

# FLUCTUATIONS AND PERIODICITY OF THE ALGAL FLORA FOUND IN EL-KHASHAB CANAL THROUGHOUT THE YEAR 1968 / 1969

By

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## Summary

Fluctuations and periodicity of the algal flora found in El-Khashab canal throughout the year 1968/1969 were investigated

68 Species of the algal flora belonging to 35 genera were identified in the canal water during summer and autumn months 1969, compared with 101 species belonging to 44 genera during winter and spring months of the same year.

7, 6, 10 and 6 species of algal population were abundant during winter, spring, summer and autumn respectively. *Frustulia rhomboides*, *Hantzschia*, *amphioxys*, *Nitzschia dubia*, *Nitzschia tryblionella* *Nitzschia tryblionella* v. *littoralis*, *Phacus* species, *Selenastrum* species were winter and spring forms ; *Nitzschia dissipata*, summer and autumn form ; *Gomphonema parvulum*, winter spring and autumn form ; *Euglena* species, a whole form.

Some kind of a «bloom» ( Hart, 1935 ) was shown by the disappearance of 58 species from Bacillariophyceae during summer and autumn months although they were present in the same water during winter and spring months of the same year. In the same time, 11 species from Bacillariophyceae newly appeared during summer and autumn although they were absent during winter and spring months. Also, 9 species from chlorophyceae disappeared while only 3 species newly appeared.

*Cocconeis placentula*, *Cyclotella kutzingiana*, *Melosira crenulata* v. *tonuis*, *Nitzschia palae* v. *tenuirostris* *Nitzschia obtusa* v. *brevissima*, *Nitzschia thermalis*, *Nitzschia thermalis* v. *intermedia*, *Navicula cryptocephala* and *Navicula advena* v. *parca* from Bacillariophyceae ; *Oscillatoria* and *Nostoc* species from Cyanophyceae ; *Euglena* and *Chlamydomonas* species from Chlorophyceae were dominant ones throughout the whole year of investigation.

### *Introduction*

In a previous work, the authors (1970c) have studied the distribution and periodicity of the algal flora found in El-Kashab canal ( Dar-El-Salam region ) during winter and spring months of the year 1968/1969 starting from December 1968 till June 1969. They found that the greatest number of the algal groups were found in winter and the least ones in spring, mainly due to the enrichment of the canal water with phosphate and nitrate in winter months. They also found that certain forms of Bacillariophyceae, Chlorophyceae or Cyanophyceae are predominating, dominating or subdominating during the different months of winter and spring. They attributed such state of existence of these algal groups to the operation of interacting nutritional and environmental factors.

The aim of the present study is to complete the work already done and to investigate the distribution and periodicity of the algal groups found in El-Khashab canal ( Dar-El Salam region ) during summer and autumn months starting from July till December 1969. By referring to the results obtained from the previous work done by the authors (1970c) during winter and spring months of the same year, a study of the seasonal or monthly fluctuations and periodicity of the algal flora found in the canal throughout the year 1968/1969 could be obtained.

### *Material and Methods*

Since the present study is a continuation to the previous work ( Nosseir and Abou-El-Kheir, 1970c ), the region and the sites of sampling and the technique followed here are the same as those mentioned in that previous work. Ten samples were taken monthly from the 5 sites selected, 2 samples from each site, throughout the summer and autumn months of the year 1969.

Data concerning the pH and nutrients of the samples (  $O_2$  ,  $PO_4$  ,  $NO_3$  , Ca , Mg , K , Cl ) as well as records for the surrounding environmental conditions were done monthly, but not mentioned in this paper. Analysis of the algal taxa during summer and autumn months of the year 1969 is shown in table (1) while table (2) shows the state of occurrence of these algal taxa.

### *Results and Discussion*

From table (1), it is evident that approximately 68 species of the algal flora belonging to 35 genera were identified in the samples collected during summer and autumn months, 1969. The greatest number of these algal groups were found in the hot season (summer) and the lowest number in the moderate season (autumn). In the meantime, the nutrients in the waters as well as the average minimum and maximum temperatures tend

to show values in autumn lower than in summer. This means that the operating nutritional and thermal conditions during summer months are more favorable than during autumn months for the growth and appearance of algae in El-Khashab canal.

Referring to the work previously done during winter and spring months, 1968/1969 ( Nosseir and Abou-El-Kheir, 1970c ), one could notice the great reduction in the number of genera and species identified since approximately 101 species belonging to 44 genera have been identified during winter and spring months compared with 68 species belonging to 35 genera during summer and autumn months of the same year. Throughout the whole year, diatoms form the main bulk of the population followed by the greens and then the blue greens in sequence. Obviously, interaction of various nutritional and environmental factors are responsible for such variation in the algal population as stated by Hart (1935), and Nosseir and Abou El-Kheir (1970c).

During summer (June — September, 1969 ), the algal flora was characterised by rich development of *Gomphonema montanum*, *Navicula advena v. parca*, *Nitzschia obtusa v. brevissima*, *Nitzschia thermalis*, *Nitzschia thermalis v. intermedia*, *Stauroneis anceps* representing the diatoms and those representing the blue-green algae are *Oscillatoria* species. During autumn of the same year ( September — December, 1969 ), the algal flora is still characterised by the rich development of *Gomphonema* especially *Gomphonema parvulum* : also *Nitzschia obtusa v. brevissima*, *Nitzschia thermalis* and *Nitzschia thermalis v. intermedia* are still having the leadership. Also it has been found that *Biddulphia laevis* appeared during July and *Aplanophilla asymmetrica* and *Aphanocapsa* species during September and November in big quantities.

The occurrence of *Chlorella* species in September in abundance is one of the surprises because it is extremely rare throughout the whole year of investigation. Also it has been noticed that *Oscillatoria* species flourished again during summer season. The occurrence of the green algae during summer and autumn was extremely rare and this is also one of the surprises because they are always found to be in copious masses in the winter and spring months ( Nosseir and Abou El-Kheir, 1970c ).

From the present results together with those already obtained, during winter, and spring months ( the authors, 1970c ) one could notice that the following species were found to be the dominant ones throughout the whole year of investigation from december 1968 till december 1969 : *Cocconeis placentula*, *Cyclotella kutzingiana*, *Melosira crenulata v. tenuis*, *Nitzschia obtusa v. brevissima*, *Nitzschia thermalis*, *Nitzschia thermalis v. intermedia*, *Navicula cryptocephala* and *Navicula advena v. parca* from Bacillario-

phyceae ; *Oscillatoria* and *Nostoc* species from Cyanophyceae ; *Euglena* and *Chlamydomonas* species from Chlorophyceae.

On the other hand, the abundant species that have been found during every season throughout the whole year of investigation are as follows :

*Winter* ( December 1968 — March 1969 ) :

*Nitzschia tryblionella*  
*Nitzschia tryblionella* v. *littoralis*  
*Nitzschia palae* v. *tenuirostris*  
*Cocconeis placentula*  
*Oscillatoria* sp.  
*Ankistrodesmus septatus*  
*Scenedesmus* sp.

*Spring* ( March — June 1969 )

*Melosira crenulata*  
*Cocconeis placentula*  
*Navicula advena* v. *parca*  
*Spirolena* sp.  
*Chlorococcum humicolum*  
*Selenastrum* sp.

*Summer* ( June — September, 1969 )

*Gomphonema montanum*  
*Navicula advena* v. *parca*  
*Nitzschia obtusa* v. *brevissima*  
*Nitzschia thermalis*  
*Nitzschia thermalis* v. *intermedia*  
*Stauroneis anceps*  
*Aplanophila asymmetrica*  
*Oscillatoria* sp.  
*Chlorella* sp.  
*Gonium* sp.

*Autumn* ( September — December 1969 )

*Nitzschia thermalis*  
*Nitzschia thermalis* v. *intermedia*  
*Nitzschia obtusa* v. *brevissima*  
*Gomphonema parvulum*  
*Ankistrodesmus septatus*  
*Oscillatoria* species.

From the systematic list of the algae found in El-Khashab canal throughout the whole year of investigation, it was concluded that

*Frustulia rhomboides*, *Hantzschia amphioxys*, *Nitzschia dubia*, *Nitzschia tryblionella*, *Nitzschia tryblionella* v. *littoralis*, *Phacus* sp., *Selenastrum* sp. were winter and spring forms; *Nitzschia dissipata*, summer and autumn form; *Gomphonema parvulum*, a winter, spring and autumn form; *Euglena species*, a whole year form.

Relevantly, Patrick (1936) found that 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.

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. Here in El-Khashab canal water, such a bloom seem to operate since 58 species from Bacillariophyceae disappeared completely from the canal water during summer and autumn months although they were present in that water during winter and spring months of the same year. In the same time, 11 species from Bacillariophyceae newly appeared during summer and autumn months although they were absent from that water during winter and spring months. Simultaneously, 9 species from Chlorophyceae disappeared while only 3 species appeared newly. The new taxa that appeared and their time of appearance during the year 1969 are as follows :

*Bacillariophyceae* :

- Biddulphia laevis* : August
- Cocconeis scutellum* : July
- Denticulata subtilis* : August
- Gomphonema angur* : July and November
- Navicula cryptocephala* v. *exilis* : October
- Navicula humirosa* : December
- Navicula lanceolata* : August and November
- Nitzschia constricta* v. *parva* : July
- Nitzschia lanceolata* v. *minima* : October
- Nitzschia scalaris* : December
- Nitzschia tryblionella* v. *cauda* : July and August.

*Chlorophyceae* :

*Aphanocapsa* sp. : September and November

*Gonium* species : September

*Meogoutia* sp. : July.

Although enough data about the nutritional and environmental conditions of the canal water during the whole year of investigation are at hand, yet one cannot correlate the monthly or seasonal fluctuations or periodicity of the algal flora to any of these conditions due to the interaction of more than one factor. Thus the fluctuations and periodicity noticed in the algal flora of El-Khashab canal throughout the months or seasons of the year 1968/1969 might be due to the sums of the nutritional and environmental conditions operating found by Fritsch ( 1906 ), Rice (1938), Hodgetts (1922), Patrick (1945), Jorgensen (1957) and Nosseir and Abou-El-Kheir (1970a, b, and c ).

TABLE 1

Analysis of the algal taxa found in El-Khashab canal during summer and autumn months, 1969.

Months	ALGAL GROUP									
	Bacillariophyceae				Cyanophyceae				Chlorophyceae	
	Genus number	Species number common	Species number uncommon	Genus number	Species number common	Species number uncommon	Genus number	Species number common	Species number uncommon	
July	10	5	22	5	1	4	8	—	8	
August	11	—	20	3	1	2	5	1	4	
September	8	—	15	5	1	4	9	2	7	
October	6	3	14	4	1	3	4	—	4	
November	8	3	13	4	—	4	7	1	6	
December	8	—	15	3	1	2	3	—	3	
Total period July—December 1969	16	—	48	5	5	5	14	—	15	
Total year <sup>a</sup> Dec. 68—Dec. 69	21	—	82	5	5	5	23	—	25	

(5) \* See table (3) in the previous paper, Nosseir & Abou-El-Kheir (1970c).

TABLE 2

Analysis of state of existence of the algal flora found  
in El-Khashab canal during summer and autumn months, 1969.

Algal flora	State of Existence				
	PD	D	SD	P	R
Bacillariophyceae	3	4	2	5	34
	5*	5	—	22	63
Chlorophyceae	1	1	1	2	—
	2*	1	—	5	13
Cyanophyceae	—	2	—	2	11
	1*	1	—	1	2

\* During winter and spring months, the authors (1970c).

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

D = dominant ( found throughout the whole period ).

SD = subdominant ( found throughout 5 months ).

P = present ( found throughout 3-5 months ).

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

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