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EFFECT OF DIFFERENT CONCENTRATIONS OF LUPINE SEED EXTRACT ON GROWTH,YIELD, YIELD COMPONENTS AND CHEMICAL COMPOSITION OF MUNGBEAN AND THE TWO WEEDS JEW'S MALLOW AND PURSLANE

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ABSTRACT

These experiments were carried out during the summer seasons of 2003 and 2004 at the greenhouse of the National Research Centre. The experiments aimed to study the effect of adding different concentrations (0 %, 5 %, 10 %, 15 %, 20 % and 25 % w/v) of aqueous extract of lupine (*Lupinus termis* cv. Giza 1) on the growth, yield, yield components and some chemical composition of mungbean as well as their effect on the growth of jew's mallow and purslane. The lupine seed extract were added weekly for 12 weeks after 30 days of seedling establishment of plants

The data revealed that the fresh and dry weight of jew's mallow was stimulated by Lupine seed extract at 5 % concentration, while no appreciable changed occurred with 15%, whereas the higher concentration (20 % and 25 %) showed inhibitory effect. However, all Lupine seed concentrations caused stimulation in the fresh and dry weight of purslane. The data also illustrated that mungbean growth and seed yield as well as total protein were stimulated by lupine seed extract at 5 % concentration. No appreciable changes occurred with 15 %, whereas the higher concentrations (20 % and 25 %) showed an inhibitory effect.

Lupine seed extract at 5 % concentration has a positive allelopathic effect due to its ability to increase plant growth and to stimulate mungbean yield production.

These results suggest the possibility of the potential beneficial involvement of Lupine seed extract as crop-crop stimulator, through its application at lower concentrations after mungbean emergence. This treatment could be effective in enhancing crop production.

INTRODUCTION

Many species within the leguminosae family contain secondary plant products that have allelopathic potential (Bell and Charlwood, 1980 and Rice, 1984). A limited number of studies have been conducted to investigate the influence of these chemicals on the growth of other leguminous plant as well as its effect on the growth and development of weed (Lehle, *et al*., 1983; White *et al*., 1989 and El-Dally and Soliman, 1997 (a and b).

The allelopathic effect of various natural compounds on the growth and development of various plants may be inhibitory or stimulatory depending on their concentration in the surrounding medium and their physiological activity within plants (Hall *et al*., 1982; Pardales *et al*., 1992 and El-Dally and Soliman (1997 a and b).

The mechanisms and mode of action of allelochemicals were discussed to be due to their effect on cell division,interactions with hormones, enzymes,respiration,photosynthesis,nutrient uptake and many indirect effects (Lovett, 1982; Leather and Einhellig, 1988 and Abou-Khadrah *et al*., 2001).

The objective of this work was to determine the effect of lupine seed extract on the growth, yield, yield components and chemical composition of mungbean as well as its effect on the growth and development of some weeds such as jew's mallow and purslane commenly present in mungbean field.

MATERIALS AND METHODS

Two pot experiments were conducted during the summer seasons of 2003 and 2004 at the greenhouse of the National Research Centre. The experiments aimed to study the effect of Lupine seed extract on the growth, yield, yield components and some chemical composition of mungbean plants (*Vigna radiata*, L. Wilczek) cv. Kawmy-1 as well as its effect on the growth of the two weeds jew's mallow and purslane.

Mungbean seeds were inoculated with specific rhizobium strain. Five inoculated seeds of mungbean, 0.2 g of jew's mallow (*Chorocorus olitorius*, L.) and 0.2 g of purslane (*Portulaca oleracea* L.) were planted in separate pots 30 cm in diameter at 3 cm depth. The pots were filed with 7 kg of clay-sandy soil, 2.5 g superphosphate fertilizer was added and 2 g urea were also added as nitrogen fertilizer. Sowing dates were 25th and 27th May in 2003 and 2004 seasons, respectively. The pots were irrigated daily with tap water. Treatments with Lupine seed extracts, 200 ml/pot, were started weekly, 30 days after sowing, for 12 weeks. The pots were divided into 3 groups for mungbean, jew's mallow and purslane. Each group consists of the following treatments, plants irrigated with water to serve as control, plants treated with 5 %, 10 %, 15 %, 20 % and 25 % Lupine aqueous extract, each treatment presented by 12 pots.

Lupine seed extract was prepared as follows :

The air dried seeds of Lupine (cv. Giza 1) were ground and sieved through 2 mm mesh screen then soaking the appropriately powdered tissue in 100 ml distilled water for 24 hr, then filtered through cheese cloth. The resulting filtrate was brought up to original volume with distilled water and refrigerated no longer than 24 hr before experimental use.

Data recorded :

1. On weeds :

Four pots were taken randomly from each treatment at 60 and 90 days from sowing for each weed, jew's mallow (*Chorocorus olitorius*, L.) or purslane (*Portulaca oleracea*, L.). Fresh and dry weight of each weed (g/pot) were recorded.

2. On Mungbean plants :

A. Plant growth ; Growth characteristics :

After 60 and 90 days from sowing in both seasons, samples of four pots were taken randomly from each treatment of mungbean plants to determine the following characteristics :

1. Plant height (cm).
2. Number of leaves/plant.
3. Number of branches/plant (at 90 days only).
4. Fresh and dry weight of whole plant (g).

5. Fresh and dry weight of leaves/plant (g).
6. Leaf area index (LAI).
7. Specific leaf area (SLA, cm^2/g).
8. Net assimilation rate (NAR, cm^2/day).
9. Crop growth rate (CGR, $g/cm^2/day$).

B. Yield and yield components :

At time of harvest (120 days from sowing) samples of four pots were taken from each treatment. The following data were recorded :

1. Number of pods/plant. 2. Weight of pods/plant (g).
3. Seed yield/plant (g). 4. Weight of 100 seeds (g).

C. Chemical analysis :

The dried seeds were ground and stored for analysis.

1- Total protein content : Total nitrogen content was estimated by kjeldahl method (Ranganna, 1979). N values were multiplied by 6.25 to calculate protein content.

2- Total carbohydrates content : Total carbohydrates content of seeds was determined colourimetrically according to Dubois *et al*. (1951). Data obtained were statistically analysed according to (Snedecor and Cochran, 1967).

RESULTS

Data presented in Table (1) showed that the fresh and dry weight of jew's mallow and purslane (shoots and roots) were significantly increased by plant age. Treatments with 5 % and 10% lupine extract increased significantly the fresh and dry weight of jew's mallow in the first stage (after 60 days from sowing). The fresh and dry weight of jew's mallow treated with 15 % lupine extract was more or less similar to the control. However, treatments with 20 % and 25 % lupine extract concentrations caused significant decreases in both fresh and dry weight. In the second stage of growth (after 90 days from sowing) only treatment with 5 % lupine extract concentration increased significantly the fresh and dry weight. However, 10 % concentration was more or less similar to the control. On the contrary, treatments with 15 %, 20 % and 25 % Lupine extract concentrations caused significant decrease in fresh and dry weight. On the other hand, the fresh and dry weight of purslane in the two stages (after 60 and 90 days from sowing) were significantly stimulated with all Lupine extract concentrations (except the dry weight in the second stage with 5 % and 10 % concentrations). The stimulatory effect increased by increasing the concentration of lupine extract.

The experimental results recorded in Table (2) revealed that all growth characteristics of mungbean were significantly increased by plant age.

Plant height in the first stage (after 60 days from sowing) was not significantly affected as a result of treatments with 5 % and 10 % lupine extract concentrations. On the contrary, the same concentrations showed significant increase after 90 days from sowing. However, treatments with 15 %, 20 % and 25 % concentrations caused significant decrease after 60 and 90 days from sowing (Table 2).

The number of mungbean leaves in the first stage was not significantly affected with 5 %, 10 % and 15 % lupine extract concentrations, while higher concentrations 20 % and 25 % caused significant decrease in the same character. In the second stage (after 90 days from sowing) the same tendency was observed and significant decreases was recorded by using 15 %, 20 % and 25 % lupine extract concentrations.

The number of mungbean branches after 90 days from sowing was recorded in Table (2). Lower concentrations of lupine extract (5 % and 10 %) caused significant increase. However, significant inhibition was recorded by the higher concentrations (20 % and 25 %).

The fresh and dry weight of mungbean plant in the first stage (after 60 days from sowing)were significantly increased by the lower concentrations of lupine seed extract (5 % and 10%). However, higher concentrations (20 % and 25 %) caused significant decrease. After 90 days from sowing, only the lower concentration of lupine extract (5 %) caused significant increase in the fresh weight of mungbean plant, while higher concentrations 15 %, 20 % and 25 % caused significant decrease in the same character. The dry weight of mungbean plants after 90 days from sowing was not significantly affected by 5 %, 10% and 15 % lupine seed extract. However, higher concentrations 20 % and 25 % caused significant decrease when compared with control.

The data recorded in Table (2) showed also that the fresh weight of mungbean leaves after 60 days from sowing was significantly increased by the lower concentrations of lupine extract (5 % and 10 %). However, treatments with 15 %, 20 % and 25 % caused significant decreases. The dry weight of mungbean leaves in the first stage (after 60 days from sowing) showed the same trend since treatment with 5 % concentration showed significant increase, while treatment with 20 % and 25 % concentrations showed significant decrease in the same character. The fresh weight of mungbean leaves after 90 days from sowing showed significant decreases with the higher concentrations of lupine seed extract (15 %, 20 % and 25 %). However, the dry weight of leaves was significantly decreased only with the higher concentrations 20 % and 25 %.

Results recorded in Table (3) revealed that leaf area index (LAI), net assimilation ratio (NAR) and crop growth rate (CGR) were not significantly affected as a result of treatments with 5 %, 10 % and 15 % lupine seed extract (except LAI in the first stage at 15 % concentration) as compared to the control. However, higher concentrations 20 % and 25 % caused significant decrease in the same characters.

Table (1.2)

Specific leaf area (SLA) in the first stage (after 60 days from sowing) was significantly decreased by the lower concentrations of lupine seed extract (5 % and 10 %) as compared to the control, while higher concentrations (15 %, 20 % and 25%) were more or less similar to the control. In the second stage (after 90 days from sowing) treatments with 5 %, 10 % and 15 % lupine extract did not cause any significant changes as compared to the control. However, higher concentrations (20 % and 25 %) caused significant increase as compared to the control.

Table (3) : Effect of different concentrations of lupine seed extract on leaf area index (LAI), specific leaf area (SLA), net assimilation rate (NAR) and crop growth rate (CGR) at different stages of growth (60 and 90 days from sowing) (Combined analysis of two seasons).

Characters Aqueous lupine extract (w/v)	LAI		SLA (cm^2/g)		NAR (cm^2/ day)	CGR (g/cm^2/day)
	At 60 Days	At 90 days	At 60 days	At 90 days		
0 %	2.13	3.81	247.37	197.34	0.48	0.61
5 %	2.13	3.87	208.44	187.35	0.48	0.62
10 %	2.10	3.84	223.21	195.50	0.45	0.58
15 %	1.92	3.78	247.98	199.90	0.45	0.57
20 %	1,17	1.89	249.22	219.42	0.17	0.11
25 %	1.08	1.59	251.10	232.29	0.15	0.08
L.S.D. at 0.05	0.15	0.21	11.23	13.94	0.05	0.06

It is obvious from Table (4) that treatments with 5 % and 10 % lupine seed extract concentrations increased significantly the number of pods/plant and the dry weight of pods/plant, while 15 % concentration was more or less similar to the control. However, treatments with 20 % and 25 % lupine seed extract concentrations caused significant decreases compared to the control.

Seed yield/plant and dry weight of 100 seeds were significantly increased as a result of treatment with 5 % lupine extract concentration, while treatments with 10 % and 15 % concentrations were more or less similar to the control.However, higher concentrations 20 % and 25 % caused significant decrease as compared to the control.

Table (4) : Effect of different concentrations of lupine seed extract on yield and yield components as well as chemical composition of mungbean at harvest stage (120 days from sowing) (Combined analysis of two seasons).

Characters Aqueous lupine extract (w/v)	No. of pods/ plant	Dry wt. of pods/ plant (g)	Seed yield/ plant (g)	Dry wt. of 100 seeds (g)	Total protein (%)	Total carbo-hydrates (%)
0 %	10.0	6.0	2.4	4.9	22.18	59.86
5 %	34.0	12.7	7.1	5.6	23.93	60.42
10 %	24.0	10.1	2.5	5.0	22.31	59.78
15 %	9.7	5.6	2.4	4.8	18.56	59.64
20 %	4.0	1.9	1.1	4.0	17.18	53.72
25 %	2.0	1.0	0.6	3.4	14.50	48.98
L.S.D. at 0.05	3.69	0.76	0.40	0.67	1.68	6.15

Protein and carbohydrate are the two important constituents of mungbean seeds. Data presented in Table (4) showed that the total protein percentage significantly increased by the lowest concentration of lupine seed extract (5 %). However, treatments with 15 %, 20 % and 25 % caused significant decreases as compared to the control.

The total carbohydrates percentage was not significantly affected by treatments with 5 %, 10 % and 15 % lupine seed extracts while treatments with higher concentrations, (20 % and 25 %) caused significant decrease as compared to the control.

DISCUSSION

Allelopathy is simply the production and release of chemicals into the environment by living plants or decaying plant tissues which affect the growth of neighbouring plants. Most of these researches has concentrated on determining the effect of decomposing crop residues on succeeding crops and the inhibition of crop production by weeds as well as the interaction of crop to crop (Mecalla and Norstadt, 1974; Cochran *et al*., 1977; Leather, 1983; Lehle, *et al*., 1983; White, *et al*., 1989; Peterson and Harrison, 1995, El-Dally and Soliman, 1997 a and b, El-Bassiouny and Messiha, 1999; Abou-Khadrah *et al*., 2001; Abdallah *et al*., 2002; Leon, *et al*., 2003; Morales-Payan, *et al*., 2003 and Skulman, *et al*., 2004). Therefore, one of the more difficult aspects of allelopathy research is differentiating between interference due to allelopathy and interference due to competition.

In this work, allelopathic influence of lupine seed extract on the growth and development of mungbean plants and two weeds, jew's mallow as well as purslane were studied in pure stand (each plant alone). The results of this investigation showed clearly that the lowest concentration of lupine seed extract (5 %) caused significant stimulatory effect on the fresh and dry weight of mungbean and jew's mallow at the two stages of growth (60 and 90 days from sowing), while higher concentrations (20 % and 25 %) caused an inhibitory effect. However, all concentrations of lupine seed extract caused stimulatory effect on the fresh and dry weight of purslane at the two stages of growth. The results reported in this work added more support to the findings of those reported by Hall *et al*. (1982), Pardales *et al*. (1992) and El-Dally and Soliman (1997a) who reported that the allelopathic action of various natural compound on the growth and development of many plants may be inhibitory or stimulatory depending on their concentrations in the surrounding medium and their physiological activity within plant. The results of this investigation are in agreement with several authors. The enhancement of mungbean yield reported in this work coinside with those previously reported by Bhowmik and Doll (1982); Sogaard and Doll (1992) and El-Daly and Soliman (1997b). Moreover, increased protein was also reported by Dornbos and McDonald (1986), Rosenberg and Rinne (1987) and El-Dally and Soliman (1997b).

These results indicate that the allelopathic compounds present in the 5 % lupine extract acted as growth regulator to stimulate mungbean growth

and its yield whereas those found in 20 % and 25 % extract were high enough to cause inhibitory effect. Similar results were also reported by El-Bassiony and Messiha, 1999. In this connection, it is worthy to mention that Rice (1984) postulated that the concentration of allelopathic compounds must reach an appropriate threshold level before inhibiting plant growth and yield.

It was also reported that the inhibiting effect of allelochemicals, found in decaying plant residues are often stimulatory at very low concentrations (Leather and Einhellig, 1985 and Mallik and Tesfai, 1988).

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دراسة تأثير التركيزات المختلفة لمستخلص بذور الترمس على النمو والمحصول ومكوناته والتركيب الكيميائى لنبات فول المانج وكل من حشيشتى الملوخية والرجلة

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اجريت هذه الدراسة بصوبة المركز القومى للبحوث خلال الموسم الصيفى لعامى ٢٠٠٣ ، ٢٠٠٤ لمعرفة اثر اضافة المستخلص المائى لبذور نبات الترمس اسبوعيا ولمدة ١٢ اسبوع بتركيزات مختلفة (صفر ، ٥ % ، ١٠ % ، ١٥ % ٢٠ % ، ٢٥ %) على نمو ومحصول نبات فول المانج وايضا اثر هذه المعاملة على نمو حشيشتى الملوخية والرجلة . وبدأت اضافة المستخلص المائى لبذور الترمس عندما كان عمر نباتات فول المانج وكل من حشيشتى الملوخية والرجلة ٣٠ يوما .

اظهرت النتائج الاثر المنشط للمستخلص المائى لبذور الترمس بتركيز ٥% على الوزن الرطب والوزن الجاف لحشيشة الملوخية فى حين كان للتركيزات العالية ٢٠ % ، ٢٥ % اثر مثبط ، بينما كان لجميع التركيزات المستخدمة اثر منشطا على الوزن الرطب والوزن الجاف لحشيشة الرجلة .

كما اظهرت النتائج على نباتات فول المانج انه بالاضافة للتأثير المنشط للتركيز المنخفض (٥ %) على النمو فقد ادى ذلك لزيادة محصول النبات وكذا المحتوى البروتينى للبذور ، بينما لم يؤثر التركيز ١٥ % فى حين ثبط تركيزى ٢٠% ، ٢٥ % صفات النمو والمحصول والمحتوى البروتينى والكربوهيدراتى.

ويمكن القول بان معدل التنشيط او التثبيط لانتاج محصول فول المانج نتيجة المعاملات المختلفة بالمستخلص المائى لبذور الترمس يرجع الى الزيادة او النقص فى المحتوى البروتينى والكربوهيدراتى . لذا فان تركيز ٥ % من مستخلص بذور الترمس له قدرة اليلوباثية ايجابية نتيجة لكونه يشجع من نمو النبات ويزيد من انتاج المحصول وتشير هذه النتائج الى امكانية الاستفادة من التركيز المنخفض للمستخلص المائى لبذور الترمس كمنشط له فاعلية لزيادة انتاج محصول فول المانج.

Table (1) : Effect of different concentrations of lupine seed extract on the fresh and dry weight of jew's mallow or purslane at different stages of growth (60 and 90 days from sowing) (Combined analysis of two seasons).

Characters Aqueous lupine Extract (w/v)	Jew's mallow				Purslane			
	Fresh wt. (g/pot)		Dry wt. (g/pot)		Fresh wt. (g/pot)		Dry wt. (g/pot)	
	At 60 days	At 90 days	At 60 days	At 90 days	At 60 days	At 90 days	At 60 days	At 90 days
0 %	29.2	71.5	4.4	12.0	114.2	247.7	5.8	12.4
5 %	41.9	132.5	6.0	25.0	130.9	285.9	7.0	13.9
10 %	39.3	75.3	5.6	12.3	233.1	342.8	12.2	19.7
15 %	30.0	33.8	4.7	6.3	301.5	472.0	18.5	28.2
20 %	19.5	33.7	2.6	6.1	469.8	622.5	27.0	33.6
25 %	9.3	17.0	1.8	2.4	496.4	907.5	29.0	55.0
L.S.D. at 0.05	2.72	7.11	0.63	1.52	13.40	14.63	2.42	10.36

Table (2) : Effect of different concentrations of lupine seed extract on some growth characteristics of mungbean at different stages of growth (60 and 90 days from sowing) (Combined analysis of two seasons).

Characters Aqueous lupine extract (w/v)	Plant height (cm)		No. of leaves/plant		No.of branches /plant	Fresh wt. Of plant (g/plant)		Dry wt. Of Plant (g/plant)		Fresh wt.of Leaves (g/plant)		Dry wt. Of Leaves (g/plant)	
	60 days	90 days	60 days	90 days	90 days	60 days	90 days	60 days	90 days	60 days	90 days	60 days	90 days

0 %	54.60	81.30	7.20	11.5	1.40	20.0	34.80	3.3	9.60	10.40	16.60	2.00	4.50
5 %	59.10	98.90	7.60	12.3	2.00	25.6	38.60	4.3	10.60	13.50	17.50	2.40	4.80
10 %	58.00	89.00	7.20	12.0	1.70	22.7	37.20	4.2	10.10	11.50	17.20	2.20	4.50
15 %	45.90	64.50	7.00	9.5	1.20	18.4	29.90	3.4	9.20	9.20	12.10	1.80	4.50
20 %	43.80	46.80	6.00	7.3	1.00	10.9	15.50	2.2	4.40	5.50	6.90	1.10	2.00
25 %	40.50	42.90	4.80	5.8	1.00	10.7	13.66	2.0	3.90	5.00	5.60	1.00	1.60
L.S.D. at 0.05	4.58	4.77	1.12	1.37	0.24	2.22	2.70	0.38	1.25	1.09	1.18	0.33	0.53