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Allelopathic Effect of Seed of Sweet Clover (*Melilotus indica L.*) and NaCl on Germination and Seedling Growth of Rice

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The effect of seed of sweet clover *(Melilotus indica L.)* was evaluated alone or in combination with NaCl on the germination and seedling growth of rice. As compared to control, there was significant inhibitory effect on germination and the maximum reduction of 25% was recorded when 0.4% NaCl and weed seed were applied together. The growth of both shoot and root significantly decreased under NaCl as well as with the placement of weed seed. Root growth was affected more than shoot. The effect of NaCl was accentuated in the presence of weed seed. Reduction in shoot length was 40 and 45% with weed seed alone and at 0.2% NaCl, respectively. The corresponding figures for root were 95% and 94%, respectively. It was concluded that weed seed of sweet clover in combination with NaCl had significant inhibitory effects on germination and seedling growth of rice.

Key words : Rice growth, NaCl, *Melilotus indica* L, Germination.

Introduction

Melilotus indica, commonly known as sweet clover, is one of the most important obnoxious weed in many countries of the world (Holm *et al* 1997) and is also a common weed of wheat, barley, sugarcane and winter vegetable fields in Pakistan. McCalla and Duley (1948) observed that soaking corn seeds in leaf aqueous extract of sweet clover for 24 h reduced germination and seedling growth in petri-dishes. Saraswat (1987) reported that sweet clover exhibited adverse allelopathic effect on the growth of rice crop.

Leachates from fresh material of sweet clover resulted in high inhibition of radicle growth of corn, bean and squash and reduction of 68% in the growth of corn has been reported (Anaya *et al* 1987). They reported that reduction is due to allelopathic potential of this weed. Winter (1961) found coumarin as a major component in leaf of sweet clover. Similarly, others (Isely 1960; Langer and Hill 1982; Nicollier *et al* 1985) have found 0-coumaric acid and melilotic acid as the major active compound in sweet clover. Other workers have reported the effect of weed seed and other parts on wheat and rice crops (Bhowmik and Doll 1979, 1984; Bhatia *et al* 1984; Alam *et al* 1997; Alam 1999; Alam *et al* 1999; 2001a & b).

Materials and Methods

Seeds of sweet clover (*Melilotus indica* L.) were collected from matured sweet clover plant growing in an agricultural land in Tando Jam. The collected seeds were cleaned and dried in the sun. The seeds were used in the experimental work of rice. At first a 0.8% agar gel was prepared and mixed thoroughly with 0, 0.2 and 0.4% sodium chloride (NaCl separately). Fifty ml of the salinized agar media from each treatment was poured into a series of 75 ml capacity of glass bowls. A similar set without seed of *Melilotus indica* and NaCl was also prepared and this was treated as control. Rice seed of cv. Shau-92 and weed seeds of sweet clover were first sterilized with 1% sodium hypochlorite (NaOCl) for three minutes and then rinsed with distilled water. Ten healthy seeds of rice were placed in circle on the surface of solidified agar gel in glass bowls. Similarly, weed seeds (0.5 g/bowl) were also placed carefully around the rice seeds in each bowl. A set containing no weed seed and no sodium chloride was also kept and treated as control. The glass bowls were covered with sterilized petri-dishes and kept in an incubator at 30°C for 120 h. The bowls were then randomized and each treatment was replicated four times. The experiment was terminated after 120 h. The germinated seeds were counted, the shoot and root length of rice seedlings were measured. The data were analyzed to evaluate treatment effects.

Results and Discussion

Placement of seeds of sweet clover alone and in combination with variable levels of NaCl significantly reduced the germination of rice. The significantly maximum reduction in germination of 25% over control was recorded 0.4% NaCl along with weed seeds, while at other treatments germination was less affected. The reduction may possibly be due to release of

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Table 1

Effect of seed of sweet clover (*Melilotus indica* L.) and NaCl on germination and seedling growth of rice* and its statistical analyses for ± S. E**

Treatments	Germination %	Shoot length (cm)	Root length (cm)
Control (no weed seed + no NaCl + Rice seed)	97 ± 5.77 (0.00)	3.71 ± 0.45 (0.00)	9.63 ± 0.54 (0.00)
Weed seed + Rice seed	83 ± 5.77 (-15)	2.25 ± 0.26 (-40)	0.44 ± 0.18 (-95)
0.2% NaCl + Rice seed	84 ± 5.58 (-13)	2.97 ± 0.40 (-20)	5.61 ± 0.26 (-42)
0.2% NaCl + weed seed + Rice seed	83 ± 5.77 (-13)	2.03 ± 0.09 (-45)	0.56 ± 0.05 (-94)
0.4% NaCl + Rice seed	80 ± 10.00 (-17)	2.30 ± 1.00 (-38)	5.61 ± 1.30 (-42)
0.4% NaCl + weed seed + Rice seed	73 ± 20.83 (-25)	1.58 ± 0.70 (-57)	0.38 ± 0.12 (-97)

*0.5 g/bowl in 50 ml of 0.8% agar; ** Values in parenthesis indicate per cent increase (+) or decrease (-) over control.

leachate from the sweet clover seeds. There are reports that incorporation of sweet clover and common lambsquarters inhibited the germination of cereal crops, wheat, red clovers, lucerne and perennial ryegrass (Gressel and Holm 1964). Similarly, aqueous extract from seeds of *Bothriochola pertusa* and other weed seeds reduced the germination of pearl millet *(Pennisutum americanum)*, Letuce *(Lecttuca sativus)*, mustard *(Brassica compastris)*, tomato *(Lycopersicon esculentum)* and chilli *(Capsicum annum)* (Hussain *et al* 1987).

Shoot and root length of rice were affected more than the germination at variable treatments compared to control. The weed seed alone, 0.2% NaCl, 0.2% NaCl + weed seed, 0.4% NaCl and 0.4 NaCl and 0.4% NaCl + weed seed reduced the shoot length by 40, 20, 45, 38 and 57 per cents, respectively. The differences between weed seed alone, 0.2% NaCl + weed seed and 0.4% NaCl were non-significant (Table 1). The effect of weed seed alone and in combination with 0.2 and 0.4% NaCl significantly reduced the root length by 95%, 94% and 97%, respectively compared to control. It was also observed that root length was affected more than the shoot length, irrespective of the treatments. This may be due to the fact that they were in direct contact with the allelochemicals. It is also obvious that the seeds of sweet clover do contain leachable allelochemicals, which have more profound affect on root than shoot. Unfortunately, there is no report on the effect of seed extract. Literature suggests that different parts of sweet clover contain large quantities of coumarin, 0-coumarin and melilotic acid as the major active compounds (Williams 1938; Isely 1960; Winter 1961; Langer and Hill 1982; Nicollier *et al* 1985). It seems that the mechanism suggested that by Avers and Goodwin (1956) and Tomaszewski and Thimann (1966) are both operative in this case. This suggests, that the inhibitory effect was due to some water soluble phytoxins compound leached from the weed seed.

This study clearly demonstrates that weed seeds of sweet clover alone or in combination with NaCl significantly reduced the germination and seedling growth of both shoot and root of rice. It is, therefore, necessary to uproot this weed from the experimental fields at the early stage of its growth.

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