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MANAGEMENT OF ROOT ROT DISEASE [*MACROPHOMINA PHASEOLINA* (TASSI.) GOID] OF CHICKPEA THROUGH BOTANICALS AND OIL CAKES

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ABSTRACT
Occurrence of root rot disease in chickpea has become a major constraint for cultivation of chickpea. Considering the fact, below investigation was carried out for this pathological problem. The efficacy of various botanicals and oil cakes were evaluated against *Macrophomina phaseolina* (Tassi.) Goid causing dry root rot of chickpea. The phyto extracts of thirteen plant species were evaluated *in vitro* by poisoned food technique against *M. phaseolina*. The extract of garlic cloves (*Allium sativum* L.) was proved excellent with maximum inhibiting (73 %) mycelial growth and sclerotial formation followed by rhizome extract of turmeric (*Curcuma longa* L) (63.98 %). The four organic extracts were tested against *M. phaseolina* by poisoned food technique *in vitro*. Significantly least growth of mycelium and maximum mycelium inhibition was recorded in extracts of neem cake (59.40 %) followed by farm yard manure (42.56 %). Next best in order of merit were castor cake and mustard cake.

INTRODUCTION

Chickpea is the world's third most important grain legume globally grown in over 40 countries (Anwar *et al.,* 2009). Bagri *et al.,* 2004 observed that Chickpea suffers from seed borne fungal diseases *viz,* black root rot, dry root rot, wet root rot, seed rotting, root rot, stem rot, crown rot, foot rot, sclerotinia wilt and gray mould. Amongst these diseases, dry rot such as dry root rots (*Macrophomina phaseolina* (Tassi.) Goid) has been reported to cause severe losses right from seedling to maturity of the crop. *Macrophomina phaseolina* (Tassi.) Goid has a wide host range and is responsible for causing losses on more than 500 cultivated and wild plant species (Khan, 2007). Datar (1999) studied the effect of garlic (*Allium sativum*) extract on charcoal rot (*M. phaseolina*) in sorghum. Phyto-extracts of eleven plant species against *M. phaseolina* of green gram and revealed that the onion bulb extract produced maximum inhibition followed by extract of acacia, ginger, neem, garlic and karanj. (Tandel *et al.*, 2010). Jha *et al.* (2000) reported that among oil cakes tested, *Brassica juncea* cake exhibited maximum inhibition of mycelial growth of *M. phaseolina* causing root rot of okra. Fungicides are widely used in conventional agriculture to control plant diseases. Prolonged usage often poses health problems as modern society is becoming more health-conscious. Botanicals or organic materials may also find favour in organic food production, both in the field and in controlled environments. Considering the importance of root rot and the subsistence chickpea cultivation in Gujarat, research priority was given to manage root rot disease. To achieve this objective, present investigation was carried out on various botanicals and oil cakes to find out suitable eco-friendly management strategies for preventing crop losses.

MATERIALS AND METHODS

a). Botanicals

The experiment was carried out at department of Plant Pathology, N.M. College of Agriculture, N.A.U., Navsari. The effect of phyto extracts of various plant species as listed in (Table - 1) were tested *in vitro* by poisoned food technique to know their inhibitory effect on the growth of *M. phaseolina*. Healthy fresh plant parts *i.e.*, leaves, bulbs or rhizomes were taken, washed thoroughly with fresh water and finally rinsed with sterilized distilled water. Fifty gram of plant parts were cut into small pieces and minced with the help of a grinder by adding 50mL sterilized distilled water. The phyto extracts were filtered through double-layered muslin cloth in 150mL conical flasks and plugged with non-absorbent cotton. These filtered

Table 1: Effect of various botanicals on the growth of *M. phaseolina in vitro*

Sr.No.	Common name of plant	Botanical name diameter (mm)	Average colony	Per cent Growth inhibition over control
1	Garlic	*Allium sativum* L.	24.03*	73.00
2	Turmeric	*Curcuma longa* L.	32.05	63.98
3	Mint	*Menthe arvensis* L.	36.31	59.20
4	Karanj	*Pongamia glubra* L.	48.48	45.52
5	Ginger	*Zingiber officinale* L.	60.10	32.47
6	Desi baval	*Acacia nilotica* L.	66.16	25.66
7	Neem	*Azadirachta indica* L.	78.13	12.21
8	Lantana	*Lantana camera* L.	83.53	6.14
9	Nilgiri	*Eucalyptus citridora* Hook.	85.00	4.49
10	Ardusi	*Ailanthus excels* L.	87.55	1.62
11	Onion	*Allium cepa* L.	88.00	1.12
12	Saptaparni	*Alstonia scholaris* L.	88.00	1.12
13	Black Tulsi	*Ocimum sanctum* L.	88.00	1.12
14	Control	-	89.00	-
	S.Em. +		0.41	
	C.D. at 5%		1.19	
	C.V.%		1.05	

Table 2: Effect of different organic extracts on the growth of *M. phaseolina in vitro*

Sr.No	Organic extract	Concentration (%)	Average colony diameter (mm)	Per cent growth inhibition over control
1	Neem cake	10	6.13* (37.73)**	53.69
		20	5.75 (33.08)	59.40
2	FYM	10	7.59 (57.81)	29.05
		20	6.85 (46.80)	42.56
3	Castor cake	10	8.42 (70.63)	13.31
		20	8.11 (65.36)	19.78
4	Mustard cake	10	8.82 (77.48)	4.90
		20	8.34 (69.10)	15.19
5	Control		9.04 (81.48)	-
	S.Em. +		0.37	
	C.D. at 5%		1.10	
	C.V.%		8.24	

extracts were autoclaved at 1.2 kg cm^{-2} pressure for 20 minutes. Autoclaved extract were individually added into previously sterilized Potato Dextrose Agar (PDA) plates @ 10 per cent and mixed thoroughly at the time of pouring in the previously sterilized Petri plates. The Petri plates were inoculated aseptically after solidification by placing 5 mm diameter mycelial disc at the centre, cut aseptically with Cork borer from 10 days old pure culture of *M. phaseolina*. Three repetitions of each treatment were maintained. The plate without phyto extract served as control. The Petri plates were incubated at 27 + 20 °C temperature till the complete coverage in control plate. The per cent growth inhibition (PGI) of the pathogen was worked out by using formula given by Vincent (1947).

b). Oil cakes

The aqueous extracts of different organic materials *viz*., FYM, neem cake, castor cake and mustard cake (Table 2) were prepared by suspending 30g of each organic material in 150mL sterilized distilled water in flask and left for 10 days. The flasks were shaken on alternate day for thorough mixing and dissolution of the content. After 10 days, the flasks were thoroughly shaken and content was filtered through double layered muslin cloth and autoclaved at 1.2 kg cm^{-2} pressure for 20 minutes. The autoclaved extracts were individually added in previously sterilized molten potato dextrose agar medium @ 10% and 20% at the time of pouring in Petri plates and mixed thoroughly and allowed it to solidify. All the plates were incubated at 27 + 2ºC temperature after placing the 5mm discs of actively growing 10 days old pure culture of *M. phaseolina*. Three repetitions were kept for each treatment. The per cent growth inhibition (PGI) of the pathogen was worked out by using formula given by Vincent (1947).

RESULTS

a). Botanicals

The aqueous extracts of commonly available thirteen plant species were evaluated *in vitro* for their inhibitory effect on the mycelial growth and sclerotial formation by *M. phaseolina*. The results presented in Table 1 revealed that all the plant extracts inhibited the growth of the fungus as compared to control, except Ardusi (*Ailanthus excels* L.), onion (*Allium cepa* L.), saptaperni (*Alstonia scholaris* L.) and Black Tulsi (*Ocimum sanctum* L.). The cloves extract of garlic (*Allium sativum* L.) (24.03mm) allowed minimum growth of the pathogen followed by finger extracts of turmeric (*Curcuma longa* L.) (32.05mm) and leaves extract of mint (*Menthe arvensis* L.) (36.31mm). the next in order of merit were leaves extract of karanj (*Pongamia glubra* L.) (48.48 mm), rhizomes extracts of Ginger (*Zingiber officinale* L.) (60.10 mm), leaves extract of Desi Baval

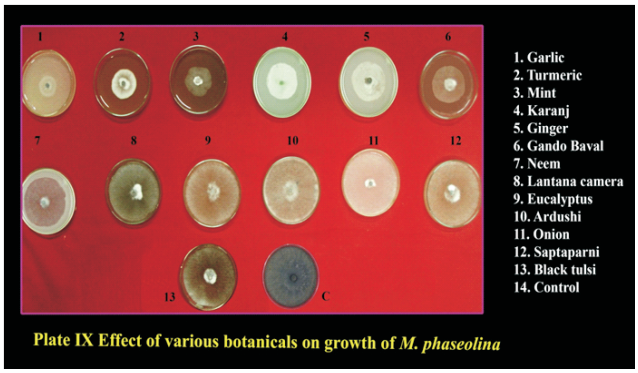

Figure 1: Effect of various botanicals on the growth of *M. phaseolina in vitro.*

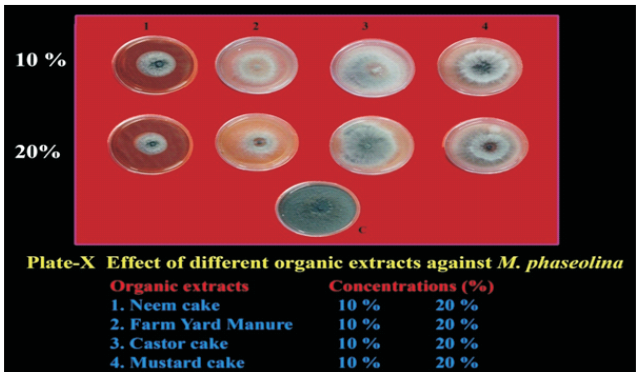

Figure 2: Effect of different organic extracts on the growth of *M. phaseolina in vitro*

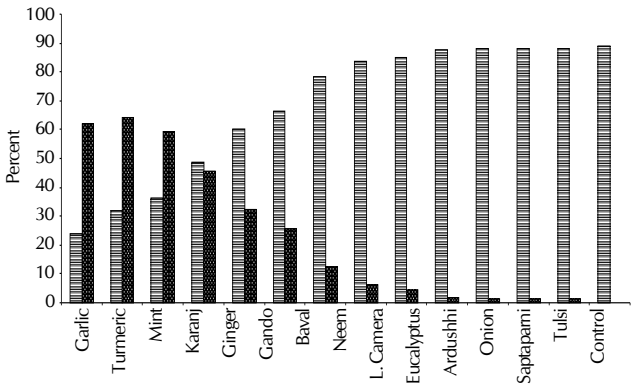

Figure 3: Effect of various botanicals on the growth of *M. phaseolina in vitro*

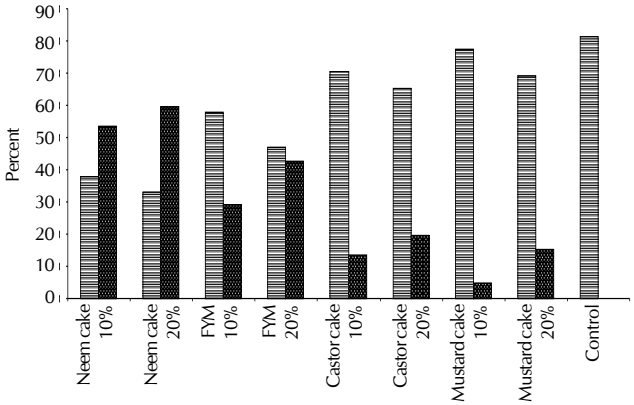

Figure 4: Effect of different organic extracts against *M. phaseolina in vitro*

(*Acacia nilotica* L.) (66.16 mm) and leaves extract of Neem (*Azadirachta indica* L.) (78.13mm). whereas, leaves extract of Lantana (*Lantana camera* L.) (83.53mm) and leaves extract of Nilgiri (*Eucalyptus citridora* Hook.) (85.00mm) were least effective. The leaves extract of Ardusi (*Ailanthus excels* L.) (87.55mm) which was statistically at par with bulb extract of Onion (*Allium cepa* L.) (88.00 mm), leaves extract of Saptaparni (*Alstonia scholaris* L.) (88.00 mm) and leaves extract of Black Tulsi (*Ocimum sanctum* L.) (88.00mm) were less effective. The cloves extract of garlic (*Allium sativum* L.) (73.00%) produced maximum growth inhibition of the pathogen followed by finger extracts of turmeric (*Curcuma longa* L.) (63.98%) and leaves extract of mint (*Menthe arvensis* L.) (59.20%). The next in order of merit were leaves extract of karanj (*Pongamia glubra* L.) (45.52%), rhizomes extracts of ginger (*Zingiber officinale* L.) (32.47%) leaves extract of desi baval (*Acacia nilotica* L.) (25.66%) and leaves extract of neem (*Azadirachta indica* L.) (12.21%). Whereas, leaves extract of lantana (*Lantana camera* L.) (6.14%) and leaves extract of nilgiri (*Eucalyptus citridora* Hook.) (4.49%) were least effective in inhibiting the growth of the pathogen. The leaves extract of ardusi (*Ailanthus excels* L.) (1.62%), bulb extract of onion (*Allium cepa* L.) (1.12%) leaves extract of saptaparni (*Alstonia scholaris* L.) (1.12%) and leaves extract of Black Tulsi (*Ocimum sanctum* L.) (1.12%) were least effective in inhibiting the growth of the pathogen.

b). Oil cakes

The aqueous extracts of different oil cakes were evaluated for their inhibitory effect to *M. phaseolina*. The results presented in Table 2 indicated that organic extracts produced significant inhibitory effect on the fungal growth. Among all the organic extracts, significantly minimum growth was recorded in the extract of neem cake @ 20 % (33.08mm) followed by neem cake @ 10 % (37.73mm). Next best in order of merit was farm yard manure @ 20 % (46.80mm), farm yard manure @ 10 % (57.81mm), castor cake @ 20 % (65.36mm) and mustard cake @ 20 % (69.10mm). Whereas, castor cake @ 10 % (70.63mm) and mustard cake @ 10 % (77.48mm) were poor in inhibiting growth of the pathogen. Maximum per cent growth inhibition of *M. phaseolina* was recorded in neem cake @ 20 % (59.40%) followed by neem cake @ 10 % (53.69%). Next best in order of merit was farm yard manure @ 20 % (42.56%) followed by farm yard manure @ 10 % (29.05), castor cake @ 20 % (19.78%) and mustard cake @ 20 % (15.19%). whereas, castor cake @ 10 % (13.31%) and mustard cake @ 10 % (4.90%) were least effective in inhibiting the growth of the pathogen.

DISCUSSION

The present studies are in confirmation with those described earlier by other workers *viz*., Datar (1999) studied the effect of botanicals on *M. phaseolina* and found that out of four rhizomes and bulbs extracts tested, garlic (*Allium sativum*) extract was found most inhibitory to *R. bataticola*. Dubey and Dwivedi (1991) found fungitoxic properties of *Acacia arabica* L., *Allium cepa* L. and *A. sativum* against vegetative growth and sclerotial viability of *M. phaseolina*. Kane *et al.* (2002)

reported that crude extract of *A .sativum*, *Eucalyptus globulens* L. and *Zingiber officinale* L. were effective in inhibiting the mycelial growth of the *R. Solani* to the extent of cent per cent. Tandel et al. (2010) tried phyto-extracts of eleven plant species against M. phaseolina of green gram and revealed that the onion bulb extract produced maximum inhibition (98.14%) followed by extract of acacia, ginger, neem, garlic and karanj.

Jha *et al*. (2000) reported that among oil cakes tested, *Brassica juncea* cake exhibited maximum inhibition of mycelial growth (51.8%) at 5 per cent concentration of *M.phaseolina* causing root rot of okra.

From this study, it is clear that garlic, turmeric, Neem cake and FYM were found high effective in reducing the growth of *M. phaseolina* causing dry root rot in chickpea.

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