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INFLUENCE OF LEAF EXTRACT OF COMMON PURSLANE (*PORTULACA OLERACEA* L.) AND SODIUM CHLORIDE SALINITY ON GERMINATION AND SEEDLING GROWTH OF RICE (*ORYZA SATIVA*, L.CV.IR-8)

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ABSTRACT

Leaf aqueous extract of common purslane (*Portulaca oleracea* L.) was evaluated alone or in combination with NaCl to see its effect on germination and seedling growth of rice. There was no effect of leaf extract or sodium chloride salinity on the rice seed germination. It was observed that leaf extract alone and also 0.2% NaCl alone had no significant effect on shoot and root lengths, but leaf extract in combination with NaCl reduced the shoot length by 45% and 55.6% over the control The growth of root was affected in a similar way and the leaf extract with NaCl levels reduced the root lengths by 67.0 and 90.8% over the control. The NaCl level (0.4%) alone reduced the root length by 40.1%.The two combined stresses were more deleterious on seedling growth than the single stress. Over all, the root growth was affected more than the shoot.

Key words: common purslane, leaf extract, NaCl., rice, growth

INTRODUCTION

Plants influence growth of each other by means of exudates, leachates or from the residue incorporated in the growing medium (Colton and Einhellig, 1980; Rice, 1984). It is commonly assumed that reduction in main crops from weeds is the direct result of competition or of both acting together. Literature reveals that allelopathic interference by weed extracts has been established as one of the several factors that regulate the growth of plants (Alam *et al*, 1997., Duke *et al*., 2007., Rice, 1984). A variety of organic compounds have been implicated as the possible agents responsible for growth reduction and it has been asserted that in most cases, it is the collective action of several compounds, which cause the growth depression (Rice, 1984). Pope *et al* (1985) reported that root exudates of *Portulaca oleracea* reduced the seedling growth of soybean. Dharmaraj *et at* (1988) reported that root and shoot leachates of *Portulaca oleracea* caused the greatest reduction in sorghum seed germination. Phenolics were present in the leachates. *Portulaca oleracea* has been shown to have allelopathic potential against lettuce and *Trifolium* (Souto *et al*, 1990). Gressel and Holm (1964) reported decreased growth of alfalfa and radish due to residues of common purslane.

Common purslane (*Portulaca oleracea*) is a stout , annual, succulent weed with fleshy stems and thick leaves which is very common in warm areas (Horowitz, 1971). It is considered as one of the most serious weeds of 45 crops in 81 countries (Holm, *et al* 1969). The alleopathic effects of common purslane has been reported by several workers. Le Tourneau *et al* (1956) reported inhibitory effect of aqueous extract of *Portulaca oleracea* on germination , shoot and root growth of wheat. Germination is one of the most salt-sensitive stage and severely inhibited with increasing salinity both in glycophytes and halophytes (Sosa *et al*, 2005). Earlier studies on allelopathic effect of common purslane have been carried out under normal growth conditions, but there seems to be no report on crop plants growing under saline conditions. The objective of this study was to ascertain the effects of aqueous leaf extract of common purslane (*Portulaca oleracea* L.) in the presence or absence of NaCl on the germination and seedling growth of rice. Although this weed is not found in rice field , but its leaf extract was used for rice cultivar under laboratory experiment. This will also show the effect of two stresses (salinity and leaf extract) on the growth of rice.

MATERIALS AND METHODS

The fresh leaves of common purslane (*Portulaca oleracea* L.) were collected, washed thoroughly with distilled water and dried in an oven at 70^{o}C for 72 hours. The dried leaf samples were ground in a Wiley mill to pass through a 20 mesh screen. The aqueous leaf extract was prepared by soaking 5 g of the powdered leaf sample in 100 ml distilled water for 24 hours. Afterwards, the extract was filtered, using Whatman filter paper N0. 42 and then kept in a refrigerator in a reagent bottle. Five ml of aqueous leaf extract was added to 0.8% agar-gel, prepared in distilled water and supplemented with 0.0, 0.2 and 0.4% sodium chloride (NaCl) solution. Fifty ml of the agar media of each treatment was poured into a series of 100 ml capacity of glass bowls. A similar set, but without leaf extract was also

prepared to determine the NaCl effect and the bowl with only 0.8% agar gel was considered as control treatment. Good healthy rice (*Oryza sativa* L.) seeds of salt tolerant cultivars (IR-85) were selected and surface sterilized with 2% sodium hypochlorite solution for three minutes and then rinsed and washed thoroughly with distilled water several times and briefly blotted with fine quality filter paper. Ten healthy rice seeds per bowl were placed on the surface of the solidified agar gel contained in each bowl in a circle with the embryo side up and pointing inwards. The bowls were then covered with sterilized Petri dishes and incubated at 28^{o}C in an incubator . The bowls were kept in a randomized design with four replications. The experiment was terminated after five days of growth. Seeds were considered germinated when the emergent radicle reached 2 mm in length. The germinated seeds were counted. Their shoot and root lengths were measured. The Duncan Multiple Range Test was used to assess the treatment effects.

RESULTS AND DISCUSSION

i) Germination:

The leaf extract of common purslane and NaCl levels had no effect on rice germination (Table 1). The leaf extract in combination with NaCl also did not show any effect on seed germination. This shows that for germination phenomenon, there was a tolerance behavior in rice seed to bear the negative effects of two stresses, and thus there was no harmful effect of the treatments on seed germination. Seed germination is considered to be the most critical stage, especially under stress conditions. The first necessity of seed germination of any crop is water for hydrolysis of reserves, as a medium of translocation, hydration of enzymes for operational conformation of cell membranes and organelles and finally to provide the driving force for cell expansion induced by germination. The finding of Hadas (1977) had suggested that the germination rate and the final seed germination decreased with the decrease of water movement into the seeds during imbibition. It is also known that during germination rapid biochemical changes take place which provides the basic frame work for subsequent growth and development (Ahmed & Bolton,1988 ; Murata *et al,* 1968)..

Table 1. Effect of leaf extract of common purslane (*Portulaca oleracea* L.) and sodium chloride (NaCl) on germination and seedling growth of rice.

Treatment *(Leaf extract / NaCl)	Germination (%)	Shoot length (cm)	Root length (cm)
Control (no leaf extract, no NaCl)	95a	3.09a	4.79a
Leaf extract alone	93a	3.25a** (+ 5.21)***	4.87a (+ 1.67)
0.2 % NaCl alone	90a	2.94a (- 4.85)	5.16a (+ 7.72)
Leaf extract + 0.2% NaCl	87a	1.69c (- 45.30)	1.58c (- 67.01)
0.4% NaCl alone	92a	2.59b (- 16.18)	2.87b (- 40.08)
Leaf extract + 0.4% NaCl	87a	1.37d (- 55.66)	0.44d (- 90.81)

* 250 mg leaf extract / 50 ml of 0.8% agar gel.
** Means in a column followed by same letters do not differ significantly at 5% by DMRT.
***Values in parentheses indicate percent increase (+) or decrease (-) over control.

ii) Shoot and Root growth:

Leather and Einhellig (1985) and Einhellig (1986) found seedling growth bioassay often to be more sensitive than germination bioassay. The incorporation of leaf extract alone slightly increased the shoot length compared to control (Table 1). Sodium chloride (NaCl) levels (0.2 and 0.4%) alone and in combination with leaf extract decreased the shoot length and the maximum reduction of 55.6% was recorded with 0.4% NaCl in combination with leaf extract. Similarly leaf extract alone and 0.2% NaCl alone slightly increased the root length of the rice plant of 1.67 and 7.7 %, respectively when compared with control. It was also observed that both levels of sodium chloride (0.2 and 0.4%) in combination with leaf extract and 0.4% NaCl alone significantly decreased the root growth compared to control and the per cent reductions were 76, 90 and 40, respectively (Table 1). This phenomenon indicates that both the stresses together intensified the effects. Higher salinity levels have normally been found to decrease the seedling growth of agricultural crops (Alam *et al*, 1997; Grattan *et al*, 2002; Zeng and

Shannon, 2000a and 2000b; Walia *et al*., 2005). Leachates of dried common purslane have been reported to produce high inhibition of radicle growth of corn, bean and squash at 44, 54 and 57%, respectively. They identified oxalic acid in the extract (Anaya *et al*,1987).

It appears that leaf extract of common purslane contains leachable allelochemicals, which affects root more than shoot growth of rice. Leaf aqueous extract of common purslane and NaCl (0.2%) although had no inhibitory effect on seed germination, extract inhibited shoot and root growth, when added with 0.2% NaCl.

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