

EFFECT OF DIFFERENT ALLELOCHEMICALS ON GERMINATION AND GROWTH OF HORSE PURSLANE

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Abstract

An experiment was conducted to investigate the potential of various allelopathic plants in Weed Science Laboratory Khyber Pakhtunkhwa Agricultural University Peshawar in 2010. The trial was replicated three times with Completely Randomized Design (CRD) having seven treatments i.e., Control (Tape water) sunflower (*Helianthus annuus* L.), sorghum (*Sorghum bicolor* L.), horse purslane (*Trianthema portulacastrum* L.), parthenium (*Parthenium hysterophorus* L.), datura (*Datura alba* L.), and eucalyptus (*Eucalyptus camadulensis* L.). Horse purslane seed germination was recorded for 15 days regularly and after 15 days root and shoot length data was recorded. The results revealed that *Helianthus annuus* water extract reduced germination (10.31%), shoot length (0.25 cm) and root length (0.28 cm) of horse purslane as compared to control which showed germination (86.72%), shoot length (1.81 cm) and root length (2.43 cm). The degree of percent germination inhibition of horse purslane was in the order of *Helianthus annuus* > *Parthenium hysterophorus* > *Datura alba* > *Sorghum bicolor* > *Eucalyptus camadulensis* > *Trianthema portulacastrum* > Control.

Introduction

In Pakistan horse purslane (*Trianthema portulacastrum* L.) is a serious weed of different summer crops (Nayyar *et al.*, 2001). The yield of maize was decreased (32%) by horse purslane infestation (Balyan & Bhan, 1989). In Pakistan this weed is mostly controlled through mechanical means, however this method is time consuming and very expensive (Brar *et al.*, 1995). Herbicides are the most common option for controlling horse purslane, it reduce its population by 70-80% in peanut (Grichar, 2008). The indiscriminate application of herbicides for weed control affects human health, agricultural products and pollutes our environment (Xuan *et al.*, 2004). Thus a new approach for controlling weeds should be searched which may be cost-effective, eco-friendly and easy-to-use. Allelopathy is a totally new eco-friendly concept in sustainable agriculture (Yongqing, 2005). Allelochemicals are extracted from different plants and may be used as eco-friendly alternate to synthetic herbicides. This experiment was conducted to examine the effect of various allelochemicals on germination and growth of horse purslane. The objective of the experiment was to find out suitable allelopathic plant for the management of horse purslane.

Materials and Methods

To study the effect of different aqueous extracts on germination and growth of horse purslane, an experiment was conducted during 2010 in Weed Science-Laboratory Khyber Pukhtunkwa Agricultural University Peshawar. For preparation of allelopathic aqueous extracts, plants of *Trianthema portulacastrum*, *Parthenium hysterophorus*, *Datura alba*, *Helianthus annuus*, *Sorghum bicolor* and *Eucalyptus camadulensis* were harvested at maturity. They were dried in oven for 72 hours at 70°C. The dried plants were then cut into small pieces, soaked in water for 30 hours at 25°C temperature in the ratio of 75 g herbage: 500 ml water. The mixture (herbage+water) was filtered through a muslin cloth to get the final allelopathic aqueous extract. The above mentioned method was adopted for all plants to obtain their aqueous extract. Completely Randomized Design (CRD) with three replicates was used for the experiment. All

Petri dishes were washed thoroughly with detergent using hot water to avoid fungal attack. Petri dishes having a diameter of 9 cm, were dried enough and a filter paper was placed in each Petri dish. Seed of horse purslane were soaked for 10 hours and then twenty seeds were put in each Petri dish. Aqueous extracts of all plants were applied @ 2 ml to each Petri dish, while in control treatment (Petri dish) tape water was used. Petri dishes were covered with lid and were placed at 35°C in growth chamber. The tape water was applied to each Petri dish as required to keep them moist. Germination data of horse purslane seed was recorded for 15 days regularly. After 15 days root and shoot length data was recorded with the help of a measuring tape. For analysis of recorded data MSTATC computer software was used and Fisher's LSD test was used for separation of significant means (Steel and Torrie, 1980).

Results and Discussion

Germination (%):- Statistical analysis of the data showed significant effect of different aqueous extracts on germination of horse purslane seeds. Minimum germination (10.31%) was recorded in *Helianthus annuus* aqueous extract treatment while maximum germination (86.72%) was recorded in control. Moreover, the effect of *Parthenium hysterophorus*, *Datura alba* and *Sorghum bicolor* were statistically at par to each other having 17.82%, 18.67% and 21.15% germination, respectively. The overall data revealed that *Helianthus annuus* allelochemicals successfully suppressed germination of horse purslane while lowest germinating ability was noticed in aqueous extract of *Trianthema portulacastrum*. The degree of percent germination inhibition was in the order of *Helianthus annuus* > *Parthenium hysterophorus* > *Datura alba* > *Sorghum bicolor* > *Eucalyptus camadulensis* > *Trianthema portulacastrum* > Control. The results are in line with the findings of Mahmood *et al.*, (2010) and Uygur *et al.*, (1997) who reported that aqueous extracts of *Helianthus annuus* can inhibit the germination of horse purslane significantly. Similarly, the weed germination was greatly suppressed by application of allelochemicals (Isfahan, 2007; Randhawa *et al.*, 2002; Harris, 2001).

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Table Effect of different aqueous extracts on germination (%), shoot length (cm) and root length (cm) of horse purslane.

Treatments	Germination (%)	Shoot length (cm)	Root length (cm)
Control	86.72 a	1.81 a	2.43 a
<i>Trianthema portulacastrum</i> L.	31.95 b	0.63 b	0.79 b
<i>Parthenium hysterophorus</i> L.	17.82 d	0.38 d	0.41 e
<i>Datura alba</i> L.	18.67 d	0.39 d	0.55 d
<i>Helianthus annuus</i> L.	10.31 e	0.25 e	0.28 f
<i>Sorghum bicolor</i> L.	21.15 d	0.49 c	0.57 cd
<i>Eucalyptus camadulensis</i> L.	25.00 c	0.50 c	0.61 c
LSD _{0.05}	3.47	0.04	0.05

Means not sharing a letter in common are differ significantly at P_{0.05}.

Shoot length (cm): Data regarding shoot length of horse purslane was significantly affected by aqueous extracts of all applied plants. Data showed that longest shoot length (1.81 cm) was recorded in control treatment while smallest shoot length (0.25 cm) was recorded in *Helianthus annuus* treatment. Moreover, shoot lengths recorded in *Parthenium hysterophorus* (0.38 cm) and *Datura alba* (0.39 cm) treatments were statistically at par to each other. Similarly, *Sorghum bicolor* and *Eucalyptus camadulensis* were also at par to each other having 0.49 cm and 0.50 cm shoot lengths, respectively. The overall data revealed that *Helianthus annuus* inhibited maximum shoot length as compared to all other treatments. These results are in agreement with the work of and Uygur *et al.*, (1997) and Cheema *et al.*, (2002) who reported that aqueous extracts of different weeds can decrease the shoot length of horse purslane.

Root length (cm): Statistical analysis of the data showed that there was significant effect of different aqueous extracts on root length of horse purslane. Longest root lengths of 2.43 cm and 0.79 cm were noticed in control and *Trianthema portulacastrum* treatments, respectively. Data further showed that smallest root length of 0.28 cm was recorded in *Helianthus annuus* treatment. Moreover, *Datura alba* and *Sorghum bicolor* were statically at par to each other having root lengths of 0.55 cm and 0.57 cm, respectively. The overall data revealed that maximum inhibition of root length was done by *Helianthus annuus* aqueous extract. Similar results were reported by Mahmood *et al.*, (2010) and Isfahan (2007), they were in view that aqueous extracts of *Helianthus annuus* can greatly inhibit root length of horse purslane.

Conclusion and Recommendations

The results indicate that aqueous extracts of all tested plants have ability to suppress germination, root and shoot length of horse purslane. However, *Helianthus annuus* aqueous extract can successfully inhibit germination and growth of horse purslane. Therefore, it is concluded that *Helianthus annuus* aqueous extract can be utilized as natural eco-friendly herbicide for the control of this noxious weed.

Further research is recommended on *Helianthus annuus* at different concentrations for inhibiting horse purslane germination and growth. Moreover, different parts of *Helianthus annuus* i.e., root, stem and leaf should be tested separately for its allelopathic properties and search should be done for finding the exact chemical which inhibits germination and growth of horse purslane.

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