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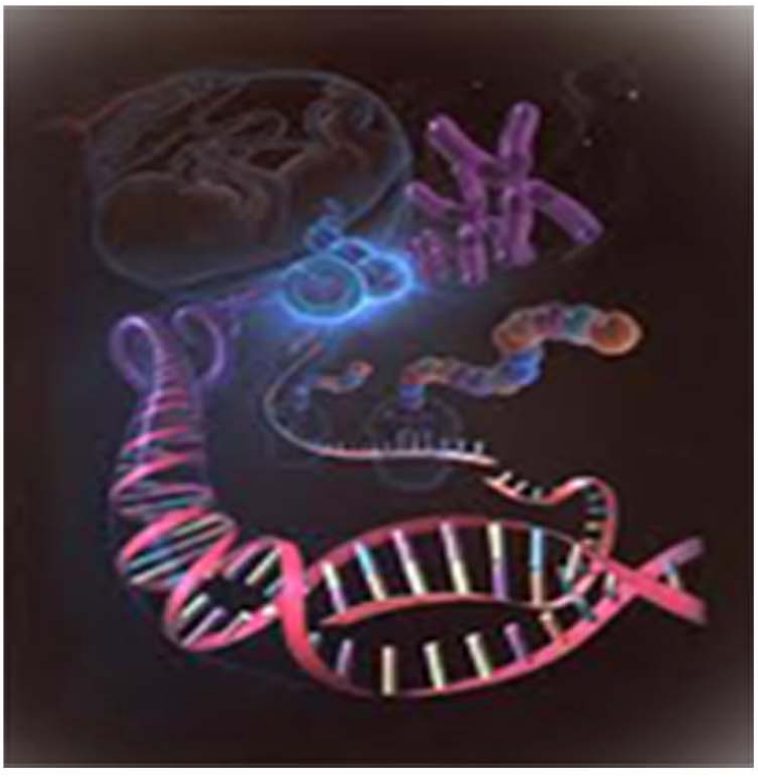

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Research Paper

BIOEFFICACY OF WATER BASED PHYTOEXTRACTS AGAINST DRY ROT AND CHARCOAL ROT PATHOGENS OF POTATO CAUSED BY *FUSARIUM* SP. AND *MACROPHOMINA PHASEOLINA* UNDER *IN VITRO* TEST CONDITION

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Potato (*Solanum tuberosum* L.) is one of the most nutritious sources of food in the world. In this experiment bioefficacy of phytoextracts of eleven plant species having medicinal values were tested *in vitro* by poisoned food technique against *Fusarium* sp. and *Macrophomina phaseolina* causing dry rot and charcoal rot diseases of potato. To manage these diseases effectively with safer approach, different concentration of phytoextracts were tested. Result revealed against *Fusarium* sp. that the Onion bulb @ 10% showed maximum growth inhibition (63.52%) followed by extract of Garlic bulb (62.05%) and Ginger rhizome (59.70%). While, extract of Onion bulb @ 10% produced maximum growth inhibition (55.27%) of *Macrophomina phaseolina* followed by Garlic bulb (54.44%), Datura leaves (52.22%) and Karanj leaves (51.11%) respectively.

Keywords: Phytoextracts, *Fusarium* sp., *Macrophomina phaseolina,* Dry rot, Charcoal rot

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most nutritious sources of food in the world. Besides cereals, potato is one of the crops, which can supplement food needs of a country. It has been recognized as a wholesome food and the richest source of energy in most of the countries of the world where, it forms an important part of the human diet. However, average annual crop losses attributed to dry rot have been estimated at 6 to 25% (Chelkowski, 1989) and found that more than 60% of tubers in storage can be affected (Carnegie *et al*., 1990). *Fusarium* sp. that causes dry rot and spread readily among tubers during handling and planting which results in seed tuber rots and poor plants stand (Hooker, 1981). However, charcoal rot (*Macrophomina phaseolina*) may cause 10-70% tuber rottage in eastern plains depending upon the period of harvest and presence of predisposing factors (Thirumalachar, 1955, Pushkarnath *et al*., 1966). Investigation conducted on the use of plant

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extracts have opened a new avenue for the control of plant diseases. Looking to the importance and need, different phytoextracts have been studied under *in vitro* condition for the effective management of dry rot and charcoal rot diseases of potato.

MATERIALS AND METHODS

Bioefficacy of phytoextracts of eleven plant species having medicinal values was tested *in vitro* by poisoned food technique. Fresh and healthy 100 g plant parts of each plant species as mentioned in Table 1 were thoroughly washed with tap water and then with sterile distilled water. These were crushed in grinder mixer by adding 100 mL distilled water to obtain 1:1 extract. The phytoextracts thus obtained were then filtered through double layered sterile muslin cloth in conical flasks and were used without sterilization. The flasks were labelled and stored in the refrigerator for further use.

100 mL of Potato Dextrose Agar (PDA) medium was taken repeatedly for fungal isolates in flasks of 150 mL capacity, plugged and sterilized by autoclaving at 1.045 kg /cm^2 for 20 min. After autoclaving and cooling to about 45^{o}C, 10 mL of the respective extracts was mixed

Table 1: Effect of Unsterilized Water Based Extract of Different Plant Species on Growth of *Fusarium* sp., and *Macrophomina phaseolina In Vitro* Test

S. No.	Name of Phytoextract	Plant Part Used	Percent Inhibition Over Control*	
			Fusarium sp.	*M. phaseolina*
I	Ardusi	Leaves	41.71(43.81)**	42.71(45.55)**
II	Bhoyringni	Leaves	45.26(49.99)	37.21(36.10)
III	Datura	Leaves	46.95(52.93)	46.54(52.22)
IV	Eucalyptus	Leaves	46.78(52.64)	44.46(48.60)
V	Garlic	Bulb	52.25(62.05)	47.81(54.44)
VI	Ginger	Rhizome	50.87(59.70)	44.94(49.44)
VII	Karanj	Leaves	36.55(34.99)	45.90(51.11)
VIII	Mahendi	Leaves	46.78(52.64)	44.78(49.16)
IX	Onion	Bulb	53.12(63.52)	48.29(55.27)
X	Lantana	Leaves	45.60(50.58)	44.30(48.33)
XI	Neem	Leaves	44.92(49.40)	43.83(47.49)
XII	Control (Sterile distilled water)	-	4.05(00.00)	4.05(00.00)
	S.Em. ±	-	0.487	0.0558
	C.D. at 5%	-	1.390	1.594
	C.V. %	-	2.27	2.71

Note: * Average of four replications; ** Figures in the parenthesis are retransformed values.

thoroughly in the flasks containing 100 mL of PDA medium. Medium without respective phytoextracts served as control. All these were poured aseptically into sterile Petri plates replicating four times per treatment. After solidification, the plates were inoculated separately with cultures of *Fusarium* sp. and *Macrophomina phaseolina* in the centre with the help of sterilized 5 mm cork borer and were incubated at 28 ± 2 °C temperature for seven days. Observations on radial growth of *Fusarium* sp. and *Macrophomina phaseolina* was measured by averaging two diameters of colony at right angle to one another and the percent growth inhibition (PGI) was calculated by the following equation (Asalmol *et al.*, 1990).

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

where,

P G I	Per cent Growth Inhibition
C	Growth in control (mm)
T	Growth in treatment (mm)

RESULT AND DISCUSSION

Dry Rot (*Fusarium* sp.)

The results presented in Table 1 revealed that all the plant extracts inhibited the growth of pathogens significantly as compared to control. The extract of Onion bulb (*Allium cepa*) produced significantly maximum growth inhibition (63.52%) of *Fusarium* sp. followed by extract of Garlic bulb (*Allium sativum*) (62.05%) and extract of Ginger rhizome (59.70%). The next effective phytoextract in order of inhibition and at par were extracts of Datura leaves (52.93%), Eucalyptus leaves (52.64%) and Mahendi leaves (52.64%).

Rest of the phytoextracts exhibited little inhibition on the growth of the pathogen and differed significantly among each other.

Charcoal Rot (*Macrophomina phaseolina)*

The results presented in Table 1 clearly revealed that all the plant extracts inhibited the growth of charcoal rot pathogen (*Macrophomina phaseolina*) significantly as compared to control.

The extract of Onion bulb (*Allium cepa*) produced maximum growth inhibition (55.27%) of *M. phaseolina* closely followed by extract of Garlic bulb (54.44%) and both being at par statistically but significantly superior over rest of the phytoextracts tested. However, extracts of Datura leaves (52.22%) and Karanj leaves (51.11%) were also at par but these phytoextracts found significantly superior over rest of the phytoextracts in order of inhibition. The next effective phytoextracts in order of inhibition were extract of Ginger rhizome (49.44%), Mahendi leaves (49.16%), Eucalyptus leaves (48.60%), Lantana leaves (48.33%) and Neem leaves (47.49%). Rest of the phytoextracts exhibited little inhibition on the growth of the pathogen and differed significantly among each other.

Research results of our study corroborate with the report of Skinner (1955) found that allicin, a major constituent of *A. sativum* containing sulphur, has strong toxic properties against several bacteria and fungi. Murthy and Amonkar (1973) found that oil of garlic (*Allium sativum* L.) in natural and synthetic forms has been reported to suppress the activity of many air and soil-borne fungi. Assadi and Behroozin (1987) showed that the extract of garlic was more inhibitory than of onion on the growth of *Fusarium solani*. Dubey

and Dwivedi (1991) found fungicidal properties of allicin, a constituent found in *Allium cepa*, against *Macrophomina phaseolina* at 0.1% concentration. Datar (1999) reported that extract of *Allium sativum* was most effective in controlling *Macrophomina phaseolina* causing charcoal rot of sorghum followed by *Allium cepa, Curcuma longa* and *Zingiber officinale*. Sindhan *et al.* (1999) reported that *Rhizoctonia solani* and *R. bataticola* causing root rot of chickpea, cotton and bhindi were more sensitive to extracts of *Allium cepa, Allium sativum, Zingiber officinale* and *Azadirachta indica* followed by *Mentha arvensis, E. globulus* and *Ocimum sanctum.*

Thus, the present findings are in confirmation with the work of above research workers.

CONCLUSION

From this experiment, it can be concluded that for *Fusarium* sp. the Onion bulb @ 10% showed maximum growth inhibition (63.52%) followed by extract of Garlic bulb (62.05%). While, extract of Onion bulb @ 10% produced maximum growth inhibition (55.27%) of *Macrophomina phaseolina* followed by Garlic bulb (54.44%). Further this extract can be effectively incorporated in different forms for the control of these fungi in the field condition.

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