

STUDIES ON THE REPRODUCTIVE BIOLOGY OF  
THE WARM WATER SQUID *LOLIGO DUVAUCELI* D'ORBIGNY

2. HISTOLOGY OF THE TESTIS

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ABSTRACT

In *Loligo duvauceli*, though the seminiferous tubules are clearly seen, it appears that the differentiation of germ cells takes place from the centre of 'seminiferous tubule' towards the periphery. This is confirmed by the occurrence of spermatogonial cells closer to the centre surrounded by the somatic cells while the spermatids occur at its margin and interspaces. The 'seminiferous tubules' do not contain septa to divide it into compartments or globules. The central narrow lumen of each 'seminiferous tubule' appears to get obliterated as the testis matures. Hence the possibility of the central canal being used for the evacuation of the spermatids is remote. A comparison of sections of young and mature testes reveals that the differentiation of the 'seminiferous tubules' takes place from the periphery.

INTRODUCTION

THE TROPICAL squid *Loligo duvauceli* has a limited distribution occurring from South Africa to Taiwan (Voss, 1963). This Indo-Malayan species though found on the east and west coasts of India, occurs seasonally in Madras Coast. The peak of the season appears to be from June to August (Sarvesan, 1974). There is little information about the reproductive system of this animal. Only Rao's (1954) work on the other common squid *Septoteuthis arctipinnis* about its biology and fishery is available. Very little is known about the reproductive system of *L. duvauceli* and hence the present study deals with the histology of the testis of *L. duvauceli*.

MATERIAL AND METHODS

Specimens of *L. duvauceli* were obtained from mechanised boats which reach the Royapuram fishing harbour (Lat. 13° 06' N, Long. 80° 18' E) of North Madras (southeast coast of India). Live, but inactive squids were obtained from the mechanised trawlers operated

by the Central Institute of Fisheries Nautical and Engineering Training, Madras, Survey-cum-Inshore Fishing Centre of Tamil Nadu Fisheries, Madras and Marine Biological Station of Zoological Survey of India, Madras.

Male squids of different sizes were dissected to expose the reproductive system. The testis was approached from different sides of the animal in order to expose their flattened and elongated nature. Care was taken to remove the testis and keep it in a clean petri-dish containing Bouin's fluid as this fixative gives better results from those reported earlier. These include Bouin's fluid (Maccary, 1810; Pattabiraman, 1981), Carnoy's fluid (Pocock, 1900), Dietrich's fluid and Gilsson's mercuronitric mixture (Weygolt, 1971); 5 % formalin, neutral buffered formalin and Zenker's fluid (Pattabiraman, 1972). Sections were taken at 5-8 $\mu$  and stained with Mallory's triple and Ehrlich's haematoxylin with aqueous eosin as the counter stain.

RESULTS

In cross section the testis appears to be laminated dorsoventrally along the main axis of the testis. Microscopical examination reveals

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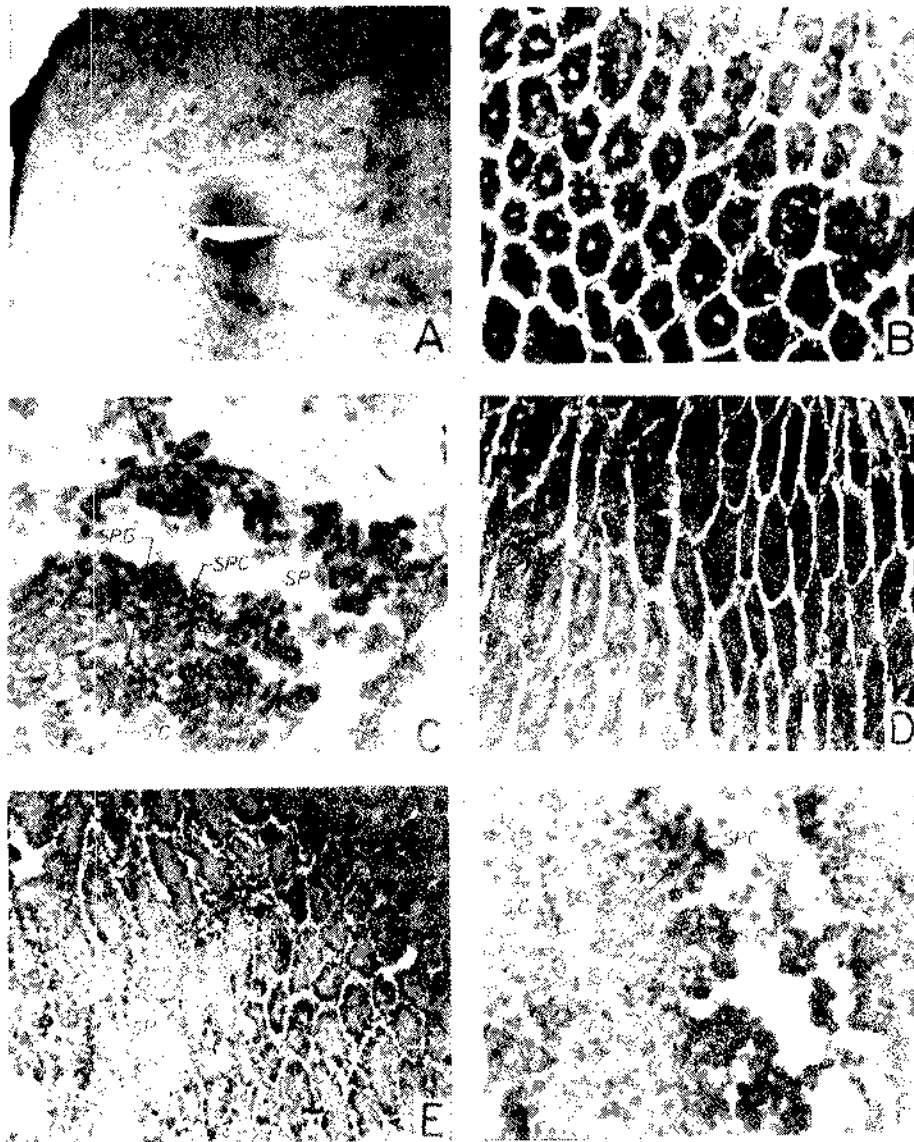


PLATE I. A. C. S. of the immature testis showing the absence of differentiation. Note the absence of 'seminiferous tubules' (X 200). B. C.S. of maturing testis. Note the 'seminiferous tubule' and the central lumen (X 80). C. C.S. of maturing testis (X 900). D. L.S. of mature testis (X 80). E. L.S. of mature testis. Note the complete absence of central lumen and the presence of spermatids in the interspace (X 80) and F. Same as E. Higher magnification (X 900). Note spermatogonia and somatic cells in the central region, spermatocytes in the periphery and the spermatids in the interspace (SC = Somatic Cell, SP = Spermatid, SPC = Spermatocyte, SPG = Spermatogonia).

that the lamination is due to successively arranged 'seminiferous tubules'. Each 'seminiferous tubule' contains a distinct narrow lumen at its middle (Pl. I B), which gets obliterated subsequently. Surrounding the lumen occur the various germinal cells (Pl. I C). Though the 'seminiferous tubules' are packed tightly within the testis to begin with, interspaces develop slowly between them which appear to run in an angle towards the left side (Pl. I D, E).

The 'seminiferous tubules' do not contain septa to divide it into compartments or lobules as in mammals (Jordon, 1947) but appear to be differentiated into central eosin stained elliptical somatic cells of 8 to 12  $\mu\text{m}$  diameter without prominent nuclei and peripheral basophilic germinal cells. Three prominent germinal cell types are obvious; fairly stained more or less spherical cells of diameter 10  $\mu\text{m}$  occurring studded around the somatic cells, darkly stained larger cells of 17  $\mu\text{m}$  diameter, which occur invariably surrounding the somatic cells and smaller clear spherical again darkly stained cells of 11  $\mu\text{m}$  diameter found accumulated in the margin often scattered in the interspace. These germinal cells could be spermatogonia, spermatocytes and spermatids respectively (Pl. I F). In certain regions of the 'seminiferous tubules' occur cells of larger size of 20  $\mu\text{m}$  diameter with prominently seen nucleus surrounded by cytoplasm containing intensely stained portions. These are likely to be primary spermatocytes.

It appears that the differentiation takes place from the centre of the 'seminiferous tubule' towards the periphery in as much as the spermatogonial cells are found close to the centre surrounding the somatic cells while the spermatids occur in the interspace and at its margin. Further, these interspaces are more wider and interconnected to converge towards the ventral opening. These appear as round spaces around the 'seminiferous tubules' in longitudinal section.

The proliferation of the cells of the compact 'seminiferous tubules' results in the loss of its tubular nature and coalescence of central lumina along with the formation of interspaces around them. These spaces develop well subsequently and get interconnected and converge towards the ventral opening to form a passage for the future germ cells.

In a young testis even the 'seminiferous tubules' are not seen (Pl. I A). The differentiation of the 'seminiferous tubules' appears to start from the periphery and proceed towards the centre of the testis.

#### DISCUSSION

The results reported in the present study on the histological nature of the testis reveal that the condition here is different from that of insects and arachnids. Even the details reported in *Octopus* (Arnold and Arnold, 1977) appear to be different. While the occurrence of 'seminiferous tubules' has been reported as a compact mass of ducts in *Octopus*, the germ cells are reported to proliferate and the spermatocytes differentiate as they move towards the central duct lumina. On the contrary in the present study though the 'seminiferous tubules' are clearly seen, it appears that the differentiation of germ cells takes place from the centre of 'seminiferous tubule' towards the periphery. This is confirmed by the occurrence of spermatogonial cells closer to the centre surrounded by the somatic cells, while the spermatids occur at its margin and interspaces. The presence of interspaces between the 'seminiferous tubules' which are more wider and interconnected to converge towards the testicular ventral opening has not been reported in any other cephalopod. The condition of the testis has a similarity to that of the mammals (Jordon, 1947); however, the 'seminiferous tubules' do not contain septa to divide it into compartments or lobules. Further, the central narrow lumen of each 'seminiferous tubule' appear to get obliterated as the testis matures. Hence the possibility of the cen-

tral canal being used for the evacuation of spermatids is remote. A comparison of sections of young and mature testes reveals that the differentiation of the 'seminiferous tubules' takes place from the periphery and proceeds towards the centre.

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