

Pictured Key to some algae of southern Australia: strap-like & small-leaved red algae. 2nd edition

Red Algae.

With some 800 species, many of which are endemic (found nowhere else), southern Australia is a major centre of diversity for red algae. Classification is based on detailed reproductive features. Collections of algae that are sterile present a problem, particularly as many species unrelated reproductively have similar vegetative form or shape, making identification very difficult if the technical systematic literature is used.

This key

Fortunately, we can use this apparent problem to advantage - common shapes or morphologies will allow you to sort *some* algae directly into the level of Genus or Family and so shortcut a systematic search through intricate and often unavailable reproductive features. The pictured key below uses this *artificial* way of starting the search for a name. It's designed to get you to a possible major group in a hurry. Then you can proceed to the appropriate fact sheets to verify identifications.

Scale and stains:

the coin used as a scale is 24 mm or almost 1" wide. Microscope images of algae are usually blue stained.

This key is *restricted* to red algae with

- compressed or flat, ribbon- or strap-shaped blades of similar size throughout the plant (about 5-15 mm wide)
- internal structure of many cells, often equal-sided ("parenchymatous")
- side blades often forked (dichotomous)

Excluded are algae where

- branches are cylindrical in cross-section and only a few mm in width. (For these, see the pictured key "*Narrow-branched red algae*.")
- small side branches form a regular, feathery (pinnate) pattern. (See the pictured key of the same name.)
- the whole plant is plate-shaped or broad-bladed (20+ mm wide). See the pictured key: "*Broad-bladed red algae*."
- the internal construction consists of strings of cells (threads and meshes). This may be obscured by the later development of additional (corticate) cells and can then only be seen clearly at plant tips or found by investigating cross sections microscopically. (Find these in other pictured keys, such as "*Filamentous red algae: Master Key*" or "*Red mesh-algae*".)

PICTURED KEY

- 1a. plants *filmy*, almost transparent, blade edges may be only 1-2 cells thick, some blades have a thicker mid-rib and faint, branched veins. Branching occurs from blade edges or from mid-ribs. Figs 6, 7.
- 2.
- 1b. plants *not filmy*, some are paper thin, but *not* semi-transparent; others are slimy, gristly, (cartilaginous) or firm in texture, smooth or with a rough or warty surface due to a coating of sponge or a crusty layer of bryozoan animals.
- 4.

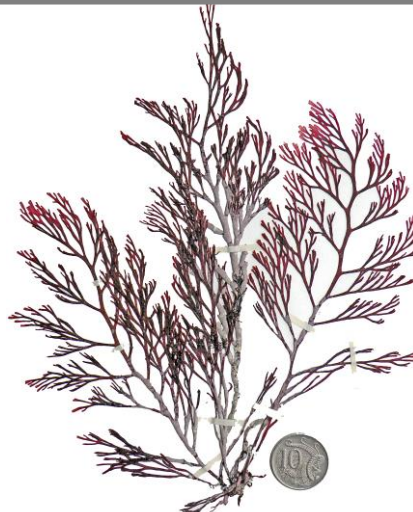


Fig.1: *Laurencia elata*, with compressed branches but < 5mm wide: **excluded** from this key. (see the pictured key: "*Laurencia and Chondrophyceus*")



Fig.2: *Hypnea*, with narrow, cylindrical branches: **excluded** from this key. (see the pictured key: "*Narrow branched red algae*")



Fig. 3: *Sarcothalia radula*, with broad blades: **excluded** from this key. (see the pictured key: "*Broad-bladed red algae*")



Fig.4: *Gigartina pinnata*, with broad main branches and pinnate side branches: **excluded** from this key. (see the pictured key: "*Feathery flat-branched red algae*")



Fig.5: *Thuretia quercifolia*, blades with chains of cells forming a meshwork: **excluded** from this key. (see the pictured key: "*Red mesh-algae*")



Fig.6: *Hypoglossum harveyanum* in the Delesseriaceae, filmy, strap-like fronds with a mid-rib, side branches arise from the mid-ribs



Fig.7: *Haraldiophyllum notii* in the Delesseriaceae, filmy fronds, mid-rib absent, flat-branched, spore patches embedded in blades

- 2a. blades are long and narrow (linear), narrower basally; fertile structures delicate, **protruding** 3.
 2b. blades broader, lance-, leaf-shaped, or forked; fertile structures **embedded** in blades. Figs 6, 7 (previous page)
 See "**Southern Australian Groups at a glance: Delesseriaceae**"

- 3a. plants grow on the feathery red alga *Ballia*; blades are 1-cell thick, older blades have irregular shorter blades arising from mid-ribs; surface cells are in **rows**, and **6-sided**; sporangia occur in small, dense linear structures (stichidia) along mid-ribs. Figs 8, 9.
 *Sonderella linearis*
 Family: Rhodomeleaceae
 Tribe: Sonderelleae

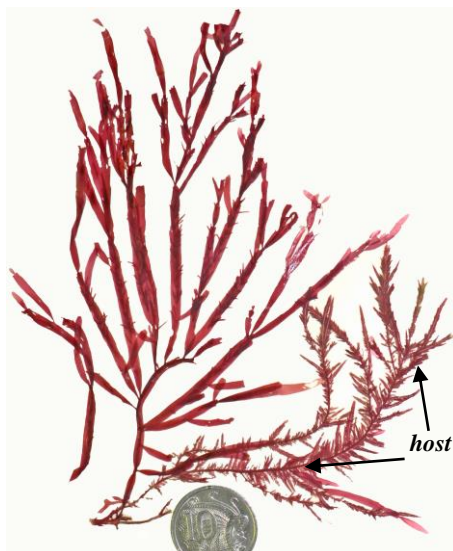


Fig. 8: *Sonderella linearis* on *Ballia callitricha* (host)

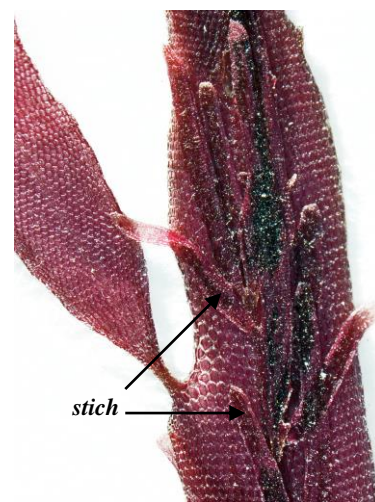


Fig. 9: *Sonderella linearis*, cells 6-sided, in rows. Linear sporangial structures (stichidia, *stich*) occur along the mid-rib

- 3b. plants grow on rock or other algae, have a short stalk, are delicate, often quickly disintegrating after collection; mature female structures (cystocarps) are on short stalks protruding in dense masses from blade surfaces. Figs 10, 11.
 *Sarcomenia delesserioides*
 Family: Sarcomeniaceae

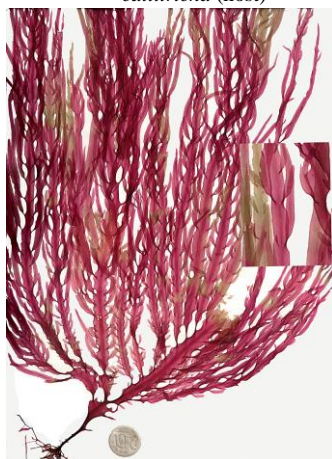


Fig. 10: *Sarcomenia delesserioides*. Insert: detail of blades



Fig. 11: *Sarcomenia delesserioides*, side branch with clusters of stalked cystocarps



Fig. 12: *Gloiophyllis barkeriae*

- 4a. blades are thin, often only 1-2 cells thick and branching is usually regular; fertile structures are **embedded** in blades. Figs 6, 7.
 See "**Southern Australian Groups at a glance: Delesseriaceae**"
 4b. blades are thicker and long and narrow (linear), forked or irregular; fertile structures **protrude** from the blade surface or edge 5.

- 5a. plants are **slimy**. (example, Fig. 12)
 See "**Pictured key: slimy/mucilaginous red algae**"
 5b. plants are firm, surfaces smooth, slippery **or** rough, (may be covered with sponge or animal growth), but **not** slimy 6.

- 6a. blades are **rough**, or warty, some extensively coated with **sponge**, or a scale of microscopic bryozoan animals 7.
 6b. blades **smooth**, or with only small, restricted patches of sponge or other animal growth 10.

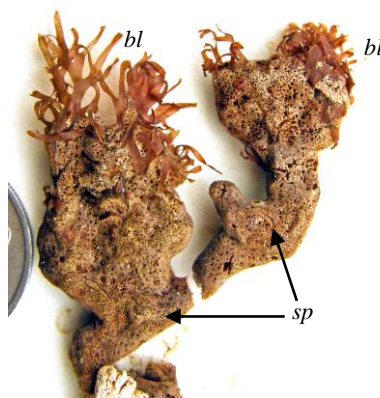


Fig. 13: *Carpopeltis spongeaplexus*, thick sponge coating (*sp*), protruding narrow algal blades (*bl*)

- 7a. the majority of the plant is covered in a thick coating of sponge and hardly recognisable as an alga, only the uppermost narrow blades protrude. Figs 13, 14.
 *Carpopeltis spongeaplexus*
 Family: Halymeniaceae

- 7b. blades easily recognisable, partially or entirely thinly coated with sponge or bryozoan colonies. 8.



Fig. 14: *Carpopeltis spongeaplexus*

- 8a. blades are covered with regular rows of a Bryozoan colony (usually *Bathypora nitens*); exposed blade-ends are chisel-like, with in-rolled margins. Figs 15-18.

..... *Amansia pinnatifida*

Family: Rhodomelaceae. Tribe: Amansieae

- 8b. blades with a warty covering of sponge 9.

9. blades long and narrow (linear) \approx 10 mm wide, **twisted**, edged with blunt teeth; side branches arise from mid-ribs; tips are often yellow to greenish under water. Figs 19-22.

..... *Osmundaria prolifera*

Family: Rhodomelaceae. Tribe: Amansieae
(Also in **Pict. keys "sponge-covered red algae"**)

- 9b. blades spatula-shaped, \approx 5 mm wide; sponge occurs between flat surface growths that face forwards. Figs 23-25. (next page)

..... *Epiglossum smithiae*

Family: Rhodomelaceae. Tribe: Amansieae



Fig. 15: *Amansia pinnatifida*,

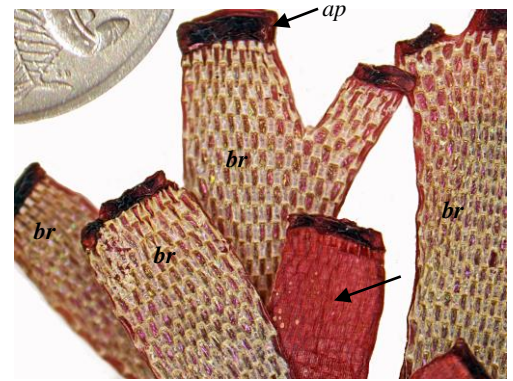


Fig. 16: *Amansia pinnatifida*, in-rolled blade ends (apex, *ap*) bryozoan coat (*br*), uncoated blade (arrowed)



Fig. 19: *Osmundaria prolifera* underwater image, blades twisted, tips greenish

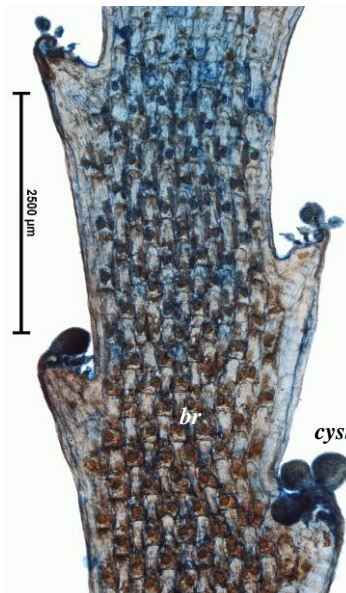


Fig. 17: *Amansia pinnatifida*, detail of differences in texture of the bryozoan coating (left) and naked blade (right)

Fig. 18: *Amansia pinnatifida*, blade edges smooth except for teeth bearing clusters of stalked, bulb-shaped cystocarps (*cys*); bryozoan coat (*br*)



Fig. 20: *Osmundaria prolifera*, blades with warty surfaces, branching from mid-ribs



Fig. 21: *Osmundaria prolifera*, dried specimen, exaggerating the surface wartiness, bluntly toothed margins towards blade ends



Fig. 22: *Osmundaria prolifera*, dried specimen, knobby marginal outgrowths bearing reproductive organs



Fig. 23: *Epiglossum smithiae*

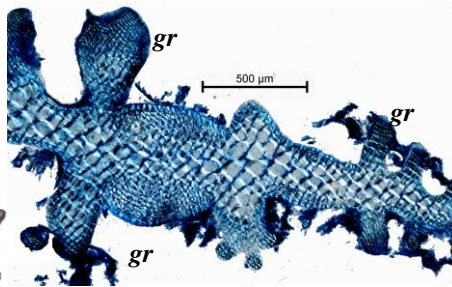


Fig. 24: *Epiglossum smithiae*, cross section, detail of surface outgrowths (*gr*)



Fig. 25: *Epiglossum smithiae*, sponge-covered spatula-shaped blades, bunches of minute reproductive structures on surfaces and edges

- 10a. blade edge prominently **saw-toothed**; mid-rib vein prominent, side veins extend to tips of marginal teeth 11.
 10b. saw-tooth edges **absent**, although minute teeth may be present; side veins absent 12.

- 11a. blades spirally twisted, teeth single
 Figs 26, 27. *Vidalia spiralis*
 Family: Rhodomelaceae; Tribe: Amansieae

- 11b. blades **not** spirally twisted, teeth may divide into 3's, or appear single if blade is denuded. Figs 28-30.

..... *Dictyomenia*
 4 spp (3 with strap-like blades)
 Family: Rhodomelaceae; Tribe Pterosiphonieae
 See **Algae at a glance: Dictyomenia**



Fig. 26: *Vidalia spiralis*

Fig. 27: *Vidalia spiralis*, detail of twisted blades with saw-toothed edges



Fig. 28: *Dictyomenia tridens*



Fig.:29: *Dictyomenia tridens*, detail of branched teeth; blades with ring cell-patterns



Fig. 30: *Dictyomenia sonderi*

- 12a. blade **edges** show numerous **lines of dividing cells** (see Fig. 27); tufts of branched hairs (trichoblasts) often occur on blade surfaces (Fig. 28).
Pollexfenia 3 spp 13.
 Family: Rhodomelaceae; Tribe: Pterosiphonieae
 See also "**Algae at a glance: Pollexfenia**"
- 12b. not as above 15.
- 13a. plants small, 20-50 mm tall, on Sea nymph (*Amphibolis*) stems. Fig. 30.
 *Pollexfenia crispata*
- 13b. plants on rock or algae, 100-250 mm tall 14.
- 14a. mid-ribs absent. Figs 27-29.
 *Pollexfenia pedicellata*
- 14b. mid-ribs prominent. Figs 31, 32.
 *Pollexfenia lobata*
- 15a. blade surfaces with definite **cell patterns** (diamonds, rows of polygonal cells, large, ghost-like rounded images, small cells in rings around large ones) 16.
- 15b. patterns of cells **absent** or indefinite (see also step 34, Fig. 98) 24.
- 16a. surface cell pattern consists of diamond-shaped or box-shaped cells often in lines at acute angles to the mid-rib 17.
- 16b. surface cell pattern at right angles to the mid-rib 21.
- 17a. tips **notched**, a microscopic **cone** in each notch. See Figs 32, 33.
 *Lenormandia*, 5 spp 18.
 Family: Rhodomelaceae; Tribe: Amansieae
- 17b. blade tops rounded, or curled-over. Figs. 39-41 (next page, from W.A., rare in S.A.) *Kuetzingia canaliculata*.
 Family: Rhodomelaceae; Tribe: Amansieae
- 18a. blades 20-40 mm wide, plants often over 200 mm tall. 19.
- 18b. blades 10-20 mm wide, plants 50-150 mm tall 20.
- 19a. blades red-brown, mid-ribs **conspicuous**, thick; basal stalks long. Figs 32-34.
 *Lenormandia muelleri*
- 19b. blades dark red, mid-ribs of side blades **inconspicuous**; basal stalk short. Fig. 35.
 *Lenormandia spectabilis*
- 20a. blade edges **without** teeth; branches and reproductive structures grow from blade mid-ribs. Figs 36, 37.
 *Lenormandia pardalis*
- 20b. blade edges **minutely toothed**; branches and reproductive structure from blade edges. Fig. 38.
 *Lenormandia marginata*

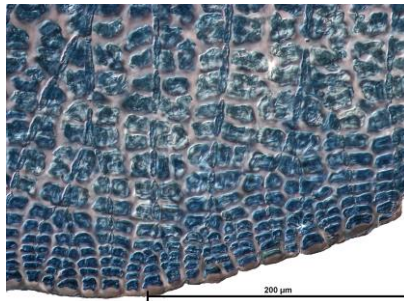


Fig. 27: *Pollexfenia pedicellata*, dividing lines of cells at blade edge



Fig. 28: *Pollexfenia pedicellata*, surface with branched hairs bearing sporangial structures



Fig. 29: *Pollexfenia pedicellata*



Fig. 30: *Pollexfenia crispata*



Fig. 31: *Pollexfenia lobata*, with ruffled blades



Fig. 32: *Pollexfenia lobata*, with linear blades



Fig. 32: *Lenormandia muelleri*, notched blade, sweeping arcs of diamond shaped cells



Fig. 33: *Lenormandia muelleri*, detail of the minute pointed tip



Fig. 34: *Lenormandia muelleri*, mid-ribs **conspicuous**, thick; long basal stalks to blades



Fig. 35: *Lenormandia spectabilis*, blades 20–40 mm wide, mid-ribs **inconspicuous**; short basal stalks to blades



Fig. 36: *Lenormandia pardalis*, blades arising from blade mid-ribs; dark female structures (cystocarps) scattered on the surface

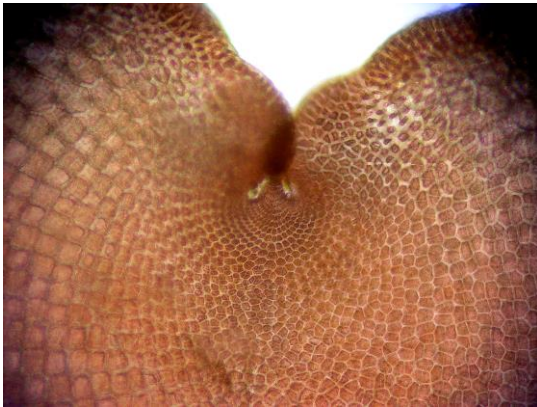


Fig. 37: *Lenormandia pardalis*, minute pointed tip in the notch of a blade, radiating cell rows, (diamond cell-patterns not yet established)

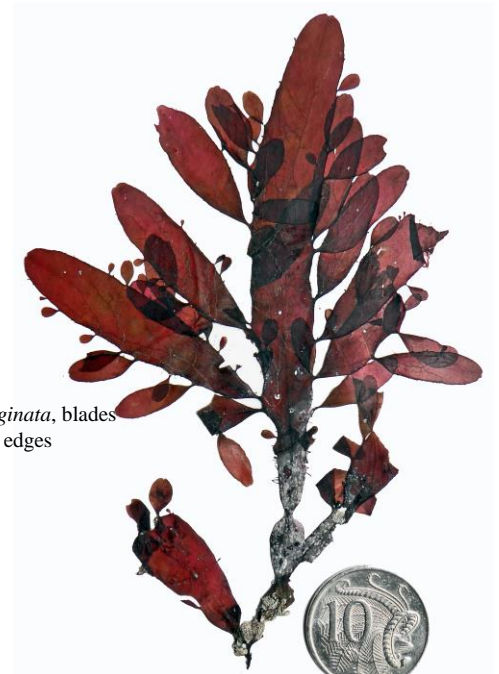


Fig. 38: *Lenormandia marginata*, blades arising from blade edges



Fig. 39: *Kuetzingia canaliculata*, blades heavily coated with whitish bryozoans

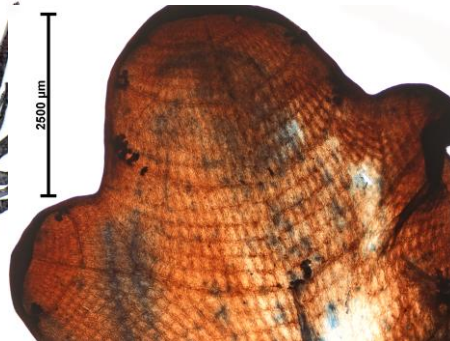


Fig. 40: *Kuetzingia canaliculata*, blade tops rounded and curled over



Fig. 41: *Kuetzingia canaliculata*, surface cell pattern, curled sporangial structures on the blade edge

21a. large, ghost-like cell images lie beneath the blade surface, distorting it into a pebble-like surface when the blade dries; blades twisted when fresh, drying almost black. Figs 42-46. (can be mistaken for a member of the Delesseriaceae)

..... *Hennedya crisper*
Family: Acrotylaceae

21b. cell rosettes (rings of small cells around larger ones) on blade surface 22.

22a. blade edges smooth; tissue squash shows large cells mixed with many fine threads; female structures (cystocarps) form pustules on blade surfaces; asexual spores occur in pyramidal stacks of 4 (tetrahedral). Figs 47-50.



..... *Leptosomia rosea*
Family: Rhodymeniaceae

22b. blade edges smooth or fringed, single threads in cores may appear as veins in some species; cystocarps occur on blade surface or edges; asexual spores are divided into stacks of 4 (zonate) 23.



23a. blade edges fringed with minute outgrowths; female structures fringe blades. Figs 51-56 (next page).

..... *Craspedocarpus* 4 spp
Family: Cystocloniaceae

See "... Groups at a glance: Cystocloniaceae"

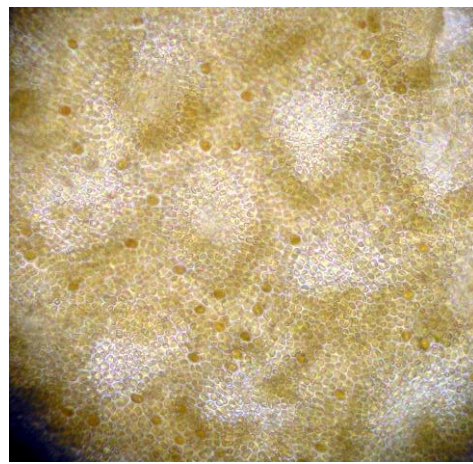
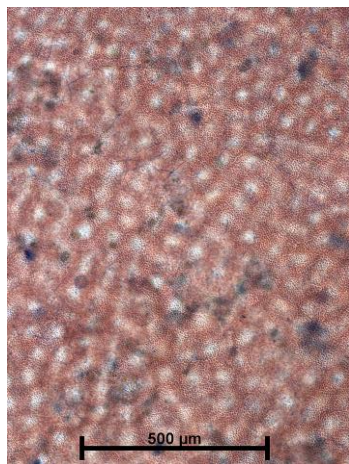
23b. blade edges smooth or fringed; cystocarps occur on blade surfaces or edges; cell rings (rosettes) and veins usually only weakly developed. Figs 57-60 (next page).

..... *Rhodophyllis* 3 spp
Family: Cystocloniaceae

See "... Groups at a glance: Cystocloniaceae"



Fig. 48: *Leptosomia rosea* on seagrass



Figs 42, 43: two microscopic surface views of blades of *Hennedya crisper* at different magnifications showing large ghost-like cell images lying beneath the surface



Fig. 44: *Hennedya crisper*, whole plant

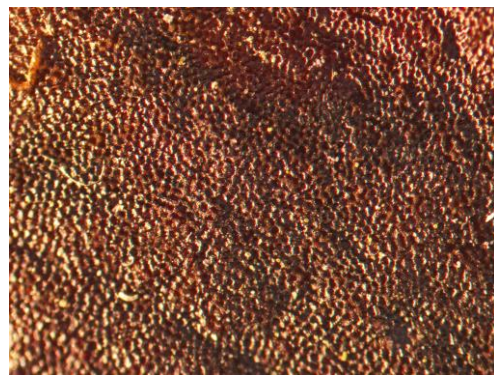


Fig. 45: *Hennedya crisper*, pebble-like surface of a dried blade

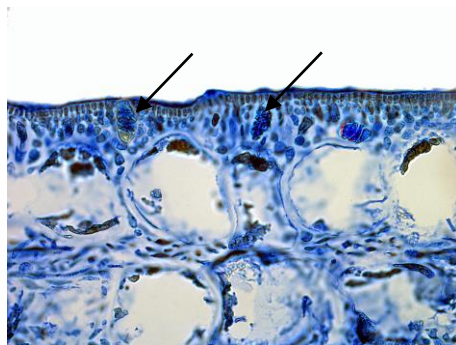


Fig. 46: *Hennedya crisper*, partial cross section with large inner cells and tetrads of spores in the outer surface layer (arrowed)

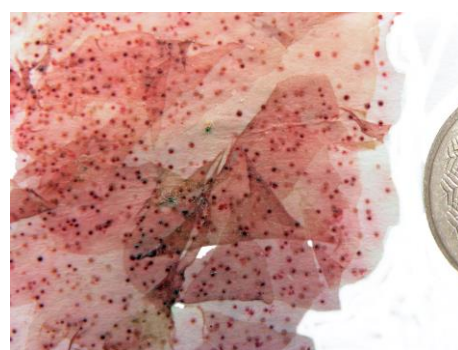


Fig. 47: *Leptosomia rosea* scattered embedded female structures

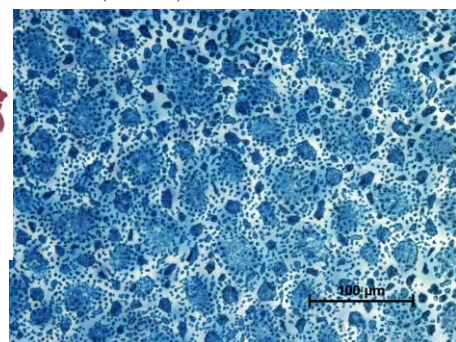


Fig. 49: *Leptosomia rosea*, surface view of cell rings (rosettes)

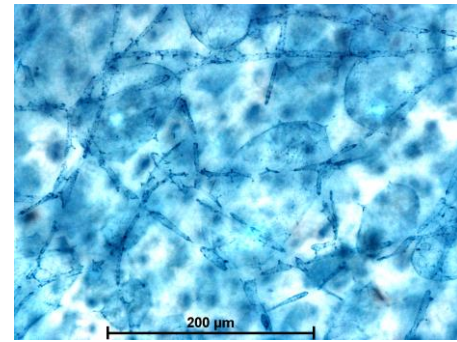


Fig. 50: *Leptosomia rosea*, tissue squash, fine threads amongst other cells

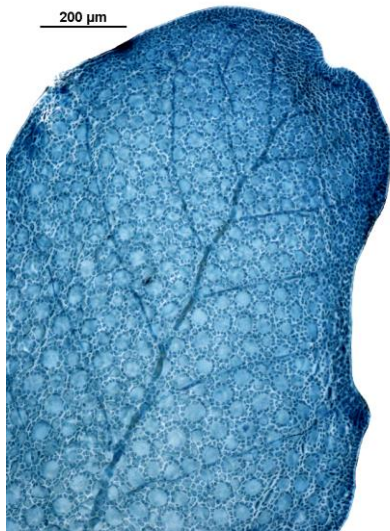


Fig. 51: *Craspedocarpus venosus* surface view of clearly defined cell rosettes, veins



Fig. 52: *Craspedocarpus ramentaceus* fringed with short blades



Fig. 53: *Craspedocarpus blepharicarpus*



Fig. 54: *Craspedocarpus blepharicarpus*, female structures (cystocarps) on blade edge



Fig. 55: *Craspedocarpus venosus*



Fig. 56 *Craspedocarpus venosus* detail of marginal female structures



Fig. 57: *Rhodophyllis volans*



Fig. 58: *Rhodophyllis membranacea*

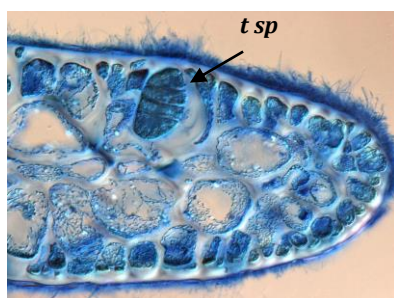


Fig. 59 *Rhodophyllis multipartita*, cross section with large zonate tetrasporangium (*t sp*)



Fig. 60: *Rhodophyllis membranacea*, weakly developed cell rosettes; veins

- 24a. cross sections of blades, or tissue squashes show a core (medulla) of fine threads, outer layers with rounded or box-shaped cells 25.
 24b. cross sections of blades show a core of large oval-shaped cells, grading to surface smaller cells. See Fig. 81. 30.

- 25a. cross sections of blades show a **narrow** core of threads 26.
 25b. cross sections show a **broad** core of threads 29.

- 26a. in cross section, core cells are flanked by large box-shaped cells at the blade surface; blade margins have minute teeth. Figs 61-64.
 *Stictosporum nitophylloides*

Family: Cystocloniaceae

- 26b. core threads are flanked by oval cells, decreasing in size toward the surface of the blade; blade edges are smooth. (See Fig. 65).
 *Carpopeltis*. 3 spp ... 27.

Family: Halymeniaceae

- 27a. blades covered in a thick coating of sponge, only the uppermost narrow blades protruding (also at step 7a). Figs 13, 14.
 *Carpopeltis spongeaplexus*

- 27b. blades generally naked 28.

- 28a. blades 3-5 mm wide, narrowing towards the base. Figs 64, 65.
 *Carpopeltis phyllophora*

- 28b. blades 1-2 (-3) mm wide, plants are often basally denuded of side branches. Figs 67-69.

..... *Carpopeltis elata*

- 29a. tissue squashes show spidery (ganglionic) cells amongst extremely fine threads; outer layers (cortex) have chains of outward-facing cells; female structures (cystocarps) are sunken in blade surfaces. Figs 73-77 (next page).
 *Cryptonemia* 5 spp

Family: Halymeniaceae

See "Algal groups at a glance: Halymeniaceae"

- 29b. ganglionic cells **absent** although core threads have many arms; cortex of an inner, dense cell layer and distinct outer layer of outward-facing cells; cystocarps occur along blade edges Figs 70-72 (next page).
 *Sarcodia marginata*

Family: Sarcodiaceae



Fig. 61: *Stictosporum nitophylloides*

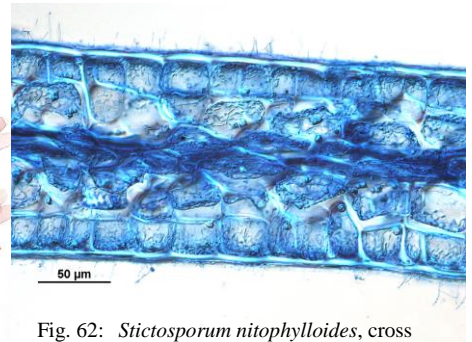


Fig. 62: *Stictosporum nitophylloides*, cross section, core of threads, surface cells box-shaped



Fig. 63: *Stictosporum nitophylloides*, toothed edges of blades

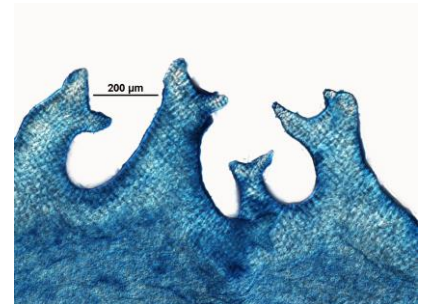


Fig. 64: *Stictosporum nitophylloides*, toothed edges of blades

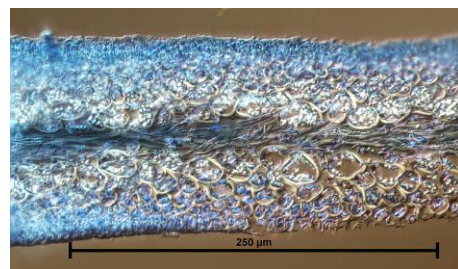
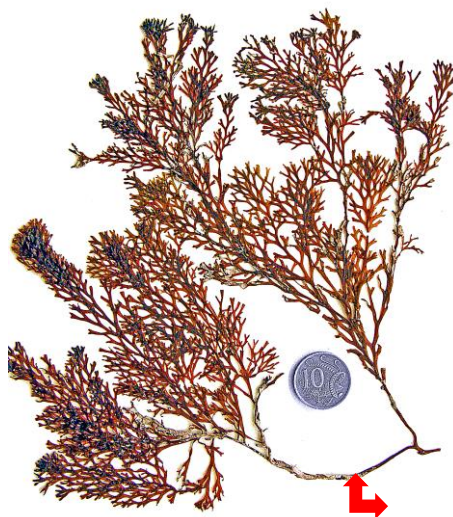


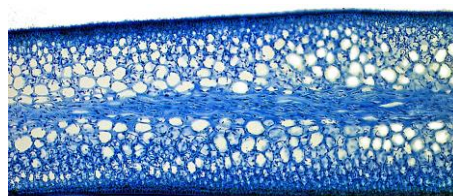
Fig. 65: *Carpopeltis phyllophora*, **narrow** core of threads (medulla, med)



Fig. 66: *Carpopeltis phyllophora*



Figs 67, 68: *Carpopeltis elata*



Figs 69: *Carpopeltis elata*, cross section





Fig. 70: *Sarcodia marginata*



Fig. 71: *Sarcodia marginata*, detail of cystocarps (arrowed) along blade margins

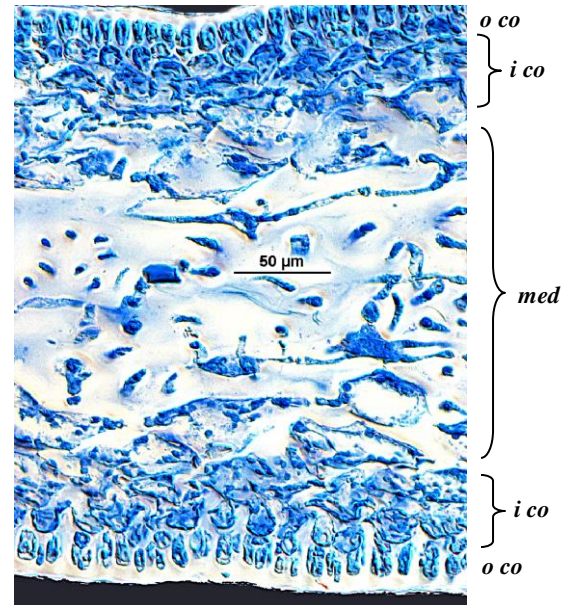


Fig. 72: *Sarcodia marginata*, cross section, medulla, (*med*) of many-armed threads, inner cortex (*i co*), outer cortex (*o co*)

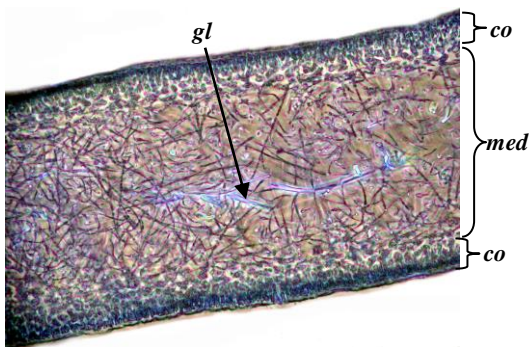


Fig. 73: *Cryptonemia digitata*, cross section, **wide** core (medulla, *med*) of fine threads, spidery (ganglionic) cell (*gl*), outer layers (cortex, *co*) of chains of outward facing cells



Fig. 74: *Cryptonemia digitata*, tissue squash, fine core threads, bright, spidery (ganglionic) cells



Fig. 75: *Cryptonemia nitophylloides*



Fig 76: *Cryptonemia digitata*



Fig 77: *Cryptonemia kallymenioides*

(core of large circular cells)

30a. plants **leathery**, forked or with a flat, thick, broad, central main branch (axis) and smaller side branches. 31.

30b. plants **softer**, flexible, main branches regularly forked **or** with a wide main branch and short side-branches forked or toothed 32.

31a. plants usually upright (except *Curdiea crassa*); female structures (cystocarps) form pimple-like bumps near blade margins. Figs 78-83.

..... *Curdiea* 3 spp
Family: Gracilariaceae
See “...groups at a glance: *Gracilariaceae*”

31b. plants grow flat on rocks, attached by short outgrowths (haptera); cystocarps generally scattered on blade surfaces. Figs 84-88.

..... *Tylotus obtusatus*
Family: Dicranemataceae



Fig. 78: *Curdiea crassa* lies flat on rocks



Fig. 79: *Curdiea crassa*, edge of the blade lifted to reveal a white layer of bryozoan animals on the underside



Fig. 80: *Curdiea angustata*



Fig. 81: *Curdiea angustata*

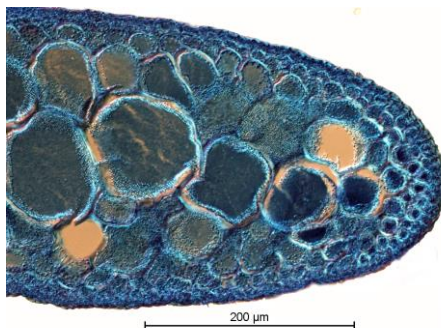


Fig. 82: *Curdiea angustata*, cross section showing core of large cells grading outwardly to smaller ones



Fig. 83: *Curdiea obesa*



Fig. 84: *Tylotus obtusatus* lies flat on rock

Fig. 85: *Tylotus obtusatus*, cross section

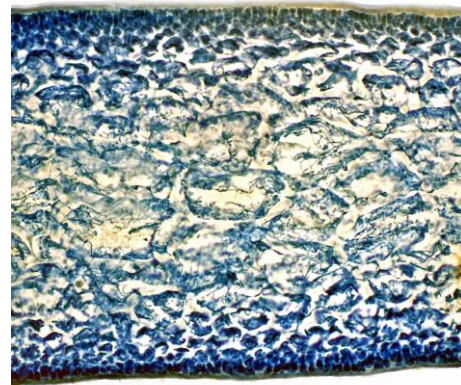


Fig. 86: *Tylotus obtusatus*, root-like attachment structures



Fig. 87: *Tylotus obtusatus*, peg-like attachment structures on the blade underside

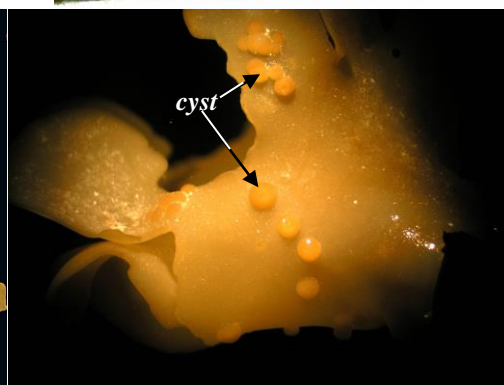


Fig. 88: *Tylotus obtusatus*, cystocarps (cyst) on the blade surface

32a. blades *forked*. Figs 89-94.

..... *Rhodymenia* in part, *Halopeltis*
See "*Southern Australian groups at a glance: Rhodymeniaceae*"

32b. main blades with short, small *side blades* 33.



Fig. 89: *Rhodymenia obtusa* (Some specimens collected from Victoria and Tasmania and placed in this species include a new species, *Rhodymenia wilsonis*)



Fig. 90: *Halopeltis cuneata* (= *Rhodymenia cuneata* and *Rhodymenia halymenioides* in the Marine Benthic Flora of southern Australia)



Fig. 91: *Halopeltis australis* (= *Rhodymenia australis* in the Marine Benthic Flora of southern Australia)



Fig. 92: *Halopeltis verrucosa* (= *Rhodymenia verrucosa* in the Flora), with a basal coating of whitish bryozoans



Fig. 93: *Rhodymenia leptophylla*

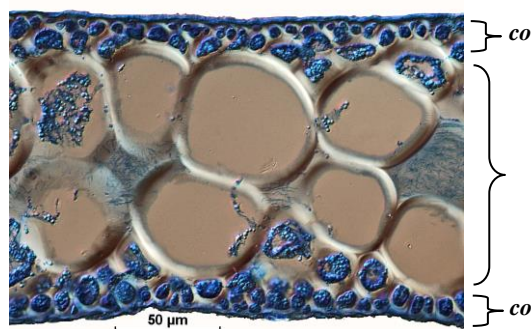


Fig. 94: *Halopeltis cuneata* (= *Rhodymenia cuneata* and *Rhodymenia halymenioides* in the Flora), cross section, wide core (medulla, *med* of large cells, rapidly grading to small cells of the narrow outer layers (cortex, *co*)

33a. short side blades fringing the main blade (axis) are narrow, usually unbranched themselves. Figs 94-96.

Rhodymenia prolificans,
Rhodymenia stenoglossa
See "*Southern Australian groups at a glance: Rhodymeniaceae*"

33b. side branches toothed or branched 34.



Fig. 95: *Rhodymenia prolificans*

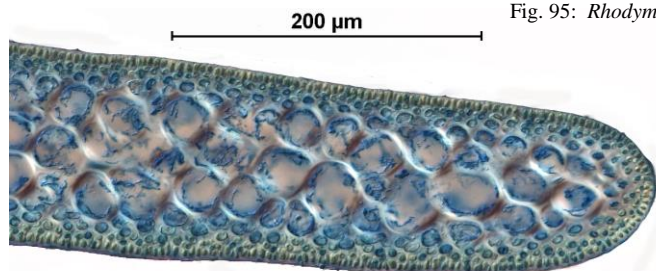


Fig. 96: *Rhodymenia prolificans*, cross section



Fig. 97: *Rhodymenia stenoglossa*

34a. side blades usually spiky, arranged in alternating sets of 2's, or 3's, 4's and 5's; some may be serrated on the outer edge. Tetrasporangia occur in finger-like structures tufted in branch angles. In cross section, the large cells of the core have **no** obscure threads wrapped around them . Figs 98-102.*Plocamium*

Family: Plocamiaceae

See "*Southern Australian groups at a glance: Plocamium*"

34b. side blades not as above, ends usually forked, rounded or horn-like. Tetrasporangia are scattered, and embedded in the blade. In cross section, the large cells of the core are ringed by obscure, extremely thin threads. See Figs 102, 103.

.....*Callophyllis*, *Austrophyllis*

..... 35.

Family: Kallymeniaceae

(next 2 pages)



Fig. 98: *Plocamium cartilagineum*

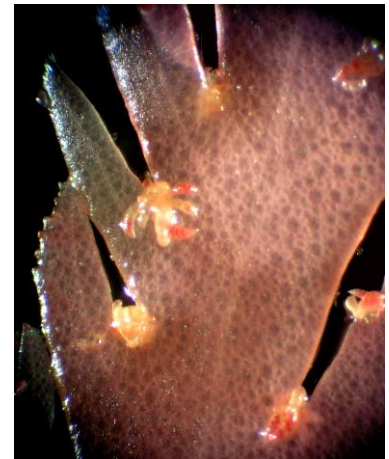


Fig. 99: *Plocamium preissianum*, tufts of reproductive structures in blade angles and ghost-like large cells of the core showing through the surface

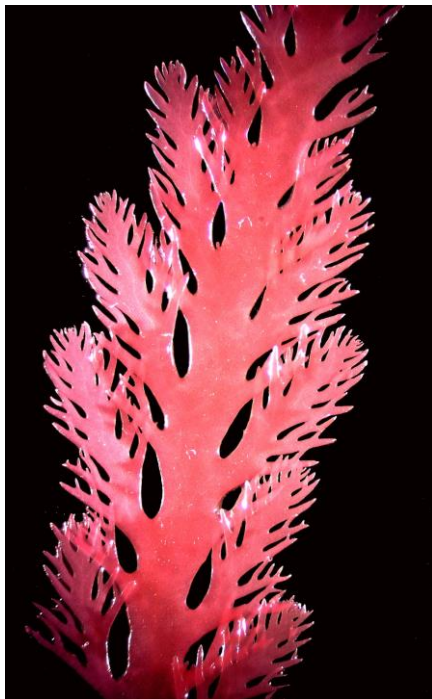


Fig. 100: *Plocamium mertensii*

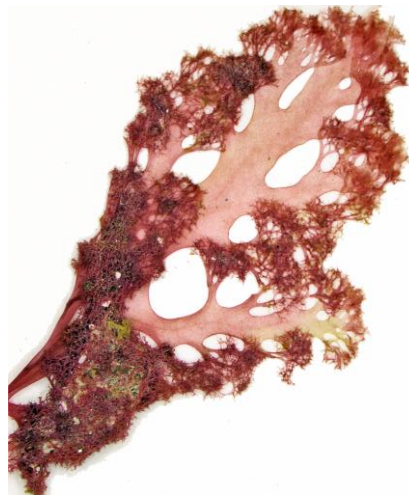


Fig. 101: *Plocamium mertensii*, The alternating sets of spiky blades seen in Fig. 99 can be obscured sometimes by bunches of tree-like branches (proliferating branchlets)

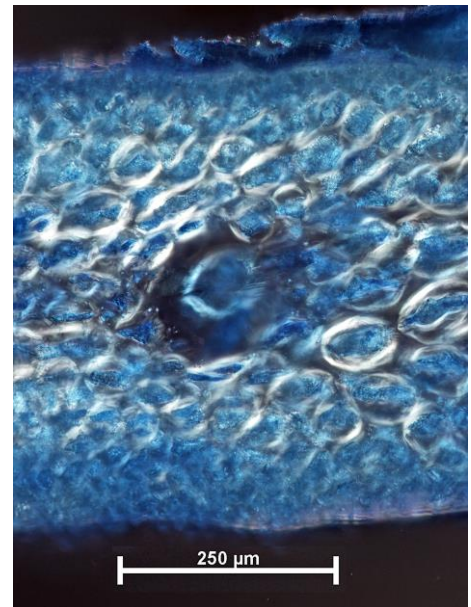


Fig. 102: *Plocamium patagiatum*, cross section through the midrib of the blade, absence of fine threads around egg-shaped cells

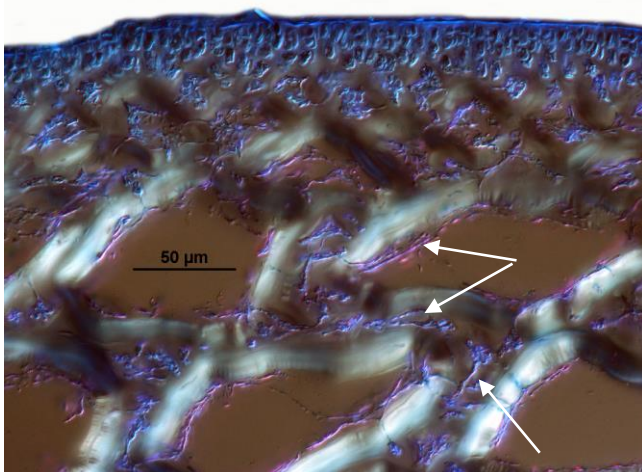


Fig. 103: *Austrophyllis harveyana*, cross section showing large, thick-walled core cells ringed by delicate threads (arrowed)

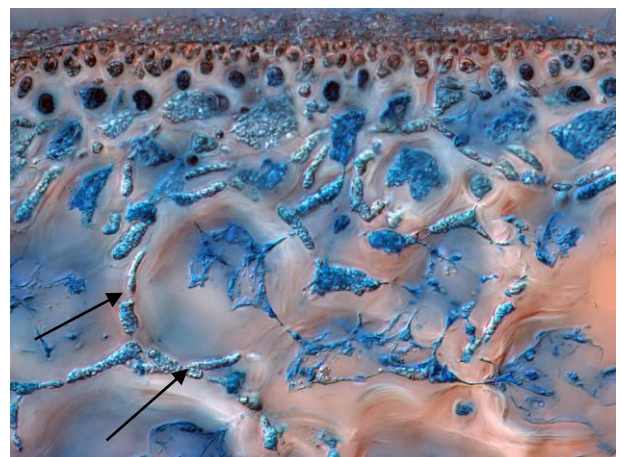


Fig. 104: *Callophyllis lambertii*, cross section showing large core cells ringed by delicate threads (arrowed)

- 35a. branching fairly regular; edges of main blades largely smooth, tips lance-shaped and parallel 36.
- 35b. branching more irregular, edges of main blades (axes) with small antler-like or spiny side prongs, tips spiny, or spreading 37.

- 36a. blades 10-50 mm wide, forked about every 10-30 mm; female reproductive structures (cystocarps) pimple-like, scattered throughout blades. Figs 105, 106, 116.

-*Austrophyllis harveyana*
- 36b. blades < 10 mm broad, cystocarps restricted to branch tips. Figs 107, 108.
- *Callophyllis cervicornis*

- 37a. plants large, robust, commonly >150 mm tall; tips rounded and about 2 mm wide, prongs on blade margins if present > 1 mm wide. Figs 109-111.

- *Callophyllis lambertii*
- 37b. plants thinner, more delicate, usually < 150 mm tall; tips \leq 1 mm wide for some distance.

- *Callophyllis rangiferina* Figs 112, 113.
-*Austrophyllis alcicornis* Figs 114, 115.

(similar vegetatively, these 2 spp are separated on female reproductive features – see individual Fact Sheets and Fig. 115)



Fig. 109: *Callophyllis lambertii*, prongs on the margins of blades

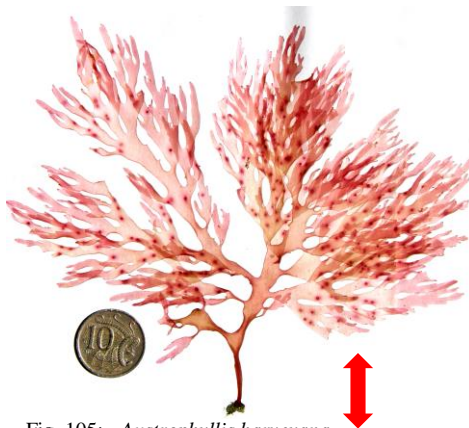


Fig. 105: *Austrophyllis harveyana*



Fig. 106: *Austrophyllis harveyana* detail of branches at tips, scattered, pimple-like cystocarps

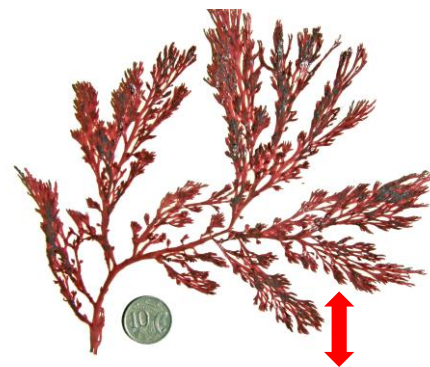


Fig. 107: *Callophyllis cervicornis*



Fig. 108: *Callophyllis cervicornis*, branch tips with cystocarps



Fig. 110: *Callophyllis lambertii*



Fig. 111: *Callophyllis lambertii* tips

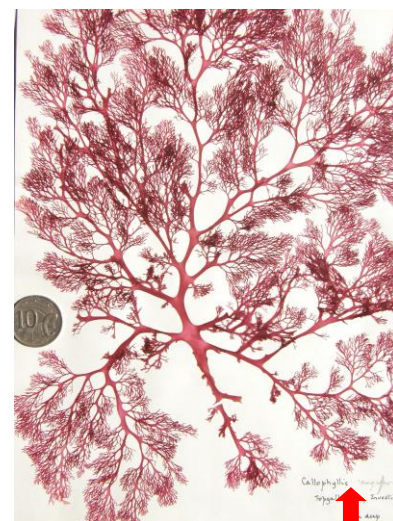


Fig. 112: *Callophyllis rangiferina*



Fig. 113: *Callophyllis rangiferina* tips



Fig 114: *Austrophyllis alcicornis*



Fig. 115: *Austrophyllis alcicornis* tips

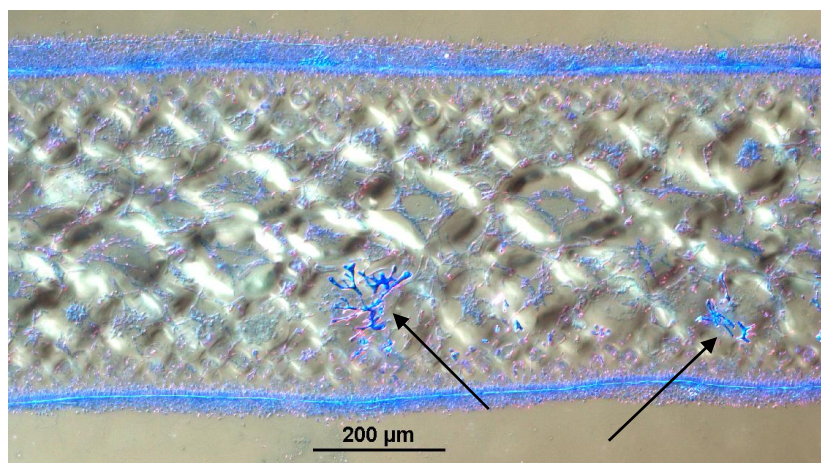


Fig. 116: *Austrophyllis harveyana*, cross section of young female stage, showing heavily stained, amoeba-like cells (arrowed) involved in reproduction, a feature separating the genus from *Callophyllis*