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PRELIMINARY SURVEY OF EDAPHIC ALGAE IN EL-MINIA REGION, NILE VALLEY, EGYPT.

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Abstract
The soil algal flora of some soils cultivated with different plants (Potato, Broad bean, Clover wheat and Barley) at El-Minia area, in addition to the physico-chemical characters was studied during October 2001. Five algal groups were recorded throughout this study, Bacillariophyta, Chlorophyta, Cyanophyta, Euglenophyta and Chrysophyta. Cyanophyta dominated the algal taxa in all soil sampled. A total of 102 algal species were identified in all the sampled soils during this investigation. Out of these, 29 species belonged to the Chlorophyta, 25 to the Bacillariophyta, 44 to the Cyanophyta, two to Euglenophyta and two to Chrysophyta. Six algal taxa were dominated, *Chlorella*, *Scenedesmus*, *Nitzschia*, *Gyrosigma*, *Lyngby*a , and *Nostoc*. It seemed probable that the organic carbon content of the soil together with carbonate are the two highly effective factors in controlling abundance and distribution of soil algae in the investigation sites.

Key words**:** Soil algae; Nile valley; Physico-chemical characters.

Introduction
The algal members which are found on and below the surface of soil are known as soil algae (edapophytes). Algae are of widespread occurrence in the soils of all continents, from the polar region to hot deserts (Starks *et al*., 1981). Soil algae are virtually ubiquitous on near the soil surface, even in soils, which support few higher plants. Soil algae are filamentous or single-celled photoautotrophic microorganisms. They use sunlight as an energy source; therefore, numbers are usually greatest near the soil surface (Whitton, 2000). .Several previous studies have presented taxonomic lists (MacEntee *et al*., 1972 and Dykstra *et al*., 1975). The isolation and identification of soil algae has been studied worldwide, Cameron and Devancy (1970); Curl and Becker, (1970); Norton and Davis, (1991); Anand and Subramanian (1994); Sieminiak (1996); Kabirov and Sukhanova (1997); Hammel *et al*., (1998); Tsujimura *et al*., (1998); Bierkens *et al*., (1998); Schmitt *et al*., (2001); Braun *et al*.,(2002); Li *et al*., (2002).

The study of microscopic algal flora of soil habitats has been stimulated recently by the assumption that any extra-terrestrial life which might exist probably develops under similar harsh environmental conditions. The Egyptian soil algal flora has been studied Fremy and Nasr (1938) in littoral rocks of the Red Sea; Aleem (1950) in the eastern Mediterranean Coast; El-Ayouty and Ayyad (1972) in a wheat filed in the Delta; Kobbia and El-Batanouny (1975) in Wadi El-

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Natroun; Salama and Kobbia (1982) in Libyan desert;; Kobbia (1983), rhizosphere algae; Kobbia (1985) in gravel and limestone deserts of Cairo-Suez Road; Kobbia and Shabana (1988) in Bahariya Oasis; Mattar (1992) in different soil habitats of Menoufia province; Atia (1993) in different soil habitats of Sohag district; Ahmed (1994) in some cultivated soils with different plants in Upper Egypt; El-Gamal (1990) in cultivated land of El-Khanka district; El-Sheekh (1998) in Western Mediterranean coastal region; Hifney (1998) in different types of soils in Assiut area; El-Attar (1999) in Qalyubia region; Mahmoud *et al*., (2000) in the soil algae on the Nile bank at Assiut, Egypt.

No efforts have so far been made to study the soil algae in middle Egypt. The present study represents the first attempt to survey the algal populations inhibiting cultivated soils around El-Minia region.

Materials and Methods

The studied area and climate

The study area (El-Minia) represents a part of the Nile Valley, it is bounded to the east and west by limestone scarps of the Nile and is surrounded from northern and southern borders by Beni Suef and Assiut Governorates, respectively. It .is delineated by latitudes 27° 30′ and 28° 45′ north and longitudes 30° 30′ and 31° 00′ east (Fig.1).

The climatic conditions of the study area are of arid type being hot, dry and rainless in summer and mild with rare rainfall in winter. The temperature ranges between 20.8 ^{o}C and 37.3 ^{o}C while the yearly references evapotranspiration amount to 1950 mm (Shided, 2001).

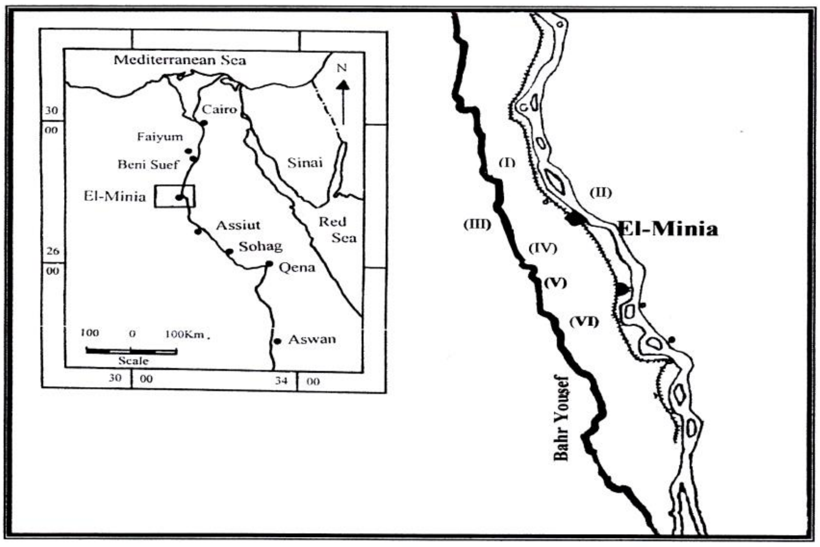


Fig.1. Location map of the study area and sampling sites.

Sampling

Six samples were taken from different cultivated sites namely, Borgaia, Tala, El-Shorafa, Maqousa, Demsher and Shalaby (table 1). Selection of these samples was based on variabilites in the cultivated plants and habitat features. Each soil sample was a composite of four random samples from each site. The samples were collected only once during October, 2001, under aseptic conditions following the method adopted by Salama and Kobbia (1982). Soil samples were taken by cores (5 cm diameter) from representative habitats at a depth of zero to two cm. Each soil samples was composed of four random samples from each site.

Table 1. The investigated sites at El-Minia comprised the cultivated lands.

Site No.	**Name**	**Location**	**Cultivated plant**
I	Borgaia	North region	Potato (*Solanum tuberosum*)
II	El-Shorafa	East region	Broad bean (*Vicia faba*)
III	Demsher	West region	Clover (*Trifolium alexanrinum*)
IV	Shalaby.	Center	Uncultivated
V	Tala	Weast-South region	Wheat (*Triticum vulgare*)
VI	Maqousa	South region	Barley (*Hordium vulgare*)

Isolation and culturing

Moist plate method recommended by Jurgenden and Davey (1968) was applied. One gram of each soil sample was placed in 99 ml of sterile water and then placed in a shaker for 15 min. Five replicate petri-dishes were inoculated each with one ml of the appropriate dilution and 25 ml of nutrient agar medium (45°C) were added. Allen and Arnon's (1955) medium incubated at 35°C was used for preferential isolation of blue-green algae. The eukaryotic algae were isolated in Chu'10 (Nichols 1973) at 25 °C. Both were incubated on 16/8 hrs. Light-dark cycle, with a light intensity (80 μmol $m^{-2}s^{-1}$). This method was recommended by Bold (1970). The numbers of colonies were proportional to dry weight soil. Algae were identified according to Fott (1972), Bourelly (1981) and Prescott (1987).. The appropriate statistic in Brillouin's index (Pilou, 1966) was used for quantitative analysis of species diversity of the phytoplankton, using the following equation:-

$$H = \frac{1}{N} \log \frac{Ni}{Ni_1 \ Ni_2 \ Ni_3 \ldots\ldots\ldots\ldots Ni_s}$$

Where H is the diversity index and N is the total number of individuals of S<u>th</u> species.

Chemicals and physical analysis of soil samples

Soil texture analysis was carried out using the sieving method by where the percentage of gravel, coarse and fine sand, silt and clay were estimated. The hygroscopic moisture content of the soil was estimated by oven drying air-dry samples. Digital pH- meter (Lutron, pH 204) measured the pH value. Conductivity was measured by a direct indicating conductivity bridge. The nitrate, phosphate, sulphate, alkalinity, chlorides and organic matter were determined according to Jackson (1960). The versene titration method (Schwarzenback and Biederman. 1948) was employed for both the calcium and magnesium determination. Sodium and Potassium were estimated using a clinical Flame Phtometer Corning 410C (Corning Science Products, Halstead, England). All chemical analysis was expressed as mg/100 g soil.

Results

Physico-chemical characters of soils samples

The results in table (2) show that the maximum moisture content of soil samples was recorded at site (VI), which was cultivated with Barley (45%), and site (V), cultivated with Wheat (38.81%) whereas site (IV), which non-cultivated was of the lowest moisture content (12.50%). The granulometric analysis of soil showed that the percentage of gravel, coarse sand, fine sand, clay and slit fractions varied remarkably from one site to another. Higher percentage of coarse sand was confined to sample (III), while the maximum percentage of fine sand and clay were represented by the non-cultivated soil (site VI). On the other hand, higher silt percentage was a distinct character of site (VI), which reached 42.78%, whereas the lower value was detected for sample (IV), which non-cultivated.

Table (2) also shows the physico-chemical characteristics of the collected soil samples. The data revealed that pH values were always on the alkaline side (7.36 – 8.62) except site (IV), which lied on the slight acidic side (6.88). Electric conductivity of sample (V) represented the highest value (35×10^5 $ohms^{-1}$) followed by site (III), while the lowest value was recorded at site (II) being cultivated with Broad bean. The data also show that the collected soil samples were characterized by higher contents of organic matter, which ranged between (4.42 – 8.66 mg/100g soils). The maximum value was recorded in site (I), which cultivated by Potato, whereas the lower value was recorded for site (VI) non-cultivated soil. All soils samples seemed to be poor in their contents of alkalinity. The highest amount of total alkalinity (60 mg/100 g soil) was observed in soil cultivated with Clover (site III), whereas the lowest value (28 mg/100 g soil) was recorded in the non-cultivated site (IV). The maximum content of chloride ions was recorded in sample (IV), followed by site (III), whereas at site (II) cultivated with Broad Bean it represented the lowest value. The highest value of nitrate-N was recorded at samples IV (non- cultivated). The results in table (2) showed also that the soluble phosphorus ranged from a minimum value (0.20 mg/100g soil) in site V and the maximum value (1.00 mg/100 g soil) in the non-cultivated site (IV). Sample (IV) was characterized by higher ammonium content. Higher cations and anions values revealed by site (IV) the non cultivated, whereas the other soil samples were characterized by lower values in compare to site IV. The higher amounts of sulphate were observed also at the non-cultivated site, but the lower contents were found at sites II and I.

Table 2. Average values of some physico-chemical characters of soils collected from different sites of El-Minia in October, 2001 (The calculated values are the mean of triplicates, the standard deviation less than 5% of these mean values).

	I	II	III	IV	V	VI
Moisture content (%)	**28.00**	**40.00**	**26.46**	**12.50**	**38.81**	**45.00**
Conductivity (ohms^{-1})	**25 x 10^5**	**14 x 10^5**	**33 x 10^5**	**15 x 10^5**	**35 x 10^5**	**20 x 10^5**
Soil texture						
Gravel %	**28.62**	**22.21**	**12.61**	**16.82**	**30.00**	**12.22**
Coarse sand %	**25.55**	**15.02**	**26.00**	**25.61**	**15.00**	**18.50**
Fine sand %	**10.27**	**22.00**	**20.22**	**33.58**	**10.68**	**17.00**
Clay %	**9.00**	**10.02**	**10.92**	**22.99**	**15.70**	**10.50**
Silt %	**26.66**	**30.75**	**30.25**	**1.00**	**28.62**	**42.78**
pH	**8.00**	**8.02**	**7.36**	**6.88**	**7.70**	**8.62**
Organic matter (mg/100 g soil)	**8.66**	**5.92**	**7.00**	**4.42**	**6.25**	**7.00**
Alkalinity (mg/100 g soil)	**44.45**	**55.81**	**60.00**	**28.00**	**33.08**	**56.23**
Chloride (mg/100 g soil)	**15.60**	**8.21**	**22.00**	**150.00**	**12.00**	**14.65**
Nitrate-N (mg/100 g soil)	**8.72**	**3.31**	**7.67**	**20.26**	**11.62**	**8.88**
Phosphate-P (mg/100 g soil)	**0.91**	**0.821**	**0.26**	**1.00**	**0.20**	**0.27**
Ammonium (mg/100 g soil)	**1.58**	**0.80**	**2.68**	**8.61**	**1.00**	**1.60**
Calcium (mg/100 g soil)	**19.50**	**16.51**	**20.02**	**140**	**29.00**	**35.66**
Magnesium (mg/100 g soil)	**6.46**	**4.33**	**5.55**	**148.00**	**8.61**	**4.32**
Sodium (mg/100 g soil)	**19.00**	**9.00**	**32.21**	**172.00**	**32.00**	**25.00**
Potassium (mg/100 g soil)	**8.00**	**5.21**	**10.82**	**99.62**	**10.00**	**9.62**
Sulphate (mg/100 g soil)	**25.00**	**25.00**	**26.00**	**32.00**	**30.00**	**30.00**

Algal densities

There are marked differences in the quantitative and qualitative composition of the algal flora in all the soil sampled. (Table 3 and Figures 2-3). Cells counts were calculated on the basis of 1.0 g dry soil. Filamentous and colonial forms were counted as one cell. In terms of total cell number for each species in all the algal groups, the total algal counts ranged from a minimum of 5.40 x 10^6 cell l^{-1} at the non-cultivated site (IV) to a maximum of 23.75 x 10^6cell l^{-1} at site III cultivated with Clover. As regards to Chlorophyta, the highest cell number was recorded in site III (5.62 x 10^6 cell l^{-1}), whereas site IV harboured the lowest cell count (1.80 x 10^6 cell l^{-1}). Bacillariopohyta counts ranged from 1.00 x 10^6cell l^{-1} at the non-cultivated site to 7.02 x 10^6 cell l^{-1} at site VI cultivated with Barley. The highest cell yield of Cyanophyta (8.35 x 10^6 cell l^{-1}) was contained in the soil samples of site III (cultivated with Clover), while the lowest one (1.60 x 10^6 cell l^{-1}) was contained in the soil samples of site IV (uncultivated). Euglenophyta and Chrysophyta were the less counted algal group in this investigation. Generally, the increase or decrease in total algal counts throughout the investigation coinciding closely with the trend in Cyanophyta and Bacillariophyta abundance (Fig.3).

Taxon composition

Five algal groups namely, Bacillariophyta, Chlorophyta, Cyanophyta, Euglenophyta and Chrysophyta were recorded throughout this study (Figure 2). Representative taxa from all these algal groups were recorded in all soil sampled except fewer groups were represented in the uncultivated site (VI). The data in Figure (3) shows that Cyanophyta dominated the algal taxa in all soil sampled (21.60% - 40%). Bacillariophyta ranked second (18.50% - 38.66%), Chlorophyta ranked the third (12% - 33.33 %), Chrysophyta ranked the fourth (4.21% - 18.52%) and Euglenophyta ranked the fifth (0.0 – 13.2 %) in order of dominance.

Fifty-seven genera (102 species) of algae were identified in all the soils sampled during this investigation. Out of these, 19 genera (29 species) belonged to the Chlorophyta; 15 genera (25 species) belong to Bacillariophyta; 20 genera (44 species) to Cyanophyta; two genera (two species) to Chrysophyta; one genus (two species) to Euglenophyta. The maximum abundance of algal taxa (86 species) was observed in the site III cultivated with Clover, whereas the minimum abundance was observed in the non-cultivated area (24 species). As shown in Figure (2) the ranking of algal taxa abundance by habitats were as follows: site III > site II > site I > site V and site VI > site IV. The blue-greens and diatoms have the greatest number of species at site III (36 species), however the lowest one was recorded at site IV. For the green algae, species ranked were, site III > site II > sites VI and I > sites IV and V.

Table (3). Relative abundance of soil algal species of soil samples collected from, different lands at El-Minia during October 2001.

Algal species	I	II	III	IV	V	VI
Chlorophyceae						
Ankistrodesmus convolutus Corda				+		+
Ankistrodesmus falacatus var.acicularis (A.Braun)	+	+	+	+	+	+
Chlamydomonas tremulans (Rodhe)	+	+	+			+
Chlamydomonas sp.	+	+	+	+		+
Chlorella ellipsoidea Gerneck	+	+	+	+	+	+
Chlorella pyrenoidea Chick	+	+	+			+
Chlorella vulgaris Beyerinck	+	+	+	+	+	+
Chlorococcus humicola (Näg)	+	+				
Closteriopsis longissima Lemmermann		+	+	+		+
Coleastrum sphaericum Näegeli	+	+	+		+	+
Crucigenia quadrata Morren	+	+	+		+	+
Dictyosphaerium pulchellum Wood	+	+	+		+	+
Gleocystis bcillus Teiling	+	+	+	+	+	+
Gleocystis major Gerneck		+	+			
Haematococcus pluvialis Flotow		+	+		+	+
Hormidium Klebsii G.M. Smith		+	+			
Kirchinerella contorta Bohlin	+	+	+			
Monoraphidium capricornutum Nygaard	+		+			+
Monoraphidium contortum Komarava	+		+			
Pandorina sp.		+	+			
Protococcus sp.		+	+			+
Pteromonas angulosa Lemmermann	+		+	+		+
Scenedesmus acuminatus Chodat	+	+	+	+	+	+
Scenedesmus arvensis Chod.	+	+	+	+	+	+
Scenedesmus bijuga (Turp.) Lag.	+	+	+	+	+	+
Scenedesmus obliquus (trup.) Kuetzing	+			+		
Scenedesmus quadricauda (Turp.) Berb	+	+	+			
Schroederia setigera Lemm			+		+	
Tetraedron muticum Hangsgirg		+	+			+
Euglenophyceae						
Euglena elastica Prescott.	+	+	+			
Euglena gracilis Klebs	+	+	+		+	+
Bacillariophyceae						
Achanthes hungarica Grun	+	+				
Amphora ovalis b. gracilis (E) Cl			+	+	+	+
Amphora veneta Kutz	+	+	+	+	+	+
Cocconies placentula intermedia (Her, Per) Hust.	+	+	+			+
Cyclotella ocellata Pantocsek		+	+			
Cymbella lanceolata Ehrenb	+					

Table (3) Continue.

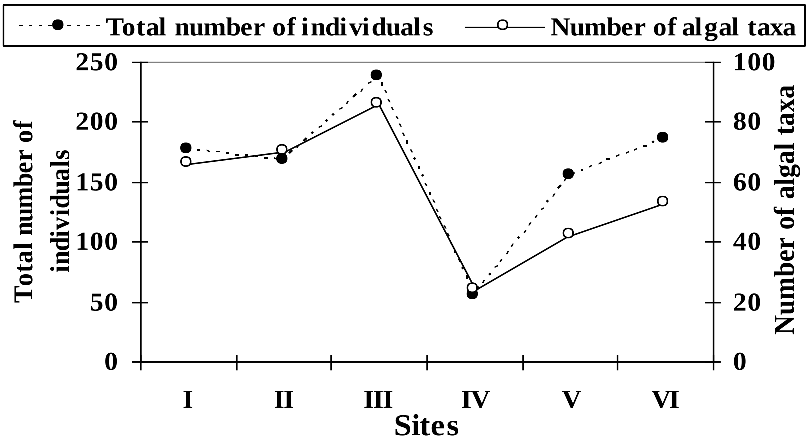
Algal species	I	II	III	IV	V	VI
Cymbella sp.			+			
Gymatopleura solea (Brebisson) W. Smith	+	+	+			
Gyrosigma attenuatum (Kz.) Cl.	+	+	+		+	+
Melosira granulata (E.) Ralfs	+	+	+		+	+
Navicula accomoda (Hust)					+	
Navicula cryptocephala Kutz.	+	+	+		+	+
Navicula sp.		+	+			
Nitzschia thermolis Grun		+	+			
Nitzschia frustulum (Kutz) Grun.	+	+	+	+	+	+
Nitzschia hungarica Grun.		+	+			
Nitzschia palae (Kutz) W. Smith.	+				+	
Nitzschia sp.	+	+			+	+
Pinnularia sp.	+	+	+			+
Pleurosigma macrum Ralfs		+	+		+	
Stephanodiscus invisitatus Hohn & Hellermann		+	+		+	+
Synedra acus radians (Kz.) A.Cl.		+	+			
Synedera ulna lanceolata (Grun)						+
Surirella ovalis Breb.			+			
Surirella sp.	+		+			+
Chrysophyceae						
Botrydium granulatum (L.) Greville			+			
Rhodomonas ovalis Nygaard	+	+	+		+	+
Cyanophyceae						
Achroonema articulatum Skuja	+	+				+
Achroonema sp.		+				
Anabaena acqualis Borge	+		+			
Anabaena circinalis var macrospora (Wittr) De Toni	+	+				
Anabaena oscillatorioides Bory	+	+				
Anabanea spiroides Klebahn	+		+	+		
Anabaena variabilis Kutz	+	+	+		+	+
Anabaena sp.	+		+		+	
Anacystis sp.		+			+	
Arthrospira sp.	+		+		+	
Chroococcus turgidus Nagel	+	+	+	+	+	+
Calothrix thermalis Hansg	+	+	+			
Calothrix sp.	+	+	+		+	+
Dermocarpa sp.	+		+			
Fischerella sp.			+		+	
Gloeocapsa punctata (Naegeli)	+	+	+	+	+	+
Gloeocapsa sp.	+	+	+		+	+
Lyngbya contorta Lemmermann		+	+			

Table 3. Continued

Algal species	I	II	III	IV	V	VI
Lyngbya limetica Lemm	+	+	+	+	+	+
Lyngbya versicolor (Wartmann)	+		+			
Lyngbya sp.	+					
Microcystis aeruginosa Kutz	+		+			+
Microcystis flos-aquse (Wittr) Kirschn		+	+			
Nodularia spumigena Merteus	+	+	+	+	+	+
Nostoc linckia Borenet & Thuret	+		+			
Nostoc lumifusum Carmicael.	+	+	+		+	+
Nostoc verrucosum Vaucher		+	+			
Nostoc sp.			+			
Oscillatoria articulata Cardner				+		
Oscillatoria brevis Gomont	+	+	+	+		
Oscillatoria tenuis var.natans Gomont.		+	+			
Oscillatoria formaso Bory.		+	+			+
Oscillatoria limosa (Roth) C.A. Agardh			+		+	+
Oscillatoria subtilissma Kutz.	+	+	+	+	+	+
Phormidium retizii (C.A.Ag.) Comont		+	+			
Phormidium dictyothallum Comont		+	+		+	+
Phormidium molle Gomont.	+	+	+		+	+
Phormidium tenme Gomont.	+		+		+	+
Phormidium nostocorum Born	+	+	+	+	+	+
Pseudonabaena catenata Lauter	+					
Rivularia sp.		+	+			
Spirulina sp.	+	+	+			
Schizothrix rivularis Wolle.	+	+	+			+
Scytonema sp.	+					+
Number of taxa	**66**	**71**	**84**	**34**	**43**	**53**
Diversity index (H)	**1.45**	**1.89**	**2.04**	**0.26**	**1.11**	**1.32**

The Blue-green algae frequently encountered from 8.3 – 42.7 %of the total algal taxa of all soils sampled and there were predominantly the filamentous, Oscillatorid forms; *Anabaena; Arthrospira; Calothrix; Oscillatoria; Phormidium; Lyngbya; Rivularia; Scytonema; Schizothrix; Nostoc* species. On the other hand green algae were represented mostly by unicellular and colonial / or coccoid forms. The predominant species of Chlorophyta were *Ankistrodesmus falacatus, Chlorella ellipsoidea, Chlorella vulgaris, Gleocystis bcillus, Scenedesmus acuminatus, Scenedesmus arvensis* and *Scenedesmus bijuga.* The dominant taxa of diatoms were, *Gyrosigma, Navicula* ., and *Nitzschia*., whereas *Euglena gracili*s and *Rhodomonas ovalis* were the dominant species of Euglenophyta and Chrysophyta, respectively. Ranking the habitats by diversity index (H), there were: site III (2.04) > site II (1.89) > site I (1.45) > site VI (1.32) > site V (1.11)

> site IV (0.26). The number of species present in a habitat is probably the best single integrative measure of diversity (Table 3).



Figure(2). Total number of algal taxa encounted and algal abundance (cell number x 10^6 /g dry soil) of soil algae at El-Minia during October 2001.

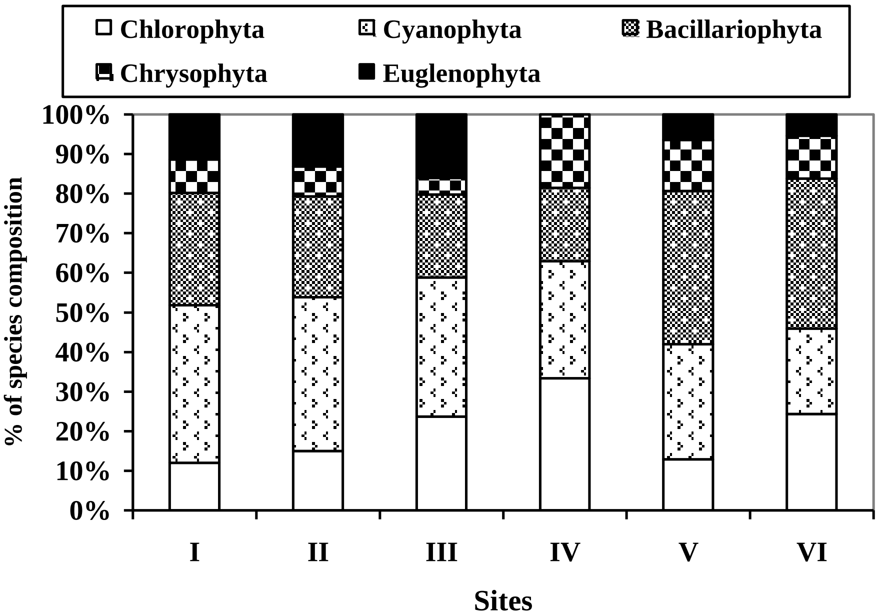


Figure (3). The percentage composition of the main algal divisions recorded at El-Minia during October, 2001.

Regarding the common species, they are shown in Table 3 and Figure (4). Six algal genera were appearing, *Scenedesmus*, *Nitzschia*, *Gyrosigma*, *Lyngby*a, and *Nostoc*. The data shows that *Lyngby*a , and *Nostoc* not only has relatively high density in each six sites, but they also are of high cellular counts. On the other hand, *Chlorella*, *Scenedesmus*, also features prominent in all sites having high cell counts. *Nitzschia*, *Gyrosigma* represented the highest abundance of all diatoms recovered in all sites.

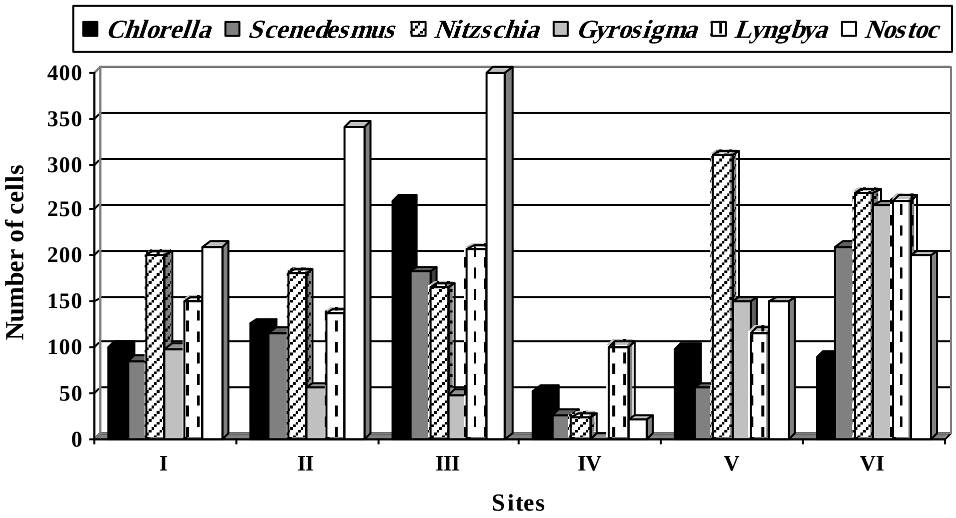


Figure (4). Abundance of common soil algae in the soil samples collected from different sites at El-Minia during October 2001 (number of cells x 10^4/ g dry soil).

Discussion

Despite the numerous studies on soil algae is still difficult to draw general conclusions on the diversity of the flora and on the functioning of this ecosystems (Hifney, 1998). Egyptian literature on the soil algae remain scare and fragmentary (Fremy and Nasr (1938), Allen, (1950), El-Ayouty and Ayyad (1972), Kobbia and El-Batanouny (1975), Salama and Kobbia (1982), Kobbia (1985), Kobbia and Shabana (1988), Mattar (1992), Atia (1993), Ahmed (1994), El-Gamal (1990), El-Sheekh (1998), Hifney (1998) El-Attar (1999) and Mahmoud *et al*., (2000) while not all regions of the Egyptian country have received any attentions). The present study represents the first attempt to survey the algal populations inhibiting cultivated soils in El-Minia area.

It is well known that changes in physico-chemical characteristics and edaphic factors of any soil, with some specific features within the algal organisms themselves constitute the main factors responsible for the existence of soil algae

(Kobbia and El-Batanouny, 1975; Salama and Kobbia, 1982; Kobbia and Shabana, 1988; Ahmed, 1994; El-Attar, 1999). In the present study, the response of algal biomass at the different investigated sites to soil texture was not reflected in retarded or activated algal growth. Similarly the results obtained by Hifney (1998) at in different types of soils in Assiut area.

The pH values of the investigated soil samples were generally on the alkaline side. Shields and Durrell (1964), accepted that neutral and alkaline soils are more favourable to development of blue-green algae. Starks et al., (1981) found that members of Cyanophyta dominated in alkaline soils (pH 8.5 – 9.5), while the Chlorophyta were better represented in acidic soils (pH 6.0 – 4.6). The moisture content of the study sites ranged from 12.5% to 45%. The higher values of moisture content resulted an elevation in algal biomass. Also, the count of Chlorophyta and Bacillariophyta were increased. Soil algae grow better in partially dry soil (40% - 60%) of water holding capacity (Round, 1981 and Darley, 1982).

The data of this investigation and those obtained by other investigators (Starks *et al*., 198, Kobbia and Shabana, 1988 and Hifney, 1998), clearly indicated that the inhibited and stimulated growth of certain algal groups or species may be one aspect of the role played by organic matter of soils in modifying algal population and activities in various soil. On the other hand Ketchum (1951) speculated that the organic nutrients might have a great effect on the algae in terms of fertilization than inorganic nutrients. Eutrophication may delimit the diversity of species (Sheath and Munawar, 1974).

The Nitrate-N and ammonium content of various investigated soils were relatively higher. This may due to rise in total-nitrogen content of the crust soil due to presence of active microflora such as nitrogen fixing cyanobacteria (Synder and Wullstein, 1973). Regarding to phosphate-P content of the soil samples it's probably low. King and Ward (1977) showed that phosphorous was the major growth-limiting nutrient in soil. On the other hand, some of the investigated soils were characterized by relatively high values of sulphate. Naguib *et al*., (1987) reported that, with nitrate as nitrogen source, sulphate was a better sulphur source for maximum growth of some blue green algae. Monovalent and divalent cations play an important role in the productivity of soils (Starks *et al*., 1981). The monvalent cations content of the investigated soils samples showed pronounced fluctuations from soil to soil. Calcium and magnesium are reported to be of importance for algal growth (Hussein 1989) but are not directly macronutrients. Calcium has been shown to be required for the growth of blue green algae (Allen and Arnon. 1955). Hunt *et al*., (1979) reported a negative correlation of magnesium on soil blue green algae abundance.

Generally, the abundance of soil algae went almost parallel to any changes in the above mentioned soil parameters. On the basis of data collecting during this investigation, the simple correlation matrix analysis of sum variable measured in the different studied sites revealed that, the moisture content and bicarbonate are the most highly significant factors in controlling the abundance and species richness of soil algae at the different sites (Table 4).

The present study showed that out of 102 identified species 44 belong to Cyanophyta, 25 to Bacillariophyta, 29 to Chlorophyta, two Euglenophyta and two to Chrysophyta. Cyanobacteria, especially the oscillatorid species showed the majority of most isolates during this investigation. Such differences in species number extend also to comprise the total counts of nearly all sites. The presence of numerous Cyanophyta species as compared with other types of soil algae is a matter of tolerance and adaptability (Kobbia and Shabana, 1988, Ahmed, 1994, Hinfey, 1989 and El-Attar, 1999). The pH value at all sites under investigation was more than 7 and this might partially explain the wide distribution of Cyanobactertial species, being represented at most sites compared with eukaryotic algal assemblage. However, another additive explanations for the widespread of Cyanophyta members in the different studied sites, may be due to presence of lower amount of carbonate and higher amount of calcium (Gorham *et al*., 1974; Kobbia and El-Batanouny, 1975) or due to the properties of prokaryotic cells (Fay and Fog, 1962; Trainor, 1978). These results are in accordance with the data of some previous studies at Egypt (Ahmed, 1994, Hifney, 1998 and El-Attar, 1999).

Amphora veneta, Cocconies placentula, Gyrosigma attenuatum, Melosira granulata, Navicula cryptocephala and *Nitzschia frustulum* excelled Bacillariophyta species occurred in all sites. The highest cell yield was contained in soil samples of Maqousa, which cultivated by Barley. This site was found to be characterized by high pH value, high moisture, alkalinity and high calcium content. Such observations indicate the importance of certain diatom species in the soil. Zafar (1964) confirmed the importance of calcium to diatoms. On the other hand Ahmed (1994) and El-Attar (1999) confirmed the importance of pH value and moisture content.

The results of this investigation reveal that the presence of Chrysophyta and Euglenophyta in soil samples which contained high levels of organic matter and sodium might indicated a response to organics (Kobbia and Shabana, 1988, Ahmed, 1994, Hinfey, 1989 and El-Attar, 1999)

As regards to the Chlorophyta the coccoid forms were the predominant in all investigated sites, namely, *Ankistrodesmus falacatus, Chlorella ellipsoidea, Chlorella vulgaris, Gleocystis bcillus, Scenedesmus acuminatus, Scenedesmus arvensis* and *Scenedesmus bijuga.* Also, Chlorophyta have predilection for organic matter and monovalent cations. These results are in accordance with that of Kobbia and Shabana (1988), Ahmed (1994), Hinfney, (1998) and El-Attar (1999).

In general, the data herein obtained, firstly the appearance of algal species from various soils seemed to governed by the physico-chemical characters of the soil. Secondly, oscillatorid Cyanophyta, Coccoid Chlorophyta and penniate Bacillariophyta represented the predominant forms in almost cultivated soils.

Table 4. Simple correlation matrix of sum variable measured in the different sites at El-Minia during October 2001 . (Marked correlations are significant at $p < 0.05$).

Variable	Biom.	S.R.	Moist.	pH	HCO_3	Cl	NO_3	PO_4	NH_4	Ca	Mg	Na	K	SO_4
Biom.	1.00	0.90*	-0.11*	0.17	-0.39*	0.15	0.07	0.63	0.12	0.19	0.17	0.12	0.14	-0.43
S.R.		1.00	-0.39*	0.48	-0.41*	-0.11	-0.07	0.49	-0.18	-0.05	-0.07	-0.13	-0.11	-0.42
Moist.			1.00	0.81	0.30	-0.81*	-0.75	-0.34	-0.86*	-0.74	-.077	-0.80	-0.79	-0.52
pH				1.00	0.42	-0.85*	-0.82*	-0.05	-0.89*	-0.82*	-0.82*	-0.88*	-0.84*	-0.71
HCO3					1.00	-0.65	-0.83*	-0.34	-0.57	-0.73	-0.69	-0.69	-0.67	-0.64
Cl						1.00	0.89*	0.53	0.99*	0.99*	1.00*	0.99*	1.00*	0.64
NO3							1.00	0.26	0.87*	0.91*	0.89*	0.92*	0.90*	0.82*
PO4								1.00	0.48	0.52	0.55	0.45	0.52	-0.14
NH4									1.00	0.97*	0.97*	0.98*	0.98*	0.60
Ca										1.00	1.00*	0.99*	1.00*	0.67
Mg											1.00	0.99*	1.00*	0.65
Na												1.00	1.00*	0.70
K													1.00	0.67
SO4														1.00

Biom indicates Biomass; S.R. indicates species richness, Moist. Indicates Moisture.

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دراسة تمهيدية على فلورا طحالب التربة في منطقة المنيا – وادى النيل – مصر

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تم في هذا البحث دراسة الفلورا الطحلبية لبعض مواقع التربة الزراعية في منطقة المنيا بالإضافة إلي العوامل المناخية والبيئية خلال شهر أكتوبر 2001. وقد سجلت الدراسة خمسة مجموعات طحلبية هي الطحالب الخضراء والطحالب الدياتومية والطحالب الخضراء المزرقة والطحالب اليوجلينية والطحالب الخضراء المصفرة. وقد أظهرت النتائج سيادة الطحالب الخضراء المزرقة على بقية المجموعات الطحلبية المسجلة في جميع المواقع محل الدراسة. ومن خلال المجموعات الطحلبية تم التعرف على عدد 102 نوعا من الطحالب، ينتمي منها 29 نوعا إلي الطحالب الخضراء و 25 نوعا إلي الطحالب الدياتومية و 44 نوعا إلي الطحالب الخضراء المزرقة و نوعان إلي كل من الطحالب اليوجلينية والخضراء المصفرة. كما أظهرت سيادة ستة أجناس طحلبية هي الكلوريللا و السينيدسموز والنتشيا والجيروسيجما والليمبيا والنوستوك.. وقد أوضحت النتائج انه من المحتمل أن يكون كل من الكربون العضوي واملاح الكربونات هما العاملان المؤثران في نوعية وتوزيع الفلورا الطحلبية في المواقع محل الدراسة.