Reproduction characterization of the gurami sago (Osphronemus goramy Lacepède, 1801): basic knowledge for a hatchery development strategy for the future

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Abstract

Background
Sago strain of giant gourami has been released on 2018 as a candidate aquaculture freshwater in Indonesia. However, information on the reproduction characterization are minimal. This study analyzed the reproduction characterization in sago strain of giant gourami broodfish as a basic knowledge for hatchery development strategy in the future.
Method
A total of 10 female broodfish and 10 males had matured oocytes were measured for body weight and length and evaluated their reproductive characterization. Broodfish are spawned naturally using 1.2-m^3 (2×1×0.6 m) concrete pond with a male-female sex ratio (1:1). Egg weight and diameter were measured for 25 eggs/female using balances (ACIS AD- 600i with 0.01 g accuracy) and Labo microscope model L-711 using software camera 3. Semen was collected using plastic syringes in 3 mL aliquots, and then placed in an insulated ice-cooled container and analyzed within two h.
Result
The average weights of broodfish females and males before spawned were 2180±159.78 g and 3060±134.99 g, respectively. The relative fecundity and egg diameter were 1029±36 eggs kg^{-1}, 2.42±0.05 mm and 10.33±1.09 mg, respectively. The hatching rate, endogenous feeding period, and embryo survival to an eyed-egg stage were 76.40±2.27%, 11.2±0.63 day, and 94.76±0.42%. Sperm characteristics, such as volume (0.60±0.12 ml kg^{-1}) and motility (70.04±2.27%). Before spawned parameters, the female fish weight had strong relationships with the female fish weight after spawned (r^2 = 0.999) and absolute fecundity (r^2= 0.921). While, the parameter of sperm concentration has a strong relationship with the sperm motility (r^2 = 0.556) and duration of sperm motility (r^2 = 0.502).
Conclusion
Sago strain of giant gourami broodfish has a good reproductive characterization for hatchery development for the future. The successful natural spawning should be followed up with the larval weaning technology and feeding to increase growth and survival.

Keywords: Aquaculture, giant gourami, broodfish, egg, sperm, hatchery performance.

Introduction

Aquaculture freshwater is a practiced in inland waters such as lakes, rivers, reservoir, floodplains and oxbow lakes, including freshwater ponds has expanded during the last decades in Indonesia[1,2,3,4,5]. Approximately 77.57% of fish freshwater aquaculture production of Indonesia sources from freshwater ponds and inland waters[6]. However, its development depends upon many factors such as fish species, aquaculture systems, water depletion, fish diseases, farmers knowledge and aquaculture practices[7,4,8,9,10].

Freshwater aquaculture is one of the fastest growing aquacultures in Indonesia with more than 3,378,298.92 metric tons produced in 2018[6,11,12]. Nile tilapia has contributed (37.93% of the total aquaculture production), African catfish (33.35%), Pangasius catfish (12.38%), common carp (9.28%) and Giant gourami (6.96%) [13,14,15].

Indonesia has many strains for giant gourami, belonging to the local "tambago, palapa, soang, galunggung and blusafir" strain which has been produced semi-intensive in small-scale farms for decades[8,14,13,16]. But it is not able to contributed maximally to the production on freshwater aquaculture of Indonesia. This a concern to be developing of newly strain of giant gourami, namely gurami sago was living a limited in West Sumatera Province of Indonesia[17,18]. Sago strain of giant gourami is one considered a source for nutritional and food security, including as an ornamental fish among many freshwater fishes' communities in Indonesia.

Sago strain of giant gourami has been released as a candidate freshwater aquaculture in 2018 (Decree of the Ministry of Marine and Fisheries, Republic of Indonesia No.56/KEPMEN-KP/2018)[19]. However, data on reproduction characterization in sago strain of giant gourami still a limited. On the other hand, the evaluated to reproduction performance on the others fish species has been beneficial impacts to developed freshwater aquaculture in the Asia region[20,21,22,23,24]. Whereas, in sago strain of giant gourami broodfish there are still gaps in knowledge in terms of size at oocyte maturity, time sexual maturity, sperm characteristics, egg hatchability, survival after eye-eggs stage, larva weaning and growth rate. These factors were identified a key challenge for successfully a hatchery performance in sago strain of giant gourami for the futures. Therefore, the present study was conducted to evaluate the reproduction characterization in sago strain of giant gurami broodfish as basic knowledge about hatchery development for the future.

Methods

Ethical considerations

There are no required permits from the government of the Republic of Indonesia to evaluation reproduction characterization in sago strain of giant gourami broodfish (*Osphronemus goramy*) for a candidate aquaculture for the future. The study was founded by Research and Community Service Universitas Bung Hatta under a competitive grants scheme called the research of Professor in 2021. Contract number: 06.02.1.46.03.2021. This grant included ethical approval and permits to collected

fish samples, reared and spawned in sago strain of giant gourami in the Aquaculture Laboratory Faculty of Fisheries and Marine Science Universitas Bung Hatta. There no suffering animal activity in this study and sago strain of giant gourami broodfish were still in good condition until return to the pond. Ethical approval was granted by the Ethics Commission for Research and Community service at Universitas Bung Hatta (023/LPPM/Hatta/I-2021).

Rearing and selection of breeders

Juvenile fish were selected about six years ago from local hatchery in Luhak District, Lima Puluh Kota Regency, West Sumatra Province. Juvenile fish kept in tank and transported by truck to Aquaculture Laboratory, Faculty Fisheries and Marine Science University of Bung Hatta. A total of 200 individuals in sago strain of giant gourami juvenile fish were reared to adult sex under the concrete freshwater pond 8.4-m^3 (6×2×0.7 m). During were reared in sago strain of giant gourami juvenile fish until adult sex were given commercial feed pellets which contained 30% crude protein and 4% crude fat. After that, a total of 30 individuals' adult sex broodfish separated according by sex and reared in two concrete freshwater ponds 18-m^3 (6×2×1.5 m). Sago strain of giant gourami broodfish were feed twice daily (09:00 AM and 16:00 PM) were with extruded pellet feed contain was 39.50% crude protein and 12.21% fat with a predetermined ratio as much as 3% biomass weight/day. Besides that, it is also were given sente leaves sufficiently were contained 2.85% protein and 0.47% fat (% wet weight). Each concrete freshwater pond has 50 mm of middle drainage, which is covered with a net of 0.5 cm mesh to prevent gurami sago broodfish from escaping and predators from entering. The water was pumped from the borehole wells at a velocity of 5 liters per minute.

A total of 20 broodfish for sago strain of giant gourami has oocyte matured was selected consisted of 10 females and 10 males. Prior to stocking of females and males broodfish were weighed using balance scale (OHAUS model CT 6000-USA with 0.1 g accuracy), and their lengths were measured using a meter ruler with 1mm accuracy. Average weight and length of the 10 female broodfish were 2140±159 g and 39.70±1.77 cm, while, 10 of male broodfish were 3060±135 g and 43.1±1.79 cm.

Reproduction characterization parameters in sago strain of giant gourami broodfish were analyzed using the following formulas: Condition factor (CF) = wet weight in gram/length^3 × 100; ovulated egg weight (g) = fish weight before spawning (g) – fish weight after spawning (g); ova somatic index (%) = egg weight ovulation (g)/ fish weight before spawning (g) x 100, absolute fecundity is the total number of eggs was estimated per nest and relative fecundity is total number of eggs per kg body weight.

Female reproductive performance

Starting in August 2020 onwards, the broodfish were checked each monthly for eggs and semen production. The broodfish were captured with a hand net and anesthetized by orally with Tricaine methanesulfonate (MS-222, ethyl 4-aminobenzoate methanesulfonate 98%, Sigma Aldrich Co, USA, MO; 50 mg L^{-1}), based on the dosage used for *Hemibagrus wyckii*[21]. Oocyte maturation was assessed for each individual. The oocyte maturity in sago strain of giant gourami females was assessed from

oocytes sampled by intraovarian biopsies using a flexible polyethylene catheter[21]. Egg diameter was measured using Labo microscope model L-711 using software camera 3.

Natural spawning of broodfish is carried out using 1.2-m^3 (2×1×0.6 m) concrete freshwater ponds with a male-female sex ratio (1:1). Before the broodfish is spawned, the ponds are drained, cleaned and all other species are removed. Then, palm fibers are provided which are placed on top of a bamboo raft in the pond. Furthermore, the pond is filled with water and the female and male broodfish are released into the spawning pond. The male broodfish made a nest for 5 to 7 days, after which spawning takes place and the female broodfish lays eggs. Spawned occur in the afternoon (ranged from 15.00 to 17.00 PM). Due to the presence of a very large oil globule, sago strain of giant gourami eggs float. After the broodfish has finished laying eggs, the eggs are kept by the female broodfish in to the nest. Furthermore, after the eggs are kept by the broodfish four hours in the nest, the eggs are collected and transferred to an incubation tray which is placed in a ventricular hatching system. A total of 100 eggs each incubation trays. Meanwhile, the broodfish were returned to their pond after spawned, and no mortality occurred.

Egg weight and diameter were measured for 25 eggs per female using balances (SHIMADZU-model AY 220 with 0.1 mg accuracy) and Labo microscope model L-711 using software camera 3. A total of 25 eggs were randomly sampled at 16 h after spawned to determine the fertility rate (FR). The hatching rate (HR) was determined by counting all hatched fry at 48 h after spawned. Then, endogenous feeding period counted until the egg yolks run out (day) and embryo survival rate to eyed-egg stage (%)

Determination of sperm quality

Hormonal stimulation for spermiation efficiency of males of sago strain of giant gourami broodfish used LHRH-a preparations (Ovaprim) with dosage 0.5 ml per kg of brooder. Semen samples were obtained from 10 broodfish in sago strain of giant gourami randomly selected from the farm. The male broodfish were first anesthetized with 50 mg L^{-1} MS-222[25], and then, weights (MaW) and total lengths (MaL) were measured. Special care was taken to avoid any contamination of semen with urine, feces, mucus and water. Semen samples were collected using plastic syringes in 3 mL aliquots, and then placed in an insulated ice-cooled container, transported to the laboratory and analyzed within 2 h.

The sperm evaluate included gross (visual) and microscopic examination as reviewed by [26,27]. The gross examination was based on visual and physical observation of parameters like the semen volume by collecting the semen in a graduated cylinder and determining the level in millimeters. The microscopic examination was carried out using Olympus model CX40, with magnification between × 10 and × 25 to determine other parameters such as motility (MO) percentage and duration were determined by observing water activated semen placed on a glass slide under a microscope. Motile sperm were observed and expressed as a percent of non-moving sperm. Motility duration (DMO) was determined as the period between movements of the sperm to cessation of any progressive using

Neubauer's hemocytometer and calculated as the number of sperm ml^{-1} [28]. Semen pH was determined with a hand pH meter (HI8424 Hanna Instruments, USA).

Water Quality

Water sample in the spawning pond and incubation trays were collected to determine the alkalinity, hardness and pH. Alkalinity and hardness were measured according to standard presudure[29]. pH values were determined with pH meter (digital mini pH meter,)-14pH, IQ Scientific, Chemo-science Thailand Co., Ltd, Thailand). An oxygen meter (YSI model 52, Yellow Spring Instrument Co., Yellow Springs, OH, USA) was used in situ, Water temperature of the spawning pond and incubation trays as measured with a thermometer (Celsius scale).

Statistical analysis

Results were given as the means (± SD). Simple linear regression analyses were performed using SPSS software (version 16.0 for Windows; SPSS Inc., Chicago, IL). The standard deviation of each parameter was determined. For linear regression analyses, significant correlations were considered at $p<0.05$, and whereas significant trends or tendencies were considered at $p<0.05$.

Results

The reproduction characterization of female broodfish in sago strain of giant gourami is summarized in Table 1. Total number of eggs was estimated per nest (absolute fecundity) varied from 2000 to 2650, while relative fecundity (total number of eggs per kg female brooder) varied were between 977 and 1071. The fertility rate ranged from 76 to 84%, and the hatching rate success ranged from 72 to 80%. Endogenous feeding period ranged from 10 to 12 days, and embryo survival rate to eyed-egg stage varied were between 94.73 and 95%.

Reproduction characterization for males broodfish and sperm samples are presented in Table 2. The average live weight of the males is 3340±275.68 g. Sago strain of giant gourami males broodfish is found to be slightly bigger than females broodfish. Gonad weight ranged from 25 to 30 g, whereas gonad somatic index ranged from 0.83 to 0.93%.

The analyzed of the linear correlation (r^2) between variables of reproduction characterization parameters in sago strain of giant gourami females broodfish shown in Table 3. This study, the reproduction characterization parameters that had strong correlations with the absolute fecundity were female fish weight before spawning (r^2 = 0.921) and female fish weight after spawning (r^2 = 0.864). Similarly, between egg diameter with the hardened egg diameter (r^2 = 0.833), hardened egg diameter increased (r^2 = 0.699) and fertility rate (r^2 = 0.568). In contrast, the egg diameter was not strongly related to absolute fecundity (r^2 = 0.169) and relative fecundity (r^2= 0.096). On the other hand, the survival rate of larval (10 days) is also had strong correlations with the hatching rate (r^2 = 0.998) and endogenous feeding period (r^2 = 0.757).

The analyzed of the linear correlation (r^2) between variables of reproduction characterization parameters in sago strain of giant gourami males broodfish shown in Table 4. The reproductive characterization parameters that had a strong correlation with gonad weight were somatic index of

gonads (r^2 = 0.836), while semen volume (r^2 = 0.521), semen pH (r^2 = 0.521) and sperm concentration (r^2 = 0.506) were moderately correlated with gonad weight. Whereas, the gonadal weight negatively related to sperm motility (r^2 = 0.017) and duration of motility (r^2 = 0.275). Besides that, the sperm concentration is also had moderately correlations with the sperm motility (r^2= 0.556) and duration of motility (r^2= 0.502).

The physic-chemical water quality parameters in the spawning ponds and incubation trays for embryo development in sago strain of giant gourami were water alkalinity ranged from 50.5 mg L^{-1} to 52.5 mg L^{-1}, hardness varied from 65.5 mg L^{-1} to 67.5 mg L^{-1}, pH ranged from 6.4 to 6.6, oxygen ranged from 6.1 mg L^{-1} to 6.7 mg L^{-1} and temperature varied from 28 °C to 30 °C.

Table 1. Reproduction characterization in sago strain of giant gourami females broodfish (Mean ± SD)

	Variables	Range (Min-Max)
Fish length (cm)	39.70±1.77	38-43
Fish weight before spawning (g)	2140±159.78	1958-2500
Fish weight after spawning (g)	2108±157.64	1930-2465
Condition factor	3.30±0.42	2.54-3.86
Egg weight ovulated (g)	32.80±2.86	28-38
Ova somatic index (%)	1.55±0.07	1.43-1.65
Absolute fecundity (egg/fish)	2205±201	2000-2650
Relative fecundity (egg/kg body weight)	1029±36	977-1071
Egg diameter (mm)	2.42±0.05	2.32-2.46
Hardened egg diameter (mm)	3.42±0.02	3.40-3.45
Egg diameter increase (%)	29.63±1.43	27.8-32.14
Egg weight (mg)	10.33±1.09	9.02-12.20
Hardened egg weight (mg)	13.36±1.27	11.74-15.20
Hardened egg weight increase (%)	22.69±2.24	19.74-24.81
Fertility rate (%)	81.60±3.37	76-84
Hatching rate (%)	76.40±2.27	72-80
Endogenous feeding period *(*day)	11.2±0.63	10-12
Embryo survival rate to eyed-egg stage (%)	94.76±0.42	94.73-95

Table 2. Reproduction characterization in sago strain of giant gourami males broodfish (Mean ± SD)

	Variables	Range (Min-Max)
Fish weight (g)	3060±134.99	2800-3200
Fish length (cm)	43.1±1.79	40- 5
Condition factor	3.74±0.43	3.08-4.38
Gonads weight (g)	27.5±1.72	25-30
Gonadosomatic index (%)	0.90±0.03	0.83-0.94
Semen volume (mL per kg body weight)	0.60±0.12	0.4-0.7
Semen pH	8.18±0.15	7.9-8.4
Sperm concentration (10^9/mL)	1.44±0.14	1.2-1.6
Motility (%)	70.04±2.27	68-75
Duration of motility (sec)	50.2±7.25	43-61

Table 3. Correlations of variables (r^2) in sago strain of giant gourami females broodfish

	FEL	FWBS	FWAS	CF	OEW	OVI	AF	RF	EW	HEW	EWI	ED	HED	HDI	FR	HR	EFP
FEL																	
FWBS	**0.720**																
FWAS	**0.717**	**0.999**															
CF	**0.757**	**0.575**	**0.574**														
OEW	**0.539**	**0.565**	**0.553**	0.365													
OVI	0.281	0.191	0.012	0.000	**0.774**												
AF	0.255	**0.921**	**0.864**	**0.637**	0.387	0.072											
RF	0.012	0.207	0.063	0.011	0.065	0.321	**0.524**										
EW	**0.894**	**0.659**	**0.655**	**0.677**	0.552	0.246	**0.567**	0.041									
HEW	**0.841**	**0.631**	**0.626**	**0.514**	**0.582**	0.295	0.468	0.004	**0.924**								
EWI	0.165	0.109	0.109	0.354	0.033	0.000	0.010	0.002	**0.924**	0.041							
ED	0.164	0.132	0.338	0.131	0.378	**0.688**	0.169	0.096	0.030	0.263	0.000						
HED	0.064	0.029	0.237	0.126	0.025	0.207	0.022	0.064	0.468	0.184	0.030	**0.833**					
HDI	0.266	0.293	0.342	0.209	0.103	0.085	0.373	0.195	0.318	0.298	0.006	**0.699**	0.294				
FR	0.026	0.229	0.020	0.000	0.135	0.264	0.000	0.004	0.067	0.004	0.160	**0.568**	0.064	0.054			
HR	0.035	0.020	0.060	0.046	0.000	0.009	0.003	0.009	0.226	0.108	0.364	0.018	0.001	0.143	**0.703**		
EFP	0.113	0.186	0.190	0.094	0.006	0.098	0.231	0.103	**0.747**	**0.806**	0.147	0.317	0.001	0.116	0.015	0.013	
SR	0.070	0.032	0.034	0.027	0.007	0.003	0.112	0.024	0.194	0.019	0.005	0.033	0.000	0.324	0.063	**0.998**	**0.757**

Statistically important at $r^2 > 0.500$ (underlined)
FeL: female fish length (cm); FWBS: female fish weight before spawning (g); FWAS: female fish weight after spawning (g); CF: condition factor; OEW: egg weight ovulation (g), OVI: Ova somatic index (%), AF: absolute fecundity (eggs), RF: relative fecundity (eggs), EW: egg weight (mg), HEW: Hardened egg weight (mg), EWI: eggs weight increase (%), ED: egg diameter (mm), HED: hardened egg diameter (mm), HDI: hardened egg diameter increase (%), FR: fertility rate (%), HR: hatching rate (%), EFP: endogenous feeding period (days), SR: survival rate (10 days).

Table 4. Correlations of variables (r^2) in sago strain of giant gourami males broodfish

	MaL	MaW	CF	GW	GI	SV	pH	SC	MO
MaL	-								
MaW	**0.714**								
CF	**0.807**	0.347							
GW	0.399	**0.550**	0.187						
GI	0.003	0.042	0.071	**0.836**					
SV	0.025	**0.576**	0.042	**0.521**	0.000				
pH	**0.516**	**0.772**	0.353	**0.521**	0.127	0.296			
SC	0.186	**0.661**	0.131	**0.506**	0.068	0.425	**0.645**		
MO	0.068	0.453	0.061	0.017	0.130	0.393	0.280	**0.556**	
DMO	0.159	0.322	0.083	0.275	0.012	0.082	0.430	**0.502**	**0.519**

Statistically important at $r^2 > 0.500$ (underlined)
MaW: male fish weight (g), MaL: male fish length (g), CF: condition factor; GW: gonadal weight (g); GI: gonad somatic index (%), SV: semen volume (ml), SC: sperm concentration (10^9/mL), MO: motility (%), DMO: duration of motility (sec).

Table 5. Summary of the fecundity, gonadal somatic index, egg diameter and hatching rate of giant gourami.

Species	Strain	Relative fecundity (egg/kg fish)	GSI (%)	Eggs diameter (mm)	Hatching rate (%)	Reference
Osphronemus goramy	Sago	1037±90	1.91±0.35	2.42±0.05	76.40±6.33	This study
Osphronemus goramy	Bastar	2423±348	2.78±1.16	2.2 ± 0.2	96.36± 2.30	[16]
Osphronemus goramy	Galunggung	4011±287	4.15±0.63	2.5±0.05	89.3±1.30	[8]
Osphronemus goramy	-	5508±1547	2.32±0.50	2.18±0.19	61.60±0.0	[30]
Osphronemus goramy	Tambago	2.896±185	3.16±0.11	2.47±0.03	91.06±4.06	[31]

Discussion

In our study, body weight in sago strain of giant gourami female broodfish before spawn ranged from 1958 to 2500 g per fish and ova somatic index ranged from 1.43 to 1.65%. Body weight in sago strain of giant gourami female broodfish is the smaller than as that of giant gourami belonging to the galunggung strain ranged from 2500 to 3500 g. Conversely, ova somatic index of galunggung strain are found to be slightly bigger than with sago strain of giant gourami ranged from 3.7 to 4.6%[8]. The differences of reproduction characterization in broodfish can be affected by strains, brood size, age used, previous spawning history and the production setting[23].

Absolute fecundity (AFs) in sago strain of giant gourami between from 2000 to 2650 eggs fish^{-1} and RFs were ranged from 977 to 1071 eggs kg^{-1}. Egg produced in kg fish^{-1} (RF) is thought to be more informative than absolute fecundity. Relative fecundity (RF) in sago strain of giant gourami were smaller compared to those in galunggung strain, palapah strain and blusafir strain[8,31,16]. On the other hand, the difference of relative fecundity can also be related to differences in broodfish size and age used[23]. Environmental factors such as rainfall is also influenced the number of eggs per spawn in giant gourami brood, while the water temperature negatively related to number of eggs per spawn[15]. Furthermore, egg diameter in sago strain of giant gourami is found to be almost the same than others strain of giant gourami (Table 5). In this study, EDs obtained average was 2.42±0.05 mm, consistent with those reported by another researcher, for example 2.18±0.19 mm for the giant gourami[30], 2.40±0.05 mm for blusafir strain[16] and 2.5±0.05 mm for galunggung strain[8]. Apparently, the differences the relative fecundity, ova somatic index, egg diameter and hatching rate of giant gourami can be influenced by differences in the strains. Furthermore, the egg diameter has been influenced by the dietary protein level[32,33,34,35], age broodfish[36], and spawning season[37,38]. In our study egg diameter was shown to be positively correlated with egg weight, hardened egg weight, and eggs weight increased. Egg weight of rainbow trout also increased after the hardening process and is a positively correlated with the viability of eggs[39]. Other egg quality metrics such as hatching rate, and survival to first feeding has been correlated with good egg quality.

In this study, the hatching rate of embryo (HRs) in sago strain of giant gourami were smaller than those of other strains of giant gouramy[8,31,16]. This condition might be affected by the egg and sperm quality in sago strain of giant gourami broodfish. In the present study, whether eggs and sperm quality are affected by feed nutrition for sago strain of giant gourami brooder is poorly understood. Meanwhile, the broodfish sex ratio has not influenced-on egg quality[8]. The reproduction characterization parameters that had strong correlations with the hatching rate were fertility rate (r^2=0.703) and survival rate (10 days) (r^2= 0.998). According to Sink *et al.*[40] that indicator of egg quality the strong correlation with biochemical composition of eggs. In this study, we did not evaluate biochemical composition of egg due to the related between egg quality and biochemical composition is difficult to interpret[41].

The keys of regulators of fish reproduced were gonadotropins (GTHs), follicle-stimulating hormone (FSH), luteinizing hormone (LH), and sex steroids[42,43]. Besides that, oocyte developed and matured also regulate by locally acting paracrine and autocrine[44,45]. However, there is not information about the effects of such kinds of factors on the oocyte develop in sago strain of giant gourami. Nevertheless, extrusion feed enriched with the vitamin E (d-α-tocopherol) as much as 137.8, 238.05, 338.72 and 439.39 mg per kg feed ingredients affected to markers of reproductive functions of giant gourami brooder (e.g., time sexual maturity, ova somatic index, relative fecundity and egg diameter)[31].

Various efforts have been made by scientists to increased reproductive performance of female broodfish such as to increase about dietary protein level for *Xiphophorus helleri*[33], *Channa marulius*[46] and *Ictalurus punctatus*[40]. Additionally, implantation of 17ß-estradiol has also managed to improve the reproductive performance in *Hemibagrus nemurus*[47]. In this context, whether the increase protein level of feed and use hormonal can increase reproduced potential in sago strain of giant gourami are poorly understood. Therefore, the experiment use of feed protein levels and hormonal dosage it is very important to applied for sago strain of giant gourami broodfish in the future.

Average SVs was found in sago strain of giant gourami are lower (0.4 to 0.6 ml) than those *Hemibagrus wyckii* (0.60 to 1.20 ml)[21], but higher than those of *Pterygoplichthys gibbiceps*[48]. It appears that the semen volume depend on fish species[21,49,50]. So many factors influenced on quality and quantity of sperm such as genetic, physiological, spawning season and environmental factors.[26,49,51,52]. On the other hand, improvements nutrition feed of broodfish and proofer feeding greatly improve gamete quality and larval production[46,53]. While, synthetic hormones such as salmon gonadotropin releasing hormone analogue and domperidone (GnRH + Domperidone) effective on sperm quality[54,55]. Nevertheless, for sperm fertility competition occurs in the aquatic environment, and that had strong correlation with the water quality in ponds. In this study, the water quality parameters in spawning ponds in terms of alkalinity (50.5 to 52.5 mg L^{-1}) and hardness (65.5 to 67.5 mg L^{-1}), pH (6.4 to 6.6) and water temperature (28 to 30 ^{o}C). The all water quality parameters can be supported the ability for sperm to fertilized an egg.

The sperm motility in sago strain of giant gourami ranged from 68 to 75%, and duration of motility ranged from 43 to 61 sec. This results that are consistent with *Genypterus blacodes* and *Esox lucius*[56,50]. The sperm motility included the percentage of motile sperm, straight line velocity, curvilinear velocity, average path velocity and linearity[50]. In this study, we did not investigate of those parameters. Meanwhile, percentage of motility sperm influenced by addition of extenders and cryoprotectants[57,58,59]. However, sperm motility on fresh semen slightly better compared to cryopreservation semen on the *Esox lucius*[50]. The fertility rate of eggs ranged from 76 and 84%, nevertheless, it is does not detected any significantly correlations between fertility rate and sperm parameters. Conversely, the sperm concentration had moderately correlation with the sperm motility and duration of motility. The parameters commonly measured to assess sperm quality in brood were volume, density and motility (such as the percentage of motile sperm, straight line velocity curvilinear velocity, average path velocity, linearity and amplitude of lateral head displacement), included fertilizing capacity [49,50,52,60]. This study, we did not investigate the ionic composition of the semen, but this phenomenon could be related to the ionic composition of semen which might has a significant influence on sperm motility and duration of motility.

Conclusion

This research analyzed the reproduction characterization in sago strain of giant gourami broodfish reared in concrete freshwater pond in the Aquaculture Laboratory Faculty of Fisheries and Marine

Science, Universitas Bung Hatta. Sago strain of giant gourami broodfish had the relative fecundities ranged from 977 to1071 eggs and egg diameter between from 2.32 to 2.46 mm. The semen volume ranged from 0.4 to 0.7 ml per kg body weight and sperm motility were between 68 to 75%. There was a strong linear relationship between absolute fecundity with the female fish weight before and after spawning. Similarly, the sperm concentration and sperm motility for the reared sago strain. Keys to increasing reproduction performance in sago strain of giant gourami depends upon weight size of broodfish, relative fecundity and hatching rates. Despite initial has been success for spawning, there are observed limitations of quality seed supply for aquaculture attributed to knowledge gaps in larval weaning, grow-up feeding technologies. Therefore, for the success practiced in hatchery, where further research is recommended for determine a proper feed formulation and the appropriate aquaculture system.

Data availability

Underlying data

Repository: Title. Reproduction characterization of the gurami sago (*Osphronemus goramy* Lacepède, 1801): basic knowledge for a hatchery development strategy for the future.

DOI: 10.6084/m9.figshare.14661189

This project contains the following underlying data:

- Table 1. Raw data of fish length, weight, absolute fecundity and relative fecundity of gurami sago broodfish
- Table 2. Raw data of egg diameter (mm) in sago strain of giant gourami broodfish
- Table 3. Raw data of hardened egg diameter (mm) in sago strain of giant gourami broodfish
- Table 4. Raw data of egg diameter increase (%) in sago strain of giant gourami broodfish
- Table 5. Raw data of egg weight (mg) in sago strain of giant gourami broodfish
- Table 6. Raw data of hardened egg weight (mg) in sago strain of giant gourami broodfish
- Table 7. The data of egg weight increase (%) in sago strain of giant gourami broodfish
- Table 8. The data of fertilization rate (%) in sago strain of giant gourami broodfish
- Table 9. The data of hatching rate (%) in sago strain of giant gourami broodfish
- Table 10. Male size, gonadal weight and semen in sago strain of giant gourami broodfish
- Table 11. Sperm concentration (10^9/mL) in sago strain of giant gourami broodfish
- Table 12. Sperm Motility (%) in sago strain of giant gourami broodfish
- Table 13. Duration motility (sec) in sago strain of giant gourami broodfish

Competing interests

No competing interests were disclosed.

Grant information

This study was funded by a competitive grants scheme called the Professor 2021. Contract number: 06.02.1.46.03.2021

Acknowledgements

The authors thank for Professor. Dr. Tafdil Husni the Rector of Universitas Bung Hatta for supporting this study through the competitive grant's schema called Research Professor, 2021. The appreciation goes to all of the students (Puji Kurniawan and Ranji Rinaldi and Muhammad Vajri Djauhari) who helped the author during data collection in the field.

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