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Effect of Sugarcane Bagasse and Supplemental Feed on Certain Reproductive Characterestics of the Catfish *Heteropneustes fossilis* (Bloch.)

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Abstract: The present investigation has been conducted to study the reproductive characterestics of the catfish, *Heteropneustes fossilis* (Bloch.) cultured in sugarcane bagasse substrate medium. Adult *H. fossilis* (av. wt. 194 g for males and 210 g for females) were reared at 20 tank^{-1}. No feed was provided to the fish in three of the substrate-added tanks (T_1) while a pelleted diet was fed to the fish in the remaining three substrate-added tanks (T_2) and the other three tanks without substrate (T_3). Finding showed that both sexes started to reach maturity after 355 days. The average diameter of the ripened egg was 1.3-1.6 mm. Fecundity varied in different experimental groups in relation to fish weight and feeding. Compared to supplemental feed (T_3) and in combination with sugarcane bagasse (T_2), sugarcane bagasse alone group (T_1) showed a positive relationship in all the parameters. These results showed that sugarcane bagasse can effectively be use as a substrate for the culture of the catfish *Heteropneustes fossilis*.

Key words: Sugarcane bagasse, artificial substrate, *Heteropneustes fossilis*, diameter, fecundity, combination

INTRODUCTION

Carnivorous fish species generally need a high protein diet and are therefore considered to be more expensive to produce even though, the costs will depend largely on local availability and price for the required feed stuffs. To compensate for feeding costs, most carnivorous species command higher market prices. Such species generally have greater export markets and therefore attract substantial investments. Species that are hardy and can tolerate unfavourable conditions will have the advantage of better survival in relatively poor environmental conditions that may occur occasionally in culture situations.

In the present study, *Heteropneustes fossilis* has been selected because the ability to adapt to fresh and brackish waters with very low oxygen content and to grow under generally poor environmental conditions make these fish extremely valuable for small and large scale rural fish farming (Pillay, 2001). Substrate-based farming practices are considered viable low-cost technologies as they help in sustainable aquaculture production (Dharmaraj *et al*., 2002).

Sugarcane bagasse is the fibrous residue remaining after sugarcane stalks are crushed to extract their juice, generated in large quantities and is currently used as a renewable resource in the manufacture of pulp and paper products and building materials. The aim of this study is to contribute information on total length, weight, gonadosomatic index spawning and fecundity of catfish *H. fossilis* cultured in substrate (sugarcane bagasse) alone and substrate with supplemental feed.

MATERIALS AND METHODS

Irrespective of sex, healthy fingerlings of *H. fossilis* (av. wt. 3.12±2 g) were collected locally from a single population and confined to large cement tanks in the laboratory. The experiment was conducted in nine 25 m^2 (5×5×1 m) cement tanks with 15 cm soil base (Dharmaraj *et al*., 2002). In all the tanks, initially added 0.25 kg of quick lime and 2.5 kg of poultry manure. Water was filled to the tanks from a perennial well and a depth of 90±2 cm was maintained throughout the experimental period.

Subsequently, poultry manure was applied at 0.3 kg tank^{-1} every 15 days. Sugarcane bagasse, procured locally was sun dried and bundles were made using nylon rope; they were introduced into six of the nine tanks randomly at the rate of 5 kg each by suspending the bundles at regular distances from bamboo poles kept across the tanks. After 45 days, once again 1.25 kg of the substrate was supplemented to each of the designated tanks. *H. fossilis* were stocked at 20 tank^{-1}, 2 weeks after the addition of manure and substrate. No feed was provided to the fish in three of the substrate-added

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Table 1: Showing the maturation stages of ovary of *H. fosssilis*

Stages	Nature of ovary	GSI	Ova diameter (mm)
1	Immature, thin, creamy white and translucent	0.20-1.500	0.10-0.20
2	Not ripe, small sac-like, red and smooth	1.52-6.250	0.20-0.90
3	Almost ripe, some large ova visible becoming fuller with much thinner mesentery walls. It was reddish-brown	2.35-21.65	0.90-1.35
4	Ripe, the membrane was very thin and red, mat green, eggs are visible with the naked eye and no ova were released when the abdomen was squeezed	2.64-25.32	1.25-1.54
5	Running ripe, large ova and the abdominal cavity was filled with ovary Membrane of the ova was thin, green and transparent. The eggs could be released by stripping or rough handling	13.75-41.08	1.62-1.68
6	Spent, large ova observed as black, mat green, transparent green and red	1.620-15.25	1.22-1.56

tanks (T_1) while a pelleted diet formulated (Table 1) (Varghese *et al*., 1976) was fed to the fish in the remaining three substrate-added tanks (T_2) and the other three tanks without substrate (T_3) at 5% body weight for the 1st 30 days and 2% thereafter in two equal rations daily.

After 358 days, 10 pairs of matured male (av. wt. 189 g) and female (av. wt. 210 g) *H. fossilis* were selected for the present study. Total lengths and weights were measured to the nearest 1.0 mm and 0.1 g, respectively. The sex was determined by examining the gonads with the naked eye. The gonads were removed, dried and weighed. The sexual cycle of females was divided into six stages (Clay and Clay, 1981). The Gonadosomatic Indices (GSI) were calculated using the formula:

$$GSI(\%) = \frac{\text{Gonad weight (g)}}{\text{Bodyweight}} \times 100$$

Sexual maturity was determined by observation of the stages of the maturation of the gonads (Clay and Clay, 1981). The egg size was measured to 0.1 mm using a micrometer eyepiece. Fecundity was calculated by gravimetric methods (Bagenal, 1978). Statistical analysis of the data included the one-way Analysis of Variance (ANOVA) using the SPSS Version 10.0 for windows on PC (Statistical Graphics Corp, US). Significant mean differences were separated at 5% using the standard methods (Steel *et al*., 1997) whereas appropriate and values are expressed as means±SE.

RESULTS AND DISCUSSION

H. fossilis was dioecious and the sex could be determined externally on most fish exceeding 13 cm in length. The experiment was conducted after 358 days. The maturation stages and nature of ovary as well as gonadosomatic index and ova diameter were given in Table 1 to identify the sexual maturity. A combination of physical, chemical and biological factors such as changes in water level; chemistry, pH, temperature, clarity and flow velocity, flooding of marginal plants, associated chemical changes and access to suitable spawning sites is responsible for triggering the spawning of catfish (Bruton, 1979). In the present study, total length, weight and fecundity of *H. fossilis* (Table 2) was studied. All the parameters studied were highest in group T_2 followed by T_3 and T_1. Increases in the growth rate of the fish slowed down in the age of maturity and this was the effect of an environmental change on the age (and size) at maturity. Wootton (1992) stated that the fish reach sexual maturity at an unusually small size in stunted populations. The fecundity of the population may be obtained from the product of the expected fecundity of an average-sized female and the total number of spawning females. In this study, total length and fish weight was taken for calculating the fecundity as fecundity increased exponentially with total length (Clay and Clay, 1981; Bruton, 1979; Gaigher, 1977).

Table 2: Showing the total length (cm), weight (g) and fecundity of *H. fosssilis*

	Experimental groups		
Parameters	T_1	T_2	T_3
Total length	29.7±1.10	35.2±2.18	31.5±2.25
Weight	190.15±2.00	225.50±2.00	224.70±2.0
Fecundity	6100±100.12	7210±112.15	7182±115.0

*Average values±SE of 10 individuals; T_1 = Sugarcane bagasse alone group; T_2 = Sugarcane bagasse+supplemental feed group and T_3 = Supplemental feed alone group

Willoughby and Tweddle stated that the ripe ovaries contained between 600 and 1,400 eggs g^{-1} wet weight. In this study, the fecundity of females was estimated to be 6100-7182 eggs per female. This can be attributed to differences in the sizes of the females making up spawning stock (Jobling, 1995). Intraspecific variations in fecundity and egg size may also be related to the time of spawning and feeding. Compared to T_2 and T_3, the fish reared in sugarcane bagasse alone (T_1) also showed good results in length, weight and fecundity rate. From all these results, sugarcane bagasse can be effectively used as a substrate for culturing the catfish *H. fossilis*.

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