Pictured Key to some common filamentous red algae of southern Australia
Part IV: nodally-corticated algae

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. 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 within this website.
Scale:	The coin used as a scale is 24mm or almost 1" wide. Microscope images of algae are usually blue stained.

This key is *restricted* to

- algae with a central thread (filament), growing in a single line (*uniaxial* algae) but the filament may be visible only near branch tips
- algae with *compact* belts of cells (*cortication*) commencing at the joints (*nodes*) between axial cells and often dividing and growing up and down axis cells to completely obscure them
- algae in Tribes in the Ceramiaceae such as the Ceramieae and Spyrideae.

Part II, a separate key, contains algae with *overlapping* whorl-branchlets that form a continuous, *loose* axial sheath.
In this key, Part IV, only algae with a well-defined outer coating of cells closely adhering to axis cells are included.
The key is largely based on that in the Flora of southern Australia, volume IIIC

1a. cellular coats (cortication) about filaments initially consisting of belts of cells restricted to the join between axis cells (nodes), later wholly covering axes with *columns* of cells (see figs 3, 16)
..…….. 2.

1b. cellular coats (cortication) near plant tips often restricted to filament nodes, well-separated in some species ***or*** in other species, wholly covering axes with *irregular* cells (see fig. 40)
Family: Ceramiaceae, Tribe: Ceramieae
……..…….. 6.

2a. plants to 80mm tall, forked (dichotomous); *spines* at nodes; cells of mature cortication box-shaped, in regular columns. Figs 1-3
..…….. *Centroceros clavulatum*
Family: Ceramiaceae, Tribe: Ceramieae

2b. plants consisting of main branches (axes), shorter side branches and thread-like filaments; axes and branches completely corticated with alternating bands of short and long cells in columns, later often obliterated by rhizoids; filaments delicate, cells naked except for prominent bands around nodes (see Fig. 14)
……. 3.
Family: Ceramiaceae, Tribe: Spyrideae
(1 genus, 4 species)

Fig 1: *Centroceros clavulatum*

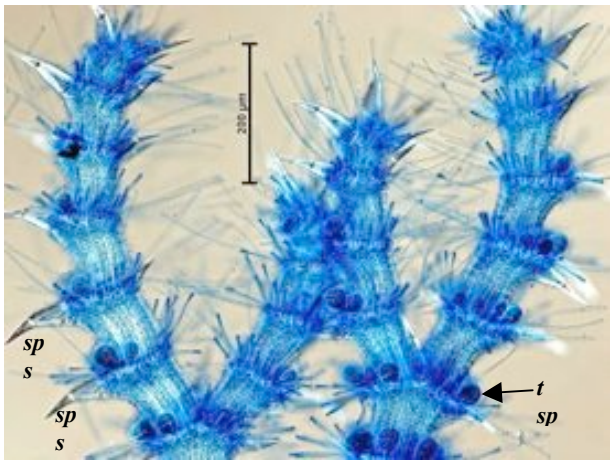


Fig. 2. *Centroceros clavulatum*: numerous hairs; columns of corticating cells; spines (*sps*); stalkless tetrasporangia (*t sp*), at nodes

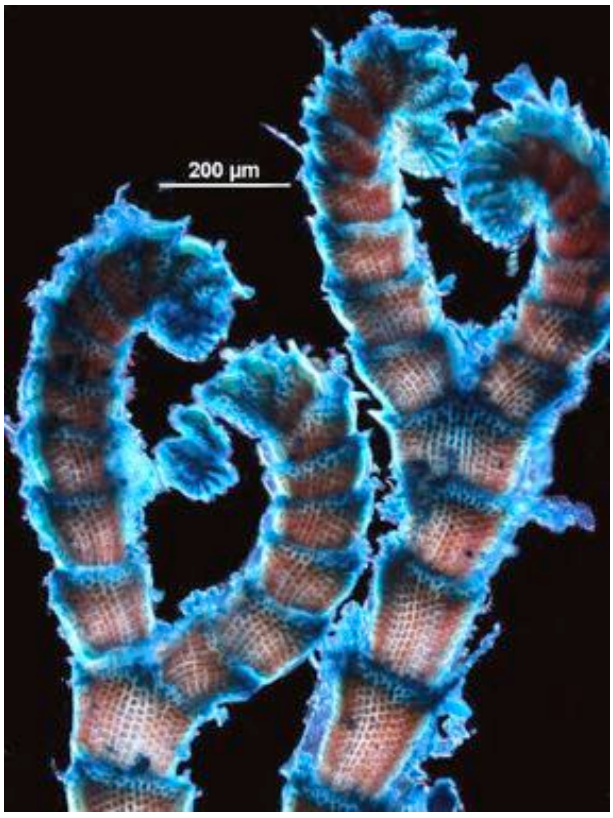


Fig. 3. *Centroceros clavulatum*: crooked, forked tips; longitudinal columns of cortical cells

3a. *filaments* stiff, opposite in 2 rows at right angles (decussate), cells oval; old plants may be denuded of filaments. Figs 4-9
…… *Spyridia dasyoides*

3b. side *filaments* flimsy, single or in a ring, cells usually elongate (see Figs 12, 14)
…….. 4.

Fig. 4: *Spyridia dasyoides*

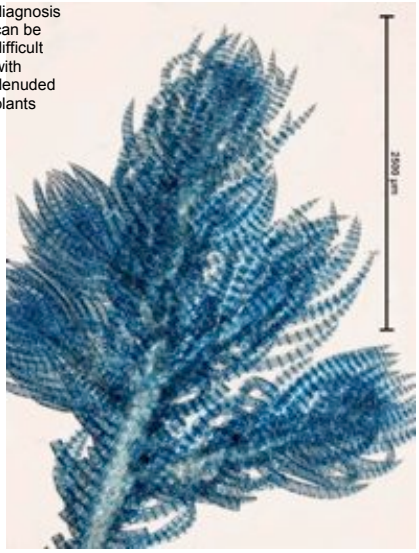


Fig. 5. *Spyridia dasyoides*: opposite, stiff, prominently banded side filaments

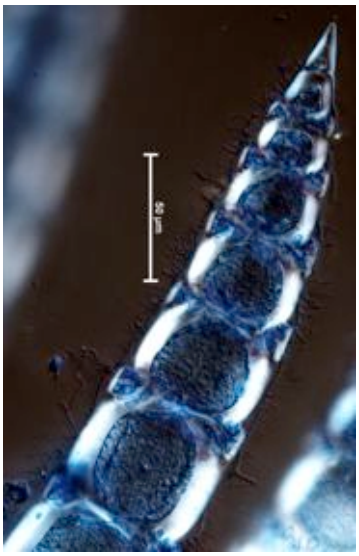


Fig. 6. *Spyridia dasyoides*: tip of a side filament; oval cells, corticating cells at nodes

Fig.8. *Spyridia dasyoides:*denuded specimen

Fig.7. *Spyridia dasyoides:*detail of normal branching

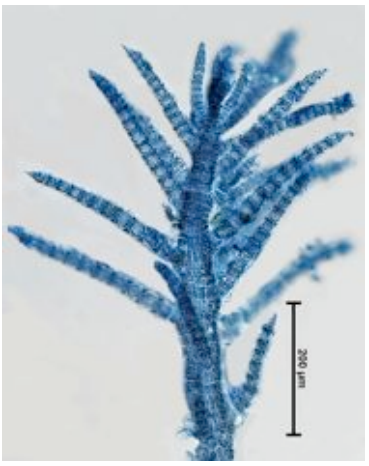


Fig.9. *Spyridia dasyoides:* plant tip with stiff filaments in 2 opposite rows (decussate)

4a . shorter *branches* cigar-shaped, cortication cells mixed with rhizoids *reaching to branch tips*; side filaments in rings; old plants often denuded, surface white-dusty. Figs 10-13
……. *Spyridia squalida*

4b. shorter *branches* slender, not noticeably pinched basally, *tips uncorticated*.
…….. 5.

Fig. 10: *Spyridia squalida*

Fig. 11. *Spyridia squalida*: old plant with dusty appearance

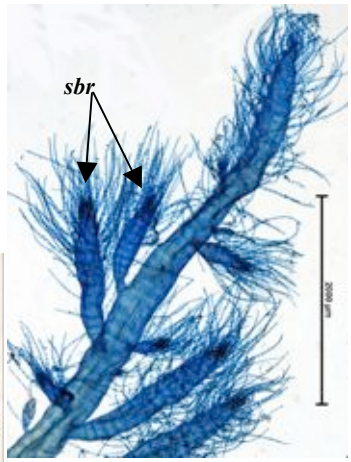


Fig. 12. *Spyridia squalida*: cigar-shaped side branches (*s br*) (pinched basally); numerous whorls of filaments

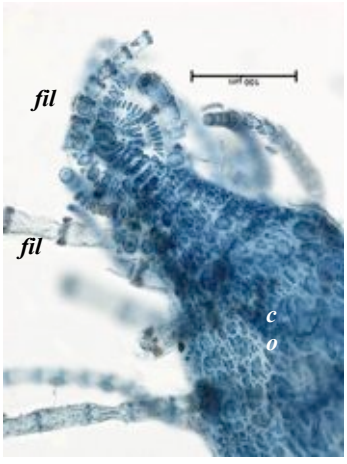


Fig. 13. *Spyridia squalida*: cortication (*co*) reaching to the tip; filaments (*fil*) with prominent but narrow bands of cortical cells at nodes

5a. filaments single per axial cell in 2 rows (decussate); nodal bands about filaments finally 2-3 cells deep. Figs 14-16 ……. *Spyridia filamentosa*

5b. filaments finally in rings of 2-6 per axial cell, cortical bands 1 cell deep. Figs 17-19 ……. *Spyridia tasmanica*

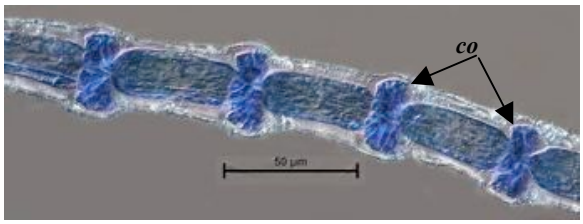


Fig. 14. *Spyridia filamentosa*: single filament; elongate cells; corticating cells (*co c*) at nodes 2 cells deep

Fig. 15. *Spyridia filamentosa*:

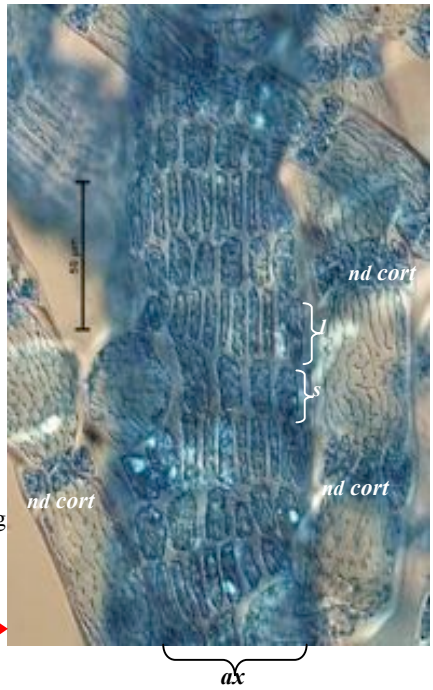


Fig. 16. *Spyridia filamentosa*: alternating elongate (*l*) and short (*s*) corticating cells along an axis (*ax*); side filaments corticated at nodes only (*nd cort*)

Fig. 17: *Spyridia tasmanica*

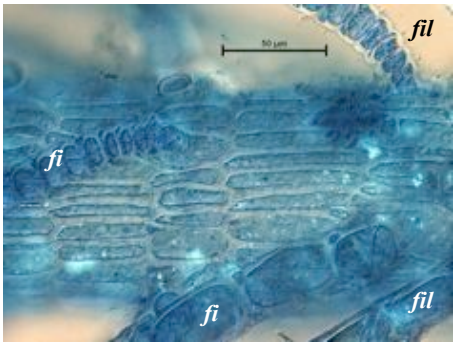


Fig. 18. *Spyridia tasmanica*: corticated axis; filament (*fil*) node cortication 1 cell deep

Fig. 19. *Spyridia tasmanica*: axis (*ax*) with alternating short and long corticating cells; filaments (*fil*) in rings of 2-4 per axial cell

6a. minute plant growing flat on segments of the articulated coralline red alga *Amphiroa* Figs 20, 21 ……. *Ceramium adhaerens* (new species, described by Womersley (2004), in *Trans. Roy. Soc SA*. 128 (2): 206)

6b. small plants, many with creeping filaments on host organisms, but always with some erect parts ……... 7.

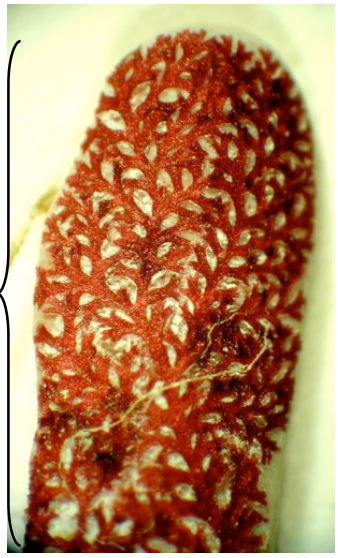


Fig. 20. *Ceramium adhaerens*: plant forming flat, red patterns on a segment of *Amphiroa gracilis*

Fig. 21. *Ceramium adhaerens*: stained microscope sporangiate specimen

7a. short spines on outer sides of branches near plant tips (often shed in mature parts) ..... 8.

7b. short spines absent , but rings of short, unbranched filaments may occur at nodes ..... 9.

8a. 5-15 mm tall, on the red coralline *Corallina* or green alga *Codium fragile*; spines coarse, 1 per node; gaps between belts of corticating cells occur throughout the plant. Figs 22, 23 ..... *Ceramium monocanthum*

8b. 40-100 mm tall, on seagrasses; spines 1-several near tips, belts of corticating cells wide in older parts, bearing numerous minute spines. Figs 24-26 .... *Ceramium puberulum*

Fig. 22: *Ceramium monocanthum*

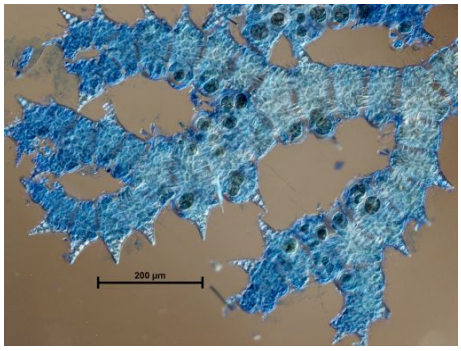


Fig. 23: *Ceramium monocanthum* tips with coarse spines and tetrasporangia

Fig. 24: *Ceramium puberulum* on a *Posidonia* leaf

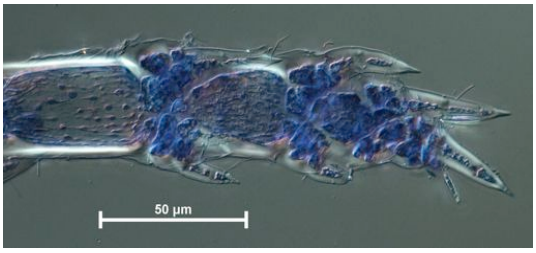


Fig. 25. *Ceramium puberulum* tip: slender spines, paired at two of the

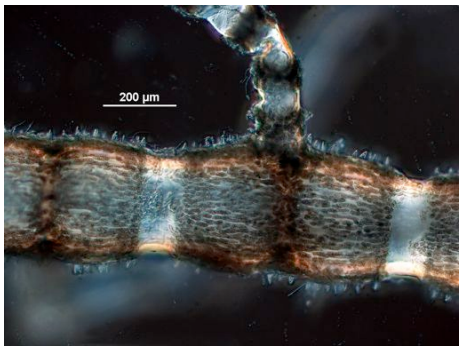


Fig. 26. *Ceramium puberulum* base: minute spines on expanded corticating belts

9a. 2-12mm tall; on seagrasses; corticating belts 2 cells deep; slender filaments 2-7 cells long in 2 rings from many nodes. Figs 27-29 ..... *Ceramium shepherdii*

9b. corticating belts >2cells deep; rings of slender filaments *absent* ..... 10.

Fig 27: *Ceramium shepherdii* on a *Posidonia* leaf

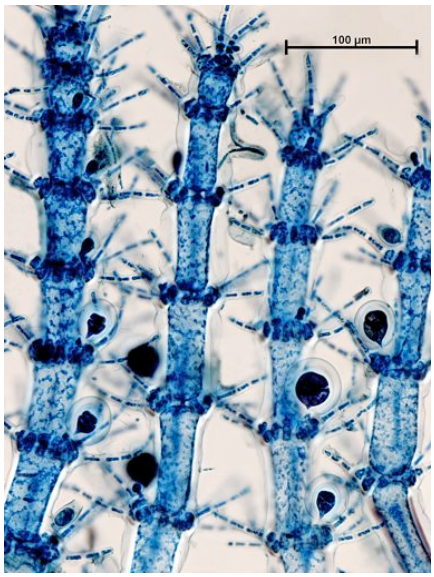


Fig 28. *Ceramium shepherdii* tips: narrow corticating belts with rings of short filaments and tetrasporangia

Fig 29: *Ceramium shepherdii*: detail of narrow corticating belts and naked, stalkless tetrasporangia

10a. axial cells completely covered by corticating cells, except at the very plant tips; tetrasporangia embedded amongst the corticating cells ..... 11.

10b. axial cells exposed to some extent, at least near plant tips; tetrasporangia protruding 12

11a. usually from sheltered waters; branching irregularly forked; axial cells covered by cortical cells to about 6 cells from plant tips; tetrasporangia *scattered* within cortical cells. Figs 30-33
..... *Ceramium rubrum*

11b. usually in strong water movement; basal stalks relatively thick (200 µm wide); corticating cells viewed from above occur in rings (rosettes); branches in alternating fan-shaped tufts; tetrasporangia in *definite bands*. Figs 34-37
..... *Ceramium pusillum*

Fig. 30: *Ceramium rubrum*

Fig. 31. *Ceramium rubrum*: complete covering of cortical cells; scattered embedded tetrasporangia (*t sp*)

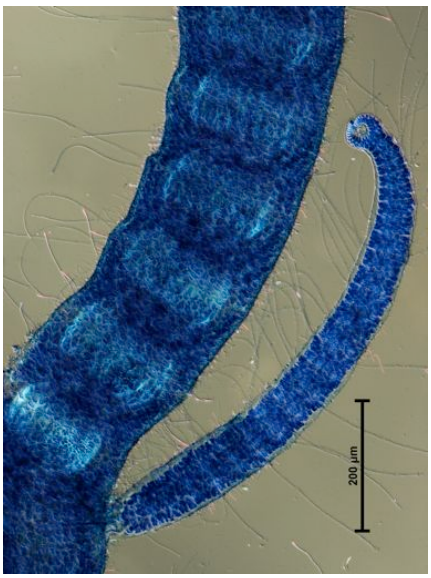


Fig. 32. *Ceramium rubrum*: old and new branches; large rounded axial cells (*ax c*) just visible beneath complete coverings of cortical cells reaching to the branch tips

Fig. 33. *Ceramium rubrum*: detail of branching

Fig. 33. *Ceramium pusillum*: basal stalk and fan-shaped terminal tufts)

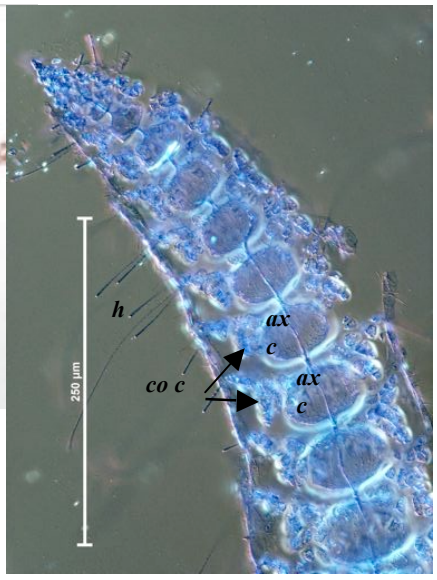


Fig. 34. *Ceramium pusillum*, branch tip: branches of cortical cells (*co c*) not yet covering the large rounded axial cells (*ax c*); surface hairs (*h*)

Fig. 35. *Ceramium pusillum*, branch tips: tetraspores in bands

Fig. 36. *Ceramium pusillum*, surface view: outer cortical cells in rings (rosettes)

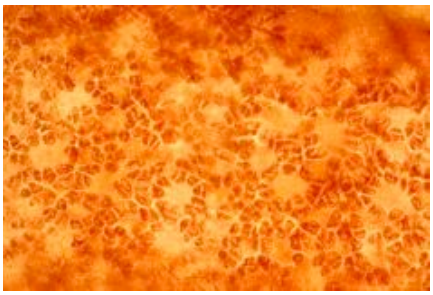


Fig. 37. *Ceramium pusillum*: detail of fan-shaped branch tufts

12a. plants relatively stiff, bases thick (300 µm wide); gaps between cortical belts narrow …….. 13.

12b. plants relatively flimsy, branch bases thin, (about 200 µm wide) branching forked or irregular; belts of nodal cells short, spaces between nodes deep; tetrasporangia often naked (without a wrapping or involucre of cells) ……..…… 16.

13a. flat-branched, at least near tips; branches spreading (divergent); spaces between nodes narrow; tetrasporangia in rings or scattered ……..……..…. 14.

13b. variously branched; spaces between nodes distinct in younger parts; tetrasporangia on *one side* of branches. Figs 46-48 ……..…. *Ceramium tasmanicum* (next page)

14a. spaces between nodes *lens-shaped*, older parts completely covered with corticating cells; tetrasporangia partly wrapped in small cells (involucre) Figs 38-40 …….. *Ceramium lenticulare*

14b. spaces between nodes in complete rings, found throughout the plant; tetrasporangia naked or with an involucre ……..…… 15.

15a. edges of nodal bands ragged; tips conical; tetrasporangia naked, *protruding*. Figs. 41, 42 ……..*Ceramium wilsonii* (new species, described by Womersley (2004), in *Trans. Roy. Soc SA*. 128 (2): 209)

15b. edges of nodal bands straight; tips narrow to a point; tetrasporangia wrapped in cells (involucre) often in short side cigar-shaped branches; cortical cells in rings (rosettes) viewed from above. Figs 43-45 …… *Ceramiun excellens*

Fig. 38. *Ceramium lenticulare*: two magnifications of a robust form

Fig. 39. *Ceramium lenticulare*: slender form

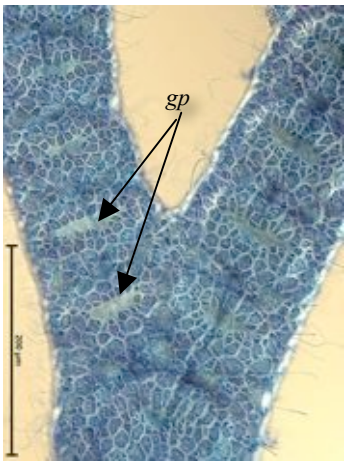


Fig. 40. *Ceramium lenticulare*: lens-shaped gaps (*gp*) between wide corticating bands

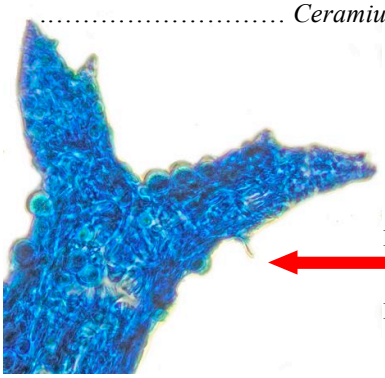


Fig. 41 *Ceramium wilsonii*: divergent, conical tips

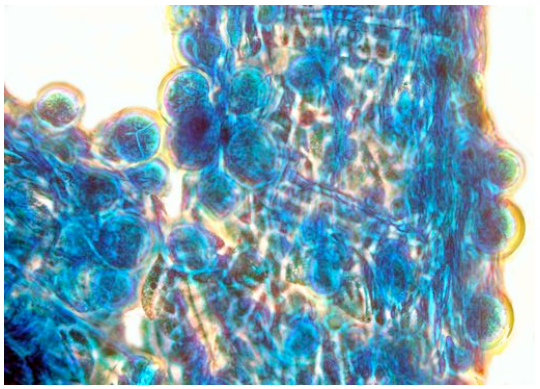


Fig. 42. *Ceramium wilsonii*: detail of superficial tetrasporangia

Fig. 43:. *Ceramium excellens*

Fig. 44:. *Ceramium excellens*: detail of flat-branching at tips

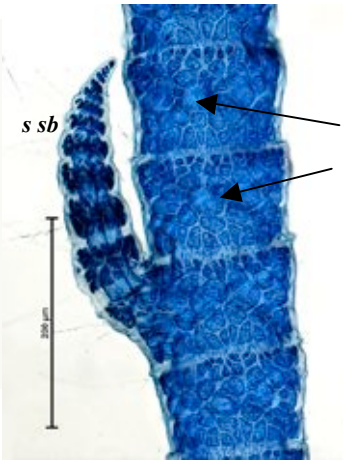


Fig. 45. *Ceramium excellens*: short side branch (*s sb*) typically bearing tetrasporangia; rings of cells (arrowed)

Fig. 46: *Ceramium tasmanicum*

Fig. 47. *Ceramium tasmanicum*: detail of forked branching

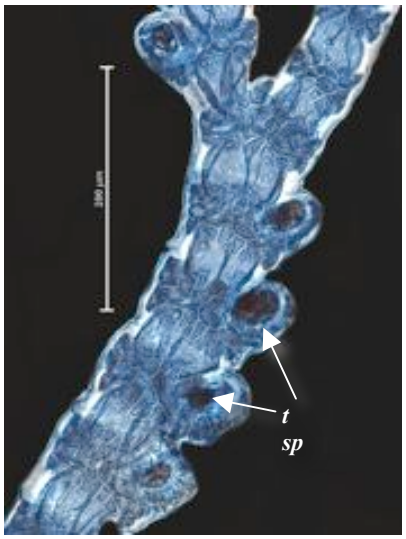


Fig. 48. *Ceramium tasmanicum*: tetrasporangia (*t sp*) wrapped in claw-like cells (involucre) on one side of branches

16a. plant at least 200µm broad basally, branching forked, tufted, tips tightly curved inwardly; bright gland cells may be present; tetrasporangia naked, or with little covering of small cells (involucre) ..... 17.

16b. plant rarely wider than 200µm wide basally; branching irregular, or with short side branches; gland cells absent; tetrasporangia with small cellular coverings (involucre) 18

17a. nodal bands prominent, often containing bright, hemispherical, superficial gland cells, tetrasporangia naked, finally in bands. Figs 49-51 .....*Ceramium isogonum*

17b. superficial gland cells uncommon; nodal bands with a ring of 7-8 bean-shaped, deeply staining cells (gland cells? *gl c*); band edges very straight, tetrasporangia often divided horizontally into two spores, with a basal cluster of corticating cell. Figs 52-54 (next page) ..... *Ceramium australe*

Fig. 49. *Ceramium isogonum*: branching pattern at two magnifications

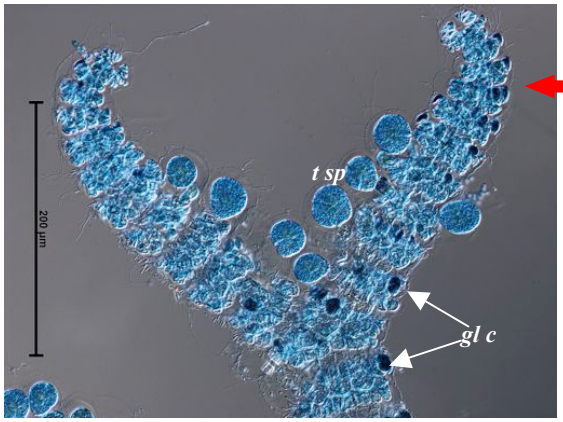


Fig. 50. *Ceramium isogonum*: tips curved inwardly; naked tetrasporangia (*t sp*); gland cells (*gl c*): corticating belts close together

Fig. 51. *Ceramium isogonum*: well-separated nodal bands; naked tetrasporangia (*t sp*); extraneous ciliate animal (*an*) on a coiled stalk

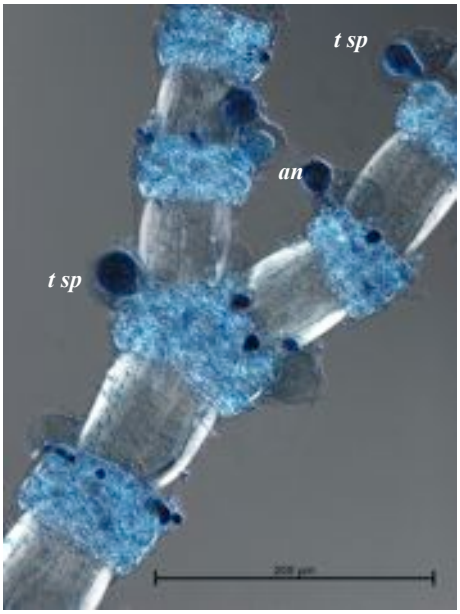


Fig. 52 *Ceramium australe* on seagrass stem: branching pattern at two magnifications

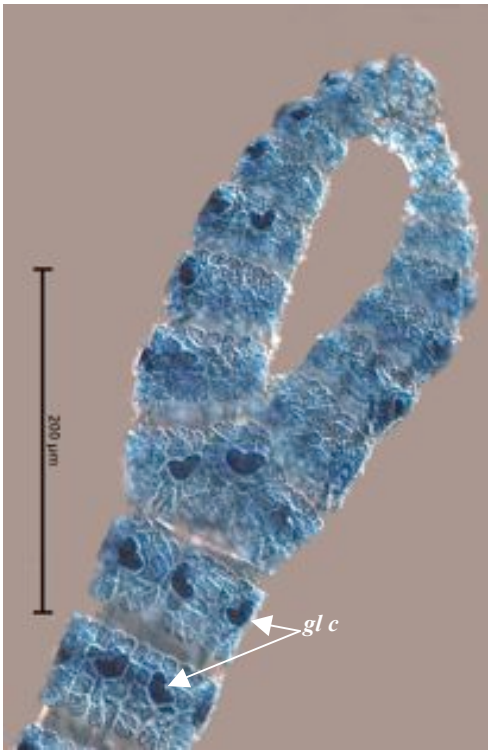


Fig. 54. *Ceramium australe*: bean-shaped cortical cells (*gl c*) in straight sided nodal bands

Fig. 53. *Ceramium australe*: tetrasporangia (*t sp*) divided into twos; slight involucre (*inv*)

18a. cells in corticating belts develop towards the branch tips only …….. 19.

18b. cells in corticating belts develop both upwards *and* downwards ……..…. 20.

19a. grows on coralline algae; corticating belts cup-shaped, of cells often ending in a short, blunt-nosed hair; tetrasporangia finally in rings. Figs 55-57
…….. *Ceramium cupulatum*

19b. grows on a variety of algae and hard surfaces; some triangular cells in corticating belts; tetrasporangia on outer side of branches only. Figs 58-60
…….. *Ceramium macilentum*

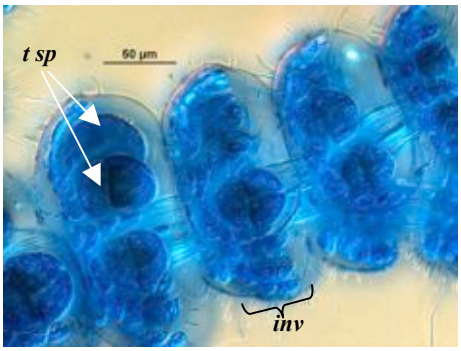


Fig. 55. *Ceramium cupulatum* (arrowed) on jointed coralline red alga *Haliptilon*

Fig. 56. *Ceramium cupulatum*: rings of tetrasporangia (*t sp*) in upward curving cortical cells forming an involucre (*inv*)

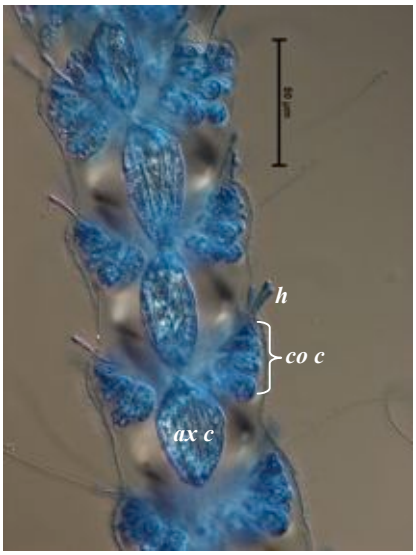


Fig. 57: *Ceramium cupulatum* focussed on axial cells (*ax c*) to show upward developing, cup-shaped corticating belt (*co c*) of cells ending in hairs (*h*)

Fig. 58. *Ceramium macilentum*: finely branched plant at two magnifications

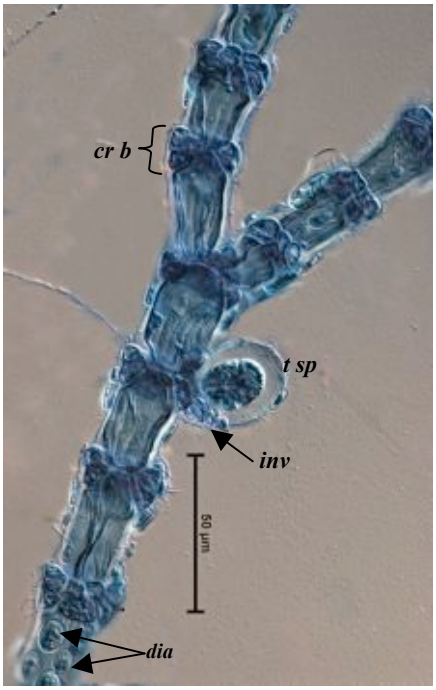


Fig. 59. *Ceramium macilentum*: tetrasporangium (*t sp*) on one side of a filament with small basal cells (involucre, *inv*); cortical bands (*cr b*) 3 cells deep; extraneous diatoms (*dia*) adhering to the axial cell wall

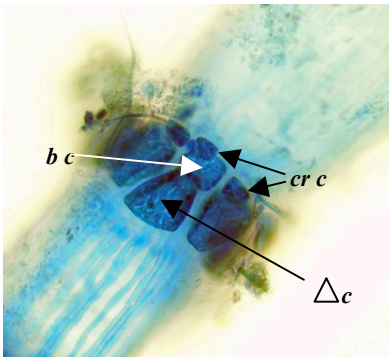


Fig. 60. *Ceramium macilentum*: cortical belt focussed to highlight an original band cell (*b c*); upward developing cortical cells (*cr c*) and triangular cortical cell (△*c*)

20a. rectangular cells lie horizontally along the base of cortical belts near plant tips; plants attached by single-celled rhizoids with minute, root-like endings; tetrasporangia in rings, wrapped in cells (involucre). Figs 61-65
…….... *Ceramium flaccidum*

20b. cortical band cells mainly equal-sided; plants attached by rhizoids with minute, elongate cells in chains; tetrasporangia in opposite pairs or on one side of axial cells
…….. 21.

Fig. 61. *Ceramium flaccidum* on seagrass stem

Fig. 62. *Ceramium flaccidum* attached to shell grit

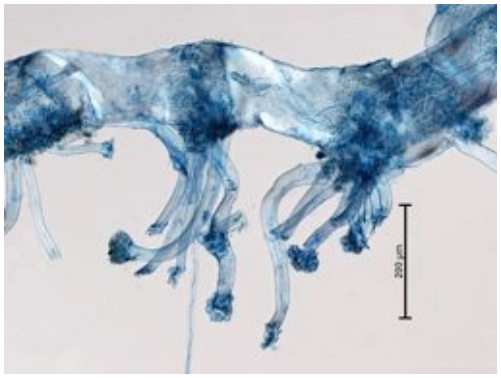


Fig. 63. *Ceramium flaccidum*: clumps of single-celled rhizoids with minute, root-like endings

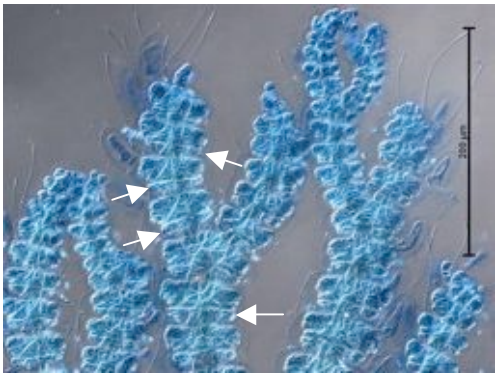


Fig. 63. *Ceramium flaccidum*: cortical bands with basal rectangular cells (arrowed)

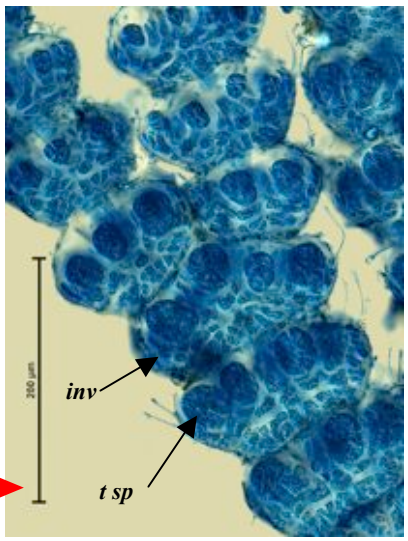


Fig. 65. *Ceramium flaccidum*: rings of tetrasporangia (*t sp*); involucral cells (*inv*)

21a. attached to large brown algae by *clumps* of rhizoids emerging from creeping filaments, upright filaments flat-branched; spaces along filaments up to 2x the width of cortical belts; tetrasporangia in opposite pairs. Figs 66-69
.....*Ceramium filiculum*

21b. on rock or plants and animals; irregularly branched but partly flat-branched near tips; spaces along filaments up to 4x the width of cortical belts; tetrasporangia on one side of axes. Figs 70-73
.....*Ceramium cliftonianum*

Fig. 66. *Ceramium filiculum* on the brown alga *Myriodesma harveyanum*

ig. 67. *Ceramium filiculum* : clumps of rhizoids from a creeping filament; three upright filaments

Fig. 68. *Ceramium filiculum*: divergent, flat-branching in upright filaments

Fig. 69. *Ceramium filiculum*: opposite pairs of tetrasporangia (*t sp*)

Fig. 70. *Ceramium* cliftonianum: irregular branching

Fig. 71. *Ceramium* cliftonianum: flat-branching towards plant tips

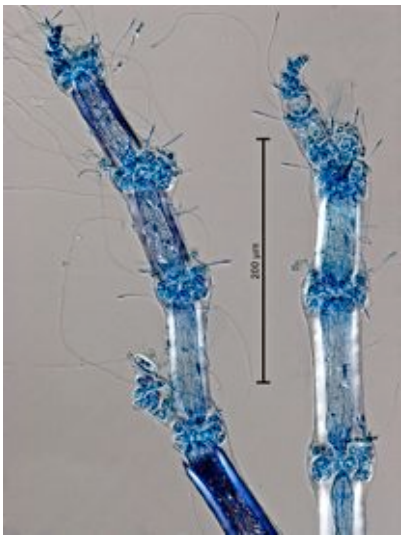


Fig. 72. *Ceramium* cliftonianum: irregular branching,; spaces between nodes = 4x depth of nodes

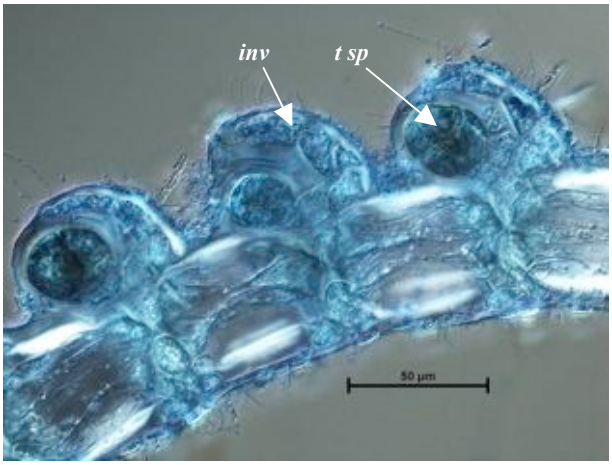
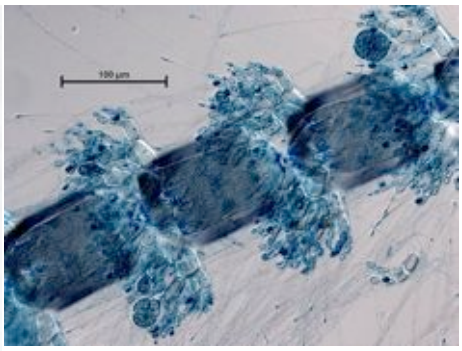


Fig. 73. *Ceramium* cliftonianum: detail of tetrasporangia (*t sp*) with claw-like wrapping (involucre, *inv*) on one side of a filament

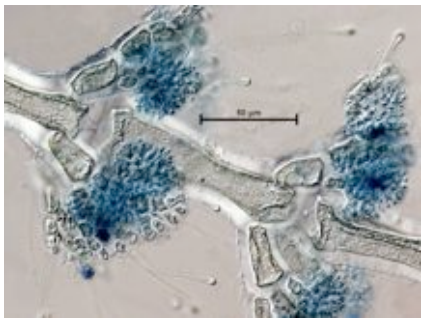
Look-alike algae

1. Other filamentous Ceramiaceae

Delicate filamentous members of various Tribes of the Ceramiaceae superficially look like some species of *Ceramium*. Microscopic inspection reveals the presence of rings or opposite pairs of short branches (whorl-branchlets) from each axial cell, separating them from *Ceramium* that has bands of closely adhering cortical cells at each axial cell.



Perithamnion muelleri

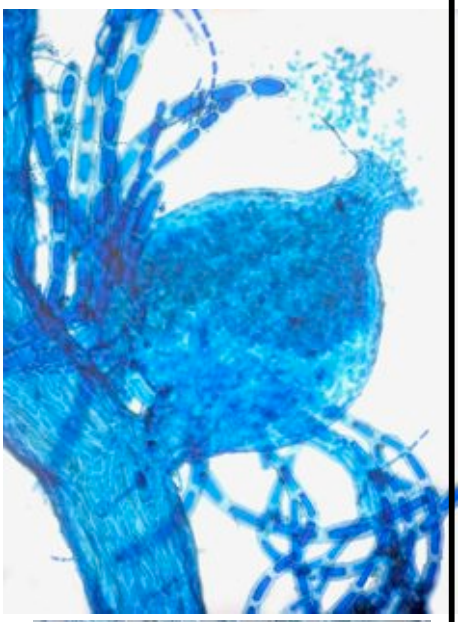


Tetrathamnion lineatum

2. Filamentous *Dasya* spp

Dasya spp have numerous naked, branched filaments arising from axes that have regular rows of cortical cells and so superficially look like *Spyridia* spp.
In *Dasya*, unlike *Spyridia,* the filaments have no rings of cortical cells, and bands of alternating short and long corticating cells do not occur. The mature female structures (cystocarps) are uniquely flask shaped in *Dasya*.

Dasya atactica



Dasya atactica: flask-shaped cystocarp and un-banded filaments

3. Filamentous Rhodomelaceae

Filamentous and delicate members of this Family may superficially look like *Spyridia* or *Ceramium*. Although they at first also have distinct bands of corticating cells, these, called pericentral cells, exactly match the length of axial cells. If actively growing, they also have terminal, delicate, naked, branched filaments called trichoblasts, which, in *Polysiphonia*, the genus most resembling filamentous members of the Ceramiaceae, are colourless.

Polysiphonia decipiens