SOME TERATOGENIC AND PATHOLOGIC IMPACT ON FISH AND EMBRYOS IN LAKE MARIUT

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Abstract

The successive changes in environmental and ecological conditions of Lake Mariut resulted into the deterioration of fish embryos and larvae of ***Oreochromis species***. Considerable morphological abnormalities such as the bending of the vertebral column, head and yolk sac deformation, delay of growth in certain organs and the whole body beside the deviation of the body parts from normal ratios were diagnosed during the developmental criteria. The high mortality also indicates the threat of the most common,, adaptable fish species in Egypt.

Introduction

Lake Mariut contributed a good part of the Egyptian inland fisheries. The main fish inhabiting the lake comprises ***Tilapia (Oreochromis spp.)*** which constitute about 88.5% of the total fish catch. The teratogenic and abnormal features observed together with the pathologic symptoms mentioned in this paper have been diagnosed through the study of the embryological characteristics of such species collected from their mother brooders inhabited in lake Mariut.

The importance of this study is derived from the sensitivity and susceptibility of the embryos to the environmental factors and conditions that may reflect on the fish catch of one of the most economically important fish in Egypt.

Materials and methods

Fish samples were collected from fishermen's catches from different locations in lake Mariut during the period from April till September for three successive years and then transferred to the laboratories. The two species under consideration; ***Oreochromis niloticus*** and ***Oreochromis aureus*** are mouth brooders which show a high degree of parental care. The mouth incubation period extends from the time of egg fertilization till complete absorption of yolk sac. The embryos and larvae are obtained from the mouth of the mother brooders.

External an morphological features of some embryos collected from the lake were observed and then compared with the same chronological embryonic and larval stages of the same species developed by using the "induced spawning method" and "artificial insemination method" (Ghabrial,1990) under laboratory conditions with high water quality.

The observations were made using the stereomicroscope WILD. MP 50, (magnification 70 -310x) equipped with a substage light source which is directed through the embryos and larvae (transillumination).

Observations

The examined embryos after six days from fertilization (Fig. 1) showed a well deformed head with a length 0.9 mm. and height 1.1 mm., the deformed yolk sac (1.4 x 1.1 mm.) showed a deviation from the normal ratios which are 2.1 x 1.9 mm. at the same stage under high water quality (Lab.) conditions. The structure and morphological characteristics are similar to the well formed fry with its fully formed eye and operculum but less developed alimentary canal.

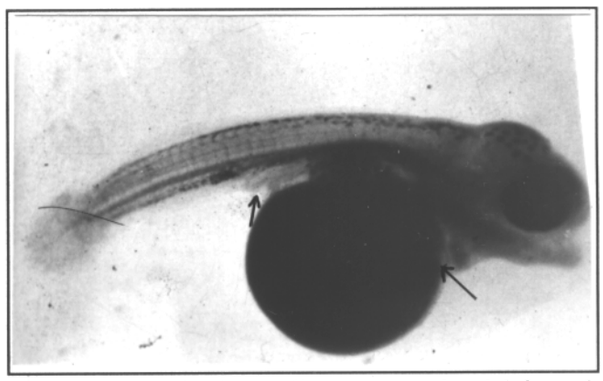

Figure 1. Less developed alimentary canal and deformed yolk sac

Figure 2 is a fully grown larval stage three days after complete absorption of yolk sac showing a short tail region and a clear deformation of the vertebral column at myotome number 5 & 6 of the tail region. The dimensional ratios of the head region were length 1.8 mm. and 1.5 mm. height. indicated a clear deformation from the normal ratios which are 2.2 mm. x 2.1 mm. at the same stage of development.

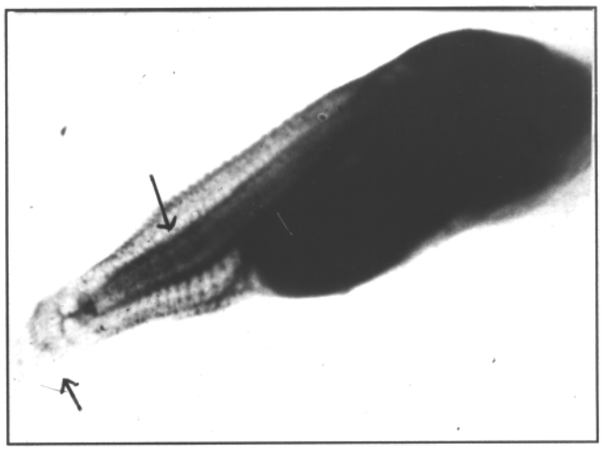

Figure 2. Short tail region and deformation of vertebral column.

The number of the anal fin rays were 11+ one spine while the dorsal were 20 fin rays + 4 spines; clearly lesser than the normal numbers which are 15 (anal) and 22 (dorsal fin rays) at the same stage under laboratory conditions.
The mortality of the fish batch from which those deformed fry were taken was considerable since the original number of eggs was 961 and the surviving fry was about 346.

The fish fry Figure 3, (a & b) show successive developmental stages of the tail region during two successive days showed underdeveloped individuals with clear microcephaly. Ossification of the caudal fin rays was highly affected since the rays became stunted and as if attaining a phalangeal pattern of segmentation, which is quite different from the normal lepidotrichia. Some embryos which were collected from the heavily polluted areas of the lake showed

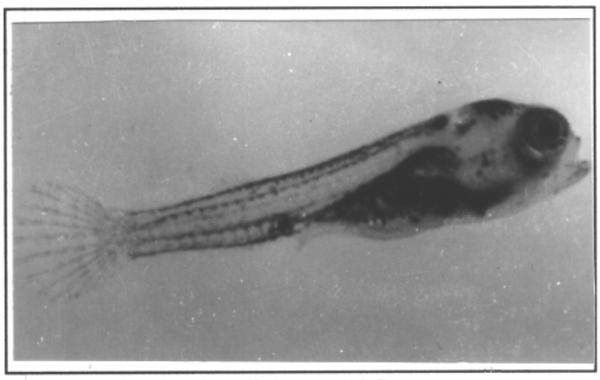

Figure 3a. Ossification of the caudal fin rays.

clear signs of bacterial and fungal infections. Since Tilapia (***Oreochromis spp***.) are present in water with a high organic load due to agricultural, sewage run-off and factories effluent discharged.

The normal embryonic fin fold of the tail bud and in the zones of the unpaired fins i.e. dorsal and ventral fins show an advanced differentiation reaching a phase where the dorsal fin extends along the entire length and the ventral one almost reaches the anus (age ± 140 h.) after fertilization. At a later stage (± 180 hours) post fertilization, a separation of the dorsal and anal fin folds from the caudal fin is clearly defined at this stage under high water quality conditions (laboratory) (Fig. 4).

The bacterial and fungal infection which were found in some samples collected from the lake at the same stage of development started as white spots on the dorsal and ventral fins, then increased on the continuous fin fold to show successive deterioration along the surrounding fins (Fig. 5 & 6). The fish fry collected from the same location and kept in the same water of the lake under laboratory conditions for morphological diagnosis at later stages, were found to have a body with high degree of infection with a degenerated tail region and decrease of movement activity and ability of swimming due to loss of appetite.

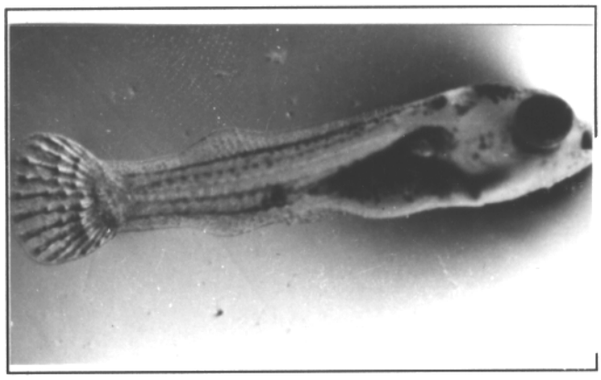

Figure 3b. Stunted rays of the caudal fin showing a phalangeal pattern.

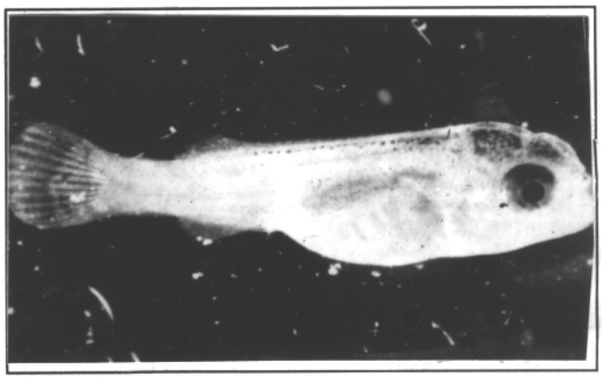

Figure 4. Normal dorsal and anal fin rays of a full grown larva stage.

Figure 5. White spots shown on the dorsal and ventral fins.

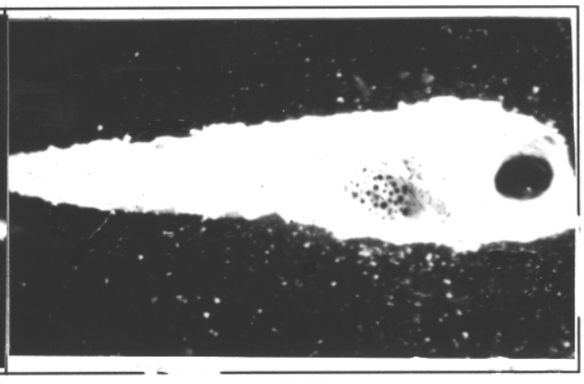

Figure 6. Successive deterioration along the fins.

Discussion

The genus ***Tilapia***, which consists of about many species and to which ***Oreochromis spp***. are belonging to, is very economically important. Beside its tolerance to different environmental

conditions and other characteristics such as their hardness, ease of breeding, diversified food habits and fast growth.

The well developed embryonic vascular system proved to have an adaptation that suits the adverse conditions of low oxygen concentration (Ghabrial , 1990), since this species under investigation can survive in habitats of poorly oxygenated areas.

In spite of the tolerance of our species to different environmental conditions, there is nevertheless a wide range of teratogenic problems may occur. The spinal malformations are not uncommon in small numbers in any intensively reared species but in Tilapia (***Oreochromis***), a particular form of spinal deformity, has been mentioned by Roberts and Sommerville (1982). There were "Saddle back"; "spinal deformities" and "dorsal fin anomaly" and they found that such fish is less resistant to diseases such as Sparolegnia fungus infection.

During their waterborne infection tests with infection pancreatic Necrosis virus (IPNV), Ahne W. et al (1989) found that the main symptoms on infected rainbow trout fry were: curvilinear bodies and darkening of caudal body, as well as distinct cranial odema. This indicates that the spinal deformities and the macrocephaly of our fry under consideration may be due to some viral infections from the water of lake Mariut.

The dimensional deviation of some fish larvae from normal ratios is a phenomenon mentioned also by Roberts and Sommerville (1982) on some ***Tilapia*** species, where it was described as "stumped body" in the mature individuals since the body was compressed anterioposteriorly. The incidence of such deformities and abnormalities in the polluted areas in lake Mariut reflects the effect of pollution on fish fry of ***Tilapia*** (***Oreochromis***) which is considered as a highly resistant species.

The high mortality in certain clutches of eggs and larvae is also associated with dwarfish in some individuals. Only 346 fish larvae survived out of about 961 eggs produced from ***O. niloticus*** with 64% loss. Some of which had dwarf larvae if compared with the normal parameters of the same species at the same age and same conditions but different water quality. This dwarfish was also found in the mature ***Sarothorodon mossambicus*** (***Tilapia*** substrate spawner) in lake sibaya (Bruton and Allonson 1974). Iles (1973) emphasized that dwarfism represents an adaptive mechanism involving reproductive and growth characteristics which enable ***Tilapia*** population to withstand high mortality.

Stunting in genus ***Tilapia*** was mentioned by Iles (1973) but the phalangeal pattern of segmentation which was quite different from normal lepidotrichia, was so far, not mentioned. This severe ossification of the fin rays of some individuals in the present study might be due to pollution or to some interaction between certain elements in water and calcium. More work has to be done to identify it physiologically and analytically.

The bacterial and fungal infection of some embryos collected from the heavily polluted areas of the lake at 25°C if maintained at the same temperature, but under laboratory conditions, the infection was severe covering almost the body.

The pathologic bacteria ***myxobacteria*** was described by Roberts and Sommerville (1982) but are usually associated with low water temperature. Avault et al (1968) stress the importance of maintaining over wintering temperature of at least, $\pm$ 4°C for this reason. Therefore, we must point out that the pathogenic infection found during our study might be a different strain other than ***myxobacteria.***

In conclusion, the environmental conditions in the Lake have to be improved, since it is considered a supply for fish fry to many fish-cultures in some near Governerates, to avoid such impact on the embryos and the high mortality associated with these infections.

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