

TURF AND FOULING ALGAE III: ENCRUSTING, THREAD- AND WORM-LIKE BROWN ALGAE

What are they?

Some marine algae exist as low crusts, minute tufts or smothering swathes on other plants and rocks, or hard surfaces such as boat hulls and wharfs.

They are often called “fouling” organisms, although in natural ecosystems they can be a perfectly normal phenomenon. Although “fouling” may be a pretty subjective term, it is a useful starting point in the identification of some of the many Brown algae of southern Australia.

Purpose of the key

Formal classification of algae relies on investigating microscopic reproductive features in detail. Often a complete set of reproductive stages is unavailable in the specimens to be investigated, making identification very difficult if the technical systematic literature is used. Fortunately some algae grow in specific places and some have recognisable shapes that allow them to be sorted 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 searching for a name.

Then you can proceed to the appropriate fact sheets or further keys to refine your identification. The key generally starts with the large and common and then proceeds to the smaller and obscure species.

Limitations

Unfortunately, to use this key, microscopic investigation of specimens will be needed.

Images used below

Unless acknowledged otherwise, all images come from pressed specimens or the extensive slide collection of the algal unit, State Herbarium of S Australia, collections generated by the late Professor Womersley and his workers over some 60 years. Images with dark backgrounds have been taken using phase contrast or interference microscopy to highlight transparent structures. Other images may be stained dark blue.

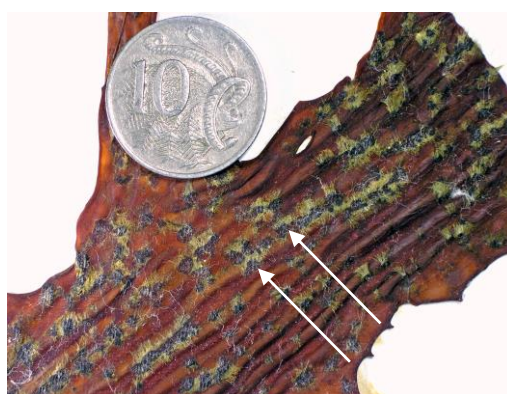
Scale

The coin used as a scale is 23 mm or almost 1” across

TYPES OF BROWN ALGAE INCLUDED IN THIS KEY



WORM-LIKE, SLIMY ALGAE
(on seagrasses or other algae)



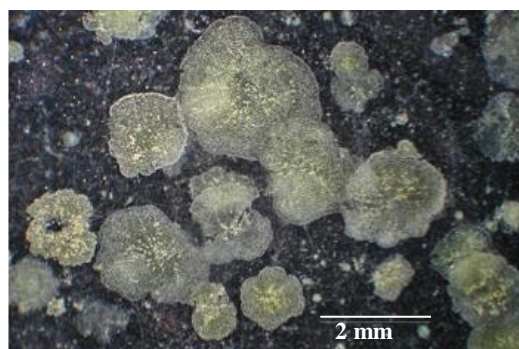
MINUTE TUFTS (on seagrasses and algae)



JELLY-LIKE BLOBS (usually on other Brown algae)



THREAD OR FILAMENTOUS ALGAE
(forming cloudy coverings on other algae)



MINUTE CRUSTS

1a. plants forming dense, worm-like, slimy threads with fuzzy surfaces, up to 300mm long and 2mm thick on larger seagrasses and algae. Fig. 1.

..... epiphytic species of the Family: Chordariaceae (*excludes* species growing on rock and in sand)

..... 2.

1b. plants forming cloudy coverings over algae *or* minute tufts or jelly blobs on algae *or* flat dark brown coatings on shells and rocks *or* minute greenish or brownish scales on other algae

..... 5.

2a. outer layer with chains of 12-30 microscopic cells of about the same size, usually curved. Figs 1-3.

..... *Cladosiphon filum*

2b. outer layer of generally straight chains of 8-15 microscopic cells; end cells globe-shaped.

..... *Polycerea* (2 spp) 4.

4a. terminal cells much larger than other cells in the chain, about 50µm wide, Figs 4-6.

..... *Polycerea nigrescens*

4b. terminal cells only slightly larger than the next 3 cells below in the chain, about 30 µm wide. Figs 7-9.

..... *Polycerea zostericola*



Fig.1.: mixed *Cladosiphon filum* and *Polycerea nigrescens* smothering a blade of *Posidonia*

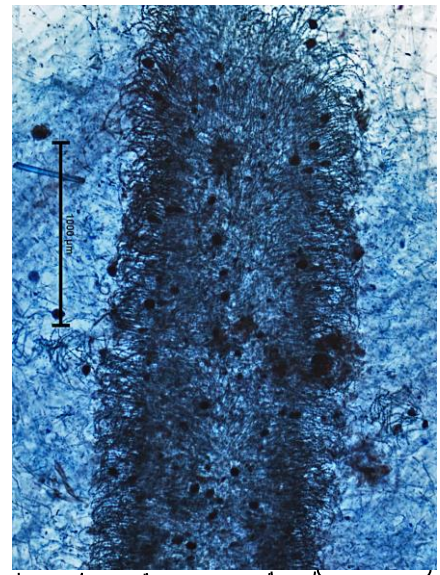


Fig. 2. *Cladosiphon filum*: fuzzy layer of colourless hairs (*h*), outer chains of cells (cortex, *co*) core of threads (medulla, *med*)

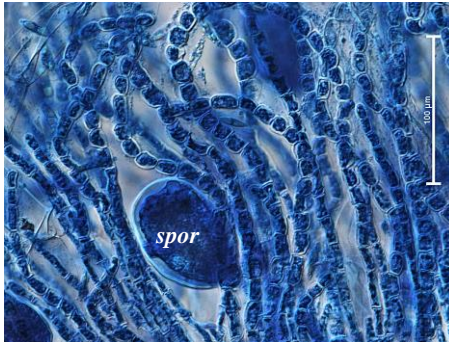


Fig. 3. *Cladosiphon filum*: detail of outer chains of cells, with basal sporangia (*spor*)

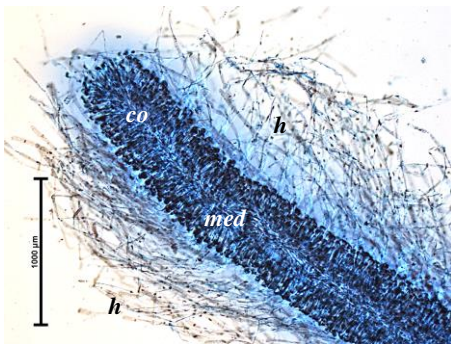


Fig. 4. *Polycerea nigrescens*: fuzzy layer of colourless hairs (*h*), outer chains of cells (cortex, *co*) core of threads (medulla, *med*)

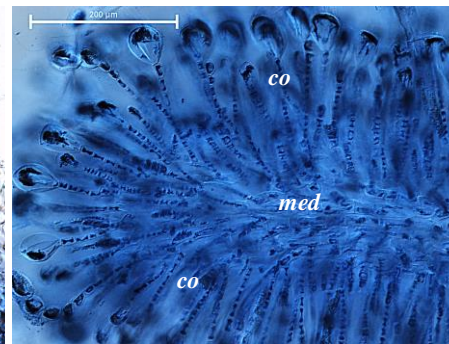


Fig. 5. *Polycerea nigrescens*: detail of outer chains of cells (*co*), core of threads (medulla, *med*)

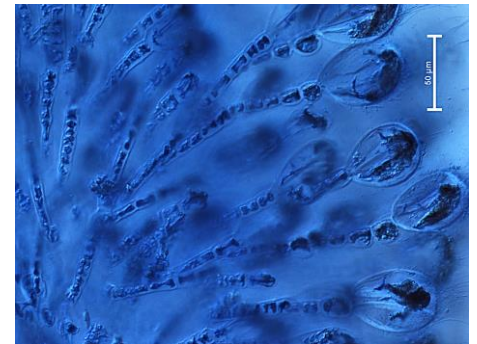


Fig. 6. *Polycerea nigrescens*, detail of outer chains of cells

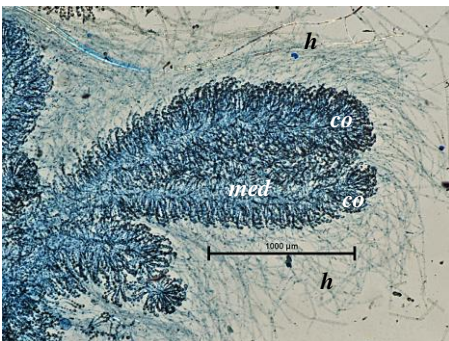


Fig. 7. *Polycerea zostericola*: fuzzy layer of colourless hairs (*h*), outer chains of cells (cortex, *co*) core of threads (medulla, *med*)

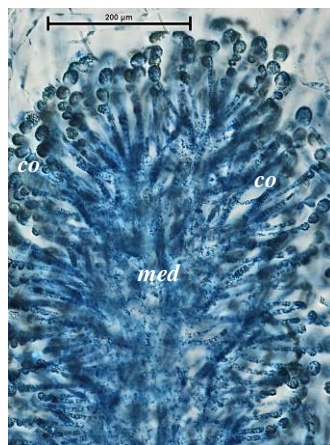


Fig. 8. *Polycerea zostericola*: detail of outer chains of cells (*co*), core of threads (medulla, *med*)



Fig. 9. *Polycerea zostericola*: detail of outer chains of cells and hairs

- 5a. plants form upright tufts or tangled masses of threads, generally on or partly from within other algae 6.
- 5b. plants forming jelly-like blobs *or* spreading encrusting layers on rocks or other algae 10.

- 6a. vegetative (non-reproductive) cells naked, in single lines, forming branched or unbranched threads of about the same shape and size. Plants not differentiated into inner cores and outer layers (although terminal hairs may be present) 7.

- 6b. plants differentiated into an inner core and outer layers *or* threads consisting of several ranks of cells (cells not in single lines) 15.

- 7a. terminal cells *conspicuous* when plants are actively growing. 8.

- 7b. terminal cells similar to lower cells. Plants common. Figs 10-12. Family: Ectocarpaceae
see "Turf and fouling algae part I: the Ectocarpaceae"

- 8a. lines of cells (threads) naked 9.
- 8b. cells dividing lengthwise, forming bands several cells across threads. Figs 19-22 (next page).
..... Genus: *Sphacelaria*, 15 spp
see "Pictured key to *Sphacelaria*"

- 9a. spore sacs initially in stalkless pairs, dividing to form small, *horizontal* clusters; a *rare*, introduced, deepwater species. Figs. 13-15.
Discosporangium mesarthrocarpum
see also the separate Fact Sheet for this species
- 9b. spore sacs stalked, *upright*, of single compartments. Figs 16-18.
.....*Sphacella subtilissima*
see also the separate Fact Sheet for this species



Fig. 10 *Hincksia sordida*, smothering large Brown algae, and a giant cuttlefish, *Sepia apama*, N Spencer Gulf, SA

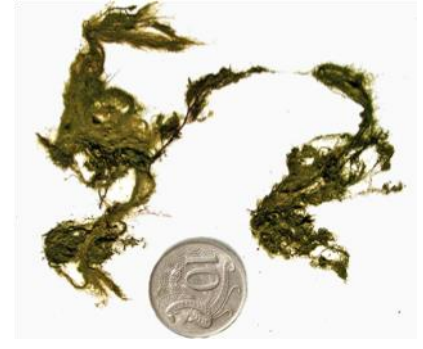


Fig. 11 *Hincksia sordida*: pressed specimens

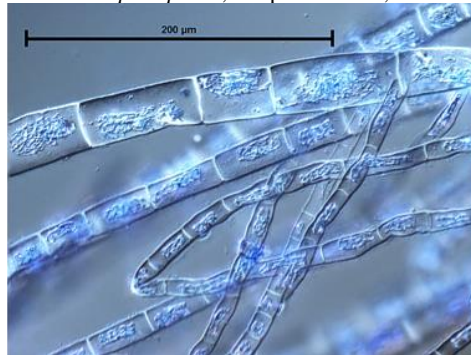


Fig. 12 *Hincksia sordida*: cell detail

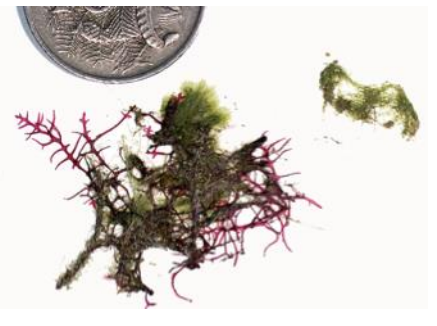


Fig. 13: *Discosporangium mesarthrocarpum* on the red alga *Laurencia* from 20m deep

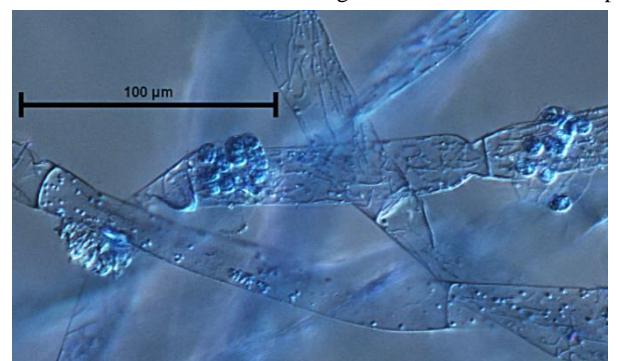
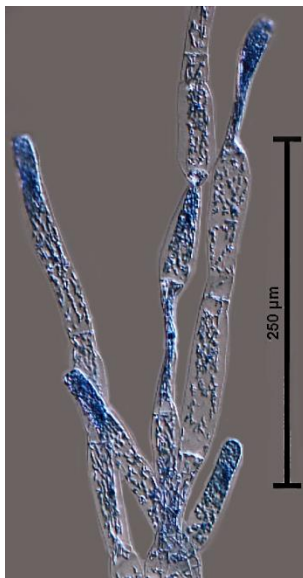


Fig. 14. *Discosporangium mesarthrocarpum*: horizontal packets of sporangia (some compartments empty)

Fig. 15. *Discosporangium mesarthrocarpum*: prominent terminal cells

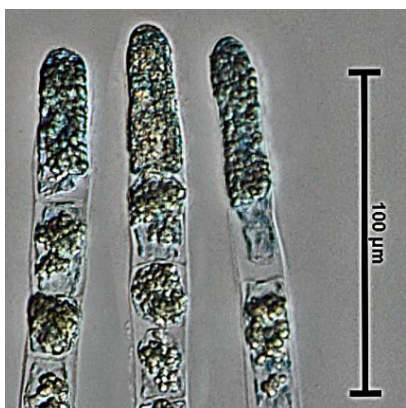


Fig. 16. *Sphacella subtilissima* prominent terminal cells



Fig. 17: *Sphacella subtilissima* (arrowed) on the wiry, tufted branch of *Bellotia*

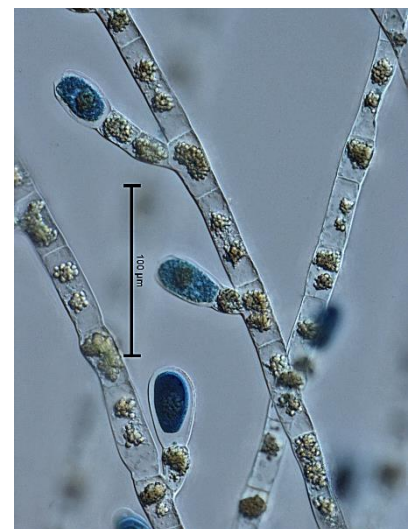


Fig. 18. *Sphacella subtilissima*: stalked sporangia

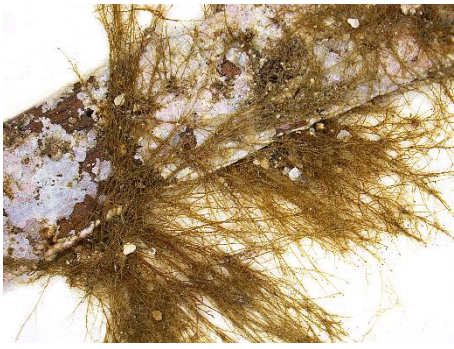


Fig. 19. *Sphacelaria biradiata* on the blade of the seagrass *Posidonia*



Fig. 20. *Sphacelaria* (=Herpodiscus) *carpoglossi* patches on the blade of the Brown alga *Carpoglossum*

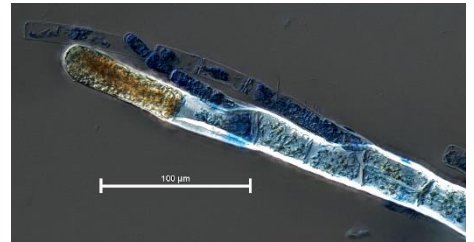


Fig. 21. *Sphacelaria tribuloides*: prominent terminal cell

- 10a. plants form jelly-like blobs *or* minute tufts differentiated into cores of colourless cells on or partially in other algae and upright threads 15.
- 10b. plants form flat, dark brown coatings on shells and rocks or minute brownish scales on other algae 11.

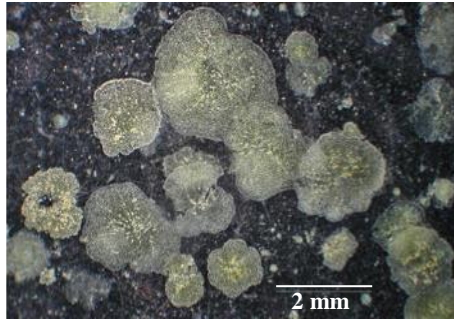


Fig. 23: *Myrionema* crusts, surface view

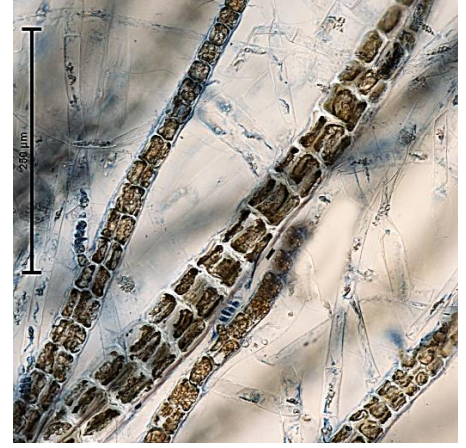


Fig. 22. *Sphacelaria*: bands of cells forming on threads

- 11a. plants form minute flat discs, pads or crusts of radiating cells on other plants or hard surfaces 12.
- 11b. plants form small to large either cushion-shaped masses *or* upright tufts of threads 14.

- 12a. discs minute, 0.5-5mm across, may appear greenish when young, found on hard surfaces or other plants; basal crusts 1-2 cells thick bearing short upright chains of coloured cells, spores or long hairs.

Figs 23-25 *Myrionema*, 5 spp., . one, *M. latipilum* is rare - see the separate Fact Sheet

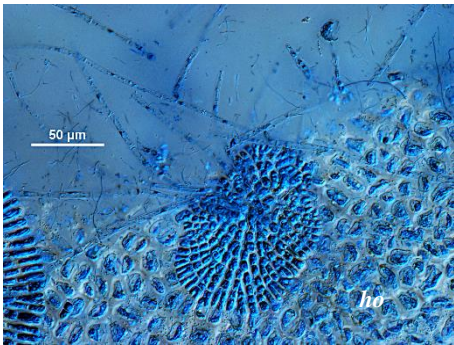


Fig. 24: *Myrionema strangulans*, on Sea lettuce, *Ulva*. (host, *ho*), surface view

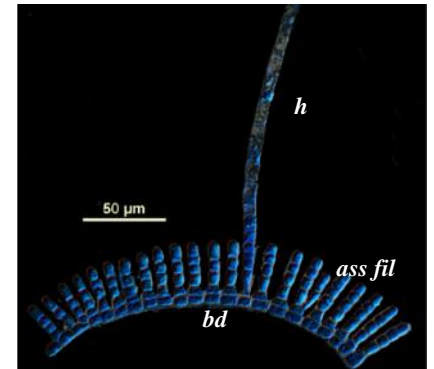


Fig. 25: *Myrionema strangulans*, piece of a disc peeled off and viewed from the side: basal disc (*bd*), chains of upright coloured cells (assimilatory filaments, *ass fil*), hair (*h*)

- 12b. discs generally larger, 0.5-10mm across, often not on other plants; basal crusts often becoming many-celled, bearing upright chains of 8-20 cells 13.

- 13a. common in the intertidal or in shallow water on rock or shellfish, dark brown or red-brown, up to 50mm across, edges ragged and surface warty in older plants; microscopic chains of cells on substrate surfaces spread radially then rise upwards. Figs 26-28.

..... *Ralfsia verrucosa*

- 13b. uncommon in shallow water or on other plants, up to 30mm across; microscopic chains of cells arise near the edges of the disc 14.

Fig. 26 *Ralfsia verrucosa*, cross section: horizontal chains of cells on the substrate rising upwards (assurgent filaments *ast fil*) then ending in upright chains of box-shaped threads (assimilatory filaments, *asy fil*)

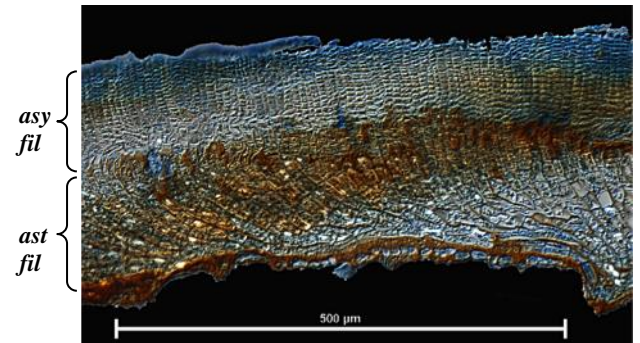


Fig. 27 *Ralfsia verrucosa*, encrusting the limpet *Cellana* from the intertidal



Fig. 28: *Ralfsia verrucosa*, on rock in the intertidal with a False limpet, *Siphonaria* and white sandgrains



- 14a. rare (from Albany WA only), forming a dark brown, jelly-like crust a few mm across on rock; thin, upright, microscopic chains of cells ending in swollen cells. Figs 28, 29.
 *Hapalospongidion capitatum*
- 14b. uncommon but widespread; forming dark brown smooth patches 5-30mm across on rock, with short, compact, microscopic chains of box-shaped cells and free threads at edges. Figs 30-32.
 *Pseudolithoderma australe*
 (as *P. australis* in the Flora)

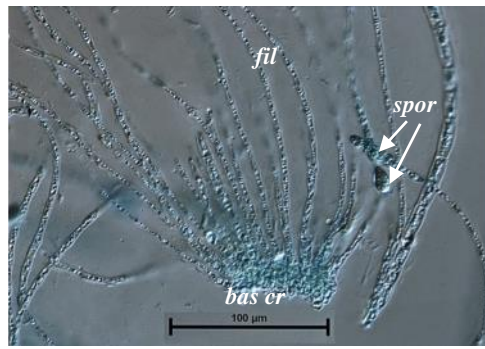


Fig. 28: *Hapalospongidion capitatum*: basal crust (*bas cr*), upright threads (*fil*), 2 types of spore sacs *spor* – single-celled and many-celled)

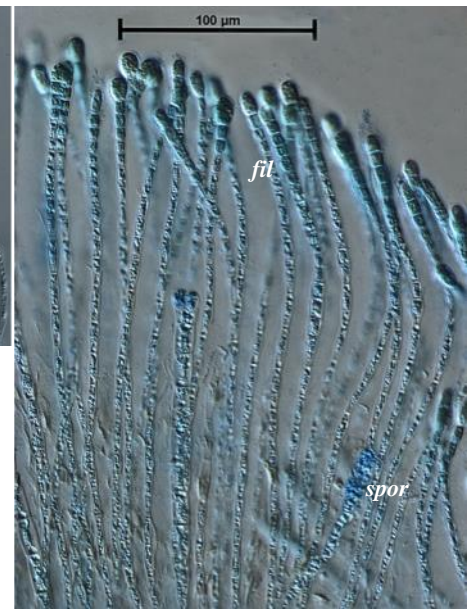


Fig. 29: *Hapalospongidion capitatum*: upright threads (*fil*) ending in swollen cells

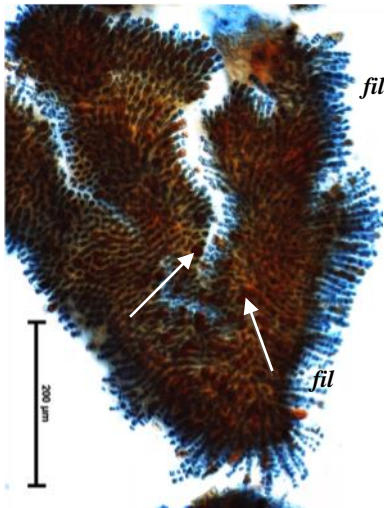


Fig. 30: *Pseudolithoderma australe*, microscopic surface view: compact cell chains of the disc with large spore sacs (arrowed), free, edge-threads (*fil*)

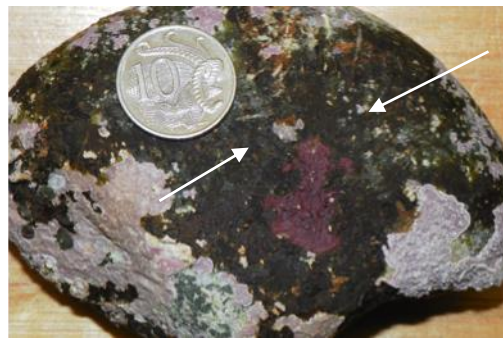


Fig. 31: *Pseudolithoderma australe*: dark-brown crusts (arrowed), amongst pink coralline red algae and dark red, leathery *Peyssonnelia* crusts on a pebble

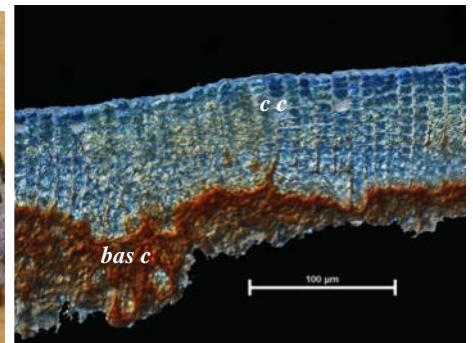
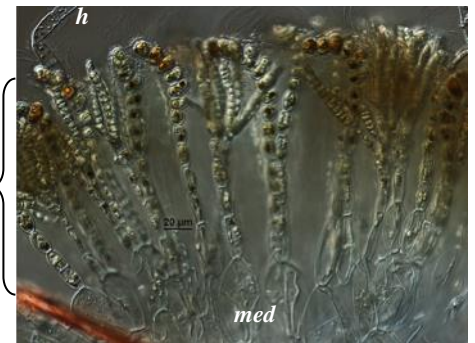


Fig. 32: *Pseudolithoderma australe* microscopic section through the crust: dark basal cells (*bas c*) torn from rock, compact cell chains (*c c*)

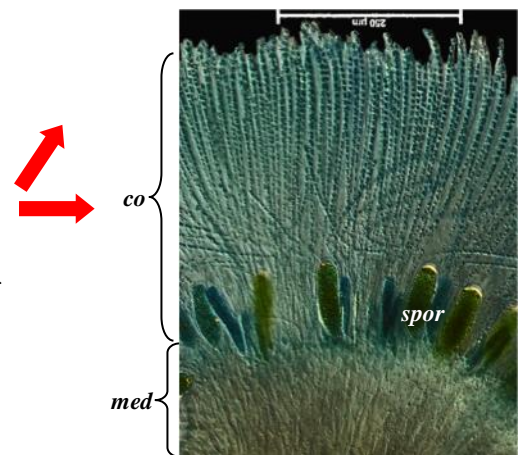
- 15a. plants cushion- or ball-shaped, 2-50mm wide, often slimy, of cores of microscopic, colourless large cells; outermost layers of coloured chains of small cells embedded in a jelly.
 16.
- 15b. plants form minute tufts on or partially in other plants
 20.
- 16a. plants often grow on species of *Cystophora*; outermost cell chains 10-16 cells long, branched, often curved; thin hairs extend beyond the plant surface. Figs 33-37.
 *Corynophloea* 2 spp
 17.
- 16b. outermost cell chains 4-10 cells long, unbranched or branched, plants growing on rock or other plants
 18.



Fig. 33: *Corynophloea cystophorae* on ultimate branches of *Cystophora moniliformis*



Figs 34, 35: *Corynophloea cystophorae*, cross sections: cortex, (*co*) of branched coloured cells, some curved; core (medulla, *med*) of egg-shaped, compact, colourless cells; hair (*h*); spore sacs (sporangia, *spor*)



17a. dark brown, firm but slimy;
internally a core of **compacted**, egg-
shaped, colourless, microscopic
cells. Figs 33- 35 (previous page).

..... *Corynophloea cystophorae*

17b. light brown, soft and slimy,
internally, a core of **loosely-
arranged** cylindrical cell.

Figs 36, 37.

.....*Corynophloea cristata*

18a. on rock; plant surfaces wrinkled;
outermost chains of cells **branched**,
core cells oval-shape, some
producing threads wandering
throughout the entire core.


Figs 38-41.

.....*Petrospongium rugosum*

18b. mainly on large brown algae; plant
surfaces smooth or lobed; outermost
chains of cells **unbranched**, ending
in **swollen** cell, cores without
“wandering” threads 19.

19a. plants ball-shaped or spreading, 10-
80mm wide, often becoming **hollow**,
on rock but mainly on large algae
and seagrasses; outermost
microscopic chains each of 3-5 box-
shaped cells. Figs 42-44.

..... *Leathesia difformis*

 young *Colpomenia* spp (Bubble-weeds) look
similar, but are generally larger, and have
equal-sided (parenchymatous) cells;
reproductive cells differ

19b. plants 2-25mm wide, solid, slimy,
on a variety of algae; outermost cell
chains each of 4-8 elongate cells.
Figs 45-47 (next page).

..... *Leathesia intermedia*

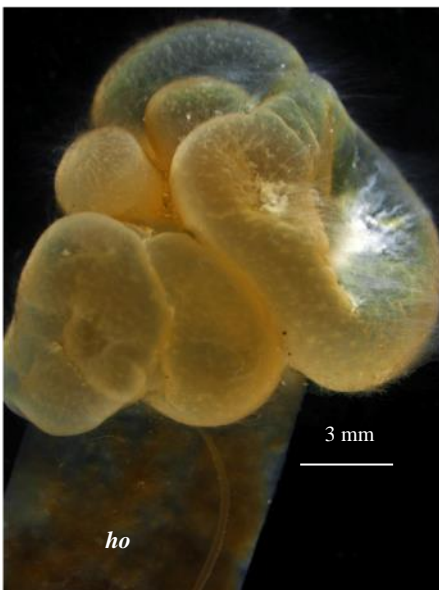


Fig. 42 *Leathesia difformis*: plant on a leaf of the seagrass, *Posidonia* (host, **ho**)

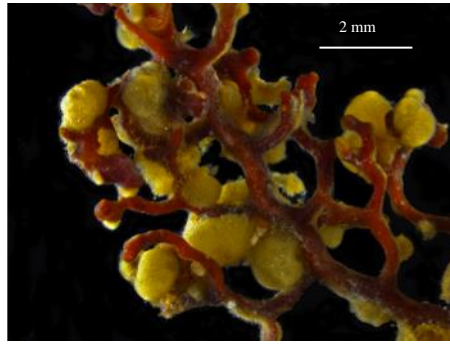


Fig. 36: *Corynophloea cristata* on ultimate branches of *Cystophora brownii*

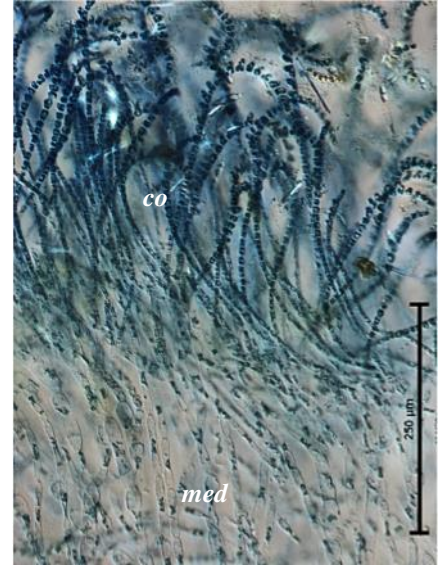


Fig. 37: *Corynophloea cristata* tissue squash: core of loosely arranged cylindrical cells (**med**); long coloured chains of the outer layer (cortex, **co**)



Fig. 38 *Petrospongium rugosum*

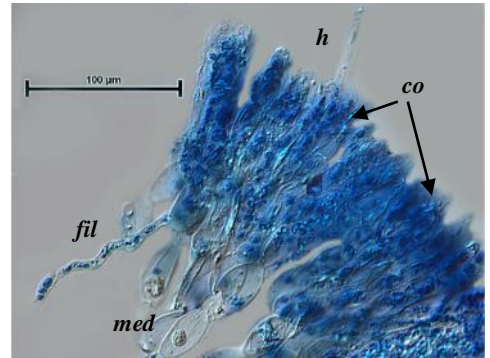
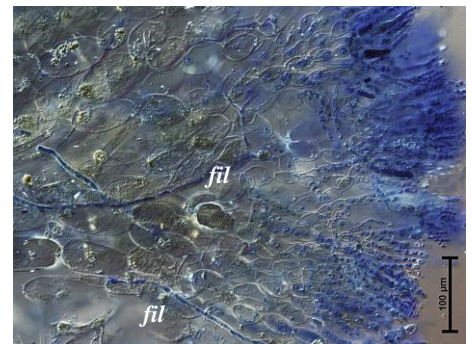
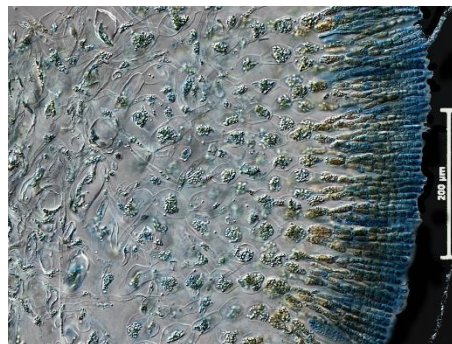


Fig.39. *Petrospongium rugosum* tissue squash: hair (**h**); outer cells (cortex, **co**), oval core cells, (medulla, **med**) one producing a wandering thread (**fil**)



Figs 40, 41 *Petrospongium rugosum* cross sections: “wandering” threads (**fil**) in the core

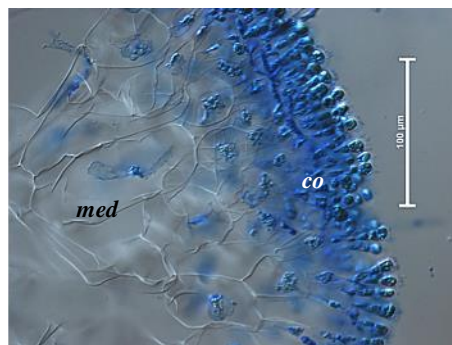


Fig. 43. *Leathesia difformis*, cross section: core cells (medulla, **med**), outer cells (cortex, **co**) of short threads, 3-5 cells long, ending in inflated cells

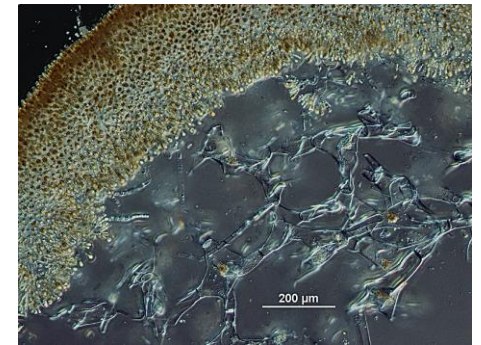
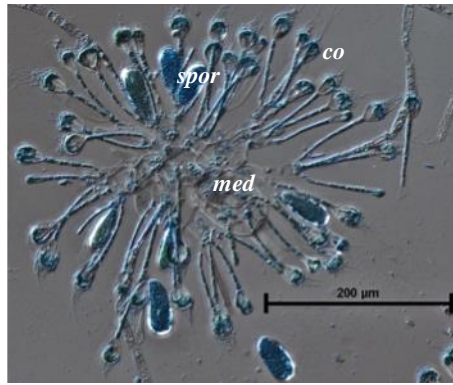


Fig. 44. *Leathesia difformis*, tissue squash: core of loose, inter-connected, colourless cells; outer “rind” of closely packed chains of small cells



Fig.45. *Leathesia intermedia* on branches of the Brown alga, *Caulocystis*



Figs 46, 47. *Leathesia intermedia* tissue squash: core (*med*); outer layer (cortex, *co*) of thin, unbranched chains of cells ending in swollen cells: spore sacs (sporangia, *spor*)

20a. plants rare, forming wispy tufts 5-15mm tall on Eel grass, *Zostera* during August-September. Figs 48-50 *Halothrix ephemeralis*
see the Fact Sheet elsewhere in these web pages

20b. plants form minute patches on Brown algae 21.

21a. rare; plants form minute tufts on stems of the seagrass *Amphibolis*. Figs 51, 52. *Acrotrichium amphibolis*
see also the separate Fact Sheet

21b. more common, but often obscure. Plants form minute tufts, small hairy or jelly-like masses on algae. 22.



Fig.48. *Halothrix ephemeralis*: tufts on Eel grass leaves



Fig.49. *Halothrix ephemeralis*: cross section of a tuft (*tuft*) at the edges of Eel grass leaf (host, *ho*)

Fig.50. *Halothrix ephemeralis*: detail of elongate coloured threads (assimilatory filaments, *asy fil*), egg-shaped outer threads (cortical filaments, *co fil*); single spore sacs (*spor*)

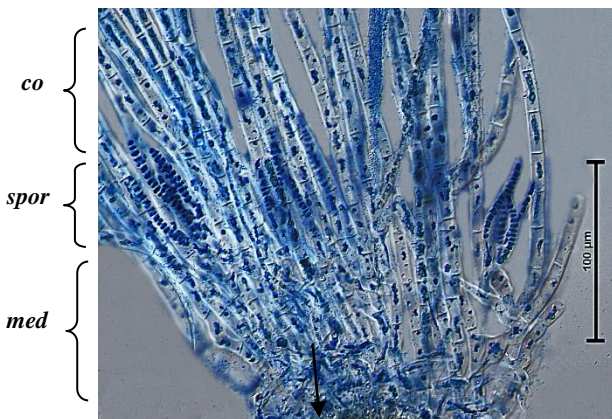
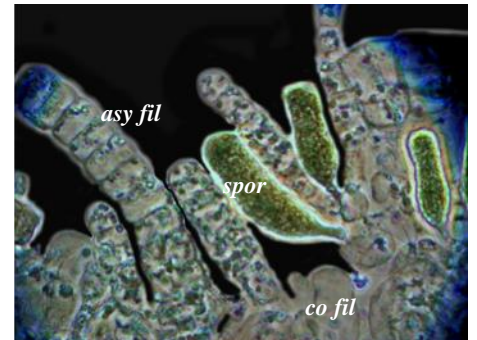
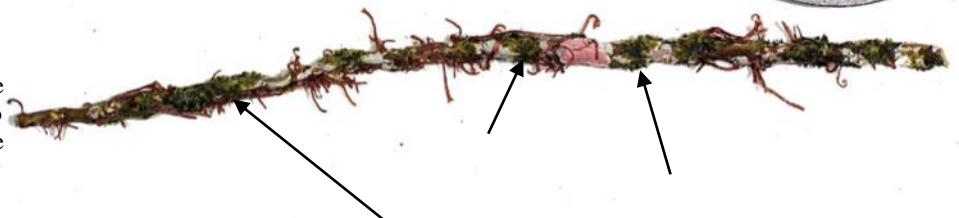


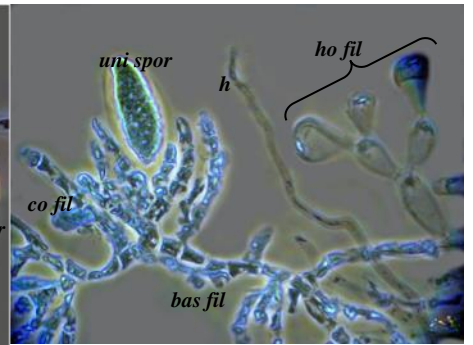
Fig. 51. *Acrotrichium amphibolis*: basal threads (medulla, *med*), horizontal band of elongate spore sacs of many compartments (plurilocular sporangia, *spor*), long outer (cortex, *co*) threads



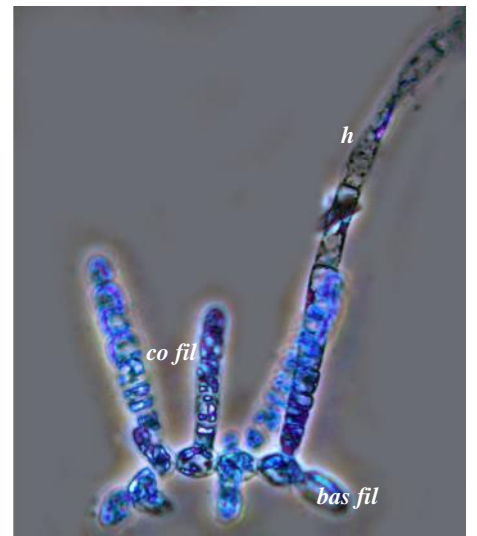
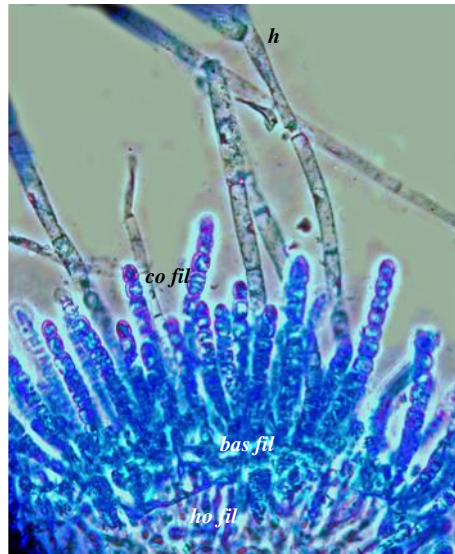
Fig. 52. *Acrotrichium amphibolis*: minute patches (arrowed) on a stem of the seagrass *Amphibolis* (covered also with encrusting coralline red algae and a tubular red alga)



- 22a. on Brown algae 23.
 22b. on the Red alga *Helminthocladia*.
 Figs 53, 54.
 *Strepsithalia aemula*
 see also the Fact sheet of this species
- 23a. on *Leathesia*. Figs 55, 56.
 *Strepsithalia leathesia*
 see also the Fact sheet of this species
- 23a. on blades of *Ecklonia*. Figs 57-59.
 *Elachista nigra*
 (as *E. orbicularis* in the Flora)
- 23c. on the Brown alga *Xiphophora*,
 usually growing out of the fertile
 openings (conceptacles) of the host.
 Figs 60-62. (next page)
 *Elachista australis*
- 23d. plants on *Cystophora monilifera*
 Figs 63-65 (next page).
 *Myriactula filiformis*.
- 23e. plants on basal leaves of
Sargassum spp **or** the surface of
 net-like *Hydroclathrus*; **single** type
 of threads in the outer layers
 Figs 66, 67 (next page)
 *Myriactula arabica*
- 23f. plants on other algae, including
Sargassum; 2 types of threads in
 outer layers 24.



Figs 53, 54. *Strepsithalia aemula*, dissected from outer (cortical) filaments of host (*ho fil*): hair (*h*), branched outer filaments (cortical filaments, *co fil*), branched basal filaments (*bas fil*), single-compartmented spore sacs (unilocular sporangia, *uni spor*) as long as cortical filaments, a species characteristic



Figs 55, 56. *Strepsithalia leathesia*, dissected from the surface of the host: outer threads (*co fil*), hairs (*h*), basal threads (*bas fil*) intermingled with a patch of host cells (*ho fil*)

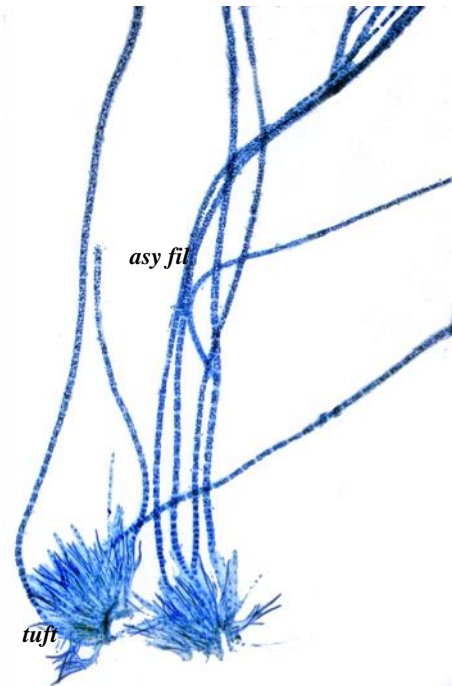


Fig 57. *Elachista nigra* dissected from its host: basal tuft (*tuft*), assimilatory filaments (*asy fil*)

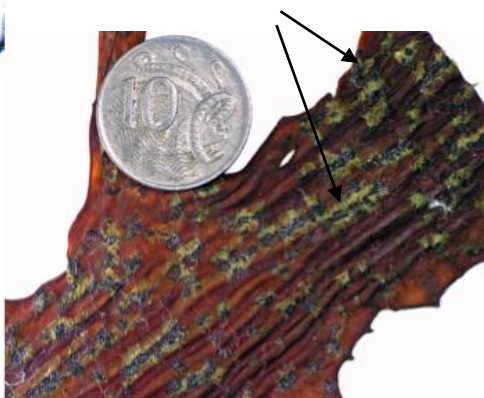


Fig. 58. *Elachista nigra* (arrowed) on the blade of the large Brown alga, *Ecklonia*

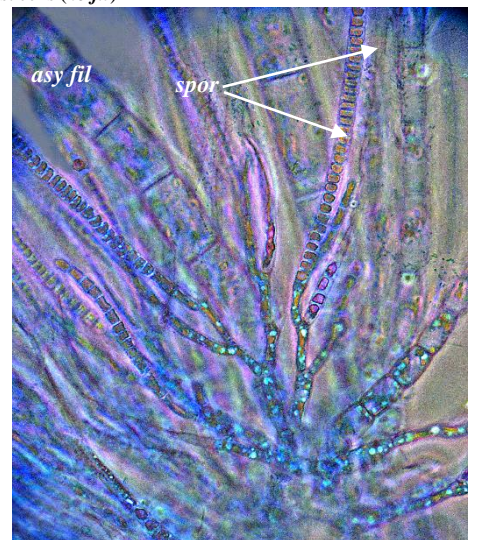


Fig 59. *Elachista nigra* dissected from its host: assimilatory filaments (*asy fil*), elongate sporangia (*spor*)



Fig. 60. *Elachista australis*: two magnifications of large plants (arrowed) extruded from the fertile pits (conceptacles) of *Xiphophora chondrophylla*

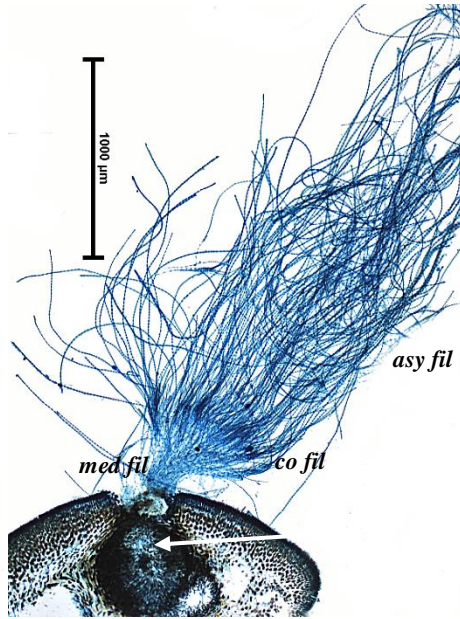


Fig. 61. *Elachista australis*, cross section through the fertile pit of the host: parasitic attachment threads (arrowed), lower (medulla) threads (*med fil*), outer (cortex), short threads (*co fil*), extended coloured threads (*asy fil*)

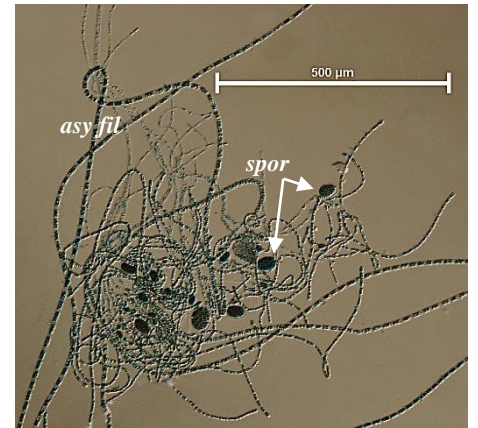


Fig. 62 *Elachista australis* removed from its host: extended coloured threads (*asy fil*), spore sacs (sporangia, *spor*) consisting of a single compartment only



Fig. 63: *Myriactula filiformis* (arrowed) on *Cystophora monilifera* fertile branches



Fig. 64: *Myriactula filiformis* magnified (arrowed) on *Cystophora monilifera* fertile branches

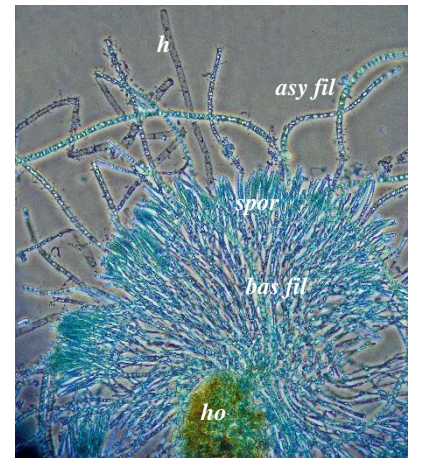
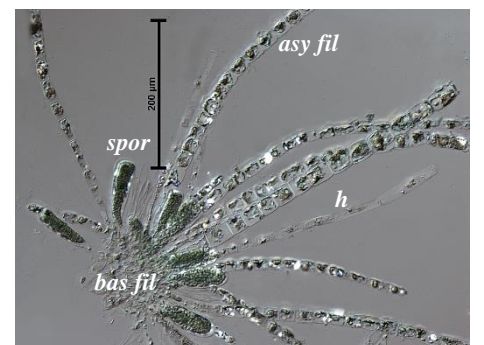
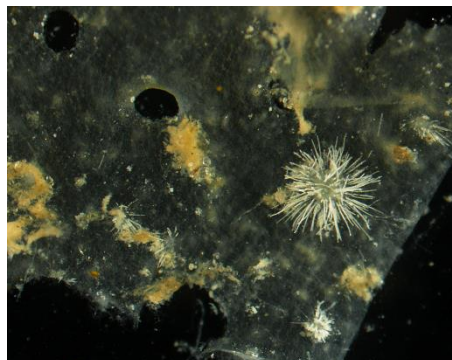


Fig. 65. *Myriactula filiformis*: colourless hair (*h*), coloured threads (*asy fil*) band of spore sacs (*spor*), mix of outer and core threads (*bas fil*), host (*ho*)

Fig. 66: *Myriactula arabica* on *Hydroclathrus*, surface view



Fig. 67: *Myriactula arabica*: colourless hair (*h*), coloured threads (*asy fil*), spore sacs (*spor*), mix of outer and core threads (*bas fil*)



- 24a. plants on *Scytosiphon*. Figs 68, 69.
 *Myriactula caespitosa*
 24b. on other Brown algae 19.
- 25a. plants on *Sargassum*. Figs 70-73.
 *Elachista claytoniae*
 25b. plants on *Colpomenia*,
Caulocystis, *Myriodesma*,
Scytosiphon, *Sphacelaria*.
 Figs 74-76.
 *Myriactula haydenii*

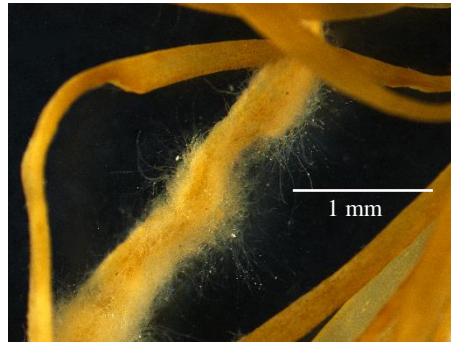


Fig. 68: *Myriactula caespitosa* on ultimate branches of *Scytosiphon*

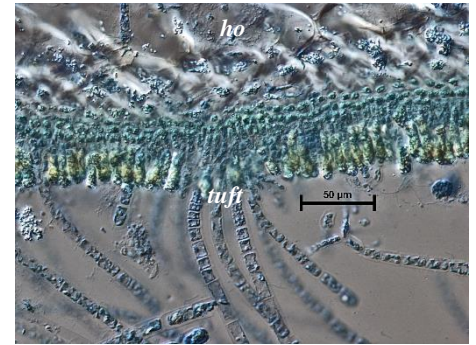
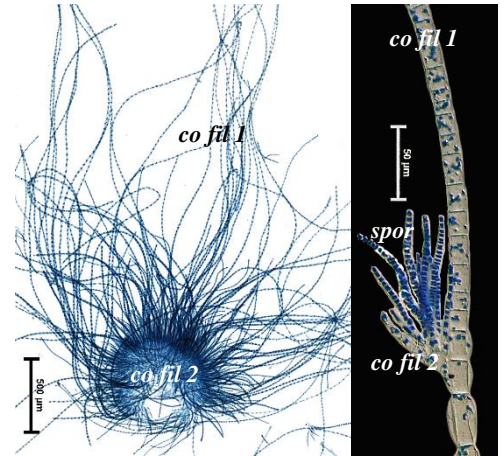


Fig. 69 *Myriactula caespitosa*: cross section of a tuft on the host *Scytosiphon* (*ho*)



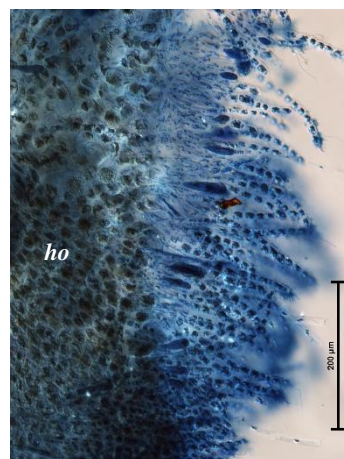
Figs 70, 71: *Elachista claytoniae* tufts (arrowed) on the basal leaves of 2 species of *Sargassum*



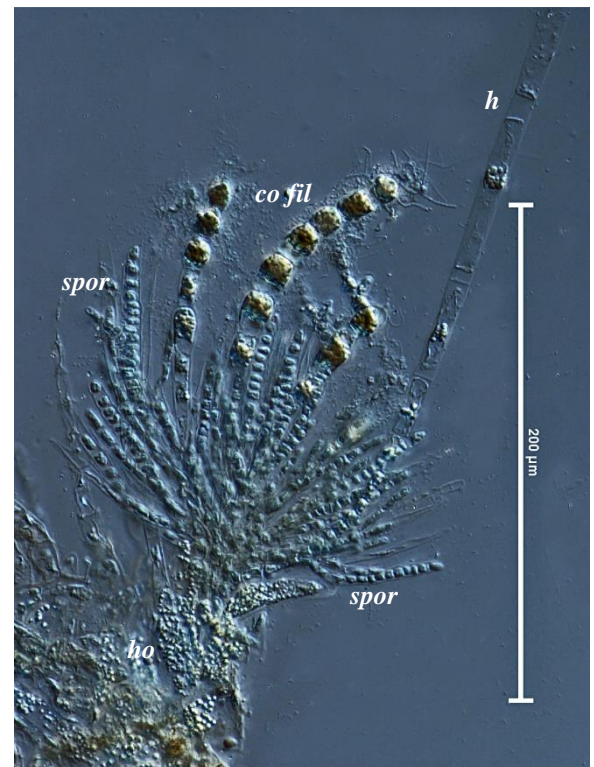
Figs 72, 73. *Elachista claytoniae*: long outer threads (*co fil 1*), short outer threads (*co fil 2*), spore sacs (*spor*)



Figs 74. *Myriactula haydenii*: wisps of threads (arrowed) attached to ultimate branches of *Caulocystis*



Figs 75. *Myriactula haydenii*: wisps of threads with deeply stained spore sacs, attached to the host *Myriodesma* (*ho*)



Figs 76. *Myriactula haydenii* dissected from the host: hair (*h*), threads with bright material (cortex filaments, *co fil*), thin chains of spores (multi-compartmented spore sacs, *spor*), basal threads (medulla filaments, *med fil*), host tissue (*ho*)