BREEDING PERFORMANCE AND TRAITS INHERITANCE OF HYBRID CATFISH, *Clarias macrocephalus* AND *Clarias gariepinus*

PHAM THANH LIEM

DOCTOR OF PHILOSOPHY
UNIVERSITI MALAYSIA TERENGGANU
MALAYSIA

2008

BREEDING PERFORMANCE AND TRAITS INHERITANCE OF HYBRID CATFISH, *Clarias macrocephalus* AND *Clarias gariepinus*

PHAM THANH LIEM

Thesis Submitted in Fulfillment of the Requirement for the Degree of Doctor of Philosophy in the Institute of Tropical Aquaculture Universiti Malaysia Terengganu

September 2008

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirements for the degree of Doctor of Philosophy

BREEDING PERFORMANCE AND TRAITS INHERITANCE OF HYBRID CATFISH, *Clarias macrocephalus* AND *Clarias gariepinus*

PHAM THANH LIEM

September 2008

Chairperson : **Associate Professor Abol Munafi Ambok Bolong, Ph.D.**

Member : **Professor Mohd Azmi Ambak, Ph.D.**
Associate Professor Siti Shapor Siraj, Ph.D.

Institute : **Institute of Tropical Aquaculture**

Interspecific hybridization between *Clarias macrocephalus* (CM) and *Clarias gariepinus* (CG) has been conducted to produce hybrid with specific desirable traits. To evaluate its potential application in aquaculture, fertility and performance of desirable traits (e.g. growth, external morphology, flesh quality, disease resistance) were examined on reciprocal F_1 and backcross hybrids. Reciprocal hybrids were partially fertile with various abnormalities in gonad development that resulted in low gamete production. Abnormalities observed in gonad development of all hybrid genotypes included a single ovary or testis, tumor-like and adipose-like tissues in ovaries, ovotestis, and retarded gonad. Reciprocal hybrid males had problems with spermatogenesis that was likely due to genetic incompatibility since treatment with hormones did not improve spermatogenesis. Backcross hybrids between CMCG hybrids (genotype is given with female in the first position) and males of the parental species were zygotically sterile. Females produced a few viable larvae while male fish produced no sperm or sperm unable to fertilize eggs. Frequencies of retarded

gonad increased from F_1 hybrids (3.19% and 4.21% for CGCM and CMCG) to backcross hybrid (6.52% and 7.37% for CMCGxCM and CMCGxCG). Fertility of the hybrid gametes was reduced significantly ($p<0.05$) from reciprocal F_1 to backcross hybrids. Strong postzygotic isolation mechanisms were observed during embryonic development of backcrosses between hybrids and a parental sire.

All hybrid genotypes showed intermediate performances between the two parental species in growth, external morphology, and disease resistance. High mortality occurred in the CGCM hybrid (58.93%) and backcross hybrids (66.87% and 69.60% for CMCGxCM and CMCGxCG) during the first month after hatching. Growth of hybrids was significantly lower than that of CG, but higher compared to CM ($p<0.05$). However, due to a lower incidence of cannibalism, final production of CMCG hybrid was similar to the production of CG. Proximate analysis indicated that moisture and protein content of all hybrid genotypes was not different from that of the parental species. No difference in external morphology was found between reciprocal hybrids, but the morphology of the backcross hybrids was closer to the morphology of the paternal species. After infection with pathogen, *Aeromonas hydrophila*, CG performed the highest disease resistance followed by the reciprocal hybrid then backcross hybrids.

Random Amplified Polymorphic DNA (RAPD) analysis was able to detect the hybrids based on the presence of "species diagnostic" markers from both parental species in their RAPD profiles. With 4 – 6 "species diagnostic" marker generated

from each primer, a single primer (e.g. S22, S25, or S27) can be used to distinguish the hybrid status or pure breeder of an individual *Clarias* catfish.