

FILAMENTOUS RED ALGAE PART VI: *POLYSIPHONIA* 2nd edition including *LEPTOSIPHONIA*, *MELANOTHAMNUS* & *VERTEBRATA*

This key is restricted to the genus *Polysiphonia* a common filamentous or thread-like group of red algae with 26 species in southern Australia as described in Womersley (2003). In addition, recent, updated names from *Algaebase* are provided.

Look alike algae

Some red algae, especially filamentous members of the Family: Rhodomelaceae such as the example opposite can be confused with *Polysiphonia*. To help exclude these, refer to the “**Filamentous Red Algae: Master Key**”. Others are illustrated on page 12.

The key is based on that described in Womersley (2003) p. 170 but use more superficial characteristics for easier recognition of the species.

Features of the genus *Polysiphonia*:

- plants often dark red brown, **almost black**. All vegetative (non-reproductive) branches are thread-like (filaments) about equal in size, that is, there is very little difference between main (axial) filaments and shorter side branches (laterals). Other members of the Polysiphoniaceae possess short laterals of limited (determinate) growth (see opposite)
- filaments have microscopic, branched, **colourless** hairs (**trichoblasts**) especially near tips, although these may be lost as the plant matures. Other Tribes in the Family Rhodomelaceae have coloured trichoblasts
- a central, single line of cells (central filament) is ringed by cells of equal length called **pericentral cells** giving young branches a banded (segmented) appearance when magnified. The number of pericentral cells per band is important in defining species, so microscopic investigation is necessary. In wet microscope preparations of plants with soft threads, pericentral cells can be floated free of the central filament and more easily counted by applying gentle pressure to the coverslip (a procedure called making a tissue squash). Tougher plants require cross sections to view the number of pericentral cells.
- in some species, older branches become wrapped (**corticated**) with cells additional to pericentral cells
- thread-like attachment organs (rhizoids), ending in attachment pads or **haptera**, some with extremely finely-divided cells, may be present
- sporangial plants produce modified branches called **stichidia** containing tetrasporangia divided in a tetrahedral pattern
- female plants produce mature flask-shaped structures called **cystocarps**
- male plants form masses of minute **spermatia**, usually on the basal cells of trichoblasts

Scales

The coin used as a scale is 24 mm or almost 1” in diameter

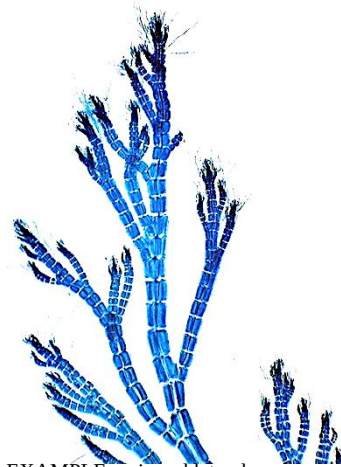
Microscope images

are usually stained blue

Names

Womersley (2003) is used as it continues to have the most accessible and comprehensive description of species.

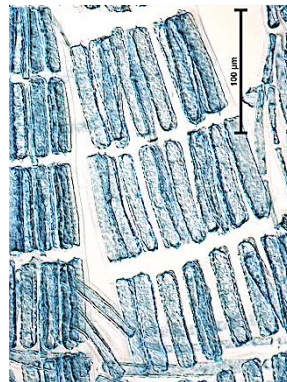
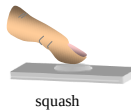
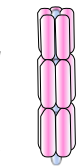
New genera from *Algaebase* have been added.



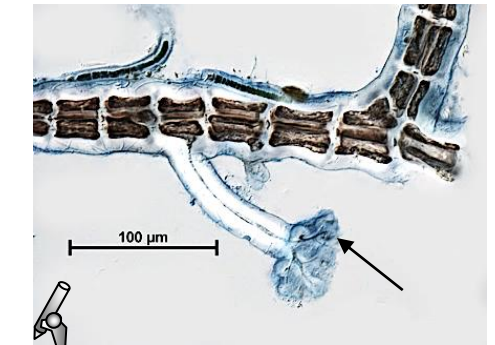
EXAMPLE: axis and laterals constructed similarly



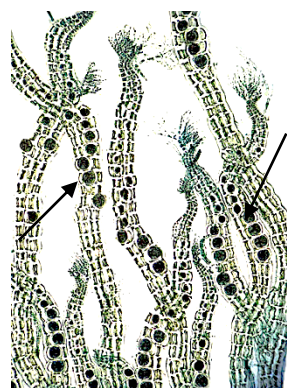
EXAMPLE:
not *Polysiphonia* but *Diplocladia patersonis*
Although similarly ending in colourless trichoblasts, laterals **are stubby** and **determinate** in growth



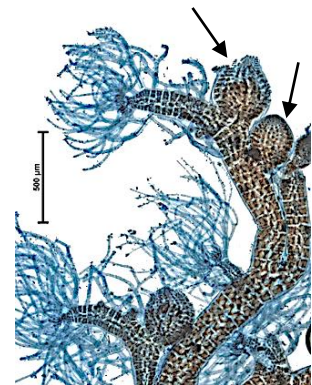
EXAMPLE: tissue squash, 9 pericentral cells exposed



EXAMPLE: rhizoid ending in a hapteron (arrowed)



EXAMPLE: sporangial stichidia (arrowed)



EXAMPLE: cystocarps (arrowed) and tips with blue stained trichoblasts



EXAMPLE: male spermatangial masses (arrowed) arise from the basal cells of a colourless trichoblast

KEY

- 1a. plants **lowly**, growing as almost microscopic tufts on other algae or seagrass (epiphytic), **or** as low intertidal mats or turfs of dense intertwined threads on rock 2.
- 1b. larger, upright, non-turfing plants epiphytic **or** on rock, with upright, distinctive axes 10.
- 2a. plants 2-5 mm tall, on other algae 3.
- 2b. mature plants usually 10-30 mm tall 4.
- 3a. plants **rare**, growing as minute tufts < 2 mm tall on the Red alga *Haplodasya urceolata*. Figs 1, 2. *Polysiphonia haplodasyae*
- 3b. plants rare or overlooked, < 5mm tall, growing on the minute bladders (utricle) of Velvet weed *Codium* sp, pericentral bands **flat**. Figs 3-5. *Polysiphonia brevissegmenta*

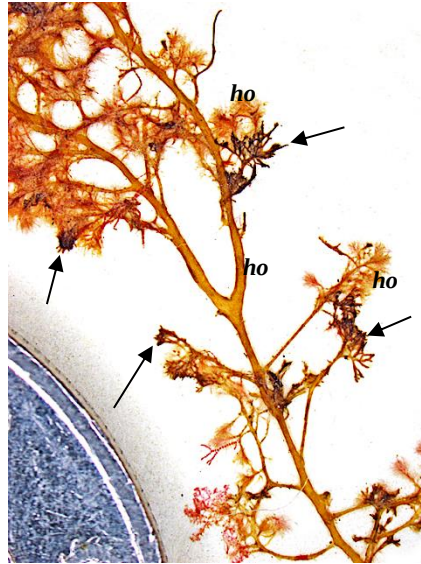


Fig. 1: *Polysiphonia haplodasyae* (dark minute tufts, arrowed) on the host (**ho**) *Haplodasya urceolata*

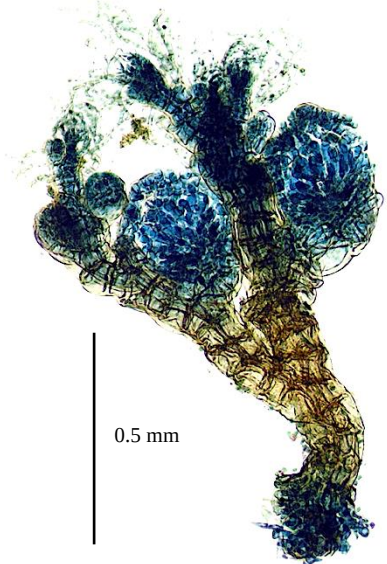


Fig. 2: *Polysiphonia haplodasyae*, whole plant, bearing cystocarps



Fig. 3: *Codium capitulum*, green algal **host** to *Polysiphonia brevissegmenta*



Fig. 5: *Polysiphonia brevissegmenta* extracted from host *Codium* material



Fig. 4: *Polysiphonia brevissegmenta* detail of flat pericentral cell segments (arrowed)

4a. plants form a fuzzy coating up to 10 mm thick on Sea Nymph, *Amphibolis* and occasionally jointed coralline Red algae. Attachment pads have many small cells. Red plastids, uniquely, are in lines **across** cellsFigs 6-8.

..... *Polysiphonia amphibolis*
4b. plants usually in the intertidal form low mats or turfs on rock or grow on other turf-forming algae. 5.

5a. **poorly collected**, only known from Albany WA and Spencer Gulf SA. Plants form mats about 10-20 mm thick. Basal runners form upright threads 50-70 µm wide; pericentral cells are rectangular, in rings of 6 in each band.

Figs 9-12 *Polysiphonia teges*
as ¹*Lophosiphonia teges* in *Algaebase*

5b. plants form turfs 20-80 mm thick 6.

6a. pericentrals **4-6 per band** 7.

6b. pericentrals **7-11 per band** 9.

7a. laterals of similar width to main branches, **4 pericentral cells per band** 8.

7b. laterals thinner than main branches, **6 pericentral cells per band**. Species widespread, growing in intertidal pools, sometimes on other algae. Special laterals (stichidia) grossly distorted by sporangia.

Figs 13-15. *Polysiphonia infestans*
as ¹*Melanothamnus infestans* in *Algaebase*



Fig. 9: *Polysiphonia teges*: piece of algal turf

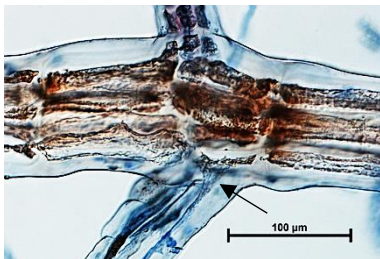


Fig. 11 (left): *Polysiphonia teges*: cytoplasm of a pericentral cell continues into a rhizoid (arrowed)
a feature used in the key of Womersley's *Marine Benthic Flora of southern Australia*

Fig.12 (right): *Polysiphonia teges*, tissue squash: central filament (**c fil**), pericentral cells (**I-VI**)

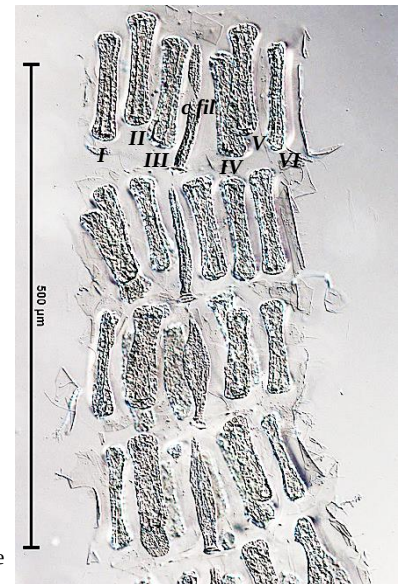


Fig.13: *Polysiphonia infestans*



Fig.14: *Polysiphonia infestans*, lateral thinner than main branch (left); special sporangial branch (right) grossly distorted

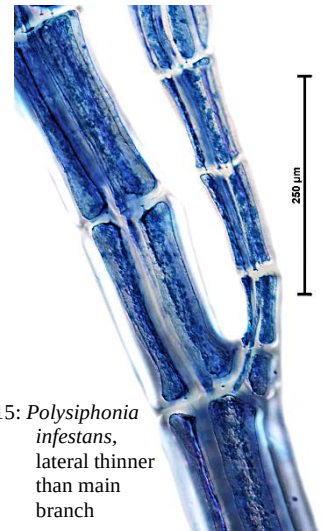


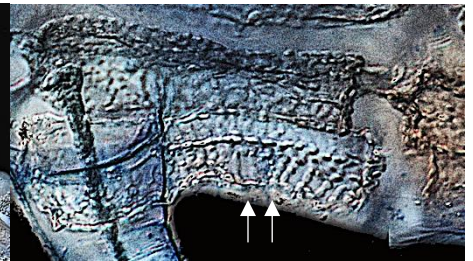
Fig.15: *Polysiphonia infestans*, lateral thinner than main branch



Fig. 6: *Polysiphonia amphibolis* fuzzy coating on seagrass leaf



Fig. 7: *Polysiphonia amphibolis* creeping rhizome and upright filaments



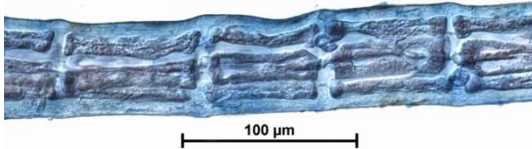
Figs 8a, b: *Polysiphonia amphibolis* large many-celled attachment pad (left) and detail of plastids in lines across a cell (arrowed, above)

8a. plants small, 20-80 mm tall, soft, **gelatinous**, branching parallel (fastigate), filaments vary in width, 70-150 μm wide. Figs 16-18.

..... *Polysiphonia sertularioides*

8b. plants delicate, may be very small, < 20 mm tall, possibly due to grazing animals, basal runner well developed, filaments about the same width, 100 μm wide, male plants uniquely with spermatangial masses ending bluntly. Figs 19-21.

..... *Polysiphonia scopulorum*



16a, b: *Polysiphonia sertularioides*
4 pericentrals per band (3 only seen at a time in surface view)

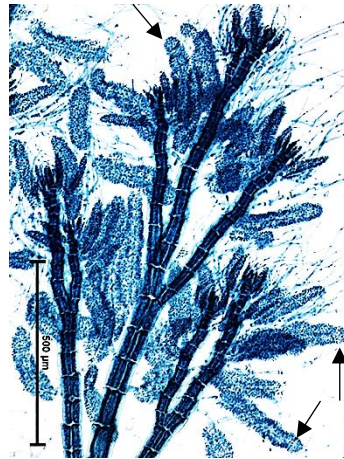


Fig.20: *Polysiphonia scopulorum*
male plants uniquely with spermatangial masses ending bluntly (arrowed)



Fig.17: *Polysiphonia sertularioides*
whole plant

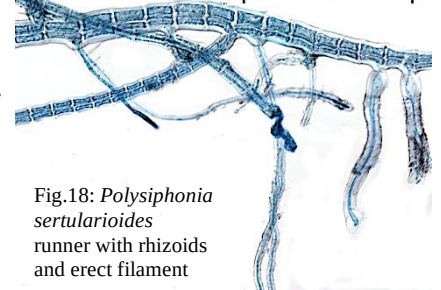


Fig.18: *Polysiphonia sertularioides*
runner with rhizoids and erect filament



Fig.19: *Polysiphonia scopulorum*
plants from rock pools

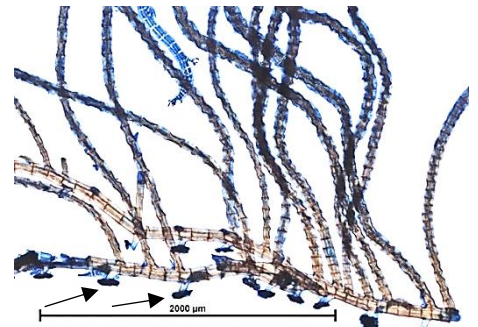


Fig.21: *Polysiphonia scopulorum*
Extensive runner with numerous haptera (arrowed) and single erect filaments

9a. collected at Tasmania only, **pericentral cells per band 10-11**. Cytoplasm of pericentral cells (arrowed) extends into adjacent rhizoids. Figs 22-24

..... *Polysiphonia adamsiae*

9b. common and widespread forming turfs on rock, sometimes in sand, usually **9-10** pericentral cells per band, but occasionally **7 or 8**, bases of rhizoids **separate** from adjacent pericentral cells. (Can be reasonably tall and so included also under step 10). Figs 25, 26, 35-37.

..... *Polysiphonia isogona*
as *Vertebrata isogona* in *Algaebase*



Fig. 22: *Polysiphonia adamsiae*

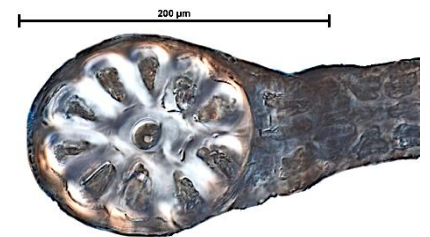


Fig. 23: *Polysiphonia adamsiae*: cross section: central filament, ringed by 10 pericentral cells

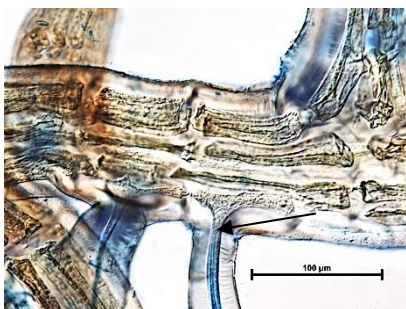


Fig. 24: *Polysiphonia adamsiae*, cytoplasm of pericentral cell (arrowed) extends into adjacent rhizoid



Fig. 25: *Polysiphonia isogona* turf

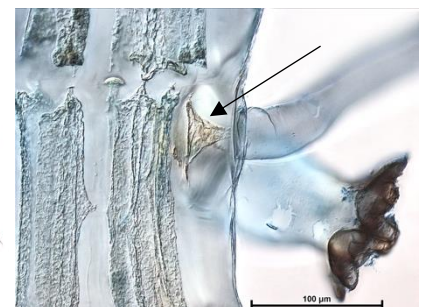


Fig. 26: *Polysiphonia isogona*, rhizoid base separated (arrowed) from the adjacent pericentral cells and short rhizoid with apical multi-cellular hapteron

(from step 1b: commencing the section “*upright, non-turfing plants*”)

- 10a. pericentral cells per band ~ **5-12** (occasionally **4** in one species) 11.
 10b. pericentral cells per band = **4-5** 16.

- 11a. pericentral bands in **middle** parts of plants are **squat**, height/width ≤ 1 12.
 11b. pericentral bands vary from square to elongate, height/length ≥ 1 15.

- 12a. basal parts coated (**corticated**) with rhizoidal filaments. Found near harbours and possibly introduced. Figs 27, 28.
 *Polysiphonia brodiei*
 as ²*Leptosiphonia brodiei* in *Algaebase*
 12b. no cortication 13.

- 13a. branching mainly **1-sided**, tips curved inwards, pericentral **cells** cubic. Plants from Rottneest I., WA. Figs 29-31.
 *Polysiphonia forfex*
 as ¹*Melanothamnus forfex* in *Algaebase*
 13b. branching more equally forked, tufted or parallel (fastigate), **cells** cubic or rectangular; plants widespread 14.

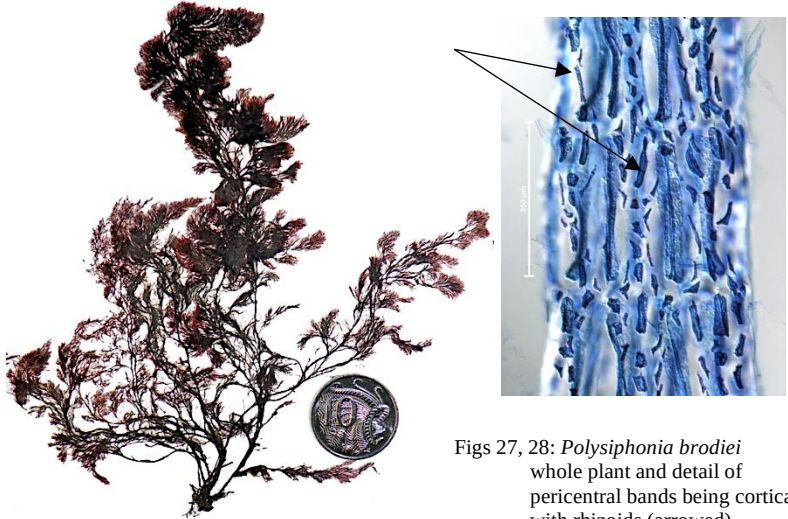


Fig. 29 *Polysiphonia forfex*

- 14a. pericentral **bands** squat near tips, rectangular in mature parts, **10-12** cells per band; plants commonly grow on the Sea Nymph, *Amphibolis*. Figs 32- 34. *Polysiphonia atricapilla*
 14b. pericentral bands more **rectangular**, 7-12 per band; plants grow on rock or sedentary marine life. Figs 35-37 (next page); described also in step 9b under turfing algae)
 *Polysiphonia isogona*
 as ¹*Vertebrata isogona* in *Algaebase*



Fig. 32: *Polysiphonia atricapilla*



Figs 27, 28: *Polysiphonia brodiei* whole plant and detail of pericentral bands being corticated with rhizoids (arrowed)



Figs 30 a, b *Polysiphonia forfex* 1-sided branching

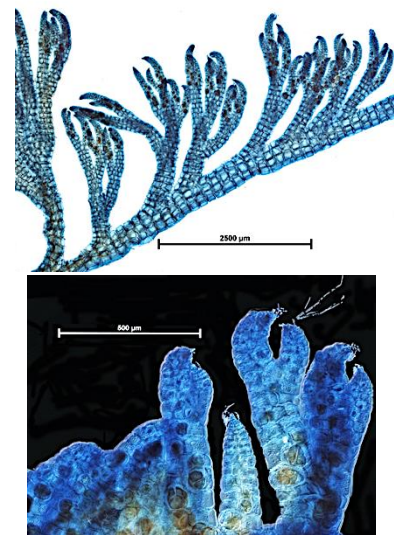


Fig. 31: *Polysiphonia forfex* tips curved inwards



Fig. 33: *Polysiphonia atricapilla* cross section, central filament ringed by 10 pericentral cells

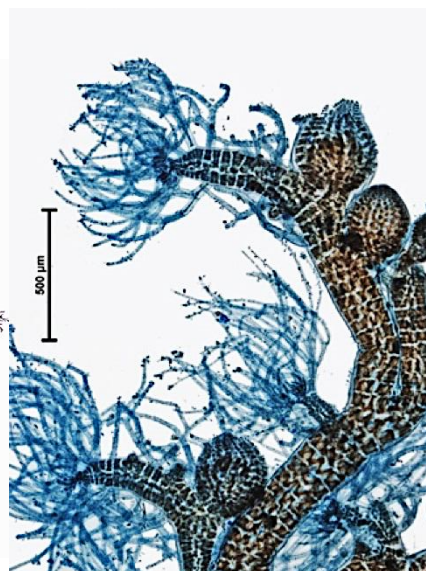


Fig. 34a: *Polysiphonia atricapilla* tips with trichoblasts, squat pericentral bands, box-shaped pericentral cells, flask-shaped cystocarps

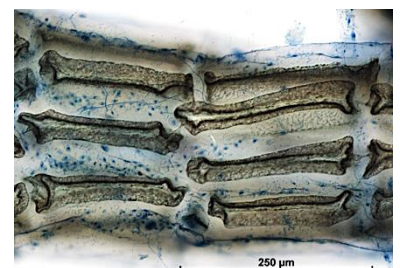
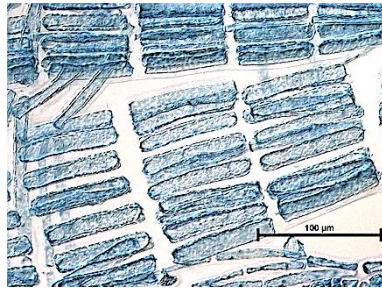
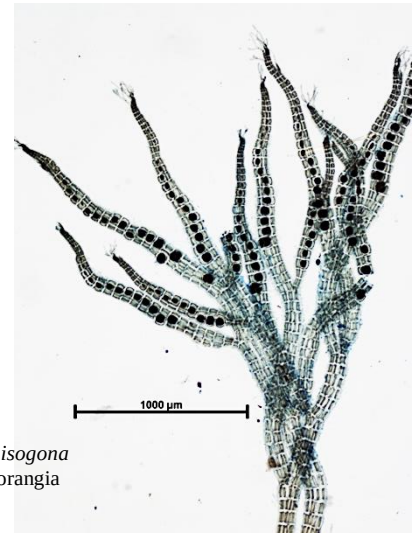


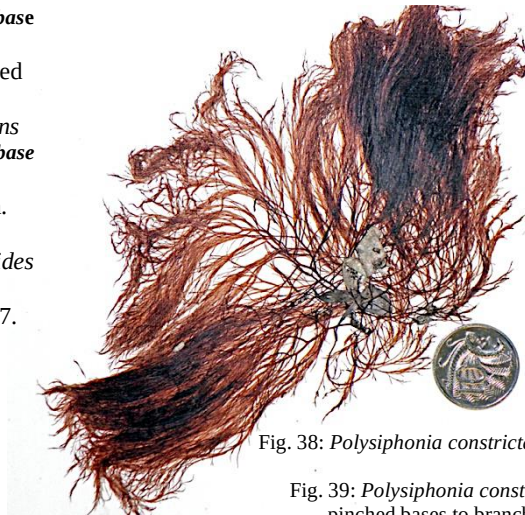
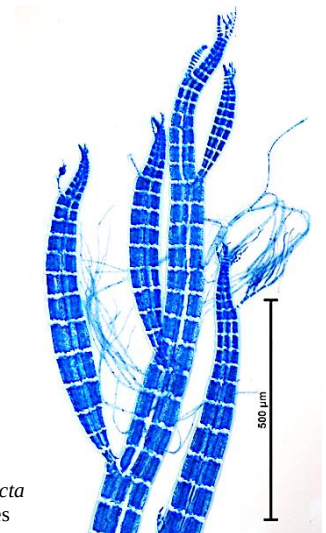
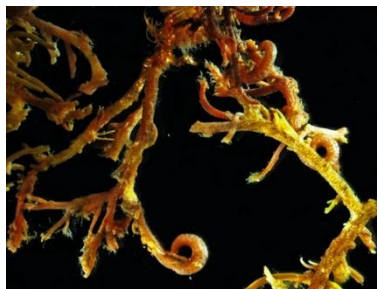
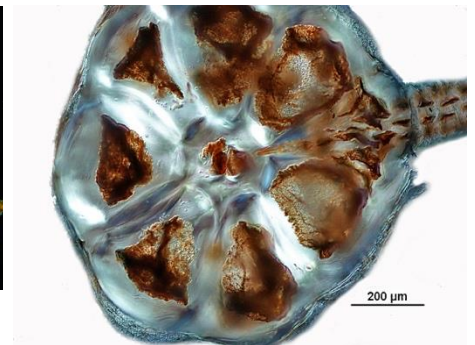
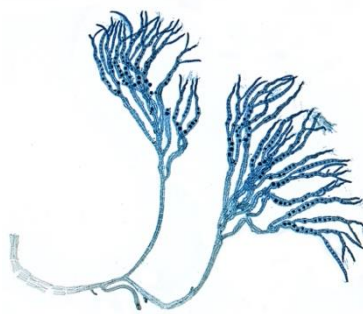
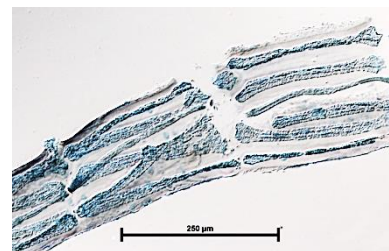
Fig. 34b: *Polysiphonia atricapilla* rectangular bands and elongate pericentral cells in mature parts

Fig. 35: *Polysiphonia isogona*Fig. 36: *Polysiphonia isogona*
tissue squash, 9 elongate pericentral cellsFig. 37: *Polysiphonia isogona*
apices bearing sporangia

- 15a. branches **pinched basally**, branching parallel (fastigate). Figs 38-39..... *Polysiphonia constricta* as ¹*Vertebrata constricta* in *Algaebase*
15b. branches **not** constricted, branching spreading (patent). A common, widespread species, hooked tendrils often occur basally. Figs 40-42.

..... *Polysiphonia decipiens* as ¹*Vertebrata decipiens* in *Algaebase*

- 16a. plants with basal runner, many upright branches, probably restricted to Tasmania. Pericentral cells per band = 5 (rarely 4). Figs 43-45 *Polysiphonia abscissoides*
16b. plants intertidal or from deep water. **Pericentral cells per band 4** 17.

Fig. 38: *Polysiphonia constricta*Fig. 39: *Polysiphonia constricta*
pinched bases to branchesFig. 40:
Polysiphonia decipiensFig. 41: *Polysiphonia decipiens*
hooked tendrilsFig. 42: *Polysiphonia decipiens*
cross section, 7 pericentralFig. 43: *Polysiphonia abscissoides*Fig. 44: *Polysiphonia abscissoides*
creeping base, upright branchesFig. 45: *Polysiphonia abscissoides*
Tissue squash, 5 pericentral cells (plus central filament cell) per band. Band heights/width > 2

17a. a deepwater plant of several main branches, **coiled tendrils** basally, 4 pericentral cells per rectangular band. Figs 46-49.

..... *Polysiphonia shepherdii*
 17b. plants in shallow or deep water, tangled basally or with a definite main axis, coiled tendrils present **or** absent, pericentral cell bands cubic **or** **rectangular** 18.

18a. growing in harbours, possibly introduced, filaments 200 μm wide, tangled basally, laterals short, **suddenly** coming to a **microscopic point**. Figs 50, 51.
 *Polysiphonia senticulosa*
 18b. tips not pointed 19.

19a. filaments thin, $\sim 100 \mu\text{m}$ wide, plants with a single axis basally. Figs 52-54.
 *Polysiphonia mollis*
 19b. filaments generally $> 100 \mu\text{m}$ wide 20.

21. plants often dark red-brown, lower branches 0.5-1.0 mm wide 22.
 21. plants red to red-brown, filaments generally $< 0.5 \text{ mm}$ wide 23.

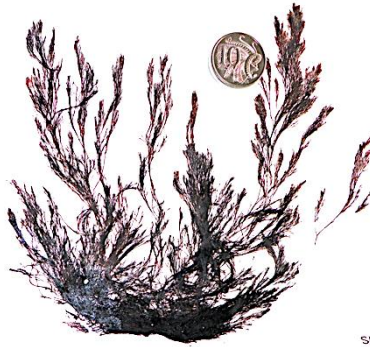


Fig. 46: *Polysiphonia shepherdii*



Fig. 48: *Polysiphonia shepherdii* coiled tendrils



Fig. 47: *Polysiphonia shepherdii* variation in shape



Fig. 49: *Polysiphonia shepherdii* cystocarp, trichoblasts numerous, may be on every band; 4 pericentral cells per rectangular band



Fig. 50: *Polysiphonia senticulosa*

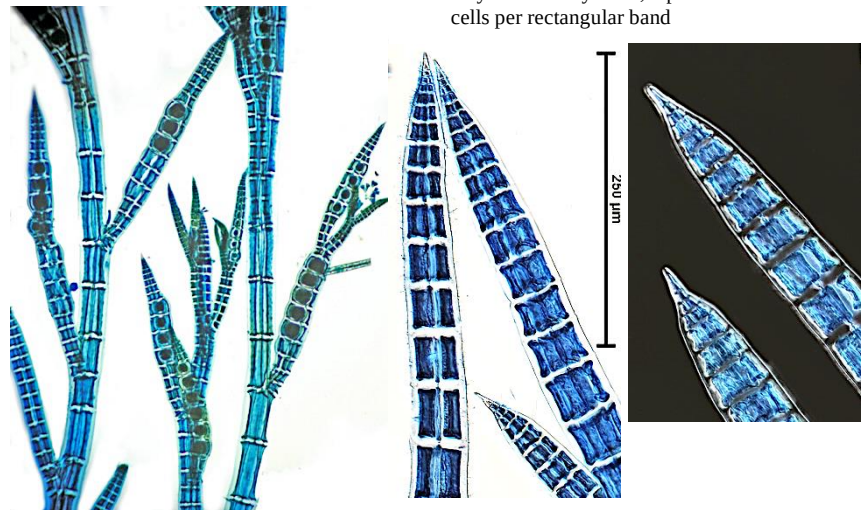


Fig. 51a, b, c: *Polysiphonia senticulosa* filament tips **pointed**, sporangia present



Fig. 52: *Polysiphonia mollis* single axis basally

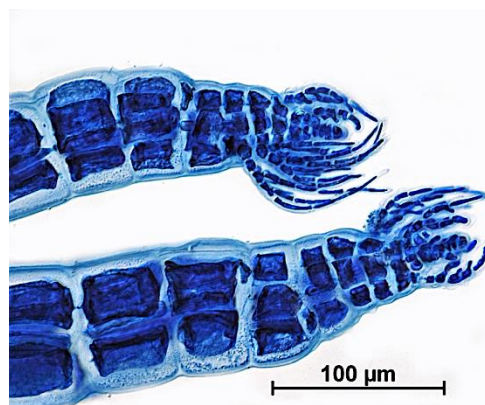


Fig. 53: *Polysiphonia mollis* blunt tips bearing trichoblasts

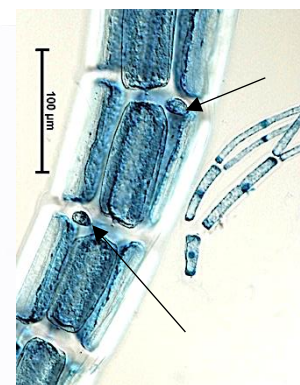


Fig. 54: *Polysiphonia mollis* pericentral bands from the middle of the plant; scars from shed trichoblasts (arrowed)

- 22a. **rare** deepwater plants, pericentral cells **cubic** (L/B ~ 1). Unique, stalked vegetative organs (**propagules**) and curled tendrils present. Figs 55-58. *Polysiphonia propagulifera*
- 22b. widespread and common species, usually on Tapegrass (*Posidonia*), pericentral cells variable in shape; tips pincer-like; propagules and tendrils **absent**. Figs 59-62. *Polysiphonia succulenta*



Fig. 55: *Polysiphonia propagulifera*

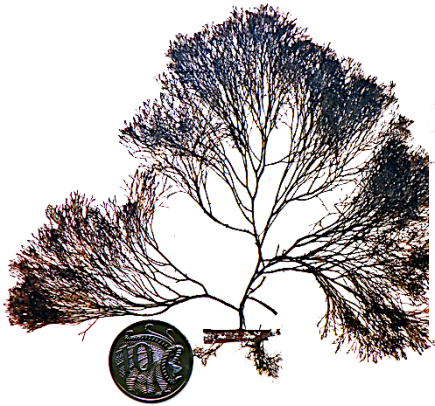


Fig. 59a, b: *Polysiphonia succulenta*
variation in plant shape

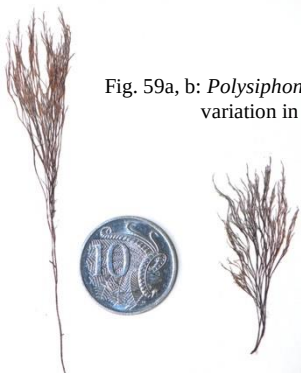


Fig. 62a, b: *Polysiphonia succulenta*
variation in pericentral
cell dimensions,
sporangia



Fig. 56: *Polysiphonia propagulifera*
branches narrowing evenly to a point;
prominent stalked propagules (arrowed)

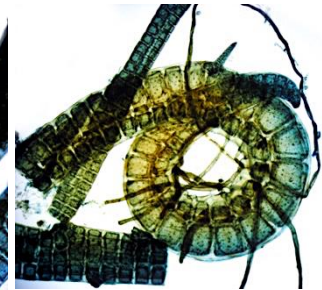


Fig. 57: *Polysiphonia propagulifera*
curled tendrils

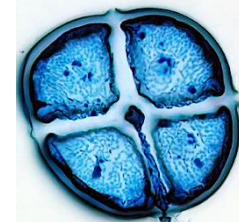


Fig. 58: *Polysiphonia propagulifera*
cross section,
4 prominent pericentral cells

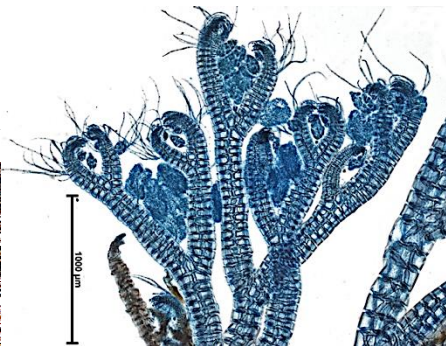
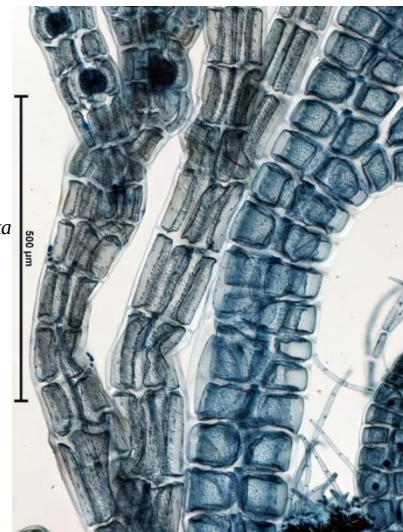


Fig. 60: *Polysiphonia succulenta*
pincer-like tips, spermatangial
masses



Fig. 61: *Polysiphonia succulenta*
cystocarps



- 23a. plants dark brown, usually on rock, many upright branches from a basal mass of horizontal filaments bearing rhizoids; cell walls **coloured brown**. Figs 63-66 *Polysiphonia blandii* as *Melanothamnus blandii* in *Algaebase*
- 23b. plants red brown, on rock or other plants; cell walls colourless 24.

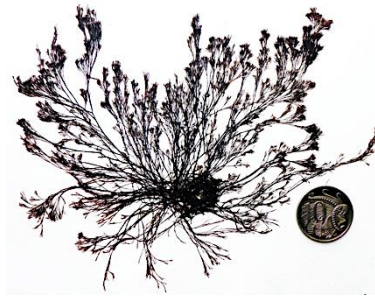


Fig. 63: *Polysiphonia blandii*

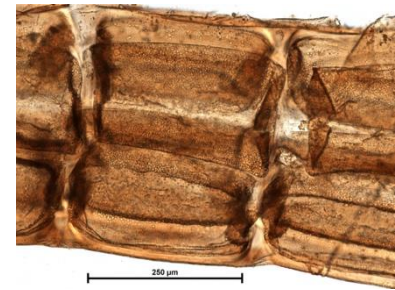


Fig. 64: *Polysiphonia blandii* brown cell walls

- 24a. usually intertidal in rough waters; base clumped, giving rise to several upright main branches, laterals spreading, about 1 mm long. Pericentral cells wrapped in additional cells (corticated). Figs 67-69. *Polysiphonia australiensis*
- 24b. intertidal or in deep water, pericentral cells elongate or equal-sided, corticated or uncorticated 25.

- 25a. plants **un-corticated**, filaments 70-150 µm wide 26.

- 25b. plants heavily **corticated**, at least on main branches, 250-1000 µm wide 27.

- 26a. filaments 100-350 µm wide, band shape varies from squarish to highly elongate in the middle plant parts (L/B = 1-12). Figs 70-72 *Polysiphonia perrinae*
- 26b. delicate plant of sheltered bays, filaments 70-80 µm wide, bands rectangular. Figs 73-75 (next page)

..... *Polysiphonia subtilissima*

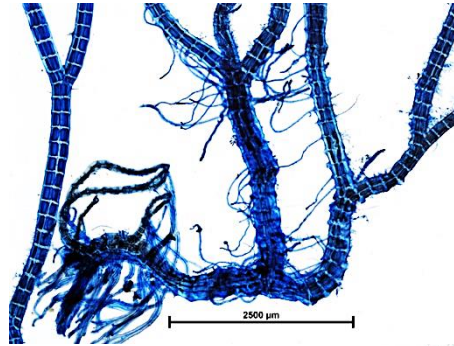


Fig. 65: *Polysiphonia blandii* filaments from the matted plant base, bearing 1-2 rhizoids per cell



Fig. 66: *Polysiphonia blandii* plant tips parallel (not pincer-like)



Fig. 67: *Polysiphonia australiensis*

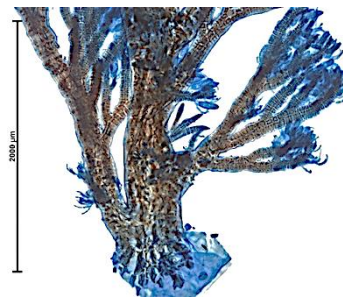


Fig. 68: *Polysiphonia australiensis* clumped base

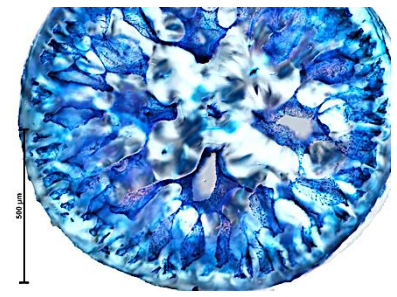


Fig. 69: *Polysiphonia australiensis* cross section; 4 pericentral cells divided outwardly to form cortical cells

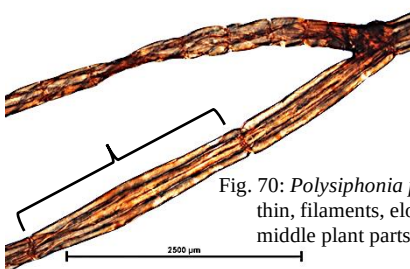


Fig. 70: *Polysiphonia perrinae* thin, filaments, elongate bands in middle plant parts (bracketed)



Fig. 71: *Polysiphonia perrinae*

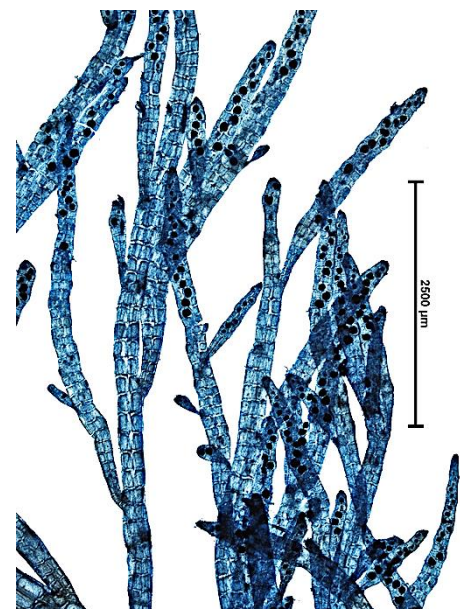


Fig. 72: *Polysiphonia perrinae* bands squarish near plant tips



Fig. 73: *Polysiphonia subtilissima*

- 27a. deepwater plant attached by a single basal disc 1-3 mm across, major branches to 1 mm wide, heavily corticated, laterals tufted and uncorticated, bases pinched basally. Figs 76-78.
 *Polysiphonia crassiuscula*
- 27b. on other algae, major branches about 250 μ m wide, several spreading, long side branches, filaments **not** pinched basally. Figs 79-82.
 *Polysiphonia daveyae*

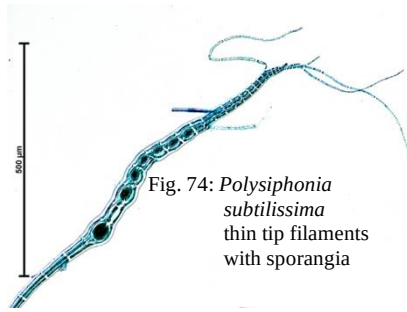


Fig. 74: *Polysiphonia subtilissima*
thin tip filaments
with sporangia

Fig. 75: *Polysiphonia subtilissima*
variation in pericentral cell and
band dimensions

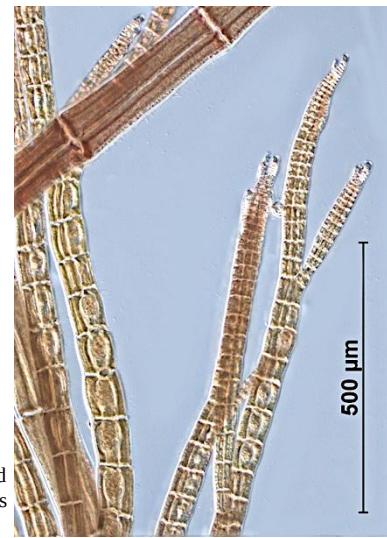


Fig. 76: *Polysiphonia crassiuscula*
heavily corticated axis, un-
corticated laterals

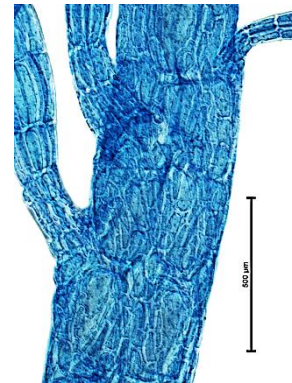
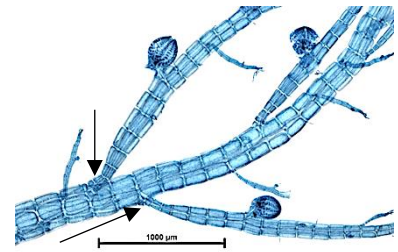


Fig. 77: *Polysiphonia crassiuscula*

Fig. 78: *Polysiphonia crassiuscula*
cystocarps on laterals
pinched basally (arrowed)



Figs 79, 80a: *Polysiphonia daveyae*
whole plant and young plants on the Red
alga *Lenormandia spectabilis*



Fig. 81: *Polysiphonia daveyae*
cross section, 4
pericentral cells
corticated



Fig. 82: *Polysiphonia daveyae*
spreading laterals,
corticated to near the tips

LIST OF SPECIES ILLUSTRATED

species	author/s	page	name in <i>Algaebase</i>	authors
<i>Polysiphonia abscissoides</i>	Womersley	6		
<i>Polysiphonia adamsiae</i>	Womersley	4		
<i>Polysiphonia amphibolis</i>	Womersley	3		
<i>Polysiphonia atricapilla</i>	J. Agardh	5		
<i>Polysiphonia australiensis</i>	Womersley	9		
<i>Polysiphonia blandii</i> (syn.)	Harvey	9	<i>Melanothamnus blandii</i>	(Harvey) Díaz-Tapia & Maggs
<i>Polysiphonia brevisegmenta</i>	Womersley	2		
<i>Polysiphonia brodiei</i> (syn.)	(Dillwyn) Sprengel	5		
<i>Polysiphonia constricta</i> (syn.)	Womersley	6	<i>Leptosiphonia brodiei</i>	(Dillwyn) Savoie & G. W. Saunders
<i>Polysiphonia crassiuscula</i>	Harvey	10	<i>Vertebrata constricta</i>	(Womersley) Díaz-Tapia & Maggs
<i>Polysiphonia daveyae</i>	Reinbold	10		
<i>Polysiphonia decipiens</i> (syn.)	Montagne	6		
<i>Polysiphonia forfex</i> (syn.)	Harvey	5	<i>Vertebrata decipiens</i>	(Montagne) Kuntze
<i>Polysiphonia haplodasyae</i>	Womersley	2	<i>Melanothamnus forfex</i>	(Harvey) Díaz-Tapia & Maggs
<i>Polysiphonia infestans</i> (syn.)	Harvey	3		
<i>Polysiphonia isogona</i> (syn.)	Harvey	4		
<i>Polysiphonia mollis</i>	Hooker f. & Harvey	7	<i>Melanothamnus infestans</i>	(Harvey) Huisman
<i>Polysiphonia perrinae</i>	Womersley	9	<i>Vertebrata isogona</i>	(Harvey) Díaz-Tapia & Maggs
<i>Polysiphonia propagulifera</i>	Womersley	8		
<i>Polysiphonia scopulorum</i>	Harvey	4		
<i>Polysiphonia senticulosa</i>	Harvey	7		
<i>Polysiphonia sertularioides</i>	(Grateloup) J. Agardh	4		
<i>Polysiphonia shepherdii</i>	Womersley	7		
<i>Polysiphonia subtilissima</i>	Montagne	9		
<i>Polysiphonia succulenta</i>	Harvey	8		
<i>Polysiphonia teges</i> (syn.)	Womersley	3		
			<i>Lophosiphonia teges</i>	(Womersley) Díaz-Tapia & Maggs

REFERENCES

Algaebase Listing the world's algae <https://www.algaebase.org/> accessed January 2025

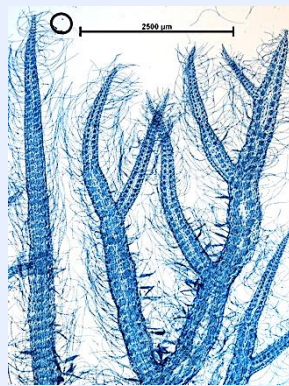
¹Díaz-Tapia, P., McIvor, L., Freshwater, D.W., Verbruggen, H., Wynne, M.J. & Maggs, C.A. (2017). The genera *Melanothamnus* Bornet & Falkenberg and *Vertebrata* S.F. Gray constitute well-defined clades of the red algal tribe Polysiphonieae (Rhodomelaceae, Ceramiales). *European Journal of Phycology* 52(1): 1-20, 77 figs

²Savoie, A.M. & Saunders, G.W. (2018 '2019'). A molecular assessment of species diversity and generic boundaries in the red algal tribes Polysiphonieae and Streblocladieae (Rhodomelaceae, Rhodophyta) in Canada. *European Journal of Phycology* 54(1): 1-25

Womersley, H.B.S. (2003) The marine benthic flora of southern Australia Part IIID. ABRS and the State Herbarium of South Australia

SOME LOOK-ALIKE ALGAE

SARCOTRICHIA
Family: Sarcomeniaceae



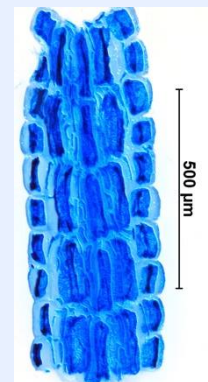
Similarities

- cells in bands
- numerous filaments that could be mistaken for trichoblasts

Difference

- axes thin but flattened

PLATYSIPHONIA
Family: Sarcomeniaceae



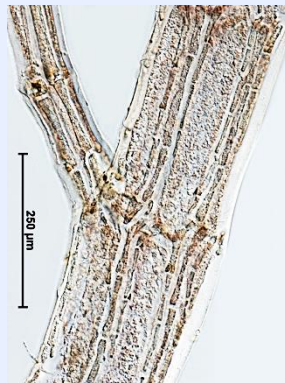
Similarities

- forked branching

Differences

- axes thin but flattened
- pairs of cells formed on pericentral cells

DASYA
Family: Dasyaceae



Similarities

- branching generally forked
- ultimate branches coloured, often uncorticated

Difference

- main branches often **corticated** with lines of rhizoids

BROGNIARTELLA
Tribe: Lophothalieae



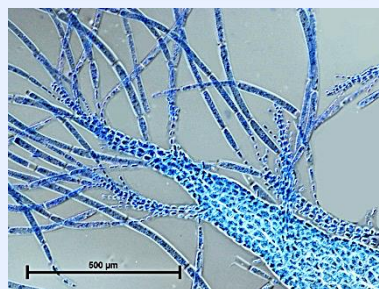
Similarities

- ultimate branches filamentous, uncorticated,
- main branches **corticated**

Differences

- laterals short
- filaments crowded, curve over tips and **enclose** them

Gonatogenia
Tribe: Lophothalieae



Similarities

- thin branches
- filamentous trichoblasts at tips

Difference

- trichoblasts are coloured