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Disease Resistance of Inbred and Crossbred *Clarias gariepinus* (Burchell, 1822) Fingerlings Strains of Rivers Benue and Donga Nigeria in Response to *Aeromonas hydrophila* Challenged

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Disease resistance of inbred and novel intra-specific crossbred fingerlings of *Clarias gariepinus* (Burchell, 1822) in response to *Aeromonas hydrophila* challenge was assessed in fisheries and aquaculture research farms with the goal of assessing symptoms, survival and growth rate in fingerlings of novel inbred and crossbred genotypes of *C. gariepinus,* in order to explore their potentials for improved aquaculture. The result demonstrates that survival and growth rates differed significantly across genotypes control and challenged treatments. Fish from challenging treatments exhibited darker coloration, slower swimming, swelling of the lower belly, ulceration, and death. 10% of the challenged ♀Bn x ♂Bn and ♀Dg x ♂Bn perished within 72 hours, while all control treatments survived. At two week, the survival rates of the challenged ranged from 30% in ♀Bn x ♂Dg, 40% in ♀Dg x ♂Dg, 80% in both ♀Bn x ♂Bn and ♀Dg x ♂Bn. Except for ♀Dg x ♂Bn, ♀Bn x ♂Dg, ♀Bn x ♂Bn and ♀Dg x ♂Bn: 2.21 ± 0.06^{d}, 0.98 ± 0.1^{c} and 0.1 ± 0.1^{ab}, growth rate were considerably greater in challenged than in control. *C. gariepinus* crossbreed (♀Dg x ♂Bn) tolerated *A. hydrophila* infection better than crossbreed (♀Bn x ♂Dg). The crossbreed *C. gariepinus* (♀Dg x ♂Bn) will increase fish production and profitability under illness challenges. If several selective breeding and back crossing of the strains and one of the parents are conducted between rivers Benue and Donga, there is possibility of obtaining fish seed with improved reproductive potential in terms of survival, growth, mortality rate, and disease resistance in terms of *A. hydrophila* challenge.

INTRODUCTION

Aquaculture accounts for approximately half of all fishes consumed globally, while developing nations account for 61 % of all traded sea food (FAO, 2018). Aquatic animals' diseases are seen as a serious danger to the sustainability of aquaculture, as they jeopardize the efforts and outcomes of millions of small fish farmers worldwide. Aquaculture has become an important component of the animal health business due to ongoing increase of cultured fish and shellfish species, and aquatic illnesses are the most significant constraint in aquaculture output. Disease frequently has a severe impact on fish feeding behavior, development and survival, resulting in significant investment losses in the fisheries business. Meanwhile, farmed fish are more sensitive to disease agents than wild caught fish. Intensification of fish culture has resulted in numerous challenges, with bacterial infections being identified as the primary issue for local fish farmers (Najiah *et al*., 2009; Oyebola *et al.,* 2017). *Aeromonas* is increasingly being blamed for illness outbreak in farmed fishes around the world. These bacterial species are common in the aquatic environment but have recently emerged as a difficult pathogen of cultured fish and the phenotypic identification of these species is difficult due to its complexity in employing growth and biochemical parameters, which causes confusion, particularly among closely related species and strains (Puthucheary *et al*., 2012). Despite the documented contributions of other *Aeromonas* species to disease outbreak in fish, *A. hydrophila* is the primary source of disease outbreaks in fresh water farmed fish, contributing to food insecurity and economic loss globally. *Aeromonas* illnesses in fish farms are accelerated by a variety of causes, including changes in pond water physical-chemical properties. Increased turbidity, temperature, salinity, pH, water conductivity and low dissolved oxygen are critical physical-chemical characteristic; these environmental conditions create stressors that predispose fish to infections and illnesses (Camus *et al*., 1998).

The employment of a genetic method has a long-term influence in combating any illness challenge since the advantages are heritable in later generations. Genetic enhancement for disease resistance may be a practical and sustainable option to preventing diseases outbreaks, and these techniques has the potential to aid in disease control (Yanez, 2014). This method makes use of fish natural immunological response, which varies within and across genotypes.

Crossbreeding to create intra-specific or inter-specific hybrids has potentials to investigate heterosis, which could be important in the evolution of genotypes that are resistant to a disease challenge. The potentials, however, must be evaluated in different fish genotypes employing different infections. Development of genotypes that are resistant to a disease challenge would be especially important for commercially valuable species that are widely farmed (Banito *et al.,* 2010 and Yanez, 2014). Because most production features are generally controlled by many gene and gene interactions, the observed phenotypes may co-vary with other importance qualities like disease resistance. This must, however, be determined for the purposes of use. In order to evolve strains of improved disease resistance and growth productivity in the case of disease challenge in aquaculture, the inbred and the intra-specific crossbred's fingerlings of *C. gariepinus* were evaluated for clinical symptoms, growth rate and survival rate in response to a disease (*A. hydrophila)* challenge.

MATERIALS AND METHODS

Study Area

The study was conducted at the Fisheries and Aquaculture Department research farm of Federal University Wukari, Taraba State 2022. The research farm is located between latitude $7^0$51 N $9^0$47 E and Longitude 7.850^{0}N 9,783^{0}E. It is a tropical zone with an average annual temperature of 27.2- 37ºC, a relative humidity of 62, and 260.4 hours of sunshine each month.

Experimental Fish

The experimental fish came from an ongoing study at the experimental site. *C. gariepinus* brooders strains were used to create the fish specimens. These strains were identified based on previous descriptions (Oyebola *et al.,* 2016) and then used to construct the inbred and crossbred progenies.

Experimentation Crosses

The generic combinations listed below were tested;

Inbred	**Crossbred**
♀Dg x ♂Dg	♀Dg x ♂Bn
♀Bn x ♂Bn	♀Bn x ♂Dg

Note: ♀Dg x ♂Dg is Donga Female X Donga Male; ♀Bn x ♂Bn is lower Benue Female X lower Benue Male; ♀Dg x ♂Bn is Donga Female X lower Benue Male and ♀Bn x ♂Dg is lower Benue Female X Donga Male.

Procedure and Culture of Aeromonas hydrophila

40 g of Mac-conkey agar was weighed and placed into a conical flask, then diluted with 100ml of distilled water using a heating mantle to completely dissolve the agar particles. The mouth of the conical flask was sealed and

autoclaved at 121°c for 15 minutes, after which the sterilize agar was allowed to cool at 45 °c. 15- 20 ml of agar was put onto pre-sterilize Petri dishes and allowed to harden. The prepared agar plates were kept in the refrigerator at 6-7 °c. Oracle Farm Limited earthen and concrete pond water was utilized. Using a candle flame, the wire loop was sterilized to a red-hot state. The wire loop was inserted deeply into the earthen pond water, and a pool of inoculums was form and streaking was done three times at varied dimensions. The Petri plates were covered and incubated for 48 hours at 35 °c.

Method of Culture

On one end of the slide, a loopful growth from a blood agar subculture was mixed in a drop of distilled water. Another loopful of growth was mixed in a drop of peptone water on the other end of the slide. The preparations were covered with a cover slip and viewed under a microscope with an X40 objective. The camera is an Olympus CX21.

Biochemical test

Biochemical test were performed in distilled water using L**-** arabinose, sucrose, Asculin, oxidase test, sodium chloride free peptone (Nacl), and Motility.

Disease Challenge Test

A two weeks old cohort of inbred and crossbred genotypes was challenged with cultured *A. hydrophila* at the Department of Fisheries and aquaculture research farm, Federal University Wukaria, Nigeria. After growing the bacterium from Benue State University Laboratory, the colony of the *A. hydrophila* required for the challenge was created. The cells were collected and re-suspended in sterile saline. The bacteria suspensions were diluted with sterile saline to yield an inoculum concentration of 2.56×10^7 cfu/ml. This concentration was chosen because 3.0×10^7 cfu/ml of *A. hydrophila* inoculum caused infection in adult *C. gariepinus* (Hanna *et al.,* 2014).

Each 30ml rearing medium prepared for the challenge of the fry of Donga female x Donga male, lower Benue female x lower Benue male, Donga female x lower Benue male and lower Benue female x Donga male received 0.5ml of the inoculum. These were prepared in threes. Earlier approaches were used in the challenge test (Schadich and Cole 2010). Fifty individuals from the two-weeks old cohort of inbred and crossbred genotypes were immersed in each of the *A. hydrophila* inoculated, 0.5ml rearing media and their replicates for 20 minutes. Each treatment was then transferred to fresh rearing water of the same volume and reared for two weeks with two ad-libitum feeding/day. 2mm blue crown feed was provided to the fingerlings. The non-challenged specimens (control) of the inbred and the crossbred were likewise created in duplicate and reared alongside the challenged specimens under the identical water and feeding circumstances.

Parameters of Water Quality

Because water is utilized in fish culture, its quality degrades quickly and requires extensive maintenance. To allow for aeration, the unclean water was drained and replaced with clean water. Water quality is affected by temperature, pH value, dissolved oxygen, ammonium content and other factors. They were measured *in situ* with a thermometer for temperature and a pH reagent for pH. Other parameters were measured by inserting the measuring instrument probes in the water at a depth of about 4cm in the middle of the cultured water and reading the meter when equilibria was reached.

Statistical Analysis

The mean values and standard error of mean (SE) of two independent replicates were used to calculate the results. Statistical Package for Social Sciences (SPSS) software (version 21, IBM SPSS) was used to perform one-way ANOVA and Duncan’s test to examined the significance difference between mean values obtained among treatments at the 5% level of significance. At p0.05, differences were considered significant

RESULTS

Table-1 display the clinical symptoms of *A hydrophila* observed within 14 days of the challenge. The symptoms include a darker skin colour, delayed mobility, abnormal enlargement of the lower belly, red patches on the skin, loss of appetite and death. Percentage individuals with darker skin colour appear solely in ♀Dg x ♂Dg ($1±0.0^{ab}$) and ♀Bn x ♂Dg ($1±0.0^{a}$) and there is no significant difference (P>0.05) across the *C. gariepinus* strains. Only ♀Bn x ♂Bn is unaffected by slow movement, whereas the others are and there is no significant difference (P>0.05) between strains (♀Dg x ♂Dg ($2±1.0^{ab}$), ♀Dg x ♂Bn ($2±1.0^{a}$), and ♀Bn x ♂Dg ($2±0.0^{a}$). Percentage individuals who had abnormal enlargement of the lower abdomen were significantly the same ($1±0.0^{ab}$) in ♀Dg x ♂Dg, and ($1±1.0^{a}$) in ♀Bn x ♂Dg. Meanwhile, ♀Bn x ♂Bn and ♀Dg x ♂Bn were found to be statistically unaffected by the symptom. The occurrences of red spot on the skin were seen to be high ($2±0.0^{ab}$) in ♀Dg x ♂Dg, while the rest were low and there was no significant difference (P>0.05) across the strains (1±0.0) in ♀Bn x ♂Bn, ($1±1.0^{a}$) in ♀Dg x ♂Bn, ($1±0.0^{a}$) in ♀Bn x ♂Dg. The symptom Pale gill ($1±0.0^{a}$) affects only ♀Bn x ♂Dg. Individuals with loss of appetite ranged from ($3±1.0^{b}$) in ♀Dg x ♂Dg, ($2±0.0^{a}$) in ♀Bn x ♂Dg and ($1±1.0^{a}$) in ♀Dg x ♂Bn. Meanwhile, the symptoms loss of appetite does not impact ♀Bn x ♂Bn. The symptoms was noticed on the ventral side of the body, near the head.

Table 1. Number of *C. gariepinus* strains with *A. hydrophila* disease symptoms challenged age cohort fingerlings of inbred and crossbred during 14 days rearing period

Symptoms	♀Dg x ♂Dg	♀Bn x ♂Bn	♀Dg x ♂Bn	♀Bn x ♂Dg	Control
Dark colour of the body	1±0.0[ab]	0±0.0	0±0.0 [a]	1±0.0 [a]	0±0.0
Slow movement	2±1.0 [ab]	0±0.0	2±1.0 [a]	2±0.0 [a]	0±0.0
Abnormal swelling of abdomen	1±0.0 [ab]	0±0.0	0±0.0 [a]	1±1.0 [a]	0±0.0
Red spot on the skin	2±0.0 [ab]	1±0.0	1±1.0 [a]	1±0.0 [a]	0±0.0
Pale gill	0±0.0 [a]	0±0.0	0±0.0 [a]	1±0.0 [a]	0±0.0
Loss of appetite	3±1.0 [b]	0±0.0	1±1.0 [a]	2±0.0 [a]	0±0.0

Mean values ± standard error mean (S.E) are duplicate determination, values are significantly different at P<0.05.
Note: ♀Dg x ♂Dg is Donga Female x Donga Male; ♀Bn x ♂Bn is lower Benue Female x lower Benue Male; ♀Dg x ♂Bn is Donga Female x lower Benue Male and ♀Bn x ♂Dg is lower Benue Female x Donga Male.

Table 2 shows that challenged *C. gariepinus* strains died within 14days of being challenged. The result showed that 10% of ♀Dg x ♂Bn crossbred population died on the second day of post challenges, 20 % within 14days, and 10% of the ♀Dg x ♂Dg inbred population died on the fifth day and 60% during the 14days period, ♀Bn x ♂Dg has a percentage mortality of 70% within 14days and ♀Bn x ♂Bn inbred had a mortality of 20% during the post challenge period. Mortality was highest in challenged ♀Bn x ♂Dg followed by ♀Dg x ♂Dg, with the same rate in both ♀Bn x ♂Bn inbred and ♀Dg x ♂Bn crossbred that had the same percentage. There was no mortality in strains control treatments.

Table-2. Percentage mortality of the *A. hydrophila* challenged age cohort fingerlings of inbred and crossbred *C. gariepinus* strains during 14 days rearing period

Day(s)	No.of fish	♀Dg x♂Dg	♀Bn x ♂Bn	♀Dg x ♂Bn	♀Bn x ♂Dg	Control
1	10	0	0	0	0	0
2	10	0	0	1(10)	0	0
3	10	0	0	0	0	0
4	10	0	0	0	0	0
5	10	1(10)	0	0	0	0
6	10	0	0	0	0	0
7	10	0	0	0	0	0
8	10	0	0	0	0	0
9	10	0	0	0	1(10)	0
10	10	0	0	0	0	0
11	10	1(20)	0	0	3(40)	0
12	10	1(30)	0	0	2(60)	0
13	10	3(60)	0	0	1(70)	0
14	10	0	2(20)	1(20)	0	0

Mean values ± standard error mean (S.E) are duplicate determination, values are significantly different at P<0.05.
Note: ♀Dg x ♂Dg is Donga Female x Donga Male; ♀Bn x ♂Bn is lower Benue Female x lower Benue Male; ♀Dg x ♂Bn is Donga Female x lower Benue Male and ♀Bn x ♂Dg is lower Benue Female x Donga Male.

Table 3 displays the growth rates of the challenged and control *C. gariepinus* strains at the end of the 336 hours (14 days) rearing period. The mean beginning weights of the strains age cohorts were: 3.6±0.0 g (♀Dg x ♂Dg), 3.7±0.2g (♀Bn x ♂Bn), 3.65±0.05g (♀Dg x ♂Bn), 3.95±0.1g (♀Bn x ♂Dg) and 3.55±0.1g (control). Regardless of age, the ♀Bn x ♂Dg and ♀Bn x ♂Bn had much higher weight than the ♀Dg x ♂Bn, ♀Dg x ♂Dg, and control. The mean final weight (g) in ♀Dg x ♂Dg (3.25±0.25) was the lowest and the greatest in the challenged ♀Bn x ♂Dg (6.16±0.16). In the survivors of the ♀Bn x ♂Dg challenged, the mean growth rate was 2.21±0.06%.

Table 3. Initial weight, final weight, growth rate and control of *A. hydrophila* challenged inbred and crossbred strains of *C. gariepinus* during 14 days rearing.

Treatment	Initial weight (g)	Final weight (g)	Growth Rate	P-Value
♀Dg x ♂Dg	3.6±0.0	3.25±0.25	-0.35±025[a]	0.001
♀Bn x ♂Bn	3.7±0.2	4.68±0.1	0.98±0.1[c]	
♀Dg x ♂Bn	3.65±0.05	3.75±0.05	0.1±0.1[ab]	
♀Bn x ♂Dg	3.95±0.1	6.16±0.16	2.21±0.06[d]	
CONTROL	3.55±0.1	4.15±0.15	0.6±0.25[bc]	

Mean values ± standard error mean (S.E) are duplicate determination, values are significantly different at P<0.05.
Note: ♀Dg x ♂Dg is Donga Female x Donga Male; ♀Bn x ♂Bn is lower Benue Female x lower Benue Male; ♀Dg x ♂Bn is Donga Female x lower Benue Male and ♀Bn x ♂Dg is lower Benue Female x Donga Male.

Table-4 illustrate the temperature, pH, ammonia, and dissolved oxygen ranges measured after *C. gariepinus* Strains were challenged. The pH of the water varies from (8.34±0.13) in ♀Bn x ♂Dg, (8.13±0.13) in ♀Dg x ♂Dg, (8.0±0.00) both in ♀Bn x ♂Bn, ♀Dg x ♂Bn, and control had the same pH. The water temperature was high in ♀Bn x ♂Bn (21.7±0.7) followed by ♀Dg x ♂Dg (21.68±1.18). Meanwhile, ♀Dg x ♂Bn, ♀Bn x ♂Dg and control had the lowest values of 21.35±1.5, 21.5±0.5, and 21.56±0.00, respectively. Ammonia had a range of (0±0.00) in ♀Dg x ♂Dg and ♀Bn x ♂Dg. Meanwhile, ♀Bn x ♂Bn, ♀Dg x ♂Bn, and control all had the same ammonia value of 0.5±0.00. The observed rate of dissolved oxygen ranges from (6.6±0.2) in ♀D x ♂D, (6.7±0.4) in ♀Dg x ♂Bn, (6.8±0.7) in ♀Bn x ♂Bn, (6.8±0.1) in ♀Bn x ♂Dg, and (6.9±0.00) in the control. The treatment control had the most dissolved oxygen.

Table 4. Water quality parameters during 14 days rearing period

Parameter	♀Dg x ♂Dg	♀Bn x ♂Bn	♀Dg x ♂Bn	♀Bn x ♂Dg	CONTROL
pH	8.13±0.13	8.0±0.00	8.0±0.00	8.34±0.13	8.0±0.00
Temperature (°c)	21.68±1.18	21.7±0.7	21.35±1.5	21.5±0.5	21.56±0.00
Ammonia (mg/L)	0±0.00	0.5±0.00	0.5±0.00	0±0.00	0.5±0.50
Dissolved oxygen(mg/L)	6.6±0.2	6.8±0.7	6.7±0.4	6.8±0.1	6.9±0.00

Mean values ± standard error mean (S.E) are duplicate determination
Note: ♀Dg x ♂Dg is Donga Female x Donga Male; ♀Bn x ♂Bn is lower Benue Female x lower Benue Male; ♀Dg x ♂Bn is Donga Female x lower Benue Male and ♀Bn x ♂Dg is lower Benue Female x Donga Male.

Table 5: Biochemical Characteristics of *Aeromonas hydrophila*.

Characteristics	Results of biochemical test
Mac-conkey agar	Y
Ox	+
Mdw	+
Nacl free	+
Ara	+
Aesc	+

Key: Mac-conkey agar, Ox = oxidase test, Mdw = Movement in distilled water, Nacl free = Sodium chloride free peptone water, Ara = L – arabinose (fermentation), Aesc = Aesculin (Hydrolysis), Y = yellow colonies (sucrose fermenting).

Figure 1 depicts the percentage survival of the challenged and control specimens at the conclusion of the 14-day (336-hour post challenge time) fingerlings rearing period. Survival rates of challenged ranged from 30% in ♀Bn x ♂Dg, 40% in ♀Dg x ♂Dg, 80% in ♀Bn x ♂Bn inbred and ♀Dg x ♂Bn crossbred while the control was 100%.

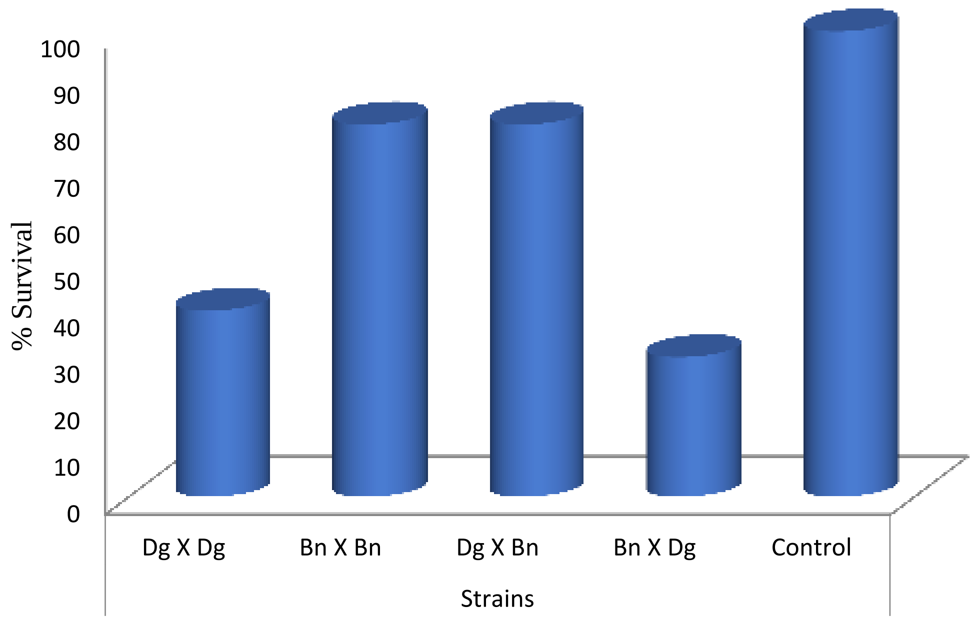

Figure 1: Survival rate of *A. hydrophila* challenged and control treatments in Age Cohort of Inbred and Crossbred *C. gariepinus* strains during 14 days rearing period

DISCUSSION

Despite the similarity in the number per treatment that showed other symptoms, the significant differences in the number of individuals per treatment that shows dark color of the body symptom in which all ♀Dg x ♂Dg individuals and ♀Bn x ♂Dg had the symptoms, while ♀Bn x ♂Bn and ♀Dg x ♂Bn were statistically similar without the symptom, could indicate the possibility of different level of reaction in the genotypes as conditioned by the extent of the pathogen effects on the strains. Except for ♀Bn x ♂Bn, all mortal specimens showed lack of appetite due to improper feeding; this is attributed to the ability to withstand the sickness. All of the tested strains exhibited appetite loss and death. In addition, the mortality rate in the ♀Dg x ♂Dg and ♀Bn x ♂Dg strains was higher than in the other strains. This could imply that the challenged ♀Dg x ♂Dg and ♀Bn x ♂Dg were more sensitive to the *A. hydrophila* challenge, whilst the ♀Bn x ♂Bn and the ♀Dg x ♂Bn were more likely to have resisted the pathogen challenge. This is consistent with Raghuvanshi *et al.,* (2007) who reported that clinical symptoms are seen in fish infected with *A. hydrophila*. In this situation, the sick fish move more slowly and remain stationary at the bottom of the tank. In addition, the skin bleeds and ulcers form on the diseased area. Before dying, the fish will swim to the surface of the water with unstable movement, and bleeding may occur at the base of the caudal and dorsal fin, and the lower belly seems swollen and swelling. According to Faktorovich (1969) and Saka *et al.,* (2017), there may be very many, and the scales may bristle out from the skin, giving the skin a "washboard" appearance. The gills may bleed to varied degrees, and ulcers on the dermis may form. Internal organs are enlarged and congested, with haemorrhages over the viscera as a result of dermal ulcers forming superficial necrotic lesions. The kidney and enlarged spleen typically contain a semi-fluid that may leak.

The challenge mean growth rate reveals that strain ♀Dg x ♂Dg has sluggish growth, which is cause by bacteria infecting the strain, resulting in negative heterosis. Only ♀Dg x ♂Dg had negative heterosis in this investigation. Heterosis for mean growth rate of the strain (♀Bn x ♂Dg) was similarly shown to be positive. Similarly, Akinwande *et al*., (2011) discovered positive heterosis in *C. gariepinus* and *C. angularis* inter-specific hybrids. Ataguba *et al*., (2010) on the other hand, found negative heterosis for growth (-42%) in hybrids of *C. gariepinus* and *Herobranchus longifilus* during 56 days of larval to fingerling rearing. The superior growth rates in the challenged treatments over the control, particularly in the challenged ♀Bn x ♂Dg and ♀Bn x ♂Bn genotypes, may be due to relatively higher mobilization for this immune response, which may have resulted in their relatively higher growth rates. Furthermore, despite their age similarities with other genotypes, the ♀Bn x ♂Dg and ♀Bn x ♂Bn genotypes had significantly superior beginning weight.

The *A. hydrophila* challenge may have activated a signal for this immunological response, which all of the challenged specimens reacted to at varying degrees, resulting in faster growth rates than the control. As a result, the discrepancies between the challenged genotypes may be due to variances in their intrinsic endowment for the immune response. Individuals can differ in their level of resistance to a pathogen, with some being completely resistant, as characterized by a gene-for-gene relationship (Verhagen *et al*., 2006), according to Oyebola (2017). Meanwhile, the ♀Bn x ♂Dg crossbred was higher in this quality, whereas the ♀Dg x ♂Bn crossbred was inferior due to being more vulnerable to the disease. The high susceptibility of the ♀Dg x ♂Bn compared to the ♀Bn x ♂Dg agreed with the fact that hybridization may produce relatively less fit hybrid genotypes with decreased performance and ability to cope with emergent pathogens; and hybrid response to disease may vary according to degree of genetic admixture (Parris 2004 and Oyebola 2017).

Mortality in the challenged specimens ranged from 10% to 70%, compared to 70% in the previous study. In this investigation, mortality rates of 60% and 70% were recorded in fingerlings, infected with *A. hydrophila*. This finding is consistent with the findings of Madubuike *et al.,* (2015) who discovered a cumulative mortality rate of 30 – 90% in catfish infected with *A. hydrophila* at a rate of 1 x 10^8 cfu/ml.

The survival rate of *C. gariepinus* strains 14 days after *A. hydrophila* challenge revealed that ♀Bn x ♂Dg and ♀Dg x ♂Dg had the lowest survival rate among the challenged. The control had higher survivals than the challenged in ♀Bn x ♂Bn and ♀Dg x ♂Bn, indicating that the *A. hydrophila* challenge may have caused extra stress, resulting in more mortality. This agrees with the findings of Olakunle *et al.,* (2020) who stated that the most important fish pathogen was *A. hydrophila*, and the highest prevalence is in polluted waters. According to Austin (1993), bacterial infections are the most important illness concern in fish aquaculture, accounting for 80% of mortalities. The water parameters values for these observations are within pisciculture allowable ranges.

A tentative identification of the *A. hydrophila* strain was obtained by a biochemical test. Gram negative, motile, oxidase-positive, L. arabinose-positive isolates were discovered. *A. hydrophila* is motile in both distilled and peptone water, which distinguishes it from other bacteria. For example, Vibrio sp is immotile in distilled water but motile in peptone water (Lamy *et al*., 2010; Laith and Najiah, 2014). According to (Jayavignesh *et al.,* 2011), members of this genus are Gram-negative bacilli, oxidase and catalase positive, capable of degrading nitrates to nitrites, glucose fermenters (It ferments glucose with or without the production of gas, which distinguishes it from Pseudomonas).

CONCLUSION

This study gives helpful information on the evolution of genotypes that are resistant to disease challenge, broodstock selection, better productivity and lucrative *C. gariepinus* culture in the face of *A. hydrophila* infection.

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