

Original Research Article

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Evaluation of Botanicals against *Fusarium solani* (Mart.) Sacc. Inciting Root Rot Disease of Bael (*Aegle marmelos* Correa)

Manjeet Singh^{1*}, Sushil Sharma² and Rajendra Nasnwa³

¹Department of Plant Pathology, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

²School of Agriculture, Suresh Gyan Vihar University, Jaipur, Rajasthan, India

³Department of Plant Pathology, SKRAU, Bikaner, Rajasthan, India

*Corresponding author

ABSTRACT

Keywords

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Nine botanicals were evaluated for their antifungal activity against *Fusarium solani* causing root rot disease in Bael by employing poisoned food technique under laboratory conditions. The results indicated that all the botanicals inhibited the growth of the *Fusarium solani* as compared to control. Out of nine botanical tested, turmeric rhizome extract was found most effective as it showed minimum mycelial growth (33.3 mm, 20.7 mm and 13.5 mm) and maximum mycelial growth inhibition (63.1 %, 77.0 % and 85.1 %) followed by neem, onion, tulsi, aonla, aak, datura and jamun at 5, 10 and 20 per cent concentrations, respectively. Congress grass recorded as least effective botanical against the pathogen at all the three concentrations.

Introduction

Bael (*Aegle marmelos* Correa) is an important and popular indigenous fruit tree of India. It is grown in various parts of South East Asia including India, Pakistan, Bangladesh, Sri Lanka, Myanmar, Thailand and most of the South-East Asian countries. In India, Bael is being grown throughout the country, it is also known by other vernacular names like Bael, sriphal, bili, belo, bilva and Bengal quince (John and Stevenson, 1979). According to Hindu customs, the leaves of Bael tree are considered sacred and offered to the Lord Shiva. Its medicinal properties have been dealt

with in the 'Charaka Samhita', an early medical treatise in Sanskrit (Aiyer, 1956). The importance of Bael fruit lies in its curative properties, which make the Bael tree one of the most useful medicinal plants of India (Kirtikar and Basu, 1935).

Though, there are scattered reports on its fruit and foliar diseases, however, heavy decline in Bael due to *Fusarium solani* (Mart.) Sacc. have been recorded in different parts of the India especially in Haryana and Rajasthan (Anonymous, 2011; Sharma and Gaur, 2014). Root rot of Bael has become a potential threat since 2007 in Haryana. The use of synthetic

fungicides for the management of disease is not only hazardous for human beings but also increases different types of environmental pollution and toxicological problems. Botanicals have assumed special significance for plant disease management in present day strategy being ecologically safe. The popularity of botanical pesticides is increasing and some plant products are being used globally as green pesticides (Gurjar *et al.*, 2012). Several botanicals have been demonstrated to possess excellent fungicidal properties (Bhardwaj, 2012). Inhibition of plant pathogenic fungi by many antifungal compounds of plant origin led to the present study to explore the feasibility of using extract of several plants for the management of *Fusarium solani* causing root rot disease of Bael under *in vitro* conditions.

Materials and Methods

To estimate the antimycotic behaviour of different botanicals against *Fusarium solani*, extracts of nine plant species viz., aak (*Quercus robur*), aonla (*Endlica phyllanthus*), congress grass (*Parthenium hysterophorus*), datura (*Datura stramonium*), jamun (*Syzygium cumini*), neem (*Azadirachta indica*), onion (*Allium cepa*), tulsi (*Octimum sanctum*) and turmeric (*Curcuma longa*) (Table 1) were evaluated. Leaf extracts of all plant species except onion bulb and turmeric rhizomes were taken and evaluated *in vitro* for their antifungal activity against *F. solani* by using poisoned food technique.

The extracts were prepared by crushing 100 g green leaves (except rhizome in turmeric and bulb in onion) of each plant species in 100 ml sterilized distilled water using mixer and grinder. The supernatant was filtered through double layered muslin cloth followed by Whatman filter paper no. 1. The filtrates were then centrifuged at 7000 rpm for ten minutes. The clear supernatants thus obtained were kept

in refrigerator at 5°C, and were used in further experiment. Three concentrations i.e. 5, 10 and 20 per cent of the stock solution were prepared.

The stock solution (100%) was further diluted with the help of double sterilized distilled water to give concentrations of 5, 10 and 20 per cent. Double strength PDA was also prepared and sterilized in autoclave for 20 minutes at 15 lbs inch⁻² pressure. This medium was taken in flask at the rate of 50 ml per flask and diluted with equal amount of extract solution to give 5, 10 and 20 per cent concentrations of each plants extract. The PDA medium containing required dose of extract was poured in sterilized petri plates with four replications of each concentration and was kept for solidification. All the plates containing phytoextracts were inoculated by placing 5 mm mycelial disc of actively growing culture of *Fusarium solani* (10 days old) grown on PDA in each petriplates and inoculated plates were incubated at 27 ± 2°C in BOD incubator. Control plates containing PDA medium and inoculated with *Fusarium solani* were also kept for comparison.

Experiment was conducted with complete randomized design. Radial growth of the *F. solani* both in treatment as well as control plates were recorded and per cent growth inhibition of *F. solani* at different concentrations was calculated on the basis of decrease in area of mycelial growth with respect to check by using the formula given by Vincent (1947) as described below.

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

Where,

I = Per cent inhibition

C = Radial growth of colony in control (mm)

T = Radial growth of colony in treatment (mm)

Results and Discussion

Efficacy of nine botanicals having antifungal activity was evaluated (Table 2 and 3; Fig. 1 and 2) *in vitro* by poisoned food technique against *Fusarium solani* inciting root rot disease of Bael. The results present in Table 2 and Figure 1 revealed that the mycelial growth of the *F. solani* was significantly reduced by all the botanicals.

Among the botanicals, Significantly lowest mycelial growth was recorded in turmeric rhizomes extract (33.25, 20.70 and 13.45 mm) followed by neem leaves extract (37.75, 27.13 and 19.80 mm) over control at 5, 10 and 20 per cent concentrations respectively and these both were significantly superior over the rest. The next best in order of merit was onion

bulbs extract (41.30, 31.17 and 24.50 mm), tulsi leaves extract (45.25, 35.40 and 28.60 mm), aonla leaves extract (51.20, 39.75 and 32.17 mm), aak leaves extract (55.55, 47.15, 38.44 mm), datura leaves extract (62.00, 56.25 and 50.30 mm) and jamun leaves extract (73.33, 64.50 and 57.50 mm) and congress grass extract (77.50, 74.75 and 67.67 mm) was found least effective and showed maximum mycelial growth at all the concentrations.

All the botanicals were found significantly effective in inhibiting the mycelial growth (Table 3 and Fig. 2). Significantly highest mycelial growth inhibition was recorded in turmeric rhizomes extract (63.06, 77.00 and 85.06 %) followed by neem leaves extract (58.06, 69.86 and 78.00 %) and congress grass extract (13.89, 16.94 and 24.81 %) was found least effective in inhibiting the mycelial growth of *F. solani* over control at 5, 10 and 20 per cent concentrations respectively.

Fig.1 Mycelial growth of *Fusarium solani* by plant extracts at different concentrations

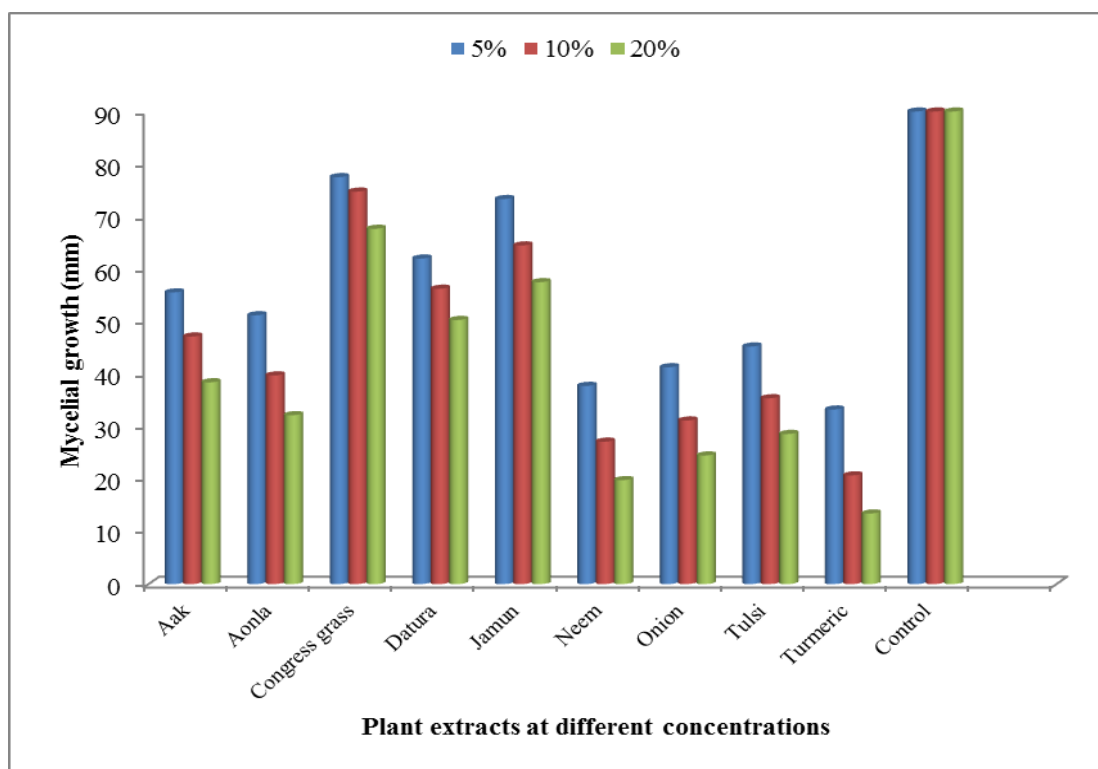


Fig.2 Mycelial growth inhibition of *Fusarium solani* by plant extracts at different concentrations

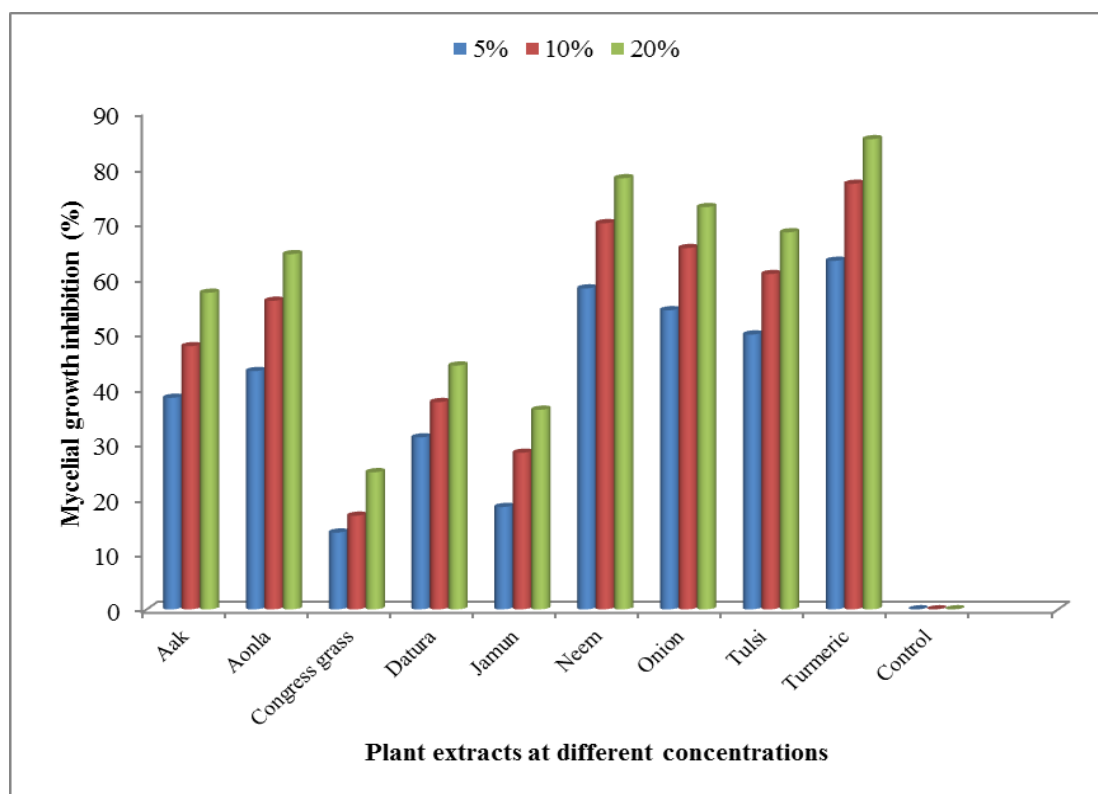


Table.1 List of different botanicals and their parts with different concentrations against *F. solani* causing root rot of Bael

Sr. No.	Common name	Botanical name	Plant part	Concentrations (%)		
1	Aak	<i>Quercus robur</i>	Leaves	5	10	20
2	Aonla	<i>Endlica phyllanthus</i>	Leaves	5	10	20
3	Congress grass	<i>Parthenium hysterophorus</i>	Leaves	5	10	20
4	Datura	<i>Datura stramonium</i>	Leaves	5	10	20
5	Jamun	<i>Syzygium cumini</i>	Leaves	5	10	20
6	Neem	<i>Azadirachta indica</i>	Leaves	5	10	20
7	Onion	<i>Allium cepa</i>	Bulbs	5	10	20
8	Tulsi	<i>Ocimum sanctum</i>	Leaves	5	10	20
9	Turmeric	<i>Curcuma longa</i>)	Rhizomes	5	10	20
10	Control*	-	-	-	-	-

*Devoid of botanical

Table.2 Effect of different botanicals on the mycelial growth of *Fusarium solani* under *in vitro* conditions

Sr. No.	Botanicals	Mycelial growth (mm)			Mean
		Concentrations			
		5%	10%	20%	
1	Aak leaves	55.55* (48.02)**	47.15 (43.21)	38.44 (38.15)	47.05 (43.13)
2	Aonla leaves	51.20 (45.53)	39.75 (38.92)	32.17 (34.39)	41.04 (39.61)
3	Congress grass	77.50 (61.49)	74.75 (59.65)	67.67 (55.17)	73.31 (58.77)
4	Datura leaves	62.00 (51.78)	56.25 (48.43)	50.30 (45.01)	56.18 (48.40)
5	Jamun leaves	73.33 (58.72)	64.50 (53.26)	57.50 (49.15)	65.11 (53.71)
6	Neem leaves	37.75 (37.75)	27.13 (31.22)	19.80 (26.23)	28.23 (31.73)
7	Onion bulbs	41.30 (39.83)	31.17 (33.77)	24.50 (29.49)	32.32 (34.36)
8	Tulsi leaves	45.25 (42.11)	35.40 (36.35)	28.60 (32.16)	36.42 (36.87)
9	Turmeric rhizomes	33.25 (35.05)	20.70 (26.87)	13.45 (21.29)	22.47 (27.74)
10	Control	90.00 (71.54)	90.00 (71.54)	90.00 (71.54)	90.00 (71.54)
Mean		56.71 (49.18)	48.68 (44.32)	42.24 (40.26)	
CD (P = 0.05) Botanicals		0.31			
Concentration		0.17			
Botanicals and concentrations		0.54			

* Average of four replications

**Figures in parentheses are angular transformed values

Table.3 Effect of different botanicals on the inhibition of mycelial growth of *F. solani* under *in vitro* conditions

Sr. No.	Botanicals	Growth inhibition (%)			Mean
		Concentrations			
		5%	10%	20%	
1	Aak leaves	38.28* (38.37)**	47.61 (43.77)	57.29 (49.33)	47.73 (43.82)
2	Aonla leaves	43.11 (41.19)	55.83 (48.49)	64.26 (53.43)	54.40 (47.70)
3	Congress grass	13.89 (22.10)	16.94 (24.51)	24.81 (30.05)	18.55 (25.55)
4	Datura leaves	31.11 (34.06)	37.50 (37.91)	44.11 (41.76)	37.57 (37.91)
5	Jamun leaves	18.52 (25.68)	28.33 (32.32)	36.11 (37.09)	27.66 (31.70)
6	Neem leaves	58.06 (49.78)	69.86 (56.85)	78.00 (62.20)	68.64 (56.27)
7	Onion bulbs	54.11 (47.50)	65.37 (54.10)	72.78 (58.71)	64.09 (53.43)
8	Tulsi leaves	49.72 (44.98)	60.67 (51.30)	68.22 (55.84)	59.54 (50.71)
9	Turmeric rhizomes	63.06 (52.71)	77.00 (61.51)	85.06 (67.46)	75.04 (60.56)
10	Control	0.00 (0.99)	0.00 (0.99)	0.00 (0.99)	0.00 (0.99)
Mean		36.99 (35.74)	45.91 (41.18)	53.06 (45.68)	
CD (P=0.05) Botanicals		0.35			
Concentration		0.19			
Botanicals and concentrations		0.61			

* Average of four replications

**Figures in parentheses are angular transformed values

Onion bulbs extract (54.11, 65.37 and 72.78 %), tulsi leaves extract (49.72, 60.67 and 68.22 %), aonla leaves extract (43.11, 55.83 and 64.26 %), aak leaves extract (38.28, 47.61 and 57.29 %) , datura leaves extract (31.11, 37.50 and 44.11 %) and jamun leaves extract (18.52, 28.33 and 36.11 %) were rated next to turmeric rhizome extract and neem leaves extract in descending order.

These findings of present investigation are in favour of work done by Patel *et al.*, (2010). They have reported mycelia growth inhibition of *Fusarium solani* by using turmeric rhizomes extract. Kapadiya *et al.*, 2014 also observed that maximum mean inhibition in turmeric rhizome extract followed by jatropa leaf extract and neem leaves extract.

The turmeric and garlic extracts were most effective in inhibiting the growth of *Fusarium* spp. (Patel and Vala, 2004; Assadi and Behroozin, 1987). Philip and Sharma, 1997; Mamatha and Ravishankar (2004); Joseph *et al.*, (2008); Obongoya (2010) also reported that neem leaf extract was effective in mycelia growth inhibition of *F. solani*. Garlic clove extract and neem leaf extract were most effective for the growth inhibition of *F. solani* (Malleesh *et al.*, (2009).

Further, it can be concluded that the efficacy of botanicals differed significantly in inhibiting the radial growth of the test fungus at all the three concentrations (5, 10 and 20%). The higher concentration of all the botanicals offered significantly higher per cent mycelial growth inhibition as compared to their lower levels. Among the different botanicals, turmeric rhizome extract had significant antifungal properties against root rot pathogen of Bael followed by neem leaves and onion bulbs extracts. These botanicals could be further subjected to field trials to access their effectiveness under field conditions.

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