1.

2.2 Methods

The work method used in this research was descriptive. It was a method for making descriptions of facts in a systematic, factual, and valid way about the effects and characteristics of a population or a particular area [9]. Data collection methods used were primary and secondary data. Primary data was data obtained directly from the source, observed, and recorded for the first time. Primary data collected through procedures and data collection techniques. The primary data in the form of observation, interviews, active participation, and using measurement instruments precisely according to the purpose [10]. Secondary data was data obtained from indirect sources and reported by people outside themselves [11]. This data was collected from documentation data, magazines, newspapers, books, research institutes, fisheries offices, libraries, reports from private parties, communities, and other parties related to selective breeding techniques in prospective Pandu and Kunti tilapia broodstock.

3. Results and discussion

Fish breeding in PBIAT Janti was carried out using individual selection methods. The individual selection was based on the diversity of distinct phenotypes [12]. This selection aimed to produce individuals who have the best phenotype [5]. The selection and cross-breeding process used at PBIAT Janti was following the previous research [13].

This exclusive selection uses a combination of tilapia broodstock strains and repeated five times. The tilapia was taken from two different types of tilapia, namely Kunti strain Gift parent (GG) and the Pandu Singapore (SS) strain male. Selective breeding was carried out horizontally, mating the female fish that were ready to spawn from the same strain of the same lineage with a ratio of male and female 1: 1, so that no cross-breeding was expected. Spawning fish at adjacent times and larvae produced from each spawning were placed in the same nursery ponds, thus requiring a lot of happa nets because the larvae were placed according to tilapia spawning and larval hatching time. The procedure of individual selection techniques showed in Figure 1.

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Figure 1. The procedure of individual selection techniques in PBIAT Janti.

Prospective broodstocks who had been selected based on natural selection so that they had adapted to the environment in PBIAT Janti were mated naturally to produce larvae. Tilapia larvae number between 400-1250 fishes a pair of broodstock. The resulting larvae were then nurtured in the nursery I until they became fingerlings with a length of 3-5 cm. The seeds from maintenance were harvested and then selected using a grading process with the help of a tool called grading tub. Fingerlings that did not pass grading had slow growth, so it is reared again in nursery II pond of 125-500 fishes, while the others are transferred for sale. This was consistent with previous research that in the process of reject selection was carried out if the quality was not as desired [14].

After nursery II the fingerlings were harvested for the grading process again to get the best 50% of the population based on optimal growth and uniform, good body shape, and bright color. This best 50% population was maintained to adults as broodstocks [15, 16].

Prospective broodstock obtained through enlargement until today was taken from 10-30 male fish and 20-40 female fish for further individual selection activities. Every single fish with the best criteria for disease resistance, the brightest color, not pale, and optimal growth was taken 10-20 male and female fish for tagging. As a control, 100 male fish and 200 female fish were taken. The two best and control fish were mated massively after being influenced by gonad maturity. The offspring that result from mating were maintained in the same environmental conditions using a pool of performance tests [17].

The selection of mature gonad broodstocks was made one by one by observing the state of the stomach and urogenital. The adult female stomach of the gonad enlarged, and the urogenital was red [18]. The female broodstock stocked into spawning hapa and left for 5-7 days until the condition was stable (no stress). Pairing male to female broodstock in a spawning tub in the ratio of 1:1 [19].

The success of selective breeding in PBIAT Janti was influenced by good water quality. Water quality monitoring had an essential role in the growth and survival of fish in addition to feed factors [20]. Some factors that influence water quality included temperature, degree of acidity (pH), and dissolved oxygen or dissolved oxygen (DO).

The temperature was a critical environmental factor for aquatic organisms. Temperature measurement was carried out three times a day, i.e., 06.00 a.m., 12.00 noon, and 17.00 noon. The results obtained at temperature measurements on larval rearing ranged from 26-32°C. This range was also still feasible because, according to previous studies, the optimum water temperature for tilapia reached between 25-32°C [21]. The environmental temperature was very influential in the growth of cultured organisms [22].

The pH value was a measure of the degree of acidity or alkali reaction on a scale of 1 to 14 [23]. The pH measurement was carried out three times a day, which was 06.00 in the morning, at 12.00
noon, and 17.00 in the afternoon. The pH of ponds in the PBIAT Janti-Klaten Workshop was between 7-8; the value was suitable for tilapia that the water's pH ranged from 6.5 to 8.5 [21].

Dissolved oxygen or dissolved oxygen was a limiting factor in intensive fish culture efforts and was the most important chemical parameter in fish culture [24]. Measurement of DO values was carried out three times a day, which was at 6:00 in the morning, at noon, and 5:00 p.m. with a value of 5.5-7.3. DO values in ponds were suitable for tilapia aquaculture activities that the minimum DO value for hatchery was 3 mg/l [21].

In addition to water quality, the feed was also needed to produce good parent selection. There were two types of feeding in larval nursery ponds in Loka PBIAT Janti, namely natural and artificial feed. Natural feed (Azolla sp.), which grew after the fertilization process, was given to fish [25]. The provision of artificial feed was made in the morning at 09.00 and the afternoon at 15.00. It aimed to optimize the growth of tilapia [26]. If it were too little, it would reduce the growth of tilapia. However, if it were too much, it would reduce water quality so that it would affect the survival of tilapia. The feed given was in the form of pellets that had been milled beforehand or powder feed as much as 0.8 kg, and 600 grams of shrimp feed was added to one-time feeding. The feed used was Hi-Pro-Vite® 782, which contained 31-33% protein. The supplementary feed used shrimp star brand 581 because it contained a high protein of up to 50%, which was good for fish growth [27].

4. Conclusion
This study showed that the selection was conducted in PBIAT Janti successfully by using 125 pairs of broodstock candidates. Larvae hatched from the spawning were reared in a nursery pond, then graded. The top 50% fish was raised until reaching the adult stage and bred again. The success was due to a well-applied selection procedure, feeding, and water quality control.

5. References
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