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Effect of some pesticides on seed germination, growth and yield characters of brinjal *(Solanum melongena* L.*)*

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ABSTRACT

The demand of different kind of organic pesticides is increasing to control pest born diseases in agriculture and to maximize the crop yield. A field study was conducted with different pesticides viz Endosulfan, Rogor individually and in combination with Kitazin (Rogor+Kitazin) on *Solanum melongena* L (Brinjal). to find out their effect on growth, yield characters and photosynthesis. Pesticides significantly influenced the plant growth, number of branches, plant height, leaf area, number of flowers and fruits were affected synergistically due to combined treatment of Rogor+Kitazin than their individual treatment.

KEYWORDS

Solanum melongena L;
Pesticides;
Yield parameters;
Photosynthesis.

INTRODUCTION

The judicious pesticide use by timely applications seems to be sound and rational approach in alleviating pest damage and can be easily adopted as a component of Integrated Pest Management (IPM) programme. The demand of different kinds of organic pesticides is increasing to control harmful effects of pests[1] and pest born diseases in agriculture to maximize the crops yield. The effectiveness of such chemicals for controlling various diseases in plants grown on the soils dependent upon several factors such as types of plants as well as the physico-chemicals behaviour of the soils viz. solil texture, nature and extents of clay, minerals, organic matter, pH, temperature, humidity, nature and extent of soluble salts and exchangeable cations etc[2].

Some of the pesticides are reported to be beneficial for plants growth if used at their lower concentration but becomes phytotoxic[3] at their higher doses due to the change in the activity of some useful soil micro organisms[4,5].

A lot of work has been done on the role of pesticides in providing protection to plants against weeds in terms of crop yield[6-8]. Only a little work has been established on the role of pesticides in affecting biochemical characteristics of the plant[9]. In the present study work has been carried out to investigate the phytotoxic effects causes by some pesticides like Endosulfan, Rogar and combination of Rogar with Kitazin on the germination, growth, yield and presence of chlorophyll level in brinjal. Plant with a view to assess its behaviour in regards to find its optimum tolerance limit for healthy growth of these plants for maximizing quality production and to minimized the risk of pollution problems posed by if in filed environment.

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EXPERIMENTAL

Material and methods

Field investigation was carried out during kharif season of 2008-2009 at the Research farm of Department of Botany, Kakatiya University, Warangal. The trails was laidout in randomized block design with 3 pesticide treatments, and untreated control, each replicate thrice. Solanum variety G.R was sown in a plot of 4.5X 4.8M with inter and intra row spacing of 90X 60 cm respectively. Agronomic practices recommended for the region were followed for raising the crop.

The effect of pesticides on growth, yield and chlorophyll content in Brinjal were studied by growing in field at various levels of 2 insecticides Endosulfan and Rogor (250, 500, 750, 1000, 1500 & 2000 ppm) and Rogor in combination with Kitazin (50+50, 100 + 100, 250 + 250, 500 + 500, 750 + 750, 1000 + 1000 ppm) for difference duration (i.e., 6, 12 and 24h). Plant without the addition of chemicals were constituted as the control.

Healthy and uniform seeds of *Solanum melogena* L (Brinjal) were selected. Surface sterilization of the seeds were done with a commercial Teepol (Reckitt colman, India) for 15 min, 0.1% $HgCl_2$ for 2-3 min. followed by washing four times with sterile distilled water to remove traces of $HgCl_2$. Equal number of seeds were sown in each row of field after the emergence of seedling, thinning was done to maintain three seedlings and allowed to grow till maturity. The entire crop was for a period of 90 days from date of sowing to the harvest.

The growth performance of the control and treated samples were compared on the basis of height of plant, length of the root, number of leaves formed, number of flowers, number of petals and sepals, number of fruits for plant and size and weight of the fruit. The data was the average of three replicates and have been analyzed statistically.

The estimation of Chlorophyll a. Chlorophyll b. and total Chlorophyll concentrations were done in matured leaves by spectro calorimeter following the method described[10] of both control as well as treated samples. The data represent the average of three replicates and was represented in figures.

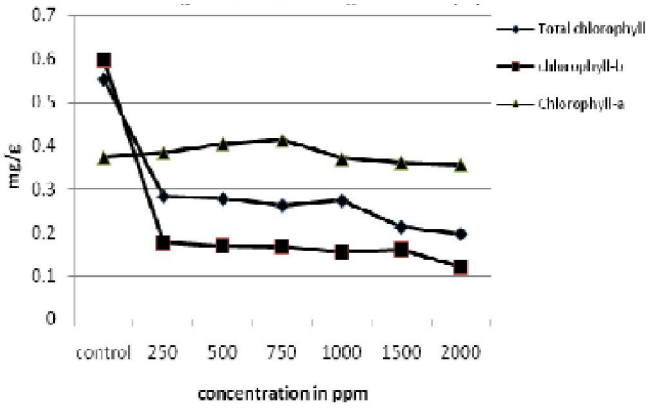

Figure 1 : Interaction of Rogor on chiorophyll

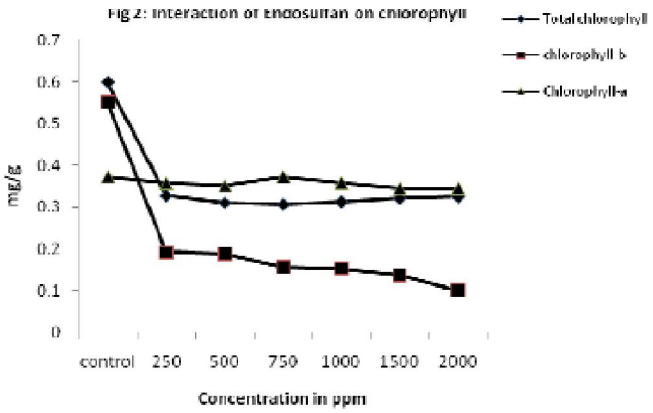

Figure 2 : Interaction of Endosulfan on chiorophyll

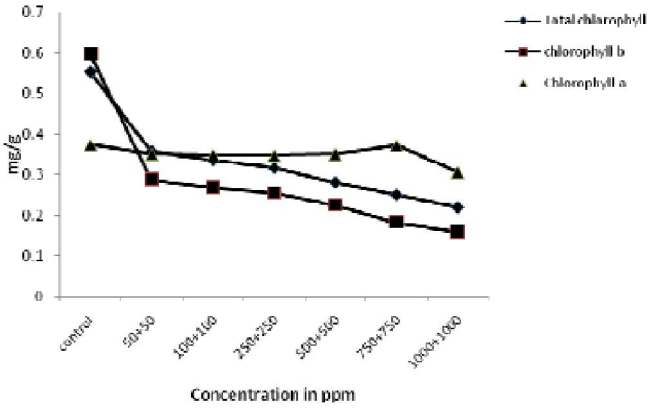

Figure 3 : Interaction of Rogor+Kitazin on chiorophyll

RESULTS AND DISCUSSION

In the control samples the germination percentage was 95.0. The effect of different concentrations of Endosulfan and Rogor individually and combination of Rogor + Kitazin on the germination percentage was maintained decreasing tendency as increasing concentrations over the control samples (TABLES 1 to 3).

Plant height was increased upto 1000 ppm in Endosulfan treated seed and then there was a decrease as

increasing concentrations. In all samples of Endosulfan treated seeds there was a increase in the plant height over controls, exceptionally in both higher concentrations (1500 & 2000 ppm). The maximum plant height was recorded in Endosulfan treated seed at a concentration of 1000 ppm (60.75 cm). Decrease in the height of the plant was recorded within Rogor treated seed as their concentrations increase but when compared to controls there was a increase in plant height up to 750 ppm. Height of the plant was also decreased as increasing their concentrations in combined treated samples of Rogor + Kitazin. Un branched and stunted growth of the plant was observed in combined treatment sample of Rogor + Kitazin.

Average number of leaves decreased as increasing concentration in all treated samples both in individual and in combinations, but in Endosulfan treated samples there was a increase in number of leaves at concentrations of 1000 ppm and particularly in that concentration maximum number of leaves (65) were recorded compared to control and other treated samples.

Length and width of the leaf decreased an increasing concentrations in all treated samples. Never these less, in Endosulfan treated samples there was a increasing tendency, maximum length (17.8 cm) and width (14.3) of the leaf was recorded at higher concentration (1500 ppm) of Endosulfan when compared to controls (13.95 and 10.83 cm) and other treated samples.

Root length was decreased as increasing concentrations in all treated samples of both individuals (Endosulfan and Rogor) and combined (Rogor + Kitazin) but root system with elongated lateral roots was seen at lower concentration (250 ppm) of Rogor compared to control and other treated samples. Rogor in combination with Kitazin treated samples there was no initiation of flowering at 500+ 500 ppm and still in higher concentrations but in lower concentration of Rogor + Kitazin (250 + 250 ppm), there was a flowering initiation and formation of fruits was not seen.

Interestingly, number of flowers, petals and sepals also varied due to pesticide interaction. In control flowers number of petals induced were 6. Maximum number of petals i.e., 8 was seen in Rogor 1500 ppm and which were fused at the basal region with 2 gynoesium.

In pesticides treated samples average number of fruits, fruit girth and fruit weight decreased as increasing their concentrations. Maximum fruit weight was seen in lower concentration (500 ppm) of Rogor (114.2 grams) treated sample compared to control and other treated samples. Change in shape and size of the fruit was observed by the incorporation of pesticides compared to control. Remarkably there was no absorption of pesticides used at lower and higher concentrations in the fruit. Fruits with thorn were formed in higher concentrations (1500 ppm) of Endosulfan.

The amount of Chlorophyll was increased in some lower concentrations of Rogor up to 750 ppm, then there was a decrease still in higher concentrations, when compared to control (0.3733). There was a decrease in Chlorophyll b and total Chlorophyll in plants obtained as their concentrations increase in Endosulfan and Rogar + Kitazin treated samples, when compared to control exceptionally there was increase in Chlorophyll 'a' content in both Endosulfan (750 ppm) and Rogor + Kitazin (750 + 750 ppm) treated plant and then followed the decreasing trend.

The toxic effects of pesticides in *Hordeum vulgare* with chlorpyrifos on seed germination and growth has been recently reported[11]. The results shows that at the lower doses of pesticides had a beneficial effect on the germination, growth and development in *solanum melongena* with fungicide[12], in *Glycine max* with carboxyl and 24D[13, 14] and in Brassica nigra with Kitazin[15].

Marked reduction in plant height after treatment with high dose of Dithane M-45 in *Cyamopsis tetragonoloba*[16] have been reported with Dithane M-45. Enosulfan induced branching variant was reported[17] in Cyamopsis. Our results of increased the root length, plant height at lower concentration of pesticidal treatment were coincided with the findings in Sorgam[18].

All the treatments resulted in better plant growth in terms of plant height and number of branches (TABLES 1,2 & 3). The plants treated with Endosulfan was distinctly superior than Rogor and in combination with Kitazin treatments. The above results were in agreements with the finding[19] who suggested that increase in plant growth of brinjal after insecticidal treatment.

Fruits of increased size and weight were also obtained with pesticides application. Similar results were reported[20] after NAA + Endosulfan treatment in brinjal. Increase in the yield of brinjal with Carbaryl[21] and with

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TABLE 1 : Effect of Rogor on Plant growth and yield characters.

Concentrations in ppm	% Germination	Plant Height (cms)	Root length (cms)	Stem girth (cms)	Average number Leaves / plant	Average leaf length (cms)	Average leaf width (cms)	Number of flowers / plant	Number of petals & sepals	Average number of fruits	Fruit girth (cms)	Fruit weight (gms)
Control	95.0	54.50 ± 0.854	12.0 ± 0.1560	4.5 ± 0.011	25.0 ± 0.0833	13.95 ± 0.0309	10.83 ± 0.0651	7 ± 0.0141	5-6 ± 0.0157	6 ± 0.108	13.25 ± 0.0287	105.6 ± 0.214
250	94	59.0 ± 0.792	13.9 ± 0.039	4.5 ± 0.011	30.0 ± 0.1354	13.10 ± 0.3130	10.5 ± 0.0230	7 ± 0.0141	5-6 ± 0.157	5 ± 0.0133	13.5 ± 0.0313	115.25 ± 0.0287
500	92	58.1 ± 0.992	13.7 ± 0.038	4.5 ± 0.011	27.0 ± 0.812	12.53 ± 0.0410	10.0 ±0.0410	7 ± 0.0056	5-7 ± 0.0162	4 ± 0.0132	14.7 ± 0.0306	114.2 ± 0.3520
750	88	56.3 ± 0.214	12.5 ± 0.029	4.3 ± 0.022	27.0 ± 0.0812	12.0 ± 0.1560	10.0 ± 0.0410	6 ± 0.0078	5-7 ± 0.0162	4 ± 0.0353	13.0 ± 0.0304	95.45 ± 0.0125
1000	81	54.0 ± 0.853	11.3 ± 0.039	4.0 ± 0.22	22.0 ± 0.0842	11.5 ± 0.396	9.5 ± 0.0525	6 ± 0.0769	5-7 ± 0.0162	3 ± 0.0092	13.0 ± 0.0312	102.6 ± 0.4432
1500	70	52.2 ± 0.902	10.5 ± 0.019	4.0 ± 0.022	20.0 ± 0.468	11.3 ± 0.0390	8.8 ± 0.4320	8 ± 1.810	6-8 ± 0.0145	7 ± 0.0172	13.25 ± 0.0287	97.45 ± 0.4425
2000	58	48.90 ± 0.851	10.5 ± 0.019	3.5 ± 0.011	20.0 ± 0.0468	10.98 ± 0.0247	8.5 ± 0.6553	4 ± 0.0691	6 ± 0.0182	2 ± 0.175	10.0 ± 0.375	57.4 ± 10.748

Mean ± S.E.

TABLE 2 : Effect of Endosulfan on plant growth and yield characters.

Concentrations in ppm	% Germination	Plant Height (cms)	Root length (cms)	Stem girth (cms)	Average number Leaves / plant	Average leaf length (cms)	Average leaf width (cms)	Number of flowers / plant	Number of petals & sepals	Average number of fruits	Fruit girth (cms)	Fruit weight (gms)
Control	95.0	34.50 ± 0.854	12.0 ± 0.1560	4.5 ± 0.011	25.0 ± 0.0833	13.95 ± 0.0309	10.83 ± 0.0651	7 ± 0.0141	5-6	6 ± 0.108	13 ± 0.304	105.6 ± 0.214
250	95	55.0 ± 0.840	11.75 ± 0	4.0 ± 0.013	23.0 ± 0.0872	12.5 ± 0.290	10.67 ± 0.0249	7 ± 0.0141	6-7	4 ± 0.0144	11.5 ± 0.0532	101.7 ± 0.212
500	98	56.15 ± 0.216	10.00 ± 0.866	4.1 ± 0.012	20.0 ± 0.0468	12.2 ± 0.0413	10.5 ± 0.0272	6 ± 0.0135	5-6	4 ± 0.0144	11.5 ± 0.532	103.5 ± 0.225
750	96	57.75 ± 0.995	9.6 ± 0.106	4.0 ± 0.013	35.0 ± 0.2713	12.0 ± 0.0330	10.0 ± 0.3831	6 ± 0.0135	5-6	4 ± 0.0144	12.3 ± 0.0302	100.5 ± 0.202
1000	85	60.75 ± 0.045	8.5 ± 0.655	4.5 ± 0.011	65.0 ± 0.7183	13.7 ± 0.0385	10.0 ± 0.3831	6 ± 0.0135	6	5 ± 0.0133	13.88 ± 0.0302	108.6 ± 0.345
1500	73	53.20 ± 1.430	8.2 ± 0.492	3.5 ± 0.0145	30.0 ± 0.2865	17.8 ± 0.1133	14.3 ± 0.0275	4 ± 0.0353	6	2 ± 0.0156	12.5 ± 0.029	54.2 ± 0.950
2000	60	50.10 ± 1.210	7.5 ± 0.469	3.0 ± 0.0148	30.0 ± 0.2865	11.52 ± 0.0532	9.11 ± 0.0185	2 ± 0.0182	6	2 ± 0.0182	10.3 ± 0.233	30.2 ± 0.283

Mean ± S.E.

TABLE 3 : Combined effect of Rogor+Kitazin on plant growth and yield characters.

Concentrations in ppm	% Germination	Plant Height (cms)	Root length (cms)	Stem girth (cms)	Average number of Leaves	Average Leaf Length (cms)	Average Leaf Width (cms)	No. of flowers / plant	Number of Petals & sepals	Are No. Fruits	Fruit girth (cms)	Fruit height (gms)
Control	95.0 ± 0.1560	54.50 ± 0.1560	12.0 ± 0.1560	4.5 ± 0.011	25.0 ± 0.0833	13.95 ± 0.0309	10.83 ± 0.0651	7 ± 0.0141	5-6 ±	6 ± 0.108	13.0 ± 0.304	105.6 ± 0.214
50+50	85.0	50.0 ± 0.815	9.5 ± 0.0188	3.5 ± 0.014	20.0 ± 0.0468	10.98 ± 0.0945	9.1 ± 1.450	5 ± 0.0137	6	3 ± 0.0162	11.2 ± 0.0325	75.25 ± 0.412
100+100	71.2	40.5 ± 0.265	9.5 ± 0.0188	3.5 ± 0.019	20.0 ± 0.0468	11.15 ± 0.0532	10.0 ± 0.0272	2 ± 0.0368	6	1 ± 0.0078	10.5 ± 0.0654	48.4 ± 0.130
250+250	50.5	31.6 ± 0.294	8.25 ± 0.490	3.0 ± 0.216	16.0 ± 0.3546	10.0 ± 0.3830	8.86 ± 1.860	1 ± 0.0078	5	-	-	-
500+500	33.0	25.4 ± 0.653	5.5 ± 1.154	2.6 ± 0.0161	16.0 ± 0.3546	9.5 ± 0.0188	7.7 ± 0.1925	1 ± 0.0056	-	-	-	-
750+750	18.0	25.4 ± 0.653	5.5 ± 1.154	2.6 ± 0.0161	12.0 ± 0.1560	9.1 ± 0.1850	7.6 ± 0.2402	-	-	-	-	-
1000+1000	8.0	13.0 ± 0.0304	4.5 ± 0.011	2.1 ± 0.361	7.0 ± 0.421	7.8 ± 0.580	6.7 ± 1.052	-	-	-	-	-

Mean ± S.E.

Planofix[22] has been reported earlier.

Quantitative estimation of total chlorophyll content and carotenoid content carried out with the leaves of plants treated with the pesticides, reveal decline in quantity is more in the combined treated plants than the individual treated brinjal, when compared to the quantities in the leaves of untreated plants. In this regard Rogor + Kitazin and Endosulfan are more effective than Rogar pesticides as evident from the Data (TABLE 1,2 & 3). The pesticides are known to cause significant influence on the photosynthetic parameters of different plant systems[23, 24].

The above results were in agreement with the finding[25, 26] who suggested that Xenobiotics have inhibitory effect on chlorophyll biosynthesis. Pesticides have been shown to increase the chlorophyll content in may plants, viz, Dimethazone[27], and Butachlor or Pendimethalin in Rice leaf Butachlor in Rice[28]. In the present study the amount of Chlorophyll was increased in some lower concentrations of Rogor up to 750 ppm which coincides with above results.

Inhibited synthesis and chlorophyll development with increase in concentration of monocrotophus in *Camellia sinesis* with xenobiotics in *Vigna mungo*[29]. Aliminium toxicityin in *Hydrilla verticillata* have been reported. Similar inhibition in chlorophyll content was observed in our results. Reduced the content of both coloured carotenoids and chlorophyll content by pesticides in Radish and flat sedge plants[30] has been reported.

The present study shows decline in chlorophyll content, when compared to its activity in untreated leaves might be due to inhibited photo synthetic electron transport[31] or due to non availability of iron for the production of chlorophyll precursor or due to its direct interference with such processes where incorporation of iron takes place in enzyme Porphyrin. Hence the present study the relationship of pesticides in both individual and in combination was proves to be phytotoxic at different concentrations.

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