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Management of alternaria leaf spot (*Aegle marmelos* Correa) of bael

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Abstract

The bael (*Aegle marmelos* Correa) is an important indigenous arid zone growing regions. To test the effect of fungicide alone and in combination against Alternaria leaf spot, a field experiment was conducted at Main Experimental Station Horticulture, Narendra Deva University of Agriculture and Technology, Faizabad during 2015-2016. Bael plants (*Aegle marmelos* Correa) grown in pot were inoculated with spore suspension of *Alternaria alternata* by hand sprayer during evening hours to prove the pathogenicity. After inoculation typical symptoms were appeared after 5-7 days on the leaves which was similar to the symptoms recorded under natural condition. Thus is Koch's postulate was proved. At the time of appearance of disease weather parameters viz. temperature and relative humidity ranged between 27.2 to 31.5°C and 70.40 to 89.00 per cent, respectively, it was also recorded that disease increases very fast when seasonal rain occurs. Efficacy of fungicides in *In vitro* condition revealed that, up to 24 hrs growth inhibition recorded in Carbendazim (83.31 Per cent). But up to 48 hrs growth inhibition was recorded in Mancozeb (87.05 per cent) and Carbendazim (79.76 Per cent) treated plates. In case of 72 hrs growth inhibition recorded in Carbendazim and Mancozeb treatments (69.54 and 86.00 percent). Up to 96 hrs 100 percent growth inhibition recorded in the plates treated with Propiconazole, Difenconazole while growth inhibition was recorded in the plates treated with Carbendazim, Mancozeb and Copper oxychloride (65.00, 82.80 and 95.320 per cent) respectively. Out of six treatments that minimum disease intensity (16.05 per cent) observed with Propiconazole @ 0.1%. This treatment were statistically at par with the treatments Difenconazole @ 0.1%, Copper oxychloride @ 0.2%, and Mancozeb @ 0.2% which have per cent disease intensity 17.10, 18.47 and 19.18 per cent respectively.

Keywords: Management, alternaria leaf spot, bael

Introduction

Bael (*Aegle marmelos* Correa.) is one of the most important indigenous arid tropic fruit belongs to family Rutaceae, It is also known as 'Shriphal' and 'Bengal Quince' (Johns and Stevenson, 1979), which is widely grown in different parts of Eastern Uttar Pradesh. It has been known in India from pre-historic times and has great mythological significance. It is a sacred tree dedicated to Lord Shiva and referred in Ramayana, Yajurveda, Buddhist and Jain literatures.

The bael leaves are also used on Vinayakachaturthi festival to worship Lord Ganesha. Bael is also called as Bengal quince, Indian quince, golden apple, holy fruit, stone apple, Bel, Bela, Sriphal, Belger, Baelpatra, Bilva, maredu, Bilpandu, Bil, Katori, Maredoa and other dialectal names in india; Matum and Mapin in Thailand; Phneover Pnoi in Cambodia; Baunav in Vietnam; Orangerdu Malabar in French; Marmelos in Portuguese. Nevertheless, the bael tree grows in almost all the states of India, however, it is widely distributed in U.P., Bihar, West Bengal, Orissa and Madhya Pradesh (Roy, 1992). Bael plants are widely and abundantly grown in eastern Uttar Pradesh particularly in Mirzapur, Varanasi, Gorakhpur, Basti, Gonda, Faizabad, Etawah districts and also Sewan district of Bihar (Teaotia *et al.*, 1963). So far, there is no any organized orcharding of bael in India. Jauhari and Singh (1971) [3] reported that the important bael growing area of Uttar Pradesh and Bihar found that among the varieties studied 'Kaghi Etawah, sewan Large, Mirzapur and Deoria Large' were good in taste and other qualities. The bael fruit is one of the most nutritious fruits, it contain 61.5 g water, 1.8 g protein, 0.39 mg thiamine, 1.19 mg fat, 87 mg riboflavin, 1.1 mg niacin, 55 mg Vitamin A, 85 mg calcium, 50 mg phosphorus, 600 mg Potassium and 8 mg vitamin 'C' per 100 g of edible portion (Gopalan *et al.*, 1971) [2]. No other fruit has such a high content of riboflavin. The ripe fruit is a tonic, restorative, astringent, laxative and good for heart and brain. The unripe fruit is regarded as astringent, digestive and stomachic and is usually prescribed for diarrhoea and dysentery. Anti-diarrhoeic activity of bael root was studied by Pitre and Srivastava (1987) [5].

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Nursery plants suffers from number of fungal foliar diseases namely root rot caused by *F.solani*, leaf spot caused by *Myrothecium roridum* and *Alternaria alternata*, die back and leaf spot caused by *Fusarium pallidoroseum* (Anonymous, 2010) [1]. keeping in view the importance of the bael crop and seriousness of the fungal foliar disease at nursery stage present research work have been undertaken with following objectives: Isolation, purification and identification of fungi associated with disease appear at nursery stage. Pathogenicity test of isolated fungi. Effect of weather parameters on diseases development. Efficacy of different fungicides against leaf spot disease caused by *Alternaria alternata*.

Materials and Methods

A field experiment was conducted on cultivar bael nursery at Main Experimental Station, Horticulture, Narendra Deva

University of Agriculture & Technology, Faizabad in Randomized Block Design with three replications during the year 2015-2016. For the management of *Alternaria* leaf spot with fungicide, (T₁ = Carbendazim 50% WP @ 0.1%, T₂ = Mancozeb 75% WP @ 0.2%, T₃ = Copper oxychloride 50% WP @ 0.2%, T₄ = Propiconazole 25 EC @ 0.1%, T₅ = Difenconazole 35 EC @ 0.1%, T₆ = Unsprayed) 1 m. x 1 m. Plot size, three replication were maintained for each treatment. Three foliar applications were given at 15 days intervals first spray was done just after initiation of disease. The data on the development of Per cent disease intensity were recorded 20 days after last spray The per cent disease intensity and per cent disease control were calculated by 0-5 scale point.

Scale for disease intensity

Table 1

Rating	Average disease intensity in (%)	Per cent area covered with disease infection
0	0%	No infection
1	0.1-5 %	0.1-5% area covered
2	5.1-20 %	5.1-20% area covered
3	20.1-50 %	20.1-50% area covered
4	50.1- 75%	50.1-75% area covered
5	75.1-100%	75.1% or above

Per cent disease intensity and per cent disease control were calculated by using the following formula (Vincent, 1947) [7]: The percent disease index (PDI) and percent disease control (PDC) were recorded according to following formula.

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Total number of fruit examined} \times \text{highest rating}}$$

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Total number of fruit examined} \times \text{highest rating}} \times 100$$

$$PDC = \frac{\% \text{ disease in control} - \% \text{ disease in treatment}}{\% \text{ disease in control}} \times 100$$

(Mckinney, 1923) [4].

Result

Alternaria leaf spot symptoms recorded during July first

week. The symptoms were recorded from initial growth of the plant. Symptoms initially started from leaf margin as well as tip of the leaves. Which are irregular and light brown in colour, later turned into dark brown to gray. In several spots coalesce to form large necrotic spots and cover large area. Under severe conditions many spots coalesce to form big patches and later such leaves defoliated from branches. First appearance of disease was recorded during 1st week of July (28th meteorological week) on bael nursery when weather factors viz., first disease appearance was recorded when temperature and relative humidity ranged between 27.2 to 31.5°C and 70.40 to 89.00 per cent, respectively. Whereas per day 3.9 hrs sun shine and 5.00 mm rainfall also favoured the first disease appearance. It was also recorded that disease increases very fast when seasonal rain occurs as shown in Table-2

Table 2: *Myrothecium* leaf spot of bael disease and its correlation with weather parameters

Date of observation (2016)	Meteorological week	Temperature (°c)		Relative Humidity (%)		Rain fall (mm)	Sunshine (hrs/day)	PDI
		Max	Min	M	E			
09July - 15 July	28	31.5	27.2	89.0	70.4	05.00	3.9	1.00
16July - 22 July	29	31.3	24.9	90.5	81.8	114.8	0.0	4.57
23July - 29July	30	31.5	26.0	90.2	78.2	27.60	2.8	8.40
30July - 05Aug.	31	32.2	25.8	89.0	70.1	62.60	2.8	10.20
06Aug. - 12Aug.	32	32.7	25.9	86.5	78.8	21.80	2.5	21.35
13Aug. - 19Aug.	33	32.2	25.9	92.1	78.8	17.80	2.5	33.75
20Aug. - 26Aug.	34	32.8	26.3	87.4	70.5	03.20	4.8	47.44
27Aug. - 02Sep.	35	34.9	26.9	87.1	69.4	15.00	5.9	54.15
03Sep. - 09 Sep.	36	34.4	26.5	87.2	64.0	02.20	7.5	62.31
10 Sep. - 16 Sep.	37	32.8	26.0	92.2	77.2	09.20	0.1	67.17

Maximum disease intensity (60.60pre cent) were recorded at 35th meteorological week when weather parameters viz. temperature and relative humidity ranged between 26.9 to 34.9°C and 69.40 to 87.10 per cent, respectively. Whereas per day 5.9 hrs sun shine and 15.00 mm rainfall also favoured the first disease appearance as showed Positive and highly

significant at 1% level of significance was noted between PDI and maximum temperature, contrary to thus correlation between PDI and rainfall was negative and significant. Rest parameters showed non-significant correlation with PDI either it was positive or negative. (Table- 3).

Table 3: Correlation coefficient of PDI of Myrothecium leaf spot of bael with weather parameters

S. No	Weather parameters	Per cent disease index of leaves
1	Maximum temperature	0.791**
2	Minimum temperature	0.270
3	Relative humidity (morning)	-0.096
4	Relative humidity (evening)	-0.384
5	Rainfall (mm)	-0.556*
7	Sun shine hrs/day	0.362*

* Significant, ** Highly significant

Results presented in Table-4 It was clear from table-10 that minimum disease intensity (16.05 per cent) observed with Propiconazole @ 0.1%. This treatment were statistically at par with the treatments Difenconazole @ 0.1%, Copper oxychloride @ 0.2%, and Mancozeb @ 0.2% which have per cent disease intensity 17.10, 18.47 and 19.18 per cent respectively.

Table 4: Effect of spray of fungicides Myrothecium leaf spot of bael.

Treatments	Concentrations	Disease intensity (%)	Disease control (%)
Carbendazim	0.1%	20.20(26.71)	67.15(55.00)
Mancozeb	0.2%	19.18(25.92)	71.68(57.80)
Copper oxychloride	0.2%	18.47(25.40)	73.494(58.95)
Propiconazole	0.1%	16.05(23.58)	78.56(62.37)
Difenconazole	0.1%	17.10(24.43)	76.42(60.94)
Control	-	67.17(55.00)	-
CD at 5%		2.58	

Nursery plants suffers from number of fungal foliar diseases namely root rot caused by *F.solani*, leaf spot caused by *Myrothecium roridum* and *Alternaria altrnata*, die back and leaf spot caused by *Fusarium pallidoroseum* (Anonymous, 2010) [1] the fungal leaf spot disease causes much vegetative loss in bael nursery and predominantly present in this region. In *in vitro* study, fungicidal efficacy on *Alternaria* leaf spot of bael nursery indicated that all the treatments were found significantly superior over control. The maximum (100.00 per cent) inhibition of the fungus was found with the treatment Propiconazole @ 0.1%, Difenconazole @ 0.1% and Copper oxychloride @ 0.2%. Similar findings were also recorded by Gohel and Solanky (2012) they found that Propiconazole @ 0.1%, Difenconazole @ 0.1% and Copper oxichloride @ 0.2% had the highest toxicity in the percent inhibition (100 per cent) and Mancozeb @ 0.2% (87.48 per cent inhibition) was found least effective against *Alternaria* leaf spot of in chilli. While Thejakumar and Devappa (2016) tested 10 fungicides in *in vitro* condition against *Alternaria alternata* causing leaf spot disease of chilli. They observed that Propiconazole at concentrations 500 1000 and 2000 ppm completely inhibited the mycelial growth of the fungus followed by Mancozeb at 1000 and 2000 ppm and Difenconazole at 2000 ppm.

It was clear from that minimum disease intensity (16.05 per cent) observed with Propiconazole @ 0.1%. This treatment were statistically at par with the treatments Difenconazole @ 0.1%, Copper oxychloride @ 0.2%, and Mancozeb @ 0.2% which have per cent disease intensity 17.10, 18.47 and 19.18 per cent respectively. Similar findings were also recorded by Gohel and Solanky (2012) tested 11 fungicides against *Alternaria alternata* and found that Propiconazole had the highest toxicity with percent disease intensity (16.60 per cent) and Mancozeb (19.82 per cent) was found, least effective.

While Dipak *et al.* (2012) reported that the Difenconazole @ 0.1%, disease intensity 18.42 per cent followed by the Copper oxychloride @ 0.25%, Propineb @ 0.25% and Mancozeb @ 0.25%, Shukhvinder (2015) also reported that Copper oxychloride @ 0.2% disease intensity (18.15) followed by Mancozeb @ 0.2% disease intensity 19.75 per cent and Carbendazim @ 0.1%, disease intensity 20.15 per cent. that's the copper oxychloride was effective in over control in ber.

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