

PICTURED KEY TO SOME SOUTHERN AUSTRALIAN ALGAE: SPHACELARIA (including HERPODISCUS)

What are they?

Fifteen species of *Sphacelaria* are found in southern Australia, commonly growing on sea grasses and Brown algae. They have:

- brown, stiff, upright threads or filaments in tufts, only about 10 mm tall
- prominent tip cells when growing actively (see Fig. 4)
- lines of cells dividing lengthwise forming prominent bands along threads.

2 types of spore sacs on different plants may be present

Purpose of the 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 searching for a name. Then you can proceed to the appropriate fact sheets or further keys to refine your identification.

Limitations

Unfortunately, microscopic investigation will be needed for definite identifications.

Images used below

These come from pressed specimens or the extensive slide collection of the algal unit, State Herbarium of S Australia, 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

Recent name changes

Classification of species in the Flora has been retained below as it relies solely on shape and anatomy of plants. Recent name changes made on the basis of genetic markers and life cycles are annotated § and the new names listed in the appendix.

1a. rare, known from plants attached to *Cystophora botryocystis* at Brighton Victoria. Branching in 2 opposite rows. Figs 1-3. see also the separate information sheet

.....*Sphacelaria spuria* §

1b. branching forked, radial or irregular
..... 2.

2a. filaments $\leq 25\mu\text{m}$ across, plants usually $\leq 10\text{mm}$ tall 3.

2b. filaments $>25\mu\text{m}$ across, plants usually $>10\text{mm}$ tall 7.

3a. cells divide *across*, forming brick-like patterns within the filament bands of cells (as in Fig. 2.); dark cells (pericysts) *present*
..... 4.

3b. cells divide across rarely or not at all; dark cells (pericysts) *absent*
..... 6.

4a. rare, only known on *Platythalia angustifolia*, WA. Figs 4-7. see also the separate information sheet
.....*Sphacelaria multiplex* §

4b. more common and widespread, on larger Brown algae, some on seagrasses 5.

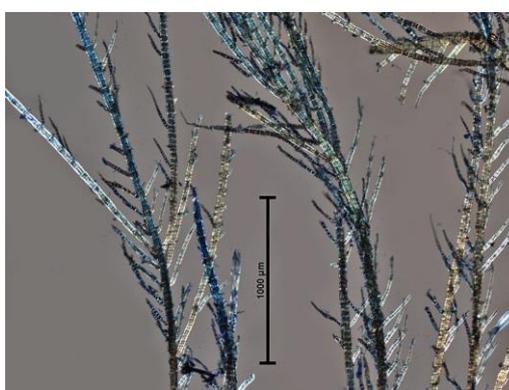


Fig. 1. *Sphacelaria spuria*: branching pattern

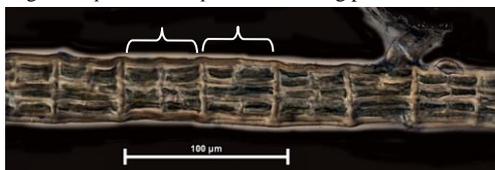


Fig. 2. *Sphacelaria spuria*: bands of cells, (two bracketed), some bands divided across

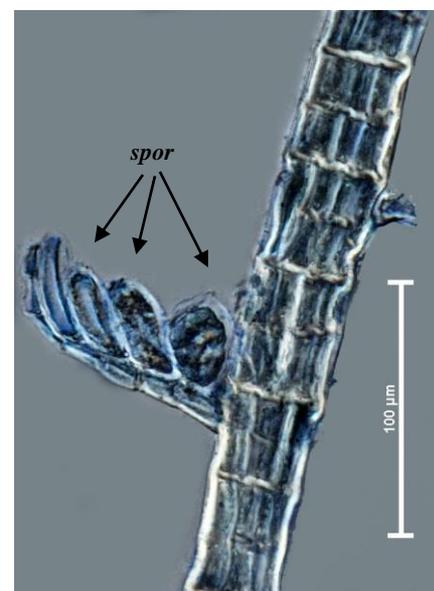


Fig. 3. *Sphacelaria spuria*: spore sacs with single compartments (*spor*) on short side branches

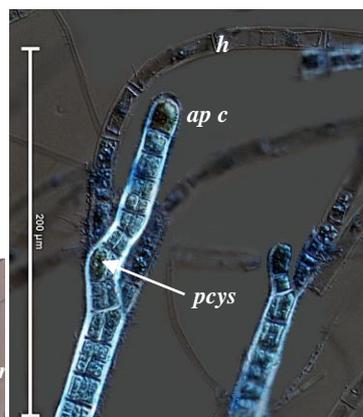


Fig. 4. *Sphacelaria multiplex*, branch tips: hairs (*h*), prominent tip cell (*ap c*), dense pericyst (*pcys*)

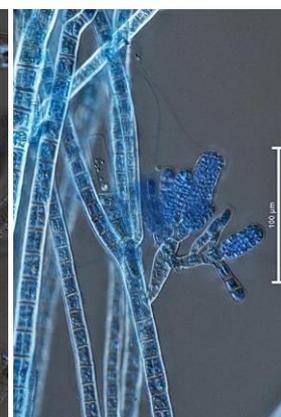


Fig. 5. *Sphacelaria multiplex*: many-compartmented spore sacs, on small, side branches

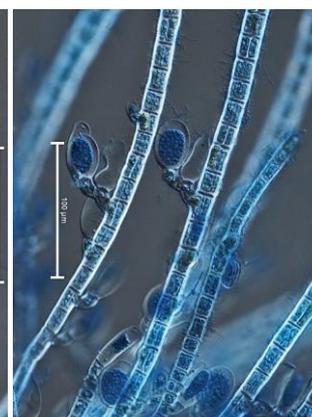


Fig. 6. *Sphacelaria multiplex*: 1-3, single-compartmented spore sacs, on side branches

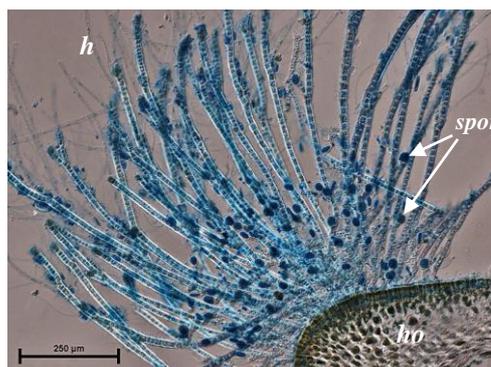


Fig. 7. *Sphacelaria multiplex*, cross section through the host (*ho*), dark stained spore sacs (*spor*), hairs (*h*)

5a. plants form dense, light-brown patches on *Carpoglossum confluens*. From West Coast SA to Tasmania. Figs 8-11.

..... *Sphacelaria carpoglossi* §
 5b. plants form patches 1-3mm across on *Cystophora* spp. From near Pt Lincoln SA to Tasmania. Figs.12-14.

..... *Sphacelaria bracteata* §
 6a. plants form patches 1-3mm across on *Cystophora* spp. From near Pt Lincoln SA to Tasmania. Figs.12-14.

..... *Sphacelaria bracteata* §
 6b. rare. Plants form dense “turfs” 2-3mm tall, probably exclusively on *Cystophora monilifera*. From Rottnest I and near Busselton WA. Figs. 15-18.

see also the separate information sheet

..... *Sphacelaria chorizocarpa*

7a. cells divide *across*, forming brick-like patterns within the filament bands (as in Fig. 2.); dark cells (pericysts) *present* 8.

7b. cells divide *across* rarely or not at all; dark cells (pericysts) *absent*; propagules (short 2- or 3-armed branches on stalks) found usually in summer are needed for confident species identification in this section of the key 9.



Fig. 8. *Sphacelaria carpoglossi* forming patches 0.5-2mm across on the dark blades of *Carpoglossum*

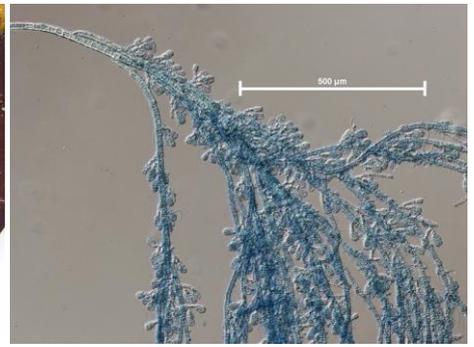


Fig. 9. *Sphacelaria carpoglossi*, dissected tuft: numerous short side branches bearing spore sacs arising at right angles

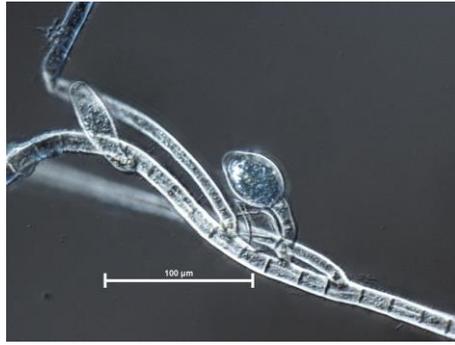
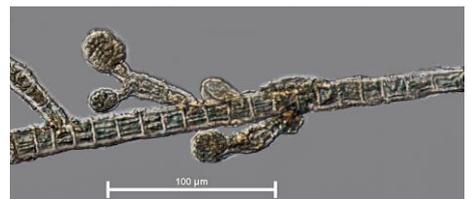
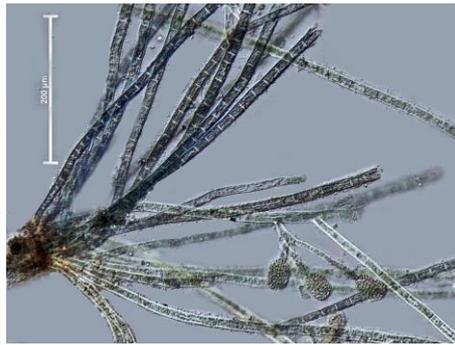


Fig. 10. *Sphacelaria carpoglossi*: young and mature single-compartmented spore sacs



Fig. 11. *Sphacelaria carpoglossi*: multiple-compartmented spore sacs forming in sequence on a short side branch



Figs 12-14: *Sphacelaria bracteata* on upper parts of *Cystophora racemosa*

← Fig. 13. dissected plant with many-compartmented spore sacs

↑ Fig. 14. detail of spore sacs and cell bands



Fig. 15: *Sphacelaria chorizocarpa* (arrowed) on *Cystophora monilifera*

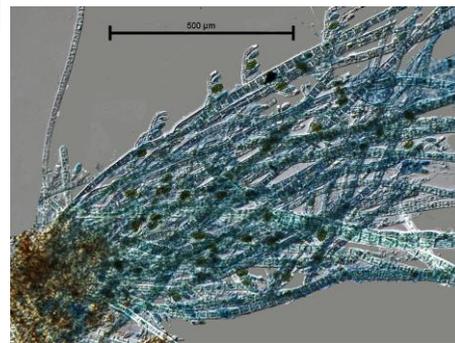


Fig. 16: *Sphacelaria chorizocarpa* tom from *Cystophora monilifera*



Fig. 17. *Sphacelaria chorizocarpa*: prominent tip cell



Fig. 18. *Sphacelaria chorizocarpa*: spore sacs

8a. plants densely tufted tall; branching *forked* or alternate; many-compartmented spore sacs on numerous short side branches at right angles to filaments. A New Zealand species found only on a drift *Cystophora monilifera* plant at Aldinga SA, but possibly more widespread. Figs 19-21.

..... *Sphacelaria implicata*^s
 8b. plants form small clumps 2-6mm tall; branching *radial* or irregular, main filaments with short side branches; many-compartmented spore sacs on short side branches at acute angles to filaments. From upper Spencer Gulf SA to Tasmania usually on *Cystophora* spp. Figs 22-24.

..... *Sphacelaria reinki*^s

9a. plants form a low turf on rock, rarely grow on seagrasses

..... 10.

9b. plants usually grow on large algae or seagrasses

..... 11.

10a. maximum of 2-3 cells seen in side views of filament bands; propagules (short-armed branches on stalks, found usually in summer) triangular, 2(-3) armed, apex arms may initially bear a hair. Figs 25-27.

..... *Sphacelaria tribuloides*

10b. maximum of 4-5 cells seen in side views of filament bands; propagules with 2 rounded arms. Figs 28-30.

..... *Sphacelaria brachygonia*



Fig. 19. *Sphacelaria implicata*: forked filaments, numerous side branches bearing sporangia

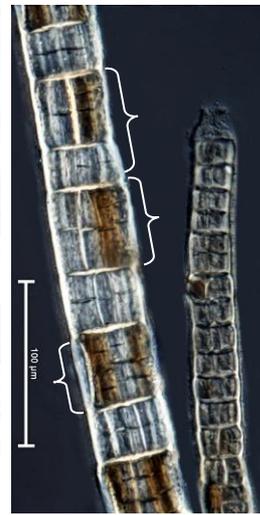


Fig. 20. *Sphacelaria implicata*: filament bands (bracketed) with cells dividing across; dense pericysts

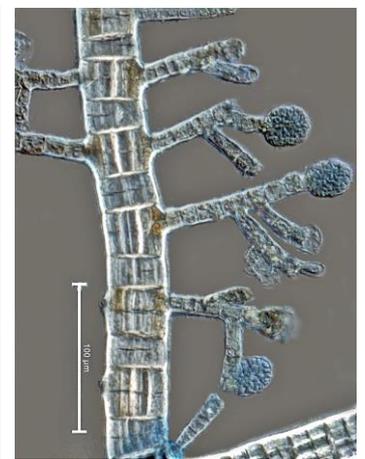


Fig. 21. *Sphacelaria implicata*: spore sacs on numerous short side branches at right angles to filaments



Fig. 22. *Sphacelaria reinki* on *Cystophora xiphocarpa*

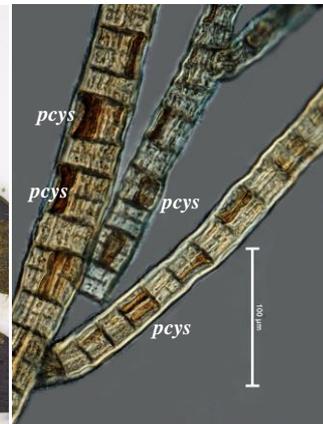


Fig. 23. *Sphacelaria reinki*: pericysts (*pcys*) prominent

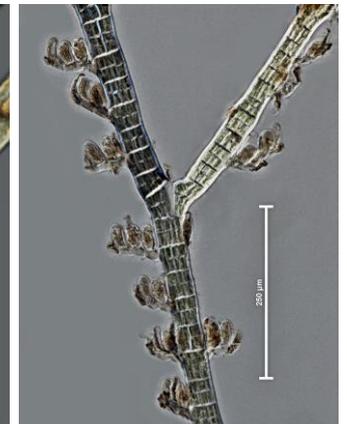


Fig. 24. *Sphacelaria reinki*: spore sacs on numerous short side branches at acute angles to threads



Fig. 25: *Sphacelaria tribuloides*

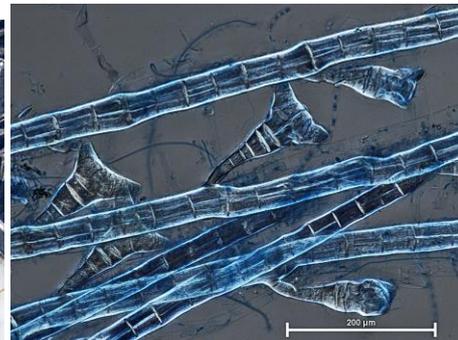


Fig. 26. *Sphacelaria tribuloides*: propagules in various aspects

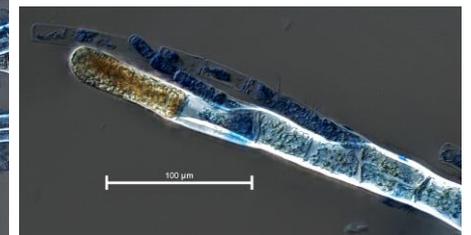


Fig. 27. *Sphacelaria tribuloides*: prominent tip cell; hairs

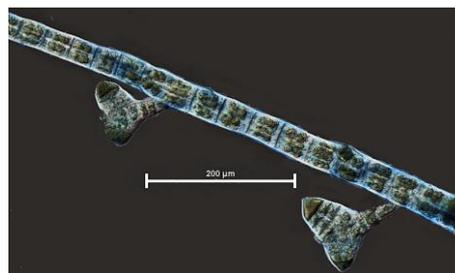


Fig. 28-30: *Sphacelaria brachygonia* two magnifications of propagules; prominent tip cells



11a. maximum width of mature filaments 25-30µm; plants, rarely on rock, form dense tufts on *Myriodesma harveyanum*; propagules (short-armed branches on stalks, found usually in summer) triangular, the two arms of mature propagules have prominent tip cells with angular internal walls. A Noumea species (on *Turbinaria*), found from the West Coast to Kangaroo I. SA, but possibly more widespread. Figs 31, 32.

..... *Sphacelaria novae-caledoniae*
 11b. maximum width of mature filaments >25µm; plants on seagrass and large Brown algae, occasionally on rock 12.

12a. propagules triangular, arms short and rounded or shortly conical. Figs 34-36.

..... *Sphacelaria novae-hollandiae*
 From Indian, Atlantic & Pacific Ocean tropical waters, Rottneest I. WA to near Adelaide SA.

12b. propagules thin, arms 2-3, relatively thin and long 13.

13a. maximum of 5-8 cells seen in side views of filament bands that are stubby (L:B ≤1); propagule arms 2, produced simultaneously, pinched basally, propagules often with a terminal hair. Figs 37-39.

..... *Sphacelaria biradiata*
 Common, on large algae and seagrasses from SW WA to Tasmania

13b. cell bands with max. of 5 cells across, L:B >1 14.



Fig. 31 *Sphacelaria novae-caledoniae*: dense tufts on upper parts of dark fronds of *Myriodesma harveyanum*



Fig. 32 *Sphacelaria novae-caledoniae*: multi-compartmented spore sac



Fig. 33. *Sphacelaria novae-caledoniae* propagules: the two arms of the mature (LHS) propagule have prominent tip cells with angular internal walls (arrowed)



Fig. 35. *Sphacelaria novae-hollandiae*: branching pattern; propagule



Fig. 36. *Sphacelaria novae-hollandiae*: propagule



Fig. 34: *Sphacelaria novae-hollandiae*



Fig. 37 *Sphacelaria biradiata* on a blade of the seagrass *Posidonia*

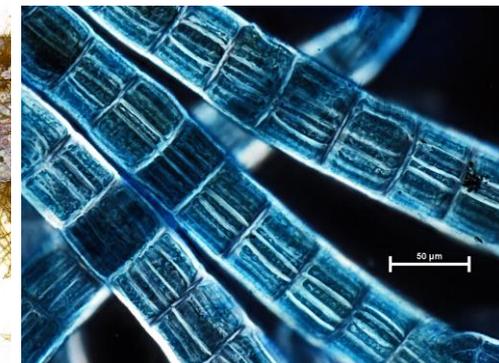


Fig. 38 *Sphacelaria biradiata*: cell bands with 5-8 cells seen in side views



Fig. 39. *Sphacelaria biradiata*: three propagules with prominent terminal hairs

14a. filaments about the same width throughout the plant, maximum of 30-40µm wide, most branches reaching the same height; propagules thin, arms linear ≈ length of the stalk. Figs 40-44.

..... *Sphacelaria rigidula*

Commonest species in southern Australia on Brown algae and rock in intertidal pools, but also worldwide in temperate seas

14b. filaments broader towards the plant base, maximum of 40-80µm wide, branches consisting of continuously growing ones and shorter side branches; propagules with 3 (2-4) arms.

..... 15.

15a. short branches usually spreading; propagule arms usually 3, produced successively, slightly pinched at the base. Figs 45-48.

..... *Sphacelaria cirrosa*

Widespread in temperate and subtropical seas; from Fremantle, WA to Port Jackson NSW, on large algae and seagrasses.

15b. branching radial or irregular; propagule arms usually 3, slender, narrow. Figs 49-51.

..... *Sphacelaria fusca*

Widespread in temperate seas; and from SW WA to Victoria on stalks of *Caulocystis* and seagrass blades



Fig. 40. *Sphacelaria rigidula* from an intertidal rock pool: branches reaching the same height



Fig. 41. *Sphacelaria rigidula* on the wiry stalks of *Cystophyllum*

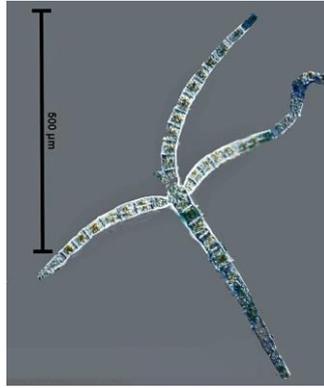


Fig. 42. *Sphacelaria rigidula*: a detached propagule with the 3 linear arms about the same length as the stalk

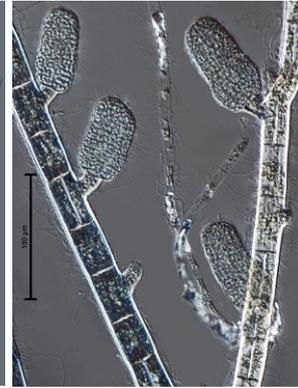


Fig. 43. *Sphacelaria rigidula*: multi-compartmented spore sacs

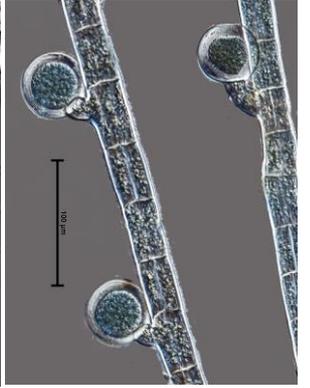


Fig. 44. *Sphacelaria rigidula*: single-compartmented spore sacs



Fig. 45. *Sphacelaria cirrosa* from a blade of seagrass

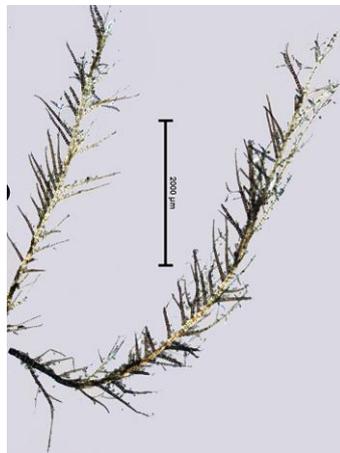


Fig. 46. *Sphacelaria cirrosa*: branching pattern

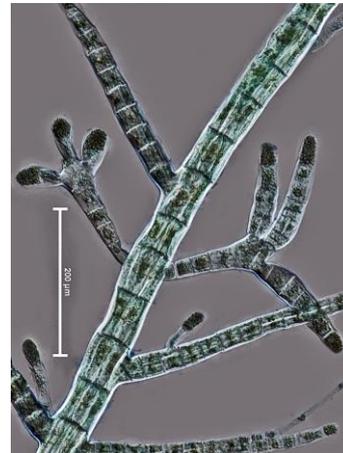


Fig. 47. *Sphacelaria cirrosa*: propagules



Fig. 48. *Sphacelaria cirrosa*: single-compartmented spore sacs



Fig. 49. *Sphacelaria fusca* on blades of *Heterozostera*

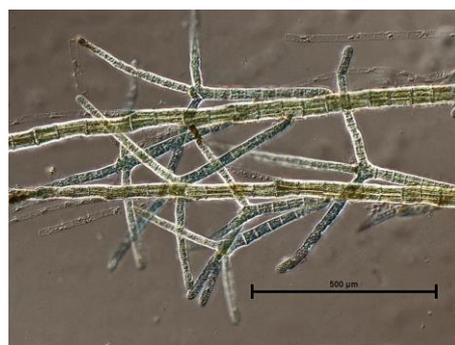


Fig. 50. *Sphacelaria fusca*: cluster of propagules

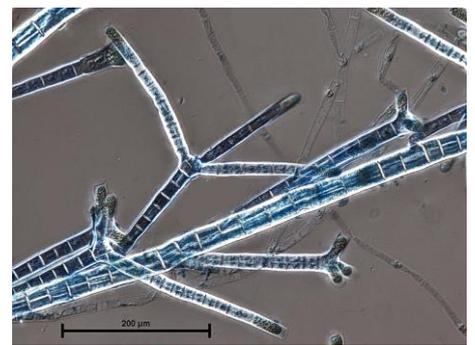


Fig. 51. *Sphacelaria fusca*: developing and mature propagules

APPENDIX:

§ Name Changes	see Draisma, S. G. A., Prud'Homme van Reine, E. F. & Kawai, H. (2010). <u>A revised classification of the Sphacelariales (Phaeophyceae) inferred from a <i>psbC</i> and <i>rbcL</i> based phylogeny</u> . <i>European Journal of Phycology</i> 45(3): 308-326.
<i>Sphacelaria bracteata</i>	<i>Herpodiscus bracteatus</i> (Reinke) Draisma, Prud'homme & H. Kawai
<i>Sphacelaria carpoglossi</i>	<i>Herpodiscus carpoglossi</i> (Womersley) Draisma, Prud'homme & H. Kawai
<i>Sphacelaria implicata</i>	<i>Herpodiscus implicatus</i> (Sauvageau) Draisma, Prud'homme & H. Kawai
<i>Sphacelaria multiplex</i>	<i>Herpodiscus multiplex</i> (Womersley) Draisma, Prud'homme & H. Kawai
<i>Sphacelaria reinki</i>	<i>Herpodiscus reinkei</i> (Sauvageau) Draisma, Prud'homme & H. Kawai
<i>Sphacelaria spuria</i>	<i>Herpodiscus spurius</i> (Sauvageau) Draisma, Prud'homme & H. Kawai

SPHACELARIA LOOK ALIKES

Members of the Families Stypocaulaceae and Cladostephaceae also have prominent tip cells that produce branched threads with bands of cells. They generally grow as relatively large plants on rock, often producing turfs in shallow waters.

In these Families, a sheath (cortex) of small cells develops, obliterating the original bands of cells.

Family: Stypocaulaceae
Halopteris



mat of stiff brown threads amongst Green algae in shallow water

- 5 species
- filaments sheathed (corticated) with small, box-shaped cells (arrowed)

Phloiocaulon



cross section

- 2 species
- filaments initially sheathed (corticated) with small, box-shaped cells, later infiltrated with numerous rhizoids forming a wide outer layer of equal-sized cells

Family: Cladostephaceae
Cladostephus spongiosus



plant on granite boulder

detail of dense rings of short branches

short side branch with spore sac

- sheathed with small, box-shaped cells
- main branches densely ringed with short side branches