PESTICIDAL EFFECT ON RICE FIELD CYANOBACTERIA IN PERAMBALUR, TAMIL NADU

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Abstract: Pesticidal effect was studied on rice field Cyanobacteria - *Anabaena cylindrica* in Perambalur, Tamil Nadu. In the present study lower concentrations of Dithane M45 and Malathion (5 ppm, 10 ppm and 15 ppm) stimulated the algal growth and their higher concentrations inhibited the algal growth when compared to control. It was clearly observed in chlorophyll a and phycobilin content of pesticides treated cells. But the increase in concentrations of both Pesticide did not affect the nitrogen fixing activity, because there was no significant decrease in nitrogen contents of cells in different treatments. Ammonia excretion by the algae was gradually decreased in 5ppm - 50ppm of Dithane M45 treated cells when compared to control. While maximum ammonia excretion was observed in 5ppm of Malathion treated cells when compared to other concentrations. The application of Cyanobacteria in rice field can increase the soil fertility and reduce the use of chemical pesticides for crop improvement.

Keywords: Ammonia excretion, cyanobacteria, chlorophyll a, nitrogen fixation, rice field, pesticides, phycobilins

INTRODUCTION

Cyanobacteria or blue - green algae (BGA) are the only source of nitrogenous biofertilizers produced at practically no energy cost of mankind. The application of nitrogen fixing cyanobacteria in rice cropping as biofertilizers has gained much significance in rice cultivation in India. Cyanobacteria are photoautotrohic microbes which utilize solar energy to reduce atmospheric dinitrogen to ammonia.

Paddy plants are affected by insects, pests; fungi, bacteria and other pathogens. So protect them from the attack of these pathogens many insecticides, pesticides, fungicides and other chemicals are sprayed on the plant. These chemicals may affect the blue green algae and other microbes. Here an attempt is making in this work to study the effect of pesticides on the growth, nitrogen content and ammonia excretion by Anabaena sp.

MATERIAL AND METHOD

Water samples were collected from paddy field in Perambalur area. Such samples were cultured in nitrogen free BG_{11} medium. The algal growth was observed and identified. These samples were subculture in nitrogen free BG_{11} medium. Such algal sample was grown in the same medium as mentioned in earlier step supplemented with various concentrations of dithane M 45 and Malathion in increasing concentrations (5ppm, 10 ppm, 15ppm, 20ppm and 50ppm). The cultures were maintained at 25^{o} C and 12 hours light and 12 hours dark (light intensity 3000 lux).

The Growth was determined every 10^{th} and 15^{th} day by measuring the chlorophyll a content of cultures from the exponential phase. The chlorophyll a was determined by McKinney's method (1941). Phycobilin pigments were estimated according to the method of Bennet and Bogorad (1973). The Nitrogen content was determined by micro-kjeldahl method of Umbriet et al., (1972).Ammonia content was estimated by Soarzano's method (1969).

RESULT AND DISCUSSION

The cultured water samples showed algal growth and were separated and identified as *Anabaena cylindrica*. Generally *Anabaena cylindrica* is a rice field Cyanobacteria applied as biofertilizer to increase the yield of paddy and other crops as it fixes nitrogen both symbiotically and non-symbiotically. The necessity to use pesticides in modern agriculture coupled with the increasing use of the Cyanobacterial biofertilizers to improve crop yields in rice have necessitated the study of the mutual influence of pesticides and Cyanobacteria .

Under lab condition such *Anabaena cylindtrica* was grown in BG11 medium in the presence of different concentrations of Dithane M45 and Malathion, its growth was not affected in T1, T2, and T3 cells treated with Dithane M45.The chlorophyll **a** content was increased in T1, T2 and T3 Dithane on the 10^{th} day, but it was decreased in T4 and T5 when compared to T0 (Table: 1 & Figure: 1).On 15^{th} day the chlorophyll a content was decreased significantly. It might be due to interference in synthesis or destruction of existing chlorophyll a.

Malathion treated cells (T1) showed greater increase in chlorophyll content on 10^{th} day when compared to T0. The other cells (T2, T3, and T4 & T5) showed decrease in chlorophyll a content on 10^{th} day. But on 15^{th} day T1 & T2 showed greater increase in chlorophyll a content when compared to T0. T3,T4 and T5 showed decrease in chlorophyll a content

(Table : 1 & Figure : 2). Phycocyanin content significantly decreased with increasing concentration of Dithane M45 both on 10th and 15th day (Table : 2 & Figure 3 & 5) .But the Phycoerythrin content was significantly increase in all the treatments with Dithane on 10th day and it was gradually decreased in T1,T2,T3,T4 and T5.Malathion treated cells showed increase in the content of Phycocyanin and Phycoerythrin both on 10th and 15th day (Table : 2 & Figure 4 & 6).

Significant decrease in growth and pigment content in *Nostoc muscorum* on treatment with methyl parathion and B enthiocarb was reported without any significant effect on nitrogenase activity (Bhunia *et al.*, 1992).The increase in concentration of Dithane M45 and Malathion did not affect the nitrogen fixing activity, because there was no significant decrease in nitrogen contents of cells in different treatments (Table: 3 & Figure: 7 & 8) . The highest Nitrogen content was observed in T3, T4 and T5 (Dithane) on the 10th day. Except T1 and all the treatment showed a increase in amount of nitrogen when compared to T0.But on 15th day there was significant decrease in nitrogen content in T3, T4 and T5 (except T1& T2) when compared to T0.Malathion treated cells showed increase in nitrogen content on 10th day in T2, T3 and T4 except in T1 and T5 (Table: 3 & Figure: 8).But it was increased in all treated cells on 15th day when compared to T0.

Kaushik and Venkataraman (1983) investigated the response of cyanobacterial nitrogen fixation to insecticides and concluded that insecticides such as BHC. Carbofuran and phorate affect differently the pigment synthesis and nitrogenase activity, the effect being stimulatory, inhibitory or neutral depending on the concentrations used. Kalita (1997) observed growth stimulation in *Anabaena azollae* up to10 µg/ml in the presence of Malathion during all the time periods exhibiting the highest and lowest stimulation after 14 and 21 days of treatment. At higher concentrations, chlorophyll-content and total nitrogen content decreased.

Ammonia excretion by the cells gradually decreased in T1 to T5 when compared to T0 on the 10th and 15th day treated with Dithane M45 (Table: 4 and Figure: 9). Maximum amount of ammonia was excreted in T1 on both 10th and 15th day by the cells when they were grown in the presence of Malathion (Table: 4 and figure: 10). But the cells grown in T2, T3, T4 & T5 excreted lesser amount of ammonia on both 10th and 15th day when compare to T0.A stimulation on ammonia excretion by cyanobacterial cultures on treatment with pesticide (Subramanian *et al*, 1987) and herbicides (Bharathi & Angadi 1981; Newton, 1986; Lattore *et al.*, 1986; Subramanian and Shanmugasundaram, 1986) have been reported.

The present study concluded that the low concentrations of DithaneM45 and Malathion showed the stimulatory effect on cyanobacterial growth .While the higher concentrations showed the inhibitory effect as indicated in the chlorophyll a content, the nitrogen fixation and the nitrogen content of cells were not affected very much.

Table 1. Pesticidal effect on chlorophyll a content of rice field Cyanobacteria – *Anabaena cylindrica*

S. No	Treatments	Dithane M45 10th day (µg/ml)	15th day (µg/ml)	Malathion 10th day (µg/ml)	15th day (µg/ml)
1	T0	1.37	0.31	0.11	1.14
2	T1	2.50	0.50	0.50	2.24
3	T2	2.10	0.22	0.10	1.8
4	T3	1.57	0.24	0.11	0.82
5	T4	0.50	0.25	0.05	0.61
6	T5	0.41	0.23	0.05	0.60

Table 2. Pesticidal effect on Phycobilins of rice field Cyanobacteria - *Anabaena cylindrica*

S. No	Treatments	Dithane M45				Malathion			
		10th Day mg/ml		15th Day mg/ml		10th Day mg/ml		15th Day mg/ml	
		PC	PE	PC	PE	PC	PE	PC	PE

1	T0	0.048	0.022	0.025	0.020	0.023	0.02	0.025	0.02
2	T1	0.006	0.040	0.014	0.016	0.044	0.039	0.066	0.47
3	T2	0.004	0.043	0.011	0.015	0.041	0.038	0.063	0.046
4	T3	0.003	0.035	0.009	0.010	0.032	0.035	0.051	0.043
5	T4	0.002	0.035	0.009	0.009	0.050	0.033	0.045	0.031
6	T5	0.002	0.030	0.007	0.008	0.031	0.033	0.042	0.030

Table 3. Pesticidal effect on Nitrogen content in cells and Culture Filtrate of rice field Cyanobacteria – *Anabaena cylindrica.*

S. No	Treatments	Dithane M45		Malathion	
		10^{th} Day mg/ml	15^{th} Day mg/ml	10^{th} Day mg/ml	15^{th} Day mg/ml
1	T0	0.13	0.16	0.14	0.08
2	T1	0.11	0.25	0.18	0.26
3	T2	0.15	0.18	0.37	0.20
4	T3	0.29	0.14	0.38	0.14
5	T4	0.27	0.12	0.48	0.11
6	T5	0.23	0.10	0.10	0.10

Table 4. Pesticidal effect on Ammonia content in culture filtrate of Rice field Cyanobacteria - *Anabaena cylindrica.*

S. No	Treatments	Dithane M45		Malathion	
		10^{th} Day mg/ml	15^{th} Day mg/ml	10^{th} Day mg/ml	15^{th} Day mg/ml
1	T0	0.25	0.50	0.28	0.23
2	T1	0.22	0.43	0.31	0.31
3	T2	0.14	0.22	0.26	0.19
4	T3	0.08	0.17	0.23	0.17
5	T4	0.05	0.10	0.17	0.17
6	T5	0.01	0.07	0.13	0.11

Figure. 1

Pesticidal effect on Chlorophyll a content of rice field Cyanobacteria - *Anabaena cylindrica*

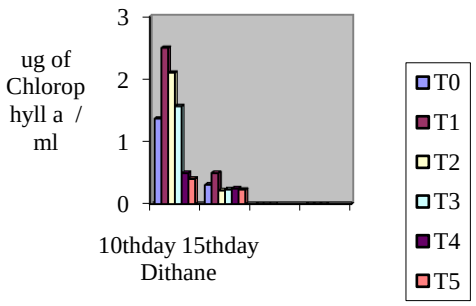


Figure. 2

Pesticidal effect on Chlorophyll a content of rice field Cyanobacteria - *Anabaena cylindrica*

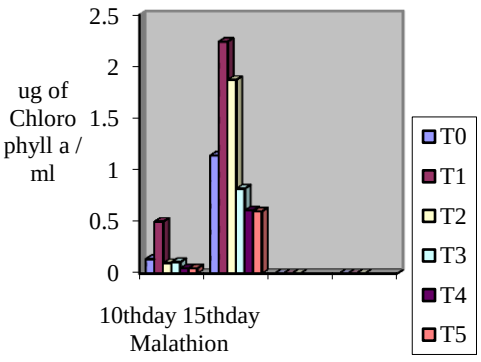


Figure. 3

Pesticidal effect on Phycobilins of rice field Cyanobacteria - *Anabaena cylindrica*

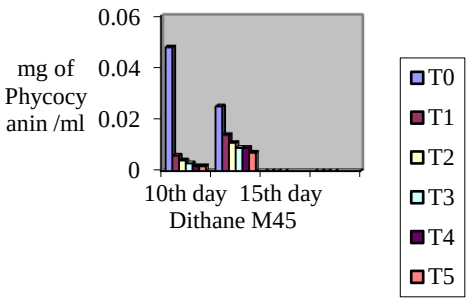


Figure . 4

Pesticidal effect on Phycobilins of rice field Cyanobacteria - *Anabaena cylindrica*

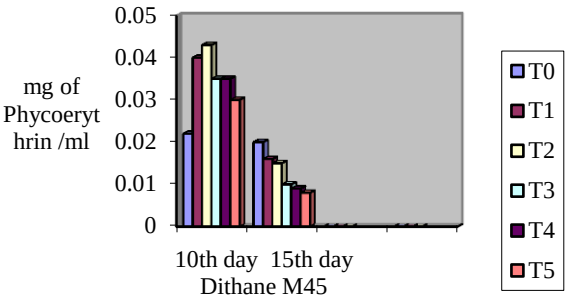


Figure. 5

Pesticidal effect on Phycobilins of rice field Cyanobacteria - *Anabaena cylindrica*

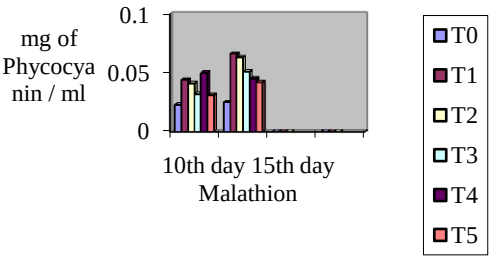


Figure. 6

Pesticidal effect on Phycobilins of rice field Cyanobacteria - *Anabaena cylindrica*

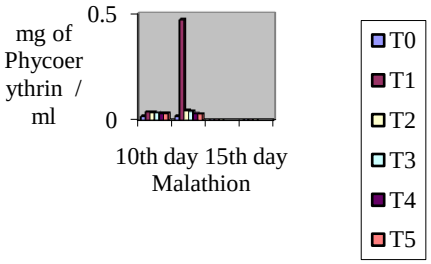


Figure. 7

Pesticidal effect on Nitrogen content of rice field Cyanobacteria - *Anbaena cylindrica*

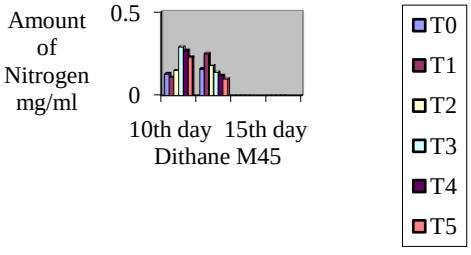


Figure. 8

Pesticidal effect on Nitrogen content of rice field Cyanobacteria - *Anabaena cylindrica*

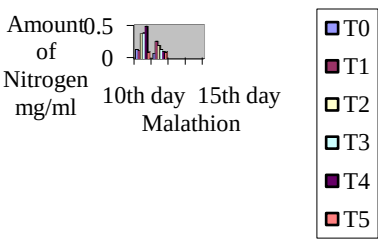


Figure. 9

Pesticidal effect on Ammonia content in culture filtrate of rice field Cyanobacteria - *Anabaena cylindrica*

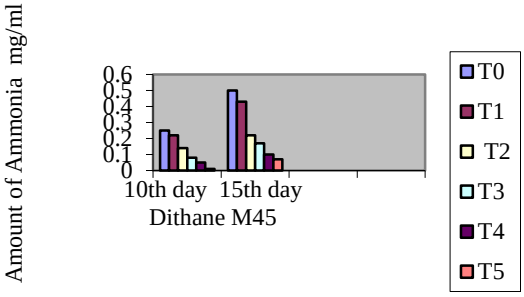
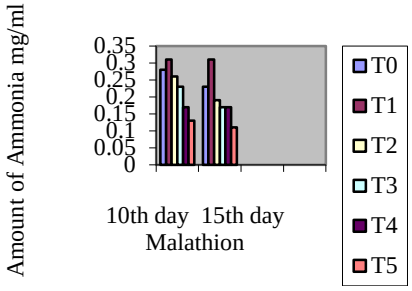


Figure. 10

Pessticidal effect on Ammonia content in culture filtrate of rice field Cyanobacteria *Anabaena cylindrica*



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