

Occurrence and Management of Fruit Rot of Chilli in Bharuch district of Gujarat

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Chilli (*Capsicum annum* L.) is an annual herbaceous vegetable and spice crop grown in both tropical and sub-tropical regions. India accounts 25 per cent of the world's total production of chilli. The fruit rot caused by *Colletotrichum capsici* is a major problem in India and is the significant economic constraints to chilli production especially in tropical and sub-tropical regions. The overdose of chemicals resulted resistance development in pathogens and have adverse effect on the consumer health. There is need to search for alternative approaches to chemical control which have minimal deleterious effects and ecofriendly in nature. An intensive roving survey was conducted during *Kharif* 2022-23 in Bharuch and Ankleshwar talukas of south Gujarat to know the intensity of *Colletotrichum* fruit rot of chilli. Maximum (20.80%) disease intensity was observed in Bhadbhut village of Bharuch taluka while minimum (10.40%) in Kapodara village of Ankleshwar talukas. Antagonists and phytoextracts were used for ecofriendly management of the fruit rot of chilli and among the four antagonists, the significantly lowest mycelial growth (18.00 mm) with highest per cent growth inhibition (78.82%) was observed in *B. subtilis* NAU isolate seven day after incubation. The neem leaf extract recorded the highest i.e.63.52 PGI than other phytoextract.

Keywords: Antagonist, *Colletotrichum capsici*, phytoextract, survey

INTRODUCTION

Chilli (*Capsicum annum* L.) is an important spice cum vegetable crop known as Capsicum, hot pepper, marcha, lal mirch, mirchi, sweet pepper or paprika. Chilli belongs to family *Solanaceae* which is native of tropical America (Hunziker, 2001). *Capsicum* contains approximately 20-27 species of which five viz., *C. annum*, *C. baccatum*, *C. chinese*, *C. frutescens* and *C. pubescens* are domesticated in different parts of the world.

Chilli fruits are used as pickles, sauces, ketchup, essence, oleoresins and are an inevitable

ingredient in Indian dishes. It is a good source of capsaicinoid, vitamin A, C, riboflavin and thiamine. Hundred gram of chilli contains about 8.8g carbohydrates, 5.3g sugar, 1.9g protein and 534µg beta carotene (Panda *et al.* 2010). Alkaloid capsaicin is extracted from chilli which has medicinal values. These properties increase the demand for chillies all over the world. The present investigation was done to reduce *Colletotrichum* fruit rots of chilli. The utilization of an antagonist and phytoextracts under south Gujarat condition was also analysed.

MATERIALS AND METHODS

An intensive roving survey was conducted during *kharif* 2022-23 in Bharuch and Ankleshwar talukas of south Gujarat to know the intensity of

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Colletotrichum fruit rot of chilli and the antagonists and phytoextracts were evaluated to know antifungal property against *Colletotrichum* fruit rot of chilli *in vitro*.

Survey

An intensive roving was conducted in Bharuch and Ankleshwar talukas of south Gujarat to assess *Colletotrichum* fruit rot of disease incidence. Total five villages from each talukas were selected and ten (10) fields was selected from each village and the observations on intensity of *Colletotrichum* fruit rot was recorded from the randomly selected ten plants at 15 days interval from each field. The observations were recorded from initiation of fruit rot disease to the harvesting of crop. The disease severity was assessed by using the following 0-5 scale (Jeyalakshmi and Seetharaman, 1998).

0	No symptoms on fruit
1	Small Circular black spots covering 1% or less of fruit area
2	Small Circular, black spots appears on skin of ripe fruit and which spre ads in direction of long axis, on discolored area numerous black acervuli are formed, 1-10% fruit area
3	The fruits with many spots drops prematurely, s eed in infected fruits turn rusty, deformed, white in color 11 -25% fruit area
4	Infected area on fruit become depressed and wrinkled 26-50% fruit area
5	The Infected fruits shrivel and dry up 51% or more of fruit area

Percent Disease Intensity (PDI) was worked out by using formula given by Wheeler (1969).

$$\text{PDI} = \frac{\text{Sum of all numerical rating}}{\text{Number of Plants observed} \times \text{maximum grade}} \times 100$$

Antagonist

In vitro

$$I = \frac{C-T}{C} \times 100 \quad I = \frac{C-T}{C} \times 100$$

Antagonistic effect of different bioagents *i.e.* *Trichoderma viride*, *T. harzianum*, *Pseudomonas fluorescens* and *Bacillus subtilis* was tested by dual culture technique for their antagonism against *Colletotrichum* fruit rot of chilli. Seven days old culture of the bio agents and the pathogen was employed by following dual culture method. Mycelial disc of 5 mm diameter was kept at

periphery of Petri plate by keeping 60 mm distance between antagonist and test pathogen. In case of bacterial bio agents half portion of plates was streaked and 5 mm. diameter mycelia discs placed at corner of Petri plates. In control, test pathogen was kept in the center of Petri plate. The Petri plates were incubated at $27 \pm 1^{\circ} \text{C}$ in BOD incubator for 7 days. Observations on mycelia growth and per cent growth inhibition were recorded after 7 days after incubation. The per cent growth inhibition (PGI) of pathogen in each treatment was calculated by following formula (Vincent, 1947).

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

Where,

I = Inhibition per cent

C = Colony diameter (mm) in control plate

T = Colony diameter (mm) in treated plate

Phytoextracts

In vitro

Efficacy of different phytoextracts of plant species having medicinal value was tested *in vitro* by poisoned food technique against *Colletotrichum* causing fruit rot of chilli. Fresh and healthy 100 gram plant parts of each species were thoroughly washed with tap water and then with distilled sterilized water. They were macerated separately in grinder by adding 100 ml ethanol.

The mixture was filtered through two fold sterilized muslin cloth and the filtrate was centrifuged at 5000 rpm for 10 mins and the clear supernatant extract was collected in sterilized conical flasks. After evaporating the ethanol from extract, the clear extract was collected and diluted with 100

ml distilled sterile water to make volume 1:1 (W/V) and was considered as 100% concentration during the study to test the efficacy of plant extracts. Each phytoextract (10 %) was mixed thoroughly in sterilized 100 ml PDA medium filled in 250 ml flask under aseptic condition. The medium was supplemented with streptomycin sulphate @ 50 ppm to prevent bacterial contamination. The 5 mm disc of 7 days old cultures of *Colletotrichum* was placed in Petri plate containing PDA medium along with phytoextracts. The mycelial growth was recorded 7 days after incubation. The per cent growth inhibition of pathogen in each treatment was calculated by the same formula described above.

RESULTS AND DISCUSSION

Survey

The intensive roving survey was conducted during *kharif* 2022-23 in ten (10) villages (Amleshwar, Bhadbhut, Borbatha, Chavaj, Dehgam, Amboli, Chapla, Dadhal, Diva and Kapodar) of Bharuch district where chilli crops were grown and the observations on intensity of *Colletotrichum* fruit rot was recorded at 15 days interval from the randomly selected ten plants of each visited field (Table 1).

The fruit rot intensity in Bharuch district was depicted in Table 2 which revealed that the disease intensity ranged from 10.40 to 20.80%. The maximum (20.80%) disease intensity was observed in Bhadbhut village while minimum (10.40%) disease intensity was observed in Kapodara village. The maximum disease intensity (16.90%) was recorded in Bharuch taluka while minimum disease intensity (13.44%) recorded in Ankleshwar taluka of Bharuch district.

Similar findings to the present investigation were reported by Badgujar *et al.* (2019) carried out an extensive roving survey during 2017-18 and 2018-19 in eight districts of Marathwada region and disease incidence ranges 12-26%. The corroborate result also observed by Charumathi and Raj (2019) who also found that the highest fruit rot disease incidence was recorded in Kovilpatti (19 %) and the least disease incidence was recorded in Sathanoor (3.6 %).

Antagonist

The four antagonists *viz.*, *Trichoderma viride* Pers, ex. grey NAU isolate, *Trichoderma harzianum* Rifai. NAU isolate, *Pseudomonas fluorescens* NAU isolate and *Bacillus subtilis* Ell NAU isolate were tested to evaluate the efficacy of bioagents against *C. capsici* causing fruit rot of chilli by dual culture method in *in vitro* condition. The observation on mycelial growth (mm) and per cent growth inhibition (PGI) were recorded after seven days of incubation and results presented in Table 3. All the antagonists significantly inhibited the mycelial growth of *C. capsici* over the control. Significantly, the lowest mycelial growth (18.00 mm) with highest per cent growth inhibition (78.82%) was observed in bacterial bioagent *B. subtilis* NAU isolate seven days after incubation. The next best treatment in order of merit was *P. fluorescens* NAU isolates (19.25 mm) with 77.35 per cent growth inhibition followed by *T. viride* Pers, ex. grey NAU isolate (21.50 mm) with 74.70 PGI which was statistically at par with *T. harzianum* Rifai. NAU isolate (22.25 mm) with 73.82 PGI against *C. capsici* at seven days after incubation (Table 3). Similar results to present investigation was reported by Shilpa and Gokulapalan (2015) who recorded maximum mycelial growth inhibition in *P. fluorescens* 90.00 PGI and by Birari *et al.* (2018) who recorded significantly the highest mycelial growth inhibition of the *C. capsici* with *T. viride* 80.48 PGI.

Phytoextracts

Total five phytoextracts at 10 per cent concentrations were evaluated against *C. capsici* causing fruit rot of chilli under *in vitro* condition by poison food technique. The observations on the mycelial growth (mm) and per cent growth inhibition (PGI) were recorded after seven days of incubation and the results are mentioned in Table 4.

All the phytoextracts were found significantly superior in inhibition the mycelial growth of *C. capsici* over the control. Among five plant extracts, neem (31.00 mm) was found the most effective in inhibiting mycelial growth at 10 per cent with 63.52 PGI followed by lemongrass (33.50 mm) with 60.58 PGI. The phytoextracts of garlic and

Table 1: Survey of fruit rot of chilli in Bharuch and Ankleshwar talukas

District	Taluka	Village
Bharuch	Bharuch	Amaleshwar
		Bhadbhut
		Borbhatha
		Chavaj
		Dahegam
	Ankleshwar	Amboli
		Chapra
		Dadhal
		Diva
		Kapodara

Table 2: Per cent Disease Intensity of fruit rot of chilli in Bharuch and Ankleshwar talukas

District	Taluka	Village	PDI (%)	Mean PDI of Taluka (%)	Mean PDI of District (%)
Bharuch	Bharuch	Amaleshwar	20.10	16.90	15.17
		Bhadbhut	20.80		
		Borbhatha	16.80		
		Chavaj	12.60		
		Dahegam	14.20		
	Ankleshwar	Amboli	14.20	13.44	
		Chapra	16.10		
		Dadhal	14.40		
		Diva	12.10		
		Kapodara	10.40		

tulsi were found less effective in inhibiting mycelial growth (38.50 and 41.25 mm) with 54.70 and 51.47 PGI, respectively against *C. capsici* at seven days after incubation. The maximum mycelial growth (43.75 mm) with the lowest 48.52 PGI was recorded in nilgiri phytoextracts seven days after incubation (Table 4).

Among the evaluated five phytoextracts, the highest (63.52%) growth inhibition was recorded

in neem and found the most effective in growth inhibition of *C. capsici* followed by lemongrass (60.58 %). The nilgiri was found the least effective as compared to the rest of phytoextracts.

The results of present investigation similar with the results obtained by Bal and Behera (2012) recorded the maximum mycelial growth inhibition (81.04%) of *C. capsici* was found in neem leaf extract followed by garlic clove extract (80.54%)

Table 3 : Bio-efficacy of antagonistic on mycelial growth inhibition of *C. capsici* in under *in vitro* condition

Tr. No.	Bioagents	Mycelial growth 7 DAI (mm)	PGI (%)
T ₁	<i>Trichoderma viride</i> Pers, ex. grey NAU isolate	21.50	74.70
T ₂	<i>Trichoderma harzianum</i> Rifai. NAU isolate	22.25	73.82
T ₃	<i>Pseudomonas fluorescens</i> NAU isolate	19.25	77.35
T ₄	<i>Bacillus subtilis</i> Ell NAU isolate	18.00	78.82
T ₅	Control	85.00	-
	SEm ±	0.292	
	CD at 5%	0.880	
	CV (%)	3.521	

* DAI: Days after inoculation *PGI: Per cent growth inhibition

Table 4. Bio-efficacy of phytoextracts (10%) on mycelial growth inhibition of *C. capsici* under *in vitro* condition

Tr. No.	Phytoextracts	Mycelial growth 7 DAI (mm)	PGI (%)
T ₁	Garlic	38.50	54.70
T ₂	Tulsi	41.25	51.47
T ₃	Nilgiri	43.75	48.52
T ₄	Lemongrass	33.50	60.58
T ₅	Neem	31.00	63.52
T ₆	Control	85.00	-
	SEm ±	0.388	
	CD at 5%	1.154	
	CV (%)	3.416	

*DAI: Days after inoculation *PGI: Per cent growth inhibition

at 5 per cent concentration and Nishanthi *et al.* (2020) recorded *A. indica* extract at 20 per cent concentration inhibited the maximum growth of *C. capsici*. Yadav *et al.* (2020) found that NSKE was found the most effective in inhibiting mycelial growth of *C. capsici* followed by garlic clove extract (41.40 and 57.60 %) and both were found significantly superior at both concentrations but highly effective at 10 per cent concentration.

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DECLARATION

Conflict of Interest: Authors declare no conflict of interest.

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