

## HYBRIDIZATION BETWEEN *CLARIAS GARIEPINUS* (BURCHELL 1822) AND *HETEROBRANCHUS BIDORSALIS* (GEOFFROY SAINT HILAIRE, 1809)

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### ABSTRACT

This study was carried to produce hybrids between crosses of *Clariid* catfish species of *Clarias gariepinus* and *Heterobranchus bidorsalis* for stock improvement. Fertility data revealed significant difference ( $p < 0.05$ ) between the hybrid cross ♀*C. gariepinus* × ♂*H. bidorsalis* ( $88.00 \pm 1.00\%$ ) compared to its reciprocal ♀*H. bidorsalis* × ♂*C. gariepinus* ( $71.67 \pm 10.41\%$ ). The reciprocal ♀*H. bidorsalis* × ♂*C. gariepinus* recorded the highest deformity ( $11.67 \pm 3.06\%$ ) that was significantly different ( $p < 0.05$ ) from the rest of the crosses. Equal sex ratio in the hybrids compared with the two parent species was recorded. Specific growth rate (SGR) of the fish species revealed highest significant difference ( $p < 0.05$ ) in the hybrid ♀*C. gariepinus* × ♂*H. bidorsalis* ( $2.64 \pm 0.09\%$ ), followed by the cross of ♀*C. gariepinus* × ♂*C. gariepinus* ( $1.91 \pm 0.02\%$ ) while there were no significant differences ( $p > 0.05$ ) between the reciprocal hybrid ♀*H. bidorsalis* × ♂*C. gariepinus* ( $2.20 \pm 0.57\%$ ) and ♀*H. bidorsalis* × ♂*H. bidorsalis* ( $2.19 \pm 0.19\%$ ). The SGR analysis proved that the crosses ♀*C. gariepinus* × ♂*C. gariepinus* had slow growth performance compared to its hybrid ♀*C. gariepinus* × ♂*H. bidorsalis*. Critical evaluation based on survival and specific growth performance showed superiority of the hybrid ♀*C. gariepinus* × ♂*H. bidorsalis*. The least survival in reciprocal hybrid ♀*H. bidorsalis* × ♂*C. gariepinus* (27.33%) can be explained from significant deformity (11.67%) recorded due to maternal effects. Hence, the hybrid ♀*C. gariepinus* × ♂*H. bidorsalis* performed better in the SGR and survival.

**Keywords:** catfish, hybrid, specific growth rate, survival, deformity

### INTRODUCTION

Hybridization has been of importance in both research and commercial aquaculture due to its benefits such as increased growth rate, sex ratio manipulation, production of sterile species and enhancement of many other desirable economic traits (Colombo *et al.*, 1996; Beaumont and Hoare, 2003; Dunham, 2004). Hybrid species possibly present higher growth and survival than either one or both of their parents species, and/or one or more characteristic(s) sought-after in the either parent species e.g. robustness, salinity/ thermal tolerance, morphology, flesh quality among others (Lenormand, 1988). Hybridization may also result to other traits that cannot be predicted from the knowledge about their parents' species and may be absent altogether, particularly in certain teleost families (Colombo *et al.*, 1996). Therefore, hybridization can be a source of evolution and speciation (Dunham, 2004). This study was aimed at producing hybrid progenies between the of *C. gariepinus* and *H. bidorsalis* for enhanced stock improvement.

### MATERIALS AND METHODS

**Location:** The research was carried out at Biotechnology Laboratory, Department of Animal science, Obafemi Awolowo University, Ile-Ife.

**Research Design:** Milt and eggs of both *C. gariepinus* and *H. bidorsalis* were collected for same parent species and inter-specific crosses. The data on fertility, hatchability, deformity and survival were obtained following Olaniyi and Omitogun (2013). The hatchlings were left for 2 weeks in the hatchery before they were transferred to bigger breeding plastic tank (2M × 1M ×

0.5M). Thirty-five fingerlings of each of the crosses were allotted into breeding plastic tank, whereby more parameters such as survival, weight, and specific growth rate were recorded up to 12th week. The data were subjected to statistical analysis using the General Linear Models (GLM) procedure of software SAS, 2002 (SAS Institute, 2002).

## RESULTS AND DISCUSSION

Effects of hybridization on fertility, hatchability and survival on the hybrids of *Clarias gariepinus* and *Heterobranchus bidorsalis*: Table 1 showed the effects of hybridization on fertility, hatchability and survival with respect to crosses between *C. gariepinus* and *H. bidorsalis*. The fertility data revealed significant difference between the hybrid ♀*C. gariepinus* × ♂*H. bidorsalis* (88.00±1.00%) compared to its reciprocal cross ♀*H. bidorsalis* × ♂*C. gariepinus* (71.67±10.41%). While all the other crosses hybrid ♀*C. gariepinus* × ♂*H. bidorsalis* (88.00±1.00%), reciprocal hybrid ♀*H. bidorsalis* × ♂*C. gariepinus* (71.67±10.41%), were not significantly different from other crosses - same parent crosses (♀*C. gariepinus* × ♂*C. gariepinus*, 83.00±7.21%; ♀*H. bidorsalis* × ♂*H. bidorsalis*, 80.67±6.03%), ( $p > 0.05$ ). Hatchability revealed no significant differences between the all same parent species crosses (♀*C. gariepinus* × ♂*C. gariepinus*, 74.67±7.23%; ♀*H. bidorsalis* × ♂*H. bidorsalis*, 68.33±3.06%) ( $p > 0.05$ ), and hybrid ♀*C. gariepinus* × ♂*H. bidorsalis* (79.33±4.04%), except with reciprocal hybrid ♀*H. bidorsalis* × ♂*C. gariepinus* (48.67±5.13%) that these were significantly different from all other crosses ( $p < 0.05$ ). The reciprocal hybrid ♀*H. bidorsalis* × ♂*C. gariepinus* recorded the highest deformity (11.67±3.06%) that was significantly different ( $p < 0.05$ ) from the rest of the crosses. The percent deformity of other crosses were not significantly different from one another ( $p > 0.05$ ). A week survival (%) revealed no significant difference ( $p > 0.05$ ) between the ♀*C. gariepinus* × ♂*C. gariepinus* (70.33±4.16%) and hybrid ♀*C. gariepinus* × ♂*H. bidorsalis* (71.00±5.29%), but both showed significant difference ( $p < 0.05$ ) compared to the crosses of the reciprocal hybrid ♀*H. bidorsalis* × ♂*C. gariepinus* (27.33±6.81%) that had the least at a week survival. Survival at both 4<sup>th</sup> through 12<sup>th</sup> weeks for hybrid ♀*H. bidorsalis* × ♂*C. gariepinus* was lowest and revealed significant difference among the rest of the crosses ( $p < 0.05$ ).

**Table 1: Effects hybridization on fertility, hatchability and survival in *Clarias gariepinus* and *Heterobranchus bidorsalis* hybrids**

Parameters (%)	♀C×♂C	♀C×♂H	♀H×♂C	♀H×♂H
Fertility	83.00±7.21 <sup>ab</sup>	88.00±1.00 <sup>a</sup>	71.67±10.41 <sup>b</sup>	80.67±6.03 <sup>ab</sup>
Hatchability	74.67±7.23 <sup>a</sup>	79.33±4.04 <sup>a</sup>	48.67±5.13 <sup>b</sup>	68.33±3.06 <sup>a</sup>
Deformity	2.67±0.58 <sup>b</sup>	2.00±1.00 <sup>b</sup>	11.67±3.06 <sup>a</sup>	2.00±1.00 <sup>b</sup>
A wk survival	70.33±4.16 <sup>a</sup>	71.00±5.29 <sup>a</sup>	27.33±6.81 <sup>c</sup>	61.00±1.73 <sup>b</sup>
4wks survival	69.67±4.62 <sup>a</sup>	69.00±7.21 <sup>a</sup>	23.00±6.08 <sup>c</sup>	58.33±4.73 <sup>b</sup>
8wks survival	66.00±6.56 <sup>a</sup>	66.67±10.41 <sup>a</sup>	21.67±7.64 <sup>b</sup>	55.00±5.29 <sup>a</sup>
12wks survival	65.30±5.42 <sup>a</sup>	64.67±11.93 <sup>a</sup>	20.96±6.78 <sup>b</sup>	52.33±3.06 <sup>a</sup>

<sup>abc</sup>Means within a row with different superscripts are significantly different (P<0.05). General Linear Model procedure (SAS<sup>®</sup>, 2002). C= *Clarias gariepinus*, H=*Heterobranchus bidorsalis*

**Table 2: Growth evaluation and sex ratio of the *Clarias gariepinus* and *Heterobranchus bidorsalis* hybrids**

Parameters	♀C×♂C	♀C×♂H	♀H×♂C	♀H×♂H
Weight (g) @ 4wks	4.58±0.28 <sup>a</sup>	2.06±0.63 <sup>a</sup>	5.69±5.51 <sup>a</sup>	2.82±0.61 <sup>a</sup>
Weight (g) @ 12wk	53.39±1.67 <sup>a</sup>	61.23±11.97 <sup>a</sup>	74.66±32.73 <sup>a</sup>	47.27±1.46 <sup>a</sup>
Avg. daily weight gain (g)	0.87±0.03 <sup>a</sup>	0.32±0.00 <sup>b</sup>	1.23±0.49 <sup>a</sup>	0.79±0.04 <sup>ab</sup>
Specific growth rate (%/d)	1.91±0.024 <sup>b</sup>	2.64±0.09 <sup>a</sup>	2.20±0.57 <sup>ab</sup>	2.19±0.19 <sup>ab</sup>
Sex ratio* (Male:Female)	1:1 <sup>ns</sup>	1:1 <sup>ns</sup>	1:1 <sup>ns</sup>	1:1 <sup>ns</sup>

<sup>abc</sup>Means within a row with different superscripts are significantly different (P<0.05). General Linear Model procedure (SAS<sup>®</sup>, 2002). C= *Clarias gariepinus*, H=*Heterobranchus bidorsalis*

Body weights at 4<sup>th</sup> and 12<sup>th</sup> weeks of the different crosses revealed no significance (P<0.05). The specific growth rate analysis proved that the progenies of ♀*C. gariepinus*×♂*C. gariepinus* recorded slow growth performance compared to its hybrid ♀*C. gariepinus*×♂*H. bidorsalis*. However, critical evaluation on the survival and specific growth performance showed the superiority of hybrid ♀*C. gariepinus*×♂*H. bidorsalis*. In a related study, but with *C. gariepinus* with *H. longifilis*, Legendre *et al.* (1992) reported the hybrids to have similar growth rates performance with *H. longifilis* and at the same time in one of their experiments hybrid ♀*H. longifilis*×♂*C. gariepinus* displayed faster growth than the *H. longifilis*. In another related study, the performance of hybrid ♀*C. gariepinus*×♂*H. bidorsalis* was significant than its reciprocal

♀*H. bidorsalis* × ♂*C. gariepinus* (Ndimele *et al.*, 2011). Colombo *et al.* (1996) explained that five possible beneficial outcomes may result from hybridization, viz: intermediacy, combinability, luxuriance, monosexuality and novelty. In the light of this study, the outcome of hybridization with respect to parameters like SGR, average daily weight gain, sex ratio etc of the different crosses confirmed the varying or mixed outcome of hybridization. Colombo *et al.* (1996) further explained that hybridization can give traits that cannot be predicted from the knowledge about the hybrids' parent species and also, it may be absent altogether particularly in some teleost families. The sex ratio (male: female) showed no significant deviation from 1:1 chi-square testing ( $p > 0.05$ ) across all the progenies (Table 2). This study showed an outcome of equal sex ratio in the hybrids compared to their parents. This result corroborated the study of Legendre *et al.* (1992) that also found out equilibrated sex ratio in the hybridization study between *H. longifilis* and *C. gariepinus*. The outcome of equal sex ratio between the hybrids and the parents confirmed the hypothesis of same sex determining mechanism as also reported in hybridization study between *H. longifilis* and *C. gariepinus* (Legendre *et al.*, 1992).

#### CONCLUSION AND RECOMMENDATION

♀*C. gariepinus* × ♂*H. bidorsalis* revealed better survival and growth based on the data, and is therefore recommended to commercial fish farmers.

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