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Domestication of Anemone Fishes with High Fecundity and Spawning Efficiency under Captive Condition for Indian Scenario

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Abstract

This present study is developed to understand the fecundity rate of seven different anemone fishes cultured in captivity.The efficiency of quality eggs of anemone fishand their developments aremuch important in marine ornamental aquaculture to enhance the production value.Hence, the experiment states that good feeding habitsof the brooders with mixed diets would increases thequantity and quality of eggs.In addition, the ideal water quality parameters like temperature-27±2^{0}C, salinity-28±1ppt, NH-$_4$-0.001ppm, dissolved oxygen 4.0±1 ppm, pH-7.7±0.2, light intensity 2500 to 3000 lux, with photoperiod (12L:12D). The feeding time was maintained thrice a day (07:00, 11:00 and 16:00 hrs)and organic wasteswere removed daily whilewater exchanged 30-40% per week.The sufficient quantity of oyster, musselsand shrimp consumed by the brooders(*A. percula, A. clarkii, A. sebae, A. sandaracinos, A. melanopus, A. frenatus,* and *A. ocellaris*) were 0.470g, 1.390g, 1.650g, 0.300g, 0.380g, 0.540g, 0.570g respectively. The calculated fecundityrate of developed brooders *A. percula,A. clarkii*, *A. sebae*, *A. sandaracinos*, *A. melanopus*, *A. frenatus*, and *A. ocellaris* were 300, 400, 200, 150, 120, 100, and 250 numbers respectively. Furthermore, the incubation time of hatchingwas noted as 171±2,177±2,152±2, 172±2, 204±2,174±2, 168±2hrs respectively of each animal.As a result, the high fecundity and production rate of anemonefish was greatly depends on thesize of parents,their maturation, feeding habits (especially oyster, and shrimp meat), and species adaptability to captive conditions.

Keywords*: Anemone fish, Broodstock, Fecundity, Marine ornamental fish*

Introduction

Ornamental fishes can be defined as attractive, colorful fishes of peaceful nature that are kept as pets in confined spaces of an aquarium or a garden pool as visually exciting objects (Mills, 1990; Dey, 1996). However, some fish species loved by aquarists are quite ugly, in such cases the peculiar appearance is a source of attraction for the aquarium lovers and naturalists (Abhisek Basu *et al*., 2012). Inspiring popularity of aquarium keeping in households in many parts of the world, ornamental fish has become an important part in international trade. The world trade of ornamental fish is valued at about US $ 9.0 billion (FAO 2004). In

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Indian domestic trade in ornamental fish is conservatively estimated at Rs.10 crores and it is growing at the rate of 20 percent annually and the present domestic demand is higher than the supply (Threatened freshwater fishes of India, 2010 and IUCN, 2011).

It has been reported that nearly 1500 species of marine ornamental fishes are traded globally, and most of these species are associated with coral reefs. Nearly 98% of the marine ornamental fishes marketed are wild collected from coral reefs of tropical countries. The fishing methods, which destroy the fragile corals, and over harvesting of the species in demand are the vital problems associated with the trade. It is widely accepted that the ultimate answer to a long-term sustainable trade of marine ornamental trade can be achieved only through the development of hatchery production technologies (Colette *et al*. 2003). Among the commercially traded families of reef fishes, Pomacentridae dominate, accounting for nearly 43% (Allen, 1991). And these fishes have some remarkable behavioral characteristics such as symbiotic association with sea anemones (Fautin and Allen, 1997), formation of a group consisting monogamous pairs and protandrous hermaphrodites (Ross, 1978).

In this context imperative to develop a method for maintaining healthy brooder in captive condition because if the brooder was healthy it can crop healthy larvae; observed food and feeding habits, physiochemical parameters, egg laying capacity of brood stock of anemone associated clown fishes.

Methodology

Seven different species of anemonefishwere procured from fish traders, Chennai, India. Animals were acclimatized and rearedat Marine ornamental fish hatchery, Centre of Advanced Study in Marine Biology, Parangipettai.Water quality parameters are maintained as temperature-27±2^{0}C, salinity-28±1ppt,NH_4-0.001ppm, dissolved oxygen- 4.0±1 ppm, pH-7.7±0.2, and light intensity 2500 to 3000 lux(12L:12D). Feeding of animals were followed thrice a day with time 07:00,11:00,16:00 and a water exchange of 30-40% per week.Organic wastes were removed regularly.

Brood stock development

Healthy fishes (Total Length= 5.6±1 cm) from each species (n=4) were collected and transferred toindividualFRP tanks (500 liter). The tankswere fitted with simple biological filters (made with gravels, activated carbon and ceramic stones), regular aeration and maintainedwith optimum physioc-hemical parameters. Each pairs were allowed with their symbiotic sea anemone Stichodactyla *haddoni* (n=14). After transferred to brooder tanks the pair formation will attains at 4-5 month period. Once the pair begins their spawning the fecundity, hatching, survival rate of larvae and maturation of brood stocks were calculated.

Feeding of the fisheswasdone three times in a day at 5% of their body weight. The fishes were fed with mixed diet of boiled oyster (*Crasosterametracensis*, and *Perna viridis*),Acetes sp. and boiled shrimps meat (*Penaes monodon, Penaus indicas*). After feeding, excess feeds, and waste materials were confiscatedfrom the tank through siphoned. The water exchange was done once in a week @ 30-40% for elimination of fouling organisms like barnacles, algal communities and other dust materials. Sea anemone (*S. haddoni*) was fed with shrimps in oneday interval.

After obtaining successful pair formation and spawn from the broodersthe fecundity, hatching, fertilization rate, and percentage of deformed larvae were calculated from the following formula. In addition, the courtship behaviours and parental care of each broodstocks were noted. Start lay eggs but if the female matured first it will stimulate the male to mature by bruising (cleaning) many areas near by sea anemone from that way female showed the willingness. Once they feel comfortably in hatchery tank then they will lay eggs. Before spawning, the pairs show their courtship behaviours which are precise in the male showed morphological and behavioral changes such as fin erection, chasing, clutch preparation, 'signal jumping' and biting the anemone. Swimming motions and finally, extension of anal, dorsal and pelvic fins accompany the aggressiveness of the male (Swagat ghosh *et al*., 2011).

Result

Egg laying brooders brushed (algae and debris) the area with mouth where they are deliberated to lay eggs. Before spawning abdomen of female was very large and it consumed large quantity feed compared to normal days. All anemone fishes recolonized the area nearby sea anemone for deposit eggs without stress (Fig. 1). During day time egg was laid by female and followed by male was fertilized the eggs was observed. More than 2-3 hours the process of fertilization took place.After fertilization, unfertilized eggs were removed from egg clutch. Embryonic development was observed by colour change and detectedunder microscope. First time seven pairslaid only few (30-50) eggs and someof them had consumed it. Based on maturation and feeding quality the quantity of eggs will increased partially. Based on weightand length of brooder, fecundity was varied in each species.The size of egg laying pair noted by collected the fish with hand-nets*A. percula, A. clarkii, A. sebae, A. sandaracinos, A. melanopus, A. frenatus,* and *A. ocellaris* (respectively- female-7.5cm and male-5.6cm, female-8.7cm and male-7.3cm, female-8.2cm and male 7.8cm, female-5.8cm and male-5.2cm, female-6.7cm and male-4.7cm, female-7.3cm and male-4.9cm, and female-6.2cm and male-5.9cm).

In a single time the sufficient quantity (oyster, shrimp and pellet) of feed taken by the brooder (wastage was collected and abridged from total) was noticed that

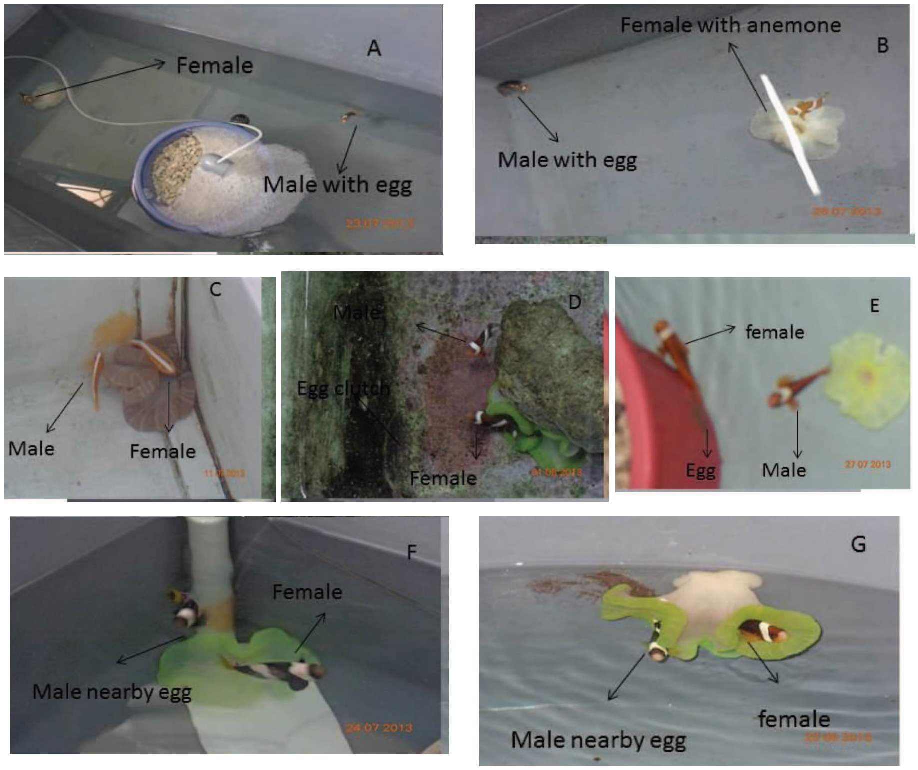

Fig. 1: Seven clownfish brooders along with egg batch

are *A. percula, A. clarkii, A. sebae, A. sandaracinos, A. melanopus, A. frenatus,* and *A. ocellaris* (respectively-0.470g, 1.390g, 1.650g, 0.300g, 0.380g, 0.540g, 0.570g). During the study total number of eggs was matured by observation that are *A. percula*-300, *A. clarkii*-400, *A. sebae*-200, *A. sandaseranus*-150, *A. melanopus*-120, *A. frenatus*-100, and *A. ocellaris*-250. Incubation times of seven pairs are noted (after fertilization to hatchout) that are-*A. percula, A. clarkii, A. sebae, A. sandaracinos, A. melanopus, A. frenatus* and *A. ocellaris*(respectively-171±2,177±2,152±2, 172±2, 204±2, 174±2, 168±2hrs) during egg development this indicates the parental care of a particular male. Parental care of seven brooders were noted by observation (1h/day), *A. melanopus* dominated (male-75% and female-25%), *A. clarkii* (male 80% and female-20%) but other five brooders only male does fanning and mouthing, female doesn't cared the eggs. In the incubation time male consumed the deformed eggs and it don't had high quantity of feed especially *A. percula* in incubation time

FCR rate is zero and other six groups both had feed. The silvery colour egg batch had hatched on 7th day night all the parents did vigorously fanned for removing the larvae from incubation, all the brooders around 1800-2100 hrs.

After egg hatching, larvae survival rate demonstrate the good pair of egg laying capacity and very high parental care, by providing suitable conditions to all larvae's and survival rate was matured by number of larvae's are surviving out of 100%. The percentages are carried the larvae survival rate, it indicates the quality of eggs and parental care of each brooder and the survival rate was matured during the growth from 1st day larvato before metamorphosis and that are *A. percula, A. clarkii, A. ocellaris, A. sebae, A. sandaracinos, A. melanopus* and *A. frenatus* (respectively -76%, 58%, 72%, 45%, 79%, 81%, 67%). Deformed larvae counted from nursery tank and deformation rate was calculated that are *A. percula, A. clarkii, A. ocellaris, A. sebae, A. sandaracinos, A. melanopus* and *A. frenatus* (respectively- 18%, 21%, 11%, 24%, 11%, 6%, 17%).

Discussion

Culturing of anemonefishes in captivecontains minimum challenges as compared to other ornamental fishes. There are many breeding experiments conducted successfully on different species of clownfishes using the running seawater (Alva and Gomes, 1989; Wilkerson, 1998; Overton *et al*., 2008). But quite contrary, the present was performed for observation ofseven brooders fecundity in ornamental fish hatchery. Fecundity rate, clutch size and spawning frequency depend on several factors such as feed quality, brooder health and environmental parameters. Even though the brood fishes were maintained in the brackishwater, the fecundity and spawning frequency were similar to those kept in running seawater (Alva and Gomes, 1989; Wilkerson, 1998; Overton *et al*., 2008). After fertilization, the parents especially the male took care of the eggs by fanning with their pectoral fins and cleaned the clutch area by gently mouthing them without disturbing and this process was continued until hatching. Similar observations were reported in other clown species (Melville and Griffiths, 1997; Overton *et al*., 2008), thus using low saline water have to influence in parental behaviour of anemone fishes.

Ignatius *et al.* (2001) observed brooders fed with clam meat and supplemented by marine polycheate attained sexual maturity within 3 months of maintenance and spawned repeatedly when compared with those pairs fed with minced fish meat alone. In the study the boiled clam, shrimp meet and commonly available pellets were provided to mature brooders for maintained the protein level. Feed conception showed the capacity of egg laying power. Co-feeding of live feeds supplemented with lipid and vitamin formulations helped to increase the nutritional reserves of broodstock and hence improved the overall egg and larval quality (Dehasque *et al*., 1995) from this work the author's suggestthespawning and embryo development are related to broodstock nutrition. Anemone fishes are liked to consume oyster feed, nonetheless shrimp meet also provided for nutritional maintenance however only small amount they took (40-50%) compared to oyster feed.

The eggs were laid always on flat and smooth substratum during morning hours on contrast to evening hours reported Alava and Gomes (1989) and Malpass (1996), like same observation was observed by present study also. The egg diameters, egg length, incubation period, size of newly hatched larvae were similar to those reported earlier. Egg development and larvae survival because of parental care (chart-1), every 5 seconds once the *A. clarkii* and *A. melanopus*male was doing fanning and mouthing of eggs and came to anemone, the female partially cares, but *A. percula A. frenatus*and *A. ocellaris*male was always stayed nearby eggs and continually cared the eggs and the female was always took rest with sea anemone. *A. sandaracinos*and *A. sebae*every 10 seconds once the male doing fanning and mouthing. Compared to other brooders of *A. clarkii* can lay high quantity of eggs but fifth batch of eggs was totally not developed properly because of movement of sea anemone fair away from eggs becauseof that no fanning and mouthing so sea anemone also responsible for egg development. *A. percula* male didn't cared the movement of sea anemone if anemone was far away from eggs it didn't came to anemone anymore, it always be nearby eggs and continue fanning was carried.

The incubation time was varied of each species because of egg development, environmental conditions (temperature) and parental care because eggs needed particular temperature which can be created by male for proper development. Survival rate of the larvae were calculated by cultured before metamorphosis so it indicates the healthy brooder which laying quality of eggs and parental care. Eggs of Amphiprion chrysopterus was 2.4 X 0.9 mm (Allen, 1980) and Hoff (1996), reported the length of anemonefish eggs ranged from 2.0 to 2.4 mm. The size of Amphiprion percula eggs is 2.0-2.3 mm length and 1.0-1.2 mm width (Dhaneesh *et al.,* 2009) but in the case of present study egg size were recorded in seven different species of anemone fishes. The hatching started about after 152 hours and 20 minutes of fertilization (Dhaneesh *et al.*, 2009) but in present study 171 hours was observed after fertilization at captive with finest water quality was given abovebut other anemonefishes were had different incubation times *A. clarkii, A. sebae, A. sandaracinos, A. melanopus, A. frenatus* and *A. ocellaris* (respectively- 177±2,152±2, 172±2, 204±2,174±2, 168±2hrs). Relation between body weight and fecundity rate was correlated.

Briefly, with the increasing demand for the captive-produced marine ornamental fish, particularly clownfishes was successfully reared in captivity by using brackish water. In this contaxt fecundity, parental care, incubation times are detilly demonstated.This hatchery production running with the goal of improving the level of local fishermans and improving the knowledge aboutmarine ornamental fishes.

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