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Hermaphroditism in Carunculina parva, a Fresh Water Mussel*

William C. Tepe

In 1898, Victor Sterki published the results of a study of sexuality in fresh water mussels in which he recorded the occurrence of a single individual of *Carunculina parva* which contained "a goodly quantity of sperm besides ova in abundance." In this early mention of hermaphroditism in this species, no details regarding the nature of the individual gonad follicles are recorded. At a later date Utterback (1916:165) wrote of *C. parva*: "Hundreds have been collected in nearly all the northwest Missouri lakes and streams, but not a single one has been found without the marsupial character of the gills and the sexually dimorphic female shell. However the male and female shells appear in central Missouri." Here again no further details are given, and it seems conclusive that Utterback's statement was based on an examination of the secondary sexual characters and did not involve analysis of the gonad tissues.

The present writer has been unable to locate any other direct reference to hermaphroditism in *C. parva*. In the description of this species in Baker's Mollusca of Wisconsin (1928:253), the author cites Utterback's statement that *C. parva* is "locally hermaphroditic" but adds no further comment.

The availability of a series of young stages of *C. parva* in the Salt Fork of the Vermilion River near Homer, Illinois, gave opportunity to study the gonads of this species in considerable detail. On June 23 and June 30, 1942, collections were taken which formed the basis of the present study. Five individuals varying in shell length from 12 mm. to 21 mm. were carefully removed from the shell and were fixed in alcohol-formol-acetic killing solution. These mussels were small enough to be embedded entire and sectioned serially at a thickness of 8 or 10 microns. They were stained in Heidenhain's iron hematoxylin.

A preliminary study revealed that the gonads of all five specimens of *C. parva* contained both eggs and spermatozoa. On closer observation it was found that the hermaphroditic condition was not one of complete balance, with equal proportions of male and female follicles, but that in every case the ovarian follicles far outnumbered the male follicles. In all the specimens the gonad tended to show a division into a large posterior-ventral region composed wholly of ovarian follicles and a much smaller anterior-dorsal region composed of sperm-bearing follicles. In Figure 1, although the orientation of the section is not perfect, male follicles are observable on the right of the photograph and female follicles on the left.

* A contribution from the Zoological Laboratory of the University of Illinois, Urbana, Illinois.

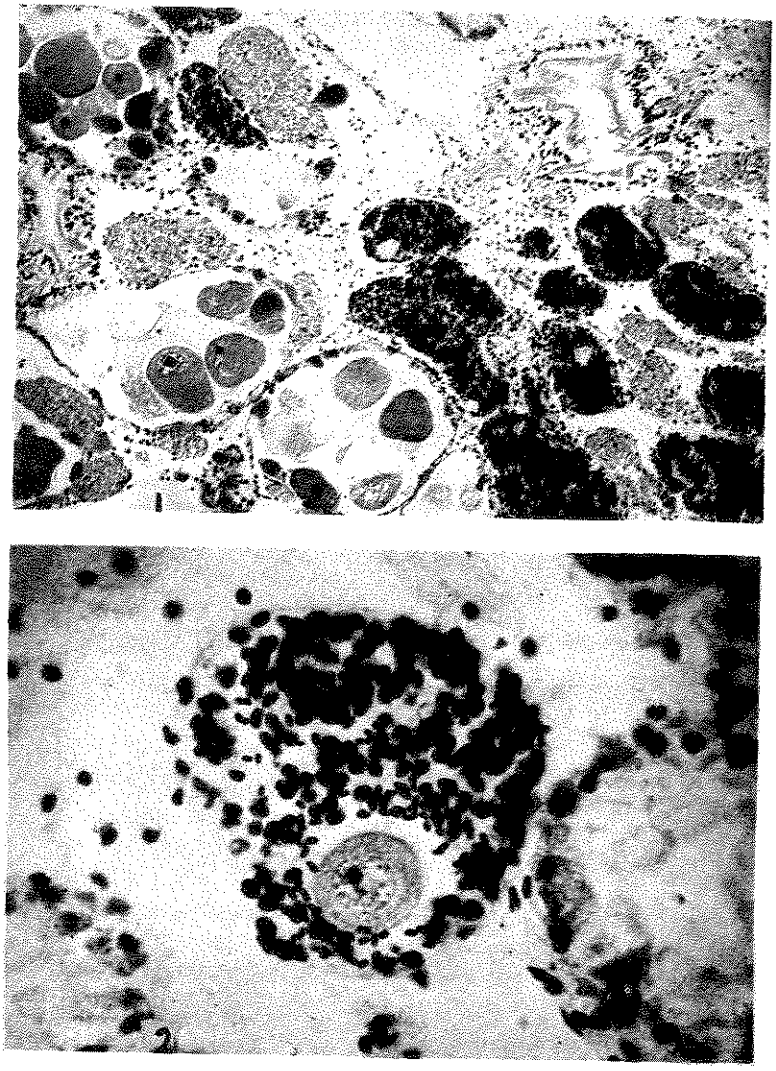

Fig. 1. Section through a typically hermaphroditic gonad of *Carunculina parva*, showing male follicles to the right and female follicles at the left. The gonad duct, in section, shows near the upper right of the photograph. Magnification, about 100 diameters.

Fig. 2. Section through a preponderantly male follicle containing a single egg. Magnification, about 575 diameters.

iroditic gonad of *Carunculina parva*, llicles at the left. The gonad duct, in ph. Magnification, about 100 diameters.

follicle containing a single egg. Mag-

Contrary to the findings of van der Schalie and Locke (1941), in their studies of *Anodonta grandis* and *A. imbecillis*, in four of the five individuals of *C. parva* under observation some follicles were found containing products of both sexes. Only one reference to the occurrence of hermaphroditic follicles has been found in the literature. Bloomer (1939:297) recording the results of studies on *Anodonta cygnea*, a European species, states:

> An examination of the sections of the gonads.... has not, with some doubtful exceptions.... revealed male and female products in the same acinus—usually each acinus produces either spermatozoa or ova.
>
> The doubtful exceptions are:—in some individuals, parts of the sections made during the autumn and winter months have what appear to be degenerate ovarian products and sperm morulae, sometimes sperm as well, in the same acinus; in several River Frome individuals.... parts of the sections show one or more ova nearly if not quite encircled by spermatozoa and sperm morulae, and in one section spermatozoa and sperm morulae in the center of ovarian products.

A typical example of the hermaphroditic follicles found in *Carunculina parva* is shown in Figure 2, a photograph of a section through a predominantly male follicle bearing fully mature sperm and a single egg. This particular follicle was located far toward the anterior-dorsal part of the gonad tissue and lay in contact with other male follicles and with the posterior lobes of the liver.

In most instances it was observed that the eggs enclosed in male follicles were smaller (20-24 microns) than eggs from strictly female follicles (40-100 microns). The eggs in essentially male follicles were free from the germinal epithelium, and their small size does not seem to indicate relative immaturity. Both eggs and spermatozoa appeared mature in all the individuals, which would seem to indicate that this hermaphroditic condition does not represent a phase in a periodic sex reversal.

The author wishes to thank Professor H. J. Van Cleave of the University of Illinois for the invaluable advice and criticism offered throughout these studies. Dr. Henry van der Schalie very kindly identified the mussels which formed the basis of this study.

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