DISTRIBUTION AND PERIODICITY OF ALGAL FLORA IN EL-KHASHAB CANAL DURING WINTER AND SPRING MONTHS

By

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SUMMARY

The distribution and periodicity of algal flora in El-Khashab canal (U.A.R.) during winter and spring months of the year 1968/1969 were investigated.

Of a total amount of 101 species belonging to 44 genera, diatoms formed the main bulk (74 sp. belonging to 19 genera) followed by the green algae (22 sp. belonging to 20 genera) and then by the blue greens (5 sp. and genera). The greatest number of these algal groups were found in winter and the least in spring mainly due to the enrichment of the canal water with PO_4 and NO_3 in winter months.

The cold season was characterised by the abundance of diatoms and blue-green while the warm season by the abundance of green algae.

Five forms from Bacillariophyceae, two from chlorophyceae and only one from cyanophyceae were the predominants. Also five forms of diatoms and only one form of either Chlorophyceae or Cyanophyceae were dominants. The subdominants, and the other forms were variable from season to season.

In the spring season, diatom species decreased due to deficiency of O , NO_3, PO_4 and Ca. But the maximum development of green algae was reached during this season where *Ankistrodesmus septatus* and *Scenedesmus sp.*, in March, and *Chlorococcum humicolum*, in May, were the most abundant. In winter, *Oscillatoria sp.* and *Nitzschia sp.* dominate the other forms of algae except in March where *Ankistrodesmus* and *Scenedesmus sp.* have the leadership and in February where *Cocconeis placentula* shares the leading position with *Oscillatoria* instead of *Nitzschia* sp.

The abundance of *Nitzschia tryblionella*, the predominance of *Cocconeis placentula*, the dominance of *Navicula cryptocephala* were mainly due to operation of suitable saliferous conditions ; the abundance of *Synedra ulna* due to operating low temperature together with enrichment of water with Ca ; the abundance of *Cyclotella Meneghiana* due to sunshine, high temperature and suitable salt content.

The succession of dominating *Navicula. Epithemia and Nitzschia species* was due to the special requirement of each species for temperature, salinity and availability of nutrients mainly NO_3 and PO_4.

Oscillatoria and *Spirolena* abundance was apparently due to sunshine.

INTRODUCTION

The factors affecting the periodicity of algae from various locations of the world have been studied by many workers. Fritsch (1906) has pointed out that periodicity in aquatic vegetation may be of two kinds, seasonal and irregular. Seasonal periodicity (or regular periods) is the result of periodically recurring factors while irregular periodicity is that which may occur at any time.

Pearsall (1932) had adopted as a working hypothesis the view that deficiency of O_2, NO_3, Si or Ca is usually the factors limiting diatom periodicity. Atkins (1932) associated diatom periodicity with silica, nitrate and phosphate. Rao (1955) found that the oxidisable organic matter and sunshine appeared to be factors affecting the periodicity of the blue-green algae. Holsinger (1955) found a general correlation between the periodic influx of organic matter during seasons of heavy rainfall and increases in the volume of phytoplankton. Gran (1929) noted that succession of dominating diatoms is probably due to the special requirements of each species for temperature and salinity. Braarud (1935) stated that salinity, pH and Ca content affect the kind of species that may be abundant, rather than the total amount of the plankton.

Other workers have also found that not one physical or chemical factor only affects the algal growth or periodicity, but the effectiveness is due to the sums of these factors together. Fritsch (1906), Rice (1938), Hodgetts (1922), Patrick (1945) have emphasized the probable importance of the factors operating together such as sunshine, rainfall, temperature and variation in water content. Jorgensen (1957) mentioned that the occurrence of new maxima of diatoms seem to depend on two main factors, availability of fresh quantities of soluble silicon in the water and the

occurrence of other plankton algae. In one and the same water, Patrick (1936) found that the different planktonic individuals show diverse variations in different seasons. Some of these individuals are permanently found in the waters but show an enormous development in one or two seasons of the year ; these species are called by Pearsall (1924) the abundant species. Pearsall (1924) stated that an abundant species is not necessarily one of the constant ones, but they attain dominance when the concentration of the nutrients such as silica, nitrate and phosphate are in higher rands. Hart (1935) stated that in temperate waters one of the most observed problems presented by the phytoplankton is the sudden appearances and disappearances of several species in tremendous quantities. This phenomenon is known as a «bloom». He further stated that the general pattern of seasonal fluctuation is influenced by the physical and chemical factors of light, temperature and availability of nutrient salts mainly nitrate and phosphate.

The distribution, growth and periodicity of algal flora found in a wide variety of ecological situations in U.A.R. have received a little work by few algologists. In two recently published papers, Nosseir and Abou-Elkheir (1969 a & b) have studied the distribution and growth of algal flora found in two main lakes in U.A.R. (Qarun and Nasser) where they correlated the existing algal flora with the dissolved nutrients of the waters. In the present investigation, the authors have chosen El-Khashab canal since it lies near-by and has not yet been studied.

El-Khashab canal lies to the East of the River Nile in Dar-El-Salam suburb near Cairo. It is an irrigation canal and receives its water from the Nile near El-Saff town, then it extends Northwards through cultivated lands between Helwan and El-Maadi. It ends in Dar-El-Salam island where it drains its water in a small Port (Athar-El-Nabi) on the Nile.

The part of El-Khashab Canal which extends through Dar-El-Salam area is about 4 km. long and it is the part from which our samples were collected. Its average width and depth is 5 and 1.5 meters respectively and it is bounded in some places by macroscopic vegetation (Fig. 1).

The aim of the present work is to investigate the distribution and periodicity of the algal flora found in El-Khashab canal (Dar-El-Salam region) during winter and spring months of the year 1968/1969 starting from December, 1968 till June, 1969. The completion of this work during summer and autumn months of the same year will be the aim of a subsequent paper.

MATERIAL AND METHODS

Regular monthly visits were made to the sites of collection for a period of 7 months. Five sites were chosen (Fig. 1), and two samples were taken from every site. The samples were centrifuged at 2000 rev./min. for 10 minutes. The resultant deposit was examined microscopically and the supernatant liquid was subjected to microanalysis for pH, O_2, NO_3, PO_4, Cl, Mg, Ca and K using the references and methods already used by the authors (1969 a).

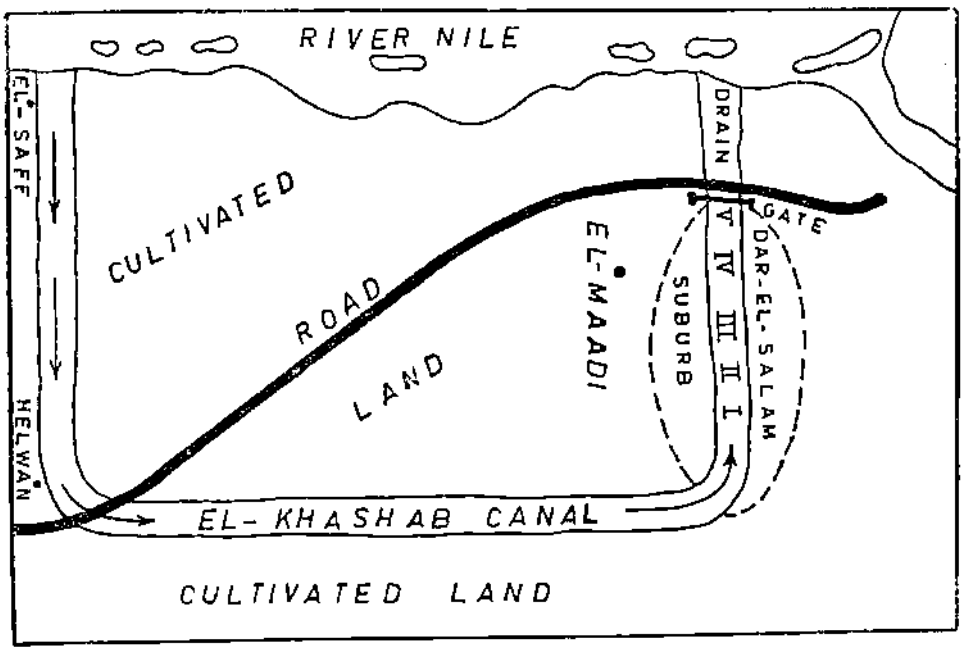

Fig. 1 — El-Khashab Canal. The dotted area and the numbers indicate the region and the sites of collection.

At the time of sampling, notes were taken of the temperature of air and water, clarity and depth of water, and whether flowing or still, weather conditions ; degree of shade over sampling points ; nature and quantity of macroscopic vegetation in water and animal life as well. The topographical factors that appeared relevant to our study are taken into consideration.

The data recorded in table (1) represent the average concentration of every nutrient or the pH found in the ten samples taken monthly from the five sites and these averages are also represented graphically by

figure (2). A full list of all algae identified is compiled in table (2). Also analysis of the algal taxa (genera and species, common and uncommon) is shown in table (3) while table (4) shows analysis of state of occurrence (predominance, dominance, subdominance, presence and rarity) of these algal taxa.

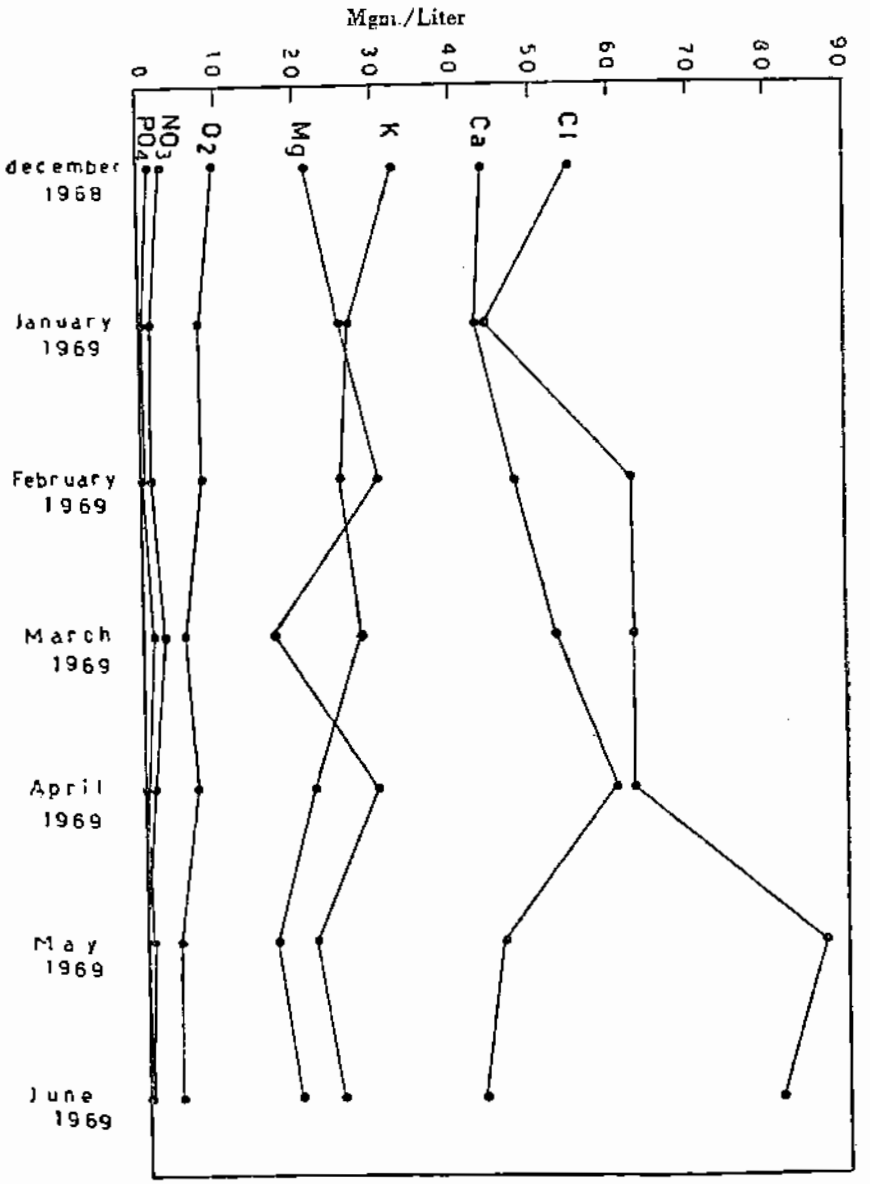

Fig. 2 — Dissolved Nutrients of El-Khashab Canal water during winter and spring months, 1968/1969 (Mg./L.).

RESULTS AND DISCUSSION

From table (2), it is clear that the ingradients of the samples were not only diatoms but also blue-green and green algae. Approximately 101 species belonging to 44 genera have been identified. However, the total volume of diatoms, blue-green and green algae vary from season to season, table (3). The greatest number of these algal groups were found in the cold season and the lowest number during the warm season. Willans (1964) indicated that the enrichment of water with nitrate, phosphate and trace of minerals may account for a significant increase in population density of phytoplankton. Hart (1935) stated that the general pattern of seasonal fluctuation of phytoplankton is influenced by the physical and chemical factors of light, temperature and availability of nutrient salts mainly nitrate and phosphate. Here in El-Khashab canal under investigation, the low nitrate and phosphate content of water seems to be responsible for the significant decrease of the algal population found in the warm season since this decrease was accompanied by significant decreases in nitrate and phosphate concentration (table 1 and figure 2).

It is also shown from table (3) that when the algal groups were arranged according to the number of species present. the diatoms come first represented by 74 species belonging to 19 genera. The diatoms were followed by the greens (22 spp. and 20 genera) and then the blue greens in sequence (5 spp. and 5 genera).

During the cold season (Dec. — March), the algal population was characterised by rich development of *Oscillatoria* and *Nitzschia*, but during the warm season (March — June) *Ankistrodesmus* and *Chlorococcum* made up a considerable part the algal community. Thereby, the cold season was characterised by the abundance of the diatoms and blue-green algae, while the warm season by the abundance of the green algae.

As shown in tables (2) and (4), the total number of diatoms dominated the other groups of algae. Of the many forms present in the Bacillariophyceae, 5 forms were the predominants and were represented by *Nitzschai obtusa. v. brevissima, Cocconeis placentula, Nitzschia palae, v. tenuirostris, Nitzschia thermalis, Nitzschia thermalis, v. intermedia*, while only one represents the Cyanophyceae *(Oscillatoria sp.)* and two represent the Chlorophyceae *(Chlamydomonas* spp. and *Euglena spp.)*.

Also among Bacillariophyceae, 5 forms were dominant and are represented by *Cyclotella kutzingiana, Hantzschia amphioxys ; Melosira crenulata v. tenuis. Navicula cryptocephala, Nitzschia dubia*, while only one

represents the Cyanophyceae (*Nostoc* sp.) and one represents the Chlorophyceae *(Chlorococcum sp.)* However the subdominant, present, and rare species are usually different from one month to another.

The occurrence of *Ankistrodesmus* in March and *Chlrococcum* in May in abundance is one of the surprises, because they are extremely rare throughout the rest of the months, as they never attain such numbers as in there months where they are present in copions masses.

In the winter season, *Oscilltoria sp.* and *Nitzschia sp.* dominate the other forms of algae present in this season, except in March where *Ankistrodesmus septatus* and *Scenedesmus sp.* have the leadership, and in February in which *Cocconeis placentula* shares the leading position with *Oscillatoria* instead of *Nitzschia.*

In the spring season, the number of diatom species started to decrease gradually especially at the end of it. The desmids firstly appeared during this season and were well represented by *Closterium* in April. The maximum development of green algae was reached during this season especially in May where *Ankistrodesmus septatus* and *Scenedesmus* sp. and *Chlorococcum humicolum* were the most abundant.

Rich (1935) correlated desmid development with pH 7. This was found concordant with the present investigation where in April the pH value of El-Khashah Canal water reached its maximum and was 6.7 with simultaneous development of desmids, *Closterium* in particular.

In May and June where the temperature started to increase, the decrease of diatoms (quantitatively and qualitatively) reached its minimum development (average minimum and maximum temperature in May and June were 20 — 28 and 21 — 40°C respectively). This was found to disagree with Godward (1937) who stated that diatoms predominate flora in the spring and autumn. However, Pearsall (1932) adopted the view that deficiency of O_2, NO_3, Si or Ca are usually the factors limiting diatom periodicity. Atkins (1932) associated diatom periodicity with silica, nitrate and phosphate. In the present investigation, the minimum development of diatoms in El-Khasbab Canal in May and June might be due to deficiency of O_2, NO_3, PO_4 and Ca where these nutrients reached their minimum concentrations (table 1 and figure 2).

Nitzschia tryblionella was found abundant during December, 1968. Foged (1947 and 1948) found it slightly saliferous and pure fresh-water alga while Budde (1930) considered it as brakish in contrast to Kolbe (1927)

who regarded it as halophilic. The chloride concentration of El-Khashab canal water during the total period of study never exceeds 90 mgm./L. and this speaks in favour of the findings of Foged (1947 and 1948) and renders this alga a pure fresh-water one.

Cocconeis placentula was found predominant and abundant especially in February and May where the salinity of the bathing water was 63 and 87 mgm./L. respectively representing the highest chloride contents throughout the whole months of study. Thus its predominance and abundance was accompanied by various levels of chloride content. This was found to agree with Foged (1947 and 1948) who found it indifferent, and with Jorgenson (1948) who found it dominant in the warm months (May and August). In contrast, Rice (1938) found it in current and this was not the case in the present study since the canal water under investigation was almost still.

Navicula cryptocephala was dominant during all months of winter and spring where salinity varies from 44 to 87 mgm./L., which is very much below 3 — 4% saline water where Budde (1930) found this alga frequent and abundant. However, Foged (1947 and 1948) found it common in stagnant and running water, a result being similar to ours.

Synedra ulna was abundant mainly in December 1968, and February, 1969. Godward (1937) found that it is common particularly at the mouth of small streams and that there is a double maximum in April and September. This seems to be not the case in the present study since this alga disappeared completely in April in El-Khashab canal water and it appeared at the end of the canal from which the samples were taken. However the abundance of *Synedra ulna* in the canal under investigation might be due to the low temperature operating during winter months as found by Rice (1938) where the average minimum and maximum temperatures during these months in El-Khashab canal water were 8 and 20°C respectively, and due to the enrichment of the canal water with Ca, table (1) and (2) as found by Patrick (1948) who stated that all species of Synedra seem to like Ca.

The abundance of *Cyclotella Meneghiana* in April and May in El-Khashab Canal water seems to be due to the bright sunshine and the relatively high temperature during this period (average minimum and maximum temperatures were 19 and 27°C respectively during April and May) as suggested by Rice (1938) and due to the presence of suitable salt content in water (63 — 87 mgm./L.) as shown by Rudde (1930) who found masses of this alga at similar low salt contents.

Epithemia sorex appeared only in December and disappeared afterwards, *Gomphonema olivaceum* only in April while *Navicula gracilis* only in January and April. Jorgensen (1948) considered the first algo as a summer form and the other two algae as spring forms.

Regarding blue-green algae, *Oscillatoria sp.* was abundant in December 1968, January and February, 1969 while *Spirolena sp.* was only abundant in April. Rao (1955) found that the oxidisable organic matter and sunshine appear to be factors affecting the periodicity of blue-green algae. During December, January and February, the O_2 concentration in El-Khashab canal water reached its maximum value (table 1). If any oxidisable matter was present during this period in the canal water, one would expect a deficit in O_2 concentration. Thus the abundance of blue-green algae in the canal water is presumably due to sunshine and not due to oxidisable organic matter.

With respect to the green algae, *Ankistrodesmus septatus* and *Scenedesmus sp.* were abundant in March while *Chlorococcum* and *Selenastrum sp.* were abundant in May. Meanwhile, NO_3 or PO_4 content of the canal water was maximum in March but minimum in May (table 1).

From the foregoing discussion, it is clear that the kind of species that may be abundant is influenced by the interaction of physical and chemical factors. The main physical factors that appeared effective in the present study are temperature, sunshine while the main chemical factors are the dissolved nutrients : Ca, O_2, PO_4, NO_3, and Cl. This was found in harmony with the findings of Pearsall (1932), Hart (1935) and Braarud (1935).

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TABLE 1

pH and Dissolved Nutrients of El-Khashab canal during winter and spring months 1968/1969 (average of 10 samples), Mgm./L.

Months	Dissolved Nutrients							pH
	O_2	NO_3	PO_4	Cl	Ca	Mg	K	
December 1968	9.55	2.90	1.46	54.90	43.90	21.50	32.45	5.26
January 1969	7.74	1.74	0.48	44.25	43.60	25.98	26.80	5.15
February 1969	7.76	1.53	0.37	63.35	48.25	30.36	25.80	6.50
March 1969	5.64	3.08	2.14	63.30	53.05	17.04	28.30	5.88
April 1969	6.64	1.26	0.73	62.92	61.00	30.12	22.25	6.70
May 1969	4.14	0.16	0.54	87.00	47.20	22.02	17.00	5.72
June 1969	4.44	0.40	0.51	82.30	43.70	25.5	20.00	6.18

TABLE 2

The algal taxa and its state of occurrence in El-Khashab canal during winter and spring months of the year 1968/69

Taxa		State of occurrence	68 Dec.	69 Jan.	69 Feb.	69 Mar.	69 Apr.	69 May	69 June
Bacillariophyceae									
Achnanthes coarctata	Bréb	R—F	+	—	—	—	—	—	—
« exilis	Kutz	R—F	—	—	—	+	—	—	—
Amphora angusta	Greg.	R—M	+	—	—	—	—	—	—
« macilenta	Greg.	R—M	+	—	—	—	—	—	—
Bacillaria paradoxa	Gmel.	R—B	+	—	+	—	—	—	—
Cocconeis placentula	Ehr.	PD—F&B	+	+	+	+	+	+	+
Coscinodiscus excentricus	Ehr.	P—M	+	+	+	—	—	—	—
Cyclotella Kutzingiana	Chuvin	D—F	+	+	+	+	+	+	+
« operculata	Kutz.	R—F	+	—	—	—	—	—	—
« Meneghiana	Kutz.	P—F	—	—	—	—	+	+	+
Cymbella affins	Kutz	R—F	—	—	—	—	—	+	+
Diatoma ovulis		R—F	+	—	—	—	—	—	—
Epithemia gibberula v. producta	Grun.	R—F	+	—	—	+	—	—	—
Epithemia Sorex	Kutz.	R—F	+	—	—	—	—	—	—
Eunotia Lunaris v. subarcuata (Naag.)	Grun.	R—F	—	—	—	—	+	+	—
Frustulia rhombides	Ehr.	P—F	+	+	+	+	+	—	—
Gomphonema mentanum	Schum.	R—F	—	—	—	—	—	+	—
« v. commutatum	Kutz.	R—F	—	—	—	—	+	—	—
« olivaceum	Grun.	R—F	—	—	—	—	+	—	+
« parvulum	Kutz.	P—F	—	+	—	+	+	—	+
Hantzschia amphioxys (Ehr.)	Grun.	D—F	+	+	+	+	+	+	+
« « intermeida	H.V.H.	R—F	—	—	—	—	+	—	—
Melosira crenulata	Kutz	P—F	+	+	+	+	—	—	—
« « v. Binderiana	H.V.H.	R—F	—	+	—	—	—	—	—
« « v. tenuis	H.V.H.	D—F	+	+	+	+	+	+	+
Melosira granulata	(Ehr.) Ralfs	R—F	+	+	—	—	—	—	—
« « v. curvata	Grun.	R—F	—	—	—	—	+	+	—
« westeii	W.Sm.	R—M	+	—	—	—	—	—	—
Navicula advena v. parca	Schm.	P—M	—	—	—	+	+	+	+
« atomoides	Grun.	R—F	—	—	+	—	—	—	—
« Bahusiensis	Grun.	R—M	—	—	—	—	+	—	—
« brevis v. elliptica	H.V.H.	R—F	—	—	—	—	+	—	—
« Cryptocephala	Kutz	D—F&B	+	+	+	+	+	+	+
« « v. veneta	H.V.H.	R—F	—	+	—	—	—	—	—

TABLE 2 (cont.)

Taxa		State of occurrence	68 Dec.	69 Jan.	69 Feb.	69 Mar.	69 Apr.	69 May	69 June
Navicula cuspidata	Kutz.	R—F	+	—	—	—	—	—	—
« elliptica	Kutz.	R—F	+	+	—	—	—	—	—
« gracilis	Kutz.	R—F	—	+	—	—	+	—	—
« gregeria	Donk.	P—B	+	+	+	—	—	—	—
« Hebes	Ralfs.	R—F	—	—	—	—	—	+	—
« hyalina	Donk.	R—M	+	—	—	—	+	—	—
« iridis	Ehr.	R—F	—	+	—	—	—	—	—
« oculata	Breb	R—F	+	—	—	—	—	—	—
« rhynchocephala	Kutz	R—B	—	+	+	—	—	—	—
« Salinarum	Grun.	R—B	—	+	—	—	—	—	—
« seminulum	Grun.	R—F	—	+	—	+	—	—	—
« sphaerophora	Kutz.	R—F	—	—	—	—	+	—	—
« viridula v. slesvicensis	H.V.H.	R—F&B	—	—	—	—	—	—	+
Nitzschia accuminata	(W.Sm.) Grun.	R—B	—	+	—	+	—	—	—
« acicularis	W.Sm.	P—F	+	—	+	—	—	—	+
« angularis	W.Sm.	P—M	—	+	+	—	+	—	—
« « v. affinis	Grun.	R—M	—	+	—	—	—	+	—
« constricta (Greg.)	Grun.	R—M	—	—	—	—	+	—	—
« communis v. abbreviata	Grun.	R—B	—	+	+	—	—	—	—
« commutata	Grun.	P—B	—	+	+	—	+	—	—
« debilis (Arnott)	Grun.	R—F	+	—	—	—	+	—	—
« dissipata (Kutz)	Grun.	P—F&B	—	+	+	—	—	—	—
« « v. acuta	H.V.H.	R—F	—	—	+	—	—	—	—
« distans	Greg.	R—M	—	—	+	—	—	—	—
« dubia	W.Sm.	D—F	+	+	+	+	+	+	+
« fasciculata	Grun.	R—M&B	+	—	—	—	—	—	—
« Frustulum (Kutz)	Grun.	R—B	+	—	—	—	+	—	—
« Hungarica	Grun.	P—B	+	—	—	—	+	—	+
« longissima (Breb)	Ralfs	R—M	+	+	—	—	—	—	—
« linearis v. tenuis	Grun.	R—F	—	+	—	—	+	—	—
« obtusa v. brevissima	Grun.	PD—B	+	+	+	+	+	+	+
« « v. nana	Grun.	R—B	+	+	—	—	—	—	—
« « v. scalpilliformis	H.V.H.	P—B	+	+	+	—	—	—	—
« ovalis	Arnott	R—F	+	—	—	—	—	—	—
« paradoxa (Gmel)	Grun.	R—B	+	—	—	—	—	—	—
« « v. major	H.V.H.	R—B	—	—	—	—	+	—	—
« panduriformis	Grun.	P—M	+	—	+	+	+	—	—
« palae (Kutz)	W.Sm.	R—F	+	+	+	—	—	—	—
« « v. fonticola	Grun.	R—F	+	—	+	—	—	—	—

TABLE 2 (cont.)

Taxa		State of occurrence	68 Dec.	69 Jan.	69 Feb.	69 Mar.	69 Apr.	69 May	69 June
Nitzschia palae	H.V.H.	PD—F	+	+	+	+	+	+	+
« plana	W.Sm.	R—B	+	—	—	—	—	—	—
« spectabilis (Fhr.)	Ralfs	R—B	—	+	—	—	—	—	—
« subtilis	Grun.	P—F	+	+	+	—	—	—	—
« « v. paleacea	Grun.	R—F&B	—	+	+	—	+	—	—
« thermalis (Kutz)	Grun.	PD—F	+	+	+	+	+	+	+
« « v. intermedia	Grun.	PD—F	+	+	+	+	+	+	+
« tryblionella	Hatz.	P—F&B	+	+	+	+	—	—	—
« « v. littoralis	Grun.	P—F&B	+	+	+	+	+	—	—
« « v. levidensis	H.V.H.	R—F	—	—	—	+	—	—	—
« vermicularis (Kutz)	Grun.	R—F	+	—	—	—	—	—	—
« vitrea	Nroman	R—B	+	+	—	—	—	—	—
« « v. recta	H.V.H.	P—F&B	+	+	+	+	—	+	—
« « v. salinarum	Grun.	R—B	—	—	—	—	—	—	+
Pleurosigma accuminatum (Kutz)	Grun.	R—F	—	—	+	—	—	—	—
« fasciola	W.Sm.	R—M	+	+	—	—	—	—	—
« macrum	W.Sm.	P—M	+	+	+	—	+	—	—
Stauroneis anceps	Ehr.	P—F	+	—	+	—	—	+	+
Synedra affinis	Kutz	R—M&B	—	—	—	+	—	—	—
« ulna (Nitz.)	Ehr.	P—F	+	—	+	—	—	+	—
« « v. Danica	H.V.H	R—B	—	—	—	+	—	—	—
« « v. longissima	H.V.H.	R—B	+	—	—	+	—	—	—
Cyanophyceae									
Anabaena spp		P	+	+	+	—	+	—	+
Lyngbya spp.		R	+	—	—	—	—	—	—
Nostoc spp.		D	+	+	+	+	+	+	+
Oscillatoria spp.		PD	+	+	+	+	+	+	+
Spirolena spp.		R	—	—	—	—	+	—	—
Chlorophyceae									
Ankistrodesmus septatus		P	—	+	—	+	+	+	+
Chlamydomonas spp.		PD	+	+	+	+	+	+	+
Chlorella spp.		R	+	+	—	—	—	—	—
Chlorococcum spp.		D	+	+	+	+	+	+	+
« humicolum		P	+	—	+	—	—	+	+
Clynidrotheca gracilis		R	—	+	—	—	—	—	—
Euglena spp.		PD	+	+	+	+	+	+	+
« spirogyra		R	—	—	+	—	—	—	—
Hydrodictyon spp.		R	+	—	+	—	—	—	—
Merismopedia spp.		R	—	—	—	—	—	+	—

TABLE 2 (cont.)

Taxa	State of occurrence	68 Dec.	69 Jan.	69 Feb.	69 Mar.	69 Apr.	69 May	69 June
Pandorina spp.	P	+	+	+	—	—	—	+
Pediastrum spp.	R	+	—	—	—	—	—	—
Planophila asymmetrica (Gren.) Wille	R	—	—	—	—	—	—	+
Pleodorina spp.	R	—	—	—	—	—	+	—
Phacus spp.	P	+	+	+	+	—	—	—
Scenedesmus spp.	P	—	—	+	+	—	+	—
Selenastrum spp.	P	+	+	—	+	—	+	+
Spirogyra spp.	R	—	—	+	—	+	—	—
Tetraedron minimum	R	—	+	—	—	—	—	—
Volvox spp.	R	+	—	—	—	—	—	—
Zygnema spp.	R	+	—	—	—	—	—	—
Desmids								
Closterium spp.	R	—	—	—	—	+	—	—

M = Marine, B = Brakish, F = Fresh-water
PD = Predominant, D = Dominant SD = Subdominant
P = Present, R = Rare.

TABLE 3

Analysis of the algal Taxa found in El-Khasbab canal during winter and spring, 1968/1969

Month	Algal Group								
	Bacillariophcae			Cyanophyceae			Chlorophyceae		
	Genus number	species number		Genus number	species number		Genus number	species number	
		common	uncommon		common	uncommon		common	uncommon
December 1968	16	8	46	4	1	3	11	1	10
January 1969	10	3	41	3	2	1	10	1	9
February 1969	12	3	33	3	1	2	9	—	11
March 1969	11	—	27	2	1	1	7	3	4
April 1969	11	2	35	4	—	4	6	1	5
May 1969	10	3	16	1	—	1	8	2	6
June 1969	9	1	19	3	2	1	7	—	8
Total period	19	74		5	5		20	22	

TABLE 4

Analysis of State of Existence of the algal flora found in El-Khashab canal during winter and spring 1968/1969

Algal Flora	State of Existence				
	PD	D	SD	P	R
Bacillariophyceae	5	5	—	22	63
Chlorophyceae	2	1	—	5	13
Cyanophyceae	1	1	—	1	2

PD = predominant (found throughout the whole period in abundance)

D = Dominant (found throughout the whole period)

SD = Subdominant (found throughout 6 months)

P = present (found throughout 3 - 5 months)

R = rare (found throughout 1 or 2 months).