PHYTOTOXIC EFFECT OF MILLET (SEEDS EXTRACT) ON GERMINATION AND SEEDLING GROWTH OF CHICK PEA, RED BEANS AND MUNG BEANS IN PAKISTAN

IJAZ AHMED QURESHI, ALIA ABBAS*, IRAM US SALAM AND SAIRA QADIR

*****Department of Botany, Federal Urdu University of Arts, Science and Technology (FUUAST) Gulshan Iqbal Campus, Gulshan Iqbal (Karachi), Pakistan.*
*****Corresponding author E-mail: abbasalia@ymail.com*

Abstract

An experiment was conducted to study the allelopathic impact of bajra (seeds extract) on the seed germination, speed of germination and seedlings growth of chick pea, red beans and mung beans. Aqueous seeds extracts of bajra with different concentrations (5, 10 & 15%) were used to investigate its effect on all the three crops. It was observed that seeds extract of Bajra exhibit very strong allelopathic effect on all growth parameters at all concentrations over to control, however seedlings of mung bean was found to be more sensitive against bajra of 15% (seeds extract) with respect to chick pea and red beans. Whereas, seed germination of chick pea is most susceptible in comparison to mung bean and red beans.

Introduction

Pennisetum glaucum (pearl millet) is a warm-season grass. It is mostly grown in rainfed areas of Pakistan because it requires hot and dry climates to grow (Mahmood and Qureshi, 1984). It performs well in the soil that contains salinity and low pH where cereals like wheat, barely and sorghum can not survive. It is used as source of daily nutrition in poor population of drought areas.

Millet seeds are extremely nutritious (Chung & Pomeranz, 1985). Pearl millet is an allelopathic plant (Radhouane, 2014), Autochthonous pearl millet ecotype (KS) has strong allelopathic potential and may be used for biological control of weeds and insects (Radhouane, 2012). Pearl millet is most effective in reducing weeds as well as crops (Narwal, 1957). Root and shoot of pearl millet contain water soluble compounds which are autotoxic (Sexena *et al.*,1996). Allelopathic chemicals releasing from millet residues may inhibit seed germination, growth and yield of soya bean (Mallik and Tesfai, 1988). Stubble extracts of pearl millet were also found to inhibit the seed germination and shoot length of wheat and lentil (Narwal *et al.*, 1989).

Pearl millet has phytotoxic effect on different crops. It inhibits the growth parameters of different crops such as root length and shoot length.

Phytotoxic effects of pearl millet on pulses such as chick pea and mung beans have not been previously reported from Pakistan that's why we plan the present study.

Materials and Methods

Seeds of pearl millet were bought, sterilized and kept in incubator, which was adjusted at room temperature (25ºC). After drying seeds, ground by willey mill. This seeds powder was used for the preparation of aqueous extracts of different concentrations (5, 10 & 15 g/100mL). In order to get seeds extract, this seeds powder was soaked in distilled water for 24 hours. After 24 hours the aqueous extracts was centrifuged and then filtered by Whattman No. 1 filter paper. These extracts concentrations were used against three test crops *e.g., Cicer arietinum* (chick pea), *Phaseolus vulgaris* (red beans) and *Vigna radiata* (mung beans). Seeds of each test crop were surface sterilized by 0.1 % Mercuric chloride ($HgCl_2$). Ten sterilized seeds of each test crop were kept at uniform distance in Petri dish containing double layer of filter paper. The filter paper were moistened with the respective extracts (3mL) in alternate days while distill water was used for the control. Germination record was taken daily whereas, root and shoot elongation were noted at the end of the experiment. All the bioassays were consisting of five replicates. The experiment was terminated after fourteen days.

Statistical Analysis: The data of percent germination were analyzed as mean and standard error. The speed of germination was calculated by following formula (Khandakar and Bradbeer 1983).
Speed of germination: "S" = [N1/1 + N2/2 +N3/3 +- - - - - - - -] x 100
Where "S" is the speed of germination
N1/1, N2/2…..are the ratio of number of seed germinated per day.

Data were subjected to analysis of variance (ANOVA) followed by the least significant difference (LSD) test at P=0.05 and Duncan's multiple range test to compare treatment means (Sokal and Rohlf 1995)

Results and Discussion

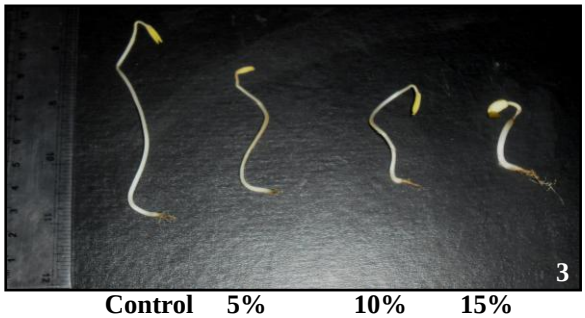
Allelopathic potentialities of *P. glaucum* (seeds extract) were tested against chick pea, red beans & mung beans (Table 1, 2 & 3). Aqueous seed extract possessed very strong allelopathic effect on seed germination, speed of germination and seedling growth of all the test crops at (5, 10 & 15%) concentration of extract over to control. Our results are an agreement with that of (Radhouane, 2014), who reported that pearl millet (seeds extract) shows allelopathic effect on seedling growth of wheat, barley and oat. Percent germination of all the test species was decreased at all concentrations of extracts with respect to control (Table 1, 2 & 3). In comparative studies of all the test crops percent germination of chick pea is found to be more influenced in each concentration of seeds extract, whereas, seed germination of red beans and mung beans were not as affected as that of chick pea (chick pea> red beans>mung beans). Our results support the findings of (Kumbhar and Dabgar, 2012), who said that *Chrozopora tinctoria* (aqueous seed extract) had allelopathic effect on seed germination of chick pea. Our findings are also an agreement with that of (Wang *et* al., 2009 and Msafri *et al.*, 2013), who proposed that in the preparation of aqueous extract of seeds certain allelochemicals are released from the seeds which effect the germination rate of cultivated crops. Speed of germination of all the test species was decreased substantially with the increasing level of concentration (seeds extract) over to control (Table 1, 2 & 3). Millet seeds contain many phenolics compounds which may lower down speed of seed germination (Radhouane & Fattouch, 2009 and Radhouane *et al.*, 2013). On comparison we found that the speed of germination of chick pea and red beans was significantly inhibited at all concentrations of seed extracts of millet with respect to mung bean. Al-Wabtan and Salama (2012), have reported that *Artemesia monosperma* seeds extract has inhibitory chemicals that influence the speed and seed germination of *Phaseolus. vulgaris.* Tanveer *et al.*, (2012) indicated that *Euphorbia dracunculoides* (seeds extract) influenced the seed germination, speed of germination and seedlings of chick peas. Shoot length of all the test crops was significantly ($p<0.05$) inhibited at all concentrations of extracts (Table 1, 2 & 3), it was observed that as the concentration of extract was increased shoot length gradually reduced. This is in accordance with Uludag *et al.*, (2006), who described that *P. glaucum* (seeds extract) either stimulated or inhibited the radicle and plumule elongation depending upon the level of concentration. Root length of all the test species showed similar trend as that of shoot length. Our findings agrees with the views of (Rice, 1984), who reported that allelochemicals are stimulatory at very low concentration and are inhibitory at higher concentration. When the root and shoot length of all the test crops were compared it was found that the root and shoot length of mung bean was significantly decreased amongst all. Hossain *et al.*, (2012), have also reported that seed aqueous extracts of *Moringa oleifera* reduces the seedling growth of mung bean. Our results are also in agreement with that of Shah *et al.*, (2013), who stated that aqueous seeds extract of *Ziziphus nummularia* reduces the shoot and root length of *Vigna radiata.*

Control 5% 10% 15%

Plate.No.1: Allelopathic effect of *Pennisetum glaucum* (seeds powder) on germination and seedling growth of *Cicer arietinum*.

Control 5% 10% 15%

Plate.No.2: Allelopathic effect of *Pennisetum glaucum* (seeds powder) on germination and seedling growth of *Phaseolus vulgaris.*



Control 5% 10% 15%

Plate.No.3: Allelopathic effect of *Pennisetum glaucum* (seeds powder) on germination and seedling growth of *Vigna radiata.*

Table 1. Effect of *Pennisetum glaucum* aqueous extract (seeds) on %germination, speed of germination and seedling length (cm) of *Cicer arietinum*.

Treatments	% Germination Mean ± S. E.	Speed of germination (%)	Shoot length (cm)	Radicle length (cm)
Control	96±2.4	62	10.02 a	5.46 a
5%	82±2.0	47	8.58 b	4.1 b
10%	70±3.1	39	6.1 c	3.24 c
15%	52±3.7	32	4.76 d	2.78 d

Table 2. Effect of *Pennisetum glaucum* aqueous extract (seeds) on %germination, speed of germination and seedling length (cm) of *Phaseolus vulgaris*.

Treatments	% Germination Mean ± S. E.	Speed of germination (%)	Shoot length (cm)	Radicle length (cm)
Control	96± 2.4	73	12.2 a	8.5 a
5%	84± 2.4	57	10.88 b	7.3 b
10%	76± 5.0	53	9.8 c	5.84 c
15%	72± 3.7	45	8.04 d	4.46 d

Table 3. Effect of *Pennisetum glaucum* aqueous extract (seeds) on %germination, speed of germination and seedling length (cm) of *Vigna radiata*.

Treatments	% Germination Mean ± S. E.	Speed of germination (%)	Shoot length (cm)	Radicle length (cm)
Control	100± 0	98	17.08 a	4.98 a
5%	92± 1.15	88	13.98 b	3.98 b
10%	85± 1.02	80	10.32 c	2.54 c
15%	80± 0.24	74	7.22 d	1.56 d

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