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EFFECT OF CERTAIN PLANT PRODUCTS AGAINST *MACROPHOMINA PHASEOLINA* (TASSI) GOID. CAUSING DRY ROOT ROT IN SUNFLOWER

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Abstract

Charcoal rot disease of sunflower caused by *Macrophomina phaseolina* is becoming more serious inflicting a significant loss in seed yield. Experiments were conducted to reduce the sclerotial germination and disease incidence by *Macrophomina phaseolina* using ecofriendly natural products. Sclerotial germination of *M. phaseolina* was completely inhibited by garlic bulb extract, followed by tulsi leaf extract which recorded 75.83 percent inhibition. Carbendazim recorded drastic reduction in PDI of sunflower and was on par with garlic bulb extract. The same trend was seen on the population of *M. phaseolina* in the rhizosphere soil. In pot culture studies, natural products viz., garlic bulb extract followed by turmeric powder significantly increased biometrics and higher seed yield of sunflower when compared to inoculated control and fungicidal treatments.

Keywords: *Macrophomina,* sclerotia, percent disease index, rhizosphere, garlic bulb.

Introduction

Sunflower (*Helianthus annuus* L.) presently is one of the largest oil resources in the world next to soybean, rapeseed and mustard. Sunflower seed oil has a production of about 18% of the world's edible vegetable oils (Faiz Hussain *et al*., 2010). Sunflower seed has an oil recovery of 35 per cent and is high in vitamin E and low in saturated fat. Sunflower is subjected to attack by a variety of fungal pathogens which affects its yield and oil quality (Sangawan *et al*., 2005). Among the many diseases, charcoal rot disease caused by *Macrophomina phaseolina* (Tassi) Goid. is becoming more serious, inflicting an estimated loss of 36.8 – 79.2 per cent seed yield (Theradimani and Hepziba, 2003).Various disease management methods have been implemented to combat and eradicate charcoal rot disease caused by *M. phaseolina* (Muhammed Anis *et al*., 2010). Use of plant products for the management of fungal diseases is considered as a good alternative to synthetic fungicides (Sharma & Kumar, 2009). Certain plant-derived compounds are found to be highly effective against fungicide-resistant microorganisms (Raja and Kurucheve, 2004). Hence, experiments were conducted to assess the efficacy of certain plant extracts against *Macrophomina phaseolina* causing dry root rot in sunflower.

Materials and Methods

Effect of natural products on the of sclerotial germination of *M. phaseolina* (Sclerotia soaking method)

Twenty five uniform sized sclerotia from ten days old culture of *M. phaseolina* were picked and placed on a cavity slide containing respective natural product extracts at 20 per cent concentrations and the cavity slides with sterile distilled water served as control. The observations on the germination and the number of germ tubes produced were recorded 24 h. after incubation (Dhingra and Sinclair, 1978).

Seedling Growth and Vigour

Ten normal seedlings were selected at random from each replication. The shoot and root length was measured from the collor to the tip of the largest primary root and the respective mean values were recorded. The vigour index (V_I) was calculated by using the formula suggested by Adeleye and lkotum (1973).

V_I= (Root length+Shoot length)xGermination percentage

Yield

Harvesting was done on 90 DAS and number of heads, weight of the heads, head diameter and seed yield were recorded.

Disease Index

The disease intensity was graded and calculated as per ICRISAT, (1988). The percent disease index (PDI) was worked out as per the following formula.

$$\text{Percent disease index} = \frac{\text{Number of plants infected}}{\text{Total no. of plants observed}} \times 100$$

Result

Effect of natural products on sclerotial germination of *M. phaseolina*

The results presented in Table 1. shows the efficacy of the natural products in inhibiting the germination of the sclerotia of *M. phaseolina*. Among the natural products, hot water extracts of garlic bulb completely inactivated the sclerotia after 2 h of soaking at 20 per cent conc. This was followed by tulsi leaf extract and turmeric powder extract which recorded (75.83 & 65.40%) inhibition of sclerotial germination. The fungicide carbendazim recorded a 100 per cent inhibition of sclerotial germination. Sclerotium treated with leaf extracts of *Vitex negundo* showed least inhibition producing 10.22 germ tubes.

Table 1: Effect of plant products on the sclerotial germination of *M. phaseolina*

Treatments	Conc. (%)	Sclerotial germination (%)	Per cent inhibition	No. of germ tubes sclerotium^{-1}	Per cent reduction
Garlic bulb extract	20	0.00	100	--	100
Turmeric powder extract	20	33.33	65.40	08.33	50.68
Tulsi ocimum	20	23.28	75.83	05.23	69.03
Vitex negundo	20	41.88	56.52	10.22	39.49
Calotropis gigantea	20	38.33	60.40	08.33	50.68
Azadirachta indica	20	23.28	75.83	05.23	69.03
Carbendazim	0.1	0.00	100	--	100
Control (Sterile water)		96.33	--	16.89	--
S. Ed.	--	0.383	--	0.324	--
C. D. (P= 0.05)	--	0.791	--	0.670	--

Effect of natural products on per cent disease index (PDI) and population of *M. phaseolina*.

The data depicted in table 2 showed significant reduction in the PDI in the sunflower plants treated with natural products and challenge inoculated with the pathogen. The results revealed maximum PDI (57.80 & 69.19%) in the inoculated control on the 60th and 90th days of sowing respectively. Among the natural products garlic bulb extract treatment recorded the least PDI (11.02 & 12.38%) followed turmeric powder extract treatment recording (13.96 & 15.33%)on the 60th and 90th DAS respectively. The same trend was followed in the population study of *M. phaseolina* where garlic bulb extract treated soil recorded a pathogen population of 12.92 x 10^3 cfu which was found to be far lesser when compared to the inoculated control recording 38.33 x 10^3 cfu of *M. phaseolina*.

Table 2 : Effect of natural products on per cent disease index (PDI) and population of

Natural products	Conc. (%)	Per cent disease index (PDI)		Population of *M. phaseolina*(10^3 cfu)
		60 DAS	90 DAS	
Garlic bulb extract	20	11.00	12.38	12.92
Turmeric powder extract	20	13.96	15.33	13.87
Tulsi leaf extract	20	16.25	21.87	21.30
Vitex negundo	20	15.18	18.77	16.13
Calotropis gigantea	20	18.25	26.87	21.30
Azadirachta indica	20	15.72	18.13	14.18
Carbendazim (ST+SD+FS)	0.1	10.68	11.21	12.68
Inoculated control		57.80	69.19	38.33
S. Ed.	--	0.383	--	0.324
C. D. (P= 0.05)	--	0.791	--	0.670

Effect of natural products on the biometrics and yield of sunflower.

The shoot length, root length, biomass production and yield was recorded. The pot trials revealed in general an increase in the biometrics and plant growth parameters due to treatment with natural products (Table. 3). Among the natural products garlic bulb extract (56, 114 cm) followed by turmeric powder

extract (54, 105 cm) and leaf extracts of *Tulsi ocimum* (30, 90 cm) recorded maximum root length and shoot length respectively and were found to be superior over control (28, 65 cm). The same trend was noticed in biomass production and seed yield. The seed yield /pot in treated with garlic bulb extract (36.8gm)was found to be far superior when compared to control (22.12gm). The carbendazim treated plants (53, 112 cm) were at par with garlic bulb extract and turmeric powder extract over root and shoot length but showed significantly reduced biomass production and seed yield.

Table 3 : Effect of natural products on biometrics and yield of sunflower

Natural Products	Root length (cm)	Shoot length (cm)	Biomass production (gm)	Diameter of head (cm)	Seed yield (gm/pot)
Garlic bulb extract	56	114	48.43	19.5	36.8
Turmeric powder extract	54	105	44.37	16.2	28.2
Tulsi ocimum	30	95	40.11	9.5	22.7
Vitex negundo	30	90	40.89	12.5	26.1
Calotropis gigantea	28	65	32.33	7.5	22.0
Azadirachta indica	34	85	30.11	9.5	18.7
Carbendazim (0.1%)	53	112	42.27	15.5	24.8
Control	28	65	32.33	7.5	22.12
S.E.D.	0.361	0.452	0.314	0.176	0.436
CD(P= 0.05)	0.746	0.934	0.649	0.363	0.901

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