

into a soft genital tube telescoped into the preceding segments. Posteriorly a pair of minute anal appendages occur, each with a stout cushion-like basal joint and a small chitinised setose apical joint. The tergal plates are devoid of the median longitudinal channel or sulcus and their margins strongly ribbed. The second abdominal plate ( $DP_2$ ) is the broadest plate. The sternal plates are rectangular and devoid of spines. The eighth sternal plate is small and not rectangular. The spiracular sclerites are continuous with the sterna, but separated by strong wrinkles. The whole interior of the trunk is loaded with the massive ovary. Although the ovary appears as a single extensive mass, the oviducts are paired and distinct as in the adult female *Lamprophorus tenebrosus* Wlk.

Department of Zoology,  
Christian College,  
Tambaram,  
Madras,  
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J. SAMUEL RAJ.

1. In one of the specimens examined the apical joint was distinctly sub-divided dorsally so as to make up the antenna 12-jointed, but not so ventrally.

#### ON THE OCCURRENCE OF DIAPAUSE IN THE EGGS OF INDIAN CYPRINODONTS

RECENTLY, while going through the article of George S. Myers<sup>1</sup> on "Studies on South American Fresh-water Fishes", I came across the following interesting remarks on the Cyprinodone fishes of the genus *Cynolebias*\*:—

"The fishes of this genus are now known, through the works of aquarists and aquarium collectors, to be annual fishes which complete a full life-cycle within one year. They are rare or absent in ordinary streams and permanent lakes and ponds, being common only in isolated water-holes, swamps and puddles that dry up in the dry season. The fishes require a deep mud bottom. The eggs which are very tough-shelled and resistant, are deposited in the mud when the ponds have begun to dry up. The adult population is wiped out upon the complete drying of the ponds and the species exist over the dry season only in the egg stage, buried in the damp mud under the hardened top crust. Advent of the wet season, with accumulation of water in the ponds and the softening of the mud initiates the hatching of the eggs. Development of the fry is exceedingly rapid, for in some instances full growth is attained

in two or three months. . . . Certain African species, *Aphyosemion caeruleum* for one, as well as several species of *Nothobranchius*, also are short-lived, and produce tough eggs which, in the few instances in which the fishes have been bred have been found to take one to several months to hatch. It is probable that these species, especially *Nothobranchius* from the drier plains of East Africa, are annual fishes."

Some time ago, while making observations<sup>2</sup> on the breeding and development of *Oryzias melastigma* (= *Aplocheilus melastigma*), I found that especially during the hot seasons if the water in the aquarium was not replenished the hatching time of the eggs was unduly prolonged. This phenomenon was rather puzzling since under similar conditions the eggs of other fishes did not show any remarkable difference in the incubation period. It was seen in a number of instances that some of the eggs of *O. melastigma* kept in a vessel would hatch out within the normal period of 8 to 14 days whereas the rest would remain with healthy embryos for weeks together except a few that died. Instances of diapause up to six weeks have been observed by me. No records were taken of the incidence of this phenomenon during the different parts of the year and observations were not conducted under natural conditions. The delay in hatching has never been consequent on the slowness of development as both in the early and late hatching the rate of development of the embryo has been the same and it was the fully developed 'ready to hatch' larva that was in a state of diapause. Perhaps the only difference between the fry of the two sets was that in the early hatching the larva possessed a little yolk, less of pigmentation and fewer fin-rays. Another interesting fact observed in the case of the eggs of this species is that if fresh-water or water of much lower salinity is added the eggs would hatch and quite normal and healthy larvæ would immediately come out. Sometimes such eggs were removed one by one into a petri-dish and just to watch the fry coming out, a jet of water was directed on to them from a pipette with the desired result. The reason for this could be explained to the sudden change in osmotic pressure due to the addition of fresh-water making the egg membrane burst since in all instances the water in which the eggs were kept was from the brackish water areas of the Cooum and Adyar, Madras. In natural conditions also the principle involved in the hatching of the eggs should be similar.

Though it appeared to me even then that this state of diapause during the egg period may be a sort of natural provision to tide over unfavourable conditions and ensure a copious supply of fry by the onset of the rains, when conditions become ideal for growth and migration, it was dismissed as rather a premature conclusion and only remarked that in some cases the hatching period has been found unduly prolonged.<sup>2</sup> It is clear now that this view is correct and though Indian species might not have developed such a degree of

\* Since sending this note for publication I was able to go through "Tropical Fishes for the Home: Their Care and Propagation" by F. H. Stoye (New York, 1935) in which interesting accounts on the breeding of the fishes of the genera *Aphyosemion*, *Nothobranchius* and *Cynolebias* are given.

specialization as the American and African species, this may be an incipient tendency towards that condition. The capacity of the eggs of Cyprinodonts to lie dormant during unfavourable season in stagnating water would certainly enhance their suitability as larvicidal fishes.

Regarding *O. melastigma*, Job<sup>3</sup> says that "At Calcutta they hatched out in eleven days in water at 88° and in fourteen days in 85°. A few eggs kept in a vessel without change of water hatched out in nineteen days". In the case of other Cyprinodonts some variations in the incubation period are recorded by Job<sup>3</sup> in *Aplocheilichthys panchax* and by Kulkarni<sup>4</sup> in *Horaichthys setnai*.

The views of some of the former workers on this subject are as follows. Tennent<sup>5</sup> in his *Natural History of Ceylon* refers to the belief that eggs of many tropical fishes are able to tide over the dry season in the mud and gives reasons against such a possibility. He is of opinion that the mature fish bury themselves in the mud under the hardened top crust and come out ready to spawn at the advent of rains. Thomas<sup>6</sup> emphasizes the need for more work for studying the capacity, if any, of the eggs of tropical fishes to aestivate. Day,<sup>7</sup> in the absence of any definite data, declines to make any comment on the view that fish full of spawn are able to aestivate till the commencement of the next rains.

I am indebted to Dr. George S. Myers of the Stanford University for sending me a copy of the *Stanford Ichthyological Bulletin* containing the article referred to above, and to Dr. S. L. Hora, Director of Fisheries, Bengal, for going through this note and communicating it for publication.

Central Research Institute,  
University of Travancore,  
Trivandrum,  
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S. JONES.

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### ON THE BIONOMICS OF BIG-JAWED JUMPER, *LACTARIA* *LACTARIUS* (Cuv. & Val)

THE Big-jawed Jumper, *Lactaria* (Cuv. and Val.) is a shoaling fish to an important fishery in the Gulf and Palk Bay, from the month of month of January. The peak of occurs in September and October.

**Food.**—The Big-jawed Jumper is a voracious fish, feeding on other smaller species as the Sprat (*Sardinella gibbosa*), the *(Engraulis indicus)*, the White-bait (*Engraulis sp.*), the Jew-fish (*Sciæna griseus*), the Silver-bellies (*Leiognathus sp.*), young fish (*Trichiurus savala*), the Sole (*Rhombus arsius*), the Shrimp (*Alpheidae*) and the Prawn (*Peneus sp.*). The White-bait appears to be its favourite food.

**Size.**—Over three thousand specimens in size from 11 to 25 cm., were reared in the laboratory of Krusadai Biological Station during the years 1940-41, 1942-43. The commercial catches consist of specimens 17 to 21 cm. in length. The percentage of males in a shoal is always less than that of the females, in some cases as low as 25. The males are smaller than the females, attaining maturity within 18 cm.; and they become mature when they are 16 cm. in length, while the females are larger, attaining a length of 25 cm. and they become mature when they are 18 cm. in length.

**Spawning season.**—The spawning is confined to the months of September and October, when the fishery is at its height. The females form the bulk of the catches; yet their heavy destruction seems to diminish or deplete the fishery.

**Eggs.**—The ripe ovarian egg measures 0.76 mm. in diameter, with a single yellowish oil-globule measuring 0.4 mm. in diameter. Attempts made to collect eggs from the sea off Thangachimadam village four miles east of Pamban, where the fishery takes place, have not been successful. It is probable that the ripe fish go to the open sea beyond the three-mile limit to spawn there unharmed. Fisheries Bureau,  
Madras,

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P. J.

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## SIR JEREMY RAISMAN'S BUDGET SPEECH

WE wish to invite the attention of our readers to the relevant portions of the enlightened budget speech of Sir Jeremy Raisman, the Finance Member to the Government of India (appearing elsewhere in this issue), relating to the capital and recurring grants for the estab-

lishment of National Research Laboratories. This generous gesture, which is "an expression of the Government's desire to foster the development of Indian industry" is hoped, will soon be followed by substantial grants.