Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2025; 13(3): 52-55

Received: 09-02-2025
Accepted: 16-03-2025

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Backyard seed production of pearl spot (*Etroplus suratensis*) in FRP/cement tanks using river water: A case study from Chengannur, Kerala

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DOI: https://www.doi.org/10.22271/j.ento.2025.v13.i3a.9501

Abstract
Pearl spot (*Etroplus suratensis*), coming in the indigenous Asian cichlids is the state fish of Kerala is a delicacy in Kerala. However, scarcity of adequate quality seeds in required time and quantity is the major bottleneck in the development of its large scale aquaculture practices like cage culture. Sustainable seed production is mainly hampered due to lack of captive reproduction by hatcheries and/or farmers. In the present study, an attempt was made in the farmer's backyard in collaboration with the farmer to achieve the natural spawning and seed production of pearl spot in small FRP/cement tanks, using wild parents from River Pampa, at Chengannur, in Kerala. Adult pearl spots ranging in size between 9 to 14 cm and 100 to 110 g were collected either from river or collected earlier and kept in cages moored in the river were stocked for acclimatization in the breeding tanks for one to two weeks. River water sand was used in the experimental tanks as the medium and substratum. Bamboo poles and roofing tiles were placed into the tank corners for hiding and egg deposition while natural spawning as these fishes are substrate spawners. Fishes were fed daily at ad libitum with artificial feeds and water exchange (50 to 60%) was done with filtered natural river water after feeding. Natural spawning, and attached eggs were obtained after three to five weeks in the bamboo poles or roofing tiles.

Keywords: Pearl spot, spawning, breeding, seed production

Introduction
The pearl spot (*Etroplus suratensis*), is a delicacy in Kerala as it is a highly delicious and nutritious fish and most of the large and small farmers wanted its farming in various extends from small tanks to large perennial as well as seasonal farms and even in cages as it fetches high prices and huge demand in the local markets. Major factors make this fish a suitable candidate species for culture is its wide tolerance of salinity from 0 ppt to 35 ppt, adaptability to various farming systems, compatibility with other fishes, omnivorous feeding habit and acceptance to any type of feed etc. The fish is found to grow more in size in lower salinities but breeding is found more in brackish water conditions (Vaitheeswaran *et al.* 2016) [26]. The demand of seed is very huge and farmers are unable to stock enough and this is the reason the farmers wanted to do seed production in their own premises. Sometimes it may fulfill their requirements as well as they can sell excess seeds to the required farmers in good prices. In coastal areas farmers are doing its breeding in the natural pond systems, even though, captive breeding has been attempted in few places with limited success for aquaculture, due to its complex reproductive behaviour (Chandrasekar *et al.* 2014, Joseph and Ignatius 2016) [5, 11].
The present study was conducted in purely fresh water conditions; using natural river water from the river Pampa as one of our cage farmer wanted to produce seeds in their farm premises using the natural parents as the transportation of seeds from other areas are found expensive and difficult and he has observed natural breeding of pearl spots and seeds in the river. Cage culture of pearl spots requires large number of seeds. The difficulty in getting adequate seeds from the wild at the required time and quantity coupled with the findings of cage cultured pearl spots with fully developed ovary during the harvest were the motive behind this study. The objective of the present research is to study the possibility of seed production of wild pearl spot using local breeders in small FRP or cement tanks in fresh water conditions for cage culture activities and its suitability for undertaking reproductive studies under captivity for popularizing the techniques among farmers.

Materials and methods

Preliminary observations

In the present study, before starting the actual experimental studies an initial one year observations were made locally to excavate the possibility of collection of pearls pots for stocking into the cages and also to find out the status of natural breeding and seed production in the riverine conditions. The study revealed that pearl spots of all sizes from 3 to 18 cm are available in the river year round however; seeds are found more restricted to summer months. Natural breeding and parents with young ones are only found occasionally. Very large adult fishes are also found in the natural conditions but rarely. These observations revealed that pearl spots breeds even in fresh water conditions especially in summer months.

Collection and acclimatization of wild parents

Pearl spot juveniles of all sizes were collected locally from the cast net and gill net operators and reared in the cages moored in river Pampa. Small seeds were nursery reared and transferred to the cages when it reaches 5 cm size (latitude 13º24' and 13º43'N and longitude 80º03' and 80º18'E) (Selvaraj *et al.* 2016a) [21]. Adult fishes around 100 g sizes were transferred to the previously set FRP tanks set with aeration, bottom sand and substrates (Fig. 1). These fishes were acclimatized in these tanks (500 l) with 10 to 12 individuals in each tank. During acclimatization, fishes were fed ad libitum with pellet feed (grow well feed) twice daily (crude protein, 36%) and one fresh water algae azolla. Around 50 to 60% of tank water was exchanged with fresh river water once daily after feeding and observations were made for further progress. It was observed that fishes started pairing within a fortnight to one month and the identified pairs were transferred carefully to separate tanks (2 pairs or 4 fishes in a tank) for spawning and larval production.

Fig 1: Pearl spot breeding unit

Spawning and seed production

The spawning tanks are also set as that of the acclimatization tank with filtered clear river water, sand bed and substrates for spawning. Fishes are observed daily and the developments were noticed and recorded. The transferred pairs started searching of nesting place in the spawning tanks and selected either bamboo poles or the roofing tiles fitted in the tank. The parent fishes initially cleaned the area, where eggs were later laid by spending almost one to two days. Pelleted feeds as well azolla were given to the tanks as in the case of acclimatization tanks initially; however the brooders were reluctant to feeding and therefore the quantity of the feeds given was reduced further and finally stopped leaving only some azolla in the tank as breeding activities progress. Spawning started after one to two weeks was also carefully monitored. The entire activities of egg laying, egg guarding, hatching and larval movements were carefully observed and recorded; egg counts were made manually without disturbing the parents or the eggs. The fertilized eggs hatched out and larvae were settled to the bottom and the parents were guarding the eggs and the larvae very sincerely even without food. The larvae started feeding on the 7th day and the larvae were reared in the tanks for one month by feeding them with live feeds like artemia nauplii or moina and pelleted feeds and then transferred to the nursery pond for further growth and development. The parents were removed from the tanks after the larvae started proper feeding.

Result and discussion

Broodstock development and breeding

Pearl spot farming and seed production in the ponds itself is a very old practice in Kerala in perennial as well as seasonal ponds due to its high demand even though seed availability is limited. However, the low fecundity combined with very low survival and recruitment during its larval stages due to high predation is the reason, even though parental care is very strong in these fishes. It is reported by many that in nature even though the fecundity of pearl spot normally varies from 750 to 3000, the number of seeds produced from a single pair will be only 250 to 400 per spawning. Many have reported intense spawning of pearl spot in Kerala backwaters during November to March with a peak during December to January, (Krishnan and Diwan 1990) [13] still the seed availability is less. Adult specimens around 100 g sizes were selected as the broodstock as the first maturity of pearl spots were reported at this size (Jayaprakash and Balakrishnan Nair 1981) [10] but reported to be vary with individual fish, as well as between fishes from different habitats (Praveen Rattan 1994) [19]. In the present study, we found that wild specimens collected from the river as well as cultured in the cages with fully ripped eggs around 100 g size (9 to 14 cm length). The pearl spots are reported to have the characteristic breeding behavior of pairing and parental caring (Bindu 2006, Padmakumar *et al.* 2009a, Abraham 2012) [3, 15, 1] adult specimens collected were acclimatized together to make the pairs before transferring them to the spawning tanks. In the acclimatization tanks the fishes started pairing with two to three weeks and the pairs were transferred (two pairs to each tank) to the spawning tanks.

In the present study, the breeding was done in fresh water conditions even though most of the natural and induced spawning reports are in brackish water conditions with an optimum salinity range from 10 to 20 ppt (Jayaprakash and Nair 1981, Krishnan and Diwan 1990, Sultana *et al*. 1995, Padmakumar 2003, 2004a, 2009b, Bindu 2006, Abraham 2012, Padmakumar *et al*. 2012) [10, 13, 24, 18, 16, 15, 3, 1, 14] as spawning of pearl spots in fresh water conditions is also reported (Selvaraj *et al.* 2016, Felix *et al*. 2017) [21, 7] and observed in the preliminary observations in the natural river conditions. The present observation suggests that the species is euryhaline in all means and the freshwater conditions are also conducive for maturation, spawning, fertilization and hatching. The filtered river water from the same river where the brooders were collected was used in the breeding tanks after filtration without any manipulations. Water temperature in the experimental tanks during the spawning periods varied

between 28 to 31 ºC. Spawning of pearl spot in the present study was found when the water temperature ranged between 29 to 30 ºC. Field based studies in Sri Lanka also have recorded matured pearl spot and their spawning in freshwater when the water temperature ranged between 25 to 30.5 ºC (Ward and Wyman, 1977, Praveen Rattan 1994) [27, 19]. The reported peak breeding season in brackish water conditions was from November to March (Jayaprakas and Nair 1981) [10] though the fish breeds throughout the year; here the spawning was obtained in May when the temperature was high 28 to 31 ºC. Spawning of pearl spots in small FRP tanks was reported earlier in Pulicat Lake in Fresh water conditions using normal drinking tap water. The results of the present study clearly indicate that natural spawning of pearl spot can be induced even in small tanks, by the farmer himself through introduction of suitable conditions in Fresh/ Brackish water conditions and this will reduce the scarcity of the seeds for farming.

Spawning and larval production

Spawning and egg lying observed in the experimental tanks were similar to the spawning behaviours observed earlier in captive breeding studies in the brackish water ponds (Biswas *et al*. 2014, Chandrasekar *et al*. 2014, Dhinamala *et al*., 2016) [4, 5, 6]. As the gonads matured the female released eggs and attached these sticky eggs carefully on to the nest surface one by one in different layers. After the extrusion of a batch of eggs, the male released milt over it for fertilization. The female then repeated the process of egg extrusion followed by the release of milt by male until the whole process of spawning is completed, a process that extended from 40 min to 1 h. The complete process of egg lying by female fish and fertilization by male fish lasted for more than an hour and thereafter the mass was actively guarded and aerated carefully with their rhythmic fanning activity by the pectoral fins, especially by the female. The guarding female occasionally cleaned the eggs using its mouth. The number of eggs per brood varied from 1500 to 2500 depending on the size and condition of the brooders. The eggs released varied between each spawning are in agreement with the fecundity value previously reported by many (Abraham 2012, Bindhu and Padmakumar 2014, Selvaraj *et al.* 2016, 2017, Felix *et al.* 2017) [1, 21, 23, 2, 7]. The eggs were oblong in shape, about 2 mm in diameter and attached at one end to the nesting object by means of a short stalk. The newly laid eggs are yellowish in colour and as the embryo develops, the yolk sac becomes pigmented and colour becomes brownish. The larvae came out after the incubation period of 82 to 100 h (3 to 4 days). During hatching, the egg membrane bursts first over the head of the larvae, which is at the free end, and this continues along the upper side by the waving of the tail. The newly hatched out larvae, were sluggish, not having mouth opening, eye or fins for swimming, with their fully packed yolk are found to sink to the small pits in sand in the tank bottom and the parents were actively guarded them.

Larval rearing and seed production

The larvae started swimming only after 4 to 6 days of hatching and then started feeding. As the yolk is fully utilized, with a week, the wrigglers develop into a free-swimming individual and early larval stage lasts for 7 days the eyes are becomes opened and they can search for the food and start feeding. The larvae gradually moved in schools and come to the water surface and fed with *Artemia* nauplii and moina. After one week the parents were caught and transferred to the acclimatization tank and the larvae were fed minimum twice with 20 to 30 artemia nauplii/ moina for about two weeks. After two weeks the larvae were fed with small particulate feeds and artemia were gradually stopped. By the time a new nursery pond was set ready with zooplankton cultures to which the larvae were transferred for further growth. The young ones fed almost exclusively on zooplankton, the advanced fry on aquatic insect larvae, filamentous algae and other vegetable matter and planktonic organisms in the pond. Worms, shrimps and insect larvae also formed part of their food. Growth was found better in the pond systems than the few larvae left in the tanks during this stage fed with pellet feed. The fry also accepted supplementary feeds comprising ground nut oil cake, rice bran and commercial pellet feeds. The present study is a first report on the breeding of wild pearl spots in captivity under freshwater conditions by a cage farmer, in the Chengannore, Alleppey district Kerala.

Fig 2: Collected pearl spot seeds from breeding tank

Conclusion

In conclusion, the present study demonstrated that the farmers can produce pearl spot seeds by induction of natural spawning of wild pearl spot in captivity using small FRP or Cement tanks.

Acknowledgments

The authors wish to thank the Director Central Marine Fisheries Research Institute for necessary funds for providing facilities and encouragement. The authors are also grateful to Head and staff of Mariculture division for the helps and encouragements during the work.

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