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Oral incubation in marine catfishes of the family Tachysuridae

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ABSTRACT

Mouth breeding in several species of tachysurid catfishes was observed during 1970–76. In all tachysurids male is the brood-carrier. Large, yolked and ripe functional ova as well as small and non-yolked, non-functional ova were extruded at the time of spawning. After retaining the large functional ova in the mouth, the non-functional ova were probably eaten by the male parent. Efficiency in fertilization and transfer of eggs was brought about by enlarged pelvic fins of female. The oral cavity of the incubating male got enlarged to receive large number of eggs and the oral epithelium secreted large quantity of mucus for the safe carrying of eggs or embryos in the mouth. The incubating parent usually went without food, although the fry fed in the parent's mouth. Incubation in *Tachysurus thalassinus* lasted for 28–30 days.

Most members of family Tachysuridae which inhabit the seas and estuaries exhibit mouth breeding. Those observed during this study were : *Tachysurus thalassinus, T. serratus, T. dussumieri, T. tenuispinis, T. caelatus, T. sona, T. maculatus, T. subrostratus, T. platystomus* and *Osteogeneiosus militaris*.

MATERIALS AND METHODS

The fish samples for investigation were collected from the trawl and drift net catches at Mandapam, Pamban, Rameswaram and Azhikode during 1969–76. Ovaries at various stages of maturity from different species of tachysurid catfishes were collected and preserved in 5% formalin. The sex of the incubating parent was noted and the eggs, embryos or yolked-young ones were collected from the mouth and preserved for further study. The stomach contents of yolked young ones and incubating parents were analysed. The length of the pelvic fin of male and female *T. thalassinus* at all stages of maturity was recorded. A few fertilized eggs of *T. thalassinus* were collected from the mouth of incubating parent and reared in the laboratory or aquarium.

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RESULTS AND DISCUSSION

Most of the members of Tachysuridae usually inhabit the shallow waters, where the bottom is muddy. Muddy bottom is not the successful spawning ground for these fishes because the eggs, being large and heavy, are likely to sink to the muddy bottom and face many natural hazards. Oral incubation appears to be a well-developed and effective way of protection of the young ones to ensure the survival of the species, as has been made out for *Felichthys felis* by Gudger (1918).

In the ovary of *T. thalassinus*, Menon (1979) observed 3 different groups of ova, a, b and c, of which the former 2 groups were reproductively non-functional. During observation on the ripe and oozing females of several species of tachysurids mentioned earlier,

it was found that the non-functional ova occupy the posterior region of the ovary. After getting liberated from the follicles they formed bunches attaching to a few posteiorly located ripe and liberated functional group c ova. While the group c ova were heavily yolked, opaque and large, the groups a and b ova were small, non-yolked and translucent (Menon 1979). On several occasions, incubating males of various species were found with all the 3 groups of ova in their mouth. Moreover, the spent ovaries of these mouthbreeding catfishes contained the ripe group c ova as well as a few remaining liberated a and b groups of ova. Thus, it was clear that the reproductively functional group c ova were liberated along with bunches of a and b groups of ova at the time of spawning in all the tachysurid catfishes studied. Further, the examination of the stomach contents of incubating males showed the remains of partly digested a and b groups of ova.

Gunter (1947) made a similar observation on the ovary of *Galeichthys felis*. He found yellow ripe eggs and whitish or opaque smaller eggs of around 3 mm in the ovary. It indicated that the smaller non-functional eggs, instead of developing further, lose their colour and whatever internal differentiation they have, and become merely sacs of clear material as spawning approaches. The exact function of the ova of groups a and b is not clearly known. However, Gunter (1947) suggested that these eggs were reproductively non-functional, and were eaten by the male as additional food before the long fast ahead. He also suggested that there might be a strong selection for females that spawn in this manner.

Modification of pelvic fins of females during breeding time

As the gonadal maturation progressed, the pelvic fins of all tachysurid female catfishes showed some peculiar modifications. At maturity stage IV, the tissues in the first ray

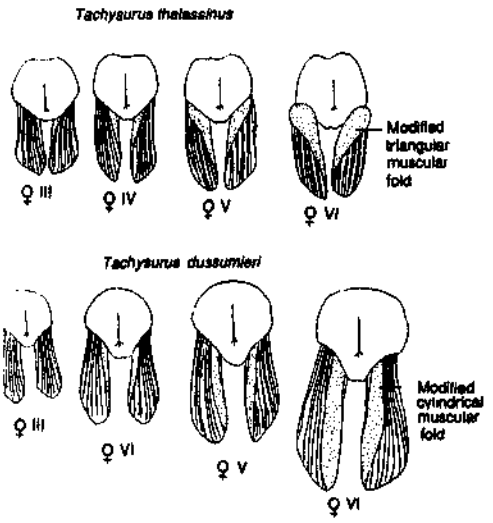

Fig. 1. Progressive modification of the inner ray of the pelvic fin of *T. thalassinus* and *T. dussumieri* females at maturity stages III–VI.

of the pelvic fin got thickened and enlarged. As the ovaries matured to stages V and VI, the anterior dorsal inner margin of each pelvic fin developed a thick muscular fold-like structure. In ripe females of *T. thalassinus*, *T. serratus*, *T. sona* and *T. maculatus* this protruberence acquired a triangular shape and in *T. dussumieri*, *T. tenuispinis*, *T. caelatus*, *T. platystomus T. subrostratus* and *O. militaris* it was cylindrical in shape (Figs 1, 2). This modification of pelvic fin did not involve any additional bony or cartilagenous structure. After spawning the fin acquired its natural size and shape except for a white thickening on the inner margin. Hardenberg (1935) and Lee (1937) noticed similar type of sexual dimorphism in *Arius maculatus* and *Galeichthys felis* respectively. Al-Hassan *et al.* (1988) observed that the pelvic fins were reliable indicators of sex. When fully extended the entire female pelvic fins were cupped. In contrast, the male pelvic fins were straight edged, nearly triangular in shape and planar when extended. But this statement did not seem to be

Fig. 2. Specially modified pelvic fin of a ripe female *T. thalassinus*.

entirely true, since the modification of pelvic fin of females took place only during breeding time after which the fins gradually reverted back to original size and shape. Therefore, the pelvic fins were reliable indicators of sex only during maturity stages IV – VI in the incubation period.

To study the sexual dimorphism during the breeding phase of *T. thalassinus*, the length of pelvic fin was plotted against total length of fish for males and females separately (Fig. 3). The relationship was linear in males and curvilinear in females. Till maturity (maturity stage III or about 20 cm) there was no difference in size and shape of pelvic fin of male and female in relation to total length. As the gonad matured further (stages IV and above) considerable change in size and shape of pelvic fins of females took place.

Modification in males associated with mouthbreeding

As the breeding time approached many morphological changes took place in male tachysurids. With maturity the male started accumulating fat in the form of mesenterial fat, its weight being 3.5–4.8% of total body weight in *T. dussumieri*. This got completely utilized by the fish during incubation period. Liebman (1933) observed a similar condition in mouthbreeding cichlids. In the mature male catfishes the oral cavity got enlarged by the contraction of some muscles connecting the floor of the buccal cavity with the pectoral girdle. The mouth cavity thus got doubled or trippled to facilitate the accommodation of a large number of eggs for incubation (Fig. 4). The membrane of the oral cavity secreted mucus which formed a thick coating all over the mouth cavity. Non-parental males and females had only few mucus cells in the oral epithelium. When the mucus cells started secreting mucus, the fish stopped feeding and was ready to receive the fertilized eggs for incubation. It was presumed that the mucus served as a lubricant and acted as a thick cushion for the eggs. The palatine and upper and lower pharyngeal toothed plates got coated with mucus, which prevented injury to the eggs or embryos when they were in the parent's mouth. Oppenheimer (1970) suggested that the function of the mucus might be that of a lubricant, which

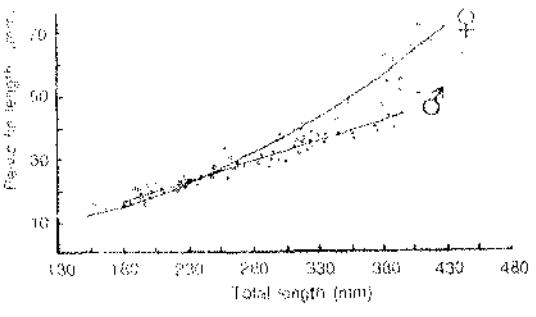

Fig. 3. Relation between total length and pelvic fin length of male and female *T. thalassinus*.

Fig. 4. Enlarged buccal cavity of an incubating male of *T. thalassinus*.

prevented coughing. During the time of incubation the oral cavity of the male parent got separated from the rest of the alimentary tract by a strong sphincter in the oesphageal region, which prevented the entry of large eggs or embryos into the stomach.

Mode of transfer of eggs

The act of spawning or the mode of transfer of eggs from the ovary into the male parent's mouth has not been reported so far. The enlargement of pelvic fin of the ripe female of several species of tachysurids and its subsequent reduction in size after spawning suggested that possibly both the pelvic fins apposed together and acted as a temporary receptacle for the safe fertilization and transfer of eggs to the male's mouth. Hardenberg (1935), Lee (1937) and Gurter (1947) believed that the enlarged pelvic fins of the ripe female fish played a role in temporarily holding the spawn for fertilization and the subsequent direct transfer to the mouth of the male parent. Dmitrenko (1970) disagreed with this hypothesis and believed that the male *T. thalassinus* does not come into contact with the female before the egg bunch is picked up from the sea bottom for fertilization and subsequent incubation in the mouth; whereas Babu (1978) stated that the female of *Tachysurus argyropleurodon* deposited her eggs in a basket formed by the pelvic fins from which she transferred them directly to the mouth of the male.

Feeding during the incubation period

The incubating male tachysurid parents completely refrained from taking any food while eggs, embryos or fry were in the mouth. Feeding was resumed after the young ones were released. Gunter (1947) and Menon (1979) stated that the incubting males may eat the non-functional eggs which are taken into the mouth along with fertilized eggs. Menon (1979) observed that the yolked young ones, even while they are in the parent's mouth, feed on small planktonic organisms entering through the respiratory incurrent of the parent. Gudger (1918) viewed that the young of *Bagrus marinus* might eat while in the parent's mouth, because the amount of yolk seemed insufficient to account for their incredible growth in such a short time of 1 month.

Length of period of incubation

Embryos of *T. thalassinus* reared in the aquarium tank were found to absorb the yolk completely after 28–30 days; the young ones normally escape from the parent's

mouth at this stage. Gudger (1918) and Gunter (1945) found the incubation period in *G. felis* as 60–70 days. Chidambaram (1942) found the period of incubation in *Arius jella* as 2 months.

In all the mouth-breeding tachysurids studied, male was the brooding parent. Hardenberg (1935), Lee (1937), Chidambaram (1942) and Ward (1957) noticed the same phenomenon in various tachysurid catfishes from tropical as well as temperate waters.

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