

FILAMENTOUS RED ALGAE: MASTER KEY 4th edition

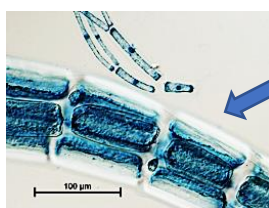
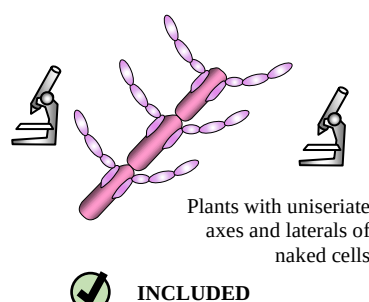
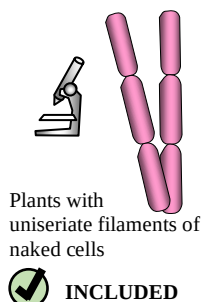
Red Algae.	With some 800 species, many of which are endemic (found nowhere else), southern Australia is a major centre of diversity for red algae. Classification is based on detailed reproductive features. Many species unrelated reproductively have similar vegetative form or shape, making identification 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 24 mm or almost 1" wide. Microscope images of algae are usually blue stained.

This key is restricted to Red algae with

- **uniserial** growth, that is, where most of the basic shape of the plant is produced from the growth of cells in a single line
- overall thread-like or **filamentous** construction with at least a few naked cells observable under the microscope
- **excluded** are **leafy, blade- and -ribbon-like red algae** and **narrow-branched red algae** consisting of relatively equal-sided (parenchymatous) cells. Also excluded are **meshwork or net-like red algae** and **felty, ropey, stringy, fuzzy and fluffy red algae** all of which are found in separate keys or algae at a glance
- this Master key is a first step in the search to identify red filamentous algae. It directs you to look in an appropriate one of the Parts I-XV

Unfortunately, in some filamentous algae the basic thread-like construction is obscured

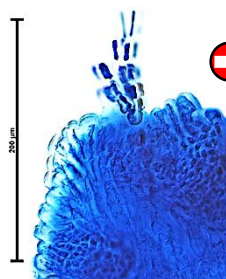
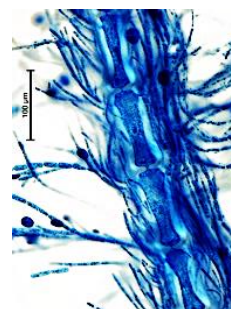
- by additional cells (cortical cells) growing around the central thread. These can be a loose sheath of additional threads (rhizoids), **or** compact, irregularly arranged cells **or** uniformly arranged cells producing branches that are felty, compressed, or slightly flattened.
- in other algae, dense, overlapping rings or whorls of short side branches obscure the underlying filamentous construction requiring investigation using a microscope.



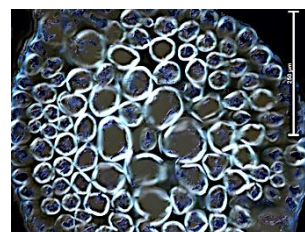
Plants with uniserial axes of large cells, ringed by blocks of cells (pericentral cells) the same length as cells of a central filament

INCLUDED

Plants with uniserial axes of large cells, smothered in hair-like filaments (rhizoids)



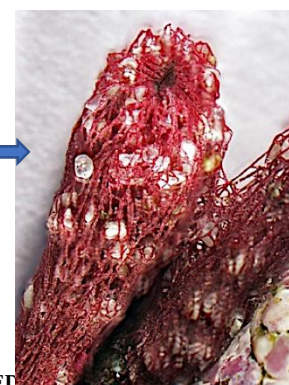
Plants such as *Laurencia* spp with uniserial filaments that protrude from their tips. Equal-sided cells occur elsewhere. Cross sections may show a central thread ringed by corticating cells. **Go to narrow-branched red algae**



Plants with naked cells in threads, but these are joined into a mesh **Go to meshwork or net-like red algae**

EXCLUDED

Go to felty, ropey, stringy, fuzzy and fluffy red algae



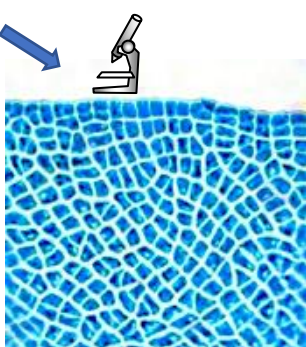
EXCLUDED

Ribbon-like algae, with equal-sided cells **go to ribbon-like red algae**



EXCLUDED

Blade-like algae, with naked, equal-sided cells **Go to blade like red algae**



FILAMENTOUS RED ALGAE MASTER KEY

- 1a. axes monosiphonous (exposed cells grow in a single line); branches are of about the same length. Compact wrappings (cortication) of regularly arranged cells around axes **absent**, although in some plants, loose rhizoids or scattered cells occur.

Figs 1-5. go to

Part I: algae with naked filaments

(Class: Bangiophyceae. Tribes: Monosporeae, Callithamnieae, Spermothamnieae, Griffithsieae, Bornetieae, Sphondylothamnieae, Spongoconieae, in the Family: Ceramiaceae. Family: Acrochaetiaceae)

- 1b. filaments ringed with short branches (whorl-branchlets) **or** tightly wrapped (corticated) with additional cells
..... 2.



Fig. 1: *Stylonema alsidii*, threads of un-connected, disc-shaped cells

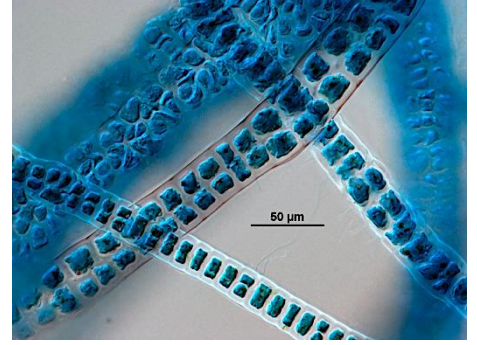


Fig. 2: *Bangia atropurpurea*, threads of naked, rectangular cells

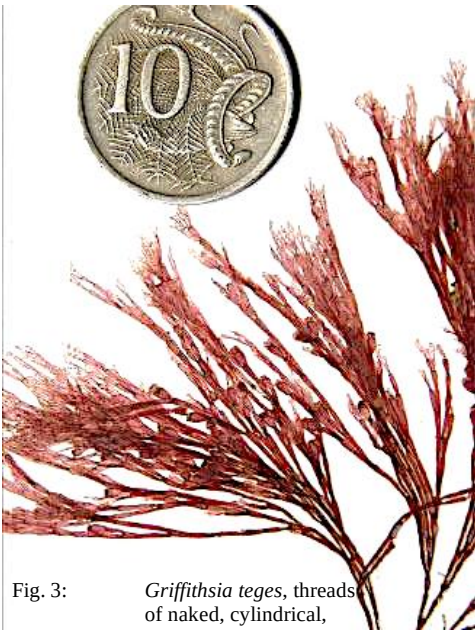


Fig. 3: *Griffithsia teges*, threads of naked, cylindrical, elongate cells

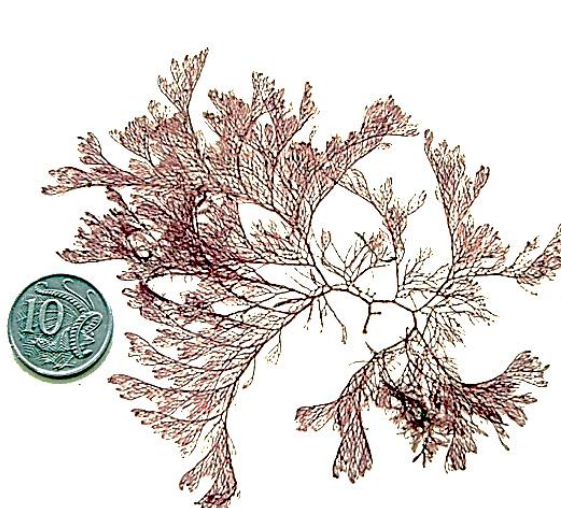


Fig. 4: *Bornetia binderiana*, threads of naked, cylindrical, elongate cells

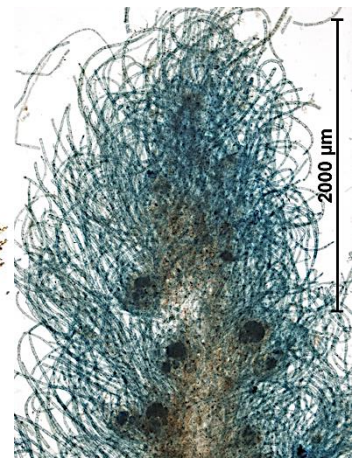


Fig. 4b: *Spongoconium*, threads of naked, cylindrical cells curl over the tip of axes wrapped in dense rhizoids

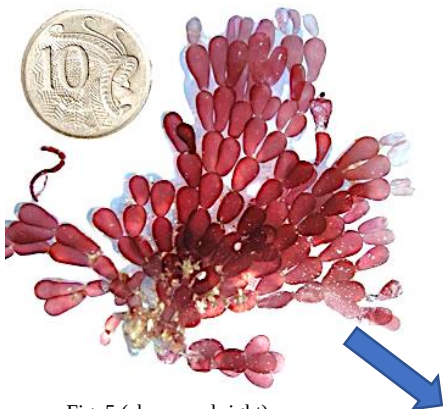


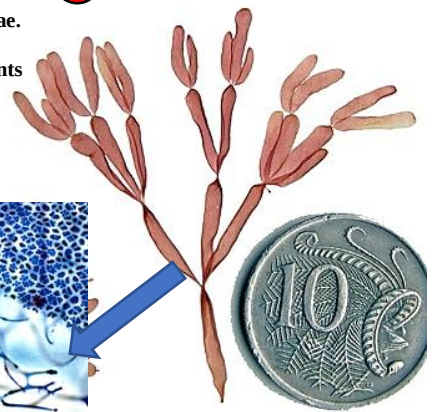
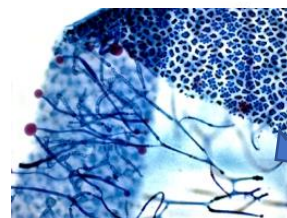
Fig. 5 (above and right): *Griffithsia monilis*, chains of naked, very large single cells
(RHS pic. J Huisman)



Warning,
look alike algae.
Plants with
multicellular segments
(go to **bead-like red algae**)



EXCLUDED



- 2a. each axial cell is ringed with whorl-branchlets (see example A opposite) 3.
- 2b. axes are wrapped with **tightly adhering** additional cells (pericentral cells) ringing a central filament **or** equal-sided corticating cells, (see examples B, C) 4.
- 3a. each axial cell is ringed with 2-4 short, **overlapping** branches (whorl-branchlets). Dense but loose rhizoids coat the axes, forming felt-like branches cylindrical or flattened in outline. Figs 6-10. **go to**
- Part II: algae with whorl-branchlets overlapping, rhizoidal covering dense**
(Tribes: Warrenieae, Wrangelieae, Lasiothaliae, Crouanieae, Dasysiphoniae in the Family: Ceramiaceae)
- 3b. each axial cell is ringed with **well-separated** opposite **pairs** or 3-4 whorl-branchlets. Figs 11-13 **go to**

Part III: algae with well-defined whorl-branchlets
(Tribes: Sphondylothamnieae, Antithamninae, Heterothamninae, Pterothamninae, Family: Ceramiaceae, *Inkyulea* of the Family: Balliaceae). See also **Part X: a miscellany of red algae**

Fig. 8 (right): *Euptilocladia mucosa* whorl-branchlets overlap to such an extent that branches appear felty

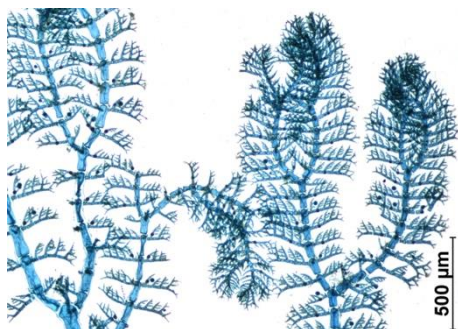
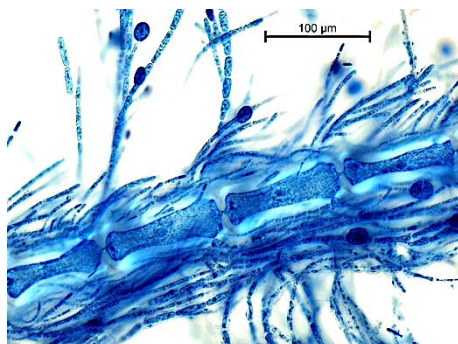


Fig. 11: *Pterothamnion cuspidatum* whorl-branchlets are in opposite pairs, well-separated and branched on one side

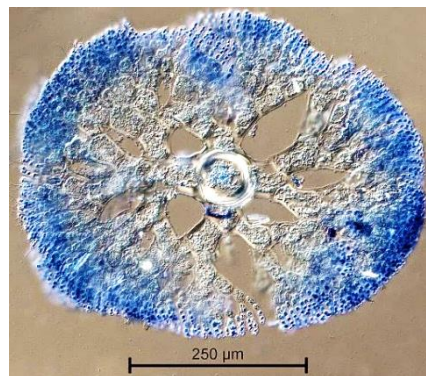
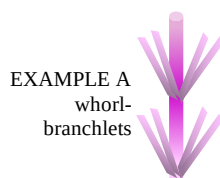


Fig. 6: *Euptilocladia mucosa*, cross section, whorl-branchlets overlapping

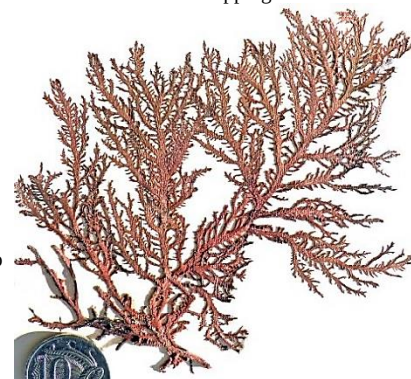


Fig. 9 (right): *Gattya pinella*, the overlapping whorl-branchlets (**wh br**) are so compact, the central filament (**c fil**), can barely be seen beneath the surface cells. Hair-like rhizoids (**rh**) are also present

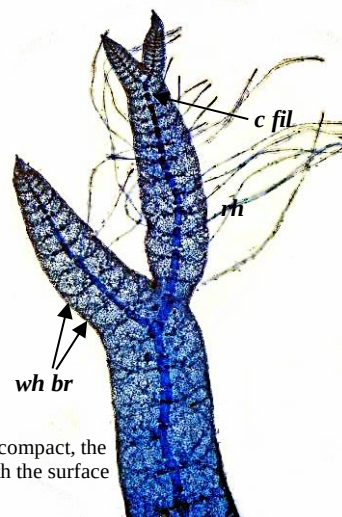


Fig. 10 (left): *Warrenia comosa* central filament is wrapped in hair-like rhizoids

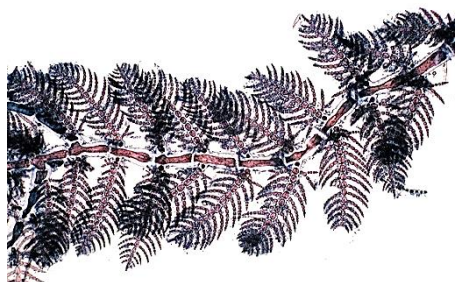


Fig. 12: *Antithamnion pectinatum* whorl-branchlets are in opposite pairs well-separated, and branched on both sides (pinnate)

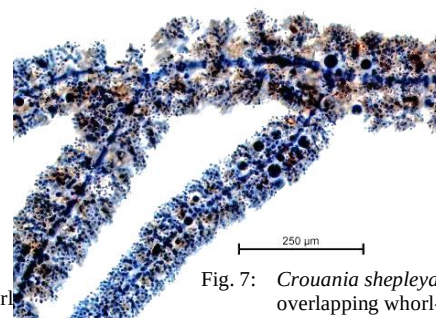
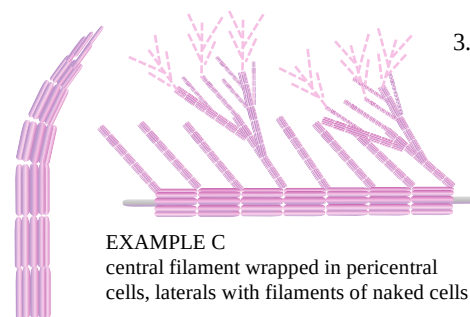


Fig. 7: *Crouania shepleyana*: overlapping whorl-branchlets

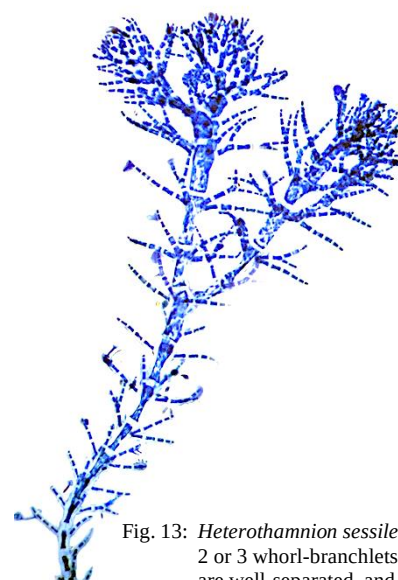


Fig. 13: *Heterothamnion sessile* 2 or 3 whorl-branchlets are well-separated, and branched irregularly

- 4a. the joints (nodes) between naked filament cells are ringed with **small** cells; main branches (axes) may be partly or wholly covered by additional corticating cells; bright gland cells may be present. Figs 14-18.

..... go to

Part IV: nodally-corticated algae

(Tribes: Ceramieae, Spyrideae, in the Family: Ceramiaceae)

- 4b. cells of central filaments of main branches (axes) are ringed by (pericentral) cells equal in length to axial cells, so forming bands, although these are sometimes obscured by a covering of additional corticating cells; bright gland cells are **absent** or produced inwardly from the pericentral cells

..... 5.

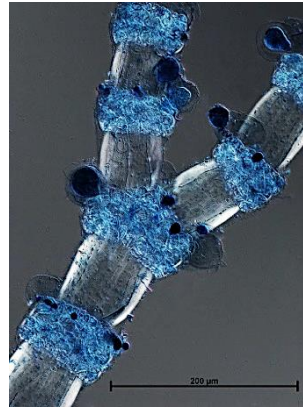
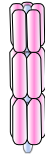
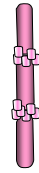


Fig. 14: *Ceramium isogonum*, well-separated nodal bands

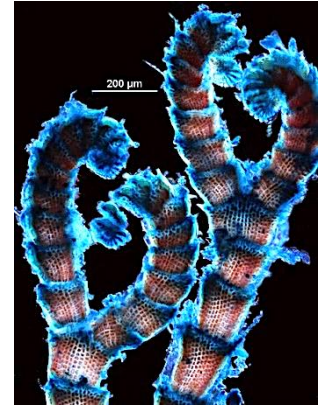


Fig. 15: *Centroceras clavulatum*, nodal cell rings; longitudinal columns of cells connect nodal rings

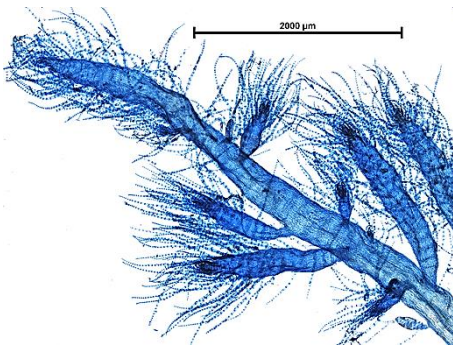


Fig. 16: *Spyridia squalida*, axis with a banded appearance and side branches with tufts of filaments

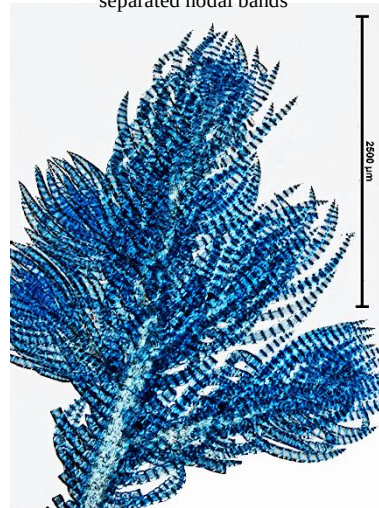


Fig. 17: *Spyridia dasyoides*, opposite, stiff, prominently banded side filaments

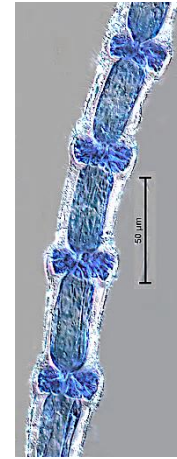


Fig. 18: *Spyridia filamentosa*, single filament, corticating cells at nodes 2 cells deep

- 5a. apical cells are prominent; pericentral cells in rings of 4, usually with 2 opposite ones each producing a **pair of flanking cells** half their length; plants often quickly disintegrating after collection. Figs 19-21

..... go to

Part V: Family: Sarcomeniaceae

- 5b. apical cells prominent or obscure, pericentral cells 3-20 forming prominent or obscure bands, pairs of flanking cells **absent**; plants not disintegrating rapidly

..... 6.

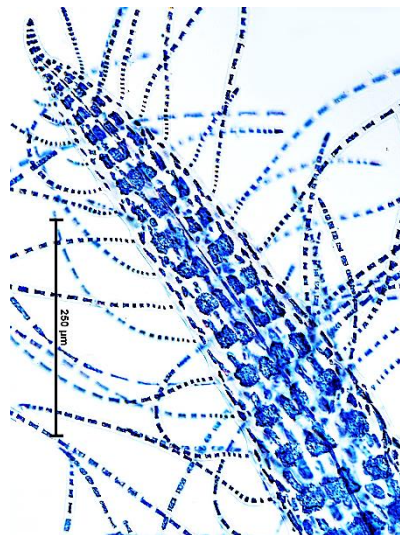
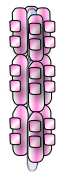


Fig. 19: *Sarcotrichia tenera*, prominent apical cell, flanking cells, hairs

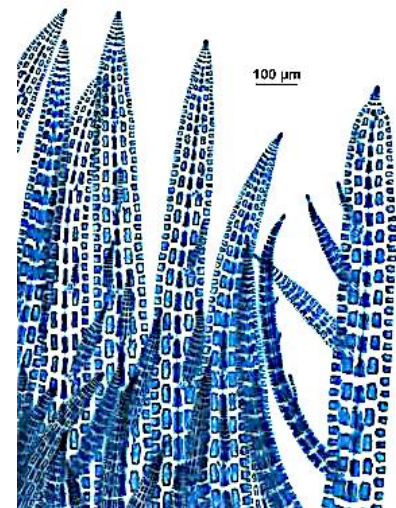


Fig. 21: *Platysiphonia delicata*, prominent apical cells

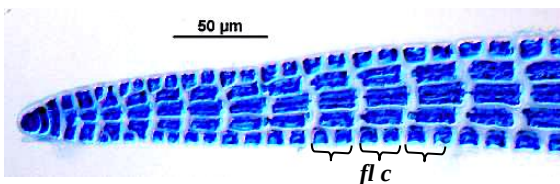


Fig. 20: *Platysiphonia delicata*, flanking cells (**fl c**) paired on 2 opposite pericentral cells

6a. branching forked, side branches similar to main branches

6b. side branches **short**, sometimes filamentous or naked or branched or in single lines (monosiphonous), or flat-branched or comb-like

7a. pericentral cells 4-20. Extremely fine, **colourless**, hair-like branches (trichoblasts) occur close to growing points but may be rapidly shed.

..... go to **Part VI: Polysiphonia**

7b. pericentral cells 3. Trichoblasts **absent**. Plants are **tiny**, rarely observed, tufted, and represent the sporangial stage of *Asparagopsis* spp (sexual plants are described in **narrow-branched red algae**) Tetrasporangia (if present) divided in a cross pattern (cruciate).

..... *Falkenbergia* stage of *Asparagopsis*

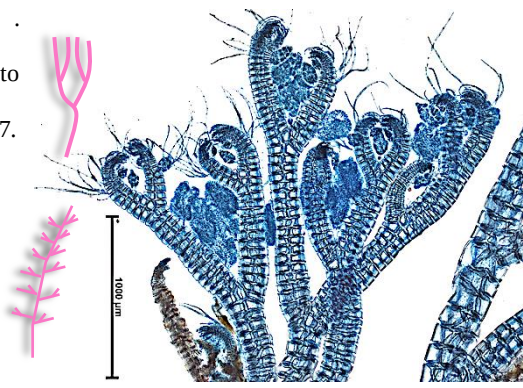


Fig. 22 (above): *Polysiphonia succulenta*, colourless trichoblasts at incurved tips, male branches

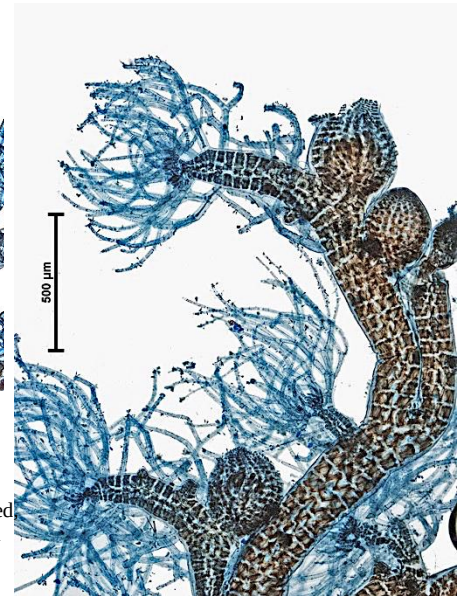


Fig 23 (right): *Polysiphonia atricapilla*, thin, branched colourless trichoblasts at tips; goblet-shaped mature female structures (cystocarps)

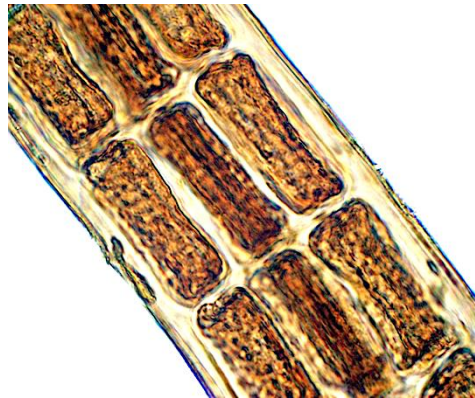


Fig. 24: *Polysiphonia teges*, bands of 4 pericentral cells (the underlying cells of the central filament, equal in length to pericentral cells, is obscured)

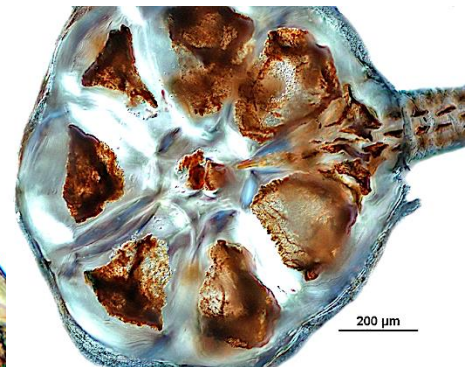


Fig. 25: *Polysiphonia decipiens*, cross section, central filament surrounded by 7 pericentral cells, origin of a side branch



Fig. 26 (left): *Falkenbergia*, several plants



Fig. 27: *Falkenbergia*, filaments with bands of 3 pericentral cells ringing narrow central cells



Fig. 28: *Falkenbergia*, tetrasporangia (*t sp*) divided in a cross pattern (cruciate)

8a. plants often tiny < 10 mm tall), creeping across or lying flat on other plants. Short side branches alternate in a **particular sequence** along axes. See examples opposite. Figs 29-33.

..... go to **Part VII: red algal creepers**
(Tribe: Hof the Family: Rhodomelaceae)

8b. plants larger, usually erect, no particular sequence of side branches along axes although they may occur on one side of the axis 9.

9a. pericentral cells 3-12 in number, can be seen in bands in side view of filaments or in cross sections of main branches (axes) at least near plant tips. Tip cells with **straight** cross-walls. Side branchlets may be naked (monosiphonous), branched or as single threads, sometimes so numerous and hair-like they give the plant a **woolly appearance**. Sporangia in **lines** or **spirals** in expanded branchlets or special cigar-shaped structures (stichidia); mature female structures (cystocarps) flask- or goblet-shaped 10.

9b. pericentral cells **absent**, equal-sided cells forming close to tips partly obliterate the line of large cells of a central thread. Tip cells with **sloping** (oblique) cross-walls; short side branchlets **flat-branched**, alternating along main branches (axes). Sporangia **scattered** in side branches, cystocarps **loosely** wrapped in filaments of side branchlets. Figs 34-39 (**next page**).

..... go to **Part VIII: axes with irregular cortication**
(Tribes: Ptiloteae and Rhodocallideae, of the Family: Ceramiaceae)

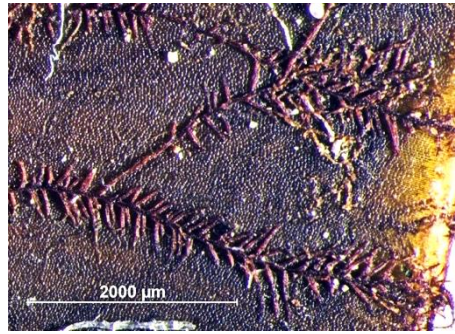
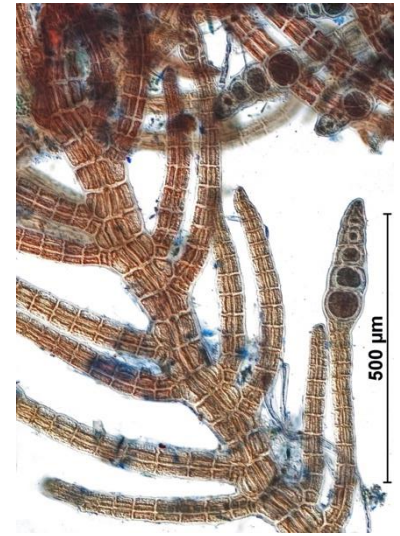


Fig. 29 (above): *Ditria expleta* plants lying along the flat blade of the Brown alga host *Lobophora variegata*



Figs 30 (right): *Ditria expleta* pairs of undivided laterals, on opposite sides of an axis, one bearing sporangia



Fig. 31 (above & right): *Herposiphoniella plurisegmenta*, a genus with 5-7 **unbranched laterals** between stubby indeterminate laterals (one set, right, marked 1 & 6)

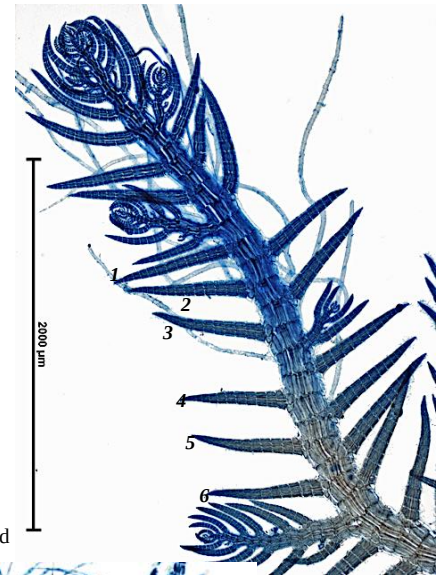


Fig. 32: *Herposiphonia calothrix* running across the surface of a piece of bleached Velvet-weed, *Codium* sp (host)

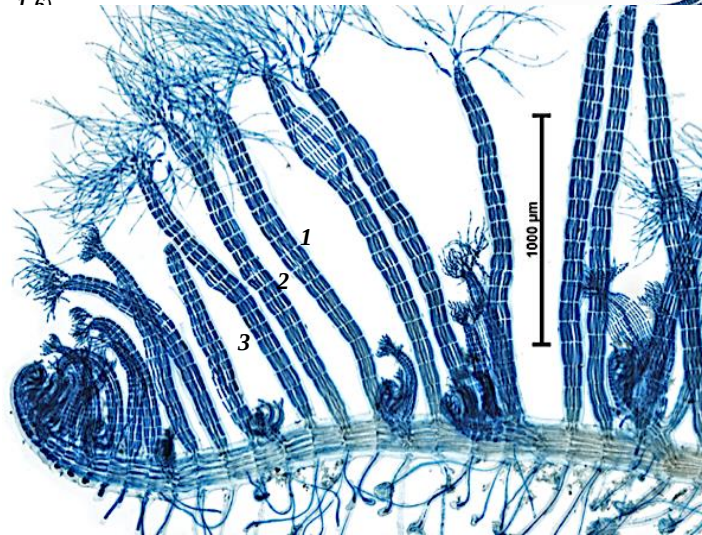
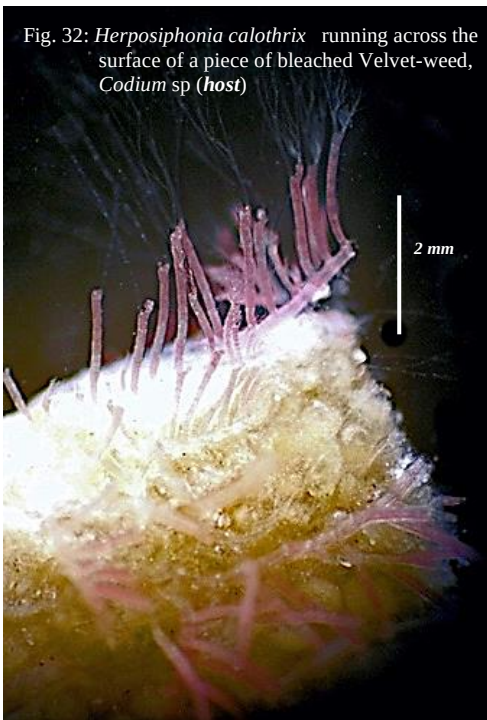


Fig. 33: *Herposiphonia calothrix* **Three** undivided determinate laterals (1,2,3) between stubby branched indeterminate laterals; numerous fine rhizoids from the base of the prostrate axis that is curved backwards at the apex



Fig. 34 *Euptilota articulata*, detail of feathery (pinnate) branching

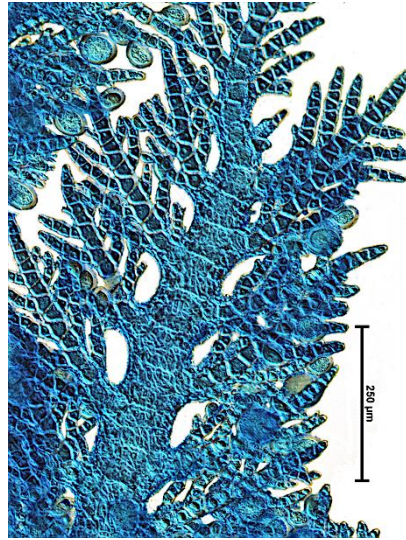


Fig. 35: *Euptilota articulata*: tetrasporangiate plant: alternating, comb-like side filaments; sloping (oblique) cross walls seen near tips; tetrasporangia (*tsp*) scattered in filaments

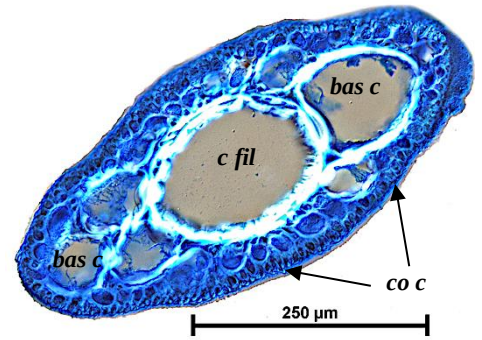


Fig. 36: *Euptilota articulata*, cross section: central filament (*c fil*); basal cells of side filaments (*bas c*); corticating cells (*co c*)



Fig. 37: *Rhodocallis elegans*, plants are flat-branched. The basic filamentous construction is visible only in undamaged branch tips and may be difficult to locate

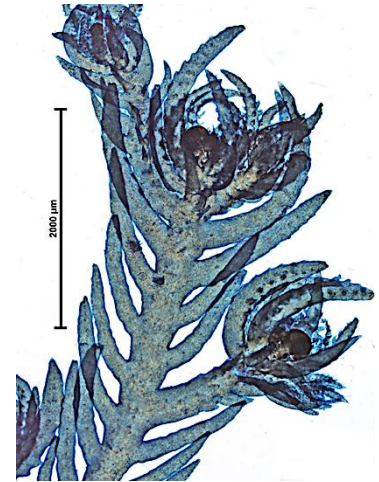
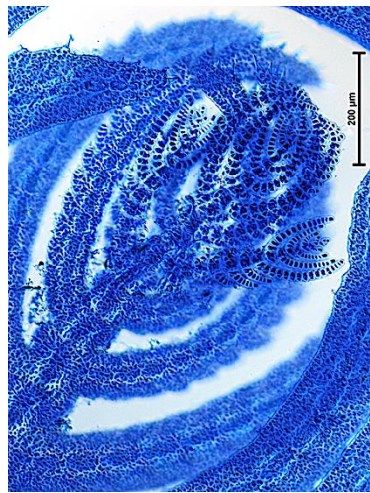


Fig. 38 (above): *Rhodocallis elegans*, naked mature female structures (cystocarps) at branch tips

Fig. 39 (left): *Rhodocallis elegans*, branch tip, filaments visible, side branches alternating

- 10a. ultimate threads of short side branches occur only on **one side**. Figs 40-43, go to
 **Part IX: Tribe Polyzonieae – one-sided algae**
 10b. not as above 11.

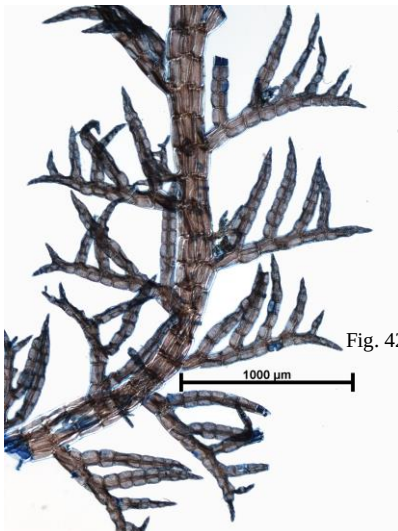


Fig. 42: *Dasyclonium incisum* ultimate branches **on upper side** of short laterals



Fig. 40: *Cliftonaea pectinata* side branches on **one side** of a flattened axis curled at the tip



Fig. 41: *Cliftonaea pectinata* bleached specimen backlit to accentuate the one-sided branching of feathery laterals

Fig. 43: *Echinospirangium semipennatum* short laterals flat, shaped like scalpel blades on **one side** of a flat axis.



- 11a. short (determinate) side branches alternate along axes and **run for 1-2 cells down them at their bases**. Figs 44- 47.
*Xiphosiphonia pennata*
 (as *Pterosiphonia pennata* in Womersley (2003)
 (Other members of the Tribe to which this belongs are in **narrow bladed Red algae**)
- 11b. not as above 12.

- 12a. sporangia **in rings of 4-6**, always in special cigar-shaped structures (stichidia). Cells at forks of side branchlets **share a common wall** at their bases (examples below)
 Figs 48-53. **go to**
Part XI. shaggy algae. Family: Dasyaceae"

- 12b. sporangia **single or paired** in a line or spiral, in stichidia or in swollen, side branchlets. Cells at forks of side branchlets have **separate walls** at their bases. 13.

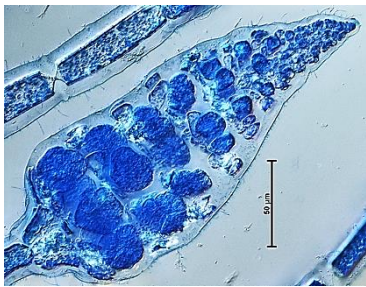


Fig 48: *Dasya atactica*, sporangial structure (stichidium) with sporangia in rings of 6

Fig. 49: *Dasya cliftonii*, cells sharing a common wall at the fork of a branchlet (arrowed), (insert enlarged)

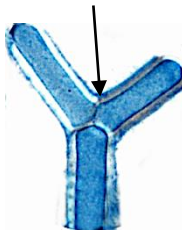


Fig. 44:
Xiphosiphonia pennata



Fig. 46: *Xiphosiphonia pennata*
ball-shaped female cystocarps

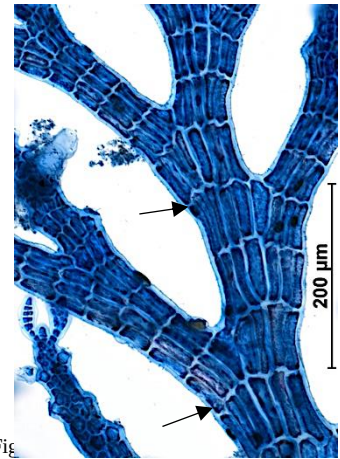


Fig
Xiphosiphonia pennata: side branches run for several cells down axes (arrowed)



Fig. 47: *Xiphosiphonia pennata*
spermatangial clusters near plant tips

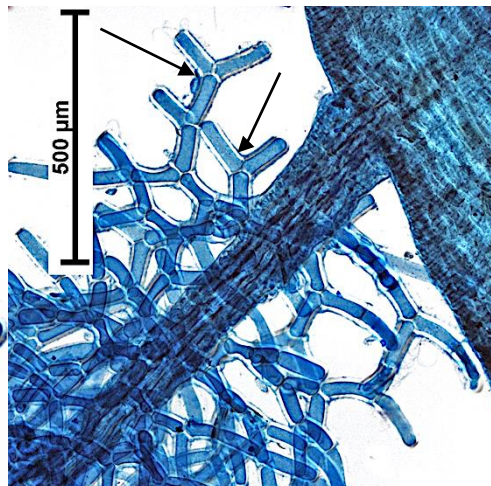


Fig 50: *Dasya crinita*, cells sharing a common wall at the fork of a branchlet (arrowed)

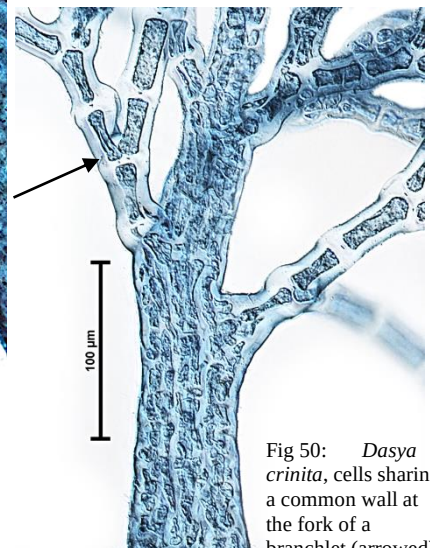
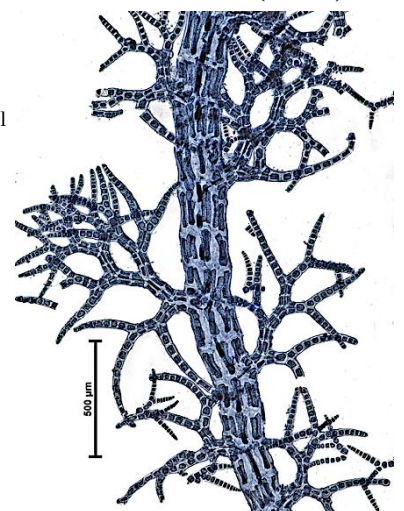


Fig. 51: *Dasya extensa*, dense hair-like side branchlets and stalked, mature female structures (cystocarps)



Fig. 52:
Dasya crescens, narrow axes with bands of 4 pericentral cells; **coloured** side filaments naked, lance-shaped

Fig. 53:
Heterosiphonia narrow axes with bands of >5 pericentral cells; (4 seen in surface view) **coloured** side



13a. laterals monosiphonous, dense, forked, overtopping plant tips, giving the plant a fluffy appearance. Figs 54-57.

..... go to **Part XII. Tribe Lophothaliaeae**

13b. laterals usually corticated, spiky, flat or shortly tufted. Figs 58-61.....

go to **Part XV. Tribe Polysiphonieae** (the genus *Polysiphonia* is treated separately in step 7a, above)

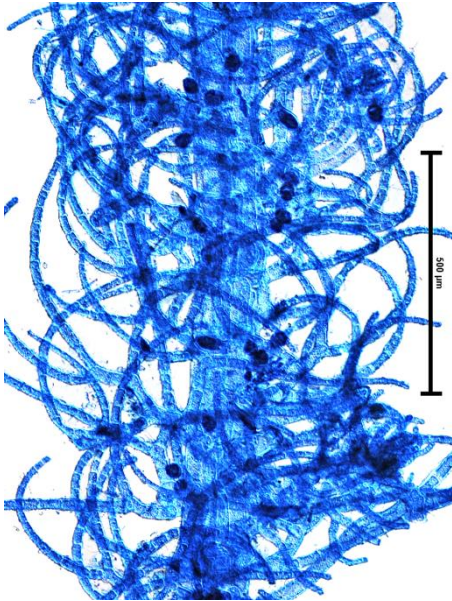
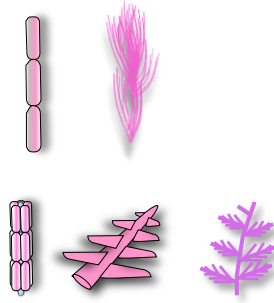


Fig. 54: *Veleroa adunca*, dense, hair-like side branchlets curved upward



Fig. 55: *Brongniartella australis* (left) and insert, above, main branches (axes) with bands of pericentral cells, cells at forks of side branchlets with **separate** walls at their bases (compare with Fig. 49 for the Dasyaceae in which branch cells share a common cell wall)

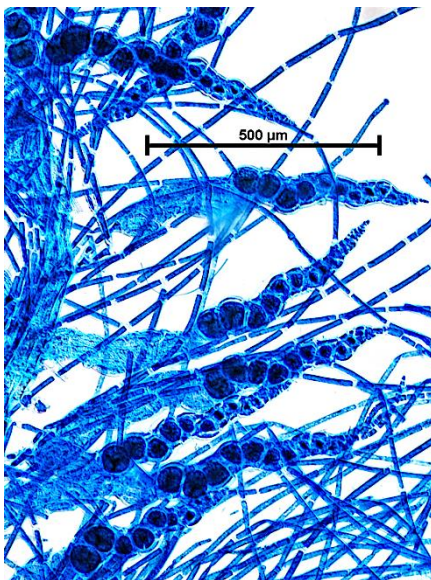
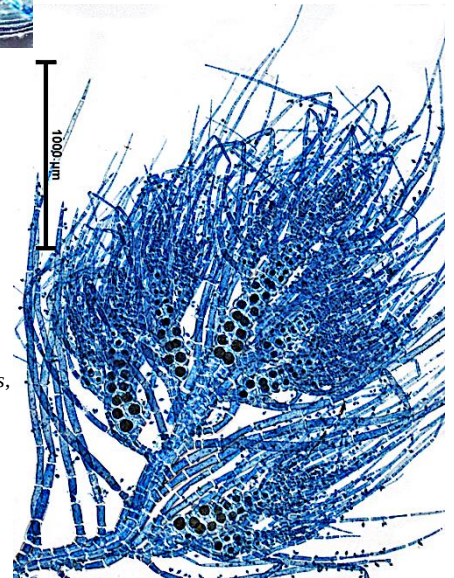


Fig. 56: (left) *Lophocladia kuetzingii*, sporangial structures (stichidia), sporangia **single**, in a spiral

Fig. 57: (right) *Lophothalia hormoclados*, sporangia **paired** in swollen side branchlets



(Tribe: Polysiphonieae)



Fig. 58: *Alleynea bicornis*



Fig. 59: *Lophurella pericladus*



Fig. 61 a, b *Pityophykos tasmanica*
Above : detail of flat laterals
Immediately above:
spiny appearance of pressed plant



Fig. 60 a, b *Echinothamnion hystrix*
Above: pressed plant
Right: detail of dense laterals



REFERENCES

- *Algaebase* <https://www.algaebase.org/> accessed March 2025
- Womersley, H,B.S (2003) Marine Benthic Flora of southern Australia Part IIID

GROUPS CONSIDERED IN THIS KEY

group	page/s	group	page/s
Acrochaetiaceae (Family)	2	Monosporeae (Tribe)	2
Antithamnieae (Tribe)	3	<i>Polysiphonia</i> (genus)	5
Acrochaetiaceae (Family)	2	Polysiphonieae (Tribe)	8, 9, 10
Balliaceae (Family)	3	Polyzonieae (Tribe)	7
Bangiophyceae (Class)	2	Pterosiphonieae (Tribe)	8
Bornetieae (Tribe)	2	Pterothamnieae (Tribe)	3
Callithamnieae (Tribe)	2	Ptiloteae (Tribe)	6, 7
†Ceramieae (Family)	2, 3, 4	Rhodocallideae (Tribe)	6, 7
Ceramieae (Tribe)	4	Sarcomeniaceae (Family)	4
Crouanieae (Tribe)	3	Spermothamnieae (Tribe)	2
Dasyaceae (Family)	8	Sphondylothamnieae (Tribe)	2, 3
Dasyphileae (Tribe)	3	Spongoclonieae (Tribe)	2
<i>Falkenbergia</i> stage of <i>Asparagopsis</i>	5	Spyrideae (Tribe)	4
Griffithsieae (Tribe)	2	Warrenieae (Tribe)	3
Herposiphonieae (Tribe)	6	Wrangelieae (Tribe)	3
Heterothamnieae (Tribe)	3	<i>Xiphosiphonia pennata</i>	8

†as Wrangeliaceae in *Algaebase*