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INFLUENCE OF SATURN HERBICIDE ON A NATURAL PHYTOPLANKTON COMMUNITY OF RICE FIELDS

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Abstract

The effects of the herbicide thiobencarb (Saturn) were tested on the growth of phytoplankton community of rice fields as an important parameter in the evaluation of herbicide phytotoxicity. The herbicidal treatments simulated by emergency of rice field and the amounts used of thiobencarb were 1.5 and 1.0 liter feddan. Fourty seven algal taxa were recoded, 10 belonged to cyanophyceae, 19 to chlorophyceae, 15 to bacillariophyceae and 3 to euglenophyeae. The effect of the two thiobencarb treatments differed significantly in their effect on phytoplankarts The high rate was significantly higher in simulating the phytoplankton communities than in the low rate treatment. The bacillariophyceae forms were relatively resistant to the herbicidal treatments. Thiobencarb was toxic to the growth of some cyanophyceae, *Anabaena spiroides* and *Chlorococcus minor.* It was lethal to *Coelspharium* and *Merismopedia eleganus.* Susceptibility to thiobencarb the green algae. Strains of *Pediastrum simplex* were more sensitive than Pediastrum duplex and *Chlorella saccharophila* was more sensitive than *C. vulgaris.* The high rate completely inhibited the growth of *Staurastrum paradoxum* and *Chlamydomonus ovalis.* The two rates of thiobencarb were lethal to all euglenophyceae. This study was examined the effect of thiobencarb herbicide on growth of phytoplankton community in rice field as important parameter in the evaluation of herbicide toxicity.

INTRODUCTION

Microscopic algae, also called phytoplankton, are tiny, free-floating algae that give the pond of water its characteristic green color. Microscopic algae are the primary producers of dissolved oxygen in pond water. The presence of a healthy level of microscopic algae in a pond is important for maintaining good water quality and health of the aquatic organisms in the pond, such as fish. Microscopic algae can undergo excessive blooms during mid-summer months, rising to the surface of the pond as a layer of yellow-green or reddish scum. A sudden die-off of microscopic algal blooms, caused by a change in water temperature or a stretch of several overcast days, can deplete dissolved oxygen levels in ponds to a critical level for the survival of aquatic organisms (Smith, 1991 and Relyea, 2004 and 2005). The wide spread use of herbicides in modern agriculture can have adverse effects on algal flora. Many reports recorded herbicide effects on algal growth, photosynthesis, nitrogen fixation, biochemical composition and metabolic activities (Kobbia *et al.,* 2001), as well as degradation and removal of herbicides by algae (Stratton, 1987). Various algae have been used to study thiobencarb herbicide mode of action, and to reveal its toxicological effects. It is widely used for weed control in paddy rice fields due to its low persistence, where its half life is 3 weeks under aerobic conditions and its high effectiveness. (Tomlin 1994). Thiobencarb undergoes volatilization, adsorption, chemical and microbiological transformations in the environment. The recommended field application Rate in terms of active ingredients is approximately 4 kg / ha or 40 / mgl for a 10 - cm deep paddy.

Yoo (1979) investigated the effects of thiobencarb on the growth, survival and succession of green algae in order to obtain better understand the interaction of thiobencarb herbicide and the primary producers of aquatic ecosystems. Susceptibility to thiobencarb differs among the planktonic algae. Among green algae, strain of *Selenastrum capricornutum* was much more sensitive than *Chlorella vulgaris* and *Scenedesmus acutus* was more sensitive than *C. saccharophila*, while the cyanobacterium *Psendamabaena galeata* was intermediate between the latter two species (Sabater and Carrasco, 1996). Thiobencarb had no pronounced effect on growth and nitrogen fixation on some heterocystous cyanobacteria using half, full or double rate of the standard field.

Thiobencarb herbicide 600g/l (Saturn 60, $C12H16ClNOS$) used to control annual grasses and sedges. It is selective herbicide, absorbed by coleoptile, mesocotyle roots and leaves. Inhibits shoot growth of emerging seedlings. The action on weed is preemergence and early post emergence. It is protein synthesis inhibitor. Thiobencarb is a thiocarbamate herbicide widely used for weed control in Egyptian paddy rice fields due to its low persistence and high effectiveness; it interferes with protein and fatty acids synthesis and inhibits photosynthesis (Corbett *et al.,* 1984). Beside the use of thiobencarb by direct application for weed control, it may enter to aquatic ecosystem through off site movement from treated fields, by surface run off or adsorbed to suspended particles. Since, algae are the primary producers of aquatic ecosystem; the damage to algae may affect both function and structure of the whole ecosystem. Hence, it is important to evaluate the impact of thiobencarb on nontarged algal organisms.

Paddy rice herbicides contribute to the reduction of weeding labor, however, there are concerns about their effects on the environment and ecosystems. The environmental burden of applied herbicides is heaviest in water systems such as irrigation channels and rivers. Herbicides are generally detected in rivers in concentrations in levels of nanogram/l for only 2 to 3 months after use. It is to be regretted that herbicides have been implicated in accidents involving fish, the impeded propagation of algae and other non-target organisms (Ueji and Inao, 2001).

Using fields and naturally occurring plankton communities in a multi-day study should be more realistic and provide better extrapolations to real environments than laboratory studies on a single species (Juttner *et al.,* 1995).

The mode (s) of action of thiocarbamate herbicides are not well understood, but they seem to inhibit fatty acid and protein synthesis (Tomlin, 1994), which in turn can have many secondary effects on growth. Altered fatty acid synthesis may also indirectly after photosynthesis and respiration (Percival and Baker, 1991).

Widely varying sensitivity to thiobencarb has been reported in chlorophyceae algae and cyanobacteria, with minimum inhibitory concentrations ranging from about 0.1 to 4 mg L (Sabater and Carrasco, 1996). In addition to species and strains differences, the variability also may result from different culturing protocols and bioassay procedures (Yoo, 1979). In fact, because of decomposition of thiobencarb in the medium, apparently accelerated by the algae or possibly by contaminating bacteria, the effects of thiobencarb are probably limited to fairly short time periods. This is consistent with their life time in the field of 2 - 3 weeks in aerobic soils (Tomlin, 1994), and earlier reports of herbicide degradation by algae (Stratton, 1987).

The aim of this study was to examine the effect of thiobencarb herbicide on growth of phytoplankton community in rice field as important parameter in the evaluation of herbicide toxicity.

MATERIALS AND METHODS

The study was conducted at Kofor negm, Ibrahimia, Sharkia Governorate, during 2003 in rice field at the approximate time of the year when the respective herbicides are applied. Thiobencarb ([S-4-Chlorobenzyl diethylthiocarbamate], Technical grade, 95 %) Villalobos, *et al.,* 2000 was obtained from KZ Company. Thiobencarb was thoroughly and homogeneously sprayed on the surface at two rates equivalent to that of direct application of 1 L feddan-1 and 1.5 L feddan thiobencarb. The above concentrations follow the recommended application rate for weed control. Each treatment was replicated three times in randomly assigned design in each trial. Pools were flushed and air-dried for 4 days. A set of measurements was taken before application (0 day) and 1, 2, 3 and 4 days after application. In case of high rate measurements were taken 0, 1, 2, 3, days. Water should not be drained, or allowed to overflow for 3 to 5 days after application and keep water low enough to avoid submerging the rice.

Quantitative estimation of phytoplankton was carried out by the technique adopted by APHA (1985) using the sedimentation method. Phytoplankton samples were preserved in Lugol's solution (prepared by dissolving 20 g of potassium iodine (KI) and 10 g iodine crystal in 200 ml distilled water solution containing 20 ml glacial acetic acid) at a ratio of 3 to 7 ml Lugol's solution to one liter sample and concentrated by sediment to one liter water sample in a volumetric for about 2 to 7 days. The surface water was siphoned and the sediment was adjusted to 100 ml. From the fixed sample, 1 ml was drown and placed into sedgwick-Rafter cell, then was microscopically examined for counting after identification of phytoplanktonic organisms. The results were then expressed as counts per liter. The phytoplankton cells were identified to four division as green algae (chlorophyceae), blue-green algae (cyanophyceae), diatom (bacillariophyceae), and euglena (euglenophyceae). For identification of the algal taxa, Fritsch (1979) and Komarek and Fott (1983) were consulted.

Statistical analysis was made by SAS (SAS Institute, 1985) statistical software package. ANOVA (after pretesting for normality) and LSM were used to test for significant differences ($P < 0.05$) among treatments in each trial.

RESULTS AND DISCUSSION

Proportionate distribution of commonly encountered algal forms is presented in Tables 1 and 2. In all, 47 algal taxa were observed, out of which 10 belonged to cyanophyceae, 19 to chlorophyceae, 15 to bacillariophyceae and 3 to euglenophyceae.

The two rates of thiobencarb herbicide treatments were found to be significantly different. Significantly different means of this herbicide was judged to be related to treatment effects. At high rate it was significantly higher in stimulated the phytoplankton communities than in the low rate treatment. The bacillariophyceae forms were relatively resistant to herbicide treatment. Thiobencarb was toxic to the growth of some cyanophyceae; *Anabaena spiroides* and *Chlorococcus minor.* It was lethal to *Coelspharium* and *Merismopedia eleganus.* Susceptibilty to thiobencarb differs among the green algae. Strains of *Pediastrum simplex* were much more sensitive than *Pediastrum duplex* and *Chlorella saccharophila* was more sensitive than *Chlorella vulgaris.* At the high rate 1.5 L / feddan the growth of Staurastrum paradoxum and *Chlamydomonus ovalis* was completely inhibited. The two rates of thiobencarb were lethal to all euglenophyceae. Some bacillariophyceae was affected by thiobencarb as *Navicula cuspidate, Nitzschia aciculariz* and *Frustulla* but the others species were unaffected.

As shown in Tables 3 and 4, and Figure 1 the phytoplankton communities were stimulated by thiobencarb herbicide after four days of application. Table 5 showed that bacillariophyceae, chlorophyceae, cyanophyceae and euglenophyceae were affected significantly ($P < 0.05$) by all factors (rate, time and their interactions), but in the case of the interaction effect between rate and time cyanophyceae was highly significant but euglenophyceae was significant, while chlorophyceae and bacillariophyceae were not significant.

To standardize the data set for percentage of division to total standing crops, measurements made at one-day intervals and averaged to obtain one value percalender experiment (Figure 2). The chlorophyceae was the most abundant group in the high and low rates comprising 45 % and 42 % of total phytoplankton numbers respectively, while bacillariophyceae was the second abundant group which representing 33 % and 32 % of total phytoplankton communities with the two rates of application. Meanwhile, the cyanophyceae was the third group but euglenophyceae was the least group which representing few numbers.of three species only.

CONCLUSION

Our results indicate that high and low rates of thiobencarb decreased growth of some algae, i. e. *Pediastrum simplex, Pediastrum duplex, Staurastrum paradoxxum* and *Chlamydomonus ovalis* and lethal to others, i.e *Coelspharium dubium, Merismopedia eleganus, Anabaena spiroides* and *Chlorococcus minor.*

Thiobencarb was toxic to the growth of the cyanobacteria *Anabaena oryza* and *Nostoc calcicola* and was more toxic than knock weed on the growth of *A. variabililis.* Thiobencarb was lethal to *Nostoc* sp. At concentrations ranging from 6 to 8 mgl (Mishra and Pandey, 1989). The inhibitory effect of thiobencarb on the growth, nitrogen fixation, chlorophyll "a" content and heterocyst formation in a mixed culture of *Anabaena, Nostoc* and *Oscillatoria* was quite marked at 55 mgl (Zargar and Dar, 1990).

Cyanobacteria are quite sensitive to herbicides because they share many common characteristics with higher plants. The sensitivity of cyanobacteria towards herbicides varies, however, depending on the species and the kind of herbicide. The results here, agree with previous reports (Stratton, 1987) pointing out a relative tolerance of some cyanophyceae, chlorophyceae and bacillariophyceae towards thiobencarb herbicide.

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Table 1. Phytoplankton community (No. of cells x 10^3 L^{-1}) in rice field treated by 1.0 liter/ feddan of thiobencarb herbicide.

Algal taxa	0 day	1 day	2 days	3 days	4 days
Bacillariophyceae					
1. *Cyclotella comta* (Her.)Kutz	11.67	8.33	25	31.67	41.67
2. *C. ocellata* Pant.	6.67	0	11.67	16.67	25
3. *Diatoma* sp.	6.67	8.33	11.67	25	31.67
4. *Epithemia zebra proboscides* (Kutz.) Grun.	8.33	6.67	0	6.67	15
5. *Frustulla* sp.	8.33	0	11.67	13.33	20
6. *Gryosigma attenuatum* (Kutz.)	5	8.33	11.67	20	26.67
7. *Melosira granulata* (Her.)	11.67	3.33	8.33	11.67	21.67
8. *Navicula anglica* Ralfs	10	8.33	25	25	21.67
9. *N. cuspidata* Kutz	6.67	3.33	11.67	16.67	30
10. *N. cuspidata* Kutz	8.33	6.67	10	11.67	15
11. *Nitzschia aciculariz* Smith	15	6.67	10	15	28.33
12. *N. closterium* Smith	6.67	3.33	13.33	13.33	0
13. *Pinnularia alpine* W. Smith	10	6.67	18.33	36.67	43.33
14. *Syndra acus* Kutz.	6.67	6.67	21.67	35	43.33
15. *S. ulna* Ehrenberg	8.33	5	13.33	13.33	16.67
Total organisms	130	81.67	203.33	291.67	380
No. of species	15	13	14	15	14
% composition	25.49	28.03	37.89	34.63	32.76
Cyanophyceae					
1. *Anabaena spiroides* Lemmermann	20	0	0	0	11.67
2. *Chrococcus minor* (Kutz.) Naegelli	5	0	3.33	6.67	21.67
3. *Coelspharium dubium* Grunow	6.67	0	5	11.67	13.33
4. *Merismopedia eleganus* Braun	8.33	0	5	13.33	18.33
5. *M. tenusisema* Lemmermann	8.33	3.33	0	0	11.67
6. *Microcystis aeroginosa* Kutzing f.	60	25	31.67	53.33	36.67
7. *M. Flos-aquae* (Wittr) Kirch	35	8.33	20	18.33	21.67

8. *Oscillatoria tenus* var. *natans* Gomont	8.33	6.67	6.67	11.67	21.67
9. *Phormidium ambigum* Gomont	11.67	3.33	1.67	6.67	15
10. *Spirolina loxissima* G. S. west.	8.33	3.33	1.67	1.67	8.33
Total organisms	171.67	50.0	75.0	123.33	180.0
No. of species	10	6	8	8	10
% composition	33.66	17.16	13.98	14.64	15.52
Chlorophyceae					
1. *Actinastrum hantzchii* Lagerheim	8.33	3	3.67	5.67	6.67
2. Ankistrodesmus falcutus (chorda) Ralf	6.67	3.33	4	5	8.33
3. Chlamydomonus ovalis Pasch	15	11.67	15	28.33	35
4. Chlorella saccharophila (Kruged)	28.33	23.33	31.67	31.67	41.67
5. C. vulgaris Beijerinck var. *vulgaris*	15	6.67	23.33	31.67	40
6. Coelastrum microporum Naegeli	6.67	8.33	15	21.67	43.33
7. *Cosmerium depressun* Lundell	11.67	8.33	15	20	23.33
8. *Crucigenia reciangularis* Nag	11.67	5	6.67	11.67	16.67
9. *Dictyospharium polchellam* wood	6.67	6.67	15	21.67	28.33
10. *Gonium sociale* (Duj.) warming	6.67	11.67	18.33	26.67	35
11. *Oocystis locustris* Chodat	10	16.67	26.67	38.33	46.67
12. *Pandorina morum* (Mull) Bory	3.33	13.33	17.33	31.67	31.67
13. *Pediastrum duplex* (Meyen) var. *duplex*	11.67	6.67	15	25	40
14. *P. simplex* var. *radianus* (af. Chodat)	6.67	0	0	6.67	11.67
15. Scenedesmus *acuminatus* (af. Smith)	10	5	10	8.33	13.33
16. *S. bijuga* (af. Smith)	5	0	0	5	8.33
17. *S. obliquus* (af. Smith*)*	13.33	15	15	28.33	35
18. *Straurastrum paradoxam* Meyen	8.33	11.67	11.67	15	23.33
19. *Tetraedron trigonium* (af. Reinsch)	5	3.33	15	25	33.33
Total organisms	190	159.67	258.33	387.33	521.67
No. of species	19	17	17	19	19
% composition	37.25	54.81	48.14	45.98	44.97
Euglenophyceae					
1. Euglena *gracilis* Klebs	6.67	0	0	11.67	31.67
2. *E. spirogyra* Her.	6.67	0	0	18.33	30
3.*Phacus orbicularis* Heubner	5	0	0	10	16.67
Total organisms	18.33	0	0	40	78.33
No. of species	3	0	0	3	3
% composition	3.59	0.00	0.00	4.75	6.75
Total standing crops	510	291.33	536.67	842.33	1160
Total number of species	47	36	38	45	46

Table 2. Phytoplankton community (No. of cells x 10^3 L^{-1}) in rice field treated by 1.5 liter/ feddan of thiobencarb herbicide.

Algal taxa	0 day	1 day	2 days	3 days
Bacillariophyceae				
1. *Cyclotella comta* (Her.)Kutz	46.67	38.33	43.33	65
2. *C. ocellata* Pant.	21.67	18.33	21.67	28.33
3. *Diatoma* sp.	18.33	11.67	20	25
4. *Epithemia zebra proboscides* (Kutz.) Grun.	23.33	16.67	13.33	18.33
5. *Frustulla* sp.	21.67	13.33	25	31.67
6. *Gryosigma attenuatum* (Kutz.)	15	16.67	18.33	25
7. *Melosira granulata* (Her.)	20	18.33	25	31.67
8. *Navicula anglica* Ralfs	25	15	21.67	30
9. *N. cuspidata* Kutz	15	18.33	21.67	26.67

10. *N. cuspidata* Kutz	13.33	13.33	20	25
11. *Nitzschia aciculariz* Smith	13.33	13.33	15	21.67
12. *N. closterium* Smith	15	18.33	23.33	31.67
13. *Pinnularia alpine W. Smith*	16.67	8.33	13.33	16.67
14. *Syndra acus* Kutz.	15	8.33	11.67	21.67
15. *S. ulna* Ehrenberg	21.67	16.67	21.67	31.67
Total organisms	301.67	245	315	430
No. of species	15	15	15	15
% composition	28.50	32.29	34.55	32.58
Cyanophyceae				
1. *Anabaena spiroides* Lemmermann	41.67	13.33	8.33	16.67
2. *Chrococcus minor* (Kutz.) Naegeli	35	11.67	5	11.67
3. *Coelspharium dubium* Grunow	23.33	8.33	6.67	13.33
4. *Merismopedia eleganus* Braun	13.33	8.33	8.33	16.67
5. *M. tenusisema* Lemmermann	21.67	11.67	10	21.67
6. *Microcystis aeroginosa* Kutzing f.	103.33	41.67	35	41.67
7. *M. Flos-aquae* (Wittr) Kirch	60	30	28.33	36.67
8. *Oscillatoria tenus* var. *natans* Gomont	41.67	30	20	30
9. *Phormidium ambigum* Gomont	25	16.67	13.33	20
10. *Spirolina loxissima* G. S. west.	30	10	21.67	11.67
Total organisms	395	181.67	156.67	220
No. of species	10	10	10	10
% composition	37.32	23.95	17.18	16.67
Chlorophyceae				
1. *Actinastrum hantzchii* Lagerheim	23.33	31.67	45	58.33
2. Ankistrodesmus falcutus (chorda) Ralf	35	48.67	58.33	66.67
3. Chlamydomonus ovalis Pasch	18.33	13.33	16.67	23.33
4. Chlorella saccharophila (Kruged)	20	0	0	15
5. C. vulgaris Beijerinck var. *vulgaris*	20	13.33	21.67	36.67
6. Coelastrum microporum Naegeli	25	15	23.33	30
7. *Cosmerium depressun* Lundell	11.67	18.33	28.33	30
8. *Crucigenia reciangularis* Nag	16.67	15	25	33.33
9. *Dictyospharium polchellam* wood	16.67	25	30	38.33
10. *Gonium sociale* (Duj.) warming	13.33	23.33	30	43.33
11. *Oocystis locustris* Chodat	18.33	23.33	28.33	36.67
12. *Pandorina morum* (Mull) Bory	21.67	15	18.33	25
13. *Pediastrum duplex* (Meyen) var. *duplex*	13.33	21.67	8.33	15
14. *P. simplex* var. *radianus* (af. Chodat)	13.33	15	25	30
15. Scenedesmus *acuminatus* (af. Smith)	20	18.33	21.67	35
16. *S. bijuga* (af. Smith)	20	21.67	30	41.67
17. *S. obliquus* (af. Smith)	13.33	6.67	13.33	18.33
18. *Straurastrum paradoxam* Meyen	0	0	6.67	13.33
19. *Tetraedron trigonium* (af. Reinsch)	13.33	6.67	10	13.33
Total organisms	333.33	332	440	603.33
No. of species	16	15	16	17
% composition	31.50	43.76	48.26	45.71
Euglenophyceae				
1. Euglena *gracilis* Klebs	8.33	0	0	20
2. *E. spirogyra* Her.	8.33	0	0	20
3. *Phacus orbicularis* Heubner	11.67	0	0	26.67
Total organisms	28.33	0	0	66.67

No. of species	3	0	0	3
% composition	2.68	0.00	0.00	5.05
Total standing crops	1058.33	758.67	911.67	1320
Total number of species	44	40	41	45

Table 3. Phytoplankton community (mean ± SE) in rice field treated by 1 L of thiobencarb/feddan.

Division	Days after application				
	0	1	2	3	4
Bacillariophyceae	130.00 Db ± 5.0	81.67Eb ± 7.26	203.33 Cb ± 6.01	291.67 Bb ± 3.33	380.00 A ± 29.3
Cyanophyceae	171.67 Ab ± 9.3	50.0Cb ± 2.89	75.0 Cb ± 2.89	123.33 Bb ± 1.67	180.00 A ± 15.00
Chlorophyceae	190 Db ± 7.64	159.67Db ± 11.17	258.33 Cb ± 22.34	387.33 Bb ± 15.77	521.67 A ± 28.04
Euglenophyceae	18.33 Ca ± 11.54	0.0 Da ± 0.0	0.0 Da ± 0.0	40.00 Bb ± 5.00	78.33 A ± 7.26
Total	510.0 Cb±11.54	291.33 Da ± 11.10	536.67 Cb ± 14.34	842.33 Bb ± 16.80	1166.00 A ± 67.27

Table 4. Phytoplankton community (mean ± SE) in rice field treated by 1.5 L of thiobencarb/feddan.

Division	Days after application			
	0	1	2	3
Bacillariophyceae	301.67 Ba ± 7.26	245.00 Ca ± 7.64	315.00 Ba ± 15.28	430.00 Aa ± 24.6
Cyanophyceae	395.00 Aa ± 20.21	181.67 Bca ± 8.82	156.67 Ca ± 14.81	220.00 Ba ± 5.77
Chlorophyceae	333.33 Ba ± 24.04	332.0Ca ± 9.17	440.00 Ba ± 14.43	603.33 Aa ± 28.04
Euglenophyceae	28.33 Ba ± 6.01	0.0 Ca ± 0.0	0.0 Ca ± 0.0	66.67 Aa ± 6.01
Total	1058.33 Ba ± 22.42	758.67 Da ± 7.31	911.67 Ca ± 22.05	1320.00 Aa ± 56.79

Note: Different capital letters indicate that there are significant difference between means at the same day after application of two rates, but small letters indicate that there are significant difference among means of the different days under the same rate.

Table 5. Least square means (LSM) analyses of variance of Phytoplankton divisions in rice field treated by different rates of thiobencarb.

Factor effect	Bacillariophyceae		Cyanophyceae		Chlorophyceae		Euglenophyceae		Total	
	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE
Rate /Fad	***		***		***		**		***	
1 L	176.67	5.80	105.00	5.13	248.83	8.99	14.58	1.77	545.00	12.72
1.5 L	322.92	5.80	238.33	5.13	427.17	8.99	23.75	1.77	1012.17	12.72
DAY	***		***		***		***		***	
0	215.83	8.21	283.33	7.26	261.67	12.72	23.33	2.50	784.17	17.99
1	163.33	8.21	115.33	7.26	245.83	12.72	0.0	2.50	525.00	17.99
2	259.17	8.21	115.33	7.26	349.17	12.72	0.0	2.50	724.17	17.99
3	360.83	8.21	171.67	7.26	495.00	12.72	53.33	2.50	1081.17	17.99
Rate *Day	NS		***		NS		*		NS	
Rate1 *0	130.00	11.61	171.67	10.27	190.00	17.98	18.33	3.54	510.00	25.45
Rate1 *1	81.67	11.61	50.00	10.27	159.67	17.98	0.0	3.54	291.33	25.45
Rate1 *2	203.33	11.61	75.00	10.27	258.33	17.98	0.0	3.54	536.67	25.45
Rate1 *3	291.67	11.61	123.00	10.27	387.33	17.98	40.00	3.54	842.33	25.45
Rate1 *4	380.00	14.02	180.00	8.23	521.67	18.53	78.33	4.01	1160.32	32.98
Rate2 *0	301.67	11.61	395.0	10.27	333.33	17.98	28.33	3.54	1058.33	25.45
Rate2 *1	245.00	11.61	181.67	10.27	332.00	17.98	0.0	3.54	758.67	25.45
Rate2 *2	315.00	11.61	156.67	10.27	440.00	17.98	0.0	3.54	911.67	25.45
Rate2 *3	430.00	11.61	220.00	10.27	603.33	17.98	66.67	3.54	1320.0	25.45

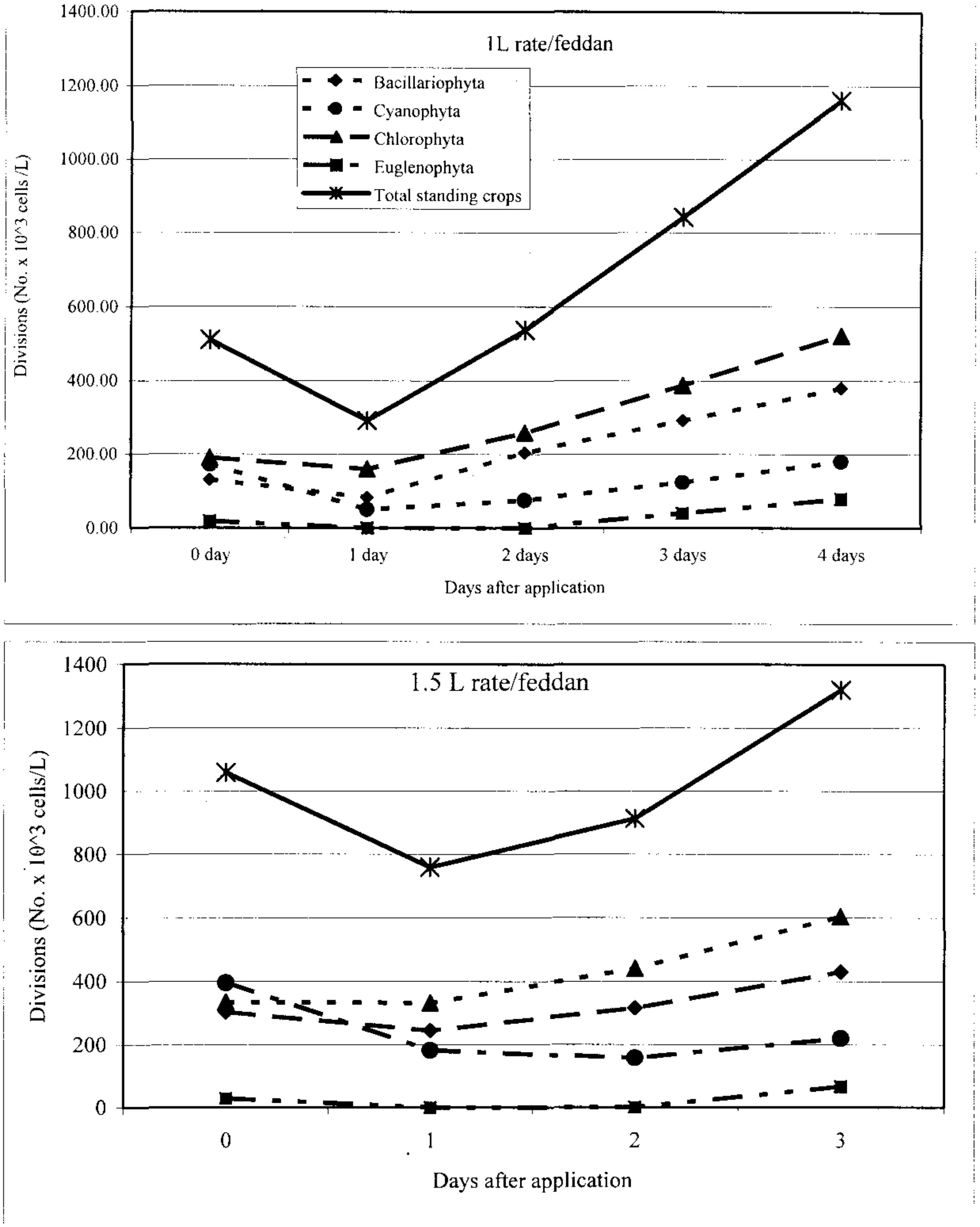
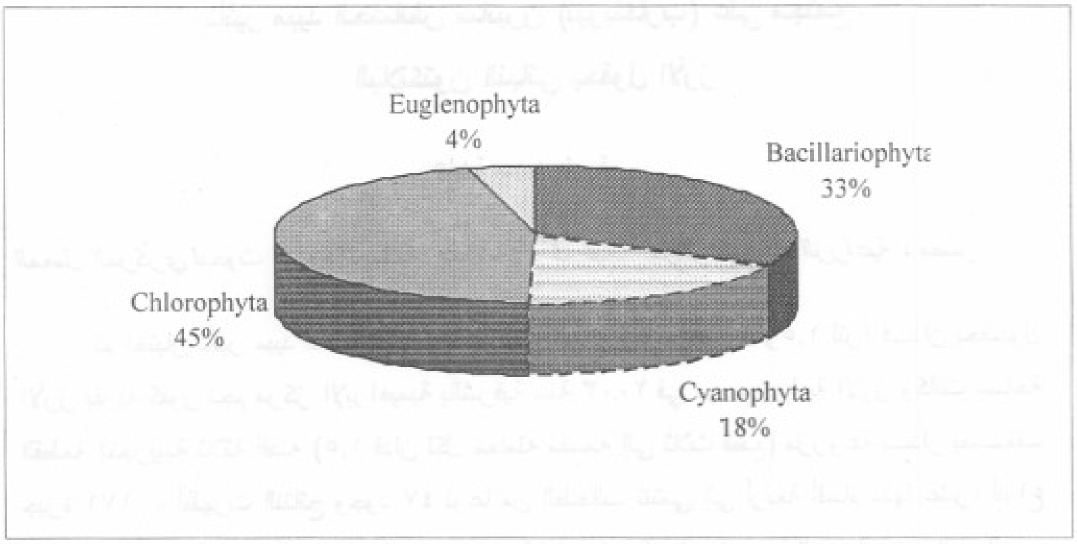


Fig. 1. Fluctuations of phytoplankton divisions with days after application of two rates of thiobencarb in rice field.



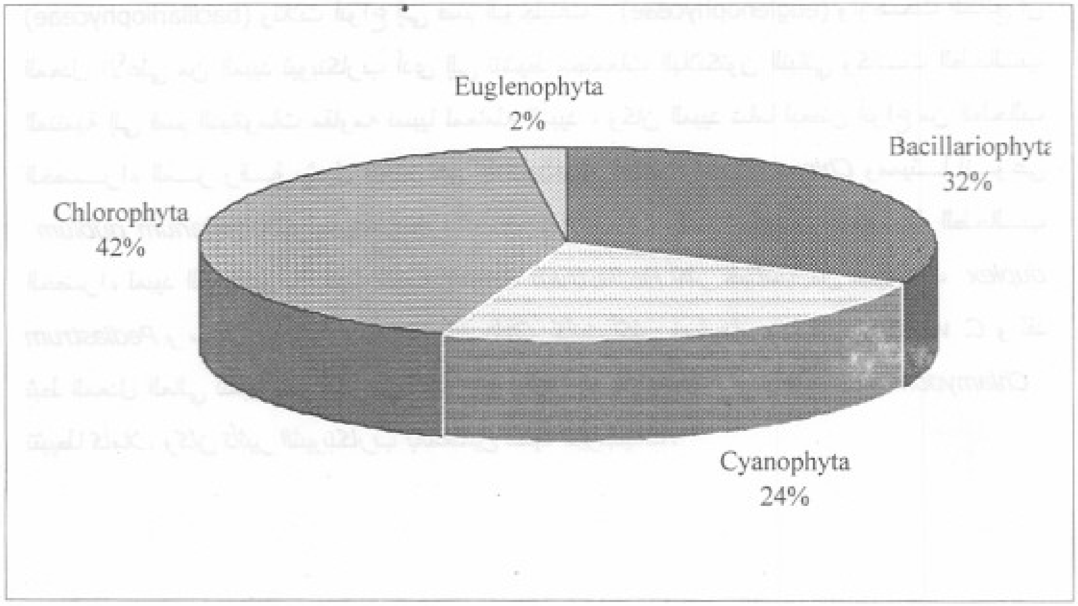


Fig. 2. Percentages of phytoplankton groups means for all days of application of two Rates of thiobencarb for rice field

تأثير مبيد الحشائش ساتيرن (ثيوبنكارب) على مجتمع البلانكتون النباتي بحقول الأرز

عايدة محمد ضوة

المعمل المركزي لبحوث الثروة السمكية، العباسه – شرقيه – مركز البحوث الزراعية ، مصر

تم اختبار تأثير مبيد الحشائش الثيوبنكارب (الساتيرن) بمعدلي ١ و١,٥ لتر/ فدان بحقول الأرز بقرية كفور نجم مركز الإبراهيمية بالشرقية سنة ٢٠٠٣ في موسم زراعة الأرز وكانت مساحة القطعة التجريبية ثلاثة أفدنه (١,٥ فدان لكل معامله مقسمه إلى ثلاث قطع) مزروعة بدار بصنف جيزة ١٧١ ، أظهرت النتائج وجود ٤٧ نوعا من الطحالب تنتمي إلى أربعة أقسام منها عشرة أنواع تنتمي إلى قسم الطحالب الخضراء (chlorophyceae) و تسعة عشر نوعا إلى قسم الطحالب الخضراء المزرقة (cyanophyceae) وخمسة عشر نوعا تنتمي إلى الدياتومات (bacillariiophyceae) وثلاث أنواع إلى قسم اليوجلينات (euglenophyceae) وأوضحت النتائج ان المعدل الأعلى من المبيد ثيوبنكارب أدى إلى تنشيط مجتمعات البلانكتون النباتي وكانت الطحالب المنتمية إلى قسم الدياتومات مقاومه نسبيا لمعامله المبيد ، وكان المبيد ساما لبعض أنواع من الطحالب الخضراء المزرقة مثل *Anabaena spiroides*، *Chlorococcus minor* ومميتا لنوعى *Coelspharium dubium*، *Merismopedia eleganus*. *هذا وقد اختلفت حساسية* الطحالب الخضراء لمبيد الثيوبنكارب حيث كانت *Pediastrum simplex* *أكثر حساسية من سلالات* *Pediastrum duplex* *و سلالة* *Chlorella saccharophila* *كانت أكثر حساسية من سلالة* *C. vulgaris* و لقد ثبط المعدل العالي للمبيد نمو نوعى *Paradoxum staurastrum* و *Chlamydomonus ovalis* تثبيطا *كاملا. وكان تأثير الثيوبنكارب بالمعدلين مميتا لليوجلينات.*