Aquaculture Biotechnology

Hybridization in Fish

Introduction to Hybridization

 It is the act of breeding between two different species/genera, which ordinarily are not interbreeding.

 Most fishes, release their gametes (egg and sperm) in water and fertilization is external.

 Hybridization natural or artificially induced.

 Esocidae, Catastomidae, Salmonidae, Poecilidae, Cyprinidae, Percidae are only some examples out of 56 families which are known for natural hybridization.

Types of hybridization

a) Natural Hybridization

- It is more common in freshwater fishes.
- Natural hybridization was recorded between different species of Carps like-Catla catla and Labeo rohita.

The reasons of natural hybridization are:

1. External fertilization habit.
2. 2. Overlapping of spawning grounds of related species due to habitat changes by the construction of dams and canals.
3. 3. Unequal abundance of the males and females of a species due to fishing pressure or other reasons.

b) Artificial Hybridization

1. Some aquarium fishes and cultured species do hybridize readily if matured male and female members are allowed to live together.

2. Use Gonadotropin Hormone for hybridization.

3. The gametes are taken out manually and mixed together for fertilization.

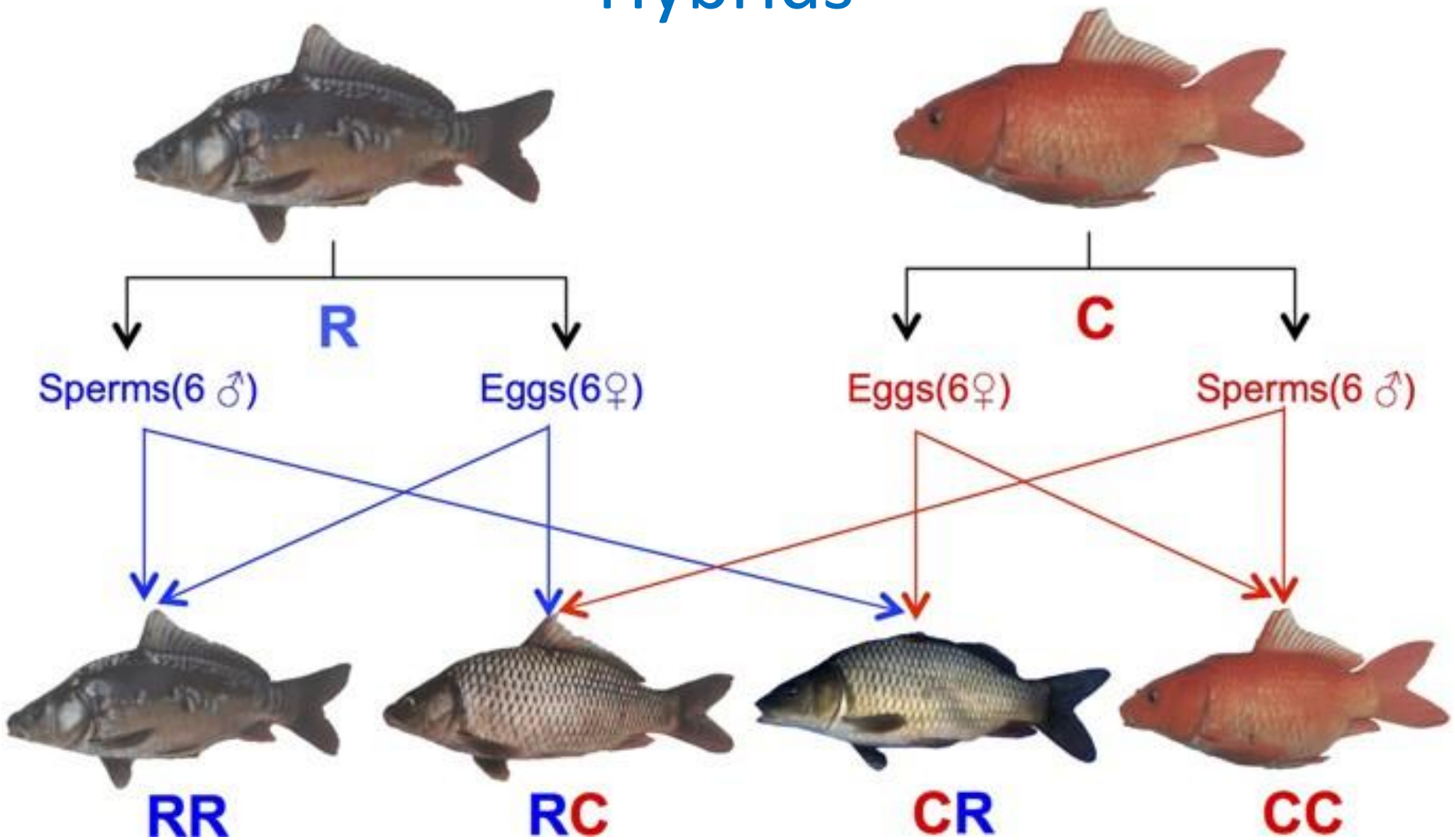
Hybrids

Hybridization natural or artificially induced, results in an embryo which resembles neither one parent nor the other parent but posses characters which are intermediate between the characters possessed by the two parents.

This embryo is called Hybrid.

The hybrid may be a diploid or polyploid

Hybrids



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Types of hybrid

a) Diploid Hybrid

1. Crosses between two different species result in diplod hybrids.

2. Mating between female Labeo calbasu and male Labeo rohita is highly successful.

3. This hybrid possessing a small head and characters which are intermidiate between those of Calbasu and Rohu.

Types of hybrid

4. Cross breeding between female Labeo rohita and male Catla catla an intergeneric diploid hybrid.

5. It has a smaller head than the head of catla but the characters are intermidiate between the two parents.

Intergeneric hybridization

Labeo rohita

×

Cirrhinus mrigala

Crossing between Rohu and Mrigal is more successful and 90% fertilisation is done and

hybrids attain full maturity in 2yrs and

showed intermediate character

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b) Triplod/Polyploid Hybrid

The triploid hybrid may be produce by chromosomal manipulation which includes the following

1. By intergeneric mating between diploid female of one species (any IMC) and a triploid male of another species (Common Carp).
2. By subjecting the normally fertilized egg, involving artificial insemination of egg of one species (common carp) by the sperm of another species (Rohu) to heat/cold/hydrostatic pressure shocks.
3. Cytochalasin or Colchicine antibiotics are used for triplod hybridization.

Examples of hybridization and markers

FAMILY	SPECIES	MARKER (S)
SALMONIDAE	Onchorhynchus mykiss X O. apache	Allozyme
	Salmo salar X S. truta	Allozyme
	Salvelinus alpinus X S. fontinalis	mT-DNA
CYPRINIDAE	Promoxis nigromaculatus X P. annularis	Allozyme
	Barbus meridionalis X B. barbus	Allozyme
	Notropsis cornutus X N. chrysocephalus	Allozyme, mT-DNA

CHARACTERISTICS OF HYBRID

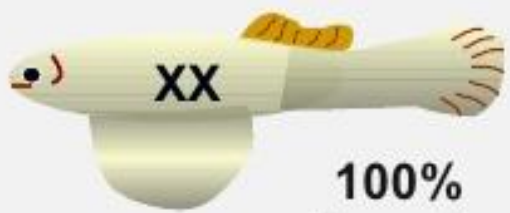
- The survival rates of hybrids vary in different crosses.
- The growth rate in hybrids is generally intermediate between the parental species.
- Hybridization of two species may result in the production of monosex population.
- Reproductive capacity of the hybrids are affected at various levels..

MONOSEX PRODUCTION

- Production of a population with single sex characteristics
- Conducted to control production of certain sex for growth.
- Avoid occurrence of breeding during grow-out.
- Main purpose of Monosex production in a population
  - advantage of certain sex
  - desire for certain sex
  - avoid reproduction during culture
  - avoid aggressive behaviour which normally exist during reproduction

Production of Monosex Strain

- Perform due to interest towards a certain gender which has a better performance compared to the other gender
- Produced using hormone tratment
- All produced seeds will be either 100% male or 100% female



100%
Female

OR

100%
Male

Challenges to Hybridization

- It is beneficial only if done with care and caution.
- Uncontrolled hybridization may cause economic loss.
- It requires a lot of experiments to find out a useful hybrid.
- Some hybrids are cultured on a commercial scale.