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ALLELOPATHIC EFFECTS OF IMPORTANT WEEDS ON GERMINATION AND GROWTH OF MAIZE (*Zea mays* L.)

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ABSTRACT

Allelopathic effects of different weeds' aqueous extracts on germination and seedling growth inhibition of Maize were studied. Treatments comprised of control (distilled water), Ammi visnaga (L.) Lam. Convolvulus arvensis L., Galium aparine L. and Trianthema portulacastrum L. shoot aqueous extracts were applied and were replicated four times using a completely randomized design with factorial arrangement. The results showed a significant inhibitory effects ($p<0.05$) of the shoot aqueous extracts of the above weeds on the germination of seed and plantlet growth of maize in comparison to the control. The largest seed germination inhibition 21.25% was recorded for the shoot aqueous extract of Trianthema portulacastrum L. in comparison with control that gave 97.25% germination. The root and shoot length of maize was greatly inhibited by the aqueous shoot extract of Trianthema portulacastrum L. (0.405) and (0.262), respectively in comparison with control treatment. The greater number of root was observed in the Petri dishes treated with shoot aqueous extract of Galium aparine L. while the smallest number was recorded in the Petri dishes treated with Trianthema portulacastrum L. Fresh weight of root is greatly affected by both the aqueous shoot extract of Convolvulus arvensis L. and Trianthema portulacastrum L. (0.065 and 0.112, respectively) and maximum fresh weight of root was recorded for the shoot aqueous extract of Ammi visnaga (L.) Lam. (0.300). The result recorded of fresh shoot weight for the aqueous shoot extract of Ammi visnaga (L.) Lam. is the smallest (0.197) as compared to control treatment (0.470). The dry shoot weight was affected by control treatment (0.0725) as compared to shoot aqueous extract of Galium aparine L. (0.767). And dry root weight was recorded lightest (0.052) for control and was noted the heaviest for the shoot aqueous extract of Galium aparine L. (0.302).

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INTRODUCTION

For protection of crop, its re-establishment and weed management, allelopathy always played an important role. Allelopathy may be defined as the stimulatory or inhibitory influence of plants on one another by producing some compounds which then runoff into the atmosphere. It is a Greek word which means mutual property of two or more plants (Rice, 1984; Lawrence *et al*., 1991). Allelochemicals are released by different plant parts naturally and artificially both (Ferguson and Rathinasabapathi, 2003). It has been reported that majority species of weed allelochemicals stop the crop production but sometimes also stimulate seed growth, germination and crop production (Narwal, 2004). Weed crop competition exist for moisture, nutrients, space and light and thus adversely affect crop yields (Kadioglue *et al*., 2005), on the germination and crop growth different parts of same weed have different allelopathic effect (Aziz *et al*. 2008).

One of the most important crops that are grown worldwide in the irrigated and rainfall areas is maize (*Zea mays* L.*)*. Maize is used as food and feed etc. and provides raw material for the industry (Nazir *et al*., 1994). Oil extracted from maize is gaining importance because having no cholesterol. By different industries like fermentation, foundry and paper textile, maize products like corn flakes, corn starch, lactic acid, alcohol, acetone and gluten germ cake are used or may directly consumed as food (Nazir *et al*., 1994). Corn product per unit area is still far below its yield potential obtained in other corn producing countries (MINFAL, 2007). The third most used cereal crop in Pakistan is maize (*Zea mays*) and it is grown in two seasons i.e. spring and autumn. In Pakistan, its production is less i.e. around 3 t ha^{-1} as compared to America (8.92 t ha^{-1}), Canada (7.82 t ha^{-1}), France (7.14 t ha^{-1}) and China (4.85 t ha^{-1}) (Anonymous, 2003).

Weeds are seen to be harming different cultivated crops and are able to cause production losses in crops such as maize (*Zea mays*) and wheat (Bhatt *et al*., 1994). Crop plants production and its quality are greatly affected by the weeds and results in financial losses (Alam, 1991). This study was carried out to achieve the objectives, to investigate the phytotoxicity of different extracts of weeds on

germination and relative growth parameters of maize, to assess the most toxic weed species on germination of maize seeds, to test susceptibility and tolerance of maize against shoots aqueous extracts of *A. visnaga, C. arvensis, G. aparine* and *T. portulacastrum.*

MATERIALS AND METHODS

A laboratory based experiment was conducted in the Weed Science (Botany) Research Laboratory, The University of Agriculture, Peshawar in order to see the allelopathic effects of different weeds i.e. *Ammi visnaga,* (L.) Lam.*, Convolvulus arvensis* L. *Galium aparine* L. and *Trianthema portulacastrum* L. shoot aqueous extracts on germination and plantlet growth inhibition of maize.

Mature plants of *Ammi visnaga* (L.) Lam., *Convolvulus arvensis* L.*, Galium aparine* L., and *Trianthema portulacastrum* L. was collected from the New Developmental Farm, The University of Agriculture Peshawar and their shoots was separately cut using cutter. The collected samples were shade dried for 15 days in the laboratory of Weed Science (Botany), The University of Agriculture, Peshawar. Those well dried shoots of weeds were then grinded using grinder into fine powder. The powder of shoots obtained from all these weeds each with 120g was separately soaked in one liter of distilled water at room temperature and was kept for 24 hours. Then its filtration was done to obtain the aqueous extracts.

The experiment was conducted using a Completely Randomized Design (CRD) with factorial arrangement, consists of four replications of each, keeping Maize seed as main factor and different weed extracts (shoot) as a sub factor. A total of 20 Petri dishes was used in this experiment, each with 9 cm diameter, each fixed with two layers of 9 cm filter paper.

Seeds of Maize were thoroughly cleaned and were dipped in aqueous solution of bleach (10%) to avoid any fungal contamination, before placing in the Petri dishes. Ten seeds of Maize were carefully placed in to each Petri dish with forceps. Shoot aqueous extract of weeds (5 ml) each was added in every Petri dish. However, 5 ml boiled water was applied to the (control) Petri dishes with the help of disposable syringes. All the Petri dishes were covered with their respective lids. They were number and were placed at room temperature in the Laboratory of Weed Science (Botany).

Treatments Applied		**Rates**
T1.	*Ammi visnaga* (L.) Lam.	120 g / L
T2.	*Convolvulus arvensis* L.	120 g / L
T3.	*Galium aparine* L.	120 g / L
T4.	*Trianthema portulacastrum* L.	120 g / L
T5.	Control/ distil water	---

During the experimentation, the data on the following parameters was recorded after every 48 hours.

- Seed germination (%) of Maize.
- Length of shoot per plant of Maize.
- Length of root per plant of Maize.
- Number of root
- Fresh mass of shoot / plant of Maize after four weeks.
- Fresh mass of root / plant after four weeks.
- Dry root mass / plant
- Dry mass of shoot / plant

Statitical analysis

The data was collected on the above parameters, tabulated and statistically analyzed using Analysis of Variance (ANOVA) and General Linear Model (GLM) techniques through computer software Minitab-17. Different means were separated using Least Significant Test (LSD).

RESULTS AND DISCUSSION

Germination percentage

Statistical analysis has shown significant ($p<0.05$) effect of shoot aqueous extracts of weeds on germination of maize. The treatment means showed that the maximum seeds germination percentage was achieved for the control which is 97.250% (Table-1) and the minimum was recorded for *Trianthema portulacastrum* L. which is 21.250% (Table-1). This indicated that shoot aqueous extract of *Trianthema portulacastrum* L. was most inhibitory to the seed germination of maize and the Maize seeds showed significant results to the different treatment. The shoot aqueous extract of *Galium aparine* L. (87.75%) and *Ammi visnaga* (L.) Lam. (84.75%) and *Convolvulus arvensis* L. (84.25%) are not significantly different from one another.

Table-1. Different treatments effect on germination (%) of maize seeds

Treat-ments	Extracts of Weeds	Germination Percentage
T1	Control	97.25 a
T2	*Ammi visnaga*	84.75 b
T3	*Convolvulus arvensis*	84.25 b
T4	*Galium aperine*	87.75 b
T5	*Trianthema portulacastrum*	21.25 c
$LSD_{(0.05)}$		5.099

Effect on root of maize

Statistical analysis has shown significant effect ($p<0.05$) of shoot aqueous extracts of *Ammi visnaga* (L.) Lam. *Convolvulus arvensis* L., *Galium aparine* L*.* and *Trianthema portulacastrum* L. on root length, number of roots, fresh and dry weight of roots of maize. The maximum radical length (9.85) observed in Petri dishes which received the distilled water i.e. control treatment (Table-2) while the minimum radical length (0.405) is observed in Petri dishes applied with the aqueous shoot extract of *Trianthema portulacastrum* L. (Table-2).These observation showed that aqueous extract of *Trianthema portulacastrum* L*.* is strongly inhibitory to the radical growth of maize. And the Petri dishes that were treated with aqueous shoot extract of *Galium aparine* L. also showed maximum root length (3.432) and the minimum root length is observed in Petri dishes received aqueous extract of *Ammi visnaga* (0.8350) and *Convolvulus arvensis* L. (1.650) and these two are not significantly different from one another. Our results are similar to Saeedipour (2010) who worked on effect of different parts of *Sinapis arvensis* on germination and development of wheat. The leaves and shoot extract were made to find out their effect on germination and dry weights of root and hypocotyls of seven day old plant. By raising the concentration of aqueous extract of different parts it's clearly stop the germination, weight and length of seedlings. The length of radical was more effected then the germination of seed.

Statistical analysis has shown significant ($p<0.05$) effect of aqueous shoot extract of weeds on the number of roots of Maize. The maximum number of roots (11.015) was observed in Petri dishes that received aqueous shoot extract of *Galium aparine* L. (Table-4) while the minimum number of roots of maize (1.715) was observed in Petri dishes treated with aqueous shoot extract of *Trianthema portulacastrum* L. (Table-2) and the effect of aqueous shoot extract of *Ammi visnaga* (L.) Lam. and *Convolvulus arvensis* L. are significantly

similar shown in (Table-2). And the Petri dishes that received control treatment also showed maximum number of roots of maize (Table-2).

Statistical analysis has shown significant ($p<0.05$) effect of aqueous shoot extract of weeds on fresh root weight of maize. The aqueous shoot extract of *convolvulus arvensis* L. showed inhibitory effect on the production of fresh root weight (Table-2) while aqueous shoot extract of *Ammi visnaga* (L.) Lam. showed maximum production of fresh root weight (Table-2) and the Petri dishes that received control treatment also have maximum fresh root weight. Control treatment extract of *Galium aparine* L. and extract of *Trianthema potulacastrum* L. they are not much different (Table-2).

Statistical analysis has shown significant ($p<0.05$) effect of aqueous shoot extract of weeds on dry root weight of maize. The lightest dry weight of root (0.052) was noted in control treatment (Table-7) while the heaviest dry mass of root (0.302) was recorded for aqueous shoot extract of *Galium aparine* L. (Table-7). And it is noticed that aqueous extract of *Trianthema portulacastrum* also have effect on dry root weight and has lightest dry weight (0.117) while effect of aqueous shoot extract of *Ammi visnaga* (L.) Lam. and *Convolvulus arvensis* L. are not significantly different from one another (Table-2).

Table-2. Different treatments effect on radical length, number of roots, fresh root weight and dry root weight of maize

Treat-ments	Extracts of Weeds	Root Length	Number of root	Fresh weight of root	Dry weight of root
T1	Control	9.8500 a	8.9000 b	0.2100 b	0.0525 d
T2	*Ammi visnaga*	0.8350 cd	7.1725 c	0.3000 a	0.2075 b
T3	*Convolvulus arvensis*	1.6500 c	6.7575 c	0.0650 d	02050 b
T4	*Galium aperine*	3.4325 b	11.015 a	0.1675 bc	0.3025 a
T5	*Trianthema portulacas-trum*	0.4050 d	1.7150 d	0.1125 cd	0.1175 c
$LSD_{0.05}$		0.9049	0.8712	0.0893	0.0454

Effect on shoot of maize

The ANOVA showed significant effect ($p<0.05$) of aqueous shoot extract of weeds. The treatment mean showed that shorter shoot length (0.262) was seen in Petri dishes that received the aqueous shoot extract of *Trianthema portulacastrum* L. while the longest shoot length (7.325) was observed in control treatment (Table-3). And the aqueous shoot extract of *Convolvulus arvensis* L. and *Galium aparine* L. are not significantly different (Table-3). But the Petri dishes that received aqueous extract of *Ammi visnaga* (L.) Lam. has also minimum shoot growth (1.335). This showed that aqueous

shoot extract of *Trianthema portulacastrum* L. has greatly inhibited the shoot length of maize (Table-3).

ANOVA showed a significant inhibitory affect of weeds on fresh shoot weight of Maize. The lightest (0.1975) fresh shoot weight was noted for aqueous extract of *Ammi visnaga* (L.) Lam. while the heaviest fresh shoot weight (0.47) was recorded in the control treatment (Table-6). Extract of *Convolvulus arvensis* L. *Galium aparine* L. and *Trianthema portulacastrum* L. are significantly similar (Table-3). These are in agreement with the results of (Aziz *et al.,* 2008), who prepared aqueous extracts of stem, leaves, fruits and roots of plant of cleavers *(Galium aparine*) and soil taken from its field, to find out the effect of cleaver plant on the wheat germination and its growth in the lab.

Statistical analysis has shown significant ($p<0.05$) effect of aqueous shoot extract of weeds of dry shoot weight of Maize. The largest dry shoot weight (0.767) of shoot was noted in treatment of *Galium aparine* L. and the smallest dry shoot weight (0.367) was recorded in controls treatment (Table-3). And the effect of aqueous shoot extract of *Ammi vesnaga* (L.) Lam. also yields lightest dry shoot weight while the aqueous extract of *Trianthema portulacastrum* L. has largest production (Table-3). Aqueous shoot extract of *Convolvulus arvensis* L. has minimum yield (0.4825).

Table-3. Different treatments effect on shoot length, fresh shoot weight and dry shoot weight of maize

Treat-ments	Extracts of weeds	Shoot length	Fresh weight of shoot	Dry weight of shoot
T1	Control	7.3250 a	0.4700 a	0.0725 e
T2	*Ammi visnaga*	1.3350 c	0.1975 c	0.3675 d
T3	*Convolvulus arvensis*	3.3750 b	0.3525 b	0.4825 c
T4	*Galium aperine*	3.3000 b	0.3450 b	0.7675 a
T5	*Trianthema portulaca-strum*	0.2625 d	0.3000 b	0.5700 b
$LSD_{0.05}$		0.4115	0.0743	0.0862

CONCLUSION

Allelopathic effects of different weeds aqueous extracts showed inhibitory effect on germination and seedling growth of Maize. All treatments were effective but shoot aqueous extract of *Trianthema portulacastrum* L. highly reduced the germination, roots and shoots growth. Thus, weed management *Trianthema portulacastrum* L. is very important in maize crop. Moreover, *Trianthema portulacastrum* L. could be used a potential bioherbecides in future.

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