Illustrated key to Brown Seaweeds. (Phaeophyceae)

By Ian Tittley.

(Natural History Museum).

1. Thallus a microscopic disc, patch, tuft or stain, <1 - 1 - (3)mm diameter
Section 1.

1. Thallus larger (macroscopic) 2.

2. Thallus filamentous or finely filiform 3.

2. Thallus not filamentous or finely filiform 5.

3. Filaments mainly uniseriate (sometimes present longitudinal cell divisions)
Section 2.

3. Filaments with longitudinal cell divisions (parenchymatous) parts may be uniseriate 4.

4. Filaments with prominent apical cell; turns black on treatment with Eau de Javelle
Section 3.

4. Filaments without prominent apical cell; do not turn black with Eau de Javelle
Section 4.

5. Thallus a crust, disc or cushion
Section 5.

5. Thallus not a distinct crust, disc or cushion 6.

6. Thallus a small knob of tissue from which a tuft of filaments arise
Section 6.

6. Thallus not a small knob of tissue 7.

7. Thallus at least in part (usually lateral branches) filiform or filamentous; with prominent apical cell; turns black with Eau de Javelle
Section 3.

7. Thallus not as above 8.

8. Thallus filiform 9.

8. Thallus not filiform 10.

9. Thallus mucilaginous, wormlike, soft to touch; constituent filaments separate under slight pressure
Section 7.

9. Thallus not mucilaginous, wormlike or soft to touch; filaments do not separate under pressure
Section 8.

10. Thallus obviously saccate or tubular
Section 9.

10. Thallus not saccate or tubular 11.

11. Thallus flattened 12.

11. Thallus not flattened 14.

12. Thallus with distinct midrib
Section 11.

12. Thallus without midrib 13.

13. Thallus membranous, ribbon-like; often delicate; usually not more than 400mm in length
Section 10.

13. Thallus cartilaginous, robust, more than 400mm in length Section 12.

14. Thallus channelled or cylindrical or
Section 13.

Thallus button-shaped

Key to Section 1.

1. Main vegetative system erect; prostrate system indistinct.
Streblonema intestinum

1. Main vegetative system prostrate or erect and prostrate 2.

2. Prostrate filaments free 3.

2. Prostrate filaments laterally fused 22.

3. Main vegetative system prostrate 4.

3. Main vegetative system erect and prostrate 5.

4. One or two chloroplasts per cell; rhizoids present; filaments do not aggregate into pseudodiscs; plurilocular sporangia multiseriate; in Bryozoans
Endodictyon infestans

4. Two or three chloroplasts per cell; rhizoids absent; filaments aggregate into pseudodiscs; plurilocular sporangia uniseriate; in or on various algae
Mikrosyphar spp.

5. Erect system less or equal to prostrate system 6.

5. Erect system greater than prostrate system 20.

6. Thallus macroscopic but very small 7.

6. Thallus microscopic 9.

7. Erect system of unbranched assimilatory filaments only; forming small pustules on Cystoseira
Herponema valiantei

7. Erect system of branched filaments 8.

8. Erect assimilatory filaments sparsely branched; pseudohairs present; rhizoids present; plurilocular sporangia multiseriate; forming velvety patches on Hiranthalia
Herponema velutinum

8. Erect assimilatory filaments branched; true hairs present; rhizoids absent; plurilocular sporangia uniseriate; endophytic in Stilophora
Streblonema stilophorae

9. Prostrate system a pseudodisc; periclinal cell divisions in the prostrate system
Phaeostroma pustulosum

9. Prostrate system of free filaments; periclinal cell divisions absent 10.

10. One chloroplast per cell 11.

10. Several chloroplasts per cell 15.

11. Erect system of colourless hairs only; epiphytic on various algae
Streblonema effusum

11. Erect system of assimilatory filaments 12.

12. Erect system of assimilatory filaments only, hairs absent 13.

12. Erect system of hairs and filaments 14.

13. Endophytic in Ascophyllum; multiseritae, ovoid, plurilocular sporangia, unilocular sporangia unknown — Streblonema breve

13. Endophytic in Petrocelis; plurilocular sporangia unknown; unilocular sporangia present — Streblonema helophorum

14. Erect assimilatory filaments unbranched; plurilocular sporangia uniseriate or biseriate; infralittoral; endophytic in Cerarium and other algae — Streblonema parasiticum

14. Erect assimilatory filaments branched; plurilocular sporangia uniseriate; eulittoral; endophytic in Mesogloia — Streblonema tenuissimum

15. Erect system of colourless hairs only — Dichosporangium chordariae

15. Erect system of hairs and filaments — 16.

16. Hairs as pseudohairs; epiphytic on Dictyotaceae — Herponema solitarium

16. Hairs as true hairs; on other algae — 17.

17. Rhizoids present — 18.

17. Rhizoids absent — 19.

18. Erect assimilatory filaments branched; plurilocular sporangia multiseriate; in Dudresnaya — Streblonema volubile

18. Erect assimilatory filaments unbranched or branched; plurilocular sporangia uni- or bi- seriate; in Chylocladia — Streblonema zanardinii

19. Plurilocular sporangia uni- or bi- seriate; endophytic in Mesogloia and Leibrannia — Streblonema sphaericum

19. Plurilocular sporangia multiseriate; in Chorda — Streblonema aequale

20. One chloroplast per cell; plurilocular sporangia, if present, uniseriate — 21.

20. Several chloroplasts per cell; plurilocular sporangia multiseriate — 22.

21. One linear chloroplast per cell; erect system of assimilatory filaments; plurilocular sporangia uniseriate, unilocular sporangia unknown; on Laminaria — Laminariocolax tomentosoides

21. One discoid chloroplast per cell; erect system of assimilatory filaments and very long hairs; plurilocular sporangia unknown, unilocular sporangia terminal; supralittoral, epilithic. — Pleurocladia lacustris

22. Thallus - (12)mm long; plurilocular sporangia elongate; epilithic, near high tide level — Kuetzingiella holmesii

22. Thallus 2 mm long; plurilocular sporangia ovoid; epiphytic on Taonia — Kuetzingiella battersii

23. Erect filaments branched — 24.

23. Erect filaments unbranched — 30.

24. One chloroplast per cell — 25.

24. Several chloroplasts per cell — 27.

25. Multicellular paraphyses present; plurilocular sporangia absent; unilocular sporangia on basal layer; epizoic or epilithic
Compsonema saxicola

25. Multicellular paraphyses absent; plurilocular sporangia abundant; epiphytic 26.

26. Basal layer indistinct; plurilocular sporangia often branched; epiphytic on Fucus and Laminaria
Protectocarpus speciosus

26. Basal layer 1 cell thick; plurilocular sporangia not branched; epiphytic on Ralfsia
Compsonema microsconicum

27. Ascocysts present 28.

27. Ascocysts absent 29.

28. Hairs abundant; many chloroplasts; unilocular sporangia present
Hecatonema foecundum

28. Hairs rare; 1 - (3) chloroplasts; unilocular sporangia unknown
Hecatonema hispanicum

29. Hairs present; plurilocular sporangia multiseriate; unilocular sporangia present
Hecatonema maculans

29. Hairs absent; plurilocular sporangia uniseriate, unilocular sporangia unknown
Hecatonema liechtensternii

30. One chloroplast per cell 31.

30. More than one chloroplast per cell 32.

31. Plurilocular sporangia lateral on assimilatory filaments
Microspongium gelatinosum

31. Plurilocular sporangia terminal on assimilatory filaments
Microspongium globosum

32. Plurilocular sporangia multiseriate; erect assimilatory filaments variable in length to 1mm; basal layer usually 2 cells thick 33.

32. Plurilocular sporangia uniseriate; erect assimilatory filaments uniform in length to 100µ; basal layer 1 cell thick 34.

33. Erect filaments in concentric bands
Chilionema ocellatum

33. Erect filaments in clumps
Chilionema reptans

34. Thallus a compact disc; down-growing rhizoids rare, not penetrating host 37.

34. Thallus not a compact disc but loose and irregular; rhizoids frequent penetrating host tissue 35.

35. Erect assimilatory filaments unbranched; unilocular sporangia terminal on filaments; on/in Laminaria
Myrionema aecidioides

35. Erect assimilatory filaments sparsely branched; unilocular sporangia on basal parts of assimilatory filaments or on prostrate system 36.

36. Plurilocular sporangia uniseriate; on Durontia
Ulonema rhizophora

36. Plurilocular sporangia unknown; on/in Mesogloia and Sauvageaugloia
Strepsithalia buffhamiana

37. Filaments with oblique cross walls — *Myrionema corunnae*

37. Filaments with transverse walls — 38.

38. Filaments bearing small protuberences — *Myrionema papillosa*

38. Filaments without protuberences — 39.

39. Ascocysts present — *Myrionema magnusii*

39. Ascocysts absent — 40.

40. Erect filaments unbranched; on *Enteromorpha* and *Ulva* — *Myrionema strangulans*

40. Erect filaments sparsely branched; on *Fucus serratus* — *Myrionema polycladum*

Key to section 2.

1. Erect system greater than prostrate system 2.

1. Erect system less than or equal to prostrate system 25.

2. Thallus less than 10mm 3.

2. Thallus more than 10mm 10.

3. Erect system as assimilatory filaments only; one linear chloroplast per cell Lariniocolax tomentosoides

3. Erect system as hairs and assimilatory filaments; more than three discoid chloroplasts per cell 4.

4. Plurilocular sporangia uniseriate; epilithic, in caves and crevices Waerniella lucifuga

4. Plurilocular sporangia multiseriate; epi- or endophytic; not in caves 5.

5. Plurilocular sporangia ovoid 6.

5. Plurilocular sporangia elongate 8.

6. Branching sparse 7.

6. Branching abundant Feldmannia globifera

7. Endophytic in Codium Feldmannia simplex

7. Epiphytic on Taonia and Dictyota Kuetzingiella battersii

8. Microscopic species; epiphytic on Padina Feldmannia padinae

8. Macroscopic species; on other algae 9.

9. Branching opposite; unilocular sporangia absent Feldmannia lebellii

9. Branching not opposite; unilocular sporangia present Feldmannia irregularis

10. Chloroplasts linear 11.

10. Cloroplasts discoid 13.

11. Filaments interwoven cord-like; right angle branches present Spongonema tomentosum

11. Filaments not interwoven; right angle branches absent 12.

12. Filament branching pseudodichotomous or alternate; plurilocular sporangia more than 125μ long, with a terminal hair Ectocarpus siliculosus

12. Filament branching opposite; plurilocular sporangia less than 125μ long, without a terminal hair. Ectocarpus fasciculatus

13. Erect system of assimilatory filaments only; hairs absent; right angle branches present; monosporangia present Acinetospora crinita

13. Erect syster of hairs and filaments; right angle branching absent; monosporangia absent 14.

14. Filaments terminate in true hairs 15.

14. True hairs absent; pseudohairs present 16.

15. Branching alte rnate or secund; plurilocular sporangia multiseriate
Sorocarpus micro orus

15. Branching irregular, pseudodichotomous or alternate, plurilocular sporangia a cluster of loculi, mulberry-like
Polytretus reinboldii

16. unilocular and plurilocular sporangia intercalary
Pilayella littoralis

16. sporangia not intercalary 17.

17. Branching sparse 18.

17. Branching abundant 19.

18. Branching irregular
Kuetzingiella holmesii

18. Branching pseudodichotomous or alternate
Giffordia fenestrata

19. Branching regular; plurilocular sporangia sessile 20.

19. Branching irregular; plurilocular sporangia pedicellate
Feldrannia globifera

20. Main branching opposite 21.

20. Main branching not opposite 22.

21. Lateral branchlets secund; corticating filaments present; plurilocular sporangia ovoid, scattered
Giffordia granulosa

21. Lateral branchlets not secund; corticating filaments absent; plurilocular sporangia elongate; in sori
Giffordia ovata

22. Branching pseudodichotomous or alternate
Giffordia mitchellae

22. Branching secund 23.

23. Plurilocular sporangia ovoid, scattered
Giffordia secunda

23. Plurilocular sporangia not ovoid, in sori 24.

24. Main axis with corticating filaments; plurilocular sporangia conical
Giffordia hincksiae

24. Main axis without corticating filaments; plurilocular sporangia elongate
Giffordia sandriana

25. Erect system assimilatory filaments; hairs absent; forming a felt on Himanthalia
Herponema velutinum

25. Erect system of both hairs and filaments; forming tufts on Cystoseira
Herponera valiantei

Addition to Section 2. (Stages to be re-numbered).

1A. Occasional longitudinal cell divisions present 26.

1A. Longitudinal cell divisions absent 2.

26. Thallus creeping; plurilocular sporangia uniseriate, clustered in sori on distal parts of the few upright filaments

Myriotrichia clavaeformis (M. repens)

26. Thallus upright; plurilocular sporangia or gametangia multiseriate 27.

27. Filament unbranched; epiphytic on Laminaria

Litosiphon filiformis

27. Filament branched 28.

28. Sporangia immersed in filament and developed from the cortical layer; epiphytic on Palmaria Stictyosiphon griffithsianus

28. Sporangia, gametangia, pedicellate or intercalary; not on Palmaria 29.

29. Branching regularly pinnate; monosporangia (in short chains of 2 - 3 loculi) and gametangia intercalary Tilopteria mertensii

29. Branching irregularly opposite 30.

30. Monosporangia sessile or pedicellate; gametangia intercalary; ultimate branching secund Haplospora globosa

30. Plant not as above 31.

31. Unilocular sporangia paired, sessile on filaments; often among Callithamnion hookeri and Plumaria Isthmoplea sphaerophora

31. Unilocular sporangia (in chains of many loculi) and plurilocular sporangia intercalary Pilayella littoralis

Key to Section 3.

1. Plant of monosiphonous filaments; longitudinal cell divisions very rare; bicellular propagules present — *Choristocarpus tenellus*

1. Plant not as above, filaments polysiphonous (parenchymatous) — 2.

2. Lateral branchlets in whorls — *Cladostephus spongiosus*

2. Lateral branchlets not whorled — 3.

3. Lateral branchlets borne between the cross wall of one articulation; sporangia not in axils of branches — 4.

3. Lateral branchlets straddling a cross wall between two articulations; sporangia borne in axils of branches — 15.

4. Secondary transverse divisions absent from every segment — 5.

4. Secondary transverse divisions present in every segment — 10.

5. Propagules absent; plant of creeping filaments giving rise to upright shoots — *Sphacelaria britannica*

5. Propagules present; plant not creeping but upright — 6.

6. Propagules with radiating arms — 7.

6. Propagules wedge-shaped — 9.

7. Branching bipinnate; partly endophytic (mainly in *Halidrys* and *Cystoseira*) — *Sphacelaria bipinnata*

7. Branching not bipinnate; widely epiphytic, also epilithic — 8.

8. Branching irregular; propagules tri or bifurcate, arms cylindrical and straight, stalk tapering to base, apical hair absent — *Sphacelaria fusca*

8. Branching pinnate; propagules trifurcate, arms sausage-shaped, often bent, stalk clavate, apical hair present — *Sphacelaria cirrosa*

9. Branching sparse, irregular — *Sphacelaria tribuloides*

9. Branching dense, pinnate — *Sphacelaria plumula*

10. Plant partly endophytic — *Sphacelaria caespitula*

10. Plant not endophytic — 11.

11. Branching sparse, irregular, laterals of indeterminate growth — 12.

11. Branching abundant, laterals of determinate growth — 13.

12. Plants tufted, more than 10mm high; unilocular sporangia in crowded racemes — *Sphacelaria racemosa*

12. Plants small tufts, mat or turf forming; unilocular sporangia paired and sessile — *Sphacelaria radicans*

13. Branching irregular, plant not feather like but tufted, sporangia pedicellate or on very short branches; rare Shetland — *Sphacelaria arctica*

13. Branching pinnate, plant feather like, sporangia on long branches; widespread — 14.

14. Corticating rhizoids formed only in one plane of branching; unilocular sporangia on ordinary laterals — *Sphacelaria plumigera*

14. Corticating rhizoids formed in all planes; unilocular sporangia borne on special stichidia arising from cortication — *Sphacelaria plumosa*

15. Plants branched in one plane; plants feather-like — *Halopteris filicina*

15. Plant branching tufted, plants (usually) shaving-brush like — *Halopteris scoparia*

in Summer?

Key to section 4.

1. Main filaments clearly branched 10.

1. Main filaments unbranched 2.

2. Filament arising from a mass of rhizoids 3.

2. Filament not arising from rhizoids 4.

3. Filament parenchymatous; does not terminate in a hair; plurilocular sporangia formed on the superficial cells of the thallus
Petalonia filiformis

3. Filament monosiphonous towards the base; with a terminal hair; plurilocular sporangia pedicellate on short laterals or sessile
Giraudia sphacelarioides

4. Main filament bearing short lateral filaments 5.

4. Short lateral filaments absent 7.

5. Laterals of equal length, often branched, densely distributed over the main filament; plurilocular sporangia uni- or bi- seriate
Leblondiella densa

5. Lateral filaments variable in length, unbranched, restricted to upper parts of main filament; plurilocular sporangia multiseriate 6.

6. Plurilocular sporangia distributed singly; uppermost lateral filaments longest
Myriotrichia clavaeformis

6. Plurilocular sporangia clustered; lateral filaments equal in length
Myriotrichia clavaeformis (syn. M. filiformis

7. Filaments almost entirely monosiphonous 8.

7. Filament in part polysiphonous (parenchymatous) 9.

8. Hairs present; thallus creeping; plurilocular sporangia uniseriate clustered in sori; epiphytic on various algae Myriotrichia clavaeformis (syn. M. repens)

8. Hairs absent; thallus upright; plurilocular sporangia multiseriate developed from epidermal cells; epiphytic on Laminaria Litosiphon filiformis

9. Small tufts, filaments to 12.5mm long, on Alaria
Litosiphon laminariae

9. Dense tufts covering host, filaments to 120mm long, on Chorda
Litosiphon pusillus

10. Main branching opposite 11.

10. Main branching irregularly opposite; ultimate branching secund Haplospora globosa

11. Sporangia partly immersed in filament and developed from cortical layer
Stictyosiphon griffithsianus

11. Sporangia not as above 12.

Footnote: Pedersen, P.M., 1978. Culture studies in the pleomorphic brown alga Myriotrichia clavaeformis (Dictyosiphonales, Myriotrichaceae) Norw. J. Bot. 25: 281 - 291.

12. Sporangia (monosporangia) intercalary in monosiphonous parts of the frond in short chains of 2 - 3 loculi; mainly lower littoral and infralittoral

Tilopteris mertensii

12. Sporangia (unilocular) in opposite pairs, sessile on monosiphonous and parenchymatous parts of the filament; mainly littoral

Isthmoplea sphaerophora

Key to Section 5.

1. Thallus a membranous sheet attached by rhizoids 2.

1. Thallus not a membranous sheet 3.

2. Thallus membranous, leathery when older, margin bears a fringe of hairs *Zanardinia prototypus*

2. Thallus delicate; margin without hairs *Cutleria multifida*

3. Thallus a gelatinous blob or cushion 4.

3. Thallus a brown crust 7.

4. Outermost layer of thallus composed of unbranched assimilatory filaments 5.

4. Outermost layer of thallus composed of branched assimilatory filaments 6.

5. Assimilatory filaments short, 2 - 4 cells; internal tissue of large stellate colourless cells; epilithic and epiphytic on various algae *Leathesia difformis*

5. Assimilatory filaments long, 10 - 17 cells; internal tissue of cylindrical cells; epiphytic on *Chondrus* *Corynophloea crispa*

6. Plant a gelatinous cushion (5 - 20mm diameter); epilithic or epiphytic on *Ralfsia* *Cylindrocarpus berkeleyi*

6. Plant a small tuft (3mm diameter); partly endophytic in *Gracilaria* *Cylindrocarpus microscopicus*

7. Erect filaments loosely coalesced, easily separable under pressure 8.

7. Erect filaments coalescent, do not separate easily under pressure 10.

8. Clavate paraphyses present; one discoid chloroplast per cell *Ralfsia pusillus*

8. Paraphyses absent; several discoid chloroplasts per cell 9.

9. Erect filaments of up to 20 cells; ascocysts absent; plurilocular sporangia unbranched *Petroderma maculiforme*

9. Erect filaments of 2 - 7 cells; ascocysts present; plurilocular sporangia branched *Symphyocarpus strangulans*

10. Several chloroplasts per cell 11.

10. One chloroplast per cell 13.

11. Crust parenchymatous, up to 40mm thick *Battersia mirabilis*

11. Crust clearly of erect filaments but separable only with difficulty 12.

12. Erect filaments rarely more than 10 cells long *Pseudolithoderma extensum*

12. Erect filaments more than 20 cells long *Pseudolithoderma roscoffensis*

13. Erect filaments about 6 - 7 cells long, seldom more than 10; paraphyses absent, sporangia terminal; plant microscopic *Sorapion sirulans*

13. Erect filaments more than 10 cells; paraphyses present; sporangia terminal on filaments at base of paraphyses 14.

14. Paraphyses cylindrical Ralfsia spongiocarpa

14. Paraphyses clavate 14.

15. Paraphyses of 2 or 3 cells Ralfsia disciformis

15. Paraphyses more than 3 cells 16.

16. Large coriaceous growths with a definite margin; paraphyses of 6 - 12 cells Ralfsia verrucosa

16. Discoid growths 10 - 20mm diameter; Margin indefinite merging with substrate; paraphyses of 3 - 5 cells. Ralfsia clavata

Key to Section 6.

1. Erect filaments of two morphologically distinct types; prominent assimilatory filaments, small paraphyses at their bases — 2.

1. Erect filaments of one morphological type only — 5.

2. Paraphyses well developed — 3.

2. Paraphyses poorply developed; epiphytic on Arthrocladia, sometimes on Scytosiphon and Spermatochnus — Elachista stellaris

3. Assimilatory filaments less than 100µ wide — 4.

3. Assimilatory filaments more than 100µ wide; on Cystoseira and Halidrys — Elachista flaccida

4. Unilocular sporangia pedicellate; forming tufts on Himanthalia — Elachista scutulata

4. Unilocular sporangia sessile or on pedicells; distinct tufts on Fucus — Elachista fucicola

5. Hairs present — 7.

5. Hairs absent — 6.

6. Plurilocular sporangia intercalary; a band of loculi surrounding the cells assimilatory filaments; unilocular sporangia absent — Halothrix lubricalis

6. Plurilocular sporangia intercalary, uni- or multi- seriate; unilocular sporangia present — Leptanatella fasciculata

7. Plant a gelatinous tuft or cushion; plurilocular sporangia multiseriate, unilocular sporangia absent — Microcoryne ocellata

7. Very small tufts; plurilocular sporangia uniseriate, unilocular sporangia present

Epiphytic on Fucus	M. clandestina
on Himanthalia	M. areschougii
on Chorda	M. chordae
on Scytosiphon	M. haydeni
on Halidrys and Cystoseira	M. rivulariae
on Dictyota	M. stellulata

Key to Section 7.

1. Frond uniaxial 2.

1. Frond multiaxial 4.

2. Apical cell of assimilatory filaments 20 - 35u diameter; frond cartilaginous; unilocular and plurilocular sporangia present
Liebmannia levillei

2. Apical cell of assimilatory filaments 15 - 20u diameter; frond very gelatinous; plurilocular sporangia unknown 3.

3. Frond slender, equal in width throughout; pale yellow brown; surface wooly
Mesogloia lanosa

3. Frond thick, unequally distended; brown in colour; surface smooth
Mesogloia vermiculata

4. Frond richly branched, 100 - 500mm in length 5.

4. Frond sparsely branched, 20 - 200mm in length 7.

5. Assimilatory filaments not sharply differentiated from central axis
Eudesme virescens

5. Assimilatory filaments sharply differentiated from central axis 6.

6. Frond rarely more than 1mm diameter; assimilatory filaments 6 - 8 cells long; inhabiting mid and lower shore levels *Sauvageaugloia griffithsianus*

6. Frond 1 - 3mm diameter; assirilatory filaments 18 - 30 cells long; inhabiting upper and mid shore levels *Sauvageaugloia chordariaeformis*

7. Frond 120 - 200mm long, 2mm diameter; brown; assimilatory filaments much branched *Cladosiphon contortus*

7. Frond 60 - 100mm long; 0.5mm diameter; yellow; assimilatory filaments simple or rarely branched *Cladosiphon zosterae*

Key to Section 8.

1. Thallus unbranched 2.

1. Thallus branched 4.

2. Thallus large, to 10m long (usually 1 - 2m); parenchymatous; unilocular sporangia emerged between paraphyses; epilithic 3.

2. Thallus small, less than 30mm; parenchymatous; plurilocular sporangia uni- or bi- seriate; unilocular sporangia unknown; epiphytic on Sauvageaugloia
Buffhamia speciosa

3. Paraphyses club shaped; plant covered with colourless hairs
Chorda filum

3. Paraphyses linear; plant covered with brown hairs
Chorda tomentosum

4. Thallus alternately branched Desmarestia aculeata

4. Thallus branching not alternate 5.

5. Thallus branching opposite 6.

5. Thallus branching not opposite 8.

6. Plant parenchymatous; often hollow; unilocular sporangia in sori encircling thallus in rings Striaria attenuata

6. Plant pseudoparenchymatous; obvious main axial filament covered with dense cortication; sporangia not encircling thallus 7.

7. Thallus about 1mm diameter, usually more than 150mm long; in summer covered with delicate green hairs, not whorled. Unilocular sporangia sunk in thallus
Desmarestia viridis

7. Thallus more than 1mm diameter, less than 150mm long; bearing whorls of monosiphonous ramuli on which develop chains of unilocular sporangia
Arthrocladia villosa

8. Thallus dichotomously branched 9.

8. Thallus irregularly branched 12.

9. Thallus uniaxial 10.

9. Thallus multiaxial 11.

10. Assimilatory filaments present only at frond apices or absent; sporangia (unilocular) often show a whorled arrangement
Spermatochnus paradoxus

10. Assimilatory filaments clothing entire frond; sporangia (unilocular) irregularly distributed over frond surface Stilopsis lejolisii

11. Assimilatory filaments covering most of the cortex; sporangia confluent
Stilophora tuberculata

11. Assimilatory filaments and sporangia scattered, surrounded by open cortex giving plant a warty appearance Stilophora rhizodes

12. Thallus pseudoparenchymatous and formed by lateral fusion of axes, branches or both; essentially filamentous nature of thallus evident. 13.

12. Thallus parenchymatous and formed by repeated cell division within axes, branches of both; separate filaments lacking. 13.

13. Thallus uniaxial 14.

13. Thallus multiaxial 18.

14. Assimilatory filaments present only at frond apices or absent
Sperrathochnus paradoxus

14. Assimilatory filaments clothing entire frond 15.

15. Assimilatory filaments more than 6 cells 16.

15. Assimilatory filaments less than 6 cells 17.

16. Assimilatory filaments 6 - 8 cells long; axes profusely branched; plurilocular sporangia unknown
Acrothrix gracilis

16. Assimilatory filaments more than 12 cells long; axes sparsely branched; plurilocular sporangia intercalary; known only from southern Britain
Lyricocladia torentosa

17. Assimilatory filaments 2 - 3 cells long, lacking a prominent apical cell
Stilopsis lejolisii

17. Assimilatory filaments 5 cells long; terminating in a large globular cell
Sphacrotrichia divaricata

18. Assimilatory filaments clothing axes from apex to base
Chordaria flagelliformis

18. Assimilatory filaments absent or only at frond apices 19.

19. Assimilatory filaments present only on the distal parts of branches; frond apices lacking a tuft of hairs; sporangia not terminal on branchlets 20.

19. Assimilatory filaments absent; frond apices with a prominent tuft of hairs; sporangia, surrounded by a whorl of monosiphonous branchlets, terminal on lateral branches
Sporochnus pedunculatus

20. Colourless hairs and paraphyses covering most of the cortex, sporangia confluent
Stilophora tuberculosa

20. Colourless hairs, paraphyses and sporangia scattered, surrounded by open cortex giving plant a warty appearance
Stilophora rhizodes

21. Branches lacking a terminal pseudohair but terminating with a small apical cell; cortical cells small and rounded, irregularly placed; plurilocular sporangia absent on acrothallus, unilocular sporangia submerged below epidermal cells 22.

21. Branches terminating in a pseudohair; cortical cells rectangular and irregularly placed; plurilocular sporangia developed from epidermal cells; unilocular sporangia unknown 24.

22. Plant unbranched; small (20 - 80mm long); epiphytic
Dictyosiphon ekmani

22. Plant branched; large; epiphytic and/or epilithic 23.

23. Branches not attenuate basally; thallus not more than 0.5mm wide, fine plant; not gelatinous and slippery — Dictyosiphon foeniculaceus

23. Branches attenuate at base; thallus 1 - 2mm wide, coarse plant, gelatinous and slippery — Dictyosiphon chordaria

24. Thallus 75 - 150mm long; fine plant, pale brown colour; central cells in L.S. longer than wide. Plurilocular sporangia absent on monosiphonous parts (in nature +) — Stictyosiphon tortilis

24. Thallus 100 - 600mm long; coarse plant, dark brown; central cells in L.S. as wide as long; plurilocular sporangia present on monosiphonous parts of the frond — Stictyosiphon soriferus

+ Apparently found on monosiphonous filaments in culture.

Key to section 9.

1. Thallus elongated and tubular — 2.

1. Thallus round — 6.

2. Thallus constricted at intervals; one chloroplast per cell; small surface cells transformed into sporangia which are not localised into sori; unilocular sporangia unknown on macrothallus — Scytosiphon lomentaria

2. Thallus not constricted; several chloroplasts per cell; unilocular and plurilocular sporangia occur in small sori dotted over the thallus. — 3.

3. Thallus at least in part flattened — Asperococcus compressus

3. Thallus tubular — 4.

4. Thallus with large discoid base; less than 10cm long — Asperococcus scaber

4. Thallus without large discoid base; more than 10cm long — 5.

5. Thallus cylindrical; 2.5 - 10mm diameter; tapering to the base — Asperococcus fistulosus

5. Thallus inflated; more than 10cm diameter; narrowing abruptly at the base — Asperococcus turneri

6. Thallus irregularly lobed, sub-spherical; gelatinous; internal tissue of colourless filaments; assimilatory filaments separate under pressure — Leathesia difformis

6. Thallus balloon-like; membranous; internal tissue of large round cells; assimilatory cells do not separate under pressure — Colpomenia peregrina

KEY TO SECTION 10.

1 Frond branched.....2.

1 Frond unbranched.....6.

2 Frond with prominent apical cell; hairs lacking.....3.

2 Frond without prominent apical cell, but with line of small apical cells; hairs present....4.

3 Thallus two cell layers thick at base; yellow-brown; on all coasts .. Dictyota dichotoma

3 Thallus three cell layers thick at base; pale yellow brown; confined to S.W. coasts. Dictyota spiralis

4 Frond dichotomously divided; dotted with sori of plurilocular sporangia. Cutleria multifida.

4 Frond divided, but not dichotomously; tetrasporangia and gametangia associated with hairs and organised in rows.....5.

5 Frond fan-shaped, less than 100mm long; with chalky deposit. Padina pavonica.

5 Frond ligulate, more than 100mm long; without chalky deposit. Taonia atomaria.

6 Attachment organ a root-like holdfast.....7.

6 Attachment organ rhizoids or a small disc.....8.

7 Stipe with a small swelling; cryptostomata present. Young Saccorhiza.

7 Stipe without a small swelling; cryptostomata absent. Young Laminaria spp.

8 One chloroplast per cell.....9.

8 Many chloroplasts per cell.....10.

9 Frond less than 2mm wide. Petalonia zosterifolia.

9 Frond more than 10mm wide. Petalonia fascia.

Addition to Section 10.

10. Thallus less than 10mm wide 11.

10. Thallus more than 10mm wide 13.

11. Sporangia formed in the epidermal cells; hairs scattered; medulla two layers of rectangular cells 12.

11. Sporangia arising from epidermal cells, raised above the surface of the frond and among multicellular hairs; medulla of many large colourless cells Asperococcus compressus

12. Epiphytic on Zostera, Chorda and other plants Desmotrichum undulatum

12. On small stones and shells; pale brown (hyaline) Punctaria tenuissima

13. Plant pale brown in colour 14.

13. Plant dark brown in colour 15.

14. Plant up to 15mm wide; sporangia arising from the epidermal cells, raised above the surface of the frond and among multicellular hairs; medulla of large colourless cells Asperococcus compressus

14. Plant 25 - 75 mm wide; sporangia formed in the epidermal cells; hairs scattered; medulla of two layers of rectangular cells Punctaria latifolia

15. Margin of frond very wavy; frond to 200mm wide; narrows abruptly to a stipe Punctaria crispata

15. Margin of fron slightly undulating; frond to 50mm wide; tapers gradually to a stipe Punctaria plantaginea

Key to section 11.

1. Frond undivided; bearing a cluster of lateral outgrowths (sporophylls) from the stipe; attached by a large root-like holdfast — *Alaria esculenta*

1. Frond divided; sporophylls absent; not attached by a root-like holdfast — 2.

2. Branching opposite — 3.

2. Branching dichotomous — 4.

3. Lateral branches narrow and ligulate — *Desmarestia ligulata*

3. Lateral branches wide and foliaceous — *Desmarestia ligulata* var. *firma*

4. Frond narrow (3mm or less); unilocular sporangia formed on terminal conical protuberences at frond apex — *Carpomitra costata*

4. Frond more than 3mm wide; unilocular sporangia absent — 5.

5. Frond papery/membranous; tetrasporangia present in sori over frond, gametangia in small sori over the frond — *Dictyopteris membranacea*

5. Frond leathery; tetrasporangia absent; gametangia in receptacles near the apical parts of the frond — 6.

6. Frond with toothed margin — *Fucus serratus*

6. Frond margin entire — 7.

7. Frond with paired vesicles in the thallus — *Fucus vesiculosus*

7. Frond without paired vesicles in the thallus — 8.

8. Receptacles terminal — 9.

8. Receptacles not terminal; apex of frond continues to grow beyond receptacles — 11.

9. Frond thin, often decayed to midrib; receptacles pointed; growing in areas of freshwater run-off. — *Fucus cernoides*

9. Frond tougher, much less decayed to midrib; receptacles not pointed; grows in estuaries but not in freshwater — 10.

10. Frond twisted; receptacles with a sterile rim — *Fucus spiralis*

10. Frond not twisted; receptacles without a sterile rim — *Fucus vesiculosus* f. *linearis*

11. Plants small, less than 100mm; grows in exposed conditions — *Fucus distichus* — 12.

11. Plants large, more than 100mm; grows in sheltered conditions — *Fucus distichus* ssp. *edentatus*

12. Frond with stiff midrib forming drooping plants on rocks — ssp. *anceps*

12. Frond less rigid; grows in upper littoral pools — ssp. *distichus*

Key to section 12.

1. Frond button (conical) shaped — *Hiranthalia elongata*

1. Frond not as above — 2.

2. Frond small, about 100mm, channelled — *Pelvetia canaliculata*

2. Frond larger than 100mm — 3.

3. Frond regularly dichotomously branched — 4.

3. Frond not regularly dichotomously branched — 5.

4. Holdfast creeping, root like; frond cylindrical, neither button-shaped nor strap shaped; receptacles terminal; known only from S.W. Britain. — *Bifurcaria bifurcata*

4. Holdfast discoid, frond button shaped with long dichotomously branched strap-shaped receptacles — *Hiranthalia elongata*

5. Frond with air bladders — 6.

5. Frond without air bladders — 13.

6. Thallus flattened, branched (irregularly dichotomous) but not bushy; air bladders at intervals along frond; globular receptacles on short branchlets — *Ascophyllum nodosum*

6. Thallus cylindrical, much branched (irregularly pinnate), bushy; air baldders pod-like or cylindrical; receptacles small and elongated — 7

7. Bladders pod-lke (siliquose) — *Halidrys siliquosa*

7. Bladders spherical — 8.

8. Receptacles and bladders intercalary on main axis — 9.

8. Receptacles and bladders on lateral branchlets — *Sargassum ruticum*

9. Axis flattened, apex surrounded by incurved young later branchlets — *Cystoseira baccata*

9. Axis radial — 10.

10. Axis bearing zones of lateral branches with zones of swellings at their bases (tophules) — *Cystoseira nodicaulis*

10. Axis lacking tophules. — 11.

11. Plants solitary; apical region of axis and young laterals covered with whorls of bifid appendages giving an Equisetum like appearance; strongly irridescent when submerged. — *Cystoseira tamariscifolia*

11. Plants caespitose; apical region of axis smooth or covered with tubercles; not irridescent. — 12.

12. Lateral branches of young plants flattened and foliose; occasional flattened lateral branches in older plants; known only from S.W. Britain. — *Cystoseira foeniculacea*

12. Lateral branches of young plants radial and filiform; never foliose; no flattened lateral branches in adult plants; known only from the Channel Isles. — *Cystoseira humilis*

13. Thallus narrow, much branched and bushy — *Desmarestia aculeata*

13. Thallus broad, divided, not bushy 14.

14. Large leathery frond, flattened stipe with frilled wings; base irregularly bulbous and warty; cryptostomata and hairs present Saccorhiza polyschides

14. Large leathery frond, tipe oval or cylindrical; no frilled wings to stipe; cryptostomata and hairs absent. 15.

15. Frond Margins wavy, centre area undulating * Laminaria saccharina

15. Frond Margin not wavy, centreparts flat 16.

16. Stipe smooth, without epiphytes 17.

16. Stipe rough with many epiphytes Laminaria hyperborea

17. Stipe flexuous, no yellow coloration at base of frond Laminaria digitata

17. Stipe stiff; yellow coloration at base of frond Laminaria ochroleuca

* L saccharina var

Streblonema breve (Sauv.) De Toni

Thallus microscopic, of irregularly branched uniseriate filaments. Erect system very reduced of a few sparsely branched filaments; prostrate system more extensive than erect system. One or two discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, ovoid in shape, terminal on filaments.
Littoral; endophytic in Ascophyllum.

Streblonema effusum Kylin

Thallus microscopic, of uniseriate filaments. Erect system of colourless hairs only; prostrate system of free filaments and rhizoids, greater in extent than erect system. One or two discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, elongate, terminal on filaments.
Littoral; endophytic.

Streblonema fasciculatum Thur in Le Jol.

Thallus microscopic, of branched uniseriate filaments. Erect system of colourless hairs only; prostrate system of free filaments and rhizoids, more extensive than erect system. One or two discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, elongate, terminal on short branchlets.
Littoral; endophytic in Eudesme, Mesogloia and Helminthocladia.

Streblonema helophorum (Rosenv.) Batt.

Thallus microscopic, of branched uniseriate filaments. Erect system of sparsely and irregularly branched assimilatory filaments; prostrate system of free filaments and rhizoids, more extensive than erect system. One discoid chloroplast per cell.
Unilocular sporangia terminal on filaments; plurilocular sporangia unknown.
Infralittoral; endophytic in Petrocelis.

Streblonema intestinum (Reinsch) Batt.

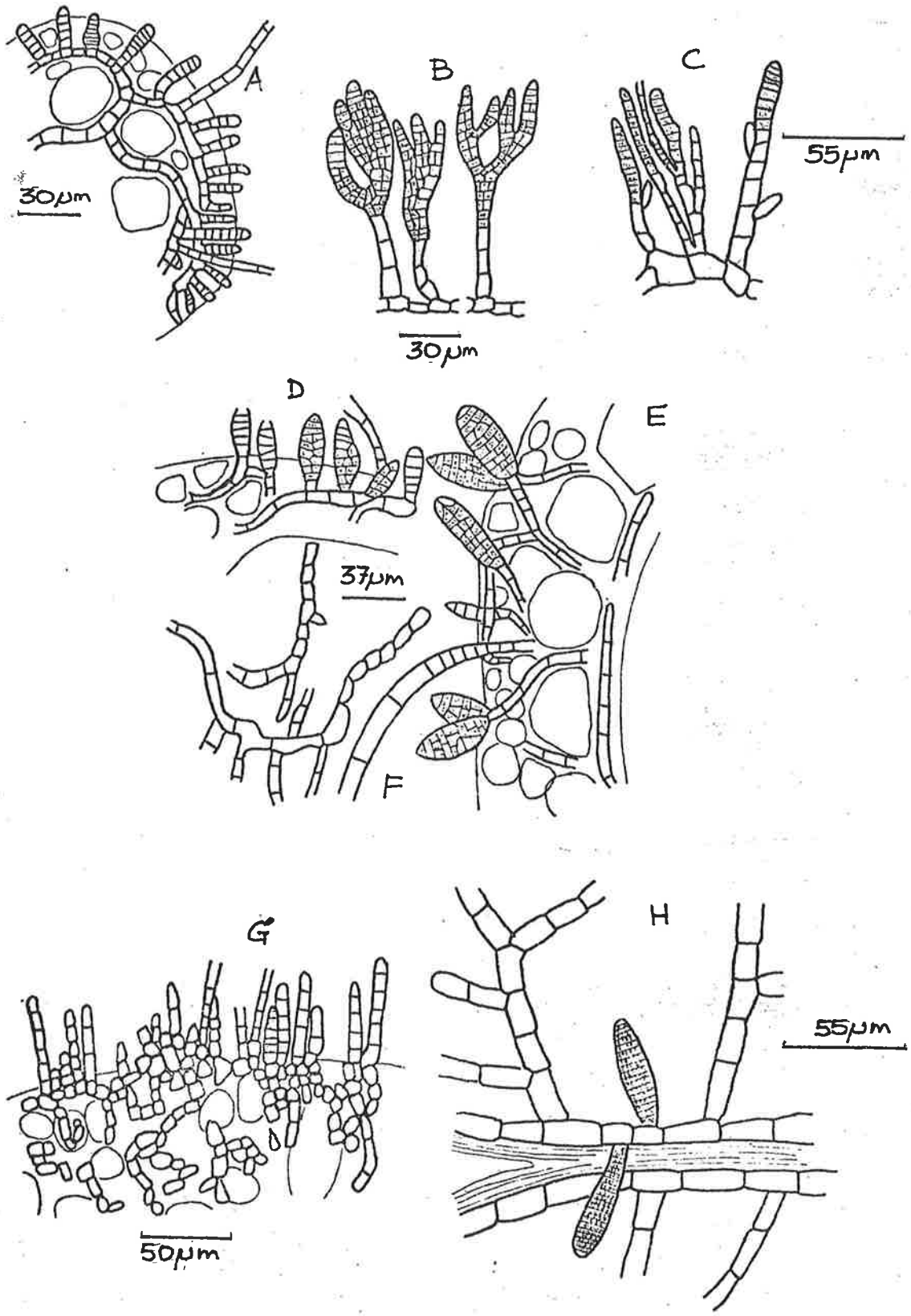
Thallus microscopic, of branched uniseriate filaments. No obvious prostrate system. Erect assimilatory filaments sparsely branched, usually irregular or irregularly alternate. Chloroplasts discoid.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, ovoid, terminal on filaments.
Infralittoral; endophytic in Brongniartella.

Streblonema parasiticum (Sauv.) Levr.

Thallus microscopic, of uniseriate filaments. Erect system of unbranched assimilatory filaments and hairs; prostrate system of free filaments and rhizoids, more extensive than erect system. One discoid chloroplast per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate or biseriate, terminal on filaments.
Infralittoral; endophytic in Ceramium, Cystoclonium and Gracilaria.

Streblonema stilophorae (Crouan frat.) Hamel.

Thallus very small 2mm [– 5mm] diameter, of branched uniseriate filaments. Erect system of hairs and sparsely and irregularly branched assimilatory filaments; prostrate system of free filaments, more extensive than erect system. Two to four discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, terminal on filaments.
Infralittoral; endophytic in Stilophora.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Endodictyon infestans Gran.

Thallus microscopic, of branched uniseriate filaments. Main vegetative system prostrate; hairs present; rhizoids present. One or two linear chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, irregular in shape.
Infralittoral; endozoic in Bryozoans.

Mikrosyphar polysiphoniae Kuck.

Thallus microscopic, of branched uniseriate filaments. Main vegetative system prostrate; hairs present. Filaments often aggregate into pseudodiscs. One or two linear chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, terminal or intercalary.
Littoral; endophytic in Ceramium and Polysiphonia.

Mikrosyphar porphyrae Kuck.

Differs from M. polysiphoniae by being endophytic in Porphyra.

Phaeostroma pustulosum Kuck.

Thallus microscopic, of uniseriate filaments. Erect system of hairs only; prostrate system of filaments often aggregated into pseudodiscs. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, irregular in shape.
Littoral; epiphytic on Zostera and various algae.

Streblonema aequale Oltm.

Thallus microscopic, of branched uniseriate filaments. Erect system of unbranched assimilatory filaments terminating in hairs; prostrate system of branched free filaments, more extensive than erect system. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, irregular in shape.
Littoral, infralittoral; endophytic in Chorda.

Streblonema sphaericum (Derb. et Sol. in Castagne) Thur. in Le Jol.

Thallus microscopic, of branched uniseriate filaments. Erect assimilatory filaments sparsely branched or unbranched; hairs present; prostrate system of free filaments, more extensive than erect system. Rhizoids apparently unrecorded. A few discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia uni- or bi- seriate, terminal on filaments.
Littoral. infralittoral; endophytic in Mesogloia and Leibmannia.

Streblonema volubile (Crouan frat.) Thur. in Le Jol.

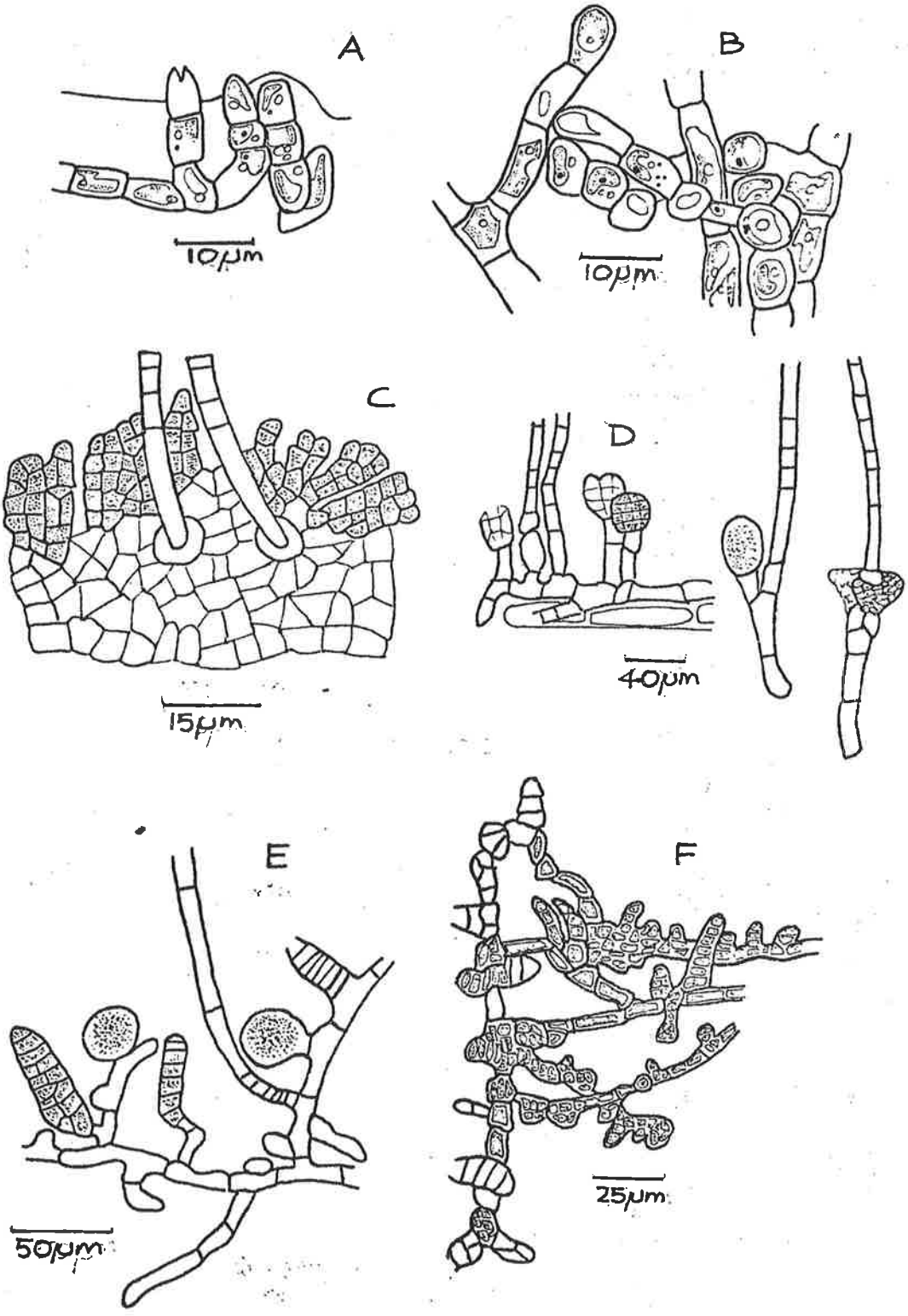
Thallus microscopic, of branched uniseriate filaments. Erect assimilatory filaments sparsely and irregularly branched often unbranched; prostrate system of free filaments and rhizoids, more extensive than erect system. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, elongate, terminal on filaments.
Infralittoral; endophytic in Dudresnaya.

Streblonema zanardinii (Crouan frat) de Toni

Thallus microscopic, of occasionally branched uniseriate filaments.
Erect assimilatory filaments unbranched; prostrate system of free filaments and rhizoids, more extensive than erect system. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uni- or bi- seriate, terminal.
Infralittoral; endophytic in Chylocladia.

Plate 2

Mikrosyphar porphyrae, plurilocular sporangia (A), vegetative filaments (B), after Kuckuck, 1897.
Phaeostrora pustulosum, hairs and plurilocular sporangia, after Kylin, 1947 (C).
Streblonema aequale, unilocular and plurilocular sporangia after Kuckuck, 1897 (D).
S. sphaericum, unilocular and plurilocular sporangia, after Sauvageau, 1892 (E).
Endodictyon infestans, plurilocular sporangia, after Lebring, 1945 (F).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Compsonema microspongium (Batt.) Kuck.

Thallus a microscopic, globose patch or cushion less than 1mm in diameter. Thallus of erect and prostrate filaments, erect system greater than prostrate system. Erect assimilatory filaments frequently branched, pseudodichotomously below, secund above; unicellular or multicellular paraphyses absent; hairs often arise unilaterally on erect filaments. Rhizoids penetrate host plant. Erect filaments arise from a basal layer one cell thick. One discoid chloroplast per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, terminal, scattered or aggregated into sori.
Littoral; epiphytic on Ralfsia.

Compsonema saxicola (Kuck.) Kuck.

Thallus a small patch or disc composed of erect and prostrate filaments; erect system greater than prostrate. Erect assimilatory filaments pseudodichotomously branched; unbranched multicellular paraphyses present; hairs present, arising from basal layer among erect filaments. Basal layer 1 – 2 cells thick. One discoid chloroplast per cell.
Unilocular sporangia present; plurilocular sporangia unknown.
Littoral; epilithic or epizoic.

Dichosporangium chordariae Wollny

Thallus microscopic, of uniseriate filaments. Erect system of colourless hairs which arise from prostrate filaments. Prostrate filaments branched, more extensive than erect system. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate and elongate.
Littoral; endophytic in various algae especially Chordaria flagelliformis.

Herponema solitarium (Sauv.) Hamel

Thallus microscopic, of uniseriate filaments. Very small and infrequent erect assimilatory filaments arise from a more extensive prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, terminal on short branchlets.
Infralittoral; epiphytic on Dictyota, Taonia and Dictyopteris.

Microspongium gelatinosum Reinke

Thallus a small globose patch or cushion, 1 – 3mm diameter. Erect system greater than prostrate; erect assimilatory filaments sparsely pseudodichotomously or alternately branched, arsing from a basal layer one cell thick; Prostrate system of free filaments. Hairs arise from basal layer. 1 [E2] discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, terminal or lateral on assimilatory filaments.
Infralittoral; epilithic, epizoid.

Microspongium globosum Reinke

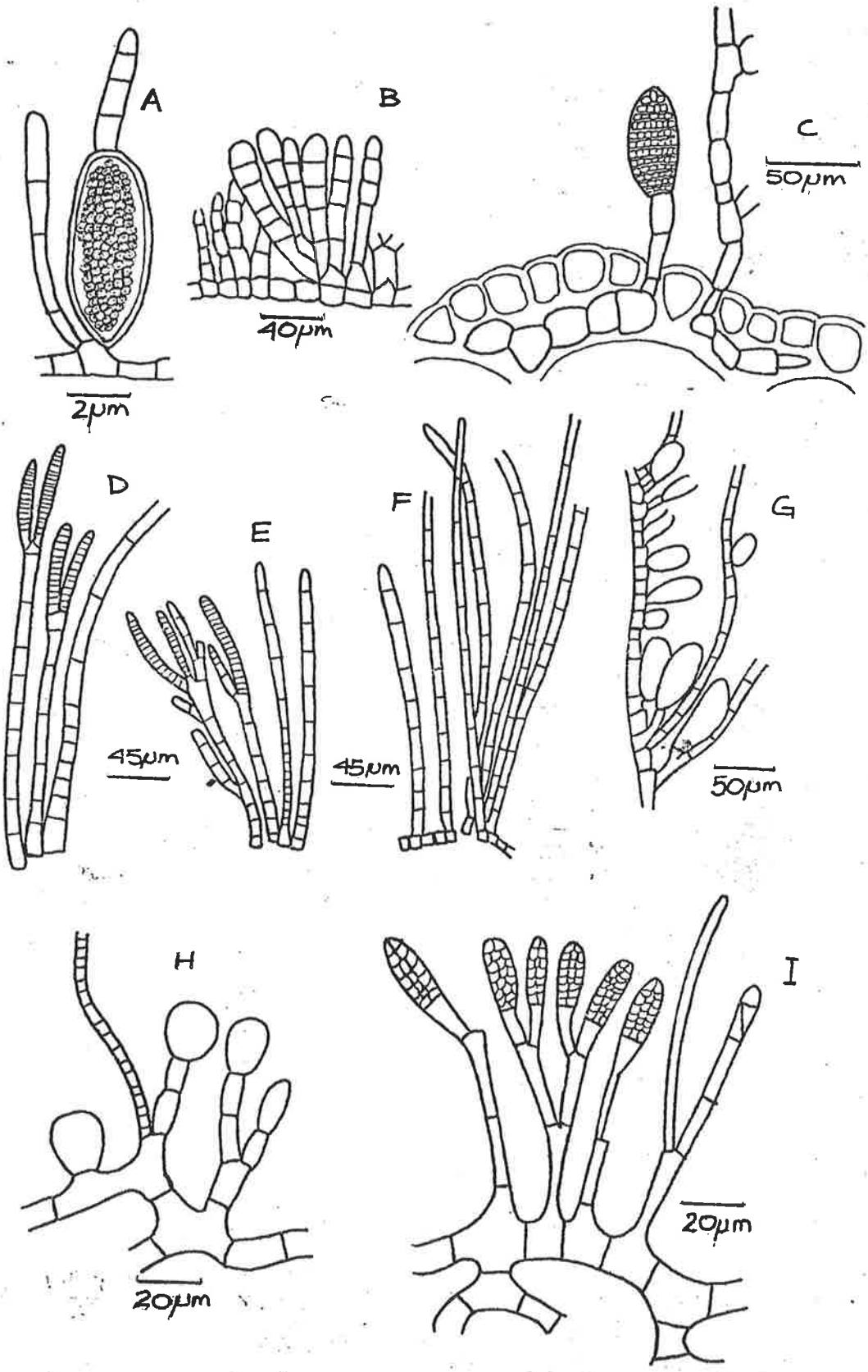
Very similar to M. gelatinosum, plurilocular sporangia terminal on assimilatory filaments.

Protectocarpus speciosus (Börg.)Kuck.

Thallus a microscopic subglobose patch or cushion of erect and prostrate uniseriate filaments; erect system greater than prostrate system. Erect filaments sparsely branched, secund or subsecund, sometimes terminating in hairs. Usually one, very rarely two discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia uni- , bi-, or multi-seriate, often branched, terminal or lateral on filaments.
Littoral; epiphytic and epizoic on Patella shells.

Plate 3

Compsonema saxicola, unilocular sporangia (A), vegetative filaments (B), after Knight & Parke, 1936.
Herponema solitarium, unilocular sporangium, after Gauvageau, 1892 (C).
Microspongium globosum, plurilocular sporangia, after Pankow, 1971 (D).
M. gelatinosum, plurilocular sporangia, after Pankow, 1971 (E).
Protectocarpus speciosus, vegetative filaments (F), unilocular sporangia (G), after Cardinal, 1964.
Dichosporangium chordariae, plurilocular sporangia, after Wollny, 1886 (H,I)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Chilionema ocellatum (Kütz.) Sauv.

Thallus a very small, globose, patch or cushion less than 4mm diameter. Thallus of erect and prostrate filaments, erect system greater than prostrate. Erect filaments unbranched, organised into concentric bands, arising from a basal layer [1] - usually 2 [rarely several] cells thick. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, elongate, on pedicells or arising from basal layer, in sori among erect filaments.
Littoral, infralittoral; epiphytic on Laminaria.

Chilionema reptans (Crouan frat.) Sauv.

Thallus a very small, globose, patch or cushion less than 4mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect assimilatory filaments un branched, in irregular patches, arising from a basal layer [1] - usually 2 -[rarely several] cells thick. Hairs rare. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, elongate, terminal on short filaments, in sori among erect filaments.
Littoral; epiphytic.

Hecatonema foecundum (Strömf.) Lois.

Thallus a small, light brown, patch or cushion 2 - 6mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect filaments pseudodichotomously branched, arising from a basal layer 2 cells thick. Assimilatory filaments often terminate in a hair. Ascocysts present. Many discoid chloroplasts per cell.
Unilocular sporangia pedicellate or terminal on short filaments, arising from the basal layer; plurilocular sporangia uni- and bi- seriate, elongate, pedicellate or terminal on filaments.
Littoral; epiphytic on various algae especially Palmaria.

Hecatonema hispanicum (Sauv.) Lois.

Thallus a minute brown, globose, patch or cushion to 2mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect filaments sparsely branched, pseudodichotomous, arising from a basal layer [1] usually 2 cells thick. Hairs rare; ascocysts present, elongate in shape. 1, [rarely 3] discoid chloroplasts per cell. Unilocular sporangia unknown; plurilocular sporangia bi- or multiseriate, terminal on filaments.
Littoral, infralittoral; epiphytic on larger brown algae.

Hecatonema leichtensternii (Hauck) Batt.

Thallus a small olive-brown, globose, patch or cushion 1 - 5mm diameter. Thallus of erect and prostrate uniseriate filaments, erect system greater than prostrate system. Erect assimilatory filaments sparsely and irregularly branched, arising from a basal layer 2 cells thick. Ascocysts absent. Hairs absent
Chloroplasts discoid.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, terminal.
Littoral; epiphytic.

Hecatonema maculans (Coll.) Sauv.

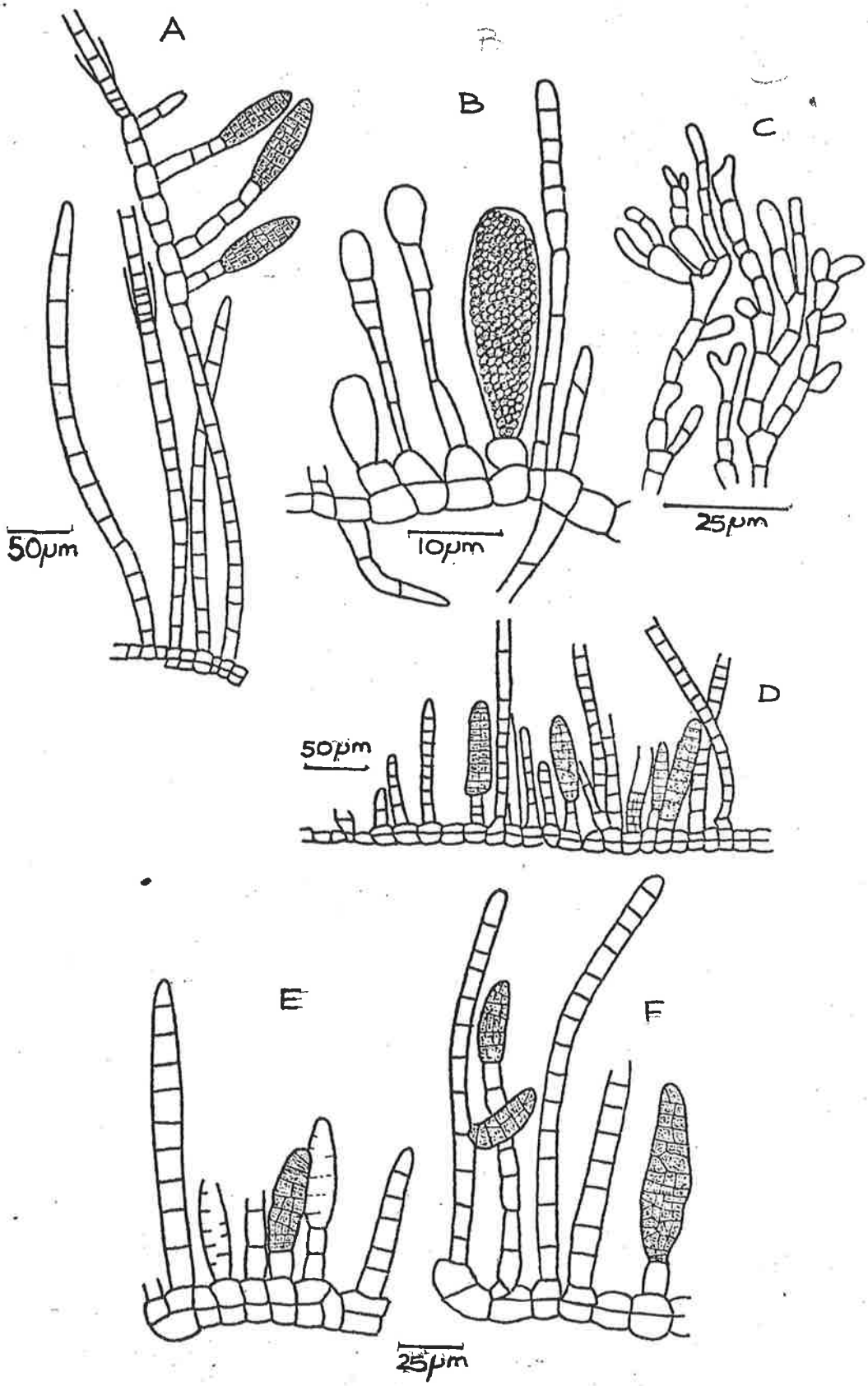
Thallus a small, brown, patch or cushion 2mm diameter. Thallus of erect and prostrate uniseriate filaments, erect system greater than prostrate. Erect filaments sparsely branched, pseudodichotomous or alternate, arising from a basal layer [1], usually 2 [rarely several] cells thick. Ascocysts absent. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia terminal on filaments; plurilocular sporangia multiseriate, sessile or on short pedicells.
Littoral; epiphytic on Palmaria and Ulva.

Ulonema rhizophorum Fosl.

Thallus a small, globose or subglobose, patch or cushion 2 - 3mm diameter. Cushion not as compact as in Hecatonema. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect assimilatory filaments sparsely branched, pseudodichotomous or alternate. Hairs present. Rhizoids abundant. Many discoid chloroplasts per cell.
Unilocular sporangia present in sori; plurilocular sporangia uniseriate, terminal.
Littoral; epiphytic/endophytic in Dumontia.

Plate 4.

Hecatonema maculans, plurilocular sporangia, after Kuckuck, 1953 (A).
Ulonema rhizophorum, unilocular sporangium (B), vegetative filaments (C), after Knight & Parke, 1931.
Chilionema ocellatum, plurilocular sporangia, after Kuckuck, 1953 (D).
C. reptans, plurilocular sporangia, after Kuckuck, 1953 (E,F).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Myrionema aecidioides (Rosenv.) Sauv.

Thallus a microscopic, globose, patch or cushion. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect assimilatory filaments unbranched, arising from a basal layer one cell thick. Hairs present. Many discoid chloroplasts per cell. Unilocular sporangia terminal, in sori; plurilocular sporangia uniseriate, terminal in sori, breaking through surface of host plant. Infralittoral; epiphytic/endophytic in Laminaria.

Myrionema corunnae Sauv.

Thallus a microscopic, dark brown, globose patch or cushion, 1 – 2mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect filaments sparsely, pseudodichotomously branched, arising from a basal layer one cell thick. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, in sori, terminal on short erect filaments.
Littoral; epiphytic particularly on Zostera.

Myrionema magnusii (Sauv.) Lois.

Thallus a very small globose patch or cushion, 0.5 – 1mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect assimilatory filaments unbranched, arising from a basal layer cells thick. Hairs present. Ascocysts present. 1 – 3 discoid chloroplasts per cell.
Unilocular sporangia in sori, arising from the basal layer; plurilocular sporangia uniseriata in sori, arising from the basal layer.
Littoral; epiphytic particularly on Zostera.

Myrionema papillosum Sauv.

Thallus a light brown, subglobose, patch or cushion, up to 5mm diameter. Thallus of erect and prostrate uniseriate filaments. Erect assimilatory filaments unbranched, arising from a basal layer one cell thick. Small protuberences present on the cells of the assimilatory filaments. Hairs present. Multicellular paraphyses present. Ascocysts present. Many discoid chloroplasts per cell.
Unilocular sporangia terminal on short pedicellate or lateral branchlets; plurilocular sporangia uniseriate, pedicellate or on short branchlets.
Infralittoral; epiphytic on Laminaria.

Myrionema polycladum Sauv.

Thallus a small, light brown, subglobose patch or cushion, 5mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect assimilatory filaments sparsely, pseudodichotomously branched, arising from a basal layer 1 cell thick. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, terminal, in sori.
Littoral; epiphytic on Fucus serratus.

Myrionema strangulans Grev.

Thallus an olive brown, subglobose patch or cushion, up to 5mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate system. Erect aasimilatory filaments unbranched, arising centrally from a basal layer one [rarely 2] cells thick. Prostraste filaments radially organised, terminally dichotomously branched. Hairs present. Multicellular paraphyses present.
Many discoid chloroplasts per cell.
Unilocular sporangia sessile, pedicellate or terminal on short erect filaments; plurilocular sporangia uniseriate, sessile, pedicellate or terminal on short erect filaments.
Littoral, infralittoral; epiphytic on Enteromorpha and Ulva.

Pleurocladia lacustris A. Br.

Thallus a microscopic, subglobose,patch or cushion up to 2mm diameter. Thallus of erect and prostrate uniseriate filaments; erect system greater than prostrate. Erect assimilatory filaments sparsely, pseudodichotomously branched, arising from a loosely organised basal layer. Numerous long hairs arise from vegetative cells. A single discoid chloroplast per cell.
Unilocular sporangia terminal or lateral on filaments; plurilocular sporangia unknown.
Supralittoral fringe; epilithic.

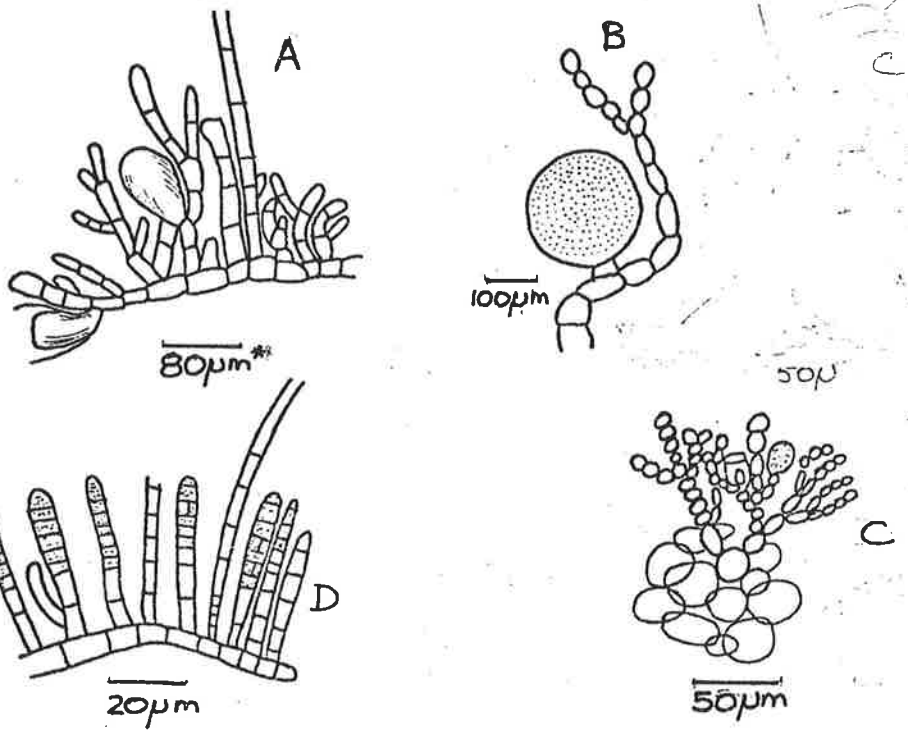
Strepsithalia buffhamiana (Batt.) Batt.

Thallus a microscopic tuft of uniseriate filaments. Erect filaments sparsely branched, greater than the procumbent system which creeps among the cortical filaments of the host plant. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia sessile on the bases of assimilatory filaments; plurilocular sporangia unknown.
Littoral; endophytic in Mesogloia and Sauvageaugloia.

Differs from Elachista by the non-cohesion of procumbent filaments.

Plate 5

Pleurocladia lacustris, unilocular sporangia, after Pankow, 1971 (A).
Strepsithalia buffhamiana, unilocular sporangia (B), vegetative filaments (C), after Newton, 1931.
Myrionema corunnae, plurilocular sporangia, after Kylin, 1907, (D).
M. orbicularis, plurilocular sporangia, ascocysts (E, F), vegetative filaments (G), after Kylin, 1947.
M. strangulans, plurilocular sporangia (H), unilocular sporangia (I), after Kylin, 1947.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C
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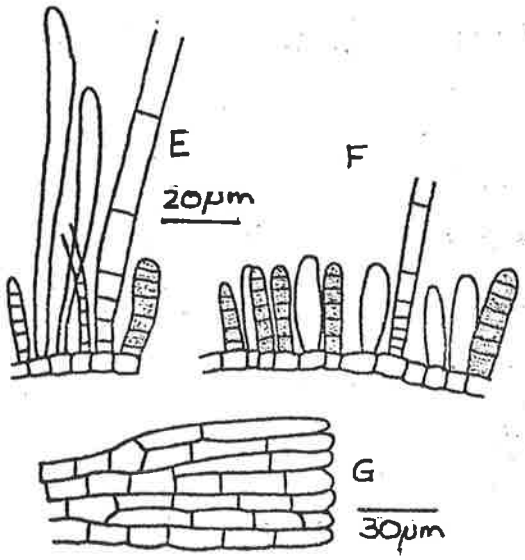
E
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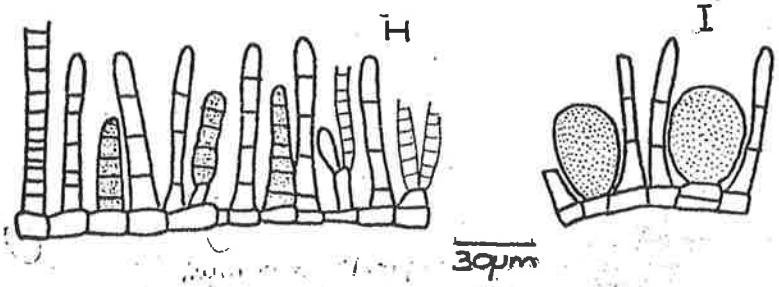
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Ectocarpus fasciculatus Harv.

Thallus filamentous, up to 200mm long. Erect vegetative system of branched uniseriate assimilatory filaments which often terminate in hairs. Branching abundant, irregularly opposite, occasionally secund. Basal system of free filaments which often aggregate into a pseudodisc. Chloroplasts linear, more than three per cell.
Unilocular sporangia on short pedicells; plurilocular sporangia multiseriate, elongate, cigar-shaped (wider in middle parts), less than 125μ in length; terminal on short branchlets or pedicellate.
Littoral, infralittoral; epilithic and epiphytic on various algae.

Ectocarpus siliculosus (Dillw.) Lyngb.

Very similar to E. fasciculatus, differs in having irregular alternate branching and plurilocular sporangia more than 125μ in length often terminating in a hair like outgrowth. Occurs in marine and estuarine conditions.

Laminariocolax tomentosoides (Farl.) Kylin

Thallus filamentous, usually less than 10mm long. Erect vegetative system of branched uniseriate assimilatory filaments. Branching sparse and irregular; plants often unbranched. Basal system of free filaments and rhizoids which penetrate the host plant. One linear chloroplast per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, sessile, pedicellate or terminal on filaments.
Littoral, infralittoral; epiphytic on Laminaria.

Pilayella littoralis (L.) Kjellm.

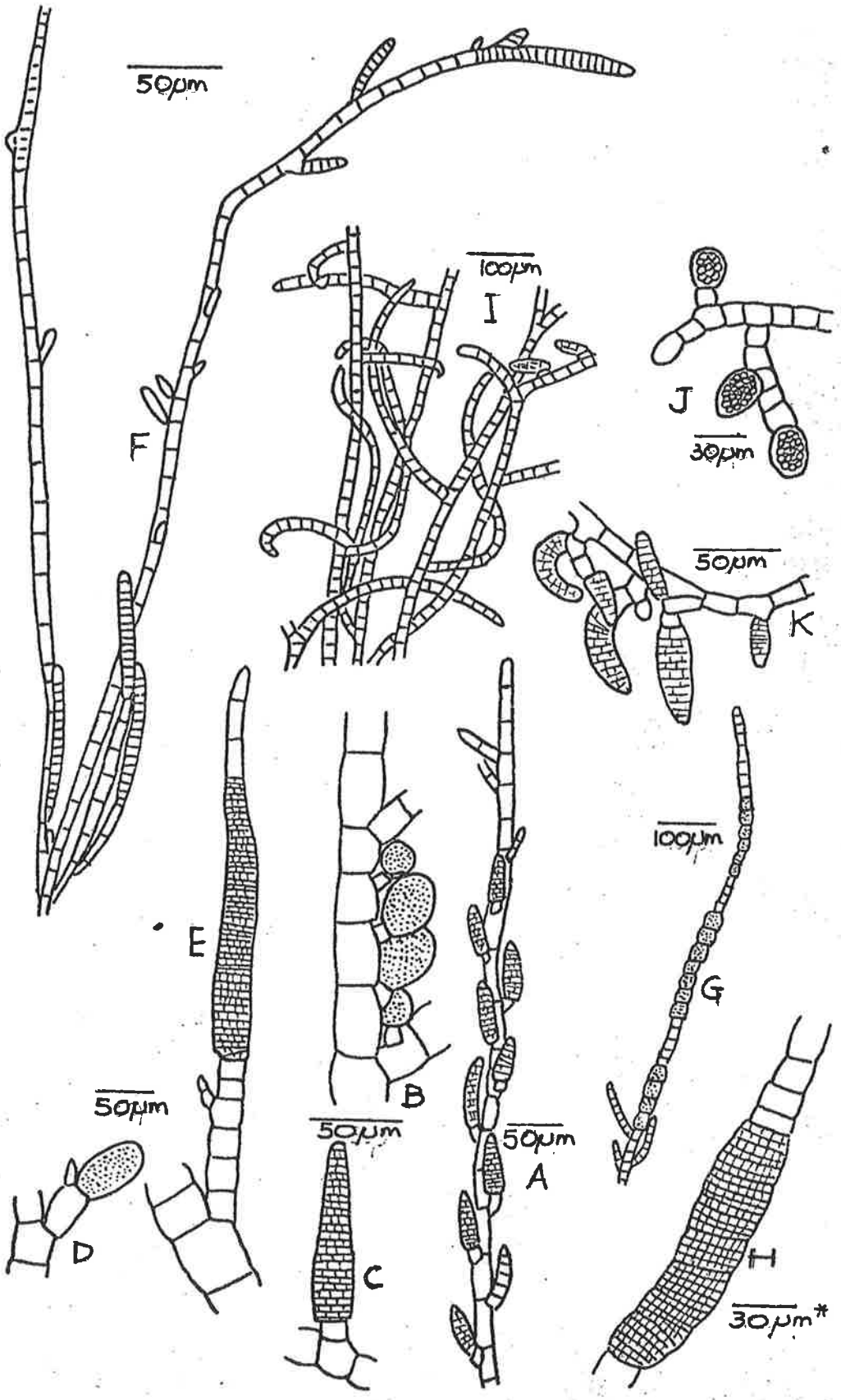
Thallus filamentous, up to 200mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching irregularly opposite. Occasional longitudinal cell divisions. Basal system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia intercalary, sometimes terminal; plurilocular sporangia also intercalary, sometimes terminal.
Littoral, infralittoral; epilithic or epiphytic. Occurs in marine and estuarine conditions.

Spongonema tomentosum (Huds.) Kütz.

Thallus filamentous, up to 200mm long. Erect system of branched assimilatory filaments; branching secund, intertwining right-angled branches present. Filaments densely interwoven thallus appearing string-like. Basal system of free filaments and rhizoids; some filaments aggregate into a pseudodisc. One or two linear chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, elongate, terminal on short branchlets.
Littoral, infralittoral; epiphytic on Fucus and Himanthalia.

Plate 6. (Taken from Cardinal, 1964, except H).

Ectocarpus fasciculatus, filament (A), unilocular sporangia (B), plurilocular sporangia (C).
E. siliculosus, unilocular sporangium (D), plurilocular sporangium (E).
Laminariocolax tomentosoides, filaments and unilocular sporangia (F).
Pilayella littoralis, unilocular sporangia (G); plurilocular sporangium (H), after Pankow, 1971.
Spongonema tomentosum, filaments (I), unilocular sporangia (J), plurilocular sporangia (K).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Feldmannia globifera (Kütz.) Hamel

Thallus filamentous, 5- [100] mm in length. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant but irregular. Prostrate system of free filaments and rhizoids. Hairs present. Several discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, ovoid, pedicellate.
Littoral, infralittoral; epiphytic.

Feldmannia irregularis (Kütz.) Hamel

Very similar to F. globifera; differs in having elongate plurilocular sporangia.

Feldmannia lebellii (Aresch. ex Crouan frat.) Hamel

Very similar to F. globifera and F. irregularis, but assimilatory filaments with irregular opposite branching. Unilocular sporangia unknown, plurilocular sporangia elongate.

Feldmannia padinae (Buffh.) Hamel

Thallus filamentous, not more than 3mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching sparse and irregular. Prostrate system of free filaments and rhizoids which grow among the outer cortical cells of Padina. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, elongate, terminal on short branches or pedicells.
Littoral; epiphytic/endophytic on Padina pavonica.

Feldmannia simplex (Crouan frat.) Hamel

Thallus filamentous, [to] 10 mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching sparse and irregular. Prostrate system of free filaments and rhizoids which ramify among the utricles of Codium. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, ovoid, pedicellate.
Littoral; epiphytic/endophytic on Codium.

Kuetzingiella battersii (Born. in Sauv.) Kornm. in Kuck.

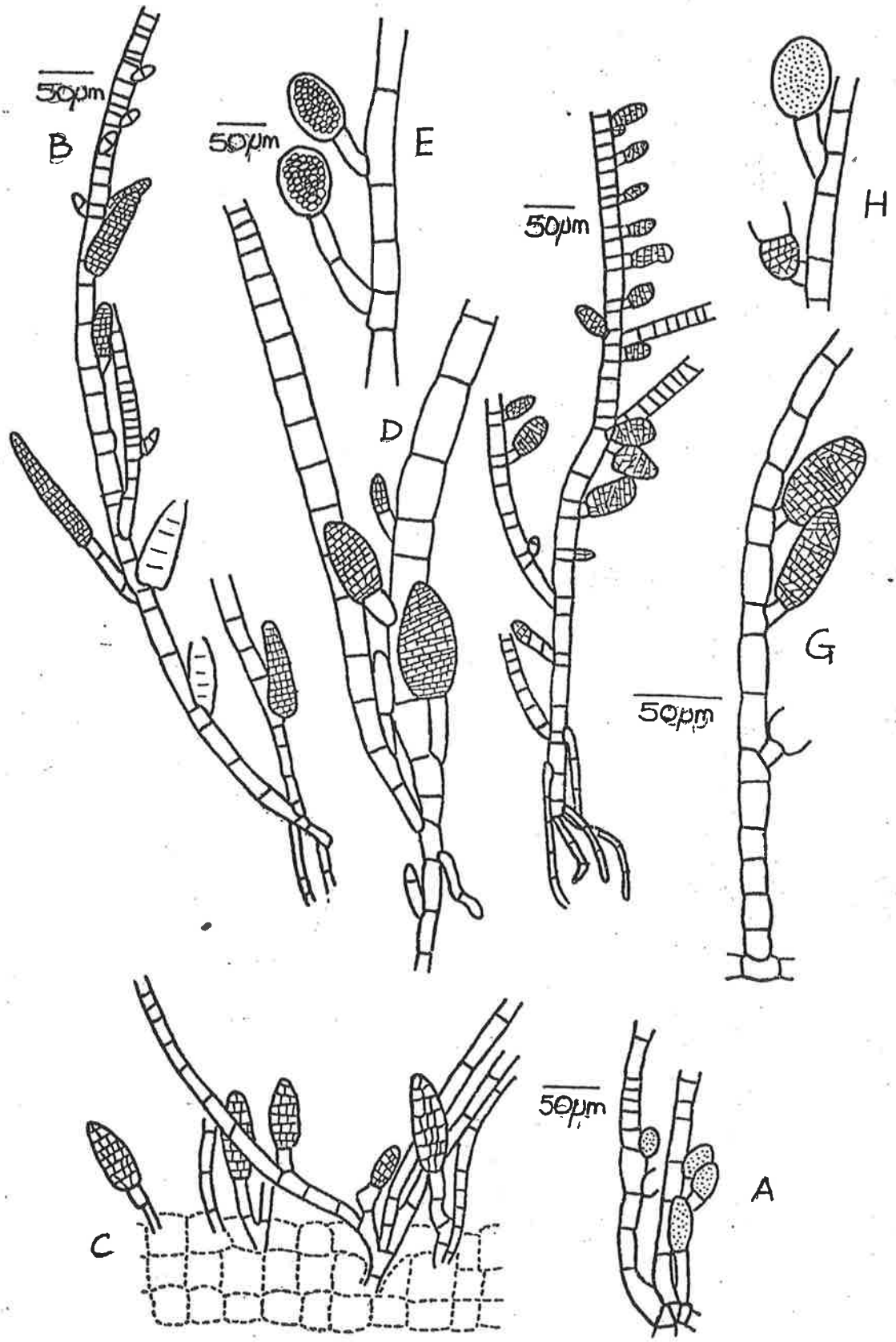
Thallus filamentous, not more than 2mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching very sparse and irregular; plants often unbranched. Prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, ovoid, sessile or on pedicells.
Littoral; epiphytic on Taonia.

Kuetzingiella holmesii (Batt.) Russell in Parke et Dixon

Very similar to K. battersii but larger (to 10mm); epilithic.

Plate 7 taken from Cardinal, 1964.

Feldmannia globifera, unilocular sporangia (A).
F. irregularis, plurilocular sporangia (B).
F. padinae, plurilocular sporangia (C), unilocular sporangia (D).
F. simplex, unilocular sporangia (F), plurilocular sporangia (E).
Kuëtzingiella battersii, unilocular sporangia (G), plurilocular sporangia (H).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Giffordia fenestrata (Berk. ex Harv.) Batt.

Thallus filamentous, to 50 mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching sparse and irregularly alternate. Prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia unknone; plurilocular sporangia multiseriate, elongate.
Littoral; epilithic.

Giffordia granulosa (Sm.) Hamel

Thallus filamentous, to 200mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant, irregularly opposite; ultimate branchlets secund. Corticating filaments present on the main axis. Prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, ovoid, sessile or terminal on short branchlets.
Littoral, infralittoral; epiphytic, epilithic.

Giffordia hincksiae (Harv.) Hamel

Thallus filamentous, to 100mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant and irregular; ultimate branchlets secund or subsecund. Corticating filaments present on the main axis. Basal system of free filaments and rhizoids. Many discoid chloroplasts per cell. Hairs present.
Unilocular sporangia present; plurilocular sporangia multiseriate, conical in shape, organised in sori (rows of sporangia) on inner faces of lateral branchlets.
Infralittoral; epiphytic on laminarians, principally Saccorhiza.

Giffordia mitchellae (Harv.) Hamel

Thallus filamentous, to 100mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant, [illegible] and alternate. Prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, elongate.
Littoral, infralittoral; on plants, animals and stones.

Giffordia ovata (Kjellm.) Kylin

Thallus filamentous, to 100mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant, irregularly opposite. Prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell. Hairs present.
Unilocular sporangia present; plurilocular sporangia multiseriate, ovoid, sessile, often in pairs on main axes and lateral branches.
Littoral, infralittoral; on plants, animals and stones. Occurs in marine and estuarine conditions.

Giffordia sandriana (Zanard.) Hamel

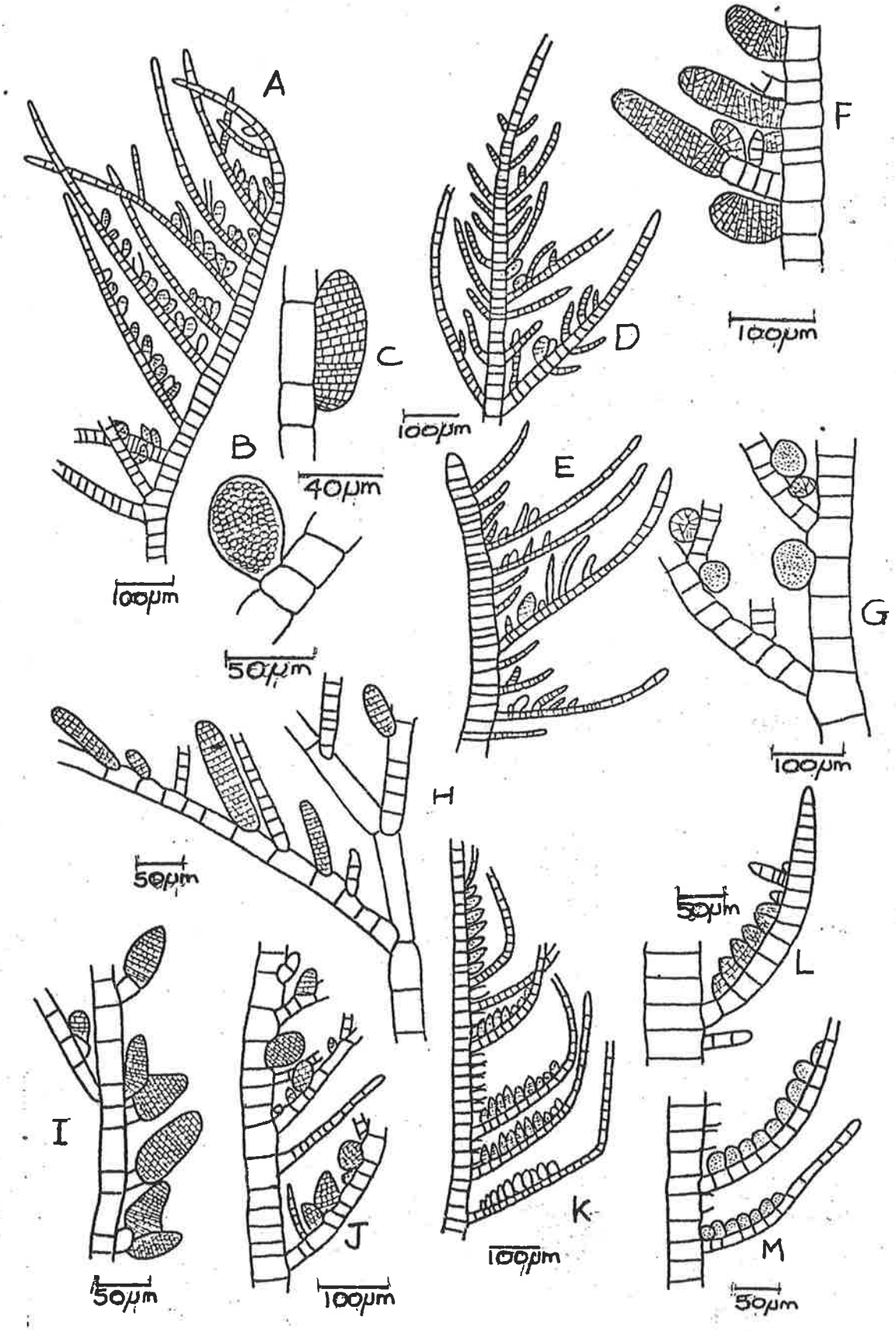
Thallus filamentous, to 120mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant, irregularly secund. Basal system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, elongate, in sori (rows) on the inner faces of lateral branches.
Littoral; on stones and plants.

Giffordia secunda (Kütz.) Batt.

Thallus filamentous, to 50mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant, regularly secund. Corticating filaments cover main axis. Basal system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, ovoid.
Infralittoral; epiphytic on Saccorhiza.

Plate 8, taken from Cardinal, 1964.

Giffordia sandriana, vegetative filaments (A), unilocular sporangium (B), plurilocular sporangium (C).
G. granulosa, vegetative filaments (E,F), plurilocular sporangia (G), unilocular sporangia (H).
G. mitchellae, plurilocular sporangia (I).
G. ovata, plurilocular sporangia (J).
G. secunda, plurilocular sporangia (K).
G. hincksiae, plurilocular sporangia sori (L), plurilocular sporangia (M), unilocular sporangia (N).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Acinetospora crinita (Carm. ex Harv. in Hook.)

Thallus filamentous, to 400mm long. Erect vegetative system of branched uniseriate assimilatory filaments; branching abundant, irregular with occasional right-angled branches. Pseudohairs present. Prostrate system of free filaments. Many discoid chloroplasts per cell.
Monosporangia present, pedicellate; plurilocular sporangia multiseriate, elongate, on pedicells at right angles to the main axis.
Littoral; epiphytic, epilithic.

Herponema valiantei (Born. ex Sauv.) Hamel

Thallus filamentous, to 1mm long. Erect vegetative system less or equal to prostrate; erect assimilatory filaments uniseriate, unbranched. Prostrate system of free filaments and rhizoids which penetrate the host plant. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, ovoid, terminal on short filaments.
Littoral, infralittoral; epiphytic on Cystoseira.

Assimilatory filaments often terminate in a pseudohair.

Herponema velutinum (Grev.) J.Ag.

Thallus filamentous, to 2mm long. Erect vegetative system less or equal to prostrate system. Erect assimilatory filaments uniseriate, branching sparse and irregular, often unbranched. Assimilatory filaments often terminate in a pseudohair. Prostrate system of free filaments and rhizoids which penetrate the host plant. Many discoid chloroplasts per cell.
Unilocular sporangia present; plurilocular sporangia multiseriate, pedicellate.
Littoral; Endophytic/epiphytic, forming a brown felt on Himanthalia.

Polytretus reinboldii (Reinke) Sauv.

Thallus filamentous, to 300mm long. Erect vegetative system of uniseriate branched assimilatory filaments; branching irregular, pseudodichotomous or altermate. Filaments often terminate in a hair. Prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia irregular in shape, sessile on branches.
Infralittoral; epiphytic on various algae.

Sorocarpus micromorus (Bory) Silva

Thallus filamentous to 200mm long. Erect vegetative system of uniseriate branched assimilatory filaments; branching alternate, ultimate branchlets secund. Filaments terminate in a colourless hair. Prostrate system of free filaments and rhizoids. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, in sori along the inner faces of branches.
Littoral; epilithic.

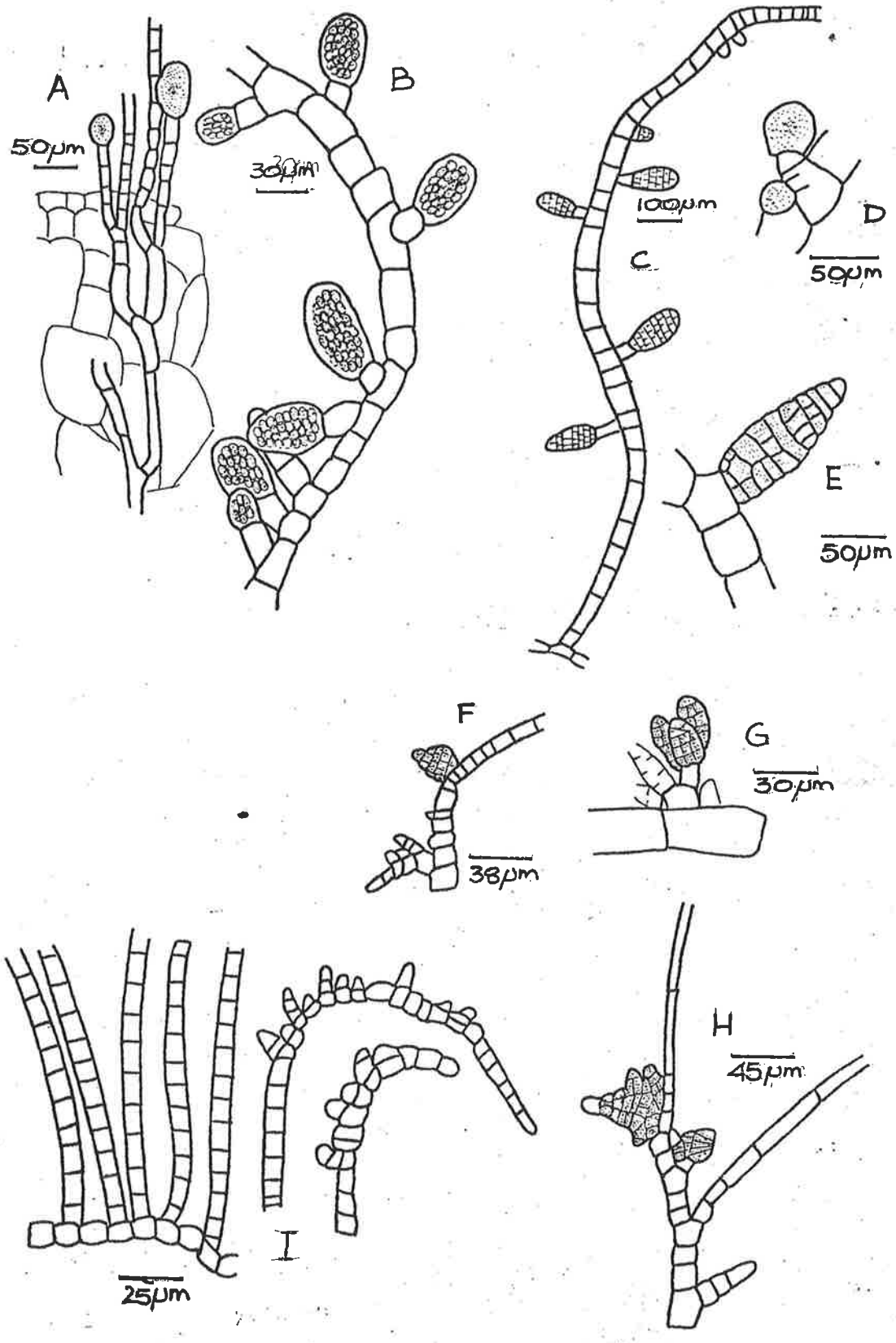
Waerniella lucifuga (Kuck.) Kylin

Thallus filamentous, almost microscopic, 0.5 – 1mm long. Erect vegetative system greater, and arising from the prostrate system. Erect assimilatory filaments uniseriate, sparsely and irregularly branched or unbranched. Pseudohairs present. Prostrate system of free filaments and rhizoids.
A few discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate or biseriate, terminal.
Supralittoral, littoral; epilithic, forms a yellow brown felt over cave walls and under sides of shaded niches.

? also in estuaries

Plate 9.

Herponera velutinum, unilocular sporangium (A) and plurilocular sporangium (B), after Cardinal, 1964.
Acinetospora crinita, filament and plurilocular sporangia (C, E), plurilocular sporangia (D), after Cardinal, 1964.
Sorocarpus micro-orus, plurilocular sporangia, after Lund & Rosenvinge 1941 (F,G,H).
Waerniella lucifuga, plurilocular sporangia, after Kylin, 1947 (J).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Chroristocarpus tenellus (Kütz) Zanard.

Thallus filamentous, to 20mm long. Erect assimilatory filaments uniseriate and branched; branching sparse, pseudodichotomous or alternate. Filaments terminate in a large apical cell; basal parts of filaments covered with rhizoidal growths. Many discoid chloroplasts per cell. Propagules present, formed of two large cells on a unicellular pedicell.
Unilocular sporangia sessile on assimilatory filaments; plurilocular sporangia multiseriate, ovoid, sessile.
Infralittoral; epilithic.

Cladostephus spongiosus (Huds.) C.Ag.

Thallus filiform, resembling a pipe cleaner. Dark brown stiff fronds, to 250mm long. Main axis irregularly forked, filamentous nature obscured by dense rhizoidal cortication, densely clothed in whorled branchlets except towards the base. Attached by a basal disc. Branchlets filamentous, segmented, segments divided by 1 - 4 longitudinal walls, secondary walls sparse or absent.
Unilocular sporangia present; plurilocular sporangia multiseriate, oval, on 1 - 2 celled pedicells on special branchlets.
Littoral, infralittoral; epilithic.

Sphacelaria britannica Sauv.

Thallus filiform, forming olive-brown velvety mats of filaments to 5mm long. Basal system a creeping network of filaments and rhizoids which give rise to the erect filaments. Erect filaments sparsely and irregularly branched, segmented, each segment with only 1 - 2 longitudinal walls and very rarely subdivided by secondary transverse walls.
Unilocular sporangia globular, pedicellate; plurilocular sporangia unknown.
Epilithic; upper littoral in shaded pools, caves or crevices.

Sphacelaria radicans (Dillw.) C.Ag.

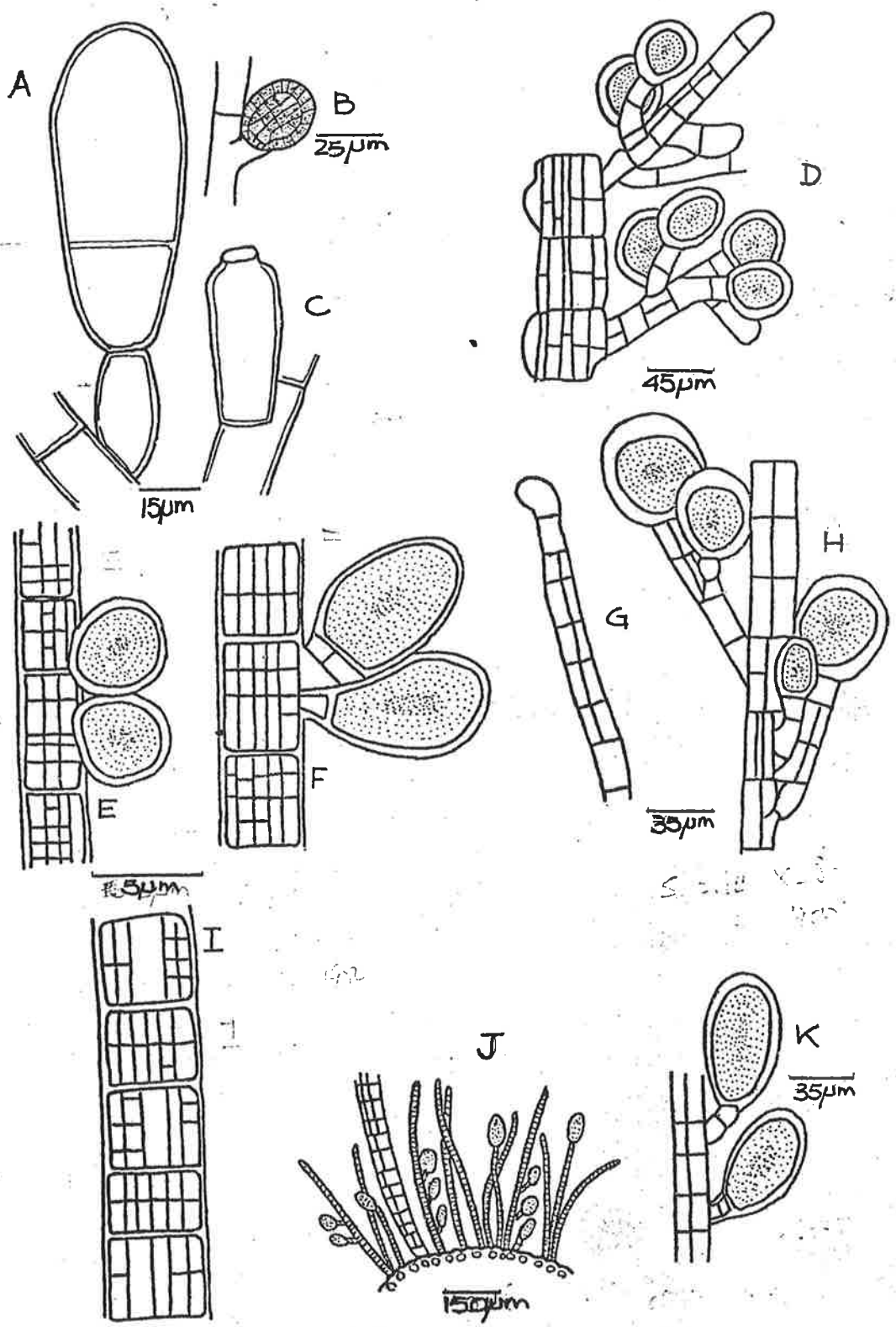
Thallus filiform, forming dark brown stiff tufts or loose mats of filaments to 10mm long. Attached by small basal discs, rhizoids or creeping filaments. Erect filaments segmented with 3 - 7 longitudinal walls and one or more secondary transverse divisions. Branching sparse and irregular, branches often pressed to the parent filament. Rhizoids incompletely corticate the lower parts of axes.
Unilocular sporangia globular, sessile or on a unicelluar pedicell, often in pairs; plurilocular sporangia only found once.
Littoral, infralittoral; epilithic and epiphytic.

Sphacelaria racemosa Grev.

Very similar to S. radicans but up to 25mm tall and not in mats. Rhizoids scarce.
Unilocular sporangia crowded in raceme-like structures on branchlets.
Upper littoral; epilithic (sand covered rock). Rare, recorded mainly from northern Britain.

Plate 10.

Choristocarpus tenellus, propagule (A), plurilocular sporangia (B), unilocular sporangia (C), after Kuckuck, 1895.
Sphacelaria racemosa, unilocular sporangia, after Lund, 1950 (D).
S. radicans, unilocular sporangia (E,F), vegetative filament (I), after Lund, 1950.
S. britannica, vegetative filament (G), unilocular sporangia (H), after Lund, 1950.
Cladostephus spongiosus, sporangial branches (J), unilocular sporangia (K) after Newton, 1931.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K
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Sphacelaria arctica Harv.

Thallus filiform, erect tufts of filaments to 50mm long. Erect filaments irregularly branched, arising from a prostrate system; segmented, each segment further divided by longitudinal divisions and secondary transverse divisions. Main axis partially covered with rhizoidal cortication. Unilocular sporangia terminal on short branchlets; plurilocular sporangia also on short branchlets.

; , rare, Shetland.

Sphacelaria cirrosa (Roth) C.Ag.

Thallus filiform, forming olive brown stiff feather-like tufts, to 50mm long. Filaments segmented, each segment with (1–) 4 – 10 (–24) longitudinal walls, but very rarely secondary transverse walls. Branches numerous, in one plane; apical cells large and conspicuous. Attached by a tiny basal disc; rhizoids sparse or absent. Propagules common, stalk narrows to the base, often with an apical hair and usually 3 cigar shaped arms.
Unilocular sporangia pedicellate; plurilocular sporangia oval, rare, pedicellate.
Littoral, infralittoral; usually epiphytic, sometimes epilithic.

Sphacelaria bipinnata (Kütz.) Sauv.

Similar to S. cirrosa but usually with abundant rhizoids in the lower parts of the plant; basal filaments penetrate host plant. Branching very rarely bipinnate. Propagules resembling those of S. cirrosa except for the absence of an apical hair.
Unilocular sporangia present; plurilocular sporangia oval–elongate, pedicellate.
Littoral pools, infralittoral; partly epiphytic on Cystoseira baccata and Halidrys.

Sphacelaria fusca (Huds.) C.Ag.

Similar to S. cirrosa but tufts not stiff, branching sparse and irregular. Propagules common, but lacking a terminal hair, stalk cylindrical not constricted at base, with 2 – 3 (–4) cylindrical arms.
Littoral pools; epilithic, epiphytic.

Sphacelaria tribuloides Menegh.

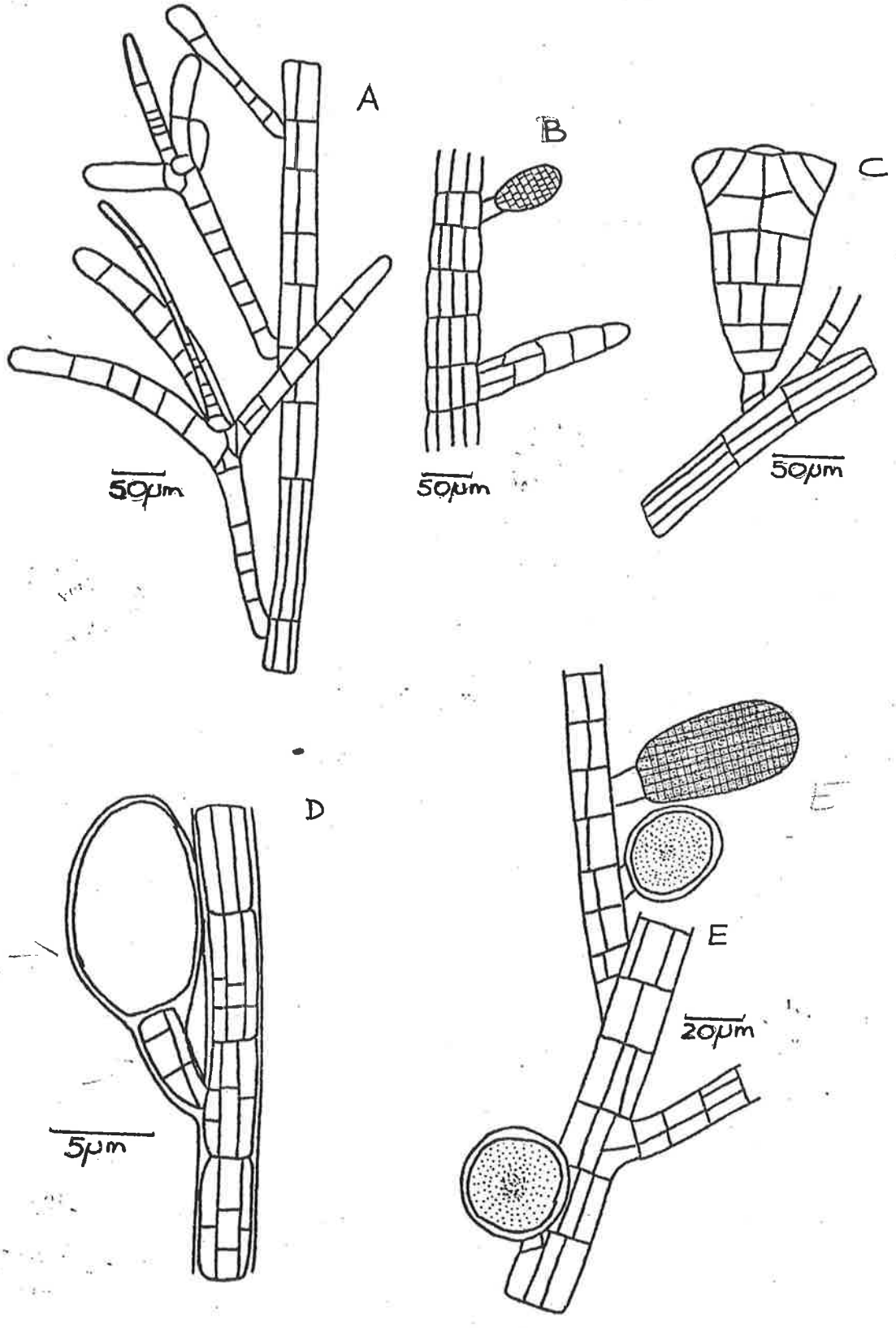
Very similar to S. fusca but with wedge-shaped propagules with 3 obvious distal lobes and no arms.
Sporangia rare; both unilocular and plurilocular sporangia known for Medterranean specimens.
Littoral pools; epilithic; rare.

Sphacelaria caespitula Lyngb.

Thallus filiform, brown tufts 1 – 3mm long arising from a thick basal disc. Erect filaments sparsely and irregularly branched towards the apex, segmented, each segment divided by 1 – 3 longitudinal divisions and 2 – 3 secondary transverse divisions. Rhizoids sparse, usually absent.
Unilocular sporangia unknown; plurilocular sporangia oval, on 3 celled pedicell borne laterally on filaments.
Infralittoral; epiphytic on Laminaria hyperborea stipes.

Plate 11.

Sphacelaria cirrosa, propagules, after Lund, 1950 (A).
S. cirrosa, plurilocular sporangium, after Pankow, 1971 (B).
S. tribuloides, propagules, after Lund, 1950 (C).
S. caespitula, unilocular sporangium, after Lund, 1950 (D).
S. bipinnata, uni- and plurilocular sporangia, after Lund, 1950 (E).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Sphacelaria plumosa Lyngb.

Thallus filiform, olive brown feather like erect tufts, to 100mm tall, attached by a basal disc. Filaments segmented, each segment with 2 – 5 longitudinal divisions and several secondary transverse divisions. Segments obscured on main axes by a dense unorganised rhizoidal cortication. Main axis subdichotomously branched, often bare below. Branches ecorticate, opposite, in one plane.
Unilocular sporangia present; plurilocular sporangia multiseriate, oval, pedicellate on special branches (Stichidia) arising from the cortex of main axis.
Infralittoral; epilithic, epizoic on shells.

Sphacelaria plumigera Holm.

Similar to S. plumosa but the corticating rhizoids are only produced in the same plane as the branching.
Unilocular sporangia not as in S. plumosa but borne on branchlets on the lateral branches; Plurilocular sporangia unknown.
Lower littoral pools, infralittoral; epilithic.

Sphacelaria plumula Zanard.

Frond filiform, olive brown feather-like tufts, to 20mm long, arising from creeping filaments. Filaments segmented, each segment with 5 – 7 longitudinal divisions but no secondary transverse divisions. Branching abundant, opposite, in one plane. Rhizoids sparse or absent. Propagules wedge shaped with 3 obvious distal lobes but no arms.
Unilocular sporangia (rare) on a one celled pedicell; plurilocular sporangia unknown.
Infralittoral; epiphytic, epilithic, epizoic on shells.

Halopteris filicina (Grat.) Kütz.

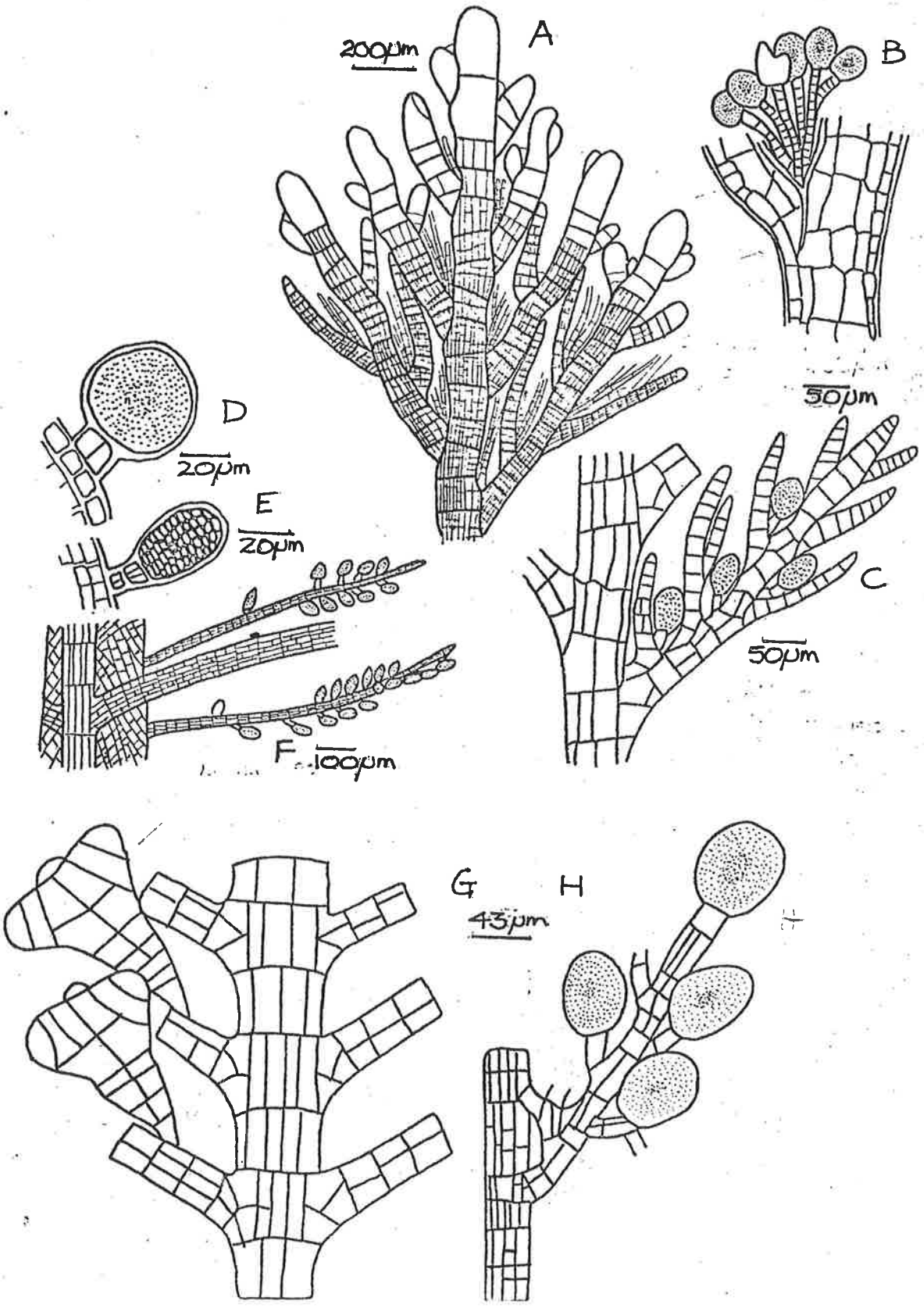
Frond filiform, olive brown stiff feather-like tufts to 100mm tall, attached by a basal disc and rhizoids. Filaments segmented, each segment with 1 – 3 longitudinal divisions and sometimes secondary transverse divisions. Branching abundant, alternate, all in one plane; main axis bare below; rhizoidal cortication sparse or absent. (lateral branches straddling cross wall between two articulations.)
Unilocular sporangia in the axils of branches, sometimes on short stalks; plurilocular sporangia present.
Littoral pools, infralittoral; epilithic, (less often) epiphytic. Common on southern coasts, rare further north.

Halopteris scoparia (L.) Sauv.

Frond filiform, dark brown stiff tufts, to 150mm long, attached by rhizoids. Filaments segmented, each segment with 1 – 3 longitudinal divisions and sometimes secondary transverse divisions. Branching abundant, irregularly alternate and pinnate; Filaments often densely packed giving from an appearance of a series of inverted cones, shaving-brush like. Lower parts of main axes often bare. (lateral branches straddling cross wall between two articulations)
Unilocular sporangia formed in clusters on short branchlets in the axils of main branches; plurilocular sporangia rare.
Infralittoral; epilithic. Common on southern coasts, rare further north.

Plate 12.

Halopteris filicina, vegetative thallus (A), unilocular sporangia (B), after Reinke, 1891.
H. filicina, unilocular sporangia, after Sauvageau, 1903 (C).
Sphacelaria plumosa, unilocular (D), plurilocular sporangia (E), reproductive branches (F), after Newton, 1931.
S. plumula, propagules, after Lund, 1950 (G).
S. plumigera, unilocular sporangia, after Lund, 1950 (H).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Giraudia sphacelarioides Derb et Sol. in Castagne

Thallus yellow brown filiform tufts to 15mm long. Filaments attenuate at apex and base, often terminating apically in a small hair; filaments apically parenchymatous, basally uniseriate. Frond branched only at the base and attached by a prominent tuft of rhizoids. Chloroplasts discoid.
Unilocular sporangia unknown; plurilocular sporangia uni - multi seriate, terminal on short lateral branchlets at the base of the frond, or formed from the transformation of monosiphonous parts of the frond, or sessile in small clusters on the sides of the filaments.
Infralittoral; epiphytic on Zostera, Cystoseira and other algae.

Haplospora globosa Kjellm.

Thallus filiform or filamentous, in tufts to 150mm long. Frond irregularly branched from a distinct main axis. Younger parts uniseriate, older (basal) parts with longitudinal cell divisions (parenchymatous). Filaments branched, lateral branchlets often terminating in a pseudohair. Attached by numerous rhizoids. Many discoid chloroplasts per cell.
Plant oogamous with oogonia developing partly immersed in the filiform frond; tubular intercalary antheridia arise by the transformation of one or two cells of a filament. Monosporangia pedicellate on monosiphonous parts of the frond.
Infralittoral; epilithic.

Isthmoplea sphaerophora (Carm. ex Harv. in Hook.) Kjellm.

Thallus filiform, yellow brown tufts to 75mm long. Filaments abundantly branched; branching opposite. Basal parts of main axis parenchymatous, (multiseriate), lateral branches uniseriate. Attached by rhizoids developed from lowermost cell of main axis. Many discoid chloroplasts per cell.
Unilocular sporangia usually in pairs sessile on filaments; plurilocular sporangia multiseriate, elongate, rare.
Littoral; epiphytic on Plumaria, Callithamnion hookeri, epilithic.

Leblondiella densa (Batt.) Hamel

Thallus filiform, black-brown, in small tufts to 40mm long. Thallus part parenchymatous, part uniseriate; parenchymatous parts differentiated into a cortex and medulla. Frond bears many uniseriate lateral filaments.
Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia pedicellate on lateral branches; plurilocular sporangia uni- or bi- seriate, terminal on lateral branches.
Infralittoral; epiphytic on Zostera.

Petalonia filiformis (Batt.) O.Kuntze

Thallus filiform or finely laminate to 100mm long. Frond unbranched, in part monosiphonous, mostly parenchymatous; cortex present. Hairs present. Attached by a mass of rhizoids. One discoid chloroplast per cell.
Unilocular sporangia unknown on macrothallus; plurilocular sporangia developed from epidermal cells.
Supralittoral, littoral; epilithic.

Stictyosiphon griffithsianus (Le Jol.) Holm. et Batt.

Thallus filiform, olive, in tufts to 150mm long. Younger parts of the thallus uniseriate, older parts parenchymatous. Filament branching opposite; often terminating in a pseudohair; basal attachment system rhizoids which penetrate the host plant. Many discoid chloroplasts per cell.

Unilocular sporangia developed from the cortical cells of the parenchymatous parts and sunk in the thallus; plurilocular sporangia present.
Littoral, infralittoral; epiphytic on Palmaria.

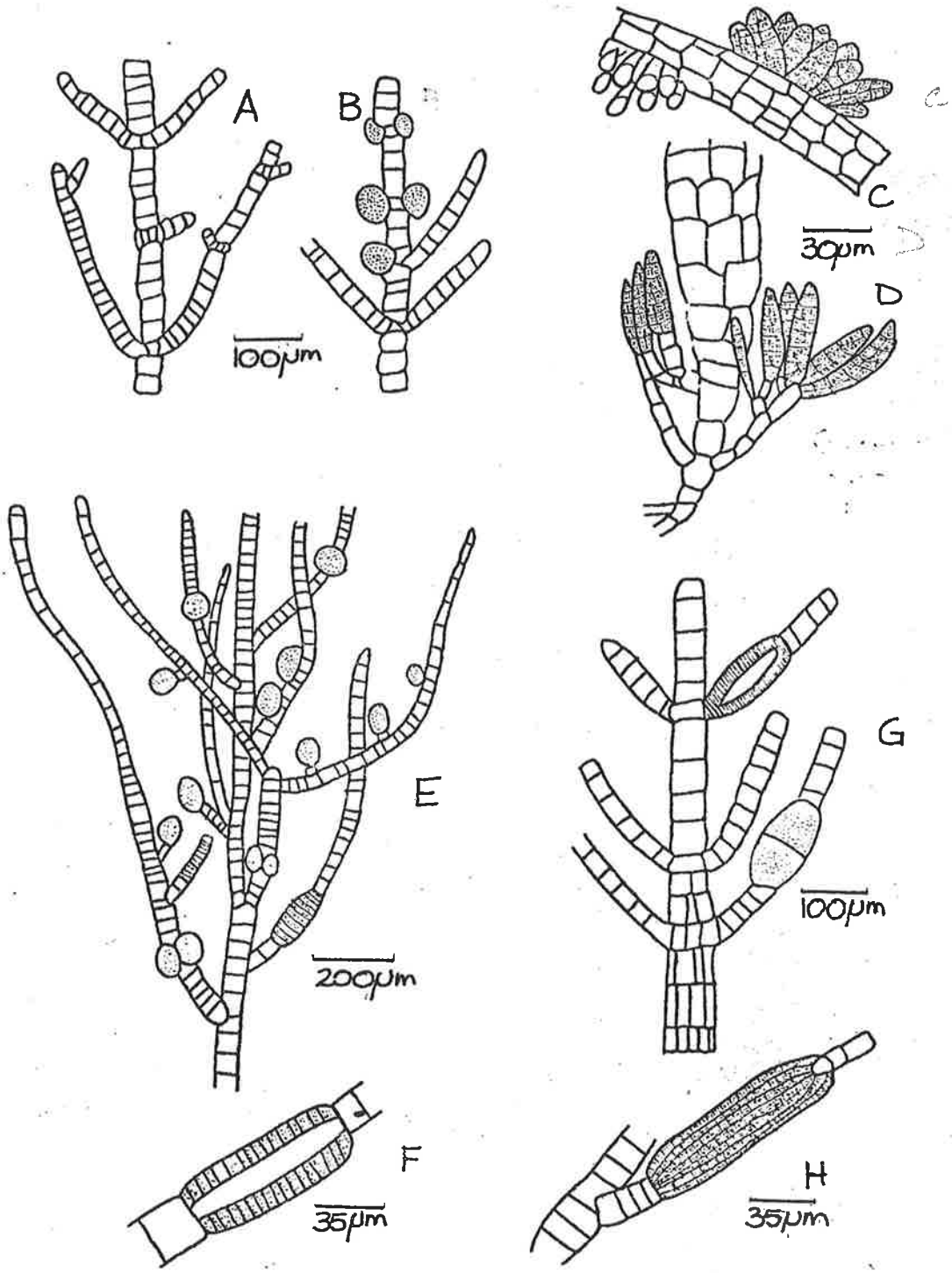
Tilopteris mertensii (Turn. in Sm.) Kütz.

Thallus filiform or filamentous, olive-brown becoming darker with age, in large tufts to 300mm long. Filament branching opposite on a distinct main axis; secondary and tertiary branches frequently present. Younger parts of the thallus uniseriate, older parts with periclinal cell divisions becoming parenchymatous. Lateral branchlets often terminating in a pseudohair. Attached by numerous rhizoids. Many discoid chloroplasts per cell.
Monosporangia formed singly or in pairs, intercalary, in monosiphonous parts of the frond; plurilocular sporangia multiseriate, formed by the transformation of one or more cells of a lateral filament.
Infralittoral; epilithic.

L Plant

Plate 13.

Isthmoplea sphaerophora, vegetative filaments (A) and unilocular sporangia (B), after Kylin, 1947.
Giraudia sphacelarioides, plurilocular sporangia, after Newton, 1931 (C, D).
Haplospora globosa, monosporangia (E) and antheridia (F), after Newton, 1931.
Tilopteris mertensii, antheridia (G, H) and oogonia (G) after Newton, 1931.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Litosiphon filiformis (Reinke) Batt.

Thallus filiform, in tufts to 10mm long. Filaments less than 40μ in diameter; unbranched; basally uniseriate, apically parenchymatous; parenchymatous parts undifferentiated. Hairs not recorded. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia multiseriate, scattered in the outer cells of the thallus.
Infralittoral; epiphytic on Laminaria.

Litosiphon laminariae (Lyngb.) Harv.

Thallus filiform, olive when young, brown when older, in tufts to 125mm long. Filaments unbranched; mainly parenchymatous but uniseriate near the base. Parenchymatous parts differentiated into a medulla and epidermis. Basal parts endophytic in host. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia developed from the outer epidermal cells; plurilocular sporangia multiseriate, also developed from the outer epidermal cells.
Infralittoral; epiphytic on Alaria.

Litosiphon pusillus (Carm. ex Hook.) Harv.

Thallus filiform, olive when young, brownish when older, in tufts to 120mm long. Filaments unbranched, 0.25 - 1mm diameter. Thallus mainly parenchymatous, uniseriate near the base. Parenchymatous parts differentiated into medulla and epidermis; older parts of the frond become hollow. Hairs abundant. Many discoid chloroplasts per cell.
Unilocular sporangia developed from the outer epidermal cells; plurilocular sporangia multiseriate, also developed from the outer epidermal cells.
Infralittoral; epiphytic on Chorda.

Myriotrichia clavaeformis Harv.

Thallus filiform, olive brown, to 10mm long. Thallus parenchymatous apically, uniseriate basally. Main filament undivided, but bearing (apically) numerous, short, often uniseriate, lateral filaments. The lateral filaments become longer towards the apex of the main filament and give it a clavate appearance. Hairs present on the distal parts of the filament. Many discoid chloroplasts per cell.
Unilocular sporangia scattered over the surface of the plant; plurilocular sporangia uni- or bi- seriate, also scattered over the surface of the plant.
Littoral; epiphytic on various algae but principally Scytosiphon.

Myriotrichia filiformis — form of M. clavaeformis.

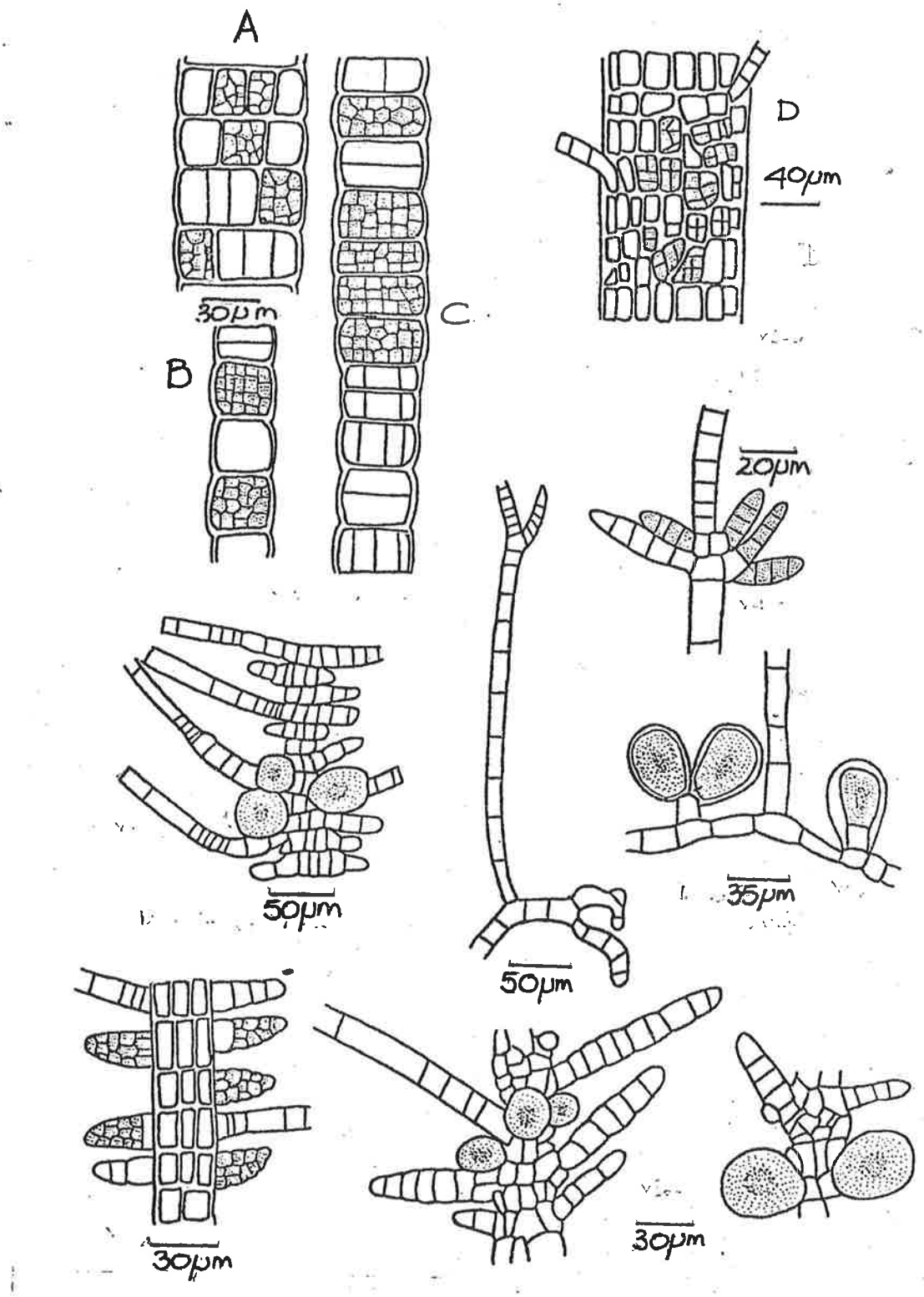
Similar to M. clavaeformis but with uniseriate filaments equal in length over the main filament; sporangia clustered in sori.

Myriotrichia repens — form of M. clavaeformis.

Thallus filiform, microscopic, to 1.5mm long. Differing from M. clavaeformis and M. filiformis in being for the greater part uniseriate, but with occasional longitudinal divisions. Main filament creeping over host plant, irregularly branched. Filaments terminate in hairs. Many discoid chloroplasts per cell.
Unilocular sporangia clustered in sori; plurilocular sporangia uniseriate, also clustered in sori.
Infralittoral; epiphytic on various algae.

Plate 14.

Litosiphon filiformis, plurilocular sporangia, after Kylin, 1947 (A, B, C).
L. pusillus, plurilocular sporangia, after Kylin, 1933 (D).
Myriotrichia filiformis, unilocular sporangia, after Kylin, 1947
M. filiformis, plurilocular sporangia, after Kylin, 1947
M. repens, after Kylin, 1933
M. clavaeformis, unilocular sporangia, after Kuckuck, 1899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Battersia mirabilis Reinke

Thallus a black leathery crust, parenchymatous, many layered, up to 40 mm thick. The upper surface carries a few, branched, uniseriate filaments. Several discoid chloroplasts per cell. +ve reaction to Eau de Javelle. Unilocular sporangia borne terminally or laterally on the free assimilatory filaments; plurilocular sporangia unknown.
Littoral; epilithic.

Petroderma maculiforme (Wollny) Kuck.

Thallus a small dark brown crust or cushion, mainly of erect but also a few prostrate filaments. Filaments coalescent, separating easily under slight pressure. Filaments branched; erect filaments of mo more than 20 cells, each with a single chloroplast. Hairs present.
Unilocular sporangia terminal in sori; plurilocular sporangia uni-, bi-, or multi- seriate, terminal in sori.
Littoral, supralittoral; epilithic or epizoic; sometimes found in caves.

Pseudolithoderma extensum (Crouan frat.) S. Lund

Thallus an extensive dark brown crust comprising mainly of erect, but also prostrate filaments. Filaments fused and do not separate under pressure; erect filaments of 2 – 7 rarely 10 cells each with several discoid chloroplasts.
Unilocular and plurilocular sporangia never on the same plant; unilocular sporangia terminal in sori; plurilocular sporangia uniseriate, also terminal in sori.
Littoral, infralittoral; epilithic and epizoic.

Pseudolithoderma roscoffensis Lois.

Thallus a circular, yellow-brown crust, 10 – 30mm diameter. Upright filaments usually more than 20 cells long; filaments fused, do not separate easily under pressure. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uniseriate, terminal on filaments.
_____ ; epilithic.

Ralfsia clavata (Harv. in Hook.) Crouan frat.

Thallus a large, orbicular, brown crust, to 20 mm diameter. Thallus formed of mainly erect filaments which curve up from a prostrate system. Margin of the thallus indistinct, merging with the substrate. Filaments fused, not separating under pressure. Erect filaments usually more than 10 cells long, each with a single discoid chloroplast. Multicellular (3 – 5 cells), unbranched paraphyses present. Hairs present.
Unilocular sporangia terminal in sori among paraphyses; plurilocular sporangia uni- and bi- seriate, terminal in sori, among the paraphyses.
Littoral; epilithic and epizoic.

Ralfsia disciformis Crouan frat.

Thallus a macroscopic, yellowish brown, crust, closely adhering to the substrate. Thallus of mainly erect filaments which arise vertically from a prostrate system. Erect filaments usually more than 10 cells long, each cell with a single discoid chloroplast. Distinguished from R. clavata by shorter less clavate paraphyses of only one or two cells, scarcely longer than the sporangia.
Unilocular sporangia terminal in sori; plurilocular sporangia unknown.
Infralittoral; epilithic, epizoic.

Ralfsia pusilla (Strömf.) Batt.

Thallus a microscopic disc, comprising mainly erect filaments which arise vertically from a prostrate system. Filaments coalesced and easily separable under pressure. Erect filaments of more than 10 cells each cell with a single discoid chloroplast. Club shaped multicellular paraphyses. Hairs in tufts over frond giving it a punctate appearance.
Unilocular sporangia terminal in sori; plurilocular sporangia unknown.
Littoral; epilithic, epizoic.

Ralfsia spongiocarpa Batt.

Thallus a macroscopic disc having a spongy appearance. Thallus mainly of erect filaments which arise from a prostrate system. Filaments coalesced, separable under pressure, usually more than 10 cells long. A single discoid chloroplast per cell. Multicellular, cylindrical, paraphyses present, 10 - 12 cells long.
Unilocular sporangia terminal in sori; plurilocular sporangia unknown.
Littoral, infralittoral; epilithic.

Ralfsia verrucosa (Aresch.) J.Ag.

Thallus a blackish-brown, extensive, orbicular crust, often peeling from the substrate. Thallus has a distinct margin. Thallus formed of erect filaments curving up from a prostrate system. Filaments fused, not easily separable under pressure, usually more than 10 cells long each cell with a single discoid chloroplast. Hairs present. Club-shaped multicellular (6 - 12 cells) paraphyses present.
Unilocular sporangia terminal in sori; plurilocular sporangia multiseriate, terminal in sori.
Littoral; epilithic, epiphytic.

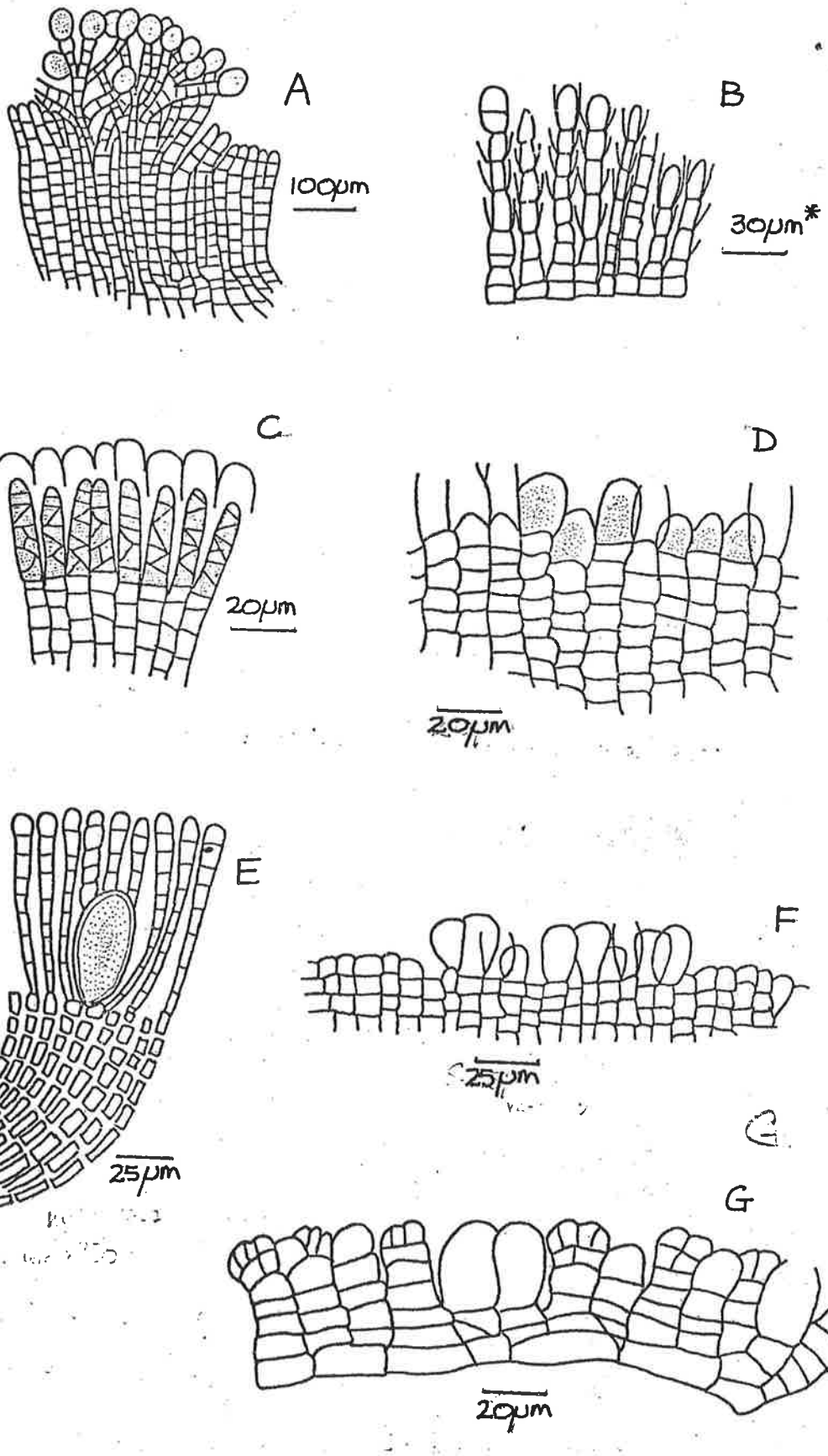
Sorapion sirulans Kuck.
Thallus a microscopic brown crust or disc, formed of mainly erect but also some prostrate filaments. Filaments fused, not separating easily under pressure. Erect filaments 2 - 7 cells, rarely 10 cells long, each cell with a single chloroplast. Hairs present. Paraphyses absent.
Unilocular sporangia present in sori, terminal on filaments; plurilocular sporangia unknown.
Littoral, infralittoral; epilithic, epizoic.

Symphyocarpus strangulans Rosenv.

Thallus a microscopic brown cushion, crust or disc, formed of erect and prostrate filaments. Erect filaments coalescent, separating under pressure, of 2 - 7 rarely 10 cells, each with a single discoid chloroplast. Hairs present; acocysts present; paraphyses absent.
Unilocular sporangia unknown; plurilocular sporangia branched, uni-, bi-, or multiseriate, terminal in sori.
Littoral, infralittoral; epiphytic.

Plate 15.

Battersia mirabilis, T.S. thallus, unilocular sporangia, after Batters, 1889 (A).
Petroderma maculiforme, after Pankow, 1971 (B).
Pseudolithoderma extensum, plurilocular sporangia, " " (C).
" unilocular sporangia, after Kuckuck, 1894 (D).
Ralfsia verrucosa, T.S. thallus, unilocular sporangia, after Kylin, 1947 (E).
Sorapion sirulans, unilocular sporangia, after Kuckuck, 1894 (F).
Symphyocarpus strangulans, unilocular sporangia, after Kuckuck, 1894 (G).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Cutleria multifida (Aglaozonia stage)

Thallus an irregularly lobed, brown membrane, 10- 20mm diameter. Thallus parenchymatous, differentiated into a medulla of 3 - 4 layers of colourless cells surrounded by 1 - 2 layers of epidermal cells. Thallus attached to substrate by uniseriate rhizoids which terminate in a small disc. Tufts of hairs arise from the upper surface of the frond.
Sporangia formed in sori on the upper surface of the frond.

Corynophlaea crispa (Harv.) Kuck. [unbranched, 10-17 cells long.

Thallus a brown, mucilaginous, globose cushion to 2mm diameter. Erect assimilatory filaments loosely coalescent (pseudoparenchymatous), forming basally a cortex and medulla of large colourless cells. Exterior assimilatory filaments of small globular cells. Unbranched multicellular paraphyses present. Hairs present.
Several discoid chloroplasts per cell.
Unilocular sporangia borne at the bases of paraphyses, sunk in the thallus; plurilocular sporangia uniseriate, borne at the bases of paraphyses.
Littoral; epiphytic on Chondrus.

Cylindrocarpus berkeleyi (Grev. in Berk.) Crouan frat.

Thallus a light brown, mucilaginous, globose cushion to 20mm diameter. Assimilatory filaments loosely coalescent (pseudoparenchymatous); terminal parts of filaments pseudodichotomously branched, branches formed of small rounded cells. Internally the thallus comprises a matrix of coalescent filaments formed of large colourless cells from which numerous rhizoids arise and penetrate the host plant. Branched paraphyses present. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia developed basally on assimilatory filaments; plurilocular sporangia similarly developed.
Littoral; epiphytic on Ralfsia and epizoic on limpet shells.

Cylindrocarpus microscopicus Crouan frat.

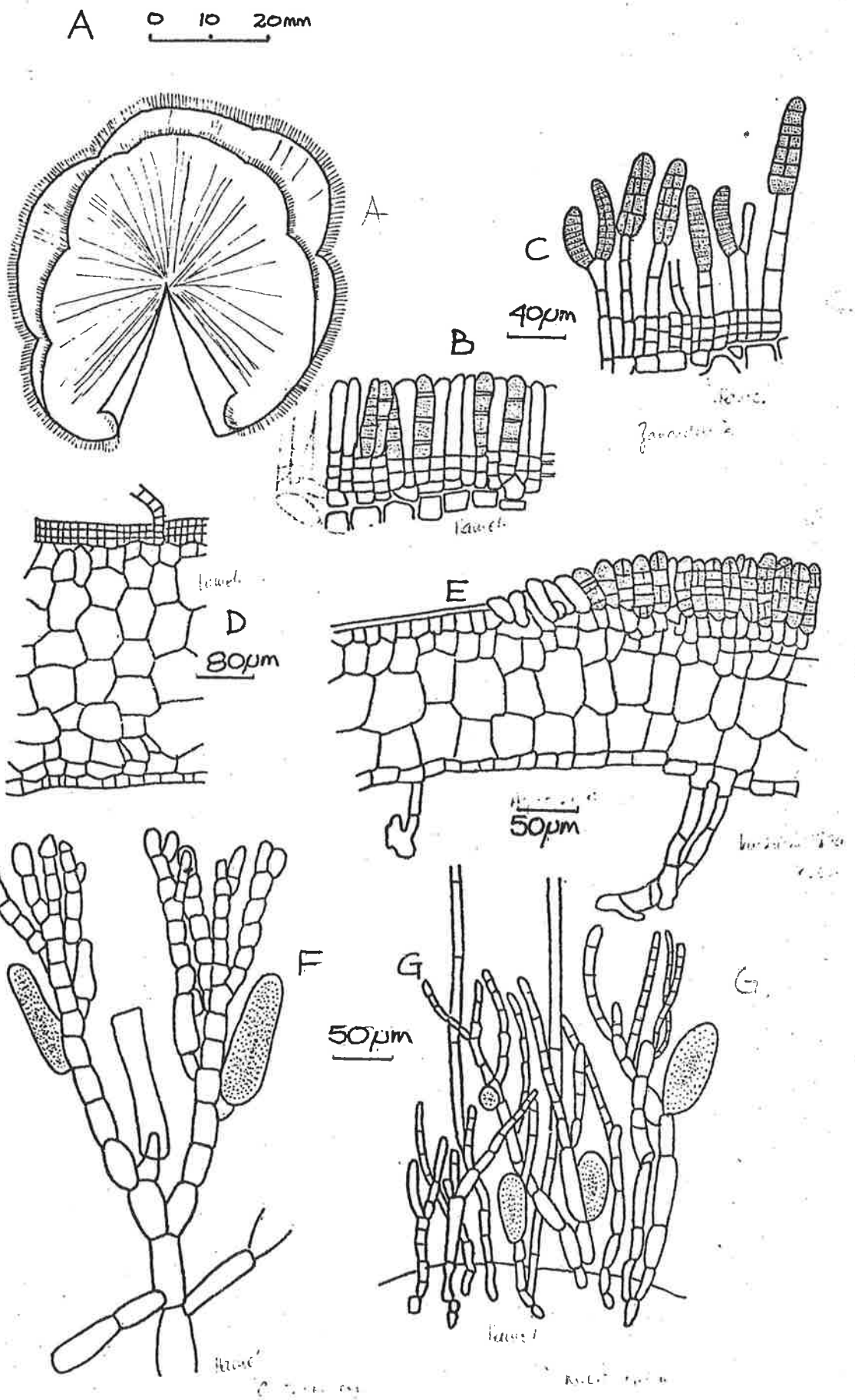
Thallus a very small tuft or cushion, to 3mm diameter. Assimilatory filaments very loosely coalescent, almost free, forming basally a loose cortex and medulla. Erect assimilatory filaments branched, secund, pseudodichotomous or alternate. Cells of the cortex and medulla colourless and larger than the exterior cells. Rhizoids abundant, penetrating host. Branched multicellular paraphyses present. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia pedicellate on the lower parts of assimilatory filaments; plurilocular sporangia uni- or bi- seriate, similarly positioned.
Littoral; epiphytic/endophytic on Gracilaria verrucosa.

Zanardinia prototypus (Nardo) Nardo

Thallus an olive brown, dark brown in older plants, round or reniform membranous sheet to 200mm diameter. Thallus parenchymatous differentiated into a medulla of large colourless cells and a 2 - 3 layered cortex and assimilatory larer on the upper surface of the thallus. A less pigmented cortex on the lower surface gives rise to numerous rhizoids; upper surface therefore smooth, lower surface felty. Margin of the thallus bears a distinct fringe of hairs. Many discoid chloroplasts per cell.
Unilocular sporangia terminal on short filaments, in sori; plurilocular sporangia uni- or bi- seriate, similarly positioned.
Infralittoral; epilithic.

Plate 16.

Zanardinia prototypus, Whole plant (A), plurilocular sporangia (B,C),
T.S. thallus, after Harel, 1931 - 39.
Aglaozonia, T.S. thallus, sporangia, after Kuckuck, 1899 (E).
Cylindrocarpus berkeleyi, unilocular sporangia, after Harel,
1931 - 39 (F).
C. microscopicus, unilocular sporangia, after Harel, 1931 - 39 (G).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Elachista flaccida (Dillw.) Aresch.

Thallus a globose cushion, to 15mm diameter, from which a tuft of free assimilatory filaments arises. Assimilatory filaments unbranched, usually more than 100μ wide, 10- 20mm long, coalescing basally together with paraphysis-like filaments into a pseudoparenchymatous cushion; cortex and medulla present in the cushion. Many discoid chloroplasts per cell.
Unilocular sporangia sunk in the cushion; plurilocular sporangia unknown.
Littoral; epiphytic on Cystoseira and Halidrys.

Elachista fucicola (Vell.) Aresch.

Very similar to E. flaccida; assimilatory filaments usually 20 - 60μ wide; epiphytic on Fucus spp.

Elachista scutulata (Sm.) Aresch.

Very similar to E. flaccida; assimilatory filaments usually 20 - 35μ wide; unilocular and plurilocular sporangia present; epiphytic on Himanthalia.

Elachista stellaris Aresch.

Thallus a minute globose cushion, to 3mm diameter, from which a tuft of free assimilatory filaments arises. Assimilatory filaments unbranched, 50μ wide, coalescing basally into a pseudoparenchymatous cushion; cortex and medulla present in the cushion although less well developed than in the previous species. Paraphyses also less well developed, similar in appearance to the assimilatory filaments. Many discoid chloroplasts per cell.
Unilocular sporangia sunk in the cushion; plurilocular sporangia uniseriate, also in the cushion.
Infralittoral; epiphytic on Arthrocladia, Scytosiphon and Spermatochnus.

Halothrix lumbricalis (Kütz.) Reinke

Thallus a globose cushion from which a tuft of free assimilatory filaments arises. Assimilatory filaments unbranched, 20 - 40μ wide, 20mm long, coalescing basally to form a pseudoparenchymatous cushion. Cortex and medulla present in the cushion, but not as well developed as in Elachista. Paraphyses absent. Rhizoidal downgrowths develop from the cushion. Many discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia, intercalary, clustered in sori encircling cells of the assimilatory filaments.
Infralittoral; epiphytic on Zostera.

Leptonematella fasciculata (Reinke) Silva

Thallus a small globose patch or cushion of erect and prostrate filaments. Erect filaments unbranched; prostrate filaments coalesce to form a rudimentary cushion. Hairs present. Several discoid or ribbon shaped chloroplasts per cell. Unilocular sporangia scattered, sessile, on [illegible]pedicells or terminal on short filaments at the bases of assimilatory filaments; plurilocular sporangia formed from intercalary cells in middle parts of assimilatory filaments.
Littoral, infralittoral; epiphytic on Alaria, Laminaria and Zostera.

Microcoryne ocellata Strömf.

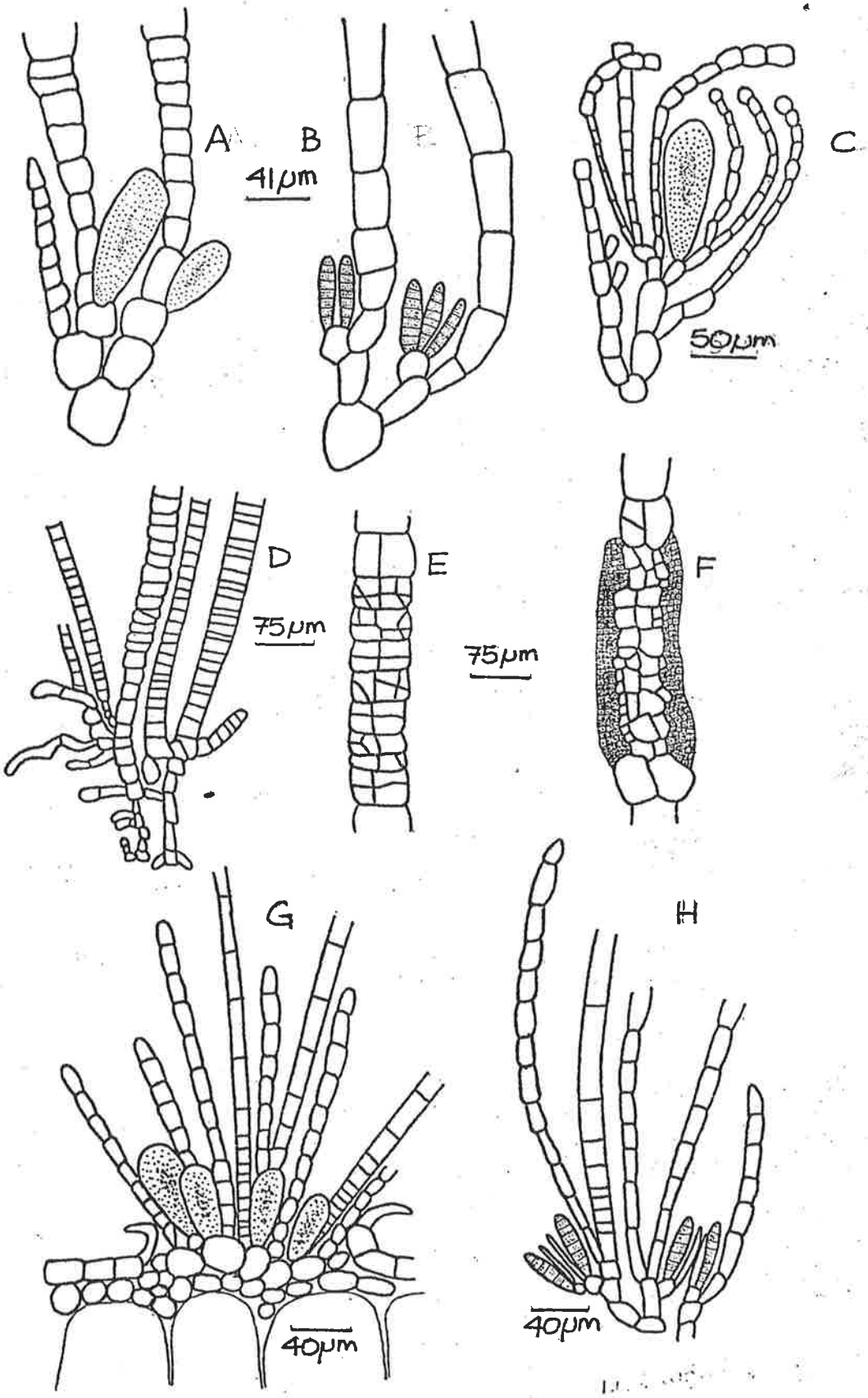
Thallus a small tuft or cushion to 3mm high. Erect assimilatory filaments unbranched, basally coalescent forming a colourless cortex and medulla. Several discoid chloroplasts per cell.
Unilocular sporangia unknown; plurilocular sporangia uni- or bi- seriate, formed in the outer cortex, at the bases of free assimilatory filaments.
Littoral, infralittoral; epiphytic on Sauvageaugloia and Chorda.

Myriactula O. Kuntze

Thallus a minute patch or cushion 1 - 2mm high. Assimilatory filaments basally loosely coalescent forming a cortex and medulla. Basal system may penetrate host plant. Hairs present. Many discoid chloroplasts per cell. Unilocular sporangia formed at the bases of assimilatory filaments; plurilocular sporangia unknown (M. areschougii, M. chordae, M. clandestina), or plurilocular sporangia uniseriate (M. haydeni, M. rivulariae, M. stellulata). Littoral, infralittoral; epiphytic on Fucus -- M. clandestina (no basal cushion, immergent filaments develop directly into paraphyses, sporangia or hairs)
epiphytic on Hirnanthalia -- M. areschougii (cushion totally immersed in host)
epiphytic on Chorda -- M. chordae
epiphytic on Scytosiphon -- M. haydeni
epiphytic on Cystoseira and Halidrys -- M. rivulariae (cushions develop in the "crypts" of Cystoseira, but not penetrating host tissue)
epiphytic on Dictyota -- M. stellulata.

Plate 17

Elachista stellaris, unilocular sporangia (A), plurilocular sporangia (B), after Kylin, 1947.
E. fucicola, unilocular sporangia, after Kylin, 1947 (C).
Halothrix lubricalis, vegetative filaments (D, E), plurilocular sporangia (F), after Pankow 1971.
Myriactula stellulata, unilocular sporangia, after Hamel, 1931 - 39 (G).
M. haydeni, plurilocular sporangia, after Kylin 1947 (H).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Cladosiphon contortus (Thur. in Le Jol.) Kylin

Thallus filiform, light brown, to 200mm long. Frond solid, gelatinous, sparsely and irregularly branched, 1 - 2mm wide; pseudoparenchymatous, of coalescent colourless filaments forming a cortex and medulla; filaments much separable under slight pressure. Thallus multiaxial; covered by free, branched, assimilatory filaments usually more than 7 cells in length. Hairs present.
Many discoid chloroplasts per cell.
Unilocular sporangia formed at the bases of assimilatory filaments; plurilocular sporangia uni- or bi- seriate, sometimes branched, terminal on assimilatory filaments.
Infralittoral; epiphytic on Zostera.

Cladosiphon zosterae (J.Ag.) Kylin

Very similar to C. contortus but differs in being smaller (0.5mm wide, 60 - 100mm long) and yellow rather than brown in colour; assimilatory filaments rarely branched.

Eudesme virescens (Carm. ex Harv. in Hook.) J.Ag.

Thallus cylindrical, yellowish brown, to 500mm long. Frond solid but soft, gelatinous, 1 - 4mm wide with numerous irregular branches. Pseudoparenchymatous, easily squashed to reveal a multiaxial medulla of numerous colourless filaments and a cortex of stalked fan-like tufts of club-shaped pigmented assimilatory filaments 15 - 28 cells long. Hairs present.
Unilocular and plurilocular sporangia formed at the bases of assimilatory filaments.
Assimilatory filaments grade into axial cells.
Littoral pools; epilithic.

Sauvageaugloia chordariaeformis (Crouan frat.) Kylin

Very similar to Eudesme, but branched only at the base of the plant. multiaxial
Internally medulla and cortex more distinct; cortical assimilatory filaments simple or sparsely branches, 18 - 30 cells long, sharply differentiated from the axial cells.
Plurilocular sporangia formed at the bases of assimilatory filaments, known only for material from France; unilocular sporangia also formed at the bases of assimilatory filaments.
Littoral pools; epilithic. Rare, recorded only from the Channel Isles.

Sauvageaugloia griffithsiana (Grev. ex Harv. in Hook.) Harel ex Kylin

Similar to Eudesme but axes 1mm or less wide, sparsely branched throughout the plant. Medulla and cortex more distinct, cortical filaments simple or sparsely branched, only 6 - 8 cells long.
Unilocular sporangia formed at the bases of assimilatory filaments; plurilocular sporangia unknown. Littoral, shallow infralittoral; Epilithic (stones), epiphytic on Zostera.

Mesogloia vermiculata (Sm.) S.F. Gray

Thallus cylindrical, ruddy olive-brown, to 300mm long. Frond soft and gelatinous, smooth, main axis obvious, 2 - 5mm wide, irregularly swollen and constricted; branching irregular, branches numerous, giving rise to secondary and tertiary branchlets. Pseudoparenchymatous, uniaxial, easily squashed to reveal a medulla of colourless filaments, and a cortex of long hairs and club-shaped pigmented assimilatory filaments 7 - 10 cells long.
Unilocular sporangia sessile or pedicellate at the base of assimilatory filaments; plurilocular sporangia unknown.
Littoral; epilthic (sand covered rock and stone).

Mesogloia lanosa Crouan frat.

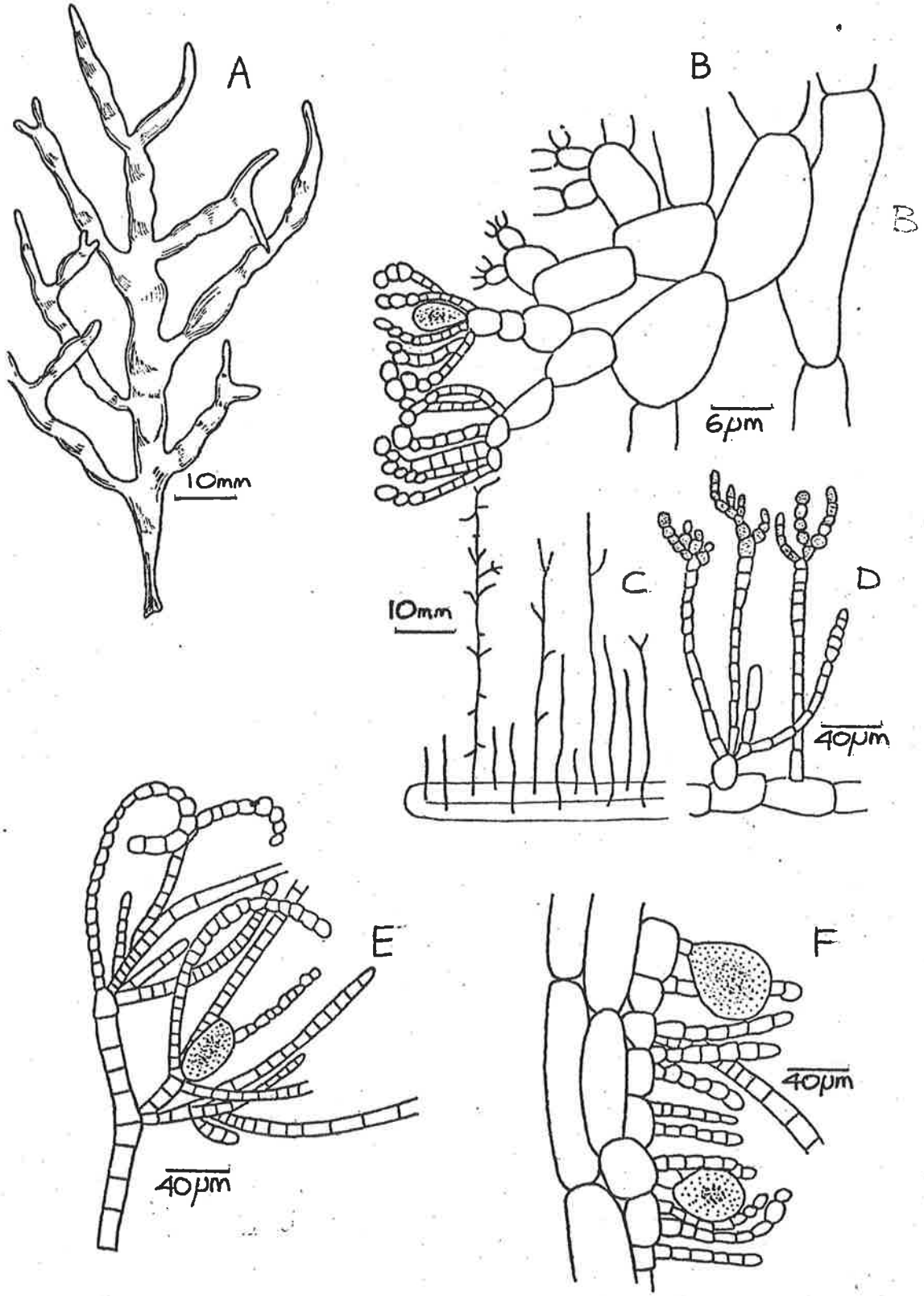
Similar to M. vermiculata but only 60 - 130mm long and has thin cylindrical branches. Looks woolly not smooth. Rare.

Leibmannia levellei J.Ag.

Similar to L. vermiculata but solid, firmer although still readily squashed. Pigmented cortical assimilatory filaments of 9 - 13 cells.
Unilocular sporangia sessile or pedicellate at the base of assimilatory filaments; plurilocular sporangia pedicellate at the base of assimilatory filaments;
Lower littoral, infralittoral; epilithic, epiphytic. Rare.

Plate 18.

Mesogloia vermiculata, frond (A), medullary and assimilatory filaments (B), unilocular sporangia, after Hamel, 1931 - 39 (B).
Cladosiphon zosterae, frond (C), assimilatory filaments, plurilocular sporangia (D), after Hamel, 1931 - 39.
Eudesme virescens, assimilatory filaments, unilocular sporangia, after Hamel, 1931 - 39 (E).
Sauvageaugloia griffithsiana, medulla, assimilatory filaments, unilocular sporangia, after Hamel, 1931 - 39 (F).


A
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B
6μm
B
10mm
C
D
40μm
E
40μm
F
40μm

Chorda filum (L.) Stackh.

Thallus cylindrical, dark brown, to 10m long. Frond unbranched, 5mm wide; parenchymatous, differentiated into a cortex, medulla and small celled epidermis; elongate medullary hyphae present; solid, becoming hollow in older plants. Frond covered by clavate unicellular paraphyses and colourless hairs; attached by a discoid holdfast.
Unilocular sporangia formed among paraphyses over the surface of the frond.
Infralittoral; epilithic, epiphytic.

Chorda tomentosum Lyngb.

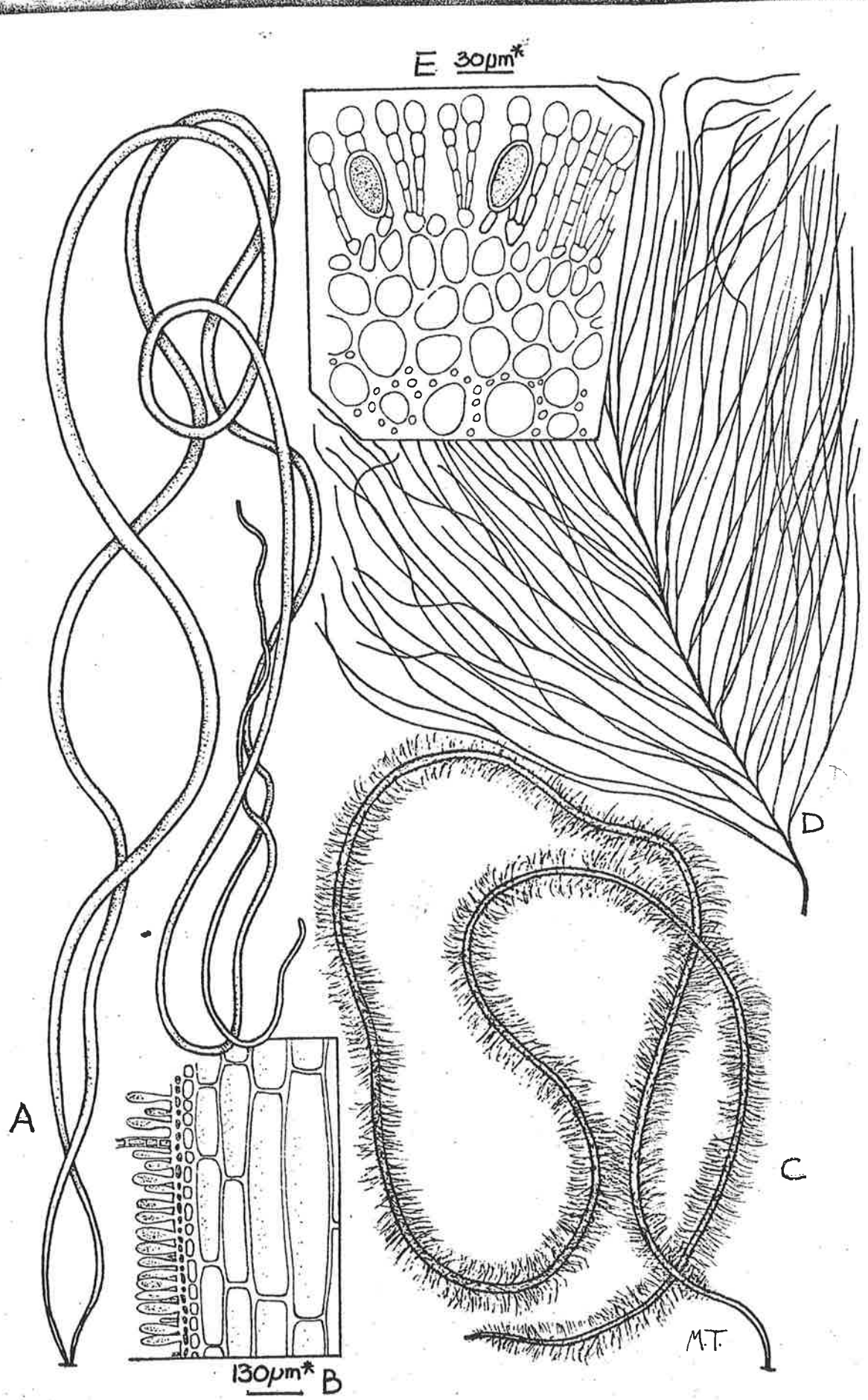
Thallus cylindrical, dark brown, to 1m long. Frond unbranched, 4mm wide; parenchymatous, differentiated into medulla, cortex and small celled epidermis; elongate medullary hyphae present. Frond covered with linear unicellular paraphyses and yellow brown hairs; solid becoming hollow in older plants; attached by a discoid holdfast.
Unilocular sporangia formed among the paraphyses over the surface of the frond.
Infralittoral; epilithic.

Chordaria flagelliformis (O.F.Müll.) C.Ag.

Thallus cylindrical or filiform, dark brown, to 700mm long. Irregularly or alternately branched from a main axis (1 - 2mm wide) giving a whiplash appearance; a few secondary branches may be present; attached by a small discoid holdfast. Frond solid, pseudoparenchymatous, of fused filaments forming a colourless cortex and medulla; filaments do not separate under pressure. Exteriorly free assimilatory filaments of less than 7 cells cover the entire frond; assimilatory filaments often branched. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia borne at the base of the assimilatory filaments and sunk in the peripheral layers of the thallus. Plurilocular sporangia unknown on the macrothallus.
Littoral; epilithic.

Plate 19

(A), Chorda filum, frond; transverse section showing paraphyses and unilocular sporangia; (B), after Newton, 1931.
C. tomentosum, frond (C).
Chordaria flagelliformis, frond; (D), transverse section showing unilocular sporangia; (E), after Pankow, 1971.


E 30µm*
A
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M.T.
D

Dictyosiphon chordaria Aresch.

Thallus cylindrical, olive, to 350 m long. Frond sparsely and irregularly branched, to 3mm wide, gelatinous, solid becoming hollow in older plants; branches attenuate at the base. Frond parenchymatous, differentiated into a cortex and medulla of large colourless cells, and epidermis of small rounded cells. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia large, sunk in the cortical layers of the thallus; plurilocular sporangia unknown on macrothallus.
Littoral, infralittoral; epilithic.

Dictyosiphon eckloanii Aresch.

Thallus cylindrical or filiform, to 800mm long. Frond unbranched, parenchymatous, differentiated into a cortex, medulla and epidermis. Hairs present. Many discoid chloroplasts per cell. Plant resembles a Litosiphon.
Unilocular sporangia sunk in outer cortical layers of thallus; plurilocular sporangia unknown on macrothallus.
Littoral; epiphytic on Scytosiphon and Cystoclonium. Known only from south western England.

Dictyosiphon foeniculaceus (Huds.) Grev.

Thallus cylindrical, bushy, olive brown, to 600mm long. Frond much branched, branching irregular, axes 0.5 - 1mm wide; parenchymatous, differentiated into a cortex, medulla and epidermis of small rounded irregularly placed cells. Younger parts of frond solid, becoming hollow when older. Attached by a small discoid holdfast. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia developed from the epidermis and sunk in the cortex; plurilocular sporangia unknown on the macrothallus.
Littoral; epilithic, epiphytic.

Stictyosiphon tortilis (Rupr.) Reinke

Thallus cylindrical, bushy, light brown, to 300mm long. Frond irregularly branched, main axis and branches 1mm wide; parenchymatous, differentiated into a medulla and epidermis of rectangular cells; solid becoming hollow in older parts. Branches usually terminate in a hair or pseudohair. Plant attached by a small discoid holdfast. Many discoid chloroplasts per cell.
Unilocular sporangia develop from the epidermal and are scattered over the surface of the frond; plurilocular sporangia multiseriate, develop from the epidermal cells and scattered over the frond but absent from the monosiphonous parts of the frond.
Littoral; epilithic. Occurs in both marine and estuarine conditions.

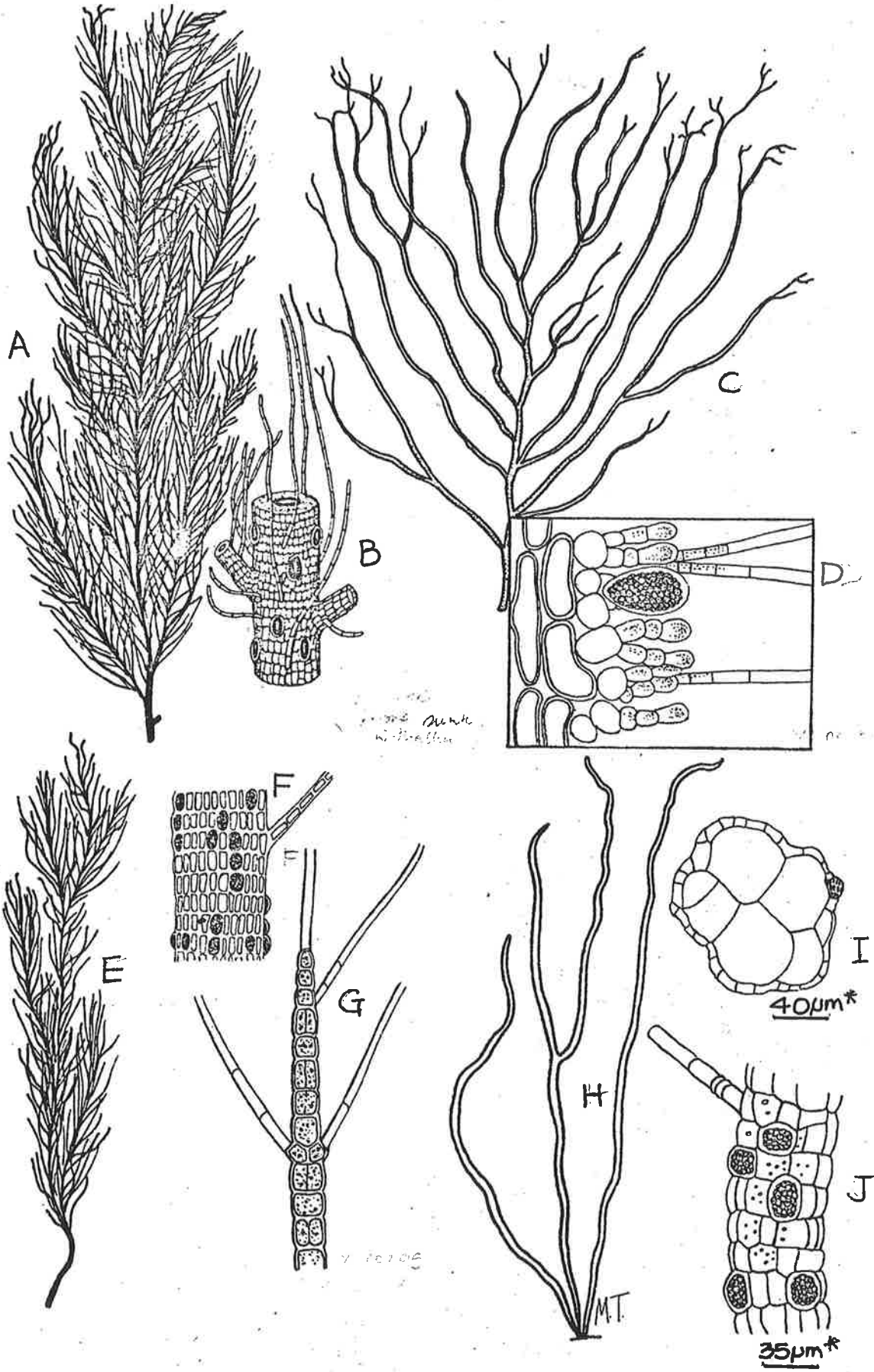
Stictyosiphon soriferus (Reinke) Rosenv.

Thallus cylindrical, light brown, to 100mm long. Frond irregularly branched, branches to 1mm wide; parenchymatous, differentiated into a medulla and epidermis of rectangular cells; solid becoming hollow in older parts. Branches terminate in a hair or pseudohair. Attached by a small discoid holdfast, many discoid chloroplasts per cell.
Unilocular and plurilocular sporangia develop from the epidermal cells, scattered over the surface of the frond; plurilocular sporangia multiseriate, present in the monosiphonous parts of the thallus.
Littoral, infralittoral; epilithic, epiphytic.

Plate 20.

Dictyosiphon foeniculaceus, frond (A), unilocular sporangia (B).
D. chordaria, frond (C); unilocular sporangia (D), after Cobi, 1874.
Stictyosiphon tortilis, frond (E), plurilocular sporangia (F), after Pankow, 1971; apical part of frond (G), after Gobi, 1874.
S. soriferus, frond (H); transverse section across thallus (I); unilocular sporangia (J), after Rosenvinge, 1935.

Fig. 8 Pl. 10.



Spermatochnus paradoxus (Roth) Kütz.

Thallus cylindrical, olive brown, to 500mm long. Frond dichotomously or irregularly branched, main axis 2 - 3mm wide; solid becoming hollow in older plants; attached by a discoid holdfast. Thallus pseudoparenchymatous with a cortex and medulla developed around a single uniaxial filament which becomes indistinct in older plants. Short unbranched uniseriate assimilatory filaments present at the apices of the frond. Unbranched multicellular paraphyses present. Many discoid chloroplasts per cell.
Unilocular and plurilocular sporangia present among paraphyses in sori which are distributed in a spiral or whorled arrangement over the frond; plurilocular sporangia multiseriate.
Littoral, infralittoral; epiphytic, epilithic.

Sporochnus pedunculatus (Huds.) C. Ag.

Thallus cylindrical or filiform, green, to 500mm long. Main axis 1 - 2mm diameter, irregularly branched, primary branches bearing many short terminally swollen branchlets giving the plants its characteristic appearance. Tufts of hairs occur at the frond apices below which are "receptacles" of multicellular paraphyses crowded together. The paraphyses are branched with large globose apical cells and bear the unilocular sporangia. Thallus pseudoparenchymatous, multiaxial, differentiated into a colourless cortex and medulla. Many discoid chloroplasts per cell.
"Receptacles" containing the unilocular sporangia are borne on short stalks along the lateral branches; sporangia formed on and among the paraphyses.
Plurilocular sporangia unknown on the macrothallus.
Infralittoral; epilithic.

Stilophora rhizodes (Turn.) J.Ag.

Thallus cylindrical, yellow olive, to 600mm long. Frond irregularly or dichotomously branched, 1mm wide, solid becoming hollow in older plants; attached by a discoid holdfast. Pseudoparenchymatous, multiaxial, differentiated into a cortex, medulla and epidermis. Short unbranched uniseriate filaments (7 cells long) present on the terminal parts of the branches. Unbranched multicellular paraphyses present; hairs present. Many discoid chloroplasts per cell.
Unilocular and plurilocular sporangia develop among paraphyses in sori which are irregularly distributed over the plant giving it a warty appearance; plurilocular sporangia uniseriate.

Stilophora tuberculosa (Hornem.) Reinke

Thallus cylindrical, brown, to 300mm long. Frond dichotomously or irregularly branched. Otherwise similar to S. rhizodes but differing in that the colourless hairs, paraphyses and sporangia cover most of the surface of the frond.
Unilocular and plurilocular sporangia occur in closely crowded sori; plurilocular sporangia uniseriate.
Littoral; epilithic, epiphytic on Fucus.

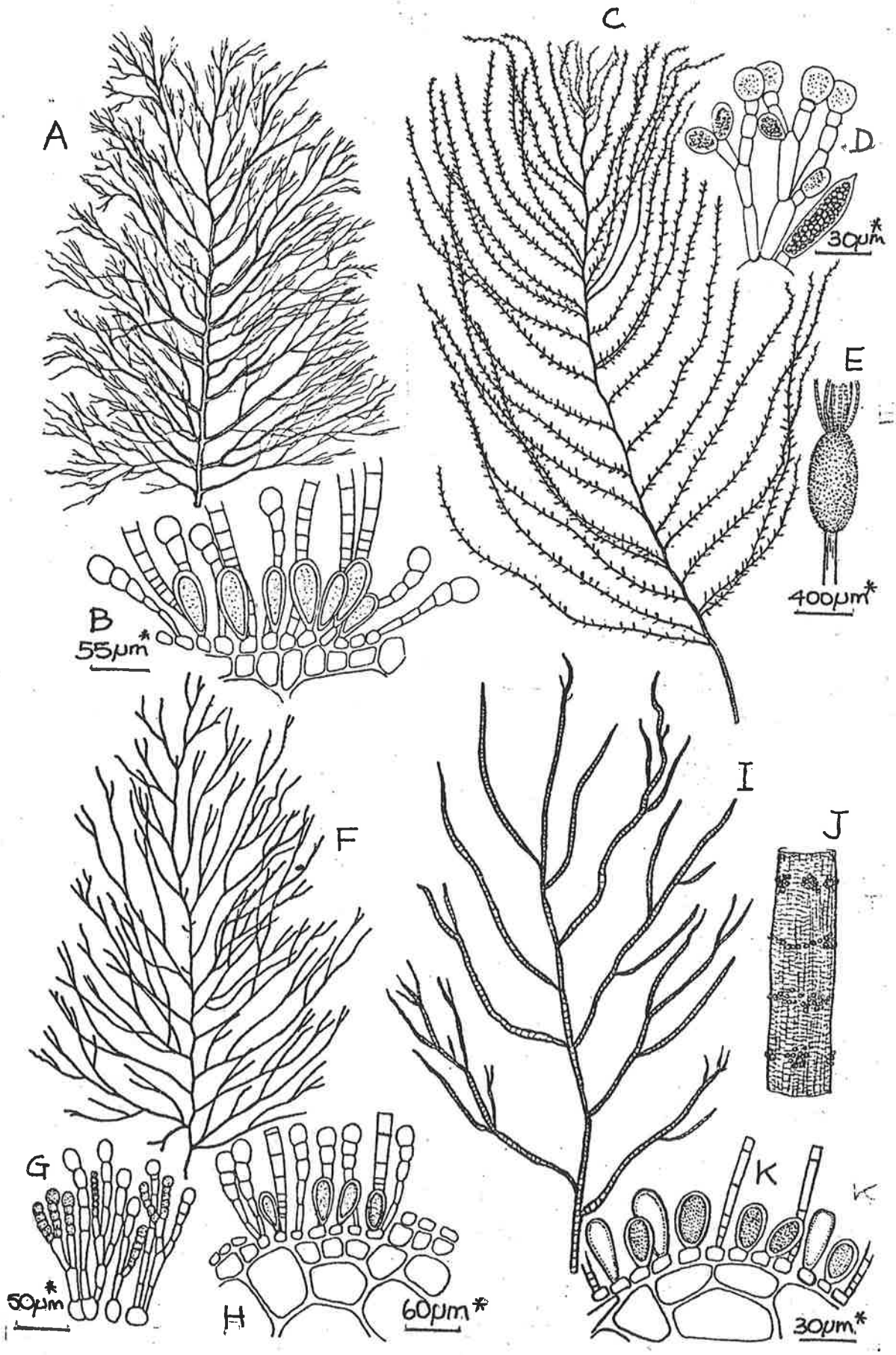
Striaria attenuata (Grev.) Grev.

Thallus cylindrical, green to light brown, to 500mm long. Frond much branched, main axis and branches 5 - 10mm wide, branches opposite, attenuate at apex and base, often terminating in hairs. Thallus parenchymatous, hollow, medulla of large colourless cells, epidermis of small cells with many discoid chloroplasts per cell.
Unilocular sporangia formed from epidermal cells, aggregated into sori associated with tufts of hairs; sori encircle thallus in rings; plurilocular sporangia unknown on macrothallus.
Infralittoral; epilithic, epiphytic.

Plate 21.

(A), (B)

. Sperratochnus paradoxus, frond; unilocular sporangia after Kylin, 1947 .
Sporochnus pedunculatus frond; unilocular sporangia and receptacle after Newton, 1931 .
(F) (C) (G) (D,E)
. Stilophora rhizodes frond; unilocular and plurilocular sporangia (H), after Kylin, 1940 .
Striaria attenuata frond; sori; unilocular sporangia, after Kylin, 1947 .
(I) (J) (K)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Arthrocladia villosa (Huds.) Duby

Thallus filiform, yellow-green, to 1m long. Frond much branched, branching opposite; main axis and branches bear whorls of uniseriate branched ramuli. Frond pseudoparenchymatous, filamentous nature obvious from a transverse section of a branch; main axis a distinct central filament, dense cortication of which gives rise to a large celled cortex and medulla, and a small celled epidermis. Many discoid chloroplasts per cell. Plant attached by a discoid holdfast.
Unilocular sporangia borne in chains on whorled tufts; plurilocular sporangia unknown.
Infralittoral; epilithic.

Desmarestia aculeata (L.) Lamour.

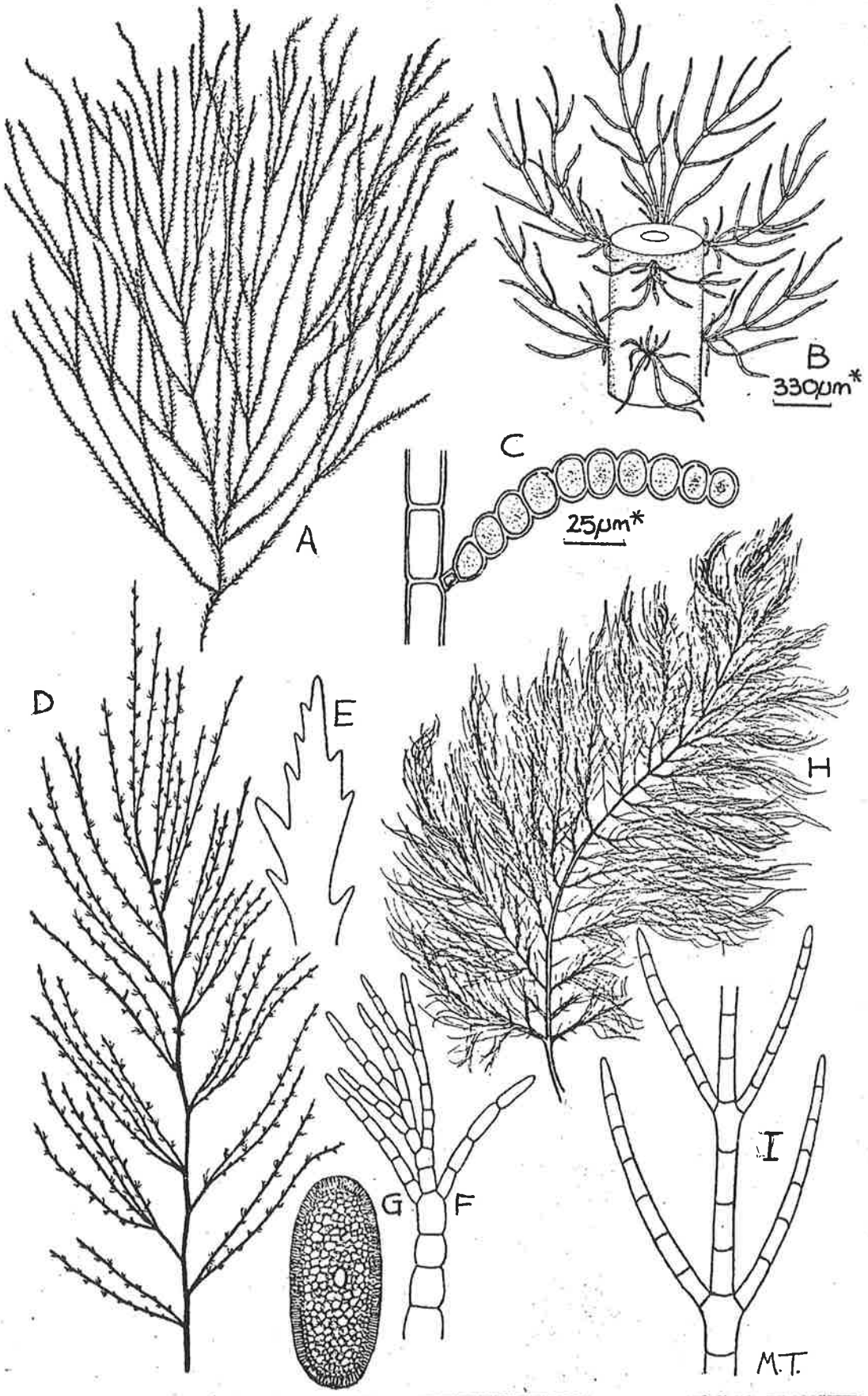
Thallus cylindrical, bushy, dark olive brown, to 1m long. Frond rigid, much branched, branching irregularly alternate, pregressively shorter distally, forming a dense bush. All axes and branches flattened, tough and opaque. In summer spring and main axis branchlets are soft to touch, yellow-brown in colour; at other times the most obvious feature is the alternately arranged sharply pointed spines. A short basal stalk arises from a discoid holdfast. Many discoid chloroplasts per cell.
Unilocular sporangia devloped from and immersed in the cortical cells; plurilocular sporangia unknown on macrothallus.
Infralittoral; epilithic.

Desmarestia viridis (O.F. Müll.) Lamour.

Thallus cylindrical, green, to 450mm long. Frond flaccid, pinnately branched. Main axis (2mm wide) with a central filament dense cortication of which gives rise to a large celled cortex and medulla, and small celled epidermis. In summer frond clother with tufts of delicate green filaments. Many discoid chloroplasts per cell. Plant decomposes rapidly.
Unilocular sporangia immersed in the cortex; plurilocular sporangia unknown on the macrothallus.
Infralittoral; epilithic, epiphytic.

Plate 22.

Arthrocladia villosa, frond (A); whorled filamentous branches (B), unilocular sporangia (C), after Newton, 1931.
Desmarestia aculeata, frond (D), spiny lateral (E), summer filamentous growth (F) after Padina, 1931; transverse section of thallus (G), after Newton 1931.
D. viridis, frond (I), lateral branch filaments (J).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Acrothrix gracilis Kylin

Thallus cylindrical threads, pale brown, to 300mm long. Main axis 1mm wide, solid or hollow, not easily distinguished among numerous irregularly placed primary and secondary branches. Frond pseudoparenchymatous, not very gelatinous but soft and easily squashed, revealing a medulla of colourless filaments (uniaxial at apex) and a cortex of hairs and simple cylindrical filaments 4 - 8 cells long. assimilatory
Unilocular sporangia borne at the base of assimilatory filaments, immersed in the cortex; plurilocular sporangia unknown.
Infralittoral; epilithic.

Myriocladia torentosa Crouan frat.

Very similar to Acrothrix but sparsely branched with a wooly surface; cortical filaments 13 or more cells long. Very rare, known only from southern Britain.
Plurilocular sporangia intercalary

Buffharia speciosa Bath.
threads
Thallus cylindrical, olive brown, to 30mm long. Frond unbranched, thread like (1mm wide), attenuate at both apex and base; parenchymatous differentiated into a cortex and medulla; covered with uniseriate lateral branchlets about 8 cells long. Many discoid chloroplasts per cell.
Littoral; epiphytic on Sauvageaugloia griffithsiana. Unilocular sporangia unknown; plurilocular sporangia uni- or bi-seriate.

Sphaerotrichia divaricata (C.Ag.) Kylin

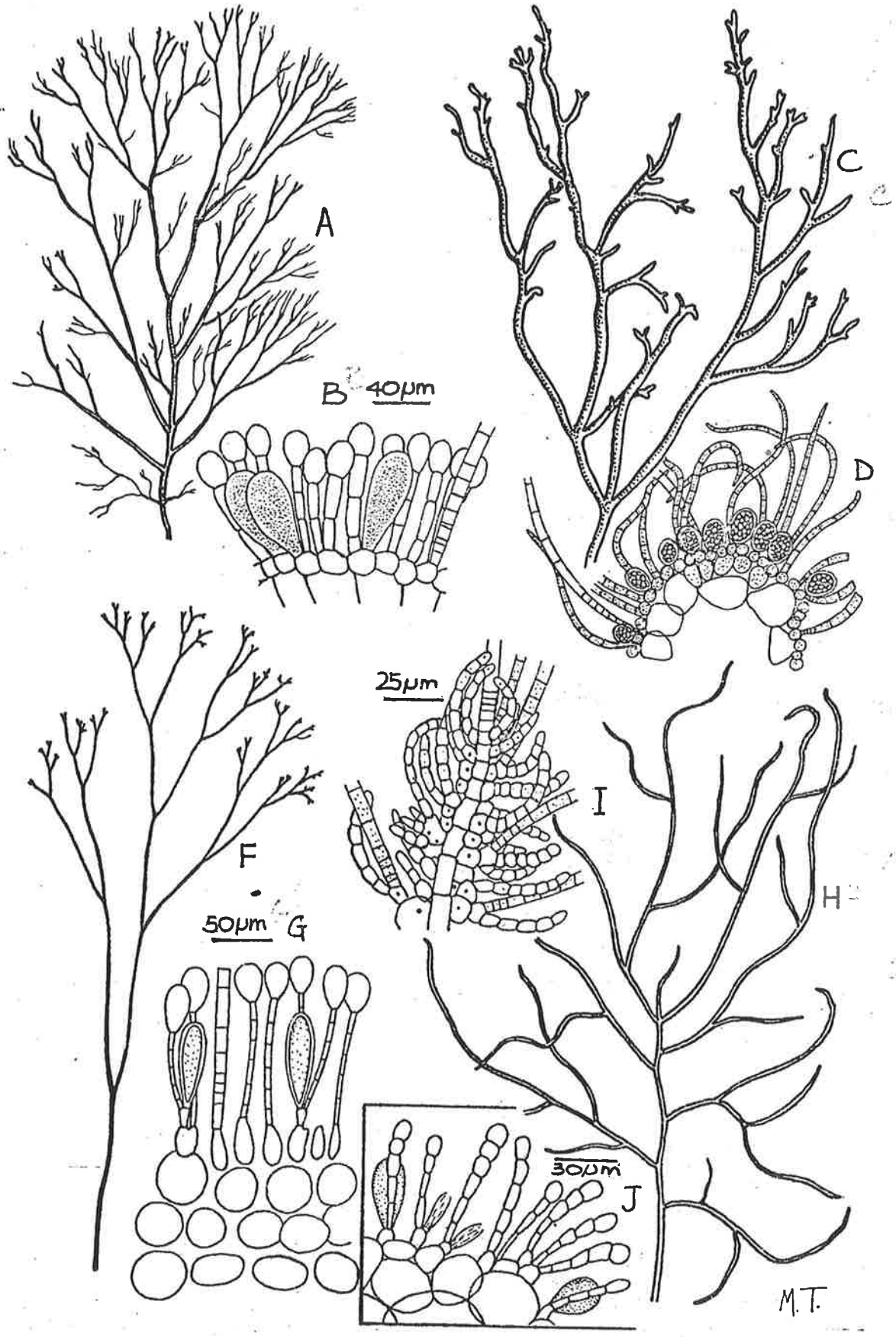
Thallus cylindrical or filiform, olive, to 700mm long. Frond irregularly branched threads, 0.5 - 1mm wide; gelatinous; pseudoparenchymatous, multiaxial, filaments coalescing to form a cortex and medulla. Fond solid becoming hollow in older plants. Externally free assimilatory filaments, 5 cells long, cover the entire frond; filaments unbranched, terminating in a large globular cell. Hairs present. Many discoid chloroplasts per cell.
Unilocular sporangia sessile on assimilatory filaments; plurilocular sporangia unknown.
Littoral; epilithic (on stones).

Stilopsis lejolisii (Thur. in Le Jol.) Kuck in Nienburg

Thallus cylindrical threads, yellow or light brown, to 500mm long. Frond irregularly or alternately branched, 1mm wide, pseudoparenchymatous forming cortex and medulla; solid becoming hollow when older. Short unbranched uniseriate assimilatory filaments 2 - 3 cells long cover most of thr frond. Unbranched multicellular paraphyses present; hairs present. Attached by a discoid holdfast. Many discoid chloroplasts per cell.
Unilocular and plurilocular sporangia occur in sori not sharply differentiated from the cortex and almost continuous over the frond.
Littoral, infralittoral; epilithic, epiphytic on Cystoseira.

Plate 23.

Stilopsis lejolisii, frond (A); unilocular sporangia (B), after Harel, 1931 - 39.
Myriocladia torentosa, frond (C); unilocular sporangia (D), after Crouan & Crouan, 1867.
Sphaerotrichia divaricata, frond (F); unilocular sporangia (G), after Kylin, 1940.
Acrothrix gracilis, frond (H); frond apex (I), after Kuckuck, 1929; unilocular sporangia (J), after Kylin, 1907.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Asperococcus compressus Griff. ex Hook.

Thallus cylindrical, but compressed, yellow to olive green, to 450mm long. Frond unbranched, attenuate at the base; parenchymatous differentiated into a medulla of large colourless cells and an epidermis; in part hollow. Many discoid chloroplasts per cell.
Unilocular and plurilocular sporangia develop in sori together with multicellular hairs, plurilocular sporangia multiseriate.
Infralittoral on various algae.

Asperococcus fistulosus (Huds.) Hook.

Thallus cylindrical, pale olive brown, to 450mm long. Frond narrow, linear, 4 - 10mm wide in the middle, attenuate basally to an inconspicuous stalk and basal attachment disc. Many discoid chloroplasts per cell. Parenchymatous, differentiated into a medulla of large colourless cells and an epidermis
Unilocular and plurilocular sporangia in sori together with tufts of hairs giving the frond a spotted appearance; plurilocular sporangia multiseriate.
Littoral, infralittoral; epilithic (rocks, stones and shells), epiphytic.

Asperococcus turneri (Sm.) Hook.

Very similar to A.fistulosus but much wider (to 100mm), more obviously irregularly inflated sack, narrowing at the base to an obvious stalk.
Lower littoral, infralittoral.

Asperococcus scaber Kuck.
Thallus cylindrical, yellow brown, to 10mm long. Frond unbranched and attached by a discoid holdfast. Frond parenchymatous differentiated into a medulla of large colourless cells (usually 4 in transverse section) and an epidermis.
Hairs present. Many discoid chloroplasts per cell.
Unilocular and plurilocular sporangia in sori together with multicellular hairs; plurilocular sporangia multiseriate.
Infralittoral; epilithic.

Colpomenia peregrina Sauv.

Thallus balloon-like, greenish or olive brown, to 200mm across. Thallus of regular spherical sacs, hollow, walls thin, matt and papery and not gelatinous; attached by basal rhizoids. Thallus parenchymatous of larger cortical cells and smaller epidermal cells, not filamentous.
Unilocular and plurilocular sporangia form dark spots or patches on the surface of the frond; plurilocular sporangia biseriate.
Littoral pools, infralittoral especially on sheltered shores; epilithic, epiphytic.
Spread to Britain from the continent this century.

Leathesia difformis (L.) Aresch.

Thallus irregular spherical lumps, olive brown, to 50mm across. Thallus solid when young but becoming hollow with thick walls; gelatinous and shiny; surface convoluted; attached by lower surface. Thallus pseudoparenchymatous constructed of numerous much branched filaments coalescing internally to form a colourless cortex.
Unilocular and plurilocular sporangia on short stalks at the bases of internal filaments; plurilocular sporangia uniseriate.
Littoral; epilithic, epiphytic.

Scytosiphon lomentaria (Lyngb.) Link

Thallus cylindrical, olive or dark brown, to 400mm long. Frond unbranched, to 7mm wide tapering towards both ends, narrowing abruptly at the base to a short stalk and a small attachment disc. Frond obviously constricted at intervals. Plant parenchymatous, large colourless cortical cells surrounded by smaller coloured epidermal cells each with a single discoid chloroplast.
Unilocular sporangia unknown, plurilocular sporangia uniseriate scattered over the surface of the frond, not associated with hairs.
Littoral, shallow infralittoral; epilithic, epiphytic.

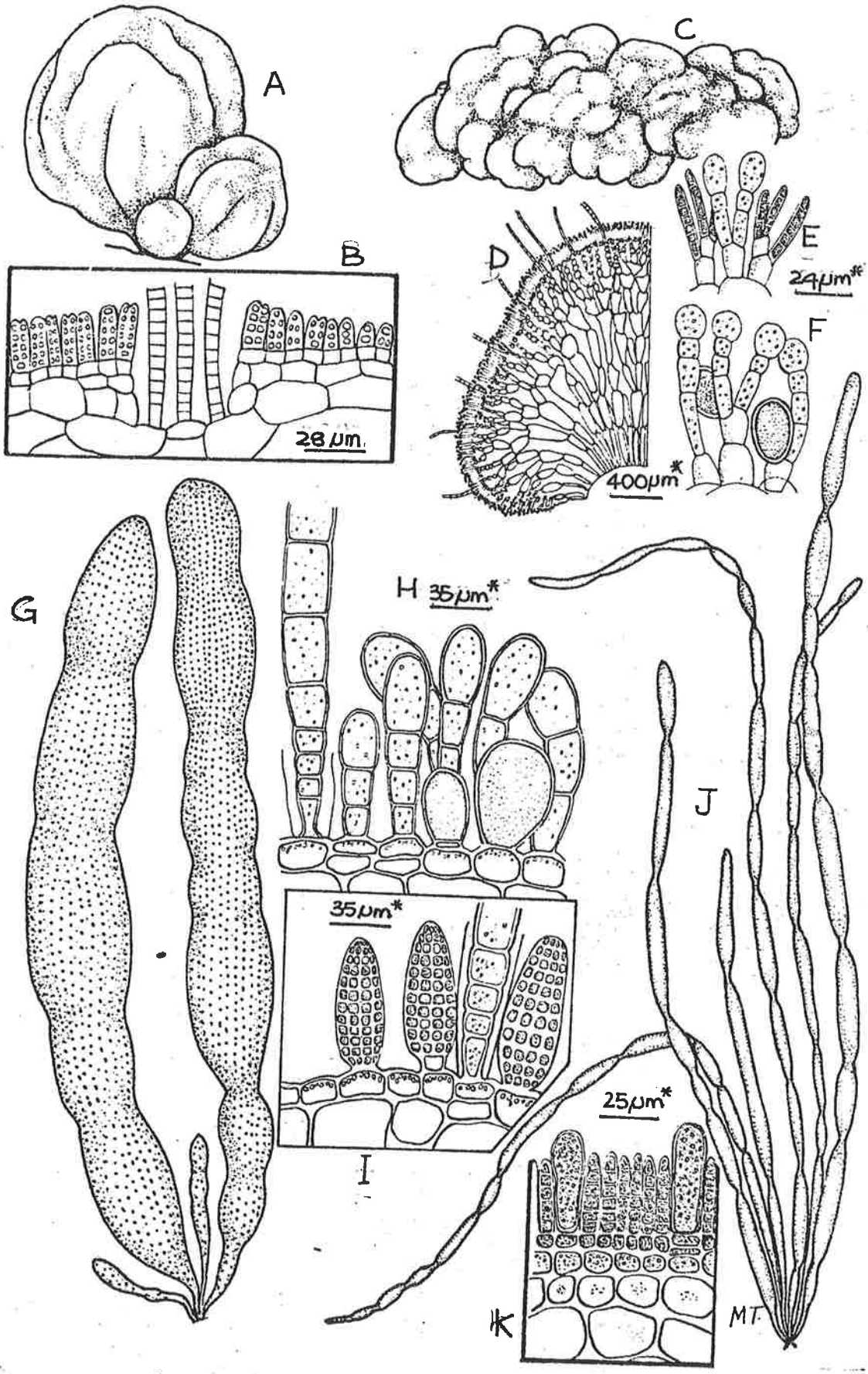
Plate 24.

A. Colaconema peregrina, whole plant (A); plurilocular sporangia (B), after Lund & Rosenvinge, 1947.

B. Leathesia difformis, whole plant; transverse section through thallus (C) showing filamentous nature; unilocular (F) and plurilocular sporangia (E), (D), after Newton, 1931

C. Asperococcus turneri, whole plant (G); unilocular and plurilocular sporangia (H), after Newton 1931.

D. Scytosiphon lomentaria, whole plant (I); transverse section showing paraphyses (K) after Newton, 1931.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Taonia atomaria (Woodw.) J.Ag.

Thallus wedge shaped, olive-green, to 300mm long. Attached by a basal pad of entangled fibres. Frond flat, thin, delicate ribbons, becoming wider apically. Variously divided, apical regions truncated and ragged. Frond bears distinct concentric lines of hairs.
Gametangia (on separate plants) and tetrasporangia form concentric lines of tiny dark dots.
Lower littoral, infralittoral; epilithic. Mainly on southern shores.

Padina pavonica (L.) Lamour.

Thallus fan-shaped, to 130mm long. Reddish brown near the base, yellowish or pale green towards the tips, with concentric lines of short orange brown hairs; one surface covered in a chalky powder. Plant attached by a small basal pad covered with entangled fibres from which arises a narrow tapering stalk which gradually expands into a broad, thin, papery fan. Younger plants entire, older plants becoming variously split and lobed to form funnel shaped tufts. The distal edge of the frond curved, often inrolled and fringed with brown hairs.
Gametangia and tetrasporangia form concentric lines of tiny dark dots between the concentric lines of hairs.
Lower littoral, infralittoral; epilithic (sandy or detrital situations). Confined to the southern coasts of Britain, and also the Channel Isles.

Cutleria multifida (Sm.) Grev.

Thallus ribbon or wedge shaped, pale brown, to 400mm long. Attached by a basal pad of entangled fibres. Frond flat, somewhat fan-shaped, with an inconspicuous stalk. Dichotomously divided, almost to the base, into narrower ribbons. Thin but usually leathery and crisp; distal ends jagged, fringed with tufts of filaments.
Gametangia together with tufts of hairs dot the surface of the frond.
Infralittoral; epilithic. Rare in the north of Britain.

Dictyota dichotoma (Huds.) Lamour.

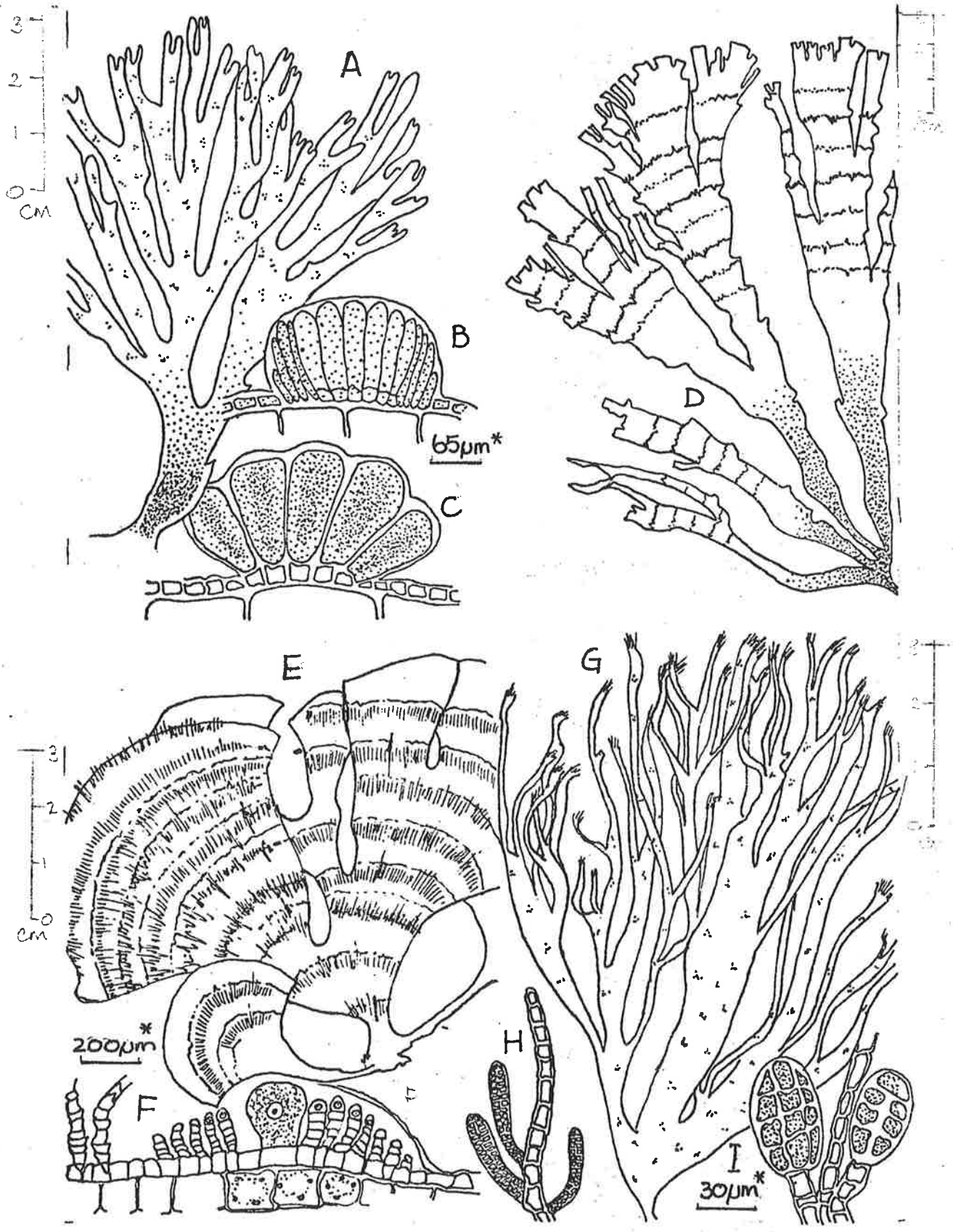
Frond ribbon like, dark brown at the base, paler towards the tips, sometimes slightly irridescent, to 300mm long. Attached by a small basal pad of matted fibres. Frond a linear, flimsy, flat, translucent ribbon. Repeatedly and regularly forked. Distal ends smoothly rounded and often indented in the middle as a new division begins. Tufts of hairs present but inconspicuous. In section the frond consists of only 3 layers of cells, a central layer of large square cells between peripheral layers of small cells.
Gametangia and tetrasporangia dot the surface of the frond.
Lower littoral pools, infralittoral; epilithic, epiphytic.

Dilophus spiralis (Mont.) Hamel

Very similar to Dictyota but paler in colour, branching less regular, frond more than 3 cell layers thick at least at the base.
Littoral; epilithic (sandy pools). Rare, south west England.

Plate 25.

Dictyota dichotoma, frond (A); male (B) and female (C) gametangia, after Newton, 1931.
Taonia atomaria, frond (D).
Padina pavonia, frond (E); male and female (F) gametangia, after Newton, 1931.
Cutleria multifida, frond (G), male and female (H), gametangia, after Newton, 1931.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Desmotrichum undulatum (J.Ag.) Reinke

Thallus ribbon-shaped, pale yellow brown, to 200mm long. Thallus very thin and narrow (to 7mm wide), attenuate at the base, unbranched. Frond parenchymatous (2 - 4 layered) differentiated into medulla and epidermis. Hairs present. Many discoid chloroplasts per cell. Unilocular sporangia occur singly, partly sunk in the thallus; plurilocular sporangia multiseriate, grouped in sori, sessile on the thallus.
Infralittoral; epiphytic on Zostera and Chorda.

Laminaria spp.

A very young plant is not unlike Petalonia fascia but has a holdfast which is root-like. In cross section the frond is formed of a clear central region of distorted gelatinous cells and hyphae, an intermediate zone of close set rounded cells and a single peripheral layer of small square cells.
+ Young Saccorhiza

Petalonia fascia (O.F.Mull.) O. Kuntze

Thallus laminate or ribbon-like, olive or pale brown, to 300mm long. Frond a flat unbranched, thin, ribbon, tapering at both ends, to 60mm wide. Usually smooth, translucent, margins entire and slightly wavy. A tiny stipe arises from an inconspicuous basal disc. A cross section of the frond reveals a medulla of pseudoparenchymatous larger central cells and an epidermis of smaller superficial cells, each of which contains a single discoid chloroplast.
Unilocular sporangia unknown on macrothallus; plurilocular sporangia microscopic, 4 - 6 cells long, formed from epidermal cells.
Littoral pools; epilithic (rocks, stones or barnacle shells), epiphytic.

Petalonia zosterifolia (Reinke) Kuntze

Very similar to P. fascia but usually les than 5mm wide; linear in shape, ribbon-like.

Punctaria latifolia Grev.

Thallus laminate, pale brown or yellowish green, to 400mm long. Frond a flat unbranched thin ribbon, lanceolate, 40-45mm wide, tapering towards both ends, margins slightly wavy. Frond narrows to a short stalk attached by an inconspicuous basal disc. Frond parenchymatous. In cross section there is a clear distinction between the larger central rectangular cells, and the smaller peripheral cells, each of which contains several plastids.
Unilocular and plurilocular sporangia in oval patches on the surface of the frond, visible as distinct spots.

Littoral; epilithic (rocks and stones) epiphytic on Zostera and other algae. Occurs only in spring and summer.

Punctaria plantaginea (Roth) Grev.

Very similar to P. latifolia but a darker olive or reddish brown colour. Lanceolate, not as wide as P. latifolia, tapering gradually towards the base. Unilocular sporangia solitary, plurilocular sporangia in rounded patches dotting the surface of the frond.

Punctaria tenuissima (C.Ag.) Grev.

Similar to P. plantaginea, but pale brown in colour, thin much wider, with a slightly wavy margin. Hairs and sporangia less conspicuous.
Infralittoral; epilithic (sandy rock). Occurs only in spring and summer.

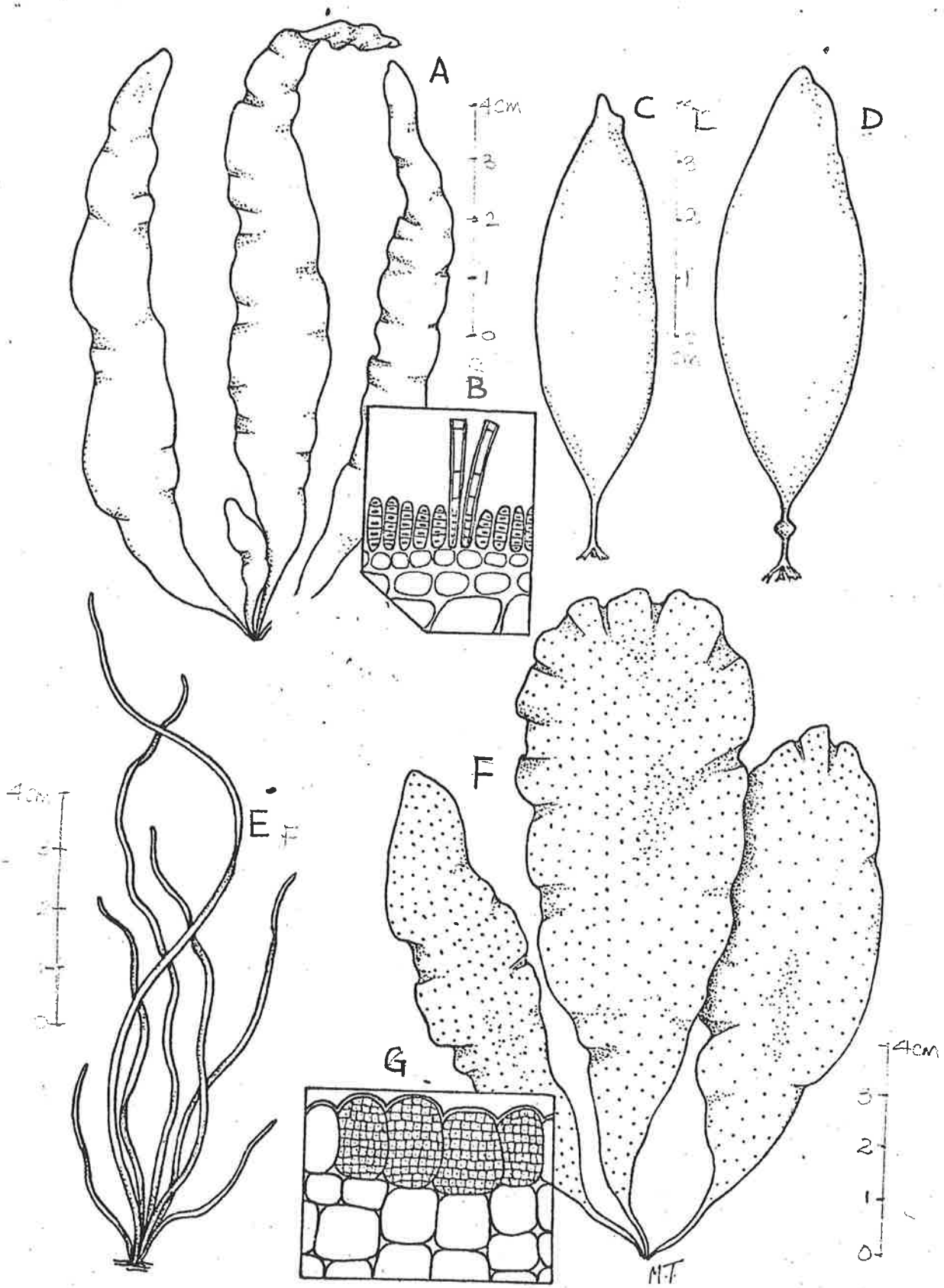
→ P. crispata

Plate 26.

Petalonia fascia, whole thallus (A); transverse section through plurilocular sporangia (B), after Kylin, 1947.
Young Laminaria spp. (C), (CC).
Young Saccorhiza (D).
Petalonia zosterifolia, whole plant (E).
Punctaria latifolia fronds (F); plurilocular sporangia (4).

Punctaria crispata

Thallus laminate, olive green - brown, mm long and mm wide; frond much wider than other Punctaria spp., margin very wavy, narrows abruptly to a small stipe, attached by a very small basal disc. Frond parenchymatous, structure similar to P. latifolia.
Unilocular and plurilocular sporangia scattered on surface of frond.
Littoral; epilithic. Known only from the Scilly Isles.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Dictyopteris membranacea (Stackh.) Batt.

Thallus laminate, green or yellow brown, to 300mm long. A fibrous discoid holdfast gives rise to a narrow, flat, strap-like frond with a distinct midrib. Margin entire or split to the midrib. Frond repeatedly and regularly forked with occasional branches arising from the midrib. Surface smooth, crisp, translucent, dotted with tiny tufts of hairs. Plant has an unpleasant smell when removed from the sea.
Male and female gametangia occur in sori; tetrasporangia scattered over the frond.
Infralittoral; epilithic. Confined to the south and west coasts of England and Ireland.

Carpomitra costata (Stackh.) Batt.

Thallus very narrow laminate, pale brown, to 300mm long. An irregular fibrous attachment disc gives rise to a long, narrow (1 - 2mm wide), ribbon-like frond with a distinct midrib. Repeatedly branched, alternate or irregularly dichotomous. Branches sometimes tipped with a tiny brush of hairs.
Unilocular sporangia formed among paraphyses in receptacle like sori. Apical or in the axils of branches, single, stalked, shaped like a bishps mitre.
Infralittoral; epilithic.

Alaria esculenta (L.) Grev.

Thallus laminate, olive or yellow brown, to 3m long. Attached by a root-like holdfast, from which arises a cylindrical, somewhat flattened distally, smooth and flexible stipe. Often with 2 lateral clusters of flattened stalked, leafy appendages (sporophylls). Frond tough but thin, translucent and rubbery, with an obvious median midrib, lanceolate, mostly entire although sometimes split obliquely from the margin to the midrib. Dotted with tiny tufts of hairs, most obvious in young plants.
Unilocular sporangia among paraphyses in raised, reddish-brown sori on the sporophylls.
Forms a narrow zone in the shallow infralittoral in exposed positions; epilithic.

Desmarestia ligulata (Lightf.) Lamour.

Thallus laminate, pale olive brown, to 2m long. A conical attachment disc gives rise to a long, flat, thin, strap-like frond with a faint midrib. Frond much divided with a main axis (to 10mm wide) and numerous narrower, lanceolate, opposite branches which are themselves oppositely branched. Margins of branchlets toothed and bearing tiny tufts of hairs in spring.
var. firma [= D. dresnayi]. A rarer, sparsely branched, broader form.
Unilocular sporangia immersed in the thallus.
Littoral pools, infralittoral; epilithic.

Plate 27.

. Dictyopteris membranacea, frond (A), female gametangia (B) and tetrasporangia (C), after New 19
. Alaria esculenta, whole frond (D).
. Carpomitra costata, whole frond (E), apical regions and sporangia (F), unilocular sporangia (G), after Newton, 1931.
. Desmarestia ligulata var firma, whole frond (H).
. Desmarestia ligulata, lateral branches, part of main axis and base (I).

Fucus vesiculosus L.

Thallus laminate, olive green or brown, to 1m long. Plant attached by a conical disc from which arises a short, cylindrical or slightly flattened stipe. Frond tough flattened with entire margins and a distinct midrib. Frond repeatedly forked; surface pitted with minute pores from which tiny tufts of hairs emerge. Spherical bladders immersed in the thallus, paired, one either side of midrib, numerous in sheltered situations, but may be sparse or absent.
Receptacles on the tips of branches, tapering to a point, simple or forked. Swollen and gelatinous when ripe, often orange coloured, spotted with conceptacles.
Epilithic (rock and stones); forms a distinct midlittoral zone.

Fucus serratus L.

Thallus laminate, olive green or brown, to 1.5m long. Plant attacged by a small disc from which arises a short stipe. Frond tough and rubbery, flattened, with a distinct midrib and serrate margin. Repeatedly and regularly forked; surface pitted with minute pores from which hairs arise. Receptacles on the tips of branches, flattened, dry and lumpy, often an orange colour, spotted with conceptacles, margin serrate.
Epilithic; forms a distinct zone in the lower littoral and shallow infralittoral.

Fucus spiralis L.

Thallus laminate, olive brown or yellowish, to 500mm long. Plant attached by a discoid holdfast. Stipe short, cylindrical or slightly flattened; expanding into a tough, flattened frond. Frond spirally twisted, margins entire, midrib conspicuous, repeatedly and regularly forked. Surface pitted with minute pores from which hairs arise. Brackish water forms may produce elongate blisters alongside midrib.
Receptacles on tips of branches, swollen and gelatinous when ripe, spotted with conceptacles and surrounded with a marginal flange of tissue.
Epilithic (rock and stones); forms a narrow upper littoral zone below Pelvetia.

Fucus ceranoides L.

Thallus laminate, yellowish or olive brown, to 600mm long. Plant attached by a conical disc. A long narrow, cylindrical stipe expands into a crisp and papery flattened frond. Frond repeatedly and regularly forked, lateral branches much narrower than main axis and arranged in fans. Frond often decayed back to mid-rib. Margins often split, midrib conspicuous; Surface with minute pores from which hairs arise. Elongate blisters may form alongside the midrib.
Receptacles on the tips of branches, narrow and tapering to a point, simple or forked; slightly swollen and gelatinous when ripe, spotted with conceptacles.
Epilithic (rocks and stones); littoral, confined to estuaries and other areas subject to fresh water.

Fucus distichus L.

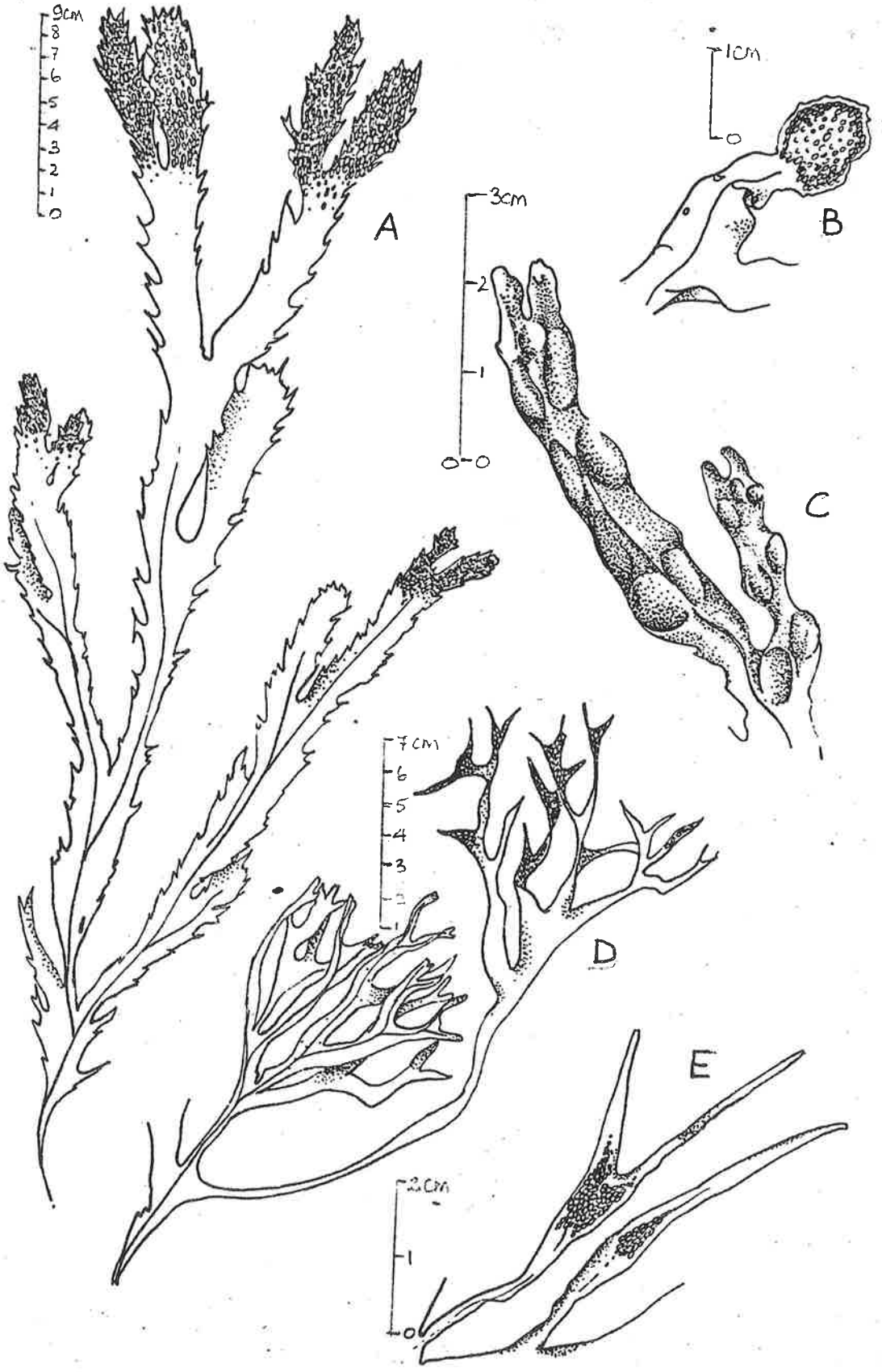
Frond laminate, olive green or brown. Attached by a conical disc. A narrow cylindrical stipe expands into a tough, leathery, flattened frond; midrib conspicuous below, obscure distally. Margin entire, vegetative growth continues beyond the receptacular area; Frond repeatedly and regularly forked. Surface with minute pores and tiny tufts or hairs. If the plant is held up to the light internal pits with no pore to the exterior are visible as circular light spots just larger than pin pricks.
Receptacles towards the tips of branches, frond usually continues growing beyond the receptacles, narrow and tapering to a point, simple or forked, swollen and gelatinous when ripe.
Sub-species anceps, to 150mm long, with a short thick stipe and drooping fronds. On heavily wave beaten shores, restricted to north west Scotland and north west Ireland.
Sub-species distichus, to 300mm long with a tough but flexible stipe. Upper littoral pools on exposed shores; known only from Shetland.
Sub-species edentatus, to 800mm long, like F. vesiculosus forms without bladders, but more greenish in colour; littoral, epilithic (open rocks and harbours) in sheltered conditions. Known only from Orkney and Shetland.

Fucus - general note

Fucus species commonly hybridise producing specimens intermediate in appearance. Some species also form very stunted and sterile plants on saltmarshes, such forms may include the species known as F. muscoides. Damaged plants often regenerate clusters of short proliferations from the injured area changing the appearance of the plant.

Plate 28.

A. Fucus serratus, whole plant (A).
B. F. spiralis receptacle showing sterile margin (B).
C. F. vesiculosus showing paired bladders (C).
D. F. ceranoides showing fan shaped fronds and forked receptacles (D).
E. F. distichus ssp anceps, receptacle and vegetative growth beyond (E).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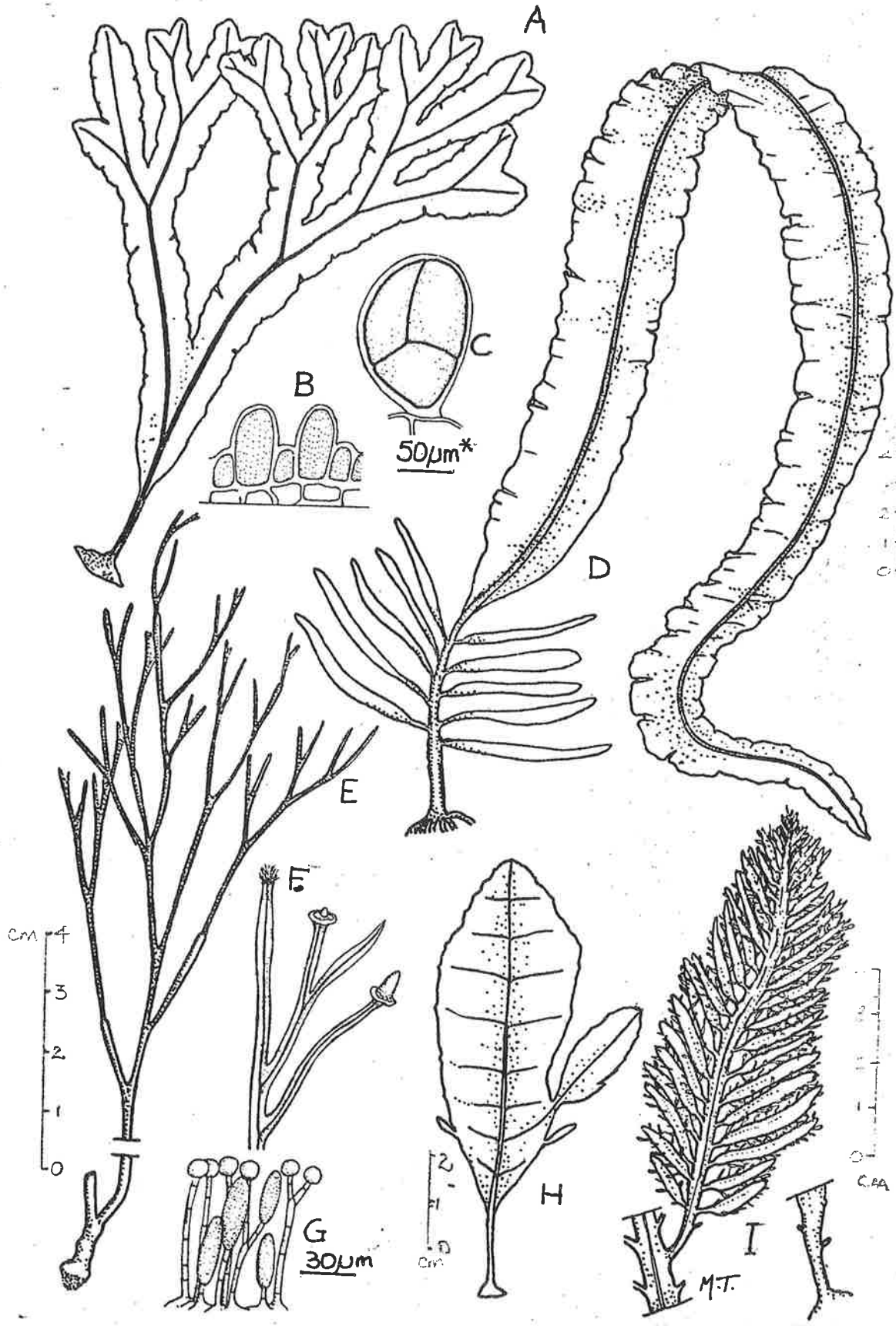
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Himanthalia elongata (L.) S.F.Gray

Thallus cone shaped, olive green brown, to 30mm tall. Initially swollen and club shaped, later cone shaped, upper surface flattened or concave with central nipple (s) which grow out into the huge reproductive straps. Attached by a small basal disc.
Receptacles flattened straps about 1m long, 5 - 10mm wide, tapering towards the tips, repeatedly forked, dotted with conceptacles from which tufts of hairs arise.
Lower littoral; on wave-washed rocks.

Laminaria digitata (Huds.) Lamour
to 2m long.

Thallus laminate, dark brown, Attached by a root-like holdfast from which a smooth, flexible, tough stipe arises. Stipe expands into a flattened blade, undivided lanceolate, pale translucent at first; later up to 1.5m long, opaque, slit into numerous straps (less so in calm waters). In spring there may be an obvious constriction between new and older growths of the blade.
Unilocular sporangia develop as sori, slightly raised irregularly raised patches on the blade.
Lower littoral, forming a distinct zone in the shallow infralittoral; epilithic.

Laminaria hyperborea (Gunn.) Fosl.

Thallus laminate, brown, to 3.5m long. Attached by a root-like holdfast of successive whorls of "roots", from which a tough, tapering, stiff and upright stipe arises; surface of stipe covered with small raised pimples and carries many epiphytic seaweeds. Stipe expands into a flattened, rubbery blade, when mature up to 2m long, opaque, dark brown, and split into numerous straps. In spring an obvious constriction new blade growth from the previous years growth.
Unilocular sporangia in sori which form slightly raised irregular patches on the blade. Plants removed from the sea may soon ooze jelly.
Infralittoral; epilithic.

Laminaria ochroleuca Pyl.

Very similar to L. hyperborea but stipe smooth and slightly more flexible, and not carrying epiphytic seaweeds. Blade much paler yellowish-brown with a translucent yellow patch at the base.
Infralittoral (sometimes forming a forest); epilithic. South west England only.

Laminaria saccharina (L.) Lamour.

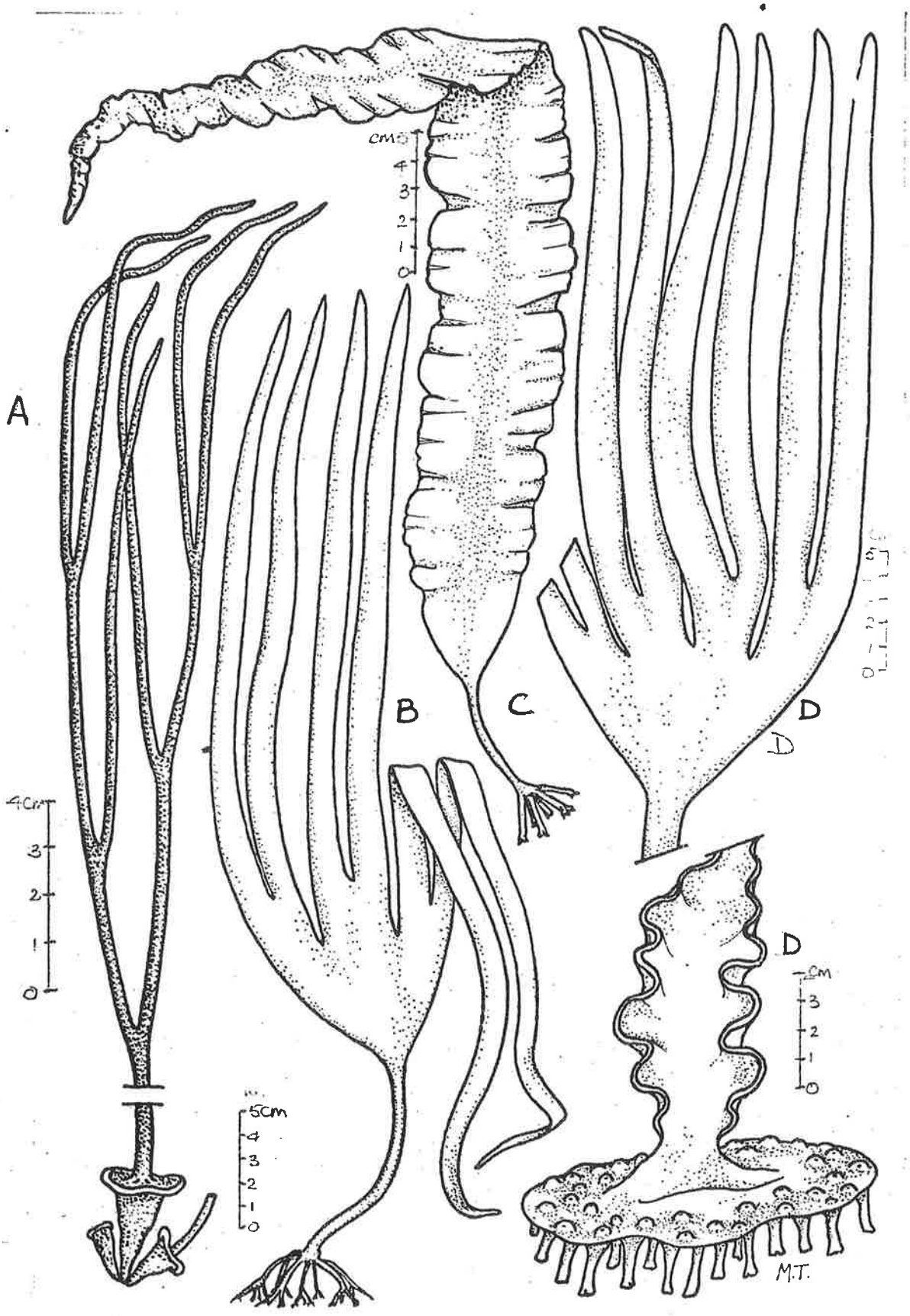
Thallus laminate, yellowish-brown, to 3m long. Attached by a root like holdfast which gives rise to a cylindrical, smooth and flexible stipe. The stipe expands into a crisp, opaque, flattened blade. Lanceolate and entire and never divided; up to 2m long and parallel sided like a huge ribbon. Characteristically (bullae) with a median flattish strip flanked by a region of deep dimples; frond margin frilled. Sometimes a constriction between new and older growths of the blade.
Unilocular sporangia in sori which form slightly raised irregular patches, mostly on the central portion of the blade.
Littoral pools, infralittoral; epilithic (rock, pebbles or loose-lying).
Most abundant in sheltered situations.

Saccorhiza polyschides (Lightf.) Batt.

Thallus laminate, yellowish to dark brown, to 2.5m long. Holdfast at first tiny and Laminaria like, soon replaced by a hollow bulbous lobed expansion to 300mm across, covered with smooth warts and attached by unbranched "roots" below. Stipe flat with a single spiral twist at the base, belt-like, stiff and brittle, often with wavy edges towards the base. Blade flat and rubbery, lanceolate, pale and translucent in young plants and dotted with tiny but obvious tufts of hairs; mature fronds opaque, 1m or more long, split into longitudinal straps.
Unilocular sporangia in sori which form irregular slightly raised patches, almost anywhere on the plant.
Epilithic (on stones or loose lying); infralittoral.

Plate 29.

A. Himanthalis elongata (A).
B. Laminaria digitata (B).
C. L. saccharina (C).
D. Saccorhiza polyschides (D).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Cystoseira foeniculacea (L.) Grev.

Thallus bushy, brown, to 600mm tall. Obvious thick cylindrical main axis bearing lateral branches and scars where these have been; attached by an irregular discoid holdfast. Lateral branches cylindrical or sometimes flattened distally with a prominent midrib and bearing spirally arranged short, thread-like, often spiny branchlets which are also similarly branched and becoming progressively shorter distally. Tufts of hairs common, bladders small, single or in short chains, often on fertile branches, absent in winter.
Receptacles on tips of branchlets, yellowish, narrow, smooth lanceolate 3 - 8mm long, often in dense clusters.
Littoral pools; epilithic. Rare, southern England and western Ireland.

Cystoseira humilis

Thallus bushy, brown, to 120mm tall. Axis cylindrical, tufted from the base, attached by small discoid holdfast. Stalk short and rough. Branches sparse - numerous, also densely branched with thin, thread-like branchlets becoming shorter distally; not'leafy'. Tufts of hairs present. Bladders rare or absent.
Receptacles on tips of branches, narrow spindle shaped, 3 - 5mm long, simple or forked.
Littoral pools; epilithic. Rare, known only from the Channel Isles.

Cystoseira nodicaulis (With.) Roberts

Thallus bushy, dark-brown, olive green, with a slight bluish irridescence in young growth, to 900mm tall. Tough and leathery, obvious main axis attached by a small discoid holdfast. Lateral branches numerous, with characteristic swollen ovoid bases (tophules), cylindrical and thread-like, usually much branched with alternate or spirally arranged branchlets, also similarly branched. Tufts of hairs sparse and inconspicuous. Bladders thin and elongate usually about 2mm long, often in short chains.
Receptacles on tips of branchlets, thin, cylindrical and lumpy or sometimes spiny, 5 - 30mm long.
Lower littoral pools, shallow infralittoral; epilithic. Rare in northern Britain.

Cystoseira tamariscifolia (Hudson) Papenf.

Thallus bushy, olive green-brown with an obvious bluish-green irridescence when submerged, to 500mm tall. Obvious cylindrical main stem, tough and leathery fixed by a small discoid holdfast. Numerous lateral branches bear numerous wiry, cylindrical branchlets arranged alternately or spirally, never'leafy'. The youngest branchlets have an Equisetum-like appearance. The entire plant is clothed in short spines making it rough to touch.
Tufts of hairs common. Bladders numerous, single, rarely in chains, often associated with receptacles.
Receptacles on tips of branches, cylindrical or swollen, simple or forked, 2 - 15mm long, clothed in spines.
Littoral pools, shallow infralittoral; epilithic. Rare in nrothern Britain.

Sargassum ruticum (Yendo) Fensholt.

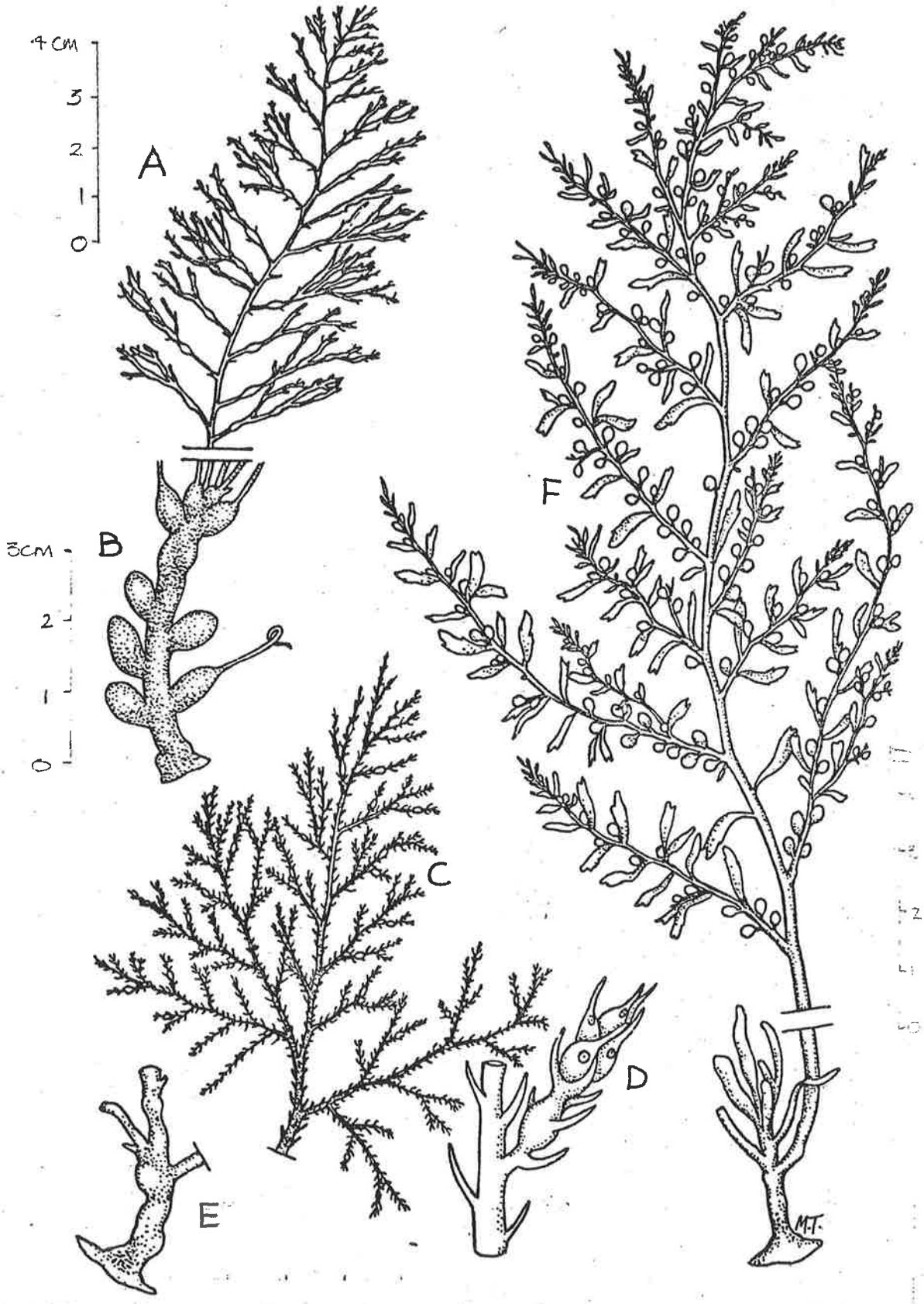
Thallus bushy, brown, to 4m long. Main axis stout, cylindrical, branched almost from the base, attached by a small discoid holdfast. Branches numerous and irregularly alternate, themselves branched similarly. Branches progressively shorter distally. Tips of ultimate branches flattened and toothed like tiny holly leaves, larger 'leaves' near base of plant have conspicuous midribs and obvious tufts of hairs. Bladders numerous, spherical or pear shaped, on tiny stalks, single or sometimes in pairs.
Receptacles on tips of branchlets; narrow cylindrical, 15 -30mm long, slightly lumpy, perforated with conceptacles.
Littoral pools, infralittoral; epilithic. A recent introduction to Britain and at present confined to the south coast.
Other species of Sargassum are occasionally washed up in the British Isles but never form attached populations.

Plate 30.

Cystoseira nodicaulis, apical part of frond (A, D) and tophules at the base (B).

C. tamariscifolia (C), apical portion of branchlet and base (E).

Sargassum ruticum, portion of frond (F).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Ascophyllum nodosum (L.) Le Jol.

Olive-green-khaki, sometimes yellowish, about 1.5m long. Tough straps 5 - 30mm wide, slightly flattened, ± oval in section; irregularly forked, with large ovoid bladders produced singly at intervals along the frond. Often bears short lateral branches which subsequently develop into receptacles. Frond attached by a conical holdfast.
Receptacles ovoid, dotted with conceptacles, on tapering stalks, arising singly or in groups on either side of the frond.
Littoral (especially sheltered situations); epilithic (rocks and boulders).
Stunted, loose-lying forms, usually more regularly forked and lacking bladders, occur in sheltered bays and sea lochs.

Bifurcaria bifurcata Ross

Thallus cylindrical, olive-green-brown, 150 - 450mm tall. Frond tough, cylindrical, smooth, repeatedly assymetrically forked, except near the base. Basal holdfast a creeping, wiry, rhizomatous system. Bladders occasionally occur singly beneath the receptacles.
Receptacles on tips of branches, yellowish, cylindrical. Conceptacles hermaphrodite.
Lower littoral (rocks and pools); epilithic. Restricted to south and west coasts.

Cystoseira baccata (Gmel.) Silva

Thallus bush-like, yellowish- dark brown, about 1m tall, tough, leathery, attached by a conical holdfast. Main axis flattened, zig-zag especially towards the base where denuded, only short spurs indicating the position of lost branches Elsewhere repeatedly and irregularly branched. Main branches cylindrical; terminal branchlets usually thread like but some may be flattened and leaf like with a prominent mid rib. Apical branchlets incurved. Branches bear round bladders, singly or in series, numerous in autumn, sparser at other seasons.
Receptacles arise in the axes of the ultimate branchlets, cylindrical, spiny, dotted with conceptacles.
Littoral, infralittoral; epilithic. Restricted to southern England and western Ireland.

Halidrys siliquosa (L.) Lyngb.

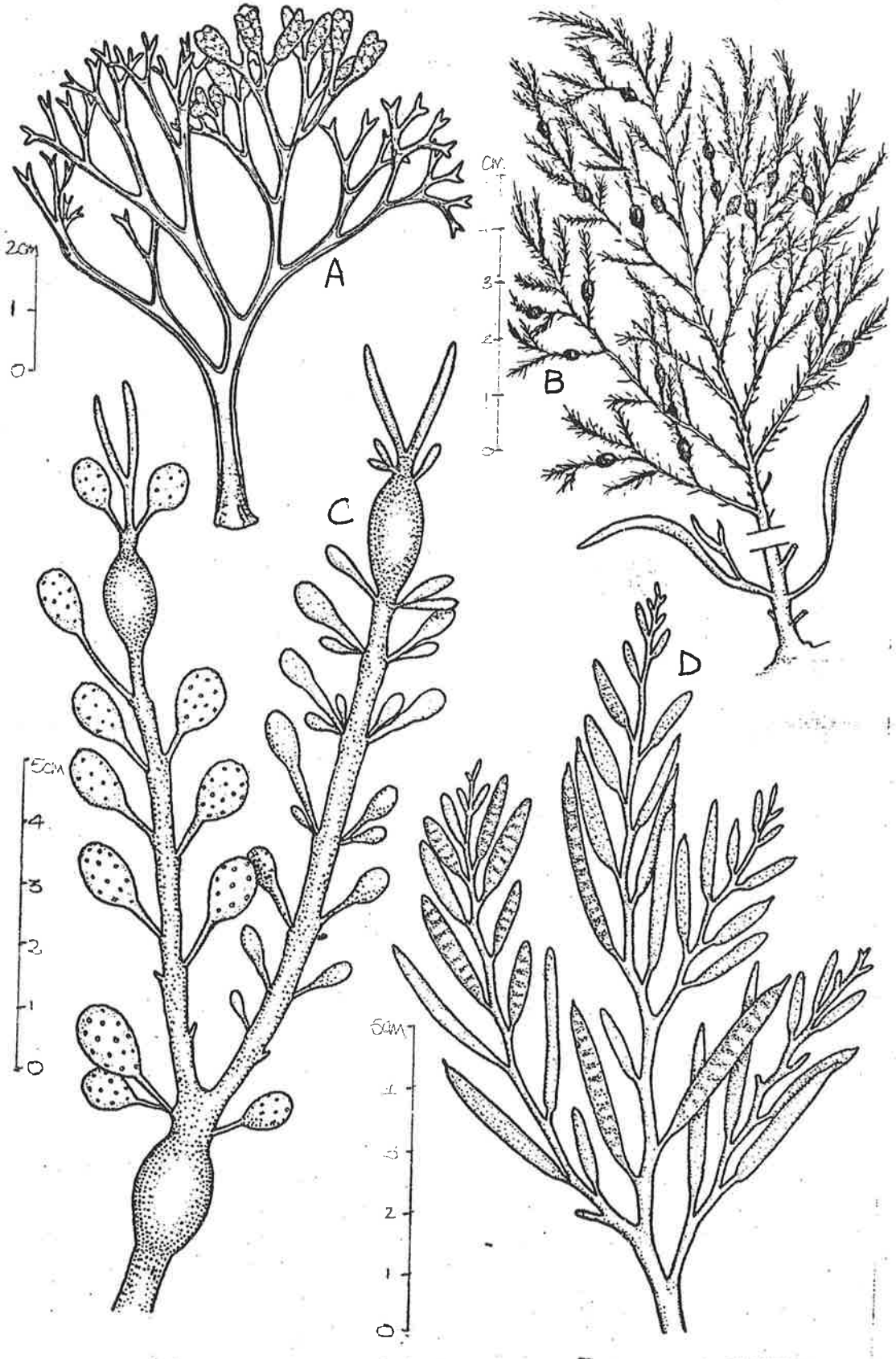
Thallus bushy, brown, to 2m long. Tough leathery, flattened fronds, distinctly zig-zag with numerous regularly alternate branches ending in a stalked elongate pod-like bladders divided transversely into 5 - 10 compartments and ending in a distinct terminal spike. Plant arises from a conical or discoid holdfast.
Receptacles terminal on short lateral branchlets, like the bladders in shape but without compartments and dotted with conceptacles. Conceptacles hermaphrodite.
Lower littoral (rocks and pools), infralittoral.

Plate 31

A Pelvetia canaliculata (A).
B Cystoseira baccata, apical and basal parts of frond (B).
C Ascophyllum nodosum, apical part of frond with receptacles and bladders (C).
D. Halidrys siliquosa, apical part of frond showing receptacles and bladders (D).

Pelvetia canaliculata (L.) Dene

Olive green, khaki, 50 - 150mm tall, 6 - 10 mm wide. Tough leathery, flattened fronds channelled on one side. Repeatedly, sometimes irregularly, forked. Holdfast an inconspicuous basal disc.
Receptacles on the tips of the branches, yellowish, angular & wedge shaped and lumpy (conceptacles); conceptacles with obvious apical pores, hermaphrodite. Often forms a narrow but distinct zone above the belts of Fucus and Ascophyllum.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Acinetospora crinita	2	9	48
Herponera valiantei	2		48
H. velutinum	2	9	48
Polytretus reinboldii	2		48
Sorocarpus micromorus	2	9	48
Waerniella lucifuga	2	9	48
Choristocarpus tenellus	3	10	51
Cladostephus spongiosus	3	10	51
Sphacelaria britannica	3	10	51
S. radicans	3	10	51
S. racemosa	3	10	51
S. artica	3		54
S. cirrosa	3	11	54
S. bipinnata	3	11	54
S. fusca	3		54
S. tribuloides	3	11	54
S. caespitula	3	11	54
S. plumosa	3	12	57
S. plurigera	3	12	57
S. plumula	3	12	57
Halopteris filicina	3	12	57
H. scoparia	3	12	57
Giraudia sphacelarioides	4	13	60
Haplospora globosa	4	13	60
Isthmoplea sphaerophora	4	13	60
Leblondiella densa	4		60
Petalonia filiformis	4		60
Stictyosiphon griffithsianus	4		60
Tilopteris mertensii	4	13	61
Litosiphon filiformis	4	14	63
L. laminariae	4		63
L. pusillus	4	14	63
Pyriotrichia clavaeformis	4	14	63
P. filiformis	4	14	63
P. repens	4	14	63
Battersia mirabilis	5	15	66
Petroderma maculiforme	5	15	66
Pseudolithoderma extensum	5	15	66
P. roscoffensis	5		66
Ralfsia clavata	5		66
R. disciformis	5		66
R. pusilla	5		67
R. spongiocarpa	5		67
R. verrucosa	5	15	67
Sorapion simulans	5	15	67
Symphyocarpus strangulans	5	15	67
Aglaozonia	5	16	70
Corynophloea crispa	5		70
Cylindrocarpus berkeleyi	5	16	70
C. microscopicus	5	16	70
Zanardinia prototypus	5	16	70

Dictyopteris membranacea	11	27	99
Desmarestia aculeata	11	27	99
Alaria esculenta	11	27	99
Desmarestia ligulata	11	27	99
Fucus vesiculosus	11	28	101
F. serratus	11	28	101
F. spiralis	11	28	101
F. ceranoides	11	28	101
F. distichus ssp anceps	11	28	102
F. distichus ssp distichus	11		102
F. distichus ssp edentatus	11		102
Himanthalia elongata	12	29	104
Laminaria digitata	12	29	104
L. hyperborea	12		104
L. ochroleuca	12		104
L. saccharina	12	29	104
Saccorhiza polyschides	12	29	105
Cystoseira foeniculacea	13		107
C. humilis	13		107
C. nodicaulis	13	30	107
C. tamariscifolia	13	30	107
Sargassum muticum	13	30	107
Ascophyllum nodosum	13	31	110
Bifurcaria bifurcata	13		110
Cystoseira baccata	13	31	110
Halidrys siliquosa	13	31	110
Pelvetia canaliculata	13	31	111