EPIPHYTIC DIATOMS AS INDICATORS OF WATER QUALITY IN FARM AND EXPERIMENTAL PONDS IN OKLAHOMA

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In 1976 we compared the relative abundance of epiphytic diatoms in two farm ponds and two experimental ponds in Bryan County, OK (1). The purpose of this note is to present the chemical data from that study and relate it to the diatom diversity.

Five macrophyte samples for diatom analysis and five water samples for chemical and physical analysis were taken twice from each of the four ponds. Farm ponds were sampled on 5/19/76 and on 8/3/76; experimental ponds were sampled on 5/20/76 and on 8/4/76. Samples at separate locations were taken near pond bottoms about 1.0 to 2.5 m deep. Dissolved oxygen, pH, and temperature of water were measured on site with standard methods. Two-liter water samples were returned to the laboratory for turbidity, Ca, K, Mg, P, N, and Si determinations (2, 3, 4). Diatom species diversity was measured (5, 6).

Turbidity, pH, and temperature (Table 1) did not fluctuate appreciably among locations at the ponds, whereas D.O. varied considerably. These parameters did not appear to differ between farm ponds and experimental ponds. Although Si and K were slightly higher in farm ponds than experimental ponds, nutrient concentrations of K, Si, and N did not differ appreciably. Mg was considerably higher in the experimental ponds than the farm ponds. Concentration of P and Ca fluctuated among ponds and between sampling dates. Diatom diversity was different among ponds (Table 1). Indices of species diversity were higher in the farm ponds than experimental ponds.

Correlation coefficients (1%** and 5%*) were determined among 11 of the parameters (Table 2). Species diversity was correlated with turbidity, K, Si, and NO_3, but it was inversely correlated with

TABLE 1. *Results of physical, chemical, and biological measurements in ponds (mean values).*

Parameter (unit)	Date and pond designation							
	IA		15		8		9	
	May	Aug	May	Aug	May	Aug	May	Aug
Turbidity (FTU)	8.4	2.6	7.6	5.1	2.5	2.0	2.2	5.4
Dissolved oxygen (mg/l)	5.6	4.6	9.1	6.7	8.8	5.0	10.7	0.8
pH	7.2	8.0	8.1	10.4	9.6	8.9	8.1	8.7
Temperature (C)	19.0	28.0	21.4	29.0	20.4	28.0	22.0	29.0
Silicon (mg/l)	2.62	1.52	3.24	1.26	1.08	0.44	0.18	0.54
Phosphate (μg/l)	5.90	5.08[a]	3.44	2.14	2.08	8.50	5.36	18.28
Calcium (mg/l)	5.30	8.10	27.32	13.40	10.84	15.00	15.30	22.90
Magnesium (mg/l)	1.48	2.44	2.52	3.20	12.70	13.90	19.20	21.66
Potassium (mg/l)	3.84	3.46	2.54	2.06	0.18	0.16	0.06	0.28
Nitrate (mg/l)	0.12	0.11	0.07	0.06	0.06	0.06	0.06	0.06
Diversity (H″(G,S))	3.07	3.84	3.13	3.53	1.00	2.03	1.61	1.28

[a]August samples for phosphate collected 8/16/76.

TABLE 2. *Correlation coefficients for chemical, physical, and biological factors for each sample.*

	Potassium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Silicon (mg/l)	Nitrate (mg/l)	Phosphate (μg/l)	Temp C	pH	D.O. (mg/l)	Turbidity (FTU)	Diversity (H″G,S)
K^+	1.000	—.891**	—.343*	.782**	.856**	—.192	—.162	—.447**	—.056	.565**	.821**
Mg^{2+}	—	1.000	.324*	—.801**	—.631**	.351*	.182	.135	—.127	—.462**	—.820**
Ca^2	—	—	1.000	.077	—.601*	.160	.158	.085	—.026	.187	—.194
SiO_2	—	—	—	1.000	.520**	—.225	—.472**	—.386*	.138	.748**	.568**
NO_3^-	—	—	—	—	1.000	—.082	—.241	—.662**	—.159	.350*	.556**
PO_4^{3-}	—	—	—	—	—	1.000	.259	—.081	—.260	.006	—.348*
T	—	—	—	—	—	—	1.000	.429**	—.510**	—.304	.158
pH	—	—	—	—	—	—	—	1.000	.042	—.315*	—.172
D.O.	—	—	—	—	—	—	—	—	1.000	—.053	—.102
Turb	—	—	—	—	—	—	—	—	—	1.000	.331*
H″G,S	—	—	—	—	—	—	—	—	—	—	1.000

** 1% probability level (0.403)
* 5% probability level (0.312)

P and Mg.

Water fertility may influence population diversity. Eminson (7) found that the diversity of epiphytes on *Myriophyllum spicatum* L. was higher in infertile broads than in fertile dykes. In the Oklahoma ponds studied, the water-soluble P was inversely correlated with species diversity, possibly because the water, with lower P concentrations, was less fertile. Cations are important, because they influence the amount of dissolved organic substances secreted by aquatic macrophytes (8). The dissolved organic substances serve as nutrient source for epiphytes (9). In our study Mg was negatively correlated with species diversity, whereas K was positively correlated (Table 2). Therefore, the concentrations of K and Mg may indirectly play a role in determining the structure of the epiphytic diatom community.

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