THE VALVULAR MEMBRANE IN YOUNG MACTRID CLAMS, *SPISULA SOLIDISSIMA*

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ABSTRACT

Juvenile surf clams, Spisula solidissima, *were reared from fertilized eggs in the laboratory. Observations were made of the appearance and activity of the valvular membrane (primary exhalant siphon), which has not previously been reported in recently-metamorphosed animals.*

The siphonal system of the bivalve mollusks has been considerably studied. Aspects of mantle fusion in the Lamellibranchia and the subsequent formation of siphons from the mantle folds were described in detail by Yonge (1957). Development of siphons in the evolution of the lamellibranchs enabled this group of animals to live in the shelter of a substrate while obtaining food and oxygen from the water above the substrate (Yonge, 1957).

In discussing the types of siphon systems,

FIG. 1. *Juvenile* Spisula solidissima *with the valvular membrane, or exhalant siphon, (on the left) fully extended to a length of 1.5 mm.*

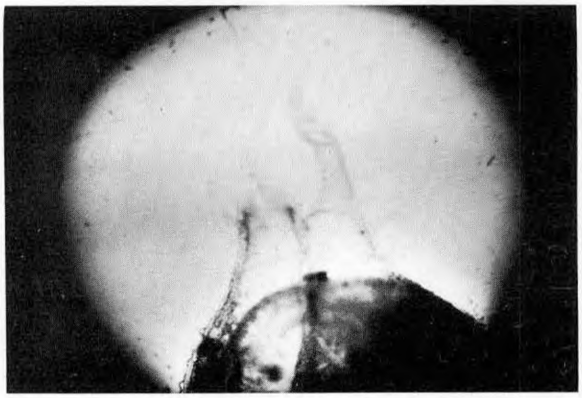

FIG. 2. *Juvenile* Spisula solidissima, *valvular membrane (on the right) collapsed but not inverted within shell.*

Yonge ascribes to the Mactridae what he terms a "type C" siphon system. In this type the opening of the definitive exhalant siphon is usually bounded by a valvular membrane (a narrow flange just inside the ring of tentacles) which, when open, controls and directs the flow of water from the exhalant siphon. However, he does not illustrate this structure in any of the Mactridae, nor does he show how this structure is formed in the young of the Mactridae. Prior to development of the definitive siphonal system in many recently metamorphosed Lamellibranchia a precursor of the definitive exhalant siphon, a valvular membrane or primary exhalant siphon is formed (Quayle, 1952; Carriker, 1961).

The presence of the valvular membrane in newly metamorphosed *Spisula solidissima* has been recently observed by the author. There was no question as to the identity of these young surf clams since they were reared from fertilized eggs spawned in the laboratory. The presence of this structure and its appearance may serve as an aid to identification of young juvenile surf clams gathered in the field.

Photographs were made approximately one month after metamorphosis; the size range of the young clams then ranged from 0.5 mm to 3.0 mm. Photograph #1 shows the siphons of a young clam 1.5 mm long. Here the valvular membrane is fully extended. Photograph #2 shows the valvular membrane in a state of collapse and dangling externally; this clam is also 1.5 mm long.

One should notice that the state illustrated in these photographs is an advanced one, in that juvenile *Spisula solidissima* of this size have already developed the inhalant siphon with its ring of tentacles, and the tentacles of the exhalant siphon have also begun to form. These structures are formed subsequent to the development of the valvular membrane.

The valvular membrane was observed to be an extremely flexible and active structure. It was rapidly extended when the young clam was pumping water through the mantle cavity, and rapidly withdrawn or inverted within the mantle cavity when the clam was disturbed.

The presence of such a "filmy membrane" on the excurrent siphon on young clams, which moved in and out with a folding motion and was held out as a hose to direct flow of water from the exhalant opening, was described in *Mercenaria mercenaria* by Belding (1912). Carriker (1961) has subsequently described in some detail the development of this membrane in young *Mercenaria mercenaria* ranging from 210 to 300 μ.

The valvular membrane of recently metamorphosed bivalve mollusks appears to function to deflect the excurrent and incurrent streams during the period of definitive siphon formation. The same function would be served in later life by the slight offset of the tips of the siphons and the smaller exhalant siphon orifice (Carriker, 1961). In describing a similar membrane in young *Mya arenaria* and *Venerupis pullastra,* Quayle (1952) reported the function of this structure to be one of keeping the mantle and gills free of feces by directing them away from the vicinity of the young animal.

Since siphon formation takes place considerably after metamorphosis and the loss of the velum, there is a sedentary phase prior to the time when the siphons are formed and the animal is able to enter the substrate (Carriker calls this the byssal plantigrade). He believes it probable that young byssal plantigrade *Mercenaria mercenaria* cannot burrow until the ring of tentacles is available on the inhalant siphon to exclude sedimentary grains. This is most likely true for other lamellibranchs that also live in soft substrates, including the *Spisula solidissima* described here.

LITERATURE CITED

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