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USE OF *AVICENNIA MARINA* IN THE CONTROL OF ROOT INFECTING FUNGI ON OKRA AND MASH BEAN

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Abstract

Use of leaves, stem and pneumatophore of *Avicennia marina* in the control the root infecting fungi viz., *Fusarium* spp., *Macrophomina phaseolina* and *Rhizoctonia solani* on mash bean and okra plants was observed. Germination of seeds, shoot length, root length, shoot weight and root weight were significantly increased in both okra and mash bean where *A. marina* plant parts viz., stem and pneumatophore powder was used @ 5% w/w. Infection of *Fusarium* spp., *R. solani* and *M. phaseolina* was significantly reduced in okra and mash bean plants where soil was amended with *A. marina* plant parts powder @ 5% w/w. *A. marina* leaves powder was more effective in control of root infecting fungi followed by stem and pneumatophore.

Introduction

Mangroves are widespread in tropical and sub tropical regions, growing in the saline intertidal zones of sheltered coast lines. Pakistan has a coastline of about 1,000 km. The Indus River delta extends over 250 km from Sir Creek at the Indian Border and Karachi in the west with about 250,000 ha of mangroves (Khan, 1966; Mirza *et al*., 1983) and therefore it ranks as the fifth or sixth largest single mangrove area in the world (Snedaker& Snedaker, 1984). In Pakistan direct utilization of mangroves is restricted to only few types, of these fuel and fodder are the major ones. Plant disease causing organisms produces serious losses to crop plants and adversely affect the agricultural economy of a country (Hafeez, 1986). The primary diseases threatening crop production are due to fungi, actinomycetes, bacteria and nematodes. These are ubiquitous soil borne plant pathogens, which infect roots of plant, resulting in the death of plants. Since damage to plants by soil borne pathogens results from below ground infection, losses to crop plants from such diseases are underestimated and generally go unnoticed (Baker & Cook, 1974). The soil borne root-infecting fungui, *M. phaseolina* is reported to produce charcoal rot over 500 species of plants (Sinclair, 1982). *R. solani* exists as active mycelium in the soil, attacks over 2000 species of plants (Parmeter, 1970) and *Fusarium* species are known to attack a wide range of host plants in different parts of the world (Booth, 1971). Soil borne root infecting fungi cause seed decay, root rot and stem rot on crop plants. The association of root knot nematode and *Fusarium* spp., in tomato and papaya has often resulted in complete destruction of crop in Karachi and Malir area (Saeed & Ashrafi, 1971) because many crop plants have little or no resistance to certain pathogens. For the control of root rot root-knot disease complex, a combined use of fungicides and nematicides has been reported which decreases severity and only produce short term control (Easton *et al*., 1975).

Organic amendments are generally used for the improvement of crop plants and increasing agricultural productivity. Stone *et al*., in 2000 showed that addition organic matter amendments (organic wastes and plant residues) to field soils suppress a variety of soil borne diseases. Various organic amendments have a suppressive effect on plant parasitic nematodes (Alam, 1976, 1990). Of the organic substrates, neem cake (Alam,

1990; Abid *et al*., 1992) brown seaweed viz., *Stoechospermum marginatum* and *Sargassum tenerrium* (Siddiqui *et al*., 1998) and datura powder (Shahwar *et al*., 1994) have shown promising results in the control of root infecting fungi. Mehdi *et al*.,(1999 and 2000) showed that *Avicennia marina* and *Rhizophora mucronata* used alone or in combination with *Paecilomyces lilacinus* significantly suppressed root infecting fungi. Combs & Anderson (1949) have reported the presence of compounds like tannins, alkaloids, and polyphenols in mangroves which play an important role in the suppression of deleterious microorganisms (Jamale & Joshi 1998; Nishiyama *et al*., 1978; Ross *et al.*, 1980). Experiments were therefore carried out to study the effect of *Avicennia marina* in the control of root rot disease of okra and mash bean.

Materials and methods

Avicennia marina plant parts viz., leaves, stem and pneumatophore were collected from Sandpits, dried and ground in a grinder @ 0.1, 1 and 5% w/w. Soil used for the experiment was obtained from the experimental plots of the Department of Botany, University of Karachi and sieved through 2mm sieve to discard particles. The was soil transferred in 8cm diam., plastic pots @ 300gm/pot soil. The soil was sandy loam (Sand, Silt, Clay; 70, 19,11%), pH range from 7.5-8.1 with moisture holding capacity (MHC) of 24% (Keen & Raczkowski, 1922), total nitrogen 1.5% (Mackenzie & Wallace, 1954), total organic matter 2.4%. Soil had natural infestation of 1-3 sclerotia of *Macrophomina phaseolina*/g as found by wet sieving dilution technique (Sheikh & Ghaffar, 1975), 5-10% colonization of *Rhizoctonia solani* on sorghum seeds used as baits (Wilhelm, 1955) and 3000cfu of *Fusarium* spp., as assessed by soil dilution technique (Nash & Snyder, 1962). After ten days of soil amendment, 5 seeds of okra and mash bean were sown in each pot. Soil without plant parts served as control. There were three replicates of each treatment and pots were kept randomized in a screen house bench of the Department of Botany, University of Karachi, where soil was kept at 50% M.H.C (Keen & Raczkowski, 1922). After 30 days, plants of okra and mash bean were uprooted and root were washed in a running tap water, surface sterilized in 1% $Ca(OCl)_2$ for 3 min., and then five 1cm long root pieces were transferred on PDA plates containing penicillin @100,000/litre and streptomycin @ 20mg/l. Petri dishes were incubated for 5 days at room temperature to confirm infection of root infecting fungi.

Data were analyzed and subjected to analysis of variance (ANOVA) following the procedure as given by Gomez & Gomez (1984).

Results and Discussion

Germination of seeds mash bean and okra showed significant increased where *A. marina* plant parts powder was used @ 5% w/w (Table 1). Greater plant height was observed in okra and mash bean where *A.marina* plant parts powder @ 5% w/w was used (Table 1). *A. marina* plant parts significantly increased the fresh weight of mash bean (Table 1) where as shoot length, shoot weight, root length and root weight of okra plants were significantly increased ($p<0.001$). Maximum shoot and root weight were observed in okra where *A. marina* used @ 1, 5% w/w. *A. marina* @ 1, 5% w/w was more effective in the suppression of *Fusarium* spp., infection on mash bean and okra ($p<0.001$) (Table 1). There was complete suppression of *R. solani* infection in mash bean and okra ($p<0.05$) where soil was amended with *A. marina* stem powder used @ 5% w/w (Table 1). Similarly infection of *M.phaseolina* was significantly reduced when soil was amended

Table 1. Effect of *Avicennia marina* on the growth parameters and control of root infecting fungi of mash bean and okra plants.

Treatments	Mash bean							
	Growth				Parameter Infection %			
	Germination %	Shoot length (cm)	Shoot weight (gm)	Root length (cm)	Root weight (gm)	*Fusarium* spp.	*R.solani*	*M.phaseolina*
Control	100.00	13.86	0.37	3.93	0.07	88.88	88.88	66.66
0.1 % leaves	100.00	12.66	0.20	3.68	0.06	33.33	33.33	0.00
1 % leaves	100.00	11.20	0.10	3.91	0.03	88.88	44.44	33.33
5 % leaves	33.33	05.60	0.33	2.28	0.06	22.22	22.22	22.22
0.1 % stem	66.66	09.21	0.20	2.48	0.04	66.66	11.11	66.66
1 % stem	100.00	13.23	0.13	6.25	0.07	100.00	22.22	55.55
5 % stem	100.00	13.92	0.41	14.5	0.11	100.00	0.00	44.44
0.1 % pneumatophore	45.83	09.22	0.23	7.53	0.10	100.00	33.33	66.66
1 % pneumatophore	91.66	11.13	0.32	11.63	0.15	100.00	22.22	55.55
5 % pneumatophore	100.00	14.21	0.48	16.29	0.16	100.00	11.11	44.44
LSD0.05=	50.85	6.871	0.424	6.353	0.06	42.19	47.88	469.81
Treatments	**Okra**							
	Growth				Parameter Infection %			
	Germination %	Shoot length (cm)	Shoot weight (gm)	Root length (cm)	Root weight (gm)	*Fusarium* spp.	*R.solani*	*M.phaseolina*
Control	91.66	11.12	0.84	6.17	0.06	100	88.88	88.88
0.1 % leaves	91.66	03.65	0.39	3.52	0.06	100	44.44	100.00
1 % leaves	83.33	09.56	0.47	3.90	0.03	88.88	22.22	77.77
5 % leaves	66.66	12.16	0.95	6.03	0.17	22.22	0.00	22.22
0.1 % stem	79.16	07.20	0.57	4.18	0.05	100.00	44.44	100.00
1 % stem	91.66	12.99	0.78	3.13	0.06	100.00	44.44	100.00
5 % stem	100.00	14.26	1.00	6.22	0.62	55.55	0.00	55.55
0.1 % pneumatophore	83.33	12.82	0.58	5.50	0.03	100.00	44.44	88.88
1 % pneumatophore	91.66	13.05	0.35	5.75	0.03	100.00	11.11	100.00
5 % pneumatophore	95.83	14.23	0.96	6.69	0.04	88.88	22.20	33.33
LSD0.05=	36.37	04.40	0.26	3.05	0.067	28.27	43.60	32.83

with *A. marina* plant parts viz., leaves, stem and pneumatophore powder used @ 5% w/w in mash bean and okra ($p<0.001$) (Table 1). Present results showed that *A. marina* plant parts viz., leaves, stem and pneumatophore were more effective in the control of *R. solani* infection in mash bean and okra used @ 0.1, 1 and 5 % w/w. Of the different plant parts of *A. marina* used, leaves were more effective in the control of root infecting fungi viz., *Fusarium* spp., *M. phaseolina* and *R. solani* followed by pneumatophore and stem. Similarly Mehdi *et al* (2000) showed that *Rhizophora mucronata* used alone or in combination with *Paecilomyces lilacinus* significantly suppressed root infecting fungi. Mehdi *et al*., (2001) reported that *A.marina* and *R. mucronata* with or without *Pseudomonas aeruginosa* significantly reduced the root knot infection in tomato. There are reports where soil amendments with oil cakes like cotton cake and neem cake showed significant results in the control of root infecting fungi viz., *F. solani, M. phaseolina* and *R. solani* (Ehteshamul-Haque *et al*., 1995). Similarly Ehteshamul-Haque *et al* in 1998 used seaweeds *Stoechospermum marginatum*, neem cake and cotton cake which showed promising results in the control of root infecting fungi on sunflower. There is need for large scale use of *Avicennia marina* in the control of root rot disease of crop plants.

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