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A PRELIMINARY REPORT ON THE AQUATIC ALGAE FROM SELECTED SITES IN SHELBY COUNTY

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ABSTRACT

Samples taken from twelve stations on the Mississippi River and its tributaries in Shelby County were assayed for the number and kinds of phytoplankton present by the Sedgwick-Rafter counting cell technique, by culturing and by special frustule preparation of the diatoms. Ten genera of Myxophyceae, six genera of Euglenophyceae, fifty-six genera of Chlorophyceae, and two genera of Dinophyceae were identified with certainty. The genera of Bacillariophyceae will be described in another report.

INTRODUCTION

The aquatic algae of Shelby County are reported from samples collected at 12 stations from October 1967 to October 1968 to study the effects of industrial wastes of Memphis and Shelby County on primary planktonic producers. The numbers and genera of blue-green, yellow-green, green and flagellate algae found in these stations are included in this report. Future studies will correlate the quality of the water supply with the numbers and kinds of dominant species of algae collected.

The algal flora of many waterways in the United States, especially of lakes and rivers in Wisconsin, Michigan, Ohio, and New York, as well as of the Great Lakes, have been extensively studied (Whitford 1960, Prescott 1962, Palmer 1962b). Not only has the importance of algae as indicators of water quality been well documented, but also their importance for many more theoretical biological questions have been and are being investigated. Because algal associations vary in different types of water and have changed through time, they have been used to determine the geological history of an era, to describe the history of the development of lakes, or to determine the advance or retreat of glaciers (Patrick 1962, Patrick and Reimer 1966). Algae, easily isolated and cultured, also offer a great diversity of types of plants and degrees of structural complexity for evolutionary, ecological and physiological studies. They are of great economic importance since they carry on over four-fifths of the photosynthesis on earth (*Encyc. Brit.*, 1961). To date, there are no published studies of the aquatic algae of Shelby County. Thus, there is a whole gamut of biological, ecological, and evolutionary problems open for investigation in West Tennessee. This elementary report hopefully will provide stimulus for more meaningful and significant studies in the future.

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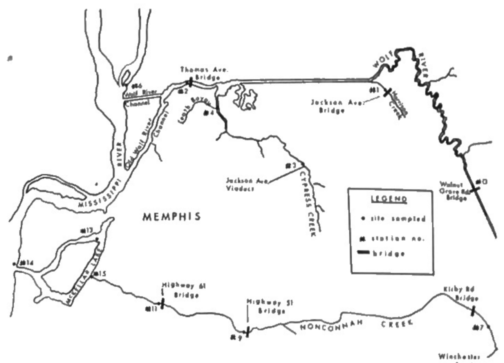

Fig. 1. Map of the area showing the location of sampling sites.

MATERIALS AND METHODS

The twelve stations sampled for this study are located on the Mississippi River and some of its tributaries in Shelby County. Three of the stations in the eastern part of Memphis (#0, 1, 7) (Fig. 1) were chosen because the water is relatively unpolluted by industrial waste. Other stations in Memphis were chosen to check the condition of the water after it received waste from heavily industrialized areas. The stations on the Mississippi River were likewise chosen in order to check the condition of this body of water before and after it was contaminated by the domestic and industrial wastes of Shelby County. Such a study as this is long overdue because cities downstream from Memphis use water from the Mississippi River for drinking.

Samples of three liters of raw water were collected every two weeks except during the summer when weekly samples were taken. Stations #0, 1, 2, 3 and 9 (Fig. 1) were sampled by lowering a polyethylene bucket from bridges. Stations #4, 6, 7 and 11 were sampled by taking water near the edge of the river, and stations #13, 14 and 15 were sampled from the side of a boat. Each sample was stored in a plastic jug and taken back to the laboratory. One liter of each sample was concentrated by sand filtration. The algae in the concentrate were counted by the Sedgwick-Rafter slide technique (Williams 1962). The number per ml and the identity of many living phytoplankton were established in this way (Table I). Because of the uncertainty of correct identification of some algae by this method, cultures of the samples were grown and studied. Increasingly, demands are being made for studies of the physiological as well as the morphological characteristics of the algae to identify them correctly (Deason and Bold 1960).

To meet these demands small amounts of the concentrated samples were sprayed out on petri dishes containing Bold's Basal Medium (Bischoff and Bold 1963) solidified with 1.5% agar. Unialgal cultures were isolated from these plates. The organisms, cultured in liquid BBM or in soil water, were then studied for confirmation of the genera. The culture vessels were kept at approximately 22C with light of 500 ft-c intensity provided by two 20-w Ken-Rad "cool white" fluorescent bulbs for 12 hours followed by 12 hours of darkness, the standard conditions of cultivation. In two or three weeks the algae appeared in large numbers and could be examined and identified.

Many genera of diatoms were also identified. These are listed as either pennate or centric diatoms in Table I because a proportional count of the dessicated frustules is necessary for the correct identification of many genera of diatoms. This count is under way at present.

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RESULTS

The dominant organisms found in this study were *Cyclotella, Stephanodiscus, Synedra, Melosira, Navicula, Scenedesmus,* and *Chlamydomonas* (Table I). The stations on the Mississippi River and McKellar Lake contained more centric than pennate diatoms. At the other stations the pennate diatoms were more abundant. Some stations contained many different genera of algae, whereas others had very few. It can also be seen in Table I that the stations with more varieties of algae had a greater number of organisms within a class.

Seasonal variation in the number and kinds of algae was apparent in this study. In all seasons *Chlamydomonas, Chlorella, Euglena, Oscillatoria, Chlorococcum* and *Trachelomonas* were dominant forms at all stations. The algae that appeared in summer, but disappeared in the fall were *Characium, Chodatella, Cosmarium, Golenkinia, Micrasterias, Micractinium, Pleodorina, Quadricoccus, Staurastrum, Tetraedron, Tetrastrum, Treubaria, Volvox,* and *Pyrobotrys.*

DISCUSSION

The dominant organisms found in this study were, with one exception, the same as those organisms which Louis Williams (1964) found to be dominant in 100 stations on the major rivers of the United States sampled from October 1961 to October 1962. *Cyclotel'a, Stephanodiscus, Synedra, Melosira, Nitszchia, Scenedesmus* and *Chlamydomonas* were the seven most important genera found in Williams' study. *Navicula* was a dominant form in the present study rather than *Nitszchia.*

There is evidence in this preliminary study that the distribution and quantity of aquatic algae in the Shelby County waterways is affected by industrial wastes. The greatest variety of species of Chlorophyceae was found at #7 where the water was unpolluted by industrial wastes. The least number of genera was found in #3, a heavily industrialized area, where only 17 genera were identified. The proportionately larger number of *Euglena, Oscillatoria* and *Navicula* found in Shelby County stations may indicate a high organic content in these waters (Palmer 1962a). Sometimes the appearance of forms which occur infrequently, such as *Penium* or *Cryptoglena,* is insignificant. They may have washed into the stream from some nearby puddle. *Protosiphon,* a terrestrial alga, may have come from the bank.

In line with other studies of this kind it would seem that the next step that should be taken in our laboratory is to identify the algae to the specific level. The species of some genera are rather easily identified, but identification of others requires considerable time and experience. As we continue the second year of study of the organisms at these stations, the seasonal variation of the different species should become clearer to us.

After the expected seasonal variation is known, then the variability in quantity, in kinds and in distribution of algal species through time and space can be looked at as indicators of changing environmental factors (Williams 1962). If a widely distributed species is not present in a particular habitat, one looks for some modification in the environment which would account for its absence. The tolerance of any species for phosphate or for any salt may be the limiting factor in its distribution (Williams 1964, Talling 1962). What causes the disappearance of one species may well account for the overproduction of another form which may itself become a serious pollutant.

It is not so much the presence of certain types of algae, important as this may be, that is the chief indicator of water quality, but it is rather the structure of the algal community (Williams 1964). The relative quantity of certain dominant species making up the community should become apparent as this study progresses. Any change in the pattern of the community which can be shown to be correlated with chemical changes resulting from industrial wastes may serve as a valid indicator of the degree of water pollution.

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TABLE I

SOME GENERA OF ALGAE OCCURRING IN SHELBY COUNTY WATERS - TOTAL COUNT*

Station Number	#0	#1	#2	#3	#4	#6	#7	#9	#11	#13	#14	#15
Number of Samples	26	22	31	26	28	27	28	22	27	26	25	8
CHLOROPHYCEAE												
Actinastrum	6		27		2	147	54	38	5	468	215	193
Ankistrodesmus	25	23	70	7	2	30	180	636	33	570	73	146
Characium	7		6		1	10	26	43	19	44	6	45
Chlamydomonas	307	412	437	147	605	173	1816	34,847	5883	2064	179	1355
Chodatella						2	72	20	7	14		
Chlorella	33	160	146	15	43	164	935	849	847	5028	229	1745
Chlorococcum	44	34	61	10	24	165	131	137	46	597	183	44
Chlorogonium							52	426	22	130	32	6
Closteriopsis										1		
Closterium	59	4	45	2	2	6	47	15	13	105	11	16
Coelastrum	27	3	38	11		17	146	262	83	1830	74	140
Coronastrum						14		18		20		
Cosmarium	1		2			2	17					
Crucigenia	3		2	1			110			4	7	2
Dactylococcus						1	1	1		1		
Desmidium							3					4
Dictyosphaerium		2	2			10	33	13	8	238	11	45
Dimorphococcus								4				
Eremosphaera		1										
Eudorina	2	4	37			8	362	645	42	23	2	14
Eurastrum									2			
Golenkinia	3		1				31	1		8	3	4
Gonium	1	17	22	1	1		43	64	4	54		4
Hyalotheca							130					
Hormidium	13	10	5		3	104	9	1	7	51	177	20
Microspora												12
Micrasterias							12	2				
Micractinium	2	10	10			10	278	1562	24	1015	19	268
Mougeotia							1					
Netrium							1	4				
Oedogonium					4	2	26					
Oocystis	3		6			6	6		1	37	11	35
Pandorina	1	15	28	1	1	23	2717	8275	962	359	11	317
Pediastrum			4	1	11	35	51		6	84	108	11
Penium		2										
Planktosphaeria							1					
Pleodorina							6			3		
Protosiphon			1							3		
Pteromonas			1			2	164	52	14			2
Pyrobotrys	2	8	47				9	6	6		2	8
Quadricoccus							10	20		154		
Scenedesmus	83	33	114	3	4	268	204	703	208	3769	308	876
Schizomeris							3					
Schroederia			2			7	94	4	5	129	5	45
Spongiococcum	4	8	17		1	4	16	18	5	102	3	6
Spirogyra		48					469		6			
Staurastrum	4					2	186	29		2	7	2
Stichococcus	1		18		12	12	389	12	5	40	11	10
Stigeoclonium		1	2		3	2		4		3		
Tetraedron	2		2			6	25		2	4		
Tetraspora								1				
Tetrastrum								12		10		
Treubaria							290		2		4	
Ulothrix		2	8		2	28	1	12		10	6	
Volvox	2							852	9		2	
Zygnema											2	
DIATOMS												
Centric	145	640	203	4	105	5462	468	739	53	9577	5518	877
Pennate	1091	1394	728	64	134	2648	1435	17,226	4142	3363	1742	1617
EUGLENOPHYCEAE												
Cryptoglena										13		
Euglena	259	461	517	25	240	325	1360	10,978	6879	2144	282	1359
Lepocinclis	2	11	5		1	2	30	16	1	24	9	10
Phacus	22	29	46		4	27	76	363	123	85	6	71
Strombomonas			17									
Trachelomonas	83	333	256	5	11	115	962	2682	1394	1230	176	624
MYXOPHYCEAE												
Agmenellum							1					
Anabaena	2	17	13	3	23	76	54	30	40	135	37	16
Anacystis							2					
Arthrospira						6				5	4	
Lyngbya	1	1	11		6	24	25	3	105	7	8	5
Nodularia						2						
Nostoc											1	
Oscillatoria	179	179	10,753	76	962	750	216	66,392	25,128	384	745	253
Phormidium	2						1		20			
Polycystis							1					
XANTHOPHYCEAE												
Botrydium			5									
Bumilleria			2			84	5	1				2
Heterothrix										5		
CHRYSOPHYCEAE												
Synura			1					25				
DINOPHYCEAE												
Ceratium	2											
Peridinium	3					2						

*Numbers in Table indicate the total number of each genera of algae found in the number of ml. equal to the number of samples taken at that station.

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