THE EXTRAORDINARY BREEDING HABITS OF THE CATFISH *MYSTUS AOR* (HAMILTON) AND *MYSTUS SEENGHALA* (SYKES)[1]

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ABSTRACT

The breeding habits of *M. aor* and *M. seenghala* are recorded for the first time. Both the species breed in the Cauvery in April and May. They build nests amidst rocks in the bed of the river after the first floods of the SW. monsoon. The nests are simple circular pits in sand and silt behind projecting slabs of rock. Three nests of *M. aor* and one of *M. seenghala* were located in 1939 and six more in 1940. Only one parent, the male, was observed to guard the nest. Eggs were never found in any of the nests.

The entire ventral surface of the breeding male was inflamed and bright red in colour. Sections of the ventral skin revealed the presence of elongated villiform processes typically with dilated ends and orifices, depending from the abdominal surface. On the analogy of the South American catfish *Platystacus* supported by the absence of eggs in the nests, it is presumed that the eggs are incubated by the male apparently attached to its ventral surface by the villiform processes.

The young congregate in a dense shoal under the parent and feed on a milky white fluid secreted by the highly vascularized ventral skin of the fish. Chemical analysis showed that the fluid consists largely of protein.

Mystus aor and *M. seenghala* are the largest species of catfish of the genus Mystus[2] and are said to attain a length of six feet or more. They inhabit the major rivers and a few large lakes and reservoirs, perennially watered by such rivers. Both are predacious. The stomach contents of a number of specimens showed that their food consists of fish and crustaceans; a few leaves, occasionally found, seem to have been consumed accidentally. They are esteemed food fish and are fairly abundant in the Cauvery at Bhavani where all the observations recorded below were made in the years 1939 and 1940.

The local Tamil names of the fish are: (*M. aor*)—'Koong keluru' = the calling catfish; (*M. seenghala*)—'Nedum thalai keluru' = the long-headed catfish. Both are noted for their sound production.

The extraordinary breeding habits recorded for the first time in this paper seem to recall in some respects those of *Platystacus* of South America and *Mystus gulio* (Hamilton).

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[1] This paper was read at the Indian Science Congress session at Madras in 1940.

[2] The generic name Mystus Gronow has been substituted for Aoria Jordan as it has been accepted by the International Commission for Zoological Nomenclature. The long delay in the publication of the paper was mainly due to the controversy over the generic name.

The Breeding Season, Grounds and Nests

In May 1923 I came across for the first time a medium-sized (18″) specimen of *M. aor* in the fish market at Bhavani which had a highly inflamed, blood-red, spongy ventral surface. It was reported by fishermen to have been caught from a nest. In subsequent years though several such specimens of *M. aor* and *M. seenghala* were obtained, their nests were not located till May 1939. At Bhavani the river bed is rocky. The fish breed amidst rocks in the months of April and May at the onset of the south-west monsoon floods.

The method for locating and examining nests adopted was as follows: The fishermen were made to dive in all likely spots to see if the fish were nesting. After locating a nest, some hours were allowed to ensure the return of the parent fish to the nest, if it had been scared away by the preliminary examination by divers. Two or three cast nets were then simultaneously shot on the nest from two or three directions, the nets overlapping so as to prevent the escape of the parent fish. The fishermen then dived and caught the fish and collected the contents of the nest with their hands. Even so, the fish and the young often escaped capture. Not more than one parent fish was found in the nest. In all only five nests of *M. aor* and *M. seenghala* were found by me from 8th to 16th May, 1939. The particulars of the nests located are given below :

8-5-39 Nest No. 1 : depth 7½′ : parent *M. aor*, 460 mm long ; 5 young caught, 22 mm long.

16-5-39 Nest No. 2 : depth 8′ : *M. seenghala*, 685 mm ; young escaped capture.

16-5-39 Nest No. 3 : depth 7½′ : parent fish absent ; nest left undisturbed.

16-5-39 Nest No. 4 : depth 7′ : parent *M. aor* escaped[1] ; over 100 young caught, 18 mm long.

16-5-39 Nest No. 5 : depth 7′ : parent *M. aor*, 420 mm ; 7 young caught, 36 mm long.

In 1940 Dr. Bhimachar, at my request, examined nests at Bhavani and confirmed all my observations up to 1939. The particulars of the six more nests found by him are as below :

6-5-40 Nest No. 1 : depth 7½′ : parent *M. aor*, 368 mm long ; 5 young, 12 mm long.

6-5-40 Nest No. 2 : depth 8½′ : parent *M. aor* escaped ; 2 young, 16 mm long.

6-5-40 Nest No. 3 : depth 13′4″: parent absent ; 4 young, 18 mm long.

7-5-40 Nest No. 4 : depth 8½′ : parent *M. aor*, 388 mm long ; 2 young, 17 mm long.

7-5-40 Nest No. 5 : depth 12½′ : parent escaped ; 3 young, 20 mm long.

9-5-40 Nest No. 6 : depth 11′ : parent *M. aor*, 342 mm long ; 1 young, 23 mm long.

[1] The fish was seen and identified though it finally escaped capture.

Dr. Bhimachar observed that the fry in the nest nibble at the hands of the fisherman mistaking them for their parent, when he searches the nest for the young in the dark. Thus made sure, he scoops out the nest for the fry. It will be seen later that the young feed on the milky secretion of the abdominal skin of the parent and this is further evidence that they do so.

The nest is a more or less circular depression excavated by the fish in dark clayey sand measuring as much as 18″ in diameter and 6″ in depth at the centre, if the fish is an adult about 18″ in length. It is well protected against the current, being excavated below and behind a projecting slab or shelf of rock. Usually there are rocks on either side also for further shelter.

No eggs were found in any of the nests; the fishermen also declared that they have never seen eggs in these nests at any time. The mature eggs in females dissected were of sufficient size to be recognizable if laid and yet no fisherman had at any time seen them. There was no evidence of viviparity in any of the several ovigerous females dissected during the breeding season.

The single parent fish in the nest was found to be the male both by appearance and dissection. Sections of the gonad also showed sperm heads (Fig. 1).

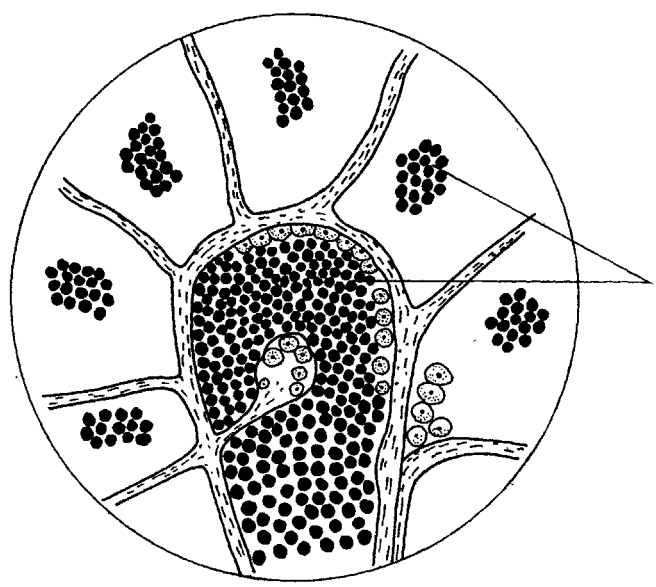

FIG. 1. Transverse section of the gonad of a nesting male fish *Mystus aor*. × 10.
H—heads of spermatozoa.

ABDOMINAL SKIN OF THE NESTING MALE

The ventral surface of the male in the nest was bright red and spongy suffused with blood, including the pectoral, ventral, anal fins and the lower caudal lobe. Large blood-vessels with their ramifications were visible to the

naked eye all over the surface. The presence of blood-vessels was further confirmed by the sections of the skin (Fig. 2). The unexpected structures

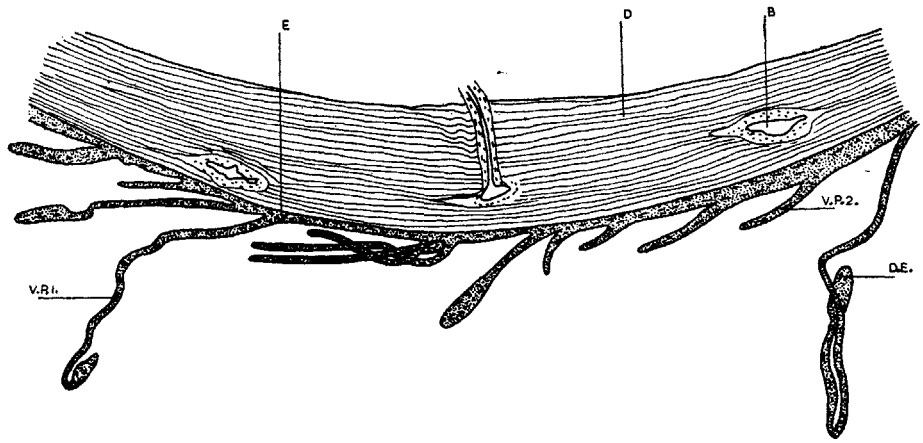

FIG. 2. Vertical section of the abdominal skin of a nesting male fish *Mystus aor*.
B—blood-vessel, *D*—dermis, *De*—dilated end of villiform process, *E*—epidermis, *V.P.* (1 and 2)—villiform process.

revealed by these sections, however, were the numerous villiform processes with dilated ends and orifices made up entirely of epidermal cells, depending from the abdominal surface. In some sections the whole elongated process can be seen, while in others detached cross-sections and cut pieces of these processes can be made out. As fairly thick sections were cut with a Jung microtome whole processes which escaped the blade were available for observation in the section. The free ends of these processes were dilated. Further, the processes appeared to be hollow. Whether they are perfect tubes or merely elongated lamellae with sides folded over enclosing a channel is not quite clear. A few of these processes showed a medium longitudinal slit lending support to the latter view, whereas in a few cross-sections, the lumen appeared to be circular indicating a perfect tube. The nuclei seen in the epidermis were either circular or elongated but the cell outlines were not clear. Occasionally a cushion-like thickening formed by a fold of the entire skin was found in which both the dermis and epidermis are involved. From the free end of the fold a cluster of villiform processes arise (Fig. 3).

In this connection a comparison with Eggert's sections of the ventral skin of a female *M. gulio* carrying ripe eggs is interesting. The many folds of the skin, the enormous thickness of the epidermis, the prominent albumen and mucous cells were not seen in the sections of *M. aor* while the peculiar villiform processes are absent in *M. gulio*. The striking morphological characters of the ventral skin of *M. aor* recall the highly specialized mode of incubating eggs obtaining in *Platystacus* of South America. In *Platystacus* ' during the breeding

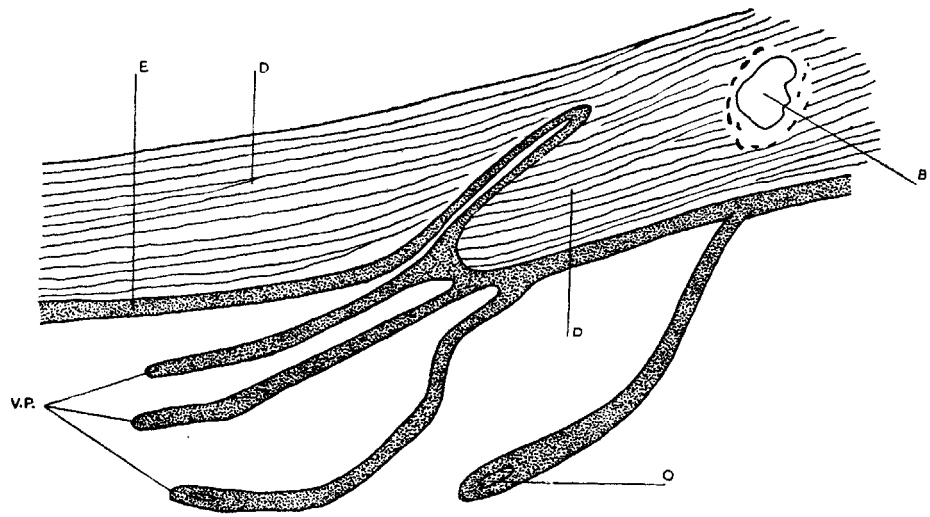

FIG. 3. Vertical section of abdominal skin of a nesting male fish *Mystus aor*, showing a cushion formed by a fold of the skin.
O—orifice, *V.P.*—villiform process.

season the skin of the lower surface of the female becomes very swollen and tender assuming a soft spongy condition. As soon as the eggs have been extruded and fertilized, she lies on them pressing them into this soft tissue and each egg becomes attached to the skin by a small stalked cup remaining thus fixed until hatched'. Eggert remarks that while papilli serving for the affixing of the eggs in Aspredo (*Platystacus*) are shaped like mushrooms, the structure in *M. gulio* consists of folds of skin. The condition in *M. aor* and *M. seenghala* is quite different from that of both the above fish, though it approaches that of *Platystacus*. Further unlike them it is the male that tends the nest and nurses the fry in *M. aor* and *M. seenghala*.

Though specimens of breeding males carrying eggs have not been obtained, it is not improbable that the villiform processes with dilated ends and orifices serve as stocks for carrying the eggs before hatching. It is otherwise difficult to account for the fact that no one has seen eggs in the nests.

NURSING OF THE YOUNG BY THE MALE

Another novel feature presented by the reproductive behaviour of these fish is the method of feeding the fry. The nests were amidst dark grey granite boulders and were excavated in dark clayey sand with no white food material in them. Nevertheless the transparent fry with well-developed mouths and vents (Figs. 4–6) had protruding rounded abdomens of a milky white colour gorged with food they had eaten. As there was no white food in the nest, a

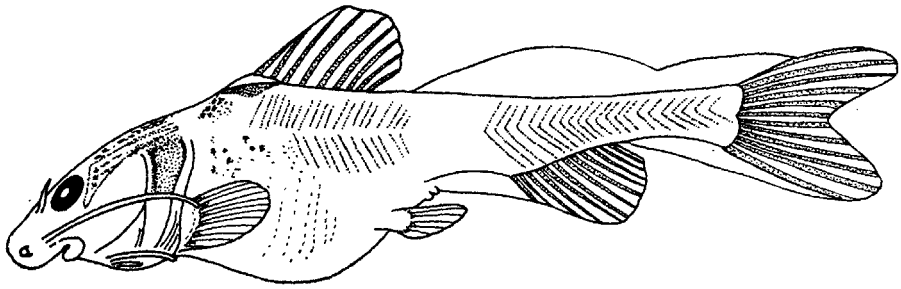

FIG. 4. Side view of fry of *Mystus aor*, 18 mm long. × 10.

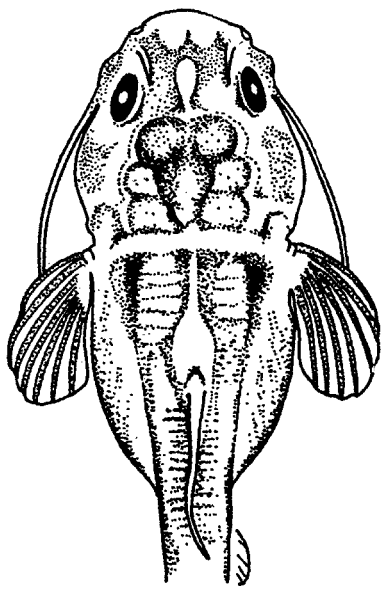

FIG. 5. Dorsal view of fry of *Mystus aor*, 18 mm long. × 10.

parent fish with its fry was placed in a large bath tub of water for observation. The fish kept gently swimming and turning round keeping to the centre of the tub. The young at first scattered all over the tub soon collected under the parent and kept swimming immediately below it in a dense shoal, some seemed to peck at their parent though it was difficult to observe feeding of the young in a bath tub. The parent was secreting a thick milky white fluid from its inflamed ventral surface which evidently forms the food of the young, as a dissection of the fry showed that they had eaten the same substance. Nearly an ounce of the fluid was collected for chemical analysis. Lockwood (1868) and Dufosse (1874) have inferred that the male Hippocampus nourishes its brood on a secretion of the mucous membrane lining its brood pouch, while Eggert suggested a possibility of similar feeding on morphological grounds in *M. gulio*. As the young in the nests reach 36 mm (the size of the largest fry

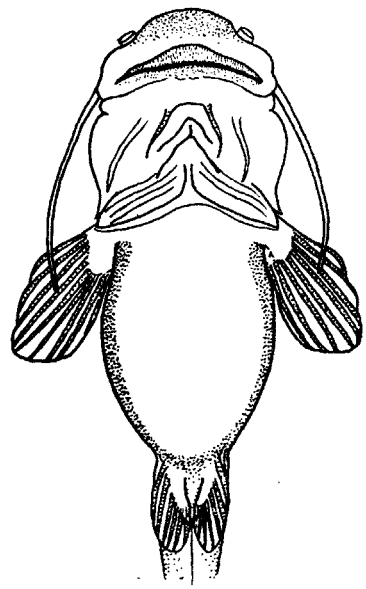

FIG. 6. Ventral view of fry of *Mystus aor*, 18 mm long. × 10.

collected) their abdomen was neither prominent nor very white, and the secretion from the parent also decreased. The ventral surface of the parent was distinctly less inflamed and showed only isolated patches of plexus of blood-vessels here and there, indicating a gradual return to normal condition. In both the species the ventral surface in the nesting male receives a copious supply of blood to provide for the growth of the villiform processes and the secretion of food for the young.

Through the courtesy of Dr. Aykroyd, then Director of Nutrition Research, Coonoor Laboratory, the sample of the milky secretion collected was analysed. He reported as follows :

> 'Mr. Ranganathan has examined the milky secretion from catfish. Examination under the microscope showed plenty of degenerate granular matter. There were no free fatty globules. Chemical examination also did not reveal the presence of fat. The material is mostly made up of organic matter containing a small percentage of ash. Phosphate and sulphate were not present while calcium was present in small amounts.
>
> Protein tests were all positive; it is probable that the secretion product is mainly composed of protein material. Tests for the presence of lactose and other sugars were inconclusive; confirmatory tests could not be done as the sample sent was insufficient.
>
> Vitamin A was not present.
>
> The secretion in no way resembles milk in its composition.'

The breeding habits described above are the same for both *M. aor* and *M. seenghala*.

ACKNOWLEDGEMENT

I am indebted to Dr. B. S. Bhimachar, F.N.I., for re-examining the nests at my request in 1940 and confirming all my observations.

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