ISSN 0975-6299 Vol 2/Issue 1/ Jan-Mar 2011

International Journal of Pharma and Bio Sciences

RESEARCH ARTICLE

BIOCHEMISTRY

PESTICIDES INDUCED ALTERATIONS IN PHYSIOLOGICAL RESPONSES IN *SOLANUM MELONGENA* L.

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ABSTRACT

Treatment with pesticide Endosulfan individually and in combination with Kitazin for different concentrations and durations were studied on seed germination, seedling growth, number of lateral roots, fresh and dry weights of *Solanum melongena* L. (Brinjal). A part from effect on early seedling growth the present investigation was also extended to study some enzymes such as Amylase, Protease and Protein content were studied in 48h germinating seeds. The effect of pesticides on various attributes studied was varied with level of concentrations and durations. It was observed that pesticides individually and in combination might affect the enzyme activities.

KEYWORDS

Solanum melongena, Endosulfan, Kitazin, Seeding growth and Biochemical activities.

INTRODUCTION

Pesticides are the modern tools to the farmers to control pests, diseases and weeds and to increase crop yields. But they have to be applied on crops at proper times, uniformly and efficiently. Pesticides are used in agriculture mainly for the purpose of increasing plant productivity. A lot of work has been done on the role of pesticides in providing protection to plants against weeds in terms of crop yield [1-3]. Only a little work has been established on the role of pesticides in affecting biochemical characteristics of the plant[4] .

Some of the pesticides are reported to be beneficial for plants growth if used at their lower concentration but becomes phytotoxic[5] at their higher dose and to the change in the activity of some useful soil micro organisms[6-7]. By repeated and extensive application of pesticides, it ultimately reaches the plant body and soil, which in turn may interact with plant growth and with soil organism and their metabolic activities[8]. By keeping all these in view, the present endeavor to focus on the effects of two pesticides like Endosulfan individually and in combination with Kitazin on seed germination, seedling growth and Biochemical activities in Green Round Brinjal (*Solanum melongena* L.) which is an important vegetable crop grown in India.

MATERIAL AND METHODS

Healthy and uniform seeds of brinjal (*Solanum melongena* L.) variety Green Round (GR) were selected and surface sterilization of the seeds was done with commercial detergent Teepol (Reckitt Colman, India) for 15min, 0.1% $HgCl_2$ for 2-3 minutes followed by washing four times with sterile distilled water to remove traces of $HgCl_2$. Thereafter, seeds was subjected to imbibition to various concentration of Endosulfan 35 E.C individually (200, 500, 700, 1000 1500 and 2000 ppm) and in combination with an equal amount with Kitazin 48% E.C (50+50 , 100+100, 250 + 250, 500 + 500, 750 + 750, and 1000 + 1000 ppm) for different durations (i.e., 6,12 & 24h). These concentrations and durations were tried and found to be the optimum levels for seed germination. After the pesticidal treatment, seeds of each treatment were rinsed with distilled water and allowed to germinate and grow in petri plate lined with moistened filter paper in laboratory conditions. The emergence of radical was considered for germination of seed. The seedling growth studied after 15days of planting. Fresh and dry weights of total seedlings were measured. For dry weight, seedlings were kept in an oven for 48h at 60°C. The data was average of three replicates and have been analyzed statistically.

For biochemical studies seeds were separately treated and allowed to germinate for 48h. The estimation of Protein content following method of Lowry *et al*[9] and Protease[10] using casein as a substrate, and Amylase activity[11] were studied. For all experiments simultaneously controls were also maintained.

RESULTS AND DISCUSSION

The influences of different concentrations of Endosulfan individually and in combination with Kitazin on germination of seed and seedling growth were shown in Table 1 and 2. The percentage of germination in an individual treatment with Endosulfan exhibited inhibitory effect in all treated samples for different durations except 500 ppm of 6h and 200 & 500 ppm of 12h duration which showed increase in percentage of germination when compared to controls.

Table . 1
Effect of Endosulfan on germination and seedling growth of brinjal after 15days of planting

Duration	Concentration in ppm	% of Germination	Shoot length	Root length	Total length	Number of lateral roots
6h	Control	95.0	3.5 ± 1.361	2.2 ± 0.604	5.7 ± 0.532	-
	200	95.0	3.6 ± 0.795	2.3 ± 0.588	5.9 ± 2.028	0.15 ± 0.0028
	500	96.0	3.66 ± 1.1634	2.84 ± 0.656	6.50 ± 3.260	0.40 ± 0.025
	700	90.0	3.4 ± 0.614	2.22 ± 0.815	5.62 ± 0.874	0.67 ± 0.064
	1000	85.0	2.68 ± 0.352	1.84 ± 0.423	4.52 ± 1.408	0.67 ± 0.064
	1500	75.0	1.88 ± 0.441	1.62 ± 0.416	3.50 ± 1.361	1.0 ± 0.125
	2000	70.0	1.67 ± 0.351	1.28 ± 0.182	2.95 ± 1.159	* 1.65 ± 0.419
12h	Control	95.0	3.4 ± 0.614	2.0 + 0.398	5.4 ± 2.442	-
	200	96.0	3.8 ± 1.053	3.0 ± 0.539	6.8 ± 3.251	0.15 ± 0.0028
	500	98.0	*5.5 ± 2.554	2.02 ± 0.576	7.52 ± 3.927	0.15 ± 0.0028
	700	88.0	2.85 ± 1.014	2.2 ± 0.604	5.05 ± 1.618	0.6 ± 0.051
	1000	80.0	1.94 ± 0.405	1.46 ± 0.303	3.71 ± 0.868	1.25 ± 0.068
	1500	80.0	1.54 ± 0.338	1.24 ± 0.256	2.78 ± 0.859	1.42 ± 0.2517
	2000	65.0	1.25 ± 0.068	1.15 ± 0.220	2.40 ± 0.480	1.50 ± 0.281
24h	Control	85.0	2.9 ± 0.493	2.0 ± 0.398	4.9 ± 0.0137	-
	200	80.0	2.31 ± 0.662	1.8 ± 0.404	4.11 ± 1.071	0.13 ± 0.0004
	500	75.0	2.10 ± 0.446	1.70 ± 0.481	3.8 ± 1.079	0.12 ± 0.017
	700	75.0	1.68 ± 0.376	1.35 ± 0.228	3.04 ± 0.468	0.65 ± 0.112
	1000	70.0	1.68 ± 0.376	1.35 ± 0.228	3.05 ± 0.583	1.2±0.1688
	1500	60.0	1.6 ± 0.364	1.12 ± 0.148	2.72 ± 1.233	1.2±0.1688
	2000	50.0	1.15 ± 0.220	1.1 ± 0.151	2.25 ± 0.458	1.35±0.243

Significant at 1% level

Table. 2

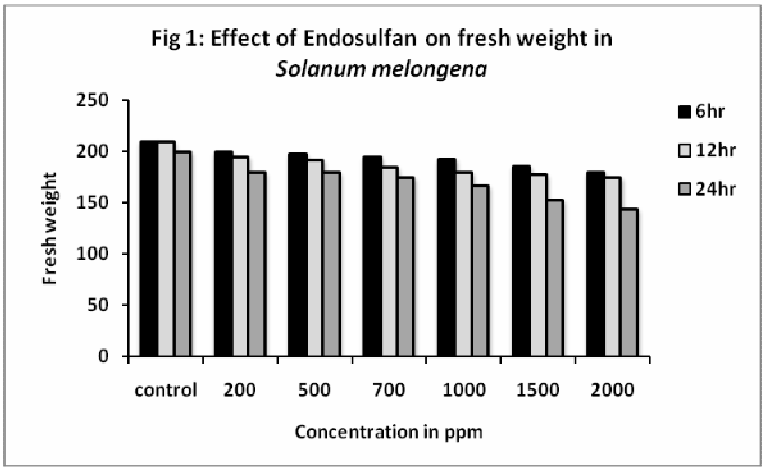
Combined effect of Endosulfan + Kitazin on germination and seedling growth of brinjal after 15days of planting

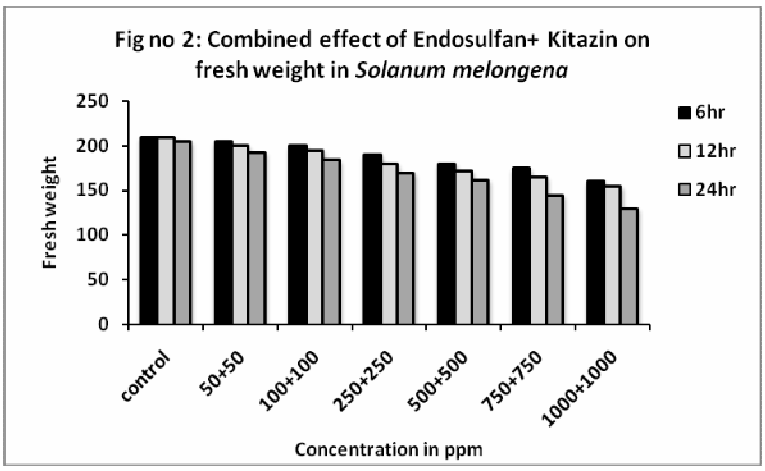
Duration	Concentration in ppm	% of Germination	Shoot Length	Root length	Total length	Number of lateral roots
6h	Control	95.0	3.5 ± 1.361	2.2 ± 0.604	5.7 ± 0.532	-
	50+50	94.0	2.8 ± 0.572	2.3 ± 0.753	5.1 ± 1.887	1.75±0.408
	100+100	90.0	2.6 ± 0.403	2.1 ± 0.044	4.7 ± 1.605	1.3 ± 0.82
	250+250	84.0	1.8 ± 0.461	1.7 ± 0.481	3.5 ± 1.361	0.4 ± 0.025
	500+500	81.0	1.61 ± 0.324	1.57 ± 0.379	3.18 ± 0.664	*0.2 ± 0.007
	750+750	75.0	1.42 ± 0.352	1.24 ± 0.256	2.66 ± 0.403	-
	1000+1000	62.0	1.18 ± 0.185	1.18 ± 0.232	2.36 ± 0.753	-
12h	Control	95.0	3.4 ± 0.614	2.00 ± 0.398	5.4 ± 2.442	-
	50+50	90.0	2.4 ± 0.966	1.9 ± 0.431	4.3 ± 1.209	1.1 ± 0.151
	100+100	88.0	1.84 ± 0.478	1.66 ± 0.344	3.5 ± 1.529	0.98 ± 0.174
	250+250	75.0	1.61 ± 0.324	1.45 ± 0.350	3.06 ± 0.664	0.3 ± 0.00128
	500+500	70.0	1.6 ± 0.394	1.30 ± 0.260	2.9 ± 0.493	-
	750+750	65.0	1.15 ± 0.203	1.10 ± 0.172	2.25 ± 0.458	-
	1000+1000	50.0	1.1 ± 0.172	*1.0 ± 0.133	2.1 ± 0.446	-
24h	Control	85.0	2.9 ± 0.493	2.0 ± 0.398	4.9 ± 0.0137	-
	50+50	80.0	1.71 ± 0.326	1.40 ± 0.301	3.11 ± 1.296	0.62 ± 0.048
	100+100	70.0	1.65 ± 0.419	1.31 ± 0.241	2.96 ± 1.054	0.4 ± 0.025
	250+250	60.0	1.25 ± 0.222	1.15 ± 0.203	2.40 ± 0.480	-
	500+500	60.0	1.1 ± 0.172	0.9 ± 0.101	2.00 ± 0.666	-
	750+750	52.0	0.88 ± 0.152	0.86 ± 0.147	1.74 ± 0.425	-
	1000+1000	35.0	0.78 ± 0.174	0.65 ± 0.084	1.43 ± 0.295	-

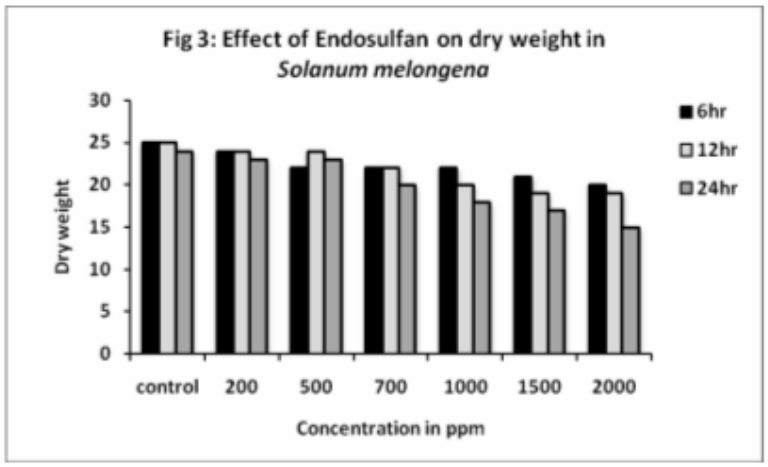
Significant at 1% level

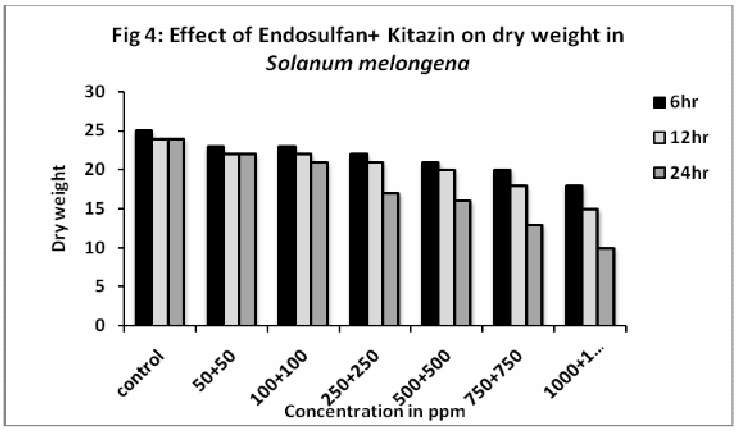
Shoot and root lengths of the seedling decreased as increasing concentrations in all durations of both pesticide treatments. However, exceptionally in an individual treatments with Endosulfan at 200 & 500 ppm for both durations (6 & 12h) showed increase in root and shoot lengths when compared to controls. Lateral roots were not induced in control samples where as induction of lateral roots were observed in almost all treated samples of Endosulfan individually and at lower concentrations of combined treatement with Kitazin. In an individual treatment of Endosulfan, number of lateral roots were increased as the concentration increased but within the durations as increasing concentrations decreased the number slightly. Interestingly in the combined treatment of Endosulfan with Kitazin the number of lateral roots decreased as the concentration increases up to 500+500 ppm (6h) and still at higher concentrations, there was no inducement of lateral roots at all durations.

Fresh and dry weights of total seedlings for both individual and combination treatment showed positive correlation with the growth of the seedings except in 500 ppm of 6h and 200 & 500 ppm of 12h treatment of Endosulfan Figs (1-4)

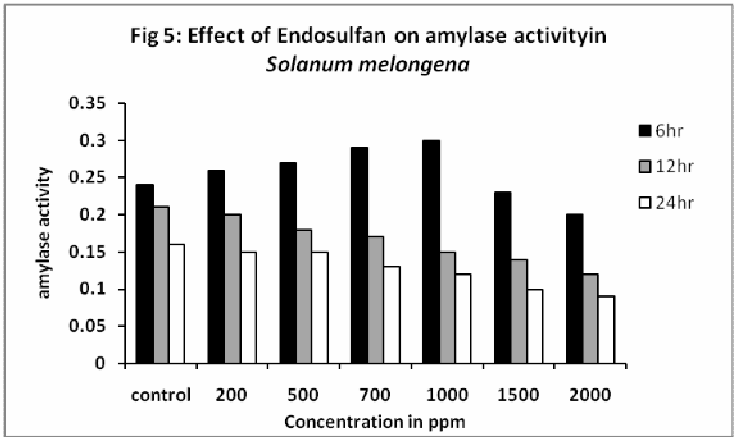








The change in biochemical activities were analyzed after 48h of seed germination in laboratory conditions and the data was represented in figs (5-10)



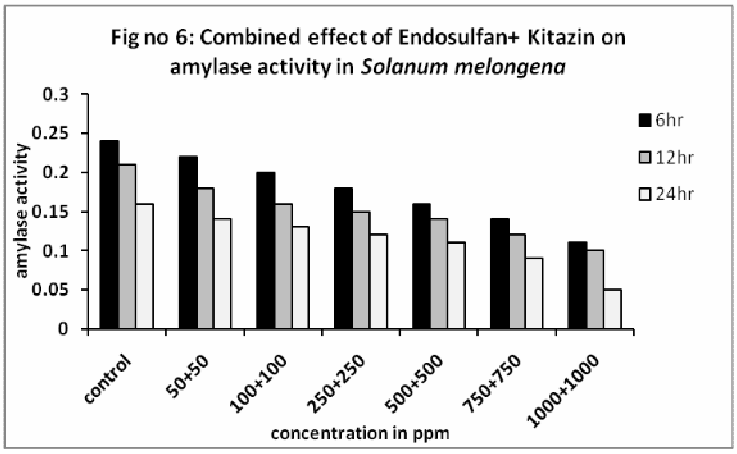


Fig no 6: Combined effect of Endosulfan+ Kitazin on amylase activity in Solanum melongena
amylase activity
0.3
0.25
0.2
0.15
0.1
0.05
0
6hr
12hr
24hr
control
50+50
100+100
250+250
500+500
750+750
1000+1000
concentration in ppm

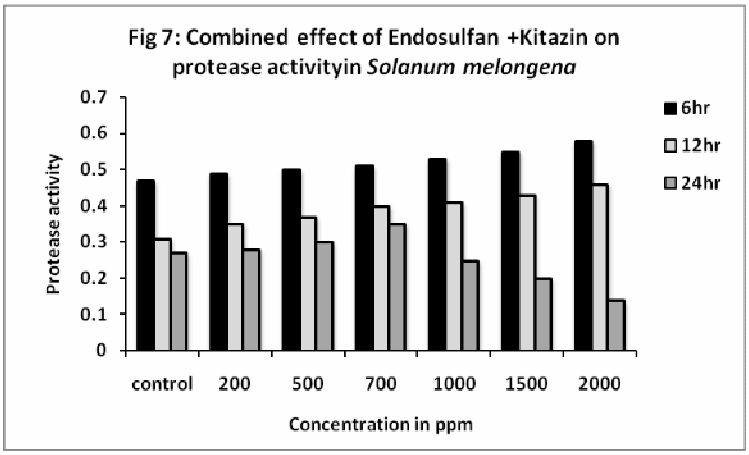


Fig 7: Combined effect of Endosulfan +Kitazin on protease activityin Solanum melongena
Protease activity
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6hr
12hr
24hr
control
200
500
700
1000
1500
2000
Concentration in ppm

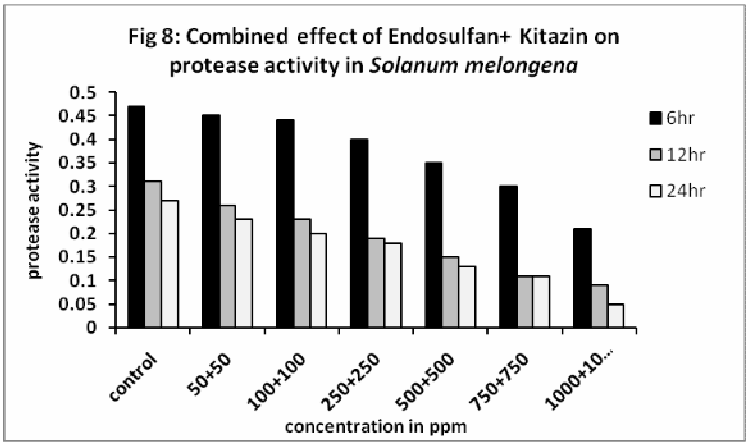
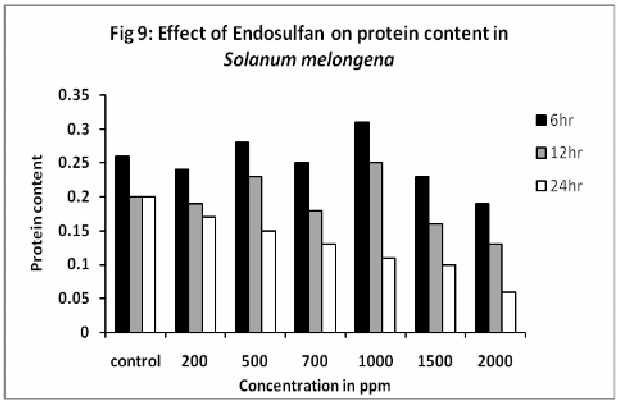
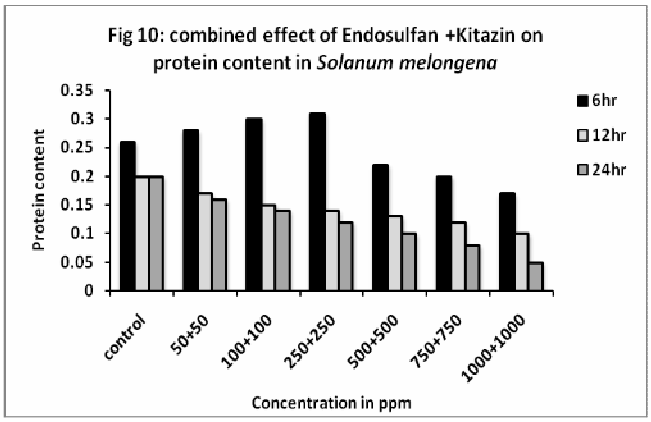


Fig 8: Combined effect of Endosulfan+ Kitazin on protease activity in Solanum melongena
protease activity
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
6hr
12hr
24hr
control
50+50
100+100
250+250
500+500
750+750
1000+10...
concentration in ppm





Amylase activity showed decrease in amount in both treatments (individual and in combination with Kitazin) as the concentration increases in all durations but in an individual treatment for 6h there was an increase in Amylase activity up to 1000 ppm and then decreased up to higher concentrations.

Protease activity was increased in both durations (6 & 12h) of individual treatment of Endosulfan. Where as in 24h treated sample at some lower concentrations up to 700ppm the enzyme activity was enhanced but later the effect was insignificant. In combination effect the enzyme exhibited decrease in its activity for all the treated samples.

Protein content in both individual and in combination treatment was showed inhibitory effect as the concentration increases in all durations, exceptionally in individual treatment of Endosolfan for 500 & 1000 ppm of both durations (6 & 12h) and in combined treatment with Kitazin in some low concentrations up to 250 + 250 ppm for 6h, showed increasing tendency.

An examination of results (Tables 1&2) show a significant beneficial effect in physiological parameters with regards to seed germination and seedling growth in Brinjal plant as a result of Endosulfan individually and in combination with Kitazin amendments at its lower doses but become phytotoxic at higher levels of its amendments. At lower concentrations of pesticide treatments showed enhanced the percentage of germination where as at higher concnetration levels seed germination was adversely effected and comparatively higher in combined treatment than individual treatment. Similar work of inhibition of seed germination and seedling growth as reported in Brinjal[12], in Chilli[13], in *Glycine max*[14], in Pisum[15], in *Brassica nigra* with Kitazin[16], and in *Vigna radiate* with DDT[17-18].

Pesticides have been shown to decreases the soluble Protein content in

many plants, viz., Bavistin and Monocrotophos in Trigonella[19] and Xenobiotics in Sunflower[20]. Janardhan[21] and Noviel[22] also reported Butachlor inhibit protein synthesis during shoot emergence. Our results were also coincided with the work of Paul and Mukherji[23] and Murthy and Rao[24] who reported on Mugbaen and *Vigna radiate* seedling germinated in different concentrations of Kitazin, that Protease activity was also affected by Kitazin treatment.

The Endosulfan and Kitazin toxicity was probably due to the high affinity for thio groups of enzymes and other proteins. Hence, pesticides individually and in combination might affect the enzyme activity.

Thus, the nature of plants grown on soil play an important role in assessing the pollutional problems posed by the extensive use of pesticides and other pollutants in soil environment.

REFERENCES

1. F.T. Davies and S.A. Duray. Effect of pre-emergence herbicide application rooting and subsequent lines growth of selected nursery corps. J.Env. Hort. 1:181-186 (1992).
2. K.M. Azam, S.A. Razvi, Z. Ali and A.A. Al-Raeesi. Management of whitefly (*Bemisia tabacci*) and tomato leaf curl virus in tomato crops. Indian J.Plant Prot. 25:36-41 (1997).
3. S. Bhagat and B.K. De. Effects of insecticides on whitely, leaf curl and yield of Tomato. Enviorn. & Ecol. 19:853-855(2001).
4. B. Jerlin. Effects of atrazine on growth nodulation and nitrogen constituents of *Vigna mungo*. J. Ecotoxicol Eniviron. Monito.11:209-214 (2001).
5. Khan, Samiullah, Khan, A. Jamal and Jabin Shagufta. Effect of endosulfan on the seed germination, growth and nutrients uptake of Fenugreek plant. J. of Industrial Pollution control, 16(2):225-230 (2000).
6. C.M. Tu. Effects of herbicides and fumigants on microbial activities in soil. Bull. Environ. Contam. Toxical.53(1):12-17 (1994).
7. Wang, Zhenzhong, Zhang, You mei, Li, Zhong-wee and Xing, Xiejia. Effect of organosphosphorus pesticide toxitcity on soil organism. Ying yong Shengtai Xuebao (China), 13(12):1663-1666 (2002).
8. H.C. Sharma and Roomiro Ortiz. Host Plant resistance to insects: An eco-friendly approach for pest management and environment conservation. J.Environ. Biol.23(2):111-135 (2002).
9. O.H. Lowry, N.J. Rosendbrough, A.L. Farr and R.J. Randal. Protein measurements with folin phenol reagent. J. Biol chem. 193:265-275 (1951).
10. H. Yomo and J.E. Verner. Control of the formation of amylases and proteases in the cotyledons of germinatory peas. Plant physiology 51:708-713 (1973).
11. C.P. Malik and M.B. Singh. In plant enzymology and histoenzymology. Kalyani Publishers, New Delhi. (1980).
12. V. Krishnasamy and I.R. Suthanthira Pandian. Effect of fungicidal seed treatment in brinjal. South Indian Horticulture. 40(4): 207-212 (1992).
13. S. Muthuswamy, D. Padmanabhan and R. Nagarajan. Efficacy of seed dressing fungicides on the viability of chilli seeds. Pesticides. 17(4):23-28 (1983).
14. M. Saraf, A. Khandelwal, R. Sawhney and D.K. Maheshwari. Effects of carbaryl and 2, 4-D on growth, nitrogenase and uptake hydrogenase activity in agar culture and root nodules formed by Bradyrhizobium Japnicum. Microbiol Res. 149:401-406 (1994).
15. D.K. Maheswari, M. Gupta, R. Swahney, and A. Khandelwal. Dual behaviour of carbaryl and 2,4-dichlorophenoxyacetic acid in Rhizobium leguminosarum 2005 under

explanta conditions. Xentrablatt Mikrobiol. 148:588-592 (1993).
16. P. Krishnamurthy and D. Rao. Effect of two fungicides on the germination and growth in *Brassica nigra* Koach. Geobios. 7:160-161(1980).
17. S.K. Sinha and A.P. Verma. Hazardous effect of Herbicides on crop plants. I. Effect of selective herbicides on physiology and cytology of Vigna radiata. National Abstract, Bioved Research society, Alahabad, pp.38 (1993).
18. C. Venkatramaiah. Effect of DDT on seed germination and seedling grow of *Phaseolus mungo* L. Com. Physiol. Ecol., 7:27-28 (1982).
19. A.B. Kamble and A.B. Sabale. Influence of Bavistin and Monocrotohos seed germination and seedling growth to *Trigonealla foenumgraecum* L. Poll. Res.18(1): 61-65 (1999).
20. G. Panduranga Murthy and S. Leelavathi. Effect of some Xenobiotics on early seedling growth and chlorophyll content in sunflower CV. “morden”, during seed germination. Eco. Env. And Cons., 8(2):129-131.
21. K.V. Janardhan. As cited in: “Nucleic acid and protein synthesis”, Agricultural Research Station, Nave Shigmosa (1988).
22. L.M. Noviel. Effect of butacholr on the protein content of C-168 and IR-36 rice cultivars as different growth stages. Weed Abstracts.32(4):pp.85 (1989).
23. A.K. Paul and E. Mukherji. Formation of reducing sugar and soluble protein and changes in protease activity in germinating mung bean (p. aureus) seeds as affected by gibberellic acid and protein synthesis inhibitor. Bull. Bot. Soc. (Bengal) 26:71-75 (1972).
24. P.K. Murthy and D. Rao. Effect of Kitazin on some enzyme activates in Vigna radiata and Vigna sinensis. SBCI News Letter 1 (2): (1982).