ON THE SUBLITTORAL ALGAE OF THE HAIFA BAY AREA

Tikvah Edelstein

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INTRODUCTION

The sublittoral algal flora is everywhere considerably less known than its littoral counterpart. This is mainly due to the technical difficulties involved in the observation and collection of specimens. Of the few publications (*) devoted to the deep-water benthonic flora of the Mediterranean, most are concerned with its western parts only. No studies dealing with the sublittoral flora of the eastern Mediterranean are available in the literature as now, except for a note by STEUER (1935) in which some deep-water algae from Alexandria were briefly mentioned; the publication of H. HUVÉ (1957*a*) on *Tenarea undulosa* collected off Cape Matapan (southern Peloponnese) and P. HUVÉ (1957) on the population of rocky coasts of the same locality. In Israel, as elsewhere, the littoral flora was mainly dealt with (RAYSS, 1941, 1944, 1954, 1955). Fortunately, a scheme of oceanographic and biological survey carried out by the Sea Fisheries Research Station, Haifa, in the Haifa Bay area in 1955-56, made available many samples of deep-water benthonic algae. These were collected at regular time intervals at fixed stations situated over various types of sea bottom (See Map 1).

The microscopic algae contained in these samples were described in a previous publication (KOMAROVSKY and EDELSTEIN, 1960). The present paper deals with the macroscopic algae found in the same material.

(1) This paper is a part of a Ph. D. thesis submitted to the Senate of the Hebrew University, Jerusalem.

* RODRIGUEZ, 1888-89; URIARTE, 1921; FUNK, 1927; STEUER, 1935; FELDMANN, 1937, 1943; HUVÉ, 1954*a*, *b*; 1956; 1957*b*; ERCEGOVIĆ, 1957.

The area

The area investigated extends over 300 km², and is bounded by the geographical latitudes 33° 02′ N and 33° 50′ N, and to the west by the 50-fathom isobath. This area offers a considerable variety of types of sea bottom. It varies gradually from coarse sand covered by blocks of rocks and gravel (0 to 10 fathoms), to fine sand mixed with mud (10 to 20 fathoms), and finallly to mud (20 to 50 fathoms). The whole area is spinkled with small patches of rocks and gravel.

Hydrographical data (*)

The annual maximum and minimum temperatures of the Israel coast are known to be higher than the corresponding levels for the western Mediterranean (Oren, 1952; Rayss, 1955). The maximum water temperature (29,5 C°) for 1956 was recorded in September, and its minimum (17,4 C°) in March.

According to Oren (1952) these temperatures were considerably higher than the corresponding averages over several years. The salinity of the water in the same region remains at the same level between January and May (39 ‰), and reaches its maximum in August (39.24 ‰). The minimum recorded in September (37.64 ‰) is due to the direct influence of the influx of fresh water from the Nile reaching the shores at this time of the year.

Methods and material

A detailed description of the methods of collection, processing etc. was given in a previous paper (Komarovsky and Edelstein, 1960). We reproduce here only the following table :

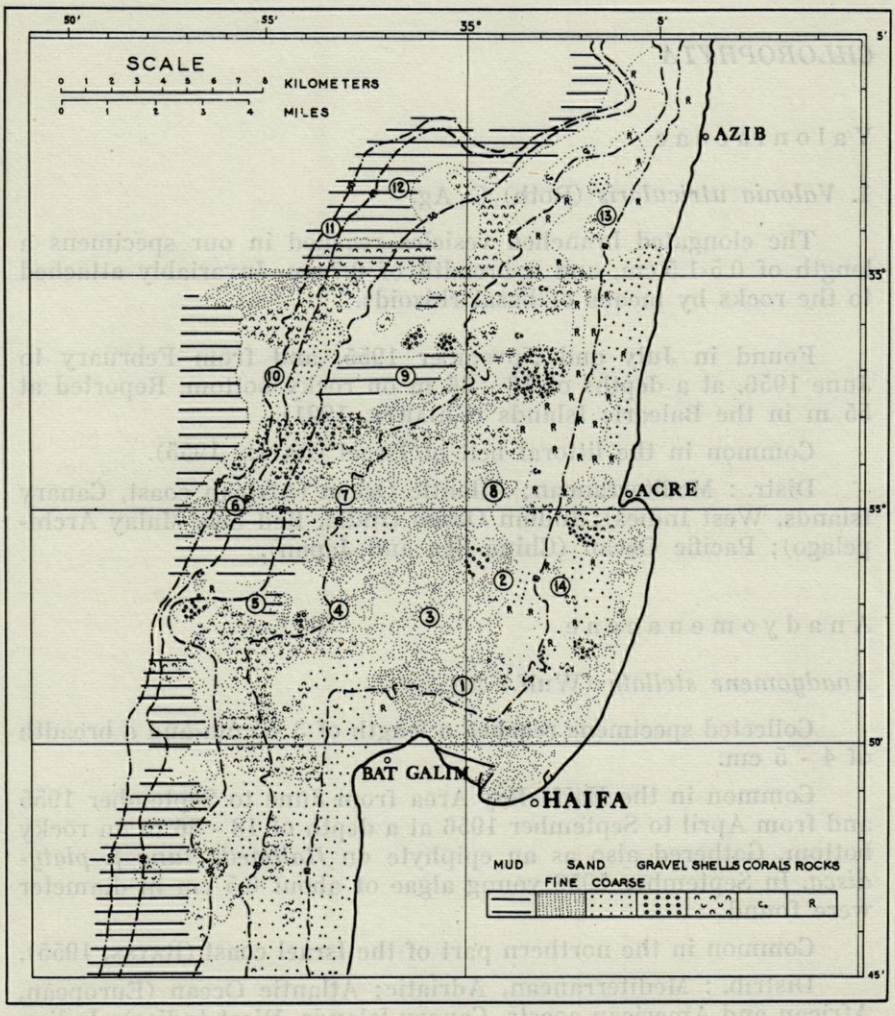
Table 1

Stations in the Haifa Bay Area - depth and type of bottom

Station No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
depth in fathoms **)	13	16	17	20	29	40	21	19	24	45	48	30	15	10
depth in meters	23	29	31	36	52	72	38	34	43	81	86	54	27	18
types of bottom	f.s.	r f.s	f.s	g s.m	r m	m	s.m	r s.m	s.m	m	m	m g	sh c.s	r

* The hydrographical data were made available by courtesy of O.H. Oren, Director, Sea Fisheries Research Station Haifa.

** 1 fathom = 1,8 m; f.s = fine sand; c.s = coarse sand; sh = shells; r = rocks; m = mud; g = gravel; s.m = sandy mud.



Map 1. — Haifa Bay, showing location of stations and types of sea bottom.

Description of species

The Cyanophyta has been already studied and reported (*) (Komarovsky and Edelstein, 1960). All other algae collected will be described here.

* A list of these species is given at the end of the section.

CHLOROPHYTA

Valoniaceae

1. *Valonia utricularis* (Roth) C. Ag.

The elongated branched vesicles reached in our specimens a length of 0.5-1.5 cm, and a breadth of 0.7 cm. Invariably attached to the rocks by means of basal rhizoids.

Found in July and November 1955, and from February to June 1956, at a depths of 18 - 36 m on rocky bottom. Reported at 55 m in the Balearic Islands (URIARTE, 1921).

Common in the littoral belt of Israel (RAYSS, 1955).

Distr. : Mediterranean; Atlantic Ocean (African coast, Canary Islands, West Indies); Indian Ocean (India, Red Sea, Malay Archipelago); Pacific Ocean (China Sea and Japan).

Anadyomenaceae

Anadyomene stellata (Wulf.) Ag.

Collected specimens reached a length of 3 - 5 cm and a breadth of 4 - 5 cm.

Common in the Haifa Bay Area from June to September 1955 and from April to September 1956 at a depth of 18 - 36 m on rocky bottom. Gathered also as an epiphyte on *Halimeda tuna f. platydisca*. In September 1956 young algae of about 0.5 cm in diameter were found.

Common in the northern part of the Israel coast (RAYSS, 1955).

Distrib. : Mediterranean, Adriatic; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (India and Malay Archipelago).

Cladophoraceae

Cladophora pellucida (Huds.) Kütz.

Filaments rigid, dark green, main axis 3 cm long and 200-400 μ in diameter, upper branches 100 - 200 μ only.

Found in June 1956 and July 1958 at a depth of 27 - 36 m, on rocky bottom. Recorded by FELDMANN (1943) at 20 to 30 m in

Algeria and 15 to 30 m off the Albères (1937), and by FUNK (1955) at 70 m in the Bay of Naples.

Common along the entire Israel coast, in shady places (RAYSS, 1955).

Distrib. : Mediterranean; Atlantic Ocean (from England to the Canary Islands).

Dasycladaceae

Dasycladus vermicularis (Scopoli) Krasser = *D. clavaeformis* (Roth) Ag.

Groups of well-developed specimens, attaining a height of 7 cm, together with younger ones, were collected from July to October 1955 and from February to August 1956, at a depth of 18 to 90 m, mostly on rocky bottom. Recorded by FUNK (1955) at 30 m in the Bay of Naples, and by STEUER (1935) at 90 m in Alexandria.

Common, but smaller in size, along the littoral belt of Israel (RAYSS, 1955).

Distrib. : Mediterranean; Adriatic; Atlantic Ocean (Canary Islands, African and American coast, Antilles, Caribbean Sea, Florida, Bermuda, Bahamas).

Derbesiaceae

Derbesia tenuissima (De Not.) Crouan

Filaments bright-green, reaching a length of 1 cm and breadth of 30 - 40 µ, arising in groups from the same point of attachment on the rocks.

Collected and common from May to November 1955, and from April to May 1956, at a depth of 18 - 36 m on rocky bottom.

Recorded by FUNK (1955) at 20 m in the Bay of Naples.

Distr. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands), Indian Ocean (Red Sea).

Derbesia neglecta Berthold

Only two small plants found, 0,5 - 1 cm, in length and 50 µ in diameter, attenuated upwards till 20 µ.

Rare, collected in September 1955 as an epiphyte on *Halimeda tuna f. platydisca,* and in July 1958 at a depth of 18 - 27 m in rocky stations. Mentioned by FUNK (1955) at 20 m in the Bay of Naples.

Distr. : Mediterranean; Atlantic Ocean (West Indies); Indian Ocean (Red Sea).

Caulerpaceae

Caulerpa prolifera (Forsk.) Lamouroux

Found only once in February 1956 at a depth of 36 m in a sandy station. According to STEUER (1935) forms in Alexandria submarine grassland at 90 m depth. Recorded also by MOLINIER and PICARD (1954*a*) at 15 - 45 m in the Gulf of Tunis.

Common along the littoral belt of Israel (RAYSS, 1955).

Distrib. : Mediterranean; Atlantic Ocean (Canary Islands, American coast, Florida, West Indies); Absent in the whole Indo-Pacific region and in the Red Sea.

Caulerpa racemosa (Forsk.) J. Ag. var. *lamourouxii* (Turner) Weber van Bosse, f. *requienii* (Montagne) W.v.B.

Rhizomes pale, 2 - 3 mm in diameter, attached to the rocks by means of branched rhizoids. The upright cylindrical assimilatory shoots, 7 cm long, are naked, not bearing any lateral bladders, characteristic of the species racemosa. This tropical alga was found for the first time in Israel waters. Specimens collected by us did not reach the dimensions given by HUVÉ (1957*b*) for the same alga from Castellorizo, but correspond to these of the specimens collected by AMAR in 1954 at Lattaquié (cf. HUVÉ, 1957*b*); found in June 1955 and July 1958 at a depth of 54 - 72 m, on rocky bottom. Details and distribution given in a previous paper• (RAYSS and EDELSTEIN, 1960).

Caulerpa scalpelliformis (Brown) Ag. (fig. 1).

One of the most frequent algae in the Haifa Bay Area, forming large fields on the sand, mud and sandy-mud types of sea bottom.

Young fronds 0,5 cm in breadth together wit holder ones reaching 1 cm breadth, as well as naked pale rhizomes, bearing numerous rhizoids, were collected all the year round, at a depth of 18 - 90 m.

Recorded in many locations along the littoral belt of Israel but not so common as *C. prolifera* (RAYSS, 1955).

Distrib. : Mediterranean (the Eastern part only); Atlantic Ocean (Canary Islands, Angola coast of Africa, coast of Brazil in America); Indian Ocean (Red Sea, coasts of Africa, Ceylon, the Malay Archipelago); Indo-Pacific region; Pacific Ocean (Japan, China, Australia, Polynesia).

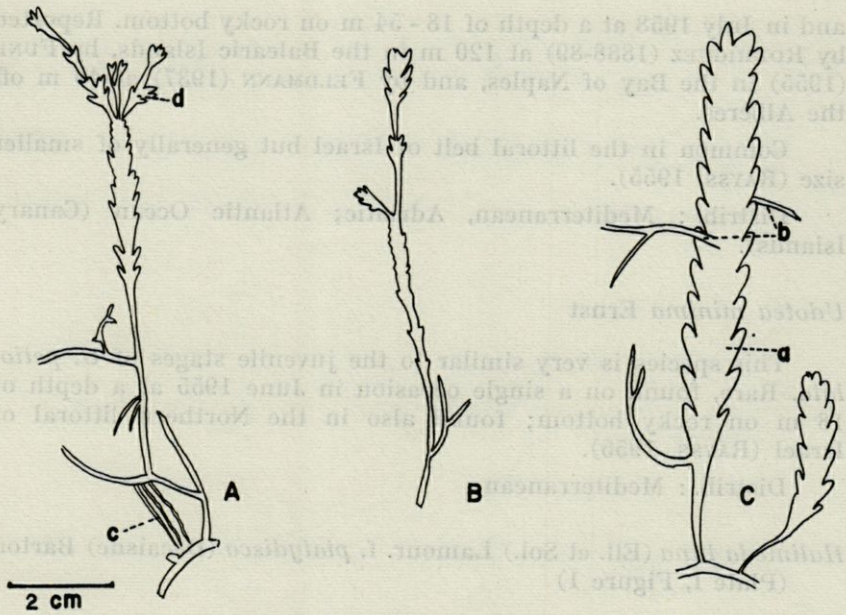


FIG. 1. — *Caulerpa scalpelliformis;* various morphological forms. A, B, C, were collected in April 1956. (a) mature thalling lobe. (b) colourless young stolons, (c) rhizoids, (d) young thallus lobes.

Udoteaceae

Pseudochlorodesmis furcellata (Zanard.) Börgesen

Erect filaments 1 cm in length, dichotomously branched at upper region.

Rare, found only on a single occasion in September 1956 at a depth of 54 m as an epiphyte on *Halimeda tuna f. platydisca.* Recorded by FELDMANN (1943) at 25 m in Algeria, and by FUNK (1955) at 25 to 45 m in the Bay of Naples.

Already collected in the northern littoral of Israel (RAYSS, 1955).

Distr. : Mediterranean, Adriatic; Atlantic Ocean (Canary Islands and the Azores).

Udotea petiolata (Turra) Börgesen

Well developed specimens, 5 - 7 cm in length, found in groups from May to November 1955, from February to September 1956

and in July 1958 at a depth of 18 - 54 m on rocky bottom. Reported by Rodriguez (1888-89) at 120 m in the Balearic Islands, by Funk (1955) in the Bay of Naples, and by Feldmann (1937) at 40 m off the Albères.

Common in the littoral belt of Israel but generally of smaller size (Rayss, 1955).

Distrib. : Mediterranean, Adriatic; Atlantic Ocean (Canary Islands).

Udotea minima Ernst

This species is very similar to the juvenile stages of *U. petiolata*. Rare, found on a single occasion in June 1955 at a depth of 18 m on rocky bottom; found also in the Northern littoral of Israel (Rayss, 1955).

Distrib. : Mediterranean.

Halimeda tuna (Ell. et Sol.) Lamour. f. *platydisca* (Decaisne) Barton (Plate I, Figure 1)

Most of the rocky stations in the Haifa Bay Area are densely populated with this species, especially those consisting of dead corals. The calcified thallus is heavily covered with various kinds of epiphytic algae (Edelstein and Komarovsky, 1961).

The forma *platydisca* is specific for deep waters; common the year round at a depth of 18 - 36 m. Plants bearing gametangia were found in June 1955 and May 1956. Recorded by Funk (1955) at 50 m in the Bay of Naples, and by Feldmann (1937) at 40 m off the Albères.

Distrib. : Mediterranean; Atlantic Ocean (Canary Islands, Florida, Bermuda, Bahamas, West Indies).

Halimeda tuna (Ell. et Sol.) Lamour f. *typica* Barton

Very similar to the *f. platydisca,* differing only in the smaller breadth of the segments.

Collected during April and May 1955 and June and September 1956, only at a depth less than 18 m on rocky bottom. Reported by Feldmann (1937) at 10 m off the Albères.

Common and scattered all along the Israel coast (Rayss, 1955).

Distrib. : Mediterranean, Adriatic; Atlantic Ocean (West Indies, European and African coast); Indian Ocean (Red Sea, India, Malay Archipelago); Pacific Ocean (Japan, America, Australia, Polynesia).

PHAEOPHYTA

Ectocarpaceae

Giffordia mitchellae (Harv.) Hamel (= *Ectocarpus virescens* Thuret)

Filaments highly branched, articulations of mean axis 2 - 3 times as long as broad, in the short branches 1,5 times. Elliptic sessile plurilocular sporangia (20 × 30 µ) found in July 1956.

Collected in May and July 1956 at a depth of 18 - 27 m on rocky bottom.

Distrib. : Mediterranean; Atlantic Ocean (from England to Canary Islands); all the warm seas.

Mesogloeaceae

Liebmannia leveillei J. Ag. (Plate I, fig. 2).

Plants filiform, 7 - 10 cm in length and 0.1 cm in diameter; olive-green. Assimilatory filaments 200 µ in length. Uni- and plurilocular sporangia found in June and August 1956 on the same plant. Unilocular sporangia 40 × 60 µ, plurilocular ones 40 × 130 µ, pedunculated.

Common in May 1955 and from April to October 1956 at a depth of 18 - 27 m on rocky bottom, always as an epiphyte on *Halimeda tuna f. platydisca.* Recorded by Funk (1955) at 20 m in the Bay of Naples.

Distr. : Mediterranean; Atlantic Ocean (from the Channel to Tangier).

Spermatochnaceae

Spermatochnus paradoxus (Roth) Kütz.

Fronds 10 - 15 cm in length, highly branched in a subdichotomous manner. Sporangia 15 µ in length, together with paraphyses and secondary assimilating filaments in small sori, scattered all over the thallus; collected in June 1955 and in the same month in 1956 at a depth of 27 - 36 m on rocky bottom, always as an epiphyte on Cystoseira platyramosa. Fund by Feldmann (1937) at 20 - 30 m off the Albères.

Distrib. : Mediterranean; northern part of the Atlantic Ocean.

Scytosiphonaceae

Colpomenia sinuosa (Mert.) Derb. et Sol.

Young plants in form of sinuous vesicles, 1 - 2 cm in diameter. The deep-water form appears to be more fragile than the littoral plants, thickness of the thallus in cross section, being 350 - 400 μ whereas in the littoral plants it reaches 500 μ. Plurilocular sporangia 30 - 35 μ in length, gathered in sori.

Rare, found only on a single occasion in July 1956 at a depth of 27 m on rocky bottom. Recorded by FELDMANN (1937) at 10 m off the Albères, and at 9 to 12 m in Algeria (1943).

Distrib. : Mediterranean; Atlantic Ocean (African, European and Aemrican coasts, West Indies, Canary Islands); Indian Ocean (Red Sea, Africa, India, Ceylon, Australia, Malay Archipelago); Pacific Ocean (Japan, China, Australia, Polynesia, America).

Rosenvingea intricata (J. Ag.) Börgesen

Thallus tube-like, some mm in diameter, highly branched irregularly.

Found in July 1955 and in the same month in 1958 at a depth of 18 - 54 m in rocky stations as an epiphyte on *Halimeda tuna f. platydisca*. Recorded by FELDMANN (1943) at 26 m in Algeria.

Distrib. : Mediterranean; Atlantic Ocean (African coast, West Indies); Indian Ocean (Red Sea, Malay Archipelago); Pacific Ocean (Polynesia).

Sphacelariaceae

Halopteris filicina (Gratel.) Kütz.

Plants collected young, reaching only 1 cm in length; rare, found in September 1956 at a depth of 18 m in a rocky station. Found by FUNK (1955) at 10 to 20 m in the Bay of Naples, by FELDMANN (1937) at 40 m off the Albères and at 30 m in Algeria (1943), and by URIARTE (1921) at 63 - 112 m near the Balearic Islands.

Distrib. : Mediterranean; Atlantic Ocean (from England to Morocco).

Sporochnaceae

Nereia filiformis (J. Ag.) Zanard.

Well-developed specimens reaching a length of 5 - 30 cm collected in May, June and September 1956 at a depth of 18 - 36 m

on rocky bottom. Young plants consisting of a short stalk, 1 cm in length, bearing some groups of brush-like assimilators found in April 1956. Recorded by FELDMANN (1937) at 30 m off the Albères, and at 25 m in Algeria (1943), by FUNK (1955) at 90 m in the Bay of Naples, and by RODRIGUEZ (1888-89) at 110 m. near the Balearic Islands.

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands); Indian Ocean (Red Sea).

Cutleriaceae

Zanardinia prototypus Nardo

Round membranous crust, 1 - 15 cm in diameter, blackish-brown, attached to the substratum only by its middle region.

Collected in June 1955 and in April 1956 at a depth of 18 - 36 m on sandy and rocky bottom. Found by FELDMANN (1937) at 40 m off the Albères, at 9 - 30 m in Algeria (1943); and by HUVÉ (1956) at 40 - 45 m, off the coast of Marseilles.

Distrib. : Mediterranean; Atlantic Ocean (from Southern England to Tangier).

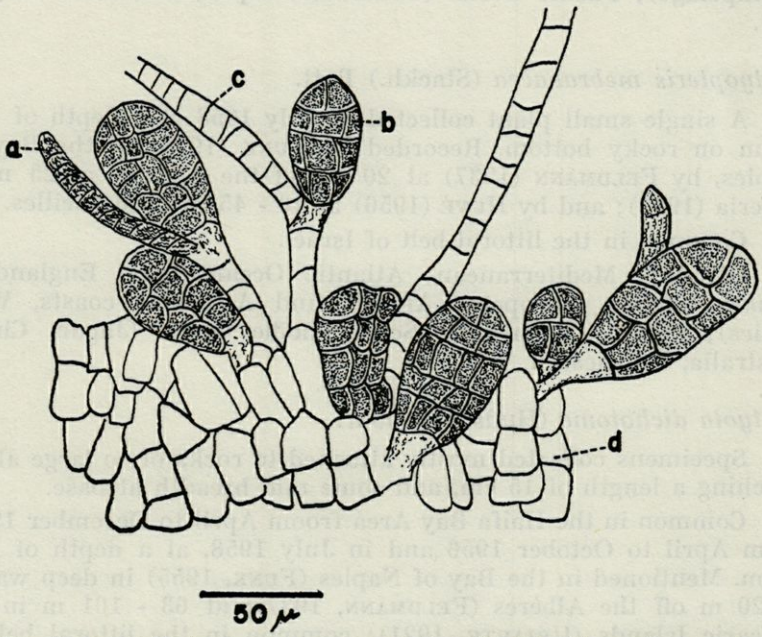


FIG. 2. — *Cutleria monoica;* sorus of antheridia (a), and oogonia (b), (c) sterile hairs, (d) surface cells of the thallus.

Cutleria monoica Ollivier (fig. 2).

Plants small, reaching only a length of 6 cm and a breadth of 0.2 - 0.3 cm at base. Monoecious, Antheridia 10-11 μ × 60-140 μ and Oogonia 17-28 μ × 40-60 μ in the same sorus; collected in April and May 1956 at a depth of 18 m in a rocky station as an epiphyte on *Halimeda tuna f. platydisca* and *Zanardinia prototypus*. Recorded by FELDMANN (1937) at 20 - 30 m off the Albères.

Distr. : Mediterranean.

Dictyotaceae

Padina pavonia Gaillon

Two well-developed specimens, 10 cm in length, found in July 1958 at a depth of 18 - 27 m on rocky bottom. Collected by FUNK (1955) at 20 m in the Bay of Naples, by FELDMANN (1937) at 10 m off the Albères, and by URIARTE (1921) at 30 m in the Balearic Islands.

Distrib. : Mediterranean; Atlantic Ocean (African and European coasts, West Indies); Indian Ocean (Red Sea, India, Malay Archipelago); Pacific Ocean (China Sea, Japan, Australia, Polynesia).

Dictyopteris mebranacea (Stackh.) Batt.

A single small plant collected in July 1958 at a depth of 18 - 27 m on rocky bottom. Recorded by FUNK (1955) in the Bay of Naples, by FELDMANN (1937) at 20 m, off the Albères, at 25 m in Algeria (1943); and by HUVÉ (1956) at 40 - 45 m in Marseilles.

Common in the littoral belt of Israel.

Distrib. : Mediterranean; Atlantic Ocean (from England to Canary Islands, European, African and American coasts, West Indies); Indian Ocean (Red Sea); Pacific Ocean (Japan, China, Australia, Polynesia).

Dictyota dichotoma (Huds.) Lamour.

Specimens collected mostly attached to rocks or to large algae, reaching a length of 15 cm, and some mm breadth at base.

Common in the Haifa Bay Area froom April to December 1955; from April to October 1956 and in July 1958, at a depth of 18 - 36 m. Mentioned in the Bay of Naples (FUNK, 1955) in deep water; at 20 m off the Albères (FELDMANN, 1937); at 63 - 101 m in the Balearic Islands (URIARTE, 1921); common in the littoral belt of Israel.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon, Australia); Pacific Ocean (Japan, China, Australia, Polynesia).

Dictyota linearis (Ag.) Grev.

Similar to *D. dichotoma,* differs only in the more delicate thallus; branches 7 cm in length and 1 mm breadth at base, attenuated to 0.1 mm at upper ends; found from June to August 1955 and in July 1958 at a depth of 27 - 36 m on rocky bottom. Recorded in Bay of Naples (FUNK, 1955) at 20 m; off the Albères (FELDMANN, 1937) at 30 m; at 25 m in Algeria (FELDMANN, 1943) and at 110 m in the Balearic Islands (RODRIGUEZ, 1880-89).

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (India, Malay Archipelago); Pacific Ocean (Japan).

Pocockiella variegata (Lamour.) Papenfuss
Dictyota variegata Lamouroux = *Zonaria variegata* J. Ag.

Plants some cm in diameter, flat, fan-shaped, Sporangia and multicellular paraphyses arranged in sori on the upper surface, and covered with a cuticle-like layer.

Densily populating the rocks in July and September 1955 at a depth of 27 - 36 m. Mentioned by BÖRGESEN (1926) at 10 - 40 m in the West Indies.

Distrib. : Mediterranean; Atlantic Ocean (African and American coasts, Canary Islands, West Indies); Indian Ocean (India, Ceylon, Red Sea, Malay Archipelago); Pacific Ocean (Australia, Polynesia).

Spatoglossum solierii (Chauv.) Kütz.

Fronds broad, irregularly branched reaching 15 cm in length.

Collected in June-October 1955 and April and September 1956, at 18 - 36 m on rocky bottom, sometimes as an epiphyte on *Halimeda tuna f. platydisca.*

Common in the littoral belt of Israel, especially in the late summer and autumn, but deep-water plants are more fragile.

Distrib. : Mediterranean; Atlantic Ocean (from Brest to Dakar, Northern coast of America).

Sargassaceae

Sargassum acinarium (L.) Ag.

Small plants bearing air-bladders and branched receptacles, collected in June-December 1955 and April-May at a depth of 18 - 90 m mostly in rocky stations, sometimes on sand.

Distrib. : Mediterranean.

Sargassum vulgare C. Ag. *var. megalophyllum* (Mont.) Grun.

Mean stalk short, 3 cm only, « leaves » elongated, reaching a length of 8 cm and a breadth of 1 cm; some are forked at their upper end, margins deeply denticulate, teeth sometimes divided.

Found in July 1955 at a depth of 27 - 36 m on rocky bottom.

Distrib. : Mediterranean; Atlantic Ocean (Canary Islands).

Sargassum vulgare C. Ag. var. *coarctatum* Küz.

Very similar to the *var. megalophyllum*, differs only in the undulate margins of the fronds; rare, collected in August 1955, 18 - 54 m on rocky bottom.

Distrib. : Mediterranean.

Cystoreira platyramosa Erceg. (Plate I, fig. 3)

Stalk cylindrical, 4 - 5 cm in length gradually flattened into dichotomous narrow branches 2 mm in breadth, arranged in one plane. Specimens collected in August 1955 bear tophuli with spiny outgrowth from which the yung laterals grow out. Older basal parts of the plant found at the same time.

Collected from June to December 1955, and from April to October 1956, at a depth of 18 - 90 m mostly on rocky bottom. Recorded by Ercegović (1957) as a neoendemic species in the Adriatic.

Distrib. : Adriatic.

RHODOPHYTA

Bangiaceae

Goniotrichum alsidii (Zanard.) Howe

Filaments microscopic, 3 - 5 mm in length and up to 20 μ thick

at base; branched several times, composed of one row of small elliptical cells (3 × 6 μ) enclosed in hyaline sheath.

Collected in April 1956, at a depth of 18 - 27 m ephiphytic on *Udotea petiolata*. Mentioned by FUNK (1955) in the Bay of Naples at 35 m; by FELDMANN (1937) off the Albères at 30 m.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, West Indies); Indian Ocean (India, Red Sea, Malay Archipelago); Pacific Ocean (China Sea, Japan, America, Australia and Polynesia).

Chaetangiaceae

Galaxaura adriatica Zan.

Plants collected 5 - 8 cm long and 1 mm in diameter; length of articulations 5 - 10 mm.

Common in the Haif a Bay area the year round, at a depth of 18 - 36 m on rocky bottom together with other Calcareous algae.

Rare in littoral zone and in a few places only along the Israel coast.

Distrib. : Mediterranean; Atlantic Ocean (Canary Islands, West Indies); Indian Ocean (Red Sea).

Gelidiaceae

Gelidium latifolium (Grev.) Thur. et Born.

The single young plant collected, 2,5 cm in length, and 1 mm breadth, agrees well with the description of *G. latifolium var. typica* from the coast of France given by FELDMANN and HAMEL (1936-37).

Collected in November 1955 at a depth of 18 - 27 m in a rocky station.

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands); Indian Ocean (Red Sea, Malay Archipelago); Pacific Ocean (Coasts of Japan, China and America).

Gelidium pectinatum (Schousb.) Mont.

Specimens 2 - 4 cm in length widely distributed during all seasons, always in association with calcareous algae.

Common at a depth of 18 - 90 m in rocky stations.

Young plants only a few mm long collected in April 1955.

Recorded by FELDMANN (1937) at 30 m off the Albères.

Distrib. : Mediterranean; Atlantic Ocean (from South of France to Cadiz, Canary Islands).

Wurdemannia miniata (Drap.) Feldmann at Hamel = *Gelidium miniatum* Kütz.

Resembles in appearance *Gelidium* but differs in its anatomical structure and zonate tetrasporangia.

Common the year round at a depth of 18 - 90 m mostly in rocky stations. Recorded by FELDMANN (1937) off the Albères in shallow waters.

Distrib. : Mediterranean; Atlantic Ocean (Canary Islands, West Indies); Indian Ocean (Mauritius); Pacific Ocean.

Dumontiaceae

Acrosymphyton purpuriferum (J.Ag.) Sjöstedt
= *Dudresnaya purpurifera* J.Ag.

A pale rose gelatinous alga, 4 cm in length and 3 mm in diameter, collected in April 1956 at 18 - 27 m on rocky bottom. Recorded by FELDMANN (1937) at 30 m, off the Albères, and by FUNK (1955) from the Bay of Napales, in shallow waters.

Distrib. : Mediterranean; Pacific Ocean.

Rhizophyllidaceae

Rhizophyllis squamariae (Menegh.) Kütz. (Plate II, fig. 2)

Thallus flat, always creeping on Peyssonnelia squamaria as epiphyte. In cross section 160 µ thick, traversed by a single row of axial cells, 15-20 × 20-25 µ. Some layers of small cells at upper region, lower part covered with many rhizoids 400 - 450 µ in length and 12 µ in diameter.

Collected in March 1956 at a depth of 27 - 36 m creeping on *Peyssonnelia* on gravel bottom. Recorded by FELDMANN (1937) at 30 m, off the Albères coast; by FUNK (1955) at 35 m in the Bay of Naples, and by HUVÉ (1956) in Marseilles.

Distrib. : Mediterranean.

Squamariaceae

Peyssonnelia squamaria (Gmel.) Decsne.

Fronds crust-like, 2 - 5 cm in diameter, attached to rocks or to large algae, sometimes free.

Common in the Haifa Bay area the year round at a depth of 18 - 27 m mostly in rocky stations. Recorded by FELDMANN (1937) at 30 m, off the Albères coast, by FUNK (1955) from the same depth in the Bay of Naples, by ERCEGOVIĆ (1957) at 60 m in the Adriatic and by URIARTE (1921) at 40 - 50 m in the Balearic Islands.

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands); Indian Ocean (Red Sea).

Peyssonnelia rubra (Grev.) J.Ag.

A reddish-purple alga attached to the substratum by means of rhizoids. Thallus, in cross section, 100 - 200 μ thick; the hypothallium layer composed of one or two rows of cells 10 - 15 μ in diameter; basal cells mostly calcified; rectangular cells of the perithallium, 15 μ in length and 13 μ breadth, arranged in erect compact threads.

Common the year round at a depth of 18 - 90 m in rocky stations, sometimes as an epiphyte on *Halimeda tuna f. platydisca*. Recorded by FELDMANN (1937) at 25-30 m, off the Albères coast, and by ERCEGOVIĆ (1957) at 40 m in the Adriatic.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon, Malay Archipelago); Pacific Ocean (Japan, China, Australia, Polynesia and America).

Peyssonnelia polymorpha (Zanard.) Schm.

Crusts highly calcified, loosely attached to rocks. Thallus, in cross section, 280 μ thick, provided with rhizoids. Hypothallium of one layer of cells 60 × 60 μ in diameter, cells of perithallium arranged in diagonal threads decreasing in size towards upper part.

Collected in October 1955 and July 1956 at a depth of 18 - 36 m on rocky bottom. Recorded by URIARTE (1921) at 40 m in the Balearic Islands; by FELDMANN (1937), from the same depth, off the Albères; by FUNK (1955) from a great depth in the Bay of Naples, and by HUVÉ (1956) at 40 - 45 m, off Marseilles.

Distrib. : Mediterranean; Atlantic Ocean (Canary Islands, West Indies).

Corallinaceae

Lithothamnium calcareaum (Pallas) Aresch.

A small branched plant with flat asexual conceptacles on the upper region, collected in April 1956 at a depth of 36 - 54 m on gravel. Recorded by FELDMANN (1937) from deep waters off the Albères, and by HUVÉ (1956) at 40 - 50 m from Marseilles.

Distrib. : Mediterranean; Atlantic Ocean (coasts of England and France).

Lithothamnium sonderi Hauck

Crusts 0.2 - 2 mm thick, attached to rocks, bearing asexual conceptacles.

Found in August 1955 at a depth of 18 - 36 m, in rocky station.

Distrib. : Mediterranean; Atlantic Ocean (coasts of England and France, Canary Islands).

Lithophyllum byssoides (Lamarck) Foslie

Strongly calcified branches of the plant adhering closely to rocks all along their length and connected to each other without any order. Recorded by P. HUVÉ (1957), at 5 m, off Cap Matapan, Peloponnese, Greece.

Collected in February and May 1956 at a depth of 18 m on rock bottom.

Distrib. : Mediterranean.

Dermatolithon papillosum (Zanard.) Fosl.

Crusts 0,5 - 2 cm in diameter adhering to rocks.

Rare, found only on a single occasion in August 1955, at a depth of 18 - 36 m in a rocky station.

Distrib. : Mediterranean; Atlantic Ocean (coasts of France).

Pseudolithophyllum expansum (Phil.) Lemoine

This calcified alga is widely distributed in the Haifa Bay area, forming a special association on rocky bottom.

Common the year round, at a depth of 18 - 36 m. Recorded by URIARTE (1921) at 83 m in the Balearic Islands; by FELDMANN (1937) at 40 m depth, off the Albères, and by FUNK (1955) in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (Canary Islands and the Azores, Mauretanian coasts).

Melobesia farinosa Lamour.

Species very common, as an epiphyte on various algae, the year round at a depth of 18 - 54 m, mostly in rocky stations. Recorded by FELDMANN (1937) at 30 m, off the Albères, and by FUNK (1955) in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands, West Indies); Indian Ocean (Red sea, Malay Archipelago, India, Ceylon, Australia); Pacific Ocean (Japan, China, Polynesia, America).

Amphiroa rigida Lamour.

Many specimens, reaching a length of 4-5 cm, found mostly together with other calcareous algae.

Common the year round at depth of 18 - 90 m, on rocky bottom. Recorded by FELDMANN (1937) off the Albères, in shallow waters.

Scattered along the littoral belt of Israel.

Distrib. : Mediterranean; Atlantic Ocean (Biarritz, Morocco).

Amphiroa cryptarthrodia Zanard.

Very similar to *A. rigida* but differing in anatomical details.

Found in September 1956 at a depth of 18 m, on rocky bottom. Collected by FUNK (1955) in the Bay of Naples.

Rather common along the littoral belt of Israel.

Distrib. : Mediterranean; Atlantic Ocean (Biarritz).

Jania rubens (L.) Lamour.

A single plant of this species collected in July 1958, at a depth of 18 - 27 m on rocky bottom. Recorded by FUNK (1955) at 30 m in the Bay of Naples, and by HUVÉ (1956) at 40 - 45 m in Marseilles.

Very common along the littoral belt of Israel.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon, Malay Archipelago); Pacific Ocean (Japan, China, Australia and Polynesia).

Grateloupiaceae

Halymenia dichotoma J.Ag.

Specimens collected reached a length of 4 - 5 cm and a breadth of 2 mm at their base, pale rose. In cross section large cells are filling the centre, gradually diminishing towards the periphery.

Found in May, July and September 1956 at a depth of 18 - 54 m on rocky bottom, sometimes as epiphyte on *Caulerpa scalpelliformis*.

Recorded by FELDMANN (1937) at 40 m, off the Albères and by FUNK (1955) at 20 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (adjoining regions of the Mediterranean).

Halymenia floresia (Clemente) C.Ag.

The deep-water form appears to be more fragile than the littoral plants, purple red.

Collected in November 1955 and in July 1958 at a depth of 18 - 27 m on rocky bottom. Found by FELDMANN (1937) at 30 m, off the Albères, and by FUNK (1955) at 20 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European, Africa and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon, Australia, Malay Archipelago); Pacific Ocean (Japan, China, Australia).

Callymeniacea

Callymenia microphylla J.Ag.

Plants 1 - 1.5 cm in length, young ones only a few mm.

Rather common, in the Haifa Bay area, the year round at a depth of 18 to 90 m, always attached to rocks. Recorded by FUNK (1955) at 25-70 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (from England to Cadiz, Canary Islands).

Callymenia reniformis (Turn.) J.Ag.

Authors' specimens agree well with *C. reniformis* var. *undulata* J.G. Agardh figured by NEWTON (1931) from the coasts of England.

Rather common the year round at a depth of 17 to 50 m in rocky and gravel stations. Plants with cystocarps encountered in July 1955.

Distrib. : Mediterranean; Atlantic Ocean (from England to Morocco, American coasts); northern parts of the Pacific Ocean.

Gracilariaceae

Gracilaria confervoides (L.) Grev.

Single specimen 10 cm in length found in April 1956, at a depth of 36 - 54 m attached to rocks by means of a small disc. Recorded by Huvé (1956) at 40 - 45 m in Marseilles.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon, Malay Archipelago, Austraila); Pacific Ocean (Japan, China, Australia, Polynesia and America).

Gracilaria dura (C.Ag.) J.Ag.

Erect fronds 8 - 10 cm in length and 2 mm in diameter, attenuate towards the apex, and attached to small rocks by means of creeping branched fibres.

Rare, found only on a single occasion in March 1956 at a depth of 36 - 54 m on rocky bottom. Recorded by Funk (1955) at 10 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (warmer regions); Indian Ocean.

Phyllophoraceae

Phyllophora palmettoides J.Ag. (Figure 3)

A highly variable species, collected in various forms. Most of the plants are stipitate, cylindrical stalks are 1 - 2 cm long, dichotomously branched, expanding into a flat leafy elongated, oval or fan-shaped lobes.

Common in the Haifa Bay area the year round, at a depth of 27 to 90 m, on gravel and rocky bottom. Recorded by Funk (1955), from shallow waters in the Bay of Naples.

Distrib. : Mediterranean.

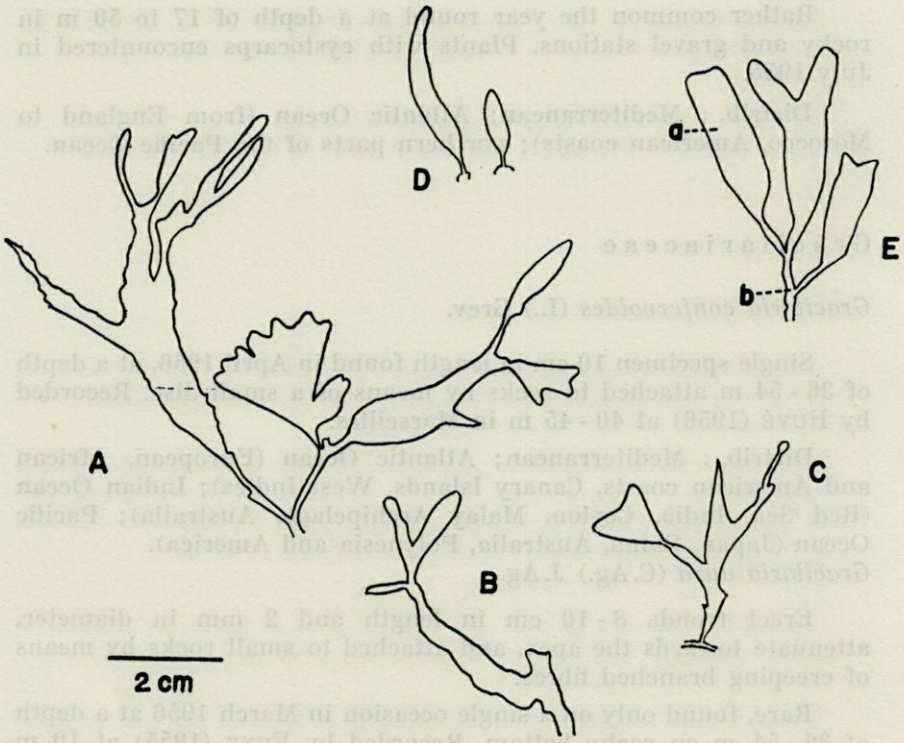


FIG. 3. — *Phyllophora palmettoides;* various morphological forms. A, B, D, E, were collected in June 1955, C, in May 1956. (a) flat lobes of thallus, (b) cylindrical stalk.

Rhodymeniaceae

Chrysymenia ventricosa (Lamour.) J.Ag.

Specimens collected reached a length of 5 cm, irregularly clefted.

Found in April, June and August 1955, at a depth of 18 - 90 m, in rocky stations. Recorded by RODRIGUEZ (1888-89) at 130 m in the Balearic Islands; by FELDMANN (1937), at 15 - 40 m, off the Albères and by FUNK (1955) at 10 - 20 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands, West Indies); Indian Ocean (Red Sea).

Botryocladia botryoides (Wulf.) Feldmann

Small specimens collected in September and October 1955 and in April 1956, at a depth of 27 - 54 m, in rocky stations.

Common in the littoral belt of Israel in sheltered sites. This species prefers shady localities, changing its colour according to the intensity of light.

Distrib. : Mediterranean; Atlantic Ocean (from Cadiz to Canary Islands).

Lomentariaceae

Chylocladia kaliformis (Good. et Woodw.) Grev.

Specimens of the Haifa Bay area agree well with the description of the plants collected by ERCEGOVIĆ (1956) near Vodnjak at 15 - 20 m and at Palagruza at 20 m (pp. 44-45, Figure 45). Thallus in cross section 100 µ thick, composed of one row of large square cells, 50-90 µ × 80-90 µ, and a few small cortical cells towards the periphery.

Collected in April and August 1955, and in May 1956 at a depth of 18 - 27 m on rocky bottom, sometimes as epiphyte on *Halimeda tuna f. platydisca.* Tetrasporic and cystocarpic plants found in August 1955. Recorded by FELDMANN (1937) at 30 m, off the Albères and by FUNK (1955) at 10 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (From Sweden to Canary Islands).

Ceramiaceae

Griffithsia tenuis J.Ag.

Plants highly fragile, 1 - 1,5 cm in length, articulated, main axis bearing whorls of branched ramuli at each node. Articulation 100 - 200 µ in diameter and 4 - 6 times as long as broad. Tetrasporangia stipitate, in whorls.

Collected in August 1955 and September 1956 at a depth of 18 m on rocky bottom as epiphyte on *Halimeda tuna f. platydisca.*

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon, Australia); Pacific Ocean (Japan, China, Australia and Polynesia).

Griffithsia schousboei Mont.

Specimens collected reached a length of 3 - 5 cm and 1 mm in diameter.

Found in August 1955 and in April 1956 at a depth of 18 - 36 m,

attached to rocks or to *Halimeda tuna f. platydisca.* In April 1956 tetrasporic plants were collected. Recorded by FUNK (1955) at 10 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (from the Bay of Biscay to Canary Islands, West Indies).

Neomonospora furcellata (J.Ag.) G. Feldm. et Meslin.

= *Griffithsia furcellata* J.Ag.

Plants with mono- and tetrasporangia collected in September 1955, at a depth of 27 m on sandy bottom, as epizoic on the stems of Hydrozoa.

Distrib. : Mediterranean; Atlantic Ocean (coasts of France, Canary Islands).

Crouania attenuata (Bonnem.) J.Ag.

The young specimen collected, 1 cm in length, resembles the one described by ERCEGOVIĆ (1949) as *Crouania attenuata var. major* Erceg.; however, not all dimensions agree well with those recorded by the above author, possibly due to the fact that ours was a young plant.

Collected in August 1956 at a depth of 18 - 36 m in a rocky station as an epiphyte on *Halimeda tuna f. platydisca.* Found by FUNK (1955) at 20 - 40 m, in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands, West Indies, America); Indian Ocean (Red Sea, Australia); Indo-Pacific region; Pacific Ocean (Australia, Polynesia).

Wrangelia penicillata C. Ag. (fig. 4).

A single plant collected in July 1955, at a depth of 27 - 36 m, on rocky bottom. Recorded by FUNK (1955) at 70 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Malay Archipelago); Pacific Ocean (Japan and Australia).

Ceramium comptum Börgesen

Plants small, 0,5 cm in length and 60 - 80 μ in diameter, fronds branched, attenuating towards the upper region and terminating in a point, corticating rings 40 μ high, composed of large rounded cells, 20 × 26 μ together with smaller ones 7 - 13 μ.

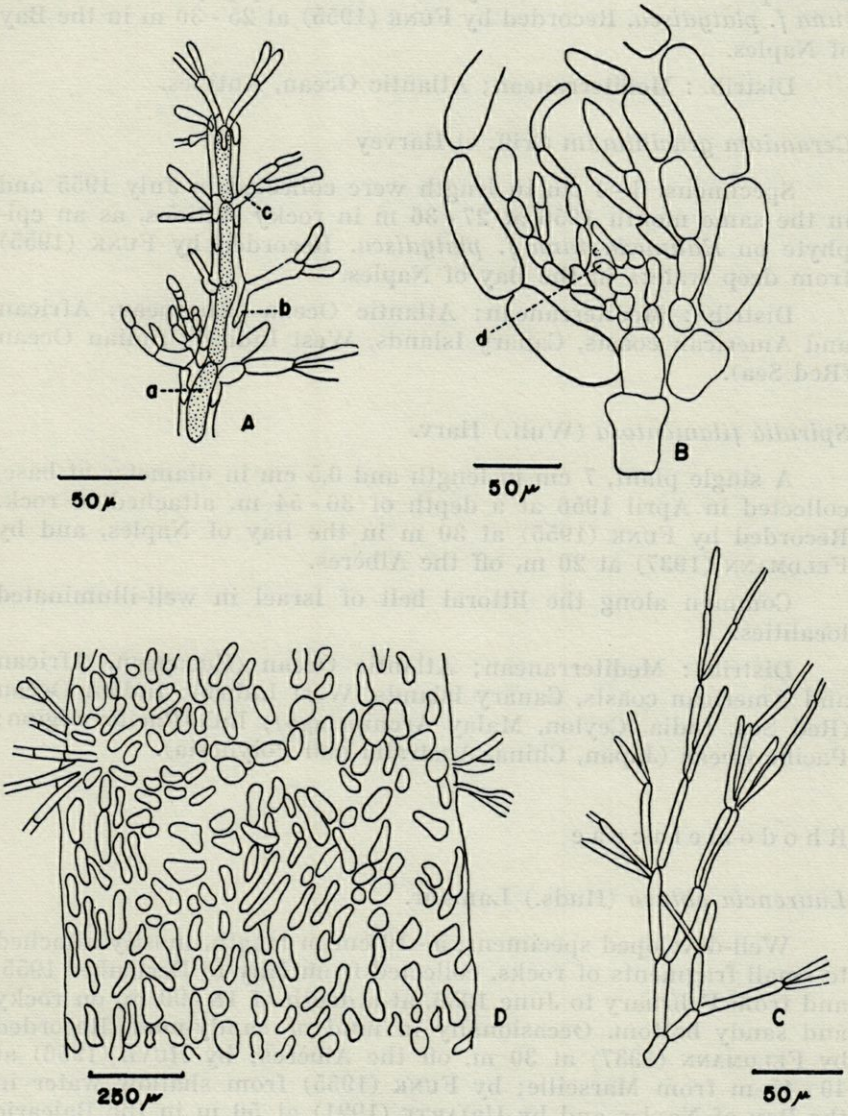


FIG. 4. — *Wrangelia penicillata;* A, part of a whorl with axial cells (a), cortical threads (b), and young laterals, (c). B, apical cell (d), C, lateral of the whorl. D, older thallus covered with cortical cells.

Collected in June and July 1955 and in April and May 1956, at a depth of 18 - 54 m in rocky stations as an epiphyte on *Halimeda tuna f. platydisca*. Recorded by FUNK (1955) at 25 - 30 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean, Antilles.

Ceramium gracillimum Griff. et Harvey

Specimens, 3 - 4 cm in length were collected in July 1955 and in the same month 1956 at 27 - 36 m in rocky stations, as an epiphyte on *Halimeda tuna f. platydisca*. Recorded by FUNK (1955) from deep waters in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea).

Spiridia filamentosa (Wulf.) Harv.

A single plant, 7 cm in length and 0,5 cm in diameter at base, collected in April 1956 at a depth of 36 - 54 m, attached to rock. Recorded by FUNK (1955) at 30 m in the Bay of Naples, and by FELDMANN (1937) at 20 m, off the Albères.

Common along the littoral belt of Israel in well-illuminated localities.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon, Malay Archipelago); Indo-Pacific region; Pacific Ocean (Japan, China, Australia and Polynesia).

Rhodomelaceae

Laurencia obtusa (Huds.) Lamour.

Well-developed specimens, 5 - 10 cm in length, mostly attached to small fragments of rocks, collected from May to December 1955, and from February to June 1956, at a depth of 18 - 90 m, on rocky and sandy bottom. Occasionally in mud or sandy-mud. Recorded by FELDMANN (1937) at 30 m, off the Albères; by HUVÉ (1956) at 40 - 45 m from Marseille; by FUNK (1955) from shallow water in the Bay of Naples and by URIARTE (1921) at 50 m in the Balearic Islands.

Common in the littoral belt of Israel.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean

(Red Sea, India, Ceylon, Malay Archipelago, Australia); Indo-Pacific region, Pacific Ocean (Japan, China, Australia and Polynesia).

Rodriguezella strafforellii Schmitz (Plate II, Fig. 1)

Branched short stalks, brown-black in colour expanding into flat divided thallus, lobes about 15 mm in length and 3 - 5 mm breadth. In cross section, large elongated cells in the centre 60 × 30 µ, diminishing towards the periphery 20 × 26 µ.

Collected in July 1955 and April 1956, at a depth of 36 - 57 m in gravel bottom. Found by FELDMANN (1937) at 20 - 30 m, off the Albères.

Distrib. : Mediterranean; Atlantic Ocean (from Morocco to Tangier).

Chondria boryana (De Notaris) De Toni

Collected specimens reached a length of 10 cm and a diameter of 2 mm at the base. Branches attenuate towards upper region. In cross section one central and five pericentral cellls visible, also subcortical and internal rhizoids at the periphery.

Found in July 1958 at a depth of 18 - 27 m, in a rocky station. Recorded by FELDMANN (1937) from shallow water off the Albères.

Distrib. : Western Mediterranean.

Alsidium corallinum J. Ag.

A very rigid species. Plants collected by us were 10 - 13 cm long, attached to the rocks. In cross section 7 pericentral siphons surround a central one, followed towards the periphery by subcortical and cortical cells.

Found in February and September 1956 at a depth of 18 - 36 m, in sandy and rocky stations. Recorded by FUNK (1955) at 10 m in the Bay of Naples.

Distrib. : Mediterranean, Adriatic; Atlantic Ocean (Canary Islands).

Polysiphonia arachnoides (Ag.) J. Ag.

Thallus cylindrical, 2 cm in length, branching mostly at right angles to the main axis, transparent, except for purple patches sprinkled at the nodes (characteristic of the species). Branches ecorticate, formed by 4 pericentral siphons round a central one.

Collected in September 1956 at a depth of 18 m, on rocky bottom.

Distr. : Mediterranean.

Polysiphonia elongata (Huds.) Harvey

Well-developed specimens collected, 10 - 15 cm in length. Branches, in cross section, formed by 4 pericentral siphons round a central one, cortex all over the main branches except the thinner ones.

Common in the Haifa Bay area, from June to October 1955 and from April to May 1956 at a depth of 27 - 54 m, in rocky and sandy stations, sometimes as an epiphyte on other algae. Crystocarpic plants collected in May 1956. Recorded by FELDMANN (1937) at 30 m off the Albères, and by FUNK (1955) at 70 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, West Indies).

Polysiphonia sanguinea (C. Ag.) Zanard.

A single plant collected, 15 cm in length. Main axis 150 - 300 μ in diameter at base. Ecorticate branchlets attenuate to 25 - 40 μ. In the cross section four pericentral siphons surround a central one. Found in April 1956 at 18 m, in a rocky station as an epiphyte on *Halimeda tuna f. platydisca.*

Distrib. : Western Mediterranean, Adriatic.

Polysiphonia subulifera (C. Ag.) Harvey

Specimens collected reached 10 cm length, blackish-brown, with short spine-like branches at intervals. Ecortiate, formed of 12 pericentral siphons round a central one; collected in June 1955 at a depth of 27 - 36 m in a rocky station. Recorded by FELDMANN (1937) at 30 m off the Albères and by HUVÉ (1956) at 40 - 45 m in Marseilles.

Distrib. : Mediterranean, Adriatic; Atlantic Ocean (From England to Canary Islands).

Polysiphonia variegata (Ag.) Zan.

A fragile plant, 9 cm in length, main branches 300 μ in diameter at base, attenuate to 15 μ in the upper regions of the branchlets. Ecorticate, central siphon surrounded by five pericentral ones.

Collected in April 1956, at a depth of 18 m in a rocky station. Recorded by FUNK (1955) at 10 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European and American coasts, West Indies); Indian Ocean.

Rytiphloea tinctoria (Clemente) C. Ag.

Specimens 8 - 10 cm in length collected from April to October 1955, from February to October 1956 and in July 1958, at a depth of 18 - 90 m, on all types of bottom of the Haifa Bay area. Recorded by FUNK (1955) from a great depth in the Bay of Naples, and by URIARTE (1921) at 57 - 66 m in the Balearic Islands.

Very common in the littoral belt of Israel, but plants of deep-water do not lose their red pigment on paper as easily as the littoral ones.

Distrib. : Mediterranean; Atlantic Ocean (European and African coasts, Canary Islands); Indian Ocean (Red Sea).

Dasyaceae

Dasyopsis spinella (C. Ag.) Zanard.

A single small plant, 3 cm in length found in June 1955, at a depth of 45 m in a gravel station. Recorded by FELDMANN (1937) at 40 - 45 m, off the Albères, and by FUNK (1955) at 60 m in the Bay of Naples.

Distrib. : Western Mediterranean, Adriatic.

Dasya elegans (Mart.) C. Ag.

A specimen 15 cm long, composed of 5 pericentral and one central siphon, corticate mostly all over the branches, found only once in April 1956, at a depth of 36 - 54 m in a gravel station. Recorded by FUNK (1955), at 25 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European and North American coasts, West Indies).

Dasya ocellata (Grateloup) Harvey

A single specimen found, 3 cm long bearing stichidia and antheridia on the upper ramuli. Branches formed of one central and five pericentral siphons, corticated all over the plant.

Collected in September 1956 at a depth of 18 m in a rocky station.

Recorded by FELDMANN (1937) at 30 m off the Albères.

Distrib. : Mediterranean, Adriatic; Atlantic Ocean (warmer regions of the European coasts, Canaries, West Indies).

Dasya punicea Menegh.

A single specimen found, 5 - 6 cm in length, bearing elongated stichidia. Branches composed of one central and five pericentral siphons, corticate mostly all over the thallus.

Collected in April 1956 at a depth of 36 - 54 m, in a gravel station.

Distrib. : Mediterranean; Atlantic Ocean, coasts of England.

Dasya rigidula (Kütz.) Ardiss.

Plants collected reached a length of 1 - 2 cm. Main branches formed of one central and six pericentral siphons, ecorticated.

Found in August and September 1955, and in May 1956 at a depth of 27 m in a rocky station as an epiphyte on *Halimeda tuna f. platydisca* and on *Cystoseira platyramosa*. Recorded by FELDMANN (1937) at 30 m off the Albères.

Distrib. : Mediterranean, Adriatic.

Heterosiphonia wurdemanni (Bailey) Falkenb.

Plants small, 1.5 cm in length, consisting of one central and five pericentral siphons. Elongated cortical cells covering only the main axis.

Collected in July 1958 at a depth of 18 - 27 m in a rocky station as epiphyte on *Halimeda tuna f. platydisca* and *Udotea petiolata*. Recorded by FUNK (1955) at 30 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, Ceylon, India, Malay Archipelago); Indo-Pacific region.

Halodictyon mirabile Zanard (Plate II, fig. 3).

Thallus net-like 2 × 1,5 cm. Authors' specimen differs from that described by BÖRGESEN (1930) from the Canary Islands, in the form of the peripherial cells. Ours had a rounded apex rather than an elongated pointed one.

Rare, found only on a single occasion, in June 1955 at a depth of 36 - 54 m in a gravel station. Recorded by FELDMANN (1937) at 20 - 30 m, off the Albères, and by FUNK (1955) from a great depth in the Bay of Naples.

Distrib. : Mediterranean, Adriatic; Atlantic Ocean (Morocco, Canary Islands).

Delesseriaceae

Hypoglossum woodwardii Kütz.

Leaf-like, narrow, 1,5 cm in length, with a conspicuous midrib bearing some rounded proliferations. Collected only on a single occasion, in July 1958, at a depth of 27 m, on a rocky bottom. Recorded by FELDMANN (1937) at 12 - 15 m, off the Albères.

Distrib. : Mediterranean; Atlantic Ocean (from England to the Canary Islands, West Indies, Bermuda).

Nitophyllum punctatum (Stackh.) Grev. var. *ocellata* J. C. Ag.

Tetrasporic and cystocarpic specimens were collected in July and August 1955, at a depth of 18 - 36 m in a rocky station as epiphyte on *Halimeda tuna f. platydisca*. Recorded by FELDMANN (1937) at 0,5 m, off the Albères, and by FUNK (1955) at 30 m in the Bay of Naples.

Distrib. : Mediterranean; Atlantic Ocean (European, African and American coasts, Canary Islands, West Indies); Indian Ocean (Red Sea, India, Ceylon).

List of Cyanophyta found in our material

Chroococcaceae
Chroococcus turgidus (Kütz.) Naeg.
Synechocystis aquatilis Sauv.
Pleurocapsaceae
Xenococcus schousboei Thuret
Oscillatoriaceae
Lyngbya aestuarii Liebm.
Lynbya confervoides C. Ag.
Lyngbya agardhii Gom.
Oscillatoria limosa Ag.
Oscillatoria margaritifera Kütz.
Oscillatoria nigro-viridis Thwaites
Spirulina subsalsa Oersted
Rivulariaceae
Calothrix confervicola (Roth) C. Ag.

DISCUSSION AND CONCLUSIONS

This paper is a first contribution to the knowledge on the deep-water algae of the Israel coast.

Of the 100 species examined, 11 belong to Cyanophyta, 14 to

Chlorophyta, 19 to Phaeophyta and 56 to Rhodophyta. The numerical ratio between the four main groups determines the floristic character of the region (FELDMANN, 1937). Of special importance is the ratio R/P between the Rhodophyta (R) and the Phaeophyta (P), the value of which was 2,9 in our region. This value is fairly close to those obtained in other localities of the Mediterranean (2,6 at Rovigno on the Adriatic and 3,5 in Minorca).

It may be of interest to note the corresponding values of R/P as given by FELDMANN, 1937.

Arctic region 1,1; (GAIN, 1912)
Algeria » 3 ; (FELDMANN)
Bahamas » 4,6; (HOWE, 1818).

Part of the algae described here are also known to be present in the littoral belt of Israel. These often differ in morphological structure from their deep-sea counterparts.

The sciaphilous species preferring sheltered localities like *Udotea petiolata, Dasycladus vermicularis* etc. were found in the sublittoral region in higher developed specimens compared with the littoral ones.

A number of characteristic deep-water algae as *Cutleria monoica, Chrysymenia ventricosa, Ceramium comptum* etc., were also found by the author.

As to the preference of algae for various types of bottom, it was found that most species prefer rocky bottom as a substatum and only few are able to grow in muddy ground. Rocky ground prevails at the shallow parts of the Haifa Bay; this seems to be the reason that most species were found in the shallow stations (in deeper stations ground is muddy).

A more detailed ecological and phytosociological survey will be given in a separate note.

ABSTRACT

The present paper deals with 89 species of algae out of 100 collected from various depths in Haifa Bay.

Dates of collection, depth and types of sea bottom are given. Other localities and depths in the Mediterranean where the same algae were previously found, together with its general geographical distribution, are likewise indicated.

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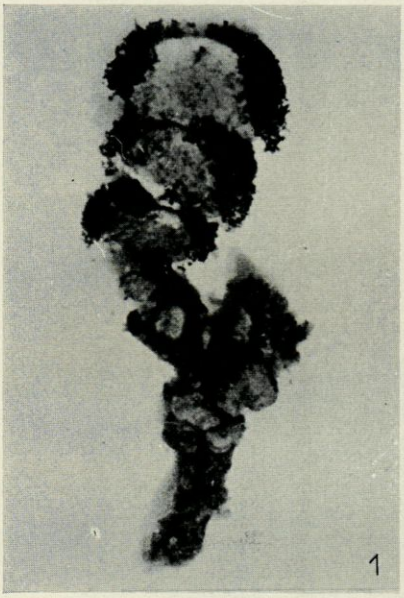


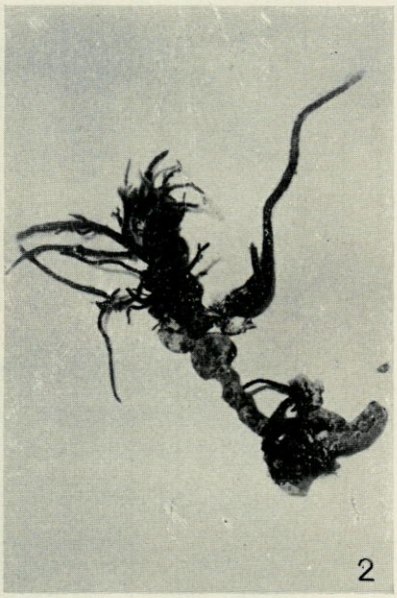
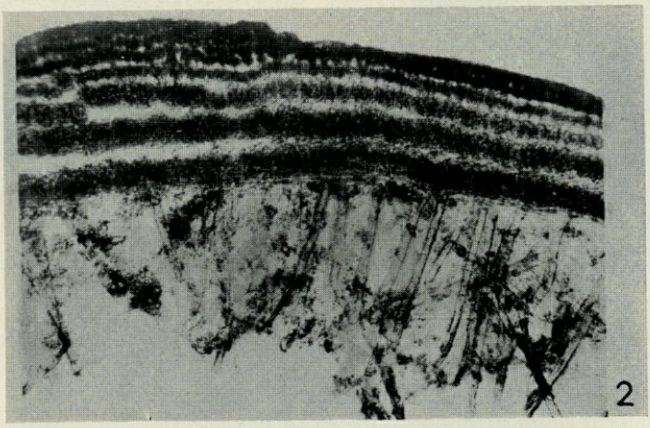


PLATE I. — 1. *Halimeda tuna* with gametangia (× 1). 2. *Liebmannia leveillei*, on *Halimeda tuna* (× 1). 3. *Cystoseira platyramosa* (× 0,5).



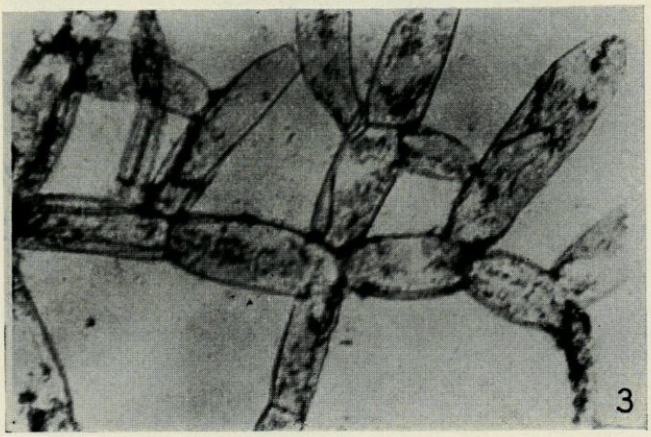


PLATE II. — 1. *Rodriguezella strafforelli* (× 1,5). 2. *Rhizophyllis squamariae*, cross section (× 140). 3. *Halodyctyon mirabile*, part of the net (× 80).