

***In vitro* Evaluation of Fungicides and Plant Extracts against *Passalora arachidicola* Causing Early Leaf Spot of Groundnut**

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ABSTRACT

Passalora arachidicola causes heavy loss to groundnut in every year in India. The present study was conducted to know the efficacy of seven different fungicides and four plant extracts against *Passalora arachidicola*, the causal agent of early leaf spot of groundnut under *in vitro* condition using 'poisoned food technique'. Among different fungicides tested, hexaconazole and tricyclazole were found to be highly effective which completely inhibited radial growth of the fungus followed by propiconazole and copper oxychloride. Among the plant extracts, pestoneem was found to be the best in arresting the radial growth of the fungus followed by garlic clove extract.

Keywords Fungicides, Plant extracts, *Passalora arachidicola*, *In-vitro* evaluation.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop grown in India. India is one of the largest producers of groundnut in the world. Groundnut seed contains about 25-28% protein and 43-55% oil (Naeem-ud-Din *et al.* 2009). Groundnut suffers from many fungal diseases such as early leaf spot, late leaf spot, crown rot or seedling blight, collar rot, rust of groundnut. Among these diseases, early leaf spot caused by *Passalora arachidicola* is considered as one of the most economically important and destructive fungal diseases in India which causes premature defoliation. It was estimated that leaf spot, in addition to rust can cause up to 50% of yield loss under severe disease outbreak (Ghewande 2009). Application of fungicides to mitigate crop losses have become very much essential with commercial introduction of high yielding, but susceptible varieties. Now a days plant extracts are also gaining importance in the management of plant diseases. Plant extracts are naturally occurring chemicals extracted from seeds, flowers, leaves, roots and stems which are toxic to the plant pathogens. Plant extracts are relatively cheaper, safe to users, non-target organisms and environment. Therefore, the present research work was carried out to evaluate the efficacy of different fungicides and plant extracts against *Passalora arachidicola* *in vitro* and thus served as a guide for field trials.

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MATERIALS AND METHODS

The present laboratory experiment was carried out to know the efficacy of different systemic, non-systemic fungicides as well as plant extracts against *Passalora arachidicola* in the Department of Plant pathology, College of Agriculture, Chiplima, Sambalpur, Orissa University of Agriculture and Technology, using 'poisoned food technique'. The fungus *Passalora arachidicola* causing early leaf spot of groundnut was isolated from diseased leaves of groundnut plants at College of Agriculture, Chiplima, Sambalpur. The fungicides were evaluated at 0.1% and 0.2% concentrations, whereas plant extracts including one ready made commercial neem based formulation (Pestoneem) were evaluated at 5% and 10% concentrations.

Healthy plant parts of the desired plant species were taken and washed thoroughly with water, air dried and used for extract preparation. Then the selected plant parts (50 g) was macerated with 50 ml sterile distilled water in a pestle and mortar. The macerate was then allowed to pass through double-layered muslin cloth and the filtrate was centrifuged at 4000 g for 30 min. The supernatant was filtered through

Whatman No. 1 filter paper and sterilized at 120°C for 20 min. The extract was preserved aseptically in a brown bottle at 5°C (Satish *et al.* 1999). The extracts thus obtained served as the crude extract (100 % concentration).

The required quantity of fungicides and plant extracts were added separately and aseptically into molten and cooled potato dextrose agar (PDA) medium to get the desired concentrations. Twenty ml of the poisoned medium was poured in each Petriplate. On solidification of the medium, the plates were inoculated with half cm disc of 10 days old mycelial mat of *Passalora arachidicola* and incubated at 28±1°C. Three replications were maintained for each fungicide and four replications were maintained for each plant extract. The fungus grown on PDA without any fungicide or plant extract served as control. The radial growth of the colony was recorded, when maximum growth in control plates was noticed. The per cent inhibition over the control was calculated by using the formula (Vincent 1927).

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

Details of fungicides/ plant extracts tested for radial growth inhibition are given below-

I Fungicides

Sl. No.	Common name	Trade name	Chemical name
1	Chlorothalonil	Kavach 75 WP	2,4,5,6-tetrachloroisophthalonitrile
2	Hexaconazole	Danzole plus 5% EC	(RS)-2-(2,4-dichlorophenyl)-1-(1H-1,2,3-triazol-1-yl) Hexan-2-ol
3	Propiconazole	Tilt 25EC	1-[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl] methyl-1,2,4-triazole
4	Tricyclazole	Beam 75WP	5-methyl-1,2,4-triazole (3,4-6)-benzothiazole
5	Copper oxychloride	Blue copper 50 WP	Copper-oxychloride
6	Mancozeb	Indofil M-45 75 WP	Co-ordination product of zinc iron and manganese ethylene bis dithiocarbamate
7	Carbendazim + Mancozeb	Saaf (12 + 63% WP)	Combined product of Carbendazim and mancozeb

II Plant extracts/ Neem based formulations

Sl No.	Common name/ Trade name	Botanical name	Plant parts used
1	Garlic	<i>Allium sativum</i> L.	Clove
2	Ginger	<i>Zingiber officinale</i>	Rhizome
3	Pestoneem (Neem- based formulation)	<i>Azadiracta indica</i> Juss	kernals
4	Neem	<i>Azadiracta indica</i> Juss	Leaf

Where,

I= Per cent inhibition

C= Radial growth in control

T= Radial growth in treatment

RESULTS AND DISCUSSION

Efficacy of seven different fungicides under *in vitro* condition were evaluated against *Passalora arachidicola* by 'poisoned food technique' at two concentrations viz., 0.1% and 0.2% as described in 'Materials and methods' and results are presented in Table 1.

It was revealed that all the fungicides tested significantly inhibited radial growth of *Passalora arachidicola*. Tricyclazole and hexaconazole completely inhibited (100%) radial growth of the test fungus *Passalora arachidicola* at the concentrations 0.1% and 0.2%. These were followed by the fungicides propiconazole (98.75%) and copper oxychloride (66.37 %). Chlorothalonil showed minimum mean inhibition of the radial growth of the test fungus (37.75%). It was also found that hexaconazole and tricyclazole showed 100% inhibition at 0.1% and 0.2% concentrations and propiconazole showed 100% inhibition at 0.2%, whereas chlorothalonil showed

the least inhibition (34.33 %) at 0.1%. Similar kind of results was obtained by Kavyashree and Yadahalli (2014) who studied efficacy of different fungicides against *Cercospora canescens* causing leaf spot of green gram under laboratory conditions and found that hexaconazole was the most effective fungicide. Suresh (2013) also reported that hexaconazole and propiconazole were effective in inhibiting the growth of *Cercospora capsici* causing leaf spot of chilli under *in vitro* condition.

In order to test the ability of plant extracts to suppress growth of the *Passalora arachidicola*, four plant extracts including one commercial formulation were used against it at two concentrations viz., 5% and 10% as described in 'Materials and methods' and results are presented in Table 2. The results revealed that all the plant extracts tested under *in vitro* condition significantly reduced growth of the test fungus. Pestoneem (neem based formulations) was found significantly superior than other treatments in inhibition of radial growth of test fungus (70%). It was followed by garlic clove extract (40.1%). Neem leaf extract was found least effective in suppressing growth of the test fungus (30.32%). Pestoneem (74.75%) was found best in arresting growth of the fungus at 10% concentration, whereas least inhibition (28.38%) was observed in neem leaf extract at 5% concentration. Hossain and Hossain (2013) reported that neem leaf extracts and garlic bulb extracts were effective in inhibiting mycelial growth and conidial germination of *Cercospora arachidicola*. Our results suggest that

Table 1. Per cent inhibition of radial growth of *Passalora arachidicola* by different fungicides. * Average of three replications. ** Figures in parentheses are arcsine transformed values

Sl. No.	Fungicides	% inhibition of radial growth* at concentrations		Mean %
		0.1%	0.2%	
1	Copper oxychloride	64.33 (53.32)**	68.41 (55.79)	66.37 (54.54)
2	Mancozeb	43.17 (41.07)	55.10 (47.92)	49.14 (44.50)
3	Chlorothalonil	34.33 (35.86)	41.17 (39.91)	37.75 (37.90)
4	Saaf	38.06 (38.09)	49.50 (44.71)	43.78 (41.42)
5	Propiconazole	97.50 (80.88)	100.00 (89.97)	98.75 (83.56)
6	Hexaconazole	100.00 (89.97)	100.00 (89.97)	100.00 (89.97)
7	Tricyclazole	100.00 (89.97)	100.00 (89.97)	100.00 (89.97)
	SEm±	0.87	1.16	
	CD at 1% level	3.63	4.91	

Table 2. Per cent inhibition of radial growth of *Passalora arachidicola* by plant extracts. * Average of four replications. ** Figures in parentheses are arcsine transformed values.

Sl. No.	Plant extracts	% inhibition of radial growth* at different concentrations		Mean %
		5%	10%	
1	Neem leaf extract	28.38 (32.19)**	32.25 (34.60)	30.32 (33.41)
2	Garlic clove extract	37.13 (37.54)	43.00 (40.97)	40.01 (39.23)
3	Pestoneem	65.25 (53.87)	74.75 (59.82)	70.00 (56.78)
4	Ginger rhizome extract	31.38 (34.06)	36.50 (37.16)	33.94 (35.63)
	SEm±	0.60	0.96	
	CD at 1% level	2.60	4.15	

plant extracts can be used for management of early leaf spot of groundnut under field condition.

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