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INTERSEXUALITY IN MYTILUS GALLOPROVINCIALIS LAM.

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A b s t r a c t

Among the 142 Mytilus galloprovincialis animals which were studied histologically, 3 revealed themselves to be intersexuate, i.e. a percentage of 2.12 %. All these 3 individuals were found in minute isolate population. Mixed acini and areas of negative induction werw found in the region where the goands are contiguous. The possible existance of sex hormones supposed to account for sexual differentiation, and which may be produced by an interstitial gland, is discussed.

In Mytilus galloprovincialis, the major part of the gonad is located within the mantle, and looks like two wings emerging from a central boby placed inside of the visceral mass. Neither the color of the gonad's central boby, nor the color of the gonadic wings show a regular sex-linked variation in population, and therefore, do not provide satisfactory clues for sex diagnosis. Hence, an accurate individual sex determination involves the necesity of a microscopic examination of the scraping products, and even a thorough histological study is necessary if the gonads have been voided, or their regeneration has recently started.

During a previous more general study of the oogenesis carried out on bivalves (BANCU-1972), a surprisingly high frequency of intersexuate animals has been detected in Mytilus galloprovincialis, as

compared with the frequencies previously reported in the very rare publications treating this subject.

Materials and methods

142 Mytilus galloprovincialis individuals, collected at the Black Sea shore, as monthly samples, between June 1968 and May 1969, were grouped, as a function of their size (which varied from 3 to 7 cm) in four batches, without specification concerning the individual size. As the initial aim of our study was neither to investigate the incidence of hermaphroditism, nor to elucidate the differention process in goands, only partial samples of gonads have been drawn, i.e. fragments located within the left part of the mantle.

The specimens have been fixed in Bouin, embeded in paraffin wax, sectioned at 5 μ, and stained by hemalun-eosin sequence.

Results

Among the 142 investigated Mytilus individuals, variable degress of intersexuality were found in 3 animals, i.a. :

No. 150 (fig. 1-3) which has been collected Nov. the 30th 1968 in a sample consisting of 18 animals. It was a functional female classified in the 4-5 cm size group. The ovarian acini were filled with large oocytes and showed a very advanced maturation, as if they were preparing to begin the voiding. However, during the winter, oocytes are appearently never eliminated, so that degeneration by supermaturation and subsquently resorbtion seems to be the most plausible fate for these oocytes, and the most plausible explanation for the observed partly-lysed oocytes occuring in fused star-like agglomeration in some acini at the periphery of the mantle.

In the middle zone of the mantle, genuine testis acini, containing spermatocytes, spermatids, and spermatozoa, were appearent (fig. 1), as well as mixed acini, containing male cells in various degrees of maturation besides of small and very small oocytes (fig. 2). It is worth

to note the occurence of a large ovarian acinus, showing in its middle a bulky group or spermatozoa, fact which seems to prove the existence of a free communication between the ovarian acini and testis acini (fig. 3).

No. 154 (fig. 4-6) collected the same day, was also a female, from the 3-4 cm group, whose ovarian acini were in the same stage of maturation as those of no. 150, and which had in one of its mantle edges a group of compact testis acini, lacking the lumen (fig. 4), but showing a massive group of relatively large cells, with rich, faint basophylic cytoplasma, and large nuclei, containing a small amount of chromatin blocks, contrasting with heavy stained spermatocytes and spermatides nuclei (fig. 5). The nature and function of these cells are difficult to ascertain. They may be spermatogonia, although in this case their position in the middle of the acinus would be anomalous. But they may be also the remnants of the bulky groups of cells which proliferate after complete voiding of the gonad, in the connective tissue surronding the acini, and which sometimes protrude into their lumen. The nature of these last cells is also uncertain.

One acinus showed at its periphery a group of very small and flattened oocytes (fig. 6).

In both animals, 150 and 154, the ovarian acini located in the proximity of testis acini showed a high degree of delay in their maturation by comparison with distant acini. These acini contained only small and very small oocytes. Moreover the testis acini were delayed in their maturation as compared to the males collected in the same sample.

No. 583 (fig. 7) collected Apr. the 29th 1968 in a sample consisting of 13 animals, was a functional male belonging to 4-5 cm size group. The testis acini were mature. They showed large amounts os spermatozoa located in radial threads and very rare spermatocytes at the periphery of the acini. Appearently this animal was at the begining of the gamete emmission. In the middle of the mantle was found only one ovarian acinus containing small oocytes. The male acini surronding this ovarian acinus, were also delayed in their maturation.

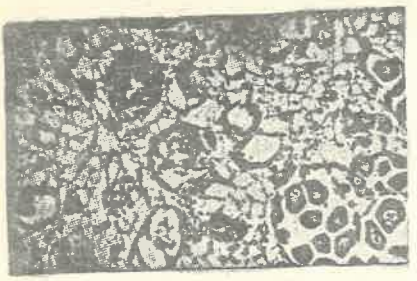

Fig. 1.

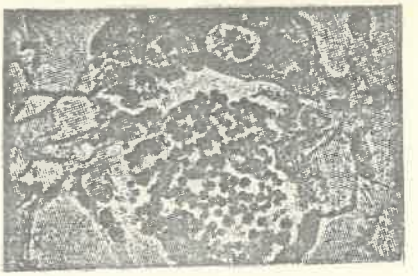

Fig. 2.

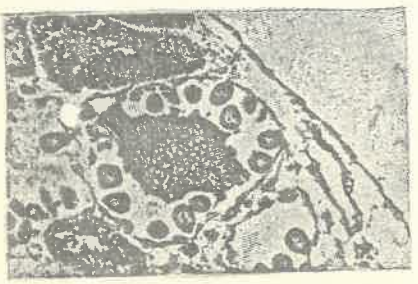

Fig. 3.

Fig. 4.

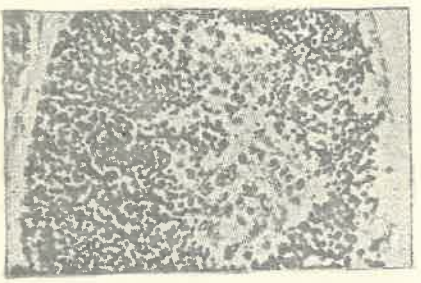

Fig. 5.

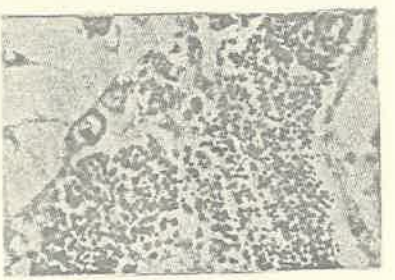

Fig. 6.

Fig. 7.

Discussion

The occurence of three intersexuate animals among the 142 studied means a percentage of 2,12% which seems surprisingly high for the genus Mytilus, concerning which CAHOUR and LUCAS (1968) reported values of only 0,114 % for M. galloprovincialis and 0,12% for M. edule (after LUBET, 1967, pers. com. to LUCAS), and 0,0125% for M. californianus (after YOUNG, 1941). Also a very low incidence has been reported in other gonochoric species as : 0,04% in Spisula solidissima (ROPES, 1968), 0,05% in Modiolus barbatus (CAHOUR and LUCA. 1968), about 0,06% in Placopecten magellanicus (MERRILL and BURCH, 1960), and 0,3% in Mya arenaria (COE and TURNER, 1938), but 4% in Dreissena polymorpha (ANTHEUNISSE, 1963). This last figure seems me anomalous high, because among 150 animals belonging to a D. polymorpha population from Snagov Lake, I found no one intersexuate by histological screening, although the distribution of males in various size classes suggested a male-female change of sex (BANCU, 1972).

It must be emphasised that the animals collected at Nov. the 30th 1968 belonged to a peculiar isolated population, fixed on a navy buoy, anchored at Midia Cape, in the northest end of Mamaia bay. The percentage of intersexuate in this sample was 11,1% (2 from 18). The animals collected Apr. the 29th 1969 come from a population attached to the landing stage of Mamaia beach, the percent of intersexuate being 7,7% (1 from 13). In both instances the original populations were isolated in the middle of sand ground of Mamaia bay, outside the normal life areal of M. galloprovincialis. In the samples collected from the rocky sea bottom running along the front of Tăbăcărie beach, no intersexuate were found so that the posibility that isolation of one small population may favour a rise in the incidence of the intersexuality cannot be disregarded.

The presence of mixed acini, as well as the existence of a region of reciprocal negative induction between both gonads (each one delaying the maturation of the other one) have also to be emphasised. These finding suggest the existence in bivalves of one, or more, sex hormones, displaying a more or less local activity, accounting for sexual

differentiation, in addition to the well known neurosecretion which controls only the rate of gamete maturation and emission (LUBET, 1955; ANTHEUNISSE, 1963). The finding of large groups of cells, reseambling in some respects to the vertebrate interstitial glands, argues in favour of this hypothesis. These cells may represent a true interstitial gland, producing sex hormones with a local action, however, a more precise definition of their role will be rendered possible only by thorough subsequent investigation. Acknowledgements The author is greatly indebted to Dr. M. T. Gomoiu for his generous aid in providing animals for this study.

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