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Evaluation of fungicides against angular leaf spot of French bean caused by *Phaeoisariopsis griseola*

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ABSTRACT

Angular leaf spot of bean caused by *Phaeoisariopsis griseola* is a serious foliar disease of French bean in northern India. The relative efficacies of different fungicides including six systemic and non-systemic fungicides and four combi-products were evaluated against *P griseola* under in vitro and in vivo conditions. The in vitro evaluation studies indicated that fenamidone (10%) + mancozeb (50%) (Sectin WG), pyraclostrobin (5%) + metiram (55%) (Cabrio Top WG), azoxystrobin (20%) + difenoconazole (12.5%) (Amistar Top SC), trifloxystrobin (25%) + tebuconazole (50%) (Nativo WG) and azoxystrobin (25%) (Amistar SC) alone were potent growth inhibitors of *P griseola*. Field evaluation for two consecutive years (2011 and 2012) revealed that four periodic sprays of Sectin at 15 days interval were most effective in controlling the disease and enhancing the green pod yield.

Keywords: French bean; angular leaf spot; *Phaeoisariopsis griseola*; fungicides

INTRODUCTION

French bean (*Phaseolus vulgaris* L) is highly profitable vegetable crop being grown round the year except winter months (Oct-Jan) in foot hills and mid-temperate areas of Himachal Pradesh. It is grown for its pods and seeds which are used as vegetable and pulses. Angular leaf spot (*Phaeoisariopsis griseola*) is one of the most widely distributed and damaging diseases of French bean. Disease severity in any crop is dependent upon the availability of primary inoculums, prevalent favourable environmental conditions and susceptible genotypes (John 1973). Angular leaf spot of French bean has been reported to cause up to 60 to 80 per cent disease in Shimla, Solan and Sirmour areas of Himachal Pradesh. Keeping in view the frequent occurrence and economic losses caused by this disease the present investigation was taken up to evaluate some promising fungicides for the control of angular leaf spot of French bean and to develop an effective and economical disease management system.

MATERIAL and METHODS

In vitro evaluation of fungicides for mycelial growth inhibition: Fourteen fungicides including six systemic and non-systemic fungicides viz carbendazim (50%) (Bavistin WP), chlorothalonil (75%) (Kavach WP), metiram (70%) (Sanit WG), mycobutanil (10%) (Index WP), dimethomorph (50%) (Acrobat WP) and azoxystrobin (25%) (Amistar SC) and four combi-products namely fenamidone (10%) + mancozeb (50%) (Sectin WG), pyraclostrobin (5%) + metiram (55%) (Cabrio Top WG), azoxystrobin (20%) + difenoconazole (12.5%) (Amistar Top SC) and trifloxystrobin (25%) + tebuconazole (50%) (Nativo WG) were evaluated under in vitro tests at 250, 500, 750 and 1000 ppm against *P griseola* by poisoned food technique on potato dextrose agar (PDA) (Nene and Thapliyal 2011). Data on mycelial growth were recorded after 7 days of incubation at 25 ± 1°C and per cent growth inhibition (PGI) for each treatment was calculated.

Per cent growth inhibition (PGI)= (C-T)/C × 100

where C= Colony diameter in control (mm), T= Colony diameter in treatment (mm)

Field evaluation of fungicides against angular leaf spot disease: The relative efficacy of the fungicides was evaluated at their recommended doses against the disease under field conditions in a randomized block design in the Department of Vegetable Science, Dr YS Parmer University of Horticulture and Forestry, Nauni, Solan, HP during 2011 and 2012 crop season where natural build up of the angular leaf spot disease had been much higher in the previous crop seasons. A susceptible French bean cv Lakshmi was sown in replicated plots. Simultaneously the control treatment plots were also maintained under each replication. The four periodic sprays of fungicides were given at 15 days interval started with the initiation of disease in the respective treatment plots.

Data recording and analysis: Observations on disease severity in all treatment plots were taken and the green pod yield records were also taken to work out the relative efficacy of different treatments. The data on the severity of the disease were recorded by using (1-9) scale (Mahuku et al 2003) with slight modifications where grade 1= 1-10 per cent infected leaf area (plants with 1-10% leaf area with lesions) and grade 3= 11-25 per cent infected leaf area (plants with ≤25% leaf area infected with lesions and sporulation, lesions covering up to 5 per cent area of pods), grade 5= 26-50 per cent infected leaf area (plants with up to 50% leaf area with lesions and sporulation associated with chlorosis and necrosis and 15% pod area covered with lesions), 7= >50 per cent infected leaf area (numerous spots reaching up to 1 cm in diameter and more than 50% leaf area covered with

lesions and associated with chlorosis and necrosis, up to 25% pod area covered with lesions) and 9= defoliation 90 per cent of leaf area (with lesions frequently associated with chlorosis, necrosis and defoliation, lesions covering 50% area of pods). Data recorded for the per cent disease severity and yield were taken during 2011 and 2012 crop season and analyzed following the method of variance described by Gomez and Gomez (1983).

RESULTS and DISCUSSION

Effect of fungicides on mycelial growth: Of the 10 fungicides evaluated under in vitro conditions (Table1) revealed that Sectin, Amistar, Amistar Top, Nativo and Cabrio Top proved most inhibitory providing cent per cent growth inhibition of the test pathogen at all the concentration levels tested. Sanit and Bavistin exhibited the complete growth inhibition at higher concentration level of 750 and 1000 ppm. The inhibitory response was also significantly higher in other fungicides tested under in vitro conditions. In overall an increased inhibitory response was recorded with the increasing dosage levels. The available literature also reveals the efficacy of carbendazim, mancozeb, hexaconazole, propiconazole and chlorothalonil against *P griseola* (Bhardwaj and Thakur 1992, Bhat 2002, Shukla and Sharma 2009). The effectiveness of combi-product fungicides can be well explained as these contain either or both of the effective constituents.

Efficacy of fungicides under field conditions: The results of study (Table 2) indicate that periodic sprays of Sectin @ 0.2 per cent tested at an interval of 15 days with the first appearance of disease proved most effective and provided 74.11 and 77.99 per cent disease control on leaves and pods respectively as well besides providing the highest green pod yield. The next best fungicides were Amistar Top, Nativo, Index, Amistar, CabrioTop and Bavistin which reduced the disease severity from 20 to 35 per cent as compared to untreated control (70.7%). Acrobat (dimethomorph) proved least effective. These observations are in accordance with the findings of Rajappan and Yesuraja (1999) who reported the effective control of angular leaf spot disease in French bean with foliar spray of carbendazim (50%) (Bavistin WP) @ 0.2 per cent and chlorothalonil 75 per cent (Kavach WP) @ 0.2 per cent. Also the foliar spray with Rovral 50WP (iprodione) @ 0.2% and Secure 600WG (fenamidione + mancozeb) @ 0.2 per cent at an interval of 7 days effectively controlled the disease and increased yield of lentil by 31.99 and 28.20 per cent respectively (Shahiduzzaman et al 2015).

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Table 1. In vitro efficacy of different fungicides against mycelial growth of *Phaeoisariopsis griseola*

Fungicide (F)	Per cent growth inhibition at different concentrations (ppm)				Mean
	250	500	750	1000	
Sanit	69.40 (56.42)	86.03 (68.08)	100.00 (90.00)	100.00 (90.00)	88.86 (76.13)
Kavach	63.30 (52.72)	65.83 (54.23)	88.88 (70.46)	97.18 (80.35)	78.78 (64.44)
Bavistin	77.13 (61.44)	88.80 (70.46)	100.00 (90.00)	100.00 (90.00)	91.48 (77.97)
Acrobat	61.83 (51.85)	62.13 (51.44)	65.90 (54.27)	77.13 (61.44)	66.50 (54.75)
Amistar	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
Index	78.77 (62.56)	82.87 (65.55)	86.53 (68.47)	94.87 (76.92)	85.76 (68.38)
Sectin	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
Amistar Top	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
Nativo	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
Cabrio Top	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
Mean	85.04 (73.50)	88.57 (75.98)	94.14 (82.32)	96.92 (84.87)	91.14 (79.18)

Figures in the parentheses are arc sine transformed values

$CD_{0.05}$

Fungicides (F)= 0.39, Concentration (C)= 0.32, F x C= 0.79

Table 2. Field evaluation of fungicides against angular leaf spot of French bean caused by *Phaeoisariopsis griseola* in 2011 and 2012

Treatment	Dose	Disease Severity		Pooled (%)	Green pod yield(q/ha)		Pooled (%)
		2011	2012		2011	2012	
Kavach	0.2	41.4 (40.03)	42.1 (40.45)	41.75 (39.90)	78.9	89.0	83.95
Acrobat	0.2	44.3 (41.69)	44.9 (42.04)	44.6 (41.79)	69.9	84.5	77.20
Sanit	0.2	38.1 (38.09)	31.7 (34.23)	34.9 (36.11)	115.6	135.8	125.7
Sectin	0.2	17.3 (23.85)	20.3 (26.59)	18.8 (25.15)	152.6	144.3	148.45
Bavistin	0.2	32.4 (34.69)	27.8 (31.87)	30.1 (33.19)	123.97	125.0	124.49
Amistar	0.1	31.3 (34.23)	33.9 (35.59)	32.6 (34.39)	109.94	112.93	111.43
Amistar Top	0.1	20.3 (26.59)	26.0 (30.61)	23.15 (28.15)	138.92	120.0	129.47
Nativo	0.1	24.7 (29.78)	28.1 (28.09)	26.24 (30.81)	124.97	116.6	120.79
Index	0.2	26.0 (30.61)	22.4 (23.19)	24.86 (29.91)	126.2	130.80	128.5
Cabrio Top	0.2	30.0 (33.19)	25.0 (27.01)	27.89 (30.66)	123.6	120	121.8
Control		78.63 (66.42)	75.0 (60.05)	76.81 (62.11)	49.5	69.7	59.6
$CD_{0.05}$		5.2367	4.3345	4.9231	7.6756	7.4282	7.2426

Figures in the parentheses are arc sine transformed values

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