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CONTRIBUTIONS TO THE STUDY OF THE MARINE ALGAE OF THE RED SEA
IV — THE ALGAE AND SEAGRASSES INHABITING THE SUEZ CANAL
(SYSTEMATIC PART)

By

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ABSTRACT

A survey of the algal and phanerogamic vegetation, inhabiting the Suez Canal, in 21 stations extending between Port Said (Mediterranean) and Port Tawfik (Red Sea) revealed the presence of 131 spp. of algae and 4 spp. of seagrasses. These are by far the highest numbers ever recorded in the Canal and represent 100% increase in the total numbers of algal and seagrass species previously known in the Canal.

The algae comprise 21 spp. of blue greens, 34 spp. of green, 20 spp. of brown and 56 spp. of red algae. The latter include 2 new species viz.,

Acrochaetium epizooicum Aleem nov. sp.
Colaconema sarconemae Aleem nov. sp.

12 other spp. are considered as new records to either the Eastern Mediterranean or to the Northern Red Sea.

The algal flora in the Bitter Lakes resembles that of the Red Sea, Tropical and subtropical algae invaded the Canal almost to el Tina, 25 km south of Port Said.

This corresponds with the current regime in the Canal. There is an almost continuous flow of Red Sea water into the Mediterranean, at least close to the bottom (due to its high σ_t). Mediterranean water, on the other hand, scarcely reaches the Red Sea.

The role of the Suez Canal in the migration of Indo-Pacific algae (and seagrasses) from the Red Sea into the Mediterranean is stressed. Numerous such algae have been established in the Eastern Mediterranean. On the other hand, only a few algae and none of the seagrasses of Atlanto-Mediterranean origin have been found in the Suez Gulf. Among the algae only Caulerpa prolifera and Halopteris scoparia were dredged in the Suez Gulf during this survey.

INTRODUCTION

The Suez Canal[1] is an artificial waterway, connecting the Mediterranean Sea with the Red Sea through 4 shallow-water lakes, very different in their salinity, successively known from north to south as: Lake Manzala (S=ca 3-6‰), Lake Timsah (S=ca 20‰), the Great Mourra (Bitter)[1] Lake (S=45-50‰) and the Little Mourra (Bitter) Lake (S=45-50‰). The length of the Canal between Port Said, on the Mediterranean and Port Tawfik, on the Gulf of Suez, is 163km; its width being 150-160 m.

Since its opening for navigation in 1869, the Suez Canal has brought into contact Atlanto-Mediterranean and Indo-Pacific faunas and floras.

The floras of the South Eastern Basin of the Mediterranean and that of the Northern Red Sea are fairly well known through the works of Aleem 1948, 1950a-c, 1951, 1978 a-c; Nasr 1947; Rayss 1955, 1959. Seagrasses of the same are known through the more recent works of Aleem 1955, 1962, 1979 and Lipkin 1977.

As to the algal and phanerogamic floras of the Canal itself, the first reference to these is found in Muschler (1908) who mentions 8 species of algae from the Canal.

This was followed by the Cambridge Expedition in 1924 who studied mainly the animal distribution in the Canal, during the months of October and November, but also presented a list of 36 species of algae identified by Lyle (in Fox 1926) in addition to 2 seagrasses viz: *Holophila stipulacea* (Forsk) Asch. and *Halodule (Diplanthera) uninervis* (Forsk.) Asch. identified by Rendle (in Fox 1926). The algal list comprised a single species of blue green algae, 11 green, 6 brown and 18 red algae.

In April 1932, Professor Gruvel of Paris, upon the invitation of the Misr Fisheries Company, visited the Canal in his capacity as a zoologist and was able to collect a few algae from the Great Bitter Lake, identified by Rob Lami (1932). These included 3 green, 3 brown and 3 red algae. It is interesting to note that both *Colpomenia sinuosa* (Mert.) Derb. et Sol. and *Hydroclathrus clathratus* (Bory) Howe collected by Gruvel flourish in spring and this explains the absence of these two species from previous records in the Canal and stresses the importance of collecting at all seasons for a comprehensive list of the algae.

Beets (1953) during a short stay at the Great Bitter Lake, made a survey of the lake and noted the important animal elements dredged from the lake bottom. He also noted a few algae, namely *Spirulina subsalsa, Falkenbergia rufolanosa, Sargassum crispum,* in addition to the seagrass *Halophila stipulacea.*

A more exhaustive study of the algae in the Canal was made by Lipkin (1972) who was able to present a list of 65 species (excluding 5 diatoms) from the Canal. However, Lipkin's study, due to war conditions, was confined mainly to the Southern Sector of the Canal viz: to 3 stations (of a few hours' diving and shore collection) along the Bitter Lakes in January 1969 and October 1971, apart from two other samples collected by H. Steinitz in 1967 and given to Lipkin for study.

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(1) Will be referred to in the text also as S.C. or the Canal. Bitter Lake (English) or Lac Amer (French) are transcripts of the Arabic name al-Buhaira (lake) al-Mourra (Bitter). Port Tawfik, al-Qantara, al-Qurantina appear in the literature also as Port Taufiq, al-Kantara (or al-Quantarah), al- Kurantinah.

MATERIAL AND METHODS

In November 1953, the writer in collaboration with the Egyptian Coast Guard Authorities, arranged a scientific expedition on board the patrol boat "Fayez", equipped for the purpose, to explore the hydrography and benthic fauna and flora of the Suez Canal during the period 23 November - 1st December, 1953. Work continued daily between sunrise and sunset, apart from a few night collections. The author, was accompanied by two assistants from the Oceanography Department, Faculty of Science University of Alexandria, as a part of their training programme. Mr. S. Morcos was thus charged with the hydrography of the Suez Canal and in this poineer cruise, we obtained data which were repeated in successive months and culminated in a dissertation he presented to the University of Kiel in Germany. The second assistant, Mr. G.A. Guirgis, was in charge of the bottom fauna, which we were able to dredge in the Canal and sort out in formol. Since I left the University of Alexandria in December 1972, I have lost contact with these valuable samples.

The algae, however, were collected from 21 stations between Port Said and Port Tawfik along the Canal, including both the east and west banks, as well as the lakes close to the Canal banks. Collections were also made by skin diving, whenever possible. Several substrates were examined including floating buoys, pier and bridge supports, causeways and living and dead corals. This is in addition to dredges made in sandy or muddy sand sites along the Canal or at Port Tawfik and in the Suez Gulf.

Ecological notes were made in situ, while specimens were sorted out on board, examined fresh, pickled in formol or dried. Careful study was made later on at Alexandria.

For the purpose of seasonal variations, two other, less intensive, collections were made in the Canal, one in June and the other in December 1957.

I have had a chance to study my materials from the Suez Canal and compare samples, whenever possible, with other herbarium specimens, at the following laboratories:

1— Dr. E.Y. Dawson Laboratory at the Hancock Foundation, Los Angeles, (February-July 1954).

2— At the Botanical Institute of the University of Leningrad (August 1961).

The species included in the list below are based entirely upon materials collected by the writer.

The following table (Table 1) shows a list of the stations examined (see also Figure 1).

NOTES ON THE SPECIES OBSERVED

In the following, a systematic account of the species identified in the Suez Canal is given. Benthic diatoms are excluded from this list and will be a subject of a separate study. Algal communities and interrelations between the flora of the Northern Red Sea and that of the Eastern Basin of the Mediterranean will be dealt with later on.

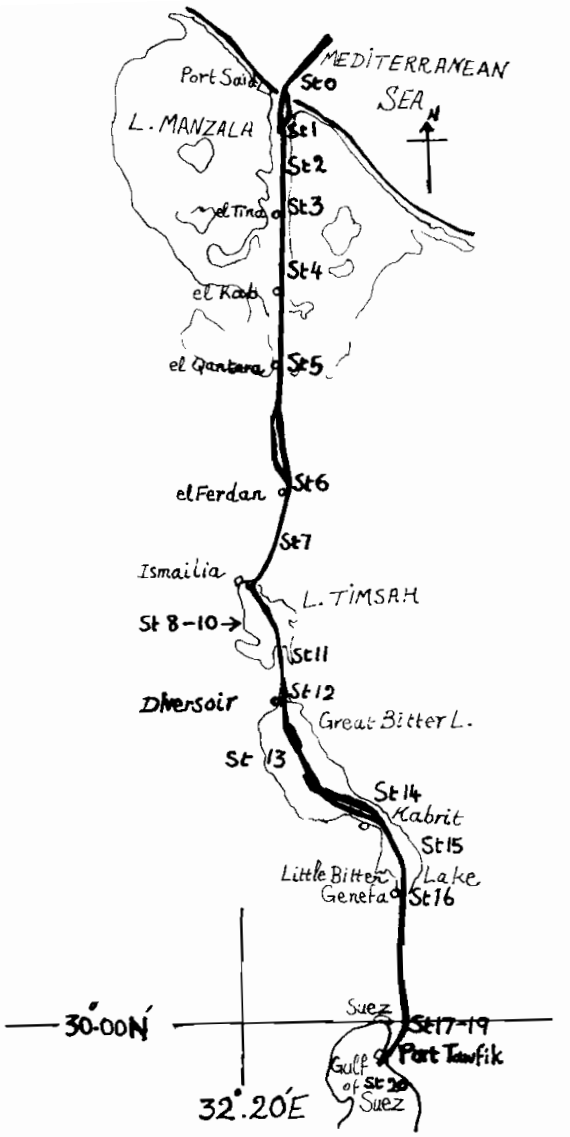

Fig. 1— Map of the Suez Canal, showing the collecting stations.

Table (1) - List of Stations

St. No.	Locality	Distance from Port Said in km
St.. 0	Port Said (Breakwater and Canal entrance)	0
St. 1	el Abouty (Kabouty)	3
St. 2	Lake Manzala connection	10
St. 3	el Tina	25
St. 4	el Kab (el Cab)	36
St. 5	al Qantara (al Kantara)	45
St. 6	al Ferdan	65
St. 7	al Quarantina	76
St. 8	Ismailia	80
St. 9	Timsah Lake Inlet	80
St. 10	Timsah Lake Center	81
St. 11	Timsah Lake Outlet	82
St. 12	Diversior	97
St. 13	Great Bitter Lake	105
St. 14	Kabrit by-Pass	118
St. 15	Little Bitter Lake	130
St. 16	Genefa (L. Bitter Lake Outlet)	133
St. 17	Port Tawfik (dredge)	160
St. 18	Port Tawfik (north)	161
St. 19	Port Tawfik (south)	163
St. 20	Green Island (North Gulf of Suez)	164

It is to be noted also that several species of red algae, particularly of the encrusting forms, are omitted from this list, because of incomplete or doubtful identification. The seagrasses encountered in the Canal are referred to, following the algal list.

New records in the Canal are marked by a single asterisk (*), while those species not recorded before either in the Red Sea or in the Eastern Mediterranean are marked by two asterisks (**).

CYANOPHYTA
CHROOCOCCALES
GLEOCAPSACEAE ELENKIN ET HOLLERBACH
Gleocapsa (Kutz.) Hollerb.
(emend. including Chroococcus Nag.)

1. *Gleocapsa turgida* (Kutz.) Hollerb. emend. in Holberbach *et al* 1953, p. 101, fig 56, 2.

=*Chroococcus turgidus* (Kutz.) Nag. in Fremy 1934 p. 24, pl. 4, fig. 5.

Found on *Jania longifurca* growing epiphytically on *Caulerpa racemosa* at Genefa (St. 16). Cells are spherical or ellipsordal, 13-25μ in diameter, bluish in colour. Sheath thick, lamellated, containing 2-4 individuals.

2. *Gleocapsa crepidinium* Thur. in Lindstedt 1943 p. 21 pl. 2 fig. 1.

=*Entophysalis deusta* (Menegh.) Drouet et Daily 1956

=*E. granulosa Kutz.* in Fremy, 1934 p. 32 pl. 6 fig. 5

This alga forms a black, thin sheath on stones bathed by waves in the upper littoral at several places in the S.C., including the Bitter Lakes. It was found also at the Breakwater in Port Said and Port Tawfik, usually in association with *Calothrix* spp. and *Achnanthes brevipes* (diatom). Previous records in the Canal were made by Lipkin (1972).

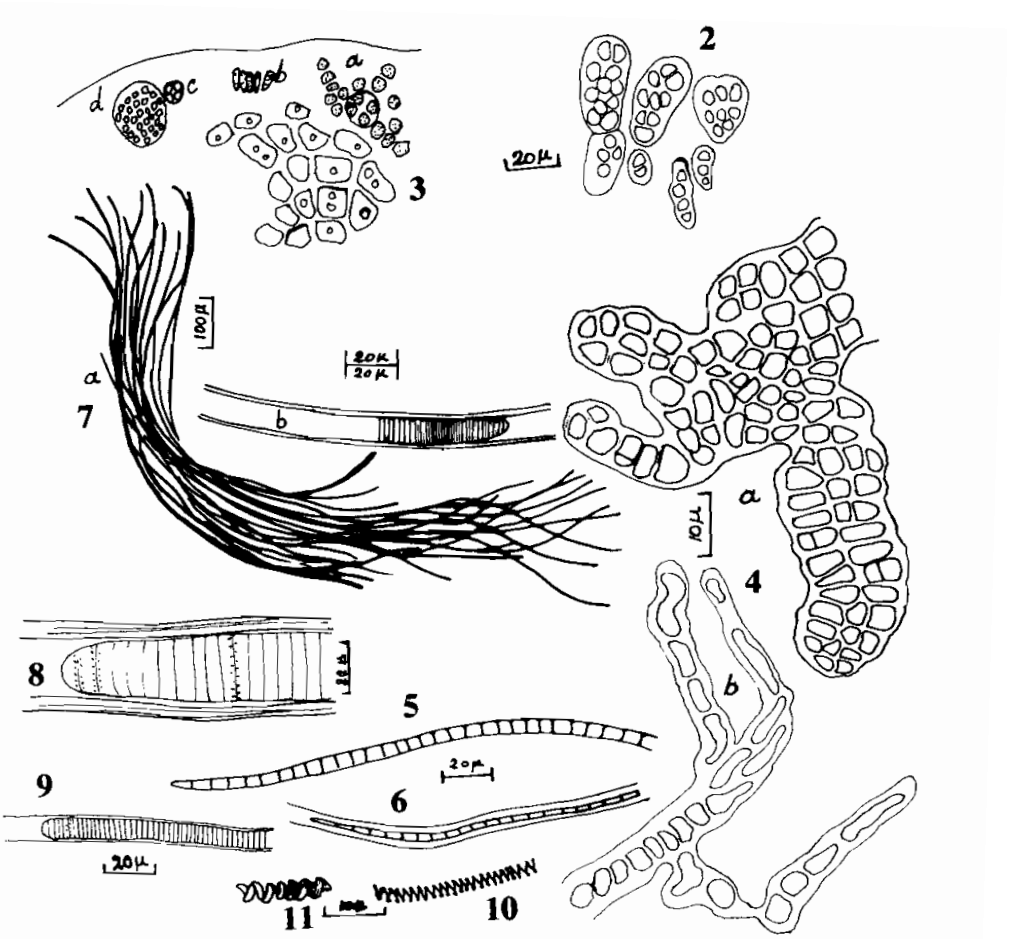

Fig. 2— *Gleocapsa crepidinum.*
Fig. 3— *Pleurocapsa amethystea:* a- gregarious cells; b- elongated cells; c-d- sporangia (all in the gelatinous sheath of *Ulva lactuca*). The cells of the latter, shown in surface view, are much larger and contain pyrenoids.
Fig. 4— *Hyella caespitosa:* a- creeping filaments; b- perforating filaments.
Fig. 5— Microcoleus chthonoplastes, single filament with tapering end.
Fig. 6— Microcoleus Wuitneri.
Fig. 7— Hydrocoleum lyngbyaceum: a- habit; b- single filament magnified.
Fig. 8— Lyngbya aestuarii.
Fig. 9— Lyngbya Martensiana.
Fig. 10— Spirulina tenerrima.
Fig. 11— Spirulina major.

PLEUROCAPSALES
PLEUROCAPSACEAE
Pleurocapsa Thuret

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3. *Pleurocapsa amethystea* Rosenvinge, 1894, p. 163; Fremy, 1934, p. 37 pl.7 fig.4.

(Fig. 3 a-c)

Violet cells of this alga were found in the gelatinous sheath of *Ulva lactuca* at Abouti, 3 km to the south of Port Said. This minute species is at first in the form of solitary cells, which multiply and become gregarious, with circular or angular walls. These measure 4-5 μ in diameter, while elongated cells measure 2-3 μ in breadth. Sporangia are spherical and contain minute cells 1-2 μ in diameter.

The species was known before from Greenland, North Sea and the Western Mediterranean.

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4. *Pleurocapsa crepidinium* Collins in Fremy, 1934, p. 38, pl. 7, fig.7.

This alga was found on the calcareous tubes of worms attached to wooden pylons at the quays of the Suez Canal Company (Port Said) in autumn.

Hyella Bornet et Flahault

5. *Hyella caespitosa* Born. et Flah. in Fremy, 1934, p. 49, pl. 12, figs 4-10, pl. 13.

(Fig. 4 a-b)

This perforating alga was rather frequent on shells of molluscs. It also bores into the calcareous tubes of *Mercierella enigmatica* (tube worm) at al Quarantina.

Perforating cells (fig. 4b) could grow wide apart and in this respect the distinction by Ercegovic (in Fremy 1934) of two other species *viz. H. tenuior* and *H. dalmatica* does not seem justified.

HORMOGONEALES
OSCILLATORIACEAE
Microcoleus Desmazieres

6. *Microcoleus chthonoplastes* Thuret in Fremy, 1934, p. 67 pl. 17, fig. 7.

(Fig. 5)

This species grew in the form of a sheat on rock surfaces together with *Lyngbya aestuarii*, at Port Said; on wooden pylons in association with *Spyridia* at el Tina, or even covering the mud in littoral pools in the Bitter Lakes. It stands excessive heat and salinity and its sheats which collect mud and organic debris have a leathery consistency. The sheat is actually formed of a large number of gelatinous tubes in which filaments of

the algae abide. These filaments taper at the tip and are composed of cells as long as broad or longer.

7. *Microcoleus Wuitneri* Fremy, 1934, p. 68, pl. 18 fig. 1.

(Fig. 6)

Trichomes in this alga are narrower than those of the preceding species. The alga was scraped from the quays of the Suez Canal Company at Port Said, where it grew with *Rhodymenia*.

Hydrocoleum Kutz.

8. *Hydrocoleum lyngbyaceum* Kutz. in Fremy, 1934, p.72, pl. 19, fig. 1.

(Fig. 7 a, b)

This alga was scraped from stones on the east bank of the Canal at Lake Timsah, where it grew in association with *Sarconema furcellatum*, *Laurencia obtusa* and *Champia irregularis*.

The genus *Hydrocoleum* differs from *Microcoleus*, essentially in two respects: its sparce number of trichomes inside the tubes and in its much shorter cells.

Phormidium Kutz.

9. *Phormidium tenue* (Menegh.) Gom. in Hollerbach *et al.* 1953, p. 484, fig. 255, 10, 12.

Cells 1-1½ μ thick. Found entangled among other algae at Port Said.

Lyngbya C. Ag.

10. *Lyngbya aestuarii* Liebmann in Fremy, 1934, p. 104, pl. 27.

(Pl. 1 fig. 1 and text figure 8)

This alga forms a slippery brownish mat on the quays of the Suez Canal Company at Port Said in autumn. Trichome yellowish in colour, sheath hyaline. Dried specimens are crisp and turn black in colour.

11. *Lyngbya majuscula* Harvey in Fremy, 1934, p. 151, pl. 3, figs. 3-4.

Recovered from small ditches at Port Tawfik. It differs from *L. aestuarii* in the absence of granules at the septa and in its non tapering filaments.

12. *Lyngbya confervoides* C. Ag. in Fremy, 1934, p. 106, pl. 28, fig. 2.

Associated with *L. aestuarii* on the eastern side of the jetty at Port Said in autumn. Also encountered at Diversoir.

13. *Lyngbya Martensiana* Menegh, in Fremy 1934, p. 107, pl. 29 fig. 1.

(Fig. 9)

Found entangled among other algae on the eastern side of the jetty at Port Said in winter.

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14. Lyngbya infixa Fremy, 1934, p. 110, pl. 30 fig. 1.

This tiny *Lyngbya* was found on *Cladophora* and other filamentous algae from several stations in autumn and summer.

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15. *Lyngbya Nordgaardii* Wille.

= *L. epiphytica Wille in Hollerbach et al. 1953, p. 530, fig. 273, 7-10*

This very small alga differs from the preceding species in the presence of constrictions at the septa. Encountered on various red algae at Port Said, Abouti, el Tina and Qantara.

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16. *Lyngbya semiplena* J. Ag. in Fremy, p. 108 pl. 28 fig. 3.

This alga formed extensive covering on smooth upper littoral rocks in autumn becoming blackish when dry.

Trichomes yellowish in colour, slightly tapering at end, 8-10 *u* thick, not constricted at the articulations. The cells are 1½-3 time as long as broad. Septa are often granulated.

This species is difficult to distinguish from *L. confervoides*, except for its thin lamellated sheath and its tapering trichomes.

Spirulina Turpin

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17. *Spirulina subtilissima* Kutz. in Fremy, 1934, p. 132, pl. 31, fig. 20.

Examination of micro-algae decanted from pickled specimens revealed the presence of this species at el Tina and Port Said.

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18. *Spirulina tenerrima* Kutz. in Fremy, 1934, p.132, pl. 31 fig. 21.

(Fig 10)

Recovered from jars containing *Sarconema furcellata* and Hydroids from el Tina.

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19. *Spirulina Major* Kutz. in Fremy, 1934, p. 131, pl. 31, fig. 18.

(Fig. 11)

Decanted from silt and mud particles from the quays of the Suez Canal Company at Port Said in autumn.

Calothrix C. Ag.

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20. *Calothrix confervicola* Roth) C. Ag. in Fremy, p. 142, pl. 36, fig. 4.
Epiphytic on other algae at el Kab in winter.

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21. *Calothrix scopulorum* (Web. et Mohr) Ag. in Fremy, 1934, p. 143, pl. 35 fig. 2.

Forms a mat on upper littoral rocks at several stations, including the Bitter Lakes. Trichomes with both basal and intercalary heterocysts.

CHLOROPHYTA
CHAETOPHORALES
CHAETOPHORACEAE

Phaeophila Hauck

1. *Phaeophila dendroides* (Cr.) Batters in Hamel, Chlor. p. 27 fig. 79,b = *P. Florideanum* Hauck, 1883, p. 464; Huber 1893.

This alga was wound endophytic in *Cladophora crystallina* at Lake Timsah.

Entocladia viridis Reinke

2. *Entocladia viridis* Reinke 1879, pl, 6 figs 6-9 = Endoderma viride (Reinke) Lagerheim in Hamel, Chlor. p. 38, fig. 13 A,B.

(Fig. 12)

Not infrequent on red algae at various stations in June and November.

Eugomontia Kornmann

3. *Eugomontia sacculata* Kornmann, 1960 = in part *Gomontia Polyrhiza* (Lagerh.) Bornet et Flahault, 1889

This alga is heterotrichous with creeping and erect filaments, the latter end with claviform cells.

Kornmann (1959, 1960) who raised this alga in cultures found that *Gomontia Polyrhiza* in fact comprises two different algae, one is a sporangial stage referred to as *Codiolum Polyrhizum* and the other is the *Gomontia* proper.

The species was perforating in molluscan shells and on Cirriped tubes in the Little Bitter Lake in November.

ULVALES

Enteromorpha Link

4. *Enteromorpha prolifera* (Fl. Dan.) J. Ag. in Kylin 1949, p.25, figs 18-20.

(Pl. II Fig. 1)

Rather frequent at the high water mark at several stations along the Canal, e.g. Port Said, el Tina, Kabrit. Specimens from the Little Bitter Lake may be referred to type II of Bliding (1939).

5. *Entromorpha flexuosa* (Wulf.) J. Ag. in Hamel, Chlor. 158 fig. 48(5-6)

Collected at el. Kab in autumn.

6. *Enteromorpha intestinalis* (L.) Link in Kutz. Tab. Phyc. VI, pl. 3, fig. 1

Frequent in brackish water at Lake Timsah.

7. *Enteromorpha compressa* (L.) Grev. in Kutz. Tab. Phyc. VI, pl. 38 fig. 1.

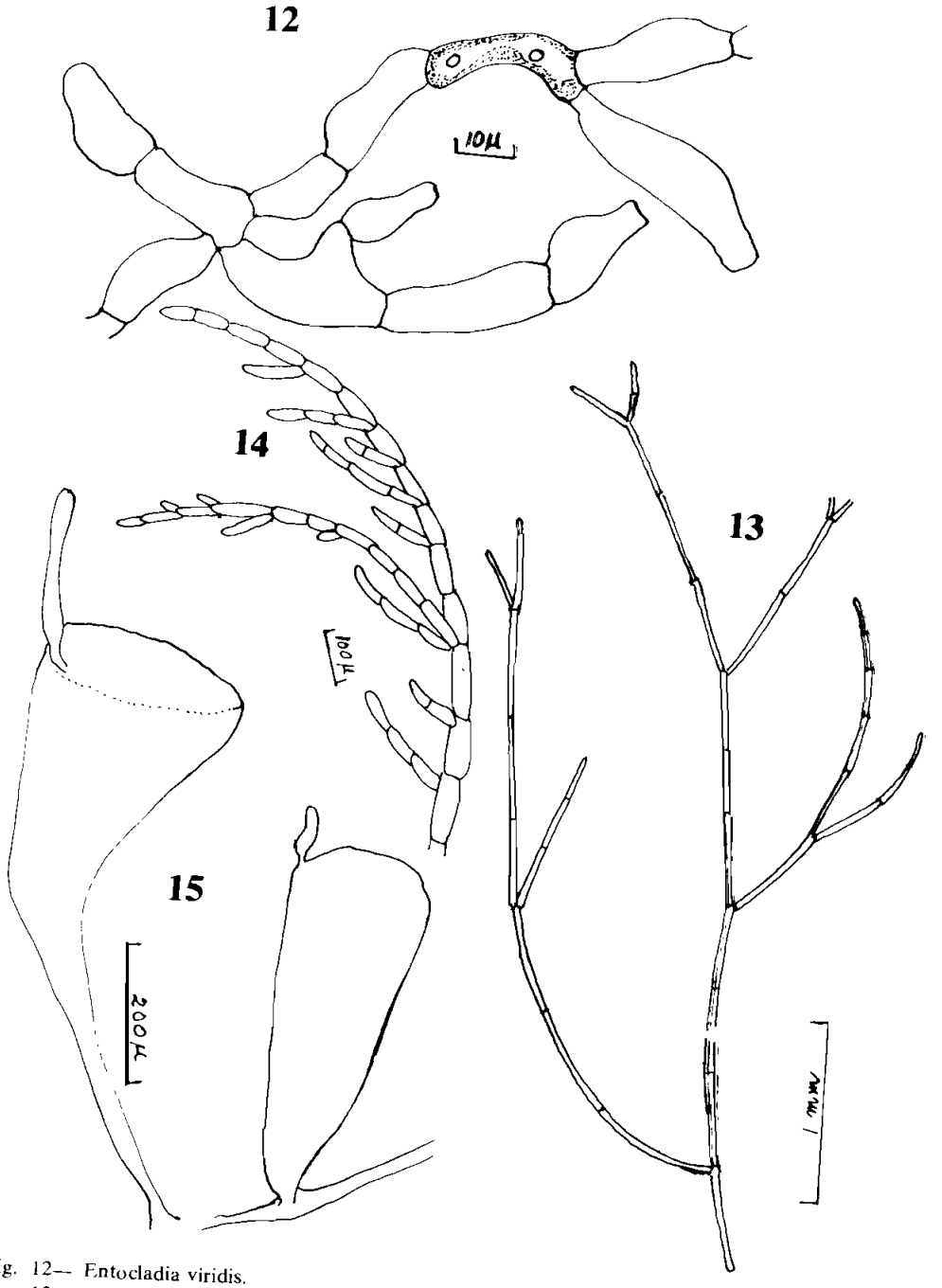

Fig. 12— Entocladia viridis.
Fig. 13— Cladophora crystallina.
Fig. 14— Cladophora albida.
Fig. 15— Codium geppii(?): utricles with empty gametangia.

Collected at el Abouty, where it grew in association with *Ulva lactuca* in brackish water.

8. *Enteromorpha clathrata* (Roth.) J. Ag. in Hamel, Chlor. p.162, figs 49-50.

Found together with *Enteromorpha flexuosa* at el Kab in December 1957.

Ulva Linneus (Emend.) Thuret

9. *Ulva lactuca* Lamour. in Hamel, Chlor. p. 140

(Pl. I. Fig. 2)

Frequent at various stations along the Canal from Port Said to Port Tawfik. At Abouty, the species flourished well also in brackish water in autumn. The species was also dredged at el Tina in November.

10. *Ulva rigida* C.Ag. = *U. lactuca* (L.) Le Jolis var. *rigida* in Hamel, Chlor. p. 140

Fronds are smaller and thicker than in the preceding species. Found on the quays at Port Said.

11. *Ulva fasciata* Delile in Hamel, Chlor. p. 138, fig. 41 I.

Formed stands in shallow water attached to stones in protected sites on the east side of the jetty at Port Said.

SIPHONOCLADALES

VALONIACEAE

Valonia C.Ag.

12. *Valonia utricularis* (Roth) C.Ag. in Hamel, Chlor. p. 109 fig. 34, 3.

Grew under projecting rocks in shaded places at Port Said.

13. *Valonia macrophysa* Kutz. in Hamel, Chlor p.109 fig. 34 (4-5)

Grew in shaded sites at the Great Bitter Lake.

BOODLEACEAE

Cladophoropsis Borg.

14. *Cladophoropsis herpestica* (Mont.) Howe = *Cladophorsopsis Zollingeri* Kutz. (Borg.) in Aleem, 1978 a, p. 81

This alga was frequent in November in the lower sector of the Canal, particularly at Qurantina, Kabrit, Great Bitter Lake and Diversoir (Little Bitter Lake). In the latter habitat the species formed a distinct belt 30 cm high, extending for about 30 m at the water level. It is to be noted that the salinity of water at this time exceeded 45‰. It was also found at Port Said.

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15. *Cladophora crystallina* Kutz. *Tab. Phyc.* IV, pl.19 fig. 2.; Hamel, 1928, p. 11 fig. 12b.

(Fig. 13)

This plant was found on small stones on the east bank of the Canal at the outlet of Lake Timsah (St.11). Its colour is yellowish green when alive, turning into a pale colour in herbarium specimens.

Plants are 10-30 cm long and soft in texture. They resemble *C. seriacea* recorded by Zanardini (1857, p.296) from Suez and as indicated by Hamel, the two species could be confounded with one another. In my specimens cells of the ramuli are much longer than in *C. seriacea.* They are 20-30 (40) μ wide and as much as 20 times longer and resemble specimens collected from littoral pools in Alexandria.

The Suez Canal specimens were heavily coated with diatoms.

16. *Cladophora patentiramea* (Mont.) Kutz. forma *longiarticulata* Reinbold (?) in Borgesen, Mauratius I, p. 36, fig. 12, 1940.

Filaments are 60-70 μ. The length of cells is usually 5-10 times as broad. Our plants differ from those of Borgesen in the absence of rhizoidal filaments which he described as "issuing on an opposite side to that at which branches are found."

Dawson (1954) also described a much larger material from Viet Nam (branches 90-140 μ wide). Thus our identification should be regarded as doubtful until further material is examined.

This alga was found at the outlet of the Small Bitter Lake (St. 16) as well as at Abouty (St. 1) in autumn.

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17. *Cladophora prolifera* L. in Hamel, 1928 (quelques Cladophora) p. 5 fig. 3.

Found in Great Bitter Lake in November 1953 and at Port Said in December 1957. Fronds turn brownish on drying.

18. *Cladophora albida* (Huds.) Kutz. Tab. Phyc.IV pl. 15 fig. b.

(Fig. 14)

Forms soft slender tufts 1-2 cm high on rocks in the lower littoral. Branchlets are often recurved. The plant grew in the Bitter Lakes at Kabrit. This species recalls that described by Skottsberg and Levring (in Levring 1941) under *C. perpusilla.*

The species was found at Port Said, Abouti and in the Bitter Lakes.

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19. *Cladophora utriculosa* Kutz. Tab. Phyc III, pl. 94; Hamel, 1928, fig. 8a.

Frequent at el Tina and Port Said.

Chaetomorpha Kutz.

20. *Chaetomorpha aerea* (Dillwyn) Kutz. in Hamel, Chlor. p. 123, fig. 38 a–h.

Frequent in Lake Timsah and at Port Said.

21. *Chaetomorpha Linum* (Mueller) Kutz. in Hamel, Chlor. p. 125, fig. 38 c–h.

Collected in the Bitter Lakes in summer.

22. *Chaetomorpha indica* Kutz. Tab. Phyc. VII, pl. 52 fig. 3; Borgesen 1935 (Bombay I) p. 12, fig. 2.

Grew attached to stones at the outlet of Lake Timsah in November at km 82. Basal cell is long (400μ) and narrow (ca 50μ wide). Higher up cells are as long as broad or up to 1.5 times longer.

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23. *Chaetomorpha capillaris* (Kutz.) Borg. in Hamel, 1931 (Chlor.) p. 120 fig. 37.

Attached to coralline algae at Port Tawfik. Fronds were rolled in spirals resembling var. *crispa* (Schusboe) Feldmann (1937, p. 209 fig. 17a).

Rhizoclonium Kutzing

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24. *Rhizoclonium Kochianum* Kutz. in Borgesen, 1935 Bombay (List of algae).

Found together with *Chaetomorpha* and *Cladophora crystallina* in the brackish water of Lake Timsah.

SIPHONALES

BRYOPSIDACEAE

Bryopsis Lamour.

25. *Bryopsis plumosa* (Huds.) C. Ag. in Hamel, Chlor. p.61 fig. 20c.

Found on Tunicata and tube worms at el Tina and el Kab in December at 0.5 to 1m below water mark.

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26. *Bryopsis hypnoides* Lamour. in Hamel, Chlor. p.68, fig. 20B.

Found at el Tina and el Kab in November.

CODIACEA

Avrainvillea Gepp

27. *Avrainvillea amadelpha* Gepp I.A. & E.S. Siboga Expd. (Codiaceae) LXII, p.42, pl.14 fig. 112-113.

(Pl. III, Fig. 1)

Plants were collected in the Little Bitter Lake (St. 16 at Genefa) from a stone ridge away from the shore at a depth of about 0.5-1m.

The alga grew in clusters in shaded sites, particularly in fissures between rocks. It reaches 4-6 cm and has a pale green colour when alive. Dried specimens turn brownish in colour.

Fronds arize from a stout irregular base 1-3 times dichotomously branching. The

fleshy flabellae are often covered with sand and mud debris.

The plant figured by Zanardini (1858 pl. 13 fig. 1a) under *Chloroplegma sordidum* and which Gepp cites as synonym to *A amadelpha* differs from our plant by its larger stipe and smaller flabellae as well as by its deep brown colour.

Codium Stackhouse

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28. *Codium tomentosum* (Huds.) Stackh. in Zanardini, 1858 p. 291; Borgesen, 1930, Journ. Ind. Bot. Soc. Vol IX p.159.

Encountered in the Bitter Lakes in November, also recorded from el Tina at a depth of 1 m under the pier together with *Solieria dura.*

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29. *Codium arabicum* Kutz.

This is often referred to as *C. adhaerens* (also in Aleem 1978a). Found once at Genefa at the outlet of the Little Bitter Lake.

*

30. *Codium geppi*(?) O. C. Schmidt, 1923, p. 50, fig. 33 from Malaya; Borgesen, 1946 (Mauritius, add. list)

(Fig. 15-16)

To this species are referred with doubt two specimens of a small *Codium* as shown in the figure, Fronds measure 3-4 cm high, slender with a slight flattening at the dichotomy, Utricles with empty gametangia are variable in size (fig. 15). Our specimens resemble figure (13K) of a species also described under *C. geppii* by Dawson (1954, p. 397) from Viet Nam. Our plant is, however, more slender at the base.

The possibility of comparing our plants also with *Codium dwarkense* Borgesen, recorded by Rayss and Dor (1963) from the Gulf of Aqaba is not overruled.

Until further material is obtained and studied, the identity of this *Codium* of which I sent a dried specimen to Dr. Paul Silva in California, remains obscure.

My specimens grew under the pier at el Kab, together with *Bryopsis,* hydroids and tunicates in December 1957.

Halimeda Lamour.

*

31. *Halimeda Tuna* (Ellis et Sol.) Lamour. in Kutz. Tab. Phyc. VII, pl. 21, fig. 4

A few specimens were collected at the jetty of Port Said (entrance of the Canal); otherwise no other samples were met with in the Canal.

CAULERPACEAE

Caulerpa Lamouroux

32. *Caulerpa racemosa* (Forsk.) W.V. Bosse, Monogr. 1898.

This species together with the following varieties were obtained in the lower littoral or by dredging in the Canal, particularly at el Tina, el Kab, Lake Timsah (June

1957), the Bitter Lakes, Port Tawfik, but not at Port Said. The varieties encountered are:

— *Caulerpa racemosa* var. *uvifera* (W.V.Bosse Monogr.) Frequent at Genefa.

— *C. racemosa* var. *Lamourouxii* forma *requienii* (W.V. Bosse Monogr.) Frequent in the Bitter Lakes.

— *C. racemosa* var. *clavifera* (W.V. Bosse Monogr.) Frequent in the Bitter Lakes.

*

33. *Caulerpa scalpelliformis* (Brown) Ag. in Zanardini 1858 p. 284

(Fig. 17)

This species was found once at Port Said on the breakwater "eastern jetty" at the mouth of the Canal at a depth of 0.5 to 1m below the water level. This site is more sheltered than on the western side of the breakwater.

Our plants are, however, much smaller in size than in the species. This is probably due to the new habitat in which the species grew. It could also be a temperature effect since in winter the water temperature at Port Said amounts to 16-18°C, whereas in the

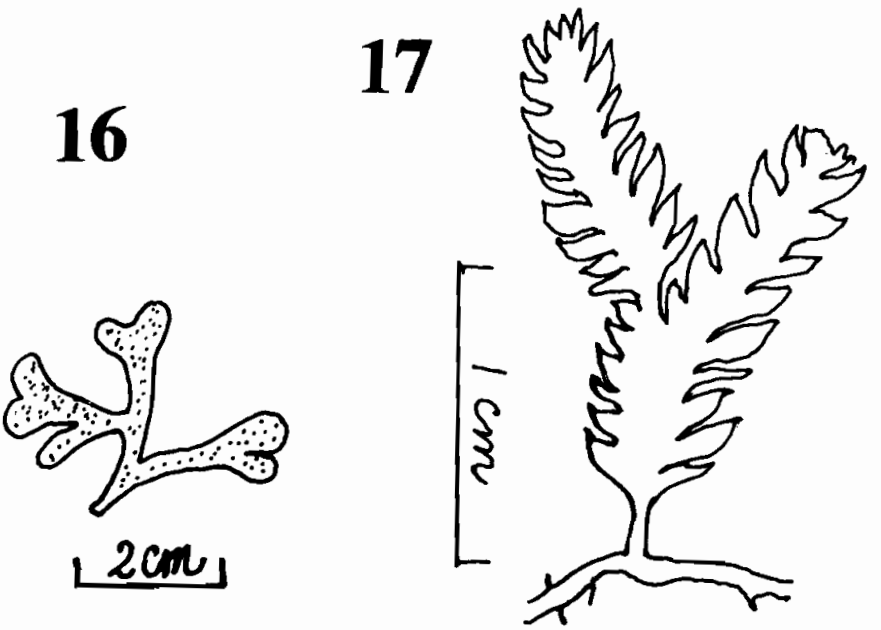

Fig. 16— Codium geppii(?): single frond.
Fig. 17— Caulerpa scalpelliformis from Port Said.

tropics, the winter temperature is several degrees higher.

Apart from the size, our specimens agree fairly well with *C. scalpelliformis,* particularly in the shape of pinnules and mode of branching.

Pinnules are alternate, subopposite or opposite. The apex of pinnules is mostly acuminate, but also tends to be obtuse or even rounded in rare cases.

I have compared my specimens with others from the Eastern Meditemanean under the No: 57828 in Herbarium Dawson at Los Angeles, collected from Palestine in December 1945 by A. Bursa and found a great similarity between the two plants, except for the size of the latter specimens, which reached 10-14 cm, in contrast to our specimens.

Weber van Bosse (1898) in her monograph of *Caulerpa* described several varieties of *C. scalpelliformis.* In this respect our plants could be compared with var. *intermedia* or var. *denticulata,* both varieties are known to occur in the Red Sea. Besides, Okamura (1915) (vol.3 pl. 125 fig. 9-10) described a new *Caulerpa* under *C. subserrata* Okamura and this bears resemblances also to our specimens, especially in the size of plants and shape of pinnules. Our specimens also approach *C. scalpelliformis* forma *Dwarkensis* described by Borgesen (1932) from Drwarke, India. The type locality of the Red Sea species described by Decaisne (1841) probably came from the Eastern Coast of the Red Sea.

34. *Caulerpa prolifera* (Fork.) Lamour. in Hamel, 1931, p. 94, fig. 29.

I was surprised when this *Caulerpa* came up in a dredge taken in the north tip of the Gulf of Suez in front of Port Tawfik. Samples of this *Caulerpa,* growing on muddy sand with stolons attached to shell debris were in a healthy condition and were neither transported by current nor loosely floating, but apparently established as a stand in this locality. The plant grows in abundance in autumn at Alexandria. I have never found it in any place else in the Red Sea so far. On occasions 1 or 2 plants came up in dredges made in the Canal but I was not sure whether they were floating with the current or growing in the Canal itself. The species was found also at Port Said. The record made by Muschler (1908) of this species at Suez thus seems justified.

PHAEOPHYTA
ECTOCAR PALES
ECTOCARPACEAE
Ectocarpus Lyngbye

*

1. *Ectocarpus elachistaeformis* Heydrich in Aleem, 1978b, p. 83, fig. 10.

This species grew together with *Goniotrichum Alsidii* on pier supports in shaded places at el Kab in December 1957.

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2. *Ectocarpus terminalis* Kutz. in Hamel, 1931-9, Pheophy. Fr. p. 51 fig., 17A.

(Fig. 20)

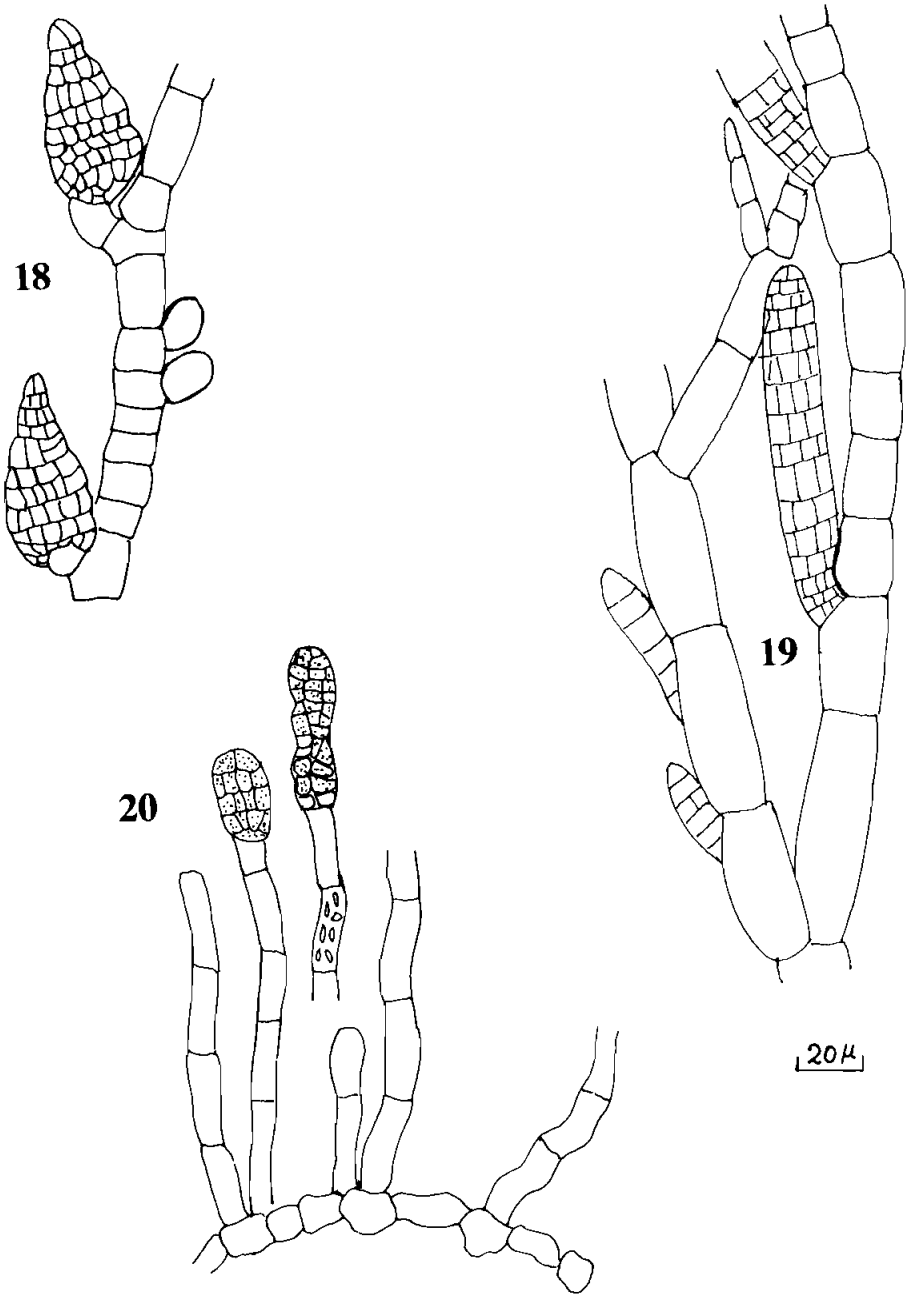

Fig. 18— Feldmannia irregularis.
Fig. 19— Giffordia Mitchellae.
Fig. 20— Ectocarpus terminalis.

This tiny alga formed small tufts, about one millimeter long, growing on hydroids at el Tina on 27 December 1957. Creeping filaments give rise to short erect filaments *ca* 10μ wide and about 25-35μ long. These end with sporangia *ca* 20μ wide X (30-60)μ long.

3. *Ectocarpus Reinboldi* Reinke var. (?) Atlas, 1890, Taf. 41, fig. 1-12.

To this species I refer with doubt a small *Ectocarpus*, a few millimeters long which was found as epiphyte on the delicate red alga *Lophocladia* growing at el Tina in December.

Filaments show intercalary growth, Sporangia are borne singly or in pairs, sessile or on a short pedicel. Chromatophores are small and discoid. Branches end with hairs. Cells are 20-30μ wide and 1.5-2 times longer. Sporangia measure 50 to 80 μ in length and 30-40 μ broad. Our plant is much smaller than Reinke's species.

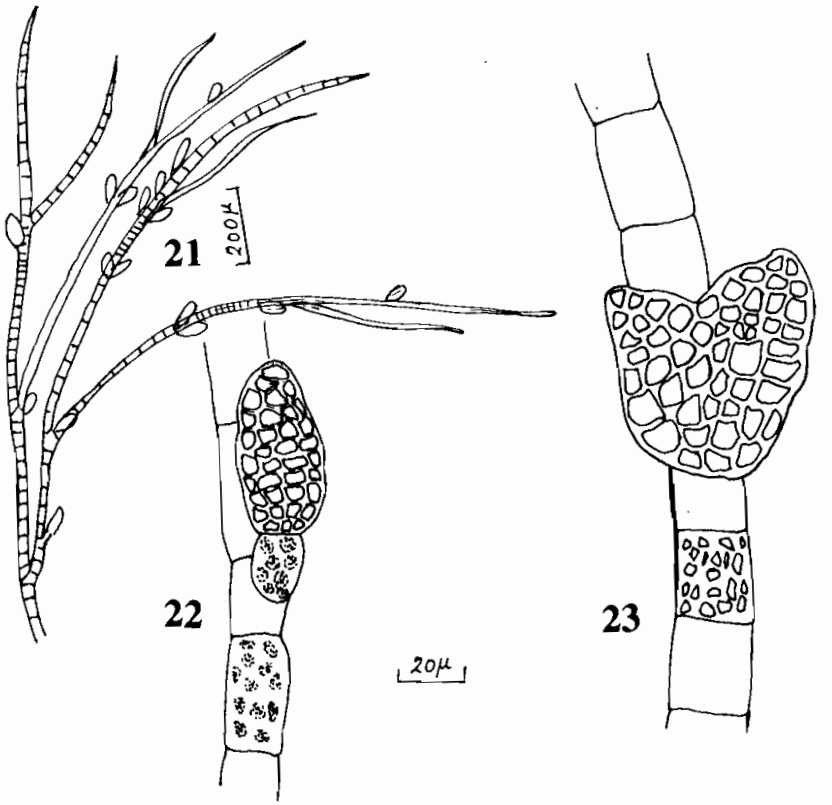

Fig. 21— 23. Ectocarpus Reinboldi: 21 - mode of branching; 22-single sporangium on short pedicel; 23-twin sporangia.

Feldmannia Hamel

4. *Feldmannia irregularis* (Kutz.) Hamel = *Ectocarpus irregularis* Kutz. Tab. Phyc. V. pl. 62 fig.1 = *Ectocarpus arabicus* Fig. et de Not. 1853 p.169 fig.5.

(Fig. 18)

Borgesen (1941 p. 23-31) also gave a full description of this species from Mauritius. The alga seems to be frequent at several stations in the Canal, especially at el Tina, el Kab and Genefa (Bitter Lake).

Giffordia Batters

5. *Giffordia indica* (Sonders) Papenfuss et Chihara in Papenfuss 1968 p.30 = *Ectocarpus duchassaingianus* Grun.

Found et el Kab in December. I had previously recorded it al al-Ghardaqa (Aleem 1978a).

6. *Giffordia Mitchellae* Harvey = *Ectocarpus Mitchellae* in Borgesen, 1939 Iranian Gulf, p. 75, figs 16-17;

(Fig. 19 and Pl. III fig. 2)

This species appears to be rather frequent in the Canal, growing on stones, on wood, on rubber tyres as well as on rocks at or near the water mark. Plants turn greenish in colour when dried.

Recorded from the following localities: Port Said, Abouty, el Tina, Lake Timsah, Bitter Lakes, Port Tawfik in November and December.

SPHACELARIALES

SPHACELARIACEAE

Sphacelaria Lyngbye

7. *Sphacelaria furcigera* Kutz. in Hamel, 1939, p. 255 fig. 47(16)

Found on pier supports at el Tina and el Kab.

8. *Sphacelaria tribulioides* Menegh. in Hamel, 1939, p.253 fig. 47(10)

On *Sargassum* and *Cystoseira* from the Great Bitter Lake.

Halopteris Kutz.

9. *Halopteris scoparia* (L.) Sauvageau, 1900-14, p. 349, fig. 69-73.

Appeared once in a dredge made at Port Tawfik in November; never recorded

before in the Canal. The species is very common at Alexandria.

DICTYOTALES
DICTYOTACEAE
Dictyota Lamour.

10. *Dictyota dichotoma* (Hunds.) Lamour.in Okamura, Icones 3,p. 39 pl. 111-113
In Great Bitter Lake in November.

Padina Adanson

11. *Padina Pavonia* (L.) Gaill. in Harvey, Phyc. Brit. pl.91.

Found both at Port Said and at Port Tawfik. Seems to be rare in intermediate stations.

PUNCTARIALES
SCYTOSIPHONACEAE
Scytosiphon Ag. (emend. Thuret)

12. *Scytosiphon Lomentaria* (Lyngb.) Ag. in Harvey, Phyc. Brit. pl. 285

Collected at el Tina in December. The only previous record of this species in the Canal was made by Lami (1932) in the Bitter Lake.

COLPOMENIA Derb. et Sol.

13. *Colpomenia sinuosa* (Mert.) Derb et Sol. in Aleem 1978 c, p. 110.

Young fronds were attached to *Hypnea* at el Tina in December; also found in November in the Great Bitter Lake on the mussel bank.

Hydroclathrus Bory

14. *Hydroclathrus clathratus* (Bory) Howe in Aleem, 1978c, p. 110 pl. 15 fig. 2
Found in the Bitter Lake with *Colpomenia*.

Rosenvingia Borgesen

15. *Rosenvingia intricata* (J.Ag.) Borgesen in Aleem, 1978c, p.110 pl. 16 fig.1
A single specimen was found on *Cystoseira myrica* in the Little Bitter Lake at Kabrit in November.

FUCALES
CYSTOSEIRACEAE
Cystoseira C.Ag.

16. *Cystoseira myrica* (Gmelin) C. Ag. in Aleem 1978c p.111, pl. 16 fig. 2

Dredged from el Tina at 8m; also found in the Bitter Lakes.

Cystophyllum C.Ag.

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17. *Cystophyllum trinode* (Forsk.) J.Ag. 1848 p. 230. Found together with *Cystoseira myrica* in the Bitter Lakes.

Sargassum C. Ag.

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18. *Sargassum crispum* (Forsk.) Ag. in Zanard. 1858, p. 25.

In the Great Bitter Lake in June.

19. *Sargassum subrepandum* (Forsk.) Ag. in Borgesen, Mauritius algae, II, p. 72 = *Fucus subrepandum* Forsk; Flora aegypt. arab. p. 192, 1775; Kutz. Tab. Phyc. XI, pl. 2 fig. 1

Obtained in the dredge at el Tina in December 1957.

20. *Sargassum denticulatum* (Forsk.) Borg. in Aleem 1978c, p. 111, pl. 18 fig. 2.

Found floating in the Great Bitter Lake in November 1953.

RHODOPHYTA
PROTOFLORIDEA
BANGIALES
Bangia Lyngbye

*

1. *Bangia fuscopurpurea* (Dillw.) Lyngb. in Hamel, 1925, Flor. Fr., p. 35.

Found on the Breakwater (Jetty) at Port Said, also at el Gameel outlet of Lake Manzala to the Mediterranean in autumn.

Porphyra C. Agardh

(Fig. 24 a-c)

2. *Porphyra umbilicalis* (L.) J. Ag. in Hamel, 1925, Florid. Fr. p. 28

A few specimens were collected at el Kab in November 1953. Thallus is more or less rounded, composed of one cell thick (fig. 24b) with a short stipe. The only previous record of this alga was that made by the Cambridge Expedition and only from Port Said.

Erythrotrichia Areschoug

3. *Erythrotrichia carnea* (Dillwyn) J. Ag. in Rosenvinge, 1909, p. 67 fig. 8; Hamel,

1925 p. 8 fig. 1.

Epiphytic on *Sarconema furcellatum* at el Kab, Port Said and on *Griffithsia* at Qantara.

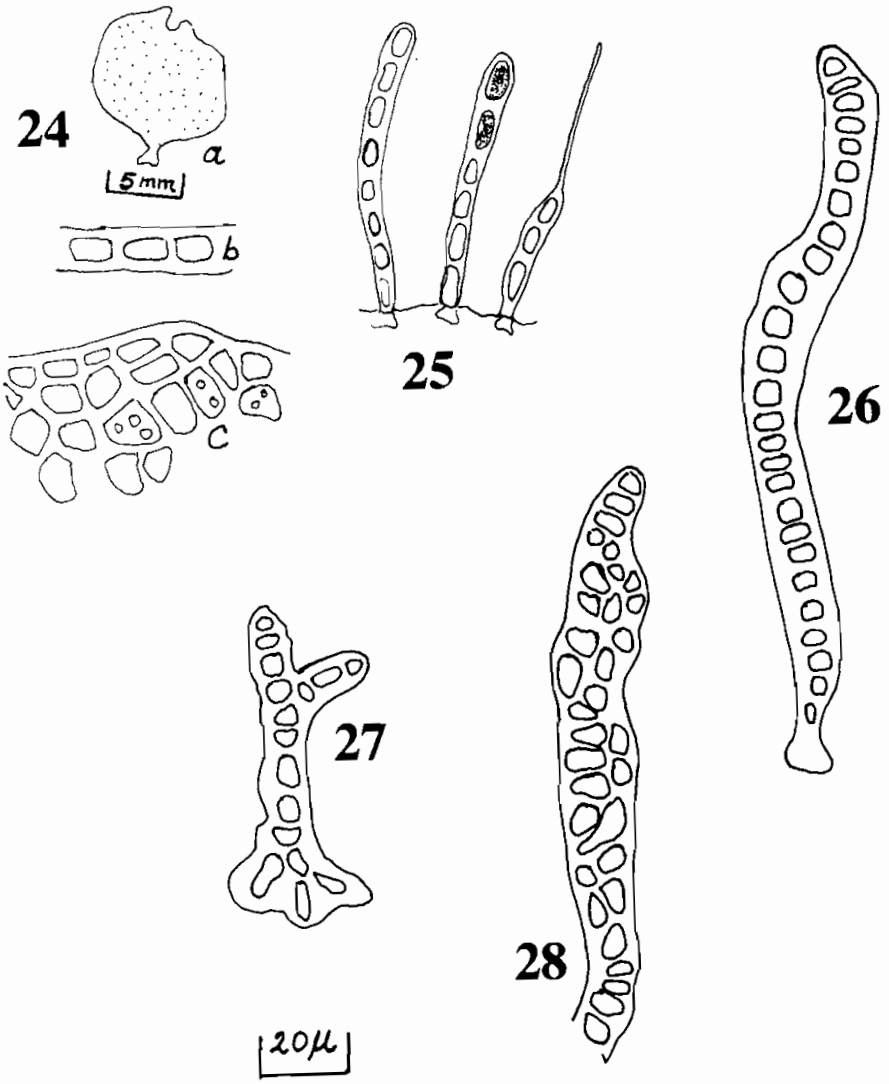

Fig. 24— Porphyra umbilicalis: a- single plant; b- T.S. in thallus showing a single cell thinkness; c- surface view showing polygonal cells.
Fig. 25— Acrochaetium unifilum.
Fig. 26— Goniotrichum Alsidii.
Fig. 27— 28. Erythrotrichia reflexa (27 - young plant, 28- upper part of mature plant).

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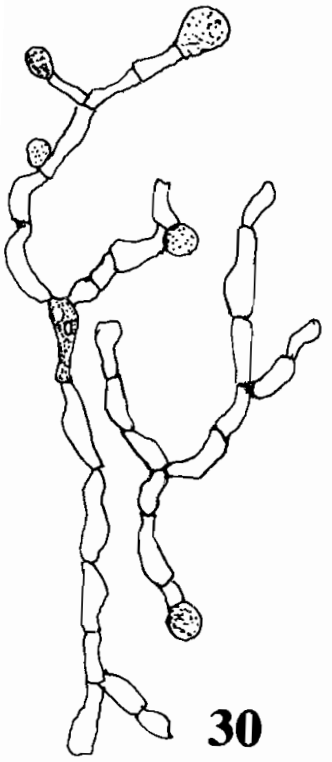
4. *Erythrotrichia investiens* (Zanard.) Bornet in Hamel, 1925, p. 14 fig. 1. Frequent on *Laurencia* at el Tina in November. This alga is characterized by its



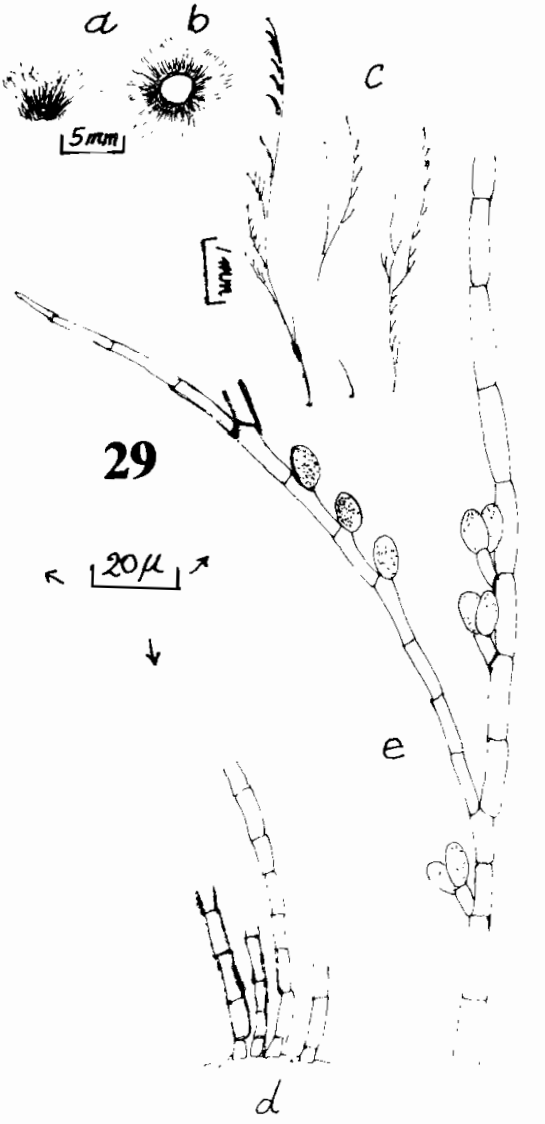


Fig. 29— Acrochaetium epizooicum nov. sp., a- habit; b- T.S. in hydroid showing dense cover by the alga; c- single filaments showing mode of branching; d- basal cells; e- filament with single and paired sporangia.

Fig. 30— Colaconema sarconemae: branching filaments with monosporangia.

basal disc and elongated cells, which may form 2 rows higher up. Cells are 10-15μ broad and upto 20μ higher up.

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5. *Erythrotrichia reflexa* (Cr.) Thuret in Hamel, 1925, p. 11 fig. 1.

(Fig. 27-28)

Epiphytic on *Hypnea musciformis* at el Tina and Port Said.

Erythrocladia Rosenvinge

*

6. *Erythrocladia subintegra* Rosenvinge, 1909, p. 73, figs 13-14.

Epiphytic on *Cladophora* at Port Said.

Goniotrichum Kutz.

*

7. *Goniotrichum Alsidii* (Zanard.) Howe, in Hamel, 1925, p. 37, fig. 7
= *Goniotrichum elegans* (chauv.) Le Jolis.

(Fig. 26)

Epizoic on hydroids at el Tina; also found on pier supports at el Kab.

Asterocystis Gobi

*

8. *Asterocystis ornata* (C.Ag.) Hamel, 1925, p. 40 fig. 7.
Epiphytic on *Hypnea* spp. at different stations.

Acrochaetium Nageli

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9. *Acrochaetium unifilum* Levring, 1953, p. 472, fig. 9.

(Fig. 25)

Thallus very small, consisting of a single erect filament. Cells 3-4μ thick and 1-2 times as long with parietal chrometophore,with a pyrenoid. Basal cell with a hyaline disc. The filament ends with a hair.

This species grew on *Sarconema furcellatum* at el Tina in November. It was first described by Levring from Australia.

*

10. *Acrochaetium robustum* Borgesen 1915, p. 40 fig. 38-40

Filaments arize from single cells aggregated together. They are 7-10μ thick. Grew on *Sargassum* from the Great Bitter Lake in autumn.

**

11. *Acrochaetium epizooicum* Aleem, nov. sp.

(Fig. 29 a-e)

Thallus minutes, epizooicum, e filis erectis et celluli basali constructus. Filis erectis subsimplicibus, 4-6 mm altis, 4-6μ crassis. Remellis ± secunda. Cellulae cylindricae, 3-6 plo diametro longioribus, chromatophorum parietale et pyrenoides continentes. Pili hyalini terminales occurunt. Monosporangia ovata, 4-6μ crassa, 8-10μ longa, 1-2 in numero, in filis unilateraliter sessilia vel in pedicillus unicellularibus.

Thallus minute, 4-6 mm long, composed of an erect filament arizing from a short basal cell (fig. 29d) and carrying secondary shorter ramules arranged in a + secund order (fig. 29-c). Filaments are cylindrical, 4-6μ in diameter, ending with hyaline hair. Basal cells are shorter than those higher up. Cells of the main filament are 3-6 times as long as broad, chromatophores parietal with pyrenoids.

Monosporangia arize singly or in pairs, are sessile or borne on a short 1-celled pedicel. They are seriately arranged on the short branches.

The species was found growing on hydroids at el Kab, Suez Canal, in salt water, at a depth of 0.5-1m below water under a pier in December 1957.

Colaconema Batters

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12. *Colaconema sarconemae* Aleem, nov. sp.

(Fig. 30)

In *Sarconema furcellatum* endophytica. Cellulae ± irregulares, 5-8μ crassae, diametro 2-4(5) plo longiores. Monosporangia rotunda vel subglobosa, 6-8μ × 10μ.

Cells ± irregular, 5-8μ thick, 2-4(5) times as long as broad. Monosporangia rounded to subglobose, measuring 6-8μ × 10μ.

GELIDIALES

GELIDIACEAE

Gelidiella Feldm. et Hamel

*

13. *Gelidiella acerosa* (Forsk.) Feldm. et Hamel, Sur quelques Gelidiacees, 1934.

Found a short distance south of Port Said at al Gameel, a connection of Lake Manzala to the Mediterranean, in brackish water.

Gelidium Lamour

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14. *Gelidium pusillum* (Stack.) Le jolis in Feldm. et Hamel, Florid, 1936 p. 236, fig. 19.

On upper littoral rocks at Port Said, Abouti and el Tina.

15. *Gelidium corneum* (Huds.) Lamour.in Borgesen, D.W.I 1920 p. 114, fig. 124.

Found at Port Said, el Tina, el Kab and Qantara.

16. *Gelidium crinale* (Turn.) Lamour. in Feldm. et Hamel, 1936 p. 240 fig. 5, pl. fig. 1.

Found at Abouti and in Lake Timsah.

CRYPTONEMIALES

CORALLINACEAE

Jania Lamour.

17. *Jania rubens* (L.) Lamour, in Kutz. Tab. Phyc. VIII, pl. 84.

Widely spread in most stations along the Canal.

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18. *Jania longifurca* Zanard. in Kutz. Tab. Phyc. VIII, pl. 78.

On *Caulerpa racemosa* in the Bitter Lakes.

19. *Jania adhaerens* Lamour, in Borgesen. D.W.I., 1920, p.195 Fig. 184-7.

Epiphytic on *Laurencia* at el Kab.

Lithophyllum Philippi

*

20. Lithophyllum (Dermatolithon) pustulatum (Lamour.) Foslie in Lemoine, 1965.

Epiphytic on various algae and on seagrasses at el Kab, el Tina and in the Bitter Lakes.

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21. *Lithophyllum incrustans* Philippi in Funk, 1929 pl. LVIII.

Found on the Breakwater at Port Tawfik in November.

22. *Fosliella farinosa* (Lamour.) Howe in Borgesen, D.W.I. 1920, p. 170, fig. 165

Epiphytic on *Caulerpa racemosa* in the Great Bitter Lake.

GRATELOUPIACEAE

Grateloupia J.Ag.

23. **Grateloupia filicina* (Wulf.) Ag. in Kutz. Tab. Phyc. XVII, pl. 22.

(Pl. IV fig. 1)

Our specimens are typically like those in Kutzing's figure. Fronds are 10-15 cm high, purple in colour, narrow at the base, dilated in the middle, being 3-4 mm in diameter. They taper at the tips and bear profuse proliferations. Cystocarpic plants were found in November, attached to the quays of the Suez Canal Company, in association with *Sarconema* and *Soliera dura*. Also found on the west bank of the Canal

between Port Said and el Tina including the Abouti station. In the latter the alga formed a belt under the *Enteromorpha* belt in November.

GIGARTINALES
Gracilariaceae
Gracilaria Grev.

24. **Gracilaria confervoides* (L) Grev. in Hauck Meeresalgen 1885, p. 182, fig. 77

Frequent at Port Said and on the west bank of the Canal south of Port Said at el Kab.

25. *Gracilaria arcuata* Zanard. 1858, p. 57 pl. 3 fig. 2.

Occurred at Port Said, el Tina, el Kab and in the Bitter Lakes along the Canal banks.

26. **Gracilaria canaliculata* (Kutz.) Sonder in Newton 1953 p. 415, pl. 3, fig. 4

Rather frequent at various stations in the *Laurencia* belt e.g. at Port Said, el Tina, Qarantina and Kabrit in November.

Branches frequently anastomose and become wrinkled when dry. Newton mentions as synonym to this species: *G. Wrightii* Turner, *G. Crassa* Harvey and *Corallopsis opuntia* J. Ag.

HYPNEACEAE
Hypnea Lamour.

27. *Hypnea musciformis* (Wulfen) Lamour. in Kutz. Tab. Phyc. 18, pl. 19

Very frequent at Port Said, el Tina and el Kab.

28. **Hypnea cornuta* (Lamour.) J. Ag. Epicr. 1876 p. 563; Borgesen, D.W.I. 1920 p. 382; fig. 368 Tanaka, 1941, p. 242, fig. 14.

This is a rather common alga in the Canal as well as at Port Said. It forms a distinct dark belt on the banks of the Canal below the *Enteromorpha,* particularly at Abouti, Qarentina and Kabrit, where it grew in autumn on small stones. Colour of living specimens is purple becoming blackish when dried.

The species was found epiphytic on *Sarconiema furcellatum* Zanardini growing in the lower littoral on the quays of the Suez Canal Company at Port Said in December 1957.

The plant is characterized by its stellate spines 1-5 (usually 3) rays which are peltately fixed on the branches or branchlets.

The thick cutile pointed out by Borgesen (l.c.) does not seem to be a constant character, since on one and the same fresh plant, the cuticle thickness could vary.

I had previously collected this plant at Alexandria.

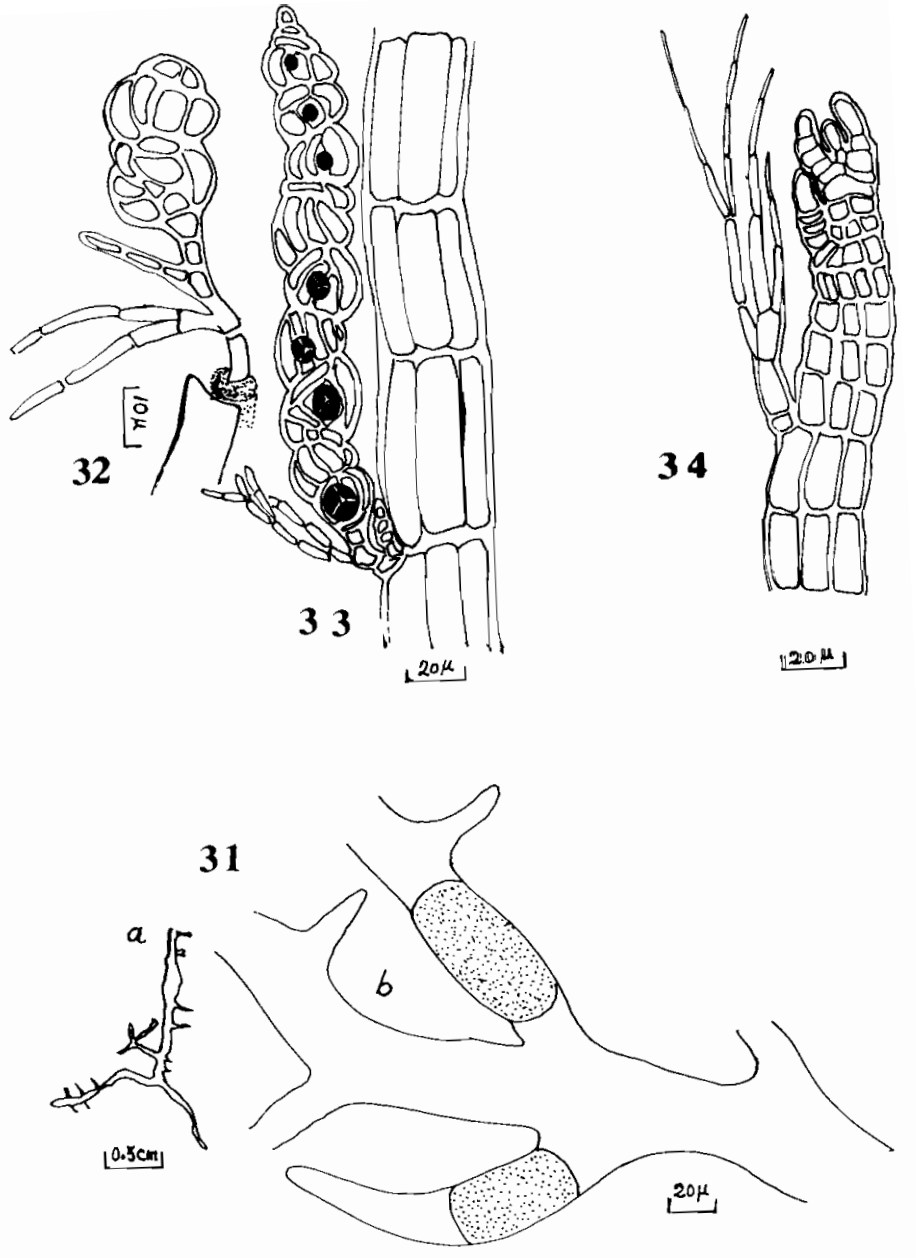

Fig. 31— Hyprea esperi; a- habit; b- fertile frond.
Fig. 32— 33. Lophocladia lallemandi; 32- young stichidium enlarged; 33- mnature stichidium.
Fig. 34— Polysiphonia variegata; apical branching.

29. *Hypnea valentiae* (Turner) Mont.

= *Hypnea valentiae* var. *hamulosa* decaisne, 1841, p. 183.

Formed bushes at el Tina in November.

30. *Hypnea esperi* Bory in Tanaka, 1941, p. 243, fig. 5.

(Fig 31 a, b)

Epiphytic on *Digenea simplex* and *Laurecia papillosa* at Kabrit in the Bitter Lakes. Found also creeping on stolons of *Caulerpa racemosa* dredged from 8 m at el Tina. Fertile fronds occur in winter.

SOLIERIACEAE

Solieria Ag.

31- *Solieria dura* (Zanard.) Schmidt in Aleem 1950 c.

Rather frequent in shaded sites e.g. under piers, at Port Said (quays), el Tina, el Kab. Colour of the plant is yellowish to pale violet, turning black when dried.

RHODYMENIALES

RHODYMENIACEAE

Lomentaria Lyngbye

32- *Lomentaria irregularis* Zanardini, 1885 p. 54 pl. 8 fig. 2.

This species was frequent in the Canal in December. It formed dense growth near the water surface, often attached to *Laurencia* and *Gracilaria* at several stations, particularly at Qantara, el Tina and el Kab.

n,v

Champia Desveaux

33. *Champia parvula* (J. Ag.) Harvey.

= *Lomentaria parvula* in Kutz. Tab. Phyc. XV, pl. 87.

Epiphytic on *Caulerpa racemosa* dredged at el Tina.

Sarconema Zanard.

34. *Sarconema furcellatum* Zanard. 1858, p. 56 pl. 8 fig. 1; Aleem 1948; Newton, 1953 p. 408 pl. 2 fig. 1.

(Pl. V, Fig. 1)

Rather frequent at several stations in the Canal, forming dense growth on wooden pylons particularly at Port Said, Abouti, el Tina el Kab, etc. Fertile fronds occurred in summer.

35. *Sarconema filiforme* (Sond.) Kylin in Borgesen, Kew Bull (1), p. 11, fig. 7.

This more slender alga was found intermingled with the previous species at el Kab, el Tina and Timsah Lake.

36. *Rhodymenia erythrea* Zanard. 1858, p. 68; Aleem 1948.

Frequent at the Canal Company quays in Port Said, at el Kab and el Tina in summer. Rarely encountered in November or December. Fertile plants (tetrasporic, male and female) occur in June.

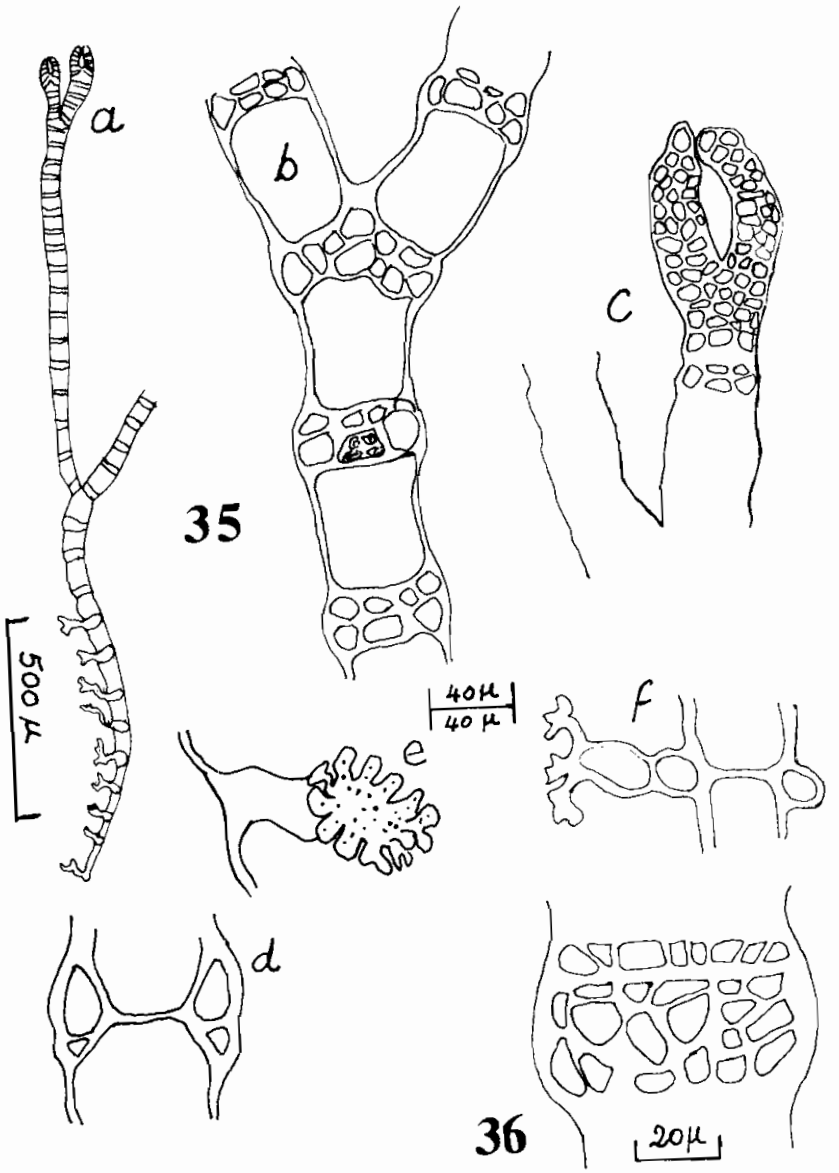

Fig. 35— Ceramium procumbens: a- habit; b- nodes and internodes; c- forcipate apex; d- optical section in a node; e- rhizoidal disc; f- rhizoidal branch with 2 cells.

Fig. 36— Ceramium taylorii: arrangement of nodal cells with a transverse area.

CERAMIALES
CERAMIACEAE
Ceramium (Roth) Lyngb.

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37. *Ceramium procumbens* Setch. et Gardn. in Dawson 1954 p. 448, fig., 56c, d.

(Fig. 35 a-f)

This tiny *Ceramium* (2-3 mm long and 30-50μ wide) was found epiphytic on *Solieria dura* dredged at el Tina in December. The plant is thin at base, becoming slightly thicker higher up. It is attached to the host by several 1-2 celled rhizoids which are branched at the base.

Cortical cells are fewer in number than in *C. taylori* and are not separated by a transverse area.

The plant also bears resemblance to *C. subverticellatum* Grun. described by Weber van Bosse (Siboga Expdn. II, 1923 p. 328 fig. 119). As a matter of fact all the tiny species of *Ceramium* need a critical revision.

38. *Ceramium taylori* Dawson 1950b p. 127 pl. 2 fig. 13 pl. 4 figs. 31-33.

(Fig. 36)

This small *Ceramium* (a few millimeters in length) was found epiphytic on *Avrainvillea amadelpha* in the Bitter Lakes (st. 16).

The plant is characterized by the division of the cortical bands by a narrow transverse line.

It was first discovered in Mexico and later on found by Dawson also in Viet Nam (1954) and by Lipkin (1972) in the Suez Canal. I also found it in the Red Sea (Aleem 1978b).

39. *Ceramium gracillimum* var. *byssoideum* (Harvey) Mazoyer in Feldm. 1942, p. 305.

Characterized by its transversely elongated internal nodal cells.

Found in the Bitter Lakes.

Spyridia Harvey

40. *Spyridia filamentosa* (Wulfen) Harvey in Borgesen, D.W.I., p. 233, fig. 222-226.

Frequent at el Tina, el Kab and Kabrit.

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41. *Spyridia aculeata* (Schimp.) Kutz. in Borgesen, D.W.I., II, p. 237, fig. 228-230.

Epiphytic on *Acanthophora* in the Bitter Lakes in summer.

Griffithsia C. Ag.

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42. *Griffithsia tenuis* C. Ag. 1828 p. 131; Hauck 1885, p. 91; Abbott, 1946 p. 441, pl. III, fig. 1-7.

Dense growth of this alga was observed in the littoral region at al Qantara attached to *Cystoseira myrica*. This association harboured also much flourescent bacteria and Foraminifera and when examined in the dark at night, strong luminescence was emitted. *Erythrotrichia carnea* grew also on this *Griffithsia*.

The high salinity of water at al Qantara (>40%‰) does not seem to prohibit the growth of such delicate algae.

The species is widely distributed in warm water. Dawson (1954) has also recorded it from Viet Nam.

The type specimen of this species in Agardh Herbarium is from Venice. However, neither Funk (1927) nor Feldmann (1942) included it in their Mediterranean flora.

RHODOMELACEAE

Laurencia Lamour.

43. *Laurencia obtuse* (Huds.) Lamour. in Borgesen, D.W.I. II, p. 247 fig. 237.

Rather Common at several stations including the Bitter Lakes.

44. *Laurencia papillosa* (Forsk.) Grev. in Borgesen, D.W.I., II, p. 246, fig. 236

Also common at most stations, forming a distinet belt in the lower littoral in the Canal.

45. *Laurencia paniculata*(?) (C.Ag.) J.Ag. in Funk, 1927 p. 448, fig. 47.

Found in shaded places at one meter or so below water at el Kab, Abouti, Kabrit; also dredged from el Tina. This identification remains doubtful until more material is studied.

Chondria C.Ag.

46. *Chondria tenuissima* (Good. et Wood.) C.Ag. in Falkenberg, Rhodomelac. 1901 p. 195, Funk, 1927.

Found on *Laurencia* at el Tina in June.

47. *Chondria repens* Borgesen in Dawson, 1954, p. 460 fig. 62 d, e.

Epiphytic on *Digenea simplex* and *Laurencia* at Kabrit.

Polysiphonia Grev.

*

48. Polysiphonia sertularioides (Grateloup) Ag. in Falkenberg 1901 p. 122, pl. 1, fig. 1-16.

Epilithic; collected at Port Said and el Tina.

*

49. *Polysiphonia variegata* (Ag.) Zanard. in Borgesen D.W.I., II, p. 269 figs. 264-266.

(Fig. 34)

Grew on *Balanus amphitrite* at el Tina, in November, 1953, forming tufts 3-5 cm high. It seems to endure desiccation. I found it frequently at Alexandria in the upper littoral, also in pools.

The species grew also at Qorintina on small stones on the east bank of the Canal.

Tetraspores occurred in November and December.

50. *Polysiphonia utricularis* Zanard. 1858, p. 49, pl. 6, fig. 2.

Collected at Port Said, el Tina, el Kab.

Herposiphonia Nageli

51. *Herposiphonia tenella* (C.Ag.) Ambronn in Falkenberg, 1901, p. 304, pl. 3, fig. 13-17.

Occurred in sand accumulated at the base of *Sargassum* and *Cystoseira* in the Bitter Lakes.

Lophosiphonia Falkenberg

52. *Lophosiphonia obscura* Falk. 1901, p. 500; Kutzing Tab. Phyc. XIII, pl. 40a-b.
Epiphytic on *Laurencia* at el Tina, el Kab and Kabrit.

Lophocladia Schmitz

53. *Lophocladia lallemandi* (Mert.) Schmitz 1893, p. 223 = *Dasya Lallemandi Mont. 1849.*
= *Polysiphonia hirsuta* Zanard. 1851.

(Fig. 32-33; Pl. VI, fig. 1)

Rather frequent at different stations in the Canal (Port Said, el-Tina, el-Kab and Qantara), particularly below low water. Plants are rose red to purple, caespitose, 5-10 cm long.

Borgesen (1934) states that the stichidia in the Indian plants were all young and small, much smaller than those of *L. trichoclados*. In our material, however, stichidia up to 500-600μ long and 70μ broad (fig. 32) were encountered. Young stichidia (fig. 32.) were globose to subglobose. Mature tetrasporangia reach 25-30μ in diameter.

In his material from the "Iranian Gulf" Borgesen (1939) noticed that the stichidia were more swollen and irregularly screw-formed. Such forms have also been observed in our material.

Acanthophora Lamour.

54. *Acanthophora najadiformis* (Delile) Papenfuss 1968 p. 96.
= *A. Delilei* Lamour. in Falkenberg, 1901 p.229 pl. 22 fig. 1.

(Pl. VII, Fig. 1)

In this species the main branches are covered with spines. Stichidia, on the other hand, are glabrous. This character distinguishes the species from *A. specifica* (Vahl.) Borgesen.

Our plants from the Suez Canal are usually 8-10 cm high. They form bushes below the *Laurencia* belt at various stations, particularly at al Qantara, Korentina (km76) and Ferdan (km 64). In the latter habitat, the plant formed a well developed belt in the

lower littoral on the east bank of the Canal. These latter plants were more robust, reaching up to 20 cm long. *Champia irregularis* is often associated with *Acanthophora.*

Leveillea Decsn.

55. *Leveillea jungermannioides* (Mert. et Her.) Harvey in Falkenberg, Rhodomelac. 1901, p. 392, pl. 6, fig. 1-13.

Epiphytic on *Cystoseira myrica* and other algae *(Sargassum, Laurencia)* in the Bitter Lakes. Also encountered at el Tina in November.

Digenea Ag.

56. *Digenea simplex* (Wulf.) Ag. in Borgesen, D.W.I. II, p. 281, fig. 281
Frequent in the Great Bitter Lake.

Marine Phanerogams in the Suez Canal

The first record of seagrasses in the Canal, dates back, as mentioned in the introduction, to the Cambridge Expedition. Rendle (in Fox 1926) identified *Diplanthera uninervis* and *Halophila stipulacea* in the Canal in addition to *Ceratophyllum demersum* (abundant fresh and brackish water species in Egypt). The latter was collected from the fresh water canal known as Ismailia Canal running along the Suez Canal. Lipkin (1972) also recorded the two former species in the Bitter Lakes.

During the present investigation the following marine phanerogams have been encountered in the Canal.

SPERMATOPYTA

1. *Halophila stipulacea* (Forsk.) Ascher, in Aleem 1962.

(Pl. VIII, Fig. 1)

This plant was dredged in great quantities at el Tina and al Qantara (2 new station records for the Canal) in November 1953. Also found in quantities in the Bitter Lakes. Plants from the Canal are less robust than those from Mersa Matrouh (Aleem, 1962) or from al Ghardaqa or Arabia.

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2. *Halophila ovalis* (R. Brown) Hooker fil in Aleem 1979, p. 77, fig. 2.

A few specimens were found among *H. stipulacea* in the sandy shore of the Great Bitter Lake in November.

3. *Halodule uninervis* (Forsk.) Aschers, = *Diplanthera uninervis* (Forsk.) Aschers. in Aleem, 1979, p. 75

Dredged from muddy bottom at el Tina in November.

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4- *Thalassia hemprichii* (Ehr.) Aschers. in Aleem 1979, p. 76.

Only a few leaves were found entangled with algae at el Tina, others were found floating in the Canal.

CONCLUSIONS

From the foregoing survey of the algae and phanerogams inhabiting the Suez Canal and with reference to hydrographic and ecological observations, to be published separately, the following major conclusions could be drawn out.

1. The numbers of algal species encountered during this survey in the Suez Canal (131 spp.) and that of marine phanerogams (4 spp.) represent the highest numbers so far recorded in the Canal. Thus the Cambridge Expedition during October and November 1924 compiled a list of only 36 algae and 2 marine grasses in the Canal, while Lipkin (1972) recorded 65 algae (excluding 5 diatoms) and 2 seagrasses.

2. Our list comprises 21 spp of blue green algae, 34 spp. of green algae, 20 spp. of brown algae and 56 spp. of red algae, thus representing a total increase of about 100% of the number of species previously known in the Canal. While marine grasses collected, likewise, represent double the number so far known from this waterway.

3. Littoral algae along the Canal banks display zonation in narrow belts, arranged from upwards downwards as follows:

— an encrusting blue green — community
— a green algal belt of *Enteromorpha* and *Ulva*.
— a red algal belt of *Laurencia* — *Hypnea*.

To these is added a characteristic lower littoral belt of *Cystoseira myrica* — *Caulerpa racemosa* — *Sargassum* in the Bitter Lakes.

4. Since its opening in 1869, the Canal has served as a pathway for algae between the Red Sea and the Mediterranean. Several algal "immigrants" from the Red Sea have established themselves in the Mediterranean (Aleem 1948, 1950c; Lipkin 1972), while only a few species have been successful to cross in the opposite direction, i.e. from the Mediterranean into the Red Sea. Among these latter species mention is made of *Caulerpa prolifera* and *Halopteris scoparia*, dredged in Port Tawfik.

5. The presence of Indo-pacific species in the Canal benthos as well as in the Eastern Mediterranean, supports the view of "step by step" migration, although a "jump migration" is not excluded.

6. Contrary to older beliefs, the Bitter Lakes (Salinity > 45‰) do not form a barrier for species migration. Even such delicate forms as: *Griffithsia tenuis*, *Ceramium Taylori* and *Ceramium gracillimum* could thrive in these lakes.

7. During this investigation, the high-salinity Red Sea water prevailed in the Canal all the way until el Tina, 25 km south of Port Said. The Red Sea current would also flow along the bottom of the Canal into the Mediterranean most of the year (due to its high sigma-t), even though the surface wind is in the opposite direction. In fact such a N-wind should favour this bottom current.

This explains the presence of such species as *Caulerpa racemosa*, *Sarconema furcellatum* and *Halophila stipulacea* at such places as Qantara and el Tina in the Canal itself; it also explains the preponderance of species of Red Sea origin in the Eastern Mediterranean.

8. The number of tropical and subtropical algae living in the Canal increases

progressively from North to South. The Bitter Lakes harbour an algal flora similar to that prevailing in the Northern Red Sea.

9. The following algae are new records to the algal flora of the Northern Red Sea and/or the Eastern Mediterranean: Pleurocapsa amethystea Rosenvinge, Pleurocapsa crepidinium Collins, Microcoleum Wuitneri Fremy, Phormidium tenue (Menegh.) Gom., Hydrocoleum lyngbyaceum Kutz., Eugomontia sacculata Kornmann, Chaetomorpha capillaris (Kutz.) Borg., Ectocarpus terminalis Kutz., Ectocarpus Reinboldii Reinke. Acrochaetium unifilum Levring, Acrochaetium epizooicum Aleem nov. sp., Colaconema sarconemae Aleem nov. sp. Erythrotrichia investiens (Zanard.) Bornet, E. reflexa (Cr.) Thuret and Ceramium procumbens Setch. et Gardner.

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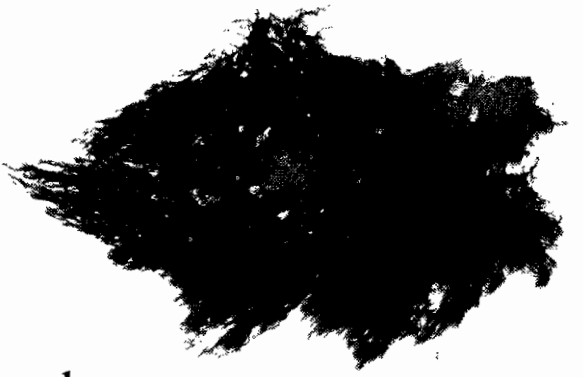

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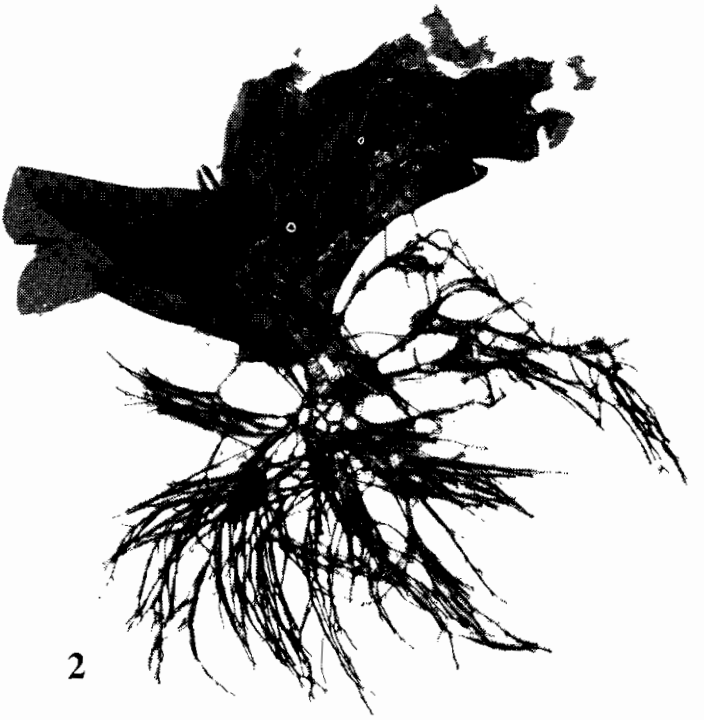

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Fig. 1- Lyngbya aestuarii (X 1).
Fig. 2- Ulva lactuca epiphytic on Hypnea sp. (X 1).

1

Fig. 1- Enteromorpha prolifera.

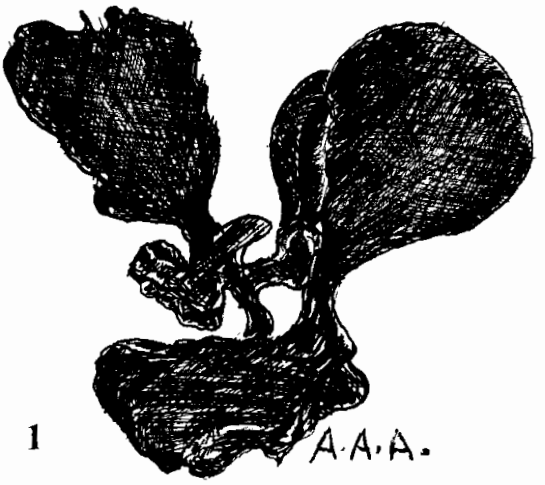

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Fig. 1- Avrainvillea amadelpha (X 1).
Fig. 2- Giffordia Mitchellae (X 1).

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Fig. 1- Grateloupia filicina (X 1).

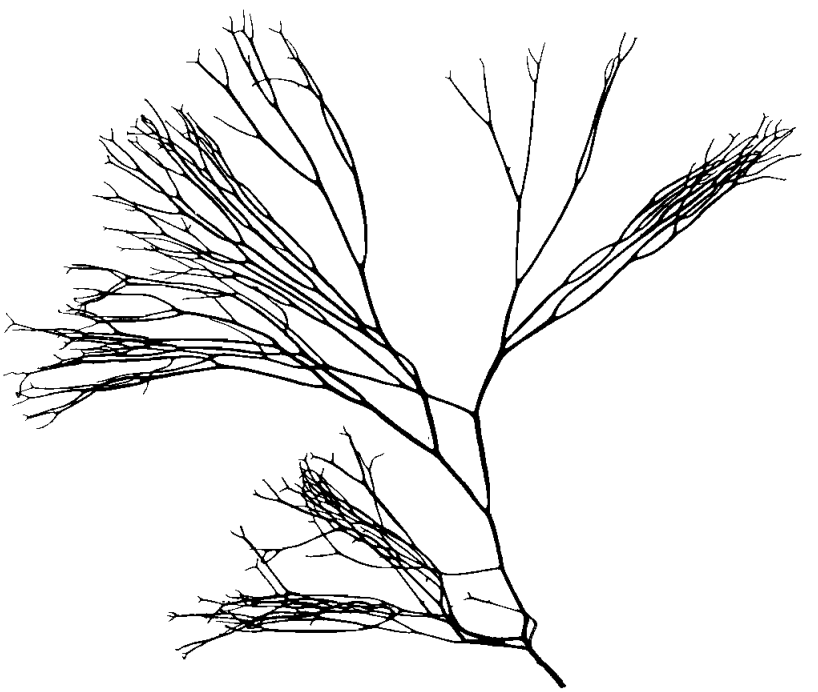

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Fig. 1- Sarconema furcellatum (X 1).

1

Fig. 1- Lophocladia lallemandi (X 1).

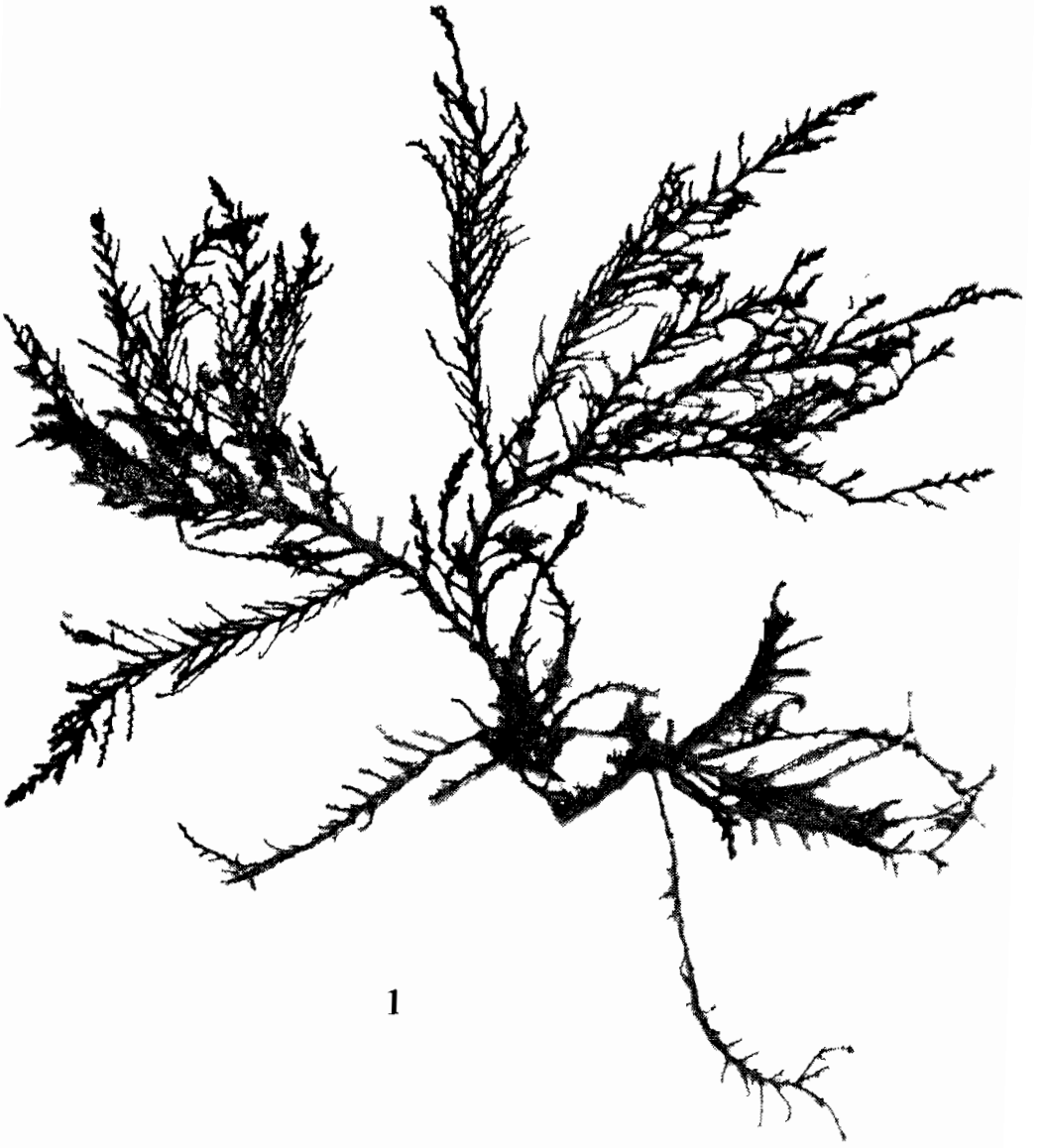

Fig. 1- Acanthophora najadiformis from the Great Bitter Lake (X 1).

Fig. 1- Halophila stipulacea from el Tina, 25 km south of Port Said (X 1).

دراسات على طحالب البحر الأحمر
الجزء الرابع:الطحالب البحرية والاعشاب المزهرة فى قناة السويس
(دراسة تقسيمية)

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١ ــ فى هذه الدراسة قام الباحث بجمع عينات من ٢١ محطة على طول قناة السويس بين مدخل القناة فى بورسعيد على البحر الابيض المتوسط وبورتوفيق على مدخل خليج السويس فى فصول الصيف والشتاء والخريف · وشملت الدراسة كذلك جمع عينات بالجرافة من قاع القناة ومن الجزء الشمالى لخليج السويس الى جانب تقدير بعض العوامل الهيدروجرافية كتوزيع الحرارة والملوحة على الاعماق المختلفة · ويختص هذا البحث بمناقشة نتائج الدراسة التقسيمية وحدها ·

٢ ــ تمخضت دراسة العينات ومقارنتها بعينات محفوظة فى معاشب لوس انجلوس ولننجراد عن تسجيل ١٣١ نوعا من الطحالب البحرية موزعة على طول القناة تنتمى للأقسام الاتية :

	عدد الانواع المسجلة فى هذا البحث	الانواع الجديدة للقناة	الانواع الجديدة لشرقى البحر الابيض المتوسط او لشمال البحر الاحمر
طحالب زرقاء	٢١	١٤	٥
طحالب خضراء	٣٤	١٨	٢
طحالب بنية	٢٠	٨	١
طحالب حمراء	٥٦	٣٠	٦
المجموع	١٣١	٧٠	١٤

ومن بين هذه الأنواع نوعان جديدان للعلم من الطحالب الحمراء يوصفان الأول مرة وهما : Acrochaetium epizooicum Aleem sp. nov. ·Colaconema sarconemae Aleem sp. nov.

وتعتبر الدراسة سالفة الذكر اضافة كبرى لمعلوماتنا عن طحالب قناة السويس وخاصة اذا استعرضنا تاريخ مثل هذه الدراسات فى القناة والتى بدأت بتسجيل ٨ أنواع فقط فى عام ١٩٠٨م بمعرفة موشلر وتلتها الدراسة التى قامت بها بعثة جامعة كمبردج عن فونا وفلورا القناة فى عام ١٩٢٤م والتى تمخضت عن تسجيل ٣٦ نوعا من الطحالب ، ثم الدراسة الحديثة التى قام بها ليبكين عام ١٩٧٢م وسجل فيها ٦٥ نوعا من هذه الطحالب · وعلى هذا الاساس فان الدراسة الحالية قد ضاعفت معرفتنا بطحالب القناة · كما اضافت لمعلوماتنا عن فلورا شرقى البحر الابيض المتوسط وشمال البحر الاحمر ·

وفيما يتعلق بالاعشاب المزهرة فقد كان كل ما عرف منها نوعان فقط منذ بعثة كمبردج · وفى الدراسة الحالية سجلنا اربعة انواع منها فى القناة اى بزيادة مقدارها الضعف ايضا ·

٣ ــ يوجد تشابه كبير بين طحالب البحيرات المرة (ملوحتها تزيد على ٤٥ فى الالف) وطحالب الجزء الشمالى للبحر الاحمر · كما تقل الانواع الاستوائية والمدارية بصورة عامة كلما اتجهنا شمالا فى القناة · ولا يمكن اعتبار الملوحة العالية فى هذه البحيرات عائقا لنمو الطحالب او هجرتها كما كان الاعتقاد القديم وذلك طالما وجد فيها كثير من الانواع الدقيقة وخاصة من الطحالب الحمراء وقد تأقلمت فى هذه البحيرات ·

٤ ــ لعبت قناة السويس منذ افتتاحها للملاحة فى عام ١٨٦٩م دورا فى هجرة انواع عديدة من الطحالب تنتمى فى الاصل لأرخبيل الملايو والبحر الاحمر الى شرقى البحر المتوسط حيث استقرت فى هذه البيئة الحديثة وزاد انتشارها · ومن هذه الطحالب : كوليبربا راسموزا ، كوليبربا سكالبللى فورمز ، سوليريا دورا ، هيبنيا كورنيوتا ، هيبنيا اسبرى ، لوفوكلاديا لالماندى ، وغيرها ·

اما الطحالب التى تنتمى الى فلورا البحر الابيض المتوسط والمحيط الاطلنطى فنادرة الوجود جدا فى خليج السويس · ومن هذه نوعان فقط تمكننا من العثور عليهما بالجرافة فى شمال خليج السويس وبورتوفيق وهما ··

كلويبربا بروليفرا ، وهالوبترس سكوباريا

وقد يعزى ذلك الامر الى تغلب التيار البحرى المتجه من البحر الاحمر الى البحر الابيض المتوسط والذى يسود اغلب ايام السنة على التيار القادم من الاتجاه المضاد اى من البحر المتوسط الى الاحمر · وحتى فى الجرفات التى اخذت عند التينة على بعد ٢٥ كم فقط الى الجنوب من بورسعيد وجدنا انواعا كثيرة تنتمى لفلورا البحر الاحمر ويعزى ذلك للتيار القاعى عالى الملوحة القادم من البحر الاحمر على قاع القناة · وقد يثور الجدل حول منشأ هذه المياه عالية الملوحة خاصة فى النصف الشمالى على قاع القناة فى بعض اوقات السنة ، ومهما كان الامر فهى صالحة لنمو طحالب البحر الاحمر التى ثبت وجودها فى الكاب والقنطرة وغيرهما على قاع القناة ·

وعلى الرغم من نجاح العشب البحرى « هالوفيلا ستيبيولاسى » الذى ينتمى لفلورا ارخبيل الملايو والبحر الاحمر فى التأقلم فى الحوض الشرقى للبحر المتوسط فان أيا من اعشاب هذا البحر الاخير لم يسجل وجوده حتى الان فى البحر الاحمر ·