



HYBRIDIZATION OF ROHU (*LABEO ROHITA*) AND BATA (*LABEO BATA*) AND GROWTH COMPARISON OF THE HYBRID WITH ROHU

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Abstract: A sixty-day study was carried out to compare the growth of hybrid between *Labeo rohita* (rohu) and *Labeo bata* (bata) with one of the parental species, rohu. The fertilization and hatching rates found to be lower in hybrid than those in rohu. After three days of hatching the spawns were reared in earthen nursery ponds for sixty days. The growth in weight for the first ten days and, in weight and length for the following fifty days were obtained and compared with those of rohu and significant difference in the rates of growth were observed. The hybrid showed faster growth rate than the parental species, rohu. The results obtained could be considered as preliminary finding in rohu x bata hybridization and needs further work.

Key words: Hybridization, *Labeo rohita*, *Labeo bata*

Introduction

Inland aquaculture in Bangladesh is consisted of the Indian major carps viz., catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus cirrhosus*), the Chinese carps viz., silver carp (*Hypophthalmichthys molitrix*), big head carp (*Mylopharyngodon piceus*), grass carp (*Ctenopharyngodon idella*), black carp (*Aristichthys nobilis*) and common carp (*Cyprinus carpio*). Almost the total demand of seeds of these species is being met from hatchery-produced seeds. At present about 99.6% (3,50,029 kg) of the spawn is produced in more than 700 hatcheries throughout the country (Anon, 2004). Genetically good quality fish seed is a prerequisite for successful fish culture. But in most of the cases the hatchery produced seed is under inbreeding pressure as they are negatively selected for smaller brood size at first maturity (Shah, 2004). To meet the increasing demand, the seed producers did not pay attention to the genetic quality. Consequently, the carp seed produced from the hatcheries was reported to show signs of poor genetic quality, such as poor survival and growth, susceptibility to diseases, deformities, etc. Hence, it became essential to carry out research on genetic improvement of the species. To counter genetic deterioration through inbreeding, negative selection and introgressive hybridization, development of improved brood stocks through the implementation of effective breeding plans and genetic stock improvement programs for commercially important carp species have recently been identified as important areas of research (Hussain and Mazid, 1999a).

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With a view to solve the problem of availability of seeds in the natural sources, the Government of Bangladesh emphases on the production of quality seed of fast growing desirable species in hatcheries. Hybridization is a well-known means of genetic improvement, which has a wide spread application in aquaculture. Heterosis achieved through interspecific and/or intraspecific strain crossing enables offspring to surpass its parents in one or more traits. Heterosis is effected in F_1 generation through individual loci interaction (Yan and Ozgunen, 1993). Hybridization of closely related species produces better results (Tave, 1993).

Considerable work has been carried out on hybridization in fish in India since the early attempts of Chaudhuri (1999). Kowtal (1987) reviewed all such works carried out in India with indigenous and exotic carps and listed the promising hybrids. The performance of the best Indian Major Carp hybrids were intermediate as compared with their parents (Das *et al.*, 1980), being better than Rohu but not better than catla. Dunham and Smitherman (1986) reported 55% increase in growth of channel catfish intraspecific hybrid. Strain crossing and realization of positive heterosis is now an important basis of common carp aquaculture in Israel, Vietnam and Hungary (Dunham *et al.* 2001). Basavaraju *et al.* (1995) reported that they did not get better performing hybrids in reciprocal crosses between rohu and mrigal, however, they observed *Cirrhina mrigala* female x *Labeo rohita* male hybrid growing faster than the reciprocal ones in India but Ibrahim (1977) reported that rohu female x mrigal male hybrid had better growth than their parents.

Although cross breeding is a tried-and-true method of increasing yields, the results of cross breeding programmes are impossible to predict (unless the mating has been made previously). However, according to Tave (1993) it is a quick and dirty method of improvement before selection is employed. There are many examples which show that hybridization helps to improve productivity. Chappell (1979) and Islam and Shah (2007) find that some hybrids improve yield by 10-55%.

The objectives of the present investigation were to produce a good quality F_1 hybrid of *L. rohita* and *L. bata* and compare their fertilization and hatching rate and growth with those of the parental species, rohu.

Materials and Method

The experiment was performed in the Government Fish Seed Multiplication Farm, Gallamari during the period from April 2007 to July 2007. For induced breeding PG (pituitary gland) hormone of Indian major carp was injected to two pairs of spawners. Hybrid was produced by crossing male rohu and female bata. For females two doses of PG hormone at 2 mg and 5 mg kg^{-1} of body weight were applied at 6 hours interval. For male a single dose of PG Hormone 2 mg kg^{-1} of body weight was applied at the time of second injection to the female. The sex ratio of the spawners was maintained at 1:2 (male: female). Continuous water flow was provided in the tanks by showering of water. The spawners became ready for spawning within 5-6 hours of second injection when they were stripped carefully. Eggs stripped from the females were mixed well with the milt stripped from the respective males. The inseminated eggs were then transferred into the incubation jars providing with a continuous flow of water.

Fertilization and hatching rates: The rates of fertilization and hatching were recorded by individual counting of the fertilized eggs and hatched out larvae. The fertilized eggs were easily separated from the unfertilized eggs by the presence of transparent shell with gray/ black spot within the egg shell, while the unfertilized eggs were opaque and their number was counted. Some fertilized eggs were put into a hatching chamber made with a PVC pipe of three inches diameter, cut into pieces of six inches. The bottom end of the pipe was closed with fine meshed cloth and was made to float in the bottle hatchery jar with the help of polystyrene foam attached at the rim

of the pipe. A few holes were cut on the surface of the pipe and covered with thin cloth to let water flow in the chamber. Then hatching rate was determined as follows: -

Hatching rate (%) = (No. hatched/ Total No. of fertilized eggs) X100

Spawn rearing and fry nursing: Two earthen nursery ponds measuring 1.25 dec each were used. Rotenone was applied at the rate of 25 g dec⁻¹ to remove the unexpected fauna. The ponds were limed at the dose of 1.25 kg decimal⁻¹. After five days of liming, fertilization was done by applying 2 kg mustard oil cake, ½ kg urea and ¼ kg TSP per pond (Anon, 2004).

Stocking was done at the rate of 2000 spawn deci⁻¹. The spawn were acclimatized in the nursery ponds before releasing them into the ponds. For 1st two weeks, mustered oil cake 100 g +urea 60 g +TSP 30 g were used as feeding. Next four weeks, mustered oil cake 200 g +urea 60 g +TSP 30 g were used as their feeding.

Growth: Sampling was done with the help of a seine net at every ten day intervals.. In the first sampling only the average weight of the fishes were taken. In the next samplings fry were measured in both weight and length individually. Sample fishes were anesthetized with 10% Benzokaine solution at a concentration of 1 ppt for the convenience of taking weight and length. An electronic balance with 0.1 mg and a centimeter scale with 1 mm denomination were used for weight and length measurement, respectively.

RESULTS

Fertilization rate: The fertilization rate was obtained to be higher in case of rohu (75.9%) than that of the hybrid (63%). (Fig. 1).

Hatching rate: Hatching rate for hybrid was obtained to be 50.92% and that for rohu was 73.33% (Fig.1).

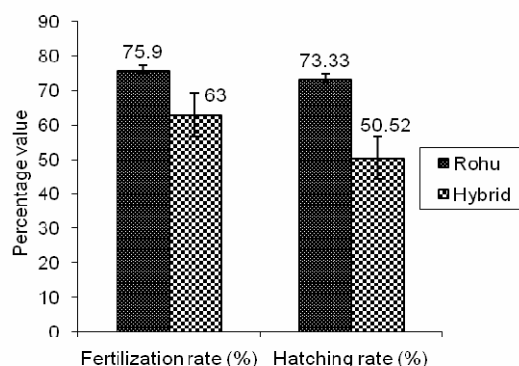


Fig. 1. Fertilization and hatching rates of hybrid and rohu.

Sampling and growth measurement: Higher growth rate was found in, rohu (Fig. 2). This indicated the production of heterosis in the hybrid.

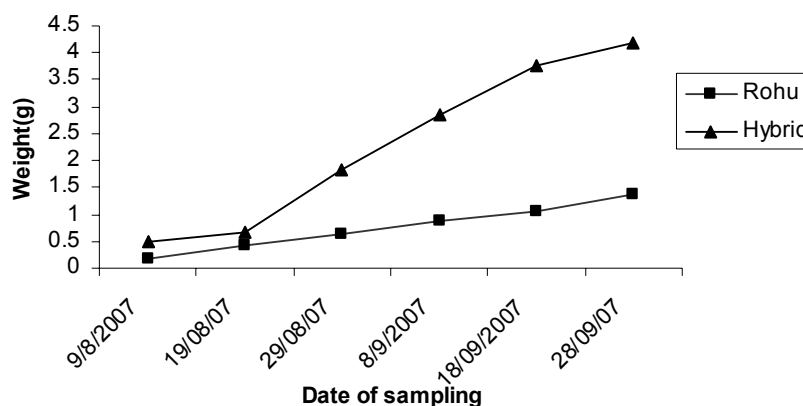


Figure 2: Growth performance of rohu x bata hybrid and normal rohu in terms of weight.

Discussion

Better fertilization and hatching rates observed in rohu than those in hybrid was probably due to the fact that in same species sperm can easily enter into the micro pile of the egg. In the present experiment, the observed better growth in the hybrid than rohu was probably due to the interaction of the dominance of the parents of the two species providing heterotic effect. Thus hybrid vigor was achieved in F_1 hybrid which was the target of the present experiment. This agree with the findings of Hooe *et al* (1994) who reported that the crosses of the silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*), black carp (*Pomoxis nigromaculatus*) all showed faster growth than their parent. Incase of an intraspecific hybridization of rohu a positive heterosis of 55.76% was observed (Islam and Shah, 2007). Hussain and Mazid (1999a) reported the widespread incidence of inbreeding depression in the form of retarded growth, poor reproductive performance, morphological deformities, and increased incidence of disease and mortality in the hatchery-produced seed in Bangladesh of seed in the hatcheries. Hussain and Mazid (1999b) reported the existing management status of the hatchery and brood stock. Eknath and Doyle (1985 a, b) reported that hatcheries in Karnataka, India, are inadvertently breeding slow-growing and late maturing individuals. Tave (1993) suggests that in an inbred population with very little amount of V_A or no V_A at all, making it difficult to bring changes in production performance through selection, the only option that is left to increase of production is hybridization. Through hybridization, Dominant Genetic Variation (V_D) is exploited. V_D is attributed to the dominant action of alleles between individual loci. Hatchery strains is stocked to hybridize with local population in order to produce faster growing hybrids that can be harvested by commercial fishermen (Moav *et al.*, 1979). Sometimes an interspecific hybrid does not exhibit heterosis for specific traits, but may still be important for aquaculture if it expresses other useful traits from the parent species. Hybridization is proposed to be a hit or miss chance (Tave, 1993). It means that through interbreeding two species or strains the chances for individual dominant loci action is 50:50; the effort may or may not produce any desired action in the phenotype. In case of strain crossing, it only becomes worthy if the population happens to have attained enough genetic differentiation.

Conclusion

Hybrid of two different species often has a higher growth rate than the single species. In case of inbreeding, heterozygosity is lost because of close mating. However, hybridization is a process by which heterozygosity in the progenies can be produced and thus hybrid vigor or heterosis is achieved. In the present experiment F₁ hybrid of rohu and bata showed better growth than rohu. So, hybridization between the species may be done to overcome inbreeding problem and to achieve heterosis for better growth and production in the aquaculture systems in the country.

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