WIRY BROWN ALGAE. 3rd EDITION

Images used below

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

Scale

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

Descriptive names

Those marked § come from Edgar, G. *Australian Marine Life, 2nd Ed.* (2008)

Limitations

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

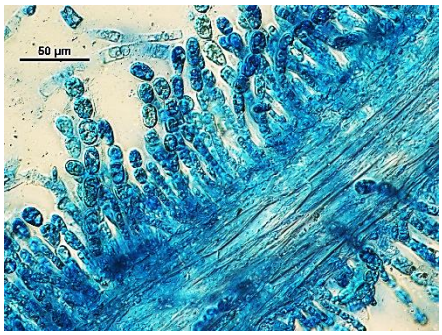
This key is restricted to brown algae 10-500 mm tall, many of which have prominent hair tufts, cylindrical branches up to 3 mm wide, equal-sided cells when viewed microscopically in cross section (see Fig. 33).

Most belong to the Family: Sporochnaceae.

EXCLUSIONS:

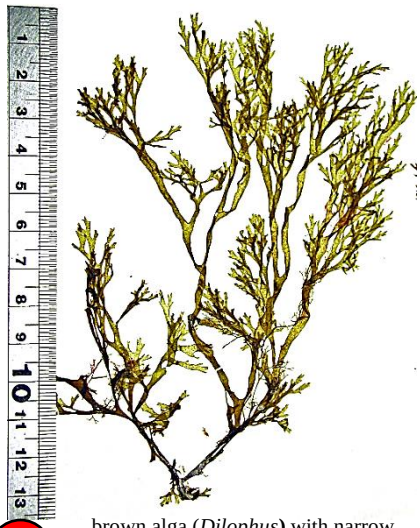
1. soft and slimy, worm-like algae of many threads interwoven together, ending in beaded chains of cells, ***or*** thread- like algae consisting of single chains of exposed cells (examples opposite).
   These are covered in the key "Turf and fouling algae III: encrusting, thread- and worm-like brown algae"
2. brown, algae with stiff, upright threads or filaments in tufts, only about 10 mm tall, with prominent tip cells when growing actively that produce lines of cells dividing lengthwise forming ***prominent bands*** along threads (example below)
   These are covered in the key "*Sphacelaria* (including *Herpodiscus*)"
3. algae with narrow, flat, ribbon-like or hollow blades only about 10 mm wide, ***or*** regularly forked
   These are covered in the key "ribbon-like Brown algae"

soft, ***slim***y brown alga, (*Cladosiphon*) – ***excluded*** from this key



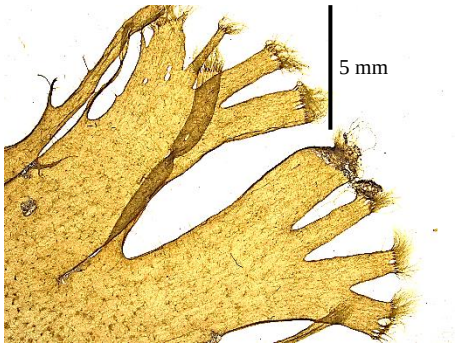
brown algae of interwoven ***threads*** ending in beaded chains of cells - ***excluded*** from this key

brown alga (*Scytosiphon*) with narrow, ***ribbon-like*** blades – ***excluded*** from this key

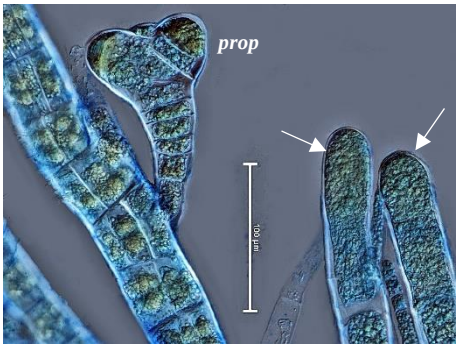


brown alga (*Dilophus*) with narrow, ***ribbon-like*** blades regularly forked – ***excluded*** from this key

brown alga (*Cutleria*), ***ribbon-like*** blades with split ends – ***excluded*** from this key



small brown alga (*Sphacelaria*) with ***prominent apical cells*** (arrowed) stiff, narrow, ***banded*** branches and uniquely shaped propagules (***prop***)



KEY

1b. branching usually dense, tufted, unless plant is ***denuded***, young branches ***banded*** microscopically or in ***rings*** about axes unless plant has been denuded ……14.

1a. branching open, branches, ***not*** banded, short laterals ***not*** in rings …… 2.

2a. dried plants almost black, stiff, wiry, several main branches (axes) densely covered with shorter, upright, radial side branches tipped with ***microscopic caps***, also with hair tufts if growing rapidly; plant base becoming thick and warty with age, up to 100 mm wide. Figs 1-3 ……..…***Perithalia caudata*** (§ Spiky tuftweed, Mermaid's hair)

2b. plants pale- to dark-brown, variously branched; often with prominent hair-tufts at tips, plant bases smaller ….....….... 2.

2a. prominent hair-tufts at tips of numerous short, wiry or peg-shaped ***side*** branches …..…….…….. 3.

2b. hair-tufts fringe all branch surfaces ***or*** are found only at branch tips ***or*** are absent …… 10.

3a. side branches arise from common points on main branches (axes) (like struts of an umbrella); hair-tufts at tips are large (like powder-puffs). Often growing in coarse sand. Figs 4, 5. …….. ***Bellotia eriophorum*** (§ Chimney-brush seaweed")

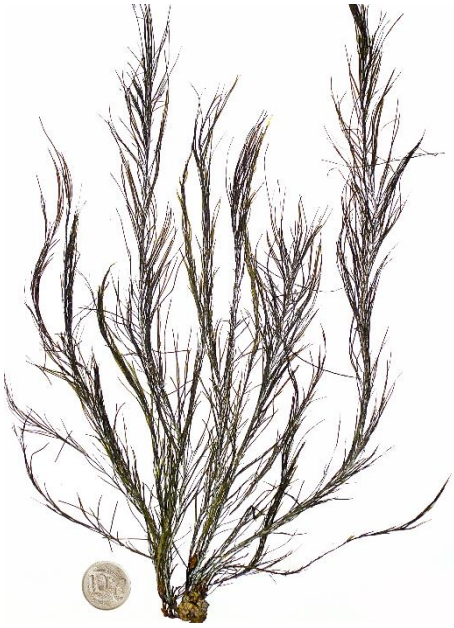
3b. side branches arise radially or in 2 rows along the axes ……...… 4.

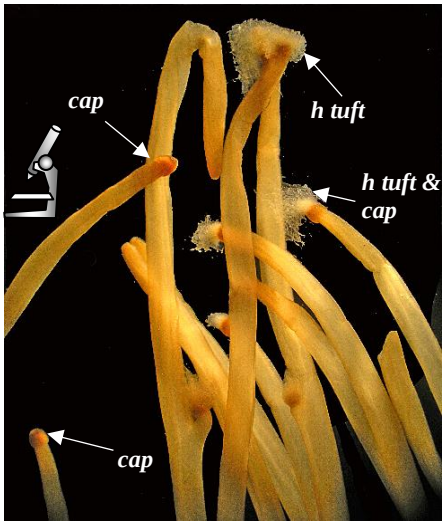
4a. plants consist of single main branches (axes) and long, spreading side branches fringed with small, wiry branchlets tipped with hair-tufts ……... 5.

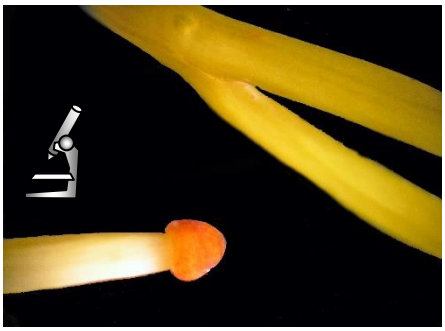
4b. plants consist of several axes fringed with small branchlets tipped with hair-tufts …… 7.

5a. plants often large (200 mm-1,000 mm tall), bases often covered with a felt of hairs, side branches ***spreading***, bearing thin branchlets tipped in hair-tufts. When fertile laterls and bases of branchlets are covered with microscopic hairs bearing spore-sacs in rows on one side. Figs 6-9 (next page) ……..… ***Encyothalia cliftonii*** (§ "Tuft-weed")

5b. not as above ……...…….. 6.







Figs 1-3: *Perithalia caudata*,
Above: whole plant
Right, above: branch tips, tip cups, some also with hair tufts
Right, below:
detail of tip-cup

Fig. 4: *Bellotia eriophorum* growing in sand, Dutton Bay, SA. Photo: D Muirhead

Fig. 5: *Bellotia eriophorum*, side branches arising in bunches from one point

Figs 6-8: *Encyothalia cliftonii*
Far left: whole plant
Centre: detail of laterals bearing radial branchlets with terminal hair-tufts
Above: detail of tufted branchlets

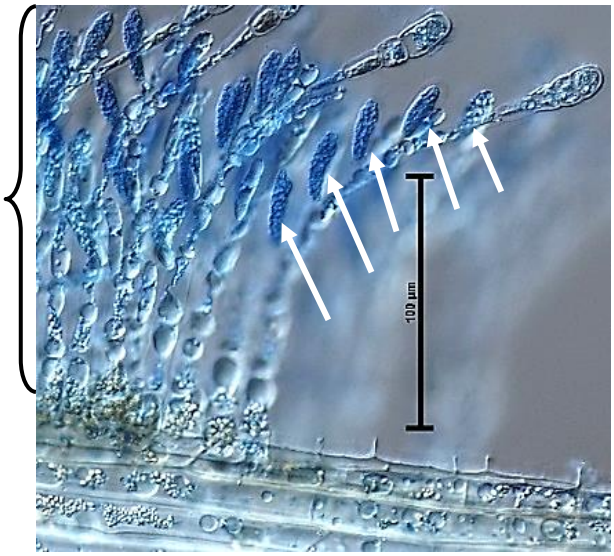


Fig. 9: *Encyothalia cliftonii*: fertile microscopic hairs (bracketed) with bulbous tips arising from the surface of a lateral and bearing cigar-shaped sporangia (arrowed) on one side

6a. axes narrow (0.2-0.4 mm wide); branchlets numerous, the hairy tufts at their tips producing an overall woolly appearance to the plant; fertile branchlets have a short stalk. Figs 10-12.
…… ***Sporochnus pedunculatus***
*Yee (2007) found some specimens included under ***Sporochnus comosus*** in the *Marine Benthic Flora* belong to this cosmopolitan and variable species

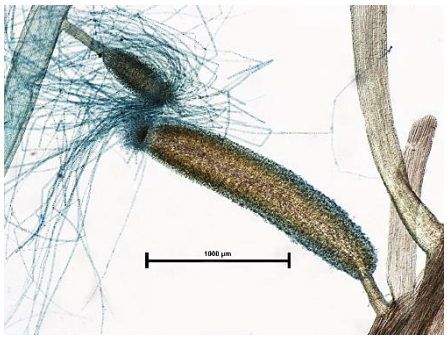
6b. axes thicker (0.5-1.5 mm wide), fertile branchlets are ***stalkless***. Figs 13-15
…… ***Sporochnus apodus***

7a. plants large, 200-900 mm tall, tree-like; axes thick, 1-2 mm wide with a prominent disc-shaped holdfast; side branches divided several times. Figs 16-18.
…… ***Sporochnus radiciformis***

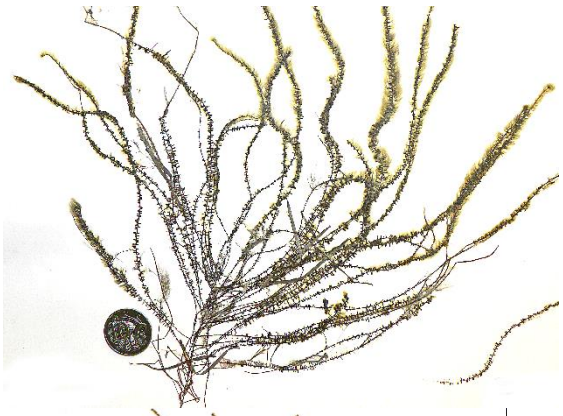
7b. plants smaller, branching more open, holdfast less conspicuous …… 8.

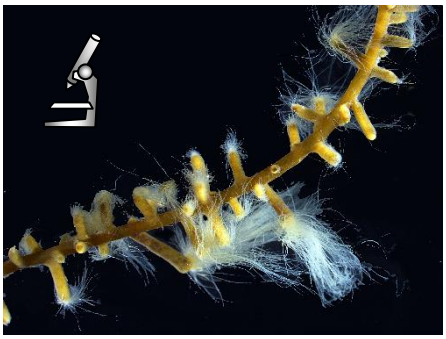
8a. branchlets long, thin, and when fertile have a relatively long stalk (2-10 mm) Figs 19-21 (next page)
…… ***Sporochnus moorei***

8b. fertile branchlets with a short stalk
…… 9.

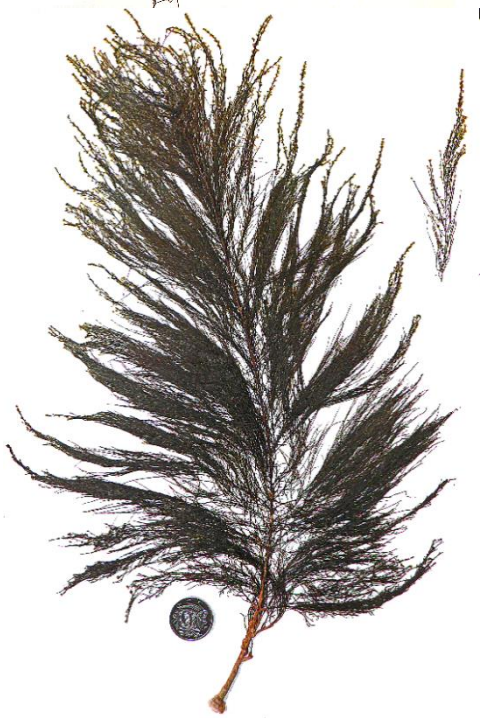


Figs 10-12: *Sporochnus pedunculatus*
Above: whole plant
Right, above: young, stalked fertile branchlets
Right, below: developing and mature branchlets





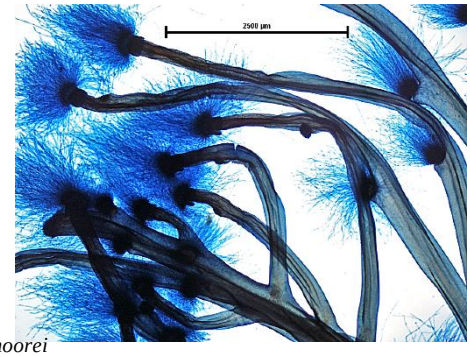
Figs. 13-15: *Sporochnus apodus*
Left: whole plant
Above: two magnifications of stalkless, fertile branchlets



Figs 16-18: *Sporochnus radiciformis*
Left: whole plant
Above: basal pad
Above: stalked fertile branchlets

*Yee, N. R. (2007). *Phylogenetic Studies of the Marine Brown Algal Order Sporochnales(Phaeophyceae)*. Ph.D. thesis, School of Botany, University of Melbourne

Figs 19-21: *Sporochnus moorei*
Whole plant

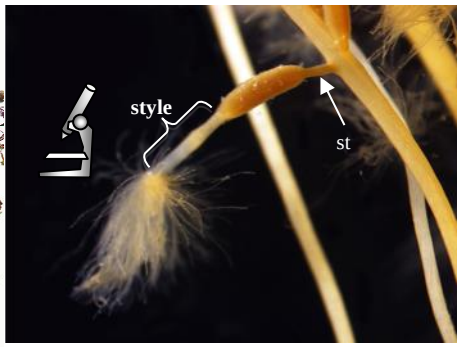


Above: linear side branches

Above: fertile branchlets with long stalks (***st***)

9a. plants much-branched; fertile branchlets elongate with sterile sections just below the tuft of hairs at tips. Figs 22-23. …… ***Sporochnus stylosus***

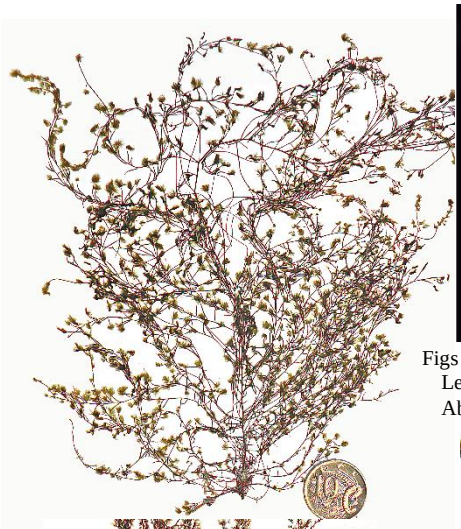
9b. plants may be excessively hairy; fertile branchlets egg-shaped, becoming elongate and sometimes curved, sterile sections below the tips are ***absent***. Figs 24-26 …….. ***Sporochnus comosus***
according to Yee, 2014, only some of the specimens listed under this name in the Flora belong to this species; the others belong to *S. pedunculatus* (see above)

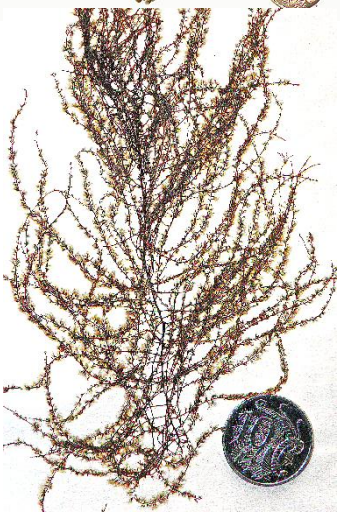


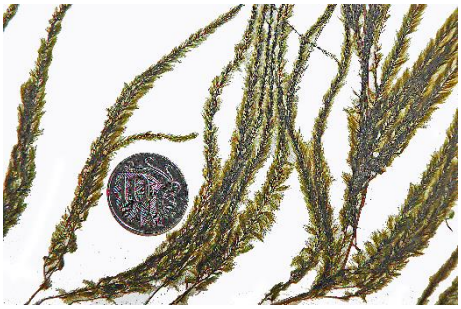
Figs 22, 23: *Sporochnus stylosus*
Left: whole plant
Above: fertile branchlet, stalk (***st***), sterile section (***style***)

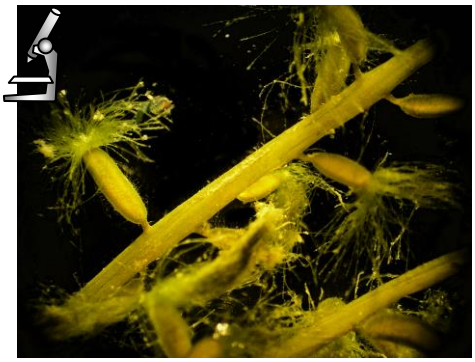
10a. branches somewhat compressed and when fertile, tips end in unique cup-and-cone shaped structures, but when non-reproductive, they bear dense hair tufts that are, however, readily shed. Figs 27-30 ……... ***Carpomitra costata***

10b. branches cylindrical; cup-and cone-structures ***absent***; hairs usually prominent ..... 11.





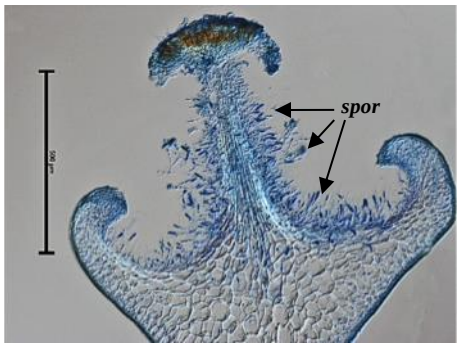




Figs 24-26 *Sporochnus comosus*
Above: whole plant
Right, above: detail, dense branchlets tip-hairs
Right, below: stalked fertile branchlets, dense

Figs 27-30: *Carpomitra costata*
Top: wiry branches ending in prominent hair-tufts
Below: fertile cup-and-cone tips

Above: tips with dense hairs



Above; fertile cup-and-cone tip in lengthwise section, minute spore sacs (***spor***)

11a. branch surfaces swathed in masses of ***long***, ***individual***, coloured hairs. Figs 30-33.
…… ***Sporochnus herculeus***
as ***Sporochnema tomentosum*** in the Flora
rare: only known from 22-30m deep at two sites in S Australia

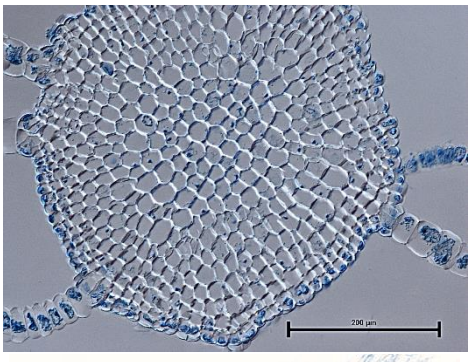
11b. branch surfaces hairless, ***or*** with hairs in discrete ***patches*** ..... 12.

12a. hairs in dense ***patches*** scattered along branch surfaces giving the plant a fuzzy appearance; microscopic spore sacs (sporangia) occur at the base of hairs. Figs 34-36.
…….. ***Austronereia australis***

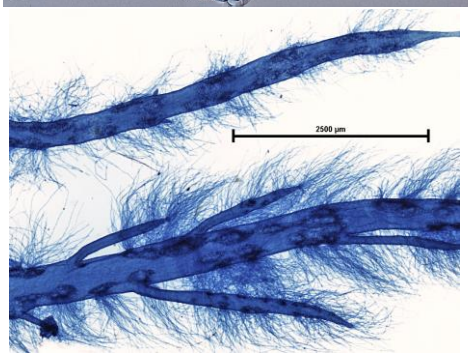
12b. hairs at branch tips ***or*** hair-like side branches in rings around branches ..... 13.

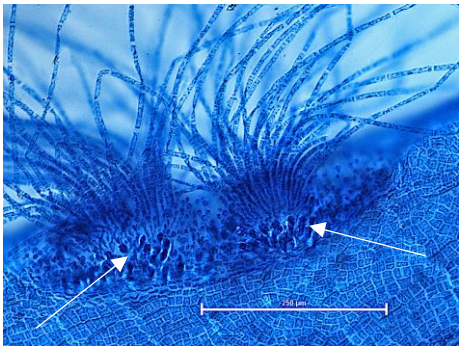
13a. hair-like side branches in rings of 4; main branches in ***opposite pairs***. Figs 37 38.
…… ***Arthrocladia villosa***
Family: Arthrocladiaceae
rare: one collection only from Pt Stanvac, S Australia, probably introduced from temperate N Hemisphere waters

13b. hair-tufts at branch tips; branch surfaces bumpy due to microscopic, globe-shaped outgrowths. Figs 39-41 (next page)
……..... ***Nereia lophocladia***
rare: only known from one collection at Pt Phillip Heads, Vic

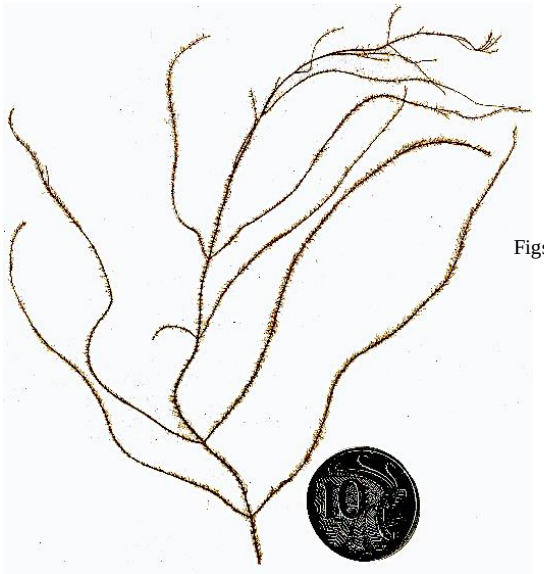


Figs 30-33: *Sporochnus herculeus*
Above: two images of hairy branches
Right: cross section showing equal-sided cells (parenchyma)



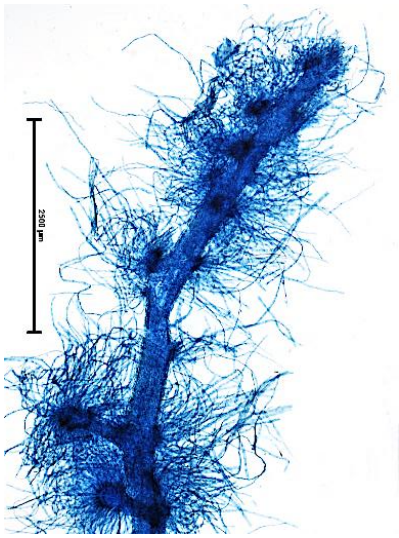


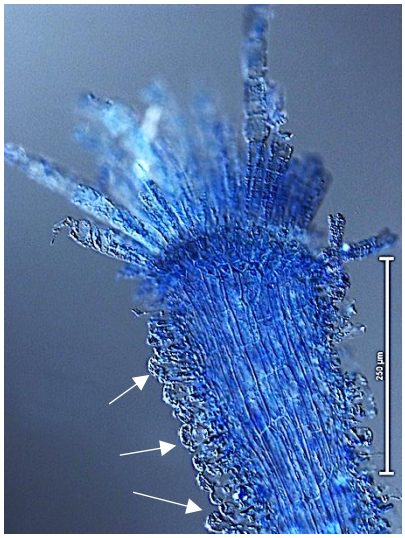
Figs. 34-36: *Austronereia australis*
Right whole plant
Far right: two magnifications of hair-patches on branch surfaces, the lower image showing minute spore sacs at bases of hairs



Figs 37, 38 *Arthrocladia villosa*
Left: whole plant
Right: hair-like side branches in rings of 4

(from previous page)





Figs 39-41: *Nereia lophocladia*,
Above: whole plant
Right: stubby laterals with tufts of long filaments apically
Far right: branch tip, globe-shaped outgrowths on surfaces (arrowed)

(From step #1:
young branches ***banded*** microscopically ***or*** in ***rings*** about axes unless plant has been denuded)

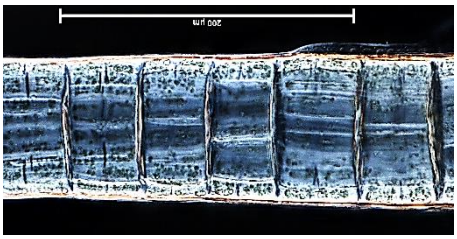
14a. laterals radially branched; axes microscopically ***banded*** when young ……. 15.

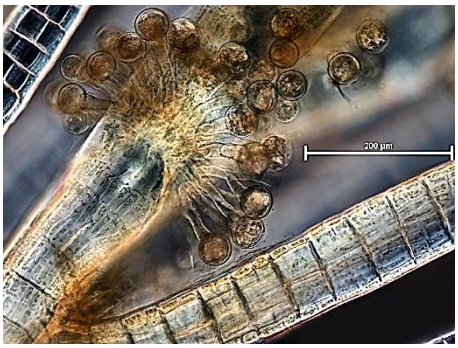
14b. stubby laterals ***in rings*** about axes, ***not*** banded when young.
Figs 42-45 … ***Cladostephus spongiosus***

15a. axes naked (un-corticated) except for rhizoids, end branch tufts brush-like, edges may be of a lighter colour.
Figs 46-49 (next page).
…… ***Halopteris* 5 spp**
H. paniculata, § Twisted filamentweed is illustrated

15b. main branches coated (corticated) with additional cells, rhizoids ***absent***. Figs 50-53 (next page) ….
***Phloiocaulon* 2 spp**
…….…. ***P. spectabile*** is illustrated

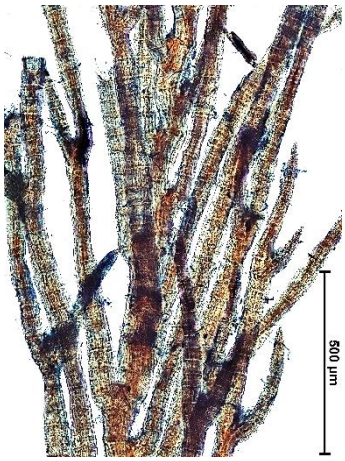
Figs 42-45 *Cladostephus spongiosus*
Above, right: whole plant, not denuded
Left: plant denuded of characteristic rings of short branches, thin, wiry axes only remaining
Centre and right: characteristic rings of side branches of two lengths, highly magnified.



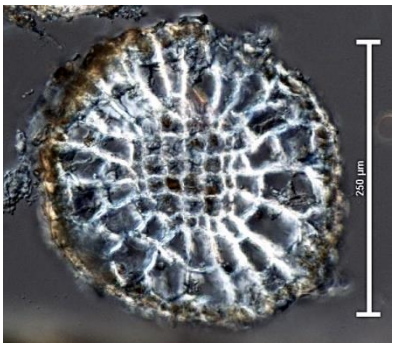


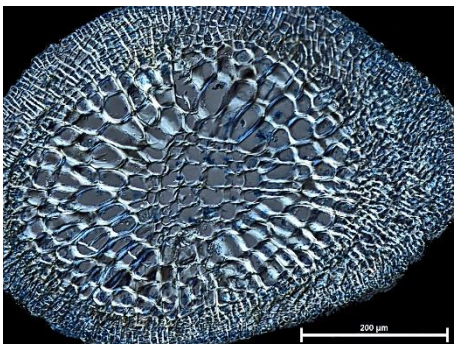
Figs 46-49 *Halopteris paniculata*
Variation in branching patterns of two plants

Upper: banded axis
Lower: bunch of stalked sporangia



Figs 50-53 *Phloiocaulon spectabile*
Above: whole plant (left) and detail of young (uncorticated) branches (right)
Below: cross sections showing central core of squarish cells and comparing a young (uncorticated) branch (left) with an older corticated branch (right)





Some additional Brown algae may become denuded of their characteristic side branches and so appear wiry, but careful investigation of specimens should distinguish them from the species in the above key.

SPECIES ILLUSTRATED IN THE KEY

species	author/s	Page/s
Arthrocladia villosa	(Hudson) Duby	6
Austronereia australis	(Harvey) Womersley	6
Bellotia eriophorum	Harvey	2
Carpomitra costata	(Stackhouse) Batters	5
Cladostephus spongiosus	(Hudson) C. Agardh	7
Encyothalia cliftonii	Harvey	2, 3
Halopteris paniculata	(Suhr) Prud'homme	7, 8
Nereia lophocladia	J. Agardh	6, 7
Perithalia caudata	(Labillardière) Womersley	2
Phloiocaulon spectabile	Reinke	7, 8
Sporochnema tomentosum (syn.)	Womersley	6
Sporochnus apodus	Harvey	4
Sporochnus comosus	C Agardh	5
Sporochnus herculeus (syn.)	J. Agardh	6
Sporochnus moorei	Harvey	4
Sporochnus pedunculatus	(Hudson) C. Agardh	4
Sporochnus radiciformis	(R. Brown *ex* Turner) C. Agardh	4
Sporochnus stylosus	Harvey	5