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A COLOUR GUIDE TO SOME GREEN SEAWEED GENERA IN SRI LANKA

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There is no reference material readily available - either in the form of scientific literature or as 'popular publications' simple enough for the non-specialist - to identify the seaweeds found in Sri Lanka's marine habitats. This colour guide has been prepared to enable identification of 17 genera of green seaweeds that occur in Sri Lanka together with brief information about their habitats.

The genera listed in the box is taken from the catalogue of Silva, Basson & Moe: plants that have been reported by various workers at various times as having been found in Sri Lanka. One exception is *Ventricaria. V. ventricosa* (formerly *Valonia ventricosa*) has not been reported from Sri Lanka in the published literature but has been found by the author off Pigeon Islands in Nilaveli.

All the plants described have been collected and photographed by the author except where stated otherwise. The descriptions of the genera are based on the material examined. These descriptions and photographs should enable the non-specialist to identify material in hand. In some cases, a microscope or good hand lens will prove useful to establish the genus with confidence.

Photographs of individual plants were usually taken in an aquarium by natural light. Photomicrographs were made as part of the joint Sri Lanka - and St. Thomas' College Sub-Aqua Clubs' marine bio-diversity (MBIOD) project at Mount Lavinia ('95-'97) funded by the GEF Small Grants Programme. The genera are listed alphabetically.

Green seaweed genera reported from Sri Lanka

ULVALES	
Monostromataceae	*Blidingia* Kylin
Ulvaceae	*Enteromorpha* Link*
	Ulva Linnaeus*
CLADOPHORALES	
Anadyomenaceae	*Anadyomene* Lamouroux
	Microdictyon Decaisne*
Cladophoraceae	*Chaetomorpha* Kützing*
	Cladophora Kützing*
	Rhizoclonium Kützing
Siphonocladaceae	*Boergesenia* J. Feldman*
	Boodlea G. Murray & De Toni*
	Cladophoropsis Børgesen*
	Dictyosphaeria Decaisne ex Endlicher*
	Struvea Sonder
	Ventricaria Olsen & J. West**
Valoniaceae	*Ernodesmis* Børgesen
	Valonia C. Agardh*
	Valoniopsis Børgesen*
BRYOPSIDALES	
Bryopsidaceae	*Bryopsis* Lamouroux*
Caulerpaceae	*Caulerpa* Lamouroux*
Codiaceae	*Codium* Stackhouse*
Halimedaceae	*Halimeda* Lamouroux*
Ostreobiaceae	*Ostreobium* Bornet & Flahault
Udoteaceae	*Avrainvillea* Decaisne*
	Chlorodesmis Harvey & Bailey
	Rhipidosiphon Montagne
	Udotea Lamouroux
DASYCLADALES	
Dasycladaceae	*Neomeris* Lamouroux
Polyphysaceae	*Acetabularia* Lamouroux

* Genera described in this article
** Genus (and species) not previously reported from Sri Lanka
After Silva, Basson & Moe (1996)

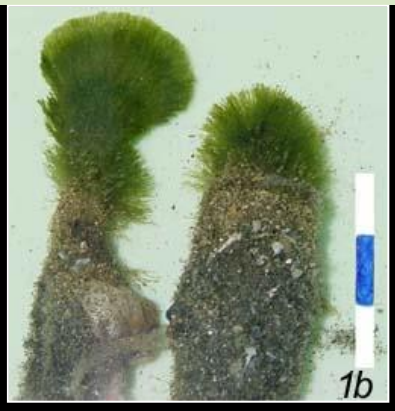
Note regarding the digital version: The text follows that in the *Loris* publication. Some of the images have been replaced by newer, better quality images in this version, and, where necessary the captions have been changed. A few additional images have been added. Two genera (*Acetabularia* and *Rhipidosiphon*) that were not described in the printed version have been added, as information and images are now available.

Description of genera

1. **Avrainvillea**:
Dark green fan-shaped or elongated fronds made up of felted filaments with Y-shaped dichotomies (forks). Growing in sand anchored by a long, cylindrical buried holdfast ("root") consisting of compacted filaments enmeshing grains of sand or with a cylindrical basal portion adherent to rock or dead coral, depending on the species. Subtidal and intertidal tide pools. Three species in Sri Lanka.

Figure 1: *A. erecta* (40-60 mm) grows on sand bottoms with a buried holdfast. Wellawatte, 3 m. Bar Reef, Kalpitiya, 3 m. 1b. shows part of the buried holdfasts, ingrained with sand.

Figure 2: *A. amadelpha* (100 mm) grows attached to hard substrates. Pigeon Islands, Nilaveli, 4 m. Inshore reef, Kattankudy, 2 m. [Was misidentified as *A. lacerata* in the printed publication.]

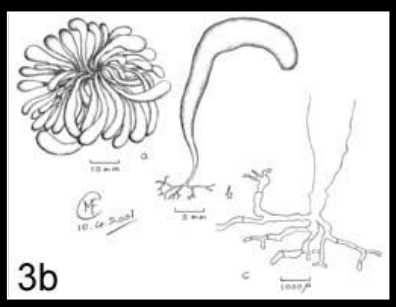


Avrainvillea erecta
(a) Underwater photograph at Bar Reef. (b) Close-ups.

Avrainvillea amadelpha
(a) Underwater photograph at Pigeon Islands. (b) A frond from Kattankudy.

2. ***Boergesenia*:** Light green, clavate (club-shaped) vesicles 30-40 mm high growing in clusters with their narrowed bases crowded, attached by rhizoids to the rock. Intertidal reef flats sheltered from waves, exposed at low tide, or shallow pools. One species in Sri Lanka.

Figure 3: *Boergesenia forbesii*, Barberyn Reef, Beruwela, intertidal.



Boergesenia forbesi
(a) *Ex-situ* photograph of a cluster of vesicles from Barberyn Reef, Beruwela.
(b) Drawing showing morphology.
a) Entire cluster. b) Single vesicle.
c) Lower end showing rhizoids

3. ***Boodlea*:** Bright green, spongy clumps attached to rocks, dead coral or other seaweed (*Halimeda opuntia*). The clumps consist of filaments (600-80µ) branching in all directions, the ultimate branchlets anastomosing with neighbouring branches by means of haptera (short cells with lobed processes.) The microscopic structure is very similar to that of *Microdictyon*, differing in the sponge-like nature of the thallus as a result of branches given off in many planes. Two species in Sri Lanka.

Figure 4: (a) *Boodlea* sp. Pigeon Islands, Nilaveli, 3-4 m. Underwater photograph.

(b) *Boodlea montagnei* Photomicrograph showing branching filaments and anastomoses.

4. ***Bryopsis*:** Green, erect filaments (400-700mm) with the ultimate lateral branches usually in two opposite series giving a feather-like appearance. Unseptate, multicellular plant body (coenocytic), the lateral branches with characteristic constricted bases. Six species in Sri Lanka, varying in size from 20 to 300 mm high. The species differ in arrangement of branches and ultimate laterals. Intertidal rocky shores and subtidal. Most collections unidentified.

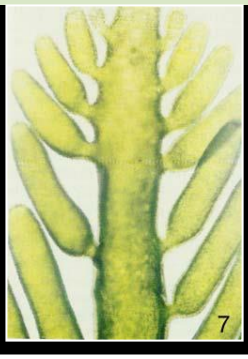
Figure: (5) *B.* sp. Bar Reef, Kalpitiya, 3 m. Underwater photograph of heavy growth on dead coral after massive bleaching event. October 1998.

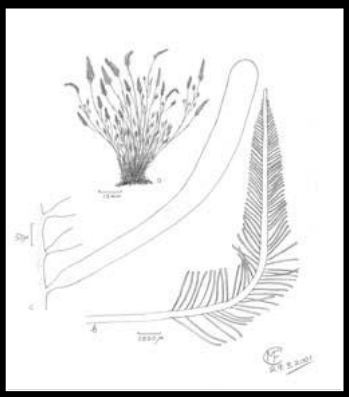
(6) Drawings of *B. ?plumosa*. Kandakuliya, 22 m and another species showing habit and details of lateral branches.

(7) *B.* ?*corticulans*, photomicrograph showing details of lateral branches with constricted bases.

5. ***Caulerpa*:** Dark or bright green unseptate, multinucleate plant body consisting of a creeping axis giving off rhizoids from the under surface and erect axes from the upper surface. The erect axes of varying height with lateral branches that take numerous forms. These usually in two opposite series, sometimes arranged all-round the axis and varying in shape from cylindrical, club-shaped, top-shaped, trumpet-shaped, stalked globules or ovoids to discoid forms and flattened, ribbon-like expanses. Thirty-five species in Sri Lanka, including many varieties and forms. The synonymy is long and frequently changing.

Note: The images in the printed article have been replaced with better quality ones. The locations given in the captions refer to the specimens in the photographs.





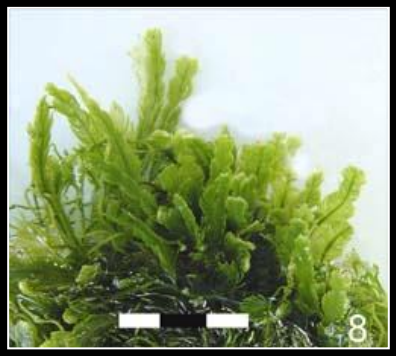


Figure: (8) *Caulerpa sertularioides* - Subtidal rocky shore, 0.1 m, Mount Lavinia.

(10) *C. nummularia* - intertidal rocky shore, Mount Lavinia.

(9) *C. racemosa* var. *macrophysa* - intertidal rocks, Barberyn Reef, Beruwela.

(11) *C. serrulata* - subtidal rocks, 3-5 m, Pigeon Islands, Nilaveli.

6. ***Chaetomorpha*:** Bright green, cylindrical cells joined end to end to form unbranched filaments (75-500µ). Either attached by rhizoids from a basal cell that is narrowed below and many times the length of subsequent cells or long, unattached filaments entangled amongst other algae, the cells sub-equal. High intertidal rocky shores, reef flats and tide pools to subtidal. Nine or ten species in Sri Lanka.

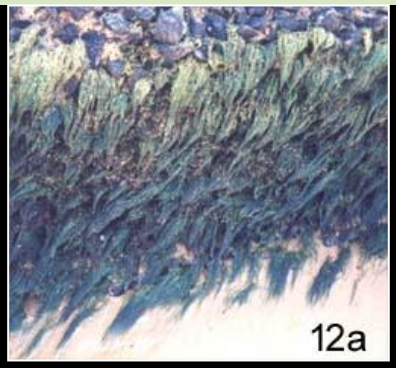


Figure 12: (a) *Chaetomorpha antennina* Wellawatte, intertidal shore structure. (b) A single clump.

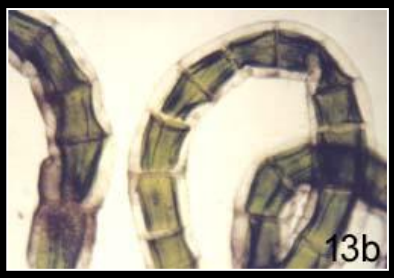


Figure 13: (a) *Chaetomorpha crassa*, unattached filaments growing entangled on other algae or solid objects. Forms entangled masses.
(b) Photomicrograph of a portion of a single filament showing square to rectangular cells joined end-to-end.

7. ***Chlorodesmis*:** Hair-like (100-220µ) unseptate, erect filaments forking repeatedly, attached below by rhizoids to rock, crowded to form a dark green, flat-topped cushion. Bases of forks constricted. The filaments 2 cm high, their lower parts buried in fine sand, the upper parts free and entangled. Subtidal. Identifies as *Chloro-desmis caespitosa* on the symmetrical constrictions of the dichotomies and the presence of needle-like crystals within the filaments (Eric Coppejans, pers. comm.) One species - *Ch. caespitosa* - reported from Sri Lanka by J. Agardh in 1887, the type locality being Colombo. There are no specimens in the National Herbarium in Peradeniya and no citations of other records from Sri Lanka in the Indian Ocean Catalogue. S. Balasub-ramaniam lists *Ch. hildebrandtii* (identified tentatively) from Mandativu in his privately circulated (undated) check-list of the marine algae of Jaffna. the present collection from Wellawatte on March 10, 2002 is probably the first time it has been re-collected in the type locality since its discovery 115 years ago (Figure 14).

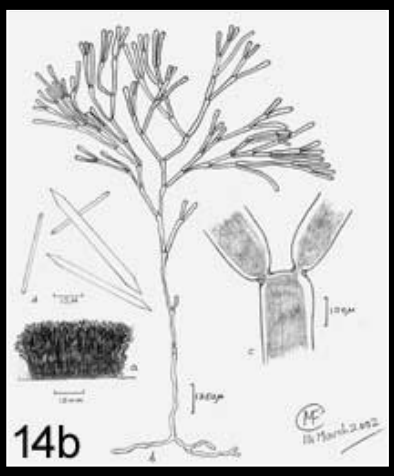


Figure: 14 (a) *Chlorodesmis caespitosa* - portion of a cushion from Wellawatte, Kinross First Reef, 2 m.

8. ***Cladophora*:** Dark green attached or unattached, filaments branched, consisting of cylindrical cells joined end to end. Branching in various patterns according to the species; branches progressively narrower (500-40µ). Tide pools, salt marsh pools, subtidal. Eight or nine species in Sri Lanka. Figures 15, 16 & 17.

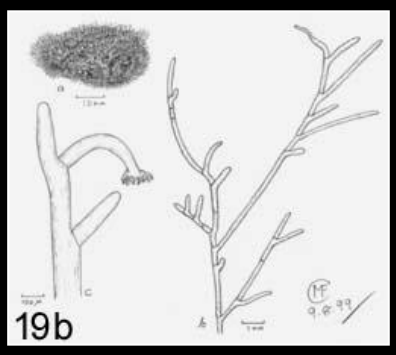
Figure 15 - Attached *Cladophora* sp. in tide pool, Barberyn Reef, Beruwela. Unidentified species growing in short tufts where water flow is swift as it drains away.

Figure 16 - Unattached *Cladophora* sp. in salt marsh pool, Kalpitiya peninsula, forming a floating mat.

Figure 17 - *Cladophora vagabunda,* an attached species that grows in shallow tide pools where the water flows in with waves and the excess flows out.
(a) A fragment of the terminal portion of a frond showing leashes of lateral branches. (Herbarium specimen)
(b) A photomicrograph montage of a terminal leash of branches showing the branching pattern.
- Mount Lavinia rocky shore.

9. ***Cladophoropsis*:** Hair-like (90-150µ), branched, septate filaments tightly interwoven to form small, dark green cushions and mats on intertidal rocks sheltered from waves. The cushions soft to touch but keep their shape out of water. Septa are not developed at the bases of branches, resulting in a distinctive appearance. One species in Sri Lanka.

Figure 18 - *Cladophoropsis sundanensis* cushions on Barberyn Reef, Beruwela, intertidal.



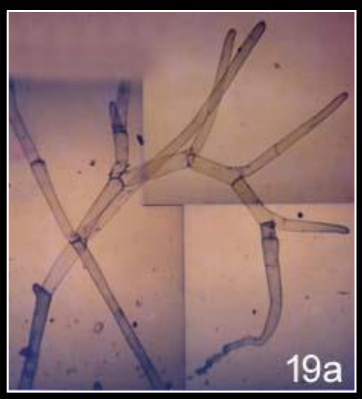


Figure 19 - Detail of filaments. (a) Photomicrograph montage. (b) Drawing showing:
a) Algal cushion;
b) Terminal portion of a filament, cells 100-150µ wide and up to 20 times as long. Apex of right-had branch attenuated and twisted - rhizoidal?
c) Rhizoid-like apical branch with "holdfast".

10. ***Codium*:** Dark green plant bodies with a core of fine filaments (20-35µ) branching to form an outer layer of swollen utricles (vesicles) that give a felt-like texture and appearance. Cylindrical, branched, erect or anastomosing creeping fronds; one species forms an irregular, lobed mass attached to intertidal hard substrates. The branching forms subtidal or intertidal. Six or seven species in Sri Lanka.

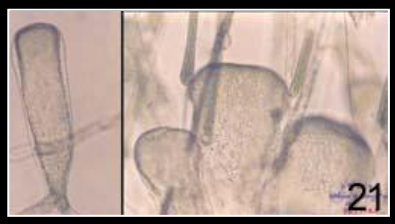


Figure: 20 (a) - *Codium* cf. *decorticatum,* Panadura, 18.5 m. (b) - *C.* sp. Uppuveli. (c) - *C. taylorii*, Weligama. (d) - *C. arabicum*, Weligama.

Figure: 21 - *C.* cf. *decorticatum*. Photomicrographs of utricles of various sizes (utricles 160-270µ wide). Larger ones with hairs.

11. ***Dictyosphaeria*:** Small (10-35 mm), light green, shiny nodules attached to the walls of tide pools, exposed at low tide, sheltered from waves. Attached by rhizoidal processes from the under surface. The nodules consist of clusters of closely adherent rounded cells; the innermost cells usually die leaving a hollow sac with a one-cell thick wall. One species in Sri Lanka (as reported in the Indian Ocean Catalogue). Subsequently Upali Mallikarachchi reported another, which was found by the author too.

Figure 23a -
(a) Thallus on rock face; a' is side view.
(b) Surface view of thallus magnified, showing bulging cells.
(c) Vertical section of thallus including a rhizoid in surface view arising from the deep surface. The large cell with spherical bodies containing chlorophyll is possibly in a reproductive phase.

Figure 22 - Tide pool wall, Barberyn Reef, Beruwela. *Dictyosphaeria cavernosa* (light green nodules), *Valonia* sp. (dark green globules).

Figure 23 - *D. cavernosa*. Close-up of a thallus from above.

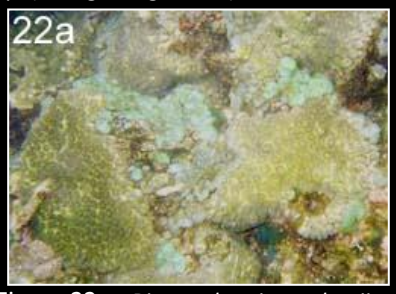


Figure 22a - *Dictyosphaeria versluysii*. Under water photograph showing blue-green thalli forming flat nodules. Trincomalee, Dutch bay, 3 m.

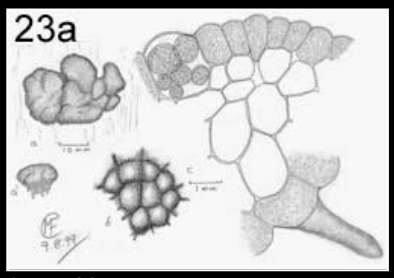


Figure 23a - *D. cavernosa*. Drawing of dissection. Explanation in left pane.

12. ***Enteromorpha*:** Light or dark green tufted, tubular, branching fronds one-cell thick. Attached to exposed intertidal or subtidal hard substrates by an expanded disc. Branching differs in the various species. Plant bodies limp and droop when exposed at low tide, but erect in subtidal habitats. Five species in Sri Lanka.

Note: *Enteromorpha* species are now considered under the genus *Ulva*.

Figure 25: (a) - A single thallus showing cylindrical branches and a dilated one, mostly branching from the base.
(b) - Enlarged drawing of the same. The fronds are all tubular.
(c) - Cells in surface view. There is only one layer of cells.

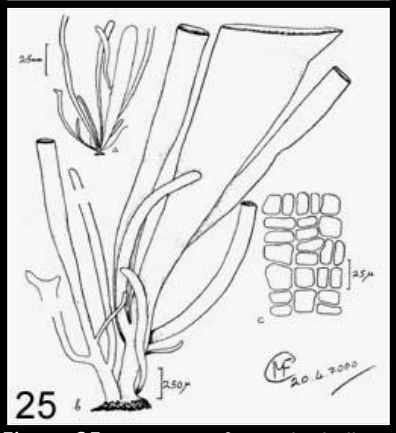


Figure 25 - Drawing of a single thallus showing branching from the base.

Figure 24 - *Enteromorpha compressa*. Wellawatte, high intertidal, growing on a shore structure, exposed at low tide. (a) Tufts of thalli enlarged.

13. ***Halimeda*:** Light or dark green branching tufts consisting of chains of flattened, calcified joints of various shapes: discoid, kidney-shaped, fan-shaped or irregular. Subtidal hard or soft substrates. When growing on soft substrates (sand or muddy sand) they may be anchored by a buried bulbous mass of rhizoids, buried parts of older branches, or the basal joint may be attached by rhizoids to a buried pebble or dead shell, depending on the species. Five species in Sri Lanka.

Figure 26 - *Halimeda opuntia*, Barberyn Reef, Beruwela, 0-2 m. *Ex-situ* photograph.

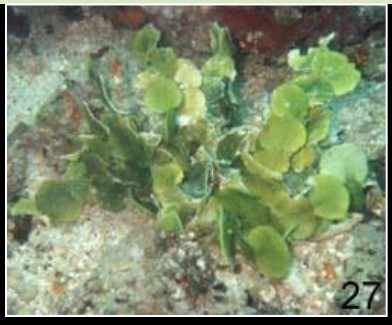


Figure 27 - *Halimeda tuna*, Uppuveli

14. ***Microdictyon*:** Delicate, light green, reticulate (net-like) fronds, somewhat lobed and irregular in shape. Young fronds fan-shaped arising from a club-shaped basal cell attached to hard substrates by rhizoids. The blade consists of a network of branching, anastomosing filaments (180-50 µ wide) expanding in one plane to form a cluster of fronds. (*Boodlea* similar but branches in more than one plane forming a spongy mass.) One species in Sri Lanka.

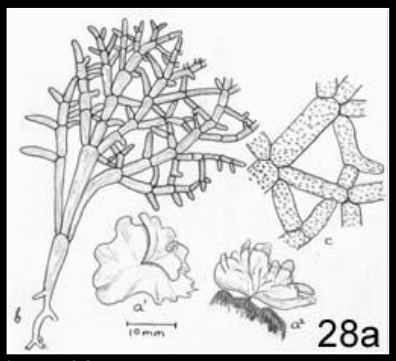


Figure 28a - *Microdictyon tenuis* (a) - drawing of thallus (a^1, a^2); a single frond (b); enlarged cells showing branching & anastomosis (c).

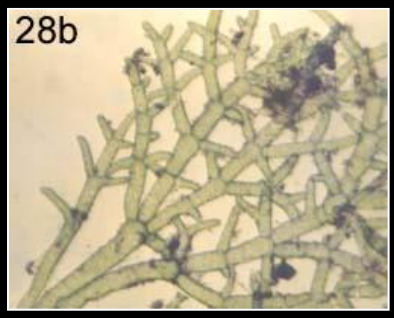


Figure 28b - photomicrograph of a portion of the frond.

15. ***Ulva*:** Shiny, light or dark green, two cell thick fronds attached to hard substrates by an expanded disc. The frond ribbon-like or wide and rolled up; entire or perforated by holes of various sizes, sometimes so large that the frond is net-like. Single, or tufts of numerous fronds depending on the species and age. Intertidal or subtidal on hard substrates. May also be found on soft substrates in shallow water attached to pebbles and dead shells. Five species in Sri Lanka.

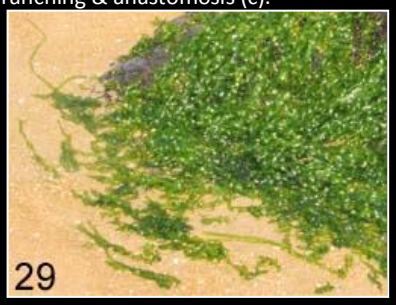


Figure 29 - *Ulva fasciata*
Mount Lavinia, intertidal rocky shore. Exposed at low tide.

Figure 30 - *Ulva rigida*
Barberyn Reef, Beruwela. In sheltered lagoon attached to pebbles on the sandy bottom, 1-2 m deep.

16. ***Valonia*:** Dark green vesicles forming firm masses of various shapes. The vesicles spherical or elongate, of various sizes. Each one produces daughter vesicles on their sides or summits, forming macroscopic plant bodies of various shapes according to the species. Intertidal or subtidal. Two or three species in Sri Lanka.

Figure 31a: *Valonia fastigiata* (side view of vesicles), Unawatuna.

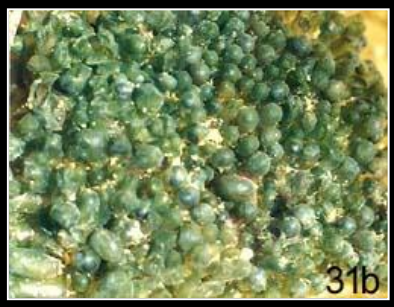


Figure 31b: *Valonia fastigiata* (viewed from above), Unawatuna.

17. ***Valoniopsis*:** Firm, dark green cushions on intertidal rocks exposed to waves. The cushions made up of crisp filaments about 1 mm thick, the sparse branches interlacing to hold the structure together. The cushions are loosely attached to the substrate by rhizoids and are often broken free and cast ashore. One species in Sri Lanka.

Figure 32 - *Valoniopsis pachynema*. Barberyn Reef, Beruwela, intertidal. Green cushions of compacted filaments.

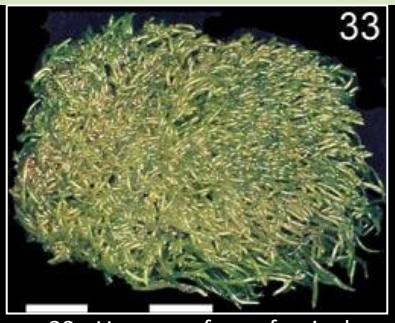


Figure 33 - Upper surface of a single detached cushion.

18. ***Ventricaria*:** Large (30-70 mm), solitary, light green vesicles growing between branches of broken, dead staghorn coral (*Acropora*). Usually only the rounded upper pole is visible, the shape being spherical, ovoid, or more or less cylindrical depending on how deep within the rubble mass it originates. One species in Sri Lanka.

This species is not reported from Sri Lanka in the literature. It has been found by the author only off Pigeon Islands, Nilaveli.

(Subsequently found in Erakkandy, Dutch Bay, Trincomalee and Irrachchal Reef, Kayankerni.)

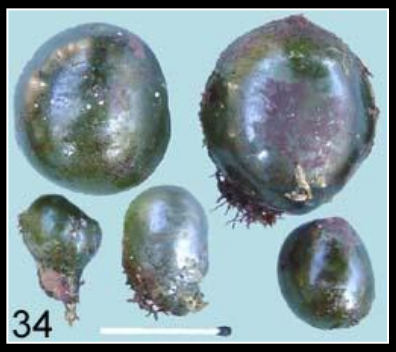


Figure 34 - *Ventricaria ventricosa.* Pigeon Islands, Nilaveli, 1-2 m. Thalli of various sizes and shapes.

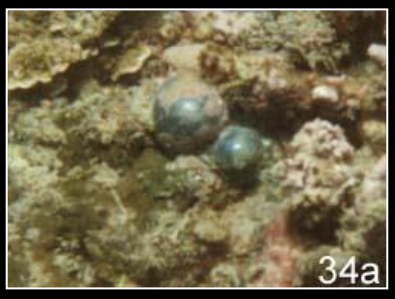


Figure 34 - *Ventricaria ventricosa.* Erakkandy, 1-2 m. Underwater photograph of two thalli amidst coral and other algae, growing at the surface, hence spherical in shape.

Two genera not described in the publication were collected subsequently and these are described and figured in the following section.

19. **Acetabularia**:
Calcified fronds consisting of a tall (up to 100 mm) stalk surmounted by a whorl of lateral branches containing chloroplasts. The lateral branches joined side-to-side forming a disc.

A. crenulata has been described by Durairatnam, 1961 from the Jaffna Lagoon and Kankesanturai. My specimens are only bleached, dried-up ones washed ashore on Casuarina Beach, Jaffna.

Acetabularia sp. was collected live at Kayankerni, Thennadi Bay, growing on shell fragments lying on the sand bottom near the shore.

(b) *Acetabularia* sp.
A live colony growing on a bivalve shell lying on the sand bottom at a depth of 2 metres. Diameter of whorls approx. 4 mm.

(c) Close-up view of the whorls.

Figure 19 -
(a) - *Acetabularia crenulata*

20: *Rhipidosiphon*:
Partially calcified filaments branching dichotomously at unequal levels, joined side-by-side forming a flat plant body, triangular in shape, producing similar-shaped daughter fronds. Said to grow to 40 mm high (Coppejans & van Reine, 1989); the specimen collected was 5 mm in height, without its attachment.

Wellawatte, reef opposite the railway station, 1.5 - 2 m, attached to gravel fragment adherent to rhizoids of *Caulerpa racemosa.* A serendipitous collection.

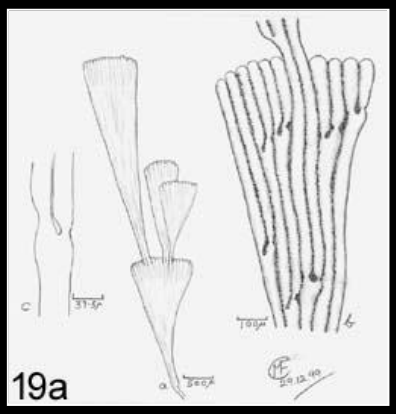
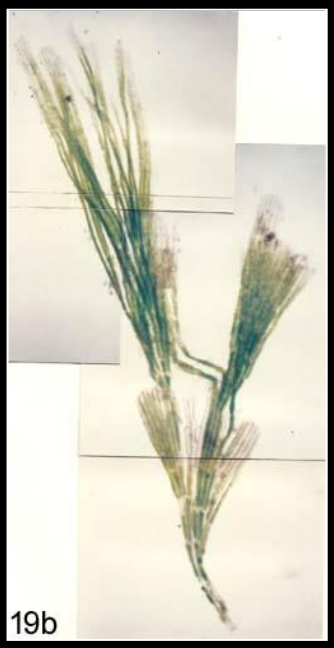


Figure 19 - *Rhipidosiphon javensis*
Wellawatte, Kinross First Reef.
(a) Drawing.
(b) Photomicrograph montage of the thallus. Actual size 5 mm.



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