

Captive breeding of *Devario pathirana* (Barred Danio) (Family: Cyprinidae)

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Abstract

Devario pathirana (Barred Danio) is a critically endangered point endemic freshwater fish confined to the southern part of Sri Lanka, The present study forecast captive breeding of this fish species. Spawning of Barred Danio didn't occur in indoor glass tanks. Captive breeding was successful in running water tank outdoor cement tank indoor cement tank and outdoor glass tanks. *Devario pathirana* found to be a group breeder and their fecundity was 80-125 per fish. Most successful outcome in breeding occurs at the female and male sex ratio of 1:3. Fertilized eggs hatched within 36-48 h and within 14-16 weeks they became maturity. Mass culture resulted in breeding more than a thousand fish within seven to nine months.

Introduction

The *Devario pathirana* (Barred Danio), which belongs to family Cyprinidae is a point endemic species and identified as a critically endangered species in Sri Lanka. (IUCN, 2000). It is locally known as “Pathirana Salaya”. The species is found in streams with pebbles and has been recorded only from Opatha area in the Nilwala River basin (Pethiagoda, 1991).

The population of the Barred Danio has declined dramatically over the past decades, due to overexploitation by the aquarium fish exporters (Pethiagoda, 1991). Since *Danio pathirana* is in critically endangered in status, it is vital to take appropriate measures to prevent them under going further declining.

The present study was mainly under taken to identify various methods for captive breeding and rearing to develop a conservation plan and management strategies.

Materials and methodologies

Determination of environmental factors

Environmental parameters such as pH, conductivity, air temperature and water temperature, Dissolved Oxygen, depth and current velocity of the water were determined in the each study area fortnightly using standard methods.

Collection of brood stock from the natural habitat

Mature males and females (10 pairs) of Barred Danios were collected from the natural habitat at Opatha and 10 pairs from an aquarium.

Acclimatization and Selection of brood stocks

Mature males and females were acclimatized for a period of two weeks in indoor glass tanks (45cm x 75cm x 45 cm) at stocking density 10 individuals per tank. Depth of the water in the tank was 30 cm. Each tank was provided with a sponge filter and continuous aerator. They were fed with freshly hatched *Artemia* nauplii and mixture of beef heart and formulated food twice a day.

Breeding under captive conditions

Captive breeding experiments were conducted by arranging series of aquaria, indoor glass tank, and indoor still water cement tank, outdoor glass tank, outdoor still water cement tank and outdoor running water tank.

Females and males having the sex ratio of 1:1, 1:2 and 1:3 were respectively maintained in separate tanks. Males were introduced at 16.00h and females were released to the tank on the following morning at 8.00 h (16 hours after introduction of males). Experiment was repeated twice in a month and continued for 4 months.

Breeding under indoor conditions

Three indoor glass tanks with a size of 45 x 90 x 45 cm were used as spawning tanks. Bottoms of the spawning tanks were filled with fine sand mixed with pebbles of 3cm in size added de-chlorinated water to a depth of 15cm and allowed it for one day to get settle. *Hydrilla* spp., Java moss and *Cabomba* sp. bushes were planted at the bottom of these tanks.

Breeding under outdoor condition

Three glass tanks with a size of 45 x 90 x 45 cm and conditioned cement tank with 8 x 1.5 x 0.18m were used for spawning and were kept under the shade. The brood stocks were introduced to above as mentioned.

Breeding under flowing water condition

A concrete tank with a size of 10 x 1 x 0.18m was kept in a shady place and continuous water supply was given to the running water system by using 1.5 horse power motor. The water was allowed to circulate continuously this system.

RESULTS AND DISCUSSION

The method adopted to breed the fish is in the following manner,

1. Running water tank
2. Outdoor cement tank
3. Indoor cement tank
4. Outdoor glass tanks
5. Indoor glass tanks

Spawning was not taken place in indoor glass tank. However, captive breeding was successful in flowing water tank, outdoor cement tank and outdoor glass tank. Out of the four systems adopted for breeding, the running water system was the most successful than other three systems, when comparing the production of hatchling. This is due to the reason that running water system apart from the other physical factors maintained in the tanks shown greater success because of moving water, the velocity of the running water in the tank and the natural habitat is almost the same. Therefore, spawning can be enhanced by providing running water while maintaining the other environmental parameters at the optimum.

After the introduction of females in to the breeding tanks males and females exhibited active swimming movements and chasing behaviour on the following day morning. Most active chasing behaviour was shown in running water tanks with females and males at ratio of 1:3.

The indoor /outdoor glass tanks were maintained while the physical factors and the other conditions remains same, depth of the water, properties of the substratum were changed. In this experiment no spawning was occurred. However, there was an incidental spawning occurred for which the reason cannot be explained.

Fertilized eggs hatched within 36-48 h. The moments of the hatchlings could be observed after 3 days from hatching. They usually swim on the water surface. It was observed that they have spawning interval of 14-18 days.

The food materials provided to the hatchlings are given in table 3.

Table 1 Food Items Given to the Hatchlings

Age (Days)	Food Materials
1-3	Egg Yolk
4-9	Freshly hatched <i>Artemia nauplii</i>
10- Onwards	Macerated Beef Heart + Formulated Food + Freshly hatched <i>Artemia nauplii</i>

They were transferred into a rearing tank with a stoking density of 1000 individuals per 1200 liters of water, fed with same food and left until they were release after quarantine. Body markings of the juveniles were observed within the eight to nine weeks and within 14- 16 weeks they became maturity. The population of first generation exceeded more than 2000 in number under such captive conditions.

Table 2 Sex ratio of the parents and resulted Hatchlings

Sex Ratio (F: M)	1:1	1 : 2	1: 3
No of resulted Hatchlings	50-60	60-70	80-100

Devario pathirana found to be a group breeder and the possible method for stimulating for spawning would be female and male sex ratio of 1:3, along with supplying their preferred environmental conditions in captivity.

The increasing in the production of the hatchlings by a single female with more males resulted greater production of hatchling. This could be explained that the number of eggs released by a single female would be getting chances of fertilized by the sperms and released by more males.

The environmental parameters were assessed and brought to optimum in the laboratory conditions.

Table 3 Physical Parameters of Captive Breeding Tanks

Station	Runing water tank	Outdoor cement water tank	Indoor glass tanks	Outdoor glass tanks
Water Temperature / °C	28.2	28.0	28.1	28.5
Air Temperature / °C	31.25	31.25	31.25	31.25
Conductivity / µs	101	83	85	80
Depth/ cm	15	18	15	15
Velocity /ms ⁻¹	0.19	0	0	0
pH	6.5	7.15	7.0	7.2
DO	5.5	5.1	4.8	5.0

CONCLUSION

Captive breeding of *Devario pathirana* is success in running water with significant space in captivity. This species prefer to group breeding under 1:3 sex ratio of female: Males. It is a multiple spawner and breed once in every two weeks. It reaches maturation within four months.

Most of the endemic fresh water fish species in Sri Lanka are threatened and some of them are in danger of extinction, unless appropriate conservation and management strategies are not developed. Although in nature biogeographical segregation of *Devario pathirana* unavoidable, the anthropogenic activities, deforestation, gem and sand minding, indiscriminate use of agro chemicals, development projects and ornamental fish trade place further deterioration of its population size.

Multidisciplinary strategies should be taken along with the continuous assessment of the conservation status should be practiced to all the endemic as well as other fresh water fish species to maintain the existence of them.

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