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EEFECT OF *SARGASSUM* SEAWEED AND MICROBIAL ANTAGONISTS IN THE CONTROL OF ROOT ROT DISEASE OF SUNFLOWER

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Abstract

Seaweed viz., *Sargassum tenerrumum, S.swartzii* and *S.wightii* bused as soil amendment alone or with *Pseudomonas aeruginosa, Bradyrhizobium japonicum* and *Paecilomyces lilacinus* significantly ($p < 0.05$) reduced infection of *Macrophomina phaseolina* and *Fusarium solani* on sunflower. Seaweeds were found less effective or increased *Rhizoctonia solani* infection. Combined use of seaweed with *P.lilacinus* and *B.japonicum* showed better results against *M.phaseolina* and *F.solani* than their separate use. Greater plant height was produced where *P.aeruginosa* was used with *S.swartzii*. Use of *P.aeruginosa* with *S.tenerrumum* and *P.lilacinus* with *S.swartzii* produced greater fresh weight of shoot than other treatments.

Introduction

Use of seaweed for better plant growth has received the attention of Plant scientists throughout the world (Atzmon *et al.*, 1994; Staden *et al.*, 1995), since it contains greater potash and equal nitrogen as compared to farm yard manure (Chapman & Chapman, 1980). A wide variety of marine algae have been found to possess useful biochemical compound (Hopps & Levring, 1982). Antimicrobial activity of seaweed has also been reported (Pratt *et al.*, 1951). Seaweed collected from Karachi coast were found to inhibit the growth of fungi *in vitro* (Usmanghani & Shameel, 1986). Experiments were therefore carried out on the use of seaweed viz., *Sargassum* spp., in the control of root rot disease of sunflower. Effect of seaweed on the efficacy of biocontrol agent *Pseudomonas aeruginosa* was also studied and compared with *Bradyrhizobium japonicum* and *Paecilomyces lilacinus*

Materials and Methods

Seaweed viz., *Sargassum tenerrimum* J.Ag., *S. swartzii* (Turn.) C.Ag., and *S. wightii* Grev., collected from Bholeji, Karachi, were washed dried under shade and powdered in an electric blender and mixed in sandy loam soil, pH. 8.05 @ 0.5 and 1.0% w/w. The soil had a natural infestation of 3-11 sclerotia g^{-1} of soil of *Macrophomina phaseolina* as found by wet sieving and dilution technique (Sheikh & Ghaffar, 1975), 5-10% colonization of *Rhizoctonia solani* on sorghum seeds used as baits (Wilhelm, 1955) and 3500 cfu g^{-1} of soil of mixed population of *F.solani* and *F.oxys-*

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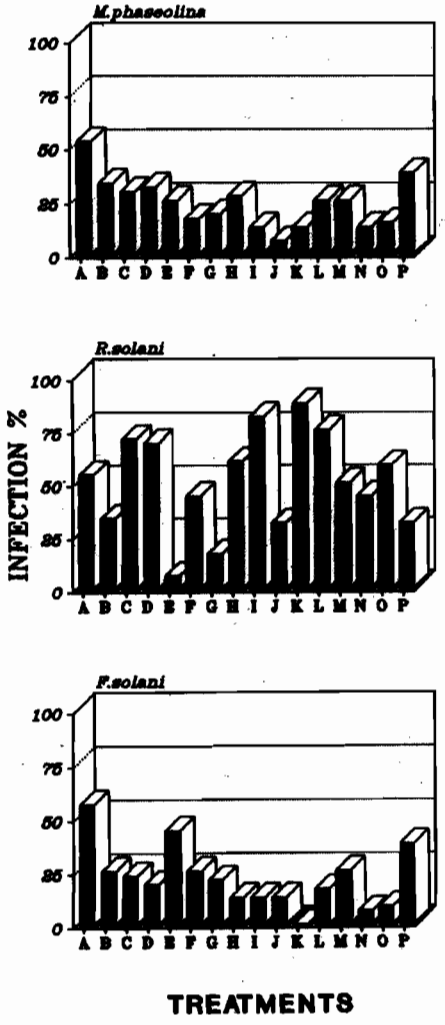

Fig. 1. Effect of *Sargassum* spp., and biocontrol agents in the control of root infecting fungi of sunflower: A= Control, B= *S.tenerrumum*, C= *S.swartzii*, D= *S.wightii*, E= *P.lilacinus*, F= *B.japonicum*, G= *P.aeruginosa*, H= B+E, I= B+F, J= B+G, K= C+E, L= C+F, M= C+G, N= D+E, O= D+F, P= D+G, $LSD_{0.05}$, Treatments = 24.4, Pathogens = 10.5

porum as assessed by soil dilution technique (Nash & Snyder, 1962). Amended soil was transferred in 8 cm diam., plastic pots @ 250 g per pot. Pots were watered daily and kept at 50% W.H.C. (Keen and Raczkowski, 1921). After three weeks, aqueous suspension of *P.lilacinus* (10^7 cfu ml^{-1}) multiplied on Potato Dextrose Agar, *P.aeruginosa* (10^8 cfu ml^{-1}) multiplied on Nutrient Agar and *Bradyrhizobium japonicum* (cfu 10^8 ml^{-1}) multiplied on Yeast Extract Mannitol Agar were drenched in each pot @ 25 ml/pot. Five seeds of sunflower (*Helianthus annuus*) cultivar HO-1 were sown in each pot. Each treatment was replicated four times and the pots were randomized on a screen house bench.

After 30 days growth plants were uprooted. After washing in tap water 5 cm long root pieces from each plant were cut, surface sterilized with 1% $Ca(OCl)_2$ for 3 minutes and transferred on to PDA plates containing penicillin (100000 units/litre) and streptomycin (0.2 gm/litre). Plates were incubated for 5 days at 28°C and incidence of root infecting fungi viz., *M. phaseolina*, *R. solani*, and *F. solani* were recorded. Data on plant height and fresh weight of shoots were also recorded. Data were analysed and subjected to factorial ANOVA followed by Least Significant Difference (LSD) according to Gomez & Gomez (1984).

Results

Soil amendment with seaweed viz., *S.tenerrumum*, *S.swartzii*, *S.wightii* and biocontrol agents viz., *P.lilacinus*, *B.japonicum* and *P.aeruginosa* significantly ($P<0.05$) reduced infection of *M.phaseolina* and *F.solani* on sunflower roots whereas *S.swartzii* and *S.wightii* increased *R.solani* infection. Use of *P.lilacinus* and *P.aeruginosa* were found more effective in controlling the infection of *R.solani* as compared to *B.japonicum* or *S.tenerrumum*. Complete control of *F.solani* infection was found where *P.lilacinus* was used with *S.swartzii*. Combined use of *P.lilacinus* with *S.wightii* showed better control of *M.phaseolina* and *F.solani* than their separate use. Greater plant height was produced where *P.aeruginosa* was used with *S.swartzii* followed by *B.japonicum* with *S.swartzii* and *P.lilacinus* with *S.wightii*. Maximum fresh weight of shoot (4.0 g/plant) was produced as compared to control (1.6 g/plant) where *P.aeruginosa* was used with *S.tenerrumum* and *P.lilacinus* with *S.swartzii* (Fig. 1)

Discussion

In the present study use of *Sargassum* spp., and biocontrol agents significantly (p,).05) reduced the infection of root infecting fungi on sunflower and increased plant growth. Paracer *et al.*, (1987) reported that use of selected seaweeds as biocontrol agent offers a potential novel approach to control population of plant parasitic nematodes. A wide varieties of marine algae have been found to possess useful biochemical compound which have been studied as potential biocidal and pharmaceutical agents (Colwell, 1983; Stein & Borden, 1984; Targett & Mitsui, 1979; Fenical, 1982). Of these *Ascophyllum nodosum* was found to reduce the fecundity of *Meloidogyne javanica* root knot nematode in tomato (Whapham *et al.*, 1995). Whereas *in vitro* growth inhibition of fungi by tropical seaweed (Welch, 1962) and antimicrobial activity of seaweed from the coast of Pakistan have been reported (Usmanghani & Shameel, 1986) but there does not appear to be any previous report on the use of seaweeds in the control of root infecting fungi of sunflower. In the present study combined use of *P.aeruginosa* (Weller, 1988) or *P.lilacinus* (Ehteshamul-Haque, *et al.*, 1990) which are used as biocontrol agents for the control of root rot pathogens showed better control of *M.phaseolina* and *F.solani* and increased plant growth when used with seaweed than either used alone. A significant increase in plant height and fresh weight of shoot of okra was observed where seaweed was used with rhizobia (Ehteshamul - Haque *et al.*, 1996). It would suggest that *Sargassum* spp., could be exploited and used as soil

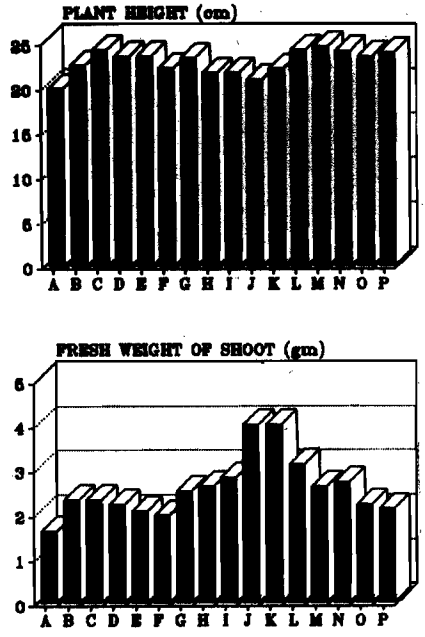

Fig. 2. Effect of *Sargassum* spp., and biocontrol agents on height and fresh weight of shoot of sunflower plant:
A= Control, B= *S.tenerrumum*, C= *S.swartzii*, D= *S.wightii*, E= *P.lilacinus*, F= *B.japonicum*, G= *P.aeruginosa*, H= B+E, I= B+F, J= B+G, K= C+E, L= C+F, M= C+G, N= D+E, O= D+F, P= D+G, $LSD_{0.05}$ = 3.1 $LSD_{0.05}$ = 1.6

amendment for the control of root infecting fungi of sunflower which may result in better plant growth. Use of seaweed with a compatible biocontrol agent also seems promising.

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