SUPPRESSION OF SOME BROAD LEAF WEEDS THROUGH HERBICIDES AND PATHENIUM EXTRACT

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ABSTRACT

To study the potential of pre-emergence herbicides (pendimethalin, s-metolachlor) and Parthenium extract against three winter weed species including (Rumex crispus, Vicia ludoviciana and Anagallis arvensis), a pot based study was undertaken during October-November 2011 in the department of Weed Science, the University of Agriculture Peshawar, Pakistan. The experiment was laid out in a completely randomized design (CRD) having four replications. The results showed that all the studied parameters were significantly affected by all the treatments. Moreover, the lowest seed germination % and fresh and dry weed biomass were recorded for pendimethalin. In addition, the pre application of Parthenium extract also performed well against the studied weed species.

Key words: broad leaf weeds, herbicides, parthenium extract, weed suppression.

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INTRODUCTION

Weeds are adapted to varying climatic and soil conditions. These are distributed everywhere and no crop is free of weeds. Weeds rob crops for soil nutrients and water, and compete with them for light, carbon dioxide and growing space (Hashim and Marwat, 2002). Weed infestation is of great concern for farmers and are the major pests of crop husbandry and are managed properly for realizing higher yield (Hassan and Marwat, 2001). Therefore, herbicides are extensively used and recommended for weed management. However, due to deleterious effects of herbicides alternate methods are explored

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for weed management in all the crops. Among other options, allelopathy has been extensively reviewed in the last decades by conducting experiments to demonstrate the nature of allelopathic effects of weeds on crops (Putnam and Duke, 1974). Allelopathy may be used as a tool in weed management by applying the residues of allelopathic weeds or crop plants as mulches water extracts in the field (Drost and Doll, 1980). Many plant products are known to inhibit germination and growth of other plants. This is the property of all herbicides. Therefore, the plant product can be a possible alternative to synthetic herbicides and these may be used as natural herbicides (Mahmood and Cheema, 2004). The idea of natural herbicides is the occurrence of the allelopathic phenomenon, which refers to biochemical interactions between all types of plants. Several workers reported the possibility of using allelopathy in weed control (El-Rokiek *et al*., 2006). There are many weed species that are allelopathic in nature. It is viable weed management strategy but needs to be extensively studied under laboratory as well as in the field conditions. It is a natural and environment friendly technique which may prove an effective strategy for weed management and thereby increase crop yields. Among weeds, *Parthenium hysterophorus* L. is an aggressive weed having allelopathic effect and drastically retards the growth of many species (Tefera, 2002). Allelopathy seems to be an effective, economic and natural method as well as alternative of herbicides for weed control (Cheema *et al.*, 2005). Although we cannot eliminate the use of herbicides, their use can be reduced by exploiting allelopathy as an alternate weed management tool for crop production against weeds and other pests (Jamil, 2004). The existing methods of weed control are either expensive or hazardous to health or environment, and the application of chemical herbicides may cause pollution (Batish *et al.,* 2007), while hand weeding is laborious, intensive and costly. This situation demands that efforts should be made to develop an alternative technology for weed control. So allelopathy could be an appropriate potential technology for this purpose. Considering the importance of costs of weeds in terms of yield reduction, expenditure on their control and successful utilization of weeds allelopathic properties, the present study was designed to investigate the feasibility of using herbicides and weeds aqueous extracts as a weed control approach for controlling weeds.

MATERIALS AND METHODS

Pot experiment entitled "suppression of some broad leaf weeds through herbicides and pathenium extract" was conducted at the department of Weed Science, the University of Agriculture Peshawar Pakistan during October-November 2011. The experiment was conducted in pots using a completely randomized design (CRD) having four replications. Plastic pots of 12 cm height and 15 cm diameter were filled with soil and ten seeds of each *Rumex crispus*, *Vicia* sp. and *Anagallis arvensis* were planted in each pot. After sowing the 1st two pots were sprayed as pre-emergence through Stomp 330 EC (pendimethalin) and Dual gold 960 EC (s-metolachlor), respectively; while the Parthenium extracts were assigned to other two pots as pre-application and post-application, respectively. The fifth treatment was kept untreated for comparison. The experiment duration was 45 days after planting and the necessary data were recorded in this period.

Preparation of Parthenium extract

The Parthenium plants were collected from the district of Peshawar at the pre-flowering stage, then washed and dried in oven for 72 hours at 65 C^0. The dried leaves were separated from stems and ground in the laboratory in a mechanical grinder. A ground material of 110 g sample of Parthenium extract were soaked in I liter of distil water to make the solution. The water soaked material was filtered through muslin cloth to obtain the aqueous extract of Parthenium leaves.

Statistical analysis

The data recorded for the both experiments for each parameter were individually subjected to ANOVA using MSTATC Software Package to establish differences among the treatment means and the significant means were subjected to LSD test to decipher the differences among the treatment means.

RESULTS AND DISSCUSSIONS

Germination percentage

Statistical analysis of the data revealed that different treatments significantly ($\alpha<0.05$) affected the germination of all the test weed species at 15 days after application (Table-1). The results showed that the pre-application of both the herbicides (Stomp 330 EC and Dual Gold 960 EC) and Parthenium extract greatly inhibited the germination of the tested weed species as compared to the post application of Parthenium extract and control pots. The logic behind the same results from the Parthenium post application and control pot is due to the application of Parthenium extract after 30 days of seed planting in the pots. The species means showed non-significant results against different treatments at 15 days after application. The treatment means showed that lowest weed germination percentage (15.16 %) was recorded for Stomp and the highest (86.0%) was noted for both post application of Parthenium and control pot. As for interaction between weed species and treatment, their interaction was non significant. However, the highest value were recoeded for *Anagalis arvensis* ×

parthenium post-application (91.6%) while the lowest were recorded for *Anagalis arvensis* × Stomp 330 EC (9.3%). Similar results were reported by Deshpande *et al.* (2006) they observed highest weed control in pre-emergence application of Stomp 330 EC. These results are supported by the findings of Kadioglue *et al*. (2005). They reported inhibition in the germination rate and final germination of lentil, chickpea, and wheat with different plant part extracts of different broad and narrow leaf weeds.

Table-1. Germination percent of weed species affected by different treatments at 15 days after application

Treatments	Weed species			Means
	Vecia ludoviciana	*Rumix crisipus*	*Anagalis arvensis*	
Stomp 330 EC	20.3	15.9	9.3	15.16 cd
Dual gold 960 EC	25.7	20.6	20.5	22.26 c
Parthenium pre-application	45.3	52.7	43.9	47.3 b
Parthenium post-application	86.9	89.3	91.6	89.26 a
Control	80.8	90.4	88.4	86.53 a
Means	51.8	53.7	50.74	

$LSD_{0.02}$ for treatments: 23.52, $LSD_{0.02}$ for species: NS

Germination percentage at 30 days after application

The ANOVA revealed that like the germination % at 15 days after application the data of the weed germination % also significantly affected by different treatment (Table-2). This time the pot assigned to the post application of Parthenium also inhibit the germination of the tested weed species. The species means showed significant results to the different treatment and minimum germination % (46.92 %) was noted for *Anagallis arvensis* while; the maximum germination % (57.5 %) was recorded for *Vicia ludoviciana.* Similarly the treatment means also showed significant figures regarding germination % and the lowest (18.86%) germination % were found for Stomp 330 EC while maximum (92.6 %) germination % was calculated for control pot. Parthenium leaf extract (10 %) causes the failure of Eragostis seed germination (Tefera, 2002). However, the interaction between weed species and treatment was non significant. The maximum value was recorded for *Anagalis arvensis* × control (95.3) while the lowest germination percent were recorded for *Anagalis arvensis* × Stomp 330 EC (12.5 %). The result are similar to Maharjan *et al*. (2007) who observed that Parthenium leaf extract have inhibitory to the seed germination of wheat and other crops. The inhibitory effects of *P.*

hysterophorus L., on germination of many crops have been reported (Narwal, 1994). Weeds also exert allelopathic effects on crop seed germination and growth by releasing water-soluble compounds into the soil (Batish *et al*., 2007).

Table-2. Germination percent of weed species affected by different treatments at 30 days after application

Treatments	Weed species			Means
	Vecia ludoviciana	*Rumix crisipus*	*Anagalis arvensis*	
Stomp 330 EC	26.8	17.3	12.5	18.86 cd
Dual gold 960 EC	33.4	22.2	29.6	28.4 c
Parthenium pre-application	68.5	61.3	52.3	60.7 b
Parthenium post-application	66.6	52.9	44.9	54.8 b
Control	92.2	90.4	95.3	92.6 a
Means	57.5 a	48.82 b	46.92 b	

$LSD_{0.02}$ for treatments: 18.22, $LSD_{0.02}$ for species: 5.35

Fresh biomass (g)

The perusal of the data indicated that fresh biomass of tested species decreased with the application of different treatments (Table-3). Species means show that lowest fresh biomass of 6.28 g was observed for *Anagallis arvensis* and highest (8.04 g) was recorded in *Vicia ludoviciana*. The treatment means was also significant against tested weed species. The minimum (4.1 g) fresh biomass noted for Stomp 330 EC which was statistically at par with Dual Gold 960 EC that gave fresh biomass of (5.4 g). The maximum (13.4 g) fresh biomass was observed in the control pots. The interaction between weed species and treatment is non significant. Maximum value for fresh biomass were recorded for *Rumix crisipus* × control (12.9 g) while minimum value were recorded for *Anagalis arvensis* × Stomp 330 EC (1.9 g). Similarly, Ansar *et al.* (2009) also reported the lower fresh and dry weed biomass in the herbicide treated plots as compared to control treatments. Qasem (2006) also reported that application of herbicide significantly reduced weed biomass m^{-2}.

Table-3. Fresh biomass (g) of weed species affected by different treatments

Treatments	Weed species			Means
	Vecia ludoviciana	*Rumix crisipus*	*Anagalis arvensis*	
Stomp 330 EC	4.5	6.1	1.9	4.1 cd
Dual gold 960 EC	6.5	5.8	3.9	5.4 c
Parthenium pre-application	8.5	9.9	6.8	8.4 b
Parthenium post-application	8.3	9.2	5.9	7.8 b
Control	12.4	14.9	12.9	13.4 a
Means	8.04 b	9.18 a	6.28 c	

$LSD_{0.02}$ for treatments: 8.66, $LSD_{0.02}$ for species: 4.52

Dry biomass (g)

Statistical analysis of the data depicted that different treatments and weed species had significant effect on dry biomass of the test species (Table-4). The species means showed that the lowest dry biomass (0.72 g) was indicated for *Anagallis arvensis* while, the highest dry biomass (0.88 g) and (0.87 g) was recorded for *Vicia ludoviciana* and *Rumex crispus* respectively. The treatment means found also significant on dry biomass like fresh biomass and the minimum dry biomass of (0.55 g) was recorded for Stomp 330 EC which is statistically comparable with Dual Gold 960 EC that gave a dry biomass of (0.58 g). Moreover the maximum dry biomass (1.52 g) calculated for control pot. The interaction between weed species and treatment was non significant. Maximum value for fresh biomass was recorded for *Anagalis arvensis* × control (1.60 g) while the lowest were recorded for *Anagalis arvensis* × Stomp 330 EC (0.35 g). The result are similar to Marwat *et al.* (2008) who reported that by increasing concentaration of parthenium extract inhibit weed growth causes in decreasing dry biomass whether applied pre emergence and post emergence

Table-4. Dry biomass (g) of weed species affected by different treatments

Treatments	Weed species			Means
	Vecia ludoviciana	*Rumix crisipus*	*Anagalis arvensis*	
Stomp 330 EC	0.63	0.68	0.35	0.55cd
Dual gold 960 EC	0.72	0.58	0.44	0.58cd
Parthenium pre-appl.	0.77	0.89	0.63	0.76 b
Parthenium post-appl.	0.74	0.81	0.59	0.71 b
Control	1.53	1.44	1.60	1.52 a
Means	0.87 a	0.88 a	0.72 b	

$LSD_{0.02}$ for treatments: 1.05, $LSD_{0.02}$ for species: 2.25

CONCLUSION

In conclusion, the effect of parthenium as post application on different winter weeds was significant. Therefore, it can be used as a bioherbicide. However, care should be taken to avoid crop injury because the parthenium has a high allelopathic effect. Furthermore, the pre application of Stomp 330 EC is best for the control of the tested weeds because it showed promising results in term of weed suppression.

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