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Effects of Various Concentrations of Rogor and Nuvan on Seedling Growth of *Vigna mungo*

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Abstract

The objective of current study is to find effect of various concentrations of pesticides on seedling growth *Vigna mungo,* a laboratory experiment was conducted with pesticide Rogor (Dimethoate) and Nuvan (dichlorovos). The seeds of the plants were sterilized, washed and then transferred in Petri dishes lined with filter paper. The seeds were moistened with different concentrations of rogor and nuvan e.g. 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 5.0%, 7.5%, 10.0% on alternate days. Samples were collected on $7^{th,}$ 14^{th} and 21^{th} day of radicle emergence than root, shoot length, leaf area, fresh and dry weight of control and treated plants were taken. *Vigna mungo* show almost same trends of responses to seedling growth with various concentrations of pesticides Rogor and nuvan, there is inhibition of seedling growth at higher concentration and less effect in lower concentrations. The growth gradually decreases after 0.5% with increasing concentrations of pesticide. It was concluded that 0.5% concentration rogor and nuvan is best for the plant seedling growth which least effects the plants.

Keywords: Pesticide, Vigna, Rogor, Nuvan, Seedling.

Introduction

The pests of the field are destroyed by pesticides but the excessive use of these pesticides has created much hindrance in normal growth of plants. These chemicals interfere the normal physiology, yield, growth and ecology of the plants. The chemical pesticides also affect seed germination and growth of seedlings. Many chemical pesticides also accumulate in plant tissues and cause harmful effects in other members of food chain at higher tropic levels. Such chemicals may also cause harmful effects to man also so it is important for us to find correct concentration of pesticides which is least effective to plant and much effective to pests.

For studying the effect of various concentrations of pesticides on seed germination and seedling growth of *Vigna mungo,* a laboratory experiment was conducted with two selected pesticides, i.e., Rogor (Dimethoate) and Nuvan (dichlorovos).

Materials and Methods

Healthy seeds were selected for uniformity (e.g. seeds of uniform size and vigor). The selected seeds were surface sterilized with 0.1% $HgCl_2$ and then were thoroughly washed with distilled water. These seeds were transferred to Petri dishes containing filter paper. The seeds were then treated with different concentrations of selected chemical pesticides. The control seeds were treated with distilled water only. In each Petri dish, 10 seeds were placed at equal distance and the emergence of radicle was taken as the criterion for germination. The selected pesticides (Rogor and Nuvan) were diluted with distilled water to prepare different concentrations, viz., 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 5.0%, 7.5% and 10.0%. The control concentration was distilled water alone. The seeds in the Petri dishes were moistened with 5 ml of each concentration (control, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 5.0%, 7.5% and 10.0%) of pesticides at alternate days.

For analyzing the seedling growth, the samples were collected on 7^{th}, 14^{th} and 21^{st} day of radicle emergence. First of all the shoot and root length were recorded and then plant fresh weight of samples was taken. Dry weight was taken after drying the plants in oven at 100°C for two days.

Results and Discussion

The effect of different concentrations of pesticide on seed germination and seedling growth were studied on *Vigna mungo* variety "Type-9".

The results for effect of Rogor on seedling growth of *Vigna mungo* are shown in table 1 and figure 1(A, B, C, D). During the present study, the

results are almost parallel to *Vigna radiata*. The samples were taken at 7th, 14th and 21st days of seedling growth with concentration of pesticide (Rogor) as 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 5.0%, 7.5% and 10.0%.

The results (Table 1 and figure 1 A, B, C, D) show shoot length 4.23, 6.21, 7.28 cm, and 3.42, 5.90, 6.94 cm, and 3.21, 4.68, 5.39 cm, and 3.12, 3.56, 4.23 cm, and 2.52, 2.90, 3.78 cm, and 2.09, 2.89, 3.21 cm, and 1.22, 1.94, 2.32 cm, respectively at respective sampling days and respective pesticide concentrations while for control plant the shoot length were 4.80, 7.34 and 9.56 cm respectively on 7th, 14th and 21st days. The data for root length show 2.70, 3.38, 5.28 cm for control plant and 2.10, 2.84, 4.64 cm, and 2.15, 2.46, 4.90 cm, and 1.62, 2.11, 3.69 cm, and 1.57, 2.14, 3.16 cm, and 1.22, 1.71, 2.89 cm, and 0.74, 2.52, 2.13 cm, and 0.43, 1.22, 1.40 cm respectively for different increasing pesticide concentrations. No results were obtained for 10.0% concentration.

The data for leaf area for the above values are recorded as 4.13, 5.16, 5.32 cm^2 for control plant and 3.84, 4.43, 4.64 cm^2, and 3.10, 3.34, 4.13 cm^2, and 2.17, 2.94, 3.31 cm^2, and 1.97, 2.26, 2.84 cm^2, and 1.32, 1.91, 2.33 cm^2, and 0.94, 1.22, 1.52 cm^2, and 0.53, 0.92, 1.13 cm^2 respectively for different increasing concentrations of pesticide on respective sampling days. No results were obtained for 10.0% concentration. The data for fresh weight with increasing concentrations were 186.0, 275.0, 282.0 mg, and 160.0, 197.0, 248.0 mg, and 142.0, 167.0, 224.0 mg, and 131.0, 152.0, 192.0 mg, and 118.0, 127.0, 154.0 mg, and 92.3, 111.0, 122.0 mg, and 52.0, 98.0, 105.0 mg respectively at respective concentrations and sampling days. The control plant fresh weight for 7th, 14th, 21st days were 185.0, 274.0, 322.0 mg respectively. The data for dry weight were observed as 41.32, 45.42, 54.31 mg, and 32.21, 40.32, 46.41 mg, and 26.30, 34.63, 42.73 mg, and 22.33, 26.52, 32.41 mg, and 19.26, 24.22, 27.91 mg, and 14.28, 18.31, 21.20 mg and 8.23, 13.51, 14.33 mg respectively for different Increasing concentration of pesticide Rogor at different sampling days. The data observed for control plants are 41.81, 50.90 and 62.35 mg at 7th, 14th and 21st days respectively.

The results depicted in table 2 and fig. 2 (A, B, C, D) are for effect of different concentrations of Nuvan on *Vigna mungo*. During the sampling, the same trends of the responses to various concentrations of pesticide are shown by seedling growth parameters as described in previous samples. The shoot length as compared to control plants, i.e., 6.00, 7.48, 8.90 cm at 7th, 14th, 21st days respectively were recorded as 5.90, 7.40, 8.80 cm, and 4.89, 7.05, 7.80 cm, and 4.40, 5.72, 6.33 cm, and 4.22, 4.69, 5.32 cm, and 3.62, 4.31, 4.90 cm, and 3.21, 3.90, 4.30 cm, and 2.30, 3.08, 3.42 cm respectively at different concentrations.

The length of roots was observed as 3.7, 4.3, 6.3 cm, and 3.11, 3.45, 5.1 cm, and 2.6, 3.1, 4.63 cm, and 2.54, 3.11, 4.1 cm, and 2.2, 2.7, 3.9 cm, and 1.73, 2.5, 3.1 cm, and 1.39, 2.19, 2.39 cm respectively with increasing concentrations of pesticide, while the control values are 3.73, 4.38 and 6.3 cm at 7th, 14th and 21st days respectively.

The leaf area observed during present study were 5.20, 6.30, 6.40 cm^2, and 4.25, 4.51, 5.30 cm^2, and 3.50, 4.15, 4.55 cm^2, and 3.17, 3.45, 4.02 cm^2, and 2.54, 3.15, 3.40 cm^2, and 2.16, 2.50, 2.74 cm^2, and 1.74, 2.19, 2.33 cm^2, with increasing concentrations of pesticide, while the data for Control plants were 5.32, 6.30, 6.50 cm^2 respectively on respective sampling days. The fresh weight for increasing pesticide concentrations were 115.0, 278.0, 324.0 mg, and 168.0, 204.0, 252.0 mg, and 150.0, 174.0, 231.0 mg, and 138.0, 160.0, 201.0 mg, and 125.0, 138.0, 161.0 mg, and 98.3, 116.0, 128.0 mg, and 58.0, 74.0, 111.0 mg, while the control plant show 216.0, 280.0, 326.0 mg values at 7th, 14th and 21st days respectively. The dry weight as observed from the data follow the same trend as fresh weight. The control plants show 45.0, 54.0, 69.0 mg dry weight as compared to 44.00, 54.00, 68.00 mg, and 33.30, 41.30, 46.00 mg, and 28.00, 36.70, 43.70 mg, and 22.40, 28.60, 32.50 mg, and 20.30, 25.30, 29.00 mg, and 15.30, 20.00, 23.40 mg, and 9.33, 15.50, 20.30 mg respectively with increasing concentrations. No results were obtained at 10.0% concentration as there was no germination.

The results for the present study show that there is general inhibition of seedling growth at higher concentrations of pesticides and less effect on growth is seen in lower concentrations, i.e., 0.5% and 1.0% pesticide. No seedling germination was observed at 10.0% pesticides concentration. The seedling growth gradually decreases after 0.5% pesticide with increasing concentrations of pesticides.

The inhibition of seedling growth may be due to inhibition of hydrolytic enzyme synthesis or the blocking of enzyme pathway in the seed during germination. Our results coincide with Gange et al. (1992) and other workers also.

Inhibition of germination and seedling growth with high concentrations of pesticide may be due to Inhibition of hydrolytic enzyme synthesis or the blocking of enzyme pathways in the seed during germination (Gange et al., 1992) according to Dauterman et al., 1960, the Pesticides are absorbed by different parts of plants like leaves, roots, etc. and inside the plants the pesticides are metabolized with the different metabolic pathways and thus reduce growth.

Seedling part	Concentration of Rogor in percentage																										
	0%			0.5%			1.0%			1.5%			2.0%			2.5%			5.0%			7.5%			10.0%		
	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21
Shoot length (cm)	4.80 ±1.2	7.34 ±0.9	9.56 ±0.15	4.32 ±0.21	6.21 ±0.64	7.28 ±0.04	3.42 ±0.75	5.90 ±0.02	6.94 ±0.03	3.21 ±0.22	4.68 ±0.34	5.39 ±0.14	3.12 ±0.15	3.56 ±0.17	4.23 ±1.2	2.52 ±0.64	2.90 ±0.02	3.78 ±0.03	2.09 ±0.05	2.89 ±0.03	3.21 ±0.03	1.22 ±0.05	1.94 ±0.06	2.32 ±0.07	0.00	0.00	0.00
Root length (cm)	2.70 ±0.01	3.38 ±0.04	5.28 ±0.02	2.10 ±0.04	2.84 ±0.03	4.64 ±0.04	2.15 ±0.06	2.46 ±0.01	4.90 ±0.02	1.62 ±0.03	2.11 ±0.15	3.69 ±0.03	1.57 ±0.04	2.14 ±0.01	3.16 ±0.01	1.22 ±0.01	1.71 ±0.02	2.89 ±0.05	0.74 ±0.05	2.52 ±0.06	2.13 ±0.07	0.43 ±0.15	1.22 ±0.16	1.40 ±0.18	0.00	0.00	0.00
Leaf Area (cm^2)	4.13 ±1.2	5.16 ±1.3	5.32 ±1.43	3.84 ±1.33	4.43 ±1.22	4.64 ±1.21	3.10 ±1.5	3.34 ±1.21	4.13 ±1.31	2.17 ±0.94	2.94 ±0.95	3.31 ±1.22	1.97 ±1.23	2.26 ±1.41	2.84 ±1.50	1.32 ±1.14	1.91 ±1.17	2.33 ±1.19	0.94 ±1.01	1.22 ±1.03	1.52 ±1.04	0.53 ±1.01	0.92 ±0.92	1.13 ±1.95	0.00	0.00	0.00
Fresh Weight (mg)	185.00 ±7.64	274.00 ±3.92	322.00 ±5.35	186.00 ±5.31	275.00 ±5.51	282.00 ±3.24	160.00 ±4.48	197.00 ±5.64	248.00 ±3.79	142.00 ±3.84	167.00 ±4.81	224.00 ±4.82	131.00 ±4.88	152.00 ±5.1	192.00 ±7.61	118.00 ±7.77	127.00 ±8.11	154.00 ±9.12	92.30 ±6.33	111.00 ±5.11	122.00 ±4.88	52.00 ±5.1	98.00 ±2.71	105.00 ±2.22	0.00	0.00	0.00
Dry Weight (mg)	41.81 ±0.05	50.90 ±1.57	62.30 ±2.67	41.32 ±3.31	45.42 ±2.11	54.31 ±2.20	32.21 ±1.97	40.32 ±1.87	46.41 ±0.95	26.30 ±0.81	34.63 ±1.81	42.73 ±1.89	22.33 ±1.82	26.52 ±1.95	32.41 ±2.22	19.26 ±2.21	24.22 ±2.23	27.91 ±2.28	14.28 ±1.97	18.31 ±1.09	21.20 ±1.68	8.23 ±1.97	13.51 ±1.85	19.33 ±2.10	0.00	0.00	0.00

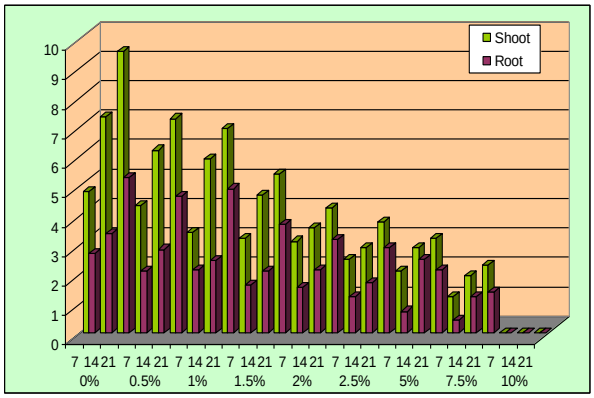

Fig. 1A. Effect of Various Concentrations of Rogor on Seedling Length of *Vigna mungo.*

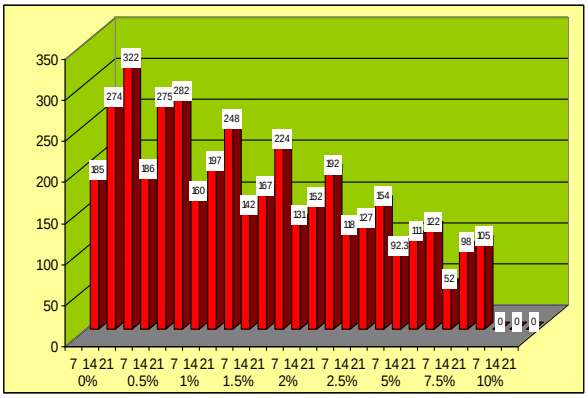

Fig. 1C. Effect of Various Concentrations of Rogor on Fresh Weight of *Vigna mungo.*

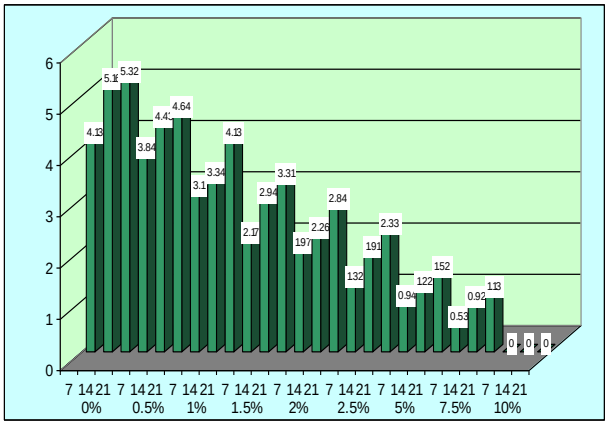

Fig. 1B. Effect of various concentrations of Rogor on leaf area of *Vigna mungo.*

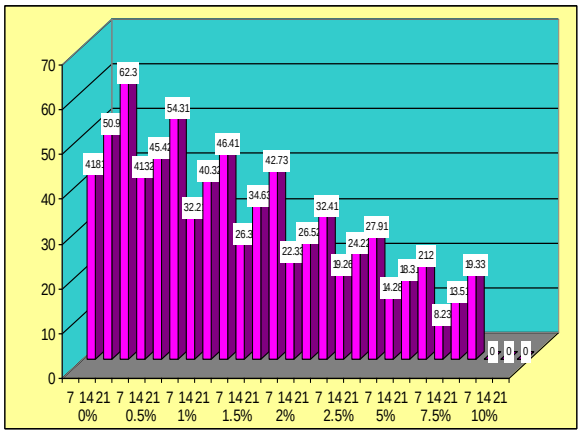

Fig. 1D. Effect of Various Concentrations of Rogor on Dry Weight of *Vigna mungo*

Seedling part	Concentration of Nuvan in percentage																										
	0%			0.5%			1.0%			1.5%			2.0%			2.5%			5.0%			7.5%			10.0%		
	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21	7	14	21
Shoot length (cm)	6.00 ±0.05	7.48 ±0.02	9.9 ±0.03	5.9 ±0.05	7.4 ±0.01	9.8 ±0.8	4.9 ±0.04	7.05 ±0.78	7.8 ±1.5	4.4 ±1.3	5.72 ±0.06	6.3 ±0.05	4.2 ±0.02	4.69 ±0.06	5.3 ±0.04	3.62 ±0.07	4.31 ±1.2	4.9 ±1.1	3.21 ±1.11	3.9 ±1.2	4.3 ±0.06	2.3 ±0.03	3.08 ±0.01	3.42 ±0.05	0.00	0.00	0.00
Root length (cm)	3.73 ±0.03	4.38 ±0.04	6.30 ±0.1	3.70 ±0.02	4.30 ±0.03	6.30 ±0	3.10 ±0.03	3.45 ±0.02	5.10 ±0.03	2.60 ±0.1	3.10 ±0.03	4.60 ±0.01	2.50 ±0.05	3.11 ±0.04	4.10 ±0.03	2.20 ±0.04	2.70 ±0.05	3.90 ±0.04	1.73 ±0.06	2.50 ±0.04	3.10 ±0.01	1.40 ±0.03	2.19 ±0.02	2.39 ±0.01	0.00	0.00	0.00
Leaf Area (cm^2)	5.32 ±1.3	6.3 ±1.6	6.5 ±1.2	5.2 ±1.4	6.3 ±0.98	6.4 ±0.3	4.3 ±1.12	4.5 ±1.13	5 ±1.2	3.5 ±1.2	4.2 ±1.35	4.6 ±1.44	3.2 ±0.98	3.5 ±1.3	4 ±1.2	2.54 ±1.4	3.15 ±1.5	3.4 ±1.2	2.16 ±1.3	3 ±1.2	2.7 ±1.25	1.7 ±1.5	2.2 ±1.21	2.3 ±1.31	0.00	0.00	0.00
Fresh Weight (mg)	216.00 ±1.56	280.00 ±1.9	326.00 ±5.2	215.00 ±6.32	278.00 ±4.52	324.00 ±2.4	168.00 ±2.48	204.00 ±2.67	252.00 ±5.1	150.00 ±4.6	174.00 ±7.12	231.00 ±5.13	138.00 ±4.21	160.00 ±4.28	201.00 ±9.6	125.00 ±8.91	138.00 ±8.65	161.00 ±10	98.30 ±4.56	116.00 ±3.54	128.00 ±4.52	58.00 ±5.12	74.00 ±5.23	111.00 ±5.65	0.00	0.00	0.00
Dry Weight (mg)	45.0 ±0.05	54.0 ±1.23	69.0 ±1.61	44.0 ±1.32	54.0 ±3.26	68.0 ±3.5	33.0 ±3.59	41.0 ±2.45	46.0 ±4.21	28.0 ±1	37.0 ±0.7	44.0 ±1.23	22.0 ±0.05	29.0 ±0.08	33.0 ±1.23	20.4 ±1.12	25.3 ±1.21	29.0 ±2.2	15.3 ±1.21	20.0 ±1.4	23.0 ±1.46	9.3 ±1.25	16.0 ±1.5	20.0 ±4.56	0.00	0.00	0.00

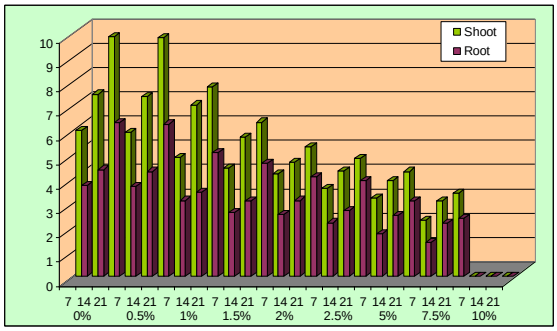

Fig. 2A. Effect of various concentrations of Nuvan on seedling length of *Vigna mungo*

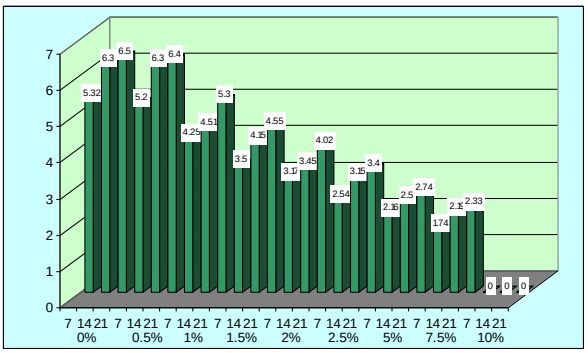

Fig. 2B. Effect of various concentrations of Nuvan on leaf area of *Vigna mungo*

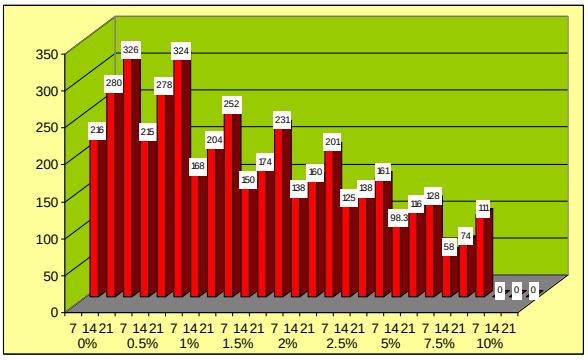

Fig. 2C. Effect of various concentrations of Nuvan on fresh weight of *Vigna mungo*

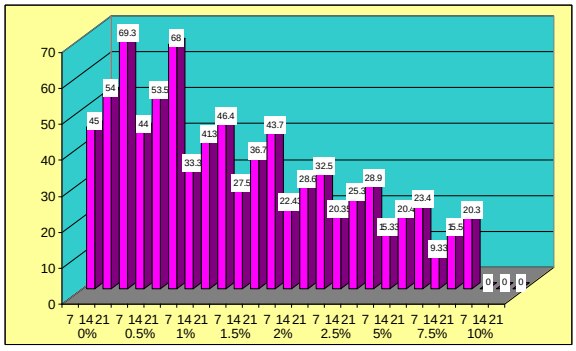

Fig. 2D. Effect of various concentrations of Nuvan on dry weight of *Vigna mungo*

Conclusion

It is concluded from the present study that pesticides high concentrations of rogor and nuvan is toxic to crop plants like Vigna radiate and Vigna mungo although these chemicals can be favorably used for agriculture crop protection in low concentrations only like 0.5% which is least toxic to crops and have good effect on insect pests .

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