WORM-LIKE BROWN ALGAE OF SOUTHERN AUSTRALIA

This 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. All but the worm-like *Scytosiphon lomentaria* in the Family: Scytosiphonaceae belong to the Family: Chordariaceae. Practically all grow in the summer months, and all are spore plants. Sexual plants are small, obscure, and in most cases, unknown.

Limitations Unfortunately, to use this key, microscopic investigation of specimens will be needed. Also, this key overlaps somewhat with "**turf and fouling algae. III. worm and threadlike brown algae**" and species may appear in more than one step of the key in order to capture those that may have variable shapes.

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 24 mm or almost 1" across.

Names Scientific names follow those found in Womersley, H B S. (1987). *The Marine Benthic Flora of Southern Australia Part II* as it continues to provide the most comprehensive and accessible account. §Denotes a common name from Edgar, G J (2012) *Australian Marine Life. 2nd edition.* Reed New Holland.

1a. plants ***unbranched***, or branched only at the very base of the plant, or with inconspicuous stubs < 10 mm long as side branches ..... 2.

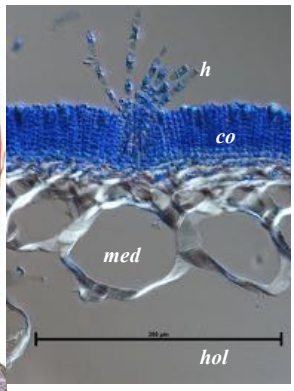
1b. plants with distinctly forked branches or with side branches > 10 mm long ..... 6.

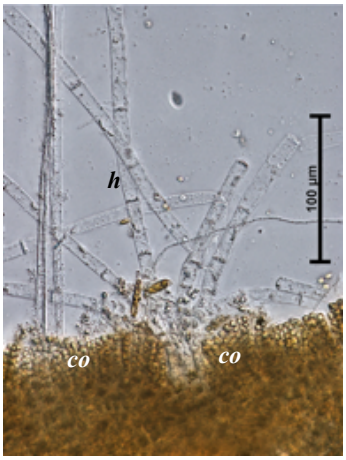
2a. ***mature*** strands ***hollow***, 1-5 mm wide, drooping on rocks between waves or at low tide; cellular parts of cores with equal-sided cells; surface layers (cortex) of tightly-packed, outward-facing chains of coloured cells with colourless hairs in tufts. Figs 1- 4.
..... *Scytosiphon lomentaria*
§Tubular stringweed
Family: Scytosiphonaceae

2b. ***mature*** strands ***solid*** or partially hollow, core (medulla) of colourless thread-like cells, surface (cortex) of loosely-packed filaments of coloured cells, surface often very hairy ..... 3.

3a inner, sub-surface layer of colourless filaments and outer surface of coloured filaments of 2 sorts (short and long) growing outwardly, with numerous colourless hairs. Figs 5-8.
..... *Myriogloea sciurus*

3b. not as above ..... 4.

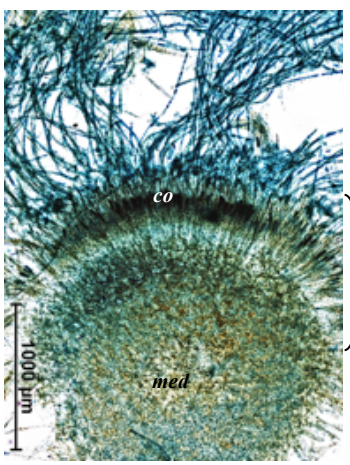




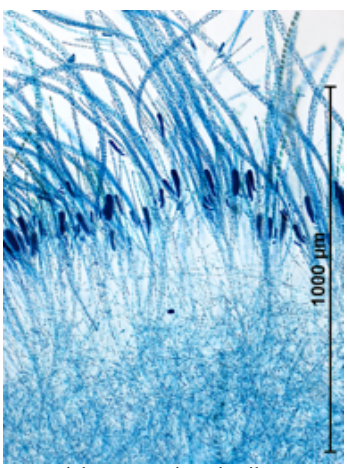
Figs 1- 4: *Scytosiphon lomentaria*
Above, left: plants hanging on granite boulders, exposed between waves
Above, centre: pressed plants showing variations in form
Above, right: cross section of outer part of a strand; hollow core (*hol*), cellular part of the core (medulla, *med*), outer layer of chains of small, coloured cells (cortex, *co*), tuft of hairs (*h*)
Right: side view, unstained, tuft of colourless hairs (*h*) surface layer (cortex, *co*) of tightly packed chains of bead-like cells

Figs 5-8 *Myriogloea sciurus* narrow-stranded plants; minute holdfasts arrowed

detail of strands with protruding coloured filaments



cross section, wide core (medulla, *med*) of fine filaments, colourless inner surface layer (sub-cortex, (*s co*), outer surface layer (cortex, *co*) of long, coloured filaments and hairs

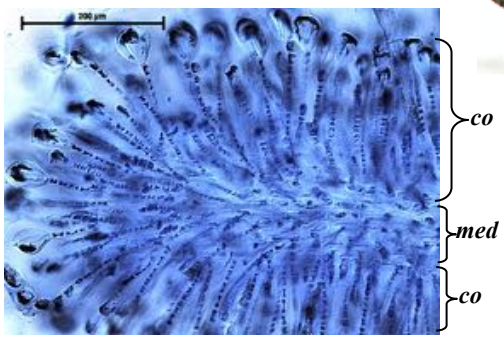


partial cross section, detail

4a. tissue squashes of outermost layers (cortex) show branched chains of small cells each ending in a larger, ***swollen*** cell. Grows on seagrasses.

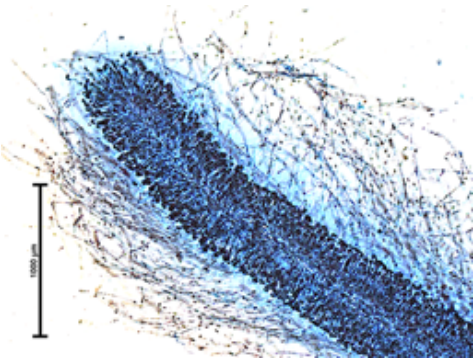
Figs 9-12 superficially like the species in 4b., often growing with it ..... *Polycerea nigrescens*
also found in "turf and fouling algae III. worm and threadlike brown algae"

4b. tissue squashes of the cortex show chains of cells of similar sizes ..... 5.



5a. outer layer of chains of small cells usually ***curved*** at the tips. Figs 13-18. ..... *Cladosiphon filum*
§Brown spaghetti weed
also found in "turf and fouling algae III. worm and threadlike brown algae"
superficially like *Polycerea nigrescens*, above, and often growing with it

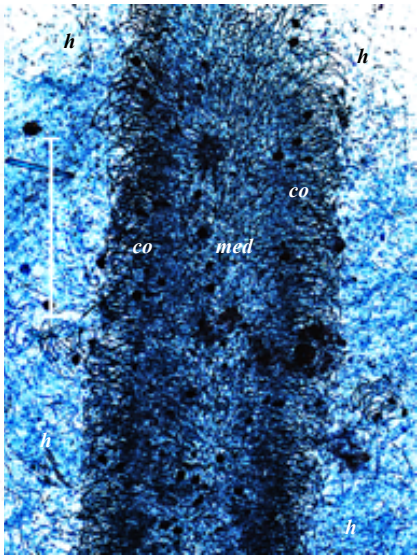
5b. outer layer with straight chains of small cells ..... 6.



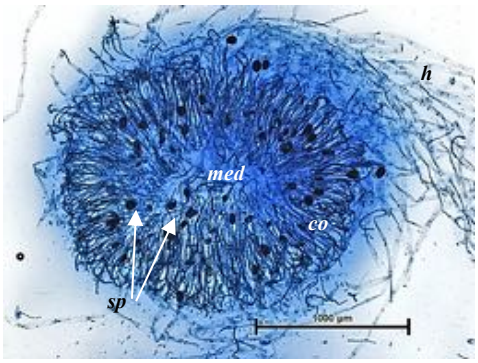
Figs 9-12 : *Polycerea nigrescens*
Top, left: mix of *P. nigrescens* **and** *Cladosiphon filum* on a seagrass (*Posidonia*) leaf, indistinguishable on superficial features
Top, right: side view of a young, solid strand with numerous hairs extending from the outermost layers
Far left: lengthwise view, tip of a strand, surface filaments (cortex, *co*), core (medulla, *med*)
Left: surface filaments with globe-shaped terminal cells

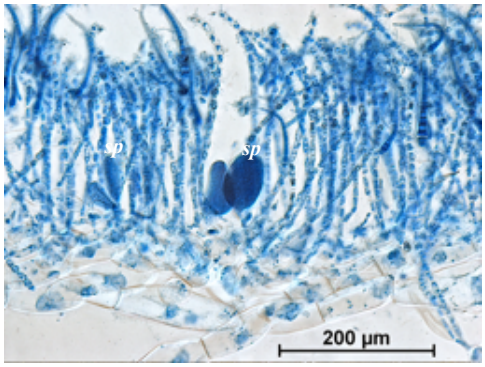
Figs 13-15: *Cladosiphon filum*
Left: detail of strands, minute protruding hairs

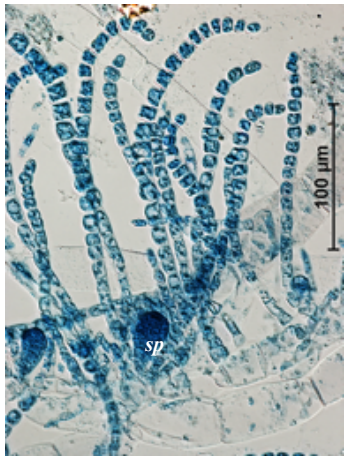
Centre: whole plants on seagrass leaves



Right: lengthwise view of a strand, protruding hairs (*h*), outer layer (cortex *co*) of curved chains of small cells, core (medulla, *med*) of twisted filaments







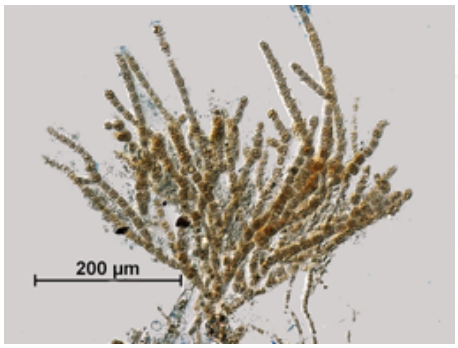
Figs 16-18: *Cladosiphon filum*
Left: cross section, protruding hairs (*h*), outer layer (cortex, *co*) of curved chains of small cells, core (medulla, *med*) darkly stained spore sacs (*sp*)

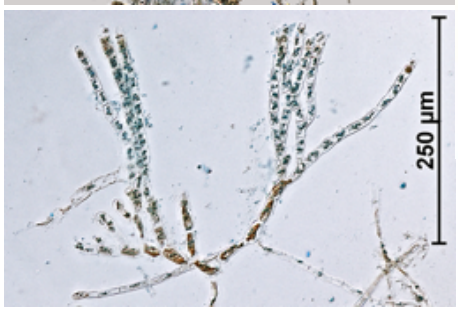
Centre: surface filaments, one (arrowed) showing the curved nature, two spore sacs (*sp*)

Right: detail of curved cortical filaments, darkly stained spore sacs

6a. branching generally in long strands from near the plant base; surface (cortical) filaments branched several times. Figs 19-22.
..... *Suringariella harveyana*

6b. plants with long or short ***side branches***; cortical filaments branched or unbranched (picks up species from step #1b)
..... 7.

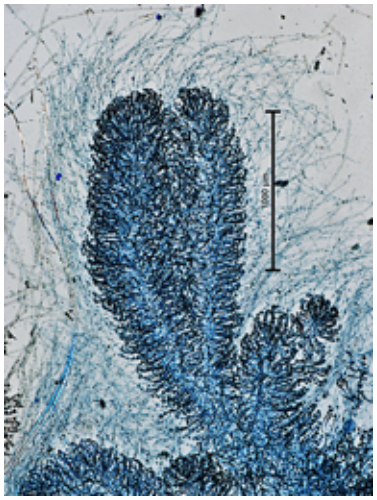




Figs 19-22: *Suringariella harveyana*
Left, above & below: tissue squashes of surface (cortical) branched filaments
Centre: whole plants
Right: plant base, with minimal side branching, fronds showing coloured filaments extending from the surface

7a. surface (cortical) cells in chains 8-13 cells long with a ***swollen apical cell*** 2-3 times the diameter of the cells in the middle of the thread. Grows on seagrass stems. Figs 23-26.
..... *Polycerea zostericola*
(a second species, *Polycerea nigrescens*, seen in step 4a. above, generally has ***unbranched*** strands, cortical filaments are ***6-9*** cells long and the terminal swollen cell is about 5 times the diameter of other cells in the thread)

7b. apical cells of surface (cortical) filaments ***not*** swollen ..... 8.



Figs 23-26: *Polycerea zostericola*

Above, left: plants on seagrass (*Heterozostera*) stems
Above, right: detail of branching pattern of a small plant
Left: strand tips, numerous hairs extending from the surface
Right: surface (cortical) tuft, coloured filaments, mature ones about 12 cells long with swollen terminal cells, and 3 colourless hairs (*h*)

8a. core is compact, of chains of box-shaped, cells
..... 9.

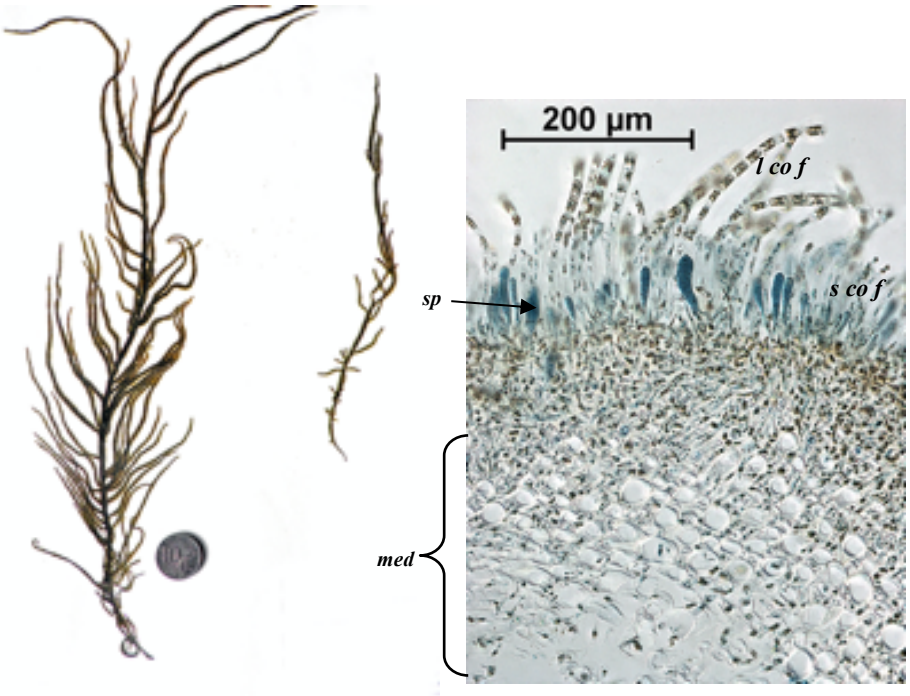
8b. core cells thread-like, often mixed loosely with a mass of extremely thin filaments
..... 11.

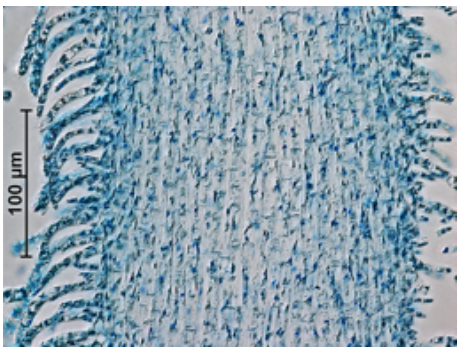
9a. coloured surface filaments unbranched but of 2 sorts: short and long
..... 10.

9b. coloured surface filaments short ***or*** long ***or*** in tufts, sometimes mixed with colourless hairs .....11.

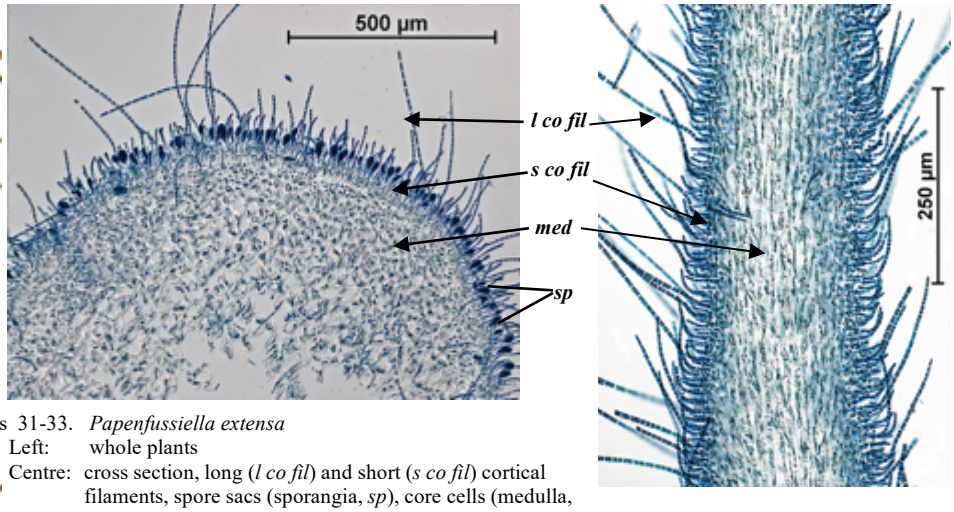
10a. known only from E coast of Tasmania (and New Zealand); cells of surface filaments length ÷ breadth = 1-2. Figs 27-30.
..... *Papenfussiella lutea*

10b. known only from Pt Peron WA, but possibly with a greater distribution; cells of surface filaments length ÷ breadth = 3- 4. Figs 31-33.
..... *Papenfussiella extensa*





Figs 27-30: *Papenfussiella lutea*
Left: lengthwise section, core cells box-shaped, L÷B =1-2
Above, centre: whole plants
Below, centre: fronds showing long coloured cortical filaments extending from the surface
Above, right: cross section, long (*l co fil*) and short (*s co fil*) cortical filaments, spore sacs (sporangia, *sp*), core cells (medulla, *med*)



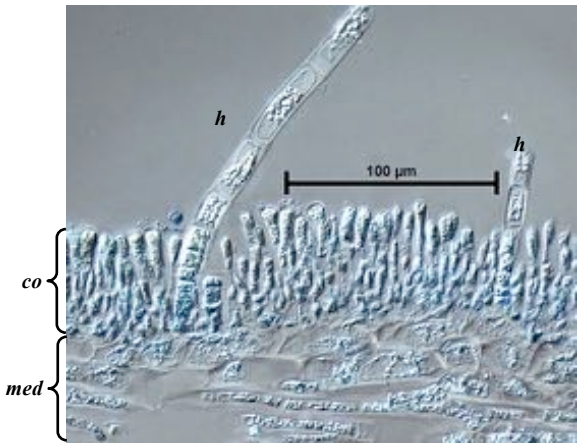
Figs 31-33. *Papenfussiella extensa*
Left: whole plants
Centre: cross section, long (*l co fil*) and short (*s co fil*) cortical filaments, spore sacs (sporangia, *sp*), core cells (medulla, *med*)
Right: lengthwise section, core cells (medulla, *med*) L÷B = 3 to 4

11a. side branches may be long; surface filaments short, 2-3 cells long, dense, like palings in a fence. Figs 34-37.
..... *Chordaria cladosiphon*

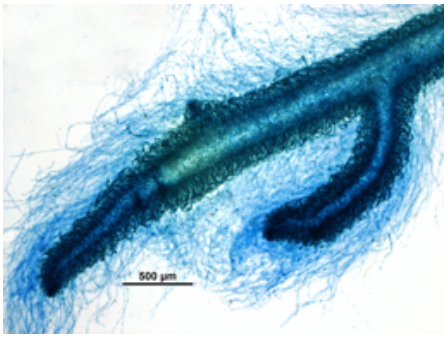
11b. branching near the plant base forked, of long, thin strands, side branches usually short; surface filaments not as above. ..... 12.

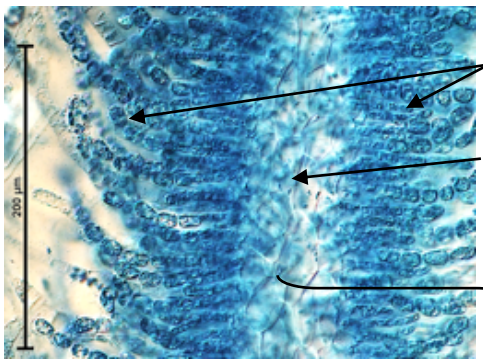
12a. surface filaments 12-30 cells long, ***curved***; plants grow on rock. Figs 38-43.
..... *Cladosiphon vermicularis*
(a second species, *Cladosiphon filum*, seen in step 5a. above, has usually ***unbranched*** strands, generally grows on sea grasses and its colourless hairs are wider – about 20 µm wide compared to *C. vermicularis* where they are about 10 µm wide)

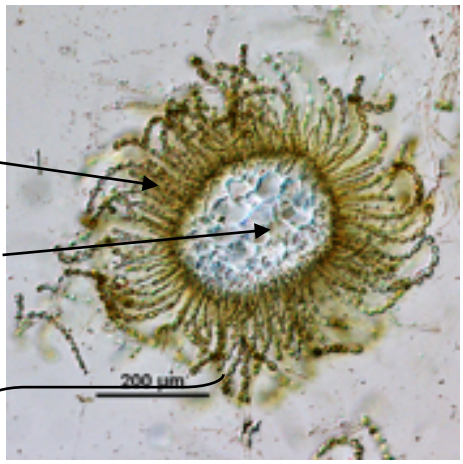
12b. surface filaments not curved or in bunches ..... 13.



Figs 34-37: *Chordaria cladosiphon*
Above, left: whole plant
Below, left: detail of branching pattern
Above, right: lengthwise section surface cells (cortex, *co*), core (*med*), hair (*h*)
Below, right: variation in branching pattern, long side branches





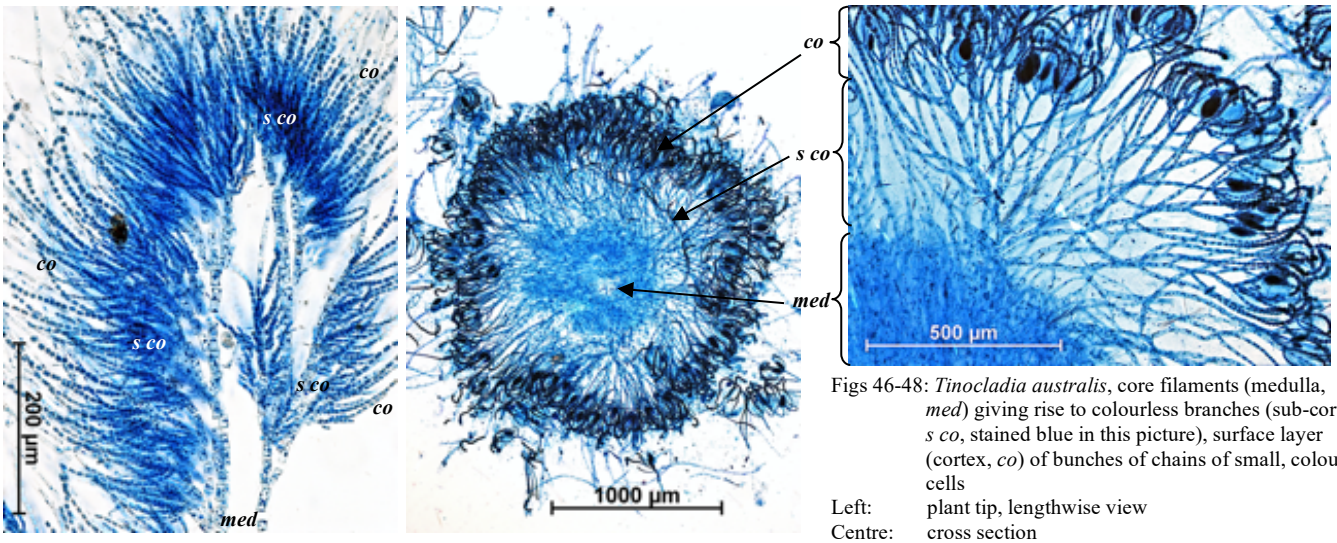


Figs 38-43: *Cladosiphon vermicularis*
Above, left: whole plant
Above, centre: variation in plant shapes
Above, right: detail of coloured surface filaments extending from the strand surface
Below, left: plant tips, numerous fine hairs extending beyond the dense, highly stained cortex
Below, centre: longitudinal section,
Below, right: cross section
curved surface filaments (cortex, *co*), core (medulla, *med*) of compact cells

13a. plants variable in shape, thin-branched, or squat with few, or occasionally many broad branches; tissue squashes show a core of ***concentrated fine*** filaments, a ***wide***, ***colourless*** sub-surface ring of branched filaments ending in ***tufts*** of long, ***coloured*** surface filaments and no hairs. Figs 44-48.
..... *Tinocladia australis*

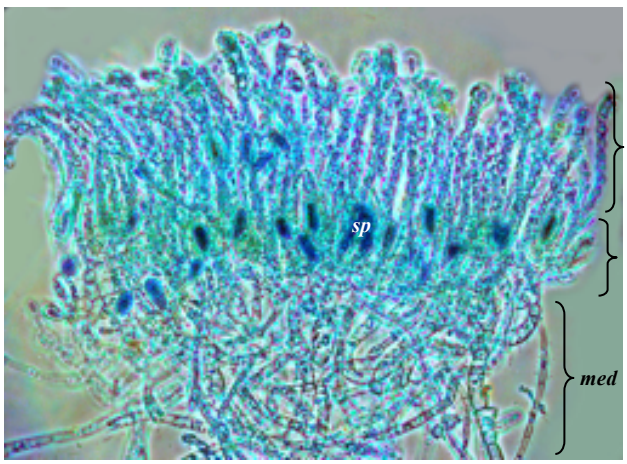
13b. plants small, gelatinous, squat, tissue squashes show a core of ***loose, wide*** filaments, ***insignificant*** colourless sub-surface ring, surface chains of coloured cells and no hairs. Only known from Tasmania. Figs 49-51.
..... *Mesogloiopsis tasmanica*

Figs 44, 45: *Tinocladia australis* examples of variation in shape



Figs 46-48: *Tinocladia australis*, core filaments (medulla, *med*) giving rise to colourless branches (sub-cortex, *s co*, stained blue in this picture), surface layer (cortex, *co*) of bunches of chains of small, coloured cells
Left: plant tip, lengthwise view
Centre: cross section
Right: detail of branching

Figs 49-51: *Mesogloiopsis tasmanica*
Left: whole plant
Below and Right: tissue squashes, loose core (medulla, *med*) filaments, narrow region of colourless branched filaments (sub-cortex, *s co*), surface (cortex, *co*) layer of chains of small, egg-shaped, coloured cells, densely stained spore sacs (sporangia, *sp*)



SPECIES FOUND IN THE KEY

species	author(s)	page(s)	current name in *Algaebase*	author
Mesogloiopsis tasmanica	Womersley & Bailey	6		
Tinocladia australis,	(Harvey) Kylin	6	*Eudesme australis*	(Harvey) J. Agardh
Cladosiphon vermicularis	(J.Agardh) Kylin	5		
Chordaria cladosiphon	Kützing	5		
Papenfussiella extensa	Womersley & Bailey	4		
Papenfussiella lutea	Kylin	4		
Polycerea zostericola	(Harvey *ex* Kützing) Kylin	3		
Polycerea nigrescens	(Harvey *ex* Kützing) Kylin	2, 3		
Suringariella harveyana	(J Agardh) Womersley & Bailey	3		
Cladosiphon filum	(Harvey) Kylin	2		
Myriogloea sciurus	(Harvey) Kuckuck *ex* Oltmans	1		
Scytosiphon lomentaria	(Lyngbye) Link	1		