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Initial success of captive breeding and larval rearing of endemic fresh water food fish *Systemus spilurus* (Günther, 1868) in Sri Lanka

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1. Introduction

Systemus spilurus (olive barb or “Mas Pethiya”) is an endemic fish to Sri Lanka, distributed in rivers, streams, reservoirs and irrigation canals of south western, Mahaweli, dry and transitional ichthyological zones. This species was previously described as *Puntius sarana* (Hamilton, 1822), native to South and South East Asia (Pethiyagoda et al., 2012, Sudasinghe et al., 2020). However, recent nomenclature updated the name to *Systemus spilurus* redescribing it as an endemic species to the country Sri Lanka (Pethiyagoda et al., 2012, Sudasinghe et al., 2020). *S. spilurus* has been a popular food fish species across the country, reaching an average size of 600 g and included in the group of minor cyprinids in fishery subsector reports. This group alone contributed a catch of 11,260 MT in 2019. With the local perception as a nutritive fish species. *S. spilurus* has a considerable harvesting pressure on its existing stocks, leading to population. Though the systematically review made species data confusion for past records, it is assumed that the species is under heavy fishing pressure, as of many freshwater fish species (Goonatilake et al., 2020). Hence, stock enhancement via captive breeding programs is necessary to be implemented, yet, no previous efforts are made in this regard. Therefore, present study was aimed at developing captive breeding and larval rearing protocols for *S. spilurus*.

2. Materials and Methods

This study was conducted at the National Aquaculture Development Authority of Sri Lanka (NAQDA), Aquaculture Development Center (AQDC); Dambulla. (7.8726° N, 80.6299° E). Wild caught *S. spilurus* was acclimatized in 6 x 4 x 0.5 m tanks in a flow through system. During acclimatization, adaptation and behavioural changes were observed in the morning and evening. Natural feeds were supplied first and gradually replaced with formulated diets (38% Crude Protein) fed at 2-3% of the body weight. With the onset of rains, stage of maturity of both the males and females was examined, and the water quality parameters were recorded. Matured adults were selected and a commercial hormonal mixture of sGNRHa and Domperidone was administered at the rate of 0.4 ml per kg for females and 0.2 ml per kg of male as per Chakraborty et al. (2007). They were then introduced into a 3m x 1.5m x 0.45m cement tank with coconut leaves as substrate, at 1:2 female/male ratio.

Brooders were removed after laying completed, and embryonic development was photographically recorded. The first feeding was done for 60 hours post hatch free swimming larvae using blended chicken egg mixture and continued for five days. This was followed by *Artemia* nauplii for another five days. Post larvae were then stocked in cement tank 3m x 1.5m.

at the water depth of 0.2m. were fed with daphnia, followed by formulated powered fish feed contained 38% of Crude Protein (CP) for 12 days. Water quality was measured using portable test kit, Milwaukee® (Romania).

3. Results and Discussion

This study was the first of its kind to breed *S. spilurus* under captive conditions in Sri Lanka, and to provide a successful larva rearing protocol. Broodstock fish in the acclimatization showed signs of final maturation by the time of 8th week. Mean values of water quality parameters during the acclimatization were Dissolved Oxygen (DO) 7.8 ± 0.21 ppm, pH 7.8 ± 0.29 and temperature 27.4 ± 0.42 °C. Markedly high levels of DO and slightly low temperature might be mimicking the rainy conditions, stimulating final maturation of the fish. When the maturity of the fish was observed with the females having bulging abdomen and swollen vulva, and males having whitish milt oozing at a gentle press of the abdomen, they were used for induced breeding induction. Matured *S. spilurus* was sexually dimorphic, where males were bright olive-green dorsally side and silver colour ventrally. They also have slender body with rough pectoral fins and operculum.

Hormone administered brooders developed typical signs of breeding by accelerated swimming, chasing each other and aggressive movements evident after about 6 hours of injection. After about a 7 hr and 45 min latency period, spawning was observed for a period of approximately 45 minutes. Once the brooders were spent, they were removed to post-spawning tanks. Most of the eggs were attached to the coconut leaf substrate, but some were spread over the tank floor. They were spherical in shape, and fertilized eggs were ranged 1.3-1.5 mm in diameter. Unfertilized eggs were about 0.9-1.1 mm in diameter. Average estimated production per female was 32030 eggs. While in the coconut leaf substrate eggs were then transferred to adjacent cement tank (1.3 m x 1.5 m x 0.45m), wherein a flow through system was maintained. Eggs started to hatch after about 16 hours, resulting larvae of 3-3.5 mm length. Plate 1. shows sequential development of embryonic stages of *S. spilurus*.

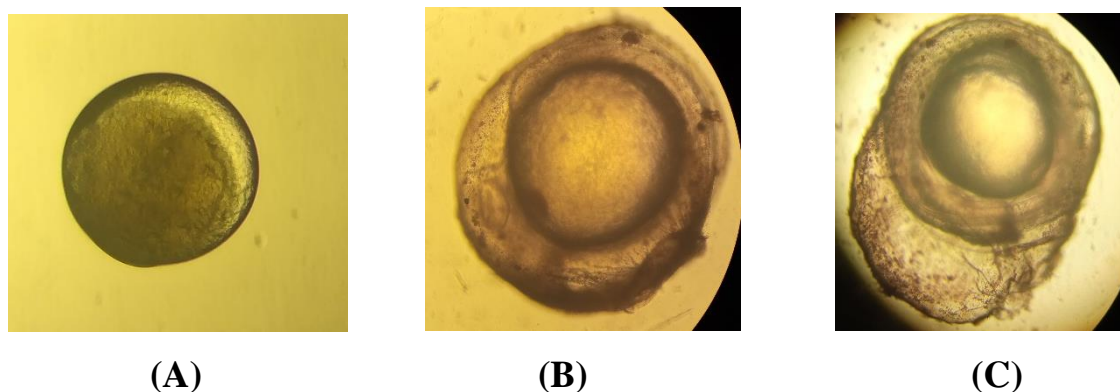


Figure 1. embryonic development of *S. spilurus* (A) 2 hours after fertilization (B) 06 hours after fertilization (C) 12 hours after fertilization.

Water quality parameters during larval rearing were pH $7.4 \pm 0.24 \pm 0.21$, DO 7.9 ± 0.29 mg/l and temperature 27 ± 0.32 °C. Yolk-sac absorption of the hatchlings was completed by 45-60 hours. Blended whole chicken egg was fed to free swimming larvae at 3 hours' interval during daytime, 4 hours interval during night and continued for five days. *Artemia* nauplii were fed at the same frequency for another five days. Then the larvae were thinned to a density of 1500 per 3m x 1.5m x 0.2m cement tanks. About 20500 larvae were successfully recovered by this method of culturing. *S. spilurus* post larvae attraction to feeding was comparatively high with 10th day of the feeding. Then feeding was followed by daphnia and formulated powdered feed.

From 12th day onwards, adult colours were appearing as light green colour on the dorsal side. From the same day onwards, larvae were fed with artemia, daphnia and formulated powder feed with 42% CP.

4. Conclusions

Present study provides first evidence of successful captive breeding of *S. spilurus* using sGnRH and domperidone, at the rate of 0.4 mg/Kg for females and 0.2 mg/kg for males. It further provides a larval rearing protocol for successful nursing of their larvae, suggesting a possible application of captive breeding and larval rearing of this species for conservation or commercial purposes.

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