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In vivo efficacy of botanicals against powdery mildew of chilli caused by *Leveillula taurica* (Lev) Arn

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Abstract

Powdery mildew of chilli incited by *Leveillula taurica* is one of the most serious diseases of chilli. Field experiment was carried out to know the effect of different botanicals against powdery mildew of chilli during kharif, 2015. Seven botanicals namely Onion, Garlic, Tulsi, Turmeric, NSKE, Neem and Mehndi were tested against powdery mildew of chilli. Among the seven treatments minimum per cent disease incidence recorded in garlic (T₂) (37.14%) followed by Tulsi (T₃) (38.75%), Turmeric (T₄) (40.05%), NSKE (T₅) (41.82%), Neem (T₆) (42.60%), Onion (T₁) (44.71%) and Mehndi (T₇) (46.56%). Highest per cent disease incidence recorded in control (T₈) (56.21%).

Keywords: Chilli, *Leveillula taurica*, powdery mildew, botanicals, garlic, neem

Introduction

Chilli (*Capsicum annum* L.), is an important solanaceous vegetable cum spice crop. It is also known as 'Red Pepper'. Chilli, the native of New World of tropics and sub-tropics was introduced into India from Brazil in 16th century by the Portuguese. It is good source of vitamin A, vitamin C and thiamine. Pungency, one of important quality attributes of *Capsicum species* is due to the presence of alkaloid 'capsaicin' in the fruit and also contains capsanthin and oleoresin. India is the largest producer of chillies in the world. The area, production and productivity of chilli were 774.87 thousands hectares, 1492.14 thousands MT and 1.93 MT/ha respectively (Indiastat, 2013-2014) [3]. The major growing states of the country and the major growing states in terms of production share are Andhra Pradesh, Karnataka, Orissa, Maharashtra, West Bengal, Rajasthan and Tamil Nadu.

In Maharashtra, chillies are grown on an area of 99.50 thousands hectares with the production of 45.60 thousands MT and productivity 0.46MT/ha (Indiastat, 2013-2014) [3]. Chilli crop suffers with many fungal, bacterial, viral and nematode diseases resulting huge yield losses (Kalmesh and Gurjar 2001). Major diseases of chilli are: damping off, anthracnose or fruit rot or dieback, wilt, leaf spots, powdery mildew and root rot. Among these diseases fungal disease powdery mildew caused by *Leveillula taurica* (Lev.) Arn. is a major constraint in chilli production in India causing heavy yield loss ranging from 14 to 24% due to severe defoliation and reduction in photosynthesis, size and number of fruits per plant (Mathur, *et al.* 1972, and Gahokar and Peshney, 1981) [5, 2]. Considering economic importance of powdery mildew of chilli different botanicals were tested under field condition.

Materials and Methods

The field trial was conducted during Kharif, 2015 at Research Farm, Horticulture Research Scheme (Vegetable), VNMKV, Parbhani (M.S.) India. The experiment was laid out in Randomized Block Design (RBD) with three replications and eight treatments with control. The seeds of chilli cv. Pusa Jwala were sown in small beds and the nursery was raised. The seedlings of 35 days old were transplanted to the main field by following spacing of 60×45 cm and with plot size of 2.4x3.15 m. The recommended package of practices was followed for the trial.

All the foliar sprays (treatments) were given as per their doses. The first spray of botanicals was done after first appearance of disease. The same concentration was followed for second spray at 7 days interval with untreated plots served as control. The severity of powdery mildew was scored at 7 days interval after each spray. The disease severity of powdery mildew was

recorded on 10 plants and 10 leaves on lower, middle and upper leaves by using 0-9 disease rating scale (Mayee and Datar, 1986) and expressed as Percent Disease Index (PDI) (Wheeler, 1969) [15].

$$PDI = \frac{\text{Summation of numerical ratings}}{\text{Total number of plants observed} \times \text{Maximum rating}} \times 100$$

Further, per cent disease control (PDC) was worked out by applying the formula

$$PDC = \frac{\text{PDI in control plot} - \text{PDI in treatment plot}}{\text{PDI in control plot}} \times 100$$

Table 1: Show the percent of infection

Grade	Percent Infection
0	0%
1	1-10%
3	11-25%
5	26-50%
7	51-75%
9	>75%

Statistical analysis

All the data related to diseases incidence and yield was statistically analyzed. Calculations were made after applying the test of significance of the means (Panse and Sukhatme, 1978).

Table 2: Experimental details

Sr. No.	Common Name	Botanical Name	Part Uses	Concentration%
1	Onion	<i>Allium cepa</i>	Bulb	10
2	Garlic	<i>Allium sativum</i>	Clove	10
3	Tulsi	<i>Ocimum sanctum</i>	Leaves	10
4	Turmeric	<i>Curcuma longa</i>	Rhizome	10
5	NSKE	<i>Azadirachta indica</i>	Seed kernel	10
6	Neem	<i>Azadirachta indica</i>	Leaves	10
7	Mehndi	<i>Lawsonia inermis</i>	Leaves	10

Results and Discussion

Effect on powdery mildew incidence

Result (Table 3) indicated that, all the treatments significantly reduced the powdery mildew disease incidence in chilli crop. The per cent powdery mildew incidence recorded in the plots before spray treatments ranged from 19.66% to 24.7%.

Table 3: *In vivo* evaluation of botanicals against chilli powdery mildew incidence

Tr. No.	Treatments	*First appearance	*First spray	*Second spray	*Mean PI
T ₁	Onion	24.00 (29.33)	66.01 (54.33)	44.13 (41.62)	44.71 (41.96)
T ₂	Garlic	21.37 (27.53)	49.05 (44.45)	41.00 (39.81)	37.14 (37.88)
T ₃	Tulsi	19.66 (26.32)	53.54 (47.02)	43.05 (41.00)	38.75 (38.49)
T ₄	Turmeric	20.07 (26.57)	57.20 (49.13)	42.90 (40.91)	40.05 (39.61)
T ₅	NSKE	21.00 (27.27)	59.98 (50.75)	44.50 (41.84)	41.82 (40.29)
T ₆	Neem	24.50 (29.66)	56.31 (48.62)	47.00 (43.28)	42.60 (40.74)
T ₇	Mehndi	23.54 (29.02)	64.77 (53.59)	51.37 (45.78)	46.56 (43.02)
T ₈	Control	22.98 (28.64)	67.75 (55.39)	77.91 (61.96)	56.21 (48.56)
	SE ±	0.38	0.43	0.31	0.39
	CD @ 5%	1.16	1.31	0.95	1.19

*mean of three replications, PI- Per cent incidence of disease, Figures in parentheses are angular transformed values

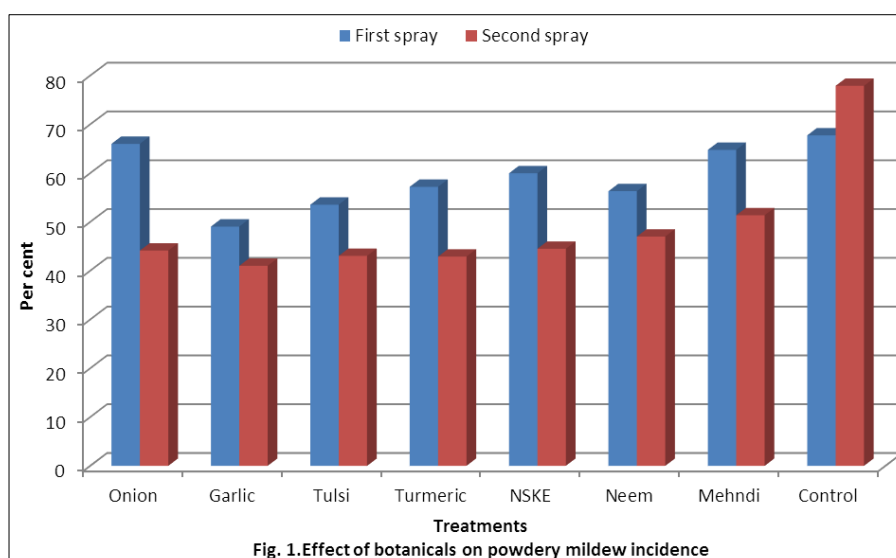


Fig 1: *In vivo* efficacy of botanicals against chilli powdery mildew incidence

The per cent powdery mildew disease incidence before first spray treatment of tulsi @ 10% (T₃) recorded was 19.66%, followed by turmeric (T₄) (20.07%), NSKE @ 10% (T₅) (20.07%), garlic @ 10% (T₂) (21.37%), mehndi @ 10% (T₇) (23.54), onion @ 10% (T₁) (24.00) and neem @ 10% (T₆) (24.5%) respectively.

The per cent powdery mildew incidence recorded in the plots after first spray treatments ranged from 49.05% to 67.75%. The minimum per cent powdery mildew disease incidence at first spray treatment of garlic @ 10% (T₂) recorded was 49.05%, followed by tulsi (T₃) (53.54%), followed by turmeric (57.20%) and neem (57.20%). The highest per cent

powdery mildew incidence recorded on control (67.75%) followed by mehndi (64.77%) and NSKE (T5) (59.98%) respectively.

The per cent powdery mildew incidence recorded in the plots second spray treatments ranged from 41.00% to 77.91%. The minimum per cent powdery mildew disease incidence at second spray treatment of garlic @ 10% (T₂) recorded was 41.00%, followed by onion T₁ (42.13%), followed by turmeric (42.90%) and tulsi (43.05%). The highest per cent powdery mildew incidence recorded on control (77.91%) followed by neem (T7) (47.00%), NSKE (T5) (44.50%) and onion (T1) (42.90%) respectively.

The mean per cent powdery mildew incidence recorded with all the treatments was ranged from (37.14%) to (56.21%). In untreated control it was (56.21%). Among the botanicals tested garlic recorded significantly least mean disease incidence (37.14%), followed by tulsi (38.75%), turmeric (40.05%), NSKE (41.82%), neem (42.60%), onion (44.04%), and mehndi (46.56%). Thus of the botanicals tested garlic, tulsi and turmeric 10% were found effective in minimizing the disease incidence as compared to untreated control (without spray). The field plot evaluation of botanicals indicated that all the treatments significantly reduced per cent disease incidence over untreated control (Table 3).

Effect on powdery mildew severity

Results (Table 4) revealed that all botanicals significantly reduced the powdery mildew severity and effectively reduced

the same in chilli crop. The per cent disease severity recorded before spray treatments was ranged from (8.83%) turmeric to 13.7% (control) respectively, which was statistically non significant. The per cent powdery mildew disease severity recorded after first spray treatments ranged from 35.7% to 51.77% respectively. The highest disease severity of 51.77% recorded from the plots receiving untreated control plots which were followed mehndi (46.44%), onion (44.43%) and neem (43.10%), respectively. The lowest disease severity after first spray was recorded in plot receiving sprays garlic (35.7%), followed by tulsi (38.96%), turmeric (40.92%) and NSKE (41.10%), respectively.

After second spray, the disease severity was in the range of 29.90% to 44.98%. The highest disease severity of 44.98% was recorded in plots receiving control which was statistically at par with the disease severity recorded in untreated control plots. The plots receiving sprays of garlic @ 10% (T₂) exhibited lowest disease severity of (29.90%) followed by tulsi @ 10% (T₃) (34.03%), turmeric (@ 10% 36.12%) and NSKE @ 10% (T₅) (37.14), neem @ 10% (T₆) (39.40%), onion @ 10% (T₁) (40.66%) and mehndi @ 10% (42.46), respectively.

Thus of the botanicals tested Garlic, tulsi and turmeric (10%) were found effective in minimizing the disease severity as compared to untreated control. Result (Table 4) revealed that all treatments revealed that all botanicals tested significantly reduced powdery mildew intensity.

Table 4: *In vivo* evaluation of botanicals against chilli powdery mildew severity

Treatments	Disease severity* (%)			Mean % PDS
	First appearance	First spraying	Second spraying	
Onion	12.13 (20.38)	44.43 (41.80)	40.66 (39.61)	32.40 (34.69)
Garlic	11.02 (19.38)	35.70 (36.69)	29.90 (33.14)	25.33 (30.21)
Tulsi	9.00 (17.45)	38.96 (38.62)	34.03 (35.69)	27.33 (31.51)
Turmeric	8.83 (17.28)	40.92 (39.76)	36.12 (36.94)	28.62 (32.34)
NSKE	10.00 (18.43)	41.10 (39.87)	37.14 (37.54)	29.41 (32.84)
Neem	9.90 (18.33)	43.10 (41.03)	39.40 (38.88)	30.80 (33.70)
Mehndi	12.90 (21.72)	46.44 (42.95)	42.46 (40.66)	34.10 (35.72)
Control	13.7 (21.72)	51.77 (46.01)	44.98 (42.11)	36.81 (37.35)
SE ±	0.26	0.35	0.30	0.27
CD @ 5%	0.81	1.06	0.93	0.82

*Mean of three replication, PDS - Per cent Disease Severity, Figures in parentheses are angular transformed value

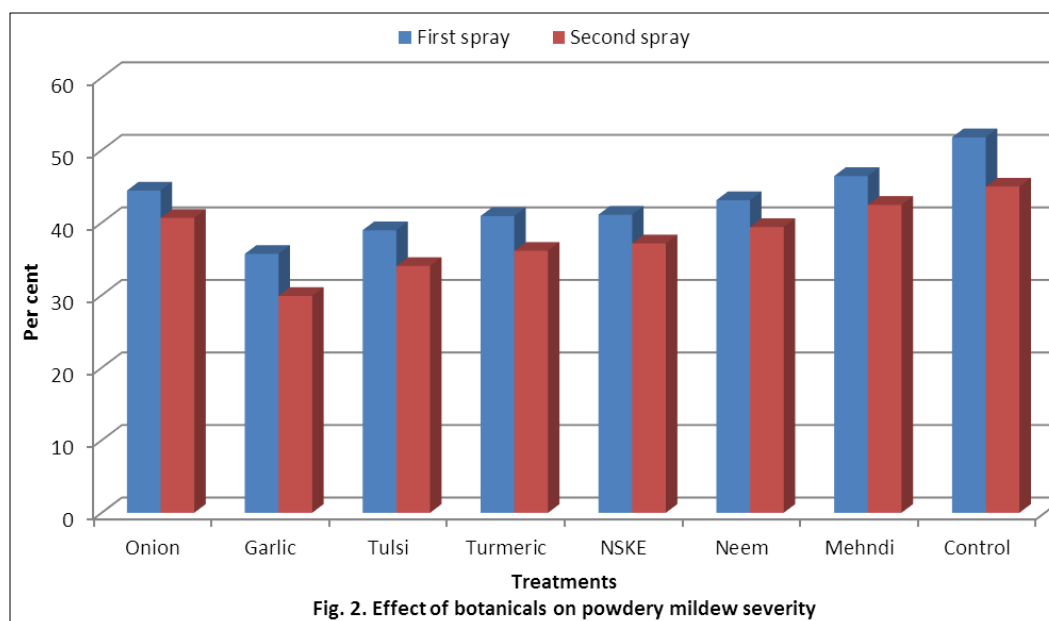


Fig 2: *In vivo* efficacy of botanicals against chilli powdery mildew severity

Effect on powdery mildew intensity

Results (Table 5) revealed that all treatments significantly reduced the powdery mildew intensity. The per cent disease intensity recorded before spray treatments was in the range of 16.82% to 22.46% respectively.

The lowest per cent disease intensity after first spray (41.00%) was recorded in the plots receiving sprays of garlic

@10% (T₂) which was significantly lower than other treatments and untreated control (792.05%). The plots receiving sprays of garlic @ 10% recorded the per cent disease intensity of (41.00%) which followed tulsi @ 10% (41.22%), turmeric @ 10% (45.15%), NSKE @ 10% (51.98%) and neem @ 10% (55.58%) respectively.

Table 5: *In vivo* evaluation of botanicals against chilli powdery mildew intensity and disease control

Tr. No.	Treatments	*Disease intensity (%)			PI*	PDC*
		First appearance	First Spraying	Second spraying		
T ₁	Onion	17.07 (24.40)	65.12 (53.80)	57.01 (49.02)	46.40 (42.93)	21.72 (27.77)
T ₂	Garlic	18.49 (25.46)	51.03 (45.59)	41.00 (39.81)	36.84 (37.36)	37.85 (37.96)
T ₃	Tulsi	22.46 (28.28)	52.30 (46.31)	41.22 (39.94)	38.66 (38.43)	34.78 (36.13)
T ₄	Turmeric	20.13 (26.65)	55.98 (48.43)	45.15 (42.21)	40.42 (39.47)	31.81 (34.33)
T ₅	NSKE	17.00 (24.35)	56.63 (48.80)	51.98 (46.13)	41.87 (40.32)	29.36 (32.80)
T ₆	Neem	16.82 (24.21)	61.62 (51.71)	55.58 (48.20)	44.67 (41.94)	24.64 (29.76)
T ₇	Mehndi	18.66 (25.59)	67.26 (55.09)	59.00 (50.18)	48.30 (44.02)	18.52 (25.48)
T ₈	Control	21.33 (27.50)	84.46 (66.78)	72.05 (58.08)	59.28 (50.34)	-----
	SE ±	0.27	0.19	0.43	0.25	0.23
	CD @ 5%	0.82	0.58	1.30	0.76	0.72

*mean of three replications, PDC per cent disease control, Figures in parentheses are angular transformed value

The highest per cent disease intensity after first spray (72.05%) was recorded in the plots receiving untreated control, which was followed by mehndi @10% (59.0%) and onion @ 10% (57.01), respectively.

The lowest per cent disease intensity after second spray (51.03%) was recorded in the plots receiving sprays of garlic @ 10% which was significantly lower than other treatments and untreated control (84.46%). The plots receiving sprays of tulsi @10% recorded the per cent disease intensity of 52.30% which was and turmeric @10% (55.98%) respectively. The highest per cent powdery mildew intensity after second spray was recorded from untreated control plot (84.46%) which was followed by plots receiving of mehndi @10% (67.26%), onion (65.12%) and neem @10% (61.62%), respectively. The highest mean per cent disease intensity after second spray was observed in untreated control plots (59.28%). In the plots receiving botanicals spray the highest mean per cent disease intensity of 59.28% was observed in the plots receiving untreated control which was statistically at par with each other. The plots receiving sprays of mehndi @ 10% recorded per cent disease intensity of (48.30%) which was followed by onion @ 10% (46.40%), and neem @ 10% (44.67%). The lowest mean per cent disease intensity was recorded from the plots receiving the sprays garlic @ 10% (36.84%) which was statistically at par with the plots receiving sprays tulsi @ 10% (38.66%), turmeric @ 10% (40.42%) and NSKE @ 10% (41.87%), respectively. These findings are in agreement with the results of Singh and Prithviraj (1997) [12], Ravikumar (1998) [8], Sindhan *et al.* (1999) [11], and Rettinassabady *et al.* (2000) [9], Sharmila (2006) [13] similar with those reported earlier by Sudha and Lakshmanan (2007), Surwase *et al.* (2009) [14], Kachhot *et al.* (2011) [4], Dinesh *et al.* (2011) [1], Khalikar *et al.* (2011).

Per cent disease control

Data obtained on the per cent disease control presented in (Table 5) revealed that after the spray per cent disease control of 37.85%, was recorded in the plots receiving sprays of garlic extract @ 10% (T₂). The next best botanicals in controlling the disease were tulsi @ 10% (T₃) which gave 34.78% disease control over untreated control. The plots receiving sprays of turmeric @ 10% (T₄) recorded 28.62%

disease control followed by NSKE @ 10% (T₅) and neem @ 10% (T₆) which recorded 29.36% and 24.64% disease control. This was followed by onion @ 10% (T₁) (32.40%) and mehndi @ 10% (18.52%), respectively.

Conclusion

Seven botanicals namely Onion, Garlic, Tulsi, Turmeric, NSKE, Neem and Mehndi were tested against powdery mildew of chilli. Among the seven treatments minimum per cent disease incidence recorded in garlic (T₂) (37.14%) followed by Tulsi (T₃) (38.75%), Turmeric (T₄) (40.05%), NSKE (T₅) (41.82%), Neem (T₆) (42.60%), Onion (T₁) (44.71%) and Mehndi (T₇) (46.56%).

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