

NOTE ON *CAPULUS UNGARICUS* (L.)

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(Text-figs. 1-3)

The marine gastropod *Capulus ungaricus* (L.) is found on rocks and shells, and is known often to associate with filter-feeding lamellibranchs, particularly frequenting beds of *Pecten maximus* (L.), *Chlamys opercularis* (L.) and *Modiolus modiolus* (L.). It has also been found on the shells of living *Turritella communis* Risso (Jones, 1950, unpublished) and on the superior part of the calcareous tubes of *Protula intestinum* Lam. (Lo Bianco, 1888).

Capulus itself is well known to be a ciliary feeder, and its feeding mechanism has been described by Orton (1912) and Yonge (1938). Observation of the site of several specimens on the shells of living lamellibranchs, together with the fact that the gastropod possesses a long mobile proboscis capable of great extension, led Orton (1949, 1950) to suggest that *Capulus* might also be 'semi-parasitic' on lamellibranchs, from which it could collect food by inserting the proboscis inside the bivalve shell and reaching the food in the food-grooves on the gill lamellae or on the recurrent ciliated path along the edge of the mantle. Living material was therefore collected and observed in the hope of obtaining further evidence as to the truth of this suggestion.

Twenty-nine attached specimens were obtained from off the south coast of the Isle of Man, mostly by dredging from the local beds of scallops, queens and horse mussels. Twenty-two were on the shells of living lamellibranchs, one was close to the aperture of a tube of *Pomatoceros* on the shell of a living *Chlamys opercularis*, two were on empty shells, the valves of which were still attached to each other, and four on the outer surface of single valves.

The position on the valve was recorded for twenty-six individuals, of which twenty-three were situated as previously described by Orton (1949). In its characteristic position the gastropod sits at the edge of the valve with the front margin of the shell projecting a little over it and the apex pointing inwards (Fig. 2A, C). Fig. 1 shows the sites of *Capulus* found on *Chlamys opercularis*. More *Capulus* were on the right valve, which is the flatter of the two and lies undermost when *Chlamys* is living, than on the left. The majority had attached themselves to the anterior half of the margin of the valve, only three out of fifteen being on the posterior side; the smallest of these was that situated by the aperture of a *Pomatoceros* tube, partly on the *Chlamys* and partly on the tube itself, and the other two were on single valves. None have yet been found on the posterior auricle. The numbers are few, but suggest a possible prefer-

ence for the anterior edge from the auricle and byssal notch round the ventral curve of the margin. Thus almost all the *Capulus* were on that part of the circumference of the valve where the wide inhalant current of *Chlamys* would be operative and away from the powerful exhalant current which goes out posteriorly over a more restricted region. *Capulus* on *Pecten maximus* (Fig. 2C) and *Monia patelliformis* (L.) were similarly placed. On *Modiolus modiolus*, *Capulus* were on the ventral edge, above or posterior to the emergence of the byssus, again away from the exhalant current (Fig. 2A).

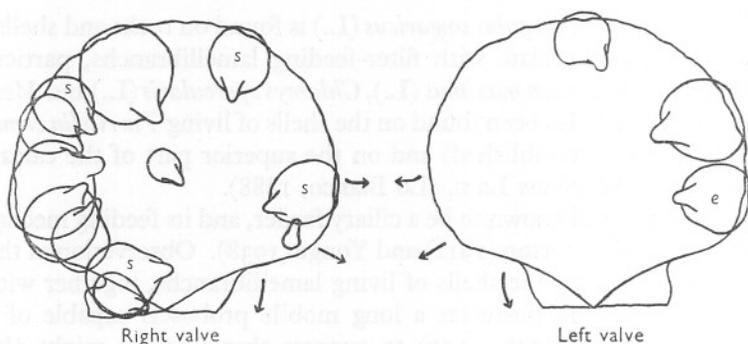


Fig. 1. Composite diagram showing positions of *Capulus ungaricus* on *Chlamys opercularis*. *e*, on empty shell, the valves of which were still attached to each other; *s*, on single valves. Otherwise on shells of living *Chlamys*. Arrows show direction of outgoing currents of *Chlamys*.

When *Capulus* is removed from its attachment, the site often displays a scar which may vary from just a cleaner patch, the sculpture of the valve being unaffected, to a well-defined, almost circular mark with a grooved margin within which the sculpture of the valve is destroyed (Fig. 2B). The circumference of the scar corresponds to that of the aperture of the animal's shell, and the grooved margin sometimes found suggests that the edge of the calcareous part of the shell works on the valve and mechanically produces the groove. The shell of *Capulus* has a fringed periostracum prolonged well beyond the calcareous edge, and this border fits closely on to the undulations of the valve beneath, except at the anterior margin, where the shell projects a little beyond the edge of the valve. In this region there is often a semi-lunar gap in the valve edge, as was first noticed by Orton (1949) in the case of a single specimen on *Monia*. It is sometimes difficult to assess the genuineness of this gap, as *Capulus* on a ribbed shell may be so placed that the mid-anterior margin is opposite a ridge on the outer surface, i.e. opposite a natural inward undulation of the valve, and valves are often chipped. But in some cases the outer layers of the shell are recessed farther back than the inner, which suggests that the *Capulus* itself was responsible for the gap rather than that it settled, by preference or chance, over such a gap already there. In this

connexion I have once seen a *Capulus* remove a piece of shell from the edge of a *Pecten* valve by means of its radula.

The majority of those *Capulus* which had been settled sufficiently long to leave a scar had shown no change in position when kept in sea water in aquarium tanks for periods of up to 3 months, but some power of movement

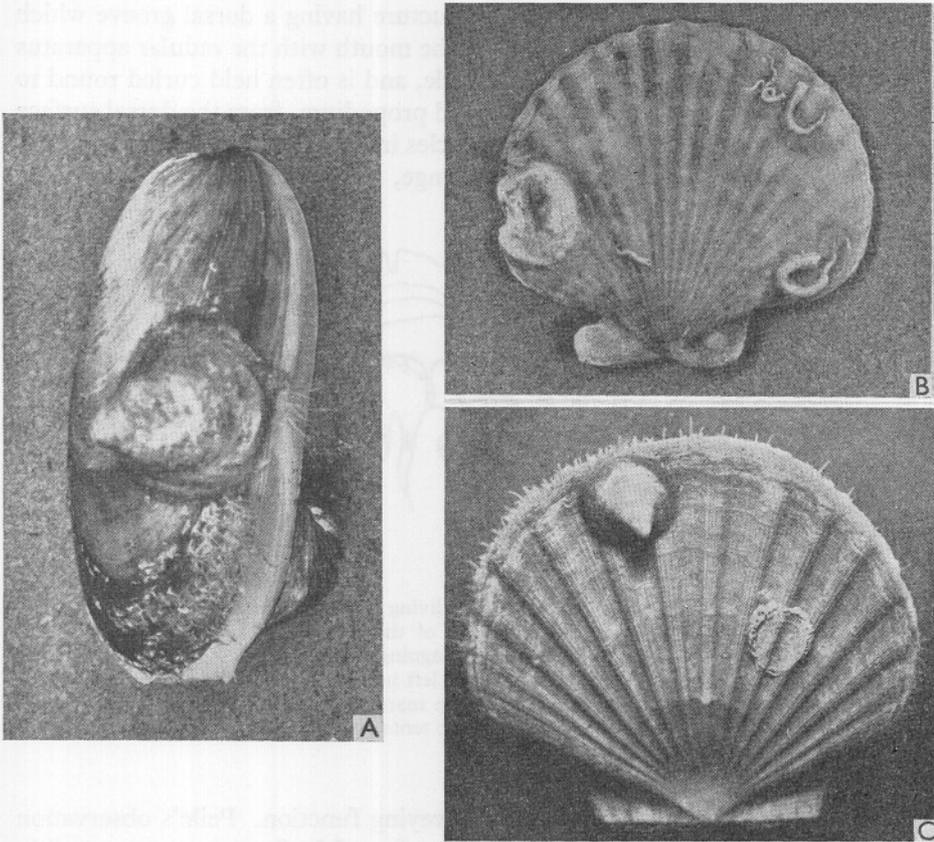


Fig. 2. A: two *Capulus ungaricus* on the shell of a living *Modiolus modiolus*, one on each valve: length of *Modiolus* shell, 62 mm. B: scar left by *Capulus ungaricus* on shell of *Chlamys opercularis*: the shell of the *Chlamys* measures 77 mm from apex to mid-ventral margin. C: *Capulus ungaricus* on the shell of a living *Pecten maximus*: the shell of the *Pecten* measures 120 mm from apex to mid-ventral margin.

is retained; an animal 39 mm in length, the largest found, was able when freed from its attachment to climb up the side of its container for a short distance, and while some of the smaller ones revealed evidence of long settlement others frequently moved off their attachments, leaving no scar, or were brought up free in the dredge.

From this it would appear that while after metamorphosis there is a mobile phase during which the animals crawl actively on the substrate, they tend to settle and remain in later life on the shells of ciliary feeders in a position which would give them the opportunity of using the proboscis to collect food as previously suggested.

The so-called proboscis is in fact a prolongation of the lower lips of the animal to form an almost cylindrical structure having a dorsal groove which runs longitudinally from the soft tip to the mouth with the radular apparatus at the base. The proboscis is not eversible, and is often held curled round to left or right and hidden between head and propodium, from the dorsal surface of which it is stated to take up food particles in mucus, brought thither by the animal's own ciliary feeding currents (Yonge, 1938). According to Yonge, the

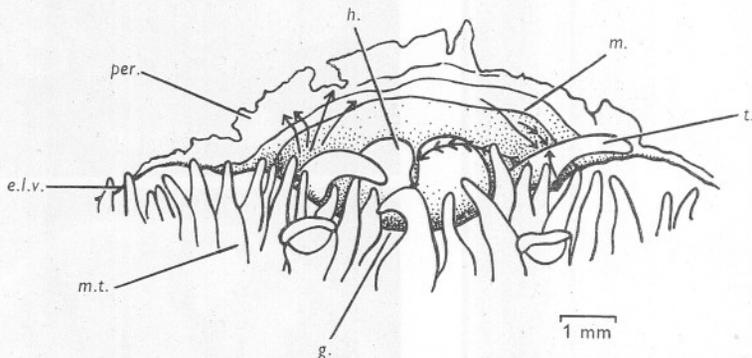


Fig. 3. *Capulus ungaricus* attached to shell of living *Chlamys opercularis*. Right valve of *Chlamys* removed and corresponding lobe of the mantle and gill reflected. Arrows indicate the directions of the ingoing and outgoing currents of *Capulus*, and continuous arrows a string of particles passing over the left head lobe to the mouth. *e.l.v.*, edge of left valve of shell of *Chlamys*; *g.*, gap in the margin of the *Chlamys* valve; *h.*, head of *Capulus*; *m.*, mantle of *Capulus*; *m.t.*, mantle tentacles of *Chlamys*; *per.*, periostracum of *Capulus*; *t.*, cephalic tentacle of *Capulus*.

radula appears to have essentially a conveying function. Peile's observation (1937) that the teeth are slightly blunted in a few of the front rows may possibly be correlated with the formation of the gap mentioned above. On one occasion, when suspended particles of carmine were being used to demonstrate the ciliary currents of a *Capulus* attached to *Chlamys*, the lips diverged and the radula was seen, appearing to grasp a string of particles as does that of *Crepidula fornicata* (L.), but also the string of particles appeared at one time to go smoothly into the mouth, without the emergence of the radula. Fig. 3 shows a sketch made on this occasion; one valve of the *Chlamys* had been removed, and the corresponding lobe of the mantle reflected. The head and cephalic tentacles of the *Capulus* can be seen in the gap between the two shells, over which gap the mantle tentacles of the *Chlamys* partially extend. The

arrows indicate the directions of the inhalant and exhalant currents of the *Capulus*, as far as they could be seen in this view, and the string of particles passing into the mouth. The current of the *Capulus* also drew down particles from the region of the mantle tentacles of the *Chlamys*.

From such a position the proboscis could be inserted between the valves of a feeding lamellibranch, and in fact has now been observed to be so inserted in the case of a *Capulus* on the shell of a living *Chlamys opercularis*. The proboscis was seen on four occasions to be extended through the gap, over the edge of the *Chlamys* valve, and in between the margins of its velum. It therefore seems clear that *Capulus* may feed on those planktonic constituents already collected by the *Chlamys* on which it sits. The relationship appears, however, to be facultative. Not only have *Capulus* lived for many weeks on single valves in the aquaria at Port Erin and Cullercoats, where their only source of food would be those particles collected by their own ciliary feeding mechanism, but also they have been regularly brought up on rocks and stones in regions off the Northumberland coast where their usual bivalve 'hosts' are scarce (Dr H. O. Bull, personal communication).

As regards the effect on the bivalve, the probable removal of some of its food supply has no obvious detrimental effect, for *Pecten*, *Modiolus* and *Chlamys* bearing *Capulus* have lived for months in aquarium tanks. The velum and velar tentacles of *Chlamys* did not appear to be affected in any way by the insertion of the proboscis, which did not even cause them to retract.

This work was carried out while holding a Herdman Studentship of the University of Liverpool.

SUMMARY

Capulus ungaricus on the shells of living lamellibranchs occupies a characteristic position, at the edge of the valves, away from the exhalant current, and with the anterior margin overlying the valve edge. The valve is scarred by the continued presence of the gastropod and the site of the latter is often associated with a semi-lunar gap in the valve edge.

Insertion of the proboscis of *Capulus* through this gap and between the vela of *Chlamys opercularis* has been observed, thus strongly supporting Orton's suggestion that the gastropod might utilize its position to become semi-parasitic. The association appears to be facultative and to have no obvious detrimental effect upon the 'host'.

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