

## Interspecific hybridization between cyprinids *Carassius auratus* goldfish and *Cyprinus carpio* koicarp

Y. Ananth kumar<sup>1\*</sup>, Mohamed Abdhul Kadher Haniffa<sup>2</sup>

1. Department of Zoology, V.H.N.S.N College, Virudhunagar, Tamilnadu, India.

2. Centre for Aquaculture Research and Extension (CARE), St. Xavier's College, Palayamkotai, Tamilnadu, India.

E-mail : ananth2481@gmail.com; ananthneon@rocketmail.com

Contact No : +91

Submitted : 11.12.2012

Accepted : 27.01.2013

Published : 30.04.2013

### Abstract

Koicarp and Goldfish were induced to spawn by administering ovaprim. Each breeding set contained two males and one female in both species and the mature brooders were selected by sexual dimorphism. Induced breeding was attempted by intraperitoneal injections of ovaprim at a dosage of 0.3ml/kg to goldfish and 0.3ml/kg to koicarp. Diameter of the fertilized eggs of goldfish ranged between 0.9-1.0mm; koicarp ranged between 0.9-1.10mm and hybrid ranged between 0.9-1.0mm. The percentage of fertilization of gold fish, koicarp and hybrid was 90%, 80% and 90% respectively. The length of the hatchlings were 2.7±0.2mm in koicarp, 2.6±0.2mm in hybrids and goldfish. The hatchlings started exogenous feeding when the yolk sac was totally absorbed after 3 days. The chromosome number of hybrids is 2n=60, goldfish 2n=42 and koicarp 2n=78

### INTRODUCTION

Genetic methods provide powerful tools to identify cryptic species or species with a few readily identifiable phenotypic characteristics. Furthermore, nuclear genetic markers in particular allow species hybrid identification. Since they can identify the contributions of both the father and mother to the hybrid genome<sup>[1]</sup>. Artificial production of hybrids is a powerful tool in fish culture and it has emphasized the cytological basis for applied hybridization<sup>[2]</sup>. Efforts to clarify the situation are impeded by difficulties in identification of pure bred *Carassius auratus* and hybrids by external morphological investigations and by some unresolved taxonomic problems in the genus<sup>[3]</sup>. Since goldfish and koicarp was one of the earliest fishes to be domesticated and is still one of the most commonly kept aquarium fishes<sup>[4]</sup>. It was to hybridize and evaluate the growth performance, size and colour variation of hybrids between koicarp and goldfish. In contrast few more literature on hybridization in other ornamental fish species especially *Salmonids*, *Cichlids*, and *Catfishes*<sup>[5,6]</sup> only few reports on hybridization among the cyprinids species such as *Catla catla*, *Labeo rohita*, *Labeo calbasu* and *Cirrhinus mrigala*<sup>[7]</sup> and few reports on hybridization among catfishes such as *Clarius macrocephalus* X *C. gariepinus*<sup>[8,9]</sup> and on *Heteropneustes fossilis* X *H. microps*<sup>[10,11]</sup>. The described karyological studies made on Indian cyprinid species and demonstrated an increase in the lifespan of fish with larger genomes, from an analysis of a wide range of species<sup>[12]</sup>. Within individual orders such as the Cypriniformes the relationship was positive but not significant, possibly because of the limited number of samples analyzed. In this present study we report an interspecific hybridization between goldfish and koicarp by induced spawning.

### MATERIAL AND METHODS

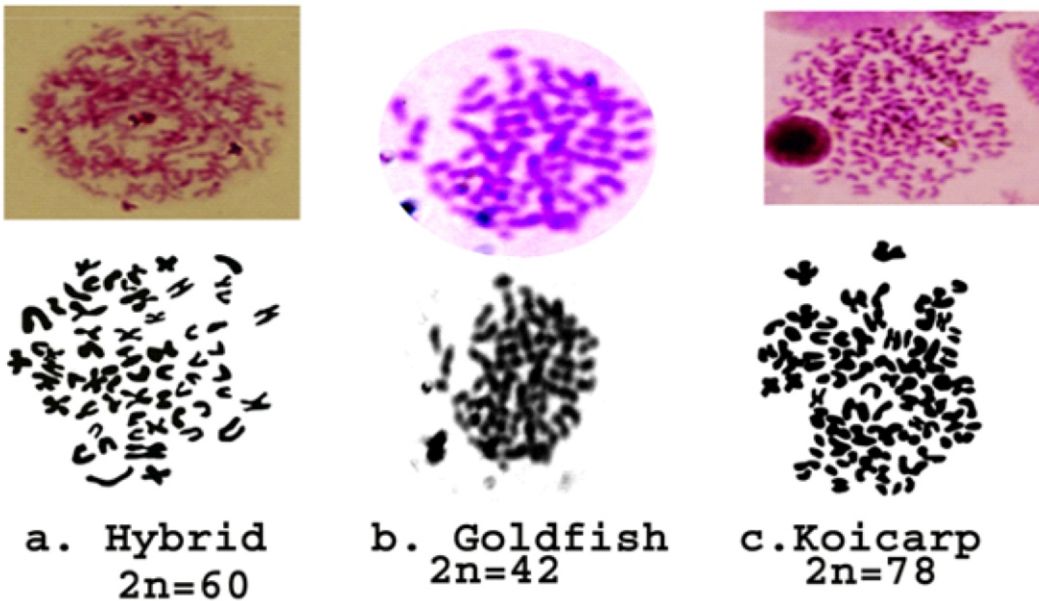
Koicarp and goldfish were used in this experiment were collected from local aqua farm and stocked in a earthen pond (7.5 x 5 x 1.5m) at Centre for Aquaculture Research and Extension for one month. During the stocking period the breeders were fed on finely chopped beef liver and artificial feeds. The two breeding

sets consisting of two male goldfishes (length: 12-15cm; weight 55-60gm) and one female koicarp (length: 16cm; weight 75gm) and another breeding set for experiment was two male koicarps (length: 15-18cm; weight: 60-80gm) (Fig 1 a and b). Another two breeding set consisting of two male koicarps (length: 12-15cm; weight 55-60gm) and one female koicarp (length: 18cm; weight 80gm) and two male goldfishes (Length: 12-15cm; weight: 50gm) and one female goldfish (Length: 14cm; weight: 55gm) receiving the same treatment served as control. Profused spawning was induced by a single intramuscular injection of ovaprim (Syndel laboratory, Canada), 0.3ml/body weight to both male and female. After the injection the breeders were released into the breeding tank (1500 l) containing aquatic macrophytes like *Hydrilla verticillata* for hiding purpose.

### RESULTS AND DISCUSSION

The results of induced breeding experiment are summarized in Table 1. The hormone induced fishes showed breeding behavior after 8 hours of injection irrespective of dosage. All the times the more active and aggressive male paired with the female and the other male was found passive and idle in the center for the breeding tank. After the spawning the fertilized eggs were collected, counted and the percentage of fertilization was determined<sup>[13]</sup> the hybrid eggs and control were transparent adhesive and were attached to the aquatic macrophytes *Hydrilla verticillata*. The egg diameter 1±0.50mm in the hybrid as well as in the control (Fig 2. a, b and c). The hybrids spawned less number of eggs than the control. Hatching took place an approximately the same time in the control as well as hybrid completed after 72h post-fertilization. Hatching was nearly same in the control and in the hybrids (Table 1). The fertilization frequency of the hybrid eggs in the present experiment (90%) is much compared to earlier reports in goldfish 90%<sup>[14]</sup> using Ovaprim in koicarp *Cyprinus carpio* 80% using ovaprim<sup>[7]</sup>, *Heteropneustes fossilis* X *H. microps* (80%) using Ovaprim<sup>[3]</sup>. The reciprocal intergeneric hybrids have been reported in the *H. Fossilis* X *Clarius batrachus* using HCG<sup>[15]</sup>.

The total length of hybrids were found to be 2.6mm, goldfish

**Fig 1****a. goldfish- female****b. Koicarp male****Fig 4: Karyotype****a. Hybrid  
2n=60****b. Goldfish  
2n=42****c. Koicarp  
2n=78**

2.6mm and in koicarp 2.7mm on the day of hatching (Fig 3. a, b and c). After 25 days of hatching the mean total length and weight of the hybrid were ( $24 \pm 0.8$ mm), goldfish ( $17 \pm 0.2$ mm) and koicarp ( $25 \pm 0.2$ mm), the mean total of hybrids in 60 days after hatching which was higher than goldfish but similar to koicarp (length: 3.5 to 4.2cm ; weight 0.9 to 2.5gm) respectively. But both control showed wider variations koicarp (length 4.5 to 5cm) and weight (2 to 3.5gm) in goldfish (length 2.5 to 3 cm; weight 0.5 to 2.5gm) at day 60. The chromosome number of the hybrid ( $2n=60$ ), goldfish ( $2n=42$ ) and koicarp ( $2n=76$ ) (Fig 4. a , b and c). The percentage of survival at 3, 25, 60 days were higher than the control. The control species goldfish had white uniform coloration with red patches. In koicarp had uniform orange with different coloration and the hybrids were uniform golden brown coloration. The hybrids displayed an intermediate condition for most of the external morphological character. The most

prominent intermediate character was presence of barbells at the mouth which were absent in the goldfish and the barbells were present in the lower lip of koicarp. Some of the characters such as head length (1.5cm), caudal fin length (3cm), snout length (0.3cm), and pre-orbital length (0.6cm) did not display an intermediate range but the values were either lower or higher than those of the parental species .The hatching frequency and proportions of larvae in the two experiments showed that cross fertilization between goldfish and koicarp led to normal development. The intermediate morphology and the chromosome number  $2n=60$  suggest that products of the contribution of haploid set of genome from each parent and these hybrids were true.

#### CONCLUSION

The feasibility of hybridization between koicarp and goldfish

**Table 1.** Induced breeding of Gold fish (Female) (*Carassius auratus*) and Koi Carp (Male) (*Cyprinus carpio*) and survival of the hybrid and control.

Species	Weight of the fish (gm)	Hormone dosage (ml/kg)	Fertilization (%)	Incubation Period (h)	Survival of hatchlings (%)	Survival after 3 days (%)	Survival after 25 days after hatching (%)	Survival at 60 days after hatching (%)
<b>Control</b> gold fish ( <i>Carassius auratus</i> )	M- 30	0.3	90	72	90	80	36	30
	M-35							
	F-45							
<b>Control</b> Koi Carp ( <i>Cyprinus carpio</i> )	M-70	0.3	80	72	80	70	25	22
	M-76							
	F-90							
<b>Hybrid</b> Koi Carp ( <i>Cyprinus carpio</i> ) and gold fish ( <i>Carassius auratus</i> )	KM-60	0.3	90	72	90	90	90	70
	KM-63							
	GF-55							

M- Male, F-Female, KM-Koicarp male, GF-Goldfish females

has been demonstrated in the present study. Ovaprim is effective in induced spawning in cyprinid species to produce hybrids. For future hybridization for cyprinid species the present dosage of 0.3ml/kg bodyweight of ovaprim may be used as standard. The present study suggests that the two species are very similar to each other.

## REFERENCES

- Hanfling, B., Bolton, P., Harley, M., and Carvalho, F. 2005. A molecular approach to detect hybridization between crucian carp (*Carassius carassius*) and non-indigenous carp species (*Carassius* spp. and *Cyprinus carpio*), *Freshwater biology* 50, 403-417.
- Stebbins, G.L. 1958. Hybrid inviability, weakness and sterility. *Advances in Genetics* 9: 147-215.
- Sridhar, S. and Haniffa, M.A. 1999. Interspecific hybridization between the catfishes *Heteropneustes fossilis* (Bloch) and *Heteropneustes microps* (Günther) (Siluridae: Heteropneustidae). *Curr. Sci.* 76: 871-873.
- Richi R., and H.A. Baensch 1991 *Aquarium Atlas*, Mergus, Melle, Germany 992 PP.
- Liu, S., Liu, Y., Zhou, G., Zhang, X., Luo, C., Feng, H., He, X., Zhu, G., and Yang, H., 2001. The formation of tetraploid stocks of red crucian carp X common carp hybrids as an effect of interspecific hybridization, *Aquaculture*, 192:171-186.
- Argue B.J., Liu, Z., and Dunham, R.A. 2003. Dressout and fillet yields of channel catfish, *Ictalurus punctatus*, blue catfish *Ictalurus furcatus*, and their F1, F2 and backcross hybrids, *Aquaculture*, 228: 80-90.
- Haniffa, M.A., Allen Benziger, P.S., Jesu Arockia Raj, A., Nagarajan, M., and Siby, P., 2007. Breeding behavior and embryonic development of Koi carp (*Cyprinus carpio*) *Taiwania* 52(1): 93-99.
- Abot Munafi A.B., Liem, P.T., Ambak, M.A and Siraj, S.S., 2004. Breeding performance of the hybrid catfish (*Clarias macrocephalus* X *C. gariepinus*) in captivity. Paper presented at the 7<sup>th</sup> Asian fisheries forum, 30/11-04/2004. Penang, Malaysia.
- Na-Nakorn, U., Rangsin, W., and Boon-ngam J., 2004. Allotriploidy increases sterility in the hybrid between *Clarias macrocephalus* and *C. gariepinus*. *Aquaculture*, 237: 73-88.
- Wheeler A. 2000. Status of the Crucian carp *Carassius auratus* (L) in the UK. *Fisheries Management and Ecology*, 7, 315-322.
- Reddy, P.V.G.K. 1999. Genetic resources of Indian major carps. *FAO Fisheries Technical Paper* 387. FAO, Rome. 76 p.
- Griffith, O.L., G.E.E. Moodie and A. Civetta. 2003.

Genome size and longevity in fish. *Experimental Gerontology* 38:333-337.

13. Lagler, K.F. *Freshwater fishery biology*. W.M.C Brown company publishers Iowa, 2<sup>nd</sup> edn 1982. pp108

14. Haniffa, M.A., and Ananth Kumar, Y., 2006. A Simple low cost technique for breeding goldfish. *Infotish International* 5: 25-27.

15. Padhi, B.K., Datta, P and Mandal, R.K. 1995. Reciprocal hybridization between two freshwater catfishes : *Heteropneustes fossilis* (Bloch) and *Clarias batrachus* (Linn) *Indian J.Exp.Biol.* 33 : 433 436.

16. Chondar, S.L. 1977. Systematic account of carp hybrid. 1. *Labeo gonius x Labeo calbasu*. *J. Inland Fish.Soc.India.* 9:172-174