INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 4, No. 4, p. 126-30, 2014

RESEARCH PAPER OPEN ACCESS

Effect of saffron residue on redroot pigweed (*Amaranthus retroflexus* L.) and small bind weed (*Convolvulus arvensis* L.) control

Rouhollah Sohrabi, Bahram Mirshekari*, Farhad Farahvash

Department of Agronomy and Plant Breeding, College of Agriculture, Tabriz Branch, Islamic Azad University, Tabriz, Iran

Key words: Integrated weed management, minimum-tillage, saffron residue.

http://dx.doi.org/10.12692/ijb/4.4.126-130 Article published on February 20, 2014

Abstract

In a rotational sequence, when an allelopathic plant is left as a residue or mulch, especially in minimum-tillage systems could control subsequent weeds growth. To study effect of saffron residues on redroot pigweed (*Amaranthus retroflexus* L.) and small bind weed (*Convolvulus arvensis* L.) control an experiment was conducted under laboratory and green house conditions in a CRD with factorial arrangement at three replications. Studied treatments were leaves, corms and leaves+corms extracts in different concentrations (0, 1%, 2%, 3% and 4%). Statistical analysis of the results was carried out by MSTATC software and LSD was used for comparison of means. Extract of corm, leaves and corm plus leaves caused 24%, 24% and 53% reduction in final germination percentage of both weeds, respectively, compared to an un-primed check. These reduction values of seed germination have been probably arisen from effect of saffron allochemicals on enzymes activities responsible for germination. Redroot pigweed rate of germination affected more than small bindweed by concentration of saffron extract. At the higher extract concentration (4%), germination rate in redroot pigweed decreased up to 77%, but only 51% in small bindweed. Saffron extract could intensively decrease seedling dry weight of redroot pigweed (39%) rather than small bindweed. Seedling dry weight in *Convolvulus* was greater than *Amaranthus*, especially when the seeds were treated with saffron corm plus leaves extract. The farmers that rotate summer crops after saffron could incorporate saffron residues in the soil, and this can be use in controlling of some dominant weeds as an effective way in integrated weed management strategies.

* **Corresponding Author:** Bahram Mirshekari ✉ mirshekari@iaut.ac.ir

Introduction

An allelopathic plant can potentially be used to control weeds. In a rotational sequence, when an allelopathic plant is left as a residue or mulch, especially in minimum-tillage systems could control subsequent weeds growth. Also, allelopathy is characterised by a reduction in plant emergence or growth, and reducing their performance in the association3. *Crocus sativus* L., commonly known as saffron, is a perennial stem less herb of the *Iridaceae* family, widely cultivated in Iran and other countries, such as Spain and Greece. Biochemicals which are known as allelochemicals and can have beneficial (positive allelopathy) or detrimental (negative allelopathy) effects on the target organisms. Allelochemicals are a subset of secondary metabolites14 which are not required for metabolism (i.e. growth, development and reproduction) of the allelopathic organism. Allelochemicals with negative allelopathic effects are an important part of plant defense against herbivory.

Traditionally farmers have recognized the harmful effect of saffron debris on following crop for many countries. Leaves and corms incorporated in the soil inhibited the emergence and growth of tomato and wheat. So that, significant reduction in emergence, shoot length and it's dry weight were observed as the plant residues in the soil were increased, and the leaves were more effective than the corms (4). Study of Hosseini and Rizvi (2007) showed that effect of substances present in saffron corms was evident on percent and rate of germination, dry weight of radicle and plumule of wheat seeds. Characters under investigation were adversely affected by extracts of corms. It appeared that substances extracted from saffron corms showed toxicity effects reducing yield. Izadpanah *et al.* (2009) reported that by increasing saffron extract concentration, the percentage and the rate of germination, fresh weight and dry weight of *Cucurbita pepo* decreased dramatically. Garlic mustard is an invasive plant species and it's success in growth may be partly due to its excretion of an unidentified allelochemical that interferes with mutualisms between native tree roots and their mycorrhizal fungi.

The possible application of allelopathy in agriculture is the subject of much research. The main objective of this study was to determine effect of saffron residues on the weeds control.

Materials and methods

Experimental procedure

Study of the allelopathic effects of water extracts from saffron leaves and corms from 4-years-old plantation on germination and seedling establishment of redroot pigweed (*Amaranthus retroflexus* L.) and small bind weed (*Convolvulus arvensis* L.) was conducted under laboratory and green house conditions in a CRD with factorial arrangement at three replications. The leaves and corms were thoroughly washed, dried at 75°C and grounded (0.5 mm). Water extracts of materials were prepared according to Narwal11. Studied treatments were leaves, corms and leaves+corms extracts in different concentrations (0, 1%, 2%, 3% and 4%). The extracts were deposited on petri-dishes with 25 seeds.

Studied traits

After ten days studied traits were measured. Seedling vigor index (SVI) was calculated according to Abdul-Baki and Anderson2 by using below equation.

SVI = SDW × FGP;

Where, FGP and SDW are final germination percentage and seedling dry weight of weeds, respectively.

Statistical analysis

Statistical analysis of the results was carried out by MSTATC software and LSD was used for comparison of means.

Results and discussion

Mean squares of effect of saffron residues on primary growth of redroot pigweed and small bind weed have been indicated in Table 1. Extracts of corm, leaves and corm plus leaves caused 24%, 24% and 53% reduction in FGP of both weeds, respectively, compared to an

un-primed check (Fig. 1). In an experiment conducted by Alimoradi *et al.* (2008) leaves extract of saffron had significant effect on seed germination of *Rapistrun rogosum* and *Gypsophylla pillosa*. These reduction values of seed germination have been probably arisen from effect of saffron allochemicals on enzymes activities responsible for germination. Redroot pigweed rate of germination (GR) affected more than small bindweed by concentration of saffron extract. At the higher extract concentration (4%), GR in redroot pigweed decreased up to 77%, but only 51% in small bindweed. This is in good agreement with reports of Abbasi, which has been emphasized on higher effect of saffron extract on GR in smaller seeds than larger ones.

Table 1. Mean squares of saffron residues effect on primary growth of redroot pigweed and small bind weed.

		Mean Squares			
SV	df	FGP	GR	biomass production	SVI
Weed (A)	1	0.245	0.162	0.430**	0.829**
Saffron residues (B)	2	9.238**	0.895	0.008	0.714*
Concentration (C)	4	0.601	3.623**	0.007	0.017
A×B	2	0.735	0.181	0.007	0.920**
A×C	4	0.127	0.124	0.006	0.037
B×C	8	0.247	0.175	0.007	0.025
A×B×C	8	0.309	0.201	0.008	0.018
Error	60	2.163	0.801	0.008	0.235
CV(%)	-	19.38	9.18	12.7	17.71

*, ** mean significant difference at 5% and 1% probability levels, respectively.

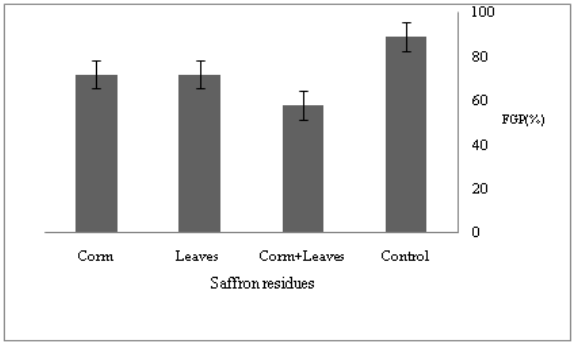

Fig. 1. Means comparison of weed FGP as affected by saffron residues.

Saffron extract could intensively decrease SDW of redroot pigweed (39%) rather than small bindweed. With consideration of greater effect of crop extract on GR in *Amaranthus*, this result was not un-expected. Turk and Tawaha (2003) reported that plant tissues in earlier growth stages are more susceptible to allelopathic compounds than later stages. SVI in *Convolvulus* was greater than *Amaranthus*, especially when the seeds were treated with saffron corm plus leaves extract. So that SVI in *Convolvulus* was 14.7, but only 8.5 in *Amaranthus* (Fig. 2). A study of *Kochia scoparia* in northern Montana showed that when *Kochia* precedes spring wheat (*Triticum aestivum*), it reduces the spring wheat's growth. Effects included delayed emergence, decreased rate of growth, decreased final height and decreased average vegetative dry weight of spring wheat plants. It seems that saffron residues could probably suppress primary growth of *Amaranthus* rather than *Convolvulus*.

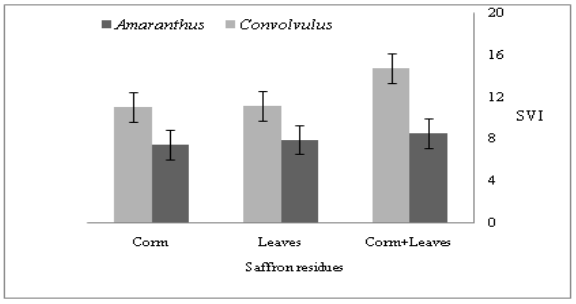

Fig. 2. Mean comparisons of weeds SVI as affected by saffron residues.

Conclusion

The studied weeds especially *Amaranthus* are more prevalent as a noxious weed in summer crops such as corn, sugar beet and soybean in Iran. The farmers that rotate these crops after saffron could incorporate saffron corm and leaves residues in the soil, and this can be use in controlling of some dominant weeds as

an effective way in integrated weed management strategies.

Acknowledgements

The authors would like to offer particular thanks to Islamic Azad University of Tabriz, Iran for kindly providing the materials studied. The corresponding author is also grateful to Prof. Dr. K. Arsalan, from Department of Agronomy, Turkey, for critically reviewing of the manuscript.

References

Abbasi F. 2005. Allelopathic effects of saffron corms on germination of several important crops. 4th World Congress on Allelopathy. 21-26 August, Wagga Wagga, NSW Australia.

Abdul – Baki AA, Anderson JD. 1973. Vigor determination in soybean by multiple criteria. Crop Science **13,** 630-633. http://dx.doi.org/10.2135/cropsci1973.0011183X001300060013x

Alimoradi L, Azizi G, Jahani M, Siah-Marguee A., Keshavarzi A. 2008. Allelopathy as an alternative method for weed control in saffron fields: A suitable approach to sustainable agriculture. Congress on Competition for Resources in a Changing World: New Drive for Rural Development, 7-9 October, Tropentag, Hohenheim. http://dx.doi.org/10.5772/54164

Asgharipour MR, Rashed Mohassel MH, Rostami MH, Eizadi E. 2006. The Allelopatic potential of saffron (*Crocus sativus* L.) on following crop in rotation. 2nd International Symposium on Saffron Biology and Technology, 28-30 October, Mashhad, Iran. http://dx.doi.org/10.6018

Esmaeili N, Ebrahimzadeh H, Abdi K, Safarian S. 2011. Determination of some phenolic compounds in *Crocus sativus* L. corms and its antioxidant activities study. Pharmacology Magazine **7(25),** 74–80.

Fraenkel GS. 2009. The raison of secondary plant substances. Plant Science **129,** 1466–1470.

Han C, Pan K, Wu N, Wang J, Li W. 2008. Allelopathic effect of ginger on seed germination and seedling growth of soybean and chive. Scientia Horticulturae **116,** 330-336. http://dx.doi.org/10.1016/j.scienta.2008.01.005

Hosseini M, Rizvi SJH. 2007. A preliminary investigation on possible role of allelopathy in saffron (Crocus sativus L.). ISHS Acta Horticulturae, 739.

Izadpanah F, Feizi T, Ghomi S. 2009. Evaluation of the effects of saffron (*Crocus sativus* L.) corm extract on growing indices of *Cucurbita pepo* var. *styrica*. 3rd International Symposium on Saffron, Krokos, Greece.

Kong CH, Li HB, Hu F, Xu XH, Wang P. 2006. Allelochemicals released by rice roots and residues in soil. Plant and Soil **288,** 47-56. http://dx.doi.org/10.1007/s11104-006-9033-3

Narwal SS. 1996. Suggested methodology for allelopathy field observations and methodology. Narwal, S.S., and Tauro, P. (Eds.). Scientific Publishers. Jodhpur 255-266.

Overcast MC, Brimhall JJ. 2000. Allelopathic effects of selected weed exudates on germination and early growth of *Triticum aestivum* in orthern Toole County, Montana.

Pitsikas N, Boultadakis A, Georgiadou G, Tarantilis PA, Sakellaridis N. 2008. Effects of the active constituents of *Crocus sativus* L., crocins, in an animal model of anxiety. Phytomedicine **15(12),** 1135-1139. http://dx.doi.org/10.1016/j.neulet.2012.08.081

Stamp N. 2003. Out of the quagmire of plant defense hypothese. The Quarterly Review of Biology **78(1),** 23–55.

Stinson KA, Campbell SA, Powell JR, Wolfe BE, Callaway RM, Thelen GC, Hallett SG, Prati D, Klironomos JN. 2006. Invasive plant suppresses the growth of native tree seedlings by disrupting belowground mutualisms. Plant Biology **4(5),** 140. http://dx.doi.org/10.1371/journal.pbio.0040140

Turk MA, Tawaha AM. 2003. Allelopathic effect of black mustard (*Brassica nigra* L.) on germination and growth of wild oat (*Avena fatua* L.). Crop Protection **22,** 673-677. http://dx.doi.org/10.1016/S0261-2194(02)00241-7