Allelopathic Effect of Some Weed Extracts on *Triticumaestivum* and *Viciafaba*

Mahmoud S. Mahmoud
Department of Pesticide Chemistry and Technology, Faculty of Agriculture
Alexandria University, Alex., Egypt.
Email: ms_kassem2 [AT] yahoo.com

ABSTARCT---- ***Laboratory experiment was conducted in faculty of agriculture, Alexandria University to determine allelopathic effect of four weeds (Amaranthuscruentus, Sinapisarvensis and Sisymbriumirio and Sonchusoleraceus) on two winter crops (Triticum aestivum and Vicia faba). Different concentrations (2.5, 5, 10 and 20%) from the stock solution of leaf extract were used to evaluate its effect on germination, shoot and root length as well as total chlorophyll content of tested crops. The results indicated reduction in all measured parameters especially at higher concentrations. The lower concentration (2.5%) did not affect germination, shoot and root length and chlorophyll content measurements. It was concluded that aqueous leaf extract of the used weeds had allelopathic effect on these crops.***

Keywords--- Allelopathy, *A.cruentus*, *S.arvensis*, *S.irio*, *S.oleraceus*, *Triticumaestivum*, *Viciafaba*, Chlorophyll content

1. INTRODUCTION

DeCandolle[1] was probably the first person to suggest the possibility that many plants may excrete something from their roots, which is injurious to other plants [2].

Allelopathy concerns the effects of one plant on another due to chemicals released by them, or the breakdown products of their metabolites [3].

These effects may be beneficial or harmful on both crop and weed species, from the release of biochemicals, known as allelochemicals, from plant parts by leaching, root exudation, volatilization, residue decomposition, and other processes in both natural and agricultural systems. Allelopathic inhibition is complex and can involve the interaction of different classes of chemicals, such as phenolic compounds, flavonoids, terpenoids, alkaloids, steroids, carbohydrates, and amino acids, with mixtures of different compounds sometimes having a greater allelopathic effect than individual compounds alone [4].

Many studies were carried out to determine the allelopathic interference between weeds and cultivated plants[5],[6], [7], [8] and [9], the extracts were either from fresh weeds [2], [10], [11] and [12] or dry weed biomass [13] and [14].

Many weeds were used in these experiments such as *Chenopodiumambrosioides L.*[15] and [16].

The main objectives of this research is to investigate the allelopathic effects of four weeds on seed germination, shoot and rootlength and total chlorophyll content of two important crops in Egypt.

2. MATERIALS AND METHODS

Laboratory experiment was conducted to determine the effects of weed extract of *Amaranthuscruentus*, *SinapisArvensis*,*Sisymbriumirio* and *Sonchus oleraceus* on seed germination and chlorophyll content of Wheat (*Triticum aestivum*) and Faba bean (*Vicia faba*).

2.1. Preparation of weed extract.

The healthy weeds were collected from Elhagger, El-Beheira governorate.Weed extracts were prepared according to Mali and Kanade [17]. 10g fresh leaves of each weed were homogenized in 10ml distilled water. Then it was filtered through Whatman No. 1 filter paper and volume was made to 100ml with distilled water. This solution was treated as stock solution (0.1g/ml), then 2.5, 5, 10 and 20% concentration of stock solutions were prepared for treatment. Wheat and faba

bean seeds were selected kept in plastic bowls containing 2.5, 5, 10 and 20% concentrations of weed extracts for 12 hours. Simultaneously control was made using distilled water.

2.2. Effect on germination.

The seeds were first sterilized then treated seeds (ten for wheat and five for faba bean)were kept in plastic bowls [12 cm in diameter] over filter paper at room temperature. The germination of seeds was monitored daily and the evaporated contents were compensated with distilled water if necessary. The number of germinated and non-germinated seeds was counted and final shoot and root length were measured at the end of the 21th day.Seeds whose root emerged were considered to be germinated.

2.3. Chlorophyll content measurement.

After 21 days leaves were cut into small pieces then 250 mg was homogenized by hand glass homogenizerusing 5 ml acetone. The resulted homogenate was filtered then the filtrate was completed with acetone to satisfy final volume of 50 ml, and the absorption of the clear solution was measured spectrophotometrically at 645 nm and 663nm according to Grodzinsky and Grodzinsky[18].

Chlorophyll a and b concentrations in mg/gm were calculated as follows:

Cha= (12.7 Ex 663-2.69 Ex645) x 0.2
ChB= (22.9 Ex 645- 4.68 Ex663) x 0.2

Where,

Cha and ChB are chlorophyll a and chlorophyll b concentrations in mg/gm leaves, respectively.Statisticalanalysis of data was carried outaccording to software version beta [19].

3. RESULTS AND DISCUSSION

The data in tables (1) and (2) showed that there was a significant difference in germination of both wheat and faba bean at extract concentrations 5, 10 and 20%.While in the case of least concentration (2.5 %) there was no significant difference in germination compared to the control except in the case of *Sisymbriumirio* and *Sochusoleraceus* in wheat, this results resembles those of Edrisi and Farahbakhsh[20] who found that *Sisymbriumirio*L. water extract had a great inhibitory effect on germination and primary growth of wheat.

The highest extract concentration (20%) gave no germination in both *Amaranthus cruentus* and *Sonchus oleraceus* in wheat as well as *Sochusoleraceus* in faba bean. Generally, it was observed that the used extract concentrations was inversely proportional to germination.

Table(1): Effect of weed extracts on Wheat germination

Extract concentrations (%)	*Sinapisarvensis*		*Sisymbriumirio*		*Amaranthuscruentus*		*Sonchusoleraceus*	
	number	%	number	%	number	%	number	%
2.5	8.67	86.70	7.67	76.70	8.33	83.30	8	80
5	7.33	73.30	7.33	73.30	6.33	63.30	7.00	70
10	5	50	6.33	63.30	4.33	43.30	4.33	43.30
20	1.67	16.70	3	30	0	0	0	0
control	9.67	96.70	9.33	93.30	9.33	93.30	9.33	93.30
Total seeds	10							
LSD0.05	1.29		1.68		1.65		1.06	

Table (2): Effect of weed extracts on Faba bean germination								
Extract concentrations (%)	*Sinapisarvensis*		*Sisymbriumirio*		*Amaranthuscruentus*		*Sonchusoleraceus*	
	number	%	number	%	number	%	number	%
2.5	4.66	93.2	4.33	86.6	4.33	86.6	4.66	93.2
5	4.33	86.6	3.33	66.6	3.33	66.6	4	80
10	2.33	46.6	2.66	53.2	1	20	1	20
20	0.66	13.2	1	20	0.33	6.6	0	0
control	5	100	5	100	5	100	5	100
Total seeds	5							
LSD0.05	1.09		0.81		1.27		0.88	

The data in tables (3) and (4) showed that all used concentrations caused significant reduction in wheat shoot and root length except in the case of shoot length by *Sinapis arvensis* at 2.5 and 5% extract concentration.

Table (3): Effect of weed extracts on Wheat shoot length								
Extract concentrations (%)	*Sinapisarvensis*		*Sisymbriumirio*		*Amaranthuscruentus*		*Sonchusoleraceus*	
	length	% R	length	% R	length	% R	length	% R
2.5	20.10	1.95	19.40	5.37	18.20	11.22	20.13	1.80
5	19.70	3.90	19.50	4.88	17.30	15.61	18.20	11.22
10	17.40	15.12	19	7.32	13.50	34.15	14.20	30.73
20	15.50	24.39	17.30	15.61	0	100.00	0	100
control	20.50							
LSD0.05	0.92		0.81		0.73		0.65	

Table (4): Effect of weed extracts on Wheat root length								
Extract concentrations (%)	*Sinapisarvensis*		*Sisymbriumirio*		*Amaranthuscruentus*		*Sonchusoleraceus*	
	length	% R	length	% R	length	% R	length	% R
2.5	21	4.98	20	9.50	19.50	11.76	20	9.50
5	20.40	7.69	20.10	9.05	20.20	8.60	20.17	8.73
10	18.90	14.48	19.20	13.12	14.80	33.03	14.60	33.94
20	18.60	15.84	16.90	23.53	0	100.00	0	100
control	22.10							
LSD0.05	0.85		0.62		0.71		0.68	

Table (5) illustrated that the lowest extract concentration (2.5%) did not cause any significant reduction in faba bean shoot length in the case of *Sinapis arvensis* and *Amaranthus cruentus* as well as 5% by using *Sisymbrium irio* extract, while all other concentrations caused significant decrease in shoot length.

Table (5): Effect of weed extracts on Faba bean shoot length								
Extract concentrations (%)	*Sinapisarvensis*		*Sisymbriumirio*		*Amaranthuscruentus*		*Sonchusoleraceus*	
	length	% R	length	% R	length	% R	length	% R
2.5	34.20	0.87	32.10	6.96	34.30	0.58	32.90	4.64
5	32.70	5.22	33.40	3.19	32.00	7.25	30.00	13.04
10	19.70	42.90	29.10	15.65	17.80	48.41	13.90	59.71
20	12.30	64.35	16	53.62	10.20	70.43	0	100
control	34.50							
LSD0.05	1.68		1.43		1.76		1.39	

Concerning with root length in faba bean, table (6) the least concentration did not cause any significant difference from the control in the case of *Sinapis arvensis* as well as 2.5 and 5% in the case of Sisymbrium*irio* extract.

Table (6): Effect of weed extracts on Faba bean root length

Extract concentrations (%)	*Sinapisarvensis*		*Sisymbriumirio*		*Amaranthuscruentus*		*Sonchusoleraceus*	
	length	% R	length	% R	length	% R	length	% R
2.5	18.10	8.12	19.40	1.52	18.40	6.60	17.30	12.18
5	17	13.71	19.30	2.03	18.50	6.09	17	13.71
10	15.20	22.84	14.40	26.90	13.40	31.98	11.30	42.64
20	9.60	51.27	12.10	38.58	7.80	60.41	0	100
control	19.70							
LSD0.05	0.91		0.75		0.89		1.01	

The data in tables (7) and (8) showed that the total chlorophyll content was affected by extract treatments as there were significant differences in most of used concentrations.

Table (7): Effect of weed extracts on wheat total chlorophyll content mg/gm fresh weight

Extract concentrations (%)	*S.arvensis*			*S.irio*			*A.cruentus*			*S.leraceus*		
	C.A	C.B	T.C	C.A	C.B	T.C	C.A	C.B	T.C	C.A	C.B	T.C
2.5	0.41	0.2	0.61	0.4	0.22	0.62	0.44	0.19	0.63	0.42	0.2	0.62
5	0.39	0.21	0.6	0.38	0.26	0.64	0.41	0.24	0.65	0.42	0.19	0.61
10	0.34	0.16	0.5	0.39	0.15	0.54	0.37	0.18	0.55	0.4	0.18	0.58
20	0.35	0.17	0.52	0.31	0.15	0.46	0	0	0	0	0	0
control	0.49	0.21	0.7									
LSD0.05			0.09			0.04			0.03			0.03

Table (8): Effect of weed extracts on faba bean total chlorophyll content mg/gm fresh weight

Extract concentrations (%)	*S.arvensis*			*S.irio*			*A.cruentus*			*S.leraceus*		
	C.A	C.B	T.C	C.A	C.B	T.C	C.A	C.B	T.C	C.A	C.B	T.C
2.5	0.66	0.3	0.96	0.68	0.29	0.97	0.61	0.26	0.87	0.62	0.24	0.86
5	0.58	0.24	0.82	0.62	0.27	0.89	0.54	0.23	0.77	0.59	0.25	0.84
10	0.5	0.2	0.7	0.45	0.24	0.69	0.51	0.21	0.72	0.58	0.22	0.8
20	0.45	0.17	0.62	0.37	0.21	0.58	0.36	0.17	0.53	0	0	0
control	0.69	0.33	1.02									
LSD0.05			0.16			0.06			0.08			0.04

C.A= Chlorophyll A, C.B= Chlorophyll B, T.C= Total chlorophyll content

The least significant reduction in wheat total chlorophyll content was determined in the case of *Amaranthuscruentus* at 5% extract concentration which caused 7.14% reduction, while the highest was found in the case of 20% extract concentration of *Sisymbrium irio* which caused 34.29% reduction compared to the control.

Concerning with faba bean also it was found that Sisymbrium *irio* at 5% extract concentration caused the least reduction (12.75%), while the highest reduction was determined in the case of *Amaranthuscruentus* at 20% extract concentration which caused 48.04% reduction in total chlorophyll content.

It has been suggested that some allelopathic compounds may interfere with thesynthesis of porphyrin, precursors of chlorophyll biosynthesis [21].

Allelochemicals in plant aqueous extracts might have inhibited chlorophyll in the tested Plants species by interfering with the biosynthesis of photosynthetic pigments or enhancing their degradation or through the integration of both [22].

Changes in chlorophyll contents in our studies are also supported by the findings of Inderjit&Dakshini[23] who cited allelochemical-mediated reduction in seedling photosynthetic pigments primarily due to phenolic acids.

4. CONCLUSION

From the previous data, we noticed that extract concentrations (10 and 20%) affects strongly the growth and length of both shoot and root of tested plants, also, total chlorophyll content of plant leaves was reduced. Since those results derived from laboratory experiments, which often differ from those obtained during field experiments [24], further research to test the phytotoxicity ofextracts under field conditions is under way.

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