

Captive breeding and embryonic development of Honey Gourami, *Colisa sota* (Ham.-Buch.)

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Abstract

Honey Gourami, *Colisa sota*, has high ornamental as well as food value. The natural resources of this species are gradually declining, due to destruction of its habitat, over fishing for aquarium trade and human consumption. The fish was bred in captivity under controlled environment. It laid about 200-400 eggs in bubble nest built by the male. Hatching started within 28-30 hrs after egg laying. The hatchlings became free swimming by 3rd to 4th day of hatching. The male showed territoriality and parental care by guarding the eggs and hatchlings. The larval survival was 30-35%. The breeding behavior, embryonic and post embryonic development of the fish were studied.

Key words: *Colisa sota*, Captive breeding, Embryonic development

Introduction

'Gouramis' are a popular choice among aquarium hobbyists. *Colisa sota* (Hamilton-Buchanan), commonly known as 'Chuna Kholisa' in India (Day 1958) and Honey or Sunset Gourami in aquarium fish trade circles, is distributed in the tropics along the Gangetic provinces, Assam and Bangladesh (Talwar and Jhingran 1991), where the water temperature varies between 22 and 28 °C. The fish commonly inhabit freshwater pools, ditches, ponds, wetlands and marshes (Rahman 1989) as well as rivers and lakes with vegetation (Menon 1999). The sexually mature males of the fish have beautiful bright orange-yellow colour, often with dark stripes along the series of the scale. A brown, lateral band extends from the base of the eye, up to the base of the tail (Fig. 1). The fish becomes more colourful during breeding period. The mature females have slightly shaded, brownish orange body with a silvery fluorescent glow. The fish possess high value as food fish, especially in the eastern and northeastern regions of India and is being captured indiscriminately from the wild. Owing to the coloration, small size and compatibility to confined environment, the species has also gained importance as an indigenous aquarium fish in India and is being exported live to USA, Singapore, Japan, Republic of Korea, Germany, Hong Kong, Taiwan, Thailand, Malaysia and China (Sugunan *et al.* 2002, Tripathi 2004). The trade of this species, in the country, for

aquarium purposes as well as human consumption, is entirely supported by capture from the wild. Although the conservation status of the fish is yet to be assessed (CAMP 1998), the natural resources of this species are gradually declining due to destruction of its habitat and over fishing. Continuous exploitation of their wild populations might endanger them. Therefore, it was felt necessary to develop captive and controlled breeding technology for the fish to propagate and conserve their natural resources. This communication deals with the captive breeding, breeding behavior, and embryonic as well as post-embryonic development of the fish.

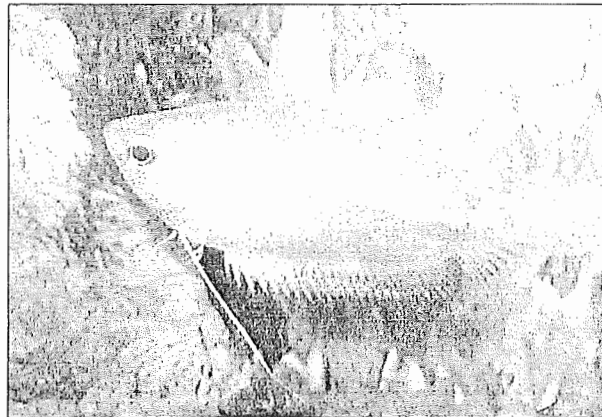


Fig. 1. Sexually mature male *Colisa sota*

Materials and methods

The experimental fishes (30-47mm in total length) were collected from a wetland in Coochbihar district, West Bengal, India during the month of August. The fishes were acclimatized to captive conditions by maintaining them, for one month, in a tank (30x15x15 inch size) having sandy bottom, filled with chlorine free tap water and fitted with a biological filter. The tank was provided with plenty of aquatic plants (*Hydrilla* sp., *Vallisnaria* sp. and *Ceratophyllum* sp.). The fishes were fed on zooplankton (Copepods, Cladocerans, Ostracods, insect larvae, etc.) and *Tubifex* worms, twice daily (morning and evening) until satiation. After a month the fishes were transferred to a smaller, all glass aquarium (24x12x15 inch size) filled with tap water and provided with aquatic plants (*Hydrilla* sp.) and reared on the same diet and feeding regime, for about eight to nine months, until they showed secondary sexual characters. The sexually gravid males (30-35mm in total length) developed a darker lateral stripe and bright orange-yellow coloration and females developed bulging belly and were larger in size (40-47mm in total length) than males with slightly pale orange coloration. Sexual dimorphism was not prominent in immature fishes. Five set of breeding aquaria (18x10x10 inch size); each of which were divided in to two chambers of equal size, using transparent, perforated plastic panels and each chamber provided with aeration (Fig. 2) were set up for simultaneous breeding trials. Then a pair each of sexually mature male and female was transferred to the separate chambers of breeding aquaria to build up

their natural breeding urge. As males of the species build bubble nest for breeding activities (Sten 1956), the chamber holding male in each of the aquarium was provided with floating aquatic plants having broad leaves (*Commelina* sp.), which served as nesting ground. Chlorine free tap water, with mild aeration, was used throughout the period of breeding. The temperature, dissolved oxygen, pH, and hardness of the water in the aquaria were monitored through out the breeding time, following APHA (1980).



Fig. 2. Breeding aquarium with perforated separator.

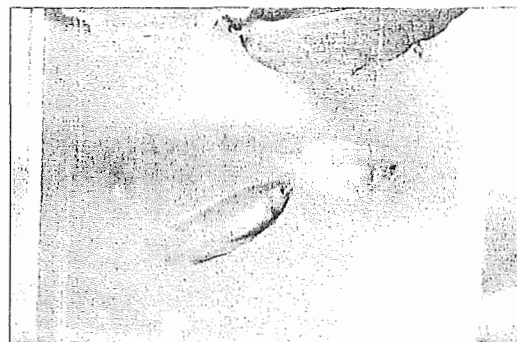


Fig. 3. Male *Colisa sota*, pushing the female towards bubble nest.

After releasing in to the breeding aquaria the male and female moved close to the perforated divider, in an attempt to meet each other. The presence of a sexually gravid female seemed to intensify the nest-building urge of the male. The male started briskly moving between the floating plants in the tank, as if in search of a suitable place. In between this, it frequently darted back to the female swimming close to the divider. In two to three days the male started building bubble nest under the leaves of the floating plants. Male showed no appetite during this period. The plastic dividers of the breeding aquaria were removed, as soon as the male started building nest to facilitate the pair to meet each other. Soon after the divider of the breeding aquaria was removed, the male started displaying courtship behavior by swiftly darting towards the bubble nest in an attempt to lead the female towards it. Whenever the female did not follow the male to the nest; it pushed the female towards it by nudging under her caudal region with its snout. By this time, a line of dark bluish-green colour developed at the ventral side of the male, starting from the opercula to the caudal region, (Fig. 3). The courtship display continued for almost 24 hour until the female attracted with the male for mating beneath the nest. The pair successfully spawned in the bubble nest. The male produced bubbles more vigorously, with its mouth and enclosed the eggs in these bubbles and floated them in the nest (Fig. 4). Spawning occurred invariably in the early morning hours in all the breeding sets. Male showed territorial behavior by guarding the nest. The egg laying and natural fertilization process continued for two days. The dark bluish-green colour developed at the ventral side of the male, before spawning, disappeared with the end of courtship. The male showed parental care by taking care of the eggs, fanning them with

its fins, and guarding the nest, until the eggs were hatched out and the young larvae became free swimming. When the breeding process was over, the female was removed from the aquaria to avoid predation on eggs and larvae.

Results and discussion

Hatching started within 28-30 hrs after egg deposition was completed. The newly hatched larvae remained in the bubble nest or attached to floating leaves or walls of the breeding aquaria. The hatchlings became free swimming by the 3rd to 4th day of breeding. At this stage the males were removed from the tanks. The number of eggs laid and percentage of hatching was calculated by counting the un-hatched eggs in the nests under a dissection microscope and young ones through sampling as well as by counting the dead larvae settled in the bottom of the tank (by siphoning). The water quality, number of eggs laid by each female, percentage of hatching and larval survival are shown in Table 1. The hatchlings were fed as per the following schedule. From the 1st to 3rd day no feed was given as they nourished from the yolk sac. From 4th to 10th day the feeding was done with laboratory prepared green water containing micro algae (Taras 1963), mostly *Chlorella* sp. From 11th to 20th day the hatchlings were fed on laboratory prepared infusorians (mainly protozoans, ciliates, rotifers) and boiled egg yolk. From 21st day onwards the feeding gradually switched over to live copepods, cladocerans, ostracods, insect larvae, *etc.* and as the young ones grew, gradually live *Tubifex* worms was also included in the daily diet. The feeding schedule was as mentioned earlier.

Table 1. Water quality of hatching aquaria, number of eggs laid, percentage of hatching and larval survival

Breeding set	1	2	3	4	5
Water temperature (°C)	27.9	28.5	28.9	28.7	27.8
DO ₂ (mg/l)	8.5	8.5	7.7	7.9	7.7
pH	7.2	7.1	6.1	7.1	6.9
Hardness (mg/l)	150	157	150	152	155
No. of eggs	380	200	400	300	240
Hatching (%)	100	95	99	100	100
Survival (%)	30	35	32	31	30

The freshly laid eggs were spherical, translucent and off white in colour. The development of the embryo was studied live by placing them in a petri dish filled with water siphoned from the breeding aquaria, to avoid any shock, and by observing them under a microscope attached with a CCD camera and computer based image processing software (Axio Vision 1). The eggs measured 0.5-0.68 mm in length. The fertilized eggs had double layer, the outer being transparent and the inner containing yolk material (Fig. 5). The previtelline space varied between 0.2-0.25 mm in width. Within 16-20 hours the first cell division took place (Fig. 6). Then invagination of the yolk mass started and the semi germ ring was formed over the yolk mass. The yolk plug stage appeared by 21 hours of fertilization (Fig. 7). From the dividing cell mass,

differentiation in to a developing embryo was discernable in 22 hours. In 24-hour-old embryo, the yolk mass, tail, head, and rudimentary eyes were visible and few myotomes also appeared (Fig. 8). Subsequently the optic vesicle became distinct and the embryo could be clearly differentiated in to head and tail regions. More myotomes appeared and rudiments of auditory capsules were visible at 24-25 hour after fertilization. The embryo started twitching movement inside the egg and hatching took place after 28-30 hours of fertilization.

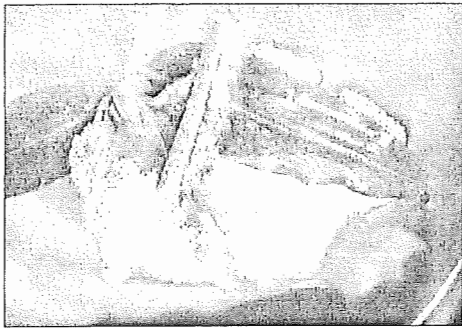


Fig. 4. Bubble nest of *Colisa sota* laden with eggs.

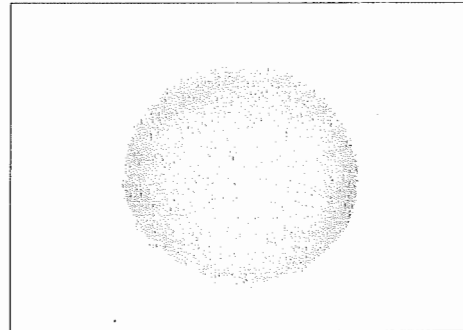


Fig. 5. Fertilized egg with double wall.

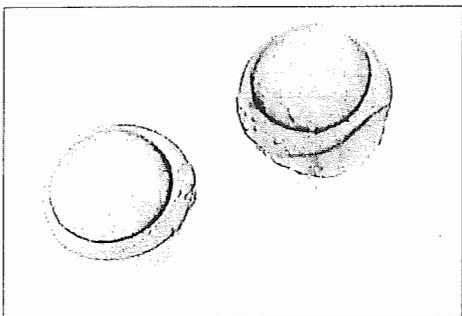


Fig. 6. Eighteen-hour-old embryos (first cell division)

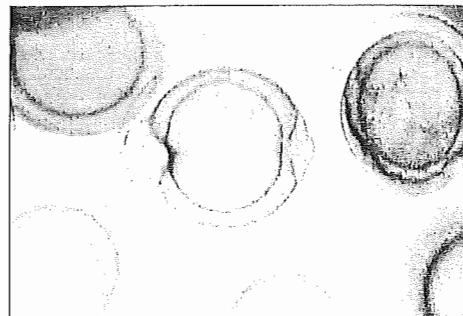


Fig. 7. Embryo after 21 hour (yolk plug stage)

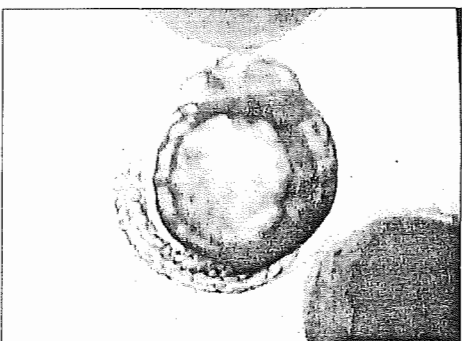


Fig. 8. Embryo after 24 hour (Head, yolk mass and tail visible).

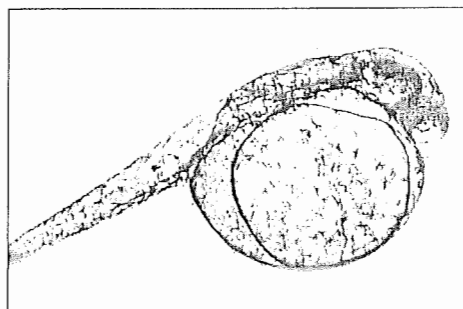


Fig. 9. Just hatched larva (at 28 hour).

The just hatched larvae were almost transparent, except the eyes (Fig. 9). The entire head region was attached to the yolk sac. One-day-old larvae measured 1.75-2.25 mm in length, with large yolk sac and eyespots. After 48 hours of hatching, the larvae measured 3.5-3.65 mm in length. Pigmentation started appearing on the body at this stage. Mouth could be differentiated ventrally to the head region; eyes became distinct and size of the yolk sac gradually reduced at this stage (Fig. 10). The pectoral fin buds appeared and the myotomes were well defined. In 72 hours, the hatchlings reached 3.75-4 mm in length; the mouth became terminal and vertebral column well defined (Fig. 11). The lenses and eye orbits became clearly visible, the yolk mass got absorbed completely and the mouth became upturned, typical of the adult fish, by 96 hours of hatching (Fig. 12). The pectoral fin buds enlarged and at the same time dorsal, caudal and ventral fins appeared as a continuous transparent flap with slight demarcation of fins. At this stage the larvae became free swimming and the mouth started functioning. In five to six days the larva became more active and resembled an adult fish (Fig. 13).

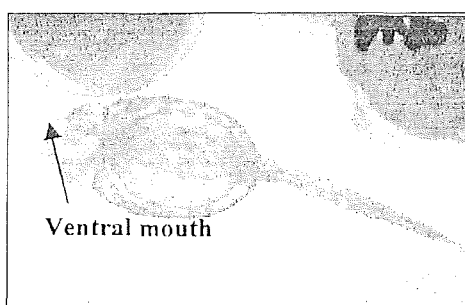


Fig. 10. 48 hour old larva with ventral mouth.

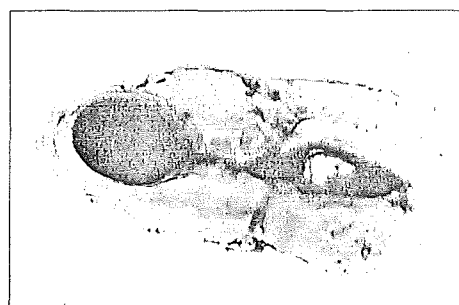


Fig. 11. 72 hour old larva with terminal mouth.

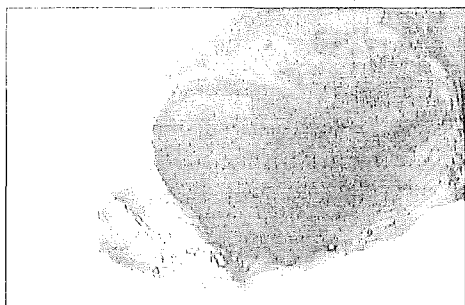


Fig. 12. 96 hour old larva with mouth turned upwards.

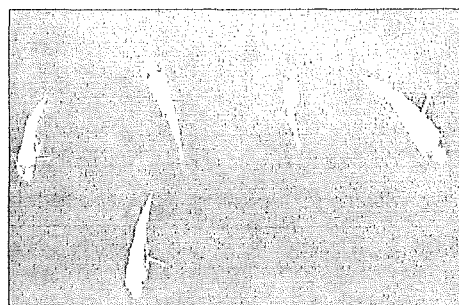


Fig. 13. Fully developed fry stage of *Colisa sota*.

The swim up fry from all the breeding aquaria were pooled and reared in separate rearing tanks. The fry took eight to nine months to become mature. Although there was 95-100% hatching of eggs, the survival rate of fry was 30-35% as mortality occurred in 7 to 15 day old fry. Trials are being carried out to ascertain the causes for low larval mortality to improve survival.

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