The Life-Histories of *Cerithiopsis tubercularis* (Montagu), *C. barleei* Jeffreys and *Triphora perversa* (L.).

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With Plates 1–2.

THE life-histories of the two species of Cerithiopsis are described here for the first time, that of *Triphora perversa* is partly known already. All three species are common in Plymouth and their larvæ are very common in the plankton in spring and summer. Pelseneer (1926) has described the eggs and newly-hatched larvæ of *Triphora perversa* from the Brittany coast and Fischer (1884) has noted that it has a very long free-swimming life, still being a veliger with up to 7 or 8 whorls. The eggs of *Cerithiopsis barleei* have now been found at Plymouth and the larvæ reared as far as a stage just before settling down, the late stages from the plankton being reared to the crawling stage in plunger-jar. The eggs of *Cerithiopsis tubercularis* have not yet been seen, but the larvæ are common in the plankton and the late larvæ have also been reared in a plunger-jar until the crawling stage.

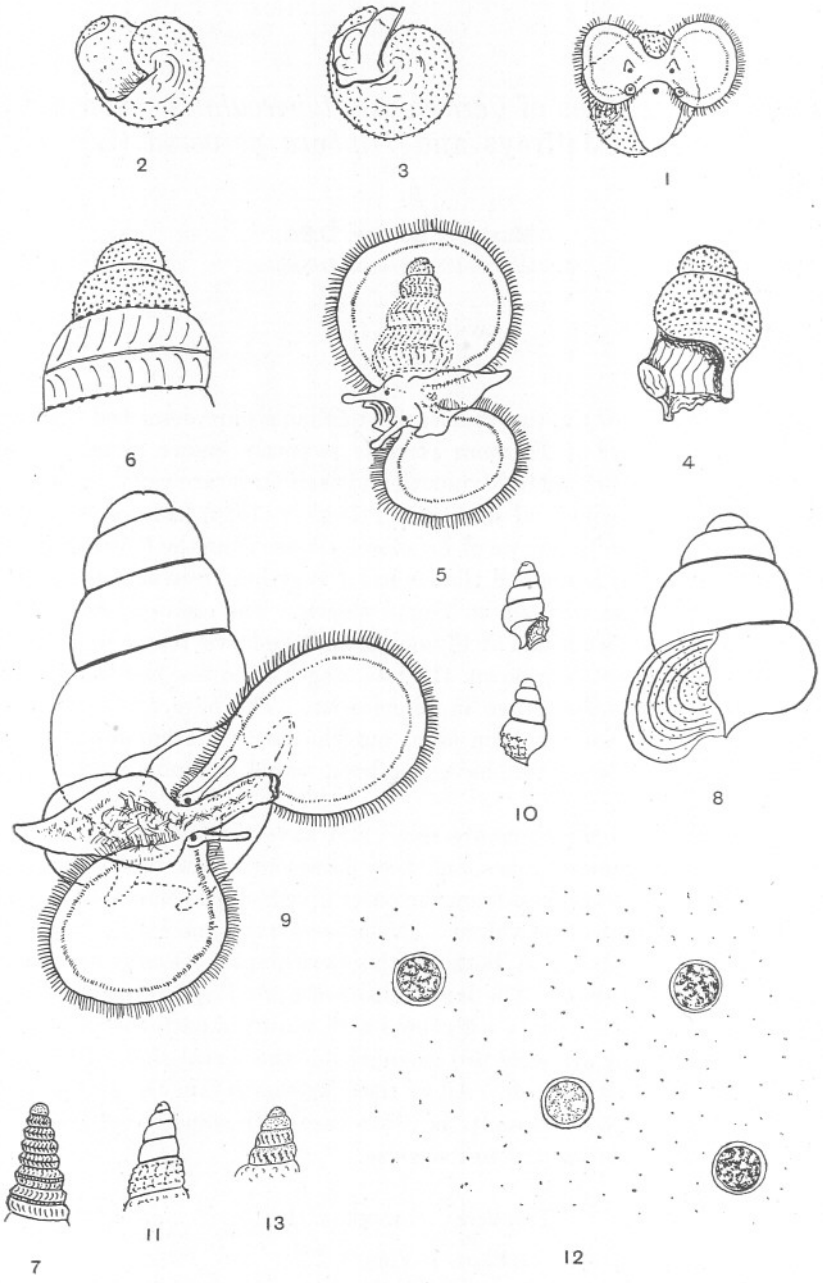
The larvæ of all the three are small and have the velum bilobed and colourless with rounded lobes, and they have one character in common which is the marked process from the outer lip which projects between the outer marginal lobes of the velum. This process is less marked in Triphora, but is peculiarly large in both of the Cerithiopsis species, especially *Cerithiopsis tubercularis*. The larval shells of both *Triphora perversa* and *Cerithiopsis barleei* are finely sculptured with beautiful patterns for several whorls so that they are easy to recognise, but the larval shell of *Cerithiopsis tubercularis* is smooth. All of these species retain the larval shell as the apex and do not lose it, as is the case with some turreted shells, thus making the larvæ easy to recognise.

TRIPHORA PERVERSA (L.).

(Plate 1, Figs. 1–7.)

Fairly common both in the Sound and outside ; occasionally in deeper water. Those from inshore are usually found in crevices of rock, on bryozoa

PLATE 1.



or in sponges and are inconspicuous and easily passed over. The larvæ are common in spring and summer, especially summer, both inside and outside the Sound. Even as far out as Station E1, fourteen miles from Plymouth, they are abundant. All stages from the newly hatched larvæ to those with six or seven whorls are found in the plankton, but the eggs have not yet been obtained at Plymouth although adults have been kept for months in plunger-jars. They apparently feed on debris which has accumulated in the jars for no special food was given to them. Pelseneer (1926) found the eggs laid on old shells at Roscoff and describes these and the newly hatched larvæ and figures the latter. They are laid in gelatinous capsules and the larvæ hatching from them are tiny sinistral molluscs with one whorl. He does not mention any sculpture on the shell, but those from Plymouth, obviously only a day or two old, were sculptured with fine dots. *Triphora perversa* is truly sinistral in both animal and shell, and therefore easily recognisable in all stages.

The early larvæ obtained from the plankton (Plate 1, Figs. 1–3) measure 0·16 mm. across the shell which is covered with raised dots except at the base where there are spiral striæ, the outer lip being slightly produced and incurved. The colour of the shell is brown, and it is rather thick and not very transparent. The animal is pale yellowish white, the velum quite colourless. There is a short foot, the eyes, short tentacles and otocysts conspicuous. The velum which has two almost round lobes measures 0·18 mm. across and has the usual cilia bordering the groove to the mouth (Plate 1, Fig. 1). This young larva is very like that of *Cerithiopsis barleei*,

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EXPLANATION OF PLATE 1.

(Scale B is six times the scale of A, Scale C, twice the scale of A.)

(Figs. 1–4, 6, 8, 9 Scale B, Fig. 5 Scale C, Figs. 7, 10–11, 13 Scale A, Fig. 12 on a smaller scale.)

Figs. 1–7. *Triphora perversa.*

Fig. 1.—Early larva, shell 0·16 mm. across, from plankton.
Figs. 2–3.—Shells of same.
Fig. 4.—Shell slightly older, 0·24 mm. long, from plankton.
Fig. 5.—Older larva from plankton, shell 0·64 mm. long.
Fig. 6.—Apex of shell of same.
Fig. 7.—Apex of adult shell.

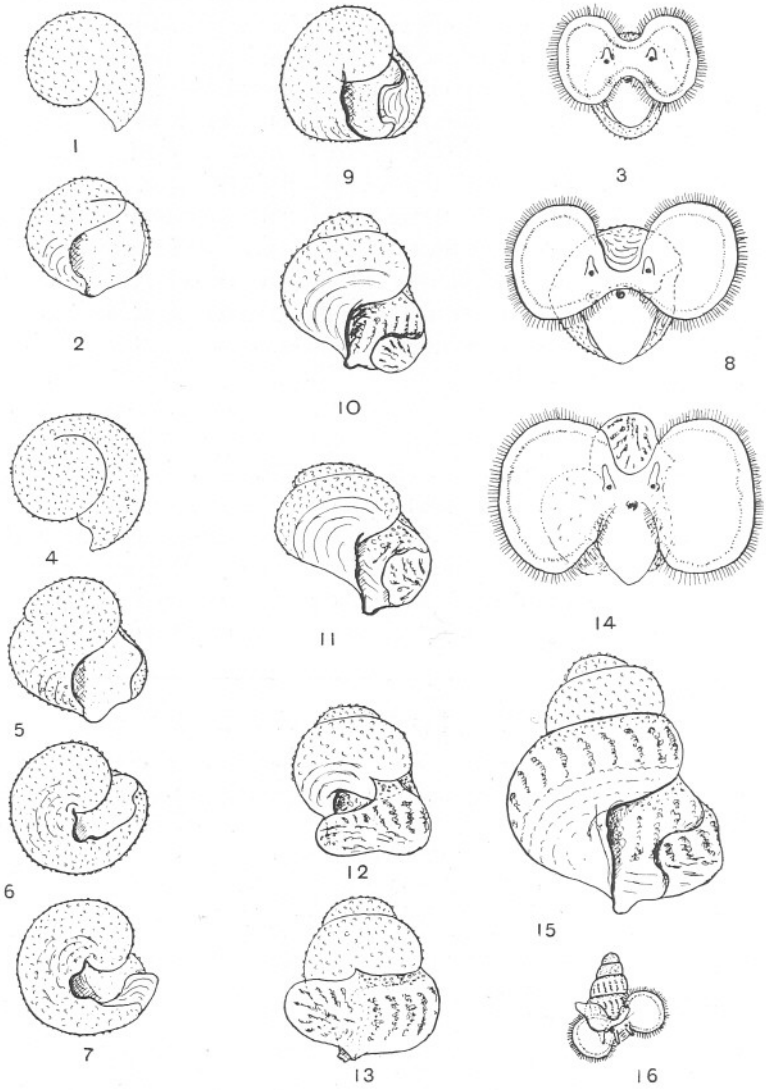
Figs. 8–11. *Cerithiopsis tubercularis.*

Fig. 8.—Young shell from plankton, 0·24 mm. long.
Fig. 9.—Older larvæ from plankton, shell 0·48 mm. long.
Fig. 10.—Shell of older larva from plankton, ready to metamorphose, 0·64 mm. long.
Fig. 11.—Apex of adult shell.

Figs. 12–13. *Cerithiopsis barleei.*

Fig. 12.—Egg nests laid in *Ficulina ficus.*
Fig. 13.—Apex of adult shell.

PLATE 2.



except that it is sinistral in both animal and shell. The shape, colour and sculpture are very similar and show that the two species are obviously closely related. Indeed, they are much more like one another than are the larvæ of the two Cerithiopsis species, *Cerithiopsis barleei* and *Cerithiopsis tubercularis*.

With two whorls the shell measures 0·2 mm. long (Plate 1, Fig. 4), the upper whorl and a half dotted with raised spots, the second half of the last whorl striated with oblique wavy longitudinal striæ, the outer lip being produced in a conspicuous process. Later stages have the whorls with similar striæ, with dots at the sutures, the tentacles growing longer and the velum larger. When the shell measures 0·64 mm. long there are six to seven whorls, the first one and a half dotted, the next five striated with a slight keel at the periphery, altering at the seventh whorl into the adult tuberculated sculpture (Plate 1, Figs. 4–6). The last part of the seventh whorl and the eighth are beginning to be tuberculate on each side of the keel. At this stage the animal is ready to crawl and will soon lose the velum. Some of the larvæ with seven whorls lost the velum in the plunger-jars, others in the plankton still had the velum with seven and a half whorls. The late larvæ have an almost colourless animal with a colourless velum, the lobes nearly round and each nearly as long as the shell. One lobe is usually smaller than the other. The foot is pointed behind, slightly produced in front and the tentacles are long (Plate 1, Fig. 5). Up to now the larva is a planktonic feeder, but when it crawls it apparently eats detritus or algæ as the older stages live very happily in the plunger-jars feeding on the bottom or sides of the glass where there is a slight deposit or algal growth. This long larval life must last for some months, but no exact data are available. Early stages are found in late May and throughout the summer and early autumn, late stages in summer and autumn. Vayssière (1931) has recently figured from the Mediterranean a larva, gastropod shell which he names *Sinusigera dautzenbergi*. This is almost certainly a late larval stage of *Triphora perversa*.

EXPLANATION OF PLATE 2.

(Scale B is six times the scale of A.)

Cerithiopsis barleei.

(Figs. 1–15 Scale B, Fig. 16 Scale A.)

FIGS. 1–3.—Newly hatched larva from egg, shell 0·14 mm. across.
FIGS. 4–6.—Shells of slightly older larvæ reared in plunger-jar.
FIGS. 7–13.—Older larvæ reared in plunger-jar.
FIG. 14.—Older larva, shell 0·2 mm. long, reared in plunger-jar.
FIG. 15.—Shell 0·32 mm. long, reared in plunger-jar.
FIG. 16.—Late larva, ready to metamorphose, from plankton, shell 0·64 mm. long.

Cerithiopsis tubercularis (Montagu).

(Plate 1, Figs. 8–11.)

This mollusc is common both inside and outside the Sound, usually on or in sponges. Even as far out as Station E1 the larvæ are common as well as being very frequently found in the shallower waters. It is probable that its eggs are laid on or in the sponges, but it is difficult to keep these sponges alive in the plunger-jars, and this fact probably accounts for the eggs never having been found although the adults were kept for months in the plunger-jars and lived quite happily without the sponges, probably feeding on debris or small algæ.

It is already well known that the apex of this shell is smooth and consists of about four and a half whorls before the tubercles of the adult shell are formed. This smooth part, which is a transparent horn colour, sticks out prominently from the adult shell being more cylindrical and of more even width than the remaining whorls (Plate 1, Fig. 11). It is this part which constitutes the larval shell. The youngest larvæ seen consisted of two to two and a half whorls, the outer lip having an enormous plate-like outgrowth which bends over the aperture, the lobes of the velum protruding at each side when the animal is swimming (Plate 1, Fig. 8). This outgrowth is marked by concentric layers of growth with dots in between for rather more than a semicircle, the sculpture being obliterated as growth proceeds leaving the larval shell smooth except for this labial outgrowth. With two and a half whorls the length of the shell is 0·24 mm. with three and a half whorls it is about 0·28 mm. long, whilst when approaching the end of its larval life with four to four and a half whorls it measures up to 0·64 mm. in length (Plate 1, Figs. 9–10). Just before metamorphosis the last half-whorl has the typical tubercles of the adult. There is a dark line at the suture of all the larval whorls and on the columella and the aperture there is also dark brown, the base being carinated and the outer lip at the last larval stages having lost the large process on the outer lip although the velum is still present. The animal is pale yellowish white with a colourless velum. The foot which is mottled with grey on the sole and pointed posteriorly is flexible in front forming a long process which can be moved about under the head region. The tentacles are long and the eyes conspicuous, the velum with two rounded lobes, one usually larger than the other (Plate 1, Fig. 9). The larvæ at 0·64 mm. began to crawl in the plunger-jars and soon lost the velum. Here again there must be a long arval life although probably not so long as that of Triphora.

Cerithiopsis barleei Jeffreys.

(Plate 1, Figs. 12–13 ; Plate 2.)

This mollusc is common, living in *Ficulina ficus*. It is usually in those from outside the Sound where they are found, although it is sometimes seen in those from inside and the larvæ occur both outside and inside in late spring and summer, even as far as Station E1, where all three of these species described may occur in numbers together.

Early in May, 1932, a mass of Ficulina containing a hermit crab was obtained from outside, and crawling on it was an adult *Cerithiopsis barleei*. This was placed in a plunger-jar and a few days afterwards small round patches were noticed in the sponge. These were about 1·5 mm. across, placed at intervals of about 5 mm. or more apart, pinkish white or brownish purple. On closer investigation it was seen that each mass was a nest of eggs embedded in the sponge, the top hardly raised from the sponge surface (Plate 1, Fig. 12). Inside each nest were many eggs, the undeveloped eggs pinkish, the later stages brown ; some of them nearly ready to hatch with a fully formed horny shell and bilobed velum with rounded lobes. There were 13 of these egg-masses at first, each containing about 200 eggs. Later on more were laid, about 20 altogether, laid by the one mollusc. The eggs began to hatch out on May 23rd and continued to do so for some days. On inspection it was seen that the shell was exactly like the tip of the adult, and as it grew it was easy to see that it was the young of *Cerithiopsis barleei* which has a very characteristic apex (Plate 1, Fig. 13). The sculpture is very like that of *Triphora perversa*, the top two whorls dotted with raised spots, the third and fourth striated with undulating striæ, the fifth tuberculated with the sculpture of the adult shell. One would expect therefore to find the larval shell with four to four and a half whorls to be planktonic which proves to be the case, the latest larvæ being found in the plankton at this stage and almost immediately losing the velum and crawling. Those hatched from the egg lived until they had nearly four whorls, feeding on Nitzschia in the plunger-jars.

The newly hatched larva has a slightly produced horn-coloured shell about 0·14 mm. across and consisting of one and a quarter whorls (Plate 2. Figs. 1–3). The surface is covered with raised dots except at the base where it is striated. The outer lip is slightly drawn out. The colourless velum measures 0·16 mm. across, having round lobes with the usual ciliary structure, the rest of the animal is a pale yellowish, almost colourless, the eyes and otocysts conspicuous, the tentacles rudimentary, the foot rounded. The larva grows quickly and soon a large process grows from the outer lip similar to that in *Cerithiopsis tubercularis*. In this character the two species are much alike. A two-days' old larva has a

shell measuring 0·16 mm. across with one and a half whorls. One slightly older has the outer lip drawn out and the process long with striated markings, the velum being about 0·24 mm. across (Plate 2, Figs. 4–10). The shell has now the beginning of a third whorl which has the undulating striæ on the upper part. The tentacles are now longer and the velum large (Plate 2, Figs. 10–14). The process from the outer lip grows very large, about as long as half the shell diameter, and the shell increases to three to three and a half whorls with a length of 0·32 mm. They were reared in a plunger-jar as far as this stage (Plate 2, Fig. 15) and were about four weeks old. Similar stages were found in the plankton and all the younger stages ; also older forms which were kept until they crawled. The latest larval stages with four and a half whorls measured 0·64 mm. long. The foot has an elongated and mobile front like that of *Cerithiopsis tubercularis*, the tentacles are long and the velum large. The larva now loses the velum and crawls.

In July and August several more adults were found laying eggs in Ficulina and continued to lay them in the plunger-jar.

One sees that in all these species the larval life is somewhat similar, although distinct differences are seen and all are easily distinguishable. The length of larval life varies, being longest in *Triphora perversa*. The shell may be sculptured or unsculptured, and this is apparently not a generic distinction as of the two species of Cerithiopsis, one is sculptured, the other smooth in its larval shell. A character common to all is the great production of the outer lip into a plate-like process—largest of all in *Cerithiopsis tubercularis*, large in *Cerithiopsis barleei*, less pronounced in *Triphora perversa*. They all agree in the form of the animal, pointed foot with flexible front, fairly long tentacles, and a simple colourless bilobed velum with rounded lobes.

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