Pictured Key to some common filamentous red algae of southern Australia
Part III: algae with well-defined whorl-branchlets

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, Part III, only includes algae with well-defined branchlets. In this key, Part III, only algae with well-defined branchlets are included. These algae are often inconspicuous epiphytes of other, larger plants.

The key is restricted to:
- algae consisting of threads (filaments) of cells growing in a single line (uniiarial algae)
- algae with neither compact wrappings (cortication) nor regularly arranged (pericentral) cells around main branches (axes). There may be a dense but loose, irregular or ropey sheath of rhizoids, however
- algae with distinct rings or opposite short side branches (whorl-branchlets)

The key includes Tribes in the Ceramiaceae such as the Sphondylothamniaceae, Antithamniaceae and Heterothammniaceae. Algae with compact wrappings (cortication) so complete that the basic filamentous construction is completely obscured are covered in a separate pictured key.

Part II, a separate key, contains algae with overlapping whorl-branchlets that form a continuous, loose axial sheath.

In this key, Part III, only algae with well-defined, often well-separated whorl-branchlets are included. These algae are often inconspicuous epiphytes of other, larger plants.

The key is largely based on that in the Flora of southern Australia, volume III.

Scale: The coin used as a scale is 24mm or almost 1” wide. Microscope images of algae are usually blue stained.

This key is restricted to

1a. plants 50-200 mm tall, gland cells (Figs 20, 27) absent; much-divided polysporangia (Fig. 4) may be present; axis bases often ropey with dense rhizoids; cells often large

………………………………………………………….. 2

Family Ceramiaceae, Tribe: Sphondylothamniaceae

1b. plants 5-50 mm tall (except Macrothamniasis, 200mm) often inconspicuous, attached to other algae; gland cells may be present; axis bases naked or with a light sheath of rhizoids

………………………………………………………….. 6.

2a. cells long, visible to the naked eye; whorl-branchlets opposite or in rings of 3; polysporangia (Fig. 4) present, reproductive structures in claw-like reduced branchlets. Figs 1-4

………………………………………………………….. 3. Involucrana (2 species)

2b. cells microscopic, whorl-branchlets in rings of 2-5

………………………………………………………….. 3.

3a. attachment pads (haptera) without finger-like extensions, whorl-branchlets 4, tip cells narrowing to a point. Figs 5-8

………………………………………………………….. Drewiana nitella

3b. attachment pads (haptera) with finger-like (digitate) extensions. Fig. 9

………………………………………………………….. 4.

*“Algae Revealed” R N Baldock, S Australian State Herbarium, July 2012: filamentous algae with whorl-branchlets Pt III*
4a. tip cells short, sharply conical. Figs 9–12

4b. tip cells blunt or tapering gradually to a point 

5a. whorl-branchlets usually in 2 rows (distichous), axes often ropey with rhizoids. Figs 16-18

5b. whorl-branchlets usually radial; plants delicate, inconspicuous, grow on other algae. Figs 13-15

5c. whorl-branchlets feathery (pinnate), plants to 200mm tall, axes often ropey with rhizoids …….19.

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6a. gland cells usually present (see Figs 20, 23, 27) ................................................................. 7.

6b. gland cells absent ........................................ 19.

7a. gland cells on special 2 or 3-celled stalks (Figs 27, 28) or at tips of whorl-branchlets (Fig. 20); mature female structures (cystocarps) naked; whorl-branchlets opposite or in 2 rows ................................................................. 8.

Family: Ceramiaceae, Tribe: Antithamnieae

7b. gland cells lie along the cells of whorl-branchlets (see Figs 37, 46); whorl-branchlets radial or comb-like (pinnate) ........................................ 10.

8a. plants small, gland cells at tips of whorl-branchlets; whorl-branchlets = 2 large, obvious + 2 small, obscure ones on each axis cell, branched like teeth of a comb (pinnate). Figs 19, 20

......................... Acrothamnion preissii

8b. plants on special 2-3 celled stalks ............ 9.

9a. plants 10-200 mm tall, whorl-branchlets 3 (2 in 1 species) per axial cell; minute stalks bearing the glands bear also tetrasporangia or male spermatangial clusters. Figs 21-25

.......................... Macrothamnion (3 species)

9b. plants 5-40 mm tall, whorl branchlets 2 per axial cell, oppositely (pinnate) or irregularly branched; gland cells on separate minute branches to tetrasporangia or spermatangial clusters. Figs 26-34

.......................... Antithamnion (11 species)

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Fig. 19: Acrothamnion preissii

Fig. 20. Acrothamnion preissii: gland cells (gl c) at whorl-branchlet tips

Fig. 19: Acrothamnion preissii

Fig. 20. Acrothamnion preissii: gland cells (gl c) at whorl-branchlet tips

Fig. 21. Macrothamnion pellucidum

Fig 22. Macrothamnion acanthophorum: axis (→); 2 opposite whorl branchlets per axial cell; tip cells sharply pointed

Fig 24: Macrothamnion pellucidum

Fig 25. Macrothamnion pellucidum: needle-point tip cell and hooked spines near ends of whorl-branchlets

Fig 26. Antithamnion pectinatum: pinnate whorl-branchlets

Fig 27. Antithamnion pectinatum: gland cell (gl c) lying along a 3-celled stalk within a pinnate whorl-branchlet

Fig 28. Antithamnion cruciatum: gland cell (gl c) lying along a 3-celled stalk within an irregularly branched whorl-branchlet

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Fig 29. *Antithamnion cruciatum*: irregularly-branched whorl-branchlets with tetrasporangia basally

Fig 30. *Antithamnion cruciatum*: stalkless tetrasporangia and gland cells on minute, 3-celled branches

Fig 31. *Antithamnion hanovioides* on the blade of the seagrass *Posidonia sinuosa*

Fig 32. *Antithamnion hanovioides*: axis (→) of box-shaped cells; whorl-branchlets rigid, pointed

Fig 33. *Antithamnion hanovioides*: whorl-branchlets rigid, pointed; gland cells prominent

Fig 34. *Anthamnion gracilentum*: a red-brown fuzz on the end branches of the brown alga *Cystophora intermedia*
10a. plants mostly delicate, but range from 10-200 mm tall, lower parts sometimes wrapped densely in rhizoids, gland cells lying over only one cell of a whorl-branchlet, sometimes at an angle. Figs 35-37

………………………….. *Pterothamnion* (8 species)

10b. plants small, inconspicuous, 2-40 mm tall, mostly on larger algae; gland cells often overlap 2 whorl-branchlet cells. Figs 38-40

……………………………………………………………………………………………

Family: Ceramiaceae. Tribe: Heterothamniaceae

11a. parasites, with basal pads penetrating the brown algae *Hormosira, Cystophora* or *Platythalia*. Figs 38-40

…………………………………….*Heterothamnion* (4 species)

11b. plants growing on the surface of other algae

……………………………………………………………………………………………

11.

Family: Ceramiaceae. Tribe: Heterothamniaceae

11a. parasites, with basal pads penetrating the brown algae *Hormosira, Cystophora* or *Platythalia*. Figs 38-40

…………………………………….*Heterothamnion* (4 species)

11b. plants growing on the surface of other algae

……………………………………………………………………………………………

12a. usually 3 whorl-branchlets per axial cell, their basal cells unbranched (except *Aa. glandifera*, Fig 44) …………………………………… 13.

12b. usually 3-6 whorl-branchlets per axial cell, their basal cells branched ………………………………………………………………………………… 14.

13a. whorl-branchlets vary in number (1-4 or more) per axial cell, usually equal in size. Figs 41, 42

…………………………………….*Antithamniella* (3 species, excluding *Aa. glandifera*, (see opposite)

13b. whorl-branchlets mostly 3 per axial cell, unequal in size. Figs 45-48, next page

…………………………………………………………………………………………….. *Trithamnion* (4 species) (next page)

“Algae Revealed” R N Baldock, S Australian State Herbarium, July 2012: filamentous algae with whorl-branchlets Pt III
whorl-branchlets short, poorly branched, rings of branchlets well-separated. Figs 49, 50

………………………………… Amoenothamnion (including Leptoklonium) (3 species)

whorl-branchlets longer, if short, branched several times, rings of branchlets closer together when mature

………………………………… 15.

whorl-branchlets appearing feathery, actually of 2 large + 2 minute and obscure whorl-branchlets per axial cell; plants attached by clumps of pads with finger-like tips. Figs 51, 52

………………………………… Acrothamniopsis eliseae

may be confused with Antithamnion pectinatum

whorl-branchlets not feathery, 3-5 per axial cell, equal in size

………………………………… 16.

tetrasporangia and male spermatangia in minute clusters lying in the angle between the whorl-branchlets and axial cells (adaxial). Figs 53, 54

………………………………… Elisiella (2 species)

diagnosis can be difficult

not as above ………………………….. 17.

Fig. 49: Amoenothamnion plantonicum

Fig. 50: Leptoklonion fastigiatum

Fig. 51: Acrothamniopsis eliseae

Fig. 52: Acrothamniopsis eliseae: clumps of attachment pads (at pd)

Fig. 53: unstained Elisiella arbuscula: minute bunches of tetrasporangia (arrowed) lying toward the axial cells

Fig. 54: Elisiella arbuscula: tetrasporangia (t sp) and gland cells (gl c) in a minute bunch removed from a whorl-branchlet

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17a. whorl-branchlets 3 per axial cell. Figs. 55, 56

............................... Scageliopsis patens

17b. whorl-branchlets 4-5 per axial cell ............ 18.

Fig. 55: Scageliopsis patens

Fig. 56. Scageliopsis patens: gland cell (gl c), tetrasporangia (t sp) dividing into a cross pattern (cruciate), basal cells of whorl-branchlets branched

18a. minute spermangia and tetrasporangia found at tips of whorl-branchlets. Figs. 57-59

............................... Perithamnion (8 species)

May be confused with Elisia arbucula

18b. spermangia and tetrasporangia in minute clusters near the base of whorl-branchlets. Figs. 60-62

............................... Tetrathamnion lineatum

Diagnosis can be difficult

Fig. 57: Perithamnion muelleri

Fig. 58. Perithamnion muelleri: tetrasporangia (t sp) at tips of whorl-branchlets

Fig. 59. Perithamnion muelleri: spermangia (sperm) at tips of whorl-branchlets

Fig. 60: Tetrathamnion lineatum

Fig. 61. Tetrathamnion lineatum: 4 whorl-branchlets per axial cell

Fig. 62. Tetrathamnion lineatum: spermangial clusters (sperm) on basal cells of whorl-branchlets

“Algae Revealed” R N Baldock, S Australian State Herbarium, July 2012: filamentous algae with whorl-branchlets Pt III
19a. a pair of opposite whorl-branchlets equal in size per axis cell .......................... 20.

19b. short feathery side branches appear to alternate along axes; microscopic investigation shows 3 whorl-branchlets per axial cell = 1 large and feathery + 2 two small, inconspicuous ones.

Figs 63-65

................................. Inkyuleea (2 species) (as Ballia mariana and B ballioides, in the Flora)

Fig. 63: Inkyuleea ballioides

Fig. 64: Inkyuleea mariana

20a. basal cell of whorl-branchlets wedge-shaped; plugs between axis cells button-shaped; tetrasporangia in minute branches on basal cell of whorl-branchlets; axes heavily covered in rhizoids. Figs 66-71

Ballia (2 species, Ballia callitricha common)
Order: Balliales, Family: Balliaceae (Ceramiaceae, Tribe Pterothamnieae in the Flora)

20b. whorl-branchlet cells similar; cell plugs not button-shaped; tetrasporangia at tips of whorl-branchlets. Figs 70, 71 next page

......................... Gymnothamnion (2 species, 1 rare)

Fig. 66: Ballia callitricha

Fig. 67. Ballia callitricha: prominent tip cells; white bryozoan Aetea anguina tubes commonly found along the axis (arrowed)

Fig. 68. Ballia callitricha: wedge-shaped basal cell (b c) of whorl-branchlets; button-shaped plugs between axis cells (pl)
Look-alike algae

1. filamentous Rhodomelaceae

Some members of this Family such as Echinothamnion hystrix shown opposite look superficially like some Antithamnion species (for example, A. hanovioides). Seen under the microscope the Rhodomelaceae have blocks of flanking (pericentral) cells along filaments. This feature can be used to separate species in that Family from the Ceramiaceae Family described in the key above.

2. filamentous Ceramiaceae

In this Tribe of the Family: Ceramiaceae, small cells ring the shoulders of axis cells, often completely covering or corticating them. In some species, such as Ceramium macilentum and C. puberulum shown opposite, large gaps occur between corticating rings of cells and look superficially like whorl-branchlets. These corticating cells lie flat against the axis and should not be confused with true whorl-branchlets. There is a separate key (Part IV) that includes them.