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EFFECT OF AQUEOUS EXTRACTS OF SORGHUM ON HORSE PURSLANE (CARPET WEED)

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Abstract

A laboratory experiment was conducted to evaluate the Allelopathic potential of sorghum water extracts on germination and growth behaviour of *Trianthema portulacastrum*. In this experiment sorghum stem water extract were prepared at 20, 40, 60, 75, 85 and 100 % concentrations and distilled water is used in the control treatment. Among the different concentrations of Sorghum Water Extract (SWE), concentrations at 100%, 85% and 75% significantly inhibited the germination, shoot and root length of *Trianthema portulacastrum*.

Introduction

Allelopathy plays a significant role in agro ecosystems and affects the growth, quality and quantity of the products by the interactions among crops and weeds. Allelochemicals released from plant parts are largely classified as secondary plant metabolites (such as alkaloids, isoprenoids, phenolics, flavonoids, terpanoids, gluconolates, etc.). These chemicals may present in any parts of the plant. Some times these chemicals released together may exert toxicities in an additive or synergistic manner (Putnam and Tang, 1986). It has been shown that crop accessions possess strong allelopathic potential against the growth of a different weed species. Sorghum (*Sorghum bicolor* L.) is one of the allelopathic species that suppresses the growth of weeds also reported to injure the succeeding crops. Sorghum causes soil sicknesses and adversely affects the growth of the other crops in rotation systems. It is sometimes used in integrated pest management systems as green manure or cover crop to suppress weeds or as crop residue stubbles in no-tillage farming. Mature sorghum herbage is reported to posses number of water soluble allelochemicals (Putnam and Duke, 1974). It contains numerous allelochemicals with strong phytotoxic potential against weeds, itself and other crops. It was reported that at least nine water-soluble allelochemicals from mature sorghum plants that are phytotoxic to weeds (Cheema,1988).

Possibilities of controlling weeds with *Sorghum bicolor* were investigated and sorghum at maturity was found to decrease the dry weight of weed species *viz*., Lambsquarters, broad-leaf dock, swinecress, blue pimpernel, canary grass and bermuda grass by 49-71 per cent. Further, allelopathy can play an important role for controlling weeds through proper management of existing cropping systems by including this allelopathic crop (Cheema and Ahmad, 1992). Utilizing residue allelopathy as a management tool may be one of the more readily applicable uses of allelopathy in agroecosystems. Of all the possible strategies involving allelopathy for weed control, management of selectively toxic plant residues is the most successful, effective and readily available method. Allelopathy offers potential for biorational weeds control through production and release of allelochemicals from leaves, flowers, seeds, stems and roots of living or decomposing plant materials.

The water extracts of sorghum (*Sorghum bicolor*) were used in the present study contain a number of allelochemicals which are more effective to control weeds. Several allelochemicals are found in sorghum distributed in leaves, stems, roots, flowers and fruit (Santos, 1996). These include the chlorogenic acids, pcoumaric and p-hydroxybenzaldehyde found in *Sorghum halapense* (Abdoul-Wahab and Rice, 1967). Dhurrin found in *Sorghum halapense* (Nicolieur *et al*., 1988), Sorgoleone found in *Sorghum bicolor* and *Sorghum* *sudanense*(Netzly *et al*., 1988), strigol and sorgolactane both present in *Sorghum bicolor* (Hauck *et al*., 1992). According to Rice (1984) the effects of sorghum allelochemicals are concentration-dependent and selective. Sorgoleone has been characterized as a potent bioherbicide, which is inhibitory to broad leaf and grass weeds at concentration as low as 10µM (Netzyl and Buttler, 1986; Einhelling and Souza, 1992). The some of phenolic acids (p-hydroxybenzoic, p-coumaric, ferulic acids) inhibited hydraulic conductivity and nutrient uptake by roots of plants, resulting in growth inhibition (Blum *et a*l. 1999). The occurrence of allelopathic traits in sorghum has attracted the attention of scientists for their potential use in weed management.

Horse purslane (*Trianthema portulacastrum* L.) is one of the serious weeds of maize, pulses, sugar cane, cotton and summer vegetables. Seeds have mainly no dormancy and can germinate soon after they mature. Its physiological characteristics made it well known competitive weed for crops. It could reduce crop yields by 32 per cent (Balyan and Bhan, 1989). The different concentration of Sorghum water extract at higher concentration (100%) was reported to reduce the germination of *Trianthema portulacastrum* by 15 to 20 per cent also reduced the shoot and root length, while lower concentration (25%) of the extract promoted shoot length of *Trianthema portulacastrum* (Randhawa *et al*., 2002). The various botanicals extract of sunflower (*Helianthus annuus* L.), Sorghum (*Sorghum bicolor* L.), Parthenium (*Parthenium hysterophorus* L.), datura (*Datura alba* L.) and eucalyptus (*Eucalyptus camadulensis* L) had strong allelopathic effect on the germination of *Trianthema portulacastrum (*Muhammad Saeed *et al*., 2011). Therefore, the present study initiated to investigate the "Allelopathic potential of sorghum stem water extract on germination and growth behavior of carpet weed (*Trianthema portulacastrum*)" under laboratory condition.

Materials and Methods

The experiment was conducted in the laboratory, Department of Agronomy, Annamalai University, Annamalainagar to investigate the allelopathic potential of sorghum (*Sorghum bicolor* L.) aqueous extract on germination and growth behaviour of *Trianthema portulacastrum*. The experiment was carried out by following Completely Randomized Design (CRD) and replicated 3 times. The experiment consists of sorghum (*Sorghum bicolor* L.) plant as a donor plant and *Trianthema portulacastrum* as a receptor plant with seven concentrations *viz*.,T_1- Control (Distilled water), T_2- 20% sorghum water extract, T_3- 40% sorghum water extract, T_4- 60% sorghum water extract, T_5- 75% sorghum water extract, T_6- 85% sorghum water extract and T_7- 100% sorghum water extract.

Collection of Sorghum plant and weed seeds

Field grown sorghum plant sticks were harvested at maturity stage and the contaminants like soil on the plants were washing gently with tap water and kept for drying under shade till complete drying was ensured. The well dried plants were chopped into about one cm pieces with knife. Chopped plant material was dried in an oven at 70°C for 48 hours. The oven dried material was put in Willy mill and ground powder were kept in polythene bag with its mouth properly closed was used for preparation of aqueous extracts. The ground powder of sorghum plant was weighed at the ratio of 1 g herbage: 20 ml water (Hussain and Gadoon, 1981). 5g herbage was soaked in distilled water for 24 hours at room temperature (26-30°C) in a clean beaker. The water extracts were obtained by filtering the mixture through a Whatman no.42 filter paper. The filter was designated as a stock solution of 100% concentration and 20%, 40%, 60%, 75% and 85% were prepared by diluting it with distilled water. The water extracts were individually bottled and tagged.

Pre-treatment of weed seeds

Weed seeds were collected from the field and cleaned manually and physical purity was ensured. The weed seeds used in the experiment were pre-cleaned and treated by using 2 per cent sodium hypochlorite solution for 2-3 minutes as precautionary measure against pathogens and pollutants. The germination test was carried out in sterile petrdishes of 100×20 mm dimension. 25 surface sterilized seeds of *Trianthema portulacastrum* were sown in each petridishes and replicated 3 times. Whatman no.1 filter paper was used as medium of germination. Approximately five ml of solution or extraction was applied to each petridishes according to the treatment concentrations and the control treatment received 5ml of distilled water. Both treated and control petridishes were kept continuously moist by applying aqueous extraction whenever needed to avoid the drying out of seeds throughout the incubation period. The dishes were covered with aluminum foil sheet and kept at room temperature (26-30°C) for seed germination in the laboratory. The data on germination, shoot and root length and their weight were observed on 10 days after sowing and the data were subjected to statistical analysis.

Result and Discussion

The data regarding percentage germination of *Trianthema portulacastrum* was significantly influenced by all the treatments over the control (78.67%). Among

Table 1. Allelopathic effect of sorghum water extract (SWE) on germination percentage, shoot length (cm) and root length (cm) of *Trianthema portulacastrum* L.

Treatments	Germination percentage (%)	Shoot length (cm)	Root length (cm)
T_1 - (Distilled water)	78.67	6.50	6.38
T_2 - 20% SWE	60.00	5.01	2.31
T_3 - 40% SWE	56.00	4.82	2.29
T_4 - 60% SWE	46.67	3.78	1.78
T_5 - 75% SWE	32.00	2.51	1.13
T_6 - 85% SWE	31.67	1.96	0.44
T_7 - 100% SWE	28.00	1.03	0.27
SE.d	7.55	0.58	0.35
CD (p=0.05)	16.47	1.26	0.78

the treatments compared significant inhibition on germination percentage (28%) was observed with T_7 100% SWE concentration which was on par with the treatment T_6 85% SWE concentration (31.67%) and the treatment T_5 75% SWE concentration (32.00 %). Lower inhibition of germination was recorded with 20 % SWE concentration. The data regarding shoot length and root length of *T.portulacastrum* were significantly influenced by all the treatments over the control (shoot length (6.50cm) and root length (6.38cm)). Among the treatments compared 100 % SWE concentration produce significantly lower shoot length (1.03cm) and root length (0.27 cm) which was on par with shoot length (1.96 cm) and root length (0.44 cm) in T_6 85% SWE and shoot length (2.51 cm), root length (1.13 cm) in T_5 75% SWE concentration. Maximum shoot length and root length was observed at 20 % SWE concentration. The present study reveals that volatile compound released from sorghum leaf act as growth inhibitor for *Trianthema portulacastrum.* The phenolic compounds released from sorghum would inhibit cell division and thereby affect the germination and growth of the weed species. These findings are in line with Sangita Chandra *et al.*, (2013). It is concluded from the present study that higher concentrations of Sorghum Water Extract (SWE) (100% and 85%) significantly inhibited the germination, shoot and root length of *Trianthema portulacastrum.*

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