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SIZE VARIATION, GROWTH AND BODY CONFORMATION OF RECIPROCAL HYBRIDS OF *Clarias gariepinus* (BURCHELL 1822 AND *Heterobranchus bidorsalis* (GREFFROY, 1809)

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ABSTRACT:

Reciprocal hybrids of *Clarias gariepinus* and *Heterobranchus bidorsalis* were compared for size variation, growth and body conformation. Growth was observed to be significantly faster ($P< 0.05$), and size variation less pronounced (CV = 26%) for *C. gariepinus* (female) and *H. bidorsalis* (male) hybrid, than the reciprocal (CV = 38%)

No difference was observed in the body conformation between the reciprocal hybrids. However, the percent head length of the standard length was significantly smaller ($P< 0.05$) in the reciprocal hybrids than that observed for the parent species.

INTRODUCTION:

There had been a rapid progress in the area of hybridization, following the success recorded in induced fish breeding through hypophysation technique. Hybridization is mostly directed at stock improvement with respect to economic traits including fast growth, improved body conformation, disease resistance/stress tolerance etc.

Interspecific and intraspecific hybidzation of the various species of the popular clariid catfishes have been widely reported (Hecht, 1985; Legendre, 1991; Nwadukwe, 1995; Oelleraman, 1983; and Salami *et al* 1993). In the available studies on the hybridization of *C. gariepinus* and *H. bidorsalis* (Salami *et al* 1993), and Oladosu *et al* 1993 the focus were on growth, fry survival and reproductive capacity of the hybrids.

However, optimal production of the seed of clariid catfish species has been greatly hindered by the cannibalistic tendencies of these group of fishes. This is further compounded by the usually pronounced size variation readily observable within population of the same age (Ayinla *et al* 1989). Also the dress-out weight of these group of fishes could be better and their acceptability wider with smaller head length in relation to the standard body length.

This study compares the population structure of the reciprocal hybrids of *C. gariepinus* and *H. bidorsalis*, in search of a cross that will yield better size uniformity and body conformation, and yet fast growing.

MATERIALS AND METHODS:

Identification and Selection of broodfish:

Broodfish used in this study, are hatchery bred *Clarias gariepinus* and *Heterobranchus bidorsalis*, selected from the broodstock of the African Regional

Aquaculture Centre (ARAC). The identification of these two species were based on method described by Teugels (1982 and 1990).

Gravid female fish were selected based on ovarian biopsy, and the viability of the eggs assessed as described by Legendre (1986). Hyperaemia of the tip of the urogenital papillae was the major criterion used in the selection of ready to spawn males.

Hybridization:

The artificially induced spawning method (dry stripping) was used for gamete procurement. Female broodfish were injected intramuscularly with dry carp pituary extract (Argent chemical Inc., USA), in the evening, Female *C. gariepinus* received a single dose of 4mg/kg of CPE (Hogedoorn *et al* 1980), while *H. bidorsalis* also received a single dose of 6mg/kg of CPE (Nwadukwe *et al* 1992). The induction temperature was 27°C. A latency period of 9 hours was observed, and the ovulated eggs were stripped seperately into dry plastic receptacles. Males were sacrificed and milt were extracted from the testes using razor blades, and washing with 0.9% saline solution. The eggs of *H. bidorsalis* female (Hf) were fertilized with the milt from *C. gariepinus* male (Cm), in one treatment (Hf x Cm) while the eggs of *C. gariepinus* female (Cf) were fertilized with the milk of *H. bidorsalis* male (Hm) in a reciprocal treatment (Cf x Hm). Both treatments were replicated once. Fertilized eggs in different treatments were incubated differently in equal volume of water in fibre glass troughs of the same size.

Larval rearing:

Hatching was observed within 24 hours, and was completed within 32 hours. Dead eggs and deformed fry were removed by siphoning. Good water quality was maintained by daily renewal of water in all troughs.

Following absorption of yolk, fry were nursed on mixed zooplankton collected from organically enriched ponds. Fry were fed *ad libitum.* Compounded fry diet (35% crude protein) was introduced as supplement to the zooplankton diet by the sixth day post-hatch. The quantity of the dry diet was gradually increased until it completely replaced the mixed zooplankton diet.

Fry in each trough were transfered to seperate concrete tanks measuring 1.76m x 1.76 x 1m. The tanks were earlier impounded and fertilized with chicken manure applied in jute bags (to avoid pollution). The jute bags were removed when satisfactory bloom of plankton was observed. The 35% CP mash were then replaced with crumbs of the same crude protein level. Feeding was done twice daily, morning and evening, for all treatments.

Morphomeric Measurements:

Measurement of standard body proportions used in fish description were made as described by Teugels (1982). This was carried out for both the broodfish and 100 randomly

sampled 31 days old hybrid fingerlings, per replicate of the different treatments. Emphasis was placed on the percent head length of the standard length and the percent standard length of the total length.

Growth and Survival Monitoring:

In a seperate trial, growth rate of the reciprocal hybrid was studied using 50 fry. The initial weight (10 days post hatch) and the final weight (38 days post hatch) were recorded and used in calculating the percent specific growth rate for all replicates, using the formular described by Keshavanath *et al* (1991).

Water Quality Monitoring:

The dissolved oxygen level, temperature and pH of water in all trials were monitored using a digital oxygen and temperature meter (oxyguard handy MK II), and a digital pH meter (Aquatic Ecosystem Inc. Florida).

Data Analysis:

Coefficient of variation and percent specific growth rate were calculated for the reciprocal hybrids. Percent SGR values were compared using analysis of variance (at 1%, 5% and 10%). Also, percent head of length of the standard length, and percent standard length of the total length were compared between the reciprocal hybrids, as well as with the parent lines, using the same statistical method aforementioned. The coefficient of variation was further analysed for significant difference (at 1 and 5%) as described by Gregory (1977).

RESULTS:

Growth and Survival:

The specific growth rate (SGR) as observed for a fry rearing period of 38 days showed a significantly faster growth ($P<0.05$) in Cf x Hm cross than the reciprocal (Table 1). However survival rates was observed to be higher in the Hf x Cm cross. The mean values of temperature, dissolved oxygen and pH, observed during fry rearing were 26.07°C, 5.87mg/l and 7.82 respectively.

Size variation:

Variation in size was observed to be significantly lower ($P<0.05$) in the Cf x Hm cross, in which a coefficient of variation (Cv) of 26% was recorded (Fig. I). However, occurence of runts was more pronounced, and shooter less observed in the Hf x Cm cross, while a higher frequency of uniform size fingerlings was observed in Cf x Hm cross.

Body Conformation:

The percent standard length of total length was highest in *C. gariepinus* followed by *H. bidorsalis*, Hf x Cm cross and Cf x Hm cross respectively. The difference in the values of the percent head length of standard length observed for the reciprocal hybrids was not significant. Significant difference was however observed ($P< 0.05$) between the reciprocal hybrids and the parent species (Tabel 2).

It should be noted also that while the percent standard length of total length was higher in Hf x Cm cross (86.25 ± 2.54) than the Cf x Hm cross (84.99 ± 1.71), the reverse was the case for the observed percent head length of standard length.

DISCUSSION:

Reciprocal hybridization between *C. gariepinus* and *H. bidorsalis* has earlier been reported to be feasible (Salami et al, 1993, Oladosu *et al*, 1993), as is also observed in this study.

The results obtained in this study shows a significantly faster growth for the Cf x Hm cross (Table 1.). This differs with the observation made by Salami *et al* (1993), where no difference was observed on the growth of the reciprocal crosses. Sex-linked difference in growth rate of *C. gariepinus* was said to have been reported in favour of males (Legendre 1992). He also observed that there is no sex linkage in the growth difference in the reciprocal crosses *C. gariepinus* and *H. longifilis*. The difference observed in the growth rate of the reciprocal hybrid in this study could also not be explained based on sex-linked difference in growth especially when the faster growth was observed in Cf x Hm. This could however be so if sex-link difference in the growth of *H, bidorsalis* occur, and in favour of the male. The difference in growth observed cannot be said to be due to environmental conditions of rearing either, since condition of rearing were similar in all treatments. Water quality parameters are in the range that supports good fish growth (Boyd, 1982).

Size variation among clariid catfish species has earlier been reported (Viveen et al, 1986 and Ayinla *et al* 1989). Ayinla et al (1989) reported four distinct groups in a population of the same age. They suggested that the variation in size was greatly influenced by broodstock (female) size. The present study also observed variation in the size of fingerlings population of the reciprocal hybrid of the same age. The significance of size variation in a population of fish species with high carnibalistic tendency is the attendant adverse effect on the yield. Shooter in a population tends to carnibalise on the runt and the medium sized individuals (Ayinla *et al*, 1989). This is evident in the finding of this study where in percentage survival, which was suspected to be greatly influenced by the

carnibalistic behaviour of the clariid catfishes, was observed to be higher in Hf x Cm cross which also has a significantly higher ($P<0.05$) coefficent of variation (Fig. 1). Furthermore, the Cf x Hm cross which has a lower coefficient of variation (higher uniformity), has a higher proportion of shooters hence the lower survival rate observed in this group. It is obvious therefore, that carnibalism can only be eliminated in a population of clariid catfish species if there is complete uniformity in size. The results of this study has shown that the hybridization of *C. gariepinus* and *H. bidorsalis* cannot achieve this.

The observation made by Legendre *et al* (1992) that the reciprocal crosses of *C. gariepinus* and *H. longifilis* displayed intermediate external morphology, agreed with the finding of Salami et al (1993), on the reciprocal crosses of *C. gariepinus* and *H. bidorsalis*. As observed in this present study however, the percent head length of standard length (% HL of SL), and the percent standard length of total length (% SL of TL), are exceptions to this general observation. The % HL of SL is significantly lower in the reciprocal hybrids when compared to the parents species, while there is no difference in the % SL of TL. This tend to show that the hybrid may possess better dressout weight than the parent species of the same size.

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TABLE 1: **Percent specific growth rate and survival of reciprocal hybrid between 10 days and 38 days post hatch.**

	Hf x Cm	Cf x Hm
Initial weight (mean) (g)	0.0054	0.0023
Final weight (mean) (g)	0.0340	0.1133
Percent daily growth rate	2.8775[a]	6.0235[b]
Percent survival (mean ± Std)	25.25 ± 12.73	17.00 ± 7.10

Values in the same row but with different superscripts are significantly different ($P<0.05$).

TABLE 2: Body Conformation of the Reciprocal hybrids and the parent lines.

Fish Speices	% SL of TL		% HL of SL	
	Range	Mean ± SD	Range	Mean ± SD
C. gariepinus	87.0-87.24	87.11±0.85	32.77-33.33	33.05±0.32[a]
H. bidorsalis	87.71-87.79	86.75±0.85	30.00-31.76	30.97±0.88[a]
C_f x H_H hybrid	76.92-91.55	84.99±1.71	18.14-32.56	26.07±2.90[bc]
H_f x C_H hybrid	77.78-91.91	86.25±2.54	18.18-33.33	25.96±3.05[c]
	SL	=	Standard legnth	
	TL	=	Total length	
	HL	=	Head length	

Values in the same column but with different superscript are significantly different ($P<0.05$).

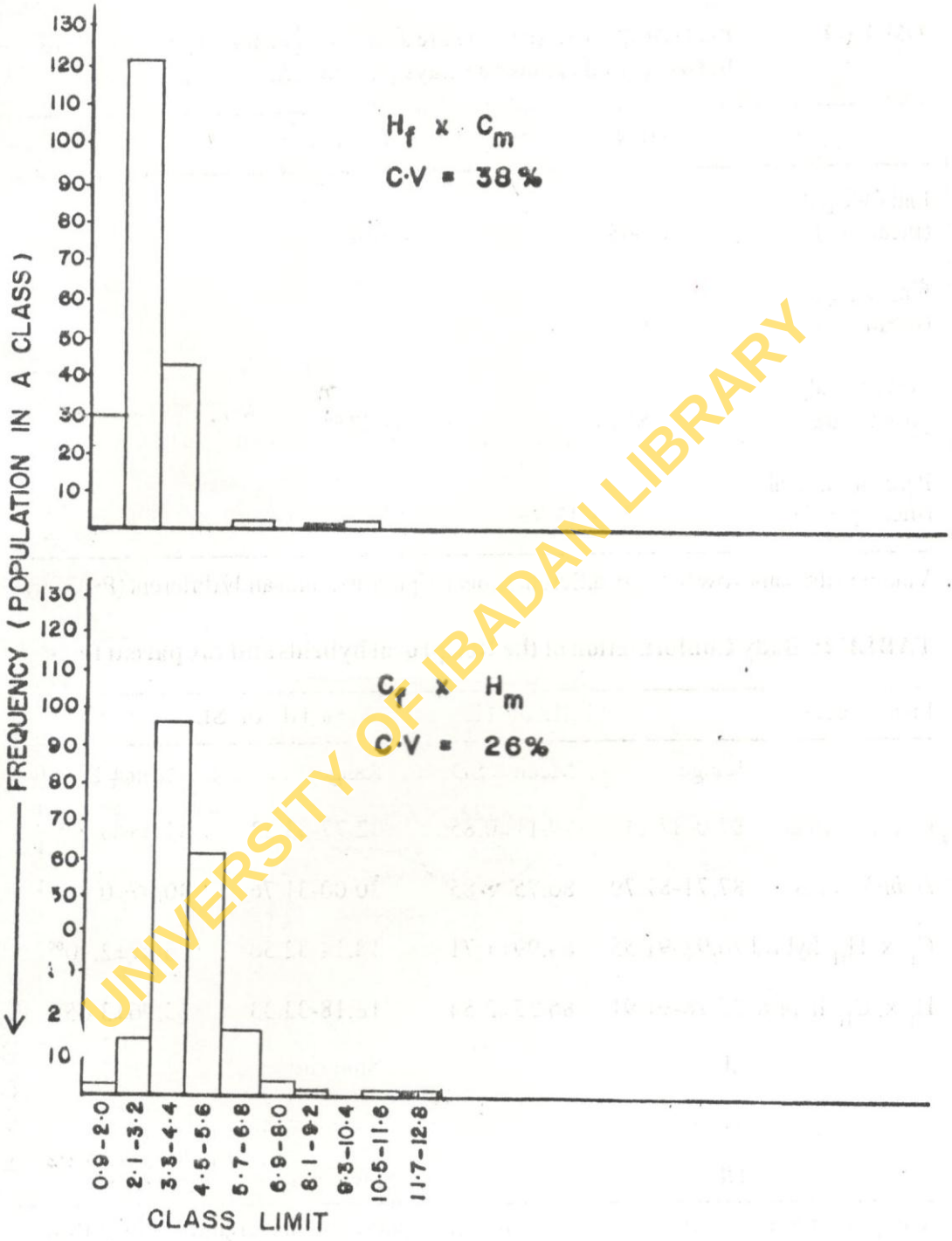

Fig. 1: Size Distribution in Hybrid Populations

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