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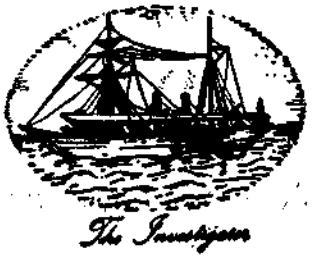

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PRELIMINARY EXPERIMENTS ON BREEDING OF CEPHALOPODS

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ABSTRACT

The results of preliminary experiments on hatching and rearing of a squid *Sepioteuthis lessoniana* and a cuttle fish *Sepia aculeata* are described. The hatchling survived for a maximum of 10 days.

INTRODUCTION

BIDDER (1950), Wells (1962), Boycott (1965), Fields (1965) and Schroder (1969 a, b) expressed difficulties in maintaining squids alive for appreciably long durations. Attempts to rear young squids captured from sea by trawlers and small set nets in Japan have resulted in high rate of mortality and this method of collection and culture was considered impractical (Bardach *et al.*, 1972). Egg clusters were collected from spawning areas and hatched and reared in laboratories in Japan. This approach also posed problems such as providing right type of food for young ones. Choe and Oshima (1963) reared three species of cuttle-fish *Sepia esculenta*, *S. subaculeata* and *Sepiella maindroni* and two species of squids *Sepioteuthis lessoniana* and *Euprymna beryii* in Japan. La Roe (1971) cultured and maintained *Sepioteuthis sepioidea* and *Doryteuthis plei* from egg stage to sexually mature condition. In India, no work has been done on rearing cephalopods except on the embryonic development of *Sepioteuthis arctipinnis* (= *S. lessoniana*) (Alagarswami, 1966). The present authors made attempts to culture the squid *Sepioteuthis lessoniana* and cuttle fish *Sepia aculeata* at Mandapam along the south-east coast of India based on collections made from coastal areas during March-June, 1979.

The authors are grateful to Dr. E.G. Silas, Director, Central Marine Fisheries Research Institute for his keen interest and encouragement and to Dr. P.S.B.R. James for facilities provided and to Shri P. Bensam for critically going through the paper and for giving valuable suggestions for improvement. The authors are also thankful to Mr. P. Raghavan for taking photographs.

COLLECTION OF EGG CLUSTERS

Rao (1954) has stated that squids begin to spawn from January in offshore waters and migrate inshore where they continue to spawn till the end of July. In the Palk Bay, fishermen capture spawning squids by encircling them by '*Chippi valai*' after placing branches of *Cassia* plant on which the species lay their eggs. Often egg clusters are found washed ashore in Palk Bay and Gulf of Mannar.

Dhargavalasai on Palk Bay appeared to be the best place for collection of squid eggs. Egg clusters of *Sepia aculeata* which are relatively rare were found only on one occasion in the shore-seine attached together with those of the squid.

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Description of Egg Capsules

The egg capsules of *S. lessoniana* contained a central gelatinous matrix by which they were attached to marine algae, sea grass or any other submerged objects. From the base, the egg capsules were arranged in radiating pattern. Squids are known to prefer their own egg masses already present in the environment for depositing their subsequent egg capsules (Plate I). The weight of the egg clusters collected in the present investigations varied from 122 g to 1,500 g and the number of egg capsules in a cluster ranged from 26 to 545 (Table 1).

Table 1. *Weight of egg clusters, the number of capsules in each and mean weight of capsules in the case of* Sepioteuthis lessoniana

Weight in g	No. of egg capsules	Mean weight of a capsule (in g)
122	32	3.81
157	32	4.91
200	52	3.85
162	26	6.23
146	66	2.21
880	300	2.93
1500	545	2.75

The number of eggs in a capsule and their range and mean length are listed in Table 2. In the fully developed condition, the movement of embryos were visible through the translucent gelatinous capsule.

Table 2. *Length of egg capsules and number of eggs in* Sepioteuthis lessoniana

Number of egg capsules studied	Number of eggs present	Egg capsule length in mm	
		Range	Mean
13	1	25-37	30
66	2	35-50	38
249	3	35-60	48
131	4	50-73	58
52	5	60-78	66
14	6	79-82	75

The egg capsules of *S. aculeata* were pear shaped (Plate I) and each was found attached to a central gelatinous matrix and contained only one embryo. The embryos were visible through the translucent gelatinous capsule. The number of eggs in a few clusters collected and their length and width are given in Table 3.

Table 3. *Number of eggs, their mean length and width in the case of* Sepia aculeata

Number of capsules in a cluster	Length of capsule in mm		Width of capsule in mm		Average weight of the capsule in g
	Range	Mean	Range	Mean	
13	12-22	19.5	8-16	13.6	1.4
15	16-21	19	11-20	14	1.5
16	17-22	19	12-17	14.3	1.5

Hatching Experiments

The egg clusters of *Sepioteuthis lessoniana* and *Sepia aculeata* collected on 27-3-'79 from the shore seines operated in Dhargavalasai were reared in an aquarium tank. The water temperature ranged from 29°C to 30°C and salinity from 31.05‰ to 32.87‰. The distal eggs were found to develop faster than the basal ones in the strand and hatch out earlier. Hatching was observed on 3rd and 4th April. The newly hatched squids were active and agile and measured 7 to 8 mm. Fresh plankton consisting of copepods and decapod larvae were introduced in the tank as food ; but it was observed that they were not feeding on plankton and the hatchlings survived only for 5 days.

In the case of egg clusters collected on 19-4-'79 most eggs hatched out from 24th to 29th April, 1979. A total of 384 young squids hatched out and all the young ones were reared in a shaded concrete tank. The young ones survived for a total duration of ten days. Later collections of egg capsules on 17-5-'79, 16-6-'79 and 27-6-'79 also gave a hatching percentage of 80 to 100.

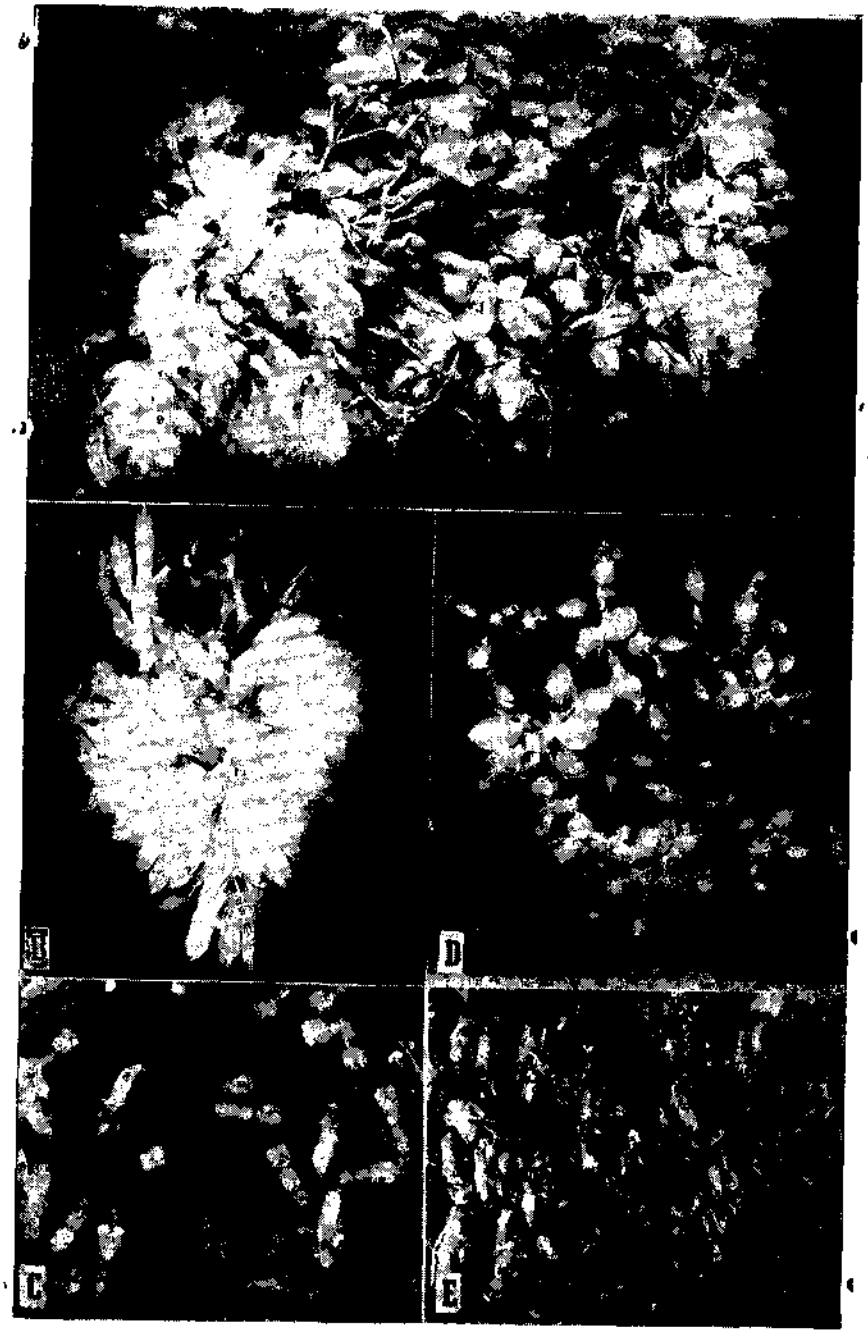

PLATE I A. Egg clusters of squid and cuttlefish found laid up together, B. Egg clusters of the squid *Sepioteuthis lessoniana*, C. Hatchlings of *Sepioteuthis lessoniana*, D. Egg clusters of the cuttlefish *Sepia aculeata* and E, Hatchling of *Sepia aculeata*.

Egg capsules of *Sepia aculeata* introduced into tanks on 27-3-'79 hatched out on the night of 31-3-'79 and also subsequently. The young cuttlefish measured 10 to 11 mm (Plate I). They were always observed to hatch out of the capsules near the base of their attachment. All the young cuttlefish died within 4-5 days.

Remarks

La Roe (1971) recommends opaque tanks especially of wood or cement as superior to glass tanks for hatching and survival of young ones of squids. Seminatural substrata including gravel, rock pieces or sea grasses were found to provide a calming and beneficial effect on the squids. But Choe and Oshina (1963) prefer glass tanks indoors for rearing experiments. The present studies on the survival of newly hatched squids show that in glass tanks with running sea water inside the aquarium survival was for 5 days only, while in concrete tanks with artificial sandy bottom, granite, coral stone and seaweeds, survival was for ten days.

La Roe (1971) succeeded in rearing newly hatched squid *S. sepioidea* by giving proper choice and quantity of food upto sexually mature condition for a period of 146 days. *S. sepioidea* was found to thrive well on the mysid *Musidium columbia* and older ones were found to feed primarily on *Gambusia*, as well as on penaeid prawns and fish of 3.7 cm in length. In the present study, newly hatched squids and cuttle fishes *S. lessoniana* and *S. aculeata* were provided with fresh plankton containing copepods and decapod larvae twice a day but the hatchlings did not prefer this food.

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PCBs AND PESTICIDES CONTENT IN CULTURED COCKLES FROM THE STATE OF PENANG MALAYSIA

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ABSTRACT

A survey on the PCBs and persistent pesticides content in cultured cockles obtained from 10 different farms in the State of Penang, *viz.* Bukit Dumbar, Pantai Acheh, Kuala Sungei Pinang 1, Kuala Singei Pinang 2, Kuala Jalan Bharu, Batu Maung 1, Batu Maung 2, Batu Maung 3, Sungei Nibong and Kuala Juru, demonstrated values ranging between the region of 160.29-335.31 ppbs for PCBs (Kanechlor 400) and non-detectable levels of p,p'DDE in most samples except for cockles obtained from the Batu Maung 1 site which demonstrated a value of 9.24 ppb.

The values for PCBs content in cultured cockles on comparison with shellfish of *Barbatia bicolorata*, *Atrina vexillum*, *Pinctada vulgaris* and *Saccostrea cucullata* from the Marine Depot, which had values of 436.55, 519.79, 467.25 and 461.57 ppbs respectively, were relatively low.

Based on these results it is concluded that cultured cockles in the State of Penang are acceptable for consumption from the viewpoint of their contamination.

INTRODUCTION

IN THE Malaysian context, the extent of heavy metal contamination has already been reported by Lee and Low (1976) and Sivalingam *et al.* (1979). Similar pollution evaluation studies on tropical benthic algae have also been carried out by Sivalingam (1978). However, the evaluation of pollutants such as PCBs, persistent pesticides and oil are yet to be reported.

The aquaculture of cockles *Anadara granosa*, in the world is well known to be regionalised within the west coast of Peninsular Malaysia (Table 1) with an annual production of 46,423.19 matric tons in 1977 with the State of Perak being the largest producer followed by Penang, Selangor, Kedah and West Johore.

TABLE 1. *Production of cockles* Anadara granosa *in Malaysia during the year* 1977**

States in west coast		Production (Ton)
Perlis	..	—
Kedah	..	233.82
Penang	..	4143.92
Perak	..	39,230.6
Selangor	..	2803.9
Negri Sembilan	..	—
Malacca	..	—
West Johore	..	10.95
Kelantan	..	—
Trengganu	..	—
Pahang	..	—
East Johore	..	—
Total (Tons)	..	46,423.19

** Data from annual fisheries statistics, 1977.

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