

## The Eggs and Larvæ of some British Turridæ.

By

Marie V. Lebour, D.Sc.,

Naturalist at the Plymouth Laboratory.

---

With Plates I-IV.

---

IN a previous paper (Lebour, 1933) the eggs and larvæ of *Philbertia* (*Comarmondia*) *gracilis* were described, showing lens-shaped sessile egg-capsules and a planktonic larva with elaborately sculptured shell and large brightly spotted velum, which remained as a veliger until it had attained several whorls and was of a large size before metamorphosis. Lens-shaped capsules are apparently typical of the group (Jeffreys, 1867, and observations at Plymouth) and finely sculptured embryonic shells with several whorls are already known in many species (Jeffreys, 1867; Cossmann, 1895; Thiele, 1929). Researches in the Plymouth plankton show that members of this family are common and are some of the largest and most conspicuous gastropod larvæ. They are therefore of considerable economic importance in the sea.

Winckworth (1932) in his recent list of British Marine Mollusca recognises six genera in the Turridæ. Of these four occur at Plymouth: *Hædropleura*, *Lora*, *Mangelia* and *Philbertia*. *Lora* (*L. rufa*) has only been seen at Plymouth as a dead shell; *Hædropleura* (*H. septangularis*) has only been obtained once alive at Plymouth, but three species of *Mangelia* (*M. attenuata*, *M. nebula* and *M. coarctata*) and six species (all the British species known) of *Philbertia* occur, some of which are common. Winckworth recognises the sub-genus *Bela* in *Mangelia* to which both the common species of *Mangelia* belong (*M. nebula* and *M. coarctata*) and three sub-genera of *Philbertia*: *Comarmondia*, *Philbertia* and *Teres*. *Philbertia gracilis* belongs to the sub-genus *Comarmondia* and is fairly common, usually on the outside dredging grounds, alive; *Philbertia teres* is the only species belonging to the sub-genus *Teres* and has not yet been obtained alive at Plymouth, dead shells occasionally occurring in the shell gravel of the Eddystone Grounds; the sub-genus *Philbertia* contains *Philbertia leufroyi*, *P. purpurea*, *P. asperrima* and *P. linearis*. *Philbertia purpurea* has occasionally been found alive from low water to 5 fathoms (Mar. Biol. Assoc., 1931); *P. asperrima* is dredged sometimes in the Sound; *P. leufroyi* is fairly common in the outside waters and *P. linearis*

is the commonest of all, occurring both in the Sound and outside but most commonly near the coast.

The turrids may be divided into two groups by the embryonic shell and these coincide with *Hædropleura*, *Lora* and *Mangelia* on the one hand, which have a smooth apex, and *Philbertia* on the other, the species of which have a sculptured apex. *Hædropleura* and *Lora* are operculated whilst *Mangelia* and *Philbertia* have no operculum in the adult, the larva shedding this on metamorphosis.

Sculptured apices in the species of *Philbertia* are already known as mentioned above, but the existing descriptions are not always altogether accurate, the fossil species frequently being described with the top whorls smooth when in the living form of the same species they are seen to be reticulated. This is not to be wondered at when one realises that the sculpture may wear away very soon. Tiele (1929) describes the top whorls of *Philbertia* as spirally sculptured when really it is usually reticulated but in a different way from the following embryonic whorls: *Comarmondia*, however, has minute flecks instead of reticulations on the top whorl. Mr. Dennis Curry has kindly sent me some specimens of turrids from the Barton Beds whose apices are very similar to the recent species *Philbertia linearis*, *P. leufroyi*, *P. purpurea*, *P. asperrima* and *P. teres*, and one which somewhat resembles that of *Mangelia coarctata*. In his book on shells of Port Alfred, South Africa, Colonel Turton (1933) figures and describes as a new species of *Trophon* (*T. ornatus*, Plate XVIII, Fig. 544) a shell which is almost certainly the young of a turrid of the *Philbertia* type with a similar sculpture. It is evident that the sculpture of the embryonic whorls of the *Philbertias* is an ancient character and one which is world-wide in distribution and we have in it a clear guide to the affinities of those shells which possess such markings.

The embryonic whorls of all the turrids show plainly on the adult shells and those of the *Philbertias* (excluding *P. gracilis*) are so much alike that it is difficult to see any differences at all. On very close examination, however, although the markings are all of the same type, it is seen that the number of embryonic whorls varies slightly with the species, the whorls may be different in breadth, the colour may be different and the quality of the markings may be more or less distinct. Larval shells of this *Philbertia* type are common in the plankton in spring and summer; only very occasionally in autumn and winter. They occur both in the inshore and outside plankton. Most of them belong to *Philbertia linearis*, but those of *P. leufroyi* can be recognised, and, probably, those belonging to *P. asperrima*. *P. purpurea* and *P. teres* have not been seen as larval forms. In all the *Philbertias* the embryonic shell is brown or more or less a dark horn-colour. The following is the sculpture in all the typical *Philbertias*, e.g. *P. linearis*, *P. leufroyi*, *P. asperrima* and *P. purpurea*;

also of *P. teres*: the first whorl or whorl and a half is reticulated (Plate III, Fig. 2), the reticulations being formed by raised spiral striæ and straight striæ crossing them at right angles, the points where the striæ meet appearing as slight prominences; the reticulations are thus straight up and down. Suddenly at about the second half of the second whorl the sculpture changes, a series of raised lines running out from the suture and from there oblique reticulations originate; as Jeffreys puts it, "like the meshes of a fire-guard" (Plate III, Fig. 3). Here again, where the meshes cross there are raised points. The reticulations are now oblique instead of straight, and they run nearly to the base of the shell where spiral striæ are seen. The third and fourth whorls are carinated and the fifth also in those species which possess more than four embryonic whorls. Below the periphery the reticulations are not so regular, but spiral lines with flecks and smaller reticulations take their place (Plate III, Figs. 6-7; Plate IV, Fig. 1). On the last embryonic whorl, third, fourth or fifth, as the case may be, there are three spiral ridges forming the carinations which end in a broad rounded process curving inwards on the outside of the shell aperture and supporting the velum (Plate IV, Figs. 2-3). *Philbertia teres* has the longest embryonic shell (Plate IV, Fig. 11), consisting of 5 to  $5\frac{1}{2}$  whorls; *P. linearis* and *P. asperima* coming next (Plate IV, Figs. 7, 9) with 4 to  $4\frac{1}{2}$  whorls; *P. leufroyi* (Plate IV, Fig. 8) with  $3\frac{1}{2}$ ; *P. purpurea* (Plate IV, Fig. 10) with 3. The embryonic sculpture ends with the loss of the velum, the shell afterwards taking on the adult pattern and losing the operculum (Plate IV, Figs. 4, 5). The animal in all the larvæ known is almost or completely colourless, very rarely with grey or pinkish in parts. The velum is spotted with orange in *Mangelia nebula* and *Philbertia gracilis*, but in all the true *Philbertias* known it is colourless. At first bilobed, the velum may grow to a large size and in the older larvæ has four lobes, in *Mangelia nebula* being capable of covering both shell and animal like a true veil; in *Philbertia gracilis* the lobes are very long and narrow, and in the *Philbertias* proper they are large and broad. Two more larvæ have been seen in the Plymouth plankton which have not yet been attributed to any species. It is very probable that they belong to the smooth-topped turrids. Both have a large and conspicuous velum, with brown or orange colouring.

#### DESCRIPTION OF THE EGGS AND LARVÆ OF THE PLYMOUTH PLANKTONIC FORMS.

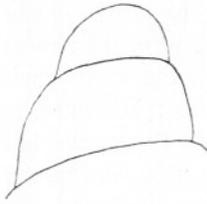
##### Family TURRIDÆ.

The eggs and larvæ have been seen at Plymouth in *Mangelia nebula*, *Philbertia gracilis* and *Philbertia linearis*; the larvæ hatched out from the egg in the first and second and the later larvæ from the plankton

PLATE I.



1



2



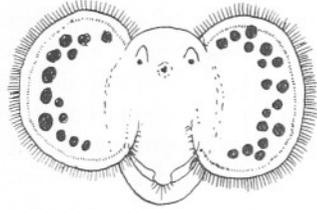
5



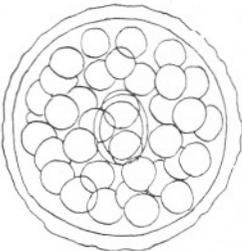
3



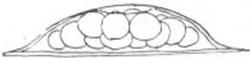
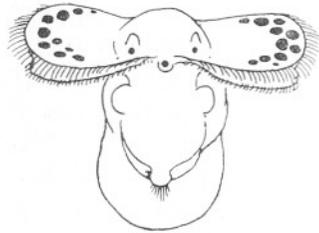
4



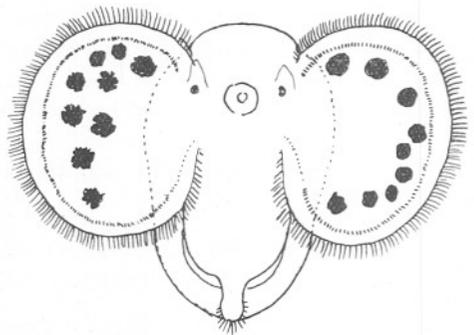
8



6



7



9

in all three were reared until metamorphosis. The life-history of *Philbertia gracilis* has already been described (Lebour, 1933), those of *Mangelia nebula* and *Philbertia linearis* are described here for the first time. The eggs of the other species are not known, but the larvæ of *Philbertia leufroyi* and *P. asperrima* have been recognised in the plankton. The two last are so like those of *P. linearis* that a separate description is unnecessary.

In order to obtain the eggs the adults were kept in plunger-jars. It was difficult at first to keep them alive for long because the natural food was not known. The radula which consists of few long pointed teeth suggests carnivores of a predatory type. Most of the species naturally live on shelly or sandy gravel where numerous worms or foraminifera abound. Apparently they do not eat the latter which lived and multiplied quite happily in the same aquarium as the turrids, but it seems very likely that they eat small worms, for the one specimen of *Hædropleura septangularis* and several *Philbertia linearis* have lived for some months in a plunger-jar with brown deposits of some alga which harbours small worms and infusoria in abundance.

#### Genus HÆDROPLEURA.

*Hædropleura septangularis* (Montagu), (Plate I, Fig. 1). Only one specimen has been seen alive from Plymouth, dredged in the Sound. Apex smooth for  $2\frac{1}{2}$  whorls, the third whorl with fairly close ribs. Eggs and larvæ not known.

#### Genus LORA.

*Lora rufa* v. *ulideana* (Thompson), (Plate I, Fig. 2), dead shell only, found in outside dredgings, Eddystone Grounds. Smooth rounded apex,

#### EXPLANATION OF PLATES.

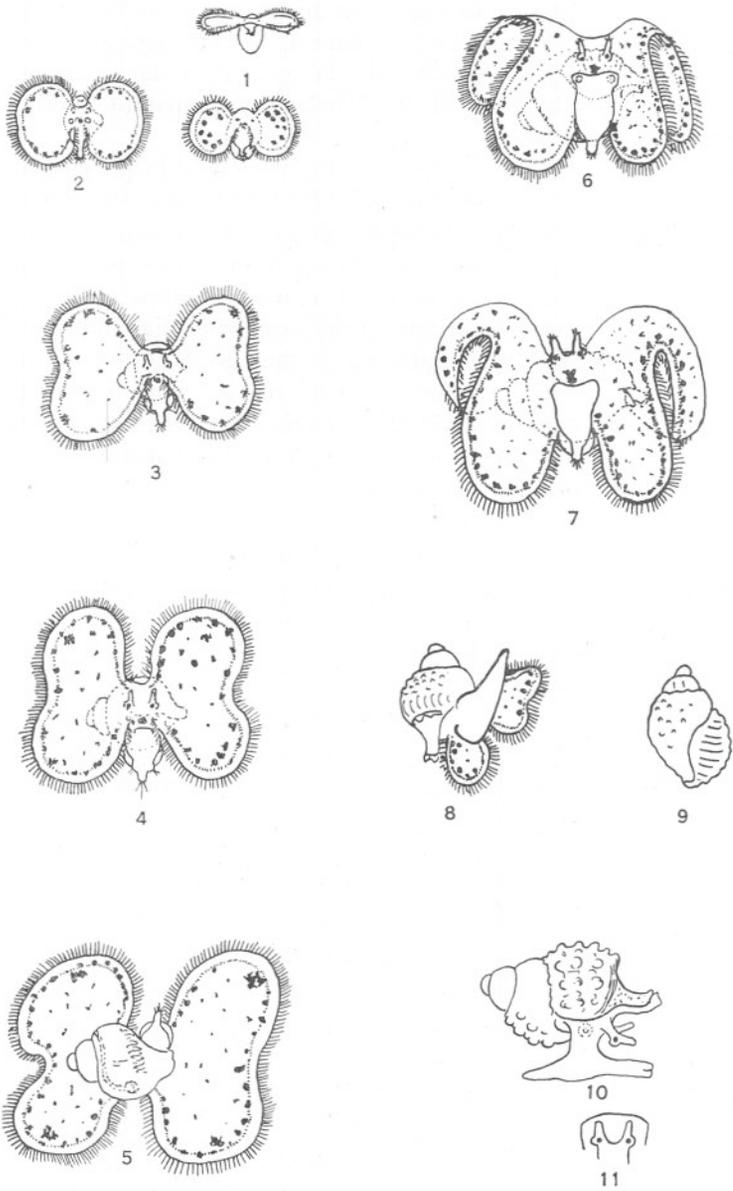
(Scale B is 3 times the scale of A.)

#### PLATE I.

(Figs. 1-7 scale A, 8-9 scale B.)

- FIG. 1.—Apex of adult *Hædropleura septangularis*  
 FIG. 2.—Apex of adult *Lora rufa*.  
 FIG. 3.—Apex of adult *Mangelia nebula*.  
 FIG. 4.—Apex of half-grown *Mangelia nebula*.  
 FIG. 5.—Apex of adult *Mangelia coarctata*.  
 FIG. 6.—Egg-capsules of *Mangelia nebula* laid in plunger-jar, 1.6 mm. across.  
 FIG. 7.—Egg-capsules of *Mangelia nebula* laid on siphon of *Lutraria*, 1.76 mm. across.  
 FIG. 8.—Newly hatched larvæ of *Mangelia nebula* from eggs in plunger-jar, shell 0.23 mm. across.  
 FIG. 9.—Newly hatched larva of *Mangelia nebula* from egg-capsule on *Lutraria* siphon, shell 0.30 mm. across.

PLATE II.



very broad, of about 2 whorls, the extreme top hidden. Eggs and larvæ not known.

Genus *MANGELIA*.

*Mangelia attenuata* (Montagu). Although this species is recorded from Plymouth in the Fauna List it has not been seen recently.

Sub-genus *BELA*.

*Mangelia coarctata* (Forbes). (Plate I, Fig. 5).

This species occurs in the Sound, off Drake's Island, dredged in sandy gravel and is not uncommon. The first  $2\frac{1}{2}$  whorls are smooth, the third with close ribs with striæ in between. Eggs and larvæ not known.

*Mangelia nebula* (Montagu), (Plate I, Figs. 3, 4, 6-9 ;  
Plate II, Figs. 1-11).

This species is recorded only from one locality in the Plymouth Fauna list but it is in reality very common and frequently dredged in the Sound, especially in Cawsand Bay and off the White Patch, on the east side of the Sound. More rarely it is found further out. The adult which is a reddish brown colour has a smooth apex, at about the third whorl tending to be tuberculated (Plate I, Figs. 3-4), after which the adult sculpture begins. An adult kept in a plunger-jar laid one egg-capsule, the only one after repeated attempts at keeping the animals which lived for some time in various plunger-jars but never laid any more eggs. Mr. G. A. Steven, however, found some eggs on the dredged severed siphon of a lamelli-branch, probably *Lutraria*, which agreed with those obtained from the mollusc itself in the plunger-jar, and the young which were hatched out were similar. The only difference was in the size, the capsules on *Lutraria* being larger and the newly hatched larvæ also larger. The larvæ are so peculiar and characteristic that there can be no doubt that they both belong to *Mangelia nebula*. Later larvæ in the plankton were identified as the same mollusc and by keeping these until metamorphosis it was proved that they were *Mangelia nebula*.

PLATE II.

(Scale A) *Mangelia nebula*.

FIG. 1.—Newly hatched larvæ from *Lutraria* siphon.

FIG. 2.—The same, 2 days old.

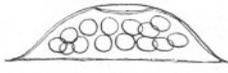
FIGS. 3-9.—Larvæ from plankton.

(3) shell 0.46 mm. long ; (4) shell 0.76 mm. long ; (5) shell 0.80 mm. long ;  
(6) shell 0.90 mm. long ; (7) shell 0.96 mm. long ; (8) shell 0.90 mm. long ;  
beginning to lose velum ; (9) empty shell.

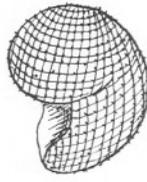
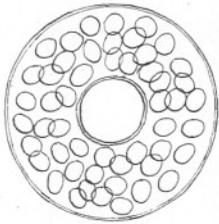
FIG. 10.—Metamorphosed larva, shell 1.12 mm. long.

FIG. 11.—Front of same.

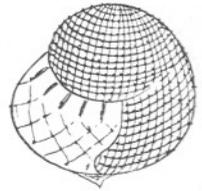
PLATE III.



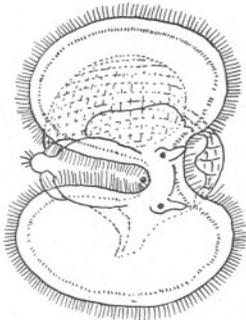
1



2



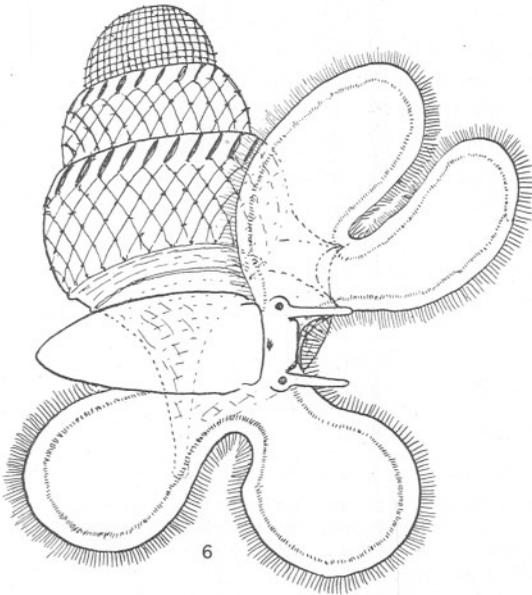
3



4



5



6



7

The egg-capsules (Plate I, Fig. 6) are smooth and transparent, lens-shaped and attached by the under flat surface, the upper surface rounded with a thin part in the centre where a hole is formed when the larvæ are ready to emerge. Diameter of capsule laid in plunger-jar, 30.1.33, 1.6 mm., height 0.32 mm.; diameter of capsules laid on Lutraria siphon, 18.5.31, 1.76 mm. The eggs when newly laid measured about 0.16 mm. across. There were about 60 opaque eggs in the capsule laid in the plunger-jar; fewer in those from the siphon which were further advanced (Plate I, Fig. 7). Later on (14.2.33) the larvæ nearly ready to hatch were dying in the capsule and were removed to a fresh plunger-jar in which several veligers hatched out but did not grow and soon died. The newly hatched larva (Plate I, Figs. 8-9; Plate II, Fig. 1) is very peculiar. The shell measures about 0.23 mm. across in those from the eggs laid in the plunger-jar; the foot is short with a rounded ciliated lobe behind; in front of the eyes is a rounded prominence; the tentacles short. The velum is bilobed, having large rounded lobes with the usual cilia and measuring 0.4 mm. across or more, ornamented on each side with several large and conspicuous brilliant orange spots. The spots may vary in number and arrangement, about 9 to 12 being usual. Those hatched from the siphon of Lutraria were larger, the shell about 0.3 mm. across and the velum about 0.64 mm. across, but the larvæ were in other respects exactly alike. Those from the siphon lived for a few days and grew, showing a posterior siphon on the shell and the posterior knob of the foot long (Plate II, Fig. 2). Young larvæ were found in the plankton slightly older than this and through the spring and summer later larvæ were common in the tow-nettings both in the Sound and outside, but especially rather close to the coast. The largest numbers occurred from May to September, but specimens were seen also in early autumn. Very young metamorphosed forms were dredged in October and November. As the larva grows the spots on the velum increase and tend to form a border, but they are also irregularly scattered on the surface and sometimes the pigment congregates as a mass at the outer corner of each lobe. The shell is clear, transparent and colourless for about three whorls when it measures about 0.70 mm. in length, the apex slightly oblique, the posterior canal conspicuous; eyes and tentacles well developed; foot with three ciliated

## PLATE III.

(Fig. 1 scale A, Figs. 2-7 scale B.)

- FIG. 1.—Eggs of *Philbertia linearis* laid in plunger-jar, 1.5 mm. across.  
 FIGS. 2.—Very young larval shell of *Philbertia linearis* from plankton, 0.19 mm. across.  
 FIG. 3.—Shell of *Philbertia linearis* slightly older, from plankton.  
 FIGS. 4-6.—Later veligers of *Philbertia linearis* from plankton.  
 FIG. 7.—Shell of *Philbertia leufroyi*, late larva, from plankton.

lobes posteriorly, the median lobe long and projecting beyond the foot. As the animal grows the front of the foot grows beyond the mouth. The velum tends to be four-lobed and grows very large, the breadth being more than three times the length of the shell and in the later stages being held over the shell and animal so that they are completely covered. Thus it swims covered over with a true veil. The shell 0.96 to 1 mm. long, has now  $3\frac{1}{2}$  to 4 whorls and the animal is nearly ready to metamorphose. The shell and animal siphon are conspicuous, the eyes on short tentacles showing the adult form, the foot with the lobes dwindling and finally absent. The fourth whorl is now showing a tuberculated appearance, or even the third whorl may show this (Plate II, Figs. 7-9). Near the aperture there may be spiral striæ. The velum then dwindles, the operculum is shed and the animal crawls (Plate I, Fig. 10), becoming like a miniature adult. The front of the foot is almost square, the base a light grey, otherwise the animal is colourless. It is quite easy to recognise all these stages including the young crawling mollusc.

Genus **PHILBERTIA**.

Sub-genus **COMARMONDIA**.

*Philbertia gracilis* (Montagu). (Plate IV, Fig. 6).

The egg-capsule and larvæ of this species have already been described. Egg-capsules lens-shaped with reticulations on the upper surface. In 1933 a further supply of egg-capsules was obtained in a plunger-jar, April-March, and the larvæ hatched out more successfully. These showed that all the larvæ developed and hatched in a very late stage of development with a long shell siphon and deeply coloured velum. It is thus abnormal for any to be eaten by the others and it is not a case of "nurse" eggs as was at first thought. The top whorls are flecked but not spirally striated and the later whorls conspicuously keeled and marked with oblique striæ. The larva grows to a large size in the plankton, the later stages having four very long velar lobes with orange spots. Both shell sculpture and velum are quite unlike the true *Philbertias*. The sub-genus should probably be raised to a genus.

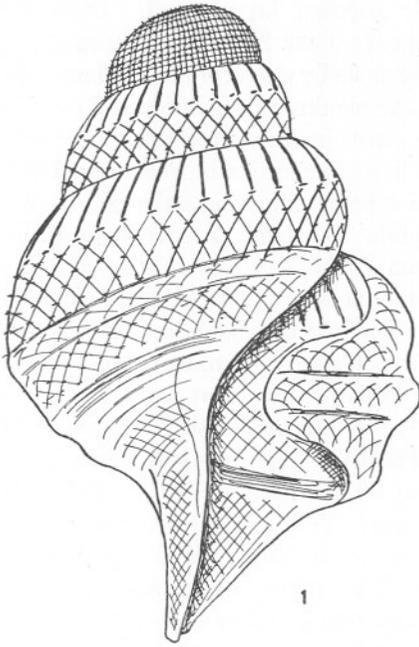
Sub-genus **PHILBERTIA**.

*Philbertia linearis* (Montagu), (Plate III, Figs. 1-6 ;  
Plate IV, Figs. 3, 5, 7).

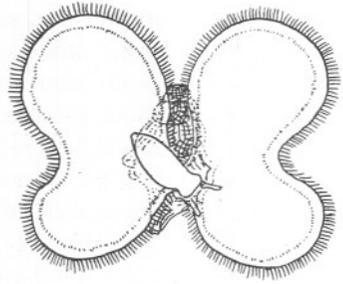
Jeffreys has described the egg-capsules and newly hatched larvæ of this species (as *Defrancia*), but the measurement of the capsule and number of eggs do not agree with the Plymouth specimen. He has also

noticed the sculpture on the newly hatched larval shell. *Philbertia linearis* is fairly common in dredgings from the Sound and occasionally occurs on the outside grounds on sandy or shelly gravel or in hard-branched Bryozoa. The larvæ are common in the plankton both inside and outside the Sound, but particularly near the coast, in spring and summer, rarely in autumn. Egg-capsules were laid in a plunger-jar in February, 1932, and through March, but the larvæ died before hatching although moving about and possessing a shell and velum. A single capsule was laid by another individual in January, 1933. The capsules of the first lot measured 1.5 mm. across, the second measured 2 mm. The capsules described by Jeffreys measured  $\frac{1}{8}$  inch across and contained 200 to 300 eggs whilst the eggs in the first lot from Plymouth numbered only about 60 and in the second lot about 80. It is possible that there was some mistake in Jeffreys' species. The Plymouth eggs measured 0.14 mm. to 0.15 mm. across. The egg-capsule (Plate III, Fig. 1) is lens-shaped, like that of *Mangelia nebula*, and has no reticulations similar to *Philbertia gracilis*. It is colourless and transparent. Very young larvæ were found in the plankton and also all stages up to the latest larvæ which metamorphosed into *Philbertia linearis*. The earliest free-swimming larvæ (Plate III, Fig. 2) were seen in February and various stages were found throughout the spring and summer, dwindling in early autumn and absent in December and January. All the larvæ, even those quite newly hatched, have a dark brown shell with conspicuous straight reticulations, as described above. The velum is colourless, at first bilobed, then larger and slightly indented at the sides to form four blunt lobes. It has the usual cilia round the edge. Eyes and tentacles conspicuous. The rest of the animal is colourless, the foot at first short with a small knob posteriorly; round thin operculum; mouth showing in front; later the foot is pointed behind and the front part covers the mouth. The youngest larva seen measures about 0.19 mm. across the shell and has one whorl and a half; the outer lip produced for support of the velum. Very soon the oblique striations begin and the shell canal is formed (Plate III, Fig. 3). Later, the shell being about 0.44 mm. long with a conspicuous canal, there are  $2\frac{1}{2}$  whorls and the velum is beginning to be four-lobed (Plate III, Fig. 5). The foot at this stage is bluntly pointed and the tentacles well developed. When the shell is about 0.52 to 0.80 mm. long there are  $3\frac{1}{2}$  to 4 whorls, the velum is much larger and may project some way beyond the shell, the siphon projects from the shell siphon and the foot is like the adult. It is now nearly ready to metamorphose and when the shell has  $4\frac{1}{2}$  whorls and measures about 0.96 mm. the animal can crawl as well as swim and very soon loses the velum and operculum, and the adult sculpture begins. This species must remain a long time as a veliger and is one of the common forms in the Plymouth plankton.

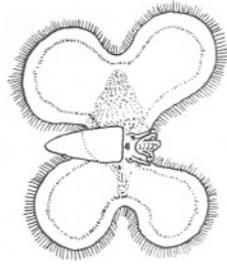
PLATE IV.



1



2



3



6



4



5



7



8



9



10



11

*Philbertia leufroyi* (Smith), (Plate III, Fig. 7, Plate IV, Figs. 2, 4, 8).

Although the species is not recorded in the Plymouth Fauna list it is not uncommon in the outside dredging grounds and has probably been confused with *P. linearis* which it closely resembles. It is, however, broader and larger and more speckled with brown instead of having brown lines. The apex is very like that of *P. linearis* but with fewer whorls (Plate IV, Fig. 8) and broader, therefore by measurement the larval shells may be distinguished and as the veliger has fewer whorls for its size than *P. linearis* it may be distinguished in the later stages. The velum in the late stage is larger than in *P. linearis*, but the animals are very similar. There are  $3\frac{1}{2}$  whorls in the embryonic shell of *P. leufroyi* and they may be of a pinkish brown to deeper brown. Jeffreys has noticed the reticulations on the whorls. No egg-capsules were seen, but the breeding season appears to be in spring and summer and the larvæ are seen together with those of *P. linearis* or separate.

*Philbertia asperrima* (Brown), (Plate IV, Fig. 9).

Jeffreys noticed the sculpture on the embryonic whorls of this species. It is occasionally dredged in the Sound and outside but is not common. The larvæ are very like those of *P. linearis* and *P. leufroyi*, the animal being slightly grey on the body and foot. There are  $4\frac{1}{2}$  whorls as in *P. linearis* but the spire is rather longer and the markings are much more irregular, the colour being lighter. These larvæ are not at all common and are very difficult to distinguish from *P. linearis*. They occur in summer. No egg-capsules have been found.

PLATE IV.

(Fig. 1 scale B, Figs. 2-11 scale A.)

- FIG. 1.—Late larval shell of *Philbertia leufroyi*, nearly ready to metamorphose, from plankton.  
 FIG. 2.—Late veliger of *Philbertia leufroyi*, just before metamorphosis, from plankton.  
 FIG. 3.—Late veliger of *Philbertia linearis* not quite ready to metamorphose, from plankton.  
 FIG. 4.—*Philbertia leufroyi*, metamorphosed in plunger-jar.  
 FIG. 5.—*Philbertia linearis* metamorphosed in plunger-jar.  
 FIG. 6.—Apex of adult *Philbertia gracilis*.  
 FIG. 7.—Apex of adult *Philbertia linearis*.  
 FIG. 8.—Apex of adult *Philbertia leufroyi*.  
 FIG. 9.—Apex of adult *Philbertia asperrima*.  
 FIG. 10.—Apex of adult *Philbertia purpurea*.  
 FIG. 11.—Apex of adult *Philbertia teres*.

*Philbertia purpurea* (Montagu), (Plate IV, Fig. 10).

Jeffreys noticed the sculpture on the embryonic whorls. It is recorded from several localities in the Plymouth Fauna list but is seldom found, and only one dead specimen from the Eddystone sandy gravel has been seen in recent years. The embryonic shell has only 3 whorls, the smallest number of all the Plymouth species, but the same sculpture as the other *Philbertias* is present. The eggs and larvæ have not been seen.

Sub-genus **TERES**.*Philbertia teres* (Reeve), (Plate IV, Fig. 11).

Jeffreys noticed the sculpture of the embryonic whorls of this species. It has not before been recorded from Plymouth and has only been seen as dead specimen from the Eddystone shell gravel. It has the typical *Philbertia* sculpture but the adult shell has spiral ribs on the adult whorls. This species has the largest number of embryonic whorls of any of the Plymouth *Philbertias* and is already known to have such a long apex, consisting of 4 or 5 whorls, 5 in the Plymouth specimen, 4 according to Thiele (1929). The eggs and larvæ are not known.

## LITERATURE.

- COSSMANN, M. 1895. Essai de Paléoconchologie comparée, Première libraires, pp. 1-179.
- JEFFREYS, G. 1867. British Conchology, Vol. IV.
- LEBOUR, M. V. 1933. The Eggs and Larvæ of *Philbertia gracilis* (Montagu). Jour. Mar. Biol. Assoc., N.S., Vol. XVIII., No. 2, pp. 507-510.
- PLYMOUTH MARINE FAUNA. 1931. Second Edition. Marine Biological Association.
- THIELE, J. 1929. Handbuch der Systematischen Weichtierkunde. Part I, pp. 1-778.
- TURTON, W. H. 1932. The Marine Shells of Port Alfred, S. Africa. London; pp. 1-331.
- WINCKWORTH, R. 1932. The British Marine Mollusca. Journ. of Conch., Vol. 19, No. 7, June, pp. 211-252.