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Captive Culture of Boeseman's Rainbowfish (*Melanotaenia boesemani*): First Approach in Indian Perspective

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Abstract

Boesemani Rainbowfish is one of the most popular ornamental fishes in international ornamental fish trade as well as in India due to its attractive color pattern, shape and ability to live in confined environment. This fish species is endemic to Lake Ayamaru and surrounding tributaries of West Papua, Indonesia and is used to being imported to India for ornamental fish markets. Due to high market price, this fish species still is out of reach to general fish hobbyists in India. The main reasons behind high market price are low supply and high import cost. Captive culture of this fish species can solve the problem of low supply as well also cut down the market price by curbing the import cost. With this aim, the present experiment was conducted to standardize the captive culture of Boesemani Rainbowfish in Indian climatic condition. Captive culture was done using sex ratio of 1:1 and stocking group of 40 individuals in the breeding tank. Important parameters related to captive culture like fertilization rate, hatching rate and larval survivability were measured. Fertilization rate, hatching rate and larval survivability was found to be 90.21%, 84.58% and 60.31% respectively.

***Key words*:** Boeseman's Rainbowfish, Ornamental fish, Captive breeding, Culture

Boeseman's Rainbowfish (*Melanotaenia boesemani*), also known as Boesemani Rainbowfish is one of the most popular ornamental fishes of the world due to their vivid coloration, unique body shape and ability to thrive in captive condition [1-3]. The male of Boeseman's Rainbowfish has completely different color pattern from other Rainbowfishes. In full maturity, the males display brilliant bluish-grey coloration at the head and anterior part of the body while posterior part of the body and fins are bright yellow to orange-red. Between these two areas, more specifically behind the pectoral fin, alternating light and dark vertical bars are present [4-5].

This fish species is endemic to Lake Ayamaru and a few surrounding tributaries of West Papua, Indonesia [5-7]. Like goldfish, one of the most popular varieties of ornamental fishes worldwide; this fish species is not much old in its entry in the world ornamental fish trade. In 1983, this fish species was introduced in the ornamental fish keeping hobby and since then has gradually increased its popularity among ornamental fish hobbyists [8]. With increasing popularity and high demand, the male fishes have been caught and exported in large number from their natural habitats; that leads to over-exploitation of its population [4] and turned this species as endangered under IUCN Red List [9]. Considering its increasing economic value and over-exploitation, captive culture can be the best solution to sustain the demand as well as to reduce the pressure on its natural population. Earlier Akshan *et al*. [10] only have tried to culture this species in captivity.

In India, Boeseman's Rainbowfish is used to being imported mainly from Indonesia and is being sold with a price of Rs. 500-550/pair in wholesale as well as in retail markets. Due to high price, this fish species is till date out of reach for most of the ornamental fish hobbyists of India. Captive breeding technique of this fish species to some extent may solve the problem with enhanced supply and curbing of import value. With this aim, the present experiment was conducted to standardize the captive breeding of Boeseman's Rainbowfish in Indian climatic condition.

MATERIALS AND METHODS

Selection of brood fish

Male and female of Boeseman's Rainbowfish can be identified easily; males are different in their color and have more elongated dorsal fin rays and deep bodied than the females. Females are with a broad dark mid-lateral stripe along with series of narrow longitudinal stripes which are yellow or reddish-orange in color [4]. For this experiment, 20-24 months old males (Fig 1) and females (Fig 2) with length range of 8-10 cm were selected as brood fish.

Fig 1 Male brood fish of Boeseman's Rainbowfish

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Fig 2 Female brood fish of Boeseman's Rainbowfish

Rearing of brood fish

For the first three weeks, male and female brood fishes were stocked in two separate aquariums with size of 90 × 45 × 45 cm and volume of 48 gallon; water depth of 40 cm was maintained. Total 20 individuals of each sex were stocked in two aquariums. Brood fishes were fed twice daily; once in the morning and another time in the evening with live feed (*Tubifex* and blood worm) *ad libitum* (Fig 3).

Fig 3 Feeding brood fishes with *Tubifex*

Setting up of breeding tank

After three weeks of rearing, male and female brood fishes were stocked in the breeding tank (size 120 × 45 × 45 cm, volume 65 gallon and depth 40 cm) in the ratio of 1:1 following the standardized stocking density [2], [10]. In total 40 brood fishes were stocked in the breeding tank (Fig 4) as rainbow fishes usually spawn in groups and stocking in groups can reduce the stress [4]. For the easy collection of eggs, spawning mops made up of wool (Fig 5) and synthetic rope were set inside the breeding tank. After stocking of brood fishes, they were kept in undisturbed condition for next two days.

Fig 4 Breeding tank with spawning mops

Fig 5 Wool made spawning mop

Setting up of hatching tank

Spawning mops with attached eggs (Fig 6) were transferred to the hatching tank with size of 30 × 15 × 15 cm; water depth of 10 cm was maintained in the tank. An air diffuser with slow diffusion rate was kept inside the tank to maintain the optimum dissolved oxygen level. The eggs with spawning mops were kept in the hatching tank for 8-10 days. Color of fertilized and unfertilized eggs was noted down and the diameter of the eggs was measured using stage and ocular micrometer.

Fig 6 Spawning mop with attached eggs

Setting up of larval rearing tank

The hatched-out larvae with size range of 3-5 mm were transferred to the larval rearing tank with size of 45 × 30 × 30 cm; water depth of 20 cm was maintained in the tank. A weak aeration was provided to maintain the optimum dissolved oxygen level and a low intensity light was kept on for continuous basis. Larvae were not fed for the first three days as the yolk sac supports the nutrition during this phase; after that tiny natural live feed like infusoria and brine shrimp nauplii were fed *ad libitum*. For the first 5-6 days, larvae were supplied with infusoria (5-6 times per day) (Fig 7) and then from 7 day onward they were supplied with brine shrimp nauplii (3-4 times per day) (Fig 8). Larval rearing was continued for 25-30 days post hatching.

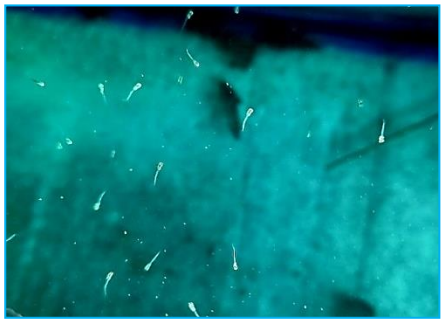

Fig 7 Six (6) days old fry

Fig 8 Fifteen (15) days old fry

Management of water quality parameters

Water quality parameters like temperature, pH, TDS and dissolved oxygen were measured on daily basis to maintain the optimum water quality of the brood rearing tank, breeding tank, hatching tank and larval rearing tank. Water temperature, pH, TDS and dissolved oxygen were measured using digital thermometer (Hanna HI98501), digital pH meter (Hanna HI98107 pHep), digital TDS meter (Hanna HI98301 DiST1) and portable dissolved oxygen meter (Hanna HI9146) respectively.

Data analysis

Average number of eggs per spawning, fertilization rate, hatching rate and larval survivability were measured as per following formula:

$$\text{Average number of eggs/spawning} = T_{ec}/\ T_{fb}$$

Where;
T_{ec} = Total number of eggs collected
T_{fb} = Total number of female brood fishes

$$\text{Fertilization rate (\%)} = T_{fe} \times 100/\ T_{ec}$$

Where;
T_{fe} = Total number of fertilized eggs
T_{ec} = Total number of eggs collected

$$\text{Hatching rate} = T_{he} \times 100/T_{ec}$$

Where;
T_{he} = Total number of hatched eggs
T_{ec} = Total number of eggs collected

$$\text{Larval survivability (\%)} = T_{lsu} \times 100/\ T_{lst}$$

Where;
T_{lsu} = Total number of larvae survived
T_{lst} = Total number of larvae stocked

RESULTS AND DISCUSSION

Average number of eggs per spawning was found to be about 50-55. The fertilized eggs are spherical in shape and light yellowish in color; unfertilized eggs are opaque. The average egg diameter was found to be 1.07±0.0175 mm which is close to the observation (1.09 ± 0.0158 mm) by Radael *et al*. [2]. The observed average diameter of the eggs is also in correspondence to the egg diameter of other rainbow fishes [11-13].

Fertilization rate and hatching rate was found to be 90.21% and 84.58% respectively which are almost close to the earlier report of 91.47% and 86.12% [10]. The larval survivability was recorded as 60.31% which is higher than the earlier reported value of 47.24% [10].

In all the aquariums, the water quality parameters were maintained in the following range:

Temperature: 28-30°C; pH: 6.5-7; TDS: <120 ppm and Dissolved Oxygen: 5-7 ppm

Even with high fertilization and hatching rate, the major problem in captive culture of Boeseman's Rainbowfish is low larval survivability which may be due to non-availability of right size of food that fit in their small mouth gape. In their experiment, Akshan *et al*. [10] fed the larvae with infusoria and rotifers, but they did not mention the actual time period for which these two live feeds were supplied. In our experiment, for the 25-30 days of larval rearing period, infusoria was supplied for first 5-6 days (excluding the 3 days phase of yolk sac stage) when the mouth gape was very small and then from 7^{th} day onward with increase of mouth gape, we supplied brine shrimp nauplii. Enhanced larval survivability in our experiment compared to Akshan *et al*. [10] may be due to the supply of proper type of live feed for proper time period.

Further studies are needed to standardize the first feed for the larvae of Boeseman's Rainbowfish to enhance the larval survivability. In this regard, micro-worm can be considered as larval feed for future experiment. Apart from live feed, consideration can be provided for commercially prepared micro-pellet with enriched nutrient content.

On the other hand, nutritional enrichment for the brood fishes to promote fertilization and hatching rate as well as larval survivability should also be considered. In this regard, report of Said *et al*. [14] can be considered who achieved enhanced fertilization and hatching rate and larval survivability of Ajamaru Lakes rainbowfish (*Melanotaenia ajamaruensis*) with addition of 3-6% of *Spirulina* in the diet of brood fishes.

CONCLUSION

The present research was conducted to standardize the captive breeding technique of Boeseman's Rainbowfish in Indian climatic condition. It has been observed that 20-24 months old brood fishes should be selected for captive breeding purpose and the brood fishes should be stocked @ 1:1 in the breeding tank to achieve maximum success in respect to fertilization rate. Satisfactory level of fertilization rate (90.21%) and hatching rate (84.58%) has been achieved in the experiment but much higher larval survivability (60.31%) has been achieved in this experiment which might be due to the supply of proper type of live feed at the proper time period. Infusoria has been found to be suitable for the first 5-6 days of larval rearing while brine shrimp nauplii should be supplied for rest of the larval rearing period to support higher larval survivability. Water quality parameters which have been found to be optimum for captive breeding of Boeseman's Rainbowfish are as follow: temperature: 28-30°C; pH: 6.5-7; TDS: <120 ppm and dissolved oxygen: 5-7 ppm.

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