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A SYNOPTIC KEY TO THE RHODOPHYTA OF THE WESTERN MEDITERRANEAN PART. I GIGARTINALES, HALYMENIALES, HILDENBRANDIALES AND PLOCAMIALES

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RHODOPHYTES
GIGARTINALES
HALYMENIALES
HILDENBRANDIALES
PLOCAMIALES
CLÉ TAXONOMIQUE
STRUCTURES DE REPRODUCTION
MÉDITERRANÉE DE L'OUEST

RÉSUMÉ. – Une clé dichotomique pour la détermination des Gigartinales, Halyméniales, Hildenbrandiales et Plocamiales de Méditerranée occidentale est présentée. Elle a pour objectif de faciliter la reconnaissance de ces algues rouges. Ce travail inclut l'ordre des Gigartinales, avec 69 espèces groupées en 19 familles et 35 genres, l'ordre des Halyméniales, avec 13 espèces appartenant à 2 familles et 6 genres, l'ordre des Hildenbrandiales, avec 1 famille, 1 genre et 3 espèces, et l'ordre des Plocamiales, avec 1 famille, 1 genre et 2 espèces. Le genre *Wurdermannia* Harvey est inclus dans la clé, bien que son appartenance aux Gigartinales reste incertaine. Quelques descriptions morphologiques et anatomiques des structures de reproduction sont aussi inclues, d'après des données de la littérature et de nos propres observations.

RHODOPHYTA
GIGARTINALES
HALYMENIALES
HILDENBRANDIALES
PLOCAMIALES
TAXONOMIC KEY
REPRODUCTIVE STRUCTURES
WESTERN MEDITERRANEAN

ABSTRACT. – A synoptic key for identifying the Gigartinales, Halymeniales, Hildenbrandiales and Plocamiales from the Western Mediterranean has been prepared in order to facilitate the recognition of these red algae. The orders Gigartinales, with some 69 species grouped in 19 families and 35 genera, Halymeniales, with 13 species grouped in 2 families and 6 genera, Hildenbrandiales, with 1 family and 1 genera of 3 species, and Plocamiales, with 1 family and 1 genus of 2 species are included. The genus *Wurdermannia* Harvey is also included in the key, although it has not finally been established whether it belongs to the order Gigartinales or not. Morphological and anatomical descriptions of the reproductive structures, using data from the literature and from personal observations are presented.

INTRODUCTION

This is intended to be the first publication in a series of keys to the different orders of benthic marine algal flora from the western Mediterranean (excluding the recently introduced species). The present paper includes the order Gigartinales with 69 species grouped in 19 families and 35 genera, the order Halymeniales with 13 species grouped in two families and six genera, the order Hildenbrandiales with one family and one genus of three species, and the order Plocamiales, with one family and one genus of two species. The genus *Wurdermannia* Harvey is also included in the key although it has not yet been finally established whether it belongs to the order Gigartinales or not.

The key should serve as a tool to identify genera and species of these groups. An effort has been made to base dichotomies in the key upon more than a single distinction. Vegetative characteristics are used to separate genera and species where appropriate, but as definitive identification can only rarely be obtained from general appearance and form of the Rhodophyta, or from sterile material, reproductive stages have been incorporated in unavoidable cases. Many of the families have a highly distinctive female reproductive system from which they can be recognized, although such characters may often be difficult to observe. The main reproductive characteristics are listed for each genus in Table I. The use of dimensions such as the length and width of thalli is only a guide in the key, since such characteristics tend to be very variable and unstable.

Following the key is a listing of the genera and species currently recognized in the studied area. We have included the order Cryptonemiales (Kylin, 1956) in the order Gigartinales, following Kraft & Robins (1985), because we consider that

GENUS	*Acrosymphyton*	*Calosiphonia*	*Schmitzia*	*Catenella*	*Caulacanthus*	*Feldmannophycus*	*Cruoria*	*Calliblepharis*	*Rhodophyllis*	*Dudresnaya*	*Halarachnion*	*Neurocaulon*	*Chondracanthus*	*Gloiosiphonia*	*Thuretella*	*Schimmelmannia*	*Hypnea*	*Callophyllis*	*Kallymenia*	*Meredithia*	*Nemastoma*	*Predaea*	*Metapeyssonnelia*	*Peyssonnelia*	*Polystrata*	*Gymnogongrus*	*Phyllophora*	*Schottera*	*Contarinia*	*Rissoëlla*	*Chondrymenia*	*Platoma*	*Schizymenia*	*Sphaerococcus*	*Acrodiscus*	*Aeodes*	*Cryptonemia*	*Grateloupia*	*Halymenia*	*Sebdenia*	*Hildenbrandia*	*Plocamium*	*Wurdemannia*
ORDER	GIGARTINALES																																		HALYMENIALES						HILDENBRANDIALES	PLOCAMIALES	?
FAMILY	Acrosymphytaceae	Calosiphoniaceae		Caulacanthaceae			Cruoriaceae	Cystocloniaceae		Dumontiaceae	Furcellariaceae		Gigartinaceae	Gloiosiphoniaceae			Hypneaceae	Kallymeniaceae			Nemastomataceae		Peyssonneliaceae			Phyllophoraceae			Rhizophyllidaceae	Rissoëllaceae	Sarcodiaceae	Schizymeniaceae		Sphaerococcaceae	Halymeniaceae					Sebdeniaceae	Hildenbrandiaceae	Plocamiaceae	*Incertae sedis*
structure Uniaxial/Multiaxial	U	U	U	U	U	U		U	U	U	M	M	M	U	U	U	U	M	M	M	M	M				M	M	M		M	M	M	M	U	M	M	M	M	M	M		U	M
LIFE HISTORY																																											
Triphasic/Biphasic	T	T	?	T	T	T	T	T	T	T	T	T	T	T	?	?	T	T	T	T	T	T	?	T	?	B	T	T	T	T	?	T	T	T	?	T	T	T	T	T		T	?
Isomorphic/Heteromorphic	H	H	?	I	I	I	I	I	I	I/H	H	H	I	H	?	?	I	I	I	H	H	H	?	I	?	H	I	I	I	I	?	H	H	I	?	I	I	I	I	I		I	?
FEMALE GAMETANGIA																																											
Monocarpogonial/Polycarpogonial	M	M	M	M	M	M	M	M	M	M	M	M*	M	M/P	M	M	M	M/P	M/P	M/P	M	M	?	M	?	M	M	M	?	M	?	M	M	M	?	M*	M	M	M/P	M		M	?
number of cells of the carpogonial branch	sv	3	3	2-5	3	2-5	2-3	3	3	sv	3	3	3	3	3	4	3*	2	2	2	3	2-5	?	3-6	?	2/4	3-4	4	?	2-3	?	3	3	3	?	2	2	2	2	2-4		3	?
carpogonial branch Simple/Branched	B	S	S	B*	S	S	S	S	S	S*	S	S	S	S	S	B	S	S	S	S	S	S	?	S	?	B	S	S	?	S*	?	S	S	S	?	S	S	S	S	S		S	?
Procarpic/Non-procarpic	N	N	N	N	N	N	?	P	P	N	N	N	P	P	P	P	P	P	N	N	N	N	?	N	?	P	P	P	?	P	?	N	N	P	?	N	N	N	N	N		P	?
supporting cell acting as auxiliary cells (Yes/No)							?	N	N				Y	N	N	N	N	Y					?		?	Y	Y	Y	?	Y	?			Y	?							Y	?
auxiliary branch borne on supporting cell (Yes)							?	Y	Y					Y	Y	Y	Y						?		?				?		?				?								?
auxiliary cell a nearby cortical or medullar cell (Yes)		Y	Y	Y	Y	Y	?				Y	Y									Y	Y	?		?				?		?	Y	Y		?					Y			?
auxiliary cells in special filaments (Yes)	Y						?			Y									Y	Y			?	Y	?				?		?				?	Y	Y	Y	Y				?
carpogonial and auxiliary cells in ampullae																							?		?				?		?				?	Y	Y	Y	Y				?
subsidiary cells present (Yes)																		Y	Y	Y			?		?				?		?				?								?
carpogonial branch with nutritive auxiliary cells (Yes)																							?		?				?		?	Y	Y		?								?
auxiliary cell with adjacent nutritive cells (Yes)	Y							Y	Y	Y							Y					Y	?		?				?		?				?					Y		Y	?
MALE GAMETANGIA																																											
Scattered/in Clusters/in SOri/in CHains	C	C	C	S	S	C	SO	S	S	C	SO	SO	SO	C	C	C	CH	SO	S	S	C	C	?	SO	?	SO	SO	SO	SO	SO	?	C	C	SO	?	S	S	S/S	SO	S/SO		SO	?
in special branchlets or bladelets (Yes/No)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	?	N	?	N	N	N	N	N	?	N	N	N	?	N	N	N	N	N		N	?
GONIMOBLAST																																											
developing Inwards/Outwards	O	O	O	I	I	I	?	I	?	O	I	?	I	O	O	O	I	I/O	O	O	O	O	?	O	?	I	I	I	?	I	O	O	O	O	?	?	O	O	I	O		O	?
on Auxiliary cell/on Connecting filament	C	A	C	A	A	A	?			C	A	?							C*	?	C	C/A	?	C	?				?		?	A	A		?	A	A	A	A	A			?
with involucre Cellular/Filamentous/Absent	A	A	A	A	A	A	?	C	C	A	'A	A	C	A	A	A	C	F	A	A	A	A	?	A	?		C	C	?	?	?	A	F	C	?	F	F	F	F	F		C	?
with ostiole Present/Absent	A	A	A	P*	P*	P*	A	A	A*	A	P	A	A	A	A	A	A	P	P/A	A	P	P*	?	A	?		A	A	A	P	P	P	P	A	?	A	P	P	P	P		A	?
in special branchlets or bladelets (Yes/No)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y/N	N	N	N	N	?	N	?	N	Y	N	N	N	N	N	N	Y	?	N	Y*	N	N	N		Y*	?
TETRASPORANGIA																																											
Cruciately/Tetrahedrally/Zonately/Irregularly arranged	T/Z	C	?	Z	Z	Z	Z	Z	Z	Z*/C	Z	Z	C	C	?	?	Z	C	C/Z	Z	?	C/Z	?	C	C	C	C	C	C/Z/I	Z	?	?	Z/C	Z	C	C	C	C	C	C/I	Z	Z	Z
Scattered/in SOri/in Conceptacles	S	?	S	S	S	SO	S	S	S	S	S	?	S	S	?	?	SO	S	S	S	?	S	?	SO	SO	SO	SO	SO	SO	S	?	?	S	SO	SO	S	S	S	S	S	C	SO	SO
in special branchlets or bladelets (Yes/No)	N	N	N	N	N	N	N	Y*	Y*	N	N	N	N	N	?	?	Y	Y*	N	N	?	N	?	N	N	N	N	N	N	N	?	N	N	N	N	N	N*	Y*	N	N	N	Y	N

Table 1. Type of structure and main reproductive characteristics of the genera treated (sv = several); (* = usually); (? = unknown); (grey colour = unattainable characteristics).

the fact that the Cryptonemiales have auxiliary cells in accessory systems within the thallus, as opposed to Gigartinales supposedly transforming vegetative cells into auxiliary cells, is insufficient basis for placing the Cryptonemiales in a separate order. The Hildenbrandiales (Pueschel & Cole, 1982), Plocamiales (Saunders & Kraft, 1994) and Halymeniales (Saunders & Kraft, 1996) are considered as separate orders, following recent molecular studies, but since their morphology and reproductive structures are similar to the Gigartinales, the families in these orders are not separated in the key. Other taxa have been separated as orders and are not covered in this first part. These taxa included the Ahnfeltiales (Maggs & Pueschel, 1989), representatives of which are not known in Western Mediterranean, the Corallinales (Silva & Johansen, 1986), which is a clearly distinguishable order, and the Gracilariales (Fredericq & Hommersand, 1989) which requires more investigation in the Mediterranean. The taxonomic arrangement below the level of families follows Silva *et al.* (1996).

CURRENT KEY

1. Thallus prostrate, with a dorsiventral symmetry. Plants calcified or not. Structure consisting of a single basal layer of branched filaments (hypothallus), with each cell dividing into one or more upper cells (upper *coxal* cells) and, occasionally, one or more lower cells (lower *coxal* cells). The upper *coxal* cells give rise to filaments of apical growth directed to the upper surface (perithallus), erect or slightly inclined towards the margin. In the latter case, they can become erect later (secondary perithallus) due to persistent growth. The species with lower *coxal* cells can also develop some filaments directed to the undersurface (subhypothallus) 2

1. Thallus erect (at least the gametophyte), without a dorsiventral symmetry. Plants not calcified. Structure different from above..... 28

2. Plants crustose, not calcified. Cells very small, usually ≤ 5 µm in diameter. Hypothallus with each cell dividing into an erect unbranched or sparsely branched filament. Secondary perithallus and subhypothallus absent. Rhizoids absent. Tetrasporangia developing from spherical or ovate conceptacles ....Family HILDENBRANDIACEAE Genus *Hildenbrandia*..... 3

2. Plants crustose or not, calcified or not. Cells not very small, > 5 µm in diameter. Hypothallus with each cell dividing into one or more *coxal*, upper cells and, occasionally, one or more lower *coxal* cells. Perithallus erect or slightly inclined towards the margin. Secondary perithallus and subhypothallus sometimes present. Rhizoids present or absent. Tetrasporangia not developing from conceptacles, scattered or in sori 5

3. Genus *Hildenbrandia*

3. Thallus rosy to dark red. Tetrasporangia ovoid, appearing cruciate or irregular, with non-parallel cleavage..... *H. rubra*

3. Thallus brownish or purplish red. Tetrasporangia elongated, appearing zonate..... 4

4. Thallus brownish red. Conceptacle chamber spherical, with a small ostiole. Tetrasporangia with parallel, transverse or oblique cleavage, 5-10 × 20-30 µm..... *H. crouanii*

4. Thallus purplish red. Conceptacle chamber ovoid, with a large ostiole. Tetrasporangia always with transverse cleavage, 10-15 × 25-40 µm..... .....*H. occidentalis*

5. Hypothallus with some filaments larger than the others, appearing in surface view as a more or less conspicuous percurrent midrib and as a distinct central axis in cross section. Each hypothallial cell giving rise to more than one upper and one lower *coxal* cells. The filaments of the perithallus and subhypothallus are erect. Thallus not calcified. Gland cells are present, situated in the upper surface of the blade and apparent in surface view as white microscopic rounded spots.....Family RHIZOPHYLLIDACEAE Genus *Contarinia*..... 6

5. Hypothallus either sparingly branched and more or less parallel (radially arranged), or much branched to form a polyflabellate layer (polyflabellately arranged), but not appearing as a distinct central axis in cross section. Each hypothallial cell giving rise to no more than one upper and one lower *coxal* cells. The filaments of the perithallus and subhypothallus are usually inclined towards the margin. Thallus calcified or not. Gland cells are absent 7

6. Genus *Contarinia*

6. Plants are flattened, forming reniform and encrusting fronds, irregularly branched, with sinuous and lobed margins. In longitudinal section, hypothallial cells up to 35 (-40) µm long and 20 µm broad. Erect filaments up to 10-25 µm wide at basal parts. Gland cells ovoid or pyriform in cross section. Tetrasporangia cruciately arranged..... .....*C. peyssonneliaeformis*

6. Plants range from compressed to flattened, forming band-shaped segments almost regular in width (1-2 mm), irregularly dichotomously-distichously branched, with dentate margins. In longitudinal section, hypothallial cells up to 130 (-150) µm long and 60 µm broad. Erect filaments up to 30-45 µm at basal parts. Gland cells spherical. Tetrasporangia irregularly zonate.....*C. squamariae*

7. Each hypothallial cell cutting off a single upper *coxal* cell. Subhypothallus absent. Secondary perithallus absent. Plants fleshy, gelatinous. Carpogonial branch 2-3 celled. Tetrasporangia zonately arranged..... .....Family CRUORIACEAE Genus *Cruoria* *C. cruoriaeformis*

7. Each hypothallial cell cutting off either one single upper *coxal* cell, or one upper and one lower *coxal* cell, or one indiscriminately upper or lower *coxal* cell. Subhypothallus present or absent. Secondary perithallus present or absent. Plants gelatinous or firm and coriaceous. Carpogonial branch 3-6 celled. Tetrasporangia (when present) cruciately or irregularly cruciately arranged..... .....Family PEYSSONNELIACEAE.... 8

8. Thallus lacking rhizoids. Plants encrusting, entirely calcified. Each hypothallial cell cutting off one upper and one lower *coxal* cell. Secondary perithallus present.....Genus *Polystrata* 9

8. Thallus adhering to the substratum by rhizoids which arise along the whole of their undersurface. Plants foliose or encrusting, calcified or not. Each hypothallial cell dividing into either one upper and one lower *coxal* cell, or only one single upper *coxal* cell, or one indiscriminately upper or lower *coxal* cell. Secondary perithallus present or absent 10
9. Genus *Polystrata*
   9. Subhypothallus not well developed, sometimes absent near the margins, up to 2 cells long (comprising the *coxal* cell). Perithallus cohesive after decalcification.....*P. compacta*
   9. Subhypothallus well developed, but a little shorter than perithallus. Perithallus loosely cohesive after decalcification.....*P. fosliei*
10. In the centre of the thallus, the hypothallus gives rise only to a simple perithallus, but, near the margin, it gives rise also to a subhypothallus, due to the fact that the single *coxal* cell is situated indiscriminately at the upper or the lower part of the hypothallial cell. Thallus entirely calcified. Hypothallus polyflabellately arranged. Secondary perithallus present. Rhizoids one cell in length .....Genus *Metapeyssonnelia* *M. feldmannii*
10. The hypothallus generates only a single upper *coxal* cell. Subhypothallus usually absent, but, in some species, a lower *coxal* cell per hypothallial cell and a few developed subhypothallus can be also present. Thallus calcified or not. Hypothallus radially or polyflabellately arranged. Secondary perithallus present or absent. Rhizoids one or more cells in length. .....Genus *Peyssonnelia*..... 11
11. Genus *Peyssonnelia*
   11. Thallus not calcified. Subhypothallus present. Hypothallus radially arranged. Rhizoids multicellular 12
   11. Thallus calcified. Subhypothallus absent. Hypothallus radially or polyflabellately arranged. Rhizoids one or more cells long..... 13
   12. Only one subhypothallial cell present (lower *coxal* cell). Rhizoids branched. Plants between 95 and 295 µm thick. Thallus membranous to cartilaginous in texture .....*P. squamaria*
   12. Two subhypothallial cells present (including the lower *coxal* cell). Rhizoids unbranched. Plants between 155 and 385 µm thick. Thallus firm, cartilaginous to coriaceous in texture...*P. coriacea*
   13. Thallus entirely calcified. Secondary perithallus present..... 14
   13. Thallus with hypobasal calcification and with or without cystoliths. Secondary perithallus present or absent 16
   14. Rhizoids unicellular, unbranched. Plants with concentric growth zones from the marginal thallus meristem. Thallus ⩽ 565 µm thick. Hypothallial cells ⩽ 90 µm long.....*P. rosa-marina*...15
   14. Rhizoids more than one cell long, usually branched. Plants without concentric growth zones from the marginal thallus meristem. Thallus ⩽ 385 µm thick. Hypothallial cells ⩽ 65 µm long ....*P. polymorpha*
   15. Plants free-living, forming more or less globulous rhodoliths due to the occasional overturning of the plant on itself and the consequent change of its growing direction. The loose wrapping of the thallus delimits large cavities filled up with fine sediments .....*P. rosa-marina* f. *rosa-marina*
   15. Plants growing on hard bottom, with a planar or slightly undulate frond...*P. rosa-marina* f. *saxicola*
   16. Rhizoids one cell long. Cystoliths absent. Hypothallial cells radially or polyflabellately arranged... 17
   16. Rhizoids more than one cell long. Cystoliths present or absent. Hypothallial cells radially arranged.. 27
   17. Hypothallus polyflabellate..... 18
   17. Hypothallus not distinctly polyflabellate 20
   18. Perithallial filaments relatively free. Plants loose and gelatinous. Hypobasal calcification not well developed.....*P. armorica*
   18. Perithallial filaments laterally cohesive. Plants neither loose nor gelatinous. Hypobasal calcification well developed 19
   19. Secondary perithallus present. Thallus 300-500 (– 800) µm thick. Tetrasporangia laterally inserted on the basal cell of the sterile filaments of the sori.... .....*P. codana*
   19. Secondary perithallus absent. Thallus 70-125 µm thick. Tetrasporangia inserted at the apex of the ba*sal cell of the sterile filaments of the sori*.....*P. dubyi*
   20. Angle of perithallus/hypothallus ⩽ 50º 21
   20. Angle of perithallus/hypothallus > 50º 23
   21. Thallus ⩽ 190 µm thick. Hypothallial cells ⩽ 30 µm long. Secondary perithallus absent.....*P. crispata*
   21. Thallus up to 300 (-500) µm thick. Hypothallial cells usually > 30 µm long. Secondary perithallus present 22
   22. Hypothallial cells 60-175 µm long. Rhizoids long .....*P. atropurpurea*
   22. Hypothallial cells 25-80 µm long. Rhizoids short and globose.....*P. magna*
   23. Thallus ⩽ 425 µm thick.....*P. harveyana*
   23. Thallus ⩽ 200 µm thick 24
   24. Thallus ⩾ 140 µm thick. Secondary perithallus present..... 25
   24. Thallus < 140 µm thick. Secondary perithallus absent or not well developed..... 26
   25. Tetrasporangia inserted at the apex of the basal cell of the sterile filaments of the sori.....*P. rara-avis*
   25. Tetrasporangia laterally inserted on the basal cell of the sterile filaments of the sori.....*P. hongii*
   26. Hypobasal calcification well developed, to 70-110 µm thick. Secondary perithallus absent. Surface plane. Thallus firm, coriaceous, but fragile and broken easily.....*P. stoechas*
   26. Hypobasal calcification not well developed, to 45-70 µm thick. Secondary perithallus sometimes present but not well developed. Surface undulated. Thallus membranous to coriaceous, not fragile..... .....*P. inamoena*
   27. Cystoliths present. Thallus ⩽ 145 µm thick, membranous to cartilaginous in texture, whitish seen from below. Secondary perithallus absent. Hypobasal calcification up to 70 µm thick.....*P. rubra*
   27. Cystoliths absent. Thallus ⩽ 300 µm thick, firm, coriaceous in texture, not whitish seen from below. Secondary perithallus present. Hypobasal calcification up to 240 µm thick.....*P. bornetii*

28. Structure uniaxial. Growth by a single apical cell or by a small group of them 29

28. Structure multiaxial. Growth by a marginal meristem of many apical cells 50

29. Growth maintained by transverse division of a single apical cell. Thallus erect and bushy (at least the gametophyte). Tetrasporangia cruciately or zonately arranged 30

29. Growth by oblique division of a single apical cell or by a small group of them. Thallus erect, decumbent or prostrate. Tetrasporangia zonately arranged ... 41

30. Thallus is terete to flat. Plants rose pink in colour, mucilaginous and soft in texture. Structure consisting of a very apparent axial filament of elongated cells producing whorls of 3-4 repeatedly branched filaments composed of cells diminishing in size toward the periphery, where they are embedded in mucilage to form a loose cortex. In younger parts the whorls are distinct in surface view as annulations, but, in adult parts, the axial filament is usually surrounded by a compact layer of branched rhizoidal filaments produced by the periaxial cells and the bands are not distinct. Procarpic or non-procarpic. Carpogonial branch 3 or more cells long. Carposporophytes lacking involucre and ostiole. Spermatangia grouped on terminals or on subterminal cells of whorled branches. Tetrasporangia cruciately or zonately arranged 31

30. Thallus flattened. Plants dark red in colour, membranous to cartilaginous in texture. Structure different from above. Procarpic. Carpogonial branch 3-celled. Carposporophytes with a cellular pericarp, non ostiolate. Spermatangia in depressed sori. Tetrasporangia zonately arranged 38

31. Plants are terete or flat.Whorls of 4 branched filaments. Procarpic. Auxiliary cell situated on a branch arising from the supporting cell. Outer cells moniliform.....Family GLOIOSIPHONACEAE 32

31. Plants are terete or slightly compressed.Whorls of 3-4 branched filaments. Non-procarpic. Auxiliary cell not situated on a branch arising from the supporting cell. Outer cells moniliform or radially elongated..... 34

32. Plants flattened. Axes branching somewhat pinnate. Carpogonial branch 4-celled .....
.....Genus *Schimmelmania*
S. ornata

32. Plants terete. Axes branching alternately or irregularly. Carpogonial branch 3-celled..... 33

33. Outer cells not provided with terminal hair cells. Monocarpogonial. Auxiliary cell branch 2-celled, unbranched, with auxiliary cell intercalated.....
.....Genus *Thuretella*
T. schousbœi

33. Outer cells occasionally provided with terminal hair cells. Mono- or polycarpogonial. Auxiliary branch usually 5-celled, occasionally branched from subtending cells, with auxiliary cell terminal.....
.....Genus *Gloiosiphonia*
G. capillaris

34. Carpogonial branch 3-celled. Auxiliary cells numerous in cortex, indistinguishable before fertilization. Whorls of 3-4 branched filaments. Outer cells moniliform.....Family CALOSIPHONACEAE 35

34. Carpogonial branches > 3 cells long. Auxiliary cells in special filaments, easily distinguishable before fertilization. Whorls of 4 branched filaments. Outer cells moniliform or radially elongated 37

35. Gonimoblast arising from the auxiliary cell. Outer cells always lacking terminal hyaline hairs.....
.....Genus *Calosiphonia*..... 36

35. Gonimoblast arising from the connecting filament, near the auxiliary cell. Outer cells sometimes provided with hyaline hairs.....Genus *Schmitzia*
S. neapolitana

36. Genus *Calosiphonia*

36. Main axes usually simple, occasionally with some spine-like alternate or unilateral branches. Plants up to 2 (-4) cm high and 1-2 mm broad
.....*C. dalmatica*

36. Main axes many times branched alternately. Plants up to 1-8 (-12) cm high and 2 mm broad....
.....*C. vermicularis*

37. Outer cortical cells moniliform, occasionally provided with terminal hyaline hairs. Carpogonial branches initially unbranched, latter producing opposite laterals to one or two orders, except for the carpogonium and its two subtending cells. Auxiliary cell branch 5-16 cells long, with auxiliary cell terminal...
.....Family ACROSYMPHYTACEAE
Genus *Acrosymphyton*
A. purpuriferum

37. Outer cortical cells radially elongated, not provided with hyaline hairs. Carpogonial branches usually simple. Auxiliary cell branch 10-20-cells long, with auxiliary cell larger than the others, very distinct, intercalary, with the cells situated under and over it acting as nutritive cells
.....Family DUMONTIACEAE
Genus *Dudresnaya*
D. verticillata

38. Plants dichotomously or laterally branched. Axial filament distinct throughout, surrounded by rhizoids, and the whole immersed in some layers of large rounded or elongated thick-walled and compacted cells. Cortex consisting of an outer part of several layers of moniliform cells arranged in radial rows, and a subcortex of slightly larger ovoid cells...
.....Family SPHAEROCOCCACEAE
Genus *Sphaerococcus*..... 39

38. Plants repeatedly pinnate branched, with alternating groups of 2-5 branchlets. Axial filament sometimes distinct throughout, immersed in some layers of large rounded or elongated thick-walled and compacted cells. Cortex of cells not arranged in radial rows.....Family PLOCAMIACEAE
Genus *Plocamium*..... 40

39. Genus *Sphaerococcus*

39. Plants up to 4-5 cm broad, with a non conspicuous percurrent midrib. Larger medullary cells up to 60-70 µm in diameter. Outer cortical cells 10-15 µm in diameter in surface view.....
.....*S. rhizophylloides*

39. Plants up to 10-15 (-25) cm, lacking a midrib. Larger medullary cells up to 100-130 µm in diameter. Outer cortical cells 5-10 µm in diameter in surface view.....*S. coronopifolius*

40. Genus *Plocamium*

40. Main axis ≤ 2000 µm broad. Ramuli and secondary branchlets and arrangement of ramuli along axes not always unilateral.....*P. cartilagineum*
40. Main axis ≤ 250 µm broad. Ramuli, secondary branchlets and arrangement of ramuli along axes unilateral.....*P. secundatum*

41. Thallus flattened, usually complanately branched from the margins, lacking spine-like branchlets. Procarpic. Nutritive cells present ....Family CYSTOCLONIACEAE..... 42
41. Thallus terete or only slightly compressed, not complanately branched, sometimes bearing numerous spine-like branchlets. Procarpic or non-procarpic. Nutritive cells present or absent 45

42. Thallus erect, growing from a branched holdfast in the Mediterranean species. Plants cartilaginous in texture. Fronds not anastomosing. Growth by a single apical cell. Thallus transversed by a less-conspicuous axial filament, surrounded by several lacunose layers of longitudinally elongated cells.... .....Genus *Calliblepharis* 43
42. Thallus erect or somewhat prostrate, growing from a discoid holdfast. Plants thin and delicate, membranous when young and more firm in older specimens. Fronds occasionally anastomosed or fixed to other species by rhizoids produced secondarily from the frond surface. Growth by a small group of apical cells. Thallus appearing transverse by a diffuse axial filament in longitudinal section, and scarcely and irregularly celled in transverse section ....Genus *Rhodophyllis* 44

43. Genus *Calliblepharis*
43. Thallus lanceolate, ≥ 10 mm wide. Blade is simple or irregularly branched. Marginal proliferations usually ≤ 5 mm long, simple. Thallus ≤ 650 µm thick. Axial filament surrounded by cells up to 50-200 µm longitudinally elongated up to 2 times their diameter. Cortex of 2-3 layers of pigmented cells.....*C. ciliata*
43. Thallus linear-lanceolate, usually 2-6 mm broad. Blade dichotomous or irregularly branched. Marginal proliferations up to 15-30 mm long, sometimes hooked, especially those arising from the apex. Thallus up to 350 (-400) µm thick. Axial filament surrounded by cells from 50 µm to over 100 µm in diameter, longitudinally elongated up to 5 times their diameter. Cortex of a single layer of pigmented cells ....*C. jubata*

44. Genus *Rhodophyllis*
44. Thallus up to 1-5 (-7) cm high and 1 cm wide, erect or somewhat prostrate.....*R. divaricata*
44. Thallus < 1 cm long and 2 mm wide, prostrate.... .....*R. strafforellii*

45. Medullary cells with numerous secondary pit-connections. Procarpic. Auxiliary cell branch originating from the supporting cell and adjacent outwardly to the carpogonial branch, with intercalary auxiliary cell. Gonimoblast developing adjacent nutritive cells. Carposporophytes enclosed in a hemispherical poreless pericarp. Spermatangia formed in chains in outer cortical cells of short lateral branchlets. Tetrasporangia grouped in the swollen parts of special short lateral branchlets .....Family HYPNEACEAE Genus *Hypnea*.....46

45. Medullary cells lacking secondary pit-connections. Non-procarpic. Auxiliary cell is a nearby cortical cell. Gonimoblast not developing adjacent nutritive-cells. Carposporophytes without pericarp, usually ostiolate. Spermatangia in clusters or rosettes on thallus surface. Tetrasporangia scattered or in sori on thallus surface..... .....Family CAULACANTHACEAE..... 48

46. Genus *Hypnea*
46. Thallus ≤ 3 cm high. Main axes ≤ 800 µm in diameter.....*H. furnariana*
46. Thallus > 3 cm high. Main axes ≥1000 µm in diameter 47
47. Plants without definite main axes, 2-6 (-15) cm high and to (110-) 250-660 (-1000) µm in diameter. Main branches usually straight. In cross section, axial cells 20-40 (-65) µm in diameter, surrounded by cells ≤ 160 µm wide. In longitudinal section, medullary cells ≤ 250 µm long. .....*H. cervicornis*
47. Plants with main axis usually remaining conspicuous, 10-16 (-20) cm high and 1000 (-2000) µm in diameter. Main branches usually swollen and crozier-hooked. In cross section, axial cells 25-30 µm thick, surrounded by cells ≤ 90 µm wide. In longitudinal section, medullary cells ≤ 320 µm long.....*H. musciformis*

48. Branches segmented with elongated-ovoid internodes and constricted nodes. Segments terete to compressed. Cortex 2-5 cells thick. Growth by a single apical cell or by a small group of apical cells ....Genus *Catenella* *C. caespitosa*

48. Branches not segmented, axes of constant diameter but pointed apices. Plant terete. Cortex one cell thick. Growth by a single apical cell..... 49

49. Medulla lacunose. Two periaxial cells per axial cell. Tetrasporangia scattered.....Genus *Caulacanthus* *C. ustulatus*

49. Medulla not lacunose. Only one periaxial cell per axial cell. Tetrasporangia grouped in sori..... .....Genus *Feldmannophycus* *F. rayssiae*

50. Plants with a large, much-lobed supporting cell, that gives rise to several sterile (subsidiary) cells, similar in shape to the supporting cell. Carpogonial branch 2-celled, arising from the subsidiary cells. Plants flattened, foliose. Cortex of cells decreasing in size from the medulla outwards, not arranged in radial rows.....Family KALLYMENIACEAE... 51

50. Plants without subsidiary cells. Carpogonial branch ≥ 2-celled, arising from the supporting cell. Plants flattened, compressed or terete. Cortex of cells sometimes arranged in radial rows..... 58

51. Medulla compact, composed of large, rounded, thick-walled cells through which a delicate network of cobwebby filaments permeates, denser at the basal parts. Inner cortical cells ovoid to angular; outermost rounded. Procarpic. Supporting cell acting as auxiliary cell. Carposporophytes surrounded by sterile strands from the gametophytes, usually ostiolate .....Genus *Callophyllis* *C. laciniata*

51. Medulla lax, filamentous, interwoven with very obvious stellate or ganglionic cells. Inner cortical cells stellate, the following large and angular or slightly stellate, and the outermost small, ovoid or irregularly shaped. Non-procarpic. Auxiliary cell systems with several subspherical to ovoid subsidiary cells on an ovoid auxiliary cell. Carposporophytes lacking filamentous involucre and ostiole 52

52. Gametophytes erect, with a simple or branched stipe from which arise a series of more or less alternately arranged blades. Plants strongly concave and auriculate at the base, the older blades enveloping the younger. Thallus dark red in colour; gelatinous and thin when young, and cartilaginous and thicker in older specimens. Medullar ganglionic cells present, yellow staining. Gametophytes and tetrasporophytes heteromorphic. Tetrasporangia zonately arranged ... .Genus *Meredithia*
M. microphylla

52. Thallus erect or somewhat decumbent, sessile or shortly stalked, broadly expanded above to form a single blade. Plants initially undivided, but adults can be lobed, laciniate or also irregularly dichotomously branched, sometimes perforated (not in Mediterranean species). Thallus rose-pink to dark red in colour, fleshy-membranous in texture. Medullar cells present, either ganglionic and yellow staining, or stellate and hyaline. Gametophytes and tetrasporophytes isomorphic. Tetrasporangia cruciately or irregularly arranged.....Genus *Kallymenia* 53

53. Genus *Kallymenia*
    53. Inner cortical cells ⩾ (40-)60 µm in diameter. Outer cortical cells rounded in surface view, and developing rosettes around large inner cells. Medullar cells stellate, usually colourless, ⩾ 50 µm large 54
    53. Inner cortical cells < 60 µm in diameter. Outer cortical cells ovoid, polyhedral or irregularly shaped in surface view, not forming rosettes around larger inner cells. Medullar cells ganglionic or stellate, yellow staining, usually < 50 µm large 55
    54. Thallus lobed. Inner cortical cells between 40-100 µm in greatest dimension. Medullar stellate cells with a rounded to ovoid body, (25-) 50-100 µm in diameter, and radiating arms ⩽ 300 µm long .....*K. feldmannii*
    54. Thallus laciniate and sometimes slightly pinnate at the ends. Inner cortical cells up to 70-185 µm in size. Medullar stellate cells with a very elongated body, to 70-230 µm long and 20-120 µm wide, and arms 20-115 µm in length originating mainly at distal parts of the cell.....*K. lacerata*
    55. Frond irregularly, di- or trichotomously branched, reniform when very young. Outer cortical cells irregularly shaped.....*K. patens*
    55. Frond simple, lobed or laciniate, sometimes with marginal proliferations. Outer cortical cells rounded, polyhedral or irregularly shaped 56
    56. Inner cortical cells up to 25-30 µm in diameter .....*K. spathulata*
    56. Inner cortical cells up to 40-50 µm in diameter 57
    57. Outer cortical cells rounded to ovoid or irregularly shaped in surface view. Medullary cells stellate or ganglionic in shape, with radiating arms ⩽ 320 µm in length. Polycarpogonial .....*K. reniformis*
    57. Outer cortical cells usually polyhedral in surface view, occasionally irregularly shaped. Medullar cells ganglionic, with radiating arms ⩽ 1000 µm in length. Monocarpogonial.....*K. requienii*

58. Medulla compact, of hyaline cells 59

58. Medulla lax, filamentous, occasionally with stellate or X-shaped cells (small ganglionic cells with body cell about twice the medullary filament diameter) remaining 65

59. Medulla of large cells with a core of small cells within. Plants membranous, terete, consisting of a prostrate and erect system of entangled and irregularly divided branches. Tetrasporangia in small ramuli, zonately arranged.....Genus *Wurdermannia*
W. miniata

59. Medulla lacking a core of small cells. Plants cartilaginous, compressed or flattened, erect, usually dichotomously or irregularly dichotomously branched. Tetrasporangia not in small ramuli, cruciately arranged.....Family PHYLLOPHORACEAE 60

60. Cortex of several layers of small isodiametric cells mostly arranged in radial rows. Plants compressed, shortly stipitate, dividing in one plane. Life history biphasic, with tetrasporophytes hemiparasitic, as pustules on the surface of female gametophytes ....Genus *Gymnogongrus* 61

60. Cortex of small cells not arranged in radial rows. Plants flattened, with a long stipe, not complanately branched. Life cycle triphasic with isomorphic gametophytes and tetrasporophytes 62

61. Genus *Gymnogongrus*
    61. Thallus up to 5-7 (-15) cm high, and 2-4 mm broad. Apices obtuse. Medullar cells 100-250 µm and 2-3 times longer. Pustule small in proportion to branches, scattered over both surfaces.....*G. crenulatus*
    61. Thallus up to 2.5 (-5) cm high and 0.5-0.6 mm broad, except in bifurcations, which are 0.8-1.1 mm wide. Apices acute. Medullar cells 10-20 µm, and 4-8 (10) times longer. Pustule large in proportion to branches, sometimes completely encircling them.....*G. griffithsiae*

62. Thallus arising from a branched cylindrical rhizomatous holdfast. Midrib absent. Carpogonial branches situated in the blade surface. Tetrasporangia aggregated in a series of sequentially developing sori that protrude as bands on both surfaces of frond..... .....Genus *Schottera*
S. nicaeensis

62. Plants arising from a discoid holdfast. Midrib-like thickening present in some species. Carpogonial branches situated in special bladelets. Tetrasporangia in elevated sori, not sequentially developed ....Genus *Phyllophora*.... 63

63. Genus *Phyllophora*
    63. Stipe short in relation to total length of the plant. Blade more or less parallel-sided. Margin undulated. Thallus with a basal or medium midrib-like thickening formed by secondary growth of the cortical layer.....*P. crispa*

63. Stipe long in relation to total length of the plant. Blade more or less fan-shaped. Margin plane. Thallus lacking midrib-like thickening.....64
64. Blade very divided, with acute apices. Stipe usually representing up to half of the total length of the frond. Medullary cells up to 40-50 µm in diameter.....*P. heredia*
64. Blade usually with a single dichotomy and obtuse apices. Stipe usually less than one third of total length of the frond. Medullary cells ≤ 90 µm in diameter.....*P. sicula*
65. Outer cortex arranged in filamentous fascicles. Non-procarpic..... 66
65. Outer cortex not arranged in filamentous fascicles. Procarpic or non-procarpic..... 70
66. Carpogonial branch with adjacent nutritive auxiliary cells (nutritive cells originating from the same branch system of the carpogonial branch)..... .....Family SCHIZYMENIACEAE.. 67
66. Carpogonial branch without adjacent nutritive auxiliary cells.....Family NEMASTOMATACEAE . 68
67. Gland cells rounded to ovoid in shape formed in an intercalary position in cortical fascicles. Gametophytes erect or somewhat decumbent, the branching is dichotomous or irregularly lobed or palmate to pinnate. Branches often anastomosing. Carposporophytes lacking a filamentous involucre..... .....Genus *Platoma* *P. cyclocolpum*
67. Gland cells ellipsoid to ovoid in shape, situated at the end of the cortical filaments. Gametophytes erect, simple or irregularly lobed, sometimes laciniate. Branches not anastomosing. Carposporophytes with a filamentous involucre..... .....Genus *Schizymenia* *S. dubyi*
68. Gland cells present in gametophytes of Mediterranean species. Fronds gelatinous but cartilaginous at the base. Auxiliary cell without nutritive cells. Gonimoblasts developing from the connecting filament. .....Genus *Nemastoma* *N. dichotomum*
68. Gland cells absent in gametophytes of Mediterranean species. Fronds soft and mucilaginous, very delicate. Auxiliary cell bearing short simple or branched chains of subspherical nutritive cells. Gonimoblast developing either on auxiliary cells or on connecting filaments near the point of union with auxiliary cell .....Genus *Predaea*..... 69
69. Genus *Predaea*
    69. Plants up to 4-5 (-9) cm high, dichotomously or irregularly branched. Outer cortical cells ovoid to cylindrical. Carpogonial branch 2-celled. Nutritive cells originating in groups of (3-) 5-12 (-15) cells, situated on the cells site under and over the auxiliary cell. Gonimoblast developing on a lateral swelling of the junction filament, the gonimoblast and the connecting filament remaining side by side. Gonimoblast rounded or sometimes pyriform, radially orientated..... .....*P. ollivieri*
    69. Plants up to 1-4 (-7) cm high, simple or sparsely branched dichotomously or irregularly at the apices. Outer central cells cylindrical. Carpogonial branch 3-celled. Nutritive cells originating in groups of 1-5 per bearing cell, in close related cells, but not always in the upper and the lower part of the auxiliary cell. Gonimoblast initially formed on the auxiliary cell, and originating opposite to the connecting filament. Gonimoblast ovoid to lobed.....*P. pusilla*
70. Carpogonial and auxiliary branches in a special compact branch system (ampulla). Non-procarpic. Tetrasporangia cruciately arranged..... .....Family HALYMENIACEAE....71
70. Carpogonial and auxiliary branches not in a special compact branch system (ampulla). Procarpic or non-procarpic. Tetrasporangia cruciately or zonately arranged..... 80
71. Cortex of cells arranged in radial rows. Inner cortical cells ovoid to ameboid. Medulla filamentous, with numerous X-shaped cells remaining..... 72
71. Cortex not in radial rows. Inner cortical cells stellate and lying in the plane of the flattened surface. Medulla filamentous but lacking X-shaped cells... 76
72. Margin rolled over one of the sides giving a concave-convex appearance. Plants segmented, rigid, sometimes spirally twisted..Genus *Acrodiscus* *A. vidovichii*
72. Margin not rolled over one of the sides. Plants not segmented, not rigid, not spirally twisted.....73
73. Thallus with a canaliculated margin in the Mediterranean species, sometimes distinct only with a magnifying glass. Plants simple, flattened..... .....Genus *Aeodes* *A. marginata*
73. Margin not canaliculated. Plants simple or variously divided, flattened or compressed..... .....Genus *Grateloupia*.... 74
74. Genus *Grateloupia*
    74. Thallus flattened, foliose, simple or deeply divided once to several times, often proliferous from damaged or truncated parts. Plants 2-6 cm wide.....*G. doryphora*
    74. Thallus compressed, not foliose, dichotomously or pinnately branched. Plants ≤ 5 mm broad 75
    75. Frond branching repeatedly dichotomous. Plants up to 1.5-3.0 mm wide, attenuated towards the outer surface.....*G. dichotoma*
    75. Frond initially dichotomous and becoming largely complanately branched, bi- or tripinnate when old. Plants up to 3 (-5) mm wide..... .....*G. filicina*
76. Medulla lax in young parts, with filaments forming bridges from cortex to cortex. Thallus simple or variously branched. Stipe filamentous. Thallus usually rose pink in colour, very soft and gelatinous in texture. Carposporophyte and tetrasporangia scattered and immersed in outer cortex..... ..... Genus *Halymenia*...77
76. Medulla usually fairly compact and strong, without filaments forming bridges from cortex to cortex. Thallus leaf-like, with proliferations of the same shape of the main blade, with the thallus appearing catenate. In cross section, the stipe is celled, with a secondary developed cortex arranged in concentric circles. Thallus dark-red in colour, membranous to cartilaginous in texture.

Carposporophyte and tetrasporangia scattered or occurring in secondary bladelets ....Genus *Cryptonemia*.... 79

77. Genus *Halymenia*
77. Plants terete or slightly compressed, dichotomously or subdichotomously branched, sometimes whorled. Medulla lax, with occasionally transversely orientated filaments. When the thallus is folded, creases are formed.....*H. trigona*
77. Thallus flattened, simple, pinnate or dichotomously branched. Medulla lax in young parts with many to most filaments transversely orientated, dense and irregular in older parts. When the thallus is folded, creases are not formed. 78
78. Thallus lanceolate, simple or, rarely, divided once dichotomously. Plants up to 180 (-300) µm thick. Medullar filaments unbranched, 8-14 µm thick. Outer cortical cells polyhedral in surface view, compact, ≤ 15 µm in greatest dimension .....*H. latifolia*
78. Thallus complanately much-branched to 4-5 orders, pinnate or occasionally subdichotomous. Plants ≤ 800 µm thick. Medullar filaments branched, of 2 sizes, 10-15 and 15-20 µm. Outer cortical cells ovoid in surface view, ≤ 10 µm in diameter, and radially elongated (up to 10-15 µm high) .....*H. floresia*

79. Genus *Cryptonemia*
79. Blades ≤ 3 cm broad, into which the stipe extends as an evanescent midrib-like thickening in mature plants .....*C. lomation*
79. Blades ≤ 0.5 cm broad. Midrib absent..... .....*C. tunaeformis*

80. Cortex of cells arranged in radial rows. Inner cortical cells ovoid to ameboid. Medulla of a network of irregularly oriented filaments and numerous X-shaped cells remaining. Thallus erect or decumbent. Procarpic or non-procarpic.....81
80. Cortex of cells not arranged in radial rows. Inner cortical cells stellate and lying in the plane of the flattened surface. Medulla filamentous, lacking X-shaped cells, but occasionally with some stellate cells remaining. Thallus erect. Non-procarpic....84
81. Medulla consisting of primary filaments, usually longitudinally orientated, interlined with some secondary short filaments, 1-3 cells long, thinner, usually transversely oriented. Procarpic..... .....Family GIGARTINACEAE Genus *Chondracanthus*.....82
81. Medulla lacking secondary filaments. Procarpic or non-procarpic.....83

82. Genus *Chondracanthus*
82. Fronds compressed or terete, irregularly branched. Plants erect or decumbent, often arching and reattaching on contact.....*C. acicularis*
82. Fronds flattened, regularly pinnately branched. Plants erect, not reattaching .....*C. teedii*

83. Margin ribbed and dentate. Thallus leafy and simple or dichotomously branched. Procarpic. Plants midlittoral .....Family RISSOELLACEAE Genus *Rissoëlla* *R. verruculosa*
83. Margins smooth or ribbed, but not dentate. Thallus almost as long as it is broad, lobed. Non-procarpic. Plants sublittoral .....Genus *Chondrymenia* *C. lobata*

84. Medulla lax, in younger parts transversed by a network of filaments mostly at right angles to plane of the flattened surface, and dense and transversely oriented in older ones. Cortex thin. Outer cortical cells radially elongated. Gland cells absent ....Family FURCELLARIACEAE...85
84. Medulla appearing empty in younger part, and transversed by a network of filaments mostly at right angles to plane of the flattened surface in older ones, usually with numerous stellate cells remaining. Cortex thick. Outer cortical cells not radially arranged. Gland cells sometimes present ....Family SEBDENIACEAE Genus *Sebdenia*...86

85. Fronds bearing a long, terete and caulescent stipe, usually branched in mature plants, with an inner part filamentous, and an outer part of little and radially elongated cells. Plants flattened, with blades broader than high and peltate. Plants cartilaginous..... .....Genus *Neurocaulon* *N. foliosum*
85. Fronds lacking a caulescent branched stipe. Plants compressed or flattened (subcylindrical when narrow), entire or irregularly dichotomously branched, often furnished with ligulate proliferations from the margins and blade surface. Thin plants soft and diaphanous, gelatinous; thicker plants subcartilaginous .....Genus *Halarachnion* *H. ligulatum*

86. Genus *Sebdenia*
86. Refringent gland cells present. Medullary stellate cells abondant.....87
86. Gland cells absent. Medullary stellate cells rare. .....*S. monardiana*
87. Gland cells very obvious situated in the center of the stellate cells and 20-30 µm in diameter, or over the medullar filaments, and then 15-20 µm thick. Thallus 400-500 µm thick, cuneiform, thicker at the base and margins, first simple and lanceolate, later divided in large subdichotomous lobes, with deep sinus. Margin whole. Stellate cortical cells 20-50 (-70) µm in diameter.....*S. rodrigueziana*
87. Gland cells not obvious, situated in the center of the stellate cells and 10-15 µm in diameter. Thallus ≤ 1500 µm thick, more or less flattened, but usually cylindrical at the apices, dichotomously or subdichotomously branched, usually with marginal proliferations. Stellate cortical cells up to 15-20 (-25) µm in diameter... .....*S. dichotoma*

TAXONOMIC ARRANGEMENT OF THE GENERA TREATED

Order GIGARTINALES Schmitz *in* Engler

Family ACROSYMPHYTACEAE Lindstrom
Genus *ACROSYMPHYTON* Sjöstedt; *"Acrosymphytonema" stadium* Boudouresque, Perret-Boudouresque & Knoepffler-Péguy

A. purpuriferum (J. Agardh) Sjöstedt
Tetrasporophyte: *"Acrosymphytonema breemaniae"* Boudouresque, Perret-Boudouresque & Knoepffler-Péguy

Family CALOSIPHONACEAE Kylin
Genus *CALOSIPHONIA* P.L. Crouan & H.M. Crouan
C. dalmatica (Kützing) G.B. De Toni
C. vermicularis (J. Agardh) Schmitz
Genus *SCHMITZIA* Lagerheim ex P.C. Silva
S. neapolitana (Berthold) Lagerheim ex P.C. Silva

Family CAULACANTHACEAE Kützing
Genus *CATENELLA* Greville
C. caespitosa (Withering) Irvine *in* Parke & P.S. Dixon
Genus *CAULACANTHUS* Kützing
C. ustulatus (Turner) Kützing
Genus *FELDMANNOPHYCUS* Augier & Boudouresque
F. rayssiae (J. Feldmann & G. Feldmann) Augier & Boudouresque

Family CRUORIACEAE Kylin
Genus *CRUORIA* Fries
C. cruoriaeformis (P.L. Crouan & H.M. Crouan) Denizot

Family CYSTOCLONIACEAE Kützing
Genus *CALLIBLEPHARIS* Kützing
C. ciliata (Hudson) Kützing
C. jubata (Goodenough & Woodward) Kützing
Genus *RHODOPHYLLIS* Kützing
R. divaricata (Stackhouse) Papenfuss
R. strafforellii Ardissone

Family DUMONTIACEAE Bory de Saint-Vincent
Genus *DUDRESNAYA* P.L. Crouan & H.M. Crouan
D. verticillata (Withering) Le Jolis

Family FURCELLARIACEAE Greville
Genus *HALARACHNION* Kützing
H. ligulatum (Woodward) Kützing
Tetrasporophyte: *Cruoria rosea* P.L. Crouan & H.M. Crouan
Genus *NEUROCAULON* Zanardini ex Kützing
N. foliosum (Meneghini) Zanardini

Family GIGARTINACEAE Kützing
Genus *CHONDRACANTHUS* Kützing
C. acicularis (Roth) Fredericq *in* Hommersand, Guiry, Fredericq & Leister
C. teedii (Mertens ex Roth) Kützing

Family GLOIOSIPHONACEAE Schmitz
Genus *GLOIOSIPHONIA* Carmichael *in* Berkeley
G. capillaris (Hudson) Carmichael *in* Berkeley
Tetrasporophyte: *Rhododiscus pulcherrimus* P.L. Crouan & H.M. Crouan
Genus *THURETELLA* Schmitz
T. schousbœi (Thuret) Schmitz
Genus *SCHIMMELMANNIA* Schousboe ex Kützing
S. ornata Schousboe ex Kützing

Family HYPNEACEAE J. Agardh
Genus *HYPNEA* Lamouroux
H. cervicornis J. Agardh
H. furnariana Cormaci, Alongi & Dinaro
H. musciformis (Wulfen) Lamouroux

Family KALLYMENIACEAE (J. Agardh) Kylin
Genus *CALLOPHYLLIS* Kützing
C. laciniata (Hudson) Kützing
Genus *KALLYMENIA* J. Agardh
K. feldmannii Codomier
K. lacerata J. Feldmann
K. patens (J. Agardh) Parkinson
K. reniformis (Turner) J. Agardh
K. requienii J. Agardh
K. spathulata (J. Agardh) Parkinson
Genus *MEREDITHIA* J. Agardh
M. microphylla (J. Agardh) J. Agardh
Tetrasporophyte: *Rhodochorton hauckii* (Schiffner) Hamel

Family NEMASTOMATACEAE Schmitz *in* Engler
Genus *NEMASTOMA* J. Agardh
N. dichotomum J. Agardh
Genus *PREDAEA* G. De Toni
P. ollivieri J. Feldmann
P. pusilla (Berthold) J. Feldmann

Family PEYSSONNELIACEAE Denizot
Genus *METAPEYSSONNELIA* Boudouresque, Coppejans & Marcot
M. feldmannii Boudouresque, Coppejans & Marcot
Genus *PEYSSONNELIA* Decaisne
P. armorica (P.L. Crouan & H.M. Crouan) Börgesen
P. atropurpurea P.L. Crouan & H.M. Crouan
P. bornetii Boudouresque & Denizot
P. codana (Rosenvinge) Denizot
P. coriacea J. Feldmann
P. crispata Boudouresque & Denizot
P. dubyi P.L. Crouan & H.M. Crouan
P. harveyana P.L. Crouan & H.M. Crouan
P. hongii Marcot-Coqueugniot
P. inamoena Pilger
P. magna Ercegovic
P. polymorpha (Zanardini) Schmitz *in* Falkenberg
P. rara-avis Marcot & Boudouresque
P. rosa-marina Boudouresque & Denizot
f. *rosa-marina* Boudouresque & Denizot
f. *saxicola* Boudouresque & Denizot
P. rubra (Greville) J. Agardh
P. squamaria (Gmelin) Decaisne
P. stoechas Boudouresque & Denizot
Genus *POLYSTRATA* Heydrich
P. compacta (Foslie) Denizot
P. fosliei (Weber-van-Bosse) Denizot

Family PHYLLOPHORACEAE Nägeli
Genus *GYMNOGONGRUS* Martius
G. crenulatus (Turner) J. Agardh
G. griffithsiae (Turner) Martius
Genus *PHYLLOPHORA* Greville
P. crispa (Hudson) Dixon
P. heredia (Clemente y Rubio) J. Agardh
P. sicula (Kützing) Guiry & Irvine
Genus *SCHOTTERA* Guiry & Hollenberg
S. nicaëensis (Lamouroux *ex* Duby) Guiry & Hollenberg

Family RHYZOPHYLLIDACEAE Schmitz
Genus *CONTARINIA* Zanardini
C. peyssonneliaeformis Zanardini
C. squamariae (Meneghini) Denizot

Family RISSOËLLACEAE Kylin
Genus *RISSOËLLA* J. Agardh
R. verruculosa (Bertoloni) J. Agardh

Family SARCODIACEAE Kylin
Genus *CHONDRYMENIA* Zanardini
C. lobata (Meneghini) Zanardini

Family SCHIZYMENIACEAE (Schmitz & Hauptfleisch) Masuda & Guiry
Genus *PLATOMA* Schousboe ex Schmitz
P. cyclocolpum (Montagne) Schmitz
Genus *SCHIZYMENIA* (J. Agardh) J. Agardh
S. dubyi (Chauvin ex Duby) J. Agardh

Tetrasporophyte: *Haematocelis rubens* J. Agardh

Family SPHAEROCOCCACEAE Dumortier emend. Searles

Genus *SPHAEROCOCCUS* Stackhouse

S. coronopifolius (Goodenough & Woodward) Stackhouse

Tetrasporophyte: *Haematocelis fissurata* P.L. Crouan & H.M. Crouan

S. rhizophylloides Rodríguez Femenías

Order HALYMENIALES Saunders & Kraft

Family HALYMENIACEAE Bory de Saint-Vincent

Genus *ACRODISCUS* Zanardini

A. vidovichii (Meneghini) Zanardini

Genus *AEODES* J. Agardh

A. marginata (Roussel ex Montagne) Schmitz

Genus *CRYPTONEMIA* J. Agardh

C. lomation (Bertoloni) J. Agardh

C. tunaeformis (Bertoloni) Zanardini

Genus *GRATELOUPIA* C. Agardh

G. dichotoma J. Agardh

G. doryphora (Montagne) Howe

G. filicina (Lamouroux) C. Agardh

Genus *HALYMENIA* C. Agardh

H. floresia (Clemente y Rubio) C. Agardh

H. latifolia P.L. Crouan & H.M. Crouan

H. trigona (Clemente y Rubio) C. Agardh

Family SEBDENIACEAE Kylin

Genus *SEBDENIA* (J. Agardh) Berthold

S. dichotoma (J. Agardh) Berthold

S. monardiana (Montagne) Berthold

S. rodrigueziana (J. Feldmann) Codomier

Order HILDENBRANDIALES Pueschel & Cole

Family HILDENBRANDIACEAE Rabenhorst

Genus *HILDENBRANDIA* Nardo

H. crouanii J. Agardh

H. occidentalis Setchell *in* Gardner

H. rubra (Sommerfelt) Meneghini

Order PLOCAMIALES Saunders & Kraft

Family PLOCAMIACEAE Kützing

Genus *PLOCAMIUM* Lamouroux

P. cartilagineum (Linnaeus) P.S. Dixon

P. secundatum (Kützing) Kützing

INCERTAE SEDIS

Genus *WURDERMANNIA* Harvey

W. miniata (Sprengel) J. Feldmann & Hamel

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ANALYSE D'OUVRAGE/*BOOK REVIEW*

M. NORMAN, 2000. Cephalopods – a world guide. ConchBooks (E-mail : conchbooks@conchbooks.de), D-55546 Hackenheim (Allemagne). p., 708 fig., 16 x 24 cm. Couverture : carton rigide plastifié. 41.00 Euros (+ frais d'expédition en Europe : 5.50 Euros). [Demander les conditions de vente pour l'édition en Allemand].

Depuis la parution, en 1987, du grand livre des Céphalopodes rédigé et illustré par Kir. N. Nesis (« Cephalopods of the World »), les teuthologistes et les naturalistes amateurs s'intéressant aux Poulpes, Seiches, Sépioles et Calmars, attendaient un ouvrage faisant « systématiquement » appel aux photos en couleur. L'excellent livre de Norman répond pleinement à cette attente, en présentant près de 230 espèces par une véritable galerie de portraits d'animaux vivants – pour la plupart photographiés dans leur environnement naturel. Dans un avant-propos enthousiaste, Kir Nesis insiste sur l'importance de cette approche : « [les céphalopodes] sont difficiles à identifier quand ils sont morts, voire fixés, alors qu'ils sont très différents entre eux dans leur environnement naturel, grâce aux couleurs et comportements si diversifiés ».

Afin de permettre au lecteur non initié de se familiariser avec ces animaux, Norman commence par une introduction se terminant par un glossaire, continue par une brève description des caractéristiques de la classe des Céphalopodes, avec un survol de la systématique – d'ailleurs bien visualisée dès le sommaire – couvrant les différents groupes, en ajoutant un bref rappel sur les formes fossiles. Pour chaque groupe taxonomique, une brève introduction présente l'essentiel de sa répartition géographique et de sa biologie/écologie, avec des renvois à une ou plusieurs des 35 « histoires illustrées [picture stories] ». Ces histoires offrent des observations inédites ou peu connues, qui sont autant de suggestions pour des études futures.

Contrairement aux compilations plus ou moins réussies de certains « éditeurs d'images », Norman offre un véritable précis de teuthologie, richement illustré, avec un index des noms scientifiques et vernaculaires ; en même temps il attire l'attention du lecteur (et en particulier du plongeur scientifique) sur les nombreuses questions non encore résolues. Ainsi 20 espèces de Poulpes non encore décrites « lege artis » (ce qui exigerait le dépôt d'un ou de plusieurs spécimens types) sont représentées par d'excellentes photos accompagnées de brèves descriptions biologiques –voilà un exemple de ce que Nesis dit dans son avant-propos !

Ce très beau livre témoigne d'un souci permanent de soigner le contenu autant que l'esthétique. L'auteur, un scientifique de renom international, a su créer, avec le concours d'une maison d'édition spécialisée dans le domaine du livre naturaliste, un guide « haut de gamme ».

M. NORMAN & A. REID, 2000. A Guide to Squid, Cuttlefish and Octopuses of Australasia. CSIRO Publishing (E-mail : sales@publish.csiro.au), 150 Oxford Street, Collingwood, Victoria 3066 (Australie). 96 p., 242 figs, 16.5 x 24 cm. Couverture : carton souple plastifié. 32.00 $AU.

Bien que ce guide soit le « petit frère » de CEPHALOPODS ñ A WORLD GUIDE, il peut être utilisé de manière parfaitement indépendante, pour identifier la soixantaine d'espèces de Céphalopodes recensés sur les côtes Australiennes et dans les régions avoisinantes comprises entre 10°N et 50°S, et entre 95° et 190°E.

L'introduction est suivie de brefs rappels sur (1) le rapport systématique entre les Céphalopodes et les autres Mollusques, (2) l'évolution des Céphalopodes, (3) leur importance dans la faune marine actuelle, (4) les grands groupes de Céphalopodes vivants et l'essentiel de leur biologie.

A quelques exceptions près, la présentation de chaque espèce occupe une page entière : une grande photo en couleur montrant l'adulte, une ou deux petites photos consacrées à un détail morphologique ou de comportement, toutes avec de brèves légendes, un texte succinct indiquant le mode de vie, la taille adulte, quelques caractéristiques de la reproduction, puis un cartouche contenant les caractères distinctifs de l'espèce et une petite carte montrant sa répartition géographique.

Pour une trentaine d'espèces de Seiches, l'os (sépion) est présenté en vues dorsale et ventrale ; ces « portraits de pièces détachées » sont réunis dans une série de planches qui seront particulièrement appréciées par les collectionneurs fréquentant les plages. En effet, les sépions, détachés du corps après la mort de l'animal, peuvent s'échouer sur une plage, à l'issue d'une dérive plus ou moins longue ; ils sont alors des indicateurs intéressants, quoique « approximatifs », de la présence d'une ou de plusieurs espèces de seiches dans une zone plus ou moins vaste.

Notons enfin l'excellent glossaire ainsi que l'index réunissant les noms scientifiques et vernaculaires. Tout comme son « grand frère » le « Guide mondial des Céphalopodes », ce fascicule est un excellent outil de travail doté d'une grande qualité esthétique.

S. v. Boletzky