

CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

Zooplankton

Sheets 129–132

PROSOBRANCHIA

**Veliger larvae of Taenioglossa
and Stenoglossa**

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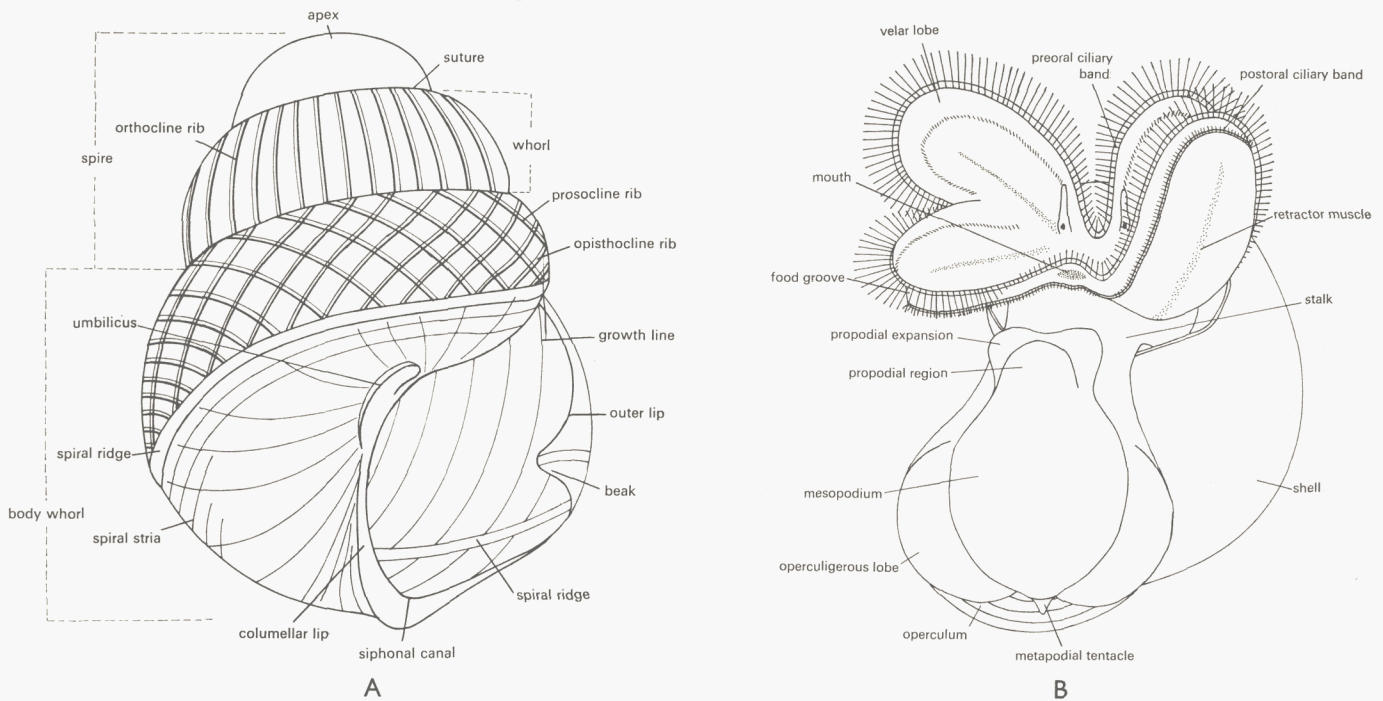
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General remarks

A number of features useful in the identification of prosobranch larvae are distinguishable only when they are alive and swimming. The delicate markings on the shell and some pigment of the soft tissues, however, are retained for some weeks in larvae fixed in CARRIKER's fluid: 40% formaldehyde 5 ml, sugar 50 g, borax 0.5 g, filtered seawater 500 ml.

Since there is no close correspondence between larval and adult appearance the order in which species are described is alphabetical except for *Rissoa* spp. (figured on p. 21), *Hydrobia ulvae*, which has a brief larval life and is not planktotrophic, and a larva of uncertain identification (? *Haedropleura septangularis*); the last two species are not in the keys. Terms used in the descriptions are given in the diagrams of a shell (A) and veliger (B).

The larvae considered in the keys are planktotrophic. Very young stages are often difficult to identify since the majority hatch with an unpigmented, bilobed velum and lack pigmentation elsewhere, the foot is a simple lobe with no propodial region and any characteristic patterns on the shell surface are not readily visible. The keys are based on larvae of at least $1\frac{1}{2}$ whorls and where changes affecting identification occur during larval life, especially in the velum, foot and shell, these are indicated. In some cases identifications are made by alternative pathways through the keys.



KEYS TO THE IDENTIFICATION OF VELIGERS

- A Velum and foot retracted, their pigments seen through shell.
 B Velum and foot extended.

A

- | | | |
|--|--------------------------|---|
| 1. Shell sinistral, reddish-brown | <i>Triphora perversa</i> | |
| Shell dextral | | 2 |
| 2. Shell double; inner and outer layer (scaphoconch) widely separate | | 3 |
| Shell not double. | | 7 |
| 3. Scaphoconch globular and without a beak | <i>Velutina velutina</i> | |
| Scaphoconch nautiloid, with a beak. | | 4 |

4. Scaphoconch keeled, inner shell excentrically placed within it. Yellow pigment blobs on velum and mantle..... 5
 Scaphoconch not keeled, inner shell centrally placed within it. No yellow pigment blobs 6
5. Pigment blobs large and numerous..... *Lamellaria perspicua*
 Pigment blobs small and scattered..... *Lamellaria latens**
6. Alimentary tract heavily pigmented black until near metamorphosis. Velum bordered by only thin lines of red pigment .. *Trivia monacha*
 Little black pigment on alimentary tract and velar edge heavily pigmented dark red..... *Trivia arctica*
7. Shell all brown..... 8
 Shell pale to deep horn-colour, colourless or with purplish-red..... 10
8. Bright orange pigment on velum..... *Philbertia gracilis*
 No orange pigment on velum 9
9. Reticulate sculpture on embryonic and larval whorls. Siphonal canal long by $2\frac{1}{2}$ -whorl stage *Philbertia linearis*
 Reticulate sculpture on larval whorls only; embryonic whorls have granulated surface. Siphonal canal remaining short..... *Simnia patula*
10. Sutures between whorls conspicuously pigmented..... 11
 Sutures between whorls not conspicuously pigmented. No purplish-red colour in shell..... 12
11. Beak prominent and tongue-shaped. Body tissues never bright purple..... *Bittium reticulatum*
 Beak prominent and pointed. Body tissues never bright purple *Cerithiopsis barleei*
 Beak broad and plate-like. Body tissues never bright purple..... *Cerithiopsis tubercularis*
 Beak broad, not prominent. Body tissues and parts of shell bright purple..... *Aclis minor*
12. Shell conspicuously shiny with oblique cleft in apex. Whorls flattened, not dipping to suture 13
 Shell not conspicuously shiny. No oblique cleft in apex. Whorls not flattened, dipping to suture 14
13. Shell apex pointed and aperture acutely angulated above *Balcis alba*
 Shell apex blunt and aperture not acutely angulated above..... *Balcis devians*
14. Shell unsculptured or with a single spiral line, ridge or keel extending on to beak, or with spiral rows of tubercles; growth lines may be prominent 15
 Shell more elaborately sculptured..... 27
15. Shell with beak..... 16
 Shell without beak..... 22
16. Conspicuous orange-yellow pigment blobs on velum..... 17
 No orange or yellow pigment on velum..... 18
17. Shell with well developed siphon Young & mid veliger *Mangelia nebula*
 Shell with siphonal expansion only..... Mid and late veliger *Rissoa inconspicua* and young and mid veliger *R. parva***
18. Shell without an umbilicus..... 19
 Shell umbilicate 20
19. Shell with siphonal expansion and a spiral ridge develops on the 2nd whorl and extends on to beak
Cingula semistriata and late veliger *Rissoa parva***
 Shell with siphonal notch and no spiral ridge Young veliger *Lacuna vineta*
20. Velum with crescentic band of black pigment and body heavily pigmented black. Tubercles on shell. Mid and late veliger. *Littorina neritoides*
 Pigment on velum, if present, dark red. Body not heavily pigmented black. Shell with or without spiral ridge on body whorl..... 21
21. Beak broad and tapering to a blunt point. Siphonal expansion not developing into a siphonal canal *Rissoa membranacea*
 Beak chisel-shaped and very pronounced until just before metamorphosis when siphonal canal becomes large 25
22. Shell umbilicate 23
 Shell without an umbilicus or whorls coiled in one plane. No siphonal canal 26
23. Shell loosely coiled almost planorbiform up to 2-whorl stage. $2\frac{1}{2}$ -whorl stage with conspicuous siphonal canal and blobs of red velar pigment
 Young and mid veliger *Aporrhais pespelicani*
 Shell globular and without a siphonal canal. No red pigment blobs on body tissues 24
24. Densely scattered spots of yellow pigment on foot, visible through closed operculum *Littorina littorea*
 No yellow pigment on foot..... Mid and late veliger *Lacuna vineta*
25. Velum unpigmented Young veliger *Nassarius incrassatus*
 4 large red patches on velum and sometimes a thin red line Mid and late veliger *Nassarius incrassatus*
 Red pigment band on velum, but no red patches *Nassarius reticulatus*
26. Shell planorbiform, very transparent, with round aperture. Velum colourless or with semilunar band of reddish pigment, but no pigment spots..... *Caecum imperforatum*
 Shell conical with tumid whorls shelving above and below the suture. Aperture not very broad. No velar pigment.
 Young and mid veliger *Turritella communis*
 Shell low with enlarged body whorl and very broad aperture. Velum with thin line of dark red pigment and numerous pigment spots, typically yellow and black..... *Crepidula fornicata*
27. Sculpture only on embryonic shell 28

* This distinction should be attempted only when both species are available.

• These species are difficult to separate. See descriptions for distinguishing characters.

Sculpture only on larval whorls.....	29
Sculpture on all whorls.....	31
28. Four large patches of red pigment on velum, but no yellow pigment.....	<i>Natica alderi</i>
Numerous blobs of bright yellow pigment on velum and sometimes a line of red pigment.....	Young veliger <i>Mangelia attenuata</i>
29. Larval whorl laterally compressed with median lobed keel. Sculptured with conspicuous orthocline ribs.....	<i>Tornus subcarinatus</i>
Larval whorls not laterally compressed and ridges, if present, not orthocline.....	30
30. Third whorl sculptured with numerous equidistant spiral ridges. Siphonal canal.....	Late veliger <i>Aporrhais pespelicani</i>
Second or third whorl sculptured with 4 spiral ridges which form crenations on the outer lip. No siphonal canal. Late veliger <i>Turritella communis</i>	
Third whorl sculptured with a few rows of large tubercles which form crenations on the outer lip. Siphonal canal. Late veliger <i>Mangelia nebula</i>	
31. Embryonic shell sculptured with a regular reticulation of undulating spiral and broken orthocline lines.....	<i>Alvania crassa</i>
Embryonic shell sculptured with spiral lines or rows of tubercles.....	32
32. Sculpture on body whorl a median band of closely packed tubercles.....	<i>Rissoa sarsi</i>
Sculpture on body whorl consisting of pronounced growth lines in mid veliger (forming a median keel which extends back from the beak along the whorl) and in the late veliger, a few spiral rows of large tubercles which form crenations on the outer lip	
	Mid and late veliger <i>Mangelia attenuata</i>
Entire surface of body whorl sculptured with minute tubercles.....	33
33. Very minute tubercles form spiral lines on embryonic whorl and slightly larger ones on the third whorl border a slight median ridge.	
Over rest of shell they are irregularly arranged in approximately spiral rows.....	<i>Alvania punctura</i>
Minute tubercles always regularly arranged in equidistant spiral rows. No median ridge.....	Young and mid veliger <i>Littorina neritoides</i>

B

1. Velar lobes not indented laterally.....	2
Velar lobes slightly indented laterally.....	41
Velar lobes indented laterally to form 4 or 6 lobes.....	49
2. Shell double inner and outer layers (scaphoconch) widely separate.....	3
Shell not double.....	5
3. Scaphoconch globular and without beak.....	Young veliger <i>Velutina velutina</i>
Scaphoconch nautiloid and with beak.....	4
4. Velum unpigmented.....	Young veliger <i>Trivia monacha</i>
Velum pigmented with large and numerous yellow spots associated with food groove.....	Young veliger <i>Lamellaria perspicua</i>
Velum with small and scattered yellow pigment spots.....	Young veliger <i>Lamellaria latens</i>
5. Velum unpigmented.....	6
Velum pigmented (sometimes only thin line at base of preoral ciliary band).....	22
6. Shell all brown.....	7
Shell pale or deep horn-coloured, colourless or with purplish-red.....	9
7. Shell sinistral.....	<i>Triphora perversa</i>
Shell dextral.....	8
8. Reticulate sculpture on embryonic and larval whorls.....	Young veliger <i>Philbertia linearis</i>
Embryonic whorls with granulated surface, reticulate sculpture on larval whorls.....	Young veliger <i>Simnia patula</i>
9. Sutures between whorls conspicuously pigmented.....	10
Sutures between whorls not conspicuously pigmented. No purplish-red colour in shell.....	11
10. Beak prominent and tongue-shaped. Body tissues never bright purple.....	<i>Bittium reticulatum</i>
Beak prominent and pointed. Body tissues never bright purple.....	<i>Cerithiopsis barleei</i>
Beak broad and plate-like. Body tissues never bright purple.....	<i>Cerithiopsis tubercularis</i>
Beak broad, not prominent. Body tissues and parts of shell bright purple.....	<i>Aclis minor</i>
11. Shell conspicuously shiny. Oblique cleft in apex. Whorls flattened not dipping to suture.....	12
Shell not conspicuously shiny. No oblique cleft in shell apex. Whorls not flattened, dipping to suture.....	13
12. Shell apex pointed and aperture acutely angulated above.....	<i>Balcis alba</i>
Shell apex blunt and aperture not acutely angulated above.....	<i>Balcis devians</i>
13. Shell unsculptured or with a single line or spiral ridge extending on to the beak, growth lines may be prominent.....	14
Shell more elaborately sculptured.....	18
14. Shell beaked.....	15
Shell without beak.....	17
15. Beak prominent and chisel-shaped.....	Young veliger <i>Nassarius incrassatus</i>
Beak broad and tapering to a blunt point.....	16
16. Marked umbilicus. Spire depressed.....	<i>Rissoa membranacea</i>
No umbilicus. Spire blunt, not depressed.....	Young veligers <i>Cingula semistriata</i> , <i>Rissoa inconspicua</i> and <i>R. parva</i> **

** These species are difficult to separate. See descriptions for distinguishing features.

17. Shell planorbiform. Aperture round	Young veliger <i>Caecum imperforatum</i>	
Shell conical with tumid whorls shelving above and below suture. Aperture not round	Young and mid veliger <i>Turritella communis</i>	19
18. Embryonic shell unsculptured		20
Embryonic shell sculptured		20
19. 2nd whorl laterally compressed with pronounced orthocline ribs and median lobed keel	Young veliger <i>Tornus subcarinatus</i>	
Shell not laterally compressed. No orthocline ridges, but 1 to 4 spiral ridges on body whorl form crenations on outer lip	Late veliger <i>Turritella communis</i>	
20. Shell without beak	Young veliger <i>Littorina neritoides</i>	21
Shell with beak		21
21. Embryonic shell sculptured with a regular reticulation of undulating spiral and broken orthocline lines	Young veliger <i>Alvania crassa</i>	
Embryonic shell sculptured with spiral lines	Young, mid and sometimes late veliger <i>Alvania punctura</i>	
22. Velum with spots of orange or yellow pigment		23
No orange or yellow pigment spots on velum		27
23. Shell brown with reticulate sculpture	Young veliger <i>Philbertia gracilis</i>	
Shell colourless or horn-coloured, without reticulate sculpture		24
24. Mesopodium narrowing abruptly posteriorly to a long finger-shaped process		25
Mesopodium rounded posteriorly, not narrowing abruptly to a finger-shaped process		26
25. Embryonic shell sculptured with spiral lines	Young veliger <i>Mangelia attenuata</i>	
Embryonic shell unsculptured	Young veliger <i>Mangelia nebula</i>	
26. Shell low, without beak. Body whorl greatly enlarged and aperture very broad	<i>Crepidula fornicata</i>	
Shell conical with beak. Body whorl not enlarged and aperture not very broad ..	Late veliger <i>Rissoa inconspicua</i> and mid veliger <i>R. parva**</i>	
27. Larval whorl laterally compressed with median lobed keel. Sculptured with conspicuous orthocline ribs.	Mid and late veliger <i>Tornus subcarinatus</i>	
Larval whorls not laterally compressed. No orthocline ridges		28
28. Dark pigment on velum forms a line encircling each lobe at base of preoral ciliary band and not extending towards centre		29
Dark pigment on velum forms a broader semilunar band which may extend towards the centre of each lobe		37
29. Embryonic shell sculptured		30
Embryonic shell unsculptured		32
30. Embryonic shell sculptured with a regular reticulation of undulating spiral and broken orthocline lines. Mid and late veliger <i>Alvania crassa</i>		
Embryonic shell sculptured with spiral lines		31
31. Sculpture on body whorl a median band of closely packed tubercles	<i>Rissoa sarsi</i>	
Entire surface of body whorl sculptured with minute tubercles irregularly arranged in approximately spiral rows. Late veliger <i>Alvania punctura</i>		
32. Shell conical, no umbilicus	Mid and late veliger <i>Cingula semistriata</i> and late veliger <i>Rissoa parva**</i>	
Shell globular, small umbilicus	Young veliger <i>Rissoa inconspicua</i>	
Spire depressed, marked umbilicus		33
33. Shell with beak		34
Shell without beak		36
34. Intestine unpigmented. Dark pigment on velum only as thin inconspicuous red line	Late veliger <i>Rissoa membranacea</i>	
Intestine black. Dark pigment on velum a conspicuous line		35
35. Shell beak pronounced. Conspicuous growth lines form median keel extending back from beak along the whorls.	Young veliger <i>Nassarius reticulatus</i>	
Shell beak small. No median keel	Early mid veliger <i>Lacuna vineta</i>	
36. Shell loosely coiled almost planorbiform. Umbilicus wide and shallow with penultimate coil visible through it. Young veliger <i>Aporrhais pespelicani</i>		
Shell tightly coiled, not planorbiform. Umbilicus less wide, deep	Mid and late veliger <i>Lacuna vineta</i>	
37. Shell planorbiform. No umbilicus	Mid and late veliger <i>Caecum imperforatum</i>	
Shell not planorbiform. Marked umbilicus		38
38. Shell beaked and may be faintly sculptured with regular spiral rows of minute tubercles		39
Shell without beak and unsculptured (growth lines may be prominent)		40
39. Stomach heavily pigmented black	Mid and late veliger <i>Littorina neritoides</i>	
No black pigment on stomach	Early mid veliger <i>Lacuna vineta</i>	
40. Densely scattered spots of yellow pigment on mesopodium	<i>Littorina littorea</i>	
No yellow pigment on foot	Late veliger <i>Lacuna vineta</i>	
41. Shell double inner and outer layers (scaphoconch) widely separate		42
Shell not double		44
42. Scaphoconch globular and without beak	Mid and late veliger <i>Velutina velutina</i>	
Scaphoconch nautiloid, with beak		43

** These species are difficult to separate. See descriptions for distinguishing features.

43. No yellow pigment spots on velum	Mid and late veliger <i>Trivia monacha</i>	
Conspicuous yellow pigment spots on velum		56
44. Velum with conspicuous spots of orange or yellow pigment		45
No orange or yellow pigment spots on velum		46
45. Shell brown, all whorls sculptured	Early mid veliger <i>Philbertia gracilis</i>	
Shell colourless, unsculptured until 3-whorl stage when large tubercles develop on the body whorl ..	Mid and late veliger <i>Mangelia nebula</i>	
Shell colourless, embryonic shell sculptured with spiral lines	Mid and late veliger <i>Mangelia attenuata</i>	
46. Shell brown with reticulate sculpture	Mid veliger <i>Philbertia linearis</i>	
Shell colourless or horn-coloured. Sculpture, if present, not reticulate		47
47. Shell without beak	Young veliger <i>Aporrhais pespelicani</i>	
Shell with pronounced beak		48
48. Red pigment on velum, if present, forming a patch at the anterior and posterior coner of each lobe. Early mid veliger <i>Nassarius incrassatus</i>		
Red pigment on velum forming a broad line at the base of the preoral ciliary band	Mid and late veliger <i>Nassarius reticulatus</i>	
49. Velum colourless		50
Velum pigmented		51
50. Velar lobes long and very narrow	Mid veliger <i>Simnia patula</i>	
Velar lobes broad	Mid and late veliger <i>Philbertia linearis</i>	
51. Velum with a conspicuous patch of dark red pigment at the end of each lobe, internal to the food groove		52
Dark red pigment on velum, if present, not concentrated into a conspicuous patch at the end of each velar lobe		54
52. Shell with pronounced beak until near metamorphosis; then propodial region of foot becomes expanded into 2 antero-lateral horns.		
	Mid and late veliger <i>Nassarius incrassatus</i>	
Shell without beak and propodial region of foot not becoming expanded into 2 antero-lateral horns		53
53. Embryonic shell faintly sculptured with regularly arranged rows of minute tubercles. No siphonal canal. Velum not becoming 6-lobed		
	<i>Natica alderi</i>	
Embryonic shell unsculptured. Siphonal canal conspicuous. Velum becoming 6-lobed	Mid and late veliger <i>Aporrhais pespelicani</i>	
54. Shell double inner and outer layer (scaphoconch) widely separate		55
Shell not double		57
55. No yellow pigment spots on velum which is bordered by a thick line of dark red pigment at the base of the preoral ciliary band. <i>Trivia arctica</i>		
Velum with yellow pigment spots and a thin line of red pigment at the base of the preoral ciliary band		56
56. Yellow pigment blobs large and numerous	Mid and late veliger <i>Lamellaria perspicua</i>	
Yellow pigment blobs small and scattered	Mid and late veliger <i>Lamellaria latens*</i>	
57. Shell brown		58
Shell colourless		59
58. Velum bordered with a line of reddish-brown pigment at the base of the preoral ciliary bands and orange pigment spots scattered irregularly in the region of the food groove	Mid and late veliger <i>Philbertia gracilis</i>	
Velum bordered by an almost continuous band of brown spots at the base of the preoral ciliary band. No orange spots. Late veliger <i>Simnia patula</i>		
59. Embryonic shell sculptured with spiral lines	Mid and late veliger <i>Mangelia attenuata</i>	
Embryonic shell unsculptured	Mid and late veliger <i>Mangelia nebula</i>	

* This distinction should be attempted only when both species are available.

Aclis minor* (Brown)**Taenioglossa Aglossa Aclididae***

Shell: Transparent, colourless, or horn-coloured except for conspicuous purplish-red on columella, umbilicus and sutures (the purplish colour, sometimes faint, which has been attributed to the rest of the shell disappears on removal of the soft tissues). Conical at first, spire becoming elongated. Embryonic whorl sculptured with scattered minute tubercles. Successive whorls have narrowly spaced orthocline striae which become very faint so that shell appears smooth and shiny by 4-whorl stage. Beak broad, not prominent.

Velum: Bilobed and colourless always. Right lobe occasionally the larger.

Foot: Remaining colourless for most of larval life except for a little scattered black pigment in mid region of mesopodium; by 4-whorl stage mesopodium may become heavily pigmented black. Posterior part of mesopodium small, not extending beyond operculum. Propodial region becoming very long and mobile at swimming-crawling stage and, as in *Littorina* spp., used with posterior part of mesopodium in a stepping method of locomotion.

Other pigmentation: Stomach and oesophagus usually become pigmented black by $2\frac{1}{2}$ -whorl stage.

Alvania crassa* (Kanmacher)**Taenioglossa Rissoacea Rissoidae***

Shell: Transparent and colourless at first, becoming more opaque and horn-coloured. Embryonic shell sculptured with regular reticulation of undulating spiral and broken orthocline lines forming rows of alternating plates. Successive whorls with growth lines and a prominent spiral ridge, similar to *Rissoa parva*, which develops on 3rd whorl and extends on to beak. Beak pronounced, but not so long as in *A. punctura*. By metamorphosis whorls have strong distantly spaced orthocline ribs and crowded spiral striae, giving the reticulate appearance of the adult sculpture; outer lip now thick and crenated.

Velum: Similar to *A. punctura* except that line of red pigment at base of preoral ciliary band develops at earlier stage.

Foot: Similar to *A. punctura*, but mesopodium becomes larger and black pigmentation disappears at metamorphosis.

Right and left pallial tentacles: Developed by $3\frac{1}{2}$ -whorl stage.

Other pigmentation: Oesophagus and stomach remain unpigmented, but initial part of intestine becomes black by $2\frac{1}{2}$ -whorl stage and later black pigment extends down its length. Osphradium becomes black.

Alvania punctura* (Montagu)**Taenioglossa Rissoacea Rissoidae***

Shell: Transparent and colourless at first, becoming opaque and dark horn-colour by 3-whorl stage. Entire surface sculptured with minute tubercles: very minute ones aggregated to form spiral lines on embryonic whorl and slightly larger ones irregularly arranged in approximately spiral rows on larval whorls. On body whorl tubercles border a median spiral ridge which extends on to beak. Beak prominent. No siphonal canal. Conspicuous crenations on outer lip by 3-whorl stage.

Velum: Bilobed, becoming large with breadth more than length of shell at 3-whorl stage. Remains unpigmented for most of larval life, but a thin line of red pigment often develops at base of preoral ciliary band by $2\frac{1}{2}$ -whorl stage and at 3-whorl stage is usually conspicuous. One lobe frequently the larger.

Foot: With ciliated operculigerous lobes and long, mobile propodial region typical of rissoids. Posterior part of mesopodium not becoming very large. Stalk massive and heavily pigmented black, the black pigment extending down on to operculigerous lobes and base of propodium. Dark red pigment in mid region of mesopodium and yellow pigment spots beneath operculum.

Left pallial tentacle: Developed by 3-whorl stage.

Other pigmentation: Black pigment may develop on oesophagus, stomach and intestine.

Aporrhais pespelicani* (L.)**Taenioglossa Strombacea Aporrhaidae***

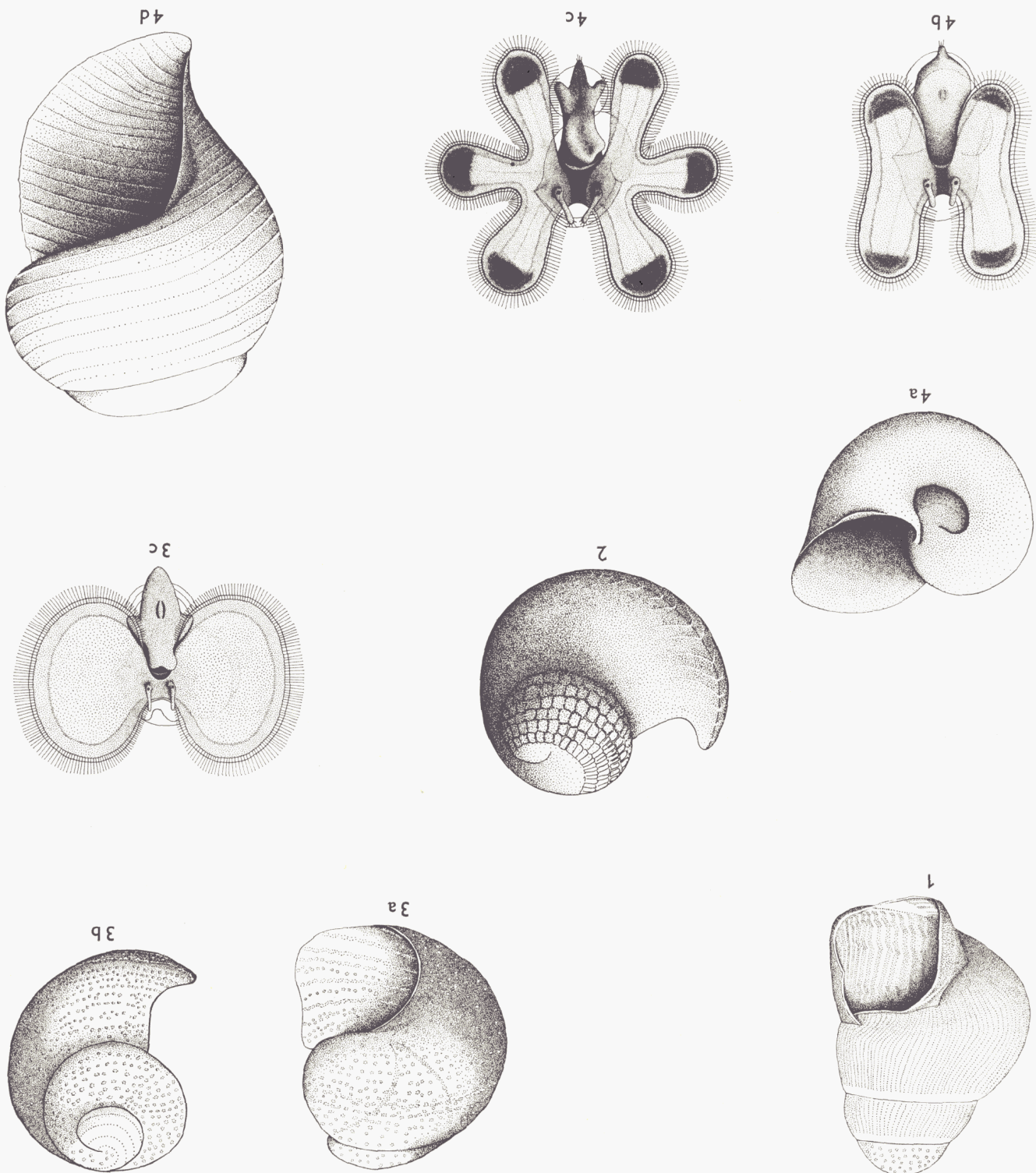
Shell: Colourless and unsculptured at first; becoming dark horn-colour by 3-whorl stage and sculptured with numerous, evenly spaced spiral ridges on body whorl. Up to 2-whorl stage shell loosely coiled and almost planorbiform; umbilicus wide and shallow with penultimate coil visible through it and siphonal canal incipient. By $2\frac{1}{2}$ -whorl stage siphonal canal conspicuous and umbilicus deep and narrow. No beak.

Velum: Bilobed at first with thin line of red pigment at base of preoral ciliary band. Each lobe becomes elongated antero-posteriorly with a red pigment spot at the anterior and posterior corner internal to the food groove, and by 2-whorl stage has become divided into two long lobes. At $2\frac{1}{2}$ -whorl stage velum has six long lobes, each with a median retractor muscle, a conspicuous patch of red pigment at the end and a thick line of red pigment associated with both preoral and postoral ciliary bands.

Foot: Becoming large with very long mobile propodial region and small knob-like operculigerous lobes with non-vibratile cilia at their extremities. At $2\frac{1}{2}$ -whorl stage foot is colourless except for a little scattered red pigment in mid region of mesopodium and on stalk. Later mesopodium becomes dark purplish-black and this pigment extends up centre of propodium. Whole foot can be rotated through 180° relative to shell on end of long, mobile stalk.

Other pigmentation: Intestine black. Stomach unpigmented. Scattered black pigment around mouth and between eyes at $2\frac{1}{2}$ -whorl stage; later becomes continuous with thick border of red pigment on velum and extends down oesophagus. Osphradium bright red and conspicuous at this stage.

1. *Alvis minor* (Brown), shell length 0.31 mm; 2. *Alvania crassa* (Kamnacher), shell length 0.48 mm; 3a *Alvania punctura* (Montagu), shell length 0.32 mm; 3b. *Alvania punctura* (Montagu), shell length 0.29 mm; 3c. *Alvania punctura* (Montagu), 2-whorl stage. 4a. *Aporrhais pespellicani* (L.), shell length 0.64 mm; 4b. *Aporrhais pespellicani* (L.), 1 $\frac{1}{2}$ -whorl stage; 4c. *Aporrhais pespellicani* (L.), 2 $\frac{1}{2}$ -whorl stage; 4d. *Aporrhais pespellicani* (L.), shell length 2.40 mm.



Balcis alba (da Costa)***Taenioglossa Aglossa Eulimidae***

Shell: Transparent, white and conspicuously shiny. Unsculptured with oblique cleft at apex. Spire elongated. Whorls flattened, not dipping to sutures. No beak or siphonal canal. Aperture acutely angulated above with smooth outer lip.

Velum: Bilobed and always colourless. Right lobe occasionally the larger.

Foot: Mesopodium develops 2 large operculigerous lobes, but propodial region remains small. Scattered black pigment on stalk; later this extends down operculigerous lobes.

Other pigmentation: Black pigment on oesophagus and stomach and round mouth. Intestine remains unpigmented.

Balcis devians (Monterosato)***Taenioglossa Aglossa Eulimidae***

Shell: Similar to *B. alba*, but squatter in shape and aperture not acutely angulated above. Characteristic curve of shell appears after velum is lost.

Velum: Similar to *B. alba*.

Foot: Similar to *B. alba*, but remains colourless until about 3-whorl stage when purplish-black pigment develops on anterior part of mesopodium and operculigerous lobes.

Other pigmentation: Black pigment on oesophagus and round mouth at 2-whorl stage, but not so heavy as in *B. alba*. Purplish-black pigmentation on stomach only near openings of oesophagus and intestine. Intestine unpigmented except for a little scattered black pigment near its origin.

Bittium reticulatum (da Costa)***Taenioglossa Cerithiacea Cerithiidae***

Shell: Horn-coloured with sutures and columella reddish-brown. Whorls, only $2\frac{1}{2}$ in late larva, tumid dipping to sutures. Unsculptured except for median spiral ridge which develops on second whorl and extends on to prominent tongue-shaped beak. No siphonal canal.

Velum: Bilobed and colourless.

Other pigmentation: Body remains colourless.

Caecum imperforatum (Kanmacher)***Taenioglossa Cerithiacea Caecidae***

Shell: Planorbiform, colourless, smooth and very transparent. Aperture round and body whorl beginning to uncoil. No beak or siphonal canal. Operculum very thick and colourless.

Velum: Bilobed. Colourless at first, but by 2-whorl stage developing a semi-lunar band of reddish-purple pigment around the broadest part of each lobe. This resembles early pigmentation in *Littorina littorea*, but is not so conspicuous.

Foot: Colourless. Propodial region becoming fairly long, but mesopodium not extending beyond operculum and showing little extensibility.

Other pigmentation: Body remains colourless and very transparent.

Cerithiopsis barleei (Jeffreys)***Taenioglossa Cerithiacea Cerithiopsidae***

Shell: Shiny with elongated spire. Colourless at first, but becoming horn-colour with conspicuous purplish-red, on columella, siphonal canal and sutures (similar to *Aclis minor*). Sculpture of minute tubercles, scattered on youngest whorls and on older ones mostly aggregated to form widely spaced and regular prosocline ribs. At end of 4th whorl, 3 spiral ridges are developed abapically and extend on to beak. Beak large with prominent point. Siphonal canal short and broad.

Velum: Bilobed and colourless always. Right velar lobe usually the larger.

Foot: Becoming large with long mobile propodial region. Mesopodium may become heavily pigmented black by 3-whorl stage, but often foot remains unpigmented except for a little scattered black pigment on stalk.

Other pigmentation: Black pigment on intestine, stomach and oesophagus by $3\frac{1}{2}$ -whorl stage.

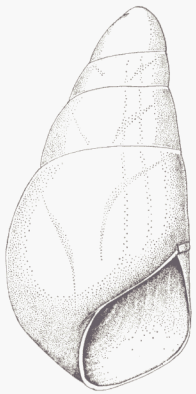
Cerithiopsis tubercularis (Montagu)***Taenioglossa Cerithiacea Cerithiopsidae***

Shell: Shiny with elongated spire. White or horn-coloured with conspicuous purplish-red on columella, siphonal canal and sutures. Unsculptured except for faint growth lines and a single spiral ridge on 4th whorl. Beak broad and plate-like. Siphonal canal short and broad.

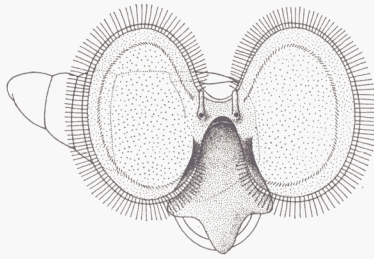
Velum: Similar to *C. barleei*.

Foot: Proportions similar to *C. barleei*. Usually heavily pigmented black, except in mid region of mesopodium and at extreme posterior end where light grey. A groove runs down centre of posterior half of mesopodium. Lemon yellow spots on metapodium near columellar edge visible through operculum when animal withdrawn.

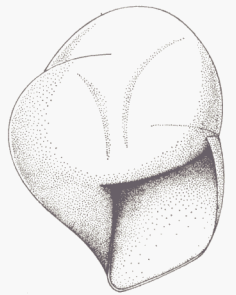
Other pigmentation: Intestine, stomach and oesophagus remain unpigmented.



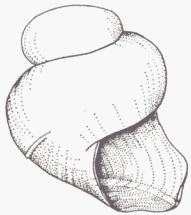
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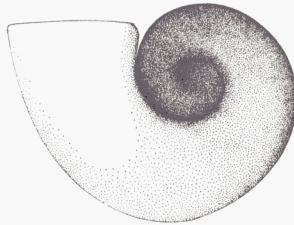
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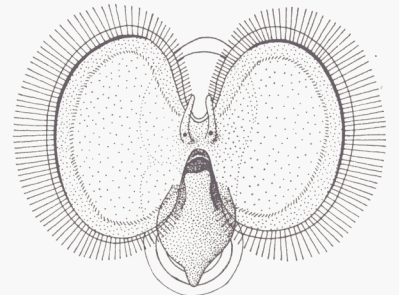
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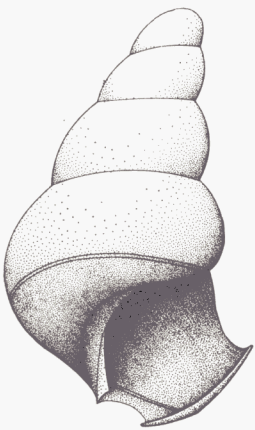
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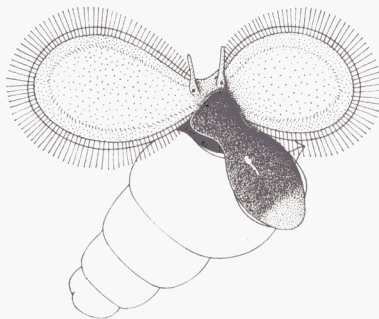
7a



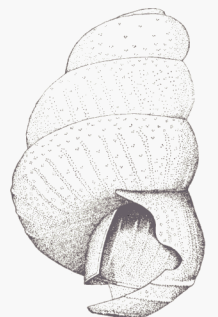
7b



9a



9b



8

5a. *Balcis alba* (da Costa), shell length 0.55 mm; 5b. *Balcis alba* (da Costa), 4-whorl stage; 5c. *Balcis devians* (Monterosato), shell length 0.33 mm; 6. *Bittium reticulatum* (da Costa), shell length 0.38 mm; 7a. *Caecum imperforatum* (Kanmacher), shell length 0.30 mm; 7b. *Caecum imperforatum* (Kanmacher), 2-2 $\frac{1}{4}$ -whorl stage; 8. *Cerithiopsis barleei* Jeffreys, shell length 0.36 mm; 9a. *Cerithiopsis tubercularis* (Montagu), shell length 0.46 mm; 9b. *Cerithiopsis tubercularis* (Montagu), 5-whorl stage.

Cingula semistriata* (Montagu)**Taenioglossa Rissoacea Rissoidae***

Shell: Transparent and colourless at first, becoming pale horn-colour and, soon after metamorphosis, developing the dark brown pigmentation of the adult. Becoming conical. Unsculptured except for a faint spiral line similar to *R. parva*. Short, broad beak and siphonal expansion.

Velum: Bilobed, becoming large. Colourless at first, but later with a thin line of red pigment along base of preoral ciliary band.

Foot: Becoming large with ciliated operculigerous lobes and long mobile propodial region typical of rissoids. Mesopodium with dark red pigment in mid region and the usual diffuse yellow pigment on anterior part of operculigerous lobes.

Metapodial tentacle: Well developed by $2\frac{1}{2}$ -whorl stage. No pallial tentacle.

Other pigmentation: Black pigment beginning to develop on intestine at $2\frac{1}{2}$ -whorl stage.

Crepidula fornicata* (L.)**Taenioglossa Calyptraeacea Calyptraeidae***

Shell: Transparent and colourless at first, becoming more opaque and pale horn-colour. Initial whorl nautiloid. Mouth of subsequent whorl greatly expanded especially laterally, height remaining low. No beak, umbilicus or siphonal canal. Unsculptured except for conspicuous growth lines. At swimming-crawling stage mantle spreads posteriorly to cover ventral half of coils and secretes a calcareous ledge, the posterior half of the limpet-like shell of the adult.

Velum: Bilobed with scattered pigment spots and thin line of red pigment at base of preoral ciliary band. Pigment spots large and predominantly yellow, but some larvae also develop black ones. Number and position of spots very variable, but mainly in region of food groove at first and becoming more numerous and scattered later.

Foot: Mesopodium large and bordered at $1\frac{1}{2}$ -whorl stage by small pale yellow spots of very variable number; at $1\frac{3}{4}$ -whorl stage there is also scattered dark red pigment in mid region of mesopodium and a triangular black spot at its posterior tip. Propodial region mobile, becoming large and expanded antero-laterally into 2 recurved horns. At late stage base of stalk has scattered black pigment.

Other pigmentation: Intestine black, oesophagus colourless at first, but becoming orange-red by $1\frac{3}{4}$ -whorl stage. Osphradium black and conspicuous by $1\frac{3}{4}$ -whorl stage.

Lacuna vincta* (Montagu)**Taenioglossa Littorinacea Lacunidae***

Shell: Colourless and transparent at first; becoming dark horn-colour near time of metamorphosis with the brown spiral bands of the adult appearing. Unsculptured. Spire not elongated. Pointed beak at time of hatching becomes less pronounced as shell grows and disappears by $2\frac{1}{2}$ -whorl stage or earlier. At this stage there is a conspicuous umbilicus and siphonal notch.

Velum: Bilobed, small at first, but becoming considerably larger than shell. Colourless for first 3 days, but a very faint line of red pigment develops along base of preoral ciliary band at $1\frac{1}{2}$ -whorl stage and gradually becomes more distinct and is conspicuous by 2-whorl stage. This pigment may develop as a thick semilunar band around the broadest part of each lobe, but usually it is thinner and continuous round the margin of each lobe.

Foot: Metapodium small and triangular at first, elongating later and becoming expanded laterally to form operculigerous lobes. Colourless at first, but later dark red pigment appears in mid region of mesopodium and extends anteriorly and posteriorly. By swimming-crawling stage propodial region very long, usually with black pigment on propodium. Stalk also heavily pigmented and anterior part of metapodial lobes red.

Other pigmentation: Initial part of intestine black by $1\frac{1}{2}$ -whorl stage. Lateral bands of black pigment on oesophagus by 2-whorl stage fuse later and extend on to buccal region (giving the appearance of a dark area between the eyes). Scattered black pigment on stomach by metamorphosis.

Lamellaria latens* (Müller)**Taenioglossa Lamellariacea Lamellariidae***

Shell: Distinguished from that of *L. perspicua* only by coarser denticulations on keels of scaphoconch.

Velum: Like that of *L. perspicua* but yellow spots smaller and not so numerous, although scattered generally over velar lobes.

Foot: Like that of *L. perspicua*, but yellow pigment less developed.

Other pigmentation: As in *L. perspicua*, but yellow spots not so numerous.

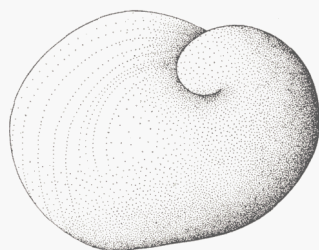
Lamellaria perspicua* (L.)**Taenioglossa Lamellariacea Lamellariidae***

Shell: Double; inner and outer layer (scaphoconch) widely separate. Scaphoconch nautiloid, colourless and very transparent; flat laterally with 2 median keels which anteriorly border chisel-shaped beak. Keels sculptured with minute denticulations. Inner shell chalky-white, not opaque, smooth; excentrically placed within scaphoconch.

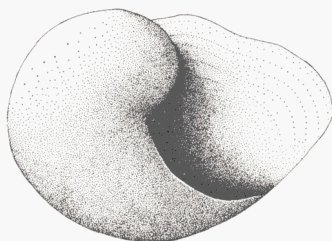
Velum: Bilobed at first and bordered with bright yellow pigment spots associated with food groove. Becoming 4-lobed with a thin line of red pigment along base of preoral ciliary band. Yellow spots become more numerous, very conspicuous and scattered generally over velar lobes. Later velum becomes 6-lobed, the middle lobe on each side remaining smaller than the other two.

Foot: Becoming large, with short, broad propodial region. Colourless at first, but, as velum becomes 4-lobed, scattered yellow pigment spots develop on mesopodium and pale yellow pigment mid ventrally; also faint reddish-brown pigment down centre of mesopodium when velum 6-lobed.

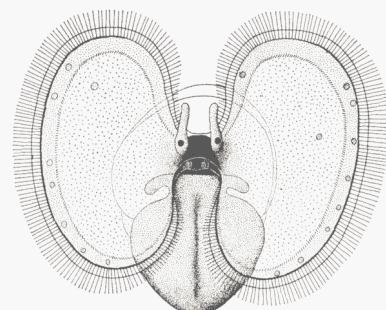
Other pigmentation: Conspicuous yellow pigment spots scattered over mantle; concentrated particularly at mantle edge and sometimes in region of digestive gland. Similar pigment spots may develop on intestine when velum becomes 6-lobed. Body tissues remarkably transparent.



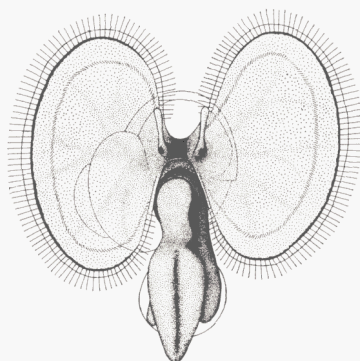
11 a



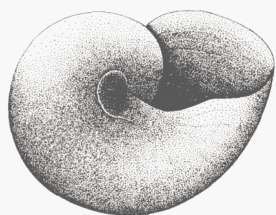
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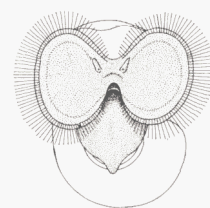
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12 c



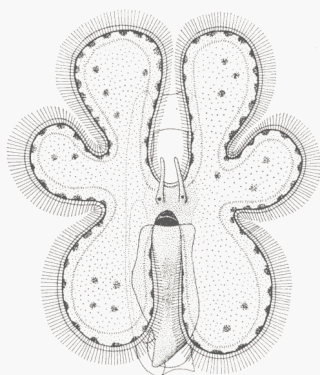
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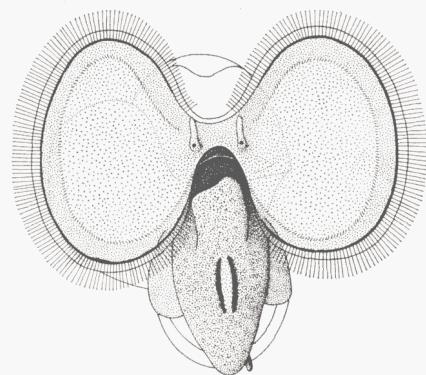
12 b



13 a



13 b



10

10. *Cingula semistriata* (Montagu), $2\frac{1}{2}$ -whorl stage; 11 a. *Crepidula fornicata* (L.), shell length 0.65 mm; 11 b. *Crepidula fornicata* (L.), shell length 0.65 mm; 11 c. *Crepidula fornicata* (L.), $1\frac{3}{4}$ -2-whorl stage; 12 a. *Lacuna vineta* (Montagu), shell length 0.52 mm; 12 b. *Lacuna vineta* (Montagu), 3 days after hatching; 12 c. *Lacuna vineta* (Montagu), $2\frac{1}{2}$ -whorl stage; 13 a. *Lamellaria perspicua* (L.), shell length 0.92 mm; 13 b. *Lamellaria perspicua* (L.), late veliger.

Littorina littorea* (L.)**Taenioglossa Littorinacea Littorinidae***

Shell: Transparent and colourless at first, becoming pale horn-colour. Globular. Unsculptured except for faint growth lines. No beak or siphonal canal. Umbilicus wide.

Velum: Bilobed with broad band of purple black pigment at base of preoral ciliary band. Pigment thickens anteriorly to form semilunar area on each lobe.

Foot: Colourless at first, but by $1\frac{3}{4}$ whorl stage mid region of mesopodium has black pigment and elsewhere densely scattered spots of bright yellow. Propodial region short at this stage, becoming long by swimming-crawling stage and used with the posterior part of the mesopodium in a stepping method of locomotion; always colourless. Broad operculigerous lobes.

Other pigmentation: Intestine black. At about 2-whorl stage most larvae have purple-black pigment on stomach and dorsal surface of head. In some larvae stomach pigmentation becomes very dense and black, while in others it is hardly developed at all. Black pigment on oesophagus at swimming-crawling stage.

Littorina neritoides* (L.)**Taenioglossa Littorinacea Littorinidae***

Shell: Pale horn- colour at first with a more or less circular aperture and no beak. Faintly sculptured with spiral rows of minute tubercles. Later becoming dark horn-colour and globular with a short broad beak and marked umbilicus. Tubercles over whole shell, disappear at metamorphosis or earlier.

Velum: Bilobed. Colourless at first, but developing black pigment like *L. littorea* by 2-whorl stage.

Foot: Colourless at first, becoming black. Posterior part of mesopodium remaining small, but propodial region becoming long and mobile and used for crawling as in *L. littorea*.

Other pigmentation: Intestine and stomach becoming black as soon as velar pigmentation developed and very soon after this whole body, except tentacles, heavily pigmented black (colourless tentacles thus very conspicuous at this stage). Density of pigment reduced as larva grows.

Mangelia attenuata* (Montagu)**Stenoglossa Toxoglossa Conidae***

Shell: Colourless and transparent. Embryonic shell sculptured with spiral lines, growth lines on subsequent whorl and median keel extending on to beak, tubercles develop on 3rd whorl as in *M. nebula*.

Siphonal canal, as in *M. nebula*, well developed at an early stage.

Velum: Like that of *M. nebula*.

Foot: Like that of *M. nebula*.

Other pigmentation: Like that of *M. nebula*.

Mangelia nebula* (Montagu)**Stenoglossa Toxoglossa Conidae***

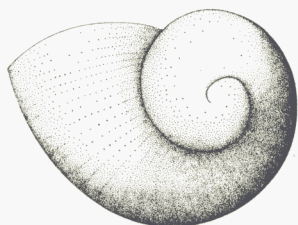
Shell: Colourless and transparent, whorls dipping to sutures. First 2 whorls unsculptured except for spiral ridge arising low on second. This becomes the lowest of 4 ridges evident on the 3rd whorl. The other 3 are broader and are soon crossed by longitudinal grooves which transform the ridges in 3 rows of tubercles. Opening of shell overhung by short beak, later lost. Siphonal canal well developed at an early stage.

Velum: Two lobes, each slightly intended laterally, at $1\frac{1}{4}$ -whorl stage. Conspicuous blobs of orange-yellow pigment form an almost continuous band in region of food groove and are scattered elsewhere. Thin lines of red pigment at base and periphery of both preoral and postoral ciliary bands thicken and become conspicuous by about $2\frac{1}{4}$ -whorl stage. Velum now partially subdivided into 4 very large, broad, blunt lobes which become reflected over shell as animal swims.

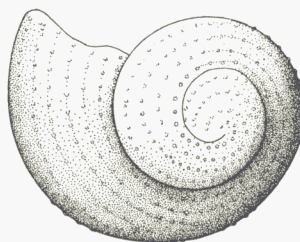
Foot: Mesopodium short and broad at first, narrowing abruptly posteriorly to a long finger-shaped process which is retained as, later, foot becomes long and narrow. Propodial region short. Foot remaining colourless except for lateral line of dark red pigment along mesopodial edge and a little scattered dark red pigment in centre of sole. At late stage dark red pigment on propodium and scattered spots of yellow on mesopodium.

Other pigmentation: Dark red pigment along edge of mantle, pallial siphon and in region of mouth; latter extending as 2 bands up oesophagus by $2\frac{1}{4}$ -whorl stage. Osphradium bright red at this stage. Scattered spots of orange-yellow pigment on intestine when velum 4-lobed and sometimes circles of orange-yellow pigment on mantle skirt.

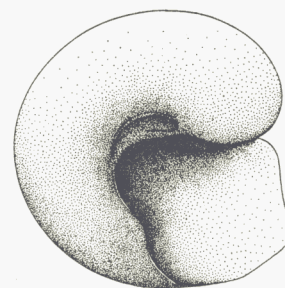
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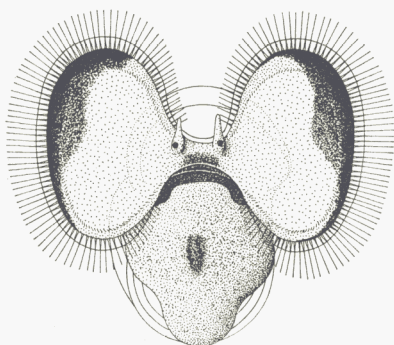
14a



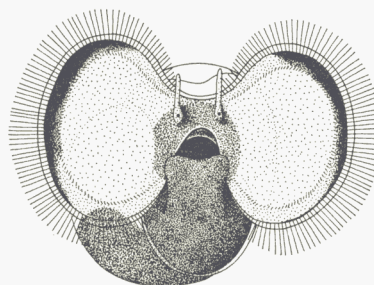
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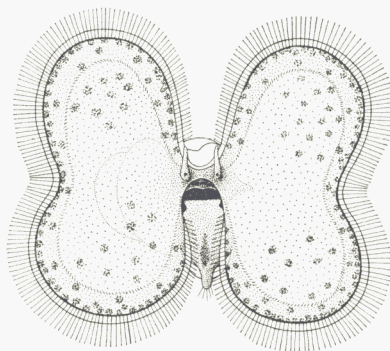
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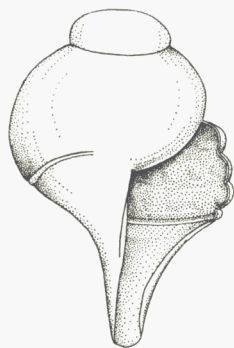
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15c



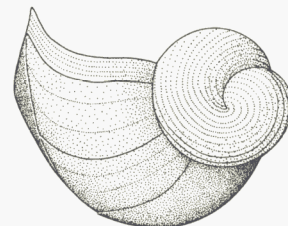
17b



17a



17c



16

14a. *Littorina littorea* (L.), shell length 0.25 mm; 14b *Littorina littorea* (L.), $1\frac{3}{4}$ -whorl stage; 15a. *Littorina neritoides* (L.), shell length 0.37 mm; 15b. *Littorina neritoides* (L.), shell length 0.37 mm. Dead shell, no sculpture; 15c. *Littorina neritoides* (L.), 2-whorl stage; 16. *Mangelia attenuata* (Montagu), shell length 0.63 mm; 17a. *Mangelia nebula* (Montagu), shell length 0.70 mm; 17b. *Mangelia nebula* (Montagu), 2-whorl stage; 17c. *Mangelia nebula* (Montagu), Late veliger to show reflection of velar lobes over shell.

Nassarius incrassatus* (Ström)**Stenoglossa Buccinacea Nassariidae***

Shell: At first, very like that of *Rissoa membranacea*, with a depressed spire and marked umbilicus; transparent, pale horn-colour and unsculptured except for faint growth lines. Later a conspicuous spiral ridge develops on 3rd whorl and extends on to the pronounced, chisel-shaped beak. Whorls becoming more rounded and siphonal canal broad. By swimming-crawling stage shell deep horn-colour and numerous spiral and orthocline ribs developed, giving a reticulate appearance. The conspicuous beak is lost by metamorphosis and the outer lip has a slightly crenulate edge. Velum: Bilobed and colourless at first. Later each lobe elongates and develops an anterior and posterior dark red pigment spot internal to the food groove; by $2\frac{1}{2}$ -whorl stage velum is 4-lobed. Pigment spots become larger and denser and a thin line of red pigment develops at base of preoral ciliary band, thickest in vicinity of each spot. Velar lobes become very long (twice length of shell) with a median retractor muscle down each. At $2\frac{3}{4}$ -whorl stage also red pigment along postoral ciliary band in vicinity of pigment spots.

Foot: Mesopodium triangular, colourless at first, but by $2\frac{1}{2}$ -whorl stage dark red pigment in mid region and a red antero-median band up the elongating stalk; propodial region colourless. At swimming-crawling stage massive foot with 2 antero-lateral horns, gyrates on elongated stalk. Dark red pigmentation spreading around stalk and extending down centre of mesopodium.

Other pigmentation: Intestine becoming black. Dark red or black pigment on buccal walls at $2-2\frac{1}{2}$ -whorl stage. Later scattered black on oesophagus and on gastric wall adjacent to its opening. Rest of stomach unpigmented though may appear black when animal partially retracted as pigment at base of foot seen through it. Osphradium red and conspicuous by $2\frac{3}{4}$ -whorl stage.

Nassarius reticulatus* (L.)**Stenoglossa Buccinacea Nassariidae***

Shell: Very pale horn-colour and transparent at first, becoming deep horn and more opaque. Distinct growth lines following contour of beaked outer lip give the appearance of a median keel extending back along whorls. Otherwise shell unsculptured. Siphonal canal becomes well developed as in *N. incrassatus* and umbilicus marked. Beak lost by metamorphosis and reticulations are developed as in *N. incrassatus*.

Velum: Bilobed at first with a conspicuous line of red pigment along base of preoral ciliary band. Lobes elongate and become indented laterally by 2-whorl stage and a thin line of red pigment develops along postoral ciliary band. Velum becomes large and pigment line along preoral ciliary band thickens.

Foot: Mesopodium triangular; colourless at first, but dark red pigment soon develops over all except the periphery. Propodial region develops by 2-whorl stage and is always colourless. At swimming-crawling stage massive foot with 2 antero-lateral horns gyrates on elongated stalk which is heavily pigmented.

Other pigmentation: Initial part of intestine black on hatching. Later, pigmentation extends towards anus and scattered black pigment develops round the mouth and on the buccal walls (appearing as a horseshoe shaped patch above mouth as animal swims). Stomach and oesophagus remain unpigmented. Kidney becomes opaque white.

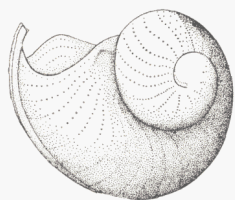
Natica alderi* Forbes**Taenioglossa Naticacea Naticidae***

Shell: Transparent at first, colourless except for chestnut-brown along suture lines. Embryonic shell sculptured with regularly-arranged, spiral rows of minute tubercles. Larval whorls smooth except for conspicuous growth lines. Shell becoming globular with whorls shelving towards sutures. No beak or siphonal canal. Umbilicus marked.

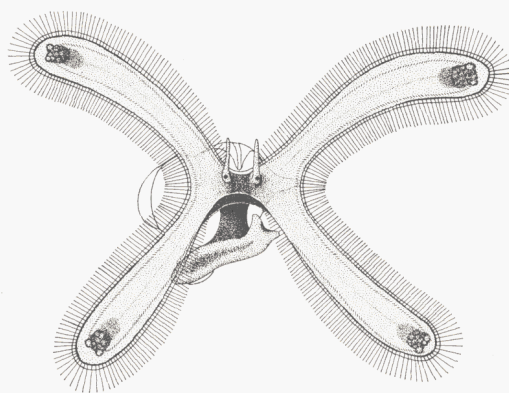
Velum: Bilobed and colourless at first; becoming 4-lobed by $1\frac{1}{2}$ -whorl stage with a large dark red pigment spot at the end of each lobe, internal to food groove. By $2\frac{1}{4}$ -whorl stage, lobes become very long with a median retractor muscle down each and a thin line of red pigment at base of preoral ciliary band.

Foot: Mesopodium broad and pointed posteriorly, colourless at first, but later grey pigment down centre and over stalk. Large operculigerous lobes develop and propodial region becomes very long and mobile with a median ciliated groove along its length. A broad extension develops from base of propodium which at metamorphosis will cover opening to shell. At metamorphosis foot is short and thick and the opercular fold develops to cover shell posteriorly.

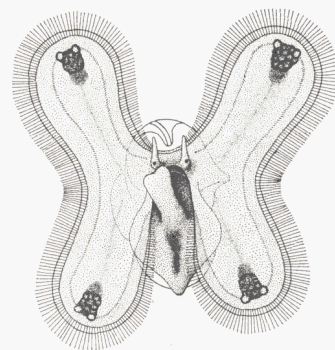
Other pigmentation: Stomach wall has scattered carmine pigment at $1\frac{1}{4}$ -whorl stage and becomes mottled with black by $1\frac{1}{2}$ -whorl stage. Later scattered black pigment on oesophagus and at $2\frac{1}{2}$ -whorl stage intestine has scattered dark red pigment and appears black later.



18a



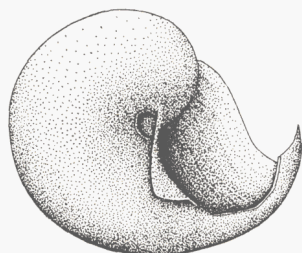
18d



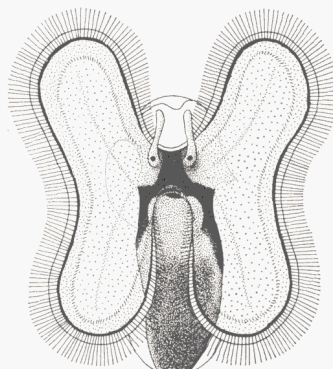
18c



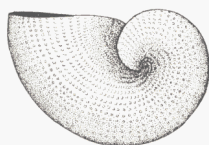
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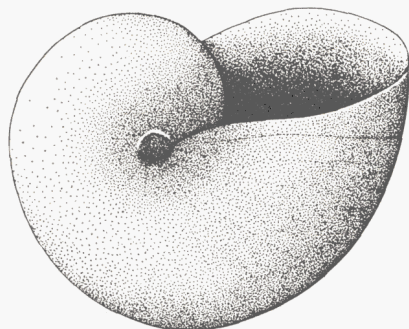
19a



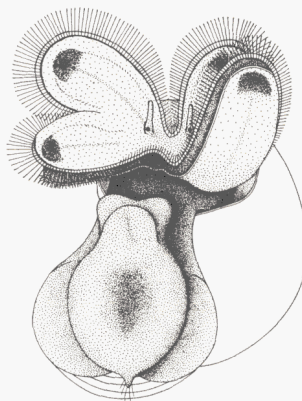
19b



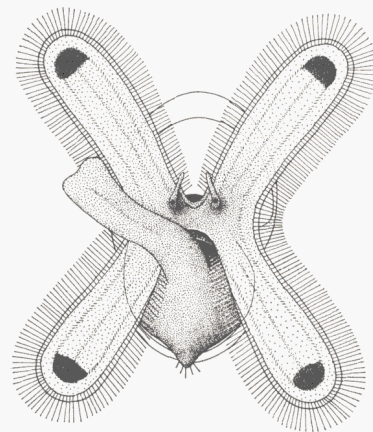
20a



20b



20d



20c

18a. *Nassarius incrassatus* (Ström), shell length 0.35 mm; 18b. *Nassarius incrassatus* (Ström), shell length 0.32 mm; 18c. *Nassarius incrassatus* (Ström), 2-2½-whorl stage; 18d. *Nassarius incrassatus* (Ström), 3-whorl stage; 19a. *Nassarius reticulatus* (L.), shell length 0.44 mm; 19b. *Nassarius reticulatus* (L.), 2-whorl stage; 20a. *Natica alderi* Forbes, shell length 0.24 mm; 20b. *Natica alderi* Forbes, shell length 0.70 mm; 20c. *Natica alderi* Forbes, 2¼-whorl stage; 20d. *Natica alderi* Forbes, late veliger.

Philbertia gracilis* (Montagu)**Stenoglossa Toxoglossa Conidae***

Shell: Brown and not very transparent. Spire becomes elongate. Embryonic whorls sculptured with a reticulate pattern of minute tubercles. Larval shell with band of regular prosocline ribs bisected by a spiral ridge and separated from the unsculptured abapical part by 2 other spiral ridges. These 2, close together at their origin (on 3rd whorl), separate and then run parallel on to beak. Beak prominent by $1\frac{1}{2}$ -whorl stage and siphonal canal long.

Velum: Bilobed at first, each lobe broad and with a lateral indentation. Becoming 4-lobed by $1\frac{1}{2}$ -whorl stage. Bordered by a line of reddish-brown pigment along both preoral and postoral ciliary bands and with orange spots associated with food groove. Velar lobes become very long with a median retractor muscle down each.

Foot: Mesopodium triangular, broadening anteriorly to a short propodial region and tapering posteriorly to a finger-shaped process. Colourless or tinged with scattered reddish brown pigment. No operculigerous lobes.

Other pigmentation: Intestine may become black by $1\frac{1}{2}$ -whorl stage and there is scattered reddish-brown pigment between the eyes. Orange pigment may develop on inhalant siphon at $1\frac{1}{2}$ -whorl stage or later, and is scattered on mantle edge by 3-whorl stage.

Philbertia linearis* (Montagu)**Stenoglossa Toxoglossa Conidae***

Shell: Pinkish-brown, becoming more yellow-brown on later whorls. Not very transparent. Embryonic sculpture consists of a reticulation formed by the crossing of regular spiral lines and orthocline ribs. Orientation of the ribs changes abruptly in middle of 2nd whorl so that the larval shell is sculptured with reticulating prosocline and opisthocline ribs. A spiral ridge, developed on 3rd whorl and extending on to beak, separates sculptured band from unsculptured abapical part as in *P. gracilis*. Beak prominent and siphonal canal becoming long.

Velum: Bilobed at first, becoming indented to form 4 blunt lobes with a median retractor muscle down each. Unpigmented.

Foot: Triangular, broadening anteriorly to short propodial region and remaining colourless. No operculigerous lobes. Ventral pedal gland not conspicuous.

Other pigmentation: Black pigment usually develops on intestine and oesophagus at an early stage, and on stomach and round mouth by 3-whorl stage.

Simnia patula* (Pennant)**Taenioglossa Cypraeacea Cypraeidae***

Shell: Orange-brown, becoming dark brown and very opaque. Globular. Embryonic whorls with granulated surface. Successive whorls sculptured with a coarse reticulation formed by the crossing of regular prosocline and opisthocline ribs. Beak prominent. Siphonal canal prominent, but not becoming as long as in *Philbertia* species.

Velum: Bilobed, becoming 4-lobed. Lobes becoming very long and narrow by $2\frac{1}{2}$ -whorl stage with a median retractor muscle down each, but remaining colourless until near metamorphosis when brown pigment spots form an almost continuous band at base of preoral ciliary band.

Foot: Mesopodium broad, expanded laterally to give operculigerous lobes, tapering posteriorly. Propodial region short. Operculigerous lobes unpigmented, but dark purplish-brown pigment on mesopodium by $1\frac{1}{2}$ -whorl stage surrounding a greyish-white mid ventral area.

Other pigmentation: Intestine becoming black and brown pigment developing round mouth. Stomach, mantle edge and general body may become heavily pigmented black by $2\frac{1}{2}$ -whorl stage.

Rissoa inconspicua* Alder**Taenioglossa Rissoacea Rissoidae***

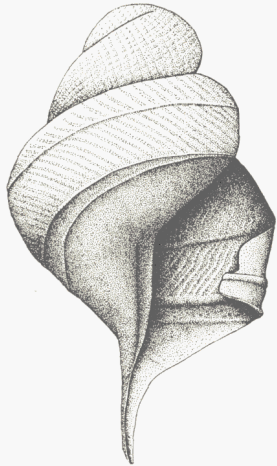
Shell: Transparent and colourless, becoming dark-horn to pale-brown by swimming-crawling stage (3-whorl). The purple apex characteristic of the adult appears after metamorphosis ($3\frac{3}{4}$ -whorls). Unsculptured except for a median spiral ridge similar to *R. parva*, but less conspicuous and not usually developed until near swimming-crawling stage. Shell becoming conical, but usually more globular than *R. parva*. Short, broad beak and siphonal expansion.

Velum: Bilobed. Colourless at first, but margin becoming pigmented with dark red at base of preoral ciliary band. Later a few bright orange-yellow spots appear on each lobe irregularly distributed in vicinity of food groove, and usually a line of dark red pigment in vicinity of postoral ciliary band.

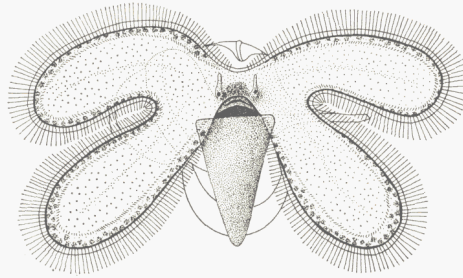
Foot: Triangular at first. Becoming large by $2\frac{1}{4}$ -whorl stage with long mobile propodial region and ciliated operculigerous lobes. Mesopodium with black pigment in mid region and usually conspicuous yellow spots; the latter fading to a faint yellowish tinge at a later stage. Propodial region may also develop similar spots which disappear at a later stage. Stalk and operculigerous lobes heavily pigmented black except for small postero-medial area on each operculigerous lobe.

No pallial tentacle, but metapodial tentacle long at $3\frac{3}{4}$ -whorl stage.

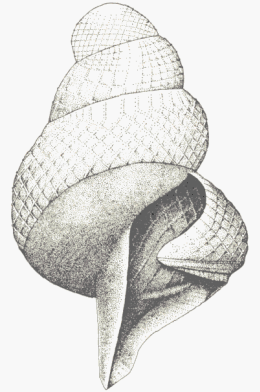
Other pigmentation: Initial part of intestine heavily pigmented black at early stage; later pigment extends further down intestine. Scattered black pigment round mouth and on oesophagus by $2\frac{1}{2}$ -whorl stage (may form a thick band joining up with red pigment on velum). Pale yellow pigment between eyes similar to the conspicuous yellow pigment found here in *R. parva*. At a later stage yellow pigment spots occur on stomach and occasionally black pigment on osphradium.



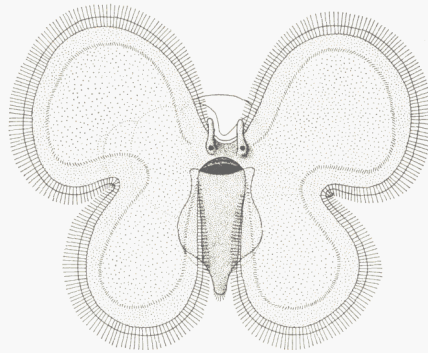
21 a



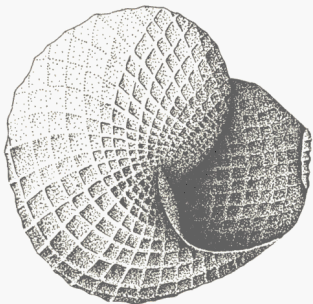
21 b



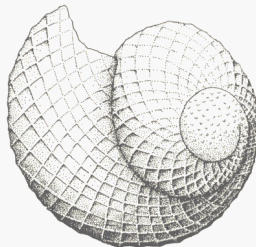
22 a



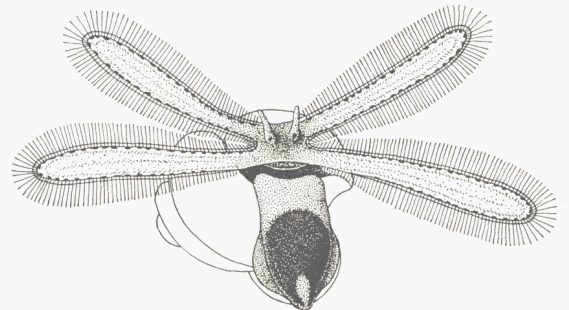
22 b



27 a



27 b



27 c

21 a. *Philbertia gracilis* (Montagu), shell length 2.56 mm; 21 b. *Philbertia gracilis* (Montagu), 3-whorl stage; 22 a. *Philbertia linearis* (Montagu), shell length 0.52 mm; 22 b. *Philbertia linearis* (Montagu), 3-whorl stage; *Rissoa* spp. 23–26, see page 21; 27 a. *Simnia patula* (Pennant), shell length 0.62 mm; 27 b. *Simnia patula* (Pennant), shell length 0.62 mm; 27 c. *Simnia patula* (Pennant), 3-whorl stage.

Rissoa membranacea* (Adams)**Taenioglossa Rissoacea Rissoidae***

Shell: Pale horn-colour, transparent and smooth; very like young shell of *Nassarius incrassatus* in that spire depressed and umbilicus and siphonal expansion marked, but beak short and broad. Spiral ridge, typical of rissoids, developed near end of 3rd whorl, just prior to metamorphosis. Shell becoming dark horn-colour by this stage.

Velum: Bilobed and colourless. At 2-whorl stage a very faint thin line of red pigment sometimes develops at base of preoral ciliary band. Foot: Metapodium not becoming so well developed as in other rissoids, but propodial region characteristically long and mobile by $1\frac{1}{2}$ -whorl stage. Unpigmented, but sometimes dark red pigment develops in mid region of mesopodium at $1\frac{1}{2}$ -whorl stage and black on anterior part of operculigerous lobes and sides of propodium. Later this is lost, leaving foot unpigmented by 2-whorl stage except for a little scattered yellow. Other pigmentation: Intestine, stomach and oesophagus remain unpigmented. By metamorphosis buccal mass characteristic bright yellow.

Rissoa parva* (da Costa)**Taenioglossa Rissoacea Rissoidae***

Shell: Transparent at first, becoming pale horn-colour. The adult orthocline bands of brown pigment are developed after metamorphosis (4-whorl stage). Unsculptured except for a median spiral ridge which develops on 2nd whorl and extends on to short broad beak. Shell becoming conical. Siphonal expansion present.

Velum: Bilobed. Colourless at first, but by 3-whorl stage and sometimes much earlier, bordered by conspicuous spots of orange-yellow pigment. Size of spots and breadth of pigmented area vary considerably from individual to individual: they may be small forming a more or less continuous band round velar lobes or larger as in *R. inconspicua*. At $3\frac{1}{2}$ -whorl stage a thin line of red pigment usually develops at base of preoral ciliary band. Velum becomes large. At swimming-crawling stage yellow pigment absorbed, followed by gradual thinning of red pigment line, except in region of mouth where it broadens and becomes continuous with pigment between eyes. Right velar lobe frequently the larger.

Foot: Typically rissoid, becoming large with ciliated operculigerous lobes and long mobile propodial region. Stalk heavily pigmented by $2\frac{1}{2}$ -whorl stage with yellow and dark red or black, the latter extending down on to the anterior part of the operculigerous lobes. Major part of each operculigerous lobe, unlike *R. inconspicua*, usually remains colourless. Mesopodium pigmented with dark red down the centre and a little scattered yellow. Scattered yellow pigment on propodium too. (When foot partially retracted, stalk pigmentation gives a very yellow appearance to both mesopodium and propodium.)

Metapodial tentacle: Short at $2\frac{1}{2}$ -whorl stage, becoming long. Right pallial tentacle developed by 4-whorl stage. $4\frac{1}{2}$ -whorl stage has a long penis.

Other pigmentation: Usually some black pigment on intestine at 3-whorl stage or later. Yellow pigment spots, resembling those on velum, appear on stomach and in vicinity of digestive gland at 3-whorl stage and later ($3\frac{1}{2}$ -whorl stage), bright yellow pigment at base of each tentacle median to the eyes and dark red or black pigment on oesophagus. Osphradium occasionally black. By metamorphosis the bright yellow buccal mass of the adult is conspicuous.

Note on unusual forms of R. parva.

Although most larvae of *R. parva* are covered by the above description, some resemble *R. inconspicua* in pigmentation. Velum may be pigmented as early as $1\frac{1}{2}$ -whorl stage with conspicuous lines of red pigment along both preoral and postoral ciliary bands and large spots of yellow pigment associated with food groove. Initial part of intestine and buccal region may be heavily pigmented black as early as $1\frac{1}{2}$ -whorl stage. Very occasionally the major part of each operculigerous lobe becomes pigmented black as in *R. inconspicua*.

Characters for distinguishing between R. inconspicua and R. parva.

The 2 spp. cannot be distinguished with any certainty up to $2\frac{1}{4}$ -whorl stage. At $2\frac{1}{2}$ -whorl stage can usually be distinguished by:

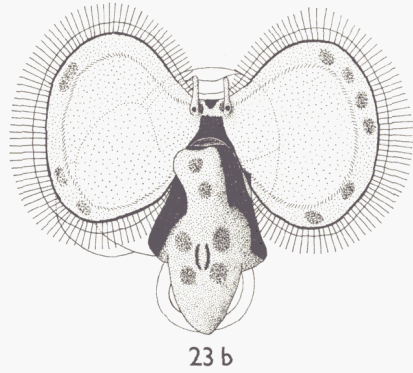
1. Median spiral ridge on shell of *R. parva*; not usually developed until later in *R. inconspicua*.
2. Shell shape: *R. parva* conical, *R. inconspicua* more globular.

Rissoa sarsi* (Lovén)**Taenioglossa Rissoacea Rissoidae***

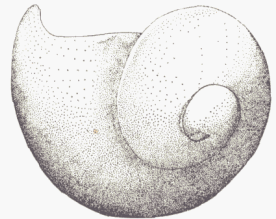
Shell: Transparent and colourless at first, becoming opaque and horn-coloured, dark around aperture. Embryonic shell sculptured with minute tubercles, closely packed to form conspicuous spiral rows and sparsely scattered between. Prominent sculpture on successive whorls is a median spiral band, consisting of rows of minute tubercles, which extends on to the pronounced, pointed beak. Siphonal expansion present. Velum: Bilobed with faint thin line of red pigment along base of preoral ciliary band. Pigment gradually thickens and becomes more conspicuous. Right velar lobe frequently the larger. Left lobe may lack pigment.

Foot: Becoming large. Operculigerous lobes usually developed, but very variable in size and may be reduced anteriorly. As in other rissoids, mesopodium has dark pigment down centre surrounded by diffuse yellow pigment. At $1\frac{1}{2}$ -whorl stage dark pigment also on stalk and extending up sides of propodial region. Later, usually by 2-whorl stage, whole foot heavily pigmented black.

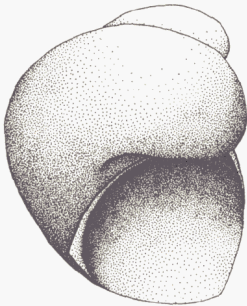
Other pigmentation: Intestine usually black at $2\frac{1}{2}$ -whorl stage, although sometimes never pigmented. Scattered black pigment round mouth at $2\frac{1}{2}$ -whorl stage.



23 b



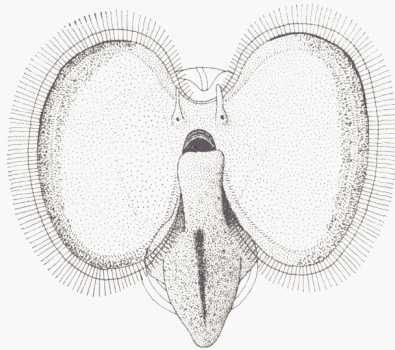
24 a



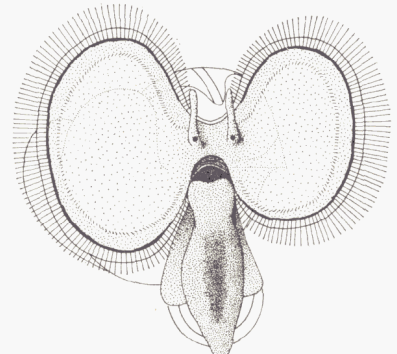
23 a



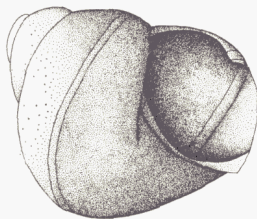
24 b



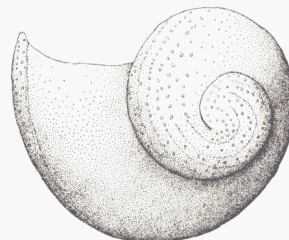
25 b



26 b



25 a



26 a

23 a. *Rissoa inconspicua* Alder, shell length 0.42 mm; 23 b. *Rissoa inconspicua* Alder, $2\frac{1}{2}$ -3 whorl stage; 24 a. *Rissoa membranacea* (Adams), shell length 0.39 mm; 24 b. *Rissoa membranacea* (Adams), shell length 0.33 mm; 25 a. *Rissoa parva* (da Costa), shell length 0.43 mm; 25 b. *Rissoa parva* (da Costa), 3-whorl stage; 26 a. *Rissoa sarsi* (Lovén), shell length 0.35 mm; 26 b. *Rissoa sarsi* (Lovén), $2\frac{1}{2}$ -whorl stage.

***Tornus subcarinatus* (Montagu)**

Shell: Transparent and colourless. Embryonic whorl smooth. Larval whorl loosely coiled and somewhat laterally compressed, with a median lobed keel; sculptured with conspicuous orthocline ribs separated by incised grooves extending on to keel. Aperture rounded with slight beak but no siphonal canal. Umbilicus wide.

Velum: Bilobed. Colourless at first, but dark red-purple pigment soon developing as a broad band across the middle of each lobe and by 2-whorl stage this covers the anterior $\frac{2}{3}$ of each lobe (no pigment in preoral cells).

Foot: Mesopodium becoming large with development of operculigerous lobes, tapering posteriorly; propodial region with small, rounded antero-lateral lobes, becoming long and mobile. Propodial region and operculigerous lobes remain colourless, but, as velum becomes pigmented, dark red-purple pigment develops as blotches on the mesopodium and extends up stalk. An oval area on mesopodium remains unpigmented.

Right pallial tentacle: Developed at metamorphosis; bifid.

Other pigmentation: Stomach becomes pigmented soon after velum and foot; purplish at first, but later black. Intestine becomes pigmented next, appearing black by 2-whorl stage. Purple pigment on oesophagus at this stage; later becoming continuous with pigment on velum.

Taenioglossa Rissoacea Tornidae***Triphora perversa* (L.)*****Taenioglossa Cerithiacea Triphoridae***

Shell: Sinistral. Reddish-brown and not very transparent. Spire becoming elongated. Embryonic whorls sculptured with a reticulate pattern of minute tubercles. Larval whorls with regular orthocline ribs and 2 pronounced spiral ridges; the adapical one originating on 2nd whorl and the abapical one on 4th whorl. Beak pronounced. Siphonal canal very broad. Late larva has a 3rd spiral ridge on 5th (body) whorl and this whorl is paler in colour.

Velum: Bilobed and colourless always. Left lobe typically larger.

Foot: Colourless. Mesopodium remaining small and pointed posteriorly. Propodial region becoming long and mobile by $3\frac{1}{2}$ -whorl stage. No operculigerous lobes.

Other pigmentation: Any pigment on body obscured by shell colour.

Trivia arctica* (Montagu)**Taenioglossa Lamellariacea Eratoidae***

Shell: Double; inner and outer (scaphoconch) layers widely separate. Scaphoconch nautiloid, colourless and very transparent with pronounced rounded beak, unsculptured except for faint growth lines. Inner shell smooth, white and somewhat opaque, with more or less circular aperture; in contrast to *Lamellaria* spp. placed centrally within scaphoconch so that the whorls of the two correspond. At late stage inner shell has wide umbilicus and siphonal canal. Very similar to *T. monacha*, but reaching a larger size before metamorphosis.

Velum: Bilobed and colourless at first, becoming markedly 4-lobed by $1\frac{1}{4}$ -whorl stage with a line of red pigment along base of preoral ciliary band (it may appear almost black). Lobes become very long (longer than shell in late larva) and heavily pigmented by a thickening and darkening of the red pigment. There is a median retractor muscle down each lobe.

Foot: Short at first, but by $1\frac{1}{2}$ -whorl stage mesopodium long and narrow and expanded laterally into large, triangular-shaped lobe. Propodial region short, though long enough to extend over oral region at late stage. Colourless at first; but mesopodium soon with dark red pigment down centre and scattered yellow pigment elsewhere.

Other pigmentation: Intestine unpigmented at first, but black pigment developing on initial part by $1\frac{1}{2}$ -whorl stage. Faint black pigment also developing laterally on stomach at $1\frac{1}{2}$ -whorl stage.

Trivia monacha* (da Costa)**Taenioglossa Lamellariacea Eratoidae***

Shell: Like that of *T. arctica*, but not becoming so large.

Velum: Bilobed and colourless at first; becoming large and slightly indented at the sides. Later with a thin line of red pigment along base of preoral ciliary band. This thickens slightly and a similar line develops along postoral ciliary band; velum remains lightly pigmented in comparison with *T. arctica*.

Foot: Like that of *T. arctica*.

Other pigmentation: Intestine, stomach and oesophagus dark brown or purplish-black from time of hatching until just before metamorphosis. Style sac region of stomach less heavily pigmented and appears dark red. Body tissues yellow or orange and somewhat opaque.

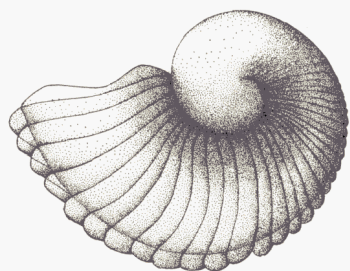
Turritella communis* Risso**Taenioglossa Cerithiacea Turritellidae***

Shell: Colourless at first, becoming pale horn-colour. Unsculptured until 3- or 4-whorl stage when 4 spiral ridges are developed on body whorl. These form crenations on outer lip. Whorls tumid, shelving above and below suture. No beak or siphonal canal.

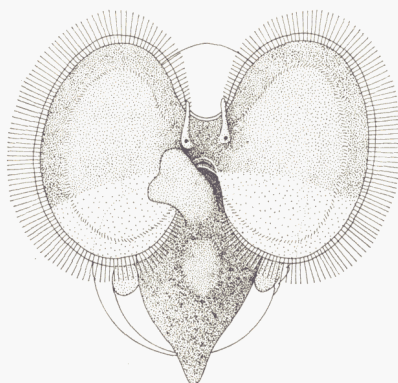
Velum: Bilobed and colourless always.

Foot: Mesopodium short and broad at first, remaining unpigmented. Propodial region becoming fairly long and mobile; posterior part of mesopodium showing little extensibility.

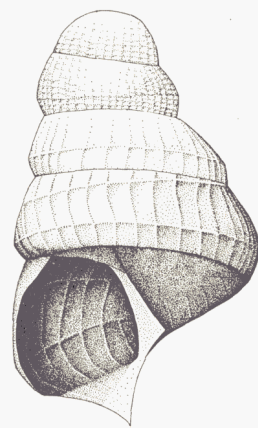
Other pigmentation: Body remains unpigmented.



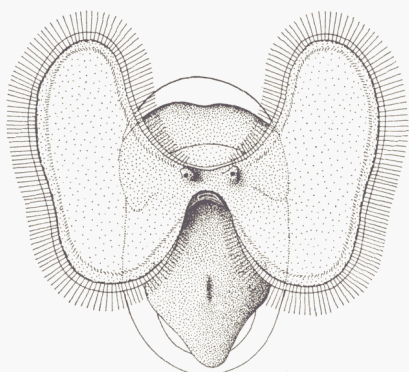
28a



28b



29



31b



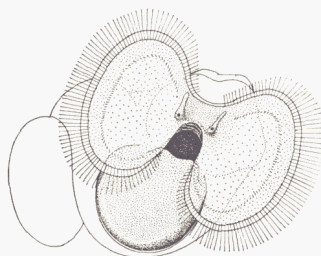
30



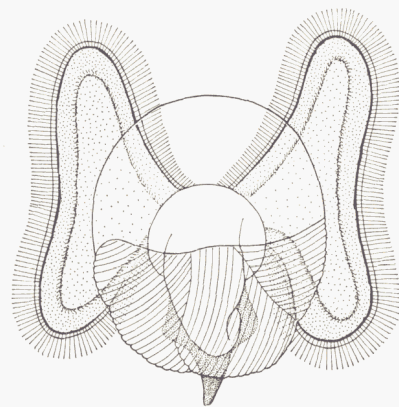
31a



32a



32b



33

28a. *Tornus subcarinatus* (Montagu), shell length 0.42 mm; 28b. *Tornus subcarinatus* (Montagu), 2-whorl stage; 29. *Triphora perversa* (L.), shell length 1.01 mm; 30. *Trivia arctica* (Montagu), mid veliger from the left with velum partially retracted to show distinguishing pigmentation; 31a. *Trivia monacha* (da Costa), mid veliger from the left with velum partially retracted to show distinguishing pigmentation; 31b. *Trivia monacha* (da Costa), early mid veliger; 32a. *Turritella communis* Risso, shell length 0.36 mm; 32b. *Turritella communis* Risso, 2 $\frac{1}{4}$ -whorl stage; 33. *Velutina velutina* (Müller), 1 $\frac{1}{2}$ -whorl stage.

Velutina velutina* (Müller)**Taenioglossa Lamellariacea Lamellariidae***

Shell: Double; inner and outer (scaphoconch) layers widely separate. Scaphoconch globular, colourless and very transparent; sculptured at first with spiral striations, but 2nd half of 1st whorl smooth and gelatinous; appears entirely gelatinous in older larvae. Inner shell smooth at first, but by 2-whorl stage sculptured with 3 longitudinal ridges, later more; outer lip becoming thick, white and opaque. No beak or siphonal canal. Velum: Bilobed. Colourless at first, but by $1\frac{1}{2}$ -whorl stage with a thin line of red pigment at base and periphery of both preoral and postoral ciliary bands. Later velum becomes slightly 4-lobed and the red pigment bands thicken.

Foot: Becoming large with long mobile propodial region, but no operculigerous lobes. Mesopodium developing scattered reddish-brown pigment and dark red-brown mid ventrally. Scattered brown pigment on stalk and as median line down mesopodium.

Other pigmentation: Scattered black pigment on intestine at 2-whorl stage. Mantle edge also becoming heavily pigmented black at late stage.

Hydrobia ulvae* (Pennant)**Taenioglossa Rissoacea Hydrobiidae***

Shell: Transparent and colourless at first, becoming horn-coloured. Little more than one whorl at time of hatching. No sculpture or shell beak. Velum: Bilobed. Lobes small, unpigmented or with a semilunar, purplish-black band on each. Preoral cilia weak and can scarcely lift the larva; no food groove.

Foot: Propodial region well developed when larva hatches and conspicuously ciliated. Mesopodium triangular, bluntly pointed posteriorly. Statocysts conspicuous.

Other pigmentation: Some black pigment granules on initial part of intestine.

Larval life about 2 days, of no importance in the plankton. Larvae have yolk store in digestive gland.

Haedropleura septangularis* (Montagu)?**Stenoglossa Toxoglossa Conidae***

Velum: Slightly 4-lobed at $1\frac{1}{4}$ -whorl stage with a thick band of dense purple-black pigment along the base of the preoral ciliary band. By 2-whorl stage dark pigment extends right across the velar lobes, although it remains less dense in the centre.

Tentacles: Becoming long, with conspicuous eye on swollen base of each.

Pigmentation: Dark purple-black pigment on intestine and oesophagus and between the eyes. Stomach and mantle edge soon becoming similarly pigmented, obscuring the black larval kidney which was conspicuous before. Adult kidney readily visible as yellowish-white mass in region of heart. Black osphradium developed by $1\frac{1}{2}$ -whorl stage. Digestive gland colour in plankton yellow-brown.

Foot: Becoming heavily pigmented dark purple-black, pigment darkest in the centre forming a median band down mesopodium. No epipodia and propodial region short.

Shell: Transparent and shiny. Embryonic shell appearing smooth, but on close inspection seen to be covered with numerous, very minute elevations. These become more prominent by $1\frac{1}{2}$ -whorl stage so that the shell appears granular. Successive whorls have faint reticulate sculpture. The apex appears to coil in the opisthobranch way, but the rest of the shell is dextral. Prominent beak, abruptly pointed, and siphon.

A few specimens only. Identification not confirmed.

Descriptions of prosobranch veligers in the literature

Aelis minor: THORSON (1946).

Alvania crassa: LEBOUR (1934a as "unknown rissoid"; 1936); 1st description LOVÉN (1839), but figure could be any rissoid; SIMROTH (1911) reproduces this figure (= *Rissoa costata* Adams).

A. punctura: LEBOUR (1934a, 1937); THORSON (1946).

Aporrhais pespellicani: LEBOUR (1933a, 1937); THORSON (1946).

Balcis alba & *B. devians*: LEBOUR (1935a, 1937).

Caecum imperforatum: LEBOUR (1936, 1937).

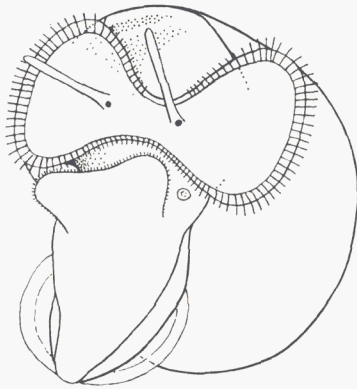
Cerithiopsis barleei & *C. tubercularis*: LEBOUR (1933b, 1937).

Cingula semistriata: LEBOUR (1934a, 1937).

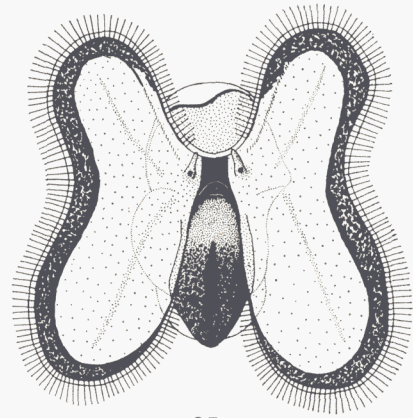
Crepidula fornicata: LEBOUR (1937); THORSON (1946); WERNER (1954); CONKLIN (1891, 1897) – no good descriptions of free larva; ANKEL (1935) – no drawings; ORTON (1912) – very little.

Lacuna vineta: LEBOUR (1937); HERTLING & ANKEL (1927) – no drawings.

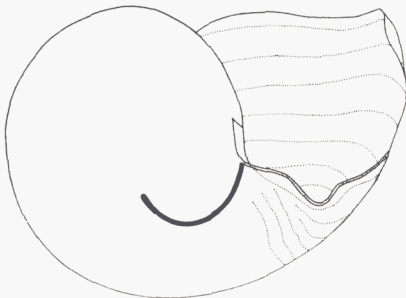
Lamellaria perspicua & *L. latens*: LEBOUR (1935b, 1937); SIMROTH (1911) also described this larva with poor drawing; PELSENEER (1911) gives short description and poor drawing of *L. perspicua*.



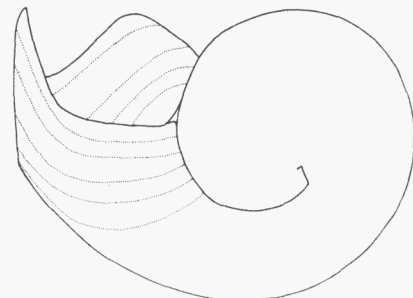
34



35a



35b



35c

34. *Hydrobia ulvae* (Pennant), shell length 0.39 mm; 35a. *Haedropleura septangularis* (Montagu)?, $1\frac{1}{2}$ -whorl stage; 35b. *Haedropleura septangularis* (Montagu)?, shell length 0.47 mm; 35c. *Haedropleura septangularis* (Montagu)?, shell length 0.47 mm.

Littorina littorea: LEBOUR (1935c, 1937); THORSON (1946); PELSENEER (1911) gives partial description of early larva with figure; TATTERSALL (1920) gives poor description and reproduces poor drawings of larvae from CAULLERY and PELSENEER (1910); SMIDT (1944) gives drawing of shell labelled *L. littorea* which looks like *L. neritoides*.

L. neritoides: LEBOUR (1935c, 1937); LINKE (1935) corrects LEBOUR's paper (1934a) where *Rissoa sarsi* is confused with *L. neritoides*.

Mangelia attenuata: THORSON: (1946).

Mangelia nebula: LEBOUR (1934b, 1937).

Nassarius incrassatus: LEBOUR (1931a, 1937); THORSON (1946).

N. reticulatus: LEBOUR (1931a, 1937); THORSON (1946); PELSENEER (1911) drawings and description of young veliger.

Natica alderi: LEBOUR (1936, 1937), as *N. poliana* Chiaje; THORSON (1946), as *N. nitida* Donovan; HERTLING (1932), as *N. pulchella*, describes newly hatched larva with poor drawing.

Philbertia gracilis: LEBOUR (1933c, 1937).

Philbertia linearis: LEBOUR (1934b, 1937); THORSON (1946).

Rissoa inconspicua: LEBOUR (1934a, 1937); THORSON (1946).

R. membranacea: LEBOUR (1934a, 1937); THORSON (1946); SMIDT (1938, 1944).

R. parva: LEBOUR (1934a, 1937).

R. sarsi: LEBOUR (1934a, 1937); THORSON (1946).

Simnia patula: LEBOUR (1932, 1937).

Tornus subcarinatus: LEBOUR (1936, 1937).

Triphora perversa: LEBOUR (1933b, 1937); THORSON (1946); PELSENEER (1926) description of newly hatched larva with poor drawing not showing shell.

Trivia arctica: LEBOUR (1933d, 1935b, 1937).

T. monacha: LEBOUR (1931b as *T. europea*, 1933d, 1935b, 1937); PELSENEER (1926) newly hatched larva as *Cypraea europea*.

Turritella communis: LEBOUR (1933a, 1937); THORSON (1946).

Velutina velutina: LEBOUR (1935b, 1937); THORSON (1946).

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