



The morphology of brooded larval shells in *Kellia suborbicularis* (Montagu, 1803) (Bivalvia: Galeommatoidea: Kelliidae)

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ABSTRACT The larval morphology of the prodissoconch I of a Mediterranean specimen of *K. suborbicularis* (Montagu, 1803) is for the first time investigated with the scanning electron microscope, thanks to the finding of a brooding adult specimen. The size of the Mediterranean *K. suborbicularis* larvae is larger than that from the Atlantic, even if the "late brooding-" or "releasing-time" seems to be the same in the two regions (October). No other ecological or morphological differences were observed in the adult life. Only the study of more conspicuous material both from the Atlantic and the Mediterranean Sea will allow to interpret the observed discrepancy.

RIASSUNTO La morfologia larvale della prodissoconca I di un esemplare mediterraneo della specie *Kellia suborbicularis* (Montagu, 1803) viene illustrata per la prima volta con foto al microscopio a scansione grazie al ritrovamento di un esemplare adulto incubante. La taglia delle larve mediterranee di *K. suborbicularis* è più grande di quella dell'Atlantico, anche se il tempo di rilascio delle stesse sembra essere lo stesso nelle due aree (Ottobre). Non è stata notata alcuna differenza nell'ecologia o nella morfologia dell'adulto. Solo attraverso l'esame di più materiale proveniente dall'Atlantico e dal Mediterraneo si potrà eventualmente interpretare la differenza osservata.

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INTRODUCTION

Kellia suborbicularis (Montagu, 1803) is a small free-living bivalve which can be found in crevices or holes both on hard or soft substrata (POPHAM, 1940). It has two complete demibranchs on each side (ATKINS, 1937), which are known to host, during breeding, myriad of larvae (DEROUX, 1961). It is supposed to be a protogynous hermaphrodites by OLDFIELD (1961; 1964), but OCKELMANN & MUUS (1978) do not share this opinion.

In Galeommatoidea brooding behaviour is frequent (PONDER, 1998) and show a tendency towards lecithotrophy and ovoviparity (CHANLEY & CHANLEY, 1970).

Among the Mediterranean bivalves brooding behaviour is known for *Lasaea rubra* (Montagu, 1803), *Tellimya phascolionis* (Dautzenbergh & Fisher H., 1925), *Tellimya ferruginosa* (Montagu, 1808), *Mysella bidentata* (Montagu, 1803) and *Kellia suborbicularis* (Montagu, 1803) (Deroux, 1961).

This phenomenon is especially remarkable in *T. ferruginosa* and *K. suborbicularis*, due to the very great amount of retained larvae (DEROUX, 1961); the last species embryos are then released as bivalved veliger (OLDFIELD, 1964) mainly in September-October (LEBOUR, 1938). Embryos of *K. suborbicularis* are known to be too small to be easily studied (OLDFIELD, 1964); in this work we document its "prodissoconch I", with the help of SEM photography.

MATERIALS AND METHODS

One specimen of *Kellia suborbicularis* (Montagu, 1803) brooding embryos was collected on October 1984 during the Bannock cruise in the Pontine Islands (South Tyrrhenian Sea), Station 49 (40°55.09' N, 13°00.36' E; 71 m depth).

Samples were collected by a Van Veen grab and sieved with a 2 mm mesh net. The bottom sediment was composed by gravelly sand with abundant shell debris.

Shelled embryos were dissected out from the gills; their prodissoconchs and the adult shell were polished with oxygen-peroxyde, dehydrated in alcohol then sputtered with gold for Philips E 515 SEM observations.

RESULTS

The larval shells extracted from the gill pouches are "D" shaped and measure about 103-104 µm in length and 66-69 µm in height. The hinge margin is straight and there are no signs of denticles. The sculpture is formed by a coarse texture of rounded depressions, more marked along the ventral margin (Figs. 1-4). Larval shells are only vaguely umbonate in respect of LEBOUR's (1938) specimens (Figs 7-9).

The shell of the brooding adult resulted partially damaged by the sampling activities. This lead on one hand to discover the brooded embryos, but, on the other hand, made the estimation of the approximate number of them impossible, due to the loss of an unknown number of larval shells. The hinge of the brooding adult is reported in Fig. 5 and 6.

DISCUSSION

Brooding behaviour is positively selected whenever it is necessary to concentrate the hatching event in space or time.

In Galeommatoidea the larval development could be direct or indirect (PONDER, 1998). All the species however, retain their larvae into the mantle cavity until at least the shelled prodissoconch stage, the larvae being released to develop further in the plankton (PONDER, 1998). For many species the peak of the release of larvae occurs during the summer months, but other species release larvae intermittently throughout the year (BOOTH, 1979). *K. suborbicularis* adults with developing eggs in the gills, are known to occur in the Plymouth area, in May, July and August, while shelled veliger larvae are

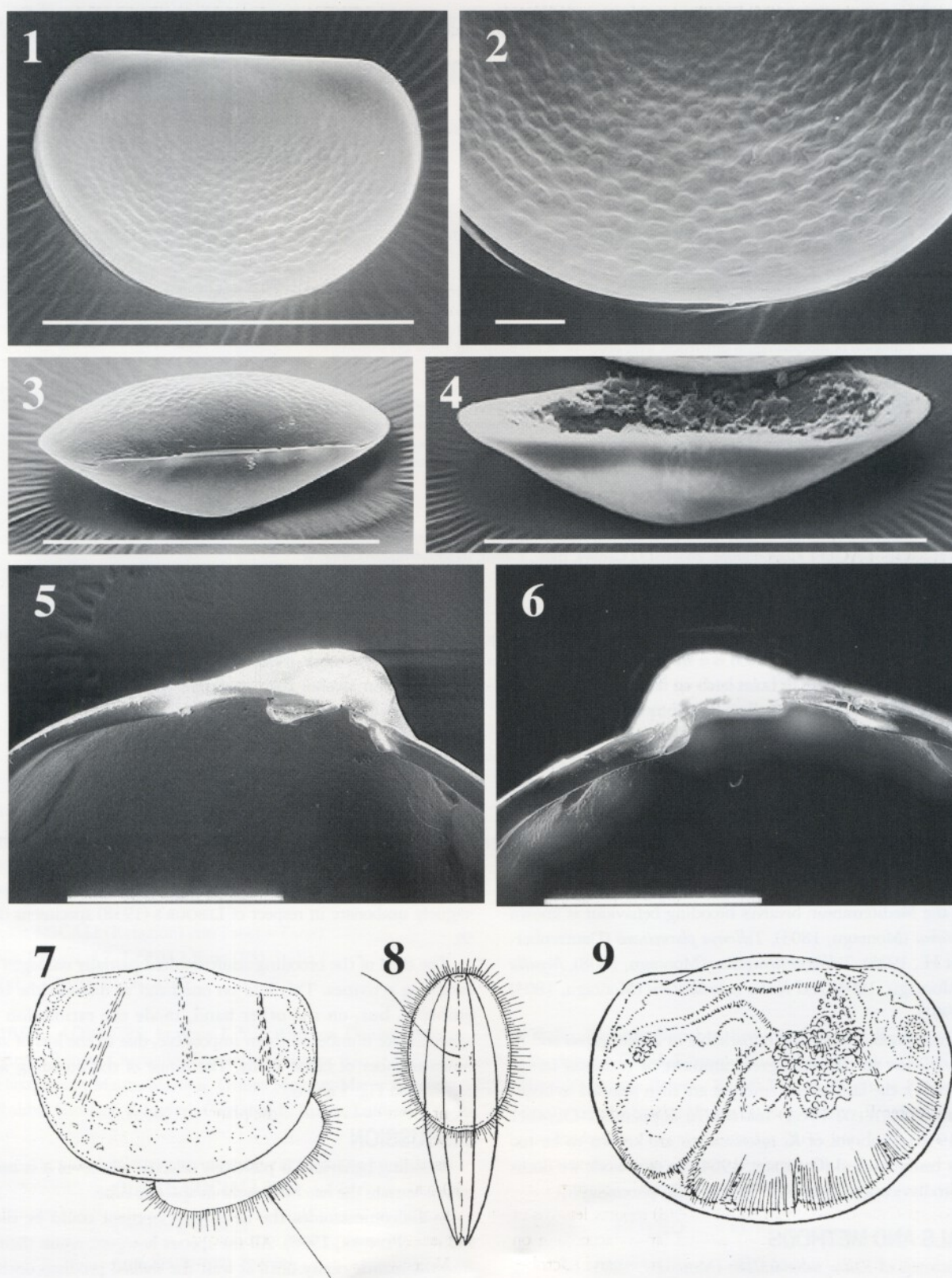


Fig. 1: *K. suborbicularis* "D" shaped brooded larvae. 1 – The entire larval shell (scale bar: 100 µm). 2 – Particular of the riddled surface near the ventral edge (scale bar: 10 µm). 3 – View of the larva from the dorsal margin, with the hinge in evidence (scale bar: 100 µm). 4 – Same view of a single valve (scale bar: 100 µm). 5 – View of the hinge of the left valve of the brooding specimen (scale bar: 1 mm). 6 – View of the right valve hinge (same scale). 7 – Lebour's (1938) original figure of a newly extruded larva (September; 64 µm in length). 8 – The same, ventral view. 9 – Lebour's (1938) original figure of a veliger one day after extrusion (October; 80 µm in length).



Genus or species	Author	Dimensions at hatching (prodissoconch I)	Larvae released as:	Reference
Family: GALEOMMATIDAE				
<i>Galeomma turtoni</i>	Turton, 1825	70 µm (trochophores ?)	Early shell-less larvae	LEBOUR, 1938
Family: KELLIIDAE				
		64-80 µm (length)	Shelled Veliger larva at hatching	LEBOUR, 1938 (Plymouth)
<i>Kellia suborbicularis</i>	(Montagu, 1808)	110 µm (length) 160 µm (length)	After 14 days After 3 weeks	
<i>Kellia suborbicularis</i>	(Montagu, 1808)	300-370 µm (length) 103-104 µm (length) 66-69 µm (height)	Veliger ready to metamorphose Still brooded larvae	Present study (Mediterranean)
Family: LASAEIDAE				
<i>Lasaea rubra</i>	(Montagu, 1803)	600 µm	Adult miniature	LEBOUR, 1938
Family: MONTACUTIDAE				
<i>Tellimya ferruginosa</i>	(Montagu, 1808)	140 µm (length) 150 µm (length)	Veliger larva Late Veliger larva	LEBOUR, 1938 LEBOUR, 1938
<i>Mysella bidentata</i>	Montagu, 1808	127-148 µm (length) 93-115 (height)		OCKELMAN & MUUS, 1978
<i>Tellimya phascolionis</i>	(Dautzenberg & H. Fisher, 1925)	————	Adult miniature	OLDFIELD, 1961
<i>Epilepton clarkiae</i>	(W. Clark, 1852)	————	Adult miniature	PEELSENER, 1925

Tab. 1. Main dimensional values of some *Galeommatoidea prodissoconchs*.

emitted from September to October (LEBOUR, 1938). Since the larvae of this species can be found in the plankton in any month of the year, but especially in summer and early autumn, the breeding season appears to be spring-summer and early autumn, with occasional larvae in the winter (LEBOUR, 1938). LEBOUR (1938) reports lengths of 64-80 µm for *K. suborbicularis* released shelled larvae, according on the month at which they were released (September and October respectively) (Tab. 1).

The *K. suborbicularis* brooded larvae from Bannock expedition had complete larval shells, and thus were probably near to be released in the plankton. Their size however, 103-104 µm in length and 66-69 µm in height, results to be larger than that reported in the Atlantic for yet released larvae and more similar to the one of larvae which

spent about two weeks in the plankton (Tab. 1).

Lecitotrophy has to be excluded, among Mediterranean populations of *K. suborbicularis*, since their larval size being smaller than 230-500 µm (typical of prodissoconchs I without planctonic phase; JABLONSKI & LUTZ, 1980) undoubtedly ascribe these brooded larvae to planktotrophic or lecithotrophic veligers.

Moreover, lecitotrophy occurs in Galeommatoidea only when a specialised commensal adult ecology is employed. Among Mediterranean Galeommatoidea in fact, this behaviour is known only for *Tellimya*, *Mysella*, *Epilepton* and *Hemilepton* (review in BOSS, 1965), but not for *Kellia*.

No data concerning latitudinal shifts in the larval strategies are available for these small bivalves and, in the absence of more nume-



rous living-collected specimens to study, the interpretation of the different sizes between Mediterranean and Atlantic *K. Suborbicularis* larval shells remains open.

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