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Management of leaf blight disease of mung bean through botanicals and chemicals

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Abstract
Occurrence of leaf blight disease has become a major constraint for cultivation of mung bean. Considering the fact, below investigation was carried out for this pathological problem. The efficacies of various botanicals were evaluated against *Macrophomina phaseolina* causing leaf blight of mungbean. The phyto-extracts of six plant species were evaluated *in vitro* by poisoned food technique against *M. phaseolina*. The finger extract of Turmeric having fungal colony diameter of 24.03 mm allowed minimum growth of the pathogen followed by clove extracts of Garlic (68.44 mm), finger extract of Ginger (78.13mm) and leaf extract of Black Tulsi (82.00 mm). Six fungicides were tested *in vitro* against *M. phaseolina* i.e. Thiram Carbendazim, Captan, Benomyl, Mancozeb and Tricyclazole by poison food technique. Mancozeb, Benomyl and Tricyclazole completely inhibited the mycelial growth followed by Thiram (1.8 mm), Carbendazim (61.24 mm) and Captan (72.38 mm).

Keywords: Leaf blight, mung bean, *Macrophomina phaseolina*, botanicals, fungicides

Introduction
The mung bean [*Vigna radiata* (L.) Wilczek.] Is a legume cultivated for its edible seeds and sprouts across the Asia. The major portion is utilized in making dal, curries, soup, sweets and snacks. With sprouting there is an increase in the thiamine, niacin and ascorbic acid, thus mungbean sprouts are increasingly becoming popular in certain vegetarian diets. Moreover, its food values lie in high and easily digestible protein. The grains contain approximately 25-28% protein, 1.0-1.5% oil, 3.5–4.5% fiber, 4.5–5.5% ash and 62–65% carbohydrates on dry weight basis. Amino acid analysis indicates that it is an excellent complement to rice for balanced human nutrition.

The major fungal diseases which infect the crop are leaf blight [*Macrophomina phaseolina* (Tassi) Goid.], powdery mildew (*Erysiphe polygoni* DC), web blight (*Thanatephorus cucumeris* (Fr.) Donk, *Cercospora* leaf spots (*Cercospora canescens* Ellis and Martin, *C. cruenta* Sacc., *C. dolichi* Ellis and Everlast, *C. kikuchi* Matsumoto & Tomoyasu and Anthracnose (*Colletotrichum dematium and C. lindemuthianum* (Philip *et al*., 1969., Dwivedi and Saksena, 1974., and Grewal, 1988) [9, 3, 4].

Macrophomina phaseolina is one of the most damaging seed and soil borne pathogen, infecting about 500 plant species in more than 100 families throughout the world [(Kunwar *et al*, 1986, Mihail and Taylor 1995)] [7, 8]. Under favorable conditions the fungus causes many diseases like leaf blight, damping off, seedling blight, collar rot, stem rot, charcoal rot and root rot in various economically important crops. Mung bean was observed severely affected by leaf blight caused by *Macrophomina phaseolina*. In *Kharif* as well as during summer season. The pathogen attacks on all parts of plant *i.e.* root, stem, branches, petioles, leaves, pods and seeds. Soil and seed borne nature of the disease possesses problems for an effective disease management. Therefore, an attempt has been made to integrate management of leaf blight disease on mungbean incited by *Macrophomina phaseolina* which have become a serious problem in hampering the production of the mung bean in all growing areas of India. Datar (1999) [1] 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) [11]. 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 leaf blight and the subsistence mung bean cultivation in India, research priority was given to manage leaf blight disease.

To achieve this objective, present investigation was carried out on various botanicals to find out suitable eco-friendly management strategies for preventing crop losses.

Materials and methods

The experiment was carried out at Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The effect of Six aqueous extracts of commonly available plant parts were evaluated *in vitro* for their inhibitory effect on the mycelial growth and sclerotial formation by *M. phaseolina*. The plant parts selected were clove extracts of Garlic (*Allium sativum* L.), finger extract of Turmeric (*Curcuma longa* L.), finger extract of Ginger (*Zingiber officinale* L.), leaf extract of Neem (*Azadirachta indica* L.), bulb extract of onion (*Allium cepa* L.) and leaf extract of Black Tulsi (*Ocimum sanctum* L.). as listed in Table 1. 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 50 ml sterilized distilled water. The phyto extracts were filtered through double-layered muslin cloth in 150 ml conical flasks and plugged with non-absorbent cotton. These filtered extracts were autoclaved at 1.02 kg/cm^2 pressure for 20 minutes. Autoclaved extract were individually added into previously sterilized Potato Dextrose Agar (PDA) plates @ 10 percent 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 plates without phyto-extract served as control of test fungus. The Petri plates were incubated at 28±2 °C temperature up to 9 days in control plate. The percent growth inhibition (PGI) of the pathogen was worked out by using formula given by Vincent (1947) [12].

$$\text{Growth inhibition (\%)} = \frac{C-T}{C} \times 100$$

Where,

C = Mycelial growth in control plate
T = Mycelial growth in treatment plate

Like wise another experiment was carried out in the same laboratory of College of Agriculture, Raipur. Six fungicides were tested *in vitro* against *M. phaseolina* i.e. Thiram Carbendazim, Captan, Benomyl, Mancozeb and Tricyclazole. Potato dextrose agar medium was sterilized in conical flask of 250 ml capacity. Prior to pouring, all fungicides Mancozeb, Thiram, Carbendazim, Captan, Tricyclazole and Benomyl were added at a concentration of 100 ppm to PDA. The medium was then poured in sterilized petriplates. Five mm discs of the test pathogen cut from the margin of seven days old culture were placed centrally in each of the petriplate. The disc was kept inverted to allow the contact of the fungus with the medium. The inoculated petriplates without fungicides served as control. The inoculated plates were kept in incubator at 28±2°C. Colony diameter of the pathogen was measured after 4, 6 and 8 days of inoculation with the help of scale and sclerotial formation was recorded after 8 days of inoculation. Three replications of each treatment were maintained. The plate without fungicide served as control of test fungus. The Petri plates were incubated at 28±2 °C temperature till the complete coverage in control plate. The percent growth inhibition (PGI) of the pathogen was worked out by using formula given by Vincent (1947) [12].

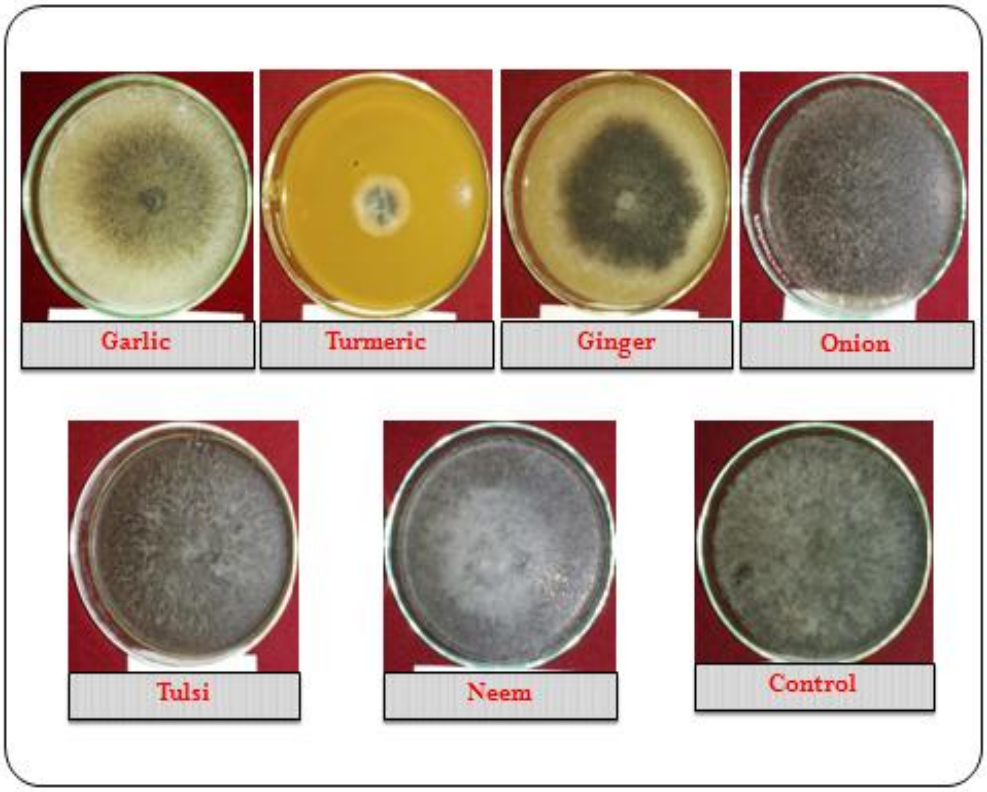
Results and discussion

The aqueous extracts of commonly available six plant species were evaluated *in vitro* for their inhibitory effect on the mycelial growth and sclerotial formation by *M. phaseolina*. The data are in Table 1, Plate 1, Fig 1& 2 revealed that out of six; only four plant extracts inhibited the growth of the fungus as compared to control. Neem and Onion were statistically at par with control. The finger extract of Turmeric having fungal colony diameter of 24.03 mm allowed minimum growth of the pathogen followed by clove extracts of Garlic (68.44 mm), finger extract of Ginger (78.13mm) and leaf extract of Black Tulsi (82.00 mm).

The results of present studies are in confirmation with the findings of earlier workers viz., Datar (1999) [1] studied the effect of botanicals on *M. phaseolina* and found that out of four rhizomes and bulbs extracts tested, Garlic (*Allium sativum* L.) extract was found most inhibitory to *R. bataticola*. Dubey and Dwivedi (1991) [2] 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) [5] 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 percent. Tandel *et al.* (2010) [11] 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. On the contrary, Onion bulb extract was not found effective against *M. phaseolina* in present investigation.

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

S. No.	Common name of plant	Botanical name	Average colony diameter (mm)	Percent growth inhibition over control
1.	Garlic	*Allium sativum* L.	68.44	23.11
2.	Turmeric	*Curcuma longa* L.	24.03	73.00
3.	Ginger	*Zingiber officinale* L.	78.13	12.22
4.	Neem	*Azadirachta indica* L.	88.23	0.87
5.	Onion	*Allium cepa* L.	88.33	0.76
6.	Black Tulsi	*Ocimum sanctum* L.	82.00	7.87
7.	Control		89.00	_
SEm±			2.18	
CD at 5%			6.68	



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

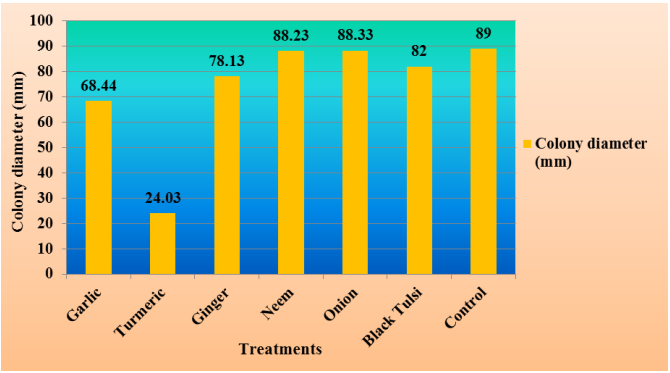


Fig 1: Average colony diameter (mm)

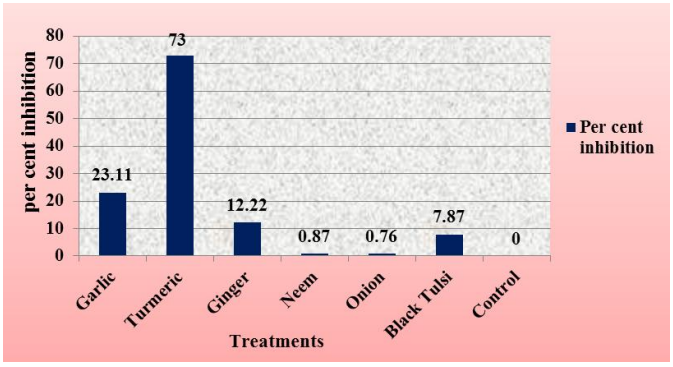


Fig 2: Effect of different fungicides on growth of *Macrophomina phaseolina in vitro*

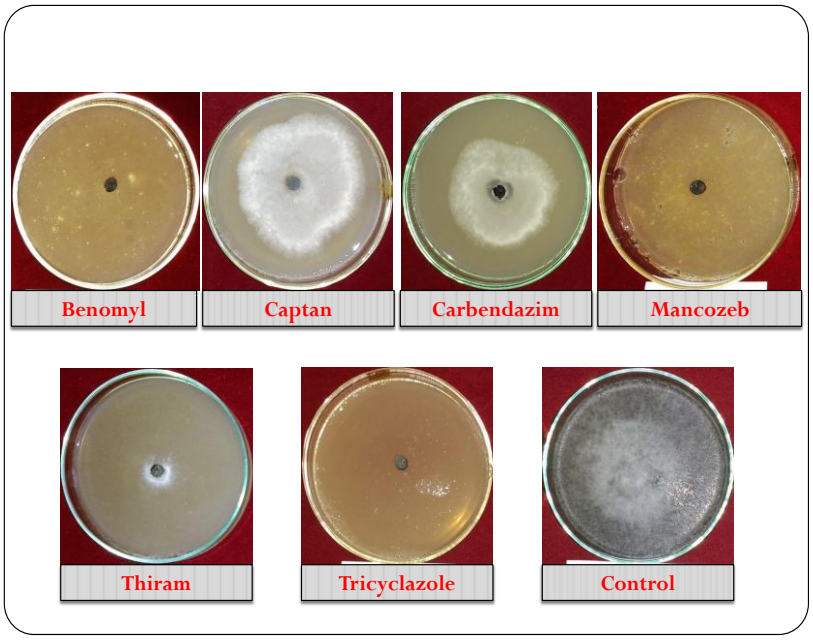
Six fungicides were tested for their efficacy on *Macrophomina phaseolina in-vitro* condition. The chemicals used were Thiram, Carbendazim, Captan, Benomyl, Mancozeb and Tricyclazole incorporated in potato dextrose agar medium.

Table 2: Effect of different fungicides on growth of *Macrophomina phaseolina*

S. No.	Fungicides	Mean colony Diameter (mm)	Reduction over control (%)
1.	Thiram 75% WP	1.80	98.00
2.	Carbendazim 50% WP	61.24	31.96
3.	Captan 50% WP	72.38	19.58
4.	Benomyl 50% WP	0.00	100.00
5.	Mancozeb 75% WP	0.00	100.00
6.	Tricyclazole 75% WP	0.00	100.00
7.	Control	90.00	-
SEm±		1.46	
CD at 5%		4.48	

The data presented in Table 2, plate 2, Fig 3 & 4 revealed that all treatments were significantly superior over control in checking the mycelial growth of the test fungus. Mancozeb, Benomyl and Tricyclazole completely inhibited the mycelial growth followed by Thiram (1.8 mm), Carbendazim (61.24 mm) and Captan (72.38 mm).

The findings of present study was in agreement with the findings of other researchers. Khalikar *et al.* (2011) [6] reported that among seven fungicide tested, Mancozeb, Hexaconazole, Benomyl and Chlorothalonil effectively inhibited mycelial growth. Sangappa *et al.* (2016) [10] revealed that among seven systemic fungicides tested, Benomyl, Hexaconazole, Thiophanate methyl and Triademefon showed 100 percent mycelial inhibition..



Plates 2: Effect of different fungicides on growth of *Macrophomina phaseolina*

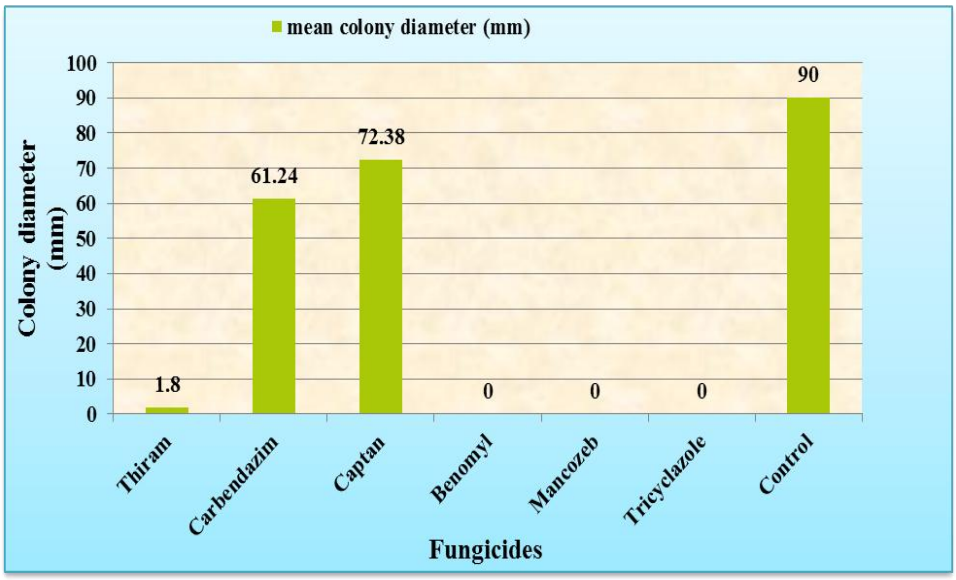


Fig 3: Effect of different fungicides on growth of *Macrophomina phaseolina in vitro*

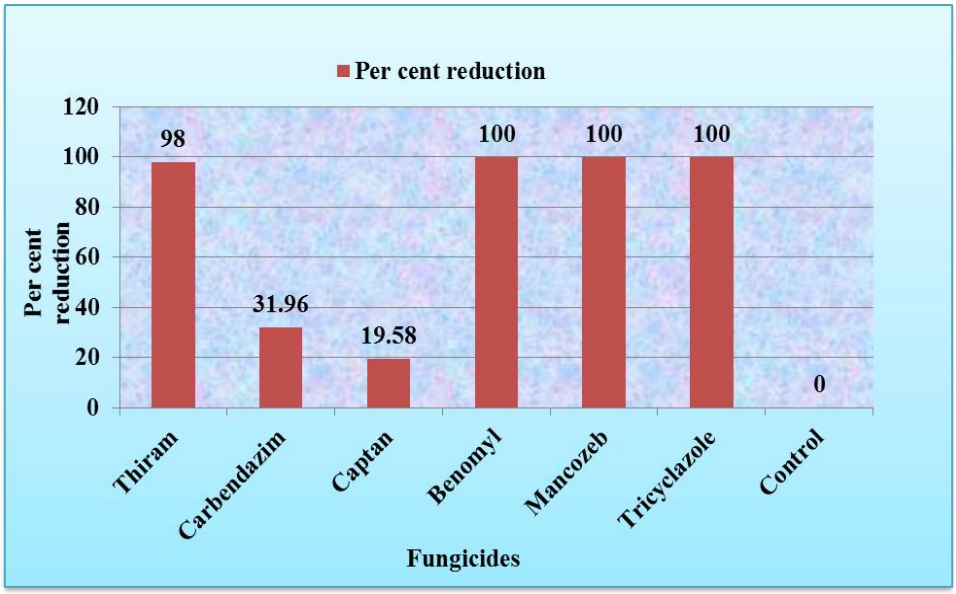


Fig 4: Percent reduction in mycelial growth over control

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