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CONTROL OF ROOT ROT-ROOT KNOT DISEASES OF COWPEA AND OKRA BY AQUEOUS PLANT EXTRACTS

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ABSTRACT

The different concentration of plant extracts of *Datura alba* Nees and *Cynodon dactylon* (L.) Pers. were used at 25, 50 and 100 % w/v to examined their effects in the control of root diseases in okra and cowpea. Highest concentration significantly enhanced the germination and growth parameters in terms of root length, root weight, shoot length and shoot weight in both cowpea and okra. Plant extract also reduced the infection of pathogenic fungi like, *Macrophomina phaseolina*, *Rhizoctonia solani* and *Fusarium* spp. on both okra and cowpea plants by increasing concentration at 25, 50 and 100 %. Plant extracts significantly suppressed formation of galls at 100 % extract of *D. alba* and *C. dactylon* on cowpea and okra. Both soil drenching and seed treatment with plant extracts showed significantly result in enhancement of growth parameters and reduction of root diseases.

Key words: *Cynodon dactylon*, *Datura alba*, cow pea, okra, root infecting fungi, *Meloidogyne javanica.*

INTRODUCTION

Plant disease causing organisms produce serious losses in crop plants and adversely effect the agricultural economy (Hafeez, 1986). The primary diseases threatening agents are fungi, actinomycetes, bacteria and nematodes. These are ubiquitous soil borne pathogens which infect root of plants 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 and Cook, 1974).

Of the soil borne root infecting fungi *Macrophomina phaseolina* (Tassi) Goid is reported to produce charcoal rot, seedling blight, root rot, stem rot and pod rot on more than 500 species of plants (Dhingra and Sinclair, 1978). *Rhizoctonia solani* Kühn exists as active mycelium in soil which is known to produce seed rot, damping off seedling, wilt and root rot on over 2000 species of plant (Parameter, 1970) and *Fusarium* species (Booth, 1971) are known to attack a wide range of host plants in different parts of the world. The root knot species cause severe damage to the most important vegetable crop grown under green house conditions and in open fields (Al-Saeedy, 1985; Taylor and Sasser, 1978).Control of plant parasitic nematodes has been difficult because of the enormous variety of suitable hosts (Goody *et al*., 1965). Most of the plants that accounted for the majority of human and animal food supply are susceptible to one or more of the root knot *Meloidogyne* spp. (Taylor and Sasser, 1978). In addition these nematodes have the ability to interact synergistically with other plant pathogens and cause up to 5-34% yield loses in vegetables in tropical climates (Sasser, 1980). Root knot nematode, especially *M.incognita* (Kofoid and White) Chitwood is the most abundant and damaging nematode in Pakistan infecting about 102-plant species (Maqbool and Shahina, 2001).

The problem of adequately protecting plants against the fungus by using fungicides has been complicated by the development of fungicidal resistance and /or adverse effects on growth and productivity of the host plant as well as on the accompanying microflora (Khaled *et al*., 1995).The presence of antifungal compounds, in higher plants, has long been recognized as an important factor in disease resistance (Mahadevan, 1982). Such compounds, being biodegradable and selective in their toxicity, are considered valuable for controlling some plant diseases (Singh and Dwivedi, 1987). *Cynodon dactylon* Pers. (Poaceae) and datura alba are valuable medicinal plants (Oudhia, 1999 a & b , Oudhia and Pal, 2000, Satyavati *et al.* 1976).

The present work is undertaken to examine the efficacy of extracts of *Cynodon dactylon* L. and *Datura alba* Nees for the control of root diseases and growth of cowpea (*Vigna unguiculata* (L.) Walp. and okra (*Abelmoschus esculentus* L.).

MATERIALS AND METHODS

Collection and extraction:

The leaves of *D. alba* Nees and *C. dactylon* L. were collected from the Department of Botany, University of Karachi. The leaves of plant were air dried, then powdered in an electric grinder. For extraction, 50 g powdered leaves were soaked in 500 mL sterilized distilled water for 24h, filtered with Whatman's No 1 filter paper and stored

at 4ºC in sterilized flasks. This extract served as a stock, an appropriate volumes of which were diluted to make 50 and 25 % concentrations. To avoid contamination and prospective chemical alterations, the extracts were used within 3-4 days.

Greenhouse experiment:

The soil used for the experiments was obtained from the experimental plot of the Department of Botany; University of Karachi was sieved through 2mm sieve to discard non soil particles and transferred in 8cm diam., plastic pots @ 300gm/pot. The soil used was sandy loam (Sand, Silt, Clay; 70, 19, 11%), pH range from 7.5-8.1 with moisture holding capacity (MHC) of 24.04% (Keen and Raczkowski, 1922), total nitrogen 1.5% (Mackenzie and Wallace, 1954), total organic matter 2.4%, soil had natural infestation of 4-6 sclerotia of *M. phaseolina* /g as found by wet sieving dilution technique (Sheikh and Ghaffar, 1975), 6-10% colonization of *Rhizoctonia solani* on sorghum seeds used as bait (Wilhelm,1955) and 3700 cfu g^{-1} *Fusarium* spp., as assessed by soil dilution technique (Nash and Snyder, 1962). In an experiment, seeds of cowpea (*Vigna unguiculata* L.) and okra (*Abelmoschus esculentus* L.) were surface sterilized with 1% $Ca(OCl)_2$ for three minutes, rinse thoroughly in running tap water and dried aseptically. The seeds were treated with plant extract of *D. alba* and *C. dactylon* at the rate of 25, 50, 100% separately for 4-5 minutes and in another experiment soil was drenched with 20ml suspension of plant extract, 5 seeds of cowpea and okra were sown in each pot separately. Untreated seeds and soil was served as control. There were three replicates of each treatment and pots were randomized on a screen house bench.

Inoculation of root knot nematode:

After one week seedling emergence, roots were infested with 2000 freshly hatched juveniles of *M. javanica* by making three holes around the seedlings. These juveniles were obtained from cultures maintained on roots of egg plants (*Solanum melongena* L.) by the process of Hussey and Barker (1973). After 60 days of growth, plants were uprooted. Plant growth parameters in terms of root length, shoot length and fresh weights of shoots and roots and number of knots were recorded.

Isolation of root infecting fungi:

Root infecting fungi were determined by cutting root pieces into 5 segments and after surface sterilization in 1 % $Ca(OCl)_2$ for 3 min., the segments were plated on potato dextrose agar plates supplemented with benzyl penicillin potassium salt (0.1 g/L) and streptomycin sulfate (0.2 g/L). After 1 week of incubation, infection percentage of fungi was determined.

Statistical analysis:

Data were analyzed and subjected to analysis of variance (ANOVA) and Duncan's multiple range test to compare treatment means, using the software "statistica" (Sokal and Rohlf, 1995).

RESULTS AND DISCUSSION

Results showed that when soil was drenched with *D. alba* at 100 %, plant length were significantly ($P < 0.01$) increased on cowpea whereas soil drenching with *C. dactylon* at 100 %, plant weight of okra was significantly ($P<0.01$) increased (Table 1). Seed treatment with *C. dactylon* at 100 % increased the root length on cowpea and okra however root weight was increased when *D. alba* was used as both seed treatment and soil drenching at 100 % on okra and cowpea (Table 1). Results also showed that seed treatment and soil drenching with both plant extracts at 100% significantly ($P<0.001$) reduced the number of galls per root system as compared to control (Table 2). Root infecting fungi like *Fusarium* spp., and *M. phaseolina* were significantly ($P<0.001$) reduced when *C. dactylon* and *D. alba* used as seed treatment and soil drenching at 25, 50 and 100 % on cowpea and okra plants. *R. solani* was significantly ($P<0.005$) reduced when soil and seed was treated with *D. alba* of 25 and 100 % extract. As the concentration of plant extract increased, reduction in root infecting fungi and number of galls per root system were observed. 100 % extract concentration was found to be better for reduction of root diseases on okra and cowpea followed by 50 and 25 %. Both *C. dactylon* and *D. alba* extracts and both methods were found to be equally effective for the suppression of root diseases.

Present results showed that *D. alba* and *C. dactylon* significantly suppressed root rot fungi viz., *Fusarium* spp., *R. solani* and *M. phaseolina.* The presence of antifungal compounds, in higher plants, has long been recognized as an important factor in disease resistance (Mahadevan, 1982). Such compounds, being biodegradable and selective in their toxicity, are considered valuable for controlling some plant diseases (Singh and Dwivedi, 1987).

Datura fastuosa have been reported to contain compounds Tigloidine (3*B*-tigloyloxytropane), 6*B*-tigloxytropane-a-ol, tropine (3a-hydroxy tropane), apoatropine, hyoscyamine, scopolamine (Shahwar *et al.,* 1995) which have nematicidal activity. *Cynodon dactylon* is reported to contain cynodin, hydrocyanic acid, and triticin (Watt and Breyer-Brandwijk, 1962). Results from the present study suggested that *D.alba* and *C.dactylon* plant extracts used as a potential approach for the improvement of plant growth and in the control of root rot and root knot diseases.

Table 1. Effect of different concentrations of plant extracts on growth promotion and in the control of root diseases of cowpea and okra plant.

Treatments	**Cow pea**				**Okra**			
	Shoot length (cm)	**Shoot Weight (g)**	**Root length (cm)**	**Root Weight (g)**	**Shoot length (cm)**	**Shoot Weight (g)**	**Root length (cm)**	**Root Weight (g)**
Control	13.40	1.05	9.55	0.67	9.4	0.31	4.86	0.018
25% *Datura alba* (Seed treatment)	25.57	1.63	24.3	1.13	12.36	0.53	5.15	0.02
25% *D.alba* (soil drenching)	25.83	1.80	27.1	1.32	13.75	0.4	7.93	0.02
50% *D .alba* (seed treatment)	23.45	1.40	25.6	1.26	13.7	0.47	6.16	0.03
50% *D.alba (* soil drenching)	23.89	1.83	29.2	1.45	14.76	0.40	8.86	0.026
100% *D.alba* (seed treatment)	24.20	1.32	29	1.53	20.76	0.59	6.83	0.040
100% *D.alba* (soil drenching)	26.93	1.85	33.8	1.94	14.03	0.62	9.5	0.036
25% *Cynodon dactylon* (seed treatment)	20.62	1.13	34.1	1.34	14.43	0.52	6.88	0.027
25% *C.dactylon(* soil drenching)	20.97	1.35	31.6	1.37	12.98	0.51	5.5	0.018
50% *C.dactylon* (seed treatment)	21.83	1.24	33.2	1.35	15.79	0.52	7.14	0.024
50% *C.dactylon* (soil drenching)	22.86	1.25	24.9	1.33	13.31	0.64	7.01	0.005
100% *C.dactylon* (seed treatment)	22.64	1.33	37.3	1.86	15.41	0.56	10.08	0.022
100% *C.dactylon* (soil drenching)	23.74	1.49	36.1	1.45	17.35	0.96	9.08	0.037
LSD $_{0.05}$	5.08	0.61	2.878	1.11	4.38	0.27	4.42	0.04
Significant level p	**	NS	***	NS	**	**	NS	NS

*, $p<0.05$; **, $p<0.01$; ***, $p<0.001$; NS = Non-significant.

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Table 2. Effect of different concentrations of plant extract in the control of root rot fungi and number of galls on cow pea and okra.

Treatments	Cow pea				Okra			
	***Fusarium* spp**	***Macrophomina phaseolina***	***Rhizoctonia solani***	**Number of galls / root system**	***Fusarium* spp**	***Macrophomina phaseolina***	***Rhizoctonia solani***	**Number of galls / root system**
Control	100	100	100.0	62	100	100	100	65
25% *Datura alba* (Seed treatment)	11.1	11.1	100.0	44	44.4	88.86	11.1	44
25% *D.alba* (soil drenching)	11.1	0	88.86	44	77.76	66.63	88.66	44
50% *D .alba* (seed treatment)	0	0	100.0	35	66.63	88.86	66.63	37
50% *D.alba* (soil drenching)	0	0	88.86	36	55.5	77.76	77.766	35
100% *D.alba* (seed treatment)	0	0	100.0	26	55.533	0	66.63	25
100% *D.alba* (soil drenching)	0	0	77.76	26	66.63	0	100	25
25% *Cynodon dactylon* (seed treatment)	11.1	0	100	48	77.76	77.76	100	45
25% *C.dactylon* (soil drenching)	0	11.1	88.86	44	55.55	77.76	100	44
50% *C.dactylon* (seed treatment)	0	0	100.0	35	66.63	77.76	77.76	33
50% *C.dactylon* (soil drenching)	0	0	88.86	36	0	77.76	66.63	37
100% *C.dactylon* (seed treatment)	0	0	100.0	26	0	0	88.66	28
100% *C.dactylon* (soil drenching)	0	0	88.86	27	11.1	0	66.63	25
$LSD_{0.05}$	15.563	12.166	28.003	2.15	46.53	36.384	45.300	3.86
Significant level p	***	***	NS	***	***	***	*	***

*=p<0.05; **=p<0.01; ***=p<0.001; N.S = Non-significant.

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