

Studies on the induced spawning and larval rearing of a freshwater catfish, *Mystus punctatus* (Jerdon)

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Abstract. The freshwater catfish *Mystus punctatus* was successfully bred in the laboratory by injecting the pituitary extract of the marine catfish *Tachysurus maculatus*. The number of eggs released by a single female fish was 9050 ± 700 , the relative fecundity was 43.1 and the fertilization success was 85 ± 2.8 per cent. The average diameter of the unfertilized eggs ranged from 1.27 to 1.35 mm and the fertilized eggs ranged from 1.45 to 1.50 mm. The eggs hatched within 18 to 24 hr at a water temperature of $28.5 \pm 1.8^\circ\text{C}$, and the percentage of hatching was 78%. The larvae metamorphosed into juveniles within fifteen days of their hatching. A description of the egg and larval development to metamorphosis is given.

Keywords. *Mystus punctatus*; induced breeding; pituitary extract; hatching; metamorphosis; larval development.

1. Introduction

The freshwater catfish *Mystus punctatus* is one of the good table fishes in the inland regions of India and hence has good culture potential.

The effect of pituitary gland extract from the marine catfish *Tachysurus maculatus* to induce the breeding of freshwater catfish *Clarias batrachus* was studied by Devaraj *et al* (1972). In the present study the freshwater catfish *Mystus punctatus* was successfully induced to spawn in the laboratory by injecting marine catfish pituitary gland extract as adopted by Devaraj *et al* (1972). The larvae that hatched out from the fertilized eggs were reared in the laboratory and their development was studied.

2. Material and methods

The matured adult fish of both the sexes were collected from natural waters of Kalladaippu tank near Tuticorin of Tirunelveli district of Tamil Nadu (South India) during January to February 1981. The fish thus collected were maintained in fibreglass tanks of size $200 \times 50 \times 50$ cm, and were fed with artificial pelleted feeds (Tilapia flesh, groundnut oil cake and rice bran at a ratio of 2 : 1 : 1) at a rate of 5% body weight of fish. The water temperature maintained was $28.5 \pm 1.8^\circ\text{C}$. The pituitary glands were collected from the marine catfish *Tachysurus maculatus*. The breeding experiments were conducted in three fibreglass tanks of $200 \times 50 \times 50$ cm size, in which a water depth of 25 cm was maintained.

The females were injected with the extract containing 6 mg of dry pituitary/kg of body weight in two split doses with an interval of 3 hr while the males were given the extract of 3 mg/kg of body weight in single dose at the time of second injection to the

female. Six males (68 to 73 g) and 3 females (197 to 223 g) were used for the experiment. Very clear water was maintained in the tank. The water temperature was $28.5 \pm 1.8^\circ\text{C}$. The hatched larvae were reared in nursery tanks of size 5×5 m with a water depth of 75 cm. In these nursery tanks the water temperature was $28.5 \pm 1.8^\circ\text{C}$. The larval development was studied and discussed (Mansueti and Hardy 1967).

3. Results and discussion

After 15 minutes of the second dose of the pituitary extract injection, the experimental fish started the courtship behaviour. The males started chasing the females and twisted around the body of the females with the tail. The females released the eggs eight hours after administering the pituitary injection.

The eggs were siphoned from the tank after removing the spent fish and placed in clear water in another tank of the same size, and the temperature of the water was $28.5 \pm 1.8^\circ\text{C}$. The fertilization of the eggs was estimated as 85%. The average number of eggs released was 9050 and the diameter of the fertilized egg was 1.45 to 1.50 mm.

The eggs hatched out within 18 to 24 hr after fertilization. The percentage of hatching was 78%. The standard deviation ($\bar{x} \pm \text{SD}$) for number of fish, number of eggs collected, relative fecundity, percentage of fertilization, egg diameter and the number of degrees-days for spawning and incubation are given in table 1. The hatchlings had a large yolk sac and the larvae were found attached to the sides and bottom of the tank. The yolk was completely absorbed on the third day of hatching and subsequently the larvae were fed with plankton obtained from the ponds. The larvae started feeding from the fourth day onwards. They were then transferred to a manured cement nursery tank of size 5×5 m with a water depth of 75 cm. The postlarvae metamorphosed into juveniles within 15 days from hatching.

A description of the eggs to the fully metamorphosed juvenile is given below in order to facilitate its identification at any stage of its larval development as it was not described earlier.

3.1 Unfertilized ova

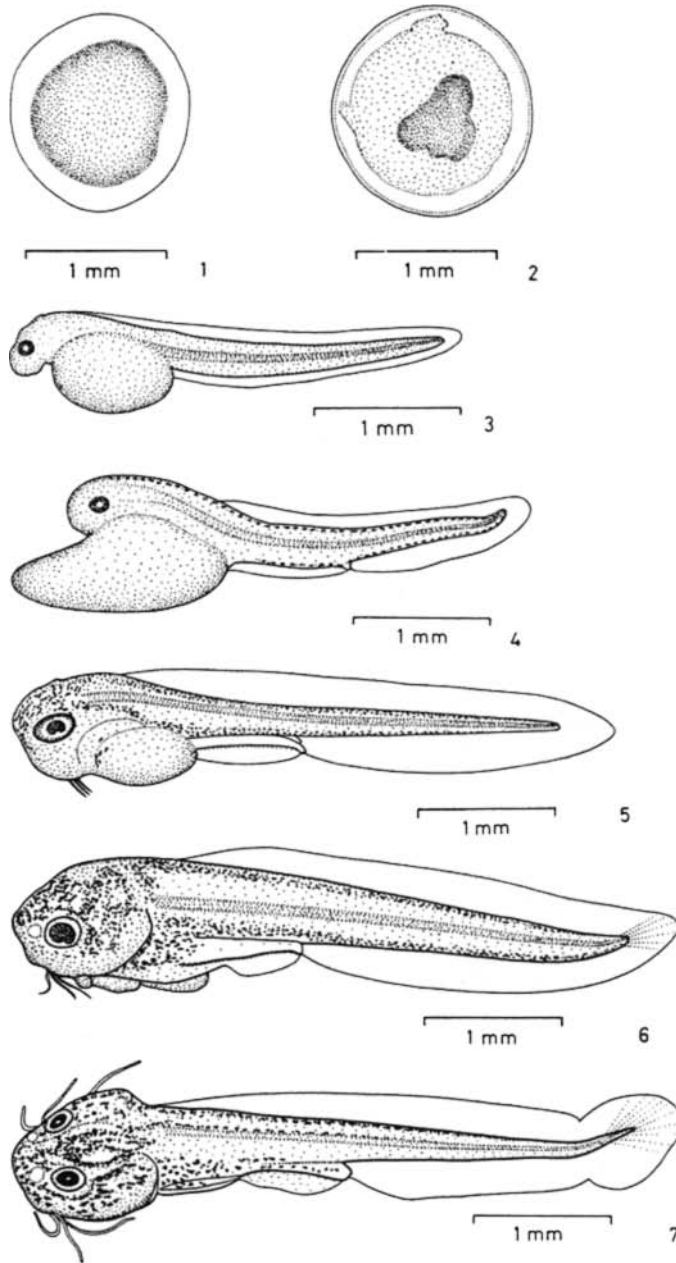
The ova (figure 1) are light yellowish in colour with a denser area in the centre. Their diameter ranges from 1.27 to 1.35 mm. The outer surface is smooth and concretions are visible.

Table 1. Standard deviation ($X \pm \text{SD}$), of the fecundity description

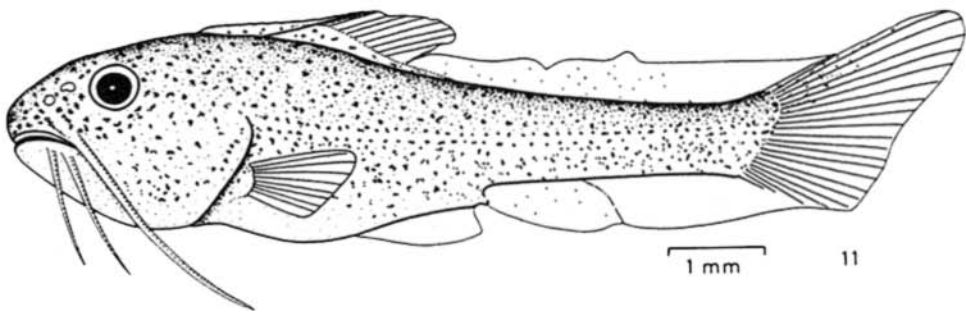
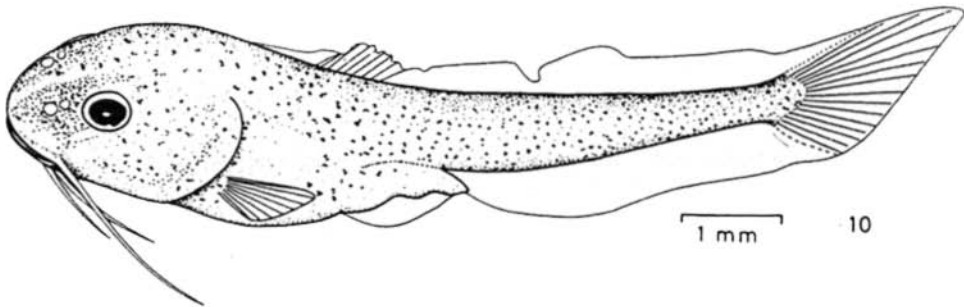
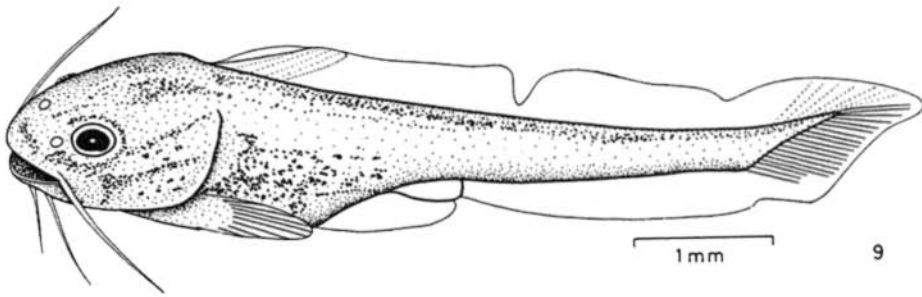
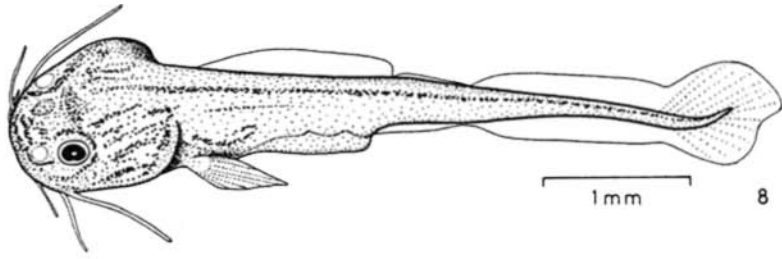
	Experiment	Control
Number of fish	♂-3; ♀-6	♂-2; ♀-1
Fish size	♂ $69 \pm 4\text{g}$; ♀ $210 \pm 13\text{g}$	♂ 69g , 71g ; ♀ 210g
No. of eggs released	9057 ± 700	—
Relative fecundity	43.1	—
Percentage of fertilization	85 ± 2.8	—
Egg diameter	Unfertilized eggs	—
	Fertilized eggs	—
	1.27-1.35 mm	—
	1.45-1.50 mm	—
Number of degrees for spawning and incubation	8 ± 2	—
Temperature	$28.5 \pm 1.8^\circ\text{C}$	$28.5 \pm 1.8^\circ\text{C}$

3.2 Fertilized egg

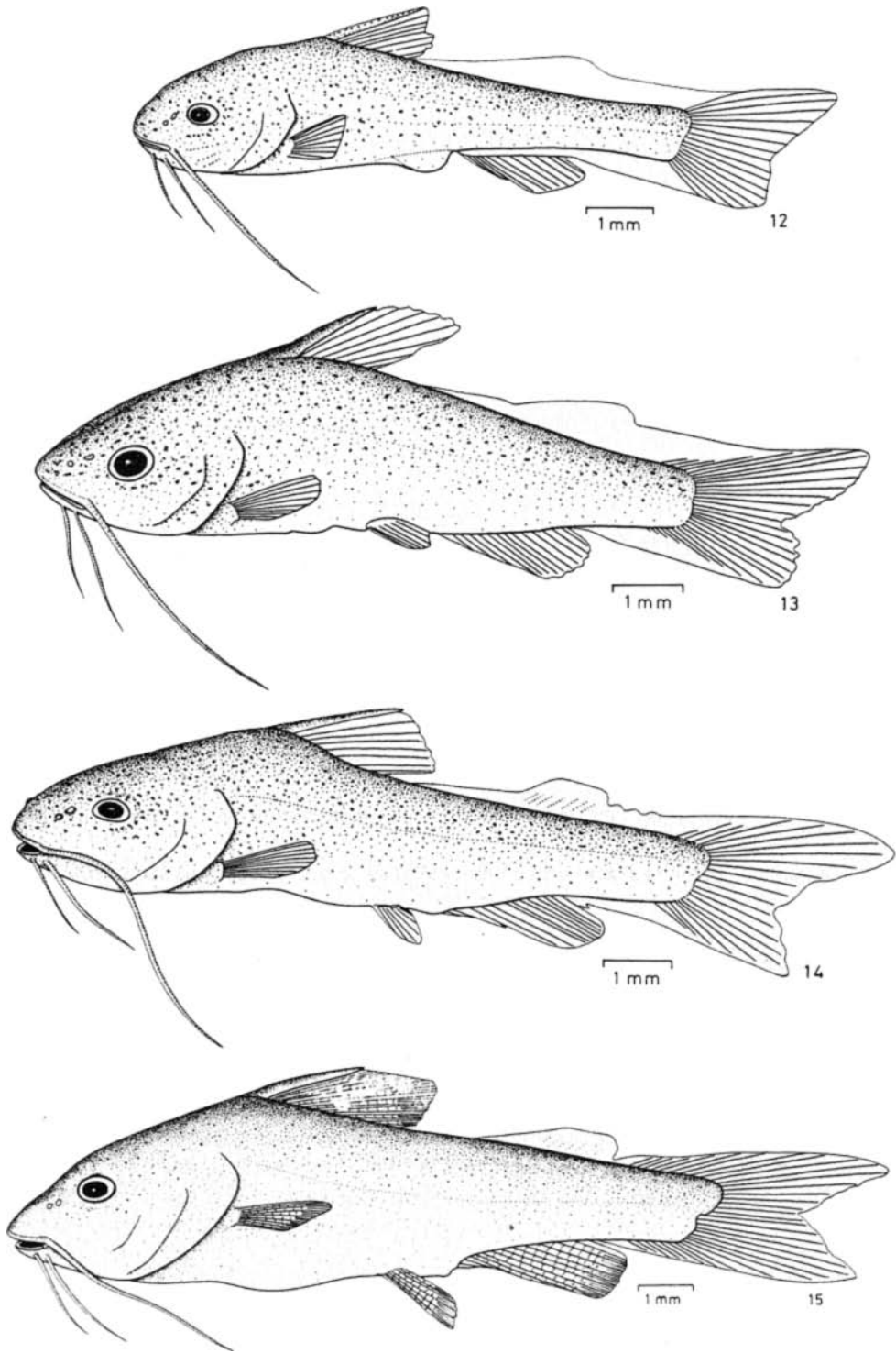
The fertilized eggs (figure 2) are also light yellowish in colour and the diameter ranges from 1.45 to 1.5 mm. The outer surface of the egg is somewhat thickened when compared to that of the unfertilized ova. The developing embryo is clearly visible under a microscope.



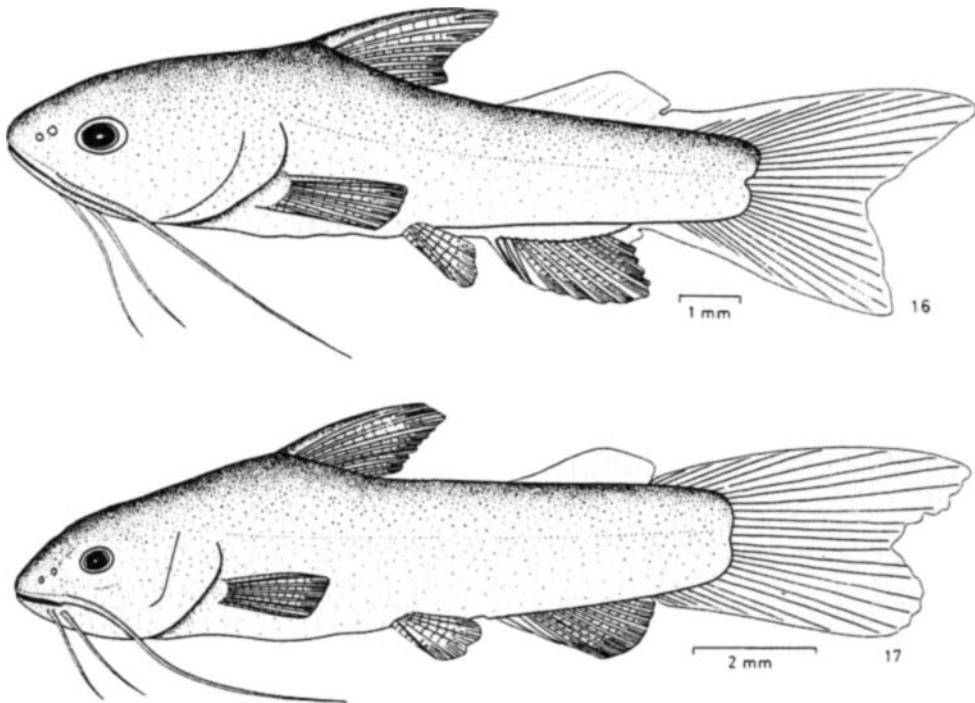
Figures 1-7.



Figures 8–11.



Figures 12–15.



Figures 16–17.

3.3 *Just hatched out larva*

The just hatched out larva (figure 3) is laden with yolk sac. The larvae measure 3.1 to 3.3 mm in total length and the yolk sac 0.8 mm on an average. The mouth has not yet formed, while the optical sac has already developed.

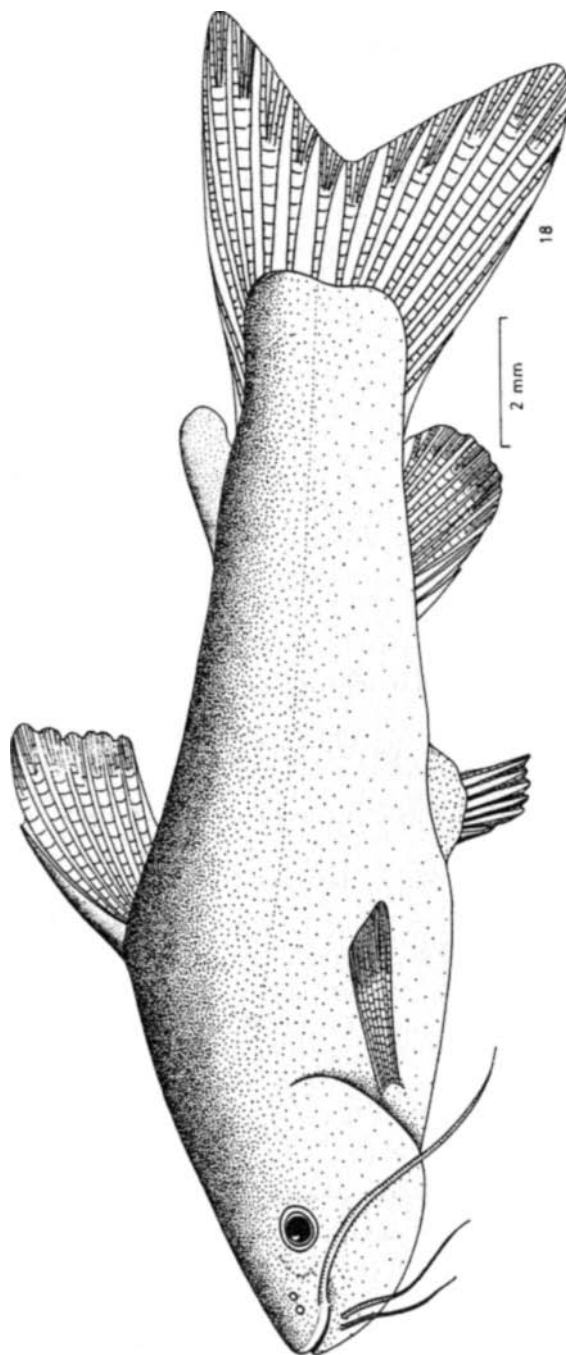
The larvae settle at the bottom and sides of the tank and their movements are restricted on account of the large yolk sac. The body is devoid of any chromatophores.

3.4 *One-day larva*

The one-day old larvae (figure 4) measure 3.4 to 3.6 mm in total length and the yolk still persists measuring 1.6 mm on an average. As in the just hatched out larva, the mouth has not yet developed. The anal opening has developed by the constriction of the ventral fin fold in the middle. The dorsal and ventral margins of the body have a row of simple chromatophores and the larvae do not swim except when disturbed.

3.5 *Two-day old larva*

The larvae (figure 5) measure 4.3 to 4.6 mm in total length. The yolk is almost absorbed. Three pairs of barbels have developed (one pair maxillary and two pairs mandibular).



Figures 1-18. Fertilized egg and larvae of *Mystus punctatus*. 1. Unfertilized ova. 2. Fertilized egg. 3. Just hatched out larva. 4. One-day larva. 5. Two-day old larva. 6. Three-day old larva. 7. Four-day old larva. 8. Five-day old larva. 9. Six-day old larva. 10. Seven-day old larva. 11. Eight-day old larva. 12. Nine-day old larva. 13. Ten-day old larva. 14. Eleven-day old larva. 15. Twelve-day old larva. 16. Thirteen-day old larva. 17. Fourteen-day old larva. 18. Juvenile.

The mouth has just formed. The chromatophores are distributed over the head and along the dorsal and ventral margins of the body. Chromatophores are also seen scattered over the opercular region. The larvae are able to swim freely.

3.6 *Three-day old larva*

They (figure 6) measure 4.6 to 5.0 mm in total length. The nostril is formed and the mouth developed. The operculum is seen as a slit. The chromatophores are found scattered over the head, below the opercular slit and along the dorsal and ventral margins of the body. The caudal rays have begun to develop. The larvae are active and freely swimming at this stage.

3.7 *Four-day old larva*

They (figure 7) measure 4.7 to 5.1 mm in total length. The eyes and nostrils are well formed. The size of maxillary barbels at this stage is more than that of the mandibular barbels. The chromatophores are scattered over the head, dorsal and ventral margins of the body, except along the posterior half of the ventral margin. The caudal fin is slightly constricted from the dorsal and ventral fin folds.

3.8 *Five-day old larva*

They (figure 8) measure 5.2 to 5.4 mm in total length. The pectoral fins are developed. The dorsal and anal fins are separated from the fin folds. The chromatophores are scattered over the head, on the dorsal margin of body and above the pectoral fin. The body is dark compared to the four day old larva.

3.9 *Six-day old larva*

They (figure 9) measure 6.4 to 6.7 mm in total length. The rays of the pectoral fins and the lower lobe of the caudal fin are calcified. The dorsal fin rays have developed and so also the ventral and caudal fin lobes. The chromatophores are scattered over the head, around the orbit, along the dorsal margin of body and over the belly region.

3.10 *Seven-day old larva*

They (figure 10) measure 9.8 to 10.1 mm in total length. Nostrils have formed. The rays of dorsal and upper lobe of caudal fin are calcified. The chromatophores are scattered throughout the body. A spine is developing in the dorsal fin.

3.11 *Eight-day old larvae*

They (figure 11) measure 10.3 to 10.6 mm in total length. The first dorsal fin spine is well calcified and the chromatophores are star-shaped over the head.

3.12 *Nine-day old larva*

They (figure 12) measure 10.4 to 10.6 mm in total length. The anal fin spines and rays are calcified. The caudal fin is clearly forked. The chromatophores are scattered throughout the body, but are more concentrated over the dorsal region of the body.

3.13 *Ten-day old larva*

They (figure 13) measure 10.6 to 10.9 mm in total length. The ventral fin rays are calcified and the caudal fin is clearly forked as in the juveniles. The adipose second dorsal fin is still attached to the upper lobe of the caudal fin. The chromatophores are more concentrated on the dorsal surface of the body.

3.14 *Eleven-day old larva*

They (figure 14) measure 12.3 to 12.7 mm in total length. The adipose second dorsal fin has just started detaching itself from the caudal fin. The spines in the anal fin are fully calcified. The chromatophores are found only along the dorsal surface of the body.

3.15 *Twelve, Thirteen- and fourteen-day old larvae*

These larvae (figures 15–17) show only minute differences in their morphology. In the twelve-day old larva, the chromatophores are very few and started disappearing. The thirteen- and fourteen-day old larvae are devoid of any chromatophores. The adipose second dorsal fin has completely separated from the caudal lobe in the fourteen day old larva and appears almost similar to that of a juvenile catfish.

3.16 *Juvenile catfish*

The juveniles (figure 18) just metamorphosed from the post-larvae show all the morphological characters of the adult. The metamorphosis from postlarvae to juvenile stage takes place mostly in about fifteen days after hatching.

Acknowledgements

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