Evaluation of phytoextracts against *Macrophomina phaseolina* (Tassi) Goid causing root rot of sesame

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ABSTRACT

Occurrence of root rot disease in sesame has become a major constraint for cultivation of sesame in Junagadh district of Gujarat State (India). Considering the fact, the following investigation was carried out for this pathological problem. The efficacy of various botanicals were evaluated against *Macrophomina phaseolina* (Tassi.) Goid causing root rot of sesame. The phytoextracts of nine 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 (77.65 %) mycelial growth and scanty sclerotial formation followed by onion bulb extract (*Allium cepa* L.) (63.98 %). while least growth inhibition (32.34 %) was recorded in ginger rhizome extract.

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INTRODUCTION

Sesame (*Sesamum indicum* L.) which belongs to the family Pedaliaceae, is one of the most important oilseed crops grown in India (Singhal, 2003). Due to intensive cultivation practices the crop has been found to suffer from many diseases of which root rot caused by *Macrophomina phaseolina* has been contributing significantly to the low yield in Gujarat which causes charcoal rot, ashy stem blight, root rot, leaf blight, capsule rot, etc. *Macrophomina phaseolina* (Tassi) Goid, a soil inhabiting pathogen, attacks a large number of host plants including oilseeds, pulses, vegetables and ornamentals (Shaw, 1912; Pearl, 1923; Park, 1927; Likhite, 1936 and Thirumalachar, 1953; Zak, 1971; Grower and Shakhuja, 1981; Gangopadhyay *et al.,*1982). Damage that occurs due to this disease is more than 31 % in Gujarat condition. However, information is lacking in Gujarat for management of root rot in sesame. Hence the present investigation was undertaken to screen various phytoextracts *in vitro* condition to manage the root rot.

MATERIALS AND METHODS

Bioassay of phytoextracts

Nine locally available plants were used for their evaluation against *M. phaseolina* following the procedure given by Bambode and Shukla (1973) with a slight modification. Fresh leaves of respective plants as shown in Table-I were first washed with tap water and then with sterilized water. Each sample was then homogenized in sterilized distilled water at the rate of 1 mL/g of tissues (1:1 V/W) with a homogenizer and filtered through a fine muslin cloth. The filtrate was centrifuged at 5000 rpm for 20 minutes and the supernatant was filtered with sterilized sintered funnel (pore size 1-2 microns), which formed the standard plant extract solution (100%). The extracts were individually incorporated into PDA medium at 2, 5 and 10 per cent concentration in 250 mL conical flasks and sterilized at 1.038 kg/cm^2 for 15 minutes. These were poured into 90 mm sterilized Petridishes with three repetitions for each extract with diferent concentrations. Control was maintained without extracts for each concentration. All the Petridishes were inoculated with four mm disc of mycelium of the pathogen and incubated at 30 ± 1°C. Five days after inoculation, the radial growth of mycelium was recorded and per cent inhibition of fungal growth for each treatment and concentration were calculated as per the formula given by Vincent (1947).

Where,

I = Per cent growth inhibition

C = Colony diameter in control (mm)

T = Colony diameter in respective treatment (mm)

$$I = \frac{C - T}{C} \times 100$$

Table 1. Evaluation of different phytoextracts tested under *in vitro* condition

Plant	Plant parts used	Concentrations (%)		
Allium sativum L.(Garlic)	Cloves	2	5	10
*Zingiber officinale*Rosc. (Ginger)	Rhizomes	2	5	10
Ocimum sanctum L.(Tulsi)	Leaves	2	5	10
Lantana camara L. (Lantana)	Leaves	2	5	10
*Jatropha curcas*L.(Jatropha)	Leaves	2	5	10
Adhatodavasica Ness. (Ardusi)	Leaves	2	5	10
*Allium cepa*L. (Onion)	Bulbs	2	5	10
Azadirachta indica A. Juss. (Neem)	Leaves	2	5	10
Curcuma longa L.(Termeric)	Rhizomes	2	5	10
Control	-	-	-	-

Sclerotial formations were counted in fungal culture suspensions under the microscope at low power (10X). The fungal culture suspension was prepared by vigorously shaking the 4 mm mycelial disc of the fungus in 10 ml sterilized distilled water. The relative degree of formation of sclerotia was recorded as below:

No. of sclerotia per microscopic field (10X)	Grade	Sign
0	Absent	-
1-4	Scanty	+
5-8	Moderate	++
9-15	Good	+++
>15	Abundant	++++

RESULTS AND DISCUSSION

The aqueous extracts of nine commonly available 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 -II revealed that all the plant extracts inhibited the growth of the fungus as compared to control, except neem, turmeric, ardusi, jatropha, lantana, and ginger.

The results revealed that maximum growth inhibition 77.65% was found in *Allium sativum* closely followed by *Allium cepa*. They were at par. It was inferred from the results that *A. sativum* and *A. cepa* extracts were very effective in reducing the growth of the pathogen, whereas O*cimum sanctum,*

Azadirachta indica extracts were moderately effective to inhibit the growth of the fungus at all concentrations. It was also observed that *Zingiber officinale, Lantana camara, Jatropha curcas, Adhatoda vasica* and *Curcuma longa* extracts were in effective to inhibit the growth of the fungus at all concentrations. The scanty sclerotial formation observed in both *A. sativum* and *A. cepa,* were abundant to moderate sclerotial formation in other treatment. Similar result was also recorded by Dhingani *et al.* (2013).

Table 2. Effect of phytoextracts on growth inhibition and sclerotial formation of *M. phaseolina in vitro.*

Phytoextract	Concentration (%)	Sclerotial formation	Per cent inhibition over control	Mean
Allium sativum L.(Garlic)	2	+	75.18	77.65
	5	+	77.03	
	10	+	80.73	
*Allium cepa*L.(Onion)	2	+	73.33	77.15
	5	+	76.66	
	10	+	81.47	
Ocimum sanctum L.(Tulsi)	2	++++	43.70	52.21
	5	+++	51.84	
	10	++	61.10	
Azadirachta indica A. Juss. (Neem)	2	++++	40.73	47.52
	5	++	48.88	
	10	++	52.96	
Curcuma longa L. (Turmeric)	2	++++	32.95	42.46
	5	++++	41.10	
	10	+++	53.33	
*Adhatoda vasica*Ness. (Ardusi)	2	++++	36.29	41.23
	5	++++	42.21	
	10	++++	45.18	
*Jatropha curcas*L.(Jatropha)	2	++++	33.70	35.79
	5	++++	35.18	
	10	++++	38.51	
Lantana camara L. (Lantana)	2	++++	29.99	34.56
	5	++++	31.10	
	10	++++	42.58	
Zingiber officinale Rosc. (Ginger)	2	++++	21.10	32.34
	5	++++	35.55	
	10	++++	40.36	
Control	-		-	
	Phytoextract (P)	Concentration (C)	P x C	
S. Em. ±	**0.895**	**0.490**	**1.550**	
CD at 5%	**2.532**	**1.387**	**4.386**	
CV %	**6.09**			

*** sclerotial formation: ++++ = abundant; +++ = good; ++ = moderate; + = scanty; - = no sclerotial formation**

Muzammil *et al.* (2014) and Meena *et al.* (2014) reported that *Allium sativum* inhibited mycelium growth of *M. phaseolina* of sunflower. Dubey and Dwivedi (1991) found fungi toxic properties of *Acacia arabica*,

Allium cepa and *A. sativum* against vegetative growth and sclerotial viability of *M. phaseolina.* 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.

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