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Physico-Chemical Complexes of Two Freshwater Ponds of Hyderabad District in Relation to Fungal and Bacterial Numbers

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Two freshwater ponds in Hyderabad district of Andhra Pradesh have been investigated for some biological and physico-chemical characteristics, viz. air and water temperature, *p*H, carbon-dioxide, organic matter, phosphates, nitrates and free ammonia. The interrelationship between these factors and seasonal fluctuation of fungal and bacterial numbers have been discussed.

Keywords: Microbes, Physico-chemical factors, Distribution, Fresh water

Introduction

Seasonal fluctuations of various physico-chemical factors in aquatic systems have an important role on the distribution, periodicity, qualitative and quantitative composition of fresh water fungi and bacteria. However, in India studies dealing with these aspects have been very few (Dayal & Tandon 1962, Srivastava 1967). Present investigations were therefore undertaken to analyse the physico-chemical complexes of two fresh water ponds of Hyderabad district in relation to bacteria and fungi.

Material and Methods

The two ponds selected for this study were the temple pond on the Anantagiri Hills of Vikarabad (Pond A) and the Osmania University Campus pond (Pond B). Pond A has a surface area of 0.0005 sq.km with a maximum depth of 4.5 m, whereas pond B is 0.007 sq.km in surface area and has a depth up to 1 m. The angiospermic flora of pond A comprises *Dopatrium lobeloides* (Retz.) Benth., *Vallisneria spiralis* L., *Ottelia alismoides* (L.), *Blyxa octandra* (Roxb.) planchex Thw., *Limnophila heterophylla* Benth., *Hydrilla verticillata* (L.F.) Roy, and *Najas* sp. In pond B, *Typha angustata* Bory and Chaut and *Ipomoea aquatica* Forsk are represented.

Water samples were collected between 8.30 and 9.30 AM at monthly intervals during 1971-72 in pyrex bottles and were analysed for albuminoid ammonia, free ammonia (A.P.H.A. 1971) oxidizable organic matter, nitrites, nitrates, phosphates, free carbon dioxide, dissolved oxygen, *p*H and temperature (Dickinson 1950, Mackereth 1957, Taylor 1949, Wilcox & Hatcher 1950). In addition, samples were collected in sterile pyrex bottles for the assessment of fungal and bacterial numbers following techniques of Willoughby (1962) and Waksman (1922). Fungi were also isolated employing boiled hemp seeds, maize grains, grass blades and fruits as baits. The data were subjected to statistical analysis.

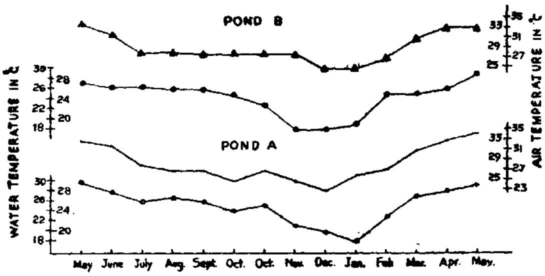

Figure 1 Physico-chemical complexes

Results and Discussion

Temperature

The water samples of the two ponds differed significantly in their physico-chemical characteristics, fungal and bacterial numbers (tables 1 & 2). During the present investigations the temperature varied from 20.6 to 26.1°C and there was a close parallel between the monthly variations in the ambient temperature and the temperature of water.

Oxidizable organic matter, carbon dioxide and pH

Amounts of oxidizable organic matter between ponds A and B did not differ significantly (t=0.850; table 1 figure 2). However, high values of organic matter were found during winter and the summer seasons. Further, in the present study, the oxidizable organic matter showed a direct relationship with free carbon dioxide and fluctuated inversely with *p*H in both the ponds (table 1 and figure 2). In the absence of detailed experiments, it may be difficult to account for this relationship. However, it may be noted that pond A (*p*H 5.9–6.1) supported a good and profuse mycopopulation represented by species of *Allomyces*, *Achlya*, *Aphanomyces*, *Acaulopage*, *Blastocladia*, *Fusarium*, *Gonapodya*, mucorales, *Pythium* and *Triscelophorus*, whereas pond B with alkaline *p*H (7.7–7.9; table 1) had poor respreentation of the fungal flora. It is likely that the density of the aquatic biota is controlling the above mentioned relationship.

Table 1 *Seasonal averages of physico-chemical factors*

Factor	Monsoon		Winter		Summer	
	A	B	A	B	A	B
Air temperature, in° c	27.8	28.9	27.6	26.6	32.6	32.7
Water temperature, in° c	26.1	26.0	21.4	20.6	28.5	27.0
Oxidizable organic matter in, ppm	6.04	5.6	6.4	8.6	2.5	6.0
Free Co_2, (in ppm)	15.2	8.6	19.5	10.3	20.2	7.8
*p*H	6.0	7.9	5.9	7.7	6.1	7.8
Phosphates (in ppm)	3.7	2.1	4.97	1.5	1.7	1.1
Nitrites (in ppm)	0.00042	0.00037	0.00062	0.0004	0.00087	0.000138
Nitrates (in ppm)	3.18	1.98	4.9	2.06	1.77	1.6
Free Ammonia (in ppm)	7.3	7.18	6.0	3.4	3.2	2.5
Albuminoid ammonia (in ppm)	7.5	9.08	4.9	3.8	3.6	2.06
Dissolved oxygen (in ppm)	5.6	4.7	12.3	7.7	6.1	3.7
Bacterial numbers X 10^3 per litre	832	924	732	600	595	670
Fungal numbers, per litre	1084	680	820	176	415	156
t values						
Table value of *t* significant at 5% level is 2.06	2.22		2.78		2.53	

A Pond A *B* Pond B

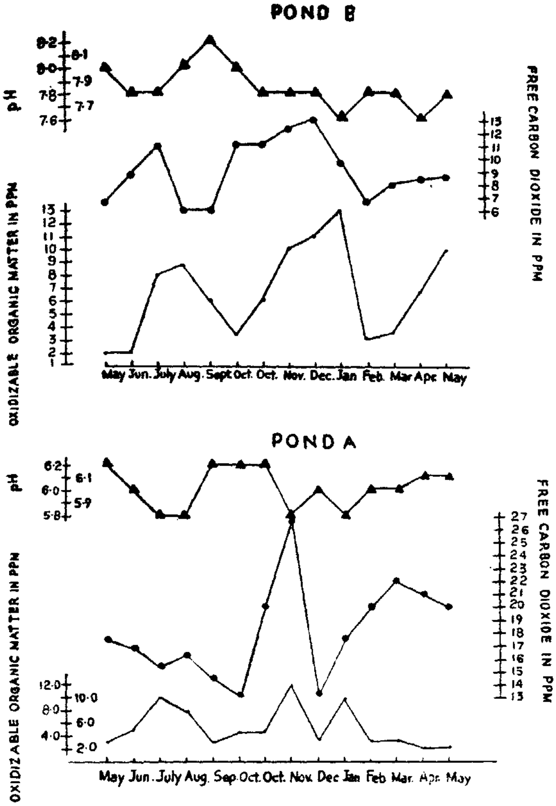

Figure 2 Physico-chemical complexes

Phosphates and oxidizable organic matter

In the present investigation, pond B showed lower concentrations of phosphates than pond A (table 1 figure 3). This may be because of differences in biological activity in the two ponds and also due to less

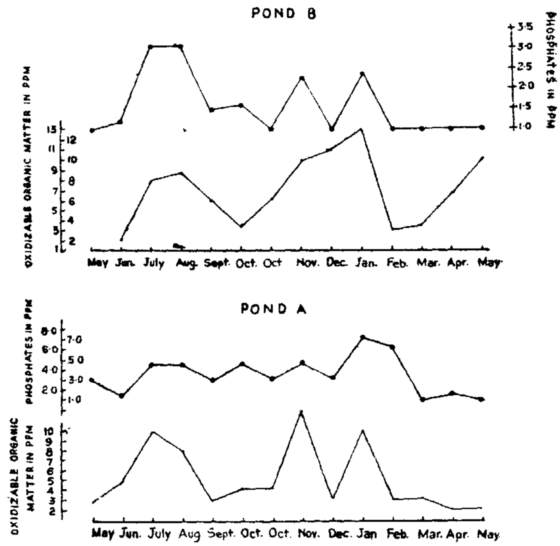

Figure 3 Physico-chemical complexes

Table 2 *Statistical data*

Factor	C.D. at 5% level		S. E.		F Values	
	A	B	A	B	A	B
Air temperature	6.708	6.325	1.56	1.45	1.423	1.507
Water temperature	8.041	7.697	1.87	1.79		
Oxidizable organic matter	4.085	0.946	0.95	0.223	1.801	6.352
Free CO_2	5.503	2.58	1.28	0.6		
*p*H	0.262	0.245	0.61	0.057	19.82	6.00
Phosphates	7.009	0.6063	1.63	0.14		
Nitrites	—	—	—	—	F values are not calculated	
Nitrates	3.130	2.614	0.728	0.608	—	—
Free ammonia	4.253	4.867	0.989	1.132	1.242	2.302
Albuminoid ammonia	4.73	7.396	1.1	1.72		
Dissolved oxygen	7.439	4.644	1.733	1.08	—	—
Bacterial numbers	25.076	34.959	5.82	8.13	F values are not calculated	
Fungal numbers	68.37	46.44	15.9	10.8		

A Pond A *B* Pond B *C D* Critical difference *S E* Standard error deposition of pollutants as also observed by Welch (1962) Ruttner (1953), and Hutchinson (1957) who recorded high values of phosphates in waters contaminated with sewage or agricultural drains. *p*H and phosphates were significantly correlated (table 2), while the monthly fluctuations of phosphates and oxidizable organic matter were more or less identical (see figure 3). The summer decline of phosphates can be attributed to the non-availability of specific bacteria and fungi that can decompose the type of organic matter present in these ecosystems.

Nitrites, nitrates and ammonia

Nitrites, nitrates and free ammonia were found to be interrelated (figure 4). Such interrelationships amongst different forms of inorganic nitrogen were also observed by Munawar (1970), Rao (1972), Seenayya (1971) and Zafar (1964) in some other fresh water ponds of this part of the country. The monthly fluctuations in nitrites, nitrates and free ammonia as noted presently, may be attributed to the growth of algae, temperature regime and active role of microbes (*see also* Willoughby 1974). It is obvious from table 1 that in the rainy season, the free ammonia was at its maximum in both the ponds and minimum in April (1972). Maximum amounts of free ammonia and albuminoid ammonia present

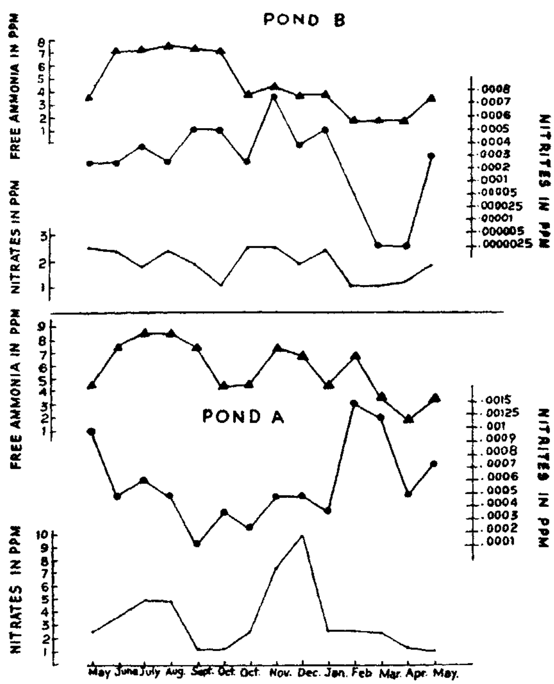

Figure 4 Physico-chemical complexes

during monsoon might also have favoured the multiplication of many zoosporangial forms of fungi.

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